The Pennsylvania State University

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HOW CAN WII LEARN FROM VIDEO GAMES?

EXAMINING RELATIONSHIPS BETWEEN TECHNOLOGICAL AFFORDANCES AND SOCIO-COGNITIVE DETERMINATES ON AFFECTIVE AND BEHAVIORAL OUTCOMES

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Abstract

When the Nintendo Wii was released to the public in November 2006, video game play was changed. The unique motion sensing technology allowed game players to interact with the game environment using kinesthetic body motions that replicated real-world activities. In essence, the Wii acts as a virtual simulator for many types of games and activities including bowling, tennis and golf. When combined with the ability to customize game avatars, the Nintendo Wii has the potential to be a powerful learning tool. Social Cognitive Theory provides a theoretical model for how these technological affordances may contribute to learning through modeled behavior.

A 2x2 fully crossed, between-subjects experiment plus control group was designed to empirically test how the type of controller (motion controller vs. symbolic controller) and avatar customization (customized vs. uncustomized) contribute to cognitive, affective, and behavioral responses when playing the *Tiger Woods PGA Tour ’08* video game. Specifically, a path analysis examined how the independent variables contributed to perceptions of presence, golf-efficacy, liking of the game of golf, and golf putting skills.

Although the original path model was not supported, a revised path model indicates that using the motion controller leads to better video game performance, in addition to better performance in a real-world putting task. Further, use of the motion controller leads to greater perceptions of golf-efficacy (as mediated by presence), and is positively correlated with liking of the *Tiger Woods PGA Tour ‘08* video game, which in turn leads to greater perceptions of liking of the game of golf. Implications of these findings are discussed from theoretical and practical perspectives and directions for future research are proposed.

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Acknowledgements

They say that it takes a community to raise a child, but no one has ever mentioned how many communities it takes to raise a Ph.D. For me, that journey has lasted through 11 years of college, in 2 different countries, through 4 different states, with support from many different people in many different communities. I am humbly and wholly in debt to so many for encouraging me to pursue my dream.

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How Can Wii Learn From Video Games? Examining Relationships Between Technological Affordances and Socio-Cognitive Determinates on Affective and Behavioral Outcomes.

Introduction

When the Nintendo Wii video game console was released in November 2006, video game play was changed (Grossman, 2006). In spite of the fact that it was released shortly after the Sony PlayStation 3, and a full year after the Xbox 360, sales figures for the Nintendo Wii rapidly outpaced the competition. Within one year's time, the Nintendo Wii had become the top selling, 7^{th} generation, console video game system (Bishop, 2007).

What was it about the Nintendo Wii that generated so much attention? The most obvious feature that distinguished the Wii from the other game consoles was the controller. This input mechanism works by replicating, onscreen, the kinesthetic motions of the video game player in the real world. For example, if players want to play the *Wii Bowling* video game, they simply hold the controller as a bowling ball and swing their arms as one would at a bowling alley. The video game character then replicates the game player's physical motions onscreen, causing the character to bowl. The use of full body motion to control the video game character has prompted one game reviewer to remark: "The sense of immersion—the illusion that you, personally, are projected into the game world—is powerful" (Grossman, 2006, p.3, ¶ 2). The fact that this console incorporates kinesthetic, motion-sensing technology with an attention-getting, immersive gaming experience should be a cue to educators and media scholars alike that there is significant potential for gamers to learn from this video game system.

The purpose of this investigation is to explore how new technological affordances in the Wii game console and individual perceptions fit into a social-cognitive framework to examine how behaviors are learned through video game play. The proceeding paragraphs will review previous literature on video games and learning. Next, Social Cognitive Theory will be discussed to demonstrate how the learning process can integrate technological and socio-cognitive variables in the context of video game play. Hypotheses will be advanced throughout, resulting in a final model for empirical testing.

Chapter 1

Literature Review

Video Games and Learning

The use of video games and game simulators as a training tool to teach skills is nothing new. The military has a history of developing and integrating video games and simulators into training to teach recruits equipment and survival skills. *Marine Doom* is a customized version of the computer game *Doom* which acts as a combat simulator to help train military recruits in tactical situations (Rice, 2007). A recent report indicates that the U.S. Department of Defense spends $4 billion per year on simulation training, and utilizes Microsoft and Sony game consoles for networked military gaming (Macedonia, 2002). The integration of these technologies is not without success. In a study conducted on the effectiveness of integrating Microsoft's *Flight Simulator*, the U.S. Navy found that those who played during early flight training were 54 percent more likely to receive above-average scores during real flight tests than peers who had never played (Macedonia, 2002).

There is a fine line between what is considered a video game (something for entertainment purposes) and what is considered a video simulation (a replication of a real-world event). Some "games" blur the boundaries to the point where it is up to the individual gamers to decide whether they will play for fun, or play to learn. For example, the computer game designed for the U.S. Army titled "*America's Army*" may be played as a first-person shooter game for fans of the genre, or as a learning simulator for those in military training (Zyda, 2005). Perhaps one of the only ways to tell if a game is intended to be a simulator versus an enjoyable pastime is to look at the research and development that went into its creation. The production of a "serious game" such as *America's Army* necessitates a design team, a human performance engineering team, instructional scientists, subject matter consultants, an art team, and a programming team (Zyda, 2005). Obviously, games that are created to train and educate are more complex and more expensive to create.

Although educational research in gaming has been done since the early 80s, it pales in comparison to the body of work that has been done on violent or other negative video game effects (Lee & Peng, 2006). Of the work that has been done examining video games and learning, most research focuses on outcome potential. That is to say, it examines whether or not game playing will be related to some successful, real-world outcome. Studies on video games have demonstrated that game play can improve spatial rotation skills (De Lisi & Wolford, 2002), math ability (Corbett, Koedinger, & Hadley, 2001), language development (Jordan, 1992), and even the ability to successfully and safely complete laparoscopic surgery (Rosser et al., 2007). In addition, educators recognize the positive impact that interactive video games have in improving motor abilities, agility, and core strength (Trout & Christie, 2007). As a result, video games may be used to enhance physical play in K-12 physical education curricula (Hayes & Silberman, 2007). Video games may also be used to teach athletes (Liebermann, Katz, Hughes, Bartlett, McClements, & Franks, 2002). Some sports games are so realistic that college-level (Ross, Jr., 2007) and professional football players (Machosky, 2005) use them as part of their training to learn offensive plays and defensive formations. Likewise, research has shown that that success in computer game putting using a computer mouse transferred into successful golf putting abilities in real life (Fery & Ponserre, 2001).

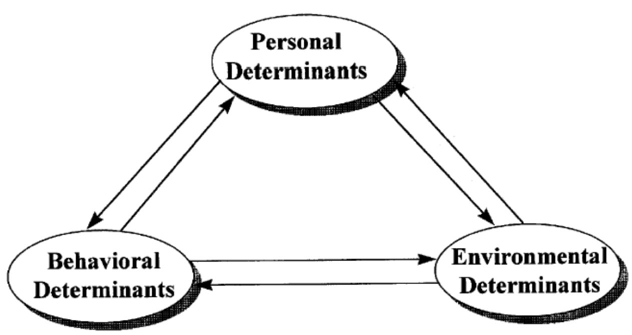
Even though the body of evidence from these studies suggests that video games are promising in terms of their learning potential, the focus on outcomes of game playing are limited in that they do not fully theorize the processes through which learning and subsequent behaviors occur. This limitation has led some scholars to observe that future research needs to look at interactions that combine form, user experience, content, and other mediating variables (Lee & Peng, 2006) in order to understand the user experience and learning process. Bandura's Social Cognitive Theory (2002) allows for the testing of both technological and socio-cognitive variables that are thought to be important in the learning process. The following section will elaborate on how Social Cognitive Theory explains how people may learn through modeled behavior.

Social Cognitive Theory

Social Cognitive Theory (SCT) proposes that people may learn behaviors by watching others (Bandura, 2002). These "others" may be real people within their environment, or people, characters, and avatars that are encountered in some mediated format, such as on television, in movies, or in video games (Downs & Smith, 2005). Bandura (1986, 2002) proposed that the ability to learn through social modeling could be explained through a triadic reciprocal causation model (see *Figure 1.*) involving personal determinates, environmental determinates, and behavioral determinates which are all interconnected.

In the context of video game play, personal determinates may include variables that are unique to each individual, such as liking a certain type of game, cognitive abilities, or spatial-rotation skills. Environmental determinates might take the form of tools or software that can be used during game play such as a visual display, a sound system and speakers, or joysticks and other input devices. Both personal determinates and environmental determinates may contribute to a behavioral pattern. For example, a person who plays a football video game by designing their own plays using a special input device may be able to remember many different types of offensive and defensive schemes for later retrieval. The liking of this type of game may lead the same person to play the game more often or play football with friends on the weekend for bragging rights. This in turn may require the same person to play the football video game more and force them to keep current with the newest football video games in order to stay competitive. The interconnectedness of all of these systems helps to create and shape the environment in which learning occurs (Wood & Bandura, 1989).

Figure 1. Bandura’s Triadic Reciprocal Causation Model.



At the individual level in order to learn and execute modeled behaviors, Bandura proposed that observers follow the processes of attention, retention, production, and motivation.

Attention. In order to successfully navigate through video game environments, gamers must pay attention. This is largely in part because players’ actions (or inactions) may fundamentally change the outcome of the game narrative. The interactivity that video gamers enjoy occurs through a continuous input/output cycle between the gamer and the video game system (Klimmt, 2003), which makes games engaging, and attention to game play a necessary antecedent for game success.

Retention. The retention process of SCT speaks to the repetitive nature of game play itself. Very few gamers are able to sit down with a new video game and play through from beginning to end without having to replay some part of the game. In many cases, repeated trials are necessary for gamers to develop the hand-eye coordination necessary to continue to more progressively difficult levels. In some cases, retention through repetition facilitates the automization of complex button-pushing sequences (Bargh, 1997) so that a player can free up cognitive resources to deal with other complexities in the game environment. It is important to recognize that at this point in the learning cycle, the knowledge for how to conduct behaviors has been learned. The processes of production and motivation regulate whether or not a game player will attempt to recreate the observed, modeled behavior in the real world.

Production. The production process details how the symbol systems stored in memory may manifest themselves in the real world (Bandura, 2002). In other words, it speaks to whether or not an observer of a modeled behavior is able to approximate the behaviors that they have witnessed in their own real-world environment. For example, a gamer playing a wrestling video game may have no problem pressing a few buttons on a game controller to execute a pile-driver (a wrestling move) on an unsuspecting opponent. However, that same gamer may not have the skills, the balance, or the strength to physically perform this feat in real life.

Motivation. If an observer of a modeled behavior is able to approximate some such behavior, then the final process of motivation may determine if a behavior is attempted in the real world. Examples of motivation in video game play are abundant. The ability to save a name as a high scorer, or the ability to unlock hidden levels or weapons may serve as rewards and motivators for gamers to continue future game play. Outside of the game world, social status and encouragement from peer groups may be motivators for people to model observed behaviors.

Additional considerations. Games played on the Nintendo Wii game console incorporate features relevant to each of Bandura's processes. The console also incorporates some unique features of its own, such as the kinesthetic motion-controlling device and the potential to customize game characters that may increase the potential to learn through Bandura's processes. In addition to learning, these features may also contribute to perceptions of "*presence.*" This term refers to an individual's perception of "being there" (Heeter, 1992, p. 262) or feeling like one is part of a video game. Perceptions of presence may intensify the attention process of SCT, en route to helping game players learn. The following paragraphs will elaborate on technological affordances and presence. The next sections will then go on to discuss how these features contribute to perceptions of self-efficacy in the learning of behaviors and affective dispositions in the context of playing a golf video game.

Technological Affordances

Today's video games are considered to be "more engaging" than previous generations of video games (Nowak, Krcmar, & Farrar, 2006). This occurs because active participation in games is made possible by interactivity and the development of involving input devices (Nowak et al., 2006). Both hardware and software components of video game systems combine to create a more realistic gaming experience for game players (Carnagey & Anderson, 2004; Ivory & Kalyanaraman, 2007). Gibson (1977, p.67) referred to these unique features in a learning environment as “affordances” and defined the term as “a specific combination of the properties of its substance and surfaces taken with reference to an animal.” Greeno (1994, p.338) defined affordances as “whatever it is about the environment that contributes to the kind of interaction that occurs.” Perhaps a more contextually appropriate definition of an affordance hails from research that examines new media technologies and human computer interaction (HCI). In this tradition, affordances are regarded as a set of capabilities inherent within a technological medium that facilitate certain actions (Sundar, 2008). The fundamental difference between the sets of definitions revolves around whether the affordance must be *perceived* by a user, or whether the affordance exists as a *property* of a medium (Bucy, 2004; Stromer-Galley, 2004; Sundar, 2004; Sundar, 2008). As an example, the Nintendo Wii game system allows gamers to play video games using full kinesthetic body motion, or the motion sensing equipment may be disabled and a gamer may play in a more traditional fashion by pushing buttons from a seated position. By manipulating the video game hardware (or software) one can change how the gamer interacts with the game environment. The fact that this is a hardware manipulation makes this affordance a property of the medium. Today’s video game controllers allow game players to do many things which they may not be aware of, such as changing point of view, changing difficulty settings, and changing the appearance of game characters. However, lack of awareness or perception does not mean that these affordances do not exist. Whether or not the gamer realizes or perceives that these manipulations are even possible is irrelevant. For the purpose of this study the term affordance will favor the latter definition and regard affordances as properties of a medium.

Sundar's (2008) MAIN model identifies the most common technological affordances that exist as properties of technological mediums: modality, agency, interactivity and navigability. In the case of video game play, the technological components used to mediate the interaction between the game world and the game player would qualify as technological affordances. Controllers for video game consoles afford game players the ability to control characters onscreen and the ability to interact with virtual stimuli. Thus, interactivity is afforded by the console system through the controller (Bucy, 2004). On the software side, the graphic interface itself could be labeled as an affordance. Additionally, game settings such as difficulty levels, music preferences, and avatar customization that contribute to the game experience would also be technological affordances. Since many video games simulate real-world situations, researchers recognize the importance of studying how differing technological affordances "provide a learning environment that reflects the same cognitive authenticity as the domain area or environment being trained" (Kirkley & Kirkley 2005, p. 45). Two interactive technological affordances that the Nintendo Wii offers are kinesthetic motion controllers and avatar customization.

Motion controllers and enactive performance. The type of kinesthetic motion sensing controllers developed for the Nintendo Wii, are markedly different from the more traditional controllers characteristic of other video game consoles. Competing consoles such as the Microsoft X-Box 360 and the Sony PlayStation 3 rely on button pushing to symbolically move game characters, or *avatars,* onscreen throughout video game play. Therefore, if a player wanted his or her video game character, known as an avatar, to swing a golf club, it would require that he or she press the "A" button in rapid sequence to build power, while pressing the "B" button to unleash the golf swing, while simultaneously using a toggle switch to control the top-spin or back-spin on the ball as it heads down the fairway. In contrast, if a player were playing a golf game on the Nintendo Wii, the player would grasp the game controller like a golf club, and swing the controller just as one would swing a golf club on a real golf course. This difference between the intuitive kinesthetic motion and the symbolic "button-bashing" has prompted one game reviewer to comment: "While Sony and Microsoft exercise your thumbs, Nintendo gives you a full body workout" (Lehrer, 2006, November 16, ¶ 2).

In considering how the kinesthetic, interactive nature of the Nintendo Wii differs from other, symbolically interactive consoles, it seems that the potential to learn and produce some behaviors outside of the game environment may be intensified. The unique kinesthetic motion sensing controller allows gamers to enact behaviors that are consistent with what would be expected in the real world. In keeping with the golf analogy, swinging the motion controller allows the gamer to experience the golf swing as in a real life performance. Whereas the symbolic controller may help to develop a cognitive script for how to swing a golf club, the motion controller allows the gamer to experience and practice the swing. Although one could argue that using the motion controller is still arguably a symbolic gesture, the degree to which cognitive resources are important differs between the types of controllers. For example, if a game player is instructed to swing the motion controller like a golf club or tennis racket, most healthy adults can accomplish this task very easily. However, teaching that same gamer how to manipulate three different buttons and a toggle switch requires more cognitive processing power in order to map a sequence of button pushes onto a sequence of avatar body motions. In essence, the motion controller minimizes the importance of the cognitive intermediary.

These two types of interactions; symbolic rehearsal vs. enactive performance, have demonstrated differential effects in behavioral psychology (Bandura, 1977) with performance based, enactive methods being superior to symbolic methods. Therefore, the interactive and enactive performance that the Wii's motion controller affords may intensify some of Bandura's processes, including attention, retention, and production, above and beyond that of traditional symbolic game controllers that rely on button pushing. This may occur because the symbolic nature of button pushing does not easily lend itself to the physical (re)production of many real-world behaviors.

Beyond allowing for the ability to perform an action, the Wii's motion controller may also encourage implicit motor learning, more commonly referred to as muscle memory (Dietrich, 2004). Implicit motor learning (or implicit motor behavior), occurs through the integration of recurrent movement patterns across multiple task experiences (Sherry & Schacter, 1987). Studies have indicated that implicit motor behaviors are enduring even when cognitive demand is high (Masters & Maxwell, 2004; Poolton, Masters, & Maxwell, 2007). Although little empirical or theoretical work has been done on the processes that govern muscle memory development, it is logical to surmise that the same processes that govern cognitive learning (attention, retention, production, and motivation) would play supporting roles in the development of these seemingly reflexive motor acts. Since the playing of a golf video game on the Nintendo Wii closely simulates the movements associated with golfing (for example, putting), it is possible that the recurrent movement could facilitate implicit motor learning. It is therefore hypothesized that:

> *H1*: Participants playing a video game through enactive performance with motion controllers on the Nintendo Wii will perform better in similar real-world tasks than those playing on controllers that afford only symbolic rehearsal.

Customization. As mentioned previously, the customization of video game software, specifically a game character, may also be regarded as an affordance. Recent technological advancements in the world of gaming allow gamers to create avatars in their likeness to play video games. Fontaine (1992) proposed that the ability of a technology to focus ones' attention would be a determinate of presence. One way to get someone's attention is to create a model in their image. A body of research has validated the import of perceived similarity when it comes to learning through modeled behavior (Bandura, 1977, 1986, 2002). Biocca (1997) argued that graphic representations of the self within a virtual environment can conjure mental models of our bodies and identities. To the degree that an individual's identity is reflected within an avatar or embodied agent, the individual should feel more a part of the mediated environment (Biocca, 1997). Empirical work supporting this contention has found that people live vicariously through their avatars in virtual environments (Chung, 2005). Through their commitment to their avatar, especially when that avatar is created in their image, a gamer should not only be paying close attention to the game, but becoming more immersed into the action. The fact that gamers can control their characters, particularly ones designed to look like themselves, should cultivate the perception of being inside a video game environment (Biocca, 1997). Presence then, is the link between the physical body and the virtual avatar in the computer interface (Bricken, 1991). The following will explore the concept of presence in greater detail.

Presence

Just as the Nintendo Wii was released to the public, a game reviewer commented on his experience playing it, saying: “although it can't compete with the visual realism of Sony and Microsoft, it ends up *feeling* much more realistic” (Lehrer, 2006, November 16, ¶ 11). This quote speaks to the level of presence that a gamer may feel when playing Nintendo Wii games. The term “presence,” shortened from “telepresence,” has been defined as an individual’s “perceptual illusion of nonmediation” (Lombard & Ditton, 1997, Presence Explicated section, ¶ 1). Further, it may be regarded as the human experience of feeling present in an environment that is generated by computers (Biocca, 1992; Tamborini & Skalski, 2006). Since new technologies such as video games can blur the distinction between real-life experience and the experience of media, presence can be thought of as the extent to which a person feels as if they exist in a mediated environment rather than in the natural physical environment (Steuer, 1992). These definitions of presence all focus on human perceptions and individual experiences, implying that attention to the mediated environment is a necessary antecedent to feeling presence. Attention, according to SCT, is also a necessary antecedent to learning a modeled behavior, creating a theoretical link between presence and learning.

Steuer (1992) notes that there are two characteristics of a technology that can add to individual perceptions of presence: vividness and interactivity. Vividness refers to a technology's ability to create a rich sensory environment. Large screen size, realistic graphics, and surround sound may all contribute to vividness (Lombard & Ditton, 1997; Steuer, 1992). Interactivity refers to the extent to which users can influence the form and content of the mediated environment in real time. Since gamers' actions while playing the Nintendo Wii are replicated in real-time through kinesthetic motion controllers, this can increase the sensation that they have become part of the game (Sundar, 2008). In addition, the ability to customize an avatar to look like a physical representation of the gamer provides an outlet to interact with the virtual environment and therefore, should increase perceptions of presence.

According to Witmer and Singer (1998), the sensation of presence may be measured through the psychological states of involvement and immersion. Involvement refers to focusing attention on a meaningful set of activities. Immersion is defined as a psychological state "characterized by perceiving oneself to be enveloped by, included in and interacting with an environment that provides a continuous stream of experiences" (Witmer, Jerome & Singer, 2005, p. 299). Involvement is defined as "a psychological state experienced as a consequence of focusing one's mental energy and attention on a coherent set of stimuli or meaningfully related activities or events. Involvement is increased by performing tasks in activities that simulate, challenge, and engage the user either cognitively, physically, or emotionally" (Witmer et al., 2005, p. 298). Creating an avatar that looks like oneself would certainly hold one's attention.

Immersion refers to the sense of being enveloped by an environment. This is more likely to occur in environments that create the perception of inclusion, natural interaction, and control (Witmer et al., 2005; Witmer & Singer, 1998) The Nintendo Wii's kinesthetic motion controller, which relies on body motion and enactive performance as opposed to symbolic rehearsal caused by button pushing, should create a more immersive experience for a gamer. This heightened sense of interaction and participation should lead to feelings of presence (Tamborini et al., 2004). As such, the following hypotheses predict:

> *H2*: Participants playing through enactive performance with motion controllers on the Nintendo Wii will feel greater perceptions of presence than those playing through controllers utilizing symbolic rehearsal.

> *H3*: Participants who customize their avatars will experience greater levels of presence during game play than those who do not customize their game character.

Self-Efficacy

Up to this point, the argument has been advanced that type of controller, avatar customization, and perceptions of presence facilitate the ability to learn a behavior. However, in order to be motivated to engage in a behavior, one must consider whether or not they believe that they have the ability to complete the behavior. This is referred to as self-efficacy.

In proposing an agentic perspective of SCT, Bandura states that the path between cognition and behavioral outcome is mediated by perceptions of efficacy (Bandura, 2001, 1977, 2002). Self-efficacy, otherwise termed “efficacy expectations,” is defined as “the conviction that one can successfully execute the behavior required to produce the outcomes” (Bandura, 1977, p. 193). More recently, it has been defined as the “belief in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura, 1997, p. 3). In the context of video game play, a person must first believe that he or she possesses the hand-eye coordination necessary to play and is capable of manipulating the controller to fulfill the objectives of the game.

Self-efficacy Theory (Bandura, 1977), which works within the socio-cognitive framework, proposes that people assess perceptions of self-efficacy through vicarious experience. Recalling that Chung's study (2005) found that people live vicariously through their avatars, this creates a strong link between the game player and the character onscreen. The underlying proposition for vicarious experience is that if a person observes another person achieve success in an endeavor (especially one that is created in their image), they themselves should feel as if they can also improve on some designated task performance (Bandura, 1977).

According to Self-efficacy Theory, one method through which people gauge their efficacy expectations is through performance accomplishments. In the context of video game play, gamers who performed well in a virtual golf game would be more likely to believe that they could perform well in a golf related task in the real world. Empirical studies conducted on performance based methods have concluded that performance based treatment procedures have been superior to symbolic treatment procedures (Bandura, Adams, & Beyer, 1977). This notion of learning vicariously through an avatar in a video game creates the link between presence and efficacy because, in this case, the avatar is an embodied version of the self, being controlled by the self. A recent study examining presence technologies in telemedicine demonstrated that self-efficacy predicts task performance, and perceptions of presence have a positive impact on future tasks (Soderholm et al., 2007). Therefore, if game players had high perceptions of presence in a video game and were to see their avatar putting a golf ball well in a video game, then they are likely to believe that they themselves would be able to succeed in putting golf balls in a real-world task similar to their avatar. Consequently, it is hypothesized that:

H4: When playing a golf video game greater perceptions of presence will be positively correlated with perceptions of real-world, golf-efficacy.

Behavioral outcomes. In general, individuals with low self-efficacy beliefs are less likely to perform related behaviors in the future (Bandura, 1982), whereas individuals with high self-efficacy beliefs are likely to perform behaviors. One study looking at phobia treatments found that the probability of successfully performing a task (read: successfully engaging in a behavior) was a function of the perception of efficacy (Bandura, Adams, & Bayer, 1977). Another study found a positive relationship between self-efficacy and motor skill acquisition (Jourden, Bandura, & Banfield, 1991). Similar relationships between efficacy and performance have been observed for computer users, finding that individuals with little confidence in their ability to use the Internet are less likely to use the Internet, or use it successfully, when compared to those with high degrees of self-efficacy (Eastin & LaRose, 2000). The same relationship between self-efficacy and performance has been observed in education with mathematics problem solving abilities (Pajares & Miller, 1994) and in sports with tennis performance (Barling & Abel, 1983).

Even though research has generally supported a link between self-efficacy and performance behavior, Bandura (2001, p.19) noted that “psychosocial software is not reducible to the biological hardware.” Each, he states, has its own set of governing principles that need to be studied individually. Consistent with Bandura's distinctions, one study found that measures of self-efficacy did not predict gymnasts' performances during a competition (McAuley & Gill, 1983). These findings support Bandura's observation that efficacy does not always translate into performance abilities. As an example related to this study, high levels of efficacy may or may not directly translate from a psychological construct into a noticeable, successful physical action such as putting golf balls after playing a golf video game. Thus, a research question asks;

RQ1: Will perceptions of golf-efficacy after playing a golf video game be positively correlated with performance behavior in a related putting task?

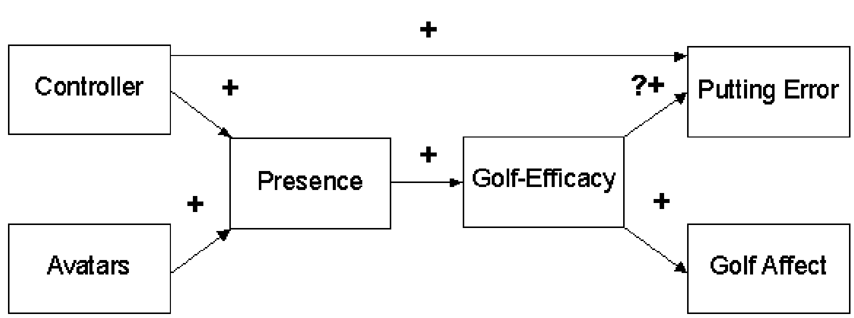
Affective outcomes. Perceptions of self-efficacy are also related to affective dispositions. Individuals enjoy engaging in behaviors that they feel they are capable of performing and may become stressed when forced to engage in a behavior that they don't believe they have the skills or knowledge to execute successfully (Bandura, 1993). Empirical work has found that high self-efficacy of computer use leads to liking computer use (Compeau & Higgins, 1995; Compeau, Higgins, & Huff, 1999). In the video game world, Vorderer, Klimmt, and Ritterfeld (2004) recognize the theoretical link between efficacy and enjoyment of video game playing. One possible explanation for this relationship may be related to *flow states* (Csikszentmihalyi, 1990). In a video game setting, flow may be attained with the correct balance of challenge and success for the game player, optimizing the game playing experience and making it more enjoyable. This positive experience may even carry over to perceptions in the real world. In the context of playing a golf video game, if a player had high perceptions of golf-efficacy, this should be correlated with liking the task at hand, i.e. playing golf in the real world. Formally stated, it is hypothesized that:

H5: Greater perceptions of golf-efficacy will be positively correlated with reports of liking the game of golf.

Proposed Theoretical Model

When all of the variables discussed in this review come together, the proposed model identifies both presence and perceptions of efficacy as central components in the learning process. Specifically, perceptions of presence are expected to mediate the relationships between the type of controller and efficacy as well as mediate the relationship between avatar customization and efficacy. Perceptions of presence are expected to be positively correlated with efficacy, which in turn is expected to be positively correlated with golf-affect. (See *Figure 2.*)

Figure 2. Complete Path Model of Expected Relationships



Note. Path signs signify hypothesized direction of relationships.

Chapter 2

Methods

Participants

A total of (n = 161) participants enrolled in undergraduate communication courses at a Big Ten university were recruited to voluntarily participate in research sessions. The majority of participants were female (n = 106), and all participants were fairly evenly distributed across represented class standings: sophomores (30%) juniors (31%) and seniors (35%). Participants reported playing video games for approximately 3 hours per week (M = 187 minutes), and reported having moderate experience playing games on the Nintendo Wii video game console (M = 3.34 on a 7-point scale). With regards to the stimulus material, participants reported little experience playing the *Tiger Woods PGA Tour 2008* video game on any console (M = 1.18 on a 7-point scale). Participants were randomly assigned to experimental conditions and received course credit in exchange for their voluntary participation.

Experimental Design

This experiment utilized a 2x2 between subjects factorial design with a control group. The manipulated variables were: type of controller used (motion controller affording enactive performance vs. traditional controller affording symbolic rehearsal) and avatar customization (customized vs. not customized). In order to ensure that results could be attributed to the video game’s type of motion and avatar customization in the experiment, a control group was used as a comparison group. The control group did not have the benefit of video game play, and their abilities served as a proxy for what may be expected in terms of putting abilities from the larger population.

Stimulus

Once assigned to an experimental condition, participants played the putting skills mini-game in *Tiger Woods PGA Tour '08* for the Nintendo Wii. Participants in the enactive performance condition played the game with the motion-sensing Wii wand. Those assigned to the symbolic rehearsal condition played the same game with the Wii Nunchuk control and the kinesthetic motion-controller disabled. For game play, the Nintendo Wii console was connected to a ceiling projector which broadcast the game image on a large projection screen. The resulting image displayed a 72" diagonal picture. The motion sensor was placed on a tower speaker directly under the projected game display, approximately 36" above the floor. Participants either stood or sat (depending on their experimental condition) approximately 6-8 feet from the screen. Speakers in the room provided surround sound, and participants played with the lights dimmed in order to provide a more immersive experience.

Procedure

Upon entering the media effects research lab, participants were asked to read and sign an informed consent form. Once consent was obtained, participants were randomly selected to participate in one of four experimental conditions or a control condition. At the beginning of each session, a survey was administered that measured basic demographic information, including: gender, academic standing, video game usage, and video game playing experience. This survey also recorded information about familiarity with the video game and measured real-world golf experience.

After completing the first survey, participants were led in to the media effects research lab to begin the experiment. For those in the avatar customization condition, the session began with the creation of an avatar. Participants were given instructions that they would need to create an avatar that resembled them as much as possible with the understanding that the avatars did not have to be perfect clones. Each participant in this condition was given instruction on how to navigate through the customization screens in order to create their avatar. After instructions were given, the researcher left the room to allow the participant to customize their avatar. Throughout this process, the experimenter checked in with the participant many times to answer questions and to ensure that the customization process was being conducted thoroughly and properly. Participants in the avatar customization condition were allowed up to 12 minutes to create their avatars. Participants had the option to manipulate or change approximately 80-90 different avatar characteristics, including facial features, body type, hair styles, and clothing preferences among others. Those in the non-customization condition played the putting skills mini-game with a pre-selected game character: *Ted Underwood*, a nondescript, middle-aged, male golfer (See Appendix A for sample customization screen shots and Appendix B for putting sample screen shots).

After this process was completed, participants were instructed on the proper use of the equipment necessary to play the putting mini-game. The objective of this game was to putt 18 holes of a golf course with the least amount of strokes possible. This was accomplished through enactive performance using full body motion holding the Wii remote as a golf putter, or accomplished from a seated position using the Wii remote and Nunchuck device to symbolically putt the golf ball. Participants were given instruction across the first three holes on how to use the controller and utilize the game components to become better golfers. After instruction was completed, participants were left to play the remaining fifteen holes on their own. The researcher left the room and closed the door, occasionally checking in on the participant during game play.

Following the video game manipulation, participants were led to an adjoining room to fill out a second survey which measured golf-efficacy, golf-affect, their experiences while playing, and beliefs about the *Tiger Woods PGA Tour '08* video game. While the participants were busy filling out this survey, the experimenter prepared the room for the putting behavior measure.

Once survey two was completed, participants were led back to the room where they had just played the video game to putt golf balls. Up to this point, the participants were unaware that this would be part of the experiment. The participant was provided with a standard golf putter (reversible for both left and right handed participants) and a standard golf ball. The participant was them asked to putt the golf ball from marked distances of 3, 6, and 9 feet. Focus was placed on putting the golf ball as close to the hole as possible. Participants were told that if the ball gently rolled out of the hole, that it would be counted as a zero score, meaning that the ball had been successfully putted in to the hole.

It is also worth noting that participants were given instructions on how to "read the green." The media lab floor made an ideal putting surface as it had both a small hill approximately three feet from the hole and substantial right-to-left break, simulating an actual putting green very nicely. While putting, the experimenter stood against the opposite wall that the participant was facing, directly in line with the cup to get the best view of the putt possible. If any part of the ball made contact with the bottom of the hole, approximately 1/4 inch deep (and didn't hit the wall 60 inches away), then it was marked as a zero score. It was also determined a priori that any uncertain calls would be awarded to the benefit of the participant to ensure a conservative putting behavior measurement.

Following the putting task, participants filled out a final survey, were then debriefed, allowed to ask questions, and thanked for their time. Sessions ranged from 60 to 75 minutes.

The control group participants (n = 30) did not participate in the video game playing session in the experiment. After filling out the first survey, which measured demographic characteristics, video game playing experience, golf experience, and golf efficacy, they proceeded directly to the putting task.

Measures

Scale construction. Previously validated scales were checked for reliability before mean scores were computed. For measures that contained mixed items from previously validated scales, or items specifically created for this experiment, exploratory factor analysis was employed using principal components extraction and varimax rotation. In order to be retained in the scale, items that were factor analyzed had to have a high degree of face validity as well as meet predetermined criteria for inclusion. The number of factors was determined using Kaiser's rule that eigenvalues be greater than 1 (Kaiser & Caffrey, 1965). In addition, factor loadings for scale items had to be > .60 for the primary factor in question, with no secondary loading > .40 (McCroskey, & Young, 1979). Assuming that the scales met these criteria, only those that achieved a Cronbach's Alpha of .70 or greater were deemed reliable and included for subsequent analyses.

Presence. The experience of a heightened sense of awareness of being present within a video game has been measured by assessing perceptions of immersion and involvement (Nowak, & Biocca, 2003; Tamborini, 2000; Tamborini et al., 2004; Witmer et al., 2005). In this experiment, presence was measured using a previously validated scale from Nowak and Biocca (2003) that included both of these components. Presence indicators were measured on 7-point scales anchored at 1 (*Not at all*) and 7 (*Extremely*). The presence scale included the following items: 1) How involving was the experience? 2) How intense was the experience? 3) To what extent did you feel that you were inside the game environment? 4) To what extent did you feel immersed in the game environment? And 5) To what extent did you feel surrounded by the game environment? These 5 items met the reliability criteria with a reliability coefficient of $\alpha = .91$.

Self-efficacy. This variable was conceptually defined as the "belief in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura, 1997, p. 3). In order to assess participants' perceptions of self-efficacy, a scale was created relevant to the task at hand (Bandura ,1986; Lee & Bobko, 1994; Maurer & Pierce, 1998; McAuley & Gill, 1983). Each of the self-efficacy items was measured on a 7-point scale, anchored at 1 (*Strongly Disagree*) and 7 (*Strongly Agree*). The following items were used to assess self-efficacy as it related to golf abilities: 1) I could be a good golfer; 2) I could be a good miniature golfer; 3) I could putt golf balls well on a real putting green; 4) I could putt golf balls well on an artificial putting green; 5) I could sink a putt from 3 feet; 6) I could sink a putt from 6 feet; and 7) I could sink a putt from 9 feet. These 7 items met all criteria and were deemed reliable with a reliability coefficient of $\alpha = .92$.

Affect. To measure participants' feelings about the game of golf, questions were created based in part on previous scales that have been designed to measure positive and negative affect (Watson, Clark, & Tellegen, 1988) and enjoyment of physical activity (Motl et al., 2001). All questions were measured with scales anchored at 1(Strongly Disagree) and 7 (Strongly Agree). Factor analysis revealed two scales, one measuring *positive golf affect* and one measuring *negative golf affect* that accounted for 69.2% of the variance. Both scales possessed a simple factor structure that intuitively made sense with eigenvalues of 4.46 and 1.78 respectively. Since the positive golf affect scale was the most statistically sound, this was the scale that was retained for analysis. The items included in this scale were 1) I would enjoy playing a round of golf; 2) I look forward to playing golf in the future; 3) I think that playing golf would not be at all fun for me; 4) I have a positive attitude toward golf; and 5) I would get bored quickly if I were golfing. These items met the reliability requirement with a Cronbach's $\alpha = .91$.

Golf behavior. To measure golfing behavior, the research lab was converted into an artificial putting green. An indoor/outdoor turf covering was secured to the floor and a 4.25 inch diameter, circular hole was cut into it to approximate putting green conditions. Participants were provided with a standard golf ball and putter and instructed to putt three times, once each, from distances of 3 feet, 6 feet, and 9 feet. For each putt, the distance from the golf ball's final resting point to the hole's closest edge was measured in inches and recorded. All measurements were rounded to the nearest quarter inch.

The cup was located in the center of the room and allowed for 60 inches of error room on all sides of the hole. Since the cup lacked sufficient depth to contain a hard-hit putt, the measurement procedure was described to the participant in detail prior to putting. Before putting, participants were given specific instructions to putt the golf ball with the least amount of force necessary to move the golf ball from the marked distance line to a resting position in the hole. Golf balls that came to rest on the white circle representing the hole, or that rolled through it and stopped before hitting the back wall were measured as a zero. However, if the ball was hit so hard that it rolled to the wall 5-feet away, it was not counted as a successful putt, and a maximum of 60 inches was recorded. The three measurements were then tallied resulting in a final golfing error score, such that the greater the number (measured in inches), the less accurate the putting behavior.

In addition to the variables measured above, questions related to previous golf experience and liking of the *Tiger Woods PGA Tour '08* video game were also asked as they could have an impact on dependent measures.

Previous golf experience. To evaluate participants' level of experience playing golf in real-life, a list of questions was generated asking about previous golf play and participation in golf-related activities. Six question items were measured with scales anchored at 1(No experience at all) and 7 (Very experienced). Participants rated their level of experience on the following golf-related activities: 1) Playing golf on a golf course; 2) Practicing putting golf balls on a putting green; 3) Playing miniature golf; 4) Playing golf on a team (high school or college); 5) Playing golf in a league; and 6) Taking lessons from a golf pro. These items met the reliability requirement with a Cronbach's $\alpha = .84$.

Liking of the Tiger Woods video game. It was believed that liking of the *Tiger Woods* golf video game could also have an impact on study results. As such, a scale was created to measure enjoyment of the golf video game. The six items were measured with scales anchored at 1 (Strongly disagree) and 7 (Strongly Agree). Participants rated the liking of their in-game playing experience based on the following statements: 1) I enjoyed playing *Tiger Woods PGA Tour '08*. 2) I thought that playing *Tiger Woods PGA Tour '08* was frustrating. 3) I had fun playing *Tiger Woods PGA Tour '08*. 4) I was disappointed when playing *Tiger Woods PGA Tour '08*. 5) I would like to play *Tiger Woods PGA Tour '08* again in the future. 6) I thought that playing the *Tiger Woods PGA Tour '08* golf video game was boring. These items also met the reliability requirement with a Cronbach's $\alpha = .88$.

Tiger Woods putting score. Finally, to determine how well participants played in the *Tiger Woods* putting challenge, their scores were recorded from the video game score card after putting the 18 holes. Participant scores were constructed by tallying the frequency of putts that it took to finish the 18-hole challenge. The lower the score, the better the participant played.

Avatar manipulation check. To assess whether or not the avatar customization manipulation was successful, a scale was created to measure avatar resemblance. Each of the items asked participants to rate perceptions of whether or not the avatar that they played as resembled them. Questions were measured using scales anchored at 1 (*Strongly Disagree*) and 7 (*Strongly Agree*). Questions included the following 1) My avatar was similar to me; 2) My avatar had an appearance like mine; and 3) My avatar resembled me.; These three questions were found to be reliable with a Cronbach's $\alpha = .85$. (See *Appendix C* for complete measurement instruments).

Analysis

The appropriate quantitative methods including analysis of covariance, correlation analyses, and path analysis were used to test each of the hypotheses advanced in the literature review. Prior to analyses, the data were examined for normality and outliers. All univariate data were determined to be normally distributed by examining skewness. All values for skewness were (< 1 , or > -1). A multivariate check for variables in the path model was conducted to identify any outliers in the data using Mahalanobis' distance. These analyses suggested that all variables met normality criteria and were acceptable for univariate and multivariate analyses. Descriptive statistics for the hypothesized variables were examined to search for any abnormalities in the data. Means and standard deviations fell within acceptable parameters for what would be expected, and minimum and maximum scores indicated that participants experienced a wide range of possible experiences for each variable. (See *Table 1*).

Table 1. Descriptive Statistics for Measured Variables Across Conditions

	Mean	SD	Min	Max
1. Presence	4.85	1.17	1.20	7.00
2. Golf Efficacy	4.12	1.23	1.29	7.00
3. Golf Affect	4.92	1.45	1.40	7.00
4. Putting Error	77.23	41.54	1.25	163.00
5. TW Like	5.62	1.10	1.50	7.00
6. TW Putt Score	74.63	12.56	41.00	113.00
7. Golf Experience	2.45	1.01	1.00	7.00

Descriptive statistics were also examined by condition to search for abnormalities in the data. Means and standard deviations by condition also fell within acceptable parameters for what would be expected in a normal population (see *Table 2*).

Table 2. Mean and Standard Deviation Scores for Measured Variables by Condition

	Condition 1	Condition 2	Condition 3	Condition 4
1. Presence	4.94 (1.15)	5.17 (1.05)	4.95 (.98)	4.35 (1.35)
2. Golf Efficacy	4.77 (1.16)	4.21 (1.25)	4.00 (1.19)	3.55 (1.09)
3. Golf Affect	5.30 (1.45)	5.63 (1.15)	4.61 (1.26)	4.13 (1.50)
4. Putting Error	66.75 (33.38)	53.60 (39.33)	91.17 (41.77)	97.25 (37.81)
5. TW Like	5.91 (.79)	6.08 (.78)	5.45 (1.07)	5.04 (1.38)
6. TW Putt Score	68.44 (9.82)	65.38 (8.76)	79.55 (9.22)	85.18 (10.86)
7. Golf Experience	3.02 (1.37)	2.49 (1.02)	2.16 (.75)	2.21 (.63)

Notes. Means are reported first followed by standard deviation scores in parentheses.
1 = Motion Controller x Avatar Customization, 2 = Motion Controller x No Avatar Customization
3 = Symbolic Controller x Avatar Customization, 4 = Symbolic Controller x No Avatar Customization

Test of the Theoretical Model

In order to test the final model, data were imported into the AMOS software program from SPSS v.16, and a path analysis was conducted using maximum likelihood estimation (Bentler & Bonett, 1980). Data were imputed in AMOS prior to subsequent path analysis to account for any missing data.

Before testing, zero-order correlations were examined in order to substantiate variable inclusion in the predicted path model (see *Table 3*). The bivariate correlations of the variables indicated that most of the relationships coincided with hypothesized predictions with some noteworthy exceptions. First, although the relationship between avatar customization and presence was directionally appropriate, it was not significant as the theoretical model had predicted. This indicated that this particular relationship would need to be reconsidered. Second, the relationships between participant sex and previous golf experience demonstrated significant relationships with many of the variables in the theoretical path model. Therefore, both sex and previous golf experience were controlled for in all analyses.

Table 3. Zero-order Correlations for All Path Model Variables

	1	2	3	4	5	6	7	8	9	10
1. Type of Controller [a]	1.00									
2. Avatar Customization [b]	.02	1.00								
3. Sex [c]	-.38**	.10	1.00							
4. Golf Experience	.27**	.11	-.37**	1.00						
5. TW Putt Score	-.63**	.07	.32**	-.14	1.00					
6. Presence	.18*	.08	-.02	.19*	-.34**	1.00				
7. TW Like	.33**	.06	-.10	.23	-.45**	.52**	1.00			
8. Putting Error	-.40**	.04	.51**	-.25**	.37**	-.14	-.23**	1.00		
9. Golf Efficacy	.29**	.20*	-.29**	.51**	-.35**	.38**	.32**	-.29**	1.00	
10. Golf Affect	.36**	.03	-.29**	.48**	-.37**	.41**	.66**	-.33**	.60**	1.00

Note. * Correlation is significant at $p < .05$
**Correlation is significant at $p < .01$
[a] Coded as a dichotomous variable with 0 = symbolic controller and 1 = motion controller
[b] Coded as a dichotomous variable with 0 = no customization and 1 = avatar customization.
[c] Coded as a dichotomous variable with 0 = male and 1 = female.

Chapter 3

Results

Hypothesis Tests

Hypothesis 1 proposed that participants playing the golf video game using enactive performance motion controllers on the Nintendo Wii would perform better in similar real-world tasks than those playing through symbolic rehearsal controllers. For this analysis, the control condition was added to determine if any of the media treatment groups performed differently. Analysis of covariance (ANCOVA) found that when controlling for sex, and previous reported golfing experience, those assigned to play *Tiger Woods PGA Tour '08* with the motion controller had the lowest putting error score when putting golf balls (M = 68.23, SE = 4.48) followed by those in the control condition (M = 79.58, SE = 6.36). Those playing in the symbolic condition with the Wii Nunchuk achieved a significantly larger putting error score (M = 88.21, SE = 4.39), $F(2, 156)$ = 4.73, $p<.01$, partial $\eta^2 = .06$. Pairwise comparisons indicated that those using the enactive rehearsal motion controller putted significantly better than those using the symbolic controller, but neither of these groups differed from the control group (see *Table 4*).

Table 4. Adjusted Putting Error Mean Scores with Control Group

	Motion Controller	Control Group	Symbolic Controller
M	68.23_a	79.58_{ab}	88.21_b
SE	4.48	6.36	4.39

Note: Means with no shared subscript differ at $p < .01$.

Since liking of the game may influence the relationship between controller and putting score, another ANCOVA was run controlling for sex, previous golf experience, and liking of the *Tiger Woods PGA Tour '08* video game. Results indicated that type of controller used remained significant controlling for all three variables, $F(1, 126) = 5.40$, $p<.05$, partial $\eta^2 = .04$. Thus, hypothesis 1 received empirical support.

Hypothesis 2 predicted that participants playing with enactive performance motion controllers on the Nintendo Wii would feel greater perceptions of presence than those playing with symbolic rehearsal controllers. Controlling for sex, previous golf experience, and liking of the video game, an ANCOVA revealed that those playing *Tiger Woods PGA Tour '08* with the motion controller did not report feeling significantly greater perceptions of presence than those playing with the symbolic controllers, $F(1, 125) = .02$, *ns*, partial $\eta^2 = .00$. Adjusted mean presence scores for the enactive performance motion controller condition ($M = 4.86$, $SE = .14$) and for the symbolic rehearsal condition ($M = 4.84$, $SE = .14$) indicated that perceptions of presence did not differ significantly by type of controller. Thus, hypothesis 2 is not supported.

Hypothesis 3 predicted that participants who customized their avatars would experience greater levels of presence during game play than those who did not customize their avatars. An ANCOVA controlling for sex, previous golf experience, and liking of the video game revealed that there were no significant differences in perceptions of presence between participants who customized their avatar ($M = 4.89$, $SE = .13$) and those that did not ($M = 4.81$, $SE = .13$), $F(1,125) = .20$, *ns*, partial $\eta^2 = .00$. Thus, hypothesis 3 was not supported.

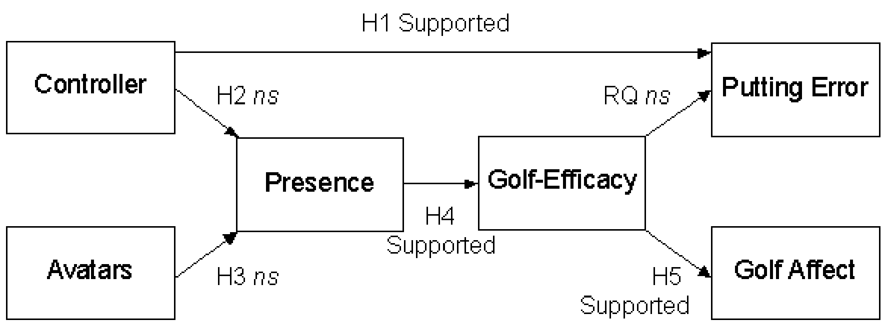
Hypothesis 4 predicted that perceptions of presence would be positively correlated with perceptions of golf-efficacy. Partial correlation analysis controlling for sex, previous golf experience, and liking of the golf video game yielded a significant positive correlation between presence and golf-efficacy, $pr = .27$, $p < .002$, $N = 125$ (2-tailed). This test indicates that those who experienced greater perceptions of presence while playing *Tiger Woods PGA Tour '08* also had greater perceptions of golf-efficacy. Thus, hypothesis 4 was supported.

The research question asked if perceptions of golf-efficacy after video game play would be negatively correlated with behavior (putting error) in a game-related real-world task (putting golf balls). Partial correlation analysis controlling for sex, previous golf experience, and liking of the *Tiger Woods PGA Tour '08* video game indicated that the relationship between golf-efficacy and putting error score was not significant, $pr = -.11$, $p = .22$, $N = 125$, (2-tailed). Consequently, the research question was not supported.

Hypothesis 5 predicted that greater perceptions of golf-efficacy would be positively correlated with reports of liking the real game of golf. Partial correlation analysis controlling for sex previous golf experience, and liking of the golf video game indicated that perceptions of golf-efficacy were positively related to liking the game of golf, $pr = .42$, $p < .001$, $N = 125$ (2-tailed). Participants that possessed a higher degree of golf-efficacy also tended to have more of a positive disposition toward the game of golf. Thus, hypothesis 5 also found empirical support.

To summarize the results of the hypothesis tests, some of the predicted relationships between variables were observed in the model, though others did not materialize (see *Figure 3*). Specifically, support was obtained for the idea that the enactive rehearsal motion controller would result in lower putting error, that greater levels of presence would be positively associated with higher levels of golf-efficacy, and that golf-efficacy would be positively associated with golf-affect. However, the predicted effect of avatar customization on presence was not significant, nor was the relationship between type of controller and presence, when controlling for sex, previous golf experience, and participants' enjoyment of the *Tiger Woods* video game experience. Further, the relationship between golf-efficacy and putting error was not significant.

Figure 3. Recap of Hypothesis Testing

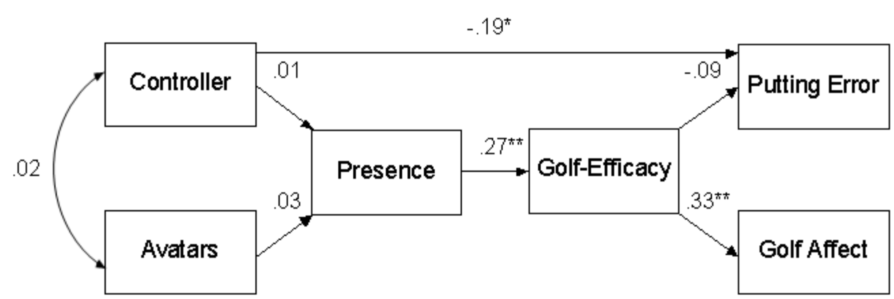


Path Analysis

To present these results in a parsimonious fashion, a path model was conducted with all hypothesized relationships included, controlling for sex, golf experience, and enjoyment of the *Tiger Woods* game experience (see *Figure 4*). Maximum likelihood estimates were employed, and fit statistics were examined. In order to determine the goodness of fit of the model to the data, the following criteria were used. First, the associated chi-square statistic and global goodness of fit indices needed to indicate model fit. Second, proposed paths needed to be directionally appropriate (i.e. proposed negative correlations should have negative path coefficients). Third, retained paths needed to make statistically significant contributions to the model through direct, indirect, or total effects. With these criteria in place, the hypothesized model was tested. Figure X shows the path coefficients for the variables in the model. Although the model controlled for participant sex, previous golf experience, and liking of the Tiger Woods PGA Tour ’08 video game, for simplicity’s sake, they are not illustrated in the model.

Overall, the fit statistics indicated that the model fit the data well, $\chi^2(8) = 8.49$, $p = .39$, RMSEA = .02, NFI = .98, CFI = 1.00. However, this close fit did not reflect significant relationships for many of the hypothesized paths. Namely, as revealed in previous analyses, the direct effects of the controller and the avatars on presence were non-significant, and the effect of perceived golf-efficacy on putting error was not significant.

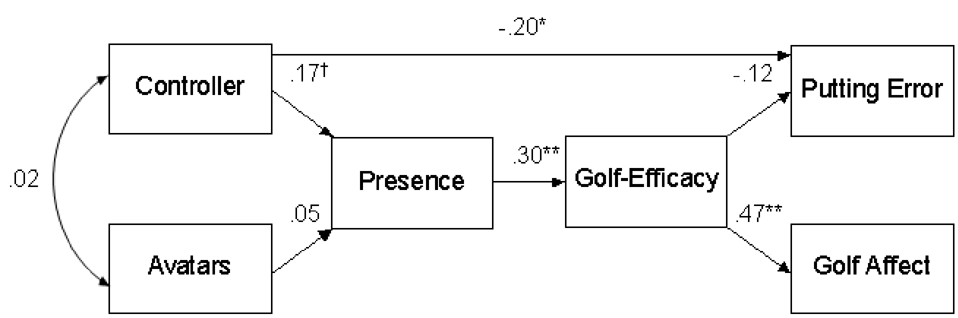
Figure 4. Proposed Model Controlling for Participant Sex, Previous Golf Experience, and Liking of the *Tiger Woods* Video Game.



Note. *p<.05, ***p*< .001
Controller was coded as a dichotomous variable with 0 = symbolic controller and 1 = motion controller
Avatars was coded as a dichotomous variable with 0 = no customization and 1 = avatar customization.

There are several reasons why this path model may have fit the data in the absence of these significant paths. First, it is important to acknowledge that the sample size is low, so fit statistics should be interpreted with caution. Second, many of the control variables appeared to play consequential roles in the model. Namely, this model employed enjoyment of the *Tiger Woods* game experience as a control variable. Within this model, enjoyment of the game was significantly correlated with the controller r = .33, $p < .001$, indicating that the participants who played with the enactive rehearsal motion controller rather than the symbolic controller enjoyed the game more. Likewise, enjoyment of the game experience was significantly related to both presence (β = .50, $p <$ .001) and to positive golf affect (β = .58, $p < .001$). Also, it is important to note the strong positive relationship between presence and liking of the *Tiger Woods* video game, r = .51, $p < .001$. Controlling for liking of the *Tiger Woods* video game may have substantially attenuated some of the paths in the hypothesized model. A re-examination of the original model without controlling for liking of the *Tiger Woods* video game verifies that this is the case (see *Figure 5*).

Figure 5. Proposed Model Controlling for Participant Sex and Previous Golf Experience



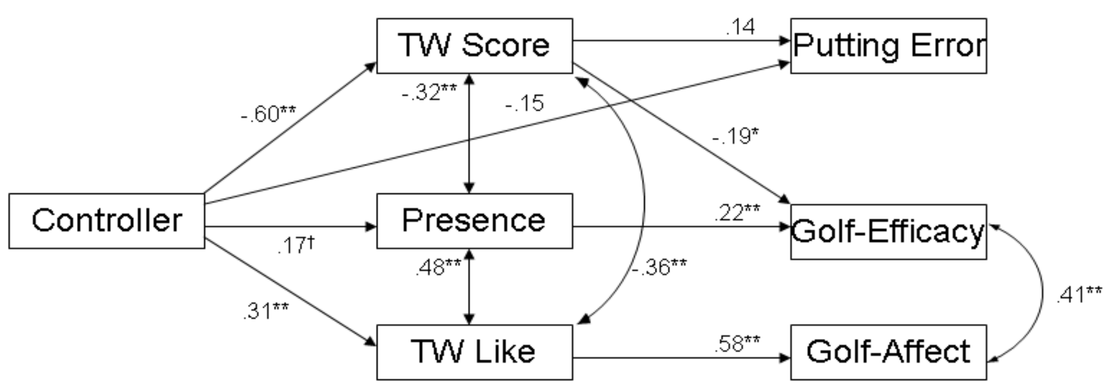
Note. †p<.08, *p<.05, ***p*< .001
Controller was coded as a dichotomous variable with 0 = symbolic controller and 1 = motion controller
Avatars was coded as a dichotomous variable with 0 = no customization and 1 = avatar customization.

When not controlling for liking of the *Tiger Woods* video game the relationship between type of controller and presence becomes much stronger as well as the relationship between golf-efficacy and golf affect. Consequently, it appears as though enjoyment is an important outcome of playing the game when using motion controllers that has implications for subsequent outcomes. Therefore, the decision was made to investigate a respecified path model which treated liking of the *Tiger Woods PGA Tour '08* video game as an additional mediating variable instead of a control. In addition, the original model did not employ other variables that may have also been consequential in the relationships between constructs. For example, the model did not account for actual performance in game play, yet this variable may be an important predictor of subsequent putting and feelings of golf-efficacy. The next section examines this reasoning in the final set of exploratory analyses.

Supplemental Analyses and Revised Model

One reason why the original theoretical model did not receive empirical support may have been the fact that liking of the *Tiger Woods PGA Tour '08* video game and game score had not been taken into account. A re-examination of the relationships between the original model's variables and additional mediating variables to explore the relationships between affordances, personal determinates, and behavior was deemed necessary. In the absence of a significant relationship between avatar customization and perceptions of presence, the decision was made to focus on the type of controller. A final revised model was tested to examine the effect of controller on three variables associated with game play: feelings of presence, feelings of enjoyment, and actual performance during video game play. These variables were, in turn, used to predict affective, cognitive, and behavioral reactions to actual golfing experiences: putting performance, golf-efficacy, and positive affect toward golf, respectively. Path analytic techniques were utilized, with the sex of the participant and actual golfing experience employed as controls. The model was further examined using Preacher and Hayes' (in press) SPSS macro that employs bootstrapping procedures to examine not only total indirect effects when multiple mediators are present, but also *specific* indirect effects (via specific mediators). With the exception of the control variables (which were retained in all instances), paths associated with the mediators were dropped from the model when 1) the mediator was unrelated to the independent variable, 2) the mediator was unrelated to the dependent variable, or 3) the mediator did not contribute to indirect or total effects. The resulting model is reported in *Figure 6*.

Figure 6. Revised Model Controlling for Sex and Previous Golf Experience



Note. *p< .01, ** p< .002, †approaches significance at p< .07.
Controller was coded as a dichotomous variable with 0 = symbolic controller and 1 = motion controller

Overall, the fit statistics indicated that the model fit the data well, $\chi^2(9) = 4.91$, p = .84, RMSEA = .00, NFI = .99, CFI = 1.00. In terms of putting performance, an examination of the paths showed that playing *Tiger Woods PGA Tour ’08* with the enactive rehearsal motion controller was significantly associated with scoring better during game play than playing with the symbolic rehearsal controller. Although the direct effects between the type of controller and putting error (β = -.15), and between *Tiger Woods* video game performance and putting error (β = .14) were not significant, the total effect of controller on putting error (direct and indirect) was significant, β = -.23, $p < .01$. Thus, it appears that playing with the motion controller results in better actual performance, partially as an outcome of playing, and partially because performing better during game play leads to better performance. Indeed, higher levels of performance appear to play a consequential role, lower scores in the game (i.e., better performance) game was also associated with greater perceptions of presence (r = -.32), greater liking of the *Tiger Woods PGA Tour ’08* video game (r = -.36), and greater feelings of golf-efficacy (β = -.19).

This model also showed that playing the enactive rehearsal motion controller was associated with greater presence to a marginally significant degree (β = .17), and presence was associated with higher levels of golf-efficacy (β = .22). Better performance on game play was also associated with higher levels of golf-efficacy (β = -.19). However, an examination of the specific indirect effects of the controller on golf-efficacy revealed that only presence served as the significant mediator. Performance on the *Tiger Woods PGA Tour ’08* video game did not mediate the relation ship between the type of controller and golf-efficacy.

Finally, in terms of golf-affect, the controller was a significant predictor of enjoyment (β = .31), with people reporting greater enjoyment of when playing the with the enactive rehearsal motion controller than the symbolic controller. In turn, greater enjoyment was associated with more positive golf-affect ($\beta = .58$). An examination of the indirect effects revealed a significant indirect effect of controller on golf-affect ($\beta = .18$). Hence, people who played using the motion controller ultimately appeared to believe they would enjoy real-world golf more via the experience of enjoyment while playing the golf video game.

To summarize, the respecified model indicated that use of the motion controller was strongly related to game performance, and the total effect of the type of controller was significantly related to putting performance in a similar real-world task. Further, presence served as a mediator between type of controller and perceptions of golf-efficacy, indicating that those who played with the enactive rehearsal controller felt like they were more "in the game" en route to feeling like they could play golf better in the real world. Finally, the type of controller was also related to liking of the video game, which was then related to anticipated liking of the actual game of golf. The theoretical and practical relevance of these findings will be elaborated upon in the discussion section.

Chapter 4

Discussion

This purpose of this experiment was to examine how technological variables including affordances provided by the Nintendo Wii worked with socio-cognitive determinates in order to facilitate behavioral learning and affect. Three out of five of the original hypotheses achieved statistical significance. Although the original theoretical model failed to garner empirical support, a respecified model provides insight into how future research may be designed. The theoretical and practical implications of each of the findings will be discussed in the following paragraphs.

Hypotheses

Hypothesis 1 demonstrated a significant main effect for type of controller used while playing the video game on putting error score even when controlling for the effects of sex, previous golf experience, and liking of the *Tiger Woods PGA Tour '08* video game. Those playing using the enactive performance motion controller achieved significantly lower putting error scores than those using the symbolic rehearsal controller. Although not significant, those using the Wii motion controller putted better than the control condition (mean difference of 11.35 feet) that had not been exposed to the video game treatment. Interestingly, those in the symbolic condition putted the worst out of all three groups. These finding may be explained in the following ways. At the theoretical level, Bandura's (2002) retention and production processes may explain this pattern. Participants were able to repeat their swing and refine their putting abilities across the trials associated with 18 different putting greens. This repetition would have facilitated the retaining of information necessary to effectively putt golf balls. Since participants received this practice through enactive rehearsal (Bandura, 1977), they were able to produce or re-produce the putting stroke again when called to perform a similar task in a real-world environment.

The second way in which this finding may be explained is through the development of neuromuscular facilitation, or implicit motor learning. The mechanics of a putting swing rely on fine-muscle coordination and movement. The repetition of putting over and over across 18 holes may have started to develop an automatic response in the muscles that allowed participants in the enactive motion control condition to putt more accurately than those pushing buttons in the symbolic rehearsal condition. This explanation would be consistent with recent work on putting skill acquisition (Poolton, Masters, & Maxwell, 2005). The development of muscle memory or implicit motor learning would explain why those in the enactive rehearsal condition achieved significantly lower putting error scores. This may further have been facilitated by the fact that the swing used for the game simulates a real golf swing very closely, allowing for easy transfer between the game and real-world environment.

Although those in the symbolic group had played 18 holes of video golf, they proceeded to putt the worst out of all three groups. Understanding the difference between implicit and explicit learning may be of value in explaining why this occurred. Since implicit motor learning is characterized by automaticity (Poolton, Masters, & Maxwell, 2005), a drawn-out cognitive procedure is not necessary to perform a task. However, those in the symbolic condition spent the entire time trying to translate very specific button pushes and symbolic manipulations into golf movements onscreen. By comparison, this is a much more cognitively oriented task, or explicit task, than putting golf balls with a natural swing with the motion controller. Not having this experience, those in the control condition didn't carry the cognitive residue that those in the symbolic condition may have had, making it easier for them to walk in and putt without having to think through the procedure.

The implications of this finding extend beyond the traditional cognitive learning of a behavior through media, but venture into the realm of behavioral proficiency. In this experiment, playing *Tiger Woods PGA Tour '08* on the Nintendo Wii with the motion controller improved a real-world performance. Practically speaking, it appears that playing this game on the Nintendo Wii with the motion controller may help to develop or fine-tune putting abilities.

Hypothesis 2 predicted that participants playing with the enactive performance motion controllers would feel greater perceptions of presence than those playing with symbolic rehearsal controllers. The analyses revealed that those playing with the motion controller had slightly greater, but not significantly greater, perceptions of presence than those playing with the symbolic controller. Given that the technologies used in the experimental conditions were held constant regardless of experimental manipulation, (i.e., video game image projected on large screen, surround sound, dimmed lights, etc.), it is not surprising that those in both the symbolic rehearsal condition and enactive rehearsal condition still scored well above the midpoint on the 7-point presence scale. These high scores indicate that there may have been a ceiling effect for perceptions of presence. Regardless, those playing with the motion controller did not enjoy significantly greater perceptions of being "in the game" than those in the symbolic button pushing condition. This indicates that form factors in the environment such as screen size and surround-sound speakers (Lombard & Ditton, 1997) may outweigh the affordance of the motion controller as far as presence is concerned.

Hypothesis 3 predicted that participants in the avatar customization condition would experience greater levels of presence than their noncustomizing counterparts. Analyses indicated that avatar customization did not lead to greater perceptions of presence while playing the golf video game. Although this particular variable was not carried over to the respecified model, lack of significance does not signify lack of importance. In the absence of a reliable declarative knowledge variable it is hard to rule out the idea that participants who customized an avatar may have paid more attention to the game and learned more declarative knowledge about golf such as stance, body positioning, or golf terminology. Future research needs to examine how avatar customization facilitates the learning process.

Hypothesis 4 predicted that perceptions of presence would be positively correlated with perceptions of golf-efficacy. This finding received statistical support. The more immersed and involved participants became in the video game, the more strongly they believed in their abilities to play golf in real life. This finding underscores the importance of presence on individuals' abilities to feel like they are actually playing the game of golf, en route to feeling like they actually can play golf. Interestingly, participants' perceptions of golf-efficacy were not correlated with putting error scores. Even though participants may have believed that they could be good golfers, this was not reflected in their ability to putt more accurately. This finding contributes to the studies which acknowledge Bandura's (2001) contention that the biological hardware may not be reducible to the psychosocial software.

Hypothesis 5 predicted that greater perceptions of efficacy would be positively correlated with reports of liking the game of golf. Intuitively, this makes sense as people are generally inclined to like things that they perceive themselves to be good at. This finding is consistent with previous studies (Compeau & Higgins, 1995; Compeau, Higgins, & Huff, 1999; Vorderer, Klimmt, and Ritterfeld 2004) and contributes to the body of literature which links efficacy to liking and enjoyment. Altogether, greater perceptions of efficacy may be regarded as a better predictor for whether or not a person will engage in an activity, not necessarily as a predictor for how they will perform.

Path Models

The final, exploratory path model provides one possible framework to understand the processes of learning behaviors through video game play. The variables in the respecified model tell the following story. First and foremost, the type of controller makes a difference. Those who played with the motion controller scored better in the game and had less putting error in the related, real life putting task. In addition, they felt more immersed in the game which was related to heightened perceptions of golf-related efficacy. Equally as important, those playing with the enactive rehearsal motion controller enjoyed playing the video game more. Liking of the video game then associated with participants' having more positive affective dispositions toward the game of golf, with these perceptions correlated with golf-efficacy. Knowing how these variables work together could help to get people on the golf course. Not only does the motion controller reduce putting error, but it increases liking of both the video game and anticipated liking of real game, while increasing people's beliefs in their own capabilities.

For those who may be timid about taking up a sport such as golf, playing a game such as this with the enactive performance motion controller is a good place to start to increase confidence and liking of the game in general. Further, the exploratory model indicates that the enactive performance motion controller appears to attenuate putting error better than the symbolic rehearsal controller does. This sets the Nintendo Wii apart from traditional game consoles as it is the only video game console that currently boasts this particular affordance. From a practical perspective, for golfers who live in climates that do not allow year-round golf play, practicing golf skills on the Nintendo Wii may be a viable option for staying sharp in the off season. The results from this study suggest that enactive performance afforded by the Nintendo Wii's motion controller can generate or strengthen muscle memory beyond what traditional button-bashing consoles are capable of.

Taken as a whole, the variables investigated in this study not only support predictions from the body of work in learning through modeled behavior, but they reinforce Bandura's (2002) triadic reciprocal causation model. Technological affordances in the environment such as motion controllers that allow enactive performance can affect personal determinates such as perceptions of presence, efficacy, and affect, which may lead back to favoring a certain combination of affordances for game play. Likewise, the environmental determinates allow gamers to develop proficiency in behaviors, while being proficient in the behavior can encourage the use of certain technological affordances in the environment. Finally, engaging in a certain behavior can lead to perceptions of efficacy, presence, or liking of a game, which in turn can motivate people to continue attempting those behaviors.

Implications

Looking at the results from this study, the nature of the content of highly interactive games becomes critical. The enactive capability of games to replicate real-world activities may be beneficial for gamers in many ways. Those who may be tentative to learn how to play an instrument may become comfortable via playing games such as *Guitar Hero* or *Rock Band*. Repeated exposure to the game could lead to finger dexterity (necessary for the playing of most instruments), liking of an instrument, and efficacy beliefs about abilities to become proficient in playing an instrument. The same may be said for other games that replicate real-world activities such as the tennis, baseball, and boxing games bundled with the Nintendo Wii game console. This precept may also encourage *Wii Fit* enthusiasts to maintain and diversify their workout routines as they build efficacy through game exercises. While learning to exercise and having fun while exercising, people may begin to like exercise and feel that they could do other exercises too.

It is important to again note that although games using the motion control device may increase perceptions of efficacy, that it does not mean that an individual will necessarily be “good at” or proficient in any real-world, related activity. For instance, one might play a game such as *Guitar Hero* very well, yet still not be able to play a guitar. In this example, perceptions of efficacy become more important as one considers whether or not they would even try to play a real guitar.

The downside of these findings represents a more complex problem. For example, in the *Grand Theft Auto* video game, it is possible to beat up a prostitute with a baseball bat and steal her money. If this is just a symbolic gesture (as it currently remains), the likelihood that the act will be carried out in real life may be lessened because of the symbolic nature of button pushing. However, if this game were released for the Nintendo Wii, this study suggests that the experience would be much different. By using full kinesthetic body motions with the Wii controller to physically enact the beating, the cognitive learning of the behavior may become paired with a physical motion sequence, thus joining cognitive memory with muscle memory. This could lead gamers to believe that they possess the skills or self-efficacy to enact these violent acts in real life. Further, they may come to enjoy this sensation. Reinforcement of this violent act through increased scores, character lives, or weapons in the game environment may encourage and reinforce this type of behavior. Needless to say it is going to become more and more important to monitor game content for consoles that utilize the motion controlling technologies.

General Limitations and Future Research

Although this study provided some insight into the process through which behavioral learning may be intensified, there were some limitations. First, sex differences proved to be significant for many of the variables in this study. Since these differences were not anticipated, no attempt was made to control for biological sex when participants were randomly assigned to experimental conditions. Future research would benefit from this control. Further, since sex was significantly related to many of the variables in this study, it begs the question; do technologies teach or refine behaviors differently? In light of the fact that males still spend more time playing video games than females, further exploration of sex differences for game related learning is necessary.

Next, it is unclear based on the results of this study whether or not the effects observed are enduring. In the short term, participants utilizing the enactive rehearsal controller tended to have lower putting error scores than their counterparts utilizing the symbolic rehearsal controller. Research suggests that time and repetition are important elements for the development of implicit motor memory (Poolton, Masters, & Maxwell, 2005). It is possible that in the time that a person would take to drive to the nearest golf course that the effect would wear off. A longitudinal design to assess performance over a period of days or weeks would help to discern the effects of these affordances over time more clearly.

It is also important to point out that the video game manipulation had participants playing 18 holes of the putting mini game, not playing 18 holes of golf from tee-shot, to fairway, to green. As such, the findings are restricted to generalizations about fine-muscle development and coordination, not to gross motor skills such as driving, hitting irons on the fairway, or using a pitching wedge from a sand trap. Future research should further investigate the relationships between technological affordances and socio-cognitive determinates on the ability to acquire both fine and gross motor movement skills.

It is important to note that this study utilized technologies that not everyone has immediate access to. For example, not every home is equipped with a game room that utilizes an overhead projector, 9-foot projection screen, and surround-sound speakers to play video games. This begs the question of the importance of form factor. Would the results from this study replicate if technologies were used that could be found in a dorm room or living room? Future research could increase the generalizability of findings by examining how form and affordances combine to affect perceptions of presence and resulting behaviors.

Finally, it is also important to acknowledge that the avatar customization condition dropped out of the final, respecified model. On the surface, it appears that the simple act of customization does not significantly contribute to the outcomes examined in this study. However, it would be premature to suggest that this variable is not important in the learning process. Recalling that a body of research has validated the import of perceived similarity when it comes to learning through modeled behavior (Bandura, 1977, 1986, 2002), it is important to delve deeper into the customization process to examine how outcomes of customization such as perceived resemblance and avatar ownership influence learning outcomes above and beyond the simple act of customization. Knowing how these variables relate to learning and affect has implications for game designers and game companies seeking to balance tight development budgets with the largest consumer return on investment.

Methodological Limitations and Future Research

In addition to some general limitations to this study, acknowledging the methodological limitations is important for guiding future research in this vein. Although the revised model fit the data from this sample, they were either respecified or derived through exploratory post-hoc analyses. As such, they should be regarded as a tentative guide for future model validation. It is important to acknowledge that the model modifications made in this study may fit the data from the obtained sample, but may not generalize to the population at large (Holbert & Stephenson, 2002; MacCallum, Roznowski, & Necowitz, 1992). More work needs to be done to cross-validate and substantiate the respecified model with additional, preferably larger samples.

The measurement of putting error may have been a limiting factor as well. Since a hole couldn't be drilled in to the media lab floor to provide sufficient cup depth to capture a hard-hit putt, a series of rules had to be devised in order to approximate putting conditions in determining the final putting error score. Although the rules were applied consistently, a better method of measuring this variable would be to have future participants putt from a raised platform with a hole or an actual putting green.

At a psychological level, putting scores may vary based on participant motivation. For example, if participants knew a priori that they would be putting golf balls, they might have paid closer attention to their movements making a concerted effort to use the video game as a learning tool. The decision to keep participants unaware of the putting task helped to situate them in more of an entertainment context, thereby improving the external validity of these findings. Future research could manipulate or examine motivation for game play to examine how the learning of behaviors or affect may differ.

A fruitful avenue for future research gleaned from this study lies in the measurement of presence. Until the advent of the Nintendo Wii, it was not feasible to measure range of motion in anything other than a fully immersive V.R. environment. As the results from this study show, the motion controller does contribute to participant perceptions of presence. It is possible that freedom of motion can be used in the video game realm as a presence measure even without the head-mount displays, tracking devices, and tactile gloves. Future studies should include measures of motion, especially when using the Nintendo Wii in video game presence research.

The point of view from which a video game player engages the virtual world is also salient in terms of presence perceptions. Since the *Tiger Woods PGA Tour '08* video game only allows for a third-person point of view, the avatar, regardless of whether or not it resembles the game player, may be a distraction which hinders perceptions of presence. This may occur as it reinforces the dual role of the gamer as both the controller and observer of the avatar's actions. Eliminating the avatar and playing from the first-person perspective is likely to increase perceptions of presence by allowing gamers to feel as if they are part of the virtual environment – not just controlling an embodied other within a virtual environment (Biocca, 1997; Tamborini & Skalski, 2006). Future work should manipulate first and third person points of view to assess how this variable contributes not only to presence, but to learning and behavior acquisition as well.

Theoretical Considerations

The relationships observed in the revised path model identify Social Cognitive Theory as a solid theoretical foundation for how people may learn behaviors through video game play. Both cognitive and affective outcomes figure prominently in the final model (perceptions of golf-efficacy and golf affect respectively), and the behavioral outcome is also consistent with SCT as it supports the importance of enactive rehearsal in learning. However, since the relationship between the type of controller and behavior (putting error score) was not mediated by any cognitive or affective variable (ie. presence, golf-efficacy, or golf affect), a question remains as to whether or not this theory holds the most explanatory power for the findings. Other learning theories may help to explain this pattern. Specifically, proponents of the Situated Cognition approach to learning would argue that the learning of the putting behavior came not from learning through a modeled behavior, but through the interaction with the environment (Brown, Collins & Duguid, 1989). The fact that participants putted golf balls better in real life indicates that a situated approach may hold at least some explanatory power.

Looking at the two theories side by side, I would argue that the combination of both theories works better at explaining these results than any one in isolation. The reason for this stems from the realization that the needs of the learner change between perception and action. Social Cognitive Theory explains the process by which people learn through modeled behavior (Bandura, 1986, 2002). The key here is that learning is cognitive, meaning that the learning is symbolic in nature, and that schemas may be developed or stored for how to engage in a task. The knowledge of how to perform an activity doesn't mean that one will be proficient in the execution. However, a person may be able to explain an undertaking explicitly having gained declarative knowledge of the task at hand (Sun, Merrill & Peterson, 2001). For example, a person may learn and be able to explain proper foot placement for a golf putting stance, club grip, head posture, etc., and create a schema for putting.

By contrast, situated learning explains how people learn through their interaction with the environment. The key here is that people may learn to execute a behavior better, through active engagement situated in a context of practice (Brown, Collins & Duguid, 1989). This theory may account for behavioral change (and the relationship between the type of controller used and putting score) better than Social Cognitive Theory does. Muscle memory or implicit motor learning may be acquired or improved upon through enactive rehearsal in the environment. This is an alternative theoretical explanation for why the motion controller produced lower putting error scores. In short, the "social-cognitive" part speaks more toward whether or not explicit, declarative knowledge is learned, and the "situated" part speaks more toward whether or not the implicit, procedural knowledge is learned. The combination of affordances that the Nintendo Wii game console provides makes it possible to explore both of these theories and their combined contributions to the learning process. Future research should explore tenets from both learning theories to examine the notion of a socially-situated model (Semin & Smith, 2002) that accounts for implicit and explicit learning as well as declarative and procedural learning through video game play. A longitudinal study could help to determine how these theories relate to the changing needs of the learner cognitively, affectively, and behaviorally over time.

Summary

This study found that using enactive or symbolic controllers differentially impacts how gamers may learn or refine behaviors. From enactive performance, players can alter behaviors more-so than through symbolic rehearsal, where players may only learn cognitive scripts. The motion controller affordance provided by the Nintendo Wii has even greater potential to teach game players to become proficient in behaviors that closely mimic real-world actions than traditional video game consoles. As console manufacturers strive to create more innovative ways to interact with video games, and as game designers push the limits of game content, the question remains—What will Wii think of next?

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Appendix A

Screenshots of Customization from *Tiger Woods Golf 2008*

The player must customize everything from muscles on the arms and length of the legs to the smallest detail of wrinkles or the bridge of the nose. This feature also allows players to create the way their golfer looks in terms of body part size, hairstyle, feature positioning (face) and golf apparel.

Appendix B
Screenshots of Putting from *Tiger Woods Golf 2008*

Appendix C
Measurement Instruments

Survey 1 Participant ID: ________________________________

Please read the instructions and complete the following questionnaire. Please answer all questions to the best of your ability.

Biological sex: Male_____ Female_____

Academic standing: Freshman_____
Sophomore_____
Junior_____
Senior (+) _____

To the best of your ability, estimate in hours and minutes the total amount of time that you play computer games or video games during an average work-week (Monday through Friday).

I play for __________hours and __________ minutes during an average work week.

To the best of your ability, estimate in hours and minutes the total amount of time that you play computer games or video games during an average weekend (Saturday through Sunday).

I play for __________hours and __________ minutes during an average weekend.

Please rate the level of experience you have in playing video games on the following console systems:

Nintendo GameCube

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Microsoft Xbox

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Sony PlayStation 2

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Nintendo Wii

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Microsoft Xbox 360

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Sony PlayStation 3

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Other (Specify) ________________________________

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Please indicate the level of experience that you have playing the following video games:

Tiger Woods PGA Tour 2005

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Tiger Woods PGA Tour 2006

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Tiger Woods PGA Tour 2007

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Tiger Woods PGA Tour 2008

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Please indicate the level of experience you have playing the following game on the specific console:

Tiger Woods PGA Tour 2008 on the Nintendo Wii

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Tiger Woods PGA Tour 2008 on the XBox 360

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Tiger Woods PGA Tour 2008 on the Sony PlayStation 3

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Please indicate the level of experience that you have in the following golf-related activities in real life:

Playing golf on a golf course

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Practicing putting golf balls on a putting green

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Playing miniature golf

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Playing golf on a team (high school or college)

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Playing golf in a league

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Taking lessons from a golf pro

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Survey 2 Participant ID: ______________________________

Please answer by circling the appropriate number for the following questions in regards to your perceived ability, beginning with the phrase:

"I am confident that…"

I could be a good golfer.
Strongly disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I could be a good miniature golfer.
Strongly disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I could putt golf balls well on a real putting green.
Strongly disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I could putt golf balls well on an artificial putting green.
Strongly disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I could sink a putt from 3 feet.
Strongly disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I could sink a putt from 6 feet.
Strongly disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I could sink a putt from 9 feet.
Strongly disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I could play the Tiger Woods PGA Tour 2008 video game well.
Strongly disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I could beat my friends playing the Tiger Woods PGA Tour 2008 video game.
Strongly disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I could play Tiger Woods PGA Tour 2008 better than the average gamer.
Strongly disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I could get good at playing the Tiger Woods PGA Tour 2008 video game.
Strongly disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

Please answer the following questions with regard to how you feel about the game of golf and golf related activities.

The thought of playing golf makes me nervous.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I have a positive outlook toward the game of golf.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I think that playing golf would not be at all fun for me.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I would enjoy playing a round of golf.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I would not have fun playing miniature golf.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I think that playing miniature golf would be frustrating for me.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I think that playing golf is too demanding to be enjoyable.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I am hesitant to golf because I an afraid of making mistakes.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I think that playing miniature golf would be nerve-racking for me.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I look forward to playing golf in the future.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I would get bored quickly if I were golfing.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I feel apprehensive about playing golf.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

Please answer the following questions with regard to the Tiger Woods PGA Tour 2008 video game and how you felt during your video game playing experience.

I think that playing the Tiger Woods PGA Tour 2008 video game regularly could make me a better golfer in real life.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I think that playing the Tiger Woods PGA Tour 2008 video game regularly could make me a better miniature golfer in real life.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I think that playing Tiger Woods PGA Tour 2008 could teach people how to play golf.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I think that playing Tiger Woods PGA Tour 2008 can fine-tune real-world golf skills.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

Playing the Tiger Woods PGA Tour 2008 video game has inspired me to play a round of golf.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

Playing Tiger Woods PGA Tour 2008 has inspired me to play a game of miniature golf.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I think that the Tiger Woods PGA Tour 2008 golf video game could help to improve someone's golf game in the off-season.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I think that playing the Tiger Woods PGA Tour 2008 golf video game can teach people the fundamentals of golf.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I enjoyed playing Tiger Woods PGA Tour 2008.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I thought that playing Tiger Woods PGA Tour 2008 was frustrating.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I had fun playing Tiger Woods PGA Tour 2008.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I was disappointed when playing Tiger Woods PGA Tour 2008.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I would like to play Tiger Woods PGA Tour 2008 again in the future.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I though that playing the Tiger Woods PGA Tour 2008 golf video game was boring.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

Survey 3 Participant ID: ________________________________

Please answer the following questions in regard to your experience while playing the video game in the experiment you just participated in.

How much were you able to control objects in the game environment?

1-----------2 ----------3---------4----------5-----------6 ----------7

No control Moderate control A lot of control

How responsive was the environment to actions that you initiated or performed?

1-----------2 ----------3---------4----------5-----------6 ----------7

Not responsive Moderately responsive Very responsive

How natural did your interactions with the environment seem?

1-----------2 ----------3---------4----------5-----------6 ----------7

Not natural Moderately natural Very natural

How much did the visual aspects of the environment involve you?

1-----------2 ----------3---------4----------5-----------6 ----------7

Not involving Moderately involving Very involving

How natural was the device which controlled movement through this environment?

1-----------2 ----------3---------4----------5-----------6 ----------7

Not natural Moderately natural Very natural

How compelling was your sense of objects moving through space?

1-----------2 ----------3---------4----------5-----------6 ----------7

Not compelling Moderately compelling Very compelling

How much did your experience in the game seem consistent with real world experiences?

1-----------2 ----------3---------4----------5-----------6 ----------7

Not consistent Moderately consistent Very consistent

How compelling was your sense of moving around inside the virtual game environment?

1-----------2 ----------3---------4----------5-----------6 ----------7

Not compelling Moderate compelling Very compelling

How engaged were your senses in this experience?

1-----------2 ----------3---------4----------5-----------6 ----------7

Not engaged Moderately engaged Very engaged

How well could you move or manipulate objects in the virtual environment?

1-----------2 ----------3---------4----------5-----------6 ----------7

Not well Moderately well Very well

How involved were you in the virtual game environment experience?

1-----------2 ----------3---------4----------5-----------6 ----------7

Not involved Moderately involved Very involved

How proficient in moving and interacting with the virtual environment did you feel at the end of the experience?

1-----------2 ----------3---------4----------5-----------6 ----------7

Not proficient Moderately proficient Very proficient

How well could you concentrate on the assigned tasks or required activities rather than on the devices used to perform those tasks or activities?

1-----------2 ----------3---------4----------5-----------6 ----------7

Not well Moderately well Very well

Were there moments during the experiment when you felt completely focused on the task in the game environment?

1-----------2 ----------3---------4----------5-----------6 ----------7

Not focused Moderately focused Very focused

How easily did you adjust to the control devices used to interact with the game environment?

1-----------2 ----------3---------4----------5-----------6 ----------7

Not easily Moderately easily Very easily

Was the information provided through different senses in the virtual environment (e.g. vision, hearing, touch,) consistent?

1-----------2 ----------3---------4----------5-----------6 ----------7

Not consistent Moderately consistent Very consistent

How much did the auditory aspects of the environment involve you?

1-----------2 ----------3---------4----------5-----------6 ----------7

Not involving Moderately involving Very involving

How much delay did you experience between your actions and expected outcomes?

1-----------2 ----------3---------4----------5-----------6 ----------7

No delay Moderate delay A lot of delay

How proficient in moving and interacting with the video game environment did you feel at the end of this experience?

1-----------2 ----------3---------4----------5-----------6 ----------7
Not proficient Moderately proficient Very proficient

How well could you examine objects from multiple viewpoints?
1-----------2 ----------3---------4----------5-----------6 ----------7
Not well Moderately well Very well

How involving was the experience?
Not at all 1-----------2 ----------3---------4----------5-----------6 ----------7 Extremely

How intense was the experience?
Not at all 1-----------2 ----------3---------4----------5-----------6 ----------7 Extremely

To what extent did you feel that you were inside the game environment?
Not at all 1-----------2 ----------3---------4----------5-----------6 ----------7 Extremely

To what extent did you feel immersed in the game environment?
Not at all 1-----------2 ----------3---------4----------5-----------6 ----------7 Extremely

To what extent did you feel surrounded by the game environment?
Not at all 1-----------2 ----------3---------4----------5-----------6 ----------7 Extremely

Please answer the following questions in regard to your experience while playing the video game in the experiment you just participated in. The "avatar" is the character onscreen that you controlled throughout the game.

My avatar thought like me.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

My avatar didn't behave like me.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

My avatar was similar to me.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

My avatar was unlike me.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

My avatar had an appearance like mine.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

My avatar resembled me.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

My avatar was a good representation of me.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I felt a sense of attachment to my avatar.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I felt a sense of ownership toward my avatar.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I am proud of the avatar that represented me.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

My avatar was an extension of me.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

Please complete the following questions only if you were able to customize your own avatar.

I thought it was cool to see my avatar onscreen.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I found the avatar customization tools too confusing to be of any value.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I like that fact that the avatar that I created was part of my game experience.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I would like to save my avatar for future use.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

It was too much work to create my avatar with too little return.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I would rather have played as a standard game character, not one that I created.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I took advantage of the full range of options possible to customize my character.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

My avatar made me feel like I was in the midst of the action.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

Please answer the following questions in regard to your experience while playing the video game in the experiment you just participated in.

I learned something about golf terminology.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I learned something about golf apparel.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I learned something about golf equipment.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

Please answer the following questions with regards to your status prior to putting real golf balls in the putting task.

Before I putted the golf balls, I took some time to think through the putting process.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I rehearsed putting the golf balls in my mind before actually putting them.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I visualized the components of a successful golf putt before I putted.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I practiced putting in my head before putting in the experiment
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree.

I mentally planned the putt before I enacted the putt.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

Putting skills: To be completed by researcher

Tiger Woods PGA Tour 08 putting score: __________

Distance from the cup measurement for 3 foot putt: ___________

Distance from the cup measurement for 6 foot putt: ___________

Distance from the cup measurement for 9 foot putt: ___________

Control Survey 1 Participant ID: ______________________________

Please read the instructions and complete the following questionnaire. Please answer all questions to the best of your ability.

Biological sex: Male_____ Female_____

Academic standing: Freshman_____
Sophomore_____
Junior_____
Senior (+) _____

To the best of your ability, estimate in hours and minutes the total amount of time that you play computer games or video games during an average work-week (Monday through Friday).

I play for __________hours and __________ minutes during an average work week.

To the best of your ability, estimate in hours and minutes the total amount of time that you play computer games or video games during an average weekend (Saturday through Sunday).

I play for __________hours and __________ minutes during an average weekend.

Please rate the level of experience you have in playing video games on the following console systems:

Nintendo GameCube

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Microsoft Xbox

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Sony PlayStation 2

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Nintendo Wii

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Microsoft Xbox 360

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Sony PlayStation 3

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Other (Specify) _______________________________

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Please indicate the level of experience that you have playing the following video games:

Tiger Woods PGA Tour 2005

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Tiger Woods PGA Tour 2006

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Tiger Woods PGA Tour 2007

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Tiger Woods PGA Tour 2008

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Please indicate the level of experience you have playing the following game on the specific console:

Tiger Woods PGA Tour 2008 on the Nintendo Wii

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Tiger Woods PGA Tour 2008 on the XBox 360

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Tiger Woods PGA Tour 2008 on the Sony PlayStation 3

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Please indicate the level of experience that you have in the following golf-related activities in real life:

Playing golf on a golf course

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Practicing putting golf balls on a putting green

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Playing miniature golf

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Playing golf on a team (high school or college)

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Playing golf in a league

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Taking lessons from a golf pro

No experience at all 1-----2-----3-----4-----5-----6-----7 Very experienced

Please answer by circling the appropriate number for the following questions in regards to your perceived ability, beginning with the phrase:

"I am confident that…"

I could be a good golfer.
Strongly disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I could be a good miniature golfer.
Strongly disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I could putt golf balls well on a real putting green.
Strongly disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I could putt golf balls well on an artificial putting green.
Strongly disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I could sink a putt from 3 feet.
Strongly disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I could sink a putt from 6 feet.
Strongly disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I could sink a putt from 9 feet.
Strongly disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I could play the Tiger Woods PGA Tour 2008 video game well.
Strongly disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I could beat my friends playing the Tiger Woods PGA Tour 2008 video game.
Strongly disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I could play Tiger Woods PGA Tour 2008 better than the average gamer.
Strongly disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I could get good at playing the Tiger Woods PGA Tour 2008 video game.
Strongly disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

Please answer the following questions with regard to how you feel about the Tiger Woods PGA Tour 2008 video game.

I think that playing the Tiger Woods PGA Tour 2008 video game regularly could make me a better golfer in real life.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I think that playing the Tiger Woods PGA Tour 2008 video game regularly could make me a better miniature golfer in real life.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I think that playing Tiger Woods PGA Tour 2008 could teach people how to play golf.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I think that playing Tiger Woods PGA Tour 2008 can fine-tune real-world golf skills.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

Playing the Tiger Woods PGA Tour 2008 video game has inspired me to play a round of golf.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

Playing the Tiger Woods PGA Tour 2008 video game has inspired me to play a game of miniature golf.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I think that the Tiger Woods PGA Tour 2008 golf video game could help to improve someone's golf game in the off-season.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I think that playing the Tiger Woods PGA Tour 2008 golf video game can teach people the fundamentals of golf.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

Please answer the following questions with regard to how you feel about the game of golf and golf related activities.

The thought of playing golf makes me nervous.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I have a positive outlook toward the game of golf.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I think that playing golf would not be at all fun for me.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I would enjoy playing a round of golf.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I would not have fun playing miniature golf.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I think that playing miniature golf would be frustrating for me.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I think that playing golf is too demanding to be enjoyable.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I am hesitant to golf because I an afraid of making mistakes.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I think that playing miniature golf would be nerve-racking for me.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I look forward to playing golf in the future.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I would get bored quickly if I were golfing.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I feel apprehensive about playing golf.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

Control Survey 2C Participant ID: ________________________________

Before I putted the golf balls, I took some time think through the putting process.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I visually rehearsed putting the golf balls in my mind before actually putting them.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I visualized the components of a successful golf putt before I putted.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

I practiced putting in my head before putting in the experiment
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree.

I mentally planned the putt before I enacted the putt.
Strongly Disagree 1-----2-----3-----4-----5-----6-----7 Strongly Agree

Putting skills: To be completed by researcher

Tiger Woods PGA Tour 08 putting score: __________

Distance from the cup measurement for 3 foot putt: ___________

Distance from the cup measurement for 6 foot putt: ___________

Distance from the cup measurement for 9 foot putt: ___________

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Curriculum Vitae

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Education:

Ph. D. College of Communications
The Pennsylvania State University, December 2008
Major cognate: Media Effects
Dissertation chair: Dr. Mary Beth Oliver
Committee: Drs. S. Shyam Sundar, Fuyuan Shen, and John Christman

Research Interests:

- Video games and cognition
- Presence (Social, Co, and Tele)
- Psychological and physiological responses to media
- Human Computer Interaction and new technology
- Exploring theories of learning and education with new technology in the classroom

Publications:

Smith, R. A., Downs, E., & Witte, K. (2007). Drama theory and entertainment education: Exploring the effects of a radio drama on intentions to abstain from sex to limit HIV transmission in Ethiopia. *Communication Monographs, 74(*2), 133-153.

Smith, S. L., Smith, S. W., Pieper, K. M., Downs, E., Yoo, J., Ferris, A., Bowden, B., & Butler, M. C. (2008) Conceptualizing altruism on American television: The development of a content coding scheme. In S. Sprecher, L. Underwood, and B. Fehr (Eds.), *The Science of Compassionate Love: Research, Theory, and Application*. Blackwell Publishers.

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