

Please cite the Published Version

Tussyadiah, I, Wang, D, Jung, TH and Tom Dieck, MC (2018) Virtual Reality, Presence, and Attitude Change: Empirical Evidence from Tourism. *Tourism Management*, 66. pp. 140-154. ISSN 0261-5177

DOI: <https://doi.org/10.1016/j.tourman.2017.12.003>

Publisher: Elsevier

Version: Accepted Version

Downloaded from: <https://e-space.mmu.ac.uk/619909/>

Usage rights:  [Creative Commons: Attribution-Noncommercial-No Derivative Works 4.0](https://creativecommons.org/licenses/by-nc-nd/4.0/)

Additional Information: This is an Author Accepted Manuscript of a paper accepted for publication in *Tourism Management*, published by and copyright Elsevier.

Enquiries:

If you have questions about this document, contact openresearch@mmu.ac.uk. Please include the URL of the record in e-space. If you believe that your, or a third party's rights have been compromised through this document please see our Take Down policy (available from <https://www.mmu.ac.uk/library/using-the-library/policies-and-guidelines>)

Virtual Reality, Presence, and Attitude Change: Empirical Evidence from Tourism

Abstract

The rapid development of virtual reality (VR) technology offers opportunities for a widespread consumption of VR tourism content. It also presents challenges to better understand the effectiveness of VR experience in inducing more favorable attitude toward tourism destinations and shaping visitation intention. Based on two studies, one conducted in Hong Kong with 202 participants and another in the United Kingdom with 724 participants, this research identified several positive consequences of the sense of presence in VR experiences. First, the feeling of being in the virtual environment increases enjoyment of VR experiences. Second, the heightened feeling of being there results in stronger liking and preference in the destination. Third, positive attitude change leads to a higher level of visitation intention. Therefore, this study provides empirical evidence to confirm the effectiveness of VR in shaping consumers' attitude and behavior.

Keywords: Virtual Reality; Presence; Attitude Change; Persuasion; Persuasive Technology; Tourism Marketing

Introduction

One of the important technological developments expected to greatly impact the tourism industry today is virtual reality (VR). Recent innovation in VR platforms, devices, and content production tools allows for VR to evolve from a niche technology mainly enjoyed within the gaming communities into the realm of everyday experiences. The availability of low cost VR viewers such as Google Cardboard and the abundance of tourism-related VR content make it easier for anyone to experience virtual tours of cities and tourism attractions from anywhere in the world. Therefore, VR today offers unbounded potentials for mass virtual visitation to actual tourism destinations. The discussions on the roles of VR in tourism and hospitality management and marketing have been found in tourism literature since the past three decades (e.g., Cheong 1995; Dewailly 1999; Guttentag 2010; Huang et al. 2016; Williams & Hobson 1995). With its unique ability to simulate intricate, real-life situations and contexts (Diemer et al. 2015), VR has been touted as a substitute to actual travel (Cheong 1995; Sussmann and Vanhegan 2009), which can be beneficial for the management of protected areas such as vulnerable natural and cultural heritage sites where limiting the number of tourists or restricting visitations is desirable. In this case, the use of VR is considered a positive contribution to environmental sustainability (Dewailly 1999). Studies also suggest VR as a powerful tourism marketing tool (Huang et al. 2016; Williams & Hobson 1995; Williams 2006) as it is able to offer more compelling imagery of tourism destinations to potential tourists by giving them a sense of what it is like to be there, a “try before you buy” experience. However, these studies are conceptual in nature, offering the potential benefits of VR applications in the tourism industry. Lacking, though, is theory-driven and evidence-based research to support these suggested potentials.

Research in psychology has sought to explain the reason behind the effectiveness of VR in shaping attitudinal and behavioral responses to virtual stimuli (Schuemie et al. 2001), most of these have focused on the concept of presence. VR provides an environment where users can retrieve information in multi-sensory modalities, including visual, auditory, and kinaesthetic, enabling users to perceive realistic representation of the environment it portrays (Slater and Usoh 1993). Further, VR environment offers situated affordances (Schuemie et al. 2001), action-supportive information on what users can do with the

environment. For example, to a human, the grounds afford walking. Therefore, users' perception of the VR environment is dependent on possible actions. This perception leads to the sense of being "present" in or "transported" to the virtual environment (Lombard and Ditton 1997; Schuemie et al. 2001; Slater 1999; Zahorik and Jenison 1998). The essence of travel and tourism experience is tourists' encounters with the destination environments, the "realities" of others. Tourists are tempted by the allure of places and landscapes; some mainly driven by desire to experience the visual sensations of distant territories (Steenjacobsen 2001), others by the deeper meaning behind interacting with the sociocultural aspects of tourism destinations (Gibson 2009). Drawing from Zahorik and Jenison (1998), successfully supporting actions such as sightseeing in a virtual tourism destination will lead users to perceive a sense of presence, of him/herself as being in the destination. Consequently, presence explains the effectiveness of VR as substitute to and/or simulation of travel.

Empirical evidence from various fields of studies, including in education, healthcare, entertainment, retailing, etc., demonstrate that VR experience leads to positive attitudinal and behavioral outcomes, such as consumer learning of products (Suh and Lee 2005), brand recognition, product recall, and memory of experiences (Kim and Biocca 1997; Mania and Chalmers 2001). These outcomes are suggested as the results of presence (Schuemie et al. 2001). However, these studies, as well as VR studies in tourism context (e.g., Huang et al. 2016), mainly dealt with simulated virtual worlds, such as a virtual office, a virtual seminar room, and 3D tourism attractions, where resemblances to real places were rather coincidental. Theoretically, researching VR experience in tourism (what this study encapsulates) will provide a better understanding of presence in VR experiences that involve virtual depictions of real environments, where possible actions, such as navigation and sightseeing, resemble (are often indistinguishable from) actual consumption. Thus, it will lead to better conceptualization of the roles of VR experience in shaping attitude towards actual consumption. From a managerial point of view, understanding how travel consumers respond to various VR stimuli, the attitudinal consequences of "having been" in a destination, is of practical importance as destination managers are increasingly faced with strategic decisions to invest in various technology platforms and modalities. Therefore, this study

aims to address the identified research gap in VR research in tourism context to address the
aforementioned theoretical and managerial challenges. Specifically, the goal of this study is investigate
the sense of presence during a virtual walkthrough of a tourism destination and how presence influences
post-VR attitude change toward the destination. In order to achieve this goal, two studies were conducted
to achieve the research goals. Study 1 was conducted with 202 participants in Hong Kong using VR street
view of Tokyo, Japan, viewed with Google Cardboard or VR video of Porto, Portugal, viewed with
Samsung Gear VR. Study 2 was conducted in the United Kingdom with 724 participants using 360-
degree VR videos of Lake District National Park, United Kingdom, viewed with Samsung Gear VR.

Virtual Reality and Tourism

Since its early conception, VR has been described as a computer-simulated environment with and within
which people interact (Diemer et al. 2015; Schuemie et al. 2001). Using VR devices, a user can
experience the virtual environment as if he or she was part of it. The virtual environment is modified in
real time as the device senses user's reactions and motions, allowing him or her to perceive a vivid mental
representation of the environment, creating the illusion of interacting with and being immersed in the
virtual world (Wirth et al. 2007). Table 1 presents an overview of VR technologies and their advantages
within the tourism context. There are two kinds of established or commonly used headsets for VR, with
numerous technical options within those two types. The first type includes untethered headsets (also
referred to as mobile VR). These are headsets that work based on using a mobile device as a display. This
can sometimes present a limitation due to the mobile devices processing power and limited ability to
process real-time 3D content. The major benefits of these mobile-based systems are cost and uptake;
many people already have a mobile device that is capable of displaying VR content to some degree
(Byond, 2016). Examples of untethered or mobile VR headsets include Samsung Gear VR, Google
Cardboard, and Google Daydream. The second common type is a tethered device, whereby the headsets
contain a display alongside internal and/or external sensors to track the position of the user. These
tethered headsets will usually require a personal computer (PC) to process the graphics and, thus, the user

is attached to the PC via a cable. This usually allows for superior quality graphics as well as real-time tracking and interaction. Established examples include the HTC Vive, Oculus Rift, and OSVR (Byond, 2016).

Recently, a number of scholars explored the benefits of VR within the tourism context. From the tourists' point of view, the main benefits of VR include enhancement of tourism experiences (Bonetti et al., 2018; Moorhouse et al., 2018); facilitation of immersive, engaging, social, and entertaining experiences (e.g. Castro et al., 2017; Guttentag, 2010; Jung et al., 2018; Tromp, 2017), as well as the potential to provide accessible tourism for all (Guttentag, 2010; Hobson & Williams, 1995). From the perspective of businesses and destinations adopting VR, factors such as marketing and promotions, sales and distribution (Gibson & O'Rawe, 2018; Williams & Hobson, 1995; Huang et al., 2016; Moorhouse et al., 2018), additional revenue generation (Radde, 2017; Tromp, 2017), as well as sustainability and the preservation of heritage (Guttentag, 2010; Hobson & Williams, 1995) were identified as the benefits of VR. A full summary of previously explored benefits of VR is presented in Table 1.

== Table 1 about here ==

Defining and Measuring Presence in Virtual Reality

The key concept that explains the effectiveness of VR in various use contexts is presence. Presence is defined in literature as the psychological state where a user is feeling lost or immersed in the mediated environment, the degree to which he or she feels physically "present" in a virtual environment (Schubert, Friedmann, and Regenbrecht 2001; Slater and Steed 2000; Slater and Usoh 1993; Slater and Wilbur 1997; Steuer 1992). Lee (2004) defines presence as a psychological state in which the virtuality (artificiality) of an experience is unnoticed; presence is the "psychological similarities between virtual and actual objects when people experience-perceive, manipulate, or interact with- virtual objects" (p. 38).

Presence has been conceptualized in terms of its descriptive (the what) and structural (the how) models; the former focuses on delineating the dimensions of presence, while the latter on explaining how presence is generated in the mind of a user (Diemer et al. 2015). Following an extensive review of

literature, Lombard and Ditton (1997) summarize six explications of presence: presence as social richness, realism, transportation, immersion, social actor within medium, and medium as social actor (Lee 2004; Schuemie et al. 2001). Schuemie et al. (2001) find that presence as transportation, which is the sensation of being transported to the virtual environment, dominates the discussion in presence literature. Heeter (1992) suggests three types of presence: personal, social, and environmental presence, each corresponds to the sense of self and encountered objects as being part of the interactive virtual environment. Similarly, Lee (2004) proposes three types of presence: physical presence (i.e., virtual physical objects experienced as actual physical objects), social presence (i.e., virtual social actors experienced as actual social actors), and self presence (i.e., virtual self/selves experienced as actual self/selves).

Kim and Biocca (1997) operationalize the transportation metaphor of presence with two measures: arrival, which describes a feeling of being present in the virtual environment, and departure, a feeling of separation from the physical environment. These were conceptualized following Gerrig's (1993) theory that through a medium, a user is first transported, then arrives at a mediated environment, and finally returns to the original physical environment. Kim and Biocca (1997) further argue that arrival and departure are not exactly equal and may exert different influence on the user's memory and/or attitude change (Kim & Biocca 1997). Slater and his colleagues (1993; 1994) propose a navigation metaphor of presence in virtual environments, which includes the user's sense of being there, the extent to which the VR experience becomes more real than everyday experience, and the locality of the virtual environment, in that users perceive it as a 'place' instead of set of images (Slater and Wilbur 1997). Slater (1999) suggest that experiencing-as-a-place is the meaning of presence: people are there, they respond to what is there, and they remember it as a place. It is important to note that Slater et al.'s (1993; 1994) measurement of presence, as explicated in SUS Questionnaire, include the state post VR experience, namely how a user remembers the virtual environment, while others focus only on the mental state during the VR experience. In fact, numerous studies regard memory of (objects within) the virtual environment as a consequence of presence (e.g., Keng and Lin 2006; Kim and Biocca 1997).

The experience of presence is a complex, multidimensional perception, which is formed through an interplay of multi-sensory information and various cognitive processes (Diemer et al. 2015). Lombard and Ditton (1997) describe presence as the perceptual illusion of being unmediated (non-mediation), an extent where the technology and the physical environment disappear from the user's awareness. That is, a user experiences the sense of presence when he or she fails to perceive the existence of a medium (i.e., a VR device) and responds as if the medium were not there. The term "perceptual" in their description shows that the illusion of non-mediation involves real-time responses of the sensory, cognitive, and affective processing systems to objects in a person's environment (Lombard and Ditton 1997). This emphasizes the attention-directing role of activity within complex interactive situations to generate the sense of presence, in addition to the immersive nature of the virtual environment (Diemer et al. 2015; Witmer and Singer 1998). Indeed, Witmer and Singer (1998) stress that both fundamental psychological states of involvement and immersion are necessary conditions for experiencing presence (see also Witmer, Jerome, and Singer 2005). They develop the measurement of presence using Presence Questionnaire (PQ) and found the following subscales of presence: involved/control, natural, and interface quality (Witmer and Singer 1998). Similarly, Schubert, Friedmann, and Regenbrecht (2001) conducted factor analyses and identified three dimensions of presence: spatial presence, involvement, and realness. A more recent operationalization by Wirth et al. (2007) associates spatial presence with two dimensions: self-location, which is the feeling of being located in mediated environments (the presence of self in the virtual environment), and perceived action possibilities.

Further, literature suggests that vital to presence is the suppression of information that is incompatible with the VR experience (Schuemie et al. 2001). With his estimation theory, Sheridan (1999) postulates that presence is the result of a continuously updated mental model of the environment. He assumes that people can never have true knowledge of objective reality and, instead, continuously make and refine a mental model that estimates reality. Through sensing and interacting with a virtual environment, designed to have a perceptual and functional similarity to a physical environment, a user would create a mental model of the virtual environment and of how he or she relates to it. The structure of

this mental model determines whether or not the user experiences presence. Even when he or she is uncertain about the reality of his or her perception in the virtual environment, such perception would be a close relative of what he or she has in the physical environments. This emphasizes the need for suppression of information or a willing suspension of disbelief for the sense of presence to come about (Nowak, Krcmar, and Farrar 2008; Schuemie et al. 2001). Seth et al. (2012) postulate that presence rests on the continuous prediction of emotional, or interoceptive, states, instead of the external environment. They suggest that, when encountering a stimulus (such as a virtual environment), a user would compare the actual interoceptive state (i.e., what he or she feels when encountering the environment) with the predicted state (i.e., what he or she expects to feel when encountering such environment). Therefore, presence is the result of successful suppression of the mismatch between the predicted and the actual interoceptive states. To summarize, Hofer et al. (2012) suggest that the experience of presence follows two steps: (1) a construction of a mental model of the virtual environment and (2) the suppression of external cues that signal the artificiality of the virtual environment.

Following these conceptualizations of presence, researchers measure presence in a variety of different ways depending on the theoretical lens they use: presence as non-mediation, presence as involvement, etc. Most of these conceptual frameworks emphasize the aspects that contribute to presence. This study focuses on presence and its consequences in inducing more favorable attitude toward the tourism destination depicted in the virtual environment. Therefore, presence is defined and measured with self-reported mental states *during* the VR experience (i.e., the experienced level of presence), following Wirth et al.'s (2007) conception of spatial presence. Table 2 summarizes the dimensions and measurements of (experienced) presence.

== Table 2 about here ==

Consequences of Presence

Presence is the key feature for effective VR applications designed for persuasion as it may be a causal factor of human information processing performance and other cognitive variables (Kim and Biocca

1997; Lombard and Ditton 1997). The propositions and findings from previous research on presence in VR demonstrate that the enhanced sense of reality during a VR experience increases enjoyment and values of the VR experience (in itself), generates positive consequences on attitude, belief, and intention, and increases performance (Bystrom, Barfield, and Hendrix 1999; Kim and Biocca 1997; Suh and Lee 2005; Schuemie et al. 2001; Vora et al. 2002). For example, research in education and training found that virtual presence promotes enjoyment and higher cognitive engagement for better learning outcomes (Bailenson et al 2008; Lee, Wong, and Fung 2010; Mikropoulos and Strouboulis 2004) and improves task performance in training simulations (Vora et al. 2002). Research in medical sciences identified presence as the main contributor to performance during rehabilitation intervention programs and immersive Virtual Reality Exposure Therapy (VRET) to eliminate phobias (Carlin, Hoffman, and Weghorst 1997; Hodges et al. 1995; Riva, Mantovani and Gaggioli 2004). The role of presence is also suggested in the field of marketing, especially with regards to advertising effectiveness, as sense of presence in mediated environments is positively correlated with more favorable attitude toward ad and brand, brand recall or product knowledge, and purchase intention (Choi, Miracle, and Biocca 2001; Klein 2003; Li, Daugherty, and Biocca 2001; 2002; Lombard and Snyder-Duch 2013). In the context of tourism, Hyun and O'Keefe (2012) found that presence via web-mediated information directly leads to positive virtual destination image.

In essence, the consequences of presence can be separated into those during and after the VR experience. During VR experience, a higher sense of presence is associated with enjoyment of virtual environment participation, the feeling of pleasure of interacting with virtual environment (Larsson, Västfjäll, and Kleiner 2001; Li, Daugherty, and Biocca 2001). That is, virtual environments that engender a high level of presence are perceived to be more enjoyable (Sadowski and Stanley 2002; Sylaiou et al. 2010). For example, Weibel et al. (2008) found a significant positive correlation between presence and enjoyment in the context of playing online games. The effect of presence on enjoyment, however, is mediated by the state of flow (Weibel et al. 2008). Still in the context of video game experience, Shafer, Carbonara, and Popova (2011) found that spatial presence is a significant predictor of enjoyment.

Ijsselsteijn et al. (2006) shows that greater spatial presence leads to greater enjoyment in an exercise-promoting virtual environment. More relevant to tourism, Zarzuela et al. (2013) demonstrate that through a VR Serious Game, educational tourism can be designed in a fun and entertaining way, implying an association between VR involvement and enjoyment, to allow tourists to learn different aspects of a city. Likewise, Sylaiou et al. (2010) investigated the relationship between presence and enjoyment in a virtual museum and identified a significant positive correlation between the two variables. Therefore, it can be suggested that the sense of presence during VR experience with a tourism destination leads to enjoyment of the VR experience.

H1: Sense of Presence during VR experience has a positive effect on Enjoyment of VR Experience.

Importantly, VR studies substantiate its persuasive role, suggesting that the subjective experience of presence in VR can translate into real world attitude and induce behavioral change (Fox, Christy, and Vang 2014). Indeed, VR applications have been designed for various persuasive goals, such as health behavior change (Fox, Bailenson, and Binney 2009; Girard, Turcotte Bouchard, and Girard 2009; Ijsselsteijn et al. 2006), promotion of prosocial behavior (Ahn, Le, and Bailenson 2013; Gillath, McCall, Shaver, and Blascovich 2008; Rosenberg, Baughman, and Bailenson 2013), advertising and e-commerce (Keng and Lin 2006; Li, Daugherty, and Biocca 2001; 2002; Suh and Lee 2005), etc. These studies found that the heightened sense of realism during VR experience leads to attitude change and the effect is transferred into the physical world, which is manifested in positive behavioral change. In marketing literature, higher levels of presence of various advertisements communicated in computer-mediated environments have been found to increase subject recall and recognition (Keng and Lin 2006), leading to more positive attitude and liking toward the ad and the advertised product (Klein 2003; Sundar and Kim 2005). In tourism, VR provides tangible images of and experiences with the destination, inducing the construction of a mental image about destination attributes (i.e., destination image) and its affordances (Govers, Go, and Kumar 2007; Nicoletta and Servidio 2012), which can be a manifest of spatial presence. Previous studies suggest that the ability to visit a tourism destination through VR may assist tourists in developing a set of realistic expectations of tourism experience with the destination (Cheong 1995;

Guttentag 2010; Williams and Hobson 1995). Studies also show that encounters with images of tourism destinations in mediated environments shape interest and attitude toward the destinations (Thomas and Carey 2005; Tooke and Baker 1996). A potential tourist who has experienced various destinations through VR will be in a better position to make an informed decision and initiate travel arrangements (Sussman and Vanhegan 2009).

H2: Sense of Presence during VR experience has a positive effect on Post VR Attitude toward destination.

H3: Enjoyment of VR experience has a positive effect on Post VR Attitude toward destination.

Attitude is a central concept in social psychology as well as consumer behavior literature as it is generally accepted that attitude predicts behavior, although the degree of attitude – behavior consistency may differ in various situations (e.g., Ajzen and Fishbein 1977; Glasman and Albarracín 2006; Smith and Swinyard 1983). Further, based on the Belief–Attitude–Intention–Behavior hierarchy (Fishbein and Ajzen 1975), the relationship between attitude and (actual) behavior is mediated by behavioral intention (Kim and Hunter 1993). The link between attitude toward tourism destination (with its characteristics) and behavioral intention to visit the destination or to participate in tourism-related activities has been supported in previous studies (e.g., Huang and Hsu 2009; Lam and Hsu 2004; Phillips, Asperin, and Wolfe 2013; Ryu and Han 2010). Researching Beijing tourists’ revisit intention to Hong Kong, Huang and Hsu (2009) identified significant influence of attitude on intention. Similar results were identified by Lam and Hsu (2004). Phillips, Asperin and Wolfe (2013) found significant influence of attitude toward consuming Korean cuisine on intention to visit Korea and to try Korean cuisine. Similar results were identified by Ryu and Han (2010) in New Orleans. As supported by previous research, it can be suggested that attitude toward tourism destination as a result of VR experience is a predictor of visitation intention to the destination.

H4: Post VR Attitude toward destination has a positive effect on Intention to visit destination.

Research Design

The main goal of this research is to assess the effects of VR experience on post-VR attitude and behavioral intention to visit a tourism destination. Key to VR experience is the extent of presence, which contributes to the level of enjoyment of VR participation. In order to assess the relative contribution of VR experience in inducing more favorable attitude toward VR stimuli (i.e., the tourism destination), it is crucial to measure post-VR attitude change, comparing attitude before and after VR experience. That is, identifying whether and how much a user's attitude changes as a result of being exposed to the virtual environment will delineate the specific effect of VR experience. Previous studies suggest that VR induces more positive attitude toward stimuli. Therefore, a positive change in attitude (i.e., stronger attitude) after VR experience is expected. Finally, this research tests the influence of attitude change on visit intention to the destination. The research framework is illustrated in Figure 1.

== Figure 1 about here ==

Measurement Items

VR Presence. In order to assess presence in VR experience, subjective measures of spatial presence as conceptualized and operationalized in Wirth et al. (2007) and Vorderer et al. (2004) were utilized.

Following the research framework, the main interest in this study is to assess presence as the subjective mental states of being in and interacting with the virtual environment during the VR experience. Two constructs from MEC Spatial Presence Questionnaire (MEC-SPQ; Vorderer et al. 2004): Self-Location and Possible Actions scales, each measured with four items, were included in the questionnaire. The measurement items were presented in a 5-point Likert-type scale with “Strongly disagree” – “Strongly agree” anchored statements (see Appendix A for a list of measurement items). VR presence was operationalized as a second-order variable, consisting of the two first-order constructs.

VR Enjoyment. In order to measure VR enjoyment, this research refers to Davis, Bagozzi, and Warshaw's (1992) definition of perceived enjoyment, which is the extent to which the activity of using VR technology to experience tourism destination is enjoyable in its own right. Measurement items from

previous research on technology acceptance and use (e.g., Moon and Kim 2001; Van der Heijden 2003) were consulted. As a result, a 5-item perceived enjoyment scale was utilized. The items were presented a 5-point Likert-type scale with “Strongly disagree” – “Strongly agree” anchored statements.

Post VR Attitude Change. In literature, the measurement of attitude change has been conducted in a variety of different ways, mostly involving taking multiple measurements at different times (generally in longitudinal studies) to measure an increase or decrease in the level of attitude (see Hughes 1967). In this study, a limited time allotted for VR experiment and survey only allows for the questionnaire to be distributed to participants after they have experienced VR. Therefore, attitude change was measured using self-reported change in intensity of preference, liking, and interest in the destination after experiencing VR on a 5-point Likert-type scale from 1 – “Much weaker” to 5 – “Much stronger,” with 3 – “About the same” as the middle point.

Visit Intention. Visit Intention was measured by 3-item scale targeting behavioral intention to visit the destination in the future, validated in previous studies on tourists’ intention to visit or revisit a destination in the future (e.g., Kozak and Rimmington 2000; Phillips, Asperin and Wolfe 2013). The scale was presented a 5-point Likert-type scale with “Strongly disagree” – “Strongly agree” anchored statements.

Data Analysis

In order to assess the measures given the data in this study context and test the hypotheses, data analyses were conducted using covariance-based structural equation modeling (CB-SEM) following the two-step approach suggested by Anderson and Gerbing (1988). The first step was to test the adequacy of the measurement model with a confirmatory factor analysis (CFA), then the second step to assess the adequacy of the structural model for hypotheses testing. The analysis was performed using MPlus program (Muthén and Muthén 1998-2012). Based on skewness and kurtosis values of all variables, an appropriate parameter estimate was selected. Several criteria were used to assess the model fit. The analysis will determine if the complete set of paths specified in the model is plausible given the sample,

thus the proposed causal model is a sufficiently “good” way to model the relationships among the variables (Gefen, Straub, and Boudreau 2000).

Study 1. Stimuli: Tokyo, Japan or Porto, Portugal

In March 2016, undergraduate and graduate students enrolled in a university in Hong Kong were invited to participate in the study as part of an experiential component of a course on tourism and technology strategy. In order to ground this research in the context of personal use of VR, existing free VR applications and personal VR devices were used in the study. Participants with Apple’s iOS smartphones were asked to download the Cardboard app and use Google Cardboard VR viewer to experience a virtual walkthrough of Tokyo, Japan, experiencing VR street view with Urban Hikes on Cardboard app (developed by Google). Other participants were asked to use Samsung Gear VR with a Samsung smartphone to visit Porto, Portugal, experiencing interactive 360-tour with Porto Interactive app (developed by Vertigo VR Studios). Participants experienced VR for about 10 minutes after a short period of familiarization with the device. After the VR experience, all participants were asked to complete the questionnaire online. A total of 202 participants completed the questionnaire. As presented in Table 3, the majority of participants are between the ages of 18 and 24 (98%), female (79%), and have a 4-Year University Degree (76%). Most participants (N = 136; 67%) used Google Cardboard, and most had never visited the destination portrayed in the VR experience (N = 144; 71%). In order to account for non-normality in the data distribution (see Table B1 in Appendix B), the analysis was performed using maximum likelihood parameter estimate with standard errors and a mean adjusted Chi-square test statistic (Satorra-Bentler corrections) that are robust to non-normality (MLM).

== Table 3 about here ==

Findings

The results from the analysis suggest that the measurement model is adequate based on several criteria. As presented in Table 4, all factor loadings are above .6 and the average variance extracted (AVE) values

of all latent variables are above the cutoff point of .5 (Hair, Black, Babin, and Anderson 2010). Therefore, convergent validity was supported. The composite reliability (CR) values of all latent variables are above the cutoff criteria of .7 (Hair et al. 2010). Further, the values of square roots of AVE of all latent variables, which are presented in the diagonal, are larger than the correlations between the corresponding variable and any other variables (see Table 5). This indicates that discriminant validity is supported. Further, the fit indices are above the thresholds of .9 (Hu and Bentler 1999): Comparative Fit Index (CFI) = .963 and Tucker Lewis Index (TLI) = .957. The value of Root Mean Square Error of Approximation (RMSEA = .056) indicates good model fit (Hu and Bentler 1999) and the value of Standardized Root Mean Square Residual (SRMR = .047) is below the threshold of .09 (Hu and Bentler 1999). These criteria suggest the adequacy of the measurement model.

== Table 4 about here ==

== Table 5 about here ==

In order to estimate the relationships between the variables hypothesized in the research framework, the structural model was consulted (see Figure 2). As a second-order variable, the paths from VR Presence to its two lower-order variables are significant (Presence → Self-Location = .894, $p = .000$; Presence → Possible Actions = .849, $p = .000$). As hypothesized, Presence has a significant positive effect on Enjoyment of VR participation ($\beta = .620$; $p = .000$; $R^2 = .384$; $p = .000$), providing support for H1. Both Presence and Enjoyment have significant positive effects on attitude change (Presence → Attitude Change = .240, $p = .000$; Enjoyment → Attitude Change = .255, $p = .000$; $R^2 = .198$; $p = .000$), supporting H2 and H3. It can be observed from the R^2 value that about 20% of the amount of variance in Post VR attitude change can be explained by the model. Finally, a significant positive effect of Attitude Change on Intention ($\beta = .333$; $p = .000$) was also identified ($R^2 = .111$; $p = .000$), providing support for H4. About 11% of variance in visit intention can be explained by the model.

== Figure 2 about here ==

Discussion

The results provide support for all hypothesized relationships in the model (see Table 6). The sense of presence during VR experience significantly leads to enjoyment of the experience, supporting Hypothesis 1. With regards to the consequences of presence on post VR attitude change, a significant effect was also identified, supporting Hypothesis 2. Further, enjoyment of VR experience also positively impacts post VR attitude change with a similar magnitude as the effect of VR presence, supporting Hypothesis 3. Finally, the relationship between post VR attitude change and visit intention is also significantly positive, which supports Hypothesis 4. Therefore, it can be suggested from these results that VR can be an effective tool for tourism marketing as it induces the sense of presence, which leads to enjoyment. These, in turn, induce positive attitude change that contributes to visit intention to the tourism destination portrayed in VR. Further, the indirect effects of VR presence and enjoyment on visit intention were calculated (see Table 7). Specifically, a significant positive indirect effect of VR presence on post VR attitude change, by way of enjoyment, was found. Other indirect effects, although smaller in magnitude, were also significant. The total effects of VR presence on post VR attitude change is .778; while total effects on visit intention is .133.

== Table 6 about here ==

== Table 7 about here ==

While the data confirmed the hypotheses, this study has some limitations. First, the participants in this study are dominated by young, female consumers. Recent studies have found that the younger the customers, the more likely they are to be interested in VR (eMarketer, 2015; Global Web Index, 2016). It can be suggested that participants in this study represent a group of customers who are highly likely to experience and be influenced by VR. However, the imbalance in gender may or may not influence the results. Second, participants were exposed to different stimuli with an unbalanced ratio: 67% used Google Cardboard. Several independent-samples *t*-tests were conducted to identify the differences across stimuli in terms of all variables (i.e., presence, enjoyment, attitude change, and intention). The differences were not statistically significant. Nonetheless, conducting a follow up study with consistent stimuli is desirable to verify the results further. Lastly, the sample size is relatively low ($N = 202$). Previous literature

suggests a minimum 100 – 150 sample size to test a simple model (Anderson and Gerbing 1988; Ding, Veliver, and Harlow 1995) or 10 observations for every indicator variable (Nunnally 1967). Based on a power analysis suggested by MacCallum, Browne, and Sugawara (1996), the minimum sample size for a close of fit (Power = 90%, significance level = .05; RMSEA₁ = .05, and RMSEA₀ = .08) is 128. A further study to test the model with a larger sample size will further support these findings.

Study 2. Stimuli: Lake District National Park, UK

Festival goers visiting Kendall Calling Festival in July 2016 and Lakes Alive Festival in August 2016 in the Lake District, UK were invited to participate in this study. Participants were asked to experience Bird Hive Lake District National Park VR application using Samsung Gear VR headset for about five minutes. The content for VR experience was captured by a drone and it contained a flight over the natural landscape of the Lake District National Park including its mountains, lakes, and forests. After the VR experience, all participants were asked to complete a questionnaire. A total of 741 participants completed the questionnaire. After eliminating responses with missing data and outliers, 724 responses were included in the analysis (see Table 8). In contrast with Study 1, participants in Study 2 are relatively balanced in gender (57% female). While the majority of participants is young (41% younger than 35), older participants are also represented in this study (about 34% are 45 years or older). A majority of participants make less than £60,000 annually. A quarter of participants (25%) have tried VR before the experience. Contrary to Study 1, most participants in Study 2 (89%) have visited the destination before being exposed to this study. Data from Study 2 are presented in Table B2 in Appendix B. The analysis was performed using the same approach as in Study 1 (covariance-based SEM with MLM).

== Table 8 about here ==

Findings

Based on several criteria, it can be suggested that the measurement model in this study is adequate. As presented in Table 9, all factor loadings are above .6 and the AVE values of all latent variables are

above the cutoff point of .5 (Hair et al. 2010). Therefore, convergent validity was supported. The CR values of all latent variables are above the cutoff criteria of .7 (Hair et al. 2010). Further, the values of square roots of AVE of all latent variables, which are presented in the diagonal of Table 10, are larger than the correlations between the corresponding variable and any other variables. This demonstrates that discriminant validity is supported. The fit indices are above the thresholds of .9 (Hu and Bentler 1999): CFI = .945 and TLI = .935. The value of RMSEA (.071) indicates moderate fit (Hu and Bentler 1999) and the value of SRMR (.087) is below the threshold of .09 (Hu and Bentler 1999).

== Table 9 about here ==

== Table 10 about here ==

The structural model is illustrated in Figure 3. The paths from VR Presence as a second-order variable to its two first-order variables are significant (Presence → Self-Location = .838, $p = .000$; Presence → Possible Actions = .833, $p = .000$). Presence has a significant positive effect on Enjoyment of VR participation ($\beta = .519$; $p = .000$; $R^2 = .270$; $p = .000$), providing support for H1. Both Presence and Enjoyment have significant positive effects on attitude change (Presence → Attitude Change = .567, $p = .000$; Enjoyment → Attitude Change = .116, $p = .000$; $R^2 = .403$; $p = .000$), supporting H2 and H3. This indicates that 40% variation in the Post VR attitude change can be attributed to variations in VR presence and enjoyment. Finally, a significant positive effect of Attitude Change on Intention ($\beta = .305$; $p = .000$) was also identified ($R^2 = .093$; $p = .000$), providing support for H4. The low R^2 value, however, indicates that only extremely small portion of variation in visit intention to the national park (less than 10%) can be explained by Post VR attitude change.

== Figure 3 about here ==

Discussion

As with Study 1, the results from Study 2 also provide support for the hypothesized model (see Table 11). The sense of presence during VR experience significantly leads to enjoyment of VR participation, supporting Hypothesis 1. Presence's influence on post VR attitude change is positive and significant,

supporting Hypothesis 2. The positive effect of enjoyment of VR experience on post VR attitude change is also significant, although with less magnitude than the VR presence, supporting Hypothesis 3. Finally, the relationship between post VR attitude change and visit intention is significant, albeit resulting in a small R^2 value. This supports Hypothesis 4. In summary, these results demonstrate the effectiveness of VR for tourism marketing as VR induces the sense of presence, leading to enjoyment, which affects positive attitude change that contributes to visit intention. Further, the indirect effects of VR presence and enjoyment on visit intention were calculated (see Table 12). Specifically, a significant positive indirect effect of VR presence on visit intention, by way of post VR attitude change, was found. Other indirect effects, although smaller in magnitude, were also significant. The total effects of VR presence on post VR attitude change is .569; while total effects on visit intention is .191.

== Table 11 about here ==

== Table 12 about here ==

From the results, it can be observed that the Satorra-Bentler corrected Chi-square value is quite large (Chi-square = 673.059; $df = 146$), which is likely due to large sample size ($N = 724$). As suggested in previous research, with large sample size, the chi-square values will be inflated (statistically significant), thus might erroneously implying a poor data-to-model fit (see Schumacker and Lomax 2004). However, the relative Chi-Square value (Chi Square / degree of freedom ratio) in this study is smaller than the suggested ratio of 5:1 as a rule of thumb for a reasonable fit (Marsh and Hocevar 1985; Schumacker and Lomax, 2004).

An Alternative Model

In order confirm the significance of post VR attitude change as a consequence of presence and to test if there are direct effects of VR presence and VR enjoyment on visit intention, an alternative model was tested. As can be seen in Figure 4, a positive direct effect of VR enjoyment on visit intention was identified ($\beta = .250$; $p = .000$), with a slightly larger magnitude compared to that of Post VR attitude change. However, the direct effect of VR presence on visit intention was not identified. Therefore, it can

be confirmed that the effect of the sense of presence during VR experience on visit intention is mediated by post VR attitude change. Compared to the main model, the R^2 value of visit intention increases in the alternative model ($R^2 = .139, p = .000$), indicating that the alternative model better explains the variance in visit intention. That is, the sense of being in the virtual environment directly results in more positive attitude toward the environment. On the other hand, the significant effect of VR enjoyment on visit intention demonstrate the role of hedonic experience with technological device in instilling behavioural intention. That is, the inflated sense of pleasure and/or excitement during a virtual walkthrough leads to positive intention for an actual walkthrough. Considering that 25% of participants have tried VR and 89% have visited destination before, the model was run for the different groups of participants (prior use of VR, prior visitation to destination) to further explicate the role of novelty. However, no significant differences were identified.

== Figure 4 about here ==

General Discussion

This study hypothesized that the sense of presence during a VR experience with a tourism destination will lead to positive consequences, which include positive VR experience from enjoyment of VR participation and, importantly, an increased level of preference, liking, and interest in the tourism destination, which leads to visit intention. The results of two studies, conducted in with different stimuli (i.e., cities and national parks) among participants with varied characteristics (i.e., students and festival goers), support all hypotheses. Firstly, significant support was found for VR presence as a second-order variable consisting of self-location and possible action, as suggested in Wirth et al.'s (2007) measures of spatial presence. Self-location denotes the sense of locating the self in the virtual environment, which is consistent with the definition of personal presence (Heeter 1992) or self presence (Lee 2004), although it is not about perceiving the existence of virtual self in the virtual environment, but about being part of the virtual environment. To some extent, this can support the concept of arrival (Kim and Biocca 1997), as participants feel present in the city or national parks depicted in VR. Possible Actions denote the

immersive nature and affordances of the virtual environments, which is consistent with the definition of physical presence (Lee 2004) and environmental presence (Heeter 1992). Importantly, it is about participants recognizing the action-supportive information from the virtual environment; the virtual environment conveying its situated affordances (Schuemie et al 2001).

Secondly, the significant effect of presence on enjoyment of VR confirms the positive value of VR as a hedonic experience. This is consistent with Shafer et al. (2011), Sylaiou et al. (2010), and Weibel et al. (2008). However, this study shows the direct effect that the sense being in the tourist city or the national park has on the feeling of pleasure while doing the virtual walkthrough. Meanwhile, Weibel et al. (2008) found the effect of presence on enjoyment to be mediated by the perceived state of flow in the context of playing video games. In the context of virtual museum, Sylaiou et al. (2008) only demonstrated positive correlations between presence and enjoyment. Therefore, this study contributes to a better understanding of the causal relationship between the two experiences in VR that involves interactions with tourism destinations, with enjoyment being the consequence of the sense of presence.

Thirdly, a significant direct effect of presence on attitude change confirms that the extent to which participants process information in the virtual environment influences changes in liking, preference, and interest in the actual environment. While previous research in advertising identified positive correlations between presence and more favorable attitude toward ad and brand (Choi, Miracle, and Biocca 2001; Klein 2003; Li, Daugherty, and Biocca 2001; 2002), this study clarifies that presence indeed leads to attitude change. In this case, the feeling of being part of a city or a park and afforded the action of sightseeing results in more favorable attitude toward the city and the park. Similar result was identified by Hyun and O'Keefe (2012), where presence results in positive virtual destination image. Furthermore, by measuring Post VR attitude change instead of attitude, this study was able to delineate specific role of VR presence on attitude formation.

Lastly, the change in attitude positively leads to visit intention. Those whose preference, liking, and interest in the city or park become stronger (i.e., more favorable attitude) after the VR experience tend to have higher level of visit intention. It is important to note that while in Study 1 the proportion of

participants who have visited the destination prior to the VR experience is small, most participants in Study 2 have visited the park. Therefore, the novelty effect of VR might be lacking and its role is more of a reminder rather than product introduction. Further, it is also important to note that the nature of traveling to the cities and the attraction depicted in stimuli is different: traveling to Tokyo or Porto for participants in Hong Kong may require a substantial effort compared to visiting a local national park for participants in the UK. It can be observed that the mean values of visit intention items in Study 2 are positively skewed, indicating that most participants intend to visit the national park in the future. Nevertheless, both studies yielded positive results, indicating that VR presence can be effective to induce intention for first time visitation and/or revisit intention, to visit faraway destinations or domestic tourism attractions. In conclusion, this study demonstrates that VR allows subjective experience in a virtual environment (e.g., virtual walkthrough or sightseeing in a tourist city or a national park) to eventually translate into real behavior (i.e., actual visitation), confirming the persuasive power of VR for tourism marketing.

Conclusion and Implication

The development of VR platforms and devices for convenient personal use in recent years offers great potential for a widespread consumption of VR tourism content. As suggested in earlier literature, the replication or creation of tourism experiences through VR will greatly impact the tourism industry (Williams and Hobson 1995). VR development presents research challenges to better understand the effectiveness of VR in providing alternative or surrogate tourism experiences and shaping consumer attitudes toward tourism destinations. Moreover, destination managers are also faced with challenges to make strategic investment decisions in order to leverage VR technology to influence consumers' travel decisions. In order to answer these challenges, this study investigates the sense of presence during VR experience involving virtual walkthrough of tourism destinations and attractions using personal devices. This study contributes to a better understanding of presence and its consequences on user attitudes in experiences involving depictions of real tourism destinations. The results show that presence contributes

positively to attitude change toward destinations. That is, a higher sense of presence during VR experiences leads to stronger interest and liking toward the destinations. Therefore, it provides theoretical explanation for the effectiveness of VR in influencing users' response to marketing stimuli, which is helpful for destination marketers justifying investment in VR and empirical support for previous conceptual research suggesting the role of VR in tourism marketing and management (e.g., Cheong 1995; Dewailly 1999; Guttentag 2010; Huang et al. 2016; Williams and Hobson 1995).

Williams and Hobson (1995) suggested that "VR has the potential to revolutionize the promotion and selling of tourism" (p. 425) as it has the ability to offer interactive experience and provide rich data to potential tourists seeking destination information (Guttentag 2010). Cheong (1995) argued that through VR, potential tourists can "'sample' the delights and have a 'feel' of each destination's atmosphere before making their decision" (p. 419). This study shows how VR users interact with the destination's characteristics, 'feel' the destination's atmosphere, and, thus, sample the destination experience as indicated by the sense of presence. It is reflected in the ability to locate the self in the destination and perceive the affordances of the destination (action possibilities), as significantly found in this study to form the sense of spatial presence in the virtual environment (Wirth et al. 2004; Vorderer et al. 2007). To justify the effectiveness of VR as marketing tools, this study demonstrates how VR capabilities in inducing the sense of presence actually lead to users having more favorable attitude toward the destinations depicted in VR, which, in turn, affects intention to visit the destinations. Results from two studies, conducted with different groups of participants using different stimuli, consistently support the hypotheses. The consequences of presence on positive attitude change is observed in situations involving experience with faraway tourism destinations (international tourism) as well as local attractions (domestic tourism). No significant differences were found between participants who have visited the destinations depicted in VR and those who have not (in both studies), between participants who have used VR before and those who used it for the first time during the study (in Study 2), and between participants using different VR viewers (in Study 1). Therefore, this study provides empirical evidence from the field of tourism to support previous research suggesting the positive consequences of presence in VR on attitude

and behavior (e.g., Choi, Miracle, and Biocca 2001; Klein 2003; Li, Daugherty, and Biocca 2001; 2002; Lombard and Snyder-Duch 2013).

Despite of the contributions, this study has some limitations, which should be addressed in future research. First, as a result of data collection procedure, the proportion of female participants in Study 1 is way larger than male participants and all of them are younger than 35 years. This generate a concern in terms of representativeness when interpreting the results. However, Study 2, which included more balanced proportion of gender and age groups, also yields the same results. This confirms that the results from Study 1 can be replicated in a different context with a more representative sample. Nevertheless, future studies applying this model in different contexts will further verify the results. Second, this study uses subjective measurements of VR presence and enjoyment, which are experienced during VR, based on participants' evaluation after VR experience. Therefore, it relies on participants' recall of the VR experience. Even though participants responded to the questionnaire right after the experience, responses may still contain inaccurate information and biases. Future research should include objective measurements of presence and enjoyment, such as using sensors and psychophysiological analysis, to eliminate potential bias. Third, while in Study 1 different groups of participants used different devices and stimuli, the small number of participants using Samsung Gear VR compared to Google Cardboard does not allow for testing a meaningful comparison. Experimental studies testing the model with devices with varying levels of immersive capabilities and content with varying levels of affordances (e.g., stimulating different types of action and interaction) will add to better understand how presence comes about. The same goes for differences between participants with prior experience and those without, in order to explicate the role of novelty in effectiveness of VR experience. Last, this study focuses mainly on the consequences of presence, but not on its antecedents. Future studies focusing on antecedents and different correlates of VR presence will be helpful to inform the design of VR for tourism and better predict the resulting visit intention.

Finally, the results of this study provide destination marketers, travel agents, and other tourism suppliers with validation that VR can be an effective marketing tool. As personal VR devices becomes

617 more accessible to a wider group of consumers, investing in VR technology for tourism marketing can be
618 a good strategy. However, as various tourism destinations have started to embrace this technology, it is
619 important to develop an overall VR experience that is presence-inducing and all around enjoyable in order
620 to make sure the user experience with VR will translate into stronger interest in the tourism destination.
621 The key is to generate VR content that can transport participants to the destination, heighten the senses of
622 being in the virtual environment and suspend sensory stimuli from the actual physical environment.
623

References

- Ahn, S.J., Le, A.M.T., & Bailenson, J. (2013). The effect of embodied experiences on self-other merging, attitude, and helping behavior. *Media Psychology*, 16, 7-38.
- Ajzen, I., & Fishbein M. (1977). Attitude-behavior relations: A theoretical analysis and review of empirical research. *Psychological Bulletin*, 84(5), 888-918.
- Anderson, J.C., and Gerbing, D.W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin* 103(3): 411-423.
- Bailenson, J.N., Yee, N., Blascovich, J., Beall, A.C., Lundblad, N., & Jin, M. (2008). The use of immersive virtual reality in the learning sciences: Digital transformations of teachers, students, and social context. *The Journal of the Learning Sciences*, 17, 102-141.
- Bonetti, F., Warnaby G., & Quinn L. (2018). Augmented reality and virtual reality in physical and online retailing: A review, synthesis and research agenda. In: Jung T., tom Dieck M. (eds) *Augmented reality and virtual reality* (pp. 119-132). Progress in IS. Springer, Cham.
- Burke, R. (1996). Virtual shopping: Breakthrough in marketing research. *Harvard Business Review*, 74, 120-131.
- Byond (2016). A Guide to Tethered and Untethered VR Headsets. Available at: <http://www.byondvr.com/guide-to-tethered-untethered-vr-headsets/>
- Bystrom, K.-E., Barfield, W., & Hendrix, C. (1999). A conceptual model of the sense of presence in virtual environments. *Presence: Teleoperators and Virtual Environments*, 8(2), 241-244.
- Carlin, A.S., Hoffman, H.G., & Weghorst, S. (1997). Virtual reality and tactile augmentation in the treatment of spider phobia: A case report. *Behavioral Research Theory*, 35(2), 153-158.
- Castro, J. C., Quisimalin, M., Cordova, V. H., Quevedo, W. X., Gallardo, C., Santana, J., & Andaluz, V. H. (2017). Virtual reality on e-Tourism. In *International Conference on Information Theoretic Security* (pp. 86-97). Springer, Singapore.
- Cheong, R. (1995). The virtual threat to travel and tourism. *Tourism Management* 16(6), 417-422.

649 Choi, Y.K., Miracle, G.E., & Biocca, F. (2001). The effects of anthropomorphic agents on advertising
650 effectiveness and the mediating role of presence. *Journal of Interactive Advertising*, 2(1), 19-32.

651 Davis, F.D., Bagozzi, R.P., & Warshaw, P.R. (1992). Extrinsic and intrinsic motivation to use computers
652 in the workplace. *Journal of Applied Social Psychology*, 11, 1111-1132.

653 Dewailly, J.-M. (1999). Sustainable tourist space: From reality to virtual reality? *Tourism Geographies*,
654 1(1), 41-55.

655 Diemer, J., Alpers, G.W., Peperkorn, H. M., Shibani, Y., & Mühlberger, A. (2015). The impact of perception
656 and presence on emotional reactions: a review of research in virtual reality. *Frontiers in*
657 *Psychology*, 6, 26. DOI: 10.3389/fpsyg.2015.00026

658 Ding, L., Velicer, W.F., and Harlow, L.L. (1995). Effects of estimation methods, number of indicators per
659 factor, and improper solutions on structural equation modeling fit indices. *Structural Equation*
660 *Modeling* 2(2): 119-144.

661 Draper, J.V., Kaber, D.B., & Usher, J.M. (1998). Telepresence. *Human Factors*, 40, 354–375.

662 eMarketer (2015). Virtual Reality Interest Highest among Gen Z.
663 <http://www.emarketer.com/Article/Virtual-Reality-Interest-Highest-Among-Gen-Z/1013295>

664 Fox, J., Bailenson, J.N., & Binney, J. (2009). Virtual experiences, physical behaviors: The effects of
665 presence on imitation of an eating avatar. *Presence: Teleoperators & Virtual Environments*, 18(4),
666 294-303.

667 Fox, J., Christy, K.R., & Vang, M.H. (2014). The experience of presence in persuasive virtual
668 environments. In Riva, G., Waterworth, J. & Murray, D. (Eds.), *Interacting with presence: HCI*
669 *and the sense of presence in computer-mediated environments* (pp.164-178). DeGruyter Open.
670 DOI: 10.2478/9783110409697.11

671 Gefen, D., Straub, D.W., and Boudreau, M. (2000). Structural equation modeling and regression:
672 Guidelines for research practice. *Communications of the Association of Information Systems*, 4,
673 1-78.

674 Gerrig, R.J. (1993). *Experiencing Narrative Worlds: On the Psychological Activities of Reading*. New
675 Haven, CT: Yale University Press.

676 Gibson, C. (2009). Geographies of tourism: Critical research on capitalism and local livelihoods. *Progress*
677 *in Human Geography*, 33(4), 527-534.

678 Gibson A., & O’Rawe M. (2018). Virtual reality as a travel promotional tool: Insights from a
679 consumer travel fair. In: Jung T., tom Dieck M. (eds) *Augmented Reality and Virtual Reality*
680 (pp. 93-107.). *Progress in IS*. Springer, Cham.

681 Girard, B., Turcote, V., Bouchard, S., & Girard, B. (2009). Crushing virtual cigarettes reduces tobacco
682 addiction and treatment discontinuation. *CyberPsychology and Behavior*, 12(5), 477-483.

683 Glasman, L.R., & Albarracín, D. (2006). Forming attitudes that predict future behavior: A meta-analysis
684 of the attitude-behavior relation. *Psychological Bulletin*, 132(5), 778-822.

685 Global Web Index (2016). 4 in 10 16-34s interested in VR. [http://www.globalwebindex.net/blog/4-in-10-](http://www.globalwebindex.net/blog/4-in-10-16-34s-interested-in-vr)
686 [16-34s-interested-in-vr](http://www.globalwebindex.net/blog/4-in-10-16-34s-interested-in-vr)

687 Govers, R., Go, F.M., and Kumar, K. (2007). Promoting tourism destination image. *Journal of Travel*
688 *Research*, 46 (1), 15-23

689 Guttentag, D.A. (2010). Virtual reality: Applications and implications for tourism. *Tourism Management*
690 30(5), 637–651.

691 Hair, J.F. Jr., Black, W.C., Babin, B.J., and Anderson, R.E. (2010). *Multivariate Data Analysis*. 7th
692 Edition. Upper Saddle River, NJ: Prentice Hall.

693 Heeter, C. (1992). Being there: The subjective experience of presence. *Presence: Teleoperators and*
694 *Virtual Environments*, 1(2), 262-271.

695 Williams, P., & Hobson, J. P. (1995). Virtual reality and tourism: fact or fantasy? *Tourism Management*,
696 16(6), 423-427.

697 Hodges, L.F., Kooper, R., Meyer, T.C., Rothbaum, B.O., Opdyke, D., de Graaff, J.J., Williford, J.S., and
 698 North, M.M. (1995). Virtual environments for treating the fear of heights. *Computer*, 28(7), 27-
 699 34.
 700 Hofer, M., Wirth, W., Kuehne, R., Schramm, H., & Sacau, A. (2012). Structural equation modeling of
 701 spatial presence: The influence of cognitive processes and traits. *Media Psychology*, 15(4), 373-
 702 395.
 703 Hu, L., Bentler, P.M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional
 704 criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1),
 705 1-55.
 706 Huang, Y.C., Backman, K.F., Backman, S.J., & Chang, L.L (2016). Exploring the implications of virtual
 707 reality technology in tourism marketing: An integrated research framework. *International Journal*
 708 *of Tourism Research*, 18, 116-128.
 709 Huang, S., & Hsu, C.H.C. (2009). Effects of travel motivation, past experience, perceived constraint, and
 710 attitude on revisit intention. *Journal of Travel Research*, 48(1), 29-44.
 711 Hughes, G.D. (1967). Selecting scales to measure attitude change. *Journal of Marketing Research*, 4(1),
 712 85-87.
 713 Hyun, M.Y., & O'Keefe, R.M. (2012). Virtual destination image: Testing a telepresence model. *Journal*
 714 *of Business Research*, 65, 29-35.
 715 Jung, T. H., Lee, H., Chung, N., & tom Dieck, M. C. (2018). Cross-cultural differences in adopting
 716 mobile augmented reality at cultural heritage tourism sites. *International Journal of Contemporary*
 717 *Hospitality Management*, 30(8).
 718 Keng, C.J., & Lin, H.Y. (2006). Impact of telepresence levels on internet advertising effects.
 719 *CyberPsychology & Behavior*, 9(1), 82-94.
 720 Kim, T., & Biocca, F. (1997). Telepresence via television: Two dimensions of telepresence may have
 721 different connections to memory and persuasion. *Journal of Computer-Mediated Communication*,
 722 3(2), n.p.

Kim, M.S., & Hunter, J.E. (1993). Relationships among attitudes, behavioral intentions, and behavior: A meta-analysis of past research, Part 2. *Communication Research*, 20(3), 331-364.

Klein, L.R. (2003). Creating virtual product experiences: The role of telepresence. *Journal of Interactive Marketing*, 17(1), 41-55. DOI: 10.1002/dir.10046

Kozak, M., and Rimmington, M. (2000). Tourist satisfaction with Mallorca, Spain, as an off-season holiday destination. *Journal of Travel Research*, 38(3), 260-269.

Lam, T., & Hsu, C.H.C. (2004). Theory of Planned Behavior: Potential travelers from China. *Journal of Hospitality & Tourism Research*, 28(4), 463-482.

Larsson, P., Västfjäll, D., & Kleiner, M. (2001). The actor-observer effect in virtual reality presentations. *CyberPsychology & Behavior*, 4(2), 239-246.

Lee, K. M. (2004). Presence, explicated. *Communication Theory*, 14(1), 27-50.

Lee, E.A.-L., Wong, K.W., & Fung, C.C. (2010). How does desktop virtual reality enhance learning outcomes? A structural equation modeling approach. *Computers and Education*, 55(4), 1424-1442.

Leonardis, D., Frisoli, A., Barsotti, M., Carrozzino, M., & Bergamasco, M. (2014). Multisensory feedback can enhance embodiment within an enriched virtual walking scenario. *Presence: Teleoperators and Virtual Environments*, 23(3), 253-266.

Li, H., Daugherty, T., & Biocca, F. (2001). Characteristics of virtual experience in electronic commerce: A protocol analysis. *Journal of Interactive Marketing*, 15(3), 13-30.

Li, H., Daugherty, T., & Biocca, F. (2002). Impact of 3-D advertising on product knowledge, brand attitude, and purchase intention: The mediating role of presence. *Journal of Advertising*, 31(3), 43-57.

Lombard, M., & Ditton, T. (1997). At the heart of it all: The concept of presence. *Journal of Computer-Mediated Communication*, 3(2), 0. DOI: 10.1111/j.1083-6101.1997.tb00072.x

Lombard, M., & Snyder-Duch, J. (2013). Interactive advertising and presence: A framework. *Journal of Interactive Advertising*, 1(2), 56-65.

749 MacCallum, R.C., Browne, M.W., and Sugawara, H.M. (1996). "Power Analysis and Determination of
750 Sample Size for Covariance Structural Modeling." *Psychological Methods* 17: 23-41.

751 Mania, K., & Chalmers, A. (2001). The effects of levels of immersion on memory and presence in virtual
752 environments: A reality centered approach. *CyberPsychology & Behavior*, 4(2), 247-264.

753 Mikropoulos, T.A., and Strouboulis, V (2004). Factors that influence presence in educational virtual
754 environments. *Cyberpsychology & Behavior*, 7(5), 582–591.

755 Moon, J., and Kim, Y. (2001). Extending the TAM for a World-Wide-Web context. *Information and*
756 *Management*, 38, 217-230.

757 Moorhouse N., tom Dieck M.C., Jung T. (2018) Technological Innovations Transforming the Consumer
758 Retail Experience: A Review of Literature. In: Jung T., tom Dieck M. (eds) *Augmented Reality*
759 *and Virtual Reality*. Progress in IS. Springer, Cham, 133-143.

760 Muthén, L.K., and B.O. Muthén. 1998-2012. *Mplus User's Guide*. Seventh Edition. Los Angeles, CA:
761 Muthén & Muthén.

762 Nicoletta, R., and Servidio, R. (2012). Tourists' opinions and their selection of tourism destination
763 images: An affective and motivational evaluation. *Tourism Management Perspectives*, 4, 19-27.

764 Nowak, K.L., Krcmar, M., & Farrar, K.M. (2008). The causes and consequences of presence: Considering
765 the influence of violent video games on presence and aggression. *Presence: Teleoperators and*
766 *Virtual Environments*, 17(3), 256-268.

767 Nunnally, J.C. (1967). *Psychometric Theory*. New York, NY: McGraw-Hill.

768 Phillips, W. J., Asperin, A., & Wolfe, K. (2013). Investigating the effect of country image and subjective
769 knowledge on attitudes and behaviors: U.S. Upper Midwesterners' intentions to consume Korean
770 Food and visit Korea. *International Journal of Hospitality Management*, 32, 49-58.

771 Radde, B. (2017). *Digital Guest Experience: Tools to help hotels to manage and optimize the digital guest*
772 *experience*. Hamburg: Tredition.

773 Riva, G., Mantovani, F., & Gaggioli, A. (2004). Presence and rehabilitation: Toward second-generation
774 virtual reality applications in neuropsychology. *Journal of NeuroEngineering and Rehabilitation*,
775 1, 9. DOI: 10.1186/1743-0003-1-9

776 Rosenberg, R.S., Baughman, S.L., & Bailenson, J.N. (2013). Virtual Superheroes: Using superpowers in
777 virtual reality to encourage prosocial behavior. *PLOS One*, 8(1), 1-9.

778 Ryu, K., & Han, H. (2010). Predicting tourists' intention to try local cuisine using a Modified Theory of
779 Reasoned Action: The case of New Orleans. *Journal of Travel & Tourism Marketing*, 27(5), 491-
780 506.

781 Sadowski, W., and Stanney, K. (2002). Presence in virtual environments. In: Stanney, K.M. (ed.),
782 Handbook of Virtual Environments: Design, Implementation and Applications (pp. 791–806).
783 Mahwah, NJ: Lawrence Erlbaum.

784 Schubert, T., Friedmann, F., & Regenbrecht, H. (2001). The experience of presence: Factor analytic
785 insights. *Presence: Teleoperators and Virtual Environments*, 10(3), 266-281.

786 Schuemie, M., Van Der Straaten, P., Krijn, M., & Van Der Mast, C.A.P.G. (2001). Research on presence
787 in virtual reality: A survey. *CyberPsychology & Behavior*, 4(2), 183-201.

788 Schumacker, R. E., & Lomax, R. G. (2004). A beginner's guide to structural equation modeling, Second
789 edition. Mahwah, NJ: Lawrence Erlbaum Associates.

790 Seth A. K., Suzuki K., Critchley H. D. (2012). An interoceptive predictive coding model of conscious
791 presence. *Frontiers in Psychology*, 2, 395. DOI: 10.3389/fpsyg.2011.00395

792 Shafer, D.M., Carbonara, C.P., & Popova, L. (2011). Spatial presence and perceived reality as predictors
793 of motion-based video game enjoyment. *Presence: Teleoperators and Virtual Environments*,
794 20(6), 591-619.

795 Sheridan, (1999). Descartes, Heidegger, Gibson, and God: Toward an eclectic ontology of presence.
796 *Presence: Teleoperators and Virtual Environments*, 8(5), 551-559.

797 Slater, M. (1999). Measuring presence: A response to the Witmer and Singer Presence questionnaire.
798 *Presence: Teleoperators and Virtual Environments*, 8(5), 560–566.

799 Slater, M., and Steed, A. (2000) A virtual presence counter. *Presence: Teleoperators and Virtual*
800 *Environments*, 9(5), 413-434.

801 Slater, M. & Usoh, M. (1993). Representations systems, perceptual position, and presence in immersive
802 virtual environments. *Presence: Teleoperators and Virtual Environments*, 2(3), 221-233.

803 Slater, M., Usoh, M., & Steed, A. (1994). Depth of presence in virtual environments. *Presence:*
804 *Teleoperators and Virtual Environments*, 3, 130–144.

805 Slater, M., & Wilbur, S. (1997). A framework for immersive virtual environments (FIVE): Speculations
806 on the role of presence in virtual environments. *Presence: Teleoperators and Virtual*
807 *Environments*, 6(6), 603–616.

808 Smith, R.E., & Swinyard, W.R. (1983). Attitude-behavior consistency: The impact of product trial versus
809 advertising. *Journal of Marketing Research*, 20(3), 257-267.

810 Steenjacobsen, J.K. (2001). Nomadic tourism and fleeting place encounters: Exploring different aspects
811 of sightseeing. *Scandinavian Journal of Hospitality and Tourism*, 1(2), 99-112.

812 Steuer, J.S. (1992). Defining virtual reality: dimensions determining telepresence. *Journal of*
813 *Communication* 42, 73–93.

814 Suh, K.-S., & Lee, Y.E. (2005). The effects of virtual reality on consumer learning: An empirical
815 investigation. *MIS Quarterly*, 29(4), 673-697.

816 Sundar, S.S., & Kim, J. (2005). Interactivity and persuasion: Influencing attitudes with information and
817 involvement. *Journal of Interactive Marketing*, 5(2), 5-18.

818 Sussmann, S., & Vanhegan, H. (2000). Virtual reality and the tourism product: Substitution or
819 complement? In Hansen, H.R., Bichler, M., & Mahrer, H. (Eds.), *Proceedings of the 8th European*
820 *Conference on Information Systems*, 2, 1077-1083.

821 Sylaiou, S., Mania, K., Karoulis, A. & White, M. (2010). Exploring the relationship between presence
822 and enjoyment in a virtual museum. *International Journal of Human-Computer Studies*, 68(5),
823 243-253.

824 Thomas, W. A. Carey, S., 2005. Actual/Virtual Visits: What are the Links? International Conference on
825 Museums and the Web 2005, Vancouver, British Columbia, Canada.
826 <http://www.archimuse.com/mw2005/papers/thomas/thomas.html>

827 Tooke, N., and Baker, M. (1996). Seeing is believing: The effect of film on visitor numbers to screened
828 locations, *Tourism Management*, 17(2), 87–94.

829 Tromp, P. (2017). How Virtual Reality Will Revolutionize the Hospitality Industry. Available at:
830 <https://www.hospitalitynet.org/opinion/4080737.html>

831 van der Heijden, H. (2003). Factors influencing the usage of websites: The case of a generic portal in the
832 Netherlands, *Information & Management* 40(6), 541-549.

833 Vorderer, P., Wirth, W., Gouveia, F.R., Biocca, F., Saari, T., Jäncke, F., ... & Jäncke, P. (2004). MEC
834 Spatial Presence Questionnaire (MEC-SPQ): Short documentation and instructions for
835 application. Report to the European Community, Project Presence: MEC (IST-2001-37661).
836 Available from <http://www.ijk.hmt-hannover.de/presence>.

837 Vora, J., Nair, S., Gramopadhye, A.K., Duchowski, A.T., Melloy, B.J., and Kanki, B. (2002). Using
838 virtual reality technology for aircraft visual inspection training: Presence and comparison studies.
839 *Applied Ergonomics*, 33, 559-570.

840 Weibel, D., Wissmath, B., Habegger, S., Steiner, Y., & Groner, R. (2008). Playing online games against
841 computer- vs. human-controlled opponents: Effects on presence, flow, and enjoyment. *Computers*
842 *in Human Behavior*, 24, 2274-2291.

843 Williams, P. (2006). Tourism and hospitality marketing: fantasy, feeling and fun. *International Journal of*
844 *Contemporary Hospitality Management* 29(2): 482-495.

845 Williams, P., and Hobson, J.S.P. (1995). Virtual reality and tourism: fact or fantasy? *Tourism*
846 *Management* 16(6), 423-427.

847 Wirth, W., Hartmann, T., Böcking, S., Vorderer, P., Klimmt, C., Schramm, H., ... & Jäncke, P. (2007). A
848 process model of the formation of spatial presence experiences. *Media Psychology*, 9, 493-525.

849 Witmer, B.J., & Singer, M.J. (1998). Measuring presence in virtual environments: A presence
850 questionnaire. *Presence: Teleoperators and Virtual Environments*, 7(3), 225-240.

851 Zahorik, P., & Jenison, R.L. (1998). Presence as being-in-the-world. *Presence: Teleoperators and Virtual*
852 *Environments*, 7(1), 78-89.

853 Zarzuela, M.M., Pernas, F.J.D., Calzón, S.M., Ortega, D.G., & Rodríguez, M.A. (2013). Educational
854 tourism through a virtual reality platform. *Procedia Computer Science* 25, 382-388.

855 Zhang, H., & Lei, S. L. (2012). A structural model of residents' intention to participate in ecotourism: The
856 case of a wetland community. *Tourism Management*, 33(4), 916-925.