The current issue and full text archive of this journal is available on Emerald Insight at:
https://www.emerald.com/insight/0959-6119.htm

Impact of virtual reality experiences on destination image and visit intentions: the moderating effects of immersion, destination familiarity and sickness

Received 29 September 2023
Revised 24 December 2023
22 March 2024
17 June 2024
Accepted 18 June 2024

Rafael Anaya-Sánchez, Francisco Rejón-Guardia and Sebastian Molinillo
Department of Business Management, University of Malaga, Malaga, Spain and Andalusian Institute for Research and Innovation in Tourism, University of Granada, Malaga, Spain

Abstract

Purpose – The aims of this study are to explore how the experience of "visiting" a destination in a virtual reality (VR) technology environment influences destination image and visit intentions and to evaluate the moderating effects of the immersion level of the technology, destination familiarity and VR sickness.

Design/methodology/approach – An empirical study was conducted in a laboratory, using two types of immersive VR technologies. The data, collected through a personal survey of 144 participants, were analysed using PLS-SEM.

Findings – The results indicated that sense of presence is a crucial determinant of the user's experience, which in turn contributed positively to destination image and visit intentions. VR sickness was observed to moderate the relationship between sense of presence and user experience, especially at low immersion levels. Destination familiarity did not influence the model's relationships.

The authors express their gratitude to the editors and reviewers for their constructive feedback during the revision process. They would also like to acknowledge all the participants who took part in the study, and the infrastructure and support of the Consumer Behaviour Lab (LICCO), located in the Faculty of Economics and Business Management of the University of Malaga.

Funding: This research was funded by the Plan for Research, Knowledge Transfer and Dissemination of the University of Malaga (Grant numbers: B3-2021/01 and B3-2023/21 MP-ECSTIA) and by the project "Chronic Emergencies and Ecosocial Transformation in Turistified Litoral Spaces" (PID2022-137648OB-C22) financed by the Spanish Ministry of Science and Innovation (National Plan for R + D + i), the Spanish State Research Agency and the European Regional Development Fund (ERDF). Funding for open access charge was provided by Universidad de Málaga/CBUA.

Declarations of interest: The authors have no relevant financial or non-financial interests to disclose.

Authors contributions: All authors contributed to the study conception, design, material preparation, data collection and analysis. The first draft of the manuscript was written by all authors, and all of them commented on previous versions of the manuscript. All authors read and approved the final manuscript.

International Journal of Contemporary Hospitality Management
Emerald Publishing Limited
0959-6119
DOI 10.1108/IJCHM-09-2023-1488

Practical implications – The findings lead us to propose that tourism destination managers: use immersive VR technologies in their marketing strategies; in these VR scenarios enhance the user's sense of presence and experience and implement segmentation strategies.

Originality/value – This is one of the first works to empirically analyse how the customer's experience of immersive technologies affects destination image and visit intentions. The study also evaluates three moderating effects: the effects of the level of immersion evoked by the technology, and destination familiarity, on the model's relationships, and the effects of a negative aspect of the technology, VR sickness, on the relationship between sense of presence and the customer experience.

Keywords Virtual reality, Destination image, Familiarity, Tourism destination, Customer experience, Google Earth, Sense of presence, Immersive technology, Visit intentions, Sickness

Paper type Research paper

1. Introduction

Virtual reality (VR) technologies, when applied to tourist destinations, provide users with a realistic preview of what the destinations look like, and allows them to move within a fully three-dimensional, interactive environment. Among the advantages that VR provides users are enhanced experiences, full immersion and the ability to form mental images of destinations, based on sensory information received, during the different phases of a visit (before, during and after) (Alyahya and McLean, 2022; Griffin *et al.*, 2023; Martínez-Molés *et al.*, 2022; McLean and Barhorst, 2022; Mou *et al.*, 2024). Meanwhile, destinations can derive benefits in marketing, revenue generation, competitive advantage and sales (Alyahya and McLean, 2022; Griffin *et al.*, 2023; Mou *et al.*, 2024).

Despite the growth in the use of VR in tourism and of the VR-related literature, few studies have analysed the antecedents and consequences of the tourist's experience in a destination's VR-based immersive environment prior to him/her going there (see Supplementary material – Appendix A). As some authors have suggested, more research is needed to increase the knowledge of consumer behaviour in immersive experiences (Branca *et al.*, 2023; Mou *et al.*, 2024; Pantelidis *et al.*, 2024). Using VR, the user can experience sense of presence, that is a feeling of being in a tourist destination without physically being there (Wei *et al.*, 2019). This is particularly important in tourism, given that its experiential nature makes pre-consumption testing impossible (Flavián *et al.*, 2021). In addition, the literature suggests that VR transforms the tourism experience (Bogicevic *et al.*, 2019; Flavián *et al.*, 2019a,b) and positively influences destination image and behavioural intentions (e.g. visit intentions) (Buhalis *et al.*, 2023; Yu *et al.*, 2024). Some research has emphasised the need to understand how VR technology-based experiences influence the images of products and services (Flavián *et al.*, 2019b), and some have shown that VR can create positive brand experiences (Bogicevic *et al.*, 2019). However, most studies have examined only the impact of human–computer interactions on consumers' responses, ignoring the fact that the essence of virtual tourism is the experience (Chang *et al.*, 2020; Fan *et al.*, 2022).

In view of these points, and taking into account the suggestions made by Zarantonello and Schmitt (2023) about future research directions, the present study has three objectives:

(1) firstly, to analyse how the user's experience of "visiting" a tourist destination through immersive VR technologies influences destination image and visit intentions;

(2) secondly, to evaluate the role of sense of presence in the customer experience; and

(3) thirdly, to examine the moderating effects of three factors, the level of immersion of the technology, destination familiarity and VR sickness (Calisto and Sarkar, 2024).

The stimulus–organism–response (S-O-R) paradigm (Mehrabian and Russell, 1974), having been shown in previous research as being valid for predicting consumer behaviour in VR tourism environments, is used as the theoretical framework for the present study. The data gathered validated all the proposed direct relationships of the conceptual model and facilitated the evaluation of the moderating effects of level of immersion, destination familiarity and VR sickness. This research contributes to the literature by increasing the knowledge about the user's experience of VR tourism and its effects on destination image and visit intentions. In particular, the study is novel in its comparison of the user's experience of two types of immersive technologies, and in considering his/her familiarity with the destination displayed in the VR representation, and VR sickness. This conceptual framework contributes to the literature by integrating these elements into a comprehensive model, shedding light on the dynamics of VR tourism experiences. On a practical level, the study's results allow recommendations to be made to tourist destinations about the design of VR experiences and about what tools they might use.

2. Theoretical background and hypotheses development

To explore the impact of the tourist's VR experience on his/her visit intentions, we draw on the SOR theoretical framework and the literature on customer experience, sense of presence and destination image (see Supplementary material – Appendix B).

2.1 Sense of presence and customer experience

The psychological state of immersion, that is of feeling really/physically present in an environment, is known as sense of presence (Steuer, 1992). Flavián *et al.* (2019a) argued that sense of presence can be attained using VR. Sense of presence in the VR context is a state in which an individual feels as if (s)he is "really there", within the VR-mediated environment (Alyahya and McLean, 2022; Bogicevic *et al.*, 2019). Sense of presence determines the user's experience in VR environments (Bogicevic *et al.*, 2019), increases his/her level of engagement in the purchase/visit experience (Pizzi *et al.*, 2020), makes the experience seem more real and affects all stages of the customer journey. Previous studies in various VR contexts, including tourism, have shown that sense of presence positively influences the customer experience (e.g. Bogicevic *et al.*, 2019; Peukert *et al.*, 2019; Yuan and Hong, 2023). Therefore, we propose that, when users feel sense of presence in a tourism-based VR environment, their experiences will be enhanced (i.e. they perceive the experience as being more interactive, more informative, more realistic, better resourced and as having more navigation options):

H1. Sense of presence positively influences the customer experience in VR tourism environments.

2.2 Customer experience, destination image and visit intentions

The image that tourists have of a tourist destination influences their decision to visit the place (Chang and Chiang, 2022). Destination image has two components: cognitive image, which is associated with one's beliefs and/or knowledge of what a place can offer, and affective image, which is associated with one's feelings and emotional responses towards the place (Griffin *et al.*, 2023; Molinillo *et al.*, 2018). In the absence of an actual experience in a tourist destination, virtual experiences are useful because they depict the attributes of the place and create an image of it in the user's mind (Jorge *et al.*, 2023). It is logical to conclude that the user's interaction with the VR stimuli depicting the destination will help him/her form an image of the actual destination (Chang and Chiang, 2022; McLean and Barhorst, 2022). Griffin *et al.* (2023) argued that immersive technologies in which the user actively participates generate a better image of the destination than do other media.

Previous works have shown that the experiences lived by tourists, based on any type of contact (online or physical) with a tourist destination, influence the destination image formation process (Baloglu and McCleary, 1999; Molinillo *et al.*, 2018). In the field of VR tourism, Chang and Chiang (2022) argued that the "flow" state achieved when viewing VR-based promotional videos influences destination image. An immersive experience enhances the virtual representation of the destination, helping to form a more positive destination image (Griffin *et al.*, 2023). Therefore, the following hypothesis is proposed:

H2. The customer's experience in a VR tourism environment positively influences destination image.

Immersive VR experiences impact on users' emotions, values and behaviours, such as shopping and WOM (Mou *et al.*, 2024). These relationships have been demonstrated in various contexts. For example, it has been shown, in the retail context, that when a user enjoys a positive experience with a VR environment, his/her purchase intentions towards the associated brand/store are enhanced (Alyahya and McLean, 2022). In tourism, it has been shown that enhanced visit intentions are among the main consequences of positive VR experiences (e.g. Lee *et al.*, 2020). Yuan and Hong (2023) concluded that the VR tourism experience positively influences visit and recommendation intentions. Chang and Chiang (2022) demonstrated that the flow state experienced in VR increases visit intentions. Similarly, Martínez-Molés *et al.* (2022) concluded that enjoyment, closely linked to the experience's emotional dimension, enhanced intentions to purchase tourism products. Thus, the following hypothesis is proposed:

H3. The customer's experience in a VR tourism environment positively influences intention to visit the tourist destination.

Destination image influences the tourist's behavioural intentions, such as his/her choice of destination and travel/visit intentions (Molinillo *et al.*, 2018; Tan and Wu, 2016). Chang and Chiang (2022) concluded that destination image influences VR users' visit intentions towards the tourist destination with which they interacted, and mediates the effects of the customer experience and visit intentions. Similarly, Morrison *et al.* (2024) concluded that the emotional bonds generated by the mental imagery evoked in VR environments create vivid perceptions of destinations, which influences users' visit intentions. Zhu *et al.* (2023) argued that high-quality mental imagery increases the user's expectations and stimulates visit intentions towards tourist destinations. Therefore, the following hypothesis is proposed:

H4. The destination image generated by VR tourism environments positively influences the user's intention to visit the tourist destination.

2.3 Moderating effects: virtual reality sickness, perceived immersion and destination familiarity

One of the most prominent negative aspects of VR identified in the literature is VR sickness (Chang *et al.*, 2020). Kim *et al.* (2018) defined VR sickness as a state of physical discomfort associated with the use of VR headsets. Symptoms include eye fatigue, disorientation and nausea; these can impair users' VR experiences (Chang *et al*, 2020). Santoso *et al.* (2022) argued that VR sickness arises due to the disorientation the VR environment causes to the user's visual, vestibular and other sensory systems, which is intensified in cases with high visual realism/high-quality images.

Feeling sick hinders users' adoption of VR (Wei *et al.*, 2023) and negatively influences their experiences, attitudes and behavioural intentions. VR sickness felt during immersive experiences significantly reduces users' attention levels, diminishes sense of presence and affects the overall experience (Mimnaugh *et al.*, 2023). Discomfort produced by VR negatively affects the cognitive aspects of the user's experience, reduces his/her physical comfort and compromises cognitive engagement, both of which are crucial for a positive VR experience (Pöhlmann *et al.*, 2023). Sense of presence is enhanced when users do not feel sick (Adhanom *et al.*, 2022). Accordingly, the following hypothesis is proposed:

H5. VR sickness negatively influences the effects of sense of presence on the customer experience.

VR immerses its users in a three-dimensional environment that reflects real-world characteristics (Pizzi *et al.*, 2020). Immersion should not be seen simply as just another feature of VR, but as a critical factor that enhances the overall experience (Mou *et al.*, 2024). Alyahya and McLean (2022) argued that VR has a greater effect on attitudes towards destinations than do other, less immersive, technologies. Peukert *et al.* (2019) argued that the degree of immersion felt by the user influences his/her enjoyment (a variable related to affective experience), because (s)he perceives greater telepresence. Flavián *et al.* (2019b) argued that the level of immersion evoked by a VR tourism experience influences user engagement. Griffin *et al.* (2023) concluded that interactive and immersive VR technologies have more positive effects on variables (e.g. users' affective destination images, visit intentions and perceptions that the material presented is realistic, informative and believable) than do less immersive technologies. The greater the user's immersion, the greater is his/her sense of presence (Fan *et al.*, 2022; Mou *et al.*, 2024). Taking these points into account, while recognising there is scant evidence in the literature, it is suggested that the level of immersion generated as a consequence of the technology used may moderate the relationships of the model's variables. Therefore, we propose the following hypothesis:

H6. The level of immersion evoked by the technology positively moderates the relationships of the proposed theoretical model of user experience in a VR tourism environment.

Destination familiarity has been defined as the visual and/or psychological impressions that a tourist forms of a destination in his or her memory (Milman and Pizam, 1995). It is a broad concept, covering the tourist's previous experience with the destination and knowledge acquired through information sources, which forms part of his/her memory (e.g. television, press, other audiovisual content) (Horng *et al.*, 2012). Thus, destination familiarity is based on the accumulated knowledge that shapes tourists' memories, influences visit intentions and moderates the effects of other variables (Horng *et al.*, 2012; Rasoolimanesh *et al.*, 2021; Shi *et al.*, 2022).

To date, few studies have examined the possible moderating effects of destination familiarity on the user experience in VR environments. Kim and Hall (2019) showed that, in VR tourism, user identity (previous visitor to the destination vs non-visitor) moderates the effects of perceived utility, perceived ease of use and perceived enjoyment on flow state. Bogicevic *et al.* (2019) found that, after an immersive experience, users who had not previously visited the destination depicted had more difficulty forming a mental image of the place than users who had previously been there. Consequently, it could be inferred that familiarity is likely to moderate the way in which environmental stimuli impact on the tourist's internal states and on how these states influence his/her responses (e.g. intention to visit the destination). Thus, we propose the following hypothesis:

H7. Familiarity with a destination positively moderates the relationships of the proposed theoretical model of user experience in a VR tourism environment.

3. Methodology

3.1 Participants

To test the study's hypotheses, data were collected in a laboratory experiment with a 2 (perceived technological immersion: low vs high) × 2 (destination familiarity: low vs high) design. The participants were students from a Spanish university (n = 144; 50.7% female; mean age = 20.45; no previous VR experience = 41%). Previous research into VR has often used student samples as they are considered a sociodemographically homogeneous and valid group, they are the main users of emerging technologies and they show a special interest in VR (Flavián *et al.*, 2021). The requirements to take part were that the participants must have made at least one international trip in the previous three years, and that they had never visited the tourist destinations used in the experiment. The first condition ensured that the participants had already (recently) travelled to a foreign tourist destination and understood what this entailed. The second, by confirming that the participants had no previous experiences of the destinations, reduced the effects of possible biases/preferences (Bogicevic *et al.*, 2021; Flavián *et al.*, 2021). The experiment was carried out in April 2023. It should be noted that if a participant experienced a very high level of VR sickness, the experiment was stopped to end his/her discomfort.

3.2 Procedure and measures

The two VR technologies were selected for their accessibility and because they offer different immersive experiences in the visualisation of tourist destinations. Specifically, Google Earth VR allows its users to explore anywhere in the world in three dimensions, while 360° Video using a VR headset offers an immersive video experience from a fixed point, with less interaction with the environment. The technologies have different advantages and limitations in terms of interactivity and immersion, which makes them suitable for different tourism marketing applications. The hardware used was the Meta Quest 2 VR device (Meta, 2023), chosen for its advanced technical characteristics, including its high-resolution screen and great autonomy. The Meta Quest 2 was the best-selling VR device from 2019 to 2023 (Statista, 2022).

The destinations, Singapore and Paris, were chosen because of their popularity in the tourism market and for the geographical and cultural distance that exists between the cities. Both cities offer a wide diversity of tourist attractions and have well-connected international airports, making them strategic destinations in the international arena. See experimental conditions and stimuli in Supplementary material – Appendix C [source: created by authors using Google Earth VR (Google, 2024) and Video 360° (YouTube, 2024)]. To validate the experimental conditions, a pre-test was performed, in March 2023, with 92 participants. The results showed the participants perceived significantly higher levels of immersion in Google Earth VR than in 360° Video (t (91) = –3.073, p < 0.001, d = –0.819; $M_{\text{Google Earth VR}} = 6.100$, n.d. = 1.190; $M_{360^\circ\ \text{Video}} = 5.281$, n.d. = 1.366). Secondly, the results showed that the participants were significantly more familiar with Paris than with Singapore (t(91) = 2.865, p < 0.001, d = 0.968; $M_{\text{Paris}} = 5.01$, n.d. = 1.507; $M_{\text{Singapore}} = 4.333$, n.d. = 1.748).

Thereafter, 144 participants were randomly assigned to one of the four experimental treatments (technologies: Google Earth VR vs 360° Video; destinations: Paris vs Singapore) and were allowed to freely interact with the technology for 10 min. In the Paris stimuli, 37 participants (25.7% of the total) used 360° Video, and 35 (24.3% of the total) used Google Earth VR. In the Singapore stimuli, 35 participants (24.3% of the total) used 360° Video, and 37 (25.7% of the total) used Google Earth VR.

At the end of the immersive experience, the participants completed a questionnaire featuring the measurement scales of the variables of the theoretical model proposed in this research and sociodemographic questions (see Supplementary material – Appendix D).

3.3 Data analysis

The data were analysed using partial least squares structural equation modelling (PLS-SEM) with SmartPLS 4.0.9 software (Hair *et al.*, 2019). The sample size significantly exceeds the minimum suggested by Hair *et al.* (2017) and had sufficient statistical power analysis based on the heuristic standards set out in Cohen's tables and the square root method. In addition, we used G*power 3.1 to estimate whether the sample size exceeded the recommended minimum (Faul *et al.*, 2009). The minimum sample size required to test the proposed model was 68 for each group, so the total sample size required is 136. In our case, the total sample is 144 participants, and all groups in the multigroup analyses exceeded the minimum size, except for the "low destination familiarity" group, which was slightly smaller.

No significant differences were found in visit intentions for the two destinations [F (1, 114.18) = 2.490, $p = 0.117$]. Thus, both destinations can be considered as equally attractive to the study participants, and given that there are no biases related to intention to visit the destinations, the structural model can be analysed. The analysis was then divided into two stages. In the first, the reliability and validity of the constructs were verified; in the second, the stability of the estimates was evaluated through a resampling procedure (bootstrapping), using 5,000 subsamples. Two-tailed tests were applied in this analysis, and a significance level of 0.05 was set. The consistent PLS-SEM (PLSc-SEM) algorithm was used to ensure consistency in the results; this version addresses the inconsistencies associated with the traditional PLS-SEM method (Dijkstra and Henseler, 2015).

4. Results

4.1 Measurement model assessment: reliability and validity

Validity and reliability tests were carried out to ensure the methodological integrity of the study. Firstly, common method bias (CMB) was addressed by applying the Harman single-factor test. The results indicated that any single factor accounted for 30.393% of the total variance, much lower than the recommended maximum threshold of 50% (Podsakoff *et al.*, 2003). The results were validated using the method proposed by Pavlou *et al.* (2007) to detect the presence of CMB in the context of PLS-SEM. The strongest correlation identified in the correlation matrix was $r = 0.794$, which falls below the threshold ($r > 0.90$) that would signal the presence of CMB. As a further test for the presence of CMB, we used Kock's (2015) comprehensive collinearity assessment method. All the variance inflation factors (VIFs) in the internal model were equal to, or less than, 1.320, well below the maximum threshold of 5, confirming no collinearity existed in the model and, therefore, no CMB.

Reliability was assessed using Cronbach's alpha (CA) and composite reliability (CR) measures. The values obtained exceeded 0.60 (Table 1), confirming reliability (Hair *et al.*, 2019). Convergent validity was evaluated using average variance extracted (AVE; Fornell and Larcker, 1981). All the AVE values surpassed the recommended minimum of 0.50 (Table 1), confirming convergent validity. As to the higher-order constructs (HOC) of sense of presence, customer experience and destination image, the following aspects were examined: the lower-order components (LOC) and the HOC as a whole (Sarstedt *et al.*, 2019). The findings validated the convergent validity of the constructs (Table 1).

To assess discriminant validity, two methods were used. Firstly, a test determined if the inter-construct correlations were lower than the square roots of their AVE values, as suggested by Fornell and Larcker (1981). Secondly, the heterotrait-monotrait ratio (HTMT)

Constructs and items	RI Weights	t	FL	M	SD	n = 144 CA	CR	AVE
EXPERIENCE (HOC)						0.934	0.945	0.547
EXP_COGNITIVE (LOC)	0.826***	23.756		5.836	1.420	0.933	0.933	0.882
EXP_COG1			0.944					
EXP_COG2			0.955					
EXP_COG3			0.919					
EXP_AFFECTIVE (LOC)	0.835***	20.335		6.016	1.064	0.868	0.868	0.717
EXP_AFFECT1			0.885					
EXP_AFFECT2			0.865					
EXP_AFFECT3			0.839					
EXP_AFFECT4			0.796					
EXP_BEHAVIOURAL (LOC)	0.850***	25.728		5.375	1.349	0.792	0.795	0.708
EXP_BEHAV1			0.784					
EXP_BEHAV2			0.874					
EXP_BEHAV3			0.862					
EXP_SENSORIAL (LOC)	0.850***	24.795		5.951	1.147	0.875	0.875	0.800
EXP_SENSORIAL1			0.880					
EXP_SENSORIAL2			0.898					
EXP_SENSORIAL3			0.905					
EXP_SOCIAL (LOC)	0.763***	19.593				0.932	0.933	0.880
EXP_SOC1			0.928	4.650	1.852			
EXP_SOC2			0.940					
EXP_SOC3			0.946					
DESTINATION IMAGE (HOC)						0.944	0.947	0.721
DESTIMAGE_AFFECT (LOC)	0.966***	100.398		5.684	1.383	0.944	0.947	0.721
DESTIMAGE_AFFECT1			0.910					
DESTIMAGE_AFFECT2			0.945					
DESTIMAGE_AFFECT3			0.929					
DESTIMAGE_AFFECT4			0.843					
DESTIMAGE_COGNITIVE (LOC)	0.960***	74.027		5.911	1.131	0.871	0.876	0.722
DESTIMAGE_COG1			0.760					
DESTIMAGE_COG2			0.870					
DESTIMAGE_COG3			0.873					
DESTIMAGE_COG4			0.891					
SENSE OF PRESENCE (HOC)						0.948	0.950	0.553
SENPRES_PHYSICAL (LOC)	0.905***	62.232		5.625	1.199	0.902	0.905	0.719
SENPRES_PHYSICAL1			0.804					
SENPRES_PHYSICAL2			0.852					
SENPRES_PHYSICAL3			0.859					
SENPRES_PHYSICAL4			0.894					
SENPRES_PHYSICAL5			0.816					
SENPRES_SELF PRESENCE (LOC)	0.901***	50.850	0.901	4.849	1.716	0.894	0.895	0.759
SENPRES_SELFPRE1			0.869					
SENPRES_SELFPRE2			0.827					
SENPRES_SELFPRE3			0.896					
SENPRES_SELFPRE4			0.889					
SENPRES_SOCIAL (LOC)	0.868***	28.605				0.902	0.904	0.719
SENPRES_SOCIAL1			0.838	4.847	1.666			

(*continued*)

Table 1.
Descriptive statistics, reliability and convergent validity

Constructs and items	RI Weights	t	FL	M	n = 144 SD	CA	CR	AVE
SENPRES_SOCIAL2			0.847					
SENPRES_SOCIAL3			0.851					
SENPRES_SOCIAL4			0.840					
SENPRES_SOCIAL5			0.862					
VISIT INTENTION				5.740	1.515	0.916	0.925	0.855
VINT1			0.908					
VINT2			0.926					
VINT3			0.941					
VR_SICKNESS				2.842	1.942	0.930	0.898	0.800
VR_SICKNESS1			0.935					
VR_SICKNESS2			0.937					
VR_SICKNESS3			0.937					
VR_SICKNESS4			0.753					

Notes: RI = repeated indicators; FL = Factor loading; M = Mean; SD = Standard deviation; CA = Cronbach's alpha. CR = Composite reliability; AVE = average variance extracted. HOC = Higher-order construct. LOC = Lower-order construct. ***Significant at 0.001. Bootstrap level based on 5,000 bootstraps
Source: Created by authors

Table 1.

was assessed to ensure that it was less than 0.90 for any pair of reflective constructs. This value is the recommended threshold for structural models involving conceptually similar constructs (Henseler *et al.*, 2015). In the present study, the HTMT ratio returned a value higher than the recommended threshold between the affective image and cognitive image constructs because two items were strongly correlated (Destimage_Cog1 and Destimage_Affect1). As eliminating these items did not affect content validity, both were removed from the analysis to reduce the HTMT value (Henseler *et al.*, 2015). Lastly, all HTMT values were consistent with the recommended limits (Table 2), which demonstrates that the constructs are not highly correlated, evidence that the model has discriminant validity.

4.2 Structural model assessment and hypotheses testing

To validate a general model that explains intention to visit a destination after an immersive experience with VR technology, the structural model was evaluated and the hypotheses were tested. The analysis used data from all the experimental participants.

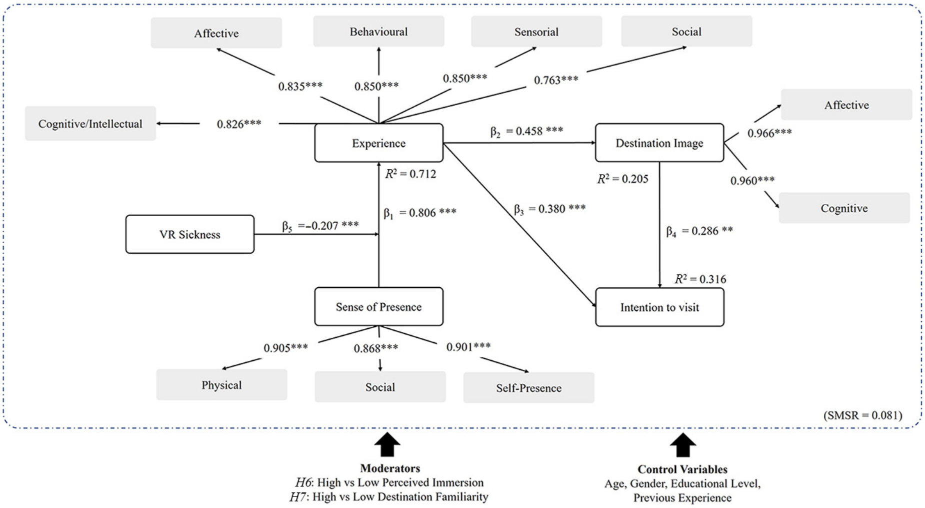
The results supported all the hypotheses (Figure 1). Specifically, it was observed that sense of presence had a significant positive influence on customer experience ($\beta 1 = 0.806$, $t = 17.712$, $p < 0.001$), supporting *H1*. Customer experience, in turn, positively influenced destination image ($\beta 2 = 0.458$, $t = 4.795$, $p < 0.001$), supporting *H2*. In addition, customer experience had a positive effect on visit intentions ($\beta 3 = 0.380$, $t = 3.601$, $p < 0.001$), supporting *H3*. Destination image had a positive effect on visit intentions ($\beta 4 = 0.286$, $t = 2.776$, $p < 0.01$), supporting *H4*. The results indicated that physical presence and self-presence were the most important factors for explaining sense of presence. The most important factors in the customer experience were behavioural experience and sensory experience. The dimensions of destination image, cognitive and affective, were equally important in explaining the HOC destination image.

The partial moderation effect exercised by VR sickness in the relationship between sense of presence and customer experience was also examined. The results indicated that VR

Table 2.
Discriminant validity

	Exp_Afect	Exp _Behav	Exp_Cog	Exp_ Sensorial	Exp_Soc	Destimage _Affect	Destimage_ Cog	Senpres_ Physical	Senpres_ Selfpre	Senpres_ Social	VR_ Sickness	Visit intention
Exp_Afect	*0.810*	0.706	0.650	0.813	0.527	0.476	0.355	0.766	0.597	0.431	0.268	0.385
Exp_Behav	0.705	*0.772*	0.751	0.757	0.749	0.382	0.325	0.820	0.781	0.699	0.093	0.470
Exp_Cog	0.651	0.750	*0.908*	0.672	0.568	0.449	0.478	0.770	0.550	0.472	0.058	0.652
Exp_Sensorial	0.810	0.755	0.674	*0.850*	0.575	0.422	0.433	0.787	0.703	0.503	0.078	0.461
Exp_Soc	0.529	0.751	0.569	0.576	*0.904*	0.347	0.312	0.729	0.718	0.758	0.185	0.340
Destimage_Affect	0.475	0.381	0.450	0.425	0.344	*0.874*	0.887	0.458	0.408	0.298	0.124	0.525
Destimage_Cog	0.355	0.325	0.479	0.434	0.311	0.889	*0.818*	0.326	0.314	0.195	0.078	0.424
Senpres_Physical	0.759	0.813	0.764	0.780	0.728	0.453	0.323	*0.805*	0.830	0.728	0.098	0.543
Senpres_Selfpre	0.598	0.783	0.551	0.704	0.720	0.405	0.314	0.833	*0.815*	0.750	0.203	0.398
Senpres_Social	0.431	0.701	0.472	0.502	0.756	0.295	0.195	0.730	0.752	*0.820*	0.189	0.326
VR_Sickness	−0.336	−0.060	−0.092	−0.088	0.137	−0.161	−0.110	−0.023	0.136	0.137	*0.600*	0.076
Visit intention	0.385	0.469	0.653	0.461	0.343	0.525	0.426	0.539	0.401	0.328	0.021	*0.895*

Notes: The square roots of the AVEs are in italics on the main diagonal. The Fornell–Larcker criterion is depicted below the main diagonal. The HTMT ratio of correlations is above the main diagonal
Source: Created by authors



Notes: ***$p < 0.001$; **$p < 0.01$ n.s. = not significant; ⟶ relationship significant
Source: Created by authors

Figure 1. Results of the structural model assessment

sickness weakens the relationship between sense of presence and the customer experience. Specifically, when VR sickness levels were low, a strong positive relationship was observed between sense of presence and customer experience. However, when VR sickness levels were high, this relationship weakened, or even became negative. Statistically, the influence of VR sickness on the effect of sense of presence on customer experience was negative when the participants suffered from sickness ($\beta 5 = -0.207$, $t = 2.406$, $p < 0.01$), supporting *H5*.

The R^2 values indicate that the model explains 71.2% of the variance in customer experience, 20.5% of destination image and 31.6% of visit intentions. To evaluate the ability of the structural model to make accurate predictions, Q^2 values were calculated using a blindfolding procedure/Stone–Geisser test. The Q^2 values obtained were 0.674 for experience, 0.146 for destination image and 0.190 for visit intentions. Therefore, it can be said that the model is useful for predicting dependent variables. Cohen's f^2 method was used to assess effect size: values above 0.35, 0.15 and 0.02 are considered strong, moderate and weak, respectively (Henseler *et al.*, 2016).

Gender, age, level of education and previous experience with VR were applied as control variables, using a bootstrapping procedure with 5,000 subsamples. This analysis revealed that the control variables had no significant effects in either the measurement model or the structural model. This finding reinforces the robustness of the relationships hypothesised in the structural model.

4.3 Multigroup analysis

To evaluate the moderating effects of perceived immersion (*H6*) and destination familiarity (*H7*), two multigroup analyses were conducted, using PLS-MGA. The variables were categorised into two levels, high and low. The sample was segmented into groups of high and low levels of perceived immersion, using the median as the cut-off point. Similarly, the sample was divided into groups of high and low destination familiarity. The findings of the MICOM analysis confirmed there was a high degree of factorial invariance between the groups, with correlations close to 1 for all variables, and non-significant *p*-value permutations. These results support the factorial invariance of the model, which provides evidence for the validity of the between-groups comparisons of the causal relationships proposed to exist between the model's constructs.

The results of the multigroup analysis are presented in Table 3. In the first analysis, which assessed the moderating effects of perceived immersion, significant relationships were found in all the model's relationships for the high and low immersion groups, except for the relationship between sense of presence and customer experience, moderated by VR sickness, in the high immersion environment. The only significant difference found between the groups was in the role of VR sickness in the relationship between sense of presence and customer experience: the effect was significantly stronger in the low perceived immersion group. Thus, the participants who experienced high immersion were less sensitive to the negative effects of VR sickness. This finding can have important implications for VR experience design, especially in terms of how to manage the effects of VR sickness for different levels of perceived immersion.

In the second analysis, which assessed the moderating effects of destination familiarity, the results showed that all relationships were significant in both groups (high and low familiarity), except in the case of the relationship between destination image and visit intentions for the high familiarity group. Consequently, destination image was not a crucial factor in determining visit intentions among those familiar with the destination. However, the between-groups comparisons showed no significant differences in any of the model's relationships.

5. Discussion and conclusions

5.1 Conclusions

This study makes a significant contribution to the field of tourism marketing and the use of VR technologies for destination promotion. The uniqueness of the study lies in its comprehensive approach, based on a SOR model that draws on sense of presence theory and on the customer experience and destination image literature. It is one of the first works to empirically analyse how the customer experience of immersive technologies affects both destination image and visit intentions. The study also evaluates three moderating effects: the effects of the level of immersion evoked by the technology and destination familiarity on the model's relationships, and the effects of a negative aspect of the technology, VR sickness, on the relationship between sense of presence and the customer experience.

In general, we confirmed that VR has the potential to bring destinations "closer" to tourists. It does so by providing an immersive, interactive environment that generates a positive customer experience and contributes positively to destination image and visit intentions. From a theoretical viewpoint, the study validates and extends the existing literature on sense of presence in VR environments, demonstrating that it is a key, determinant antecedent of the customer experience. This finding aligns with previous studies (e.g. Bretos *et al.*, 2023; Bogicevic *et al.*, 2019) into hotel services, and increases knowledge of sense of presence by extending its effects to tourism destinations.

In addition, while an analysis of the effects of two moderating variables, level of immersion and destination familiarity, did not yield conclusive results, it highlighted the need to study them further in the context of immersive environments. Significantly, our study found that VR sickness negatively impacts on the relationship between sense of presence and customer experience, particularly in low-immersion situations, such as provided by VR360 devices. This underscores the importance of addressing VR sickness in immersive VR environments, as it can diminish the effectiveness of the experience, an issue little explored in previous studies focusing on VR in tourism. On the other hand, the results

Table 3. Tests of moderation effects (perceived immersion and destination familiarity)

H6	Paths	Perceived immersion High ($n = 71$)	Perceived immersion Low ($n = 73$)	Comparison	Significant difference
$H6_1$	Sense of presence → Experience	0.710***	0.840***	1.516 ns	–
$H6_2$	Experience → Destination image	0.412***	0.299***	0.545 ns	–
$H6_3$	Experience → Visit intention	0.337***	0.314***	0.119 ns	–
$H6_4$	Destination image → Visit intention	0.257***	0.233***	0.894 ns	–
$H6_5$	Sickness × Sense of presence → Experience	−0.004 ns	−0.282***	1.992*	Yes
H7	Paths	Destination familiarity High ($n = 84$)	Destination familiarity Low ($n = 60$)	Comparison	Significant difference
$H7_1$	Sense of presence → Experience	0.971***	0.780***	0.191 ns	–
$H7_2$	Experience → Destination image	0.300**	0.567***	1.173 ns	–
$H7_3$	Experience → Visit intention	0.441***	0.288*	0.139 ns	–
$H7_4$	Destination image → Visit intention	0.205 ns	0.342***	−0.137 ns	–
$H7_5$	Sickness × Sense of presence → Experience	−0.198***	−0.212***	0.014 ns	–

Notes. ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$; comparison means the *t*-values of coefficient difference comparison; ns = not significant. $Sickness_{high\text{-}immersion}$ (M = 2.687; SD = 1.600); $Sickness_{low\text{-}immersion}$ (M = 2.870; SD = 2.067)
Source: Created by authors

showed that sociodemographic factors (gender, age, educational level) and previous experience with VR did not significantly impact on the model's outcomes.

5.2 Theoretical implications

The findings of the study make important contributions to the literature. Firstly, the results showed that the experience of "visiting" a tourist destination through an immersive VR technology has a positive impact on the user's image of the destination and his/her intentions to visit the place. These findings are in line with previous studies that highlighted the importance of analysing different VR technologies in the tourism and hospitality context (Alyahya and McLean, 2022; Tussyadiah *et al.*, 2018). The results also allow us to conclude that customer experience is more important than destination image in the determination of visit intentions (Jorge *et al.*, 2023). Therefore, the study contributes to the VR tourism literature by highlighting the role of customer experience consistently across two types of tourism technologies and destinations (Bogicevic *et al.*, 2019; Bogicevic *et al.*, 2021). In addition, the analysis of the VR experience dimensions found that the behavioural and sensory dimensions contributed most to the formation of the customer experience construct. In other words, if the VR environment creates action-oriented bodily experiences, and stimulates the user's curiosity, it will contribute positively to his/her experience. These dimensions are followed, in order of most to least importance, by the affective, cognitive and social.

Secondly, the results confirmed that sense of presence is a crucial factor in the generation of the customer experience (Alyahya and McLean, 2022). This finding, which is consistent with those of previous studies (Bogicevic *et al.*, 2019; Flavián *et al.*, 2019b; Tussyadiah *et al.*, 2018), reinforces the proposal that the effects of sense of presence can vary depending on other variables (Makransky *et al.*, 2017) and supports the proposition that sense of presence is one of the most important aspects of human–VR interactions. Specifically, it was found that physical sense of presence and self-presence were the most important dimensions in the explanation of sense of presence, and that the effect of social presence was significant, but smaller. That is, to develop a strong sense of presence when viewing a VR environment, the user must experience realism and feel that his/her own body is present in the immersive environment.

Thirdly, the moderating effects of perceived level of immersion (Bogicevic *et al.*, 2019) and destination familiarity were examined in novel ways. Regarding perceived immersion, no significant differences were found in the general model between high and low perceived levels. Although a greater intensity of relationship was observed in high immersion situations, the differences were not statistically significant. This result partially conflicts with previous studies in which immersion levels were shown to directly influence perceptions of authenticity, a positive antecedent of customer experience (Mou *et al.*, 2024). This may be because most respondents had never previously used VR devices; thus, in their first contact with the technology, they positively appreciated its immersive capacity, regardless of which technology drove the experience. Therefore, while the different technologies may be perceived as providing significantly different levels of immersion, both may teleport users sufficiently to generate a positive experience, form an image of the destination and increase visit intentions.

However, it was observed that level of immersion played a crucial role in how the VR sickness – sense of presence interaction affected the user's experience. Specifically, significant differences were observed in the relationship between sense of presence and experience, in terms of VR sickness, between the high and low perceived immersion groups. For participants who perceived a lower level of immersion, the negative effects of VR sickness had a more pronounced impact on their overall experience. On the other hand, VR sickness had no effect on people who perceived a high level of immersion. This suggests that, for the group that experienced VR sickness, the sense of presence evoked by the virtual environment was particularly critical in determining the customer experience. This may be because VR sickness causes dizziness and nausea and reduces attention levels and cognitive ability, which makes it less likely that users will be able fully to engage with the VR content. This negatively affects/disrupts the experience. In the 360° Video experiences, which provide an immersive experience from a fixed point, and with limited interaction with the environment, VR sickness adversely affected the experience due to its impact on sense of presence. This can be explained by the visual transition effects exerted on users as they are being teleported between scenarios/positions and/or by the field of view (Ang and Quarles, 2023). Thus, there is a discrepancy between user-controlled motion and pre-set motion in videos, corroborating the argument that perceptual incongruity increases VR sickness (Caserman *et al.*, 2021). On the other hand, the autonomy of motion in Google Earth VR seems to attenuate VR sickness. It is important to note that VR sickness is quite common among VR users and that it varies by gender (women suffering more), the subject's position (sitting vs standing), the duration of the experience (15 min and above) and the user's degree of interaction with the VR (Caserman *et al.*, 2021). This finding is novel and has important implications for VR design; marketers and VR developers should adopt differentiated strategies to address the effects that VR sickness can cause (based on the level of immersion perceived by the user).

Fourthly, as to moderating effects, unlike previous studies that focused more on familiarity with VR devices (e.g. Wei *et al.*, 2019), this work is novel in that it assesses the effects of familiarity with the visualised destination, an aspect that has been largely ignored in the existing literature (Guan *et al.*, 2022). Several studies, in real-world scenarios, have demonstrated the positive effects of destination familiarity on visit intentions (e.g. Shi *et al.*, 2022). Few studies have explored the effect of this construct in VR environments, although some authors found it had a positive effect on destination image (Bogicevic *et al.*, 2019) and on flow state (Kim and Hall, 2019). The present study is original in evaluating the impacts of familiarity on the experience, destination image and visit intentions. However, our findings are contrary to what might have been expected. In particular, we observed no significant differences between the relationships of the model based on destination familiarity. This might be explained by the complexity of the destination familiarity construct, which, in this research, was measured as a first-order construct with only three items. However, Tan and Wu (2016) conceptualised and analysed the destination familiarity variable as a conjunction of six first-order dimensions: educational, self-described, informational, self-assured, expected and proximate familiarity. Their results showed that not all dimensions positively influence destination image and visit intentions, where they observed differences between people who had previously visited a destination and those who had not. Similarly, the participants' lack of exposure to VR technologies may have caused them to focus more on the novelty of the experience than on the image of the destination and their visit intentions, which would explain why only small differences were observed between the two groups.

5.3 Practical implications

From a practical viewpoint, the results of this study lead us to recommend that marketers use immersive VR technologies in their strategies. As to the study's first objective, the examination of the impacts of immersive VR experiences, destinations should strongly focus on enhancing users' sensory and behavioural experiences. This might be achieved by using different sensory stimuli (e.g. haptic devices, visually stimulating designs), thus enhancing the immersiveness of the virtual environment. Similarly, to enrich tourists' experiences at cognitive, affective and social levels, they should be able to learn about the tourist destination (e.g. enhanced information, routes, tourist offers), be affectively linked (e.g. gamifying the experience using emotional content) and have the sense that they are relating to other people (e.g. facilitating interactions with avatars/AI-powered assistants/other users). All this may cause users to enjoy better, more memorable experiences that transmit a more interesting and clearer image of the destination and which encourage them to go there. We also recommend that immersive experiences include metrics, or feedback tools, to continuously evaluate the user experience, so that managers can make adjustments as necessary, with the aim of optimising the effectiveness of VR-based marketing strategies and actions.

As to the second objective, an examination of the effects of sense of presence, destinations should prioritise features that strengthen this sense in their VR environments, for example, by ensuring that the graphic quality and interactivity of the experiences allow users to explore the destination in a free and personalised way. Sense of presence can be enhanced by using haptic devices and by interactions with other users and/or AI-equipped avatars. Devices that enhance the user's real movements might be used. In addition, tourist destinations should also be aware of possible negative effects, such as VR sickness. To minimise this effect, adjustments might be made to the relevant interfaces, such as frame rate, and/or alerts might be used to ensure the viewer takes regular breaks (e.g. guaranteeing that sessions last less than 15 min). We also recommend that measures be taken to reduce VR sickness, for example, by narrowing the field of view of devices without sacrificing immersion, and that practical steps be taken to adjust VR devices to minimise user discomfort (Ang and Quarles, 2023). These suggestions should help optimise VR-based tourism experiences and minimise any adverse effects.

As to the third objective, an examination of the effects of level of immersion, while the study found no significant differences based on sociodemographic factors or previous experience with VR, companies might consider segmenting users based on their familiarity with the destination being visualised. This segmentation strategy may require specific adaptations, particularly when targeting individuals familiar with a destination. This would allow a more effective personalisation of the experience, which could provide greater user satisfaction and benefits for the destination (image, visit intentions, recommendations, etc.). For example, degree of destination familiarity could be assessed based on previously administered questionnaires, or the user's historical data; these could be used to segment those who had visited, had sometimes visited and those who had frequently visited, the destination. Thus, for users highly familiar with the destination, to maintain their interest previously presented content should be avoided. On the other hand, for users less familiar with the destination, carefully presented educational information could create a positive impression and increase their desire to actually visit the place. This segmentation strategy would make it possible to design content targeted at each type of user: thus, users who had previously visited the destination could be pointed towards alternative experiences. In addition, emotional messages (providing personalised information about available attractions, benefits, inspirational stories) that link users to the destination could be transmitted to make them want to revisit.

5.4 Limitations and future research

This study has some limitations. Firstly, the sample, all university students, does not necessarily represent the diversity of tourists in terms of origin, culture and VR experience. To improve the generalisability of the results, future research might evaluate the proposed model with a more representative, diverse sample of participants. Secondly, the study examined two already established immersive technologies (360° Video and Google Earth VR). Future research might explore and compare the impact of other emerging technologies, such as the metaverse, and/or incorporate multisensory stimuli into the equipment used, such as vests and haptic gloves, and/or use ambient scents. Thirdly, destination familiarity was measured using a one-dimensional scale, previously validated in the literature. However, the effects of this variable might be better understood if it was measured on a multidimensional scale. Fourthly, the duration of stimuli presentation in the experiment was 10 min. As the literature on VR sickness shows that its effects arise mainly after 15 min, future research might use more lengthy experiments to explore the impact of duration on VR sickness. Fifthly, the participants visualised the stimuli using the same type of device (i.e. headset). Other studies might evaluate the consistency of the results when other device types (e.g. smartphones) are used to visualise the stimuli (see Orús *et al.*, 2021). Lastly, it would be advisable to evaluate the effects exerted by the study environment; thus, future research might conduct experiments outside the laboratory (e.g. the user's home, travel agencies).

References

Adhanom, I., Halow, S., Folmer, E. and MacNeilage, P. (2022), "VR sickness adaptation with ramped optic flow transfers from abstract to realistic environments", *Frontiers in Virtual Reality*, Vol. 3, p. 848001, doi: 10.3389/frvir.2022.848001.

Alyahya, M. and McLean, G. (2022), "Examining tourism consumers' attitudes and the role of sensory information in virtual reality experiences of a tourist destination", *Journal of Travel Research*, Vol. 61 No. 7, pp. 1666-1681, doi: 10.1177/00472875211037745.

Ang, S. and Quarles, J. (2023), "Reduction of cybersickness in head mounted displays use: a systematic review and taxonomy of current strategies", *Frontiers in Virtual Reality*, Vol. 4, doi: 10.3389/frvir.2023.1027552.

Baloglu, S. and McCleary, K.W. (1999), "US international pleasure travelers' images of four mediterranean destinations: a comparison of visitors and non-visitors", *Journal of Travel Research*, Vol. 38 No. 2, pp. 144-152, doi: 10.1177/004728759903800207.

Bogicevic, V., Liu, S.Q., Seo, S., Kandampully, J. and Rudd, N.A. (2021), "Virtual reality is so cool! how technology innovativeness shapes consumer responses to service preview modes", *International Journal of Hospitality Management*, Vol. 93, p. 102806, doi: 10.1016/j.ijhm.2020.102806.

Bogicevic, V., Seo, S., Kandampully, J.A., Liu, S.Q. and Rudd, N.A. (2019), "Virtual reality presence as a preamble of tourism experience: the role of mental imagery", *Tourism Management*, Vol. 74, pp. 55-64, doi: 10.1016/j.tourman.2019.02.009.

Branca, G., Marino, V. and Resciniti, R. (2023), "How do consumers evaluate products in virtual reality? A literature review for a research agenda", *Spanish Journal of Marketing – ESIC*, doi: 10.1108/SJME-07-2022-0153.

Bretos, M.A., Ibáñez-Sánchez, S. and Orús, C. (2023), "Applying virtual reality and augmented reality to the tourism experience: a comparative literature review", *Spanish Journal of Marketing – ESIC*, doi: 10.1108/SJME-03-2023-0052.

Buhalis, D., Lin, M.S. and Leung, D. (2023), "Metaverse as a driver for customer experience and value co-creation: implications for hospitality and tourism management and marketing", *International Journal of Contemporary Hospitality Management*, Vol. 35 No. 2, pp. 701-716, doi: 10.1108/IJCHM-05-2022-0631.

Calisto, M.L. and Sarkar, S. (2024), "A systematic review of virtual reality in tourism and hospitality: the known and the paths to follow", *International Journal of Hospitality Management*, Vol. 116, p. 103623, doi: 10.1016/j.ijhm.2023.103623.

Caserman, P., Garcia-Agundez, A., Gámez Zerban, A. and Göbel, S. (2021), "Cybersickness in current-generation virtual reality head-mounted displays: systematic review and outlook", *Virtual Reality*, Vol. 25 No. 4, pp. 1153-1170, doi: 10.1007/s10055-021-00513-6.

Chang, H.H. and Chiang, C.C. (2022), "Is virtual reality technology an effective tool for tourism destination marketing? A flow perspective", *Journal of Hospitality and Tourism Technology*, Vol. 13 No. 3, pp. 427-440, doi: 10.1108/JHTT-03-2021-0076.

Chang, E., Kim, H.T. and Yoo, B. (2020), "Virtual reality sickness: a review of causes and measurements", *International Journal of Human–Computer Interaction*, Vol. 36 No. 17, pp. 1658-1682, doi: 10.1080/10447318.2020.1778351.

Dijkstra, T.K. and Henseler, J. (2015), "Consistent and asymptotically normal PLS estimators for linear structural equations", *Computational Statistics and Data Analysis*, Vol. 81, pp. 10-23, doi: 10.1016/j.csda.2014.07.008.

Fan, X., Jiang, X. and Deng, N. (2022), "Immersive technology: a meta-analysis of augmented/virtual reality applications and their impact on tourism experience", *Tourism Management*, Vol. 91, p. 104534, doi: 10.1016/j.tourman.2022.104534.

Faul, F., Erdelfer, E., Lang, A.-G. and Buchner, A. (2009), "Statistical power analyses using G* power 3.1 test for correlation and regression analysis", *Behavior Research Methods*, Vol. 41 No. 4, pp. 1149-1160, doi: 10.3758/BRM.41.4.1149.

Flavián, C., Ibáñez-Sánchez, S. and Orús, C. (2019a), "The impact of virtual, augmented and mixed reality technologies on the customer experience", *Journal of Business Research*, Vol. 100, pp. 547-560, doi: 10.1016/j.jbusres.2018.10.050.

Flavián, C., Ibáñez-Sánchez, S. and Orús, C. (2019b), "Integrating virtual reality devices into the body: effects of technological embodiment on customer engagement and behavioral intentions toward the destination", *Journal of Travel and Tourism Marketing*, Vol. 36 No. 7, pp. 847-863, doi: 10.1080/10548408.2019.1618781.

Flavián, C., Ibáñez-Sánchez, S. and Orús, C. (2021), "Impacts of technological embodiment through virtual reality on potential guests' emotions and engagement", *Journal of Hospitality Marketing and Management*, Vol. 30 No. 1, pp. 1-20, doi: 10.1080/19368623.2020.1770146.

Fornell, C. and Larcker, D.F. (1981), "Evaluating structural equation models with unobservable variables and measurement error", *Journal of Marketing Research*, Vol. 18 No. 1, pp. 39-50, doi: 10.2307/3151312.

Google (2024), "Google earth VR", available at: https://earth.google.com/web

Griffin, T., Guttentag, D., Lee, S.H., Giberson, J. and Dimanche, F. (2023), "Is VR always better for destination marketing? Comparing different media and styles", *Journal of Vacation Marketing*, Vol. 29 No. 1, pp. 119-140, doi: 10.1177/13567667221078252.

Guan, J., Chan, J.H., Bi, J. and Qi, X. (2022), "Cultural proximity, destination familiarity and tourists' sense of away-from-home (SAFH)", *Journal of Destination Marketing and Management*, Vol. 23, p. 100670, doi: 10.1016/j.jdmm.2021.100670.

Hair, J.F., Hult, G.T.M., Ringle, C.M. and Sarstedt, M. (2017), *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*, (2nd ed.) Sage, London.

Hair, J.F., Risher, J.J., Sarstedt, M. and Ringle, C.M. (2019), "When to use and how to report the results of PLS-SEM", *European Business Review*, Vol. 31 No. 1, pp. 2-24, doi: 10.1108/EBR-11-2018-0203.

Henseler, J., Hubona, G. and Ray, P.A. (2016), "Using PLS path modeling in new technology research: Updated guidelines", *Industrial Management and Data Systems*, Vol. 116 No. 1, pp. 2-20, doi: 10.1108/IMDS-09-2015-0382.

Henseler, J., Ringle, C.M. and Sarstedt, M. (2015), "A new criterion for assessing discriminant validity in variance-based structural equation modeling", *Journal of the Academy of Marketing Science*, Vol. 43 No. 1, pp. 115-135, doi: 10.1007/s11747-014-0403-8.

Horng, J.-S., Liu, C.-H., Chou, H.-Y. and Tsai, C.-Y. (2012), "Understanding the impact of culinary brand equity and destination familiarity on travel intentions", *Tourism Management*, Vol. 33 No. 4, pp. 815-824, doi: 10.1016/j.tourman.2011.09.004.

Jorge, F., Losada, N. and Teixeira, M.-S. (2023), “Behavioural intentions through virtual reality from a destination image perspective”, *Journal of Place Management and Development*, Vol. 16 No. 3, pp. 347-366, doi: 10.1108/JPMD-02-2022-0016.

Kim, M.J. and Hall, C.M. (2019), “A hedonic motivation model in virtual reality tourism: Comparing visitors and non-visitors”, *International Journal of Information Management*, Vol. 46, pp. 236-249, doi: 10.1016/j.ijinfomgt.2018.11.016.

Kim, H.K., Park, J., Choi, Y. and Choe, M. (2018), “Virtual reality sickness questionnaire (VRSQ): motion sickness measurement index in a virtual reality environment”, *Applied Ergonomics*, Vol. 69, pp. 66-73, doi: 10.1016/j.apergo.2017.12.016.

Kock, N. (2015), “Common method bias in PLS-SEM: a full collinearity assessment approach”, *International Journal of E-Collaboration*, Vol. 11 No. 4, pp. 1-10, doi: 10.4018/ijec.2015100101.

Lee, M., Lee, S.A., Jeong, M. and Oh, H. (2020), “Quality of virtual reality and its impacts on behavioral intention”, *International Journal of Hospitality Management*, Vol. 90, p. 102595, doi: 10.1016/j.ijhm.2020.102595.

Makransky, G., Lilleholt, L. and Aaby, A. (2017), “Development and validation of the multimodal presence scale for virtual reality environments: a confirmatory factor analysis and item response theory approach”, *Computers in Human Behavior*, Vol. 72, pp. 276-285, doi: 10.1016/j.chb.2017.02.066.

Martínez-Molés, V., Jung, T.H., Pérez-Cabañero, C. and Cervera-Taulet, A. (2022), “Gathering pre-purchase information for a cruise vacation with virtual reality: the effects of media technology and gender”, *International Journal of Contemporary Hospitality Management*, Vol. 34 No. 1, pp. 407-429, doi: 10.1108/IJCHM-04-2021-0500.

McLean, G. and Barhorst, J.B. (2022), “Living the experience before you go…but did it meet expectations? The role of virtual reality during hotel bookings”, *Journal of Travel Research*, Vol. 61 No. 6, pp. 1233-1251, doi: 10.1177/00472875211028313.

Mehrabian, A. and Russell, J.A. (1974), *An Approach to Environmental Psychology*, MITPress, Cambridge Mass.

Meta (2023), “Meta quest 2: Immersive All-In-One VR headset | meta store”, available at: www.meta.com/es/en/quest/products/quest-2/

Milman, A. and Pizam, A. (1995), “The role of awareness and familiarity with a destination: the Central Florida case”, *Journal of Travel Research*, Vol. 33 No. 3, pp. 21-27, doi: 10.1177/004728759503300304.

Mimnaugh, K.J., *et al.* (2023), “Virtual reality sickness reduces attention during immersive experiences”, *IEEE Transactions on Visualization and Computer Graphics*, Vol. 29 No. 11, pp. 4394-4404.

Molinillo, S., Liébana-Cabanillas, F., Anaya-Sánchez, R. and Buhalis, D. (2018), “DMO online platforms: Image and intention to visit”, *Tourism Management*, Vol. 65, pp. 116-130, doi: 10.1016/j.tourman.2017.09.021.

Morrison, A.M., Bag, S. and Mandal, K. (2024), “Virtual reality's impact on destination visit intentions and the moderating role of amateur photography”, *Tourism Review*, Vol. 79 No. 2, pp. 355-377, doi: 10.1108/TR-12-2022-0621.

Mou, Y., Fan, J., Ding, Z. and Khan, I. (2024), “Impact of virtual reality immersion on customer experience: moderating effect of cross-sensory compensation and social interaction”, *Asia Pacific Journal of Marketing and Logistics*, Vol. 36 No. 1, pp. 26-47, doi: 10.1108/APJML-11-2022-0920.

Orús, C., Ibáñez-Sánchez, S. and Flavián, C. (2021), “Enhancing the customer experience with virtual and augmented reality: the impact of content and device type”, *International Journal of Hospitality Management*, Vol. 98, p. 103019.

Pantelidis, C., Tom Dieck, M.C., Jung, T.H., Smith, P. and Miller, A. (2024), “Place attachment theory and virtual reality: the case of a rural tourism destination”, *International Journal of Contemporary Hospitality Management*, doi: 10.1108/IJCHM-09-2023-1489.

Pavlou, P.A., Liang, H. and Xue, Y. (2007), "Understanding and mitigating uncertainty in online exchange relationships: a principal-agent perspective", *MIS Quarterly*, Vol. 31 No. 1, pp. 105-136, doi: 10.2307/25148783.

Peukert, C., Pfeiffer, J., Meißner, M., Pfeiffer, T. and Weinhardt, C. (2019), "Shopping in virtual reality stores: the influence of immersion on system adoption", *Journal of Management Information Systems*, Vol. 36 No. 3, pp. 755-788, doi: 10.1080/07421222.2019.1628889.

Pizzi, G., Vannucci, V. and Aiello, G. (2020), "Branding in the time of virtual reality: Are virtual store brand perceptions real?", *Journal of Business Research*, Vol. 119, pp. 502-510, doi: 10.1016/j.jbusres.2019.11.063.

Podsakoff, P.M., MacKenzie, S.B., Lee, J.Y. and Podsakoff, N.P. (2003), "Common method biases in behavioral research: a critical review of the literature and recommended remedies", *Journal of Applied Psychology*, Vol. 88 No. 5, pp. 879-903, doi: 10.1037/0021-9010.88.5.879.

Pöhlmann, K.M.T., *et al.* (2023), "I think I don't feel sick: Exploring the relationship between cognitive demand and cybersickness in virtual reality using fNIRS", *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems (CHI '23)*, *Association for Computing Machinery*, *New York, NY*, pp. 1-16.

Rasoolimanesh, S.M., Seyfi, S., Hall, C.M. and Hatamifar, P. (2021), "Understanding memorable tourism experiences and behavioral intentions of heritage tourists", *Journal of Destination Marketing and Management*, Vol. 21 No. 1, p. 100621, doi: 10.1016/j.jdmm.2021.100621.

Santoso, H.B., Wang, J.-C. and Windasari, N.A. (2022), "Impact of multisensory extended reality on tourism experience journey", *Journal of Hospitality and Tourism Technology*, Vol. 13 No. 3, pp. 356-385, doi: 10.1108/JHTT-01-2021-0036.

Sarstedt, M., Hair, J.F., Jr, Cheah, J.H., Becker, J.M. and Ringle, C.M. (2019), "How to specify, estimate, and validate higher-order constructs in PLS-SEM", *Australasian Marketing Journal*, Vol. 27 No. 3, pp. 197-211, doi: 10.1016/j.ausmj.2019.05.003.

Shi, H., Liu, Y., Kumail, T. and Pan, L. (2022), "Tourism destination brand equity, brand authenticity and revisit intention: the mediating role of tourist satisfaction and the moderating role of destination familiarity", *Tourism Review*, Vol. 77 No. 3, pp. 751-779, doi: 10.1108/TR-08-2021-0371.

Statista (2022), "Virtual reality (VR) headset unit sales worldwide from 2019 to 2024 (in million units)", available at: www.statista.com/statistics/677096/vr-headsets-worldwide/ (accessed 25 July 2023).

Steuer, J. (1992), "Defining virtual reality: Dimensions determining telepresence", *Journal of Communication*, Vol. 42 No. 4, pp. 73-93, doi: 10.1111/j.1460-2466.1992.tb00812.x.

Tan, W.-K. and Wu, C.-E. (2016), "An investigation of the relationships among destination familiarity, destination image and future visit intention", *Journal of Destination Marketing and Management*, Vol. 5 No. 3, pp. 214-226, doi: 10.1016/j.jdmm.2015.12.008.

Tussyadiah, I.P., Wang, D., Jung, T.H. and Dieck, M.C.T. (2018), "Virtual reality, presence, and attitude change: empirical evidence from tourism", *Tourism Management*, Vol. 66, pp. 140-154, doi: 10.1016/j.tourman.2017.12.003.

Wei, W., Qi, R. and Zhang, L. (2019), "Effects of virtual reality on theme park visitors' experience and behaviors: a presence perspective", *Tourism Management*, Vol. 71, pp. 282-293, doi: 10.1016/j.tourman.2018.10.024.

Wei, Z., Zhang, J., Huang, X. and Qiu, H. (2023), "Can gamification improve the virtual reality tourism experience? Analyzing the mediating role of tourism fatigue", *Tourism Management*, Vol. 96, p. 104715, doi: 10.1016/j.tourman.2022.104715.

YouTube (2024), "YouTube 360°", available at: www.youtube.com/360

Yu, H., Oh, H. and Wang, K.-C. (2024), "Virtual reality and perceptions of destination presence", *International Journal of Contemporary Hospitality Management*, doi: 10.1108/IJCHM-05-2023-0744.

Yuan, A. and Hong, J. (2023), "Impacts of virtual reality on tourism experience and behavioral intentions: moderating role of novelty seeking", *Journal of Hospitality and Tourism Research*, doi: 10.1177/10963480231171301.

Zarantonello, L. and Schmitt, B.H. (2023), "Experiential AR/VR: a consumer and service framework and research agenda", *Journal of Service Management*, Vol. 34 No. 1, pp. 34-55, doi: 10.1108/JOSM-12-2021-0479.

Zhu, J., Jiang, Y., Jiang, Y., Wang, Y. and Yang, Q. (2023), "The effectiveness of social elements in virtual reality tourism: a mental imagery perspective", *Journal of Hospitality and Tourism Management*, Vol. 56, pp. 135-146, doi: 10.1016/j.jhtm.2023.05.024.

Further reading

Jamovi (2023), "Jamovi—stats. Open", Now, available at: www.jamovi.org/

Supplementary material

The supplementary material for this article can be found online.

Corresponding author

Sebastian Molinillo can be contacted at: smolinillo@uma.es