

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

20 **Introduction**

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

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

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

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

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

80

81 **Virtual Reality and Tourism**

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

98 is attached to the PC via a cable. This usually allows for superior quality graphics as well as real-time
99 tracking and interaction. Established examples include the HTC Vive, Oculus Rift, and OSVR (Byond,
100 2016).

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

111 == Table 1 about here ==

112

113 **Defining and Measuring Presence in Virtual Reality**

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

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

124 literature, Lombard and Ditton (1997) summarize six explications of presence: presence as social
125 richness, realism, transportation, immersion, social actor within medium, and medium as social actor (Lee
126 2004; Schuemie et al. 2001). Schuemie et al. (2001) find that presence as transportation, which is the
127 sensation of being transported to the virtual environment, dominates the discussion in presence literature.
128 Heeter (1992) suggests three types of presence: personal, social, and environmental presence, each
129 corresponds to the sense of self and encountered objects as being part of the interactive virtual
130 environment. Similarly, Lee (2004) proposes three types of presence: physical presence (i.e., virtual
131 physical objects experienced as actual physical objects), social presence (i.e., virtual social actors
132 experienced as actual social actors), and self presence (i.e., virtual self/selves experienced as actual
133 self/selves).

134 Kim and Biocca (1997) operationalize the transportation metaphor of presence with two
135 measures: arrival, which describes a feeling of being present in the virtual environment, and departure, a
136 feeling of separation from the physical environment. These were conceptualized following Gerrig's
137 (1993) theory that through a medium, a user is first transported, then arrives at a mediated environment,
138 and finally returns to the original physical environment. Kim and Biocca (1997) further argue that arrival
139 and departure are not exactly equal and may exert different influence on the user's memory and/or
140 attitude change (Kim & Biocca 1997). Slater and his colleagues (1993; 1994) propose a navigation
141 metaphor of presence in virtual environments, which includes the user's sense of being there, the extent to
142 which the VR experience becomes more real than everyday experience, and the locality of the virtual
143 environment, in that users perceive it as a 'place' instead of set of images (Slater and Wilbur 1997). Slater
144 (1999) suggest that experiencing-as-a-place is the meaning of presence: people are there, they respond to
145 what is there, and they remember it as a place. It is important to note that Slater et al.'s (1993; 1994)
146 measurement of presence, as explicated in SUS Questionnaire, include the state post VR experience,
147 namely how a user remembers the virtual environment, while others focus only on the mental state during
148 the VR experience. In fact, numerous studies regard memory of (objects within) the virtual environment
149 as a consequence of presence (e.g., Keng and Lin 2006; Kim and Biocca 1997).

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

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

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

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

197 == Table 2 about here ==

198

199 **Consequences of Presence**

200 Presence is the key feature for effective VR applications designed for persuasion as it may be a causal
201 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.

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

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

237 Importantly, VR studies substantiate its persuasive role, suggesting that the subjective experience
238 of presence in VR can translate into real world attitude and induce behavioral change (Fox, Christy, and
239 Vang 2014). Indeed, VR applications have been designed for various persuasive goals, such as health
240 behavior change (Fox, Bailenson, and Binney 2009; Girard, Turcotte Bouchard, and Girard 2009;
241 Ijsselsteijn et al. 2006), promotion of prosocial behavior (Ahn, Le, and Bailenson 2013; Gillath, McCall,
242 Shaver, and Blascovich 2008; Rosenberg, Baughman, and Bailenson 2013), advertising and e-commerce
243 (Keng and Lin 2006; Li, Daugherty, and Biocca 2001; 2002; Suh and Lee 2005), etc. These studies found
244 that the heightened sense of realism during VR experience leads to attitude change and the effect is
245 transferred into the physical world, which is manifested in positive behavioral change. In marketing
246 literature, higher levels of presence of various advertisements communicated in computer-mediated
247 environments have been found to increase subject recall and recognition (Keng and Lin 2006), leading to
248 more positive attitude and liking toward the ad and the advertised product (Klein 2003; Sundar and Kim
249 2005). In tourism, VR provides tangible images of and experiences with the destination, inducing the
250 construction of a mental image about destination attributes (i.e., destination image) and its affordances
251 (Govers, Go, and Kumar 2007; Nicoletta and Servidio 2012), which can be a manifest of spatial presence.
252 Previous studies suggest that the ability to visit a tourism destination through VR may assist tourists in
253 developing a set of realistic expectations of tourism experience with the destination (Cheong 1995;

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

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

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

262 Attitude is a central concept in social psychology as well as consumer behavior literature as it is
263 generally accepted that attitude predicts behavior, although the degree of attitude – behavior consistency
264 may differ in various situations (e.g., Ajzen and Fishbein 1977; Glasman and Albarracín 2006; Smith and
265 Swinyard 1983). Further, based on the Belief–Attitude–Intention–Behavior hierarchy (Fishbein and Ajzen
266 1975), the relationship between attitude and (actual) behavior is mediated by behavioral intention (Kim
267 and Hunter 1993). The link between attitude toward tourism destination (with its characteristics) and
268 behavioral intention to visit the destination or to participate in tourism-related activities has been
269 supported in previous studies (e.g., Huang and Hsu 2009; Lam and Hsu 2004; Phillips, Asperin, and
270 Wolfe 2013; Ryu and Han 2010). Researching Beijing tourists’ revisit intention to Hong Kong, Huang
271 and Hsu (2009) identified significant influence of attitude on intention. Similar results were identified by
272 Lam and Hsu (2004). Phillips, Asperin and Wolfe (2013) found significant influence of attitude toward
273 consuming Korean cuisine on intention to visit Korea and to try Korean cuisine. Similar results were
274 identified by Ryu and Han (2010) in New Orleans. As supported by previous research, it can be
275 suggested that attitude toward tourism destination as a result of VR experience is a predictor of visitation
276 intention to the destination.

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

278

279

280 **Research Design**

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

291 == Figure 1 about here ==

292

293 *Measurement Items*

294 *VR Presence.* In order to assess presence in VR experience, subjective measures of spatial presence as
295 conceptualized and operationalized in Wirth et al. (2007) and Vorderer et al. (2004) were utilized.
296 Following the research framework, the main interest in this study is to assess presence as the subjective
297 mental states of being in and interacting with the virtual environment during the VR experience. Two
298 constructs from MEC Spatial Presence Questionnaire (MEC-SPQ; Vorderer et al. 2004): Self-Location
299 and Possible Actions scales, each measured with four items, were included in the questionnaire. The
300 measurement items were presented in a 5-point Likert-type scale with “Strongly disagree” – “Strongly
301 agree” anchored statements (see Appendix A for a list of measurement items). VR presence was
302 operationalized as a second-order variable, consisting of the two first-order constructs.

303 *VR Enjoyment.* In order to measure VR enjoyment, this research refers to Davis, Bagozzi, and Warshaw's
304 (1992) definition of perceived enjoyment, which is the extent to which the activity of using VR
305 technology to experience tourism destination is enjoyable in its own right. Measurement items from

306 previous research on technology acceptance and use (e.g., Moon and Kim 2001; Van der Heijden 2003)
307 were consulted. As a result, a 5-item perceived enjoyment scale was utilized. The items were presented a
308 5-point Likert-type scale with “Strongly disagree” – “Strongly agree” anchored statements.

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

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

321

322 *Data Analysis*

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

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

333

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

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

352 == Table 3 about here ==

353

354 *Findings*

355 The results from the analysis suggest that the measurement model is adequate based on several criteria.

356 As presented in Table 4, all factor loadings are above .6 and the average variance extracted (AVE) values

357 of all latent variables are above the cutoff point of .5 (Hair, Black, Babin, and Anderson 2010). Therefore,
358 convergent validity was supported. The composite reliability (CR) values of all latent variables are above
359 the cutoff criteria of .7 (Hair et al. 2010). Further, the values of square roots of AVE of all latent
360 variables, which are presented in the diagonal, are larger than the correlations between the corresponding
361 variable and any other variables (see Table 5). This indicates that discriminant validity is supported.
362 Further, the fit indices are above the thresholds of .9 (Hu and Bentler 1999): Comparative Fit Index (CFI)
363 = .963 and Tucker Lewis Index (TLI) = .957. The value of Root Mean Square Error of Approximation
364 (RMSEA = .056) indicates good model fit (Hu and Bentler 1999) and the value of Standardized Root
365 Mean Square Residual (SRMR = .047) is below the threshold of .09 (Hu and Bentler 1999). These criteria
366 suggest the adequacy of the measurement model.

367 == Table 4 about here ==

368 == Table 5 about here ==

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

380 == Figure 2 about here ==

381

382 *Discussion*

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

397 == Table 6 about here ==

398 == Table 7 about here ==

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

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

414

415 **Study 2. Stimuli: Lake District National Park, UK**

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

430 == Table 8 about here ==

431

432 *Findings*

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

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

442 == Table 9 about here ==

443 == Table 10 about here ==

444 The structural model is illustrated in Figure 3. The paths from VR Presence as a second-order
445 variable to its two first-order variables are significant (Presence → Self-Location = .838, $p = .000$;
446 Presence → Possible Actions = .833, $p = .000$). Presence has a significant positive effect on Enjoyment of
447 VR participation ($\beta = .519$; $p = .000$; $R^2 = .270$; $p = .000$), providing support for H1. Both Presence and
448 Enjoyment have significant positive effects on attitude change (Presence → Attitude Change = .567, $p =$
449 $.000$; Enjoyment → Attitude Change = .116, $p = .000$; $R^2 = .403$; $p = .000$), supporting H2 and H3. This
450 indicates that 40% variation in the Post VR attitude change can be attributed to variations in VR presence
451 and enjoyment. Finally, a significant positive effect of Attitude Change on Intention ($\beta = .305$; $p = .000$)
452 was also identified ($R^2 = .093$; $p = .000$), providing support for H4. The low R^2 value, however, indicates
453 that only extremely small portion of variation in visit intention to the national park (less than 10%) can be
454 explained by Post VR attitude change.

455 == Figure 3 about here ==

456

457 *Discussion*

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

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

471 == Table 11 about here ==

472 == Table 12 about here ==

473 From the results, it can be observed that the Satorra-Bentler corrected Chi-square value is quite
474 large (Chi-square = 673.059; df = 146), which is likely due to large sample size ($N = 724$). As suggested
475 in previous research, with large sample size, the chi-square values will be inflated (statistically
476 significant), thus might erroneously implying a poor data-to-model fit (see Schumacker and Lomax
477 2004). However, the relative Chi-Square value (Chi Square / degree of freedom ratio) in this study is
478 smaller than the suggested ratio of 5:1 as a rule of thumb for a reasonable fit (Marsh and Hocevar 1985;
479 Schumacker and Lomax, 2004).

480

481 *An Alternative Model*

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

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

498 == Figure 4 about here ==

499

500 **General Discussion**

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

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

517 Secondly, the significant effect of presence on enjoyment of VR confirms the positive value of
518 VR as a hedonic experience. This is consistent with Shafer et al. (2011), Sylaiou et al. (2010), and Weibel
519 et al. (2008). However, this study shows the direct effect that the sense being in the tourist city or the
520 national park has on the feeling of pleasure while doing the virtual walkthrough. Meanwhile, Weibel et al.
521 (2008) found the effect of presence on enjoyment to be mediated by the perceived state of flow in the
522 context of playing video games. In the context of virtual museum, Sylaiou et al. (2008) only demonstrated
523 positive correlations between presence and enjoyment. Therefore, this study contributes to a better
524 understanding of the causal relationship between the two experiences in VR that involves interactions
525 with tourism destinations, with enjoyment being the consequence of the sense of presence.

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

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

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

552

553 **Conclusion and Implication**

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

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

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

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

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

615 Finally, the results of this study provide destination marketers, travel agents, and other tourism
616 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

624 **References**

- 625 Ahn, S.J., Le, A.M.T., & Bailenson, J. (2013). The effect of embodied experiences on self-other merging,
626 attitude, and helping behavior. *Media Psychology*, 16, 7-38.
- 627 Ajzen, I., & Fishbein M. (1977). Attitude-behavior relations: A theoretical analysis and review of
628 empirical research. *Psychological Bulletin*, 84(5), 888-918.
- 629 Anderson, J.C., and Gerbing, D.W. (1988). Structural equation modeling in practice: A review and
630 recommended two-step approach. *Psychological Bulletin* 103(3): 411-423.
- 631 Bailenson, J.N., Yee, N., Blascovich, J., Beall, A.C., Lundblad, N., & Jin, M. (2008). The use of
632 immersive virtual reality in the learning sciences: Digital transformations of teachers, students,
633 and social context. *The Journal of the Learning Sciences*, 17, 102-141.
- 634 Bonetti, F., Warnaby G., & Quinn L. (2018). Augmented reality and virtual reality in physical and
635 online retailing: A review, synthesis and research agenda. In: Jung T., tom Dieck M. (eds)
636 Augmented reality and virtual reality (pp. 119-132). Progress in IS. Springer, Cham.
- 637 Burke, R. (1996). Virtual shopping: Breakthrough in marketing research. *Harvard Business Review*, 74,
638 120-131.
- 639 Byond (2016). A Guide to Tethered and Untethered VR Headsets. Available at:
640 <http://www.byondvr.com/guide-to-tethered-untethered-vr-headsets/>
- 641 Bystrom, K.-E., Barfield, W., & Hendrix, C. (1999). A conceptual model of the sense of presence in
642 virtual environments. *Presence: Teleoperators and Virtual Environments*, 8(2), 241-244.
- 643 Carlin, A.S., Hoffman, H.G., & Weghorst, S. (1997). Virtual reality and tactile augmentation in the
644 treatment of spider phobia: A case report. *Behavioral Research Theory*, 35(2), 153-158.
- 645 Castro, J. C., Quisimalin, M., Cordova, V. H., Quevedo, W. X., Gallardo, C., Santana, J., & Andaluz, V.
646 H. (2017). Virtual reality on e-Tourism. In *International Conference on Information*
647 *Theoretic Security* (pp. 86-97). Springer, Singapore.
- 648 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.

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

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

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

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

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

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

734 Lee, E.A.-L., Wong, K.W., & Fung, C.C. (2010). How does desktop virtual reality enhance learning
735 outcomes? A structural equation modeling approach. *Computers and Education*, 55(4), 1424-
736 1442.

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

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

742 Li, H., Daugherty, T., & Biocca, F. (2002). Impact of 3-D advertising on product knowledge, brand
743 attitude, and purchase intention: The mediating role of presence. *Journal of Advertising*, 31(3),
744 43-57.

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

747 Lombard, M., & Snyder-Duch, J. (2013). Interactive advertising and presence: A framework. *Journal of*
748 *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.