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Is Augmented Reality Technology an Effective Tool for E-commerce? An Interactivity and Vividness Perspective

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Abstract

This study evaluates the effectiveness of augmented reality (AR) as an e-commerce tool using two products — sunglasses and watches. Study 1 explores the effectiveness of AR by comparing it to a conventional website. The results show that AR provides effective communication benefits by generating greater novelty, immersion, enjoyment, and usefulness, resulting in positive attitudes toward medium and purchase intention, compared to the web-based product presentations. Study 2 compares the paths by which consumers evaluate products through AR versus web with a focus on interactivity and vividness. It is revealed that immersion mediates the relationship between interactivity/vividness and two outcome variables — usefulness and enjoyment in the AR condition compared to the web condition where no significant paths between interactivity and immersion and between previous media experience and media novelty are found. Participants' subjective opinions about AR are examined through opinion mining to better understand consumer responses to AR.

Keywords: Augmented reality; Interactivity; Vividness; Immersion; Novelty; Previous media experience

Introduction

Thanks to the rapid advances in technology, a greater variety of promotional tools are currently available for presenting products more persuasively. One new emerging technology that has been receiving massive attention from many companies is augmented reality (AR). Cosmetic companies such as Sephora and L'Oréal introduced an AR mirror that enables customers to experience virtual facial makeup (Jaekel 2016). Other large companies such as Snap, Nike, Adidas, Mini, and eBay have been eagerly adopting various forms of AR, allowing consumers to more vicariously and realistically experience their products (Archer 2015). Perhaps more interesting is Pokémon Go, a mobile game in which AR digital graphics are overlaid onto gamers' real worlds through a mobile phone display which has had more than 500 million downloads in two months (Takahashi 2016) and generated revenues of $470 million in 82 days (Minotti 2016). The market size for AR was 640.2 million in 2015 and is expected to generate $120 billion in revenue by 2020 (Merel 2015). As such, AR is experiencing a huge popularity among companies and consumers.

AR is defined as "the superposition of virtual objects (computer generated images, texts, sounds etc.) on the real environment of the user" (Faust et al. 2012, p. 1164). AR is similar to virtual reality (VR) in aiming to enhance or enrich a viewer's experience. Unlike VR that electronically generates the image of the entire real life setting, AR creates a superimposed overlay of the viewer in the electronically generated setting (Milgram et al. 1994). Thus, AR is more beneficial than VR to both retailers and consumers in that it allows consumers to view themselves actually wearing diverse virtual products without physically trying them on in a store (Verhagen et al. 2014). In this way AR improves consumers' understanding about products, provides them with enjoyment of seeing themselves wearing

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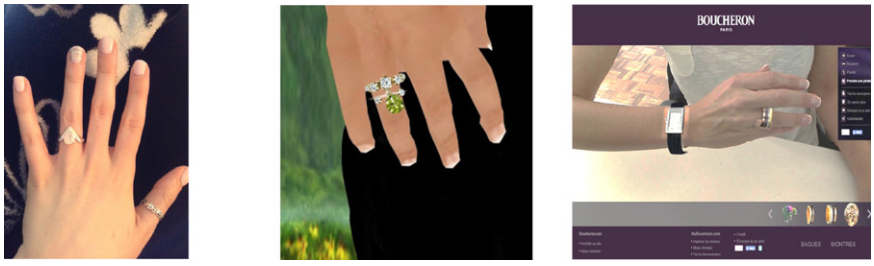
the item, and saves them transportation and shopping time, presumably resulting in its popular utilizations in e-commerce (Baek, Yoo, and Yoon 2015; Pantano and Servidio 2012). In spite of its popularity and potential, no evidence has confirmed that AR is a more persuasive tool than the existing traditional way of online product presentations in providing consumers' shopping experiences.

For this reason, we address two research questions in this study: 1) how effective are AR-based product presentations compared to traditionally used web-based product presentations; and, 2) what detailed process is used in AR compared to web to generate consumer evaluations. To these ends, we adopt two popular functional mechanisms that can predict the relative effectiveness of AR, namely *interactivity* and *vividness* (Jiang and Benbasat 2007; Keng and Lin 2006; Wu 2005). A great deal of new technology/media research has widely employed constructs such as (tele)presence, flow, mental simulation, and transportation in revealing their mediating role in explaining the effectiveness of new technologies (e.g., Bracken 2005; Fontaine 1992; Li, Daugherty, and Biocca 2002; Mathwick and Rigdon 2004; Yim, Cicchirillo, and Drumwright 2012). Yet as mediators these constructs do not provide direct explanations with respect to which controllable media features (e.g., interactivity, vividness) are associated with what specific consumer feedback thereby limiting our understanding as to how these controllable media feature(s) should be employed or further developed so as to enhance consumer evaluations. A majority of prior media studies have heavily focused on the role of interactivity (e.g., Downes and McMillan 2000; Newhagen, Cordes, and Levy 1995), while a growing number of new emerging display technologies are focusing on the effect of vividness (e.g., a better image quality) (e.g., Yim, Cicchirillo, and Drumwright 2012). By identifying how the two major media features of interactivity and vividness affect consumer evaluations when AR is used will enable marketing managers to more finely tune their e-commerce promotional strategies when using AR to boost consumer evaluations.

To address this issue as defined in the proposed research questions, two studies are conducted. Study 1 makes a direct comparison between AR design and traditional non-AR website design considering users' previous media experiences. Study 2 focuses on media features (e.g., interactivity and vividness) in identifying the process by which AR affects consumer evaluations by comparing it to the process by which traditional web features affect consumer evaluations. In addition, sentiment analysis and text analytics based on participants' general opinions about AR are used to flesh out and supplement these process findings.

Augmented Reality (AR)

The unique media features of AR are threefold. It "combines real and virtual", is "interactive in real time", and is "registered in 3-D" (Azuma 1997, p. 2). The feature of AR that most distinguishes it from other existing forms of virtual reality (VR) technologies is the media power of generating a "mixed reality" wherein the surrounding environment is real but the objects portrayed in the environment are virtual (Cho and Schwarz 2010, 2012; Drascic and Milgram 1996) (see Fig. 1). A web camera allows both physical (user's body part) and virtual objects (target product) to reside simultaneously in a user's video screen (Bell, Feiner, and Höllerer 2001). In the online shopping context this enriches a consumer's shopping experience by displaying product visualizations on images of consumers' physical features (Ma and Choi 2007). From this perspective, it appears that compared to previously adopted VR-based product presentations such as image interactivity technology (IIT), AR is a superior e-commerce tool. Specifically, IIT is fully dependent on VR in enabling consumers to experience products in a whole new world on a web site as they vicariously experience virtual products through a customizable avatar (e.g., My Virtual Model™) (Fiore, Kim, and Lee 2005). Technological limitations exist, however, in that the virtual avatar generated by IIT cannot precisely replicate the actual physical details of IIT online shoppers (e.g., appearance) as Kim and Forsythe (2008) identified in their focus group interview



Media type	Photo	Virtual reality technology Image interactive technology	Augmented reality technology
Image creation	Real images	Virtual images	Virtual images + Real images
Description	**Real me** wearing a **real** ring in the **real** world	**My avatar** wearing a **virtual** ring in the **virtual** world	**Real me** wearing a **virtual** ring in the **real** world
Tool	Camera generated	Computer generated	Camera & computer generated

Fig. 1. Real world, virtual reality, and augmented reality.