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Experiencing Interactive Advertising beyond Rich Media: Impacts of Ad Type and Presence on Brand Effectiveness in 3D Gaming Immersive Virtual Environments

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Abstract

Theories from social psychology, consumer psychology, and Human Computer Interaction suggest that 3D gaming Virtual Environments increase users affective engagement with the stimuli/environment content due to their particular structural features (high immersion, presence, etc.). This, in turn, modifies the way in which embedded advertisements are processed by providing a direct, although virtual, brand experience. At the same time, product placements and blatant advertisements (i.e., virtual 3D billboards) were previously shown to be processed differently, given the increased reactance of media users toward messages identified as ads. A 2 (ad type: billboard vs. product placement) x 2 (IVE arousability level: high vs. low arousing 3D worlds) mixed factorial design was employed to test the effects of 3D billboards and product placements embedded within a 3D gaming Virtual Environment on brand recall and recognition, and brand preference.

Introduction

Product placement, a phenomenon first used in broadcast media, have recently started to be experimented with in newer channels such as 3D gaming environments. The increased advertisers attraction to product placements is obvious. While representative of a trend aimed to "blur the lines between entertainment and persuasion (Shrum 2004), product placements are seen as a means of avoiding the obtrusiveness of classical ad formats and thus of counteracting media users psychological reactance (Edwards, Li, and Lee 2002). Along the same lines, an upcoming Gartner report (cited in Dobrow 2004) on games that incorporate marketing content (i.e., "advergaming") indicates that 30% of in-game ads are recalled after a short time, and 15% after five months, effects unheard of in classical advertising media. Moreover, "advergaming" helps increase brand and product awareness, customer loyalty, and time spent at an advertiser's web site more effectively than other online marketing devices and programs (Dobrow 2004). Backed by such theoretical and empirical views, industry market reports estimate that product placement in video games will account for over 13 billion dollars in revenue alone in the United States and 25.9 billion worldwide by 2005 (Olhava 2003).

Using brand placements to enhance the realism of media content is not completely new to either classical media or video games. Product placements in movies and TV presentations are a stable industry, with Sega introducing Marlboro advertisements into their first games during the video game boom of the 1980's (Emery 2002). However, it is only recently that research on more immersive media environments has directed its attention to marketing and persuasion implications, due to the increasing development of advanced interfaces and computer peripherals (joysticks, data gloves, 3D shutterglasses,

wireless devices, ubiquitous computing, etc.) and the mainstreaming of gaming as an entertainment medium (Grigorovici 2003 Kim and Biocca 1996). As such, the current efforts to place media form and content into experiential (multisensory) immersive environments and conceptualize them around the construct of "presence" become extremely relevant to the study of interactive advertising. Within this context, the present article takes a first step in the above-mentioned direction, reporting the results of an exploratory study that used information processing and "presence" approaches to test the effectiveness of brand placement in 3D immersive environments on the Web. After a brief review on the current theory and research of brand placement effectiveness in classical media, the presence approach to media content is used to position specific media on an immersiveness continuum. Although the prototypical example of a highly immersive medium is thought to be an Immersive Virtual Environment (IVE) in its various forms (fishtank/desktop VR, immersive displays such as the CAVE system or Head Mounted Display, etc.), 3D Web-based Environments have also been characterized as immersive when compared with 2D HTML content (Cockburn 2004). From this perspective, gaming environments are considered to have various degrees of immersiveness depending on the formal features and technologies used, and thus allow for different degrees of users sense of presence. At the same time, it is proposed that the more present users perceive a media content to be, the more effective the brand placement is, especially when the brand placement is not identified as a commercial message.

Literature

Product placements have been described as one type of a hybrid message" (Balasubramanian 1994) in that they use communications that project a non-commercial character; under these circumstances, audiences are likely to be unaware of the commercial influence attempt and/or to process the content of such communications differently than they process commercial messages" (p. 30). In general, commercial communication in media has been considered to vary along two dimensions: the extent to which the marketing nature of the message is disguised, and the extent to which it is secondary to the main media messages (Nebenzahl and Secunda 1993). From an information processing perspective then, product placements are likely to be processed differently compared to traditional ad formats, given the dissimilarities between the two On the one hand, unlike classical ad formats such as commercials, banners, or pop-ups, product placements are secondary messages. As a consequence, media users are likely to allocate most of their attentional and processing resources to encoding and storage of the main messages, and less resources to encoding and storage of the secondary (commercial) messages. One the other hand, product placements are less obtrusive and therefore media users are less likely to develop the so-called persuasion knowledge" (Friestad and Wright 1994) and psychological reactance to these commercial messages (Edwards, Li, and Lee 2002).

As an extension of the second argument, Friestad and Wright s (1994) persuasion knowledge model" posits that when users recognize and identify a message as a persuasive communication attempt, they process it differently had they not been aware of its commercial intent. While engaging in mental counterarguing, scrutinizing, or rejecting the message (Law and Braun-LaTour 2004), they may get distracted from the message, [and] disengage from the communication" (McCarty 2004, p. 49). Following a similar line of reasoning, classical advertisements are more prone to be recognized as persuasive attempts than product placements, for which a consumer s persuasion knowledge may not be activated because there is a lack of identification of the placement as a persuasion attempt" (McCarty 2004, p. 49). Thus, for advertisers, product placements have several distinct advantages when compared with traditional advertising. Not only that brand placement probably overcomes the problem of zapping" (Yang, Roskos-Ewoldsen, and Roskos-Ewoldsen 2004), but they are also less likely to be associated with cues identifying a commercial message as an attempt to persuade (Bernard 2001; Constantin and Grigorovici 2004; Rittenburg and Laczniak 1992) that would eventually lead to commercial message rejection or resistance to persuasion.

Moreover, the distance between processing of traditional ads and processing of products embedded within media content might be even larger when the media content is placed within a virtual 3D gaming environment. We propose that such an environment offers a more demanding context for users, given that 1) the high level of presence of IVE poses a highly engaging, affective experience of the host environment that will distract from additional messages, and 2) the gaming environment requires more cognitive resources to be directed towards fulfilling the game tasks.

Although it seems clear by now that product placements are processed differently than traditional ads, whether the former are

more effective than the latter or not has been a source of continuous debate (McCarty 2004). In a recent attempt to shed some light on this debate, Law and Braun-LaTour (2004) argued that although traditionally most studies used recognition and recall, brand evaluation, or purchase intention as measures of placement effects, explicit brand recall is not necessary for the effects to appear. Moreover, recall and recognition measures are not capable of detecting the more subtle effects of product placements" (Law and Braun-LaTour 2004, p. 64) and since most of the previous studies employed explicit memory measures they cannot tap into the learning without awareness" processes involved in processing product placements. Along the same lines, it has been argued that measurement of explicit memory of an ad or marketing communication may misrepresent [...] the influence of that communication" (Holden and Vanhuele 1999, p. 479). From this perspective, several studies reported brand effects (brand familiarity, preference, purchase intention, etc.) when exposure to the commercial messages was incidental (Pham 1992), lending support to the relevance of implicit memory processes (Roediger 1990; Schachter 1992) to product placement effectiveness. For instance, in the context of broadcast media, Shapiro, MacInnis, and Heckler (1997) showed that an ad displayed adjacent to a to-be-read text in a scrolling computer display influenced awareness of an existing brand, even though the task deliberately limited attention to the ad and thus the ad itself was often not remembered. Law and Braun (2000) found that products seen but not heard were least recalled, but had more influence on purchase choice. These results suggest that the less the viewers think of the placement as a plug for the product, the more successful the placement will be" (McCarty 2004, p. 57), hence the importance of product placement salience for its effectiveness. In fact the lack of association between performance on an explicit measure and an implicit one has been filled with examples, and in the context of consumer psychology, a person reports no awareness of being influenced, although his or her behavior indicates otherwise" (Law and Braun-LaTour 2004, p. 69).

Consequently, and as proposed in this study, one way of making viewers think less of the placement as the plug" is by having the brands placed in highly arousing, affective immersive program context that leaves less processing capacities to encoding placements as commercial messages, but rather wrapping" users/viewers in the program context itself while connecting the placement in an integral experiential" encounter to the brands.

Overall then, whereas product placements are likely to be remembered less than standard ad formats, the former are likely to be more effective than the latter:

H1a: In an IVE, users will have lower recall for brands associated with product placements (on-set screen placements) compared with those associated with billboards (creative screen placements of brands).

H1b: In an IVE, users will have lower recognition for brands associated with product placements (on-set screen placements) compared with those associated with billboards (creative screen placements of brands).

H1c: In an IVE, users will have greater preference for brands associated with product placements (on-set screen placements) compared with those associated with billboards (creative screen placements of brands).

The Presence" Approach to Media Environments: The Role of Immersiveness and Affect.

Coined primarily as a construct that explores what has been considered the defining characteristic of Virtual Reality technology, presence" has evolved over the years to a full body of multidisciplinary research aimed at addressing an ever expanding tendency of converging communication technologies to develop mediated environments that are able to immerse users into media presentations. For this reason, recent years have seen the development of presence into a multi-dimensional construct able to provide a comprehensive theoretical framework applicable to the entire range of media channels, in a technologically independent way (Lee 2004).

Traditionally, presence" has been conceptualized as the extent to which one feels present in the mediated environment, rather than in the immediate physical environment" (Steuer 1992, p. 79), as the perceptual illusion of nonmediation" (Lombard and Ditton 1997) or as a psychological state in which the virtuality of experience is unnoticed" (Lee 2004, p. 32). In other words, a person fails to perceive or acknowledge the existence of a medium in his or her communication environment and responds as if he or she would if the medium were not there" (Lombard and Ditton 1997, p.

77) due to the user s immersion into the mediated environment.

Thus, the more presence" a medium affords to users, the more the medium becomes transparent" and experiential (Grigorovici 2003). Depending on a mix of form and content variables (depth, breadth, range, mapping, and speed, as suggested by Steuer 1992) or how many sensory channels are immersed in the environment, a certain mediated environment could induce a varying degree of presence. In this sense, graphics-based environments can be said to attract more presence" than text-based ones, whereas 3D-based graphics with motion, interactivity, etc. are more immersive (hence offer even more presence) than 2D graphics. Thus, for instance, 3D content has been found to increase users' sense of presence, which in turn has been found to mediate and enhance attitudes towards the brand, brand recall, purchase intentions, and in general proving to be more effective persuasive tools than 2D media content (Edwards and Gangadharbatla 2001; Kim and Biocca 1997; Li, Daugherty, and Biocca 2002). At the same time, several studies reported that high quality motion based graphics 3D environments were inducing higher level of presence than low quality or text based environments (Cockburn 2004; Modjeska and Waterworth 2000). As such, presence," along with immersion as its technology-based counterpart can be characterized as a continuum, varying from low to high (A graphic representation of different types of media forms and channels as they stand on a presence continuum appears in Grigorovici 2003, p.193).

Following this line of reasoning, a presence" approach to interactive advertising becomes relevant since it has been argued that the level of involvement with the medium appears to play an important role in the persuasion process" (Volmers and Mizerski 1994, p. 98). Accordingly, Lombard and Snyder-Duch (2001) proposed a presence approach to interactive advertising, suggesting that presence could enhance effectiveness and offering potential guidelines for presence-evoking interactive advertisements" in foresight of the future of immersive interactive advertising.

However, it is still unclear how Immersive Environments and the sense of being there" would affect the processing of commercial messages embedded within such media forms. One suggestion comes from advertising content placed in traditional media. It has often been documented that TV viewers had poorer recall of commercial content in highly involving program contexts, compared with low involvement contexts (Coulter 1998; Coulter and Punj 1999; Coulter and Sewall 1995). Similarly, highly immersive environments are likely to lead to lower recall and recognition of commercial messages embedded within their content.

The same prediction comes from models of involvement derived from dual-process theories. For instance, Klimmt and Vorderer (2003) differentiated between two levels of involvement and associated them with two modes of reception: a rational, low involvement" one and a fascinated, emotionally and cognitively engaged way of enjoying [a] presentation (high involvement)" (p. 347). Following their argument, a highly involving" environment consumes more of users' cognitive resources, leaving less capacity for processing commercial messages.

At the same time, recent research suggests that 3-D Web content enhances the sense of user s presence, thus increasing their loss of self-consciousness during the commonly named virtual experience" (Li, Daugherty, and Biocca 2002). Li, Daugherty, and Biocca (2001, 2002) sustain that the virtual experience induced by the presence of 3-D objects consists of more active cognitive and affective activities than 2-D marketing messages." This type of experience created within a rich medium has been argued to simulate a direct but mediated (online) experience, known to lead to increased persuasion (Millar and Millar 1996). Thus,

H2a: In an IVE, presence will be negatively associated with brand recall such that brand recall will be lower when the brand is embedded within a high Presence IVE as opposed to a low Presence IVE.

H2b: In an IVE, presence will be negatively associated with brand recognition such that brand recognition will be lower when the brand is embedded within a high Presence IVE as opposed to a low Presence IVE.

H2c: In an IVE, presence will be positively associated with brand preferences such that brand preference will be greater wher the brand is embedded within a high Presence IVE as opposed to a low Presence IVE.

Similarly to presence" affective arousal is thought to impact the way commercial messages embedded in IVE are processed.

Several studies for example, reported an association between presence and affect and arousal, as measured through either subjective questionnaires or physiological responses (Anderson and Bushman 2001; Dillon et al. 2000, 2001; Huang and Alessi 2001). In two studies using physiological measures, Meehan (2000) reported that high presence was associated with a decrease in skin conductance levels, which indicates arousal. Pugnetti, Meehan, and Mendozzi (2001) reviewed several studies of presence in IVE using EEG, skin conductance, and heart rate. Most interestingly, results from EEG studies showed that participants who reported arousal in self reports had a decrease in amplitude in their EEG frequency during a virtual flight The authors proposed that measures of brain activity, EEG, and event related responses, can reliably be used to distinguish between automatic and controlled modes of processing during the experience of an IVE. As such, higher affective arousal should reflect in lower brand recall and recognition, but higher brand preferences.

The Affect Transfer Hypothesis

As IVE users experience high affective involvement and presence, we propose that emotional priming effects are likely to occur, and thus the affective arousal and presence elicited by the context (IVE) will transfer to the commercial messages embedded within the environment. Consistent with this hypothesis, Russell (1998) proposed a theoretical framework to explain information processing of product placements. According to this approach, "[s]ince product placement is not designed for providing factual information to the viewers, we can anticipate that it will rely more on affective processes, rather than on the cognitive aspect of the experience" (Russell 1998, p. 364). The non-conscious nature of processing product placements is consistent with the notion of effectiveness without (conscious) recall: the show-product linkage is processed non-consciously by the viewers: it is not necessary for the viewer to recall a specific exposure to the product for transformation to occur" (Russell 1998, p. 366). This is hypothesized within an affective transfer mechanism, such that the pairing of a product with an emotionally rich show [...] conditions a transfer of affect from the show to the product" (Rusell 1998, p. 367). Although these conceptualizations have been proposed in the context of a classical media environment as host for the placements, the same mechanism can be applied to immersive host environments such as 3D gaming IVE. From this perspective and consistent with the affective transfer hypothesis, the higher the degree of connectedness/association with the show/actor, the greater the affective transfer, and the stronger the transformational effect of product placement" (Russell 1998, p. 369).

Another theoretical mechanism proposed to explain the processing of product placements relies on the mere exposure phenomenon (Zajonc 1980). Within the context of product placement, Janiszewski (1993) found implicit memory processes at work due to preattentive processing of placements; although participants did not recall exposure to the brands, mere exposure resulted in more favorable attitudes towards the brands. Within the context of video games, Anderson and Bushman (2001) reported results from a meta-analysis of 35 studies, and found that exposure to video games is positively linked to physiological arousal, as a component of the affective experience. Thus, (repeated) exposure to brands embedded within highly arousing media environments is likely to result in greater brand preferences.

At the same time, the relationship between the arousal level (i.e., one s general level of stimulation or readiness to act) induced in a media user and cognitive performance was first described nearly a century ago by Yerkes and Dodson (1908). Although Yerkes and Dodson plotted their results in terms of trial needed to learn a task, which results in a U-shaped relation with arousal, the Yerks-Dodson Law generally stated that performance is an inverted U-shaped function of arousal, with the optimal arousal level (i.e., the level at which the inverted U peaks) being lower the more difficult the task.

Easterbrook (1959) argued that arousal level affects performance by determining the number of sources of information (cues") that the organism can effectively monitor. According to this cue-utilization theory, high arousal leads to greater selectivity and is thus beneficial only when relatively few cues have to be monitored (and especially when other, potentially distracting cues have to be ignored). The notion of cue utilization can also be equated with attentional selectivity. High arousa favors high selectivity, for example, focusing attention on one source of input information while ignoring others. In contrast, low arousal favors low selectivity or a division of attention across many sources of input. As such, it is expected that brands placed within low arousing environments will be better recalled and recognized than those placed within highly arousing environments. Thus,

H3a: In an IVE, environment arousability will be negatively associated with brand recall such that brand recall will be lower

when the brand is embedded within a high arousing IVE as opposed to a low arousing IVE.

H3b: In an IVE, environment arousability will be negatively associated with brand recognition such that brand recognition will be lower when the brand is embedded within a high arousing IVE as opposed to a low arousing IVE.

H3c: In an IVE, environment arousability will be positively associated with brand preference such that brand preference will be higher when the brand is embedded within a high arousing IVE as opposed to a low arousing IVE.

Support for the above-mentioned hypotheses also comes from the literature on secondary task reaction times (STRT) as a measure of processing strategies. Numerous studies (cited in Lang 2000) support the idea that secondary task reaction times are slower for messages high in emotional arousal than they are for messages low in arousal, indicating that the main task compels more attention and less resources are available for encoding secondary information.

Within the same theoretical framework, the limited capacity model of mediated information processing (LCM) (Lang 2000; Lang et al. 2003) proposes three subprocesses along which users attend to a stimulus: encoding, storage and retrieval. Due to the limited cognitive resources that IVE users have at their disposal, a choice needs to be made as to what will be stored into the sensory store" (Lang 2000) for passing on to storage and then retrieval. According to LCM, an automatic selection process can be triggered by stimulus novelty, change, and intensity. IVE provides a continuous stream of stimuli that offer exactly these characteristics: novelty (Constantin and Grigorovici 2004; Edwards and Gangadharbadtla 2001), change (due to the continuous motion and interactivity experienced) and intensity (IVE and gaming IVE have been associated with high levels of arousal and affect intensity, Grigorovici 2003). However, as encoding and storage likely limit each other" (Lang 2000, p. 53), when system resources are insufficient to meet the demands of both encoding and storage, it is likely that storage will suffer" (Lang and Basil 1998, p. 464). Consequently, the memory for brands embedded within highly immersive and arousing environments will suffer, given the increased demand for encoding information relevant to users' main navigational and gaming task. Few cognitive resources are then left for identifying and processing product placements as instances of commercial messages, and thus little advertising awareness will exist.

Secondary task reaction time measures (STRT) have been shown to be instrumental in assessing the amount of cognitive resources available for users during message processing (cognitive load) and which stimuli will be chosen to be encoded, and stored in memory for later retrieval (Lang 2000; Lang and Basil 1998; Lang et al. 2003). As such, they have a particular relevance in studying how commercial messages will be attended to in the context of a gaming IVE, especially in relationship to the degree of presence and affect that a certain IVE affords to users. For example, STRTs have been shown to be slower when cognitive load is high, and increase when resources available for encoding are higher (Lang and Basil 1998). Also, complex messages (such as IVE) will increase the amount of resources needed at encoding. Therefore,

H4a: In an IVE, secondary task reaction times will be positively associated with brand recall, such that the faster the reaction times is, the higher the brand recall will be.

H4b: In an IVE, secondary task reaction times will be positively associated with brand recognition, such that the faster the reaction times is, the higher the brand recognition will be.

Method

Design

A 2 (ad type: product placement/on-set screen placement vs. billboard/creative screen placement) x 2 (level of arousal: high vs. low) mixed design was conducted to test the effects of 3D ad type and IVE arousability on brand recall, recognition and preferences, with ad type as the within-participants variable, and level of arousal as the between-participants variable.

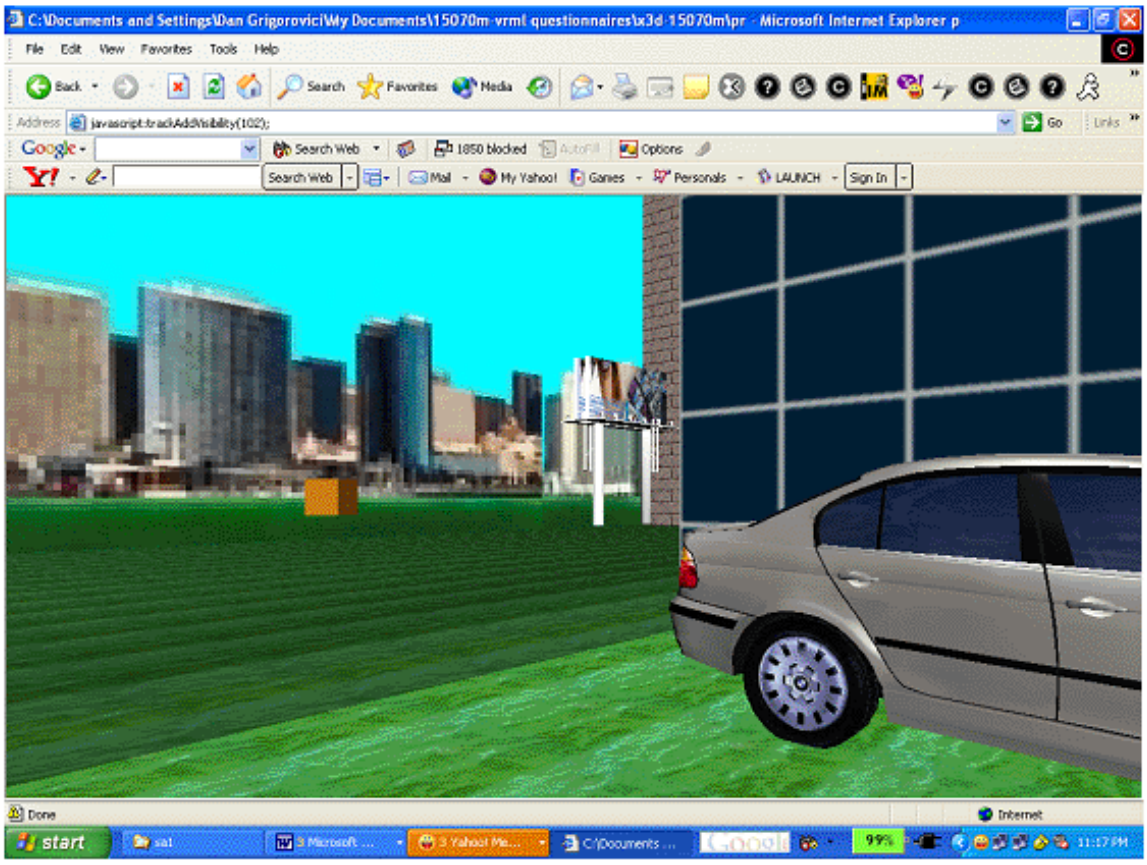
The dependent variables were presence, cognitive load, object recall, brand recall and recognition, and brand preference. Cognitive load was monitored via a secondary task reaction time (STRT) measure taken throughout the test period while

presence, memory and preference dependent variables were measured by means of a post-experiment online questionnaire.

To measure presence, the Independent Television Commission s (ITC 2000) Sense of Presence Inventory (ITC-SOPI) was used due to its cross-media validity and reliability reported in previous studies (Lessiter et al. 2001). The ITC-SOPI is a paper-and-pencil questionnaire previously tested across a variety of settings: IMAX 2D, 3D, films, video games. It is composed of four factors, each including relevant statements rated on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Responses are sought to address 15 characteristics deemed relevant to presence, among which are sense of space, involvement, attention, distraction, control and manipulation, realness, naturalness, time, behavioral realism, personal relevance, arousal, and negative effects (Insko 2003; Lessiter et al. 2001). For the present study, additional presence items were also included (i.e., several relevant items from the IPQ Sense of Presence Questionnaire, Schubert, Friedmann, and Regenbrecht 2001) as well as original items tapping into self ratings of arousal (The displayed environment was relaxing? etc.). (For the complete questionnaire, please contact the first author).

To measure cognitive capacity, three reaction time visual signals were placed in each of the eight 3D environments, and were triggered at specific times by the computer during the test period, to signal the beginning of a secondary task. The reaction time signals consisted of yellow 3D cubes that appeared in the same location in the foreground of each of the eight 3D worlds and the time latency it took participants to locate and click on the object was recorded via a touch sensor and timestamp written in the VRML code of each IVE. Reaction Time (RT) was measured in milliseconds, from the moment the cube appeared on the screen to the time participants clicked on the object. Data was sent automatically to a SQL database for storage, upon participants? clicking of the cube. Figure 1 below shows an interactive sample IVE used in the study, two types of products embedded (billboard and product placement), and the yellow RT cube stimulus.

Figure 1: Sample screenshot of low arousal IVE, with BMW product placement, Nokia cell phone billboard and the secondary reaction time object (yellow cube).



NOTE: For an interactive, experiential presentation of the stimulus, click on the image to interact with one of the stimulus IVE used in the study (before loading the 3D environment,a page with navigational instructions will be loaded).

In addition to RT and ratings of presence, memory for the products and brands embedded within the environment was also assessed via free and cued recall as well as recognition memory items included in the post-test questionnaire. The free recall questions tapping into brand recall appeared at the beginning of the questionnaire so as to avoid being influenced by the recognition test. Brand preferences toward each of the embedded ads and products were measured via a two-item, 7-point Likert-type scale (7 = "Very Likely," 1 = "Not at all Likely") preceded by "How likely are you to buy the product/service in the advertisement?" and "How likely are you to try the product/service in the advertisement?" These measures were administered separately, after participants had responded to the memory questions.

Stimulus material

Eight 3D-VRML immersive Web-based IVE were used as stimulus materials in the experiment, of which four were arousing (two outdoor, two urban), and four calming (two outdoor, two urban). Three VRML 3D objects were naturally embedded in the form of screen placements (Russell 1998) as both product placements (on-set placements) and billboards (creative placement, Russell 1998) in the background of each VE content type: a Pepsi can, a BMW car, and a Nokia cell phone. The stimulus material was shown to all participants within an Internet Explorer™ 6.0 browser, loaded with a Cortona™ VRML Client 4.2 plug-in. The experiment used a Cybelius® Virtual Workstation server as the interface between content and a SQL database for data tracking and stimulus presentation.

Participants

One hundred forty-four male and female undergraduate students from Penn State University participated in the study in exchange for class credit. Students interested in the project signed up for a particular time slot on a sign-up sheet and were told that they would be contacted by the researcher to confirm their participation in the study. After all sign-up sheets were collected, participants were randomly assigned to take part in one of the two experimental conditions: high arousing IVE, or low arousing IVE. All participants signed an informed consent form prior to their participation in the experiment. Each participant browsed individually four different 3D-VRML Web pages, which were all either arousing or calming.

To minimize order effects, the four 3D IVE that each participant was exposed to were shown in a different order. All participants were given a specific task (search an Exit door), which represented the primary task of the experiment. In addition, at specific times while navigating each 3D world, a cube appeared on the screen to signal a secondary task. Participants' reaction time (RT) to the secondary task was recorded via a timestamp. At the same time, participants' exposure to an advertisement or product placed in the 3D world was recorded by means of a tracking system and sent to a database consisting of the particular objects seen and the time of exposure (milliseconds) to each object. Participants' navigation patterns (movement speed and routes followed, stop timestamps, etc.) were unobtrusively tracked in real time using a javascript program.

After exposure to each 3D IVE, participants completed an online questionnaire designed to measure the levels of presence inside the environment, recall and recognition memory, and brand preference, as well as gathering basic information about demographics, and computer, video game, and previous use of Virtual Environments technology.

Pre-Test Procedure

Before the main experiment, a pre-test was administered to 20 students in order to select between high and low arousing IVE. The subjective ratings were combined with an online physiological measure of arousal as shown by skin conductance levels recorded during navigation of each world. Based on participants' ratings and arousal levels, eight VRML environments were selected out of twenty-four such that four worlds were low arousing and four highly arousing. Pre-test participants were drawn from the same population as participants in the main study. A student qualified to participate in the experiment only if s/he did not participate in the pre-test.

Procedure

The experiment was administered to participants individually in a laboratory that was equipped with IBM computers. Upon

entering the laboratory, the participant was told that s/he would be participating in a study involving responses to the Web. After signing an informed consent form, the participant was invited to sit in front of the computer running the stimulus.

The investigator then explained the procedure, turned the monitor on, and asked the participant to read the instructions on the screen before beginning the study. As soon as the monitor was switched on, the first screen contained instructions which read: "Welcome to the Study! You will be asked to go through four pages containing 3D worlds. During the course of the experiment, please do not click on any toolbars on your browser that will take you to any other Website. After you have finished reading these instructions and are ready, please remain still. The experiment will begin once the experimenter returns to the room and asks you to click the START button on your page."

As soon as the participant clicked on the START button, a javascript embedded in the instructions page HTML code randomly assigned him or her to one of the two IVE arousability conditions and took the participant to the first stimulus page. Each 3D world was shown on the screen for exactly three minutes. After the three-minute period, the participant was automatically redirected to an online questionnaire page containing the measures for presence, memory and brand evaluations. At the bottom of the questionnaire page, there was a button named "SUBMIT AND GO TO THE NEXT WORLD," which took participants to the next stimulus page. After submitting the fourth and last questionnaire, the participant was sent to the last page ("Thank you for participating in this experiment! Please wait for the experimenter to return"). Upon investigator's return, the participant was debriefed, thanked for his/her participation, and dismissed.

Construction of Indices

An exploratory factor analysis was conducted on the 53 items related to Presence. A matrix of Pearson's product-moment correlations was first generated from subjects' ratings of the 53 items. Unities in the diagonal were maintained and a principal components analysis with varimax rotation was performed. The number of common factors was determined by counting the number of principal components with eigenvalues greater than or equal to one. The resulting factors were then examined for common, rather than specific, variance by applying the items-on-factor criterion (i.e., at least two items with their highest loading on a given factor). An item was said to load on a given factor provided its loading on that factor was 0.6 or higher, with secondary loadings on other factors being no greater than 0.4 (McCroskey and Young 1979).

The analysis yielded 10 principal components with eigenvalues greater than one, together accounting for 61.78 percent of the variance. Six factors were ruled out because they contained only one item, so that four factors were retained in the end, counting for 52.89% of the variance. Upon rotation, 34 of the 53 measures were clearly differentiated, with their primary loading exceeding 0.6 and all other loadings below 0.4. The 34 items loading on the four factors were additively combined (after reverse-coding negatively valenced items) to form the four indices. Table 1 shows the items loading on each of the four indices, along with the respective scales reliabilities.

Table 1. Factor Loadings and Reliabilities for Presence

Perceived Realism	The objects could be touched. The world was believable. I could change the events. I moved as a response to the happenings in the environment. The environment could be part of the real world. I could move objects. The scenes could be from real world. I felt like the objects were solid. I felt like I could touch the objects. I felt like all my senses were stimulated. I felt like the environment was responding to me. It felt realistic to move an object. The world seemed consistent with the real world. I felt involved. I felt that the environment was natural.	α – .90
Engagement	I was sad the experience was over. I liked the content of the world. I would recommend this to my friends. I felt drawn in to the environment. I felt involved. I lost track of time. envRel I enjoyed the experience I was captivated. The experience was exciting The world appealed to me	α = .95
Distress	I felt disoriented. I felt tired. I felt dizzy. I got eyestrain. I felt nauseated. I got a headache.	α = .89
Attention towards the Environment	I paid more attention to the real world. I was not aware of the real world.	r = .45

NOTE: As the reliability coefficient for the Attention towards the Environment was low (Pearson's r = .45), the corresponding index was dropped from further analyses.

Findings

To test the set of H1 hypotheses, we conducted a series of analyses of covariance with ad type (billboard vs. product placement) as the independent variable, object recall, brand recall, brand recognition, and brand preference as the dependent variables, and order of world presentation and case ID as the covariates (case ID with random effects was used as a covariate so that we could eliminate the variance in dependent variables due to individual differences; thus, we increased the generalizability of our findings outside of the sample used in the study).

For all the seen objects, there was a significant main effect of ad type on object recall, so that objects seen on a billboard were recalled better (M = .47, SD = .03) than the same objects placed within the worlds (M = .24, SD = .03), $F(1, 552) = 44.07$ $p < .001$. A significant main effect of ad type on brand recall was also found, showing that in general, brand recall was better when participants were exposed to billboards (M = .45, SD = .02) rather than product placements (M = .22, SD = .02), $F(1, 906) = 74.08$, $p < .001$. Thus, H1a was supported. No effects of ad type were found on either brand recognition or brand preferences. Thus, H1b and H1c failed to receive support.

To test the impact of arousal level (high vs. low) on the same dependent variables (the H3 set of hypotheses), a series of similar analyses of covariance were conducted, with order of world presentation and case ID as covariates. The first analyses tested the effect of arousal level on object recall, brand recall, brand recognition, and preferences towards the brand. A significant effect of arousal level (i.e., level of world's arousability) on object recall was found, $F(1, 1605) = 4.06$, $p < .05$, so that low arousing worlds were associated with higher object recall (M = .31, SD = .03) than high arousing worlds were (M = .22, SD = .03). However, no effect of worlds' level of arousability was found on brand recall and brand recognition. Thus, H3a and H3b were not supported. A significant effect of arousal level on preferences towards the cell phone brand was also found, indicating that high arousal was associated with higher cell phone brand preferences (M = .32, SD = .03) than low arousal (M

= .22, SD = .03), F(1, 1605) = 4.06, p < .05. Therefore, H3c was only partially supported.

A series of multiple regression and bivariate regression analyses were conducted to test the effect of secondary task reaction time and Presence scales on object recall, brand recall, brand recognition, and brand preferences. The analyses revealed no significant effect of reaction time on object recall. However, a significant effect of reaction time on brand recall was found, with a faster reaction time indicating a higher brand recall, F(1, 942) = 3.71, p < .05, R2 = .004. Thus, H4a was supported. In terms of brand recognition, a significant effect of reaction time on car brand recognition and soda brand recognition were found, following the same pattern as shown by overall brand recall. Thus, lower (i.e., faster) reaction time indicated better car brand and soda brand recognition (see Table 2). Therefore, H4b was partially supported. A significant reaction time effect on preferences towards Nokia, the cell phone brand, was also revealed by the analysis, with slower reaction times indicating higher preferences for Nokia as predicted (see Table 2). H4c was also partially supported.

Table 2. Reaction Time Effects on Memory and Preference Measures

	F value	R^2	*β*
Object recall	ns		
Brand recall	$F(1, 942) = 3.71^{*}$	004	-.063
Car brand recognition	$F(1, 942) = 12.69^{***}$	012	-.12
Cell phone brand recogniton	ns		
Soda brand recognition	$F(1, 942) = 15.42^{***}$	02	-.13
Car brand preference	ns		
Cell phone brand prefererce	$F(1, 942) = 5.734^{*}$	006	.08
Soda brand preference	ns		

Note: $^{*}p < .05$, $^{**}p < .01$ $^{***}p < .001$

A second series of regression analyses concerned the impact of the Presence scales on the same dependent variables (the H2 hypotheses). The multivariate regression analysis conducted with perceived realism, engagement, and distress as predictors and object recall as the response showed a significant combined effect of the Presence scales on object recall, F(3, 1604) = 18.02, p < .001, R2 = .033. The subsequent bivariate analyses showed higher perceived realism to indicate higher object recall, and higher engagement to indicate lower object recall (see Table 3). A similar trend was revealed by analyses conducted with the Presence scales as predictors of brand recall; thus, the Presence scales together significantly predicted changes in brand recall, F(3, 1604) = 4.44, p < .01, R2 = .01, with higher brand recall being indicated by higher perceived realism, lower engagement, and lower distress levels (Table 3). H2a was thus supported.

The results for brand recognition converged with the previous results. The car brand recognition was significantly predicted by the presence scales, F(3, 1596) = 28.19, p < .001, R2 = .05, with higher car brand recognition being predicted by higher ratings of perceived realism, lower engagement, and lower distress.. The cell phone brand recognition was significantly predicted by the presence scales, F(3, 1604) = 5.60, p < .01, R2 = .01, with higher cell phone brand recognition being predicted by higher ratings of perceived realism and lower engagement. Similarly, the soda brand recognition was significantly predicted by the presence scales, F(3, 1588) = 8.14, p < .001, R2 = .02, with higher soda brand recognition being predicted by higher ratings of perceived realism, lower engagement, and lower distress (Table 3). Therefore, H2b was supported.

The same pattern was found in terms of brand preferences. The preference for the car brand embedded within the world was significantly predicted by the presence scales, F(3, 1604) = 27.86, p < .001, R2 = .05, with higher car brand preference being predicted by higher ratings of perceived realism, lower engagement, and lower distress. The preference for the soda brand featured in the 3D worlds was significantly predicted by the presence scales, F(3, 1580) = 46.9, p < .001, R2 = .08, with higher soda brand preference being predicted by higher ratings of perceived realism, lower engagement, and lower distress levels (Table 3). H4c was thus partially supported.

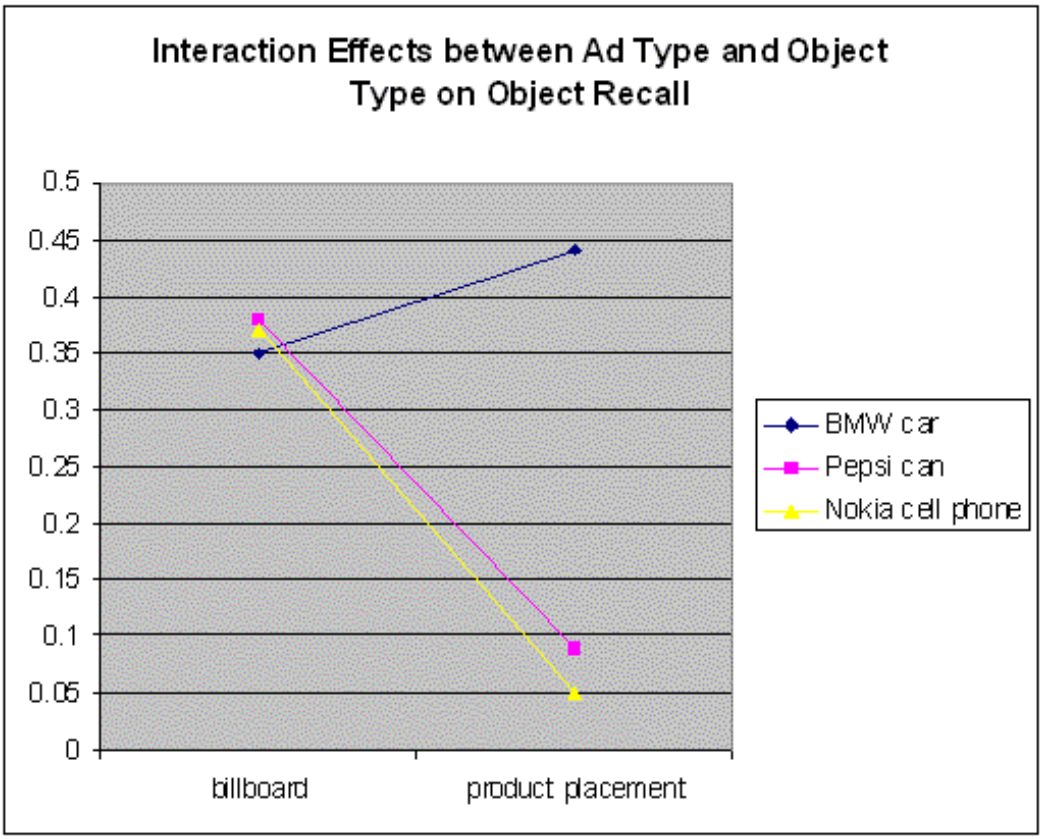
Table 3. Presence Scales Effects on Memory and Preference Measures

		t	*β*
Object recall	$F(3, 1604) = 18.02^{***}$, $R^2 = .033$		
Perceived realism		7.17***	.28
Engagement		-4.79***	-.18
Distress		ns	-
Brand recall	$F(3, 1604) = 4.44^{**}$, $R^2 = .01$		
Perceived realism		2.55*	.10
Engagement		-2.24*	-.09
Distress		-2.98**	-.08
Car brand recognition	$F(3, 1596) = 28.198^{**}$, $R^2 = .05$		
Perceived realism		8.99***	.35
Engagement		-7.30***	-.28
Distress		-3.37***	-.08
Cell phone brand recogniton	$F(3, 1604) = 5.60^{**}$, $R^2 = .01$		
Perceived realism		4.03***	.16
Engagemcnt		-2.78**	-.11
Distress		ns.	
Soda brand recognition	$F(3, 1588) = 8.14^{***}$, $R^2 = .02$		
Perceived realism		4.43***	.17
Engagement		2.62*	.10
Distress		-2.92**	-.08
Car brand preference	$F(3, 1604) = 27.86^{***}$, $R^2 = .05$		
Perceived realism		1.93^	.08
Engagement		-6.04***	-.23
Distress		-5.15***	-.13
Cell phone brand prefererce	*ns*		
Perceived realism			
Engagement			
Distress			
Soda brand preference	$F(3, 1580) = 46.90^{***}$, $R^2 = .08$		
Perceived realism		1.93*	.08
Engagement		3.70***	.14
Distress		-9.39***	-.23

Note: $^{*}p < .05$, $^{**}p < .01$ $^{***}p < .001$

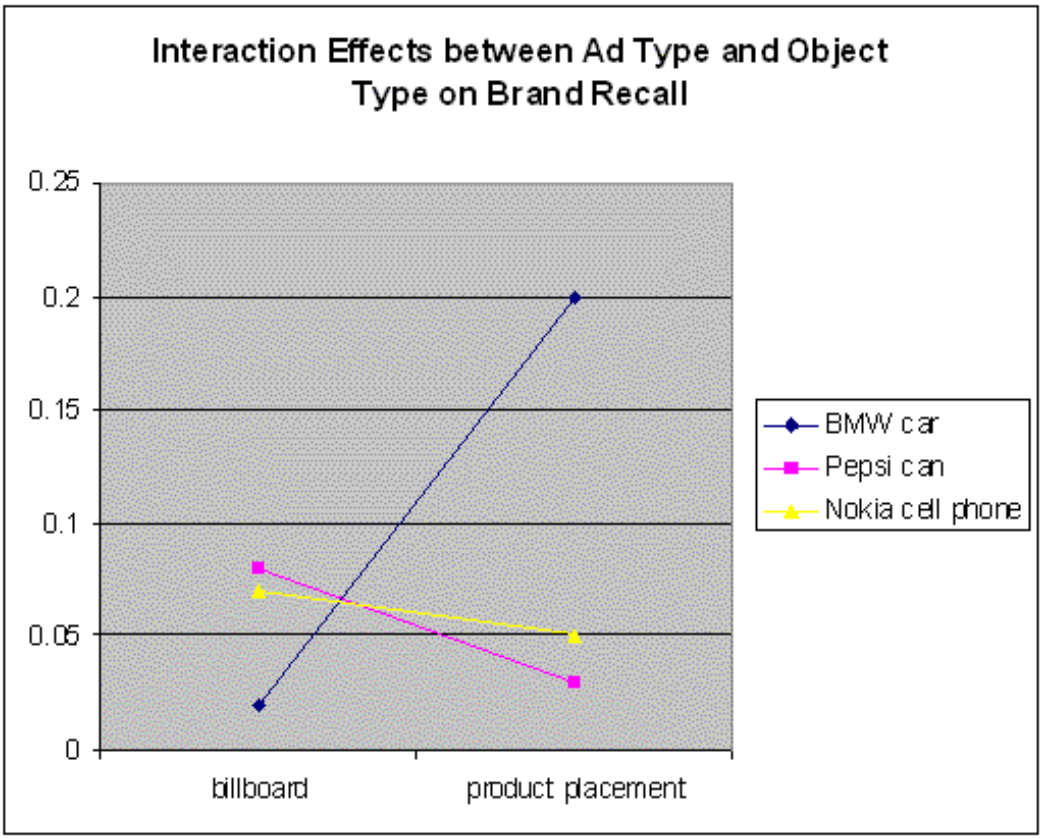
Given the differential effect of world arousability and presence level in terms of memory and preference variables for each object type (car, soda can, cell phone), a series of exploratory analyses were also conducted, with ad type (billboard vs. product placement) and object type (car, soda can, cell phone) as the independent variables, object recall, brand recall and recognition, and brand preferences as dependent variables, and order of world presentation and case ID as covariates. Beside the main effects of ad type on object and brand recall reported earlier, a significant effect of object type on object recal was also found, with the car being remembered better (M = .47, SD = .04) than the soda can (M = .34, SD = .04) or the cell phone (M = .25, SD = .04), $F(2, 552) = 10.43$, $p < .001$. But these main effects should be interpreted in the light of a significant two-way interaction between ad type and object type on object recall, $F(2, 906) = 42.22$, $p < .001$. Whereas the soda can and the cell phone were better recalled based on billboards rather than product placement, the car was better recalled based on product placement rather than billboards.

Figure 2. The interaction effects of ad type and object type on object recall



In terms of brand recall, a similar pattern was noticed. A significant main effect of object type on brand recall was found, so that the car brand was better recalled (M = .13, SD = .02) than the cell phone brand (M = .05, SD = .02) or the soda brand (M = .07, SD = .02), $F(2, 906) = 23.77$, $p < .001$. But again, the main effects should be interpreted in the light of a significant interaction between object type and ad type on brand recall, $F(2, 906) = 42.14$, $p < .001$. Following the same pattern as shown by the analyses on object recall, the car brand was better recalled when seen rather than advertised, whereas the soda brand and the cell phone brand were better recalled when advertised rather than simply seen.

Figure 3. The interaction effects of ad type and object type on brand recall.



Discussion

Overall, our findings suggest that on the one hand, there is an interaction between ad type and object type/size in terms of recall so that an on-set screen placement (Russell 1998) of a 3D product makes a difference when it comes to big, visible objects (e.g., car), whereas creative screen placements (billboards) have an impact when it comes to smaller size objects. On the other hand, the effects of arousability level, reaction time, and Presence scales (engagement) on brand recall, recognition, and preferences show that the more arousing an IVE is and subsequently, the higher the involvement (i.e., the higher the reaction time), the lower brand recall and recognition. At the same time, and perhaps most importantly for advertisers, the more preferred a brand also is. Also, the similarity between the real world experience and the IVE seems to facilitate brand recall and recognition. Engagement and distress though, are shown to have an inhibitory effect on brand evaluations.

Given the relationship between ad type and the memory measures used in this study, our results are consistent with earlier findings using brand placements in broadcast media; however, unlike classical media, the ad type effects are moderated by object size. On the other hand, this should be interpreted with caution, based on the fact that there are several variables that might have impeded both the visual perception and cognitive representation of the objects. One such variable is object color, such that the Pepsi can and cell phone were dark colored, whereas the car was light silver. Another variable could be, again, the object size. Although the scaling of the products placed in the 3D worlds was reflective of normal object proportions in the real world (e.g., Coke can on table) and proportional to the placement context in which they were embedded, it is possible that bigger objects were subjectively easier to perceive than smaller size objects. Also, the relative placement of the objects could have also biased participants' responses. In order to simulate a real world placement in context, some object types (Pepsi can, cell phone) were placed in interiors (where the environment light was darker), whereas the car was placed outdoors, where more light was available. Under such circumstances, the car might have been easier to perceive and represent than the other two objects. Several follow up studies are designed to address the aforementioned limitations of the current study.

The role of personal involvement with the product can also be a second type of mediator for the relationships found. Whereas involvement with the medium elicits the higher change in brand preferences from participants' pre-study brand preferences, it is very possible, as previous research shows, that differences in the products being advertised in terms of personal involvement with the purchase could also make a difference, and explain our differential findings in terms of brand preferences

from the low involving products (Pepsi can) to the high involving ones (BMW). This issue needs to be addressed in futureresearch, as it is well known that consumers' cognitive and behavioral measures towards differentially involving products can moderate the effects of variables such as program context or ad type on brand evaluations. In this study it was found that brand recall and recognition follow the high realism-high recall pattern espoused by the explicit memory literature in advertising effectiveness, whereas brand preferences show a distinctive one, suggesting that they could be based on personal prior involvement with the products; perceived realism is positively associated with both car and soda brand preferences. However, in terms of engagement, car preferences are negatively associated with engagement, while soda preferences are positively associated with engagement.

Generally, the present study intended to propose a new line of research and focus both researchers and practitioners' attention toward considering product placements in IVE as an important topic and from this erspective, it is merely exploratory. Despite this, the general hypothesized pattern of relationships have been supported, suggesting that according to our theoretical approach, IVE that afford more Presence and are more affectively involving for users, could represent a future venue for interactive advertising, and be potentially more effective than traditional 2D Internet or broadcast advertising. It is incumbent on future research to address the issue of novelty effects, so that it is known when 3D IVE as an advertising channel will start to become saturated and thus, prone to the same habituation and reactance processes that audiences have now in classical media. Also, further research is needed to study the specific cognitive mechanisms underlying users' processing of advertisements placed in IVE, as well as processing of IVE themselves, since Presence research is still a young field of study.

Despite these limitations, several applications to interactive advertising can be drawn from the current study. First, IVE could provide an "experiential" marketing channel that structurally has different effects compared with traditional media, due to the ability of involving media users inside their content. Secondly, IVE were shown to be associated with arousal, which has an impact on advertising effectiveness and brand evaluations, perhaps due to a preattentive, affect-infused automatic processing of commercial messages. Hence, IVE should be treated differently than traditional media, and their effects are to be searched for in terms of low brand recall but high brand preference. Consequently, placing advertising in IVE may have a more insidious and subtle influence on consumer effects that may be more needed in an era of ever-expanding "advertising wearout."

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Copyright note

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