MIS Quarterly

SPECIAL ISSUE

ENHANCING BRAND EQUITY THROUGH FLOW AND TELEPRESENCE: A COMPARISON OF 2D AND 3D VIRTUAL WORLDS[1]

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This research uses theories of flow, telepresence, positive emotions, and brand equity to examine the effect of using two-dimensional versus three-dimensional virtual world environments on telepresence, enjoyment, brand equity, and behavioral intention. The findings suggest that the 3D virtual world environment produces both positive and negative effects on brand equity when compared to the 2D environment. The positive effect of the 3D virtual world environment on brand equity occurs through telepresence, a specific aspect of flow, as well as enjoyment. The negative effect on brand equity can be explained using distraction–conflict theory in which attentional conflicts faced by users of a highly interactive and rich medium resulted in distractions from attending to the brand. Brand equity, in turn, has a positive effect on behavioral intention. The results suggest that although the 3D virtual world environment has the potential to increase brand equity by offering an immersive and enjoyable virtual product experience, the rich environment can also be a distraction. Therefore, developers of virtual world branding sites need to take into account limitations in the information processing capacity and attention span of users when designing their sites in order to avoid cognitive overload, which can lead to users being distracted from branding information. This paper not only provides a theoretical foundation for explaining users' experience with 2D versus 3D virtual world branding sites, but also provides insights to practitioners for designing 3D virtual world sites to enhance brand equity and intentions through user engagement.

Keywords: Virtual worlds, telepresence, flow, enjoyment, brand equity, behavioral intention, 2D, 3D

[1]Detmar Straub was the accepting senior editor for this paper.

The appendices for this paper are located in the "Online Supplements" section of the *MIS Quarterly*'s website (http://www.misq.org).

Introduction

The potential of three-dimensional virtual worlds (3DVWs) as a commercial and marketing tool is extremely attractive and compelling (Brandon 2007). The next generation of the Internet will incorporate 3DVWs as one of its environments (Alpcan et al. 2007). Users experience 3DVWs through their avatars, which are digital representations of themselves and simulated bodies that can move in the 3DVWs. In other words, users interact with objects and other avatars in the 3DVWs through their avatars. Because 3DVWs are characterized by three-dimensional space and are augmented with capabilities of real-time communication, freedom to navigate and manipulate objects, and interactivity among users, they provide a new platform for business and marketing (Davis et al. 2009; Eschenbrenner et al. 2008; Nah et al. 2010; Park et al. 2008; Siau et al. 2010).

Because 3DVWs can provide a richer environment to conduct business and marketing activities, customers may choose to visit these sites over two-dimensional sites for a more interactive and immersive experience. 3DVWs have the potential to revolutionize business (e.g., through virtual product experiences) and bring significant implications to business including opportunities for co-creation (Fuller et al. 2010; Siau et al. 2010) and enhancing customers' perceptions and value of a brand (Barnes and Mattsson 2008; Park et al. 2008). Various businesses have established a presence in 3DVWs. For example, American Apparel, Intel, Dell, Verizon, Cisco Systems, Warner Brothers, IBM, Circuit City, Unilever, Telecom Italia, and Nissan have a presence in Second Life. Further, services such as those offered by ExitReality[2] help businesses create a 3DVW version based on their existing 2D website.

Business activities that are conducted in the 2D environment can typically occur in 3DVWs as well. However, 3DVWs can provide additional features and affordances (Park et al. 2008). For example, Dell's virtual presence in Second Life allows customers to view a virtual replication of a computer that matches the size, color, and shape of the real-life product (Brandon 2007). However, its 2D website does not provide this capability.

Although 3DVWs can capitalize on their unique features and affordances to create greater value for customers, uncertainties exist as to how this can be accomplished and exactly what types of business and customer value can be derived. Even though many real world businesses have a presence in 3DVWs, questions arise as to how to engage customers in the new, experiential 3DVWs and, in particular, in a 3DVW site to enhance the value of a brand to its customers. Also, businesses are concerned about the potential of 3DVWs versus the 2D environment, to which many customers are already accustomed.

A crucial aspect that many businesses desire to achieve with their business sites is capturing customers' interest and engaging them in the online experience. Customers who enjoy the virtual experience of a business site and find the activities on the site engaging are more likely to develop greater loyalty, brand image, and brand association, such that they are more likely to patronize the business over its competitors in the real world (Drenger et al. 2008; Taylor et al. 2007).

Hence, there are two related questions of interest: Are the 3DVWs more capable of engaging customers and providing self-rewarding experiences to customers than the 2D environment? If so, can 3DVWs and the experiences they offer to customers be helpful for enhancing perceptions of the brand as well as their intentions to use the products or services associated with the brand? Our research focuses on answering these two questions.

This study will be of value and interest to businesses interested in engaging customers in online experiences to enhance perceptions of their brands. Specifically, we are interested in investigating if the 3DVW environment is more effective than the 2D environment in creating hedonic experiences of customers' interaction with a brand and whether such experiences help to enhance brand equity, or the added value of a brand.

Background and Literature Review

3DVWs are attracting a tremendous amount of interest from the business community. Some businesses have created a presence in 3DVWs because they see significant potential and opportunities with the exponentially increasing population in these environments (Arakji and Lang 2007; Schwarz 2006). Ives and Junglas (2008) predict that by 2018, virtual worlds will be a major, if not dominant, platform for business applications and opportunities. Barnes (2007) suggests that 3DVWs are designed to entertain as well as provide an experience that engages existing and potential customers.

With an inherently rich and immersive environment, 3DVWs can be used to maximize customers' experiences. Businesses are capitalizing on the hedonic capabilities of 3DVWs to

[2]http://www.exitreality.com/.

create these experiences (LaMonica 2007). The immersive environment afforded by 3DVWs provides users a high level of interactivity and sense of telepresence in the virtual environment (Hecht and Reiner 2007; Lok 2004; Riva et al. 2007). For instance, 3DVWs allow customers to participate in activities that are closer to experiencing the products and services, which can enhance customers' beliefs, attitudes, and behaviors toward the products (Klein 2003). Other opportunities for businesses in 3DVWs include testing new product designs and proof of concepts (Jana 2006; Lui et al. 2007), co-creating or collaborating with customers and engaging in virtual customer relationship management (Goel and Mousavidin 2007), and creating aesthetically pleasing and appealing virtual product experiences (Jiang and Benbasat 2004; Klein 2003; Tractinsky and Rao 2001). Various affordances exist in 3DVWs which can enhance customers' perceptions of a brand (Park et al. 2008). Thus, 3DVWs have the potential to create brand awareness and knowledge of real-world products and services.

Previous research has found positive relationships between attitudes toward virtual stores with well-known brands and brand attitudes, which in turn was positively related to intentions of making real-life purchases (Haenlein and Kaplan 2009). What is not clear, however, is the underlying mechanism or phenomenon that occurs in 3DVWs that enhances one's perceptions of a brand and, ultimately, one's intent to patronize the real-life business. Although businesses are exploring the potential of 3DVWs to promote or improve their brands and, ultimately, generate greater revenues, understanding customers' experiences through which brand perceptions can be enhanced is also crucial to businesses.

Consumer-Based Brand Equity

A *brand* has been referred to as a "name, term, sign, design, or a unifying combination of them intended to identify and distinguish a product or service from its competitors" (McDowell and Sutherland 2000, p. 236). *Consumer-based brand equity* is considered "a set of brand assets and liabilities linked to a brand, its name and symbol that add to or subtract from the value provided by a product or service to a firm and/or to that firm's customers" (Aaker 1991, p. 15). Also, *consumer-based brand equity* refers to "the incremental utility or value added to a product by its brand name" (Yoo and Donthu 2001, p. 1) or "the difference in consumer choice between the focal branded product and an unbranded product given the same level of product features" (Yoo et al. 2000, p. 196). In short, consumer-based brand equity can be conceptualized as the added value of a brand to a customer. Since the focus of this research is on consumer-based brand equity, we will refer to consumer-based brand equity hereinafter as *brand equity*.

Brand equity has been cited as one of the most essential assets and a key performance metric of a business (Capps 2007, Samli and Fevrier 2008, Taylor et al. 2007). The benefits of brand equity are numerous, such as enhancing customer loyalty and the likelihood of choosing a particular brand and/or paying premium prices, attracting new customers, having brand name extension capabilities, and greater resiliency to marketing actions by competitors (McDowell and Sutherland 2000; Yoo et al. 2000). Brand equity is generally considered a multidimensional concept. Various dimensions of brand equity have been identified in previous research, including brand awareness, brand associations, brand loyalty, and perceived quality (Aaker 1991; Keller 1993; Pappu et al. 2005; Washburn and Plank 2002; Yoo and Donthu 2001).

Antecedents of brand equity include many types of marketing actions that can enhance brand equity, such as public relation activities and promotional events (Yoo et al. 2000). However, from the information systems and human–computer interaction perspectives, it is not clear if hedonic or positive online experiences can lead to increased brand equity. Although Drenger et al. (2008) have examined the influence of flow and positive emotions on brand image (which is a key component of brand equity) and Nah et al. (2010) have examined the impact of flow on brand equity in 3DVWs, there has been a lack of empirical studies that examine such a relationship in 2D versus 3D environments. Therefore, research that compares online experiences of 2D versus 3D virtual worlds and their impact on brand equity can provide businesses with insights on the effectiveness of using these environments for enhancing brand equity.

3D Virtual Worlds and Brand Equity

The high degree of engagement that one can potentially experience in 3DVWs coupled with the richness of the environment provide businesses with ample opportunities to carry out marketing-related and commerce activities. Branding sites developed in 3DVWs should not simply resemble traditional advertising campaigns; they need to fully capitalize on the rich and highly interactive features of the 3DVW environment to engage and involve customers (Leggatt 2007). The coexistence of virtual reality, imagination, and innovation allows extended business applications, such as visiting a model home and experiencing it virtually, testing a newly designed product prior to the actual product

being manufactured, and creating social-shopping experiences (LaMonica 2007; Lui et al. 2007; Traum 2007).

Businesses can use the 3DVW environment to promote virtual versions of their existing products. For instance, Pontiac allows customers to custom design and test drive certain automobile models in Second Life (Brandon 2007). The findings from a pilot study suggest that a presence in virtual worlds, such as Second Life, can influence perceptions of brand value (i.e., dimensions of emotional, logical, and practical value) in both positive and negative ways (Barnes and Mattsson 2008). Arakji and Lang (2008) have proposed *avatar business value analysis*, which is a theoretical framework to facilitate the assessment of business value, such as brand awareness and revenues, in virtual world environments. In order to establish a foundation for successful virtual world commerce and activities, one important factor that is pivotal for businesses is to acknowledge that 3DVWs are "more than just another marketing channel for real world products" (Arakji and Lang 2008, p. 215). Therefore, research is needed to explore and understand the unique experiences inherent in 3DVWs.

Given the growing importance, popularity, and potential of businesses to create sites in 3DVWs, companies are looking into using 3DVWs to create a much richer environment for engaging customers in business activities, enhancing their online experiences, and promoting brand equity.

Theoretical Foundation and Hypotheses

The objective of this research is to understand the effects of 2D versus 3D virtual worlds on brand equity and behavioral intention. To generate the hypotheses for this research, we draw on (1) the theory of flow (Csikszentmihalyi 1977, 1991, 1993, 1996, 1998) and the theory of telepresence (Steuer 1992) to understand users' online experiences in the 2D and 3D virtual world environments, and (2) the theory of positive emotions (Frederickson 1998, 2001) and the theory of brand equity (Keller 1993) to identify factors influencing brand equity and the outcome of brand equity. Integrating these theoretical perspectives adds value to the research by providing a more complete and thorough understanding of users' online experiences in 2D versus 3D virtual world environments. Our overall research model is shown in Figure 1.[3]

[3]A number of models incorporating constructs such as flow, brand equity, and downstream effects have arisen spontaneously and nearly simultaneously in recent years. For example, data collection for the current research began in January 2008 and the paper was shortly thereafter under review at *MIS Quarterly* (i.e., in September 2008). Similar models were published later as conference papers, such as Hooker, Wasko, and Paradice's (2009) ICIS research-in-progress paper. This speaks highly of the vibrancy (and currency) of this stream of work.

Theories of Flow and Telepresence

Flow is an optimal state of experience in which one is completely absorbed and engaged in an activity that nothing else seems to matter. Flow is referred to as "the holistic sensation that people feel when they act with total involvement" (Csikszentmihalyi 1975, p. 36). The flow experience is characterized by some common elements (Csikszentmihalyi 1991): (1) a challenging activity that requires skills, (2) merging of action and awareness, (3) clear goals and immediate feedback, (4) concentration on the task at hand, (5) a sense of control, (6) loss of self-consciousness, (7) transformation or distorted sense of time, and (8) self-rewarding or autotelic experience.

Related to flow is the concept of telepresence. Given that the focus of this research is to compare 2D versus 3D virtual world environments, the concept of telepresence is particularly relevant. Telepresence refers to "the feeling of being a part of the phenomenal environment created by a medium" such that "the user of the medium considers the items in the mediated environment as unmediated and reacts directly to the items as if they are physically present objects" (Kim and Biocca 1997). Telepresence is also referred to as the mediated perception of an environment or "the extent to which one feels present in the mediated environment rather than in the immediate physical environment" (Steuer 1992, p. 76). According to the theory of telepresence (Steuer 1992), as interactivity and vividness of user interaction increase, the user's sense of telepresence is also enhanced.

Some researchers have identified telepresence as an antecedent of flow (Hoffman and Novak 1996; Novak et al. 2000; Zaman et al. 2010), whereas others have modeled telepresence as a component of flow (e.g., Chen 2006; Chen et al. 2000; Lee and Chen 2010; Pace 2004; Shin 2006; Skadberg and Kimmel 2004). Finneran and Zhang (2005) reported that there is no consistency in the literature regarding identifying and operationalizing factors as antecedents, components, and outcomes of flow. In studies by Chen et al. (2000) and Pace (2004), telepresence was reported as a part of online flow experiences. Similarly, the findings by Skadberg and Kimmel (2004) suggest that telepresence is a key component of flow. Given the relevance of telepresence and its relationship with flow, we reviewed journal publications on telepresence and flow in online environments and provide

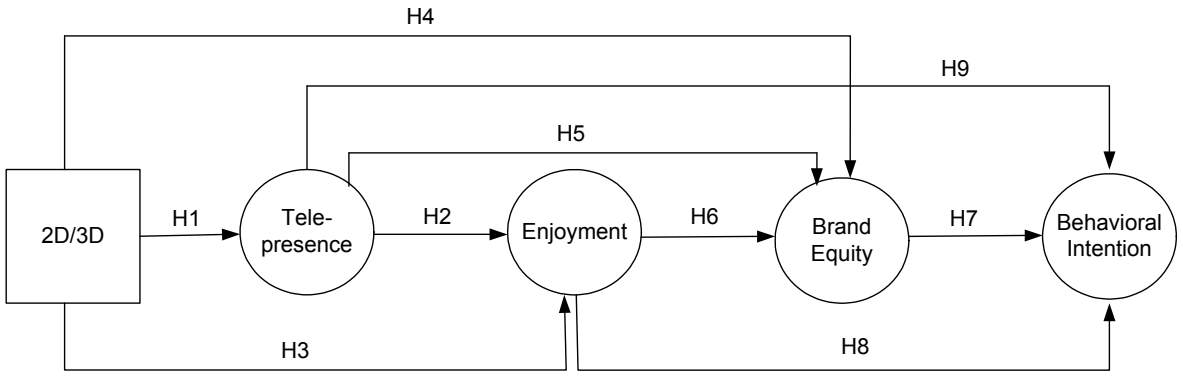

Figure 1. Research Model

a summary of the review in Appendix A. As shown in Appendix A, flow positively influences learning, attitudes, intentions, and behaviors.

In this research, our focus is on understanding how the 2D versus 3D virtual world environments can influence brand equity and behavioral intention. Hence, we focus on two key constructs in the flow literature that are most relevant to the context of our study: telepresence and enjoyment. Telepresence is of interest because of the inherent nature of the 3DVW environment that makes it unique from other environments. 3DVWs can facilitate a sense of presence and embodiment (Mennecke et al. 2011), and enjoyment is the hedonic outcome that can result from the experience (Sylaiou et al. 2010). Therefore, telepresence is fostered by the nature of 3DVWs, versus in the 2D environment, and is congruent with the IT artifact examined in this research (i.e., 2D versus 3DVW).

Telepresence

Telepresence refers to the sense of being in a mediated environment (Held and Durlach 1992; Steuer 1992) or the mental process of perceiving a mediated world as non-mediated (Lee 2004). Users who perceive a sense of telepresence are focused on the virtual or mediated environment to the extent that their stimulus field is limited to just that environment, while the physical environment is disregarded. As noted previously, "human beings can create a perceptual illusion of being present and highly engaged in a mediated environment, while they are in reality physically present in another place" (Suh and Lee 2005, p. 675, citing Biocca 1997). As noted by Steuer (1992), a virtual reality or 3DVW environment increases the interactivity and vividness of user interaction as compared to a 2D environment, thus enhancing the user's sense of telepresence. The 3DVW environment offers a greater number of sensory inputs and outputs than does a 2D environment. Sensory inputs and outputs in 3DVWs include movements in 3D space, haptic (i.e., sense of contact or touch) feedback, and sounds that simulate real sensations (Park et al. 2008).

Users in a 3DVW environment are able to interact directly with 3D objects in the virtual space and navigate in a spatial environment, thus experiencing a higher level of interactivity and vividness. Building on Steuer's work, Coyle and Thorson (2001) show that progressive levels of interactivity and vividness are positively associated with increased feelings of telepresence. Considering that users of 3DVWs are not only experiencing embodiment in the virtual environment through their avatars but are also experiencing a computer world that more closely resembles their natural surroundings, we expect the users' sense of telepresence to be higher in the 3DVWs than in the 2D environment. Telepresence is a media-induced experience (Skadberg and Kimmel 2004), which in this case, is induced by the 3DVW environment. Csikszentmihalyi (1975) suggests that activities that facilitate the flow experience, such as those available in the 3DVW environment, allow people to focus on their actions and feel in control of the environment to produce this sense of immersion. Similarly, Klein (2003) found user control and vividness (such as those afforded by 3DVWs) to enhance users' sense of telepresence. Thus, we hypothesize the following:

H1: The 3D virtual world environment affords a higher sense of telepresence than the 2D virtual environment.

Enjoyment

Lombard and Ditton (1997) provide six conceptualizations of telepresence (termed more generally as *presence* in their article) and consider presence as immersion to be a psychological component where enjoyment is the outcome. The intensity of telepresence can differ by media form, content, and media users (Lee 2004). In the context of our study, interactive and life-like objects provide an intense illusion of being present in the world which the technology creates (Lee 2004; Lombard and Ditton 1997). Such telepresence can trigger a sense of engagement in the virtual environment, which leads to enjoyment or the hedonic outcome of the flow experience (Chen 2006).

Csikszentmihalyi and Csikszentmihalyi (1988) indicate that this enjoyment is consistent across activities. In other words, they argue that even though the activities that produce flow may vary, it is the "dynamics of the experience" that produce enjoyment. Csikszentmihalyi (1997) argues that "when we are in flow, we do not usually feel happy, because we feel only what is relevant to the activity.…It is only after we get out of flow…that we might indulge in feeling happy" (p. 11). In other words, Csikszentmihalyi (1996, 1997) emphasizes enjoyment as an outcome of the flow phenomenon.

Hence, Csikszentmihalyi (1975) suggests that it is after one has felt the flow experience that one might say "that was enjoyable" (p. 43). Applying this to the context of this research, the relevant activity during flow is the experience of telepresence, and happiness or enjoyment is the hedonic outcome. Thus, we hypothesize the following:

H2: Telepresence has a positive impact on enjoyment.

According to the theory of flow, the sensory richness and spatial components of the 3DVW environment can trigger higher levels of control and interest among users, which can give rise to a more intrinsically rewarding experience interacting in a 3DVW environment (Hoffman and Novak 1996; Trevino and Webster 1992). Because 3DVWs have the potential to provide a greater sense of user control that can lead to greater exploration and discovery, users are more likely to achieve a higher level of enjoyment in 3DVWs (Ghani and Deshpande 1994; Pace 2004). Hence, we hypothesize the following:

H3: The 3D virtual world environment will lead to a higher level of enjoyment than the 2D virtual environment.

Theory of Brand Equity

The theory of brand equity proposes that consumers prefer to be associated with products and services that have a strong brand (Allen et al. 2007, citing Keller 1993). Keller (1993) defines customer-based brand equity as "the differential effect of brand knowledge on consumer response to the marketing of the brand" (p. 1). He suggests that a consumer's brand knowledge is stored in their memory structures as an associative network. According to associative network memory models, knowledge is stored and linked together through nodes (stored information) and links (associations among the nodes). The stronger the associations or links among the nodes, the greater the opportunity of recall and identification. Brand equity, which is also referred to as brand knowledge that contributes to brand differentiation, therefore, consists of brand awareness (strength of node) and brand image (brand associations). According to Keller, brand equity can occur "when the consumer is aware of the brand and holds some favorable, strong, and unique brand associations in memory" (p. 17).

Brand associations can vary by favorability, strength, and uniqueness (Keller 1993). These dimensions play a key role in determining the differential consumer response. For example, if brand image or association is positive and brand awareness is significant, consumers are more likely to respond based on brand choice. Brand awareness, or brand familiarity, can be increased by enhancing the exposure to and experience with the brand.

Brand equity is important because it refers to customers' perceived value of a brand beyond its functional value (Keller 1998). As mentioned earlier, it can be conceptualized as the added value of a brand to a customer (Aaker 1991). Brand equity is, therefore, a critical factor for organizations to consider because of its ability to influence attitudes and behaviors (Allen et al. 2007; Keller 1998) and attract customers for (repeat) visits and purchases (Mummalaneni 2005). In the context of 3DVWs, the rich and interactive environment can afford a more enriching experience for engaging customers in business activities and experiences than the traditional 2D environment, thus potentially enhancing customer-based brand equity.

Li et al. (2002) have demonstrated that 3D advertising can improve one's knowledge of a product and attitude toward a brand. With regard to aspects that can alter consumers' perceptions or actions, Suh and Lee (2005) suggest that information that is presented in a rich and interactive format can improve consumer learning and persuasion, or the process

in which changes to one's memory or behaviors occur. Therefore, we expect the interactive nature of a 3DVW environment to facilitate consumers' learning about a brand, thus increasing their brand equity. Hence, we have the following hypothesis:

H4: The 3D virtual world environment will lead to a higher level of brand equity than the 2D virtual environment.

Telepresence has been shown to mediate the relationship between media characteristics and brand perceptions, or more specifically, beliefs and attitudes about a brand (Klein 2003). According to Lombard and Ditton's (1997) conceptualization of telepresence as immersion, when a state of telepresence or immersion is created, users can become so involved, absorbed, and engaged in the experience that learning is enhanced by the experience, which causes users to be more persuaded by what they learn (Kim and Biocca 1997). Studies have shown that when a user is highly engaged in an activity, increased learning and persuasion take place (Huang 2003; Klein 2003; Lombard and Ditton 1997; Reid 2004; Skadberg and Kimmel 2004). In addition, telepresence provides virtual product experience to users, which enhances consumer learning and increases consumer knowledge about the brand (Kim and Biocca 1997; Li et al. 2002, 2003; Klein 2003; Lombard and Ditton 1997; Skadberg and Kimmel 2004). Hence, we hypothesize that telepresence has a positive impact on brand equity.

H5: Telepresence has a positive impact on brand equity.

Broaden-and-Build Theory of Positive Emotions

Drenger et al. (2008) found that the relationship between the cognitive state of flow and brand image is mediated through positive emotions. They demonstrate that flow experience does not directly influence brand image but does so through the hedonic experience that results from flow. According to the broaden-and-build theory of positive emotions, experiencing positive emotions can enhance individual resources, such as cognitive resources, through a widening of behaviors or attention (Fredrickson 1998, 2001; Fredrickson and Branigan 2005). For example, when individuals experience joy or interest, it can prompt them to be more creative and exploratory, and to acquire new information which can then lead to greater enduring personal resources such as intellectual capacities, knowledge, and cognition. Previous research has found that individuals experiencing positive emotions can experience various positive outcomes, including being open to information, having broader attention, and having more integrative thought patterns (Fredrickson and Branigan 2005). Hence, we hypothesize that enjoyment enhances consumers' learning and knowledge of the brand, which increases their brand equity. Thus, we hypothesize that enjoyment has a direct positive impact on brand equity

H6: Enjoyment has a positive impact on brand equity.

Behavioral Intention

Previous research has found relationships between brand equity and intentions to engage with a brand or organization. For example, the theory of brand equity has previously been applied in the context of web-based recruitment (Allen et al. 2007). The research findings suggest that an organization's image (which was considered as evaluations of an organization) is positively related to one's attitudes toward the organization, and indirectly related to intentions to pursue employment, along with one's attitude toward the web site and organizational information. In a service industry context, previous research has found customer-based brand equity influencing brand loyalty intentions indirectly through customer satisfaction (Taylor et al. 2007). As another example, McDowell and Sutherland (2000), who applied the theory of brand equity in the context of television audiences, found higher levels of brand equity leading to increased viewer loyalty as well as attraction of new viewers. Therefore, we hypothesize that brand equity can have a positive impact on behavioral intention.

H7: Brand equity has a positive impact on behavioral intention.

3DVW environments are able to provide an interesting and pleasurable experience, or influence a user's flow experience, to obtain repeat visitors (Koufaris 2002). Also, users may have been influenced enough to extend their positive perceptions to visiting a real-life location. Gupta and Kim (2007) found in their study of customer on-line repurchases that factors such as pleasure and convenience influence repurchase intentions. Also, research findings have demonstrated that consumer satisfaction and number of items purchased can be influenced by the pleasure experienced during an on-line customer visit (Mummalaneni 2005). Hence, enjoyment can influence behavioral intention.

H8: Enjoyment has a positive impact on behavioral intention.

As noted previously, research has demonstrated that flow can positively influence intentions and behaviors (see Appendix A). One component of flow that may contribute to the influence on intentions and behaviors is telepresence. Telepresence offers consumers a better quality and more involving virtual product experience (Klein 2003). Previous research has shown that virtual reality can increase purchase intentions, and the findings suggest that these effects take place through telepresence (Suh and Lee 2005). For instance, Kim and Biocca (1997) demonstrate that the sense of telepresence offered by television increases consumers' purchase intentions. Hence, we hypothesize that telepresence has a direct impact on behavioral intention.

H9: Telepresence has a positive impact on behavioral intention.

Research Methodology

An experimental design was used to compare 2D versus 3D virtual worlds and their impact on brand equity and behavioral intention through telepresence and enjoyment. After a comprehensive review and thorough search of one of the leading 3D virtual worlds, Second Life, we identified a branding site of a hospital[4] that fits our research purpose. The reasons for choosing this site are (1) it is one of the most technologically advanced branding sites in Second Life, (2) branding is one of the main goals of the site, and (3) the hospital walkthrough at the site involves highly structured activities, thus ensuring that all subjects experienced the same script during the virtual tour, which enhances experimental control.

The virtual hospital is a simulation of a real world hospital campus due to open in 2011. The virtual hospital provides visitors the opportunity to tour the facilities which provides an immersive experience including audio, video, and architectural innovation. The tour on the site offers a series of rooms (i.e., patient room, procedure/operating room) to visit and each of these rooms allows only one avatar or subject at a time. Hence, we scheduled subjects individually for the online tour which took about 20 minutes to complete.

We developed the 2D informational equivalent version of the 3DVW site by capturing screen shots of the entire 3D tour as well as the audio clips that go along with them to produce a user-controlled audio slideshow. Subjects in both conditions followed the same script throughout the tour. In the 3D version, subjects navigated their avatars in a 3D virtual space by following the standard script. In the 2D version, subjects navigated using two buttons: The left button, "Go back," to go back one screen, and the right button, "Continue tour," to proceed to the next screen. Both the 2D and 3D conditions were accompanied by the same audio clips during the tour and, hence, are informational equivalent.

Research Procedures

The research procedures, which were all conducted in a university computer lab, were as follows: First, the subjects were asked to fill out a pre-study questionnaire to capture their demographic information. Next, they were given a short training session on the virtual tour environment to which they were assigned. For the 2D version, we asked them to navigate the virtual tour using the "Go back" and "Continue tour" buttons. For the 3D version, we introduced them to basic movements and navigation actions (e.g., clicking on objects with mouse) in Second Life so they knew how to walk and interact with objects in the environment.

After the training session, they were asked to complete a tour or walkthrough of the virtual hospital and its facilities. During the tour, subjects' avatars wore RFID-enabled bracelets, which were given to them upon entering the hospital. The bracelets simulate the tracking of patients at the hospital and allow the avatars to visit appropriate areas of the hospital facilities. During the tour, the subjects wore headsets as they experienced multimedia content throughout the tour. After completing the tour, subjects filled out a post-study questionnaire regarding their experiences during the virtual hospital site visit, their perceptions of the brand equity associated with this hospital, and their intention to visit the real world hospital.

Measurement

The variables in our research model were captured in the post-study questionnaire using 14 items adapted from existing literature (see Table 1 for the specific sources). The variables include telepresence, enjoyment, brand equity, and behavioral intention (i.e., intention to visit real world hospital). All items were measured using a seven-point Likert scale, with 1 being strongly disagree and 7 being strongly agree. They are all reflective. Appendix B presents all of the items for these variables.

Pilot Test

We conducted pilot tests of the 2D and 3D versions before the full-scale data collection. When pilot testing the 3D version,

[4]The hospital name was not disclosed for confidentiality reasons.

Table 1. Source of Measurement for Constructs

Construct	Source	# of Items
Telepresence	Kim and Biocca 1997; Klein 2003	4
Enjoyment	Agarwal and Karahanna 2000; Koufaris 2002	4
Brand Equity	Aaker 1996; Washburn and Plank 2002; Yoo and Donthu 2001	3
Behavioral Intention	Jiang and Benbasat 2004; Koufaris 2002	3

we noticed that some subjects did not follow closely the steps given in the instruction sheet for carrying out the tour. As such, we positioned virtual ushers (i.e., as avatars) at key points throughout the tour to provide the same set of instructions in the virtual environment. When a subject's avatar completed the required viewing and activities in each room of the tour, the virtual usher sent a text-based message in Second Life to the subject's avatar to move to the next step. All ushers used standard scripts to provide instructions to the subjects' avatars.

The pilot test for the 2D version went smoothly. The only change that we made after pilot testing the 2D version was to make the "Continue tour" button unavailable to subjects while the audio clip associated with each image was playing. In this way, the subjects would not be able to interrupt or skip the audio. This provided an additional form of control that ensured subjects in both experimental conditions heard the same audio messages.

Data Analysis

The sample size was 445. Subjects were business undergraduate students taking an 'Introduction to MIS' class. We assigned 271 subjects to the 3D version of the virtual tour and 174 subjects to the 2D version. Demographics are presented in Table 2. More than 90 percent of the subjects were below 25 years old, and 61 percent of the subjects were male. Although the majority of the subjects reported not having any virtual world experience, 43 subjects indicated that they have 5 or more years of online 3DVW experience. These subjects indicated that nearly all of their 3DVW experience was in online role-playing games such as World of Warcraft.

Covariance-based SEM (CB-SEM) was used for the data analysis because it allows us to examine theory and measures simultaneously (Fornell and Bookstein 1982). In other words, CB-SEM is powerful in controlling for any possible confounding effects of measurement errors on the estimated relationships between latent variables. Given that we have a sample size of 445 and there is no serious kurtosis or skewness problem that falls outside the guidelines given by Kline (2005) for running CB-SEM, the use of CB-SEM is appropriate. We used Mplus (Muthén and Muthén 2007) to carry out the CB-SEM data analysis.

Descriptive statistics of the variables (telepresence, enjoyment, brand equity, and behavioral intention) are presented in Appendix C. Information on skewness, kurtosis, reliability, convergent and discriminant validity, as well as common method variance are also presented in Appendix C.

Hypothesis Testing

Figure 2 presents the results, and Table 3 shows the results of hypothesis testing. The independent variable, 2D/3D, is a binary variable indicating whether the subject experienced the 2D or 3D version of the tour. The other four variables (telepresence, enjoyment, brand equity, and behavioral intention) are latent variables. In this case, behavioral intention refers to intention to visit the real-world hospital.

H1 (2D/3D → Telepresence) and H3 (2D/3D → Enjoyment) are supported, suggesting that the 3D virtual environment induces higher telepresence and enjoyment than the 2D virtual environment. H2 (Telepresence → Enjoyment) is supported, which shows that telepresence also contributes to enjoyment.

H4 (2D/3D → Brand Equity) is not supported because the effect is in the opposite direction as that hypothesized.

H5 (Telepresence → Brand Equity) and H6 (Enjoyment → Brand Equity) are both supported, indicating that telepresence and enjoyment contribute to brand equity. H7 (Brand Equity → Behavioral Intention), H8 (Enjoyment → Behavioral Intention), and H9 (Telepresence → Behavioral Intention) are also supported, suggesting that brand equity, enjoyment, and telepresence positively influence behavioral intention.

Table 2. Sample Demographics

Variable	Fequency (%)
Gender	
Male	270 (60.7%)
Female	174 (39.1%)
Unknown (not provided by respondent)	1 (0.2%)
Age	
19–25	406 (91.3%)
26–35	30 (6.7%)
36–45	4 (0.9%)
Over 45	0 (0.0%)
Unknown (not provided by respondent)	5 (1.1%)

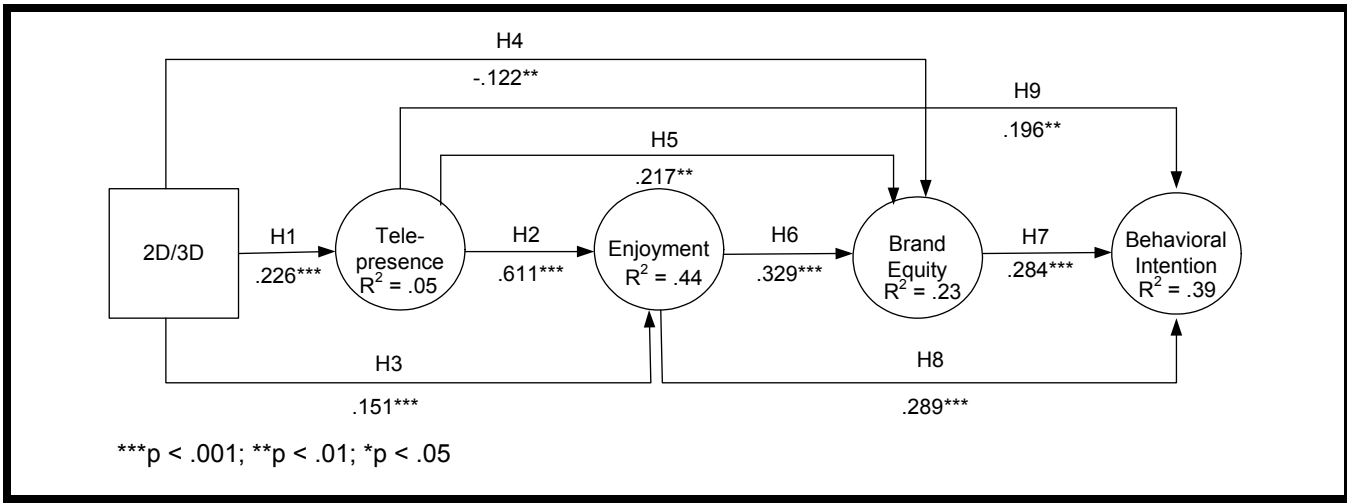

Figure 2. Results of Structural Equation Modeling[5]

Table 3. Results of Hypothesis Testing

Hypothesis	Supported?
H1: 2D/3D →Telepresence	Yes
H2: Telepresence → Enjoyment	Yes
H3: 2D/3D → Enjoyment	Yes
H4: 2D/3D → Brand Equity	No (and in the opposite direction)
H5: Telepresence → Brand Equity	Yes
H6: Enjoyment → Brand Equity	Yes
H7: Brand Equity → Behavioral Intention	Yes
H8: Enjoyment → Behavioral Intention	Yes
H9: Telepresence → Behavioral Intention	Yes

[5]The model was also analyzed with brand association (BAS) and brand awareness (BAW), separately, being substituted for brand equity (BE) and the results are similar to those in Figure 2. Considering BAS and BAW are two dimensions of BE that are clearly distinct from behavioral intention (INT), running these additional models provides evidence of BE being a distinct construct from INT. These results provide additional support that BE is distinct from INT as operationalized in this study.

Model Fit Indices

The fit indices are acceptable. Even though the chi-square statistic is significant due to the large sample size, the value of the chi-square statistic (184) divided by the degrees of freedom (82) is 2.47, which is well below the value of 5 that some researchers use as a guideline (Kline 2005). The CFI of 0.98 and TLI of 0.97 are both above the recommended value of 0.90 (Bentler 1990; Kline 2005). The RMSEA of 0.05 is within the strictest recommended value of 0.05, even though any value below 0.08 is acceptable (Browne and Cudeck 1993). The SRMR of 0.04 is also below the recommended value of 0.05. Hence, based on these guidelines, our data has very good model fit.

Variance Accounted

Figure 2 also shows the variance accounted for by each variable (R^2). Our model accounts for 5 percent of the variance of telepresence, which is not surprising given that the only antecedent to telepresence in the model is the binary variable, 2D/3D. The model accounts for 44 percent of the variance of enjoyment, 23 percent of the variance of brand equity, and 39 percent of the variance of behavioral intention.

Secondary Analysis

As shown in Figure 2 and our hypotheses, we did not hypothesize a path from 2D/3D to behavioral intention because our theoretical foundation suggests that this relationship is mediated through telepresence, enjoyment, and brand equity. The addition of a path from 2D/3D to behavioral intention shows that this path is not significant ($p = .545$) and the model fit statistics remain the same (when rounded to two decimal places). A chi-square difference test did not show any difference between the two models (i.e., the base model and the model with this path included). Hence, the base model presents the best model fit for the data.

Discussion and Conclusion

The findings from our study suggest that the 3DVW environment induces a greater sense of telepresence and enjoyment than the 2D environment. Consistent with the theory of flow in which a sense of immersion can produce hedonic outcomes as well as influence learning and attitudes, we find that telepresence positively influences both enjoyment and brand equity. In addition, telepresence has a direct impact on behavioral intention due to the enhanced virtual experience. Enjoyment that is experienced with a branding site increases both brand equity and behavioral intention. As proposed by the broaden-and-build theory of positive emotions, positive emotions, such as enjoyment, can provide the impetus for learning such that it can enhance one's perception of brand equity. In turn, a higher perceived brand equity increases one's behavioral intention, which is congruous with the predictions of the theory of brand equity as well as previous brand equity research in which individuals prefer to be associated with strong branded services, which can influence intentions to use these services. Despite the strong positive indirect effect of the 3DVW environment on brand equity that is mediated by telepresence and enjoyment, we found, to our surprise, that the 3DVW environment has a negative direct effect on brand equity.

Therefore, the findings suggest that there are two counteracting or opposing forces taking place when shifting a branding site from the 2D to the 3DVW environment. On the one hand, the 3DVW environment has a greater potential than the 2D environment to enhance brand equity through the sense of telepresence and enjoyment that are realized in the 3DVW environment. On the other hand, there is a negative effect of the 3DVW environment on brand equity. Both sets of findings will be further addressed below.

3DVWs can produce the sensation of being "there" or in a computer-generated world that affords a sense of immersion more so than the 2D environment, which is consistent with previous research findings (Coyle and Thorson 2001; Klein 2003). The experience in the 3DVW environment is also found to be more enjoyable than in the 2D environment, both by inducing the sensation of being in the computer world as well as by the nature of the 3D environment itself. Consistent with our findings indicating that telepresence positively influences enjoyment, the literature also suggests that the flow experience created by telepresence produces the hedonic outcome of an enjoyable experience (Chen 2006; Csikszentmihalyi 1975). In addition, individuals perceive the interactive experience in 3DVWs as fun and interesting. This is consistent with Pace's (2004) findings where individuals found enjoyment in discovery or in this context, in exploring the rich and highly stimulating environment. Therefore, 3DVW environments produce heightened levels of enjoyment both directly and indirectly through telepresence.

Providing an experience that immerses one in a 3DVW and that is fun and enjoyable can improve an individual's perceptions of a brand, or brand equity. Having a sense of telepresence in a branding site not only enhances one's perceptions and knowledge about the brand, but also influences

brand equity through positive feelings that are generated from telepresence. For this study, we find that telepresence both directly and indirectly (i.e., through enjoyment) enhances brand equity.

Brand equity can then prompt individuals to want or intend to use a brand, thus increasing behavioral intentions. Therefore, once individuals find value in a brand, they want to be associated with it as proposed by the theory of brand equity (Keller 1993). The enhanced virtual product experience resulting from the higher sense of telepresence in a 3DVW environment further enhances the effect on behavioral intentions. Suh and Lee (2005) found virtual reality or the 3D environment to increase product purchase intentions, but they did not test if this is a direct effect or an indirect effect through telepresence. In our research, we show that the positive effect on behavioral intention is mediated by telepresence. In other words, the increased behavioral intention arising from 3DVW experience over 2D experience occurs due to the higher telepresence (or enhanced virtual product experience) in the 3DVW environment. In addition, the enjoyment that individuals experience in the 3DVW environment can provide enticements to use those products or services associated with the brand, both directly and through brand equity. Similar to previous research findings (Koufaris 2002; Mummalaneni 2005), individuals who encounter a pleasurable experience on a branding site have intentions to use the brand or patronize its business in the future.

As noted above, the 3DVW environment also induces a negative effect on brand equity, which is contrary to our hypothesis. This is an interesting and unexpected finding that can be explained using the distraction–conflict theory. On the one hand, the 3DVW environment is immersive, fun, and interesting, which can enhance users' learning and strengthen the impact of their exposure to the brand. On the other hand, having to navigate and interact in a 3DVW site can be a distraction to the subjects in attending to the audio and visual information on the site. The latter phenomenon is explained by the distraction–conflict theory (Baron 1986).

The distraction–conflict theory, as proposed by Baron (1986), proposes that when a person experiences conflicts between focusing attention on a task versus focusing attention on a distractor, he or she may experience cognitive load problems which result in attentional focusing (Muller et al. 2004). Attentional focusing entails an individual narrowing his or her attention to just a central set of cues while ignoring peripheral cues that may be present. If a task only requires a central set of cues to perform effectively, then task performance can still be effective. However, if a peripheral set of cues is necessary for task performance, then performance may be problematic. Although the distraction–conflict theory has been applied previously to explain how the copresence of others can be a distraction and can create attentional conflicts, Nicholson et al.'s (2005) work suggests that other types of distractions, such as the world news being played in the background while one tries to complete a complex task, can also inhibit performance.

In the context of our study, the richness and variety of attentional (e.g., audio, visual, and video) cues available in the 3DVW environment may serve as a distractor to the subjects from focusing their attention on the brand information in the environment. This phenomenon was also noted by Steuer (1992) in his discussion of mitigating factors. He cited McLuhan (1964) who indicated that an extremely "hot" (or rich) medium may actually interfere with users' ability to carry out interactions mindfully in real-time. Steuer offered the same explanation as the distraction–conflict theory, noting that the limitations of human's cognitive information processing capacity may serve as a bottleneck in online environments that are highly interactive (e.g., high bandwidth) and vivid (e.g., relating to multisensory experiences). Huang (2003) also noted that the complexity of a site in terms of its richness and multidimensional format can negatively influence one's attention. Individuals who were in the 3DVW environment may have initially experienced attentional conflicts by trying to explore the interactive capabilities of the environment itself (e.g., exploring the lobby or patient room in the virtual hospital might have become the subjects' central cue set) while trying to listen to the brand information that was being presented (e.g., listening to the audio message presented throughout the tour may have become the subjects' peripheral cue set) at the same time.

Therefore, the ability to explore and perform other activities in the 3DVW environment may have presented an initial distraction to the subjects who were then unable to attend to central cues (e.g., information being verbally presented) to learn about the brand. Some of the comments provided by our subjects after the experiment validate the above explanations. Their comments suggested that they were so interested in exploring the environment that they sometimes lost track of listening attentively to the audio presentation or attending to the video presentation that accompanied the audio presentation. The distraction–conflict theory that has been observed in 3DVWs poses a paradox for businesses looking into implementing branding sites on 3DVWs. The challenge is in minimizing the distractors and in maximizing the telepresence and enjoyment components of the user experience to yield an overall positive outcome to brand equity.

Limitations and Future Research

There are a number of limitations in this research. First, undergraduate college students participated in this study. Hence, caution is needed in generalizing the findings from this study to other populations. Second, most of the students did not have much experience with 3DVWs. We ran the data analysis both with and without the subjects with experience in virtual worlds and found the results to be consistent. We acknowledge, however, that due to the limited virtual world experience of the majority of the subjects, our results may not be generalizable to users who are familiar and experienced with virtual worlds. Future research may compare the effects of 2D versus 3D virtual world environments with experienced users. In other words, individuals with various levels of technology skills will need further exploration. Third, this research study was conducted in only one virtual world environment (i.e., Second Life) with a specific branding site that pertained to a hospital brand. Further research is needed to determine the applicability of our findings to other types of services and products, as well as in other 3DVW environments.

This research opens up other questions for investigation. First, considering the flexibility of new modes of advertising and the potential reach to customers, Barnes (2007) indicates that advertising in virtual worlds, such as Second Life, needs further scrutiny to understand the impact on purchasing intentions. Issues such as security, privacy, trust, and the value of virtual currency also need to be studied if consumers are interested in doing commerce within a 3DVW. Second, future research can extend our model by looking at other factors such as specific aspects of affordances in the environment (e.g., use of haptic feedback, use of text versus audio), media characteristics (e.g., color, interactivity, vividness), and usability issues (e.g., mechanisms to improve user interactions) to further enhance brand equity through telepresence and enjoyment, and minimize the distracting effect or factors.

Implications

Opportunities to generate sales leads, market through increased brand equity, and manage customer relationships abound in 3DVWs. The immersive 3DVW environment provides businesses with the opportunity and ability to interact with customers at a more personal level.

Our findings demonstrate that enhancing brand equity and behavioral intentions is possible in the 3DVW environment if a sense of telepresence and the resulting hedonic outcome (enjoyment) are realized. In fact, through the dynamics of these factors, the 3DVW environment is potentially more conducive than a 2D environment in enhancing brand equity and behavioral intentions. Therefore, to specifically answer our research questions, 3DVWs are more capable of engaging customers and providing self-rewarding experiences to potential customers in comparison to 2D environments. Also, the experiences associated with 3DVWs (i.e., telepresence and enjoyment) are able to enhance customers' perceptions of brand equity, as well as their intentions to use the associated products or services.

Therefore, businesses interested in improving customers' perceptions of brand equity and behavioral intentions can consider the use of 3DVWs. However, they need to be careful with their site design and their use of affordances to create an immersive, interactive, and pleasurable experience without creating cognitive overload and distractions to brand information. This is especially so in the initial stage of exploring the site. When individuals visit the site for the first time, they may be more focused on exploring the site rather than reading posted material or attending to multimedia clips on the site. Hence, from the design perspective, it is important to integrate brand information with the site exploration and discovery process. It would also be helpful to keep the 3D branding sites as simple and straightforward as possible to minimize unnecessary distractions while presenting brand information in increasing levels of granularity in an activity-based format to sustain the interests of customers and to avoid cognitive overload. Having a clear goal or reward structure could also help to sustain the interests of customers in exploring the branding site.

Tractinsky and Rao (2001) suggest that social factors of online shopping are important to satisfy customers' social and psychological needs. Businesses need to strengthen the community building roles of communication, collaboration, and cooperation to succeed in virtual worlds (Fetscherin and Lattemann 2008). With the ability to create a space for interacting with others and to produce more aesthetically appealing products and environments to explore, 3DVWs can present a more inviting appeal to existing and potential customers.

Our research is one of the first to extend the theories of flow, telepresence, positive emotions, and brand equity to the 3DVW context. We combine four theoretical bases in this research to examine the joint effects and interactions between telepresence (a key aspect of flow), positive emotions, and brand equity. All theories hold well in this research. The relationships and interactions between these theories are very high (which is evident from the number of links that cross between the constructs in these theories). Hence, when

combined, these theories present a more complete picture and encompassing phenomenon to explain brand equity and behavioral intentions.

Although Csikszentmihalyi does not address telepresence directly, several researchers (e.g., Chen et al. 2000; Hoffman and Novak 1996; Novak et al. 2000; Shin 2006; Skadberg and Kimmel 2004) have examined telepresence in the context of flow. As evident from our results, telepresence is a very important construct in the 3DVW context. For subjects who experienced telepresence, they also attained a higher level of enjoyment from the online experience.

From a theoretical perspective, it is essential to include telepresence when studying 3D virtual environments (Chen et al. 2000; Klein 2003; Skadberg and Kimmel 2004; Steuer 1992). We have established the importance of examining enjoyment as a hedonic outcome of telepresence and studying the effect of telepresence and enjoyment on business-related outcomes, which are brand equity and behavioral intention in this study. Specifically, we want to highlight the importance of including mediating factors such as telepresence and enjoyment to fully understand the impact of 2D and 3D environments. For example, our study identifies both positive and negative effects of 2D versus 3D virtual world environments on brand equity. The positive effect of 3DVWs takes place through telepresence and enjoyment, while the negative effect takes place because of the split attention experienced by users when dealing with a rich and interactive medium. Hence, both the flow theory and the distraction–conflict theory come into action at the same time. This presents cautions that need to be taken and a potential paradox to organizations in their design and implementation of 3DVW sites. We propose that there is a need to balance both the telepresence/enjoyment components and the distraction effects that may result (due to the limited cognitive resources or information processing capacities of users).

In conclusion, 3DVW environments not only provide new opportunities to engage users in telepresence experiences and to enhance brand equity, but also present unique aspects for future research and practical considerations. Our research study uses the theories of flow, telepresence, positive emotions, and brand equity to assess the differences in user experiences and perceptions in 2D and 3D virtual world environments. Organizations will benefit from this research by developing their 3DVW sites and the activities within these sites around these factors in order to engage visitors in a sense of telepresence and provide enjoyable experiences, while avoiding the overwhelming effects of media richness due to limitations in human information processing capacity. Future research will also benefit from the theoretical framework in this research to understand the telepresence phenomenon in 3DVW environments and its effects on hedonic experiences as well as consumer perceptions and (intended) behaviors. Overall, 3DVW environments present new customer touch points that may prove to be one of the most engaging. Hence, such 3DVW environments provide significant potential to enhance perceived brand equity and appeal in the minds of customers.

Acknowledgments

We would like to acknowledge research funding from the Jane Robertson Layman Fund (2008-2009) from the University of Nebraska-Lincoln Research Council and the Lattanze Grant (2008-2009) from Loyola University Maryland. We also extend our appreciation for the opportunities to present this research at the Virtual Worlds Workshop at the University of Texas at Austin on April 2, 2009, the Information Systems Seminar at the National University of Singapore on October 9, 2008, and the Fall Lattanze Symposium at Loyola University Maryland on November 14, 2008.

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MIS Quarterly

SPECIAL ISSUE

ENHANCING BRAND EQUITY THROUGH FLOW AND TELEPRESENCE: A COMPARISON OF 2D AND 3D VIRTUAL WORLDS

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Appendix A

Summary of Literature on Flow and Telepresence in Online Environments

Reference/ Authors	Antecedents	Online Experience	Direct Consequences	Indirect Consequences	Research Setting	Research Method
Steuer (1992)	Vividness, Interactivity	Telepresence			Virtual Reality	Conceptual
Trevino and Webster (1992)	Tech. Type, Tech. Characteristic (Ease of Use), Ind. Diff. (Computer Skill)	Flow – Control, Attention Focus, Curiosity, Intrinsic Interest	Attitude, Effectiveness, Quantity, Barrier Reduction		Computer-mediated Communication (E-mail, Voice Mail)	Survey
Webster et al. (1993)	Software Characteristics (Flexibility, Modifiability)	Flow – Control, Attention Focus, Cognitive Enjoyment (Curiosity and Intrinsic Interest)	Exploratory Behavior (Experimentation), System Use, Perceived Comm. Quantity, Perceived Comm. Effectiveness		Software Usage in Work Setting	Survey
Ghani and Deshpande (1994)	Control, Challenge	Flow – Enjoyment, Concentration	Exploratory Use	Extent of Use	Computer Use in Workplace	Survey

Reference/ Authors	Antecedents	Online Experience	Direct Consequences	Indirect Consequences	Research Setting	Research Method
Hoffman and Novak (1996)	Control Char. (Skills, Challenges), Content Char. (Interactivity, Vividness), Process Char. (Goal-Directed, Experiential), Involvement, Focused Attention, Telepresence	Flow	Consumer Learning, Perceived Behavioral Control, Exploratory Behavior, Positive Subjective Experience		Hypermedia Computer-mediated Environment	Conceptual
Lombard and Ditton (1997)	Media Form (Vividness or Sensory Richness), Media Content (e.g., Task or Activity), Media User Variables	Presence (or Telepresence)	Arousal, Enjoyment, Involvement, Task Performance, Skills Training, Desensitization, Persuasion, Memory, Social Judgment, Parasocial Interaction/ Relationships		Virtual Environment	Conceptual
Chen et al. (1999)	Clear Goals, Immediate Feedback, Matched Skills and Challenges	Flow – Merger of Action and Awareness, Concentration, Sense of Control	Self-consciousness, Time Distortion, Autotelic Experience		Web Navigation	Survey
Nel et al. (1999)	Web Site Type (Content, Audience Focus)	Flow – Control, Attention Focus, Curiosity, Intrinsic Interest	Website Revisit		Web Sites	Experiment
Agarwal and Karahanna (2000)	Personal Innovativeness, Playfulness	Cognitive Absorption/Flow – Curiosity, Control, Temporal Dissociation, Focused Immersion, Heightened Enjoyment	Perceived Ease of Use, Perceived Usefulness, Behavioral Intention		IT (World Wide Web) Usage	Survey
Chen et al. (2000)		Flow – Merger of Action and Awareness, Concentration, Loss of Self Consciousness, Time Distortion, Sense of Control, Telepresence, Enjoyment, Perceived Challenges			Web Navigation	Survey

Reference/ Authors	Antecedents	Online Experience	Direct Consequences	Indirect Consequences	Research Setting	Research Method
Novak et al. (2000)	Skill/Control, Interactive Speed, Importance, Challenge/Arousal, Focused Attention, Telepresence/Time Distortion	Flow			Online Shopping	Survey
Rettie (2001)	Goals, Feedback, Skills, Challenge	Flow – Merging of Action and Awareness, Focused Concentration, Sense of Control, Loss of Self Consciousness, Time Distortion, Autotelic Experience			Internet Use	Focused groups
Koufaris (2002)	Product Involvement, Web Skills, Value-Added Search Mechanisms, Challenges	Flow – Shopping Enjoyment, Concentration	Intention to Return		Online Shopping	Survey
Luna et al. (2002)	Balance of Challenges/Skills, Perceived Control, Unambiguous Demands, Focused Attention, Attitude toward Site	Flow	Revisit Intent, Purchase Intent	Purchase	Online Shopping	Experiment
Huang (2003)	Complexity, Novelty, Interactivity	Flow – Control, Attention, Curiosity, Interest	Utilitarian Performance, Hedonic Performance		Web Sites	Survey
Klein (2003)	Media Richness, User Control	Telepresence	Persuasion (Belief Strength, Attitude Intensity)		Computer–mediated Environment	Experiment
Korzaan (2003)		Flow	Exploratory Behavior, Attitude	Intention to Purchase	Online Shopping	Survey
Luna et al. (2003)	Attention, Challenge, Interactivity, Attitude toward Site	Flow	Purchase Intent, Revisit Intent		Online Shopping	Survey
Novak et al. (2003)	Goal-directed vs. Experiential Activities, Skill, Challenge, Novelty, Importance	Flow			Online Shopping	Survey

Reference/ Authors	Antecedents	Online Experience	Direct Consequences	Indirect Consequences	Research Setting	Research Method
Hsu and Lu (2004)	Perceived Ease of Use	Flow	Intention		Online Games	Survey
Jiang and Benbasat (2004)	Visual Control, Functional Control	Flow – Control, Attention Focus, Cognitive Enjoyment			E-commerce Websites	Experiment
Pace (2004)	Goals and Navigation Behavior, Challenge and Skills, Attention	Flow – Joy of Discovery, Reduced Awareness of Irrelevant Factors, Distorted Sense of Time, Merging of Action and Awareness, Sense of Control, Mental Alertness, Telepresence			Web Browsing	Grounded Theory (Theoretical Sampling, Semi-Structured Interviews)
Pilke (2004)	Immediate Feedback, Clear Rules/Goals, Complexity, Dynamic Challenges	Flow			World Wide Web	Interviews
Reid (2004)	Cognitive Ability, Volitional Control, Self-efficacy	Flow and Playfulness	Competence, Creativity, User Satisfaction		Virtual Reality	Interviews, Experiment, Observation
Skadberg and Kimmel (2004)	Speed, Ease of Use, Attractiveness, Interactivity, Domain Knowledge/Skill, Information in the Web Site/Challenge	Flow – Enjoyment, Time Distortion, Telepresence	Increased Learning	Change of Attitude and Behavior	Web Browsing	Survey
Kim et al. (2005)	Skills, Challenges, Focused Attention	Flow			Online Games	Survey
Saade and Bahli (2005)		Cognitive Absorption/Flow – Temporal Dissociation, Focused Immersion, Heightened Enjoyment	Perceived Ease of Use, Perceived Usefulness	Intention to Use	Internet Learning	Survey
Siekpe (2005)		Flow – Challenges, Concentration, Curiosity, Control	Intention to Purchase, Intention to Return		Online Shopping	Survey
Suh and Lee (2005)	(Virtually High versus Low) Experiential Products	Telepresence	Product Knowledge, Attitude, Purchase Intentions		Virtual Reality	Experiment

Reference/ Authors	Antecedents	Online Experience	Direct Consequences	Indirect Consequences	Research Setting	Research Method
Chen (2006)	Clear Goal, Potential Control, Immediate Feedback, Merger of Action and Awareness	Flow – Telepresence, Time Distortion, Concentration, Loss of Self-consciousness	Positivity of Affects, Enjoyable Feeling		Web Browsing	Survey (Digitalized Experience Sampling Method)
Li and Browne (2006)	Need for Cognition, Mood	Flow – Focused Attention, Control, Curiosity, Temporal Dissociation			Online Experience	Survey
Shin (2006)	Skill, Challenge, Individual Differences	Flow – Enjoyment, Telepresence, Focused Attention, Engagement, Time Distortion	Achievement, Satisfaction		Virtual Learning Environment	Survey
Tung et al. (2006)	Product Involvement	Flow – Control, Attention, Curiosity, Interest	Mood, Attitude		Web Site Advertising	Experiment
Choi et al. (2007)	Learning Interface, Interaction, Instructor Attitude, Content	Flow	Attitude Toward E-learning, Learning Outcomes (Tech. Self-efficacy)		E-learning	Survey
Chang and Wang (2008)	Interactivity, Perceived Ease of Use	Flow	Perceived Usefulness, Attitude toward Use, Behavioral Intention		Computer-mediated Communication	Survey
Chen et al. (2008)		Flow – Control, Attention Focus, Curiosity and Interest	Communication Outcome – Effectiveness, Quality, Volume		Computer-mediated Communication	Experiment
Park et al. (2008)	Control Char. (Skills, Challenges), Content Char. (Interactivity, Vividness), Process Char. (Extrinsic/Intrinsic Motivation)	Flow	Brand Equity		Virtual Worlds	Conceptual
Guo and Poole (2009)	Website Complexity, Clear Goal, Immediate Feedback, Congruence of Challenge and Skill	Flow – Concen-tration, Control, Mergence of Action and Awareness, Transformation of Time, Transcendence of Self, Autotelic Experience			Web Sites	Experiment

Reference/ Authors	Antecedents	Online Experience	Direct Consequences	Indirect Consequences	Research Setting	Research Method
Hoffman and Novak (2009)	Skill, Challenge, Interactivity, Telepresence, Attractiveness, Novelty, Playfulness, Personal Innovativeness, Content/Interface, Ease of Use, Positive Subjective Experience/Attitude	Flow	Learning, Control/Perceived Behavioral Control, Exploratory Behavior/Curiosity/ Discovery, Positive Subjective Experience/Attitude, Ease of Use, Perceived Usefulness, Purchase/ Behavioral Intention, Addictive Behavior	Purchase/Use	Internet	Conceptual
Shin (2009)	Perceived Synchronicity	Flow	Intention		Virtual Worlds	Survey
Ho and Kuo (2010)	Computer Attitudes	Flow – Control, Focused Attention, Intrinsic Interest, Curiosity	Learning Outcomes – Adaptation, Replication, Innovation		E-learning	Survey
Lee and Chen (2010)		Flow – Concentration, Enjoyment, Time Distortion, Telepresence	Attitude, Controllability, Self-efficacy, Perceived Ease of Use	Perceived Behavioral Control, Intention, Behavior, Perceived Usefulness	Online Shopping	Survey
Nah et al (2010)	Balance of Skills and Challenges	Flow	Brand Equity	Behavioral Intention	3D Virtual World	Survey
Zaman et al (2010)	Telepresence, Perceived Control	Flow – Enjoyment, Concentration	Positive Affect, Exploratory Behavior	Perceived Expected Creativity	Instant Messaging	Survey

Appendix B

Items for Measures

Item	Construct and Measurement Items
	Telepresence (7-point Likert scale)
TP1	I forgot about my immediate surroundings when I was navigating the <hospital brand name> virtual tour.
TP2	When the virtual tour ended, I felt like I came back to the "real world" after a journey.
TP3	During the virtual tour, I forgot that I was in the middle of an experiment.
TP4	The computer-generated world seemed to be "somewhere I visited" rather than "something I saw."
	Enjoyment (7-point Likert scale)
ENJ1	I found my virtual tour of <hospital brand name> enjoyable.
ENJ2	I found my virtual tour of <hospital brand name> boring. (Reverse coded)
ENJ3	I found my virtual tour of <hospital brand name> interesting.
ENJ4	I found my virtual tour of <hospital brand name> fun.
	Brand Equity (7-point Likert scale)
BE1	Even if another hospital offers the same quality of services as <hospital brand name>, I would prefer to use the services of <hospital brand name>.
BE2	If there is another hospital as good as <hospital brand name>, I prefer to go to <hospital brand name>.
BE3	It makes sense to use the services of <hospital brand name> instead of services of any other hospitals even if they are the same.
	Behavioral Intention (i.e., intention to visit hospital) (7-point Likert scale) The header for the three intention items read: "Assuming that <hospital brand name> is available in your area…"
INT1	…I would consider <hospital brand name> the next time I need a hospital service.
INT2	…I would recommend <hospital brand name> if a friend calls me to get my advice in his/her search for a hospital.
INT3	…it is likely that I will visit <hospital brand name>.

Appendix C

Descriptive Statistics, Reliability, Validity, and Common Method Variance

Descriptive Statistics

Table C1. Descriptive Statistics of Indicators

	Aggregate Data		2D Condition		3D Condition	
Items	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
INT1	4.45	1.65	4.30	1.66	4.56	1.64
INT2	4.42	1.61	4.22	1.65	4.58	1.57
INT3	4.03	1.69	3.73	1.70	4.26	1.66
BE1	4.30	1.35	4.32	1.29	4.30	1.39
BE2	4.24	1.31	4.13	1.21	4.31	1.37
BE3	4.46	1.38	4.39	1.32	4.50	1.42
ENJ1	4.78	1.30	4.36	1.41	5.05	1.14
ENJ2	4.29	1.59	3.68	1.50	4.69	1.53
ENJ3	5.00	1.30	4.66	1.47	5.21	1.13
ENJ4	4.52	1.39	4.02	1.44	4.84	1.25
TP1	3.48	1.67	3.01	1.58	3.79	1.65
TP2	3.37	1.66	2.95	1.53	3.64	1.69
TP3	3.27	1.61	3.12	1.66	3.36	1.58
TP4	3.69	1.61	3.31	1.59	3.94	1.57

INT: Behavioral Intention; BE: Brand Equity; ENJ: Enjoyment; TP: Telepresence

Skewness and Kurtosis

A detailed discussion of skewness and kurtosis is not presented here, but they are summarized as follows: Based on Kline (2005), we examined the ratio of the unstandardized skewness and kurtosis indices divided by their standard error. Kline suggests that values less than 10 indicate no serious skewness or kurtosis problem. ENJ3 is the only item with skewness of -10.3 that exceeds this threshold. Although ENJ3's kurtosis value was below 10, it was higher than any other item and so, as an extra check on whether or not skewness and kurtosis were affecting our results, we reestimated our model after deleting ENJ3 and found that it did not change the fit indices significantly (i.e., CFI went from 0.978 to 0.982). The paths and R^2s also did not change much. Therefore, skewness and kurtosis problems were not deemed to be significant problems in our data.

Convergent and Discriminant Validity

Convergent validity was assessed using several methods. First, a general rule states that in the SEM model, the loading of each indicator on its construct should have a path weight of at least 0.7 (see Hulland 1999). The weights in our measurement model range from 0.75 to 0.96. Second, to assess reliability, we used Omega coefficients in Mplus (see Raykov and Marcoulides 2010). This model-based reliability statistic is very similar to Cronbach's Alpha and is interpreted similarly (e.g., greater than 0.8 as recommended by Cohen 1988), but is computed using model parameters—specifically the loadings for the indicators on their corresponding latent constructs as well as the indicators' residual variances—in order to give a model-specific measure of reliability. Table C2 shows the Omega coefficient for each of the latent constructs. Third, Fornell and Larcker (1981) recommend that all average variance extracted (AVE) be greater than 0.5; our model's smallest AVE is 0.65, which is shown in Table C3 as its square root of 0.80. Hence, the above statistics show that there is strong convergent validity in the data.

Table C2. Omega Coefficients for Constructs	
Construct	**Omega**
Behavioral Intention	0.95
Brand Equity	0.99
Enjoyment	0.99
Telepresence	0.88

Table C3. Correlations of Constructs and Average Variances Extracted				
Construct	**INT**	**BE**	**ENJ**	**TP**
Behavioral Intention	**0.92**			
Brand Equity	0.49	**0.88**		
Enjoyment	0.54	0.43	**0.88**	
Telepresence	0.50	0.40	0.65	**0.80**

(***Diagonal** represents **Square Root of Average Variance Extracted**)

Discriminant validity is demonstrated in two ways. First, the AVE rule from Chin et al. (2003) states that the square root of the AVE for each of the constructs should be greater than that construct's correlations with the other constructs. As shown in Table C3, the smallest square root of AVE is 0.80, which is larger than any of the interconstruct correlations. In addition, discriminant validity can be shown through pairwise factor analysis. To conduct this test, items are taken from each pair of constructs and placed in an EFA in Mplus. The same items are then placed in a CFA with one factor. If there is a significant chi-square difference, then the items do not load on one factor, which implies that the two constructs are not actually a single construct. The chi-square difference for each test is significant at the .001 level, which implies that each pair of two constructs is distinct from one another.

Common Method Variance Test

Common method variance is a phenomenon that occurs when items are artificially correlated with each other (Podsakoff et al. 2003; Podsakoff and Organ 1986). One method to detect common method variance is to conduct a series of confirmatory factor analyses on the items and force the number of factors to be one, and then sequentially add another factor until reaching four factors. If common method variance is present, we would expect items from different constructs to be more highly correlated with each other and, therefore, load together on the same factor. If the result is fewer than the four factors we expect to obtain, it suggests common method variance. Four CFAs were run in Mplus in the following order: one-factor, two-factor, three-factor, and four-factor. Each model had better fit statistics than the previous model and the chi-square difference test was significant between each pair of models. This implies that the data loads on four factors, which suggests that the items are not artificially correlated with each other.

Straub et al. (2004) suggest that reliability coefficients that are *too high* are just as problematic as reliability coefficients that are *too low* when items are presented in blocks (as in this case). In spite of scale item blocking potentially creating common method variance, it was not sufficient to fail the common method variance test.

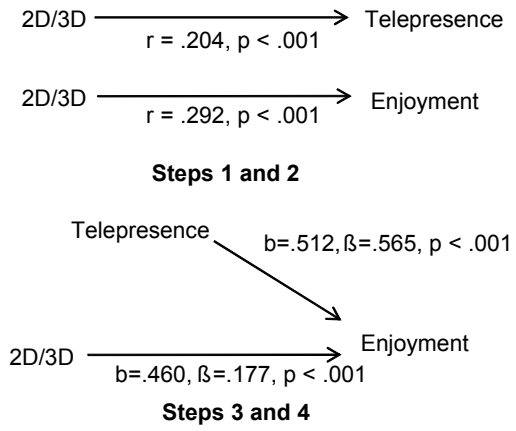
Appendix D

Mediator Tests

We carried out six mediator tests using Baron and Kenney's (1986) four-step procedures to assess the mediating effects in Figure 2.

(1) Telepresence as a mediator of the relationship between 2D/3D and Enjoyment
(2) Enjoyment as a mediator of the relationship between Telepresence and Brand Equity
(3) Brand Equity as a mediator of the relationship between Enjoyment and Behavioral Intention
(4) Enjoyment as a mediator of the relationship between Telepresence and Behavioral Intention
(5) Brand Equity as a mediator of the relationship between Telepresence and Behavioral Intention
(6) Telepresence and Enjoyment as mediators of the relationship between 2D/3D and Brand Equity

Telepresence as a Mediator of the Relationship Between 2D/3D and Enjoyment

Results from Steps 1 and 2	Results from Steps 3 and 4	Overall Results
Satisfied The bivariate relationships are significant: (i) 2D/3D and Telepresence (r = .204, p < .001) and (ii) 2D/3D and Enjoyment (r = .292, p < .001).	**Satisfied** Enjoyment = $b_0 + b_1 \times$ (2D/3D) + $b_2 \times$ Telepresence + e Step 3 is satisfied with b_2 = .512 (beta = .565, p < .001) and step 4 is satisfied with b_1 = .460 (beta = .177, p < .001).	

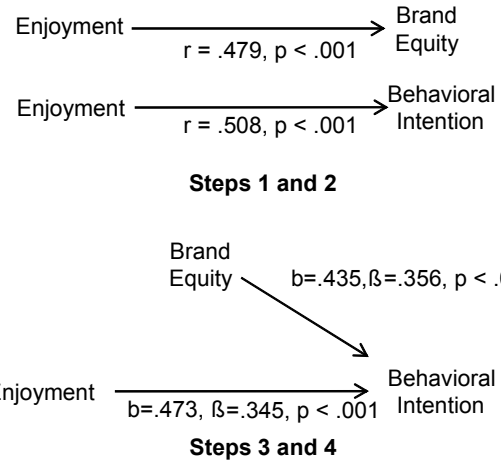
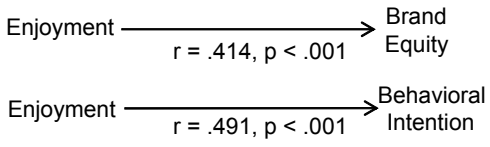
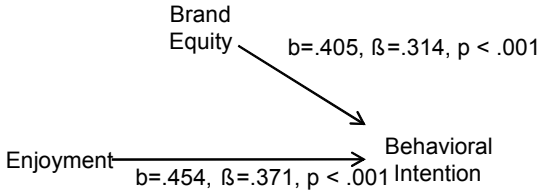
Enjoyment as a Mediator of the Relationship Between Telepresence and Brand Equity

Results from Steps 1 and 2	Results from Steps 3 and 4	Overall Results
Satisfied **2D Condition – Satisfied** The bivariate relationships are significant: (i) Telepresence and Enjoyment ($r = .659$, $p < .001$) and (ii) Telepresence and Brand Equity ($r = .373$, $p < .001$).	**Satisfied** Brand Equity = $b_0 + b_1 \times$ Telepresence + $b_2 \times$ Enjoyment + e **2D Condition – Satisfied** For step 3, Enjoyment is correlated with Brand Equity, with $b_2 = .156$ (beta = .180, $p = .056$). Enjoyment is a mediator because it is still (marginally) correlated with Brand Equity even when Telepresence is in the model. For step 4, the correlation between Telepresence and Brand Equity is such that $b_1 = .212$ (beta = .255, $p < .01$), which implies that Telepresence and Brand Equity are still correlated even when Enjoyment is in the model.	**2D Condition** Telepresence → Enjoyment: $r = .659$, $p < .001$ Telepresence → Brand Equity: $r = .373$, $p < .001$ **Steps 1 and 2** Enjoyment → Brand Equity: $b = .156$, ß = .180, $p = .056$ Telepresence → Brand Equity: $b = .212$, ß = .255, $p < .01$ **Steps 3 and 4**
3D Condition – Satisfied The bivariate relationships are significant: (i) Telepresence and Enjoyment ($r = .520$, $p < .001$) and (ii) Telepresence and Brand Equity ($r = .394$, $p < .001$).	**3D Condition – Satisfied** Step 3 is satisfied with $b_2 = .424$ (beta = .375, $p < .001$) and step 4 is satisfied with $b_1 = .187$ (beta = .199, $p < .01$), which implies that Telepresence and Brand Equity are still correlated even when Enjoyment is in the model.	**3D Condition** Telepresence → Enjoyment: $r = .520$, $p < .001$ Telepresence → Brand Equity: $r = .394$, $p < .001$ **Steps 1 and 2** Enjoyment → Brand Equity: $b = .424$, ß = .375, $p < .001$ Telepresence → Brand Equity: $b = .187$, ß = .199, $p < .01$ **Steps 3 and 4**

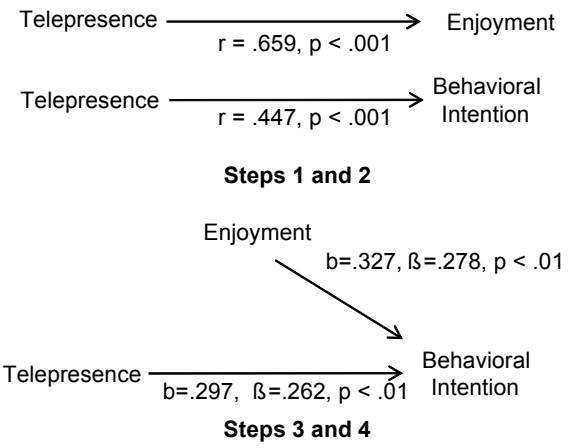
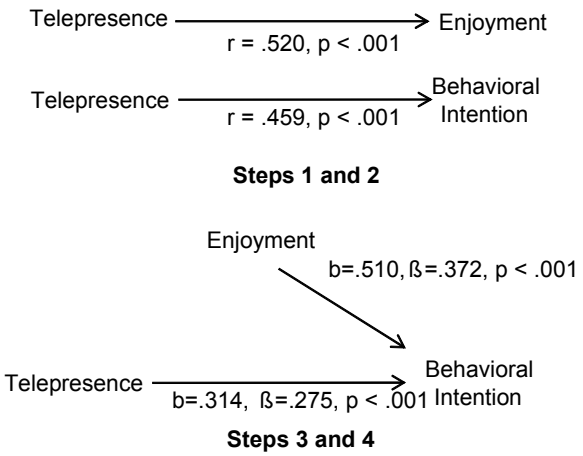
Results from Steps 1 and 2	Results from Steps 3 and 4	Overall Results
2D and 3D – Satisfied The bivariate relationships are significant: (i) Telepresence and Enjoyment (r = .601, p < .001) and (ii) Telepresence and Brand Equity (r = .384, p < .001).	**2D and 3D – Satisfied** Step 3 is satisfied with b_2 = .279 (beta = .287, p < .001) and step 4 is satisfied with b_1 = .187 (beta = .212, p < .001), which implies that Telepresence and Brand Equity are still correlated even when Enjoyment is in the model.	**2D and 3D Combined** Telepresence → Enjoyment r = .601, p < .001 Telepresence → Brand Equity r = .384, p < .001 **Steps 1 and 2** Enjoyment b=.279, ß=.287, p < .001 Telepresence → Brand Equity b=.187, ß=.212, p < .001 **Steps 3 and 4** Therefore, Enjoyment partially mediates the relationship between Telepresence and Brand Equity, and this holds true for both the 2D and 3D conditions separately as well as 2D and 3D combined. This result corresponds with the results in Figure 2 in the paper, which also shows that Enjoyment partially mediates the relationship between Telepresence and Brand Equity.

Brand Equity as a Mediator of the Relationship Between Enjoyment and Behavioral Intention

Results from Steps 1 and 2	Results from Steps 3 and 4	Overall Results
Satisfied **2D Condition – Satisfied** The bivariate relationships are significant: (i) Enjoyment and Brand Equity (r = .348, p < .001) and (ii) Enjoyment and Behavioral Intention (r = .452, p < .001).	**Satisfied** Behavioral Intention = $b_0 + b_1 \times$ Enjoyment + $b_2 \times$ (Brand Equity) + e **2D Condition – Satisfied** For step 3, Brand Equity is correlated with Behavioral Intention with b_2 = .354 (beta = .257, p < .001). Therefore, Brand Equity is a mediator because it is still correlated with Behavioral Intention even when Enjoyment is in the model. For step 4, the correlation between Enjoyment and Behavioral Intention is such that b_1 = .431 (beta = .366, p < .001), which implies that Enjoyment and Behavioral Intention are still correlated even when Brand Equity is in the model.	**2D Condition** Enjoyment → Brand Equity r = .348, p < .001 Enjoyment → Behavioral Intention r = .452, p < .001 **Steps 1 and 2** Brand Equity b=.354,ß=.257, p < .001 Enjoyment → Behavioral Intention b=.431,ß=.366, p < .001 **Steps 3 and 4**

Results from Steps 1 and 2	Results from Steps 3 and 4	Overall Results
3D Condition – Satisfied The bivariate relationships are significant: (i) Enjoyment and Brand Equity (r = .479, p < .001) and (i) Enjoyment and Behavioral Intention (r = .508, p < .001).	**3D Condition – Satisfied** Step 3 is satisfied with b_2 = .435 (beta = .356, p < .001) and step 4 is satisfied with b_1 = .473 (beta = .345, p < .001), which implies that Enjoyment and Behavioral Intention are still correlated even when Brand Equity is in the model.	**3D Condition**  **Steps 1 and 2** **Steps 3 and 4**
2D and 3D – Satisfied The bivariate relationships are significant: (i) Enjoyment and Brand Equity (r = .414, p < .001) and (ii) Enjoyment and Behavioral Intention (r = .491, p < .001).	**2D and 3D – Satisfied** Step 3 is satisfied with b_2 = .405 (beta = .314, p < .001) and step 4 is satisfied with b_1 = .454 (beta = .371, p < .001), which implies that Enjoyment and Behavioral Intention are still correlated even when Brand Equity is in the model.	**2D and 3D Combined**  **Steps 1 and 2**  **Steps 3 and 4** Therefore, Brand Equity partially mediates the relationship between Enjoyment and Behavioral Intention, and this holds true for both the 2D and 3D conditions separately as well as 2D and 3D combined. This result corresponds with the results in Figure 2 in the paper, which also shows that Brand Equity partially mediates the relationship between Enjoyment and Behavioral Intention.

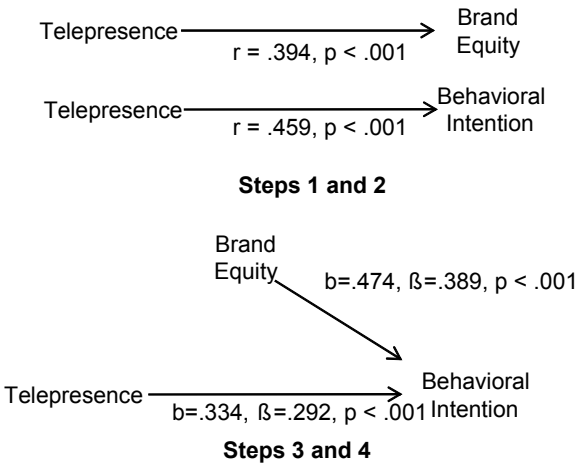
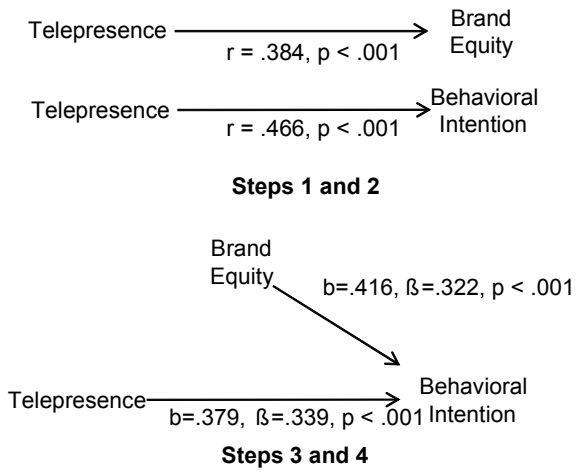
Enjoyment as a Mediator of the Relationship Between Telepresence and Behavioral Intention

Results from Steps 1 and 2	Results from Steps 3 and 4	Overall Results
Satisfied **2D Condition – Satisfied** The bivariate relationships are significant: (i) Telepresence and Enjoyment (r = .659, p < .001) and (ii) Telepresence and Behavioral Intention (r = .447, p < .001).	**Satisfied** Behavioral Intention = b_0 + b_1 × Telepresence + b_2 × Enjoyment + e **2D Condition – Satisfied** For step 3, Enjoyment is correlated with Behavioral Intention with b_2 = .327 (beta = .278, p < .01). Therefore, Enjoyment is a mediator because it is still correlated with Behavioral Intention even when Telepresence is in the model. For step 4, the correlation between Telepresence and Behavioral Intention is such that b_1 = .297 (beta = .262, p < .01), which implies that Telepresence and Behavioral Intention are still correlated even when Enjoyment is in the model.	**2D Condition** 
3D Condition – Satisfied The bivariate relationships are significant: (i) Telepresence and Enjoyment (r = .520, p < .001) and (ii) Telepresence and Behavioral Intention (r = .459, p < .001).	**3D Condition – Satisfied** Step 3 is satisfied with b_2 = .510 (beta = .372, p < .001) and step 4 is satisfied with b_1 = .314 (beta = .275, p < .001), which implies that Telepresence and Behavioral Intention are still correlated even when Enjoyment is in the model.	**3D Condition** 

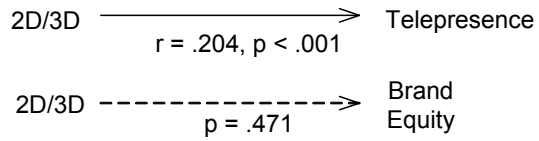
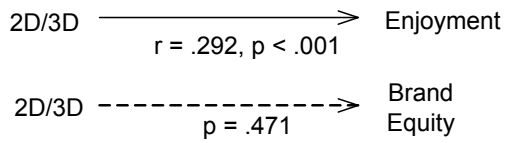
Results from Steps 1 and 2	Results from Steps 3 and 4	Overall Results
2D and 3D – Satisfied The bivariate relationships are significant: (i) Telepresence and Enjoyment ($r = .601$, $p < .001$) and (ii) Telepresence and Behavioral Intention ($r = .466$, $p < .001$).	**2D and 3D – Satisfied** Step 3 is satisfied with $b_2 = .404$ (beta = .330, $p < .001$) and step 4 is satisfied with $b_1 = .299$ (beta = .268, $p < .001$), which implies that Telepresence and Behavioral Intention are still correlated even when Enjoyment is in the model.	**2D and 3D Combined** Telepresence → Enjoyment $r = .601$, $p < .001$ Telepresence → Behavioral Intention $r = .466$, $p < .001$ **Steps 1 and 2** Enjoyment $b=.404$, ß$=.330$, $p < .001$ Telepresence → Behavioral Intention $b=.299$, ß$=.268$, $p < .001$ **Steps 3 and 4** Therefore, Enjoyment partially mediates the relationship between Telepresence and Behavioral Intention, and this holds true for both the 2D and 3D conditions separately as well as 2D and 3D combined. This result corresponds with the results in Figure 2 in the paper, which also shows that Enjoyment partially mediates the relationship between Telepresence and Behavioral Intention.

Brand Equity as a Mediator of the Relationship Between Telepresence and Behavioral Intention

Results from Steps 1 and 2	Results from Steps 3 and 4	Overall Results
Satisfied **2D Condition – Satisfied** The bivariate relationships are significant: (i) Telepresence and Brand Equity ($r = .373$, $p < .001$) and (ii) Telepresence and Behavioral Intention ($r = .447$, $p < .001$).	**Satisfied** Behavioral Intention = $b_0 + b_1 \times$ Telepresence + $b_2 \times$ (Brand Equity) + e **2D Condition – Satisfied** For step 3, Brand Equity is correlated with Behavioral Intention with $b_2 = .344$ (beta = .250, $p < .01$). Therefore, Brand Equity is a mediator because it is still correlated with Behavioral Intention even when Telepresence is in the model. For step 4, the correlation between Telepresence and Behavioral Intention is such that $b_1 = .403$ (beta = .356, $p < .001$), which implies that Telepresence and Behavioral Intention are still correlated even when Brand Equity is in the model.	**2D Condition** Telepresence → Brand Equity $r = .373$, $p < .001$ Telepresence → Behavioral Intention $r = .447$, $p < .001$ **Steps 1 and 2** Brand Equity $b=.344$, ß$=.250$, $p < .01$ Telepresence → Behavioral Intention $b=.403$, ß$=.356$, $p < .001$ **Steps 3 and 4**

Results from Steps 1 and 2	Results from Steps 3 and 4	Overall Results
3D Condition – Satisfied The bivariate relationships are significant: (i) Telepresence and Brand Equity (r = .394, p < .001) and (ii) Telepresence and Behavioral Intention (r = .459, p < .001).	**3D Condition – Satisfied** Step 3 is satisfied with b_2 = .474 (beta = .389, p < .001) and step 4 is satisfied with b_1 = .334 (beta = .292, p < .001), which implies that Telepresence and Behavioral Intention are still correlated even when Brand Equity is in the model.	**3D Condition** 
2D and 3D – Satisfied The bivariate relationships are significant: (i) Telepresence and Brand Equity (r = .384, p < .001) and (ii) Telepresence and Behavioral Intention (r = .466, p < .001).	**2D and 3D – Satisfied** Step 3 is satisfied with b_2 = .416 (beta = .322, p < .001) and step 4 is satisfied with b_1 = .379 (beta = .339, p < .001), which implies that Telepresence and Behavioral Intention are still correlated even when Brand Equity is in the model.	**2D and 3D Combined**  Therefore, Brand Equity partially mediates the relationship between Telepresence and Behavioral Intention, and this holds true for both the 2D and 3D conditions separately as well as 2D and 3D combined. This result corresponds with the results in Figure 2 in the paper, which also shows that Brand Equity partially mediates the relationship between Telepresence and Behavioral Intention.

Telepresence and Enjoyment as Mediators of the Relationship Between 2D/3D and Brand Equity

Results from Steps 1 and 2	Results from Steps 3 and 4	Overall Results
Not Satisfied Although the bivariate relationship between 2D/3D and Telepresence is significant (r = .204, p < .001) and between 2D/3D and Enjoyment is also significant, (r = .292, p < .001), the bivariate relationship between 2D/3D and Brand Equity is not (p = .471).		 **Steps 1 and 2 – Telepresence as Mediator**  **Steps 1 and 2 – Enjoyment as Mediator** The reason for the non-significant relationship between 2D/3D and Brand Equity is due to opposing or counteracting forces taking place between 2D/3D and Brand Equity. Since the first and second mediator tests support positive mediating effects of Telepresence and Enjoyment in the model, the non-significant relationship between 2D/3D and Brand Equity is likely caused by a counteracting, negative effect of 2D/3D on Brand Equity which we attribute to distraction-conflict theory.

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