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Virtual reality presence as a preamble of tourism experience: The role of mental imagery

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ABSTRACT

While the dominant research stream on tourism technologies has investigated the adoption of self-service, mobile, and web-based technologies, the potential of destination marketing through virtual technologies is yet to be fully investigated. Because of limited empirical knowledge about the application of virtual reality (VR) in tourism, this research investigates how VR can be used to deliver integrated tourist experiences prior to their stay at the hotel. Through a lab-coordinated experiment, the current study contrasts three hotel previews that differ in their level of interactivity (images vs. 360° tour vs. VR). The findings demonstrate that a VR preview induces higher elaboration of mental imagery about the experience and a stronger sense of presence compared to both the 360° preview and images preview, thereby translating into enhanced brand experience. Such findings suggest that VR is substantial in prompting tourists to "daydream" about lodging offers prior to experiencing them at the destination's premises.

1. Introduction

> "What is real? How do you define 'real'? If you're talking about what you can feel, what you can smell, what you can taste and see, then 'real' is simply electrical signals interpreted by your brain."
>
> – Morpheus from The Matrix, 1999

The commercialization of the smartphone and online virtual environments enabled marketers to inspire and engage tourists as active participants via virtual reality (VR, hereafter) applications, where they can experience the products and destinations from the comfort of their homes. The year 2017 was a breakthrough year for VR destination marketing campaigns with a creative push from global brands such as Thomas Cook, Etihad Airways, New York Times, and Disney, toward the use of immersive VR platforms (Mbryonic, 2017; Syahrin, 2017). From a hardware standpoint, a virtual environment represents a "digital space in which a user's movements are tracked and his or her surroundings rendered, or digitally composed and displayed to the senses, in accordance with those movements" (Fox, Arena, & Bailenson, 2009, p. 95). Ideally, a virtual environment provides a substitution to the real-world environment by enabling users to lock out physical world stimuli and fully immerse themselves in the virtual world (Witmer & Singer, 1998).

Despite the overwhelming presence of VR in the travel and tourism practice, the literature on VR applications in the tourism industries has been conceptual (Guttentag, 2010; Moorhouse, tom Dieck, & Jung, 2018; Saren, Harwood, Ward, & Venkatesh, 2013) with limited empirical work to date (Kim, Lee, & Jung, 2019; Tussyadiah, Wang, Jung, & tom Dieck, 2018; Wei, Qi, & Zhang, 2019; Yeh, Wang, Li, & Lin, 2017). In the tourism context, VR has been proposed as a tool to elevate experiences (Barnes, 2016), increase tourism accessibility, and contribute to heritage conservation (Guttentag, 2010). Empirical studies associated VR with higher tourists' attention, interest, desire, and action towards destinations (Yeh et al., 2017), as well as elevated enjoyment which resulted in higher liking and preference toward a destination (Tussyadiah et al., 2018).

Although marketers assumed the positive spillover of VR experiences to brand experiences (Moorhouse et al., 2018), the empirical support for such claims is lacking. In addition, the existing literature on virtual experiences has largely focused on the online 3D virtual worlds (e.g., Second Life) viewed through the lens of humanoid avatars, that are were acknowledged as VR in the broader literature (Huang, Backman, Backman, & Moore, 2013; Jin, 2009; Nah, Eschenbrenner, &

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DeWester, 2011). However, they are fundamentally different from today's immersive VR because they do not require use of a physical VR headset device (i.e., a mobile or a tethered device). Moreover, the current academic literature provides a limited understanding of the underlying processes in tourists' minds that could explain how VR stimuli translate into enhanced tourism brand experiences, compared to less interactive visual stimuli (Grüter & Myrach, 2012).

Tourism is the "amalgam of service industries" (Otto & Ritchie, 1996, p. 165), namely transportation, attractions, events, and accommodations, that jointly shape tourists' experiences at destinations (Lugosi & Walls, 2013). With the steady rise of the inbound tourism market, hotel sector has been experiencing growth in occupancy and revenues (Chen, 2016). Furthermore, hotel chains have strategically expanded their brand portfolios to diversify brands across scale and services (Wang & Chung, 2015). When planning their visits to destinations, tourist attribute importance to the geographical location, type of experience, but also to prospective hotel experiences and carefully consider accommodations options, that can make-or-break their destination experience (Han, Kim, & Hyun, 2011). Therefore, hotels seek marketing strategies to communicate the best possible experiences to tourists at each touch point of the customer journey (Baker, 2016). Building on the idea that VR experiences are an integral part of customer responses to brands (Nah et al., 2011; Van Kerrebroeck, Brengman, & Willems, 2017), this research seeks to establish an empirical connection between the two theoretical constructs—mental imagery and sense of presence (Steuer, 1992)—as precursors of tourism experience elicited by hotel brand preview stimuli.

Mental imagery, or a perceptual representation of nonverbal information in memory, has been explored in marketing research as an important mechanism for processing of marketing stimuli (Babin & Burns, 1998; Rajagopal & Montgomery, 2011). While the importance of mental imagery evoked by advertising and product presentations has been extensively investigated in the marketing of products and travel services (Jiang, Adaval, Steinhart, & Wyer, 2014; Petrova & Cialdini, 2005; Walters, Sparks, & Herington, 2007), its role in the processing of VR visual information has been overlooked. Considering the sensory richness of VR stimuli, this study proposes that tourism consumer responds to VR by picturing multiple, highly vivid images of one's self in the virtual brand environment, which reinforces the sense of presence in that brand's environment and enhances pre-consumption expectations (Rodríguez-Ardura & Martínez-López, 2014). In this study context, pre-consumption expectations are operationalized as indirect tourism brand experience, defined as internal, subjective response to contact with the hotel brand virtual stimuli (Brakus, Schmitt, & Zarantonello, 2009).

This study seeks to empirically examine the effectiveness of VR, compared with 360° web-based tours and static images, in inducing mental imagery, sense of presence, and brand experience. Specifically, we expect that the hotel preview interactivity (i.e., the extent to which the user can modify the environment), as manipulated via three types of preview that inherently differ in their interactivity level, could elicit different levels of mental imagery, presence, and brand experience. As the experience economy is one of the fastest growing sectors of the global market, it is crucial for tourism marketers to recognize the technological driving forces behind the experience. The findings from this empirical research would provide guidelines to marketers seeking to entice tourist experiences through innovative, interactive technologies. From a theoretical standpoint, understanding how VR compares with the less interactive media in stimulating imagery and presence, would shed more light on the underlying processes that shape virtual brand experiences. The theoretical model of proposed relationships is displayed in Fig. 1.

2. Theoretical background

2.1. Defining and measuring mental imagery

Neuropsychology defines mental imagery as a quasi-perceptual experience manifested in the form of sensory, picture-like representations in the human mind, generated in the absence of true stimuli (Burns, Biswas, & Babin, 1993; Kosslyn, 1976). The mental activity leading to imagery can be prompted by a single sensor or a combination of visual, olfactory, gustatory, or haptic stimuli (Miller & Stoica, 2004). Mental imagery induced by visual stimuli was found to be relevant for information cognition, learning process, reasoning, and spatial ability (Kosslyn & Ochsner, 1994).

Mental imagery is a multidimensional construct, illustrated in depth in Table 1. Consistent with Walters, Sparks, and Herington's (2007), we conceptualize mental imagery as a visual simulation response to destination advertising stimuli that consists of two dimensions, namely elaboration and quality. Elaboration of mental imagery captures the quantity of images formed in mind and the extent of individual's involvement in the fantasy imagery (Yoo & Kim, 2014). The quality of imagery depicts how vibrant, intense, clear, and sharp mental images are, and is similar to the notion of "vividness" (Babin & Burns, 1998; Ellen & Bone, 1991). Concrete representations in the advertisements were shown to enhance both quality and elaboration of mental imagery.

Prior research identified mental imagery as a process that explains the effect of website presentations on behavioral intentions (Argyriou, 2012; Lee & Gretzel, 2012; Schlosser, 2003; Yoo & Kim, 2014). Lee and Gretzel (2012) demonstrated that among the tourist destination website sensory stimuli (i.e., pictures, sounds, narratives, and their interactions) only website pictures have the power to induce mental imagery and indirectly enhance destination attitude strength, confidence, and resistance. Although extant studies extensively examined the effect of images on mental imagery processing, sparse attention has been placed on the role of mental imagery in virtual environments (Molesworth & Denegri-Knott, 2009). In virtual environments, space, though physically represented, is still perceived at a conceptual level which is why human mind employs cognitive processes such as mental imagery to understand better the virtual environment (Hofer, Wirth, Kuehne, Schramm, & Sacau, 2012; Saunders, Rutkowski, Van Genuchten, Vogel, & Orrego, 2011). This study bridges the gap in prior research by associating mental imagery, as one of the cognitive mechanisms of information processing with sense of presence, the key variable that defines users' experiences in virtual environments.

2.2. Sense of presence

According to Biocca, Kim, and Choi (2001), virtual space, physical space, and mental imagery space are three essential sources of spatial cues for the formation of presence. The phenomenon of sense of presence, also known as telepresence, is commonly used to depict the psychological effect of the feeling of presence in a non-physical space (Grüter & Myrach, 2012). Further research linked presence with the technological advancements as the feeling of "being there in a computer-mediated environment" (Mollen & Wilson, 2010; Wan, Tsaur, Chiu, & Chiou, 2007). Supposedly, individuals feel the presence in a computer-mediated environment only if they completely disregard the technology, immerse themselves in the mediated environment and become transported into the virtual space (Haans & IJsselsteijn, 2012).

The sense of presence is a crucial factor driving users' attitudes and behaviors toward the virtual environment (Animesh, Pinsonneault, Yang, & Oh, 2011; Faiola, Newlon, Pfaff, & Smyslova, 2013; Jung, 2011). Prior research suggests that consumers' interaction with the retail websites and virtual marketing presentations induces presence (Grüter & Myrach, 2012; Park, Stoel, & Lennon, 2008; Suh & Lee, 2005). That is, high level of control, media richness, vividness, and interactivity of the website enhance presence which translates into

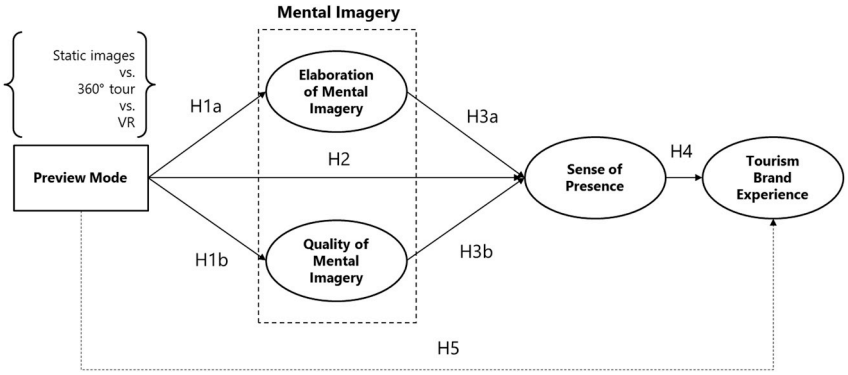

Fig. 1. Theoretical model of proposed relationships.

Table 1
Scale items and reliabilities.

Construct		Scale Items
Mental imagery (Walters et al., 2007)	Elaboration, α = .887	• The mental images that came to mind formed a series of events in my mind in which I was a part of. • The mental images that came to mind made me feel as though I was actually experiencing the hotel suite featured in this service preview. • This preview made me fantasize about having the opportunity to experience the featured hotel suite. • I could easily construct a story about myself and the featured hotel experience based on the mental images that came to mind. • It was easy for me to imagine being at this hotel suite. • Whilst reviewing this service preview I found myself daydreaming about the featured hotel suite. • Whilst reviewing this service preview many images came to mind. • The images that came to mind acted as a source of information about the featured hotel suite. • I could actually see myself in this scenario.
	Quality, α = .828	Overall the images that came to mind while I examined the virtual tour were: 1 = Dull, 7 = Sharp 1 = Weak, 7 = Intense 1 = Unclear, 7 = Clear 1 = Vague, 7 = Vivid
Sense of presence (Kim & Biocca, 1997), α = .907		• When I finished the hotel preview, I felt like I came back to the "real world" after a journey. • The hotel preview created a new world for me, and the world suddenly disappeared when I finished the preview. • The world generated by Aevum Hotels seemed to me like “somewhere I visited” rather than "something I saw." • While I was previewing the hotel suite, I felt I was in the world of Aevum Hotels. • While I was previewing the hotel suite, I sometimes forgot that I was in the middle of an experiment. • While I was previewing the hotel suite, my body was in the room, but my mind was inside the world created by Aevum Hotels. • While I was previewing the hotel suite, the world generated by Aevum Hotels was more real or present for me compared to the "real world."
Brand Experience (Brakus et al., 2009), α = .921	Sensory, α = .861	• Aevum Hotels make a strong impression on my visual sense or other senses. • I find Aevum Hotels interesting in a sensory way. • Aevum Hotels appeals to my senses.
	Affective, α = .872	• Aevum Hotels induces feelings and sentiments. • I have strong emotions for Aevum Hotels. • Aevum Hotels is an emotional brand.
	Behavioral, α = .836	• I engaged in physical actions and behaviors after previewing Aevum Hotels. • Aevum Hotels create bodily experiences. • Aevum Hotels are action oriented.
	Intellectual, α = .899	• I engaged in a lot of thinking after previewing Aevum Hotels. • Aevum hotels make me think. • Aevum Hotels stimulate my curiosity.

stronger beliefs about product attributes (Fiore, Kim, & Lee, 2005; Klein, 2003). In the destination marketing context, presence leads to a positive image of the virtual destination (Hyun & O'Keefe, 2012) and greater likelihood of visiting a real-life destination (Choi, Ok, & Choi, 2015; Han & Kai, 2015; Huang, Backman, & Backman, 2010). Furthermore, presence is positively associated with flow experience in Online Travel Agencies' websites (Liu, Pu, Guan, & Yang, 2016; Novak, Hoffman, & Yung, 2000; Rose, Clark, Samouel, & Hair, 2012).

2.3. How preview modes affect mental imagery and presence

The current research focuses on three different technology-mediated preview modes (VR, 360° web-based tours, and static images) which differ by their interactivity levels. Interactivity represents the extent to which the user is empowered to change the visuospatial perspective and content of the virtual environment (Lurie & Mason, 2007; Steuer, 1992). Therefore, the interface of virtual environments can incorporate static elements (i.e., still images portraying single visuospatial perspective) and interactive elements (i.e., those that respond to user's actions). Interactive virtual environments such as video games, 360° web-based tours, or virtual reality may enhance realism and, therefore, the extent to which visual representations replace substantive information search and substitute real-world (Burke, 1996). In prior studies, interactivity has been operationalized through two-

dimensional vs. three-dimensional product presentations (Keng & Lin, 2006; Kim et al., 2014; Li, Daugherty, & Biocca, 2001), use of multi-modality tools for website controls such as sliders, mouse-overs and zoom features (Oh & Sundar, 2015) and 360° navigational environments (Huang et al., 2013; Sundar, Go, Kim, & Zhang, 2015). For the purpose of this research we propose that tourism consumers could preview hotel environments via immersive, tethered VR devices that are characterized by the highest degree of interactivity, followed by less interactive 360° web-based tours and static images. Due to the differences in preview interactivity, we expect to observe the differences in elicited mental imagery and sense of presence.

Recent research suggested that interactivity of product presentations in online shopping (Schlosser, 2003), presence of animated features (Argyriou, 2012) and dynamic presentation formats (Kim et al., 2014) lead to more intense mental imagery. Likewise, when compared with static images, 3D visualizations of products were found to elicit greater mental imagery, reduce the perceived risk and enhance consumers' understanding of the product (Overmars & Poels, 2015; Park et al., 2008). In comparison to images, videos, or 360° tours, VR represents a hyper-realistic computer-generated environment that could induce higher mental imagery due to greater interactivity and establish the enhanced feeling of presence (Benford, Greenhalgh, Rodden, & Pycock, 2001).

It has been shown that imagery spaces generated by simple, non-virtual stimuli are not sufficient to maintain a long-lasting formation of presence (Baños et al., 2005; Rodríguez-Ardura & Martínez-López, 2014). Even moderately interactive stimuli, such as 360° web-based virtual tours are not consistently powerful to elicit higher sense of spatial presence than the stimuli with no navigability (Sundar et al., 2015). Van Kerrebroeck et al. (2017) demonstrated that mobile VR destination advertisement is perceived as more vivid than the 2D smartphone destination video, and thus evokes higher level of presence. Because virtual reality represents a digitally designed, interactive environment, it is expected that the elaboration and quality of mental imagery, and sense of presence elicited by the interactive VR preview would be higher compared to a less interactive preview, such as static images or 360° web-based tours. Thus, the following hypotheses are proposed:

H1. VR preview mode elicits higher a) elaboration and b) quality of mental imagery compared to 360° tour and static images.

H2. VR preview mode elicits higher sense of presence compared to 360° tour and static images.

The sensation of presence comprises formation of a mental model of virtual environment and suspension of disbelief (elimination of external environment stimuli) (Hofer et al., 2012). Sas and O'Hare (2003) identified creative imagination as one of the cognitive factors underlying the sense of presence. Their findings suggested that individuals with high creative imagery abilities report a heightened sense of presence when exposed to rudimentary, non-immersive VR systems (Sas & O'Hare, 2003). However, immersive media such as video-games were found to evoke equal levels of spatial presence for individuals with high and low imagery abilities. Wei et al. (2019) identified vividness as one of the predictors of presence sensed while experiencing VR roller-coaster rides. Building on these findings and the notion that vividness is a dimension of mental imagery, as well as a precursor for the formation of presence (Steuer, 1992), we propose that mental imagery and sense of presence are conceptually related. Formally:

H3a. Elaboration of mental imagery is positively associated with individual's sense of presence.

H3b. Quality of mental imagery is positively associated with individual's sense of presence.

2.4. The downstream effects on brand experience

Experience is of critical importance for tourism services and is closely connected to management, marketing, behavioral economics, and psychology research (Olsson, Friman, Pareigis, & Edvardsson, 2012; Vargo & Lusch, 2004). A key characteristic of the experiences in tourism is that they require direct involvement of the tourism consumers. In the lack of true stimuli, tourism consumers can rely on digital presentations to form indirect experiences with tourism brands, and experience brands irrespective of their body's physical location through 'para-tourism' (Jafari, 1982).

Positioned as experiential platforms, three-dimensional virtual environments have been studied initially in the context of video games as primary experience goods (Bogost, 2007). However, the research has shifted toward more general virtual environments of retail services (Bigné, Llinares, & Torrecilla, 2016; van Herpen, van den Broek, van Trijp, & Yu, 2016) or tourist destinations (Tussyadiah et al., 2018). Because VR enables consumers to transport themselves in the virtual world, the heightened sense of presence could be a mechanism that explains how VR stimuli motivate brand experience.

According to Mollen and Wilson (2010), escapism dimension from Pine and Gilmore's (1998) experience framework, defined as "a state of psychological immersion", is conceptually aligned with presence sensed in highly immersive online environments. Furthermore, Rose et al. (2012) demonstrated that presence experienced through an online retail website is an antecedent of the cognitive experiential state. Consumers of online retail websites who sense telepresence seem to fantasize about the real-world experience with the product, which enhances experiential value and behavioral intentions (Song, Fiore, & Park, 2007). Consumers who experienced greater presence were also found to have richer experiences (Li et al., 2001). As sense of presence defines the individual experience in the virtual environment, this research suggests that the positive sense of presence could spill over to brand experiences. Thus, the following hypothesis is proposed:

H4. Sense of presence is positively associated with tourism brand experience.

Marketing research recognized the importance of imagining one's self in the advertising scene as an information processing strategy which affects consumer's attitudes toward the products (Burns et al., 1993; Escalas, 2004). This research stream, where consumers place themselves in the imaginary scenario of consuming the product became known as the "pre-purchase daydreaming" (Jiang et al., 2014; Petrova & Cialdini, 2005; Walters et al., 2007).

Jiang et al. (2014) proposed that when consumers are not instructed to pursue self-imagery, multiple visuospatial perspectives (e.g., higher interactivity) provide more information and significantly impact product evaluations. In line with this finding, we assume that self-imagery does not need a formal invitation to imagine a tourist experience in a hotel room but can be implied through subtle manipulations of the visuospatial perspective (Elder & Krishna, 2012). These findings are conceptually similar to the notion that VR, as a more interactive medium than 360° tour is inherently more vivid, and consequently more self-imagery inductive, thus enhancing a sense of presence (Van Kerrebroeck et al., 2017). Based on these findings, a serial mediation mechanism is proposed to explain the effect of high-interactivity preview (VR) on brand experience via enhanced mental imagery and presence. Hypothesis 5 reflects the proposed relationships:

H5. The effect of preview mode on brand experience is mediated a) via sense of presence and b) serially via mental imagery and sense of presence.

3. Methods

3.1. Design, sample, and procedures

The study employed a one-factor, lab-coordinated experimental design on a sample of 279 students, faculty, and staff from a large Midwestern university who in return for their participation received Amazon Gift Cards as incentives. Over the course of five weeks, participants were randomly assigned to one of three presentations of an extended-stay hotel suite that differed in preview interactivity: static images vs. 360° tour vs. VR. Participants' age range was 18–69 years old (M = 23.02). Approximately 33% of participants were male, 75.9% were Caucasian, and 48.7% earned more than $49,999 annually. When asked about prior hotel experience, 94.6% reported that they spend minimum one night a year in hotels and 37.3% have had prior experience with extended-stay hotels. In addition, participants reported prior experience with computer generated images (79.6%), 360° tours (76.7%), and VR (35.1%). Those who previously tried VR devices had experience with Samsung Gear and Sony Playstation VR (see Appendix A and Appendix B for detailed demographics).

Upon arrival to the computer lab, participants received an informed consent explaining the study procedures, risks, benefits, incentives, and screening questions (i.e., Are you at least 18 years old?; Do you experience migraines, headaches, seizures, or other symptoms triggered by flashing or flickering lights?; Do you frequently experience motion sickness (dizziness, light-headedness, and nausea)?; Have you ever experienced cyber sickness (dizziness, light-headedness, and nausea) after spending time in virtual environments?). Those qualified to participate in the study read the scenario about "Aevum Hotels" brand which included the description of the hotel company (Appendix C) and received one of the three the manipulation stimuli (Appendix D).

In the static images condition, participants saw images of the hotel suite virtual environment, presented on a laptop screen. A virtual environment of the hotel suite was created using 3D Studio Max architectural modeling software and Unreal video game development engine. Participants in the 360° tour condition reviewed a web-based tour of the same space with 360° field of view, presented on a laptop screen. In the VR condition, participants saw the same hotel suite environment via an HTC Vive headset VR device. The HTC Vive device has a high field of view screen and is capable of head and motion tracking. Prior to reviewing the hotel suite, the participants received a brief demonstration of the device controls and navigation through the VR environment from the researcher. To maintain consistency across the conditions and minimize the researcher bias, participants in the first two conditions were instructed how to navigate through static images and 360° tour by the same researcher. All verbal communication with the participants followed a scripted dialogue and pertained to the explanation of the study procedures and navigation through each of the three preview modes. After providing the explanation, the researcher did not interfere with the way participants explored the preview. The preview duration across conditions did not have a significant effect on the levels of brand experience (*Roy's Largest Root* = 0.021, $F(4,271) = 1.412$, $p = .230$). Following the experimental stimuli, the participants completed a questionnaire reflecting their evaluations of the constructs of interest, control variables, and demographic characteristics.

3.2. Measures

The dependent variables were assessed on a 7-point Likert-type/semantic differential scales, by adapting current instruments for mental imagery, sense of presence, and brand experience. The list of items with scale reliabilities is available in Table 2. As a manipulation check, perceived interactivity of the preview was measured by asking the extent to which the preview was interactive (1 = not at all interactive, 7 = extremely interactive), adapted from Kalyanaraman and Sundar (2006). Towards the survey end participants indicated their demographic characteristics, prior experiences with hotel stay, VR, and other technologies, as well as weekly hours spent playing computer, video, or console games (M = 2.88). Participants reported the scenario realism as high (1 = highly unrealistic, 7 = highly realistic; M = 5.84; $t = 25.87$, $p < .001$) and found it easy to imagine themselves in the scenario (1 = very difficult, 7 = very easy; M = 5.83; $t = 21.95$, $p < .001$).

Table 2
Factor Loadings, convergent and discriminant validity.

		Factor loadings	CR	AVE	MSV	ASV
Elaboration of Mental Imagery	Elab1	.717	.92	.56	.54	.50
	Elab2	.820				
	Elab3	.786				
	Elab4	.732				
	Elab5	.790				
	Elab6	.710				
	Elab7	.740				
	Elab8	.661				
	Elab9	.756				
Quality of Mental Imagery	Qual1	.664	.81	.54	.51	.38
	Qual2	.911				
	Qual3	.375				
	Qual4	.857				
Sense of Presence	Pres1	.822	.92	.64	.61	.43
	Pres2	.780				
	Pres3	.799				
	Pres4	.839				
	Pres5	.725				
	Pres6	.854				
	Pres7	.741				
Brand Experience	Sensory	.922	.96	.87	.61	.50
	Affect	.945				
	Behavior	.905				
	Intellect	.965				

3.3. Data analysis

Because of the multidimensionality of the constructs of interest and proposed indirect effects, the SEM technique was selected because it enables concurrent testing of relationships among latent constructs, as well as more robust estimates of ordinal data. First, SPSS statistical package was used to conduct descriptive statistics, scale reliabilities, realism and manipulation checks. Next, a measurement model was tested using confirmatory factor analysis (CFA), followed by the test of structural model in MPlus using WLSMV estimator, suggested for ordinal data (Bollen, 1989).

4. Results

4.1. Manipulation checks

A one-way ANOVA revealed that perceived interactivity differed across the three previews ($F(2,276) = 69.02$, $p < .001$). Specifically, the VR preview (M = 5.98) was perceived as more interactive than 360° tour (M = 5.58, $t = 2.85$, $p < .05$) and static images (M = 4.06, $t = 10.22$, $p < .001$). In addition, 360° tour was perceived as more interactive than images preview ($t = 7.62$, $p < .001$). These results provide support for our proposed rank of the three preview modes based on their degrees of interactivity.

4.2. Confirmatory factor analysis

The adequacy of the measurement model was tested using a confirmatory factor analysis (CFA). The initial measurement model with 32 observed variables and eight latent constructs (brand experience with four subdimensions and two mental imagery dimensions, namely

elaboration and quality) had a poor fit. The model fit was improved by freeing the parameters for ten correlated residuals of observed variables that measured the same construct (M.I > 10) (Byrne, Shavelson, & Muthén, 1989). Exceptions were made for items reflecting the brand experience subdimensions. Because all items measure the construct of brand experience and consumers found it difficult to discern whether their overall experience stemmed from senses, feelings, or actions, these correlations were acceptable. The revised model had an acceptable fit based on the pre-specified goodness-of-fit criteria ($\chi 2(444)$, N = 279) = 945.339, CFI = 0.958 (> 0.95), TLI = 0.953 (> 0.95), RMSEA = 0.064 [90% CI 0.058, 0.069] (< 0.08), WRMR = 1.083(< 0.9)) (Bowen & Guo, 2012; Hu & Bentler, 1999; West, Taylor, & Wu, 2012).

The standardized loading estimates and factor variances of all observed variables were significantly different from zero ($p < .001$) and ranged from 0.375 to 0.965. The inter-factor correlations ranged from 0.609 to 0.778, which was relatively high but lower than 0.8. All squared multiple correlations of observed variables except for Qual3 were greater than 0.4 (Brown, 2015). The Qual3 squared multiple correlation was low with $R^2 = 0.141$.

Composite reliability coefficients crossed the 0.70 threshold for each latent construct and average variance extracted (AVE) were all above 0.5, providing support for convergent validity (Hair, Black, Babin, & Anderson, 2010). Maximum squared variance (MSV) values were lower than AVE, indicating good discriminant validity (Fornell & Larcker, 1981) (See Table 3).

4.3. Structural model of the effect of preview interactivity on the relationship between mental imagery, presence, and experience

The effect of the preview interactivity on brand experience and the underlying mechanisms of mental imagery and presence were tested using SEM procedure (Fig. 2). The three-level categorical independent variable was coded into two dummy variables, where the first dummy variable, d1_CGI, compared the effect of images with VR preview, and the second dummy variable, d2_360, compared the effect of 360° tour with VR preview. The final model contained two exogenous dummy variables (d1_CGI and d2_360), 32 observed indicators, eight latent variables, as well as the correlated residuals established in the CFA model. The model had an acceptable fit to the data ($\chi 2$ (500, N = 279) = 1041.86, CFI = 0.955 (> 0.95), TLI = 0.950(> 0.95), RMSEA = 0.062 [90% CI 0.057, 0.068] (< 0.08), WRMR = 1.120 (< 0.9)). The hypothesis test of not-close fit with the sample size N = 279 and df = 500 results suggested there was sufficient power (power = 1.00) to reject the hypothesis of not-close fit (MacCallum, Browne, & Sugawara, 1996). The statistical test of thirteen regression paths indicated that there was sufficient evidence to support eight paths.

The Hypothesis 1a test revealed that the images preview and 360° tour decrease elaboration of mental imagery by 0.463 SD ($p = .002$) and 0.547 SD ($p < .001$) respectively. However, quality of mental imagery resulting from the images and 360° tour was not statistically significantly different from quality of imagery induced by VR ($\beta_{CGI} = 0.015$, $p = .928$; $\beta_{360} = -0.174$, $p = .317$), suggesting that VR, images preview, and 360° tour induce equally vivid mental images in the consumers' minds, thus failing to support H1b. As per H2, compared to VR preview, images preview and 360° tour decreased sense of presence by .930 SD and 0.788 SD respectively ($p < .001$). Furthermore, elaboration but not quality of mental imagery was positively and significantly associated with sense of presence. Specifically, one SD increase in elaboration of imagery was associated with 0.470 SD increase in presence, which provides support for H3a. As suggested in H4, sense of presence was positively associated with brand experience ($\beta = 0.461$, $p < .001$).

Specifically, Hypothesis 5 proposed that the effect of preview mode on brand experience dimensions is mediated a) directly via sense of presence and b) serially through mental imagery and sense of presence. The tests of indirect effects demonstrated that as preview changed from the images to VR, there was a 0.429 SD increase in brand experience via an indirect path through sense of presence ($p < .001$). Following the indirect path through sense of presence, as preview changed from 360° tour to VR, there was a 0.363 SD increase in brand experience ($p < .001$).

Following the serial mediation through elaboration of mental imagery and presence, the change of preview from images to VR increased brand experience by .100 SD ($p = .012$). Likewise, VR preview compared to 360° tour increases brand experience indirectly via elaboration of mental imagery and presence by .118 SD ($p = .004$). There was no statistical evidence to support the indirect effect of preview interactivity on brand experience dimensions serially via quality of mental imagery and presence. No statistically significant differences were found in the effects of static images and 360° tour on elaboration ($\beta = -0.106$, $p = .509$), quality ($\beta = -0.194$, $p = .259$), and presence ($\beta = -0.145$, $p = .237$).

The model explained 6.2% of the variance in elaboration and 0.7% of the variance in quality of mental imagery, 59.6% of the variance in presence, and 70% of the variance in brand experience. Specifically, inspecting the residual variances in brand experience subdimensions, the model explained 84% of the variance in sensory experience, 94.4% in affective experience, 87.5% in intellectual experience and 77.3% in behavioral experience.

5. Discussion

The existing research recognized mental imagery as a mechanism for information processing of visual stimuli (Argyriou, 2012; Lee &

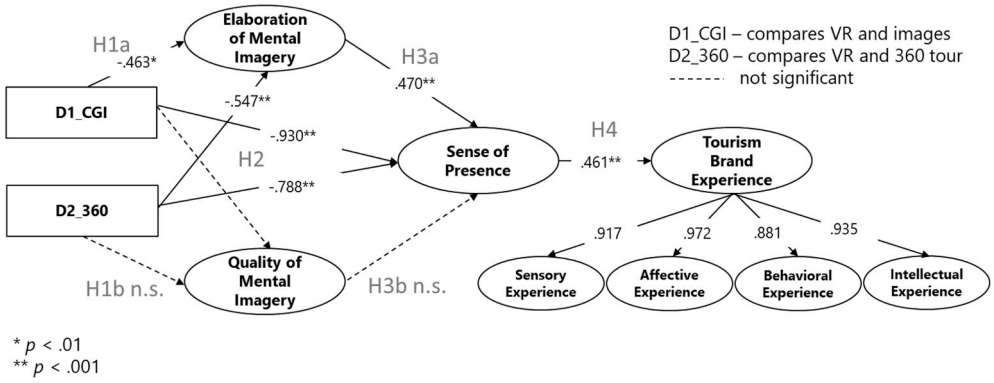

Fig. 2. Structural model results.

Gretzel, 2012; Rajagopal & Montgomery, 2011; Schlosser, 2003; Yoo & Kim, 2014) and sense of presence/telepresence which denotes experience in virtual environments (Steuer, 1992). Due to the higher interactivity of VR, the purpose of current research was to compare the mental imagery and presence induced by VR with the less interactive preview modes (static images and 360° tour). While a limited number of studies tried to establish the association between the two theories (Rodríguez-Ardura & Martínez-López, 2014), they predominantly employed correlational research in the context of mental imagery and presence elicited by websites (Suh & Lee, 2005), advertisements (Van Kerrebroeck et al., 2017), online learning environments (Rodríguez-Ardura & Meseguer-Artola, 2016) and tourist destinations (Tussyadiah et al., 2018; Wei et al., 2019). The current research investigated the underlying process mental imagery-presence that explains the effect of preview mode on tourism brand experience in the context of an extended-stay hotel.

The study findings revealed that VR preview enhances mental imagery compared to both static images and 360° tour. Specifically, VR preview boosts the elaboration but not the quality of mental imagery. Because the quality of mental imagery is conceptually equivalent to the vividness of imagery dimension, the findings from this study contradict prior research which argued that VR is perceived as more vivid than the traditional marketing mediums (Van Kerrebroeck et al., 2017). However, the study findings are in-line with existing research which identified greater levels of presence elicited by VR compared to videos (Van Kerrebroeck et al., 2017) and by web-based VR interfaces of the retail stores compared to static interface stores (Suh & Lee, 2005). In this study, VR preview mode induced a higher sense of presence than both 360° tour and static images, while no difference was found in presence between static images and 360° tour. This finding extends support to existing arguments that highly immersive virtual environments evoke a stronger sense of presence (Rodríguez-Ardura & Martínez-López, 2014).

Furthermore, this study established a positive relationship between elaboration of mental imagery and sense of presence, but it failed to find support for the association between quality of mental imagery and sense of presence. These findings therefore suggest that the quantity of images and the extent of an individual's involvement, rather than the quality of the images in mind, are positively related to sense of presence. It is possible that the relationship between quality of imagery (i.e. vividness) and sense of presence failed to reach significance due to high clarity and realism of the study manipulation across all three conditions.

Finally, the current research identified that the effect of preview mode on brand experience is mediated directly through sense of presence, as well as serially through elaboration of mental imagery and sense of presence. Because this study was interested in the indirect tourism brand experience, namely experience induced by the secondary stimuli in the lack of direct contact with the tourism brand, the findings reveal that consumers form brand experience from VR stimuli via elaboration of mental imagery and presence.

5.1. Theoretical implications

The present study contributes to a better understanding of the psychological mechanisms that explain the formation of indirect brand experience, elicited by the visual preview of tourism destination offerings, specifically hotel accommodation as a component of tourism offerings. Whereas a number of studies investigated the effect of product presentation and website interactivity on product knowledge, attitudes, and evaluations (Roggeveen, Grewal, Townsend, & Krishnan, 2015; Suh & Lee, 2005), few studies empirically supported the effect of interactivity on mental imagery (Overmars & Poels, 2015; Park et al., 2008; Schlosser, 2003) and sense of presence/telepresence (Keng & Lin, 2006; Nah et al., 2011). This study extends the tourism management literature by introducing the immersive VR preview, characterized by high interactivity and by empirically testing the effect of preview modes with varying degrees of interactivity on mental imagery and sense of presence.

Previous studies were more interested in the manipulation of vividness using mobile VR destination advertising (Van Kerrebroeck et al., 2017) because VR was believed to induce higher vividness—a key predecessor to presence (Steuer, 1992). The manipulation of the second predecessor, interactivity, was mostly neglected in applied VR tourism research due to lack of adequate, commercially available platforms. This study contributes to the prior research on destination presentation/website interactivity by reinforcing the importance of interactivity of immersive virtual reality environments in inducing elaboration of mental imagery and sense of presence, which surpasses the mental imagery and presence induced by less interactive 360° tour and static images. It is important to notice that until recently, web-based 360° tours/presentations have set the standard in academic research as highly interactive interfaces and were often described as computer-mediated VR (Suh & Lee, 2005). In the current research, the 360° tour evoked equal levels of mental imagery and presence as static images, which suggests that immersive, highly-interactive VR has a more powerful impact on peoples' visual information processing.

This research did not identify the positive effect of interactivity on quality of mental imagery, a dimension that captures imagery vividness (Walters et al., 2007). The inconsistent findings of this research could arise from the high resolution and clarity of all three previews used as experimental stimuli. That is, the vividness of preview mode was not manipulated as in Van Kerrebroeck et al.'s (2017) study. Even though the VR preview from the present study incorporated auditory modalities which should result in higher medium richness, i.e., sensory breadth of vividness, no such differences were observed. Therefore, the findings of this study challenge the prior claims that VR is inherently more vivid (Suh & Lee, 2005) and call for further research.

The study findings extend the literature on tourism consumer behavior by aligning the two theoretical constructs that explain how tourists perceive destination visual stimuli. The first is mental imagery, which stems from information processing perspectives (Paivio, 1990). The second is presence, which explains how humans perceive virtual environment through the lens of cyberpsychology (Steuer, 1992). Findings of this research suggest that elaboration of mental imagery and sense of presence are positively associated. Emphasizing the bond between the imagery and sense of presence is important, because recent studies showed that consumers tend to construct stories with product/service experiences in mind which enhance their product/service evaluations (Jiang et al., 2014), as well as transport themselves in the imaginary world of the product/service experience (Hyun & O'Keefe, 2012).

Finally, the study provides important implications for tourism branding literature. This study uncovers the indirect path of the effect of VR preview (vs. images vs. 360° tour) on tourism brand experience via presence and serially through imagery and presence. The findings emphasize how tourism brands can employ virtual technology to stimulate daydreaming (i.e. self-imagery in the scene) (Jiang et al., 2014) or preamble experience (Smolentsev, Cornick, & Blascovich, 2017) before new tourism offerings are launched. The study findings are consistent with prior research suggesting a positive spillover effect from VR-induced presence on brand attitudes (Van Kerrebroeck et al., 2017) and destination attitudes (Tussyadiah et al., 2018). Extending this line of research with additional experimental studies would help identify in what conditions and contexts is a tourist brand experience amplified due to imagery and presence.

5.2. Managerial implications

A number of conceptual studies described the immense potential of VR as a revolutionary marketing tool for tourism experiences (Barnes, 2016; Cho, Wang, & Fesenmaier, 2002; Guttentag, 2010). For instance, Guttentag (2010) proposed that "the experiential nature of VR makes it

an optimal tool for providing rich data to potential tourists seeking destination information" and that it has an "ability to provide extensive sensory information to prospective tourists" (p.641). Moreover, he noticed the difference between web-based 360° tours that consist of the panoramic photos and genuine, immersive virtual reality. Aside from contributing to the prior academic literature concerning VR, the current study provides valuable implications for the tourism marketing practitioners.

The current research shows that the interactivity of the VR enables tourism consumers to create images of selves in the services context and form mental marks of their virtual experiences that are more elaborate than the imagery resulting from 360° web-based tours and pictures. Through this process, tourists can transport themselves into the destination from the virtual world, which at that moment substitutes their physical environment. It is crucial for marketing practitioners to understand how the evoked imagery and sense of presence create the ideas of prospective experiences tourism consumers could have with the service provider. Specifically, VR can be strategically used in the development and marketing of new tourism brands, to help tourists visualize the brand tangibles (i.e., accommodations environment). Therefore, marketers are advised to develop VR platforms that are imagery inducing and enable consumers to envision themselves in the brand's world.

5.3. Limitations and future research suggestions

This study has limitations that could be addressed in future research. First, the study was conducted with a scenario-based approach where the brand experience originated from preview of a hypothetical hotel brand. Future research should validate our findings in the field setting using real tourism brands across various of destination marketing contexts (e.g., local attractions, theme parks, conference centers). Second, this research was conducted with a convenience US sample which might limit the generalizability of the findings. It would be interesting to replicate our findings with different samples, particularly prospective international travelers with different cultural backgrounds. Third, individual-level differences that could impede the formation of mental imagery and presence such as imagery abilities (Petrova & Cialdini, 2005), spatial ability (Alsina-Jurnet & Gutiérrez-Maldonado, 2010) or immersive tendencies (Witmer & Singer, 1998), might play a moderating role to attenuate the differential effects of preview modes. Additionally, chromatic vs. achromatic color schemes could also interact with the preview modes and affect imagery and presence. Future studies should seek to understand the chroma, color value, and temperature of the previews (Lee, Fujita, Deng, & Unnava, 2016; Rudd, 1972) or investigate whether imagery and sense of presence of colorblind individuals differs across the three previews, and the downstream impact on brand experience.

Furthermore, other sensory modalities such as auditory, olfactory, and haptic modalities can induce mental imagery (Miller & Stoica, 2004). Follow up studies could replicate the study by manipulating other sensory stimuli that could induce varying levels of imagery, presence, and brand experience. Finally, due to the limited technical affordances of our VR device, this research did not investigate whether the presence of others (Nowak & Biocca, 2003), intensifies imagery and sense of presence or poses a distraction.

Statement of contribution

Vanja Bogicevic contributed to theoretical development, study design, data collection, analyses, and interpretation, as well as writing the first draft of the manuscript.

Soobin Seo, Jay A. Kandampully, Stephanie Q. Liu, and Nancy A. Rudd contributed to theoretical development and the revision of the first draft of the manuscript.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.tourman.2019.02.009.

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