

Using Immersive Virtual Reality to Create Presence in Online Shopping

Wanxian Zeng

Research School of Management
Australian National University
Canberra, Australia
Email: wanxian.zeng@anu.edu.au

Alex Richardson

Research School of Management
Australian National University
Canberra, Australia
Email: alex.richardson@anu.edu.au

Abstract

Recent attempts to apply virtual reality to e-commerce implies the need for a better understanding of this emerging immersive presentation medium as an approach for digitisation and marketing of product and brand. Compared with two-dimensional presentation media (e.g. text and images), virtual reality is much more capable of enabling “presence”, the perceptual illusion of nonmediation or the feeling of being in the virtual environment instead of in the real world. This explorative study will investigate what characteristics of immersive virtual reality artefacts and their associated virtual space to digitally stimulate “presence”, and whether and how “presence” can affect consumers’ online shopping behaviour. By adopting a phenomenological approach, the findings will help to sensemake relationships of presence in online shopping context among concrete virtual environment design options, presence, and other relevant constructs, through the analysis of data collected from semi-structured interviews of users of a virtual reality shopping app.

Keywords: immersive virtual reality, presence, virtual space, digitisation, electronic commerce.

1 Introduction

Retailers are seeking competitive advantage by attracting consumers through the adoption of cutting edge digital technology and innovations, such as 3D product models, panoramic images and Virtual Reality (VR). Consumers can visit the Ikea virtual store using Google Cardboard or Samsung Gear VR, or get to know the form and function of the latest Audi car models using HTC Vive in their VR enabled showrooms. Product presentation is no longer just about communicating product information, but also arousing consumers' interest towards products and enhancing their memory of a target brand through digitalisation of the traditional product experience to create a virtual experience, ideally immersive.

Currently, the benefit of creating VR content for online shopping purposes is unclear. On 19th May 2016, eBay and Myer launched what they called the world's first VR department store app. Using their app on a mobile phone with their free (or any Google Cardboard VR) headset, allows consumers to visit a personalised VR department store and view 3D models of various products from different perspectives. Following this, another e-commerce giant, Alibaba, launched their Buy+ VR store app on 1st November 2016. They focus more on promoting the shopping experience of foreign stores which do not have a physical presence in China, such as Macy's and Chemist Warehouse. Different from eBay-Myer VR department store, Buy+ provides not only 3D models but also a virtual environment simulating the environment of physical stores in reality, to give consumers a more realistic feeling of shopping in physical stores overseas. However, after the debut of VR department store, there have been no further updates for the application and no news about its performance in attracting buyers or efficacy in boosting sales. Similarly, though 8 million people have tried Buy+ during Alibaba's 2016 shopping festival (from 1st November to 11th November 2016), there were no further updates and little information about when a newer version will be released. Therefore, the pragmatic value of mobile phone-based immersive VR applications appears to be waning.

Few information systems (IS) studies address the application of VR for e-commerce purposes. Suh and Lee (2005) use the Theory of Cognitive Fit to find the superiority of VR over static interfaces in increasing consumers' actual product knowledge and perceived product knowledge and influencing their product attitude and purchase intention. Suh and Chang (2006) use Generalised Negativity Theory to find compared with pictures and videos, VR provides higher presence which reduces consumers' perceived product risk and discrepancy between product presented and product received. Additionally, using a stimulus-organism-response framework, Yeh et al. (2017) find compared with pictures, VR generates higher positive responses from consumers (i.e. attention, interest, desire and actions). Though these give some insight into the effect of 3D product presentation on consumers' performance of acquiring product-related information by providing hedonic values and influencing purchase intention, there are other important but unsolved questions relating to immersive VR.

First, what does VR actually refer to? Suh and Chang (2006) and Suh and Lee (2005) use web-based (i.e. digitised representation) 3D models with basic zoom in/out and rotation functions as an example of VR, while Yeh et al. (2017) considers 360-degree imagery as VR. Second, "presence", the perceptual illusion of nonmediation or the feeling of being in the virtual environment (see Section 2.2 for further discussion), has frequently been used as an antecedent of how much product presentation helps consumers to determine the authenticity of presented quality. However, how "presence" is formed lacks explication. A great proportion of empirical studies in e-commerce context cite Steuer (1992)'s research and claim vividness and interactivity of virtual content/space afforded by the media leads to "presence" and ask participants to rate how vivid and interactive the virtual content/space is (e.g. Vonkeman et al. (2017)). Finding more precise antecedents of presence will facilitate the design of the virtual content/space. Finally, it remains unknown whether current VR for consumer use can stimulate "presence". Though VR is not a new concept (roots in the 1950s), it only recently became affordable and accessible to consumers, with US\$6.1 billion of investment in 2012-2015 (Llamas and Ngai 2016) triggering an influx of VR devices and content. Consumers now have a range of choices, from the high-end HTC Vive and Oculus Rift (innovative for immersiveness), to more affordable or even free Google Cardboard implementations (innovative in encouraging adoption). This affordability for adoption has led to the sudden interest of how VR and what kind of VR can be used to reshape digital business models for online shopping. Taking Alibaba Buy+ as an example, when limited trials debuted in July 2016, it was experienced via advanced VR devices (i.e. HTC Vive ~\$1300 AUD). Users had handheld controllers to digitally manipulate (both in the electronic and finger sense) via picking, rotating products and putting them into the shopping cart, and they can navigate in the virtual space if they move in reality due to roomscale-tracking sensors. However, when it was released to the public at large, in consideration of the affordability of advanced VR devices, it was redesigned to be experienced using VR cardboard implementations that cost ~\$0.20 AUD (excluding mobile phone) and simply controlled by "gaze click" (i.e. fixing your gaze on an object to select). Many users experienced cybersickness due to a narrower

field of view display, confused senses and higher latency head tracking of cheap VR devices, which inhibit them from feeling present in the virtual space due to a lack of immersion.

This paper sets preliminary steps of a phenomenological analysis of a mobile phone-based immersive VR application by a business operating through a predominant online shopping model. The phenomenological approach emphasises actual users' description of a phenomenon they have experienced. The researchers expect to gain fresh perspectives through interviews with the actual users of Alibaba Buy+ to have a better understanding VR and the associated virtual space, to answer the two research questions:

What characteristics of immersive Virtual Reality and its associated virtual space stimulate "presence"?

How (if at all) does "presence" affect online consumers' impression of the e-retailer, interest generation and actual purchasing behaviour of products?

This paper proceeds as follows; Section 2 first proposes a framework to show how concepts related to VR may be connected and form guidelines for marketing products and the brand; Section 2.1 tries to answer the question raised above: what does VR refer to; Section 2.2 introduces "presence", the vital concept related to VR and differentiating it from other presentation media, and the concept of space and place in which users are presented; Section 2.3 summarises some important tasks potential consumers need to carry out in virtual space for online shopping purposes.

2 Research Background

Figure 1 shows the connection of concepts related to VR that are informed by literature elaborated below. The top layer are tasks to undertake for online shopping purposes. Before consumers decide to buy a product, they need to complete certain tasks, such as product observation and understanding its features and functions. The middle layer addresses where tasks can be completed. To carry out tasks using VR, consumers are expected to feel present in a place which is relevant to the shopping activities. The virtual space can provide an arena which contains objects to interact with and replicate elements giving meaning of a real place, i.e. the environment, self and others (typically with avatars). Correspondingly, it will invoke different types of presence, i.e. virtual presence, spatial presence, self-presence, and social presence, so that potential consumers will transfer their previous attachment and experience of similar real places to the virtual space. The bottom layer relates to the technology and design characteristics of the investigated medium (i.e. VR) which is the foundation for presenting a realistic virtual space. The technology-involved aspects enable and confine the design quality of 3D view, the real-time feedback, navigation function, and how interactive the virtual space can be. Together, the VR system has the potential to optimise consumer attitudes towards the product and brand, and induce purchasing behaviour.

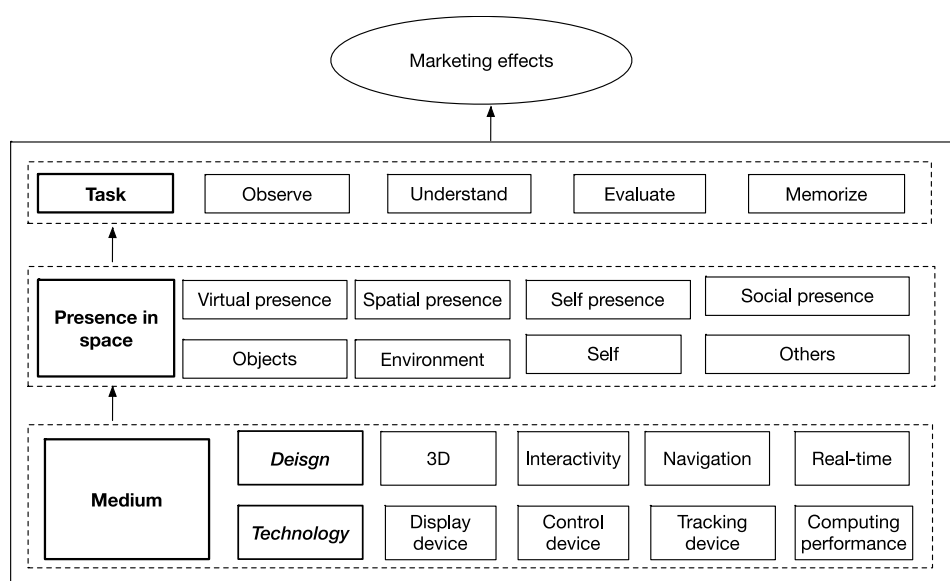


Figure 1: Research Framework

The framework is a summary of important concepts related to VR revealed in extant VR and cyberspace literature. It does not show the different level of importance of these concepts and the exact casual relationships between each concept. For example, following previous empirical studies (e.g. Shen and Khalifa (2012)), spatial presence and social presence are regarded as parallel constructs in the framework. However, there is a possibility that one type of presence is the antecedent for the other type(s) of presence to be stimulated. Further investigation through the phenomenological analysis of data collected from interviews is expected to make the framework more complete and clear, and provide some indication of causality among these concepts.

2.1 Virtual Reality as a Presentation Medium

Discrepancy exists regarding the definitions of VR leading to quite different examples of VR used to investigate its usefulness in different contexts. The primary difference of identified studies in categorising what VR is or not lies on whether the technology aspects, i.e. required devices, are involved. Table 1 presents some examples of the definitions.

Categories	Definition	Source
Technology involved	Systems that incorporate a variety of extra-peripheral devices, such as goggles, sensor gloves, and other haptic devices that enhance the sense of immersion inside the portrayed environment.	Davis et al. (2009)
	VR is defined with reference to some technological instruments, which consist of a computer system that can generate a 3D real-time animation and a head-mounted display equipped with a position tracker and a data glove.	Chan et al. (2007)
	Any system that allows the user to look in all directions and updates the user's viewpoint by passively tracking head motion, including HMDs (head-mounted displays) and CAVEs (cave automatic virtual environments).	Pausch et al. (1997)
	A system consisting of software, a head-tracking sensor, a helmet-mounted visual display that blocks users' view of the real world, 3D sound effects, and an input device the subject uses to interact with the environment.	Hoffman et al. (2003)
Technology not involved	The sensed artificiality or non-reality of simulated digital environments, which are developed to exist in computer networks, and mimic their real-world equivalents.	Featherman et al. (2006)
	A real or simulated environment in which a perceiver experiences telepresence (i.e. the sense of being in the virtual environment).	Steuer (1992) cited by Jiang and Benbasat (2004)
	A display and control technology that can envelop a person in an interactive computer-generated or computer-mediated virtual environment	Wexelblat (2014)
	A computer-generated, interactive, 3D environment in which people become immersed.	Wexelblat (1993) cited by Suh and Lee (2005)
	The use of a computer-generated 3D environment that one can navigate and possibly interact with, resulting in real-time simulation of one or more of the user's five senses.	Guttentag (2010)

Table 1. Definitions of Virtual Reality

Some key elements are identified in these definitions. In the category which involves technology, display devices (e.g. HMDs and CAVEs), control devices (e.g. gloves and haptic devices) and motion-tracking sensors (e.g. position-tracker sensors and head-tracking sensors) are important parts of a VR system. In the other category which does not involve technology, it emphasises on the computer-generated 3D digital environment which affords real-time interaction and navigation. The technology-involved definition is similar to what Mujber et al. (2004) call "fully-immersive VR" which largely isolate users

from the real world due to the capability of VR devices that can blur the distinction between the real and digital world. Users mainly participate in the virtual space and have very limited interaction with real world. The category of definitions which does not involve technology can refer both fully-immersive VR and non-immersive VR. In terms of non-immersive VR, users rely on the mouse and keyboard for interaction and navigation in virtual space, and can still perceive what is going on in the real world. In the IS studies of VR, an example of non-immersive VR is from Westland and Au (1997) which duplicated the off-shopping experience via a 3D recreation of a store with products displayed on shelves, and users can navigate around shelves and aisles via a joystick-like control.

The researchers believe both devices and the computer-generated environment are important parts of VR. The device provides a technological base for users to interact with objects and others and to navigate in the virtual space in a natural manner. Specifically, display devices such as HMDs provide 3D view, control devices such as handheld controllers enhance interactivity and tracking sensors enable more realistic navigation. Together with adequate computing performance, users can get the real-time feedback of their head and body motion. While Featherman et al. (2006) define VR as the simulated virtual environment designed to mimic the real-world equivalents, the researchers agree with Slater and Sanchez-Vives (2016) which states VR gives “the possibility to step outside of the normal bounds of reality”. The researchers argue 3D environment can also be provided by desktop computers, while interactivity and navigation can be achieved through keyboard, mouse and game pad (non-immersive VR). However, some examples used in VR studies should use other terms to avoid confusion. For example, Suh and Chang (2006) and Suh and Lee (2005)’s VR setting is limited to web-based 3D representations of products, which fail to fulfil the navigation function of VR. Additionally, Yeh et al. (2017) replicate the physical environment using panoramic images, which is not 3D but a more immersive 2D environment with a combination of a series of pictures. Consumer VR since 2016 has leapt ahead in capabilities and content diversity, so VR is ripe for further exploration. This study investigates VR for consumer use on digital media platforms backed by a large organisation (Taobao) which has a strong digital business model. The researchers will use their Buy+ platform as an example of a VR application for online shopping. It requires a Google Cardboard interface to present the virtual space in which users can navigate and interact with products via gaze click.

2.2 Presence and Space

“Presence” is an important concept for VR as it differentiates VR from other media. Steuer (1992) define VR as an environment in which a perceiver experiences telepresence. Divergent and overlapping definitions of presence (short term of telepresence) have been developed by researchers and a glut of composite terms multiplies the complexity, such as spatial presence, self-presence, social presence, co-presence, parapresence, environmental presence, and virtual presence (Lombard et al. 2015). The most general definition is “the perceptual illusion of nonmediation” (Lombard and Ditton 1997). People perceive the reality through the input of five senses (i.e. taste, sight, touch, smell, and hearing) from immediate surroundings. Computer-generated content can digitally replicate what exists in reality to stimulate our senses and trick our brain to believe the virtual space is real, thus thinking it is nonmediated. If people treat virtual space, i.e. the virtual store, as real, people may transfer their attachment to shopping places in real life to those virtual spaces, undertake similar activities and expect to have similar experiences there (Goel et al. 2011).

To digitally replicate the reality, there should be virtual objects designed to simulate things in reality. For example, both eBay-Myer VR department store and Buy+ provide computer-generated replication of a wide range of products in reality. Consumers perceive these virtual objects in 3D and can zoom in/out and rotate for a closer look. Additionally, they can change the colour and size of these objects. As it is highly compatible with in-store shopping, consumers may feel virtual presence, which relates to the realism of virtual objects in space. However, there should be more than merely objects in the virtual space. Instead, space should be attached with meanings indicating certain activities and events to happen, which makes it a place (Goel et al. 2011). Gustafson (2001) suggest that the relationships between three themes endow space meanings: environment, self, and others. It is the “self” that gives “environment” meanings based on a person’s experience and memories, which generates familiarity of a place even when that person visits it for the first time. Accordingly, it affects a person’s emotion and presumption of appropriate activities to conduct in the place. Moreover, space is meaningful if it connects “self” with “others”. “Others” is not confined to friends and relatives, but rather a community of people sharing similar characteristics or assembling for certain activities. Finally, “environment” and “others” constitute the atmosphere of the virtual space, which provides hints on what kind of places it is and what behaviour will be deemed as normal.

Table 2 presents the definition of different types of presence. If a virtual space contains some or all of these themes of a meaningful place, users will experience corresponding types of presence. First, self-presence focuses on how users themselves are embodied in the virtual space. It has three aspects: i) body-schema via using avatars or image icons, ii) emotion via interaction with objects and others in virtual space, and iii) identity via customisation of avatars (Ratan 2012). Second, spatial presence is the type of presence related to environment and it places emphasis on “being there” in the virtual environment. With the help of digitalisation to 3D and VR technology interfaces, the features of shopping stores in real life can be replicated virtually. Once there is a representation of self in the environment, users may have the illusion of being in the real physical stores. Consequently, users assign their own meanings to the virtual stores based on their previous experience of shopping in physical stores with similar design and decide what they are going to do inside the space. Additionally, social presence emphasises “the feeling of being together with others”. Others include sales representative and other consumers, who are important part of a physical store. Their existence can make the virtual space more natural and leverage the lack of sociability of online shopping websites (Shen and Khalifa 2012).

Presence Type	Definition	Source
Presence	The perceptual illusion of nonmediation.	Lombard and Ditton (1997)
Virtual presence	A psychological state in which virtual objects are experienced as actual objects in either sensory or non-sensory ways.	Lee (2004)
Self-presence	The extent to which some aspect of a person’s body-schema self, emotion-driven self and identity-relevant self is relevant during media use.	Ratan (2012)
Spatial presence	The subjective experience of being in one environment even when one is physically situated in another.	Witmer and Singer (1998)
Social presence	The feeling of being socially present with another person at a remote location.	Sallnäs (2004)

Table 2. Types of Presence

2.3 Tasks in Virtual Place

If users feel present in the virtual space, they will react and behave similarly as they do in real world, and follow their entrenched habits to examine products. To purchase a product, consumers first observe the item and understand its features and functions. Then they evaluate the product and compare it with their expectations. If it meets or exceeds their expectations, they will generate the purchase intention; otherwise, they will look for alternatives or search further information which requires them to memorise some product details for making comparisons. Different types of presence help to facilitate the evaluating process. Specifically, virtual presence provides the intuitive understanding of the product by observing the product in multi dimensions and perspectives as if they do in the physical store. Spatial presence can enable consumers to judge the quality of the product and seller from the impression and atmosphere of the virtual environment. Self-presence enables consumers to relate the product to themselves. For example, consumers can observe the product when it is put on the avatar representing consumers themselves. Social presence enables them to gain knowledge from observing behaviour of other consumers and to communicate with sales representatives.

Additionally, tasks can be facilitated by characteristics of presentation media directly. For example, compared with static images, higher-level digitalisation of objects represented in a 3D virtual space enables a better understanding of what a product will look like and how it will function in a real situation (van der Land et al. 2013) and 3D product presentation generates a higher perceived product knowledge (Jiang and Benbasat 2007a, Li et al. 2002; Suh and Chang 2006; Suh and Lee 2005). Schlosser (2006) find when the virtual space affords higher interactivity, consumers had more correct memory and false positive memory (i.e. positive memory about presented products but it is incorrect itself) towards the product. Accordingly, completing these tasks easily and confidently can lead to a stronger product affect (Vonkeman et al. 2017), and a more positive attitude towards a product (Jiang and Benbasat 2007b; Suh and Chang 2006), towards the product brand (Li et al. 2002), and towards a website (Jiang and Benbasat 2007b), and a greater intention to use an e-commerce website (Jahng et al. 2007).

3 Proposed Research Method and Future Work

VR is vastly investigated in fields such as computer science, communication and psychology. However, few studies in information systems have investigated the potential of the emerging immersive VR presentation medium and its associated virtual space for bringing business opportunities for e-retailers. Most extant IS literature investigating product presentation media usually uses the experiment and survey to collect data, which relies on profound theories and predetermined factors. For example, in those empirical studies of presentation media, particularly virtual experience, virtual worlds and 3D virtual environment, a large proportion uses vividness and interactivity of virtual content/space to predict different media's ability to induce presence. Vonkeman et al. (2017) examine how static pictures, product models with rotation function, and virtual try-on differ in generating the feeling of presence via different level of interactivity and vividness perceived by experiment participants. Additionally, Jiang and Benbasat (2007b) investigate the level of vividness and interactivity provided by static images, videos and virtual product experience in stimulating (tele)presence. Therefore, though the construct presence and its positive effects have been widely studied in the online shopping context, it remains unclear about how presence emerges and what concrete design aspects lead to presence. According to the original theory (i.e. Telepresence Theory) (Steuer 1992), vividness and interactivity consist of sub-components (i.e. breadth and depth of vividness, speed, range and mapping of interactivity). How these sub-components of frequently studied vividness, interactivity affect telepresence is yet to be investigated. Additionally, other relevant factors such as meanings of a place and user characteristics could also be integrated to improve the application and design of VR and its associated virtual space. Therefore, the expected theoretical contribution is to find out what factors influence consumers perception of the performance of presentation media (e.g. vividness and interactivity) and how these constructs further generate presence. Additionally, it verifies the positive effects of presence identified in previous studies through the analysis of qualitative data. Practically, it provides concrete virtual environment design options to generate presence, which positively influences consumers' performance and purchasing behaviour. Ultimately by doing so, the researchers wish to inform the digitalisation process of incorporating VR as a channel for commerce that drives digital transformation of electronic commerce and help clarify the increasing blurriness of boundaries between "real" and "digital" society.

This study will follow a phenomenological approach to reveal other relevant factors of stimulating presence and influencing purchasing behaviour. Phenomenology empathises suspending judgements about a phenomenon and taking fresh perspectives from individuals' description of phenomenon they have experienced (Creswell 2013). However, since the researchers are unavoidably exposed to relevant literature on VR and presence, interviews and data analysis will be conducted with great caution to avoid being influenced by prejudices and presumptions. As phenomenological approach relies on actual users' description, the researchers will have semi-structured interviews with participants being actual users who have experienced immersive VR for online shopping purpose, rather than deliberately introduce the use of VR shopping to participants in laboratory. As such, the researchers can capture how presentation media can influence participants' judgement of products and e-retailers, which is highly preferable to just asking them hypothetically whether they would like to purchase a product when an e-retailer presents the product in a certain way.

Currently, two VR applications of online shopping (i.e. eBay-Myer VR department store and Alibaba Buy+) have been used by a relatively large population. The researchers aim at finding participants who have used Buy+, regardless of whether they decided to purchase from it. Buy+ was chosen as an example of VR application for online shopping as the influence of the virtual environment is of interest, and only Buy+'s virtual environment was innovative in simulating that of physical stores (eBay-Myer VR department store uses an empty background with products "suspended in space"). Additionally, Buy+'s different environmental settings enable us to investigate how environment can influence consumers' perception of the product quality. For example, when selling luxurious products such as watches and expensive suitcases, Buy+ applies the virtual environment simulating Macy's department store which highlights the professionalism and trustworthiness of the retailers. When selling the milk power, it uses the virtual environment replicating the farm in New Zealand where cows are walking around, indicating freshness and authenticity of the produce. The choice of Buy+ will help to identify the virtual environment related design factors that influence consumers' perception.

In terms of data collection, this study will use both purposive sampling and theoretical sampling. Purposive sampling is used in the exploratory stage to locate a highly specific group of participants who were purposively chosen by Taobao as participants in their original Buy+ trial. The researchers plan to interview people who participated in evaluating Buy+ before it was released to the public. As purposive sampling cases selected rarely represent the entire population of future Buy+ users, theoretical sampling will be used as complementary technique. For theoretical sampling, participants who represent the

major categories of people relevant to the research should be selected (Neuman 2014). Therefore, other participants will be found in discussion forums and relevant online communities, who commented on their experience of Buy+ VR shopping.

Some limitations are expected. First, the participants will be the actual buyer entirely from Buy+. A follow up study will have interviews with users of other applications such as eBay VR department store for making comparisons. Second, as the participants are identified through digital social media (e.g. WeChat and Weibo), those who do not make comments on this phenomenon but are also the potential buyers will not be accessible. Third, in consideration of affordability, both eBay and Alibaba released mobile phone-based VR application which requires consumers to insert their mobile phone into a VR cardboard. Compared with computer-based VR, the computing performance of the mobile devices are much lower, with this hardware restriction inhibiting presence. Nevertheless, it can give evidence on whether current affordable VR devices available for consumer use can enable presence. Following this explorative research, the researchers are planning to conduct a quantitative study to further verify the causality of identified key constructs.

4 References

- Chan, E. A., Chung, J. W., Wong, T. K., Lien, A. S., and Yang, J. Y. 2007. "Application of a Virtual Reality Prototype for Pain Relief of Pediatric Burn in Taiwan," *Journal of Clinical Nursing* (16:4), pp. 786–793. (<https://doi.org/10.1111/j.1365-2702.2006.01719.x>).
- Choi, Y. K., and Taylor, C. R. 2014. "How Do 3-Dimensional Images Promote Products on the Internet?," *Journal of Business Research* (67:10), pp. 2164–2170.
- Creswell, J. W. 2013. *Qualitative Inquiry and Research Design*, SAGE Publications.
- Davis, A., Murphy, J., Owens, D., Khazanchi, D., and Zigungs, I. 2009. "Avatars, People, and Virtual Worlds," *Journal of the Association for Information Systems* (10:2), p. 90.
- Debbabi, S., Daassi, M., and Baile, S. 2010. "Effect of Online 3D Advertising on Consumer Responses," *Journal of Marketing Management* (26:9–10), pp. 967–992.
- Featherman, M. S., Valacich, J. S., and Wells, J. D. 2006. "Is That Authentic or Artificial?," *Information Systems Journal* (16:2), pp. 107–134.
- Goel, L., Johnson, N. A., Junglas, I., and Ives, B. 2011. "From Space to Place," *MIS Quarterly* (35:3), pp. 749–772.
- Gustafson, P. 2001. "Meanings of Place," *Journal of Environmental Psychology* (21:1), pp. 5–16.
- Guttentag, D. A. 2010. "Virtual Reality," *Tourism Management* (31:5), pp. 637–651.
- Hoffman, H. G., Richards, T., Coda, B., Richards, A., and Sharar, S. R. 2003. "The Illusion of Presence in Immersive Virtual Reality During an Fmri Brain Scan," *Cyberpsychology & Behavior: The Impact of the Internet, Multimedia and Virtual Reality on Behavior and Society* (6:2), pp. 127–131. (<https://doi.org/10.1089/109493103321640310>).
- Jahng, J., Jain, H., and Ramamurthy, K. 2007. "Effects of Interaction Richness on Consumer Attitudes and Behavioral Intentions in E-Commerce," *European Journal of Information Systems; Basingstoke* (16:3), pp. 254–269.
- Jiang, Z., and Benbasat, I. 2004. "Virtual Product Experience," *Journal of Management Information Systems* (21:3), pp. 111–147. (<https://doi.org/10.1080/07421222.2004.11045817>).
- Jiang, Z., and Benbasat, I. 2007a. "The Effects of Presentation Formats and Task Complexity on Online Consumers' Product Understanding," *MIS Quarterly* (31:3), pp. 475–500.
- Jiang, Z., and Benbasat, I. 2007b. "Research Note—Investigating the Influence of the Functional Mechanisms of Online Product Presentations," *Information Systems Research* (18:4), pp. 454–470.
- van der Land, S., Schouten, A. P., Feldberg, F., van den Hooff, B., and Huysman, M. 2013. "Lost in Space?," *Computers in Human Behavior* (29:3), pp. 1054–1064.
- Lee, K. M. 2004. "Presence, Explicated," *Communication Theory* (14:1), pp. 27–50.
- Li, H., Daugherty, T., and Biocca, F. 2002. "Impact of 3-D Advertising on Product Knowledge, Brand Attitude, and Purchase Intention," *Journal of Advertising* (31), pp. 43–57.

- Llamas, S., and Ngai, A. 2016. "Virtual Reality Market and Consumers." (<https://www.superdataresearch.com/market-data/virtual-reality-industry-report/>, accessed May 1, 2017).
- Lombard, M., Biocca, F., Freeman, J., IJsselsteijn, W., and Schaevitz, R. J. (eds.). 2015. *Immersed in Media*, Cham: Springer International Publishing. (<https://doi.org/10.1007/978-3-319-10190-3>).
- Lombard, M., and Ditton, T. 1997. "At the Heart of It All," *Journal of Computer-Mediated Communication* (3:2), pp. 0–0.
- Mujber, T. S., Szecsi, T., and Hashmi, M. S. J. 2004. "Virtual Reality Applications in Manufacturing Process Simulation," *Journal of Materials Processing Technology* (155–156), pp. 1834–1838.
- Neuman, W. L. 2014. *Social Research Methods*, Pearson.
- Pausch, R., Proffitt, D., and Williams, G. 1997. "Quantifying Immersion in Virtual Reality," in *Proceedings of the 24th Annual Conference on Computer Graphics and Interactive Techniques, SIGGRAPH '97*, New York, NY, USA: ACM Press/Addison-Wesley Publishing Co., pp. 13–18.
- Ratan, R. 2012. "Self-Presence, Explicated," *Handbook of Research on Technoself: Identity in a Technological Society*, p. 322.
- Sallnäs, E.-L. 2004. "The Effect of Modality on Social Presence, Presence and Performance in Collaborative Virtual Environments," KTH. (<http://www.diva-portal.org/smash/record.jsf?pid=diva2:9557>).
- Schlosser, A. E. 2006. "Learning through Virtual Product Experience," *Journal of Consumer Research* (33:3), pp. 377–383. (<https://doi.org/10.1086/508522>).
- Shen, K., and Khalifa, M. 2012. "System Design Effects on Online Impulse Buying," *Internet Research* (22:4), pp. 396–425.
- Slater, M., and Sanchez-Vives, M. V. 2016. "Enhancing Our Lives with Immersive Virtual Reality," *Frontiers in Robotics and AI* (3). (<https://doi.org/10.3389/frobt.2016.00074>).
- Steuer, J. 1992. "Defining Virtual Reality," *Journal of Communication* (42:4), pp. 73–93.
- Suh, K.-S., and Chang, S. 2006. "User Interfaces and Consumer Perceptions of Online Stores," *Behaviour & Information Technology* (25:2), pp. 99–113.
- Suh, K.-S., and Lee, Y. E. 2005. "The Effects of Virtual Reality on Consumer Learning," *Mis Quarterly*, pp. 673–697.
- Visinescu, L. L., Sidorova, A., Jones, M. C., and Prybutok, V. R. 2015. "The Influence of Website Dimensionality on Customer Experiences, Perceptions and Behavioral Intentions," *Information & Management* (52:1), pp. 1–17. (<https://doi.org/10.1016/j.im.2014.10.005>).
- Vonkeman, C., Verhagen, T., and van Dolen, W. 2017. "Role of Local Presence in Online Impulse Buying," *Information & Management*. (<https://doi.org/10.1016/j.im.2017.02.008>).
- Westland, J. C., and Au, G. 1997. "A Comparison of Shopping Experiences across Three Competing Digital Retailing Interfaces," *International Journal of Electronic Commerce* (2:2), pp. 57–69.
- Wexelblat, A. (ed.). 1993. *Virtual Reality Applications and Explorations*, San Diego, CA, USA: Academic Press Professional, Inc.
- Wexelblat, A. 2014. *Virtual Reality*, Academic Press.
- Witmer, B. G., and Singer, M. J. 1998. "Measuring Presence in Virtual Environments," *Presence: Teleoperators and Virtual Environments* (7:3), pp. 225–240.
- Yeh, C.-H., Wang, Y.-S., Li, H.-T., and Lin, S.-Y. 2017. "The Effect of Information Presentation Modes on Tourists' Responses in Internet Marketing," *Journal of Travel & Tourism Marketing* (0:0), pp. 1–15. (<https://doi.org/10.1080/10548408.2016.1276509>).

Copyright: © 2017 Wanxian Zeng & Alex Richardson. This is an open-access article distributed under the terms of the [Creative Commons Attribution-NonCommercial 3.0 Australia License](https://creativecommons.org/licenses/by-nc/3.0/australia/), which permits non-commercial use, distribution, and reproduction in any medium, provided the original author and ACIS are credited.