



## How do 3-dimensional images promote products on the Internet?



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### ABSTRACT

The study investigates 3D virtual advertising as it affects the online shopping environment. It examines the vividness of mental imagery as a mediator, and consumers' need for touch and product type as moderators of the effects. An experiment conducted with 207 study participants and two product types, a watch and a jacket, indicates overall that 3D advertising outperforms 2D advertising in effectiveness. The vividness of mental imagery appears to directly influence attitudes and intentions by mediating the effects of 2D versus 3D. As expected, the 3D and 2D formats consistently differed more in their effects for geometric products than for material products. Consumers' NFT affected only intentions to revisit, interacting with product type and site type. For the watch product, 3D advertising is more persuasive for both high and low NFT consumers. Comparatively, for the jacket product, 3D strongly impacts low-NFT consumers only, but has no significant difference for high-NFT study participants.

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### Introduction

Three-dimensional (3D) images strongly affect virtual experiences (Debbabi, Daassi, & Bail, 2010; Kahrmanovic, Tiest, & Kappers, 2011; Li, Daugherty, & Biocca, 2002; Mollen & Wilson, 2010); that is, psychological states that consumers experience when they interact with 3D product images in computer-mediated environments (Li, Daugherty, & Biocca, 2001). 3D virtual experiences initiate visual mental imagery that positively impacts web advertising (Coyle & Thorson, 2001; Li et al., 2002). Object interactivity makes the message more persuasive by using sensory input such as sight to generate vivid mental images of sensory modalities such as touch, taste, and smell (Schlosser, 2003). Depicting a product more visually vivid can cause mental simulation that enhances purchase intentions: an experiment showed that when a mug was pictured with the handle on the right, it offered more mental simulation and generated higher purchase intention for right-handed viewers as a match than for left-handed viewers as a mismatch (Elder & Krishna, 2012).

Those observations indicate that 3D versus 2D product visualization is a theoretically valid construct that affects virtual experience and deserves further investigation to improve consumers' experiences in online shopping contexts.

Consumers differ in terms of their haptic orientation or their need for touch (NFT), which influences their evaluations of product offerings

(Grohmann, Spangenberg, & Sprott, 2007; Krishna & Morrin, 2008; Peck & Childers, 2003a, 2003b). Higher-NFT individuals have been shown to be more confident about their product judgments when they can touch the products they evaluate, and they are more frustrated when they cannot touch the products (Peck & Childers, 2003a). The personal proclivity for touch may also influence persuasion in a virtually simulated 3D environment, and the effect could vary by product type (e.g., Li et al., 2002).

If the virtual product experience incurs more vivid mental imagery and simulates sensory information, the persuasive effects may depend on consumers' personal proclivity for the specific sensory modality; for example, if it appeals to their sense of touch it may depend on their need for touch, whether high or low. However, prior studies have apparently failed to consider virtual experience in conjunction with consumer preferences for certain sensory information. Therefore, we investigate the effects of 3D virtual advertising in the online shopping environment, examining the vividness of mental imagery for its mediating role, and consumers' need for touch and product type as moderators.

This research may contribute to further development of theories regarding consumer responses to virtual shopping experiences. It may also help marketing managers and practitioners as they undertake advertising in new media and online channels such as online shopping malls, social networking sites, and mobile apps.

### Theoretical background and hypotheses

#### 3D virtual experience – Development of mental models

Mental models are the cognitive representations of (a) situations in real, hypothetical, or imaginary worlds, including space and time;

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(b) entities found in the situation and the states of those entities; (c) the interrelationships between the various entities and the situation, and (d) events that occur in that situation (Garnham, 1997; Johnson-Laird, 1983; Radvansky & Zacks, 1997; Wyer & Radvansky, 1999; Zwaan & Radvansky, 1998). Mental models are hypothesized to exist in conjunction with the semantic networks or schematic network models of memory (Radvansky & Zacks, 1997; Yang, Roskos-Ewoldsen, & Roskos-Ewoldsen, 2004). Schemas are knowledge structures or cognitive frameworks based on past experiences: individuals dynamically construct mental models from stored schemas and merge them with new episodic information (Kuipers, 1975; Preece et al., 1997). If a given situation lacks perceptual information, individuals will supply it with default assignments based on stereotypic expectations from past experience to make the schema consistent with the mental model (Kuipers, 1975). In response to missing but expected spatial information, individuals will make inferences about the absent elements based on their memories. The integration may be so complete that they cannot distinguish episodic information from the schema's consistent information (Mania, Robinson, & Brandt, 2005).

Following that theory, when users interact with virtual environment stimuli, they develop mental models using default sensory cues stored in memory to cognitively supply missing information. In trying to make inferences or predictions about virtual worlds, they use sensory cues to relate objects, actions, or events to past experiences in the physical world. Thus they experience perceptual illusions.

#### *Vividness of mental imagery*

Imagery involves visualizing a concept or relationship (Lutz & Lutz, 1978) to draw stored, long-term memories of sensory information (e.g., hearing, touch, taste, smell, and sight) into working memory (MacInnis & Price, 1987). Individuals can experience sensory stimuli even when the true stimuli are absent because imagery is based on non-verbal, sensory representations of perceptual information in memory (Childers, Houston, & Heckler, 1985). In the same vein, imagery also refers to the quasi-sensory experiences in the absence of stimulus conditions known to produce their genuine sensory counterparts (Richardson, 1969). The crucial difference between imagery and perception is that perception starts with an external stimulus, whereas mental imagery is based on information stored in memory (Cooper, 1995; Rouw, Kosslyn, & Hamel, 1998).

Vividness is considered dominant among factors related to visual imagery (Burns, Biswas, & Babin, 1993; Ellen & Bone, 1991). Vivid information such as concrete words or pictures draw interest and attention, in addition to being sensorially, temporally, and spatially proximate (Nisbett & Ross, 1980). Vivid elements are also memorable because they prime relevant information stored in memory (Sherman, Mackie, & Driscoll, 1990).

#### *Relationship between mental models and vividness of imagery*

Vivid elements in virtual environments basically draw attention and activate relevant information in memory (Nisbett & Ross, 1980; Sherman et al., 1990), allowing viewers to fill in the information missing from the sensory stimuli. In this way, vivid stimuli may develop more concrete mental models and more vivid imagery for an object or an artificial environment.

Interactivity also evokes vivid mental images of using products (Schlosser, 2003). Directly manipulating virtual objects stimulates more vivid mental imagery and greater immersion in the virtual world. Considering that object interactivity causes individuals to mentally experience products, sensory input such as sight may allow object interactivity to deliver mental images of sensory modalities such as touch, taste, and smell (Schlosser, 2003). This reasoning infers that

consumers become mentally immersed in the virtual world by interacting with virtual objects, which leads to vivid mental imagery tied to sensations. That is, they experience quasi-sensory experience, mostly from memory.

With respect to interactivity, the more that users feel immersed in the virtual environment, the more they will see the experience as being real: they will experience thoughts, emotions, and behaviors similar to those they could experience in a real-life situation, thus creating a more compelling experience (Mantovani & Castelnuovo, 2003). When they form imagery from a mental event involving visualization, immersion in a concrete mental model may lead to more vivid or richer mental imagery.

In the virtual-store setting, when consumers view product information that includes the illusion of actually interacting with the product, the illusion may evoke more vivid imaginations of trying and using the product. By perceiving real information through one sense (e.g., seeing pictures of a product) and also virtually perceiving information through another sense (e.g., having the illusion of touching the product), their quasi-sensory product experience will be more vivid than it will be without the illusion of interacting with a product. Therefore, a virtual product experience with a fuller, more-concrete mental model represented by three dimensions rather than two, may generate more vivid imagery regarding consumption experience.

#### *Persuasive effects of virtual experience and mental imagery*

Virtual experiences have well-established persuasive effects. 3D interactions provide virtual experiences that favorably influence attitudes and intentions (Choi, Miracle, & Biocca, 2001; Coyle & Thorson, 2001; Klein, 2003; Li et al., 2002). 3D advertising enhances product knowledge, brand attitudes, and purchase intentions by creating compelling virtual product experiences (Li et al., 2002). Material products require touching for understanding; geometric products require vision for understanding (Klatzky, Lederman, & Matula, 1991). For both material and geometric goods, 3D advertising outperforms 2D advertising for yielding more favorable brand attitudes and better product knowledge (Li et al., 2001): zooming, rotating, and moving products in 3D generate limited haptic sensations (Li et al., 2002). Thus consumers using 3D product images develop vivid mental imagery and construct mental models, which positively affect their attitude toward the brand and their product knowledge.

Imagery beneficially affects persuasion (1) by transforming information stored in long-term memory into working memory; (2) by using prior personal experience to make advertisement seem more relevant, and (3) by providing multisensory experiences that are appealing in their own right (Burns et al., 1993). Given that vivid mental imagery more closely resembles the actual experience of using a product, it is thought to positively influence judgments and intentions (Bone & Ellen, 1992; MacInnis & Price, 1987).

The vividness of the mental image refers to the clarity of the imagined scenario (MacInnis & Price, 1987). Whether a consumer can vividly imagine a particular stimulus or memory depends on the nature of the stimulus and on the availability of working memory resources (Bywaters, Andrade, & Turpin, 2004). Vivid, self-related, and plausible stimuli positively and directly influence attitudes toward advertisements (Bone & Ellen, 1992). Additionally, object interactivity supports vivid mental imagery and mediates interactivity's effect on attitudes and purchase intentions by closely simulating actual product usage (Schlosser, 2003). Imagery's vividness dimension seems to mediate between the stimulus (e.g., concrete wording) and attitudinal and cognitive responses (Burns et al., 1993).

Thus, we expect that 3D advertising will be more persuasive than 2D advertising on attitudes and behavioral intentions, and that the vividness of mental imagery will mediate its persuasive effects. Using the measures of attitudes toward advertising, brand attitude, purchase

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