THE IMPACT OF STEREOSCOPIC THREE-DIMENSIONAL (3-D) ADVERTISING

The Role of Presence in Enhancing Advertising Effectiveness

Mark Yi-Cheon Yim, Vincent J. Cicchirillo, and Minette E. Drumwright

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The emergence of stereoscopic three-dimensional (3-D) technology heralds a new era for media. This new technology enhances the consumer experience in diverse media settings—movies, television, and video games—and it is extending to many different displays (e.g., laptops, photo frames, camera systems). For example, 8 of the top 10 grossing movies of 2011 were produced in 3-D (e.g., *Harry Potter*, *Transformers*) (*The Numbers* 2011). The number of 3-D cinema screens installed worldwide jumped from around 5,000 to 22,300 within 18 months, an increase of 450% (PRWEB 2011). Three-dimensional content of sports games, movies, and events via DirecTV and ESPN is now available in homes (Katzmaier 2010). In the domain of video games, more than 400 stereoscopic 3-D game titles are available for today’s gamers via 3-D capable PC and gaming consoles (Insight Media 2009). The booming public interest is encouraging advertisers to experiment with this rich, new technology as an advertising tool. Stereoscopic 3-D cinema advertisements have been presented in movie theaters for brands as diverse as Samsung Electronics, Toyota, and Skittles (Contrino 2009). VISA launched the first high-definition, stereoscopic 3-D outdoor advertising in New York’s Grand Central Terminal in 2010 (Bachman 2010).

The distinctive aspect of stereoscopic 3-D technology is that it produces pop-up 3-D visualizations with true depth off screen. As such, stereoscopic 3-D advertising is defined as computer-simulated advertising that allows consumers to experience floating, three-dimensional visualizations of the product that have true depth off screen (B2B News 2010). In contrast, traditional television representations and typical computer graphics represent the depth of images only within the screen (Dodgson 2005). We refer to the traditional format as “flat 3-D” because depth is portrayed without pop-up images off screen (see, e.g., Jin et al. 2007). Stereoscopic display technology is based on the stereo parallax principle of seeing a different image with each eye (Dodgson 2005; Jin et al. 2007; Rupkalvis 2001). To provide each eye with a different image, stereoscopic displays require viewers to wear glasses to see stereo images (the glasses type), but the invention of auto-stereoscopic technology (the nonglasses type) enables viewers to see stereoscopic images without wearing special glasses or other headgear (Dodgson 2005; Jin et al 2007). As such, it broadens the commercial uses of this new technology.

Although stereoscopic 3-D technology appears to have great potential as an advertising tool, its impact on advertising effectiveness has gone largely unexamined. This study aims to evaluate the impact of both the glasses and nonglasses types of stereoscopic 3-D advertising (treatment group) on consumer evaluations of advertising and compare it with the impact of flat 3-D advertising (control group). Central

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to this investigation is an examination of presence, which has long been considered an important construct in virtual reality research. Presence, which is sometimes referred to as “telepresence” (e.g., Hopkins, Raymond, and Mitra 2004), refers to an individual’s perception of being immersed in one context while actually being physically situated in another context (Witmer and Singer 1998). It is “the perceptual illusion of nonmediation” (Lombard and Ditton 1997, p. 2). More simply, presence has been described as a sense of “being there” (Biocca 1997; Heeter 1992; Lee 2004). Although much of the research on presence has been conducted in contexts other than persuasive messaging, presence has been found to affect diverse marketing variables, such as perceived product knowledge, brand attitudes (Grigorovici and Constantin 2004; Hopkins, Raymond, and Mitra 2004; Kim and Biocca 1997; Li, Daugherty, and Biocca 2002), recall and recognition (Keng and Lin 2006), attitudes toward the ad (Hopkins, Raymond, and Mitra 2004), and purchase intention (Hopkins, Raymond, and Mitra 2004). However, these findings are mostly confined to the context of media with a focus on interactivity, such as the Internet, and important questions still remain unanswered. For example, how does presence affect advertising effectiveness in media that do not provide a high degree of interactivity, such as stereoscopic 3-D technology? Why does presence have the impact that it does, and what other constructs come into play? This study addresses these questions, and in doing so, it examines factors that are likely to be associated with the impact of presence: enjoyment, perceived product knowledge, novelty, and cybersickness. Because a growing number of emerging new media create virtual realities (e.g., augmented realities, holograms) or attempt to stimulate vividness in generating a high sense of presence (e.g., HD radio, Blue-ray, HDTV, Ultra HDTV), this study is likely to enrich our understanding of advertising effectiveness in other contexts as well.

BACKGROUND

As mentioned above, in virtual reality, presence is often described with a simple phrase, “being there” (Biocca 1997; Heeter 1992; Lee 2004). Lee explained presence as an experience in which the individual does not notice “the para-authenticity of mediated objects” or “the artificiality of simulated objects” (2004, p. 36). Others have argued that the illusion of presence can be a product of all media (Reeves and Nass 1996). For example, people who play 3-D video games and people who engage in a virtual experience by reading a book could feel a similar degree of presence (Schiano 1999). In addition, presence varies depending on individual attention to the media stimulus (Lessiter et al. 2001). That is, generating a sense of presence relies not only on media and its specific functions, but also on factors that originate from user characteristics (perceptions of interactivity and vividness) that contribute to a sense of presence (Lessiter et al. 2001). Kim and Biocca (1997) assert that presence is not one-dimensional in that a sense of presence is a consequence of subjective internal processing (Loomis 1992). A user’s sense of presence often shifts among the virtual, physical, and imagined environments or between the concepts of “being there” and “not being there” in virtual environments (Kim and Biocca 1997). These explanations point to two key characteristics of presence: (1) it occurs when media users perceive illusions as if they physically exist (Lombard and Ditton 1997), and (2) it is an individually perceived construct (Lessiter et al. 2001). That is, technologies that produce mediated environments are important components in generating a sense of presence, but the magnitude of the technological influences are dependent on individuals’ perceptions (Rheingold 1991). Previous research has proposed that a sense of presence is primarily created by two components—interactivity and vividness.

Interactivity

The concept of interactivity has been long debated because it is a broad, encompassing, and complex construct. Kiousis (2002) summarized the debates by pointing to three different conceptualizations of interactivity: (1) as interpersonal communication, (2) as user perception, and (3) as the result of technology. Historically, communication scholars have viewed interactivity within the context of interpersonal communication in which people interact with one another as they communicate (see, e.g., Rafaeli 1988). Others have viewed interactivity as something created through individual users’ subjective perceptions of an interactive experience (see, e.g., Newhagen, Cordes, and Levy 1995). Finally, interactivity has been understood as the outcome of technological properties, since technology can play a dominant role in enabling it (see, e.g., Heeter 1989; Steuer 1992). The conceptualizations of interactivity as a construct created by media users’ perceptions and as an outcome of technology are particularly relevant to our study. Since the degree of interactivity depends on media users’ perceptions, each individual may experience a different level of interactivity, regardless of technological properties (Newhagen, Cordes, and Levy 1995). As such, even though neither stereoscopic 3-D advertising nor traditional television commercials provide a channel for interacting with the ad content, viewers could perceive some level of interactivity.

Vividness

Vividness, the other component of presence, is defined as “the ability of a technology to produce a sensorially rich, mediated environment” (Steuer 1992, p. 80). Vividness has two subdimensions: sensory breadth and depth. Sensory breadth refers to the number of different senses that a medium engages
(Steuer 1992), and sensory depth indicates the quality of the represented information that media users perceive (Steuer 1992). For example, sensory breadth suggests that because it stimulates more senses, a Web site including video, audio, and animation will produce a higher sense of vividness than a Web site presenting only still images (Coyle and Thorson 2001). Sensory depth suggests that the enhanced images of high definition television (HDTV) or stereoscopic 3-D technology will create more vividness than the flat 3-D format.

Far less research has focused on the vividness aspect of presence than on interactivity, and the studies that do exist have aimed to identify the variables that enhance vividness. High image quality (Bracken 2005; Neuman 1990), extensive field of view (i.e., viewing distance and image size) (Lombard et al. 2000; Utley 1997), and the number of sensory stimuli (Coyle and Thorson 2001) enhance vividness, and thus, are associated with an improved sense of presence (Lombard and Ditton 1997). For example, Bracken (2005) explored the impact of HDTV compared with SDTV (standard definition television). The distinctive advantage of HDTV (1080 lines) over SDTV (480 lines) is in its technological advances in terms of resolution, color, sharpness, and brightness, resulting in a better image quality (i.e., sensory depth) (Bracken 2005; Lombard and Ditton 1997). Bracken’s results indicated that participants who watched HDTV reported a higher level of presence than those who watched SDTV. Parallel to this finding, because a stereoscopic 3-D display presents an image more vividly or realistically (stimulating better sensory depth), it is likely to yield a greater sense of presence than a flat 3-D display.

Impact of Presence

Scholars have illustrated that presence is an effective means to increase persuasive power in diverse media environments (Heeter 2000; Wu and Shaffer 1987). Specifically, in the Internet context, Hopkins, Raymond, and Mitra (2004) found that a higher degree of presence favorably affected a broad range of consumer responses, including attitudes toward the ad, attitudes toward the brand, and purchase intention, and Li, Daugherty, and Biocca (2002) found evidence that a higher degree of presence also resulted in greater perceived product knowledge, as well as improved brand attitudes. In studying television infomercials, Kim and Biocca (1997) identified that presence produced favorable brand preference. In the video-game context, presence generated positive preferences among gamers for the brands they were exposed to during play (Grigorovici and Constantin 2004; Nelson, Yaros, and Keum 2006). However, the mechanisms through which presence generates its various and diverse positive effects have not been investigated. This research proposes that two dominant factors may explain the impact of presence in the context of advertising: (1) enjoyment, and (2) consumer learning or perceived product knowledge.

Enjoyment

Enjoyment is the psychological feeling of pleasure while watching an advertisement (Lin et al. 2002). Virtual reality researchers have found that participants who experienced a high sense of presence reported that their media experiences were enjoyable and pleasant (Daugherty, Li, and Biocca 2005; Lombard and Ditton 1997; Vorderer, Klimmt, and Ritterfeld 2004). Little research has examined why presence creates enjoyment, but some researchers have speculated about the relationship between presence and enjoyment. For example, Heeter (1995) asserted that presence permits media users to immerse themselves in the world constructed within a medium, which leads to a loss of self-consciousness or a sense of escape from the real world. The immersive experience causes them to forget the time elapsed and their worries, and thus, enjoyment occurs (Sherry 2004; Hoffman and Novak 1996; Vorderer, Klimmt, and Ritterfeld 2004). Through creating a sense of presence, stereoscopic 3-D technology prompts media users to enter into an immersive experience that enables them to experience enjoyment (Bracken 2005). As such, this discussion leads to the following hypothesis:

Hypothesis 1: A higher sense of presence will result in greater enjoyment.

Consumer Learning: Increased Perceived Product Knowledge

Product knowledge is classified into two subtypes: subjective product knowledge, which refers to consumers’ perceptions of their own knowledge about a product (Park and Lessig 1981), and objective knowledge, which refers to facts stored in consumers’ memories (Brucks 1985). Advertising can enhance both types of product knowledge by presenting product functions, price, design, usage, and more. However, while advertising is relatively good at improving ad viewers’ objective knowledge (e.g., facts about a product), it is often less effective in enhancing subjective knowledge about a product or service (e.g., self-confidence about product information) (Park and Lessig 1981; Rao and Monroe 1988). This is primarily because product knowledge from advertising is obtained through indirect experience with the product, which provides a limited sensory confirmation process (Li, Daugherty, and Biocca 2001, 2002). As such, it results in high uncertainty and high perceived risk in purchases (Smith and Park 1992). Indeed, research has confirmed that a consumer’s confidence is higher with direct product experience (e.g., product trial) than with indirect product experience (e.g., advertising) (Kotler 1988; Fazio, Zanna, and Cooper 1978; Smith and Swinyard 1988). Virtual experience enables consumers to perceive that they actually have had product experience more fully than other types of indirect experience (e.g., advertising), since it more closely approximates direct experience (Li, Daugherty, and Biocca 2001, 2003). Specifically, in virtual environments,
consumers are able to observe the details of a product because it is portrayed with realistic images (e.g., shape, perceived function, texture), and this leads consumers to have more confidence about the product information (Ha 2005; Kim and Biocca 1997; Wu and Shaffer 1987). That is, what consumers learn through virtual experiences can contribute to both actual and perceived knowledge about products (Li, Daugherty, and Biocca 2005; Smith and Park 1992).

In a similar vein, stereoscopic 3-D advertising viewers are able to explore multiple dimensions of a product in a manner that flat 3-D advertising viewers cannot. Theoretically, as the level of presence increases, viewers’ perceptions of products are shifted from imaginary products that cannot be experienced to real objects that exist in the world (Daugherty, Li, and Biocca 2005, 2008; Lee 2004). That is, stereoscopic 3-D advertising, which provides vividness, produces a certain level of presence, which can result in a perception of direct or close-to-direct product experiences. This perception leads to improved product knowledge. Therefore, the following hypothesis is proposed:

**Hypothesis 2:** A higher sense of presence will result in an increase in perceived product knowledge.

### Consumer Evaluations of Advertising

Many traditional advertising models assert the impact of affective and cognitive processes on the formation of attitudes toward advertising (e.g., MacInnis and Jaworski 1989; Petty and Cacioppo 1981; Vakratsas and Ambler 1999). They share the premise that a positive psychological state that occurs while watching advertising can be transferred to attitudes toward the brand or product advertised (Schlosser and Shavitt 1999; Zillmann 1996). Also, providing information that viewers need prompts positive evaluations of an ad since it is useful in making choices (Nelson 1970, 1974). For example, Ducoffe’s Advertising Value Model (1996) describes the relationships among entertainment (the ability of advertising to entertain the audience), informativeness (the ability of advertising to provide consumers with product alternatives), advertising value (an overall evaluation of the value of advertising to consumers), and attitudes toward advertising. He found that entertainment (affective) and informativeness (cognitive) resulted in advertising value and positive attitudes toward a Web ad. Thus, consistent with previous findings, enjoyment (affective) and perceived product knowledge (cognitive) are expected to result in favorable attitudes toward advertising.

Based on this discussion, we hypothesize that

**Hypothesis 3:** Greater enjoyment will result in more favorable attitudes toward advertising.

**Hypothesis 4:** An increase in perceived product knowledge will result in more favorable attitudes toward advertising.

### The Moderators in Stereoscopic 3-D Advertising Effectiveness

An important but unanswered question in virtual reality research deals with how a sense of presence is created in terms of human mental processes (Lee 2004). Given that the sense of presence perceived varies based on the degree of immersion experienced by an individual user, Rosenkrans (2009) identified the novelty effect as a potentially influential way to enhance a sense of presence because it can prompt increased attention to media. In contrast, cybersickness has been identified as a negative factor that can detract from media users’ attention to media, resulting in a reduced sense of presence (Witmer and Singer 1998).

**Novelty Effect**

Since stereoscopic 3-D advertising is still new to many people and its adoption in advertising is at an early stage, the novelty effect is likely to have an impact on advertising effectiveness. Novel advertising is defined as advertising that includes unique, unusual, and different content or design that distinguishes it from other advertising (Berlyne et al. 1963; Rosenkrans 2009). Novel advertising attracts viewers’ attention and increases their ability to process information in advertising (Lang 2000; Thorson and Lang 1992). The Limited Capacity Model (Lang 2000) supports the idea that novel stimuli play a role in initiating an automatic selection process, which leads one to attend cognitively to the stimuli. This has often been referred to as an “orienting response,” which can cause an automatic allocation of cognitive resources to encode and process sensory information (Detenber and Lang 2011; Lang 2000). Therefore, the novelty effect of advertising is expected to increase viewers’ opportunity to become immersed in the stimuli, which will result in an increased sense of presence.

It is important to note that since novelty is a subjectively perceived construct (Berlyne et al. 1963), each user may perceive novelty differently. Specifically, Tellis (1997) illustrated that novel ads can cause tedium as viewers are more exposed to them, but simultaneously, the frequent exposure to novel ads can also reduce uncertainty and tension, which is called habituation. It may be possible for some viewers to perceive a level of novelty while watching a flat 3-D ad that is similar to the level of novelty when watching a stereoscopic 3-D ad. The technological benefits (i.e., media effect) of a stereoscopic 3-D ad in generating presence may disappear for viewers who perceive high novelty in the ad content or design (i.e., the content effect) in a flat 3-D ad. In contrast, the technological benefits of stereoscopic 3-D display (i.e., media effect) will be more effective in generating presence when viewers perceive ad content or design as being low in novelty (i.e., the content effect).
Hypothesis 5: The effect of stereoscopic 3-D advertising in creating presence will be moderated by the novelty of the advertising content and design.

(a) When viewers perceive a low level of novelty in advertising content and design, stereoscopic 3-D advertising will be more effective in creating presence than flat 3-D advertising.

(b) When viewers perceive a high level of novelty in advertising content and design, stereoscopic 3-D will not be more effective than flat 3-D advertising in creating presence.

Cybersickness

Like other virtual reality–based technology, viewers of stereoscopic 3-D advertising may experience cybersickness, which is very similar to motion sickness (e.g., eye strain, headache, or nausea) (Hale and Stanney 2006). Cybersickness is caused by a mismatch between the visual and vestibular systems that affects the central nervous system (Kiryu and So 2007). Although users are not actually moving when they view stereoscopic 3-D, they often perceive that they are because of the 3-D visuals, and this perception of motion can cause cybersickness (LaViola 2000).

Cybersickness is an important factor that negatively influences the sense of presence perceived in a virtual environment (Witmer and Singer 1998). Cybersickness hinders users in paying attention to the stimuli, and it prompts them to focus on the physical world, which decreases their involvement in the virtual experience. As a result, cybersickness can reduce the sense of presence (Hale and Stanney 2006; Witmer and Singer 1998).

Similar problems due to cybersickness can occur with stereoscopic 3-D technology. For example, Jin et al. (2007) conducted qualitative research with 15-inch autostereoscopic 3-D LCD monitors. The participants reported diverse types of cybersickness, and as a result, preferred 2-D (or flat 3-D in the terminology of this study) to stereoscopic 3-D display. Since anything that irritates or distracts viewers tends to diminish advertising effectiveness (Ducoffe 1996), cybersickness is expected to weaken the ability of stereoscopic 3-D technology to create presence. Therefore, we hypothesize the following:

Hypothesis 6: The effect of stereoscopic 3-D advertising in creating presence will be moderated by cybersickness.

(a) When viewers experience a low level of cybersickness, stereoscopic 3-D advertising will be more effective in creating presence than flat 3-D advertising.

(b) When viewers experience a high level of cybersickness, stereoscopic 3-D will be less effective in creating presence than flat 3-D advertising.

GENERAL METHODOLOGY

While both the glasses and the nonglasses type of stereoscopic 3-D technology enable viewers to experience floating images off screen, they have different strengths and weaknesses. The nonglasses type is advantageous in that viewers do not have to wear glasses, but it constrains them to a relatively rigid viewing position and restricts their viewing angle (Jin et al. 2007; Rupkalvis 2001). In contrast, with the glasses type of stereoscopic 3-D technology, viewers may experience some discomfort from wearing glasses that may reduce their sense of presence, but they typically do not have viewing angle restrictions. Thus, two experiments were conducted so that each type of stereoscopic 3-D technology could be tested. Study 1 tested the effectiveness of the nonglasses type of stereoscopic 3-D technology, whereas Study 2 tested the glasses type of stereoscopic 3-D technology. In this process, a structural equation model was constructed to test H5 and H6. An ANOVA (analysis of variance) based on median values of novelty and cybersickness was used to test H5 and H6.

Research Design

Both experiments were conducted in a laboratory setting. For the nonglasses type of stereoscopic 3-D technology, we used a 19-inch Miracube autostereoscopic LCD display, which is expected to be adopted as an indoor advertising tool. For the glasses type of stereoscopic 3-D technology, we used a 32-inch Miracube stereoscopic LCD monitor, which had the same format as television commercials or cinema advertising. Both monitors were switched between stereoscopic 3-D and flat 3-D, which avoided bias caused by the devices (i.e., monitor size and design). Sound was provided using two 30-W speakers, which can be purchased commercially. Data were collected between 9 a.m. and 5 p.m. on weekdays.

Stimuli

A fast-food category was chosen for the ads because stereoscopic 3-D advertising has been used in fast-food stores (e.g., ImagePro in McDonald’s). The brand, Kentucky Fried Chicken (KFC), was selected because consumers perceived a moderate level of preference for this brand compared with McDonald’s and Burger King (Business Week 2008). The moderate level of preference was needed to avoid ceiling or floor effects in participants’ responses.

A one-minute, moving picture advertisement was created in stereoscopic 3-D and flat 3-D advertising formats using a stereoscopic 3-D video camera and computer graphic design programs (i.e., same content, but different formats). Because displaying realistic images of products provides information and builds consumer knowledge (Andrews 1989; Bauer and
Greyser (1968), the KFC ads featured diverse products, such as a “chicken tower sandwich,” a “chicken zinger sandwich,” “original recipe chicken,” and “hot & crispy chicken.” The product images were rotated in the middle of the screen to provide detailed product visuals (see Appendix 1).

Manipulation Check

Participants’ preexisting attitudes toward KFC were measured since they could influence their responses. The results confirmed that KFC was perceived as a moderately favorable brand ($M = 4.33$ out of 7, $SD = 1.23$) with a moderate level of purchase intention ($M = 4.30$ out of 7, $SD = 1.47$), so that floor and ceiling effects in participants’ responses were not expected. The manipulation check also confirmed that participants’ preexisting brand attitudes and purchase intentions were not significantly different in the two conditions (brand attitudes: $t[83] = .64, p > .5$, purchase intention: $t[83] = 1.52, p > .1$).

To reduce the confounding effects that could be caused by the different screen sizes in Studies 1 and 2, an attempt was made to equalize participants’ fields of view by controlling their viewing distances (e.g., Lombard et al. 2000). Specifically, following the guidelines suggested by THX (www.thx.com), a well-known certification program for home theater systems, participants who were exposed to the 19-inch screen had an approximately 22-inch viewing distance from the screen, and those who were exposed to the 32-inch screen had an approximately 36-inch viewing distance. These distances resulted in close to what THX characterizes as optimum television-viewing experiences in both conditions. As such, the fields of view in the two studies were considered to be roughly equivalent. However, many participants moved while watching the commercials, especially in response to virtual objects that floated off screen, so the attempt to control viewing distances may not have been entirely successful.

Dependent Variables

All the measures in the questionnaire used seven-point, semantic differential or Likert scales. Participants were first asked to answer questions regarding presence. Witmer and Singer’s presence scale (1998) was used, but some items in the original scale that were not suitable for this research (e.g., haptic) were eliminated (see Appendix 2). Measures assessing participants’ perceived enjoyment (Schlinger 1979) and perceived product knowledge (Smith and Park 1992) from the ads were used. Attention to media was measured (Novak, Hoffman, and Yung 2000) with four items: “not deeply engrossed”/“deeply engrossed”, “not absorbed intently”/“absorbed intently”, “my attention was not focused”/“my attention was focused”, and “I did not concentrate fully”/“I concentrated fully.” For advertising effectiveness, we adopted frequently used measures of the typical dependent variables: attitude toward advertising, brand attitudes, and purchase intentions (Andrews et al. 1992; Beerli and Santana 1999).

Finally, participants were asked to respond to questions regarding novelty and cybersickness. Scales measuring novelty used words such as “new,” “unique,” “different,” and “unusual,” and asked participants to indicate their degree of agreement (“strongly disagree” to “strongly agree”) (Massetti 1996). The scale for cybersickness was adopted from Bracken (2005), and consisted of four items: (1) “to what degree did you experience stomach awareness while watching the advertising?” (2) “to what degree did you experience nausea while watching the advertising?” (3) “to what degree did you experience dizziness with your eyes open while watching the advertising?” and (4) “to what degree did you experience dizziness with your eyes closed while watching the advertising?” Demographic data were collected at the end of the survey.

SPSS (Statistical Package for the Social Sciences) was used to conduct a factor analysis to confirm the simple structure of the variables of interest. For example, after all of the assumptions for the analysis were confirmed, presence showed a unidimensional component in the scale; all the items loaded above .65 (eigenvalue = 4.56, variance = 56.93%). The reliability assessment indicated that all scales exceeded the guideline of .70 (Hair et al. 1998).

Study 1 aimed to test the impact of the nonglasses type of stereoscopic 3-D display on advertising effectiveness by comparing it with the impact of the flat 3-D display when the ad content is the same.

Participants

Eighty-five college students at a southwestern university participated in the experiment. Both genders were almost equally represented (51.8% male), and the average age was 19.78 years old ($SD = 1.40$). Participants received course credit as compensation. When they came to the laboratory, they were informed of the potential risk of cybersickness (e.g., dizziness). After agreeing to participate, they were randomly assigned to one of the research conditions, either stereoscopic 3-D or flat 3-D. Each participant then watched a one-minute commercial twice.

Results

Although it was not stated as a formal hypothesis, one goal of the current study was to test the effectiveness of stereo-
scopic 3-D advertising compared to flat 3-D advertising. An independent $t$-test was used to achieve that goal (see Table 1), and the results illustrated that stereoscopic 3-D advertising was significantly better than flat 3-D advertising in terms of generating presence ($p < .001$), attention to advertising ($p < .01$), enjoyment ($p < .001$), perceived product knowledge ($p < .05$), attitudes toward advertising ($p < .06$), brand attitudes ($p < .01$), and purchase intentions ($p < .01$).

**Discussion**

Study 1 confirmed that the nonglasses type of stereoscopic 3-D advertising was superior to flat 3-D advertising in terms of advertising effectiveness. Most important, a higher sense of presence, which is expected to affect advertising effectiveness, was detected in the nonglasses type of 3-D stereoscopic advertising. However, the generalizability of these findings to stereoscopic 3-D advertising must be investigated by replicating the study with the glasses type of stereoscopic 3-D advertising. In addition, important questions remain regarding the mental processes through which presence is increased, particularly as they pertain to novelty and cybersickness. These concerns are addressed in Study 2, and subsequently, in the model test.

**STUDY 2: GLASSES TYPE STEREOSCOPIC 3-D ADVERTISING**

Similar to the objectives of Study 1, Study 2 tested the general impact of a glasses type of stereoscopic 3-D ad versus a flat 3-D ad. In addition, a structural model indicating the relationships among presence, enjoyment, perceived product knowledge, and attitudes toward advertising was tested using structural analysis. Finally, the impact of novelty and cybersickness on presence were assessed.

**Participants**

Responses from 108 college students at a southeastern university were collected in Study 2. The sample consisted of 69 female students (63.9%) and 39 male students (36.1%), and the average age was 21.01 years old ($SD = 1.57$). All participants were given course credit as compensation. Participants were randomly assigned to either the stereoscopic 3-D or the flat 3-D condition. They evaluated the same advertisement (i.e., KFC) used in Study 1.

**Results**

As in Study 1 (nonglasses type), Study 2 (glasses type) tested the effectiveness of stereoscopic 3-D advertising compared with flat 3-D advertising. An independent $t$-test identified that the glasses type of stereoscopic 3-D advertising produced significantly better ad effectiveness than the flat 3-D ad in terms of generating presence ($p < .01$), attention to advertising ($p < .05$), enjoyment ($p < .01$), attitudes toward advertising ($p < .01$), and brand attitudes ($p < .09$). Unlike Study 1, stereoscopic 3-D did not generate more perceived product knowledge or increased purchase intentions versus flat 3-D (see Table 2). Considering the results from Studies 1 and 2, we concluded that both types of stereoscopic 3-D are generally superior to flat 3-D in terms of advertising effectiveness.

**The Role of Presence in Advertising Effectiveness: Testing H1 Through H4**

To confirm the role of presence in advertising effectiveness, a structural equation model was constructed based on H1 through H4 to describe the relationships among presence, enjoyment, perceived product knowledge, and attitudes toward

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**TABLE 1**

| Study 1: Nonglasses Type of Stereoscopic 3-D Advertising Effectiveness |
|---------------------------------------------------------------|---------------------|
| Dependent variable                                            | Stereoscopic 3-D    | Flat 3-D       | $t$-Statistic |
| Presence                                                     | 4.99 (1.09)         | 3.91 (1.17)    | $t (83) = 4.43^{***}$ |
| Attention                                                    | 5.21 (1.16)         | 4.32 (1.43)    | $t (78.7) = 3.17^{**}$ |
| Enjoyment                                                    | 5.48 (1.43)         | 3.97 (1.64)    | $t (83) = 4.54^{***}$ |
| Perceived product knowledge                                  | 4.71 (1.06)         | 4.17 (1.23)    | $t (83) = 2.15^†$ |
| Advertising attitude                                          | 4.88 (1.39)         | 4.23 (1.71)    | $t (83) = 1.91^†$ |
| Brand attitude                                               | 5.17 (1.16)         | 4.22 (1.70)    | $t (72.4) = 3.01^{**}$ |
| Purchase intention                                           | 5.02 (1.23)         | 3.98 (1.70)    | $t (74.7) = 3.26^{**}$ |

Notes: Parentheses indicate standard deviation.

$^† p < .06$.

$^* p < .05$.

$^{**} p < .01$.

$^{***} p < .001$. 

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advertising. It was tested using AMOS 18.0. To test the model, the samples from Study 1 (nonglasses type of stereoscopic 3-D) and Study 2 (glasses type of stereoscopic 3-D) were combined because they were based on the same advertising content and they showed a similar pattern of distribution (see Appendix 3). In addition, the combined sample represented more diverse degrees of presence with an ideally shaped, normal distribution (close to zero; skewness = –.15, kurtosis = –.42, n = 193), providing for more precise statistical analysis with higher power (Lenth 2001). As such, the test of the model was designed to examine the theoretical relationships among the four proposed variables in 3-D advertising.

Assumption Check

The basic assumptions for confirmatory factor analysis (CFA) were tested. Kaiser-Meyer-Oklin’s measure was beyond .50, and Bartlett’s Test of Sphericity index was significant at \( p < .001 \). In addition, the normality assumption was confirmed by checking Skewness and Kurtosis values in each item, and the test results identified that all the tests were within the range of \( \pm 1.96 \) (skewness < .39, kurtosis < −.48).

Reliability and Validity

To test the reliability of each latent construct, Cronbach’s \( \alpha \)s were calculated, and the test results revealed that all the \( \alpha \) values exceeded the acceptance guideline of .70 (Hair et al. 1998). Convergent and discriminant validity tests were conducted. Convergent validity was examined by checking (1) whether the factor loadings of each latent construct were significant (Anderson and Gerbing 1988), and (2) whether each construct’s average variance extracted (AVE) was beyond the suggested value of .50 (Fornell and Larcker 1981). The results indicated that the values were acceptable for all the constructs. Comparisons of the AVE with the squared correlation (\( \phi^2 \)) between the factor and each of the other constructs confirmed discriminant validity, indicating that the AVE for each construct was greater than its squared correlation (\( \phi^2 \)) (Lichtenstein, Netemeyer, and Burton 1990). The fit of the measurement model for each construct was tested and all the constructs illustrated a proper level of model fit.

Hypotheses Test

The proposed model included H1 (presence → enjoyment), H2 (presence → perceived product knowledge), H3 (perceived product knowledge → ad attitudes), and H4 (enjoyment → ad attitudes). The structural analysis results indicated that the overall model fit was deemed to be acceptable: \( \chi^2(131) = 206.17, p < .001, \) CFI (comparative fit index) = .97, GFI (goodness-of-fit index) = .90, AGFI (adjusted goodness-of-fit index) = .87, NFI (normed fit index) = .92, RMSEA (root mean square error of approximation) = .06. The proposed hypotheses were confirmed by identifying the significance of each path coefficient among latent variables. As shown in Figure 1, the model revealed that presence resulted in both enjoyment (H1: \( \beta = .63, p < .001 \)) and perceived product knowledge (H2: \( \beta = .45, p < .001 \)), leading to positive attitudes toward advertising (H3: \( \beta = .14, p < .07, \) H4: \( \beta = .46, p < .001 \)). Thus, H1 through H4 were generally supported.

The Moderating Roles of Novelty and Cybersickness on Presence: Testing H5 and H6

H5 predicted that for viewers who perceive high novelty from ad content or design, both stereoscopic 3-D and flat 3-D would produce high presence, whereas for viewers who perceive low novelty...

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Stereoscopic 3-D</th>
<th>Flat 3-D</th>
<th>t-Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence</td>
<td>4.42 (1.12)</td>
<td>3.50 (1.17)</td>
<td>t (106) = 4.19***</td>
</tr>
<tr>
<td>Attention</td>
<td>4.75 (1.39)</td>
<td>4.05 (1.44)</td>
<td>t (106) = 2.58*</td>
</tr>
<tr>
<td>Enjoyment</td>
<td>3.79 (1.57)</td>
<td>2.97 (1.59)</td>
<td>t (106) = 2.69**</td>
</tr>
<tr>
<td>Perceived product knowledge</td>
<td>3.92 (1.52)</td>
<td>3.68 (1.49)</td>
<td>t (106) = .81</td>
</tr>
<tr>
<td>Advertising attitude</td>
<td>5.39 (1.38)</td>
<td>4.47 (1.66)</td>
<td>t (106) = 3.12**</td>
</tr>
<tr>
<td>Brand attitude</td>
<td>4.46 (1.84)</td>
<td>3.86 (1.78)</td>
<td>t (106) = 1.72*</td>
</tr>
<tr>
<td>Purchase intention</td>
<td>4.10 (1.80)</td>
<td>3.73 (1.70)</td>
<td>t (106) = 1.01</td>
</tr>
</tbody>
</table>

Notes: Parentheses indicate standard deviation.

\( \dagger p < .09. \)

\( * p < .05. \)

\( ** p < .01. \)

\( *** p < .001. \)
novelty from ad content or design, stereoscopic 3-D would produce higher presence than flat 3-D (i.e., media effect). H6 stated that for viewers low in cybersickness, stereoscopic 3-D would be more effective than flat 3-D in producing presence, while for viewers high in cybersickness, stereoscopic 3-D would be less effective than flat 3-D.

To identify the moderating effects of novelty and cybersickness, both variables were categorized as high and low based on median values (M_{novelty} = 4.50, M_{cybersickness} = 1.25). An ANOVA was conducted with presence as the dependent variable and with condition (stereoscopic 3-D versus flat 3-D), novelty, and cybersickness as the independent variables. Significant main effects were detected for novelty, F(1, 99) = 7.31, p < .01, and significant interaction effects were detected for dimension by novelty, F(1, 99) = 3.98, p < .05, and dimension by cybersickness, F(1, 99) = 5.21, p < .05, as hypothesized, while all other effects were insignificant.

More specifically, planned comparison tests identified that in the low-novelty condition, the stereoscopic 3-D ad had a greater impact on presence than the flat 3-D ad, but the results were only marginally significant, t(103) = 1.98, p < .06, M_{stereo3D} = 4.32 versus M_{flat3D} = 3.30. In contrast, no difference was detected between the two formats in the high-novelty condition, t(103) = .47, p > .6, M_{stereo3D} = 4.78 versus M_{flat3D} = 4.54 (see Figure 2). In the low-cybersickness condition, the stereoscopic 3-D ad produced a significantly higher sense of presence than the flat 3-D ad, t(104) = 4.35, p < .001, M_{stereo3D} = 4.73 versus M_{flat3D} = 3.61, whereas no difference between stereoscopic 3-D and flat 3-D was found in the high-cybersickness condition, t(103) = 1.14, p > .16, M_{stereo3D} = 4.46 versus M_{flat3D} = 4.14. In summary, the moderating effects of novelty and cybersickness were identified, illustrating that when participants perceived low ad novelty or low cybersickness, the stereoscopic 3-D ad produced a higher sense of presence than the flat 3-D ad. In contrast, there was no difference between the formats in generating presence when ad viewers perceived high novelty from the ad content or experienced high cybersickness. Thus, H5 and H6 were supported.

**GENERAL DISCUSSION**

The current study explored stereoscopic 3-D advertising as a tool to increase advertising effectiveness and compared it with the previous format of flat 3-D advertising. A model was proposed to explain how and why stereoscopic 3-D advertising could be superior to flat 3-D advertising by examining presence and related constructs. Both Study 1 and Study 2 demonstrated that stereoscopic 3-D advertising had a significantly stronger positive impact on attention to advertising, attitudes toward advertising, and brand attitudes than flat 3-D advertising. In addition, significant moderating effects of novelty and cybersickness on presence were identified. For viewers who perceived low novelty of advertising content or design (i.e., low content effect) and low cybersickness (i.e., low irritation), stereoscopic 3-D advertising was more effective in creating presence than flat 3-D advertising (i.e., high media effect). The structural equation model revealed that the increased benefits of stereoscopic 3-D advertising are due primarily to its advantage in generating presence. In summary, as ad viewers perceived a higher sense of presence from the stereoscopic 3-D advertising, they experienced greater enjoyment and increased perceived product knowledge, which resulted in more favorable attitudes toward advertising.

Although stereoscopic 3-D had a more positive effect on most measures than flat 3-D advertising, there were some exceptions in Study 2. In Study 2, compared with flat 3-D advertising, stereoscopic 3-D advertising did not generate perceptions of greater perceived product knowledge, t(106) = .81, n.s. (not significant), or increased purchase intentions, t(106) = 1.01, n.s. We speculate that this result may be due to the design and structure of the advertisement. The ads showed visuals of products with text descriptions. As such, participants in the flat 3-D condition could compensate for the lack of visual information by relying on the text-based product descriptions. As such, there was not a significant difference in perceived product knowledge or purchase intentions. Another possible explanation is that the nonglasses type of stereoscopic 3-D generated a significantly higher sense of presence than the glasses type of stereoscopic 3-D, M_{nonglasses} = 4.99, SD = 1.09, M_{glasses} = 4.42, SD = 1.12, t(98) = 2.53, p < .05. In fact, all of the dependent variables except for one—attitude toward the ad—were higher in Study 1 with the nonglasses type of stereoscopic 3-D technology (see Table 1) than in Study 2 with

**FIGURE 1**
Structural Equation Model of Advertising Effectiveness

![Diagram](image_url)

Notes: $\chi^2(131) = 206.17, p < .001$, comparative fit index = .97, goodness-of-fit index = .90, adjusted goodness-of-fit index = .87, normed fit index = .92, root mean square error of approximation = .06.

$^1 p < .07.$

$^* p < .001.$
the glasses type of stereoscopic 3-D technology (see Table 2). It could be that the nonglasses type of 3-D advertising simply produces more positive advertising effects. Differences in the monitors used in Studies 1 and 2 could have come into play as well. Even though an attempt was made to equalize participants' fields of view by controlling their distance from the screen, it could be that the 19-inch, nonglasses type display used in Study 1, which is often adopted for individual use (e.g., personal monitor), provided a shorter viewing distance and a closer look at the screen than the 32-inch, glasses type display used in Study 2, which is most commonly adopted for shared use with others. That is, differences in viewing distances and users' field of view might have strengthened or weakened the degree of presence (Lin et al. 2002; Utley 1997).

The current research made several important contributions. It highlighted and reconfirmed the crucial role that presence can play in advertising effectiveness, but it also provided important new insights. Previous studies have demonstrated that presence produces diverse positive marketing outcomes, such as better attitudes toward advertising or Web sites, greater brand preference, and higher purchase intentions (e.g., Coyle and Thorson 2001; Hopkins, Raymond, and Mitra 2004; Li, Daugherty, and Biocca 2001, 2002; Suh and Lee 2005); however, these studies did not examine the process through which presence creates its effects or provide empirical evidence of how presence results in advertising effectiveness. This study helped to fill this gap by empirically demonstrating one process through which presence can affect advertising—by allowing consumers to experience enjoyment and by enhancing their learning about products. Previous studies have focused on the positive effects of interactivity embedded in the Internet in increasing presence (e.g., Coyle and Thorson 2001; Li, Daugherty, and Biocca 2002), but our study revealed that vividness created by stereoscopic 3-D technology can also increase presence. It illustrated that a vividness-focused medium can have as positive and as diverse effects on advertising effectiveness as an interactive medium. This research also provided some counterintuitive insights regarding novelty (that a novel advertising message can neutralize the novel effects of a new medium in increasing presence) and some intuitive findings regarding cybersickness (that cybersickness can reduce presence). Theoretically, both findings are consistent with previous assertions that technological advances can play a role in increasing or decreasing users' attention to media, which affects their sense of presence (Kim and Biocca 1997; Steuer 1992; Witmer and Singer 1998). Certainly, one would expect something negative, such as cybersickness, to decrease attention and presence. However, the current study adds one more notion that may have important theoretical implications—that technological advances may be limited by a ceiling effect when generating presence. That is, there may be a ceiling on viewers' capability to increase their presence, so if an innovative creative message increases their presence to the maximum (the ceiling), an innovative new technology may not be able to boost it any higher, at least in the context of stereoscopic 3-D advertising. The ceiling effect raises some intriguing theoretical issues related to its underlying phenomenon, which could vary based on any number of factors, such as the viewer's level of involvement or type of processing (e.g., central versus peripheral processing).

Managerial Implications

Academic research in an applied field has greater impact when it is relevant to practitioners, and as such, we elaborate on the practical implications of our work for advertising managers. Because presence can enhance advertising effectiveness, our findings suggest that eliciting a high sense of presence in advertising campaigns can enhance communication initiatives in new and traditional media alike. Likewise, it can be helpful to include measures of presence in advertising research. In an era of integrated communication management, these data can be helpful in maximizing the overall effectiveness of a campaign. Managers should note that formats such as stereoscopic 3-D, which lack the type of interactivity that the Internet provides, can create a high sense of presence through vividness. This bodes well for the new and emerging media that rely primarily on enhancing the quality of visual presentation.
Managers must be attuned to the potential of cybersickness in using stereoscopic 3-D technology because of the manner in which it can decrease presence. Although there are no definitive predictors of which viewers will be affected by cybersickness, people who are unaccustomed to 3-D visualization are likely to be more susceptible. As a result, when targeting these groups, managers should attempt to mitigate cybersickness through the creative message and the manner in which 3-D technology is used. For example, they can use 3-D visualizations that minimize rapid rotations and dramatic zooming in and out. Likewise, they can avoid message content that is likely to create cybersickness, such as images that are gruesome or unseemly. Managers forewarned can minimize problems from cybersickness.

Findings related to novelty provide interesting and, in some ways, counterintuitive guidance for managers. Since stereoscopic 3-D advertising, in general, was more effective in creating presence than flat 3-D, one would think that novel advertising content or design combined with stereoscopic 3-D technology would yield an even higher sense of presence. That was not the case. When viewers perceived a high degree of novelty in advertising content or design, stereoscopic 3-D was no more effective than flat 3-D in creating presence. As mentioned earlier, this finding suggests that there may be a ceiling effect on presence. That is, once viewers reach their maximum level of presence, the impact of additional advertising tools that create presence may be lost. It also indicates that any advertising tool that is perceived as highly novel is likely to create as high a sense of presence as stereoscopic 3-D advertising. As such, stereoscopic 3-D technology should be viewed as one of many tools that can enhance advertising content. This finding also implies that the creators of stereoscopic 3-D advertising will still need to focus on providing creative content that will attract viewers’ attention and maximize ad effectiveness.

Limitations and Directions for Future Research

As is always the case, this research has some limitations. First, our findings are limited to a specific product category—fast food—and a specific ad design. Given that fast food is generally perceived as a low-involvement product, participants may have been more sensitive to the peripheral cues, such as those created by technology (i.e., media effect), rather than central cues, such as the product information in the ad (i.e., content effect) (Krugman 1965; Petty and Cacioppo 1981). Indeed, our model identified that the path coefficient between perceived product knowledge and attitudes toward advertising was only marginally significant ($\beta = .14, p < .07$), which is a relatively weak relationship compared with other relationships in the model. We speculate that this may have been because participants perceived ad messages for a low-involvement product as relatively unimportant in forming their attitudes toward advertising. In addition, since stereoscopic 3-D technology mainly stimulates viewers’ visual sense, products that will benefit from stereoscopic 3-D technology are likely to be those with important visual design features, such as clothing, furniture, and products that depend on decorative features. Therefore, future researchers are encouraged to test the proposed model with more diverse product categories, especially those with visual design features.

Second, despite efforts to equalize viewers’ fields of view in the two studies, there was possible confounding effect of screen size on presence in this research; Study 1 used a 19-inch screen, while Study 2 used a 32-inch screen, so screen size may have come into play. Prior research has found that a larger screen (46-inch) creates higher presence than a smaller screen (12-inch) (Lombard et al. 2000). In contrast, the current research illustrated the opposite: that a 19-inch screen generated greater presence than a 32-inch screen. As such, further research on the effects of screen size, especially in the context of stereoscopic 3-D display, is needed. For example, it would be interesting to examine the effects of 3-D imagery in combination with larger screen sizes (i.e., movie screens) and the impact of differences in users’ fields of view on their enjoyment.

Third, we identified the moderating role of novelty on presence in the context of 3-D advertising and controlled for it to eliminate confounding effects. However, the current study does not address a more fundamental question: Will novelty come into play in enhancing the effectiveness of 3-D advertising even after viewers have become more accustomed to it? Future research will need to address this question.

Finally, another controversial and potentially problematic issue involves the measure of presence. Because presence is a complicated construct, diverse measures have been suggested (e.g., Lessiter et al. 2001; Witmer and Singer 1998). The most common way to measure presence is using a self-reported questionnaire. Some scholars have expressed great concern about this approach, however. They have pointed to the inadequacy of trying to measure presence with a questionnaire. Presence is an emotionally laden experience that the viewer may not be fully aware of because of its immersive nature, while a questionnaire asks people to report on their cognitively stored experiences (Biocca 1997; Heeter 1992; Lee 2004). As a result, physiological measures of presence, which are less obtrusive, are often encouraged. However, physiological methods—heart rate, skin conductance, and skin temperature—are also imperfect in that the electronic devices required are often distracting and irritating, and as such, reduce presence (Meehan et al. 2002). Using self-report measures as well as a physiological measure, such as heart rate, might be the ideal way to assess presence. This area is ripe for new measure development.

Clearly, presence is central to advertising effectiveness in some contexts. Given its centrality, presence warrants increased...
attention in future research, both as an important explanatory construct and as a measurement challenge, as well as in advertising practice.

NOTE

1. In some studies, “flat 3-D” is referred to as 2-D (e.g., Chehimi, Coulton, and Edwards 2006; Keng and Lin 2006). We have opted for the term “flat 3-D” because the format does portray some dimensionality.

REFERENCES


Bauer, Raymond, and Stephen A. Greyser (1968), Advertising in America: The Consumer View, Boston: Division of Research, Graduate School of Business Administration, Harvard University.


APPENDIX 1

Stimuli: Kentucky Fried Chicken (KFC)

APPENDIX 2

Measurements

<table>
<thead>
<tr>
<th>Item</th>
<th>Standardized loading of CFA</th>
<th>AVE</th>
<th>ϕ²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence (α = .86)</td>
<td></td>
<td>.51</td>
<td>.01–.35</td>
</tr>
<tr>
<td>How completely were all of your senses engaged?</td>
<td></td>
<td>.72</td>
<td></td>
</tr>
<tr>
<td>How much did the visual aspects of the environment involve you?</td>
<td></td>
<td>.78</td>
<td></td>
</tr>
<tr>
<td>How compelling was your sense of objects moving through space?</td>
<td></td>
<td>.83</td>
<td></td>
</tr>
<tr>
<td>How much did your experiences in the virtual environment seem consistent with your real-world experiences?</td>
<td></td>
<td>.61</td>
<td></td>
</tr>
<tr>
<td>How compelling was your sense of moving around inside the virtual environment?</td>
<td></td>
<td>.79</td>
<td></td>
</tr>
<tr>
<td>How closely were you able to examine objects?</td>
<td></td>
<td>.57</td>
<td></td>
</tr>
<tr>
<td>How involved were you in the virtual environment experience?</td>
<td></td>
<td>.79</td>
<td></td>
</tr>
<tr>
<td>Were you involved in the experimental task to the extent that you lost track of time?</td>
<td></td>
<td>.57</td>
<td></td>
</tr>
<tr>
<td>Enjoyment (α = .93)</td>
<td></td>
<td>.78</td>
<td>.02–.35</td>
</tr>
<tr>
<td>The commercial was lots of fun to watch and listen to.</td>
<td></td>
<td>.93</td>
<td></td>
</tr>
<tr>
<td>I thought it was clever and quite entertaining.</td>
<td></td>
<td>.94</td>
<td></td>
</tr>
<tr>
<td>The ad wasn’t just selling the product—it was entertaining me. I appreciated that.</td>
<td></td>
<td>.87</td>
<td></td>
</tr>
<tr>
<td>I just laughed at it—I thought it was very funny and good.</td>
<td></td>
<td>.79</td>
<td></td>
</tr>
<tr>
<td>Perceived product knowledge (α = .80)</td>
<td></td>
<td>.59</td>
<td>.01–.16</td>
</tr>
<tr>
<td>I feel very knowledgeable about this product shown in the advertising.</td>
<td></td>
<td>.83</td>
<td></td>
</tr>
<tr>
<td>If a friend asks me about this product, I can give him/her advice about this product shown in the advertising.</td>
<td></td>
<td>.87</td>
<td></td>
</tr>
<tr>
<td>If I have to purchase this product today, I will need to gather very little information in order to make a wise decision.</td>
<td></td>
<td>.58</td>
<td></td>
</tr>
<tr>
<td>Advertising attitude (α = .95)</td>
<td></td>
<td>.87</td>
<td>.03–.23</td>
</tr>
<tr>
<td>Unfavorable/Favorable</td>
<td></td>
<td>.93</td>
<td></td>
</tr>
<tr>
<td>Bad/Good</td>
<td></td>
<td>.97</td>
<td></td>
</tr>
<tr>
<td>Negative/Positive</td>
<td></td>
<td>.90</td>
<td></td>
</tr>
</tbody>
</table>

Notes: AVE = average variance extracted; CFA = confirmatory factor analysis; ϕ² = the squared ϕ correlation.

All the coefficients are significant at p < .001.
APPENDIX 3

Sample Distributions of Presence from Study 1 and 2

Notes: Full score = 7. A higher score indicates a higher sense of presence.