2010

The Role of Personal Experience in Forming Spatial Presence in a Video Gaming Context

Mu Wu
Cleveland State University

THE ROLE OF PERSONAL EXPERIENCE IN FORMING SPATIAL PRESENCE IN A VIDEO GAMING CONTEXT

MU WU

Bachelor of Arts in English

Northwest Normal University

June, 2007

Submitted in partial fulfillment of requirements for the degree

MASTER OF APPLIED COMMUNICATION THEORY AND METHODOLOGY

at the

CLEVELAND STATE UNIVERSITY

August, 2010

THESIS APPROVAL

SCHOOL OF COMMUNICATION

This thesis has been approved for the

School of Communication

And the College of Graduate Studies by:

Paul Skalski

Thesis Committee Chairman
School of Communication

8/3/10

Date

Cheryl C. Bracken

Committee Member
School of Communication

8/3/10

Date

Gary Pettey

Committee Member
School of Communication

8/3/10

Date

ACKNOWLEDGEMENTS

I would like to thank my advisor, Dr. Paul Skalski, for spending an enormous amount of time reading and editing my thesis, and providing me with detailed feedback for every draft.

I would also like to thank my committee members, Dr. Cheryl Bracken and Dr. Gary Pettey, for their assistance and suggestions in helping me to improve the quality of the study.

I also want to express my thanks to Dr. Kimberly Neuendorf, Dr. Richard Perloff and other faculty for their support and encouragement throughout my study in the School of Communication at Cleveland State University.

THE ROLE OF PERSONAL EXPERIENCE IN FORMING SPATIAL PRESENCE IN A VIDEO GAMING CONTEXT

MU WU

ABSTRACT

Advanced media technologies, such as video games, provide people with brand new media experiences including a sense of spatial presence - a sense of immersing in mediated environments. Many media and user factors that may induce spatial presence have been examined in previous studies. However, personal experience as one possible factor is still under examined.

Based on the Two Level Process Model of Spatial Presence proposed by Wirth et al. (2007), the current study examined personal experience by connecting it with spatial situation models (SSMs), and comparing the effects of different types of personal experience on the process of constructing SSMs. The study proposed that people with more related prior experience are more likely to get stronger SSMs when they play video games, thus inducing higher levels of spatial presence. Furthermore, the congruence between people's prior experience and current media experience will also influence the formation of spatial presence. Gaming skill was also included in the study as a moderator in the process, meaning the level of gaming skill affects the sense of spatial presence.

By conducting a quasi experiment, 100 subjects were included in the study. The results partially supported the positive relationship between personal experience and SSMs. Furthermore, gaming skills and congruence were positively related to SSMs and the level of spatial presence, respectively.

TABLE OF CONTENTS

LIST OF TABLES

TABLE Page

LIST OF FIGURES

FIGURE Page

CHAPTER I

INTRODUCTION

In recent years, video games have become pervasive entertainment for people. According to The Entertainment Software Association (ESA) (2008), 298.2 million units of video games were sold in the United States in 2008; that is to say 9 computer or video games were sold on average every second of 2008. Such great sales volume led to $ 11.7 billion in software revenue. The industry dramatically expanding also exerts a strong impact on economic development in general. A study conducted by the ESA in 2007 reported that the entertainment software industry's annual growth rate exceeded 17 percent from 2003 to 2006, which added $ 3.8 billion to U.S. Gross Domestic Product (GDP). All of these figures indicated the fact that video games are playing an essential role in people's media lives; however, for this newly arisen medium, knowledge about the mechanisms behind human interaction with it is still insufficient as well as necessary.

Presence is a relatively new subject of academic study. Because of its pervasiveness in media experiences, it is an important concept in studying people interacting with media (Tamborini & Skalski, 2006). Previous studies have found that presence is very effective in impacting interactions between human and media and their effects. For example, presence can enhance people's enjoyment; improve task

performance; or make media messages more persuasive (International Society for Presence Research, 2000). Hence, to understand one of the current most popular entertainment media, video games, the concept of presence also plays an essential role. Moreover, the development of newly emerging gaming technologies, such as new control devices mapping real body actions and force feedback, has provided the players with higher senses of presence. For example, Wii game consoles developed by Nintendo intends to transfer human behaviors in real world sports to video gaming contexts as naturally as possible. Instead of pressing buttons, players have to move their bodies just like what they do in real world to control their characters. In more recent, Microsoft is developing a newer gaming system called Kinect, different with Wii, Kinect can sense and capture players' movements in real world without using any game controllers, and transfer the movements to virtual 3D spaces provided by video games. In other words, players are presented in game environments in a more direct and identical way, which could elicit a stronger sense of presence. Hence, research incorporating games with presence is necessary and valuable to our comprehension of interaction between humans and the game medium. Indeed, there were some studies examining the various factors that may influence gamers' sense of presence; however, previous personal experience, an important variable that may impact on players' sense of presence, has been ignored by many scholars. The current study will examine the role of personal experience in the process of interaction between people and video games, and its impact on media users' sensation of presence based on a framework of the Two Level Process Model of Spatial Presence proposed by Wirth et al. (2007).

CHAPTER II

LITERATURE REVIEW

2.1. Presence Research

According to Reeves and Nass (1996), the human brain evolved in a world in which only humans exhibited rich social behaviors and a world in which all perceived objects were real physical objects. Anything that seemed to be a real person or place was real. Thus, acceptance of what only seems to be real is automatic. For this reason, people cannot always overcome the powerful assumption that mediated presentations are actually not people and objects. People respond to simulations of social actors and natural objects as if they were in fact social and natural. Furthermore, people often don't scrutinize their actions or their environment. When people's brains automatically respond socially and naturally because of the characteristics of media or the situations in which they are used, there is often little to remind people that the experience is unreal. Reeves and Nass' media equation studies primarily focused on human-computer interaction and they did not use the term "presence" in their research; however, according to Lee (2004), media equation studies can be linked with presence and even be considered as presence studies.

Different with media equation studies, many other researchers focused on the explication of presence. Heeter (1992) divided the sense of presence into three different types: Personal presence (i.e., a feeling of being in a virtual world), social presence (i.e., a feeling of interacting or coexisting with other social entities in a virtual world), and environmental presence (i.e., a feeling of interacting with the virtual environment; for example, responses from the virtual environment to your behavior or input can leads to a sense of presence). In Biocca's study (1997) on people's embodiment in virtual environments, he specified three types of presence: physical, social, and self presence. Physical presence means a subjective feeling of physically being in a virtual environment; social presence refers to a sense of being with other intelligences (e.g., human and agents); and self presence means users experience mental models of themselves inside the virtual world. Many other scholars have tried to classify the concept of presence in different ways. Lombard and Ditton (1997) defined it as "the perceptual illusion of nonmediation," and they divided presence into six conceptualizations, which are: (1) Presence as social richness, or the extent to which a medium is perceived as sociable, warm, sensitive, personal, or intimate when it is used to interact with other people; (2) presence as realism, which means that media can produce seemingly real representation of objects, events and people; (3) presence as transportation, which is that media can give users the feeling of being transported to another place, or the objects within the media are transported to the user, or they are sharing common space with another person together; (4) presence as immersion, which emphasizes the idea of perceptual and psychological immersion; (5) presence as social actor within medium actor, which is a user's sense that they are social actors within the

medium; and (6) presence as medium as social actor, which involves social responses of media users to cues provided by the medium itself.

Using similar terms as Biocca, Lee (2004) defined physical presence as a psychological state that virtual physical objects are experienced as physical objects in either sensory or nonsensory ways; social presence as a psychological state in which virtual social actors are experienced as real social actor in either sensory or nonsensory ways; and finally, self presence as a psychological state involving a virtual self or selves experienced as actual self or selves in either sensory or nonsensory ways. Although the concept of presence has been explicated differently in different studies, it is clear that this research consistently considers presence from users' physical or spatial, social, and self feeling aspects; in the other words, spatial, social, and self presence.

However, our knowledge about why humans have a sense of presence is still insufficient. According to Reeves & Nass (1996), willing suspension of disbelief is one argument for how we experience presence proposed by Coleridge in 1847. The argument suggested that during people's interaction with media, people consciously follow the intention of authors or producers of the media product, and forgot the artificiality of mediated environment so that they can fully enjoy the products. Such an argument was completely opposite the findings of Reeves and Nass' studies (1996), which suggested that people's acceptance of mediated environments and treating media naturally are not controlled by the person, but are instead out of human's tendency of accepting any seemingly true information as real. Based on previous studies, Lee's study (2004) indicated that the fundamental mechanisms behind the sense of presence could be explained by the modularity of human minds. Specifically, people's automatic and

natural responses to mediated stimuli are primarily because humans automatically apply "folk-physics modules" and "folk-psychology modules" when they interact with a mediated environments and process media stimuli. For example, people judge virtual objects based on screen size (Lombard, Reich, Grabe, Bracken, & Ditton, 2000), and they automatically apply a size-judgment module to a virtual environment. As another example, a computer's positive responses will positively influence children's confidence and motivation (Bracken & Lombard, 2004).

In addition to the mechanisms behind presence, factors that can contribute to achieve a sense of presence are also a focus of current presence research. In general, three types of factors that can influence presence include: media form (e.g., image and audio quality), media content (e.g., social realism), and media users' individual characteristics and differences (Lombard & Ditton, 1997; Lombard, Reich, Bracken, & Ditton, 2000; Lee and Nass, 2001). A series of studies examined the specific factors contributing to form presence. For media factors, the size of a media image has an impact on human's sense of presence (Kim & Biocca, 1997; Lombard et. al., 2000). Held & Durlach (1992) found that response speed of equipment will influence presence. Furthermore, meaningful media content (Hoffman, Prothero, Wells, & Groen, 1998), number of sensory dimensions and presented channels (Kim & Biocca, 1997; Lombard & Ditton, 1997), comfort of the equipment (Barfield & Weghorst, 1993), and natural mapping devices (Skalski, Tamborini, Shelton, Buncher, & Lindmark, in press) were also found to be effective in forming users' sense of presence. On the other hand, for media users factors, familiarity with the technology (Held & Durlach, 1992; Lombard & Ditton, 1997), media users' expectations of the technology (Pettey, Bracken, Rubenking, Buncher, & Gress,

2010), gender differences (Kim, 1996; Lombard et. al., 2000), mood (Apter, 1992), and users' attention (Witmer and Singer, 1998) were found to have impact on users' sense of presence.

2.2. Spatial Presence in Video Games and the Two Level Process Model of Spatial Presence

Since the current study is focusing on users' spatial presence during interaction with a video game, an extensive discussion on spatial presence is necessary. As discussed above, spatial presence was defined as a sense or psychological state of physically experiencing virtual objects and environments, or being located in virtual environment (Heeter, 1992; Biocca, 1997; Ijsselsteijn, de Ridder, Freeman, & Avons, 2000; Lee, 2004). According to Biocca (1997), people will automatically generate a mental model of an external physical space experienced by their sensory organs. This sense of locating in the space formed by real physical space is stable and easy to be activated. Hence, when people are engaged in a virtual environment that simulates an actual physical space experienced by people, their mental models formed in the real world will be activated and automatically generate a similar sense of locating in the current virtual space, which is a sense of spatial presence. Biocca suggested that such a sense of locating in the virtual space formed by a mediated environment is less stable than the sense of locating in real world generated by interacting with real world objects.

To generate or maintain the sense of spatial presence in a game world, Tamborini (2000) suggested two factors that are essential to achieve this objective, which are: involvement, and immersion. Specifically, video game players' feelings of involvement

are associated with interactivity and vividness supported by games. According to Steuer (1992), interactivity means users' ability to influence the form and content of an environment, and three factors of response can heighten interactivity: speed, interactive range, and mapping. On the other hand, Steuer (1992) defined vividness as technology's ability to produce a rich sensory environment and ways of presenting information. Better sounds, graphic qualities, or vibrating controller can provide users' a more vivid gaming experience in order to improve gamers' involvement. Immersion is another factor that can enhance people's sense of spatial presence. According to Witmer and Singer (1998), users' focused attention can lead to involvement and immersion. Compared with involvement, immersion is a state that users are isolated from the current real environment and completely engrossed in the virtual environment. A medium that can provide users with the perception of inclusion, more natural interaction and higher controllability is more likely to isolate users from the actual environment and form a feeling of immersion, which can enhance users' sense of spatial presence.

Besides the two factors discussed above, Wirth et al. (2007) suggested personal differences also play an essential role in forming and maintaining players' sensation of spatial presence. Based on their process model of spatial presence:

> Spatial Presence is a binary experience, during which perceived self-location and, in most cases, perceived action possibilities are connected to a mediated spatial environment, and mental capacities are bound by the mediated environment instead of reality. (p. 497)

According to this model, the formation of people's spatial presence can be divided into two steps. The first step is a process to construct a spatial situation model (SSM), and the second step is a process of promoting from the SSM to a sensation of spatial presence. Specifically, SSM refers to a mental model of the spatial environment that the individual constructs based on spatial cues he/she processed and relevant personal spatial memories and cognitions (McNamara, 1986). The formation of the SSM is related to various user and media factors, such as users' ability with spatial visual imagery, attention allocation (involuntary and controlled attention), and spatial cues provided by media.

After the SSM constructed in the first step, in the second step, users will progress from the SSM to a sensation of spatial presence. In this process, several factors will have impact on the development of the process. Based on the discussion of Wirth et al., to give users a feeling of being located in a virtual environment, the SSM developed in the first step or the current mediated environment has to be considered as Primary Ego Reference Frame (PERF) so that users' perceived self-location, perceived possible actions and mental capacities are all bound to the mediated space, which gives users the sense of spatial presence. According to the theory of perceptual hypotheses, based on selecting, organizing, accentuating and fixing previous information and knowledge, people will have different expectation hypotheses in different conditions. A person can have several different expectation hypotheses at the same time, and through collecting information confirm them. Hence, once the users have constructed a SSM, a perceptual hypothesis about the medicated environment will be activated, which is the PERF; furthermore, there are also other perceptual hypotheses about the real environment. Lilly and Frey (1993)

suggested that the stronger a perceptual hypothesis, the larger possibility the hypothesis will be activated, the smaller the amount of information necessary to confirm it, and the larger the amount of information needed to disprove it. Competing with each other, a stronger SSM constructed in the first step is obviously more likely to be considered as PERF because it is more plausible and only needs less information to confirm it. However, it is not to say that users will not achieve spatial presence without a strong SSM. Various media factors, such as realism of media content, interactivity, and persistent spatial cues; and user factors, such as involvement, suspension of disbelief, and trait absorption will also influence users' hypotheses confirmation proceeding to spatial presence.

In sum, as the theoretical foundation of the current study, the Two Level Process Model of Spatial Presence suggested to explore factors that can influence spatial presence through people's mental models, which lead the study to consider personal experience as a new possible factor that may be influential in the process of forming spatial presence.

2.3. Personal Experience in Previous Literature

Experience or personal experience has typically been treated as a primitive concept. According to Webster's Dictionary and information retrieved from Wikipedia, nominally, experience (or personal experience) can be defined as (people's) knowledge or skills about an object, process or event gained from observation or direct participation in the object, process, or event. In previous research, personal experience has been divided into two different categories, direct experience and indirect experience (Fazio, Zanna, & Cooper, 1978; Fazio & Zanna, 1981; Millar & Millar, 1996; Millar & Millar,

1998). Generally, the notion that direct experience is better than indirect experience has been supported by empirical evidence (Fazio & Zanna, 1981; Skalski, Tamborini, & Westerman, 2002). More extensively, Millar and Millar (1996) found that direct experience with an attitude object will produce more affective reactions than indirect experience; in contrast, indirect experience with an attitude object will produce more cognitive reactions than direct experience. Furthermore, the authors suggested that the attitude produced by direct experience is more likely to relate with people's consummatory behaviors (i.e., the goal of the behavior is activity involved in performing it, with more focus on intrinsic enjoyment of the activity, such as watching a movie for fun). In the other words, such attitudes have stronger predictive ability to consummatory behaviors than attitudes produced by indirect experience; on the other hand, attitudes produced by indirect experience have more predictive ability in predicting instrumental behaviors (i.e., a behavior performed for accomplishing a goal beyond the activity involved in performing it, with more focus on the attributes of the object as they relate to the goal of the behavior, such as watching video clips for solving puzzles). Based on such research results, another pair of relationships were also supported, which is that attitudes formed through direct experience are more accessible when people are in consummatory situations; in contrast, attitudes formed through indirect experience are more accessible when people are in instrumental situations.

In other scholars' research, personal experience was defined differently. For example, Lee (2004) categorized human experience into three types: real experience, virtual experience, and hallucination, according to the ways of experiencing and objects that are being experienced. In his article, Lee suggested that a human's ways of

experiencing can be divided into sensory experiencing and nonsensory experiencing. The objects that are being experienced by a human can be divided into actual objects (objects existing in real world), imaginary objects, and virtual objects (which can be further divided into para-authentic, which refers to virtual objects that have counterpart in real world, such as Quicken Loan Arena in the *NBA 2K10* video game; and artificial, meaning virtual objects that only exist in virtual world). Based on this typology, he defined people's real experience as sensory experience of actual objects; hallucination refers to people's nonsensory experience of imaginary objects; and virtual experience can be defined as people's sensory or nonsensory experience of para-authentic or artificial objects.

2.4. Explication of Personal Experience

Based on above discussion of human experience, the current explication is constructed on two binary properties of a process of gaining experience, which are directness and context. Each property has two values; specifically, values of directness are direct and indirect, and values of context are real and virtual. A combination of values of each property will form a type of prior experience (e.g., direct-real); hence, four types of prior experience can be formed. Before getting into defining specific types of experience, it is necessary to discuss the definitions of properties and values. As for the property of directness, the term refers to ways of people interacting with an object, event, or process. Direct means that people personally interact with an object without any intermediaries; in contrast, indirect means that people non-personally interact with an object without actually touching on the object. In regard to the property of context, the term refers to contexts that provide an object, event or process for people to interact with.

It does not overlap with directness, and the term can be differentiated by real and virtual. Real means that objects, events or processes people interact with occur in a real world, and virtual means that objects, events or processes people interact with occur in a virtual environment. Although some objects can be found in either a real world or virtual environment (e.g., basketball games), in the current study, the context is determined by the occurrence of objects in specific situations.

Consequently, four types of experience can be formed (see Table 1). 1) Direct real experience, which refers to people's knowledge or skills that are gained through actively and personally being involved in an event, process or object in the real world (e.g., playing basketball); 2) indirect real experience, which refers to people passively gaining knowledge or skills about an object, event, or process occurring in the real world (e.g., watching a basketball game by sitting beside the court); 3) direct virtual experience, which refers to experience gained through personally interacting with an object, event, or process provided by a virtual environment (e.g., playing basketball video games), and 4) indirect virtual experience, which refers to people passively gaining knowledge or skills about an object, event, or process provided by a virtual environment (e.g., watching other people playing a basketball video game, or watching basketball games on TV).

Table 1. Types of Personal Prior Experience

		Context	
		Real	Virtual
Directness	Direct	**- Direct-Real** - Personally interacting with an objects occurred in the real word - Example: Playing basketball	**- Direct-Virtual** - Personally interacting with an object occurred in a virtual environment - Example: Playing a basketball video game
	Indirect	**- Indirect-Real** - Passively experiencing an object in the real world - Example: Watching someone playing basketball	**- Indirect-Virtual** - Passively experiencing an object in a virtual environment - Example: Watching someone playing a basketball video game

2.5. Personal Experience as a User Factor in the Two Level Process Model of Spatial Presence

At the first level of the Wirth et al. Two Level Process Model of Spatial Presence, people will form different spatial situation models (SSM) based on different media and user factors they encounter. A stronger spatial situation model will promote a stronger sensation of spatial presence. According to what discussed above, SSM is a specific type of mental model. A mental model was defined as a dynamic mental representation of a

situation, event or object (van Dijk & Kintsch, 1983). A series of academic studies have supported that mental models can be used to process, organize, and comprehend information (Radvansky, Zwann, Federico, & Franklin, 1998), make judgements (Wyer & Radvansky, 1999), make predictions and inferences (Magliano, Dijkstra, & Zwann, 1996), and describe and explain how a system operates (Rickheit & Sichelschmidt, 1999).

In contrast to general studies on mental models, studies on SSMs are still insufficient and focused mostly on situation models constructed in text comprehension. Similar to studies on mental models, situation models are also dynamic and impacted by information processed by readers and readers' prior experience (van Dijk & Kintsch, 1983; Blanc & Tapiero, 2001; Graesser, Singer, & Trabasso, 1994; Johnson-Laird, 1983). Specifically, two perspectives on the process of updating situation models were suggested by scholars. One is the online hypothesis, which considered that newly processed information is integrated into the situation model being constructed (Glenberg & Langston, 1992; Zwann & Radvansky, 1998; Morrow, Bower, & Greenspan, 1989). The other perspective suggested that the updating process is delayed rather than online. People do not update their situation model during the processing of new information, but conduct the updating after they go through all the information (de Vega, 1995).

Although these two perspectives are opposite, the role of people's prior experience in influencing updating processes of situation models is supported by many studies (van Dijk & Kintsch, 1983; Blanc & Tapiero, 2001; Graesser, Singer, & Trabasso, 1994; Johnson-Laird, 1983). Ericsson and Kintsch (1995) proposed that people's prior knowledge will enable readers to have a stronger capacity of working memory through

storing processed information in long-term memory, which will allow readers to efficiently update their situation models online as well as in a delayed way. Blanc and Tapiero (2001) found that readers' prior knowledge determines the time course and the quality of a situation model's updating process; specifically, people can integrate new incoming information to their situation models immediately. However, a high level of prior knowledge of the situation is required by the delayed updating process; furthermore, in terms of quality of the updating process, people with higher levels of specific knowledge are significantly more accurate than those people who have lower or general levels of prior knowledge.

Although studies on updating or construction of situation models primarily focused on verbal comprehension during reading, Dennis and Zimmer (1992) suggested that the mental models can be constructed from a verbal description as well as visual experience. Both kinds of information can generate very similar mental models for a person. Hence, the current study will generalize studies discussed above to a video game context. Specifically, similar with spatial visual imagery ability, in a video game context, people's personal experience may support the construction of a SSM directly. A person who has more personal experience with a topic/action may have a stronger capacity of working memory to keep more related information that is more accessible and comprehensible. This will positively impact the process of constructing and updating the SSM and provide the person with a more accurate and stronger SSM of the topic/action related to the game. For example, a person who often plays football in the real world or plays a football game will have a more accessible specific knowledge of football than those people who do not often play. When the person is playing a game like *Madden*

2009, this knowledge will be more helpful for the individual in building or updating the mental representation of the spatial arrangements portrayed by the game.

Once they have an SSM formed at the first level, people have to promote themselves from the SSM to an experiential state at the second level. According to Wirth et al., people have to determine their positions within a spatial environment through constantly monitoring their spatial surroundings and check for inconsistencies between the outer representation and their internal sensory feedbacks related to their location. Through labeling a mediated environment as PERF, people will get the sensation of spatial presence. The perceptual hypotheses theory suggests that for a strong SSM, people only need to seek a small amount of information to confirm it as PERF. Moreover, as a user factor, personal experience will also contribute to the formation of spatial presence at this level. Wirth et al. suggested that media factors such as realism and interactivity have an impact on forming spatial presence; however, people's evaluations of these factors are not completely objective. Some subjective factors of users may limit their evaluation of the media factors. For example, a very advanced technology may offer a high level of realism and interactivity, but if a media user cannot master the operation of the technology, the technology may only give the user very limited interactivity and realism. When a person who has personal experience with a game that he/she is interacting with or the game related topic, he/she may try to apply his/her mental model of the game or game related topic to the game environment. Such application of a mental model may generate two results. First, if the person's mental model can be applied to the game situation successfully (for example, if the player wins the game or gets rewarded in the game through the application), he/she may find the game more realistic or interactive,

and have a stronger feeling of involvement, which will also lead the user to a higher level of spatial presence. Another possibility is that the application of his/her mental model to the game environment is not successful (for example, a user plays a basketball game according to his/her mental model of a successful strategy in real world basketball, and finds such an application cannot lead him/her to win in the game). In this case, the person may feel the game is less realistic and interactive, which will impair the formation of spatial presence.

Incorporating the above discussion with the definition of personal experience, more can be predicted. Miller and Miller (1996) suggested that in a consummatory situation, people's attitudes formed through direct experience are more accessible, and alternatively, in an instrumental situation, attitudes formed through indirect experience are more accessible. Although the current study is not researching attitudes, the knowledge is still informative and can be extended to the study. Since people consuming video games usually do not have a goal that is beyond succeeding in the game, and the behavior is more focused on intrinsic enjoyment of playing, the present study treats interaction with a video game as a consummatory behavior. Consequently, people's direct experience may be more influential than indirect experience in influencing their game experience. Furthermore, according to a study conducted by Arthur, Hancock, and Chrysler (1997), mental representations constructed from the experience of virtual objects are not significantly different from that of the actual objects. Hence, in a gaming situation, a research question about the effect of virtual experience and real experience in constructing a SSM can be proposed as:

RQ1: Is virtual prior experience or real experience more influential in building SSMs in a game context?

One more research question concerning the unique contribution of each individual type of prior experience to the construction of SSMs can be proposed. To answering such research question is important in understanding the role of prior experience in the process of media interaction from a more specific perspective:

RQ2: Which is the most influential in building SSMs in a game context among four types of prior experience: Direct virtual, direct real, indirect virtual, and indirect real?

Another property of prior experience – directness has not been addressed in either research question. Previous literature has indicated that direct experience is more predictive than indirect experience of people's attitudes in a consummatory situation. Given that playing video games is more about enjoyment and could be considered as a consummatory behavior, one hypothesis about effects of directness of prior experience on building SSMs in a game situation could be proposed:

H1: In game situation, direct experience has a stronger impact on constructing SSMs than indirect experience.

In a text comprehension situation, researchers have shown the significant impact of prior experience and knowledge on building mental representations; specifically, people who have more prior experience and knowledge are more likely to build a stronger mental model of the texts they are reading. The current study generalized the

finding to a game context and expected to find a similar result in such more interactive condition:

H2: People who have more game topic-related prior experience are more likely to build a strong SSM than those people who have less such prior experience.

Wirth et al. (2007) mentioned the importance of consistent spatial cues in building strong SSMs; in more detail, more consistent cues are able to evoke richer and stronger SSMs; in contrast, inconsistent cues can attract user attention, but they are not able to contribute to building strong SSMs (Zwaan & Radvansky, 1998). The literature inspired the current study to consider the role of congruence between prior experience and current game experience in the process of achieving spatial presence; therefore, the study proposed the third hypothesis as:

H3: The higher the level of congruence between people's prior experience and current game experience, the higher level of spatial presence the people will report; alternatively, the higher the level of the incongruence between people's prior experience and current video game experience, the lower level of spatial presence the people will report.

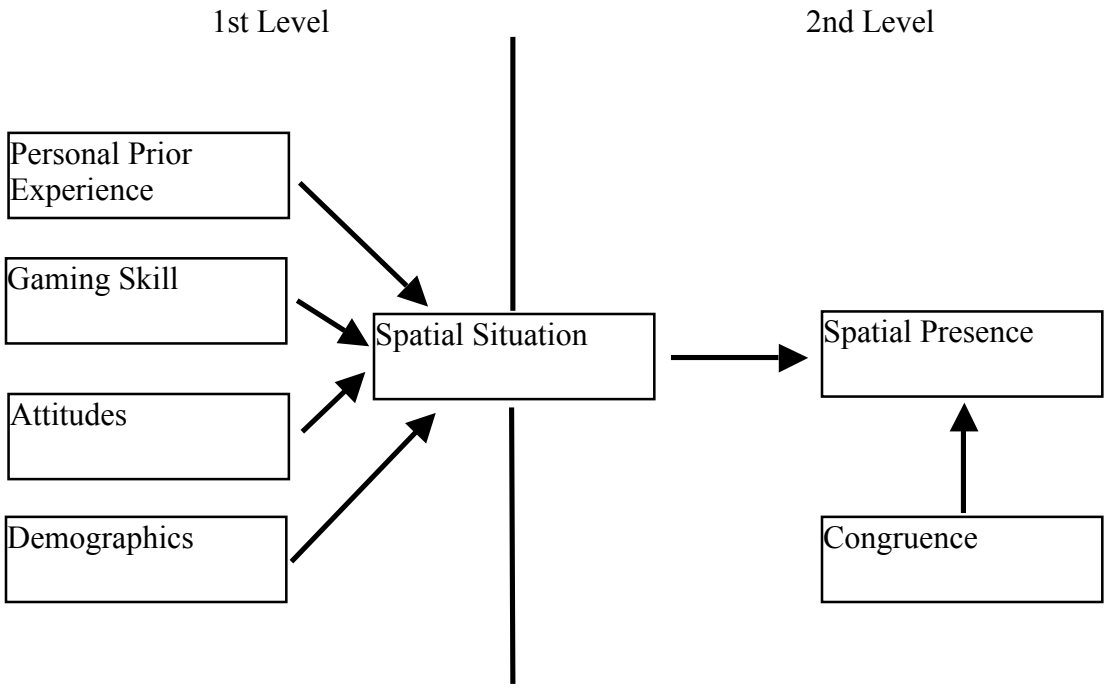
In addition to experience, other variables may affect the construction of SSMs, including attitudes (toward the mediated activity and the medium), skill (at playing video games), and demographics. The role of these variables is addressed in the following research question:

RQ3: How do attitudes, gaming skill, and demographics impact the construction of SSMs, respectively

A model showing expected relationships is shown in Figure 1

Figure 1.

A Model of Relationship between Personal Prior Experience and Spatial Presence



CHAPTER III

METHODS

3.1. Sample and Procedures

To answer and test the research questions and hypotheses, a quasi-experiment was designed and conducted. Specifically, a quasi-experiment is a controlled experiment without random assignment (Kerlinger & Lee, 2000). In this study, people had gained certain prior experience from their daily life, and it is hard to manipulate such prior experience in a short time study; therefore, prior experience types were measured before participants interacted with the experimental stimulus. Although the quasi-experimental design suffers threats to internal validity due to lack of random assignment (Atwater & Babaria, 2001), according to Goldberg (1990), the quasi-experiment is more advanced in minimizing threats to external validity of a study, which allows the study to have larger generalizability. Therefore, it is appropriate to use the quasi-experiment design in this study.

The current study was conducted in a media lab equipped with a high-resolution large screen flat TV and a XBOX 360 game console located in the School of Communication at Cleveland State University. In terms of the video game used in the

study, since basketball is a very popular sport in the United States, and people have different experience with the sport to help the study get fairly evenly distributed condition groups, a basketball game was used. Two mainstream basketball video games, *NBA2K10* and *NBA Live 2010*, were available to be selected for the study. According to the user and critic's ratings retrieved from Gamespot.com, *NBA 2K10* has higher scores on both two ratings, so *NBA 2K10* (ESRB Rating: Everyone) was used in the experiment.

Although recruiting college students as study sample is often criticized for not being representative of the entire population, it seems appropriate in this study. According to the data retrieved from 2009 Essential Facts about the Computer and Video Game Industry reported by ESA (2009), adults (older than 18) are main consumers of video games. 49% of video game players are between 18 to 49 years old, and 25% of game players are younger than 18 years old. Most college students belong to either one of two age groups, and this sample can be considered as a good representation of the population. Therefore, 100 college students from a medium-sized Midwestern university were selected for the experiment. Participation in the study was voluntary, but participants also received extra credit or fulfilled course requirements for participating in the research.

The entire experiment procedure was: the researcher first set up a 10 minute game prior the arrival of a subject. After the subject's arrival at the lab, the subject was asked to finish a pre-test questionnaire measuring related to the independent variables; then, the subject started to play the game on the system by using the default game controller and game settings. All subjects experienced the game in the exactly same condition. After the

subject finished the interaction, he or she was asked to finish another game playing questionnaire to conclude the experimental process.

3.2. Measurement

The entire measurement was divided into two questionnaires, which are "Pre-test Questionnaire" and "Game Playing Experience Questionnaire." Both questionnaires are in Appendix I. The pre-test questionnaire dealt with several concepts: Personal prior experience, attitudes toward the real world activity (basketball) and video games, gaming skill, and subjects' demographics information.

3.2.1. Personal prior experience. This section included 5 questions measuring a subject's types of prior experience with basketball and level of knowledge about the sport. Specifically, "I have a lot of experience playing basketball in the real world" was about measuring direct real experience, "I often play basketball video games" measured direct virtual experience, "I often watch basketball games on TV, the Internet, or other media channels" measured indirect virtual experience, "When I go to a basketball court, I usually watch people playing basketball rather than play it" was used to measure people's indirect real experience, and "In general, I am knowledgeable about basketball" measured people's knowledge of basketball. Subjects were asked to indicate what extent they agreed with these statements on a 1 to 7 Likert scale (1 means strongly agree, and 7 means strongly disagree). These measures were treated as single item indicators.

3.2.2. Attitudes toward basketball and video games. Two items composed this section. One item was designed to measure media users' attitudes toward the mediated activity, playing basketball (e.g., "In general, I like playing basketball."), another item

was used to measure participants'' attitudes toward the medium, video games (e.g., "In general, I like playing video games."). These two statements were also measured by using a 1 to 7 (from strongly agree to strongly disagree) Likert scale.

3.2.3. Gaming skill. In this section, 9 items from Bracken and Skalski (2005) were used to measure a subject's game playing skill. For example, "I have no problem handling the multiple buttons on currently popular game controllers" and "I can easily figure out how to play new games." These 9 items were also measured by using a 1 to 7 (from strongly agree to strongly disagree) Likert scale. The Cronbach's alpha of this 9 items skills scale was .96 indicating high reliability.

3.2.4. Demographics. Subjects were asked to indicate their gender, age, and race in this section. This section didn't include other items that are often used in demographics measurement, to reduce subjects' physical fatigue when answering questionnaires.

On the second questionnaire, subjects were asked to finish questions regarding their gaming experience; specifically, these measurements were of SSM, sense of spatial presence, congruence, and attention.

3.2.5. SSM. Six items retrieved from MEC Scale (Vorederer et al., 2004) were used to measure subjects' spatial situation models. Items like "I was able to imagine the arrangement of the spaces presented in the video game very well" and "I was able to make a good estimate of the size of the presented space" were listed and measured on a 1 through 5 (from strongly disagree to strongly agree) Likert scale. A good reliability of this 6 items scale was indicated by the Cronbach's alpha of .92.

3.2.6. Spatial presence. This section measures subjects' level of spatial presence during playing the game. Based on the MEC scale, 8 items composed this section and were measured on a similar 1 to 5 Likert scale. For example, "I felt I was like actually there in the environment of the video game" and "It seemed as though I actually took part in action of the video game." The reliability check of this 8 items scale got the Crobach's alpha of .90 indicating a high reliability.

3.2.7. Congruence. 3 items were included in this section to measure subjects' feeling of congruence between the current gaming experience and their prior experience. Specifically, these items were used to examine whether players can successfully apply their mental models gained from their prior experience to certain game environments and achieve consistent corresponding results. Items like "The game is consistent with my understanding of basketball" and "I felt that I could successfully apply my previous knowledge about the basketball or other basketball video games to this video game" were listed to compose the scale. The scale was developed by the researcher, and the Cronbach's alpha of this 3 items consistency scale is .74 indicating an acceptable reliability.

A total of 40 questions were included in the questionnaire. In the experiment, the participant's personal prior experience, gaming skill, and demographics were measured as independent variables, and the SSM, spatial presence, and congruence were measured as dependent variables. All scale reliabilities are shown in Table 2.

Table 2. Scale Reliabilities

Scales	Number of Items	Cronbach's alpha
Gaming Skill	9	.96
SSM	6	.92
Spatial Presence	8	.90
Congruence	3	.74

CHAPTER IV

RESULTS

After continuously measuring these variables, all the data collected from the experiment were input into SPSS for data analysis. Because all independent and dependent variables are measured continuously, bivariate correlation and hierarchical multiple regression analyses were used to analyze the data and test the hypotheses.

4.1. Sample Description

According to the demographic data collected from the experiment, among a total of 100 subjects who have participated in the study, 46% (*n=46*) were male, and 54% were female (*n=54*). Subjects' ages were in a range of 18 to 48, with a mean of 24 years old. In terms of race, 65% of subjects were white (*n=65*), 26% were African American (*n= 26*), and 2% were Asian (*n=2*). Hispanic and Pacific Islander were 1% for each (*n= 1* for each), and other races were 5% (*n= 5*). More descriptive statistics about all variables can be found in Appendix II.

The results also indicated that 38% of subjects (*n= 38*) have a lot of experience of playing basketball in real world (*M= 2.89, SD= 1.50*), and 19% of subjects (*n= 19*)

reported that they often play video games on basketball topic (*M= 2.04, SD= 1.33*). On the other hand, a majority of participants (63%) indicated that they often watch basketball games on TV, the Internet, or other media channels (*M= 3.70, SD= 1.47*), and 36% of participants would like to watch others playing basketball rather than participate in real world basketball games (*M= 2.95, SD= 1.37*). In general, most subjects (67%) considered themselves as knowledgeable about basketball (*M= 3.71, SD= 1.20*), and have positive attitudes toward playing basketball (55% with *M= 3.37, SD= 1.50*) as well as toward playing video games (55% with *M= 3.58, SD= 1.29*).

Regarding gaming skill, only 23% of subjects indicated that they were skillful game players and able to handle a new game in a short time; in contrast, 47% of participants did not consider themselves as skillful players (*M= 34.69, SD= 14.25*).

Furthermore, considering SSMs, over half of subjects (53%) reported that they had concrete SSMs of the game presentation and were able to imagine spatial environments presented in the game (*M= 22.76, SD= 5.38*). For another important factor, congruence, the result indicated that 44% of participants were able to successfully apply their mental models to the game context. This achieved results that are consistent with their estimations based on prior experience and knowledge (*M= 10.40, SD= 3.14*). In terms of spatial presence, 37% of subjects reported that they experienced a high level of spatial presence when playing the video game (*M= 28.55, SD= 6.86*).

4.2. Research Question 1

There are many literatures addressing the impact of real and virtual experience on people's attitudes and behaviors; however, it is hard to find support for the influence of

these two kinds of experience on construction of SSMs. Hence, the first research question asked which one is more influential in building SSMs, comparing virtual prior experience and real prior experience. A multiple regression with the virtual and real experience variables was conducted to examine the contribution of each factor in constructing SSMs.

The result indicated that both types of experience made a contribution to the construction of SSMs. Specifically, according to Pearson product-moment correlations between each type of experience and the SSM, both people's virtual ($r = .24, p = .007$) and real ($r = .23, p = .010$) experience were positively related to the construction of SSMs. A significant regression model was also found, with an R Square of .086 ($F_{(2, 97)} = 4.55, p = .013$); 8.6% of variance of the SSM can be explained by people's prior virtual and real experience, and these two types of experience significantly contribute to the construction of SSMs.

Regarding the contribution of each type of experience, neither one was found to have a significant unique contribution to the SSM. However, based on Beta coefficients of these two factors, people's virtual experience had an almost significant unique contribution to the construction of SSMs ($\beta = .19, p = .07$), which is larger than the unique contribution of real experience to the SSM ($\beta = .17, p = .10$). Regarding the first research question, although virtual and real prior experience do not have a unique impact on the SSM, the result suggests that they significantly contribute to the SSM combined, and that they make a fairly equal contribution individually.

Table 3.

Multiple Regression Predicting the SSM from Context of Personal Prior Experience

Block #	Variable	r	Final β	R^2	F
1	Real	.23*	0.17	0.07	4.55*
	Virtual	.24*	0.19		

Adjusted R^2 = .07

* denotes p< .01.

4.3. Research Question 2

Since an SSM plays an important role in the process of generating a sense of spatial presence, the second research question focused on the impacts of the four types of experience on building the SSM. Specifically, the research question asked among four types of experience (direct virtual, direct real, indirect virtual, and indirect real), which one is the most influential in building the SSM.

By using a multiple regression model, the study found that these 4 types of experience significantly contribute to the construction of SSMs ($R^2 = .15; F_{(4, 95)} = 4.20, p = .004$). Specifically, 15% of variance of SSMs can be explained by these 4 types of experience together, and people who have more these types of prior experience are more likely to have a stronger SSM when they playing the game. Pearson product-moment correlations results also indicated that among 4 types of experience, two of them

significantly correlated with the SSM. People's direct real ($r = .37, p = .00$) and direct virtual ($r = .26, p = .00$) basketball experience were found to have positive correlations with the construction of SSMs; in other words, the more the people have direct real prior experience (e.g., playing basketball in the real world) and direct virtual prior experience (e.g., playing basketball video games), the stronger the SSM they will get when they playing video games. Besides those two significant correlations, people's prior indirect virtual (e.g., watching basketball games on media channels) experience was found to have a nearly significant correlation with the SSM ($r = .16, p = .06$). Interestingly, the last type of experience, indirect real experience was negatively correlated with the SSM ($r = -.14, p = .08$). Although the correlation is not statistically significant, it still demonstrated something that the study did not expect.

To answer the second research question, Beta coefficients of each type of experience have to be reviewed. According to the results, only one out of four types of experience has significant contribution to the SSM. With a Beta coefficient of .33 ($p = .01$), people's direct real experience explains the most amount of variance of SSM among all 4 types of prior experience. Less than the direct real experience, the direct virtual experience is the second most influential (though non-significant) factor to the SSM ($\beta = .14, p = .20$). Finally, people's indirect virtual experience ($\beta = -.04, p = .73$) is more influential than indirect real experience ($\beta = .00, p = .98$) to the SSM though both of them do not have significant unique contribution. In sum, based on the results, the order of contributions of each type of experience to the construction of SSMs is: Direct real > Direct virtual > Indirect virtual > Indirect real.

Table 4.

Multiple Regression Predicting the SSM from Types of Personal Prior Experience

Block #	Variable	r	Final β	R^2	F
1	Direct Real	0.37**	0.33*	0.15	4.20*
	Direct Virtual	0.26*	0.14		
	Indirect Virtual	0.16	-0.04		
	Indirect Real	-0.14	0.00		

Adjusted R^2 = .12

* denotes p< .01; ** denotes p< .001

4.4. Hypothesis 1

The first hypothesis posited that direct experience has a stronger impact on constructing SSMs than indirect experience during video game play. To test the hypothesis, a similar multiple regression model was conducted.

This time, only direct experience was found to have a significant positive correlation (*r = .38, p = .00*) with the construction of SSMs; on the other hand, people's indirect experience only shared a very small amount of variance with the SSM. However, the regression model was found to be significant. Specifically, with an R Square of .14 ($F_{(2, 97)} = 8.14, p = .00$), the direct experience and indirect experience together explain 14.4% of variance of the SSM.

Moreover, the results indicated that people's direct experience has a significant unique contribution (*ß = .38, p = .00*) to the construction of SSMs, while indirect experience does not (*ß = - .04, p = .65*). Therefore, direct experience has a stronger impact on constructing SSMs than indirect experience, in support of hypothesis 1.

Table 5.

Multiple Regression Predicting the SSM from Directness of Personal Prior Experience

Block #	Variable	r	Final *ß*	R^2	F
1	Direct	.378**	.38**	0.14	8.14*
	Indirect	0.02	-0.04		

Adjusted R^2 = .13

* denotes p< .01; ** denotes p< .001

4.5. Hypothesis 2 and Research Question 3

The second hypothesis proposed a positive relationship between people's game topic-related prior experience and the SSM; in other words, the more game topic-related prior experience and knowledge people have, the stronger SSMs they will get. Independent variables including prior experience and knowledge, attitudes, gaming skill, age, and gender were input into a hierarchical regression model, with SSM as the dependent variable; in more detail, prior experience and knowledge was entered as the first block,

followed by attitudes toward basketball and video games as the second block, and gaming skill and gender were entered in the model as the third and fourth blocks.

Reviewing Pearson product-moment coefficients among all entered variables, most of them significantly correlate with the SSM, including knowledge ($r = .28, p = .00$), gaming skill ($r = .46, p = .00$), gender ($r = .17, p = .05$), and attitudes toward basketball ($r = .39, p = .00$) and video games ($r = .33, p = .00$). On the other hand, as Table 6 shows, only gaming skill was found to have significant unique contribution to the construction of SSMs ($\beta = .50, p = .00$). The other variables, such as knowledge and prior experience, did not have statistically significant unique contributions to the SSM.

However, this is not to say that there is not support for the proposed hypothesis. As shown in the entire regression model results, the knowledge and experience block was found significant in predicting the SSM. Specifically, a positive relationship between people's prior experience and the SSM ($R = .41$) was supported. A R Square Change of .17 ($F_{(5, 93)} = 3.71, p = .00$) indicated that 16.6% of variance of the SSM can be explained by people's game topic-related prior experience; that is to say, people who have more prior experience and knowledge about a certain video game topic are more likely to have a strong SSM when they are playing related games. Moreover, the results also indicated that game playing skill is positively related to the construction of SSMs (R^2 $Change = .061, F_{(1, 90)} = 7.83, p = .01$). In other words, people who have better skill in video games are more likely to build a strong SSM than people who have less skill. One more finding is that people's attitudes were also found to have a significant contribution in predicting the SSM (R^2 $Change = .07, F_{(2, 91)} = 4.18, p = .012$). Although it was not main purpose of this study, this positive relationship suggests that people who have more

positive attitudes toward a game topic and video games are more like to build strong SSMs.

In sum, hypothesis 2 was partially supported by the results, and two more factors, gaming skill and attitudes, were found to have a positive impact on the construction of SSMs.

Table 6.

Multiple Regression Predicting the SSM from Personal Prior Experience, Gaming Skills, and Attitudes

Block #	Variable	r	Final β	R^2 Change	F Change
1	Direct Real	0.38**	0.17		
	Direct Virtual	0.25*	0.02		
	Indirect Virtual	0.16	-0.14	0.17	3.71*
	Indirect Real	-0.13	0.08		
	Knowledge of Basketball	0.28*	0.06		
2	Attitudes toward Basketball	0.39**	0.22	0.07	4.18*
	Attitudes toward Video Games	0.33*	-0.07		
3	Gaming Skill	0.46*	.50*	0.06	7.83*
4	Gender	0.17*	-0.13	0.03	1.76
	Age	0.04	0.17		

R^2 = .32, Adjusted R^2= .25, $F_{(10, 88)}$ = 4.23**

* Denotes p< .01; ** denotes p< .001

4.6. Hypothesis 3

The ultimate purpose of this study is about the sense of spatial presence. The study expects to unveil factors that can impact users achieving spatial presence during

media interactions. Therefore, the last hypothesis proposed a positive relationship between congruence and level of spatial presence. The higher the level of congruence between people's prior experience and current game experience, the higher level of spatial presence the people will report; alternatively, the higher the level of the incongruence between people's prior experience and current video game experience, the lower level of spatial presence the people will report.

Since achieving spatial presence occurs at the second level in the Two Level Process Model of Spatial Presence, the variable congruence as well as the SSM were entered in two blocks in a regression model to predict the dependent variable spatial presence. Based on the results of correlations, both congruence ($r = .42, p = .00$) and SSM ($r = .32, p = .00$) were found to have significantly positive correlations with spatial presence. On the other hand, the Beta coefficients of each variable indicated that congruence has a unique contribution to achieving spatial presence ($\beta = .37, p = .00$); in contrast, SSM was not found to have significant unique contribution to spatial presence, which varied from the study's expectation.

However, considering the whole regression model, the results demonstrated that both congruence and SSM are effective in predicting people's sense of spatial presence. Specifically, with a R Square Change of .10 ($F_{(1, 98)} = 10.93, p = .00$), a positive relationship between the SSM and level of spatial presence was supported by the results; in other words, people with stronger SSMs are more likely to have higher level of spatial presence, which is also consistent with the relationship suggested by Wirth et al. in the Two Level Process Model of Spatial Presence. Furthermore, after controlling for the SSM, congruence was also found significant in predicting spatial presence, with an R

Square Change of .08 ($F_{(1, 97)} = 9.94, p = .00$). Thus, the positive relationship between congruence and spatial presence proposed by the study was supported.

In sum, hypothesis 3 was supported by the results. More congruence resulted in more spatial presence.

Table 7.

Multiple Regression Predicting Spatial Presence from the SSM and Congruence

Block #	Variable	r	Final β	R^2 Change	F Change
1	SSM	.32*	0.08	0.10	10.93*
2	Congruence	.43**	0.37*	0.08	9.94*

$R^2 = .18$, Adjusted $R^2 = .17$, $F_{(2, 97)} = 10.93$**

* denotes $p < .01$; ** denotes $p < .001$

CHAPTER V

DISCUSSION

5.1. Summary of Results

In general, according to the Two Level Process Model of Spatial Presence, the SSM as one type of mental model connects people's media interactions with the psychological sensation of spatial presence. Many factors are involved in this process and can potentially impact the process. This study examined people's prior experience and knowledge as factors that may impact the SSM and sense of spatial presence. The results somewhat supported the influence of experience. Four types of prior experience including direct real experience, direct virtual experience, indirect real experience, and indirect virtual experience were examined individually, and direct real was found to have a significant and unique contribution to building SSMs. Direct experience seems more effective than indirect experience in predicting an SSM, and virtual experience has a comparable contribution to real experience in building an SSM. Only direct experience was found to contribute significantly and uniquely to the construction of SSMs.

Furthermore, the results indicated that gaming skill plays the most important role in forming SSMs when people play video games. Skill explains a significant amount of

variance of the SSM, and has a significant unique contribution (the only significant unique contribution considering all predictor variables together, in fact). A significant positive relationship between people's gaming skill and SSMs was found. Another finding is that people's attitudes toward video games and game topics are positively related to the SSM. The results suggest that people who have more positive attitudes toward video games and certain game topics are more likely to construct stronger SSMs when they play related video games, although this may be dependent on skill. The relationship between skill and attitudes toward games bears further exploration in future research.

Regarding factors that may be influential in the process of promoting SSMs to the sensation of spatial presence, one factor, congruence, was found to have a significant impact in achieving spatial presence. A positive relationship between levels of congruence and levels of spatial presence was supported. The study also corroborated the positive relationship between SSMs and spatial presence, which was proposed by Wirth et al. (2007), although congruence was the only variable to make a unique contribution. In the following section, the implications of these findings will be discussed in detail.

5.2. Prior Experience and SSMs

Due to the importance of the SSM in achieving spatial presence, many researchers have investigated various factors that are potentially essential in the forming SSMs. Therefore, a goal of this study was to examine what media user factors can impact the construction of a SSM. In this study, people's prior experience was proposed to be a critical user factor in the process.

Previous literature has shown that people's prior experience and knowledge can impact the process of building SSMs (van Dijk & Kintsch, 1983; Blanc & Tapiero, 2001; Graesser, Singer, & Trabasso, 1994; Johnson-Laird, 1983). However, most of these studies focused on SSMs formed through reading texts. Due to the common characteristics of mental representations, the current study expected a positive relationship between people's prior experience and SSMs in a game context. The results supported the hypothesis. People who have more game topic-related experience and knowledge are more likely to have stronger SSMs when they are playing related video games. Other factors--gaming skill and attitudes--were also found significant in predicting SSMs; these will be discussed separately.

The results also indicated that prior experience individually does not have a significant unique contribution to the SSM. This is mainly because of the correlations among the four types experience. More specific aspects of prior experience, such as context, directness and each type of experience, were addressed in RQ 1, H 1, and RQ 2 and will now be discussed.

5.2.1. Real experience vs. virtual experience. Not many studies have investigated the impacts of real and virtual experience on people's mental representations. In one of the few investigations, Arthur, Hancock, and Chrysler (2007) did not find any significant difference in how real and virtual experience affected SSMs. Most previous studies focused on less interactive behaviors to measure impacts of real and virtual, however, such as reading texts or maps. Video game play is a more complex, interactive behavior; therefore, the current study addressed the issue of impact of real and

virtual experience on mental models in RQ 1 with an expectation of finding a difference between them in a game context.

According to the results, people's real and virtual experience together explained a significant amount variance of the SSM, which demonstrated that people who have more real and virtual prior experience will be more likely to have strong mental models when they are playing video games related to those experiences. However, regarding the unique contribution of each individual factor, both real and virtual experience did not have significant unique contributions to the construction of an SSM, though the real experience was found to have a larger contribution than the virtual experience. In other words, neither real nor virtual experience individually predicted the SSM.

Although the results of RQ 1 present some contradictions, they are still informative. They suggest that experience is important in constructing SSMs, and that real and virtual experience should be considered together in predictive models. This may be due to a natural relationship between experience types. For example, some people like playing basketball in the real world, which will give them a lot real basketball experience, and these people may also play basketball video games. Although their real and virtual experience together significantly predict their SSMs in game play, it may be difficult to predict SSMs by solely observing either real or virtual experience. Consistent with this argument, the results show a significant correlation between people's real and virtual experience ($r = .32$, $p = .00$), indicating that people who have more real experience tend to have more virtual experience.

The presence of such results is mainly because of the complexity of people's prior experience and difficulty of clearly dividing types of experience. Specifically, it is unlikely for people to have only one type of experience in the current world. People regularly interact with people, media, and other objects in their daily life, giving them a variety of prior experience types. Ideally, this study would have liked to experimentally manipulate experience types to test for relationships more cleanly. It would have been helpful to test the causal relationships in this study by comparing one real experience group, one virtual experience group, etc. But this was unrealistic given that (a) experience types develop over long periods of time, and (b) people develop many types of experiences. Therefore, this study had to rely on a more limited quasi-experimental design.

Although real and virtual experience types were not found to have unique contributions, a (non-significant) difference between them was still indicated by the results. Comparing these two groups, virtual experience contributed more than real experience in predicting the SSM. Assuming a real difference, this gap may be due to the similarities existing between people's virtual experience and playing video games. Due to these similarities, it may be easier for people to transfer their virtual experience to game play, helping them to build strong SSMs. However, this post-hoc thinking should be further tested to see if there is indeed a real difference here.

5.2.2. Direct experience vs. indirect experience. According to Miller and Miller (1996), attitudes produced by direct experience are more accessible in a consummatory situation, and attitudes formed through indirect experience are more accessible in an instrumental situation. Therefore, they suggested that attitudes formed

through direct experience are more predictive than attitudes formed through indirect experience in predicting people's consummatory behaviors; on the other hand, attitudes generated by indirect experience are more effective in predicting instrumental behaviors. Although their study was more about attitudes research, it is still useful in the current study. Since playing video games is more like consummatory behaviors, H1 proposed that the direct experience is more effective than indirect experience in predicting SSMs.

The entire regression model was found significant, which suggested that both people's direct and indirect experience can successfully predict the construction of SSMs. Specifically, people who have more direct experience and indirect experience together are more likely to have stronger SSMs. Examining unique contributions of direct and indirect experience found that the direct experience has a significant unique contribution in explaining and predicting SSMs; in contrast, there was no significant unique contribution found from the indirect experience. The results successfully supported the hypothesis.

In addition to the hypothesis, more interesting findings can be found from the results. Compared to direct experience, indirect experience contributes negatively to the SSM though the contribution is not significant. In other words, people who have more indirect experience tend to have weaker mental models when they are playing video games. Such results do not make any sense at the first glance, but an explanation can be made to provide a better understanding.

As what discussed above, mental models are dynamic, and people can have several different mental models at the same time. On the other hand, if a people spend a

lot time on indirect interaction, it must negatively impact his/her available time to do direct interaction. Therefore, when these people are required to play a video game, they may encounter more distractions when he/she building a gaming SSM due to their lack of direct experience with the video game. For example, when a people who often watch a basketball game are asked to play a basketball game, they may be able to build a strong SSM of the game at the beginning since they have a lot experience of watching basketball game. However, because of unfamiliarity with playing the game, they may need to focus more on building mental representation of the game controller so that they can get a better performance in the game. Such distraction may finally weaken the person's mental representation of the game. Again, this finding needs to be replicated significantly before a firm statement can be made, but there is a least weak evidence suggesting this.

5.2.3. Comparison of four types of prior experience. The current study suggested that prior experience has two properties, which are directness and context. Each property has two values: directness can be divided into direct and indirect, and context can be divided into real and virtual. By combining values of each property, people's prior experience can be divided into four specific types, which are direct real experience, direct virtual experience, indirect real experience, and indirect virtual experience. RQ 1 and H1 have examined these two properties separately. To compare individual impacts of the four types of prior experience on the construction of SSMs was the goal of RQ 2.

The results indicated that four types of prior experience together can significantly predict the SSM. Fifteen percent of the variance in the SSM can be explained by these four kinds of experience. Examining the contribution of four types of experience

individually, the direct real experience was found to have the largest and only significant unique contribution among them. Unique contributions of other three types of experience can be listed from large to small as direct virtual > indirect virtual > indirect real. The result of the direct real prior experience as the most influential in building SSMs among four types of prior experience was also consistent with the two findings reported in previous sections. The important role of direct real experience in constructing an SSM is consistent with core assumptions of presence, particularly the notion that presence is the perception of the virtual as real. It makes intuitive sense that people who have a higher level of direct real experience with a behavior would have a stronger mental model of the behavior, ultimately leading to presence.

5.3. Gaming Skill and SSMs

The current study did not address the role of skill in any hypotheses, but the results indicated that gaming skill is a significant factor in building SSMs. After controlling other variables, 6.1% of variance of the SSM can be explained by gaming skill. Furthermore, with a significant unique contribution of the variable to the SSM, a positive relationship between gaming skill and SSMs was supported by the results. Such results suggest that players' gaming skill level positively influences their SSMs formed through playing a game. Specifically, people who are more skillful are more likely to construct stronger SSMs when they are playing video games.

Some scholars have tested the relationship between player skill and presence, and the current study provided a different perspective to link these two variables based on previous literature. For example, Bracken and Skalski (2005) suggested that other

dimensions of presence may be affected by players' skill level after they found a significant positive relationship between players' skill level and spatial presence experienced while playing a high definition video game. While the current study did not relate skill level directly to people's sense of spatial presence, it connected skill with SSM, suggesting a mediated relationship. Specifically, people with higher skill level will build stronger SSMs, and stronger SSMs will generate higher level of spatial presence.

The result is also consistent with what the Two Level Process Model of Spatial Presence suggested. According to the model, attention plays an important role in building SSMs in the first level. The more attention the players can focus on processing spatial information received from media, the stronger the SSMs they will get at the first level, and finally the higher level the spatial presence they will achieve at the second level. However, for players with lower gaming skill level, they have to distribute more attention on remembering functions of buttons on a controller, and figuring out how to control their characters correctly, which will reduce the amount of attention that can be distributed on processing media information and building SSMs. This would likely give them weaker SSMs. Therefore, the result also suggested that game consoles mapping human behaviors more naturally with less certain skills required should be more effective in heightening players' spatial presence and enjoyment, consistent with recent research (Skalski, Tamborini, Shelton, Buncher, & Lindmark, 2010).

5.4. Congruence and Spatial Presence

According to the Two Level Process Model of Spatial Presence, media users have to consider SSMs of a media environment formed at the first level as Primary Ego

Reference Frame (PERF) so that they can promote to spatial presence at the second level. Several media and user factors, such as involvement and suspension of disbelief, were suggested by Wirth et al. (2007) to play supporting roles in this process. The current study proposed that one more factor – congruence-can also can be influential in the process of achieving spatial presence. Specifically, the more congruence between players' prior experience and current gaming experience, the higher the level of spatial presence people will achieve. In the study, level of congruence is more about applicability of prior experience to the current gaming context; this is to say that if people can apply their prior experience and knowledge to the current game situation to solve certain problems or achieve better performance, it demonstrates higher level of congruence; in contrast, if people find that their prior experience and knowledge are not applicable to the current situation, a lower level of congruence between prior experience and current gaming experience could be considered.

The results indicated that a significant amount of variance of spatial presence can be explained by congruence, and a positive relationship between the level of congruence and level of spatial presence was supported. Given congruence is directly related to spatial presence, the current study also ran an overall regression model to find out how important congruence would be. By putting congruence along with personal experience, SSM, and gaming skill into the regression model to predict spatial presence, the results indicated that congruence (β = .33, p = .01) is the most important factor in the process of forming spatial presence; among all of these variables, only congruence was found to have a significant unique contribution to forming spatial presence.

The supported relationship provides researchers with more connections among previous literatures. As Reeves and Nash (1996) suggested, human automatically respond socially and naturally to mediated presentations because the human brain evolved in a world in which only humans exhibited rich social behaviors. Hence, when people encounter any media environments, they will automatically respond to those environments based on prior experience and knowledge. In other words, people will automatically apply what they have learned from prior experience to similar current situations. Therefore, they will be upset about it and feel less involved if they find that their prior experience and knowledge do not work in an expected manner. If such incongruence occurs in a mediated environment, they are more likely to consider the mediated presentation as fake or unrealistic, which will diminish their sense of spatial presence. For example, if people find that they can make almost every three-point shot in a video game, and get a 80% three-point shot percentage (when the average is closer to 30%-40%), they will probably feel unreal even though they may be winning the game, and the incongruence may weaken their sense of spatial presence. In contrast, even though they are using more mildly immersive media, people still can get higher level of spatial presence if they can feel higher level of congruence. For example, when people watch frightening movies or read novels, characters presenting appropriate behaviors or strategies that are congruent with viewers' prior experience or knowledge in certain dangerous situations may give people a higher sense of spatial presence.

Since people automatically apply their experience and knowledge to certain related mediated situations, people can get feedback and evaluate their level of spatial presence based on the results of this application. However, the effects of congruence may

be different with effects of other factors, such as gaming skill. Congruence is more likely to happen at the second level, which is more directly related to spatial presence; in contrast, gaming skill is more related to people's mental representations. This is to say, people have to be skillful so that they can perform certain behaviors in game environments, but to be skillful only provide people with higher possibility to achieve high level of spatial presence. In the second level, whether getting congruence between prior experience and current gaming experience will influence people's level of spatial presence even though they are skillful in controlling games. Such direct relationship also can be seen in contemporary game design. In addition to pursuing better graphics and sound effects, game designers also focus on improving artificial intelligence (AI) of characters in games so that players can get more congruent responses after they performing certain behaviors in games.

5.5. SSMs and Spatial Presence

Wirth et al. posited a positive relationship between level of SSMs of media environments and sense of spatial presence in their Two Level Process Model of Spatial Presence. They suggested that people who build stronger SSMs at the first level will get higher level of spatial presence at the second level, and vice versa. However, the scholars did not test the assumption in their study. Although the current study did not list the proposed relationship as a hypothesis in the paper, the assumption was tested in the data analysis because of lack of empirical evidence and its importance in connecting other findings of the study.

The results supported the assumption, though no unique contribution was found from SSMs to spatial presence. However, this does not deny the positive relationship between SSMs and spatial presence. In this case, the result not only validates the main frame of the Two Level Process Model of Spatial Presence, but also connected more findings of the study. Specifically, based on the relationship between people's prior experience and SSMs, SSMs indeed play an important role in connecting people's prior experience and spatial presence in a game context. On the other hand, through this dimension, people's skill also can be indirectly related to the sense of spatial presence. Hence, it is rational to add prior experience and skill into the model as two user factors that are effective at the first level.

In sum, several new linkages could be added into the Two Level Process Model of Spatial Presence. Specifically, more prior experience and knowledge will heighten SSM levels, and finally lead players to higher levels of spatial presence. Gaming skill is a strong moderator that will enhance SSMs when gamers play, which will also strengthen their sense of spatial presence. At the second level, congruence between prior experience and current gaming experience was found to be a strong predictor in the process of promoting to spatial presence; a significant positive relationship between congruence and level of spatial presence was detected.

5.6. Limitations

As in almost all research, there were several limitations associated with this study. Specifically, these limitations concerned the sample, the measurement, and the experimental design.

First of all, the study recruited college students as samples of the study, which may constrain the generalizability of the results due to the potential problem of representing the whole population by using college students. As discussed above, although college students are well within the age group of majority of game players, they still do not represent the whole game population. For example, according to ESA's latest 2010 Essential Facts about the Computer and Video Game Industry, 49% of game players are in age group of 18 to 49 years old, which is a very broad range, and there are also 26% of players are above age 50. Comparing to the fact, college students gather in a younger age group. In this data, almost 75% of the sample is below age 25, which may impair the generalizability of the results. Furthermore, since this study was conducted at a campus in a relatively dense urban community, students are closer and have more opportunities to access various information and knowledge about video games and sports events from their peers as well as regular media channels, which all may affect them. In other words, students may be more informed on video games and sports than average people who are not on campus. Recruiting subjects from a broader community would help overcome this limitation.

Second, refining the definition of prior experience used in the current study is still necessary. In previous research, people's experience was usually treated as a primitive concept, and hardly any scholars defined it. The current study tried to explicate the concept and divide it into four different groups; however, the current definition is still not perfect. Due to the characteristics of experience, it is hard to completely and clearly divide people's prior experience into groups. Correlations existing among groups confounded the definitions and generated certain problems in measurement. For example,

there are some confusions existing between indirect and virtual experience. People may feel more comfortable to consider virtual experience is equal to indirect experience, or consider virtual experience as one type of indirect experience. Better and clearer definitions may allow the study to have more accurate measurement as well as predictability.

Third, the current study used a quasi experimental design to examine hypotheses and research questions. Because of the difficulty of manipulating people's prior experience, this study considered the concept as naturally formed groups, and used a non-experimental design. However, just as what discussed above, one deficiency of such design is lack of random assignment and control, which threatens the study's internal validity and introduces inaccuracy to the results due to potential existence of confounding variables. Lack of manipulation in an experimental process makes it harder to test expected causal relationships. To use a better experimental design, for example, researchers could add a training session to manipulate subjects' levels of knowledge and experience about certain game topic before letting subjects to play video games. Although such design is more complicated in operation, it should be more reliable to build a casual relationship with less confounds.

Fourth, the video game selected for the experiment may have been difficult for some participants to control. This study used a sports video game, *NBA 2K10*, rated as the most popular basketball game in the market. However, in terms of controlling the game, it requires various combinations of buttons to perform various movements and strategies, which are very important in real world basketball. The complexity of controlling the game may have discouraged players and prevented them from advanced game play,

lowering their sense of spatial presence. Since the primary purpose of the study was to test relationships among prior experience, SSMs, and spatial presence, using a video game that is easier to control may be more effective in future research.

Fifth, the reliabilities of some scales used in the study were not as high as desired. Specifically, the scale used in the study to measure level of congruence between prior experience and current gaming experience was developed by the researcher, which could be improved in the future study. The scale was composed by three items, with a Cronbach's alpha value of .743, which indicated only an acceptable reliability. Adding more items that can measure the concept more accurately could improve the reliability of the scale.

5.7. Future Research

Based on the Two Level Process Model of Spatial Presence, the current study added a new component, personal prior experience, into the model, which makes the model more effective in explaining media users' sense of spatial presence. It also found gaming skill to be a strong influence in building an SSM at the first level, and congruence as an effective predictor at the second level, leading to spatial presence. However, the complicated Wirth et al. spatial presence model still relatively new, and more studies are necessary to shed light on this concept in the future.

First, as the results indicated, the model that was used in this study was shown to be effective in providing theoretical support to spatial presence research; however, some assumptions proposed by the model still have not been tested in this system. To be more specific, the model proposed a series of media and user factors, such as people's interests,

spatial visual imagery ability, and media content, that can influence media users' attention allocation, and finally impact the process of constructing SSM at the first level; on the other hand, at the second level, with a constructed SSM, media users have to consider the SSM as PERF so that they can finally achieve sense of spatial presence. Some other factors such as involvement and suspension of disbelief will also impact the process. By connecting these concepts with spatial presence, the model will be able to provide a comprehensive and applicable system to explain sense of spatial presence. Indeed, some of these relationships have been supported in previous literature. For example, media factors like image size has been found having impacts on media users' media responses like attention allocation, and sense of presence (Reeves, Detenber, & Steuer, 1993; Prothero & Hoffman, 1995; Lombard et al., 2000); Motion has also been suggested as a media factor that can attract more media users' attention by Reeves and Nass (1996). However, there is no study that has integrated these factors together and tested them as a whole system. It is necessary to connect various factors with each other in a general model, and examine the model systematically to get more explanation.

On the other hand, to explore new factors and potential relationships, and add them into the current model is also an important step in future research. For instance, people's strong attitudes toward certain media content or form could be considered as a factor that may influence the construction of SSMs and spatial presence.

Second, examining spatial presence from a different perspective is also inspiring and helpful. As what discussed above, presence is a psychological state elicited by overlooking mediation through certain media technology (International Society for Presence Research, 2000). Specifically, to get a sense of presence, media users have to

perceive mediated environment as transparent or fail to perceive media, and advanced media technology are essential components to realize the effect. Therefore, it is no doubt that presence can be considered as a kind of media effects. Spatial presence, as a type of presence, is more related to media users' feeling of "being in the mediated environment." Given to the role of media technology played in the process of forming spatial presence, to explain the media effects from a technological perspective is also suitable.

From this perspective, the MAIN model (Sundar, 2009), a theoretical framework based on cognitive heuristics for digital information processing, is applicable, and may be productive. Different than traditional media technology studies using a user-centered or object centered approach, the MAIN model employs a variable-centered approach, which investigates media technology through specific variables embodied by media (Nass & Mason, 1990). The model identified four general variables: modality, agency, interactivity, and navigability. According to the model, these four variables, or affordances offered by media technology, provide media users certain capability or possibility to accomplish certain actions, such as retrieving information, exchanging opinions, or attaining enjoyment. Due to people's different perceptions, the same affordance on an identical medium can be perceived differently by different people. Therefore, varied cues will be perceived by people, which will trigger diverse heuristics that can lead to certain ways of interactions between people and media and various media effects. The model has been used in many studies examining various media effects, such as assessing credibility of websites (Sundar, 2008), and will be effective in predicting the psychological media effects - spatial presence.

To be more specific, all four affordances could induce heuristics that can cause different types of presence. For example, modality affordance can cue realism and being-there heuristics so that people can achieve sense of spatial presence; agency is more likely to cue control and identity heuristic, which will be effective in generating social presence. Interactivity and navigability are also able to cue a flow heuristic and play heuristic respectively to give media users a feeling of being in the environment (Sundar, Oeldorf-Hirsch, & Garga, 2008).

In addition to these possible heuristics that could be induced by these affordances, the model could also be used to explain the current study, and generate more possible assumptions. When people are in virtual environments provided by video games, because of different prior experience and knowledge about the game situation, the same affordance could be viewed differently. For those players who have more experience, the navigability affordance, for example, may cue a stronger browsing heuristic and lead players to a higher sense of spatial presence; in contrast, for people who have less experience, they may only see limited browsing possibilities provided by the navigability affordance, which may lower their sense of spatial presence. On the other hand, more potential studies could be derived from the perspective. For example, valence of people's prior experience could be an effective factor in the process of cueing heuristics. People who have more positive experience with certain object or activity (e.g., watching threatening movies), when they encounter related media content or interact with related media (e.g., watching a threatening movie in a 3D theater), affordances of media (e.g., rich modality) may cue heuristics that can lead people to enjoyment, realism and feeling of spatial presence; on the other hand, if people had negative experience with some

objects or events (e.g., car accident), and when they are interacting with certain media or related media content (e.g., playing racing video games), the same affordance of media (e.g., modality) may be more likely to cue heuristics that will make them feel uncomfortable and prevent them from playing, which will make it harder for these users to achieve sense of presence.

Third, the limitation of using college students as experimental sample has been discussed in previous sections. Due to using such sample may induce deficiency of representation of the whole population, future research could replicate the study by selecting samples from varied groups. Moreover, in future research, clearer and more concise definition of prior experience should be developed. For example, as what mentioned above, researchers can define the concept from its valence, and divide it into different groups based on this perspective. One advantage of defining the concept by its valence might be that researchers are more flexible in manipulating independent variables and designing the experiment.

Last but not least, several relationships have been supported by the current study, and to apply these findings to the media industry or people's daily life is also an important part of future study. For example, the positive relationship between level of gaming skill and construction of SSMs indicated the necessity of game systems with lower skill requirement, such as controllers that are mapping human behaviors more naturally. Moreover, the positive relationship between congruence and sense of spatial experience indicated the importance of consistence between video games and real life. Therefore, game companies should not only focus on improving factors like game

graphics and sounds, but also the logic of gaming plots, and interactions between characters and players.

REFERENCES

Apter, M. J. (1992). *The dangerous edge: The psychology of excitement*. New York: Free Press.

Arthur, E. J., Hancock, P. A., and Chrysler, S. T. (1997). The perception of spatial layout in real and virtual worlds. *Ergonomics*, *40*(1), 69-77.

Atwater, L., & Babaria, K. (2001). *Controlled experiments*. Retrieved from http://otal.umd.edu/hci-rm/cntlexp.html

Barfield, W., & Weghorst, S. (1993). The sense of presence within virtual environments: A conceptual framework. In G. Salvendy & M. J. Smith (Eds.), *Human-computer interaction: Software and hardware interfaces* (pp. 699–704). Amsterdam: Elsevier.

Biocca, F. (1997). The cyborg's dilemma: Progressive embodiment in virtual environments. *Journal of Computer Mediated Communication, 3*(2).

Blanc, N., & Tapiero, I. (2001). Updating spatial situation models: Effects of prior knowledge and task demands. *Discourse Processes*, *31*(3), 241-262.

Bracken, C. C., & Lombard, M. (2004). Social presence and children: Praise, intrinsic motivation, and learning with computers. *Journal of Communication, 54*(1), 22-37.

Bracken, C. C., & Skalski, P. (2005). Presence reactions to video games: The impact of image quality and skill level. *Conference Papers -- International Communication Association, 1-17*.

Denis, M., & Zimmer, H.D. (1992). Analog properties of cognitive maps constructed from verbal descriptions. *Psychological Research, 54*, 286–298.

de Vega, M. (1995). Backward updating of mental models during continuous reading narratives. *Journal of Experimental Psychology: Learning, Memory and Cognition, 21*(2), 373–385.

Entertainment Software Association. (2009). *2009 essential facts about the computer and video game industry*. Retrieved from http://www.theesa.com/facts/pdfs/ESA_EF_2009.pdf

Entertainment Software Association. (2008). *Sales and genre data*. Retrieved from http://www.theesa.com/facts/salesandgenre.asp.

Ericsson, K. A., & Kintsch, W. (1995). Long-term working memory. *Psychological Review, 102*, 211–245.

Fazio, R. H., & Zanna, M. P. (1981). Direct experience and attitude-behavior consistency. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 14, pp. 161–202). New York: Academic Press.

Fazio, R. H., Zanna, M. P., & Cooper, J. (1978). Direct experience and attitude-behavior

consistency: An information processing analysis. *Personality and Social Psychology Bulletin,* 4, 48–52.

Glenberg, A. M., & Langston, W. E. (1992). Comprehension of illustrated text: Pictures help to build mental models. *Journal of Memory and Language, 31*, 129–151.

Goldberg, M. E. (1990). A quasi-experiment assessing the effectiveness of TV advertising directed to children. *Journal of Marketing Research, 27*(4), 445-454.

Graesser, A. C., Singer, M., & Trabasso, T. (1994). Constructing inferences during narrative text comprehension. *Psychological Review, 101*(3), 371–395.

Heeter, C. (1992). Being there: The subjective experience of presence. *Presence: Teleoperators and Virtual Environments, 1*(2), 262-271.

Held, R. M., & Durlach, N. I. (1992). Telepresence. *Presence: Teleoperators and Virtual Environments, 1*(1), 109–112.

Hoffman, H. G., Prothero, J., Wells, M., & Groen, J. (1998). Virtual chess: The role of meaning in the sensation of presence. *International Journal of Human-Computer Interaction, 10*, 251–263.

Ijsselsteijn, W. A., de Ridder, H., Freeman, J., & Avons,. S. E. (2000). Presence: Concept, determinants, and measurement. *Proceedings of the SPIE, Human Vision and Electronic Imaging V*, 3959-3976.

International Society for Presence Research. (2000). *The Concept of Presence: Explication Statement.* Retrieved from http://ispr.info/

Johnson-Laird, P. N. (1983). *Mental models*. Cambridge, MA: Harvard University Press.

Kerlinger, F. N. & Lee, H. B. (2000). *Foundations of Behavioral Research, Fourth Edition*. New York: Harcourt College Publishers.

Kim, T. (1996). *Effects of presence on memory and persuasion*. Unpublished doctoral dissertation, University of North Carolina, Chapel Hill.

Kim, T., & Biocca, F. (1997). Telepresence via television: Two dimensions of telepresence may have different connections to memory and persuasion. *Journal of Computer-Mediated-Communication, 3*(2). Available at http://jcmc.indiana.edu/vol3/issue2/kim.html

Lee, K. W. (2004). Presence, explicated. *Communication Theory, 14*(1), 27-50.

Lee, K. W. (2004). Why presence occurs: Evolutionary psychology, media equation, and presence. *Presence: Teleoperators & Virtual Environments*, *13*(4), 494-505.

Lee, K. M., & Nass, C. (2001). Social presence of social actors: Creating social presence with machine-generated voices. *Presence 2001: 4th Annual International Workshop.*

Lilli, W. & Frey, D. (1993). The hypotheses theory of social perception. In D. Frey & M. Irle (Eds.), *Theories of social psychology, Vol. 1: Cognitive theories* (pp. 49–78). Bern: Huber.

Lombard, M. & Ditton, T. (1997). At the heart of it all: the concept of presence. *Journal of Computer-Mediated Communication, 3*(2).

Lombard, M., Reich, R., Grabe, M. E., Bracken, C. & Ditton, T. (2000). Presence and television:The role of screen size. *Human Communication Research, 26*(1), 75–98.

Magliano, J. P., Dijkstra, K., & Zwann, R. A. (1996). Generating predictive inferences while viewing a movie. *Discourse Processes, 22*, 199-224.

McNamara, T. P. (1986). Mental representations of spatial relations. *Cognitive Psychology*, *18*, 87–121.

Millar, M. M. & Millar, K. U. (1998). The effects of prior experience and thought on the attitude-behavior relation. *Social Behavior and Personality, 26*(2), 105-114.

Millar, M. M. & Millar, K. U. (1996). The effects of direct and indirect experience on affective and cognitive responses and the attitude-behavior relation. *Journal of Experimental Social Psychology, 32*(6), 561-579.

Morrow, D. G., Bower, G. H., & Greenspan, S. L. (1989). Updating situation models during narrative comprehension. *Journal of Memory and Language, 28*, 292–312.

Nass, C., & Mason, L. (1990). On the study of technology and task: A variable-based approach. In J. Fulk & C. Steinfield (Eds.), *Organizations and communication technology* (pp. 46-67). Newbury Park, CA: Sage.

Pettey, G., Bracken, C. C., Rubenking, B., Buncher, M., & Gress, E. (2010). Telepresence, soundscapes, and technological expectation: Putting the observer into the equation. Virtual Reality, 14, 15-25.

Prothero, J. D., & Hoffman, H. G. (1995). Widening the field-of-view increases the sense of presence in immersive virtual environments. *Human Interface Technology Laboratory Technical Report TR-95-2*.

Radvansky, G. A., Zwann, R. A., Federico, T., & Franklin, N. (1998). Retrieval from temporally organized situation models. *Journal of Experimental Psychology: Learning, Memory and Cognition, 24*, 1224-1237.

Reeves, B., Detenber, B., & Steuer, J. (1993). New televisions: The effects of big pictures and big sound on viewer responses to the screen. *Conference Papers – International Communication Association*.

Reeves, B. & Nass, C. (1996). *The media equation: how people treat computers, televisions, and new media like real people and places*. New York: Cambridge University Press.

Rickheit, G., & Sichelschmidt, L. (1999). Mental Models: Some answers, some questions, some suggestions. In G. Richheit and C. Habel (Eds.), *Mental models in discourse processing and reasoning* (pp. 9-40). New York: Elsevier.

Skalski, P., Tamborini, R., Shelton, A., Buncher, M., & Lindmark, P. (in press). Mapping the road to fun: Natural video game controllers, presence, and game enjoyment. Accepted for publication in *New Media & Society.*

Skalski, P., Tamborini, R., & Westerman, D. (2002). Script development through virtual worlds. *Conference Papers -- National Communication Association*.

Steuer, J. (1992). Defining virtual reality: Dimensions determining telepresence. *Journal of Communication, 42*(4), 73-93.

Sundar, S. S. (2009). Media effects 2.0: Social and psychological effects of communication technologies. In R. L. Nabi & M. B. Oliver (Eds.), *The SAGE handbook of media processes and effects* (pp. 545-560). Thousand Oaks, CA: Sage Publications.

Sundar, S. S. (2008). The MAIN model: A heuristic approach to understanding technology effects on credibility. In M. J. Metzger & A. J. Flanagin (Eds.), *Digital media, youth, and credibility* (pp. 72-100). Cambridge, MA: The MIT Press.

Sundar, S. S., Oeldorf-Hirsch, A., & Garga, A. (2008). A cognitive-heuristics approach to understanding presence in virtual environments. In A. Spagnolli and L. Gamberini (Eds.), *PRESENCE 2008: Proceedings of the 11th Annual International Workshop*

on Presence (pp. 219-228). Padova, Italy: CLEUP Cooperativa Libraria Universitaria Padova.

Tamborini, R. (2000). The experience of telepresence in violent video games. *Conference Papers -- National Communication Association.*

Tamborini, R., & Skalski, P. (2006). The role of presence in the experience of electronic games. In P. Vorderer & J. Bryant (Eds.), *Playing video games: Motives, responses, and consequences* (pp. 225-241). Mahwah, N.J.: Lawrence Erlbaum Associates.

Van Dijk, T. A., & Kintsch, W. (1983). *Strategies of discourse comprehension*. New York: Academic Press.

Vorderer, P, Wirth, W., Gouveia, F. R., Biocca, F., Saari, T., Jäncke, F., Böcking, S., Schramm, H., Gysbers, A., Hartmann, T., Klimmt, C., Laarni, J., Ravaja, N., Sacau, A., Baumgartner, T. & Jäncke, P. (2004). *MEC Spatial Presence Questionnaire (MECSPQ): Short Documentation and Instructions for Application.* Report to the European Community, Project Presence: MEC (IST-2001-37661). Online. Available from http://www.ijk.hmt-hannover.de/presence.

Wirth, W., Hartmann, T., Bocking, S., Vorderer, P., Klimmt, C., Schramm, H., Saari, T., Laarni, J., Ravaja, N., Gouveia, F. R., Biocca, F., Sacau, A., Jancke, L., Baumgartner, T., & Jancke, P. (2007). A process model of the formation of spatial presence experiences. *Media Psychology, 9*(3), 493-525.

Witmer, B. G., & Singer, M. J. (1998). Measuring presence in virtual environments: A presence questionnaire. *Presence: Teleoperators and Virtual Environments, 7*(3), 225–240.

Wyer, R. S., Jr., & Radvansky, G. A. (1999). The comprehension and validation of social information. *Psychological Review, 106*, 89-118.

Zwaan, R. A., & Radvansky, G. A. (1998). Situation models in language comprehension and memory. *Psychological Bulletin, 123*(2), 162–185.

APPENDICES

APPENDIX I

QUESTIONNAIRE

PRE-TEST QUESTIONNAIRE

Please circle the responses that best represent your answers. All of your responses will be kept strictly confidential.

1. I have a lot of experience playing basketball in the real world.

   I do not agree at all 1 2 3 4 5 I fully agree

2. I often play basketball video games.

   I do not agree at all 1 2 3 4 5 I fully agree

3. I often watch basketball games on TV, the Internet, or other media channels.

   I do not agree at all 1 2 3 4 5 I fully agree

4. When I go to a basketball court, I usually watch people playing basketball rather than play it.

   I do not agree at all 1 2 3 4 5 I fully agree

5. In general, I am knowledgeable about basketball.

   I do not agree at all 1 2 3 4 5 I fully agree

6. In general, I like playing basketball.

   I do not agree at all 1 2 3 4 5 I fully agree

7. In general, I like playing video games.

I do not agree at all 1 2 3 4 5 I fully agree

The next questions are about your skill at playing video games.

8. I often win when playing video games against other people.

Strongly Strongly
Disagree 1 2 3 4 5 6 7 Agree

9. I often win when playing video games against the computer.

Strongly Strongly
Disagree 1 2 3 4 5 6 7 Agree

10. I am a good video game player.

Strongly Strongly
Disagree 1 2 3 4 5 6 7 Agree

11. I can easily figure out how to play new games.

Strongly Strongly
Disagree 1 2 3 4 5 6 7 Agree

12. I have no problem handling the multiple buttons on currently popular game controllers.

Strongly Strongly
Disagree 1 2 3 4 5 6 7 Agree

13. I can play games with complicated control systems well.

Strongly Strongly
Disagree 1 2 3 4 5 6 7 Agree

14. I have good video game playing skills.

Strongly								Strongly
Disagree	1	2	3	4	5	6	7	Agree

15. I am a better video game player than most of my friends.

Strongly								Strongly
Disagree	1	2	3	4	5	6	7	Agree

16. I can finish video games quickly.

Strongly								Strongly
Disagree	1	2	3	4	5	6	7	Agree

Now, some final questions about you….

Are you ____male OR ____female? (check one)

How old are you (in years)? _____

What is your race?

____Asian ____Pacific Islander

____African American ____White

____Hispanic ____Other

Thank you. Please wait for the researcher to collect this and then you can begin the study.

GAME PLAYING EXPERIENCE QUESTIONNAIRE

The questions on these pages ask about the video game playing experience you just had.

There are no right or wrong answers; please simply give your first impressions and answer all of the questions as accurately as possible, even questions that may seem unusual or to not apply to the particular media experience you just had. For example, in answering a question about how much it felt like you were "inside the environment you saw/heard," base your answer on your feeling rather than your knowledge that you were not actually inside that environment.

Please circle the responses that best represent your answers. All of your responses will be kept strictly confidential.

17. I was able to imagine the arrangement of the spaces presented in the video game very well.

I do not agree at all 1 2 3 4 5 I fully agree

18. I had a precise idea of the spatial surroundings presented in the game.

I do not agree at all 1 2 3 4 5 I fully agree

19. I was able to make a good estimate of the size of the presented space.

I do not agree at all 1 2 3 4 5 I fully agree

20. Even now, I still have a concrete mental image of the spatial environment.

I do not agree at all 1 2 3 4 5 I fully agree

21. I was able to make a good estimate of how far apart things were from each other.

I do not agree at all 1 2 3 4 5 I fully agree

22. Even now, I could still find my way around the spatial environment in the video game.

I do not agree at all 1 2 3 4 5 I fully agree

23. I felt like I was actually there in the environment of the video game.

I do not agree at all 1 2 3 4 5 I fully agree

24. It was as though my true location had shifted into the environment of the video game.

I do not agree at all 1 2 3 4 5 I fully agree

25. I felt as though I was physically present in the environment of the video game.

I do not agree at all 1 2 3 4 5 I fully agree

26. It seemed as though I actually took part in action of the video game.

I do not agree at all 1 2 3 4 5 I fully agree

27. I had the impression that I could be active in the environment of the video game.

I do not agree at all 1 2 3 4 5 I fully agree

28. I felt like I could move around among the objects in the video game.

I do not agree at all 1 2 3 4 5 I fully agree

29. The objects in the video game gave a feeling that I could do things with them.

I do not agree at all 1 2 3 4 5 I fully agree

30. It seemed to me that I could do whatever I wanted in the environment of the video game.

I do not agree at all 1 2 3 4 5 I fully agree

31. I performed very well in playing this video game.

I do not agree at all 1 2 3 4 5 I fully agree

32. The game is consistent with my understanding of basketball.

I do not agree at all 1 2 3 4 5 I fully agree

33. I felt that I could successfully apply my previous knowledge about basketball video games to this video game.

I do not agree at all 1 2 3 4 5 I fully agree

34. I devoted my whole attention to the video game

I do not agree at all 1 2 3 4 5 I fully agree

35. I concentrated on the video game.

I do not agree at all 1 2 3 4 5 I fully agree

36. The video game captured my senses.

I do not agree at all 1 2 3 4 5 I fully agree

37. I dedicated myself completely to the video game.

I do not agree at all 1 2 3 4 5 I fully agree

That concludes the survey—Thank you very much for participating!

APPENDIX II

DESCRIPTIVE STATISTICS OF ALL METRIC VARIABLES

	N	Min	Max	M	SD
I have a lot of experience playing basketball in the real world	100	1.00	5.00	2.8900	1.49676
I often play basketball video games	100	1.00	5.00	2.0400	1.33273
I often watch basketball games on TV, the Internet, or other media channels	100	1.00	5.00	3.7000	1.47367
When I go to a basketball court, I usually watch people playing basketball rather than play it	100	1.00	5.00	2.9500	1.36608
In general, I am knowledgeable about basketball	100	1.00	5.00	3.7100	1.20851
In general, I like playing basketball	100	1.00	5.00	3.3700	1.49514
In general, I like playing video games	100	1.00	5.00	3.5800	1.28849
I often win when playing videogames against other people	100	1.00	7.00	3.6100	1.66906

I often win when playing videogames against the computer	100	1.00	7.00	4.0700	1.90297
I am a good video game player	100	1.00	7.00	3.8000	1.78093
I can easily figure out how to play new games	100	1.00	7.00	4.4300	1.57156
I have no problem handling the multiple buttons on currently popular game controllers	100	1.00	7.00	4.5000	1.93584
I can play games with complicated control systems well	100	1.00	7.00	3.8800	1.89246
I have good video game playing skills	100	1.00	7.00	3.9600	1.83633
I am a better video game player than most of my friends	100	1.00	7.00	3.2700	1.84147
I can finish video games quickly	100	1.00	7.00	3.1700	1.78124
I was able to imagine the arrangement of the spaces presented in the video game very well	100	1.00	5.00	3.7200	1.11988

I had a precise idea of the spatial surroundings presented in the game	100	1.00	5.00	3.6900	1.08892
I was able to make a good estimate of the size of the presented space	100	1.00	5.00	3.7800	1.11537
Even now, I still have a concrete mental image of the spatial environment	100	1.00	5.00	4.0600	0.96211
I was able to make a good estimate of how far apart things were from each other	100	1.00	5.00	3.7600	0.99615
Even now, I could still find my way around the spatial environment in the video game	100	1.00	5.00	3.7500	1.08595
I felt like I was actually there in the environment of the video game	100	1.00	5.00	3.9500	1.05768
It was as though my true location had shifted into the environment of the video game	100	1.00	5.00	3.4800	1.21838

I felt as though I was physically present in the environment of the video game	100	1.00	5.00	3.3400	1.21622
It seemed as though I actually took part in action of the video game	100	1.00	5.00	3.7800	1.07853
I had the impression that I could be active in the environment of the video game	100	1.00	5.00	3.7100	1.04731
I felt like I could move around among the objects in the video game	100	1.00	5.00	3.4800	1.15889
The objects in the video game gave a feeling that I could do things with them	100	1.00	5.00	3.6300	1.04112
It seemed to me that I could do whatever I wanted in the environment of the video game	100	1.00	5.00	3.1800	1.15802
I performed very well in playing this video game	100	1.00	5.00	2.7400	1.34555
The game is consistent with my understanding of basketball	100	1.00	5.00	4.0000	1.19764

I felt that I could successfully apply my previous knowledge about basketball video games to this video game	100	1.00	5.00	3.6600	1.31978
I devoted my whole attention to the video game	100	1.00	5.00	4.4200	0.88967
I concentrated on the video game	100	1.00	5.00	4.4700	0.89279
The video game captured my senses	100	1.00	5.00	4.1600	0.96106
I dedicated myself completely to the video game	100	1.00	5.00	4.0700	1.07548
Gender	100	0.00	1.00	0.5400	0.50091
Age	99	18.00	48.00	24.2929	5.57555
Race	100	1.00	6.00	4.1600	1.44054
Valid N (listwise)	99				

APPENDIX III

IRB APPROVAL FORM

Cleveland State University

Office of Sponsored Programs and Research
Institutional Review Board (IRB)

Memorandum

To: Paul Skalski Principal Investigator or Advisor
Communication

From: Rich Piiparinen, GA
Office of Sponsored Programs & Research

Date: April 29, 2010

Re: Results of IRB Review of your project number: 29127-SKA-HS
Co-Principal Investigator or Student: Mu Wu
Entitled: The Role of Personal Experiences in Forming Spatial Presence in a Game Control

The IRB has reviewed and approved your application for the above named project, under the category noted below. Approval for use of human subjects in this research is for one year from today. If your study extends beyond this approval period, you must again contact this office to initiate an annual review of this research. ***This approval expires at 11:59 pm on 4/20/2011.***

By accepting this decision, you agree to notify the IRB of: (1) any additions to or changes in procedures for your study that modify the subjects' risk in any way; and (2) any events that affect that safety or well-being of subjects.

Thank you for your efforts to maintain compliance with the federal regulations for the protection of human subjects.

Approval Category: **Date: 4/21/2010**

___ Exempt Status: Project is exempt from further review under CFR 46.101: b4

_X_ Expedited Review: 7

cc: Project file

Mailing Address: 2121 Euclid Avenue, PH-3rd Floor • Cleveland, Ohio 44115-2214
Campus Location: Parker Hannifin Hall • 2258 Euclid Avenue • Cleveland, Ohio
(216) 687-3630 • Fax (216) 687-9382

APPENDIX IV

CITI COMPLETION REPORT

CITI Collaborative Institutional Training Initiative

Human Research Curriculum Completion Report
Printed on 4/1/2010

Learner: Mu Wu (username: w.michael23)
Institution: Cleveland State University
Contact Information Department: Communication
Phone: 216-925-2186
Email: w.michael23@hotmail.com

Social & Behavioral Research Investigators:

Stage 1. Basic Course Passed on 12/08/08 (Ref # 2195066)

Required Modules	Date Completed	
Introduction	10/07/08	no quiz
History and Ethical Principles - SBR	11/28/08	6/7 (86%)
Defining Research with Human Subjects - SBR	12/08/08	5/5 (100%)
The Regulations and The Social and Behavioral Sciences - SBR	12/08/08	4/5 (80%)
Assessing Risk in Social and Behavioral Sciences - SBR	12/08/08	4/5 (80%)
Informed Consent - SBR	12/08/08	4/4 (100%)
Privacy and Confidentiality - SBR	12/08/08	3/4 (75%)
Cleveland Sate University	12/08/08	no quiz

For this Completion Report to be valid, the learner listed above must be affiliated with a CITI participating institution. Falsified information and unauthorized use of the CITI course site is unethical, and may be considered scientific misconduct by your institution.

Paul Braunschweiger Ph.D.
Professor, University of Miami
Director Office of Research Education
CITI Course Coordinator