Virtual reality and perceptions of destination presence

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Abstract

Purpose – This study aims to examine the underlying emotional process that explains how context-specific stimuli involved in virtual reality (VR) destinations translate into presence perceptions and behavioral intentions.

Design/methodology/approach – In total, 403 potential tourists participated in a self-administered online survey after they watched a randomly assigned VR tour. The Lavaan package in R software was used to conduct structural equation analysis and examine the proposed theoretical framework.

Findings – The results reveal that media content consisting of informativeness, aesthetics and novelty was positively related to users' sense of presence in a VR tour. The effect of media content on presence was partially mediated by emotional arousal.

Practical implications – Managers and VR designers can create an emotive virtual tour that contributes to the user's sense of presence to promote attraction to the target destination. The VR content needs to be informative, aesthetic and novel, which can excite users during the VR tour, portray virtual destinations clearly and eventually influence potential tourists' visit intentions.

Originality/value – Research on the emotional mechanism to generate presence is still in its infancy. This study integrates presence theory into a conceptual framework to explore how media content influences presence and decision-making through the emotional mechanism.

Keywords Virtual reality, Media content, Presence, Emotional arousal, Tourism experience

Paper type Research paper

1. Introduction

Virtual reality (VR) has reshaped how prospective tourists plan their trips and search for destination information (Lee *et al.*, 2020). Different from other immersive technologies such as augmented reality (AR), VR is a technology that creates a completely computer-generated environment that involves users in a three-dimensional (3D) interactive experience (Flavián *et al.*, 2019b). VR enables potential tourists to preview destinations and travel experiences virtually, which is unlike traditional media forms that allow tourists to remember a set of pictures about the destination rather than a place (Yung *et al.*, 2021). The presence construct, widely defined as the sense of being at a real destination through a VR experience, has driven

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the research and development of VR (Skarbez *et al.*, 2017). To foster a sense of being present in a remote environment, scholars have used the theoretical perspective of presence to investigate the effectiveness of VR in enhancing the presence experience for users (e.g. Wei *et al.*, 2019).

Presence rests on a continuous prediction of emotional states (Seth *et al.*, 2012). VR developers have started using a pleasure-oriented approach to create immersive experiences for users. This approach is particularly crucial in the case of destination marketing because tourist experiences are consumed mainly for hedonic purposes. Beyond acquiring information, potential travelers thirst for inspiration in virtual tours (Beck and Egger, 2018), and these invoked emotions often influence their travel decisions. A virtual environment with hedonic attributes can trigger arousing emotions without spatial and temporal restrictions, differentiating itself from traditional marketing media.

Despite the VR industry's keen interest in creating emotional engagement to evoke presence, tourism research on the issue is scarce. Researchers have proposed that enjoyment (Bigne and Maturana, 2023), emotional engagement (Wagler and Hanus, 2018), predicted happiness (Skard *et al.*, 2021) and subjective well-being (McLean *et al.*, 2023) are affective consequences of presence and are linked to user satisfaction and positive behavioral intentions. In addition, Wei *et al.* (2019) have emphasized that experiential attributes of VR destinations are particularly important for presence perceptions in a hedonically driven context. Despite the growing emphasis on the relationship between presence and emotion, calls have been made for more interdisciplinary studies to better understand the relationship between presence and emotion (Yung *et al.*, 2021). Additional research needs to show how the emotional mechanism of presence can predict tourist decision-making, especially in the pre-visit stage.

Diemer *et al.*'s (2015) theoretical framework of presence highlights the crucial role of emotional arousal. Emotional arousal refers to a state of heightened physiological activity (Mehrabian and Russell, 1974). High-intensity emotions generated from the focal experience make people more alert. Emotional arousal is generalized across specific emotion categories, which implies a general temperament dimension of emotional reactivity and variability. Strongly arousing emotions like fear and anxiety have been found to be stronger in more immersive VR setups (Juan and Pérez, 2009), while positive and non-arousing emotions such as relaxation and pleasure were influenced less by media content (Freeman *et al.*, 2005). Hence, aroused feelings may accompany either positive or negative emotional states, explaining the relationship between media content and presence. Producing arousing emotions is one of the main benefits of VR tours. Thus, emotional arousal could be a suitable method for studying how users assess the sense of presence.

To enrich our understanding of the relationship between emotional experience and presence perceptions in tourist destinations, this research examines how VR stimuli influence presence through an emotional process. By extending Diemer *et al.*'s (2015) presence theoretical framework to the context of VR destination marketing, the objectives of this study are to identify the VR content factors that affect presence through the emotional process, to test the role of emotional arousal in mediating media content toward presence and to assess the effects of presence on behavioral intentions. This study attempts to demonstrate how the emotional mechanism induces presence in virtual destinations, which allows a better conceptualization of the roles of presence in shaping users' responses. In addition, the study pioneers an investigation into emotional arousal as a vital component in explaining how VR media content shapes presence in a tourism context. The findings will help destination managers and VR designers create emotively enriched virtual tours that can spark users' interest in the target destination. Thus, this research extends presence

theory to enhance our understanding of the emotional process underlying virtual tours and helps practitioners leverage the user's emotive experience.

2. Theoretical background

2.1 Presence research in tourism management

Presence is a pivotal concept that explains the effectiveness of VR across diverse contexts (Tussyadiah *et al.*, 2018). In this paper, we focus on media presence (i.e. telepresence) and define presence as the perceptual illusion of being in the real destination via a mediated virtual destination. The sense of presence is a crucial factor driving information processing performance and decision-making. Essentially, the outcomes of presence can be divided into those during and after the virtual tour (see Supplementary Material, Appendix 1). During the virtual experience, presence is found to exert a positive impact on users' education, aesthetic, entertainment and escape experience in the context of museum marketing (Tom Dieck *et al.*, 2018). Other researchers suggested that a higher sense of presence is associated with enjoyment (Tussyadiah *et al.*, 2018), flow state (Willems *et al.*, 2019) and destination image (Hyun and O'Keefe, 2012). Importantly, the subjective experience of presence can persuade consumers to revisit and recommend the VR experience (e.g. Jung *et al.*, 2016) or translate into real-world behavioral intentions in various VR tourism contexts (e.g. Lee *et al.*, 2020). Nevertheless, most studies have concentrated on one or two persuasive effects of presence. There is a critical need to establish a comprehensive understanding of the persuasive effects of presence on the virtual and real destination shown in VR.

The tourism literature documents what factors contribute to forming presence. Consistent with other virtual environments, interactivity and vividness have been found to be the key innovative VR features that play important roles in generating presence in VR tourism (Willems *et al.*, 2019). Hyun and O'Keefe (2012) suggested an initial model of virtual destination image formation by which Web-mediated information and offline travel information exerted positive effects on presence. Drawing upon process theory, Wei *et al.* (2019) found that presence was driven predominantly by experiential and functional quality. Building on the information system success model, Lee *et al.* (2020) identified another quality construct that contributed to presence (i.e. system quality, content quality and vividness). In addition, some essential VR features such as immersion (Bigne and Maturana, 2023), media richness (Martínez-Molés *et al.*, 2022) and interactivity were found to contribute to the sense of presence. Recently, tourism literature began to provide experimental evidence that different preview modes have causal effects on presence.

However, few studies have adopted presence theories to research the mechanism of forming presence. Furthermore, existing tourism studies mostly focus on the cognitive processes that could affect the sense of presence, but there is little published research on the affective responses that lead to presence. To achieve a comprehensive understanding of presence, there is a clear need to understand the emotional formation of presence occurring in virtual destination tours. To bridge these research gaps, this research adopted Diemer *et al.*'s (2015) presence theory to delineate the emotional process of presence and summarize the persuasive effects of presence in VR tourism.

2.2 Theoretical foundation

Diemer *et al.* (2015) offered a novel view of emotion as "interoceptive inference" and provided the theoretical background for constructing the emotional mechanism of presence. Interoception is the perception of the physiological condition that is associated with the generation of subjective feeling states. During the process of interoception, media content depicts the overall theme or narrative, which can make affective predictions and induce

presence (Seth *et al.*, 2012). According to Diemer *et al.*'s (2015) model, individuals evaluate presence according to two primary factors: (1) immersion in VR system; and (2) the media content offered by VR. First, immersion refers to the technological quality of the VR system from an objective point of view. A higher level of immersion gives users higher presence ratings based on the perceptual distance they experience from the real-world setting. Second, media content refers to the overall theme or narrative depicted via a medium. VR media content can engage emotions, enhance a VR environment and ultimately increase presence ratings. For instance, the sensation of presence can be enhanced in less immersive virtual environments when using emotional content (Baños *et al.*, 2004).

This research focuses on media content, aiming to deepen the understanding of the emotional processes that contribute to the sense of presence in VR tourism. Only a few studies (e.g. Willems *et al.*, 2019) have focused on the relationship between presence and enjoyment (see Supplementary Material, Appendix 1), but relatively little attention has been paid to the emotional process of inducing presence in the hospitality and tourism literature. Diemer *et al.*'s (2015) model can help explain the emotional process of generating a sense of presence. Figure 1 depicts how media content contributes to users' feelings of presence through and how presence leads to behavioral outcomes.

Drawing upon the classification of media content by Rahimnia and Hassanzadeh (2013), this study divides VR media content into three stimuli: informativeness, aesthetics and novelty. Informativeness describes the perceptual assessment of the depth of information or destination-related knowledge conveyed through VR. Specifically, informativeness encompasses the extent to which VR fulfills its promise regarding tour information and tour availability. Most studies have relied on perceived visual appeal or vividness as indicators of aesthetic quality (see Supplementary Material, Appendix 2). However, with the evolution of VR technology, aesthetic considerations extend beyond the visual dimension and encompass sensory aspects such as touch and smell (Rahimnia and Hassanzadeh, 2013). This research adopts this broader perspective, defining aesthetics as the subjective evaluation of how product information is perceived. Although relatively few studies have incorporated the concept of novelty, the significance of this dimension is underscored by Han *et al.*'s (2018) qualitative investigation into urban heritage tourism. Within the realm of AR, hedonic attributes like stimulating interest in tourist attractions and creative alternatives for information dissemination have been recognized as contributors to user satisfaction. Therefore, novelty is defined in this study as a composite of new, unique and unusual stimuli. This reflects the degree of differentiation between current cognitive processes and past experiential encounters.

3. The conceptual model and hypotheses

Presence can result from media richness. According to media richness theory, rich communication mediums lower the ambiguity of a message, improve the ease of

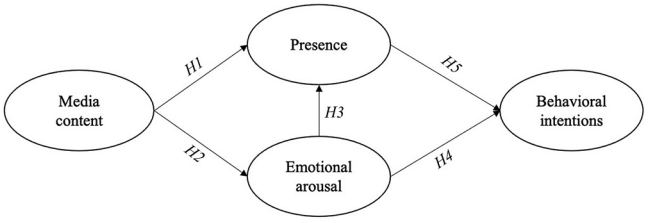

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Figure 1.
The conceptual model

interpretation and lead to a better understanding of the message (Daft and Lengel, 1986). Media richness can arise from objective characteristics such as communication capability and language variety (Lee *et al.*, 2021). The immersive, three-dimensional media content provided by VR requires more attention to uncover information and entertainment, which further increases presence. Following media richness theory, we define media content as information richness and the capability of VR design to present the destination information.

VR simulates a real tour by offering emotional stimuli through information fulfillment, aesthetics and novelty to communicate meaning through "object language." The optimal VR tour would clearly communicate information with high-quality technological support (Wei *et al.*, 2019). With this system, users would have more immersed and engaged feelings of presence from the virtual environment. Based on this reasoning and previous empirical results, we propose the following hypotheses:

H1. Media content consisting of informativeness, aesthetics and novelty is positively related to users' sense of presence in a VR tour.

Emotional arousal serves as a mediating mechanism between media content and presence in VR destinations. Media content provides emotionally relevant information, making it more appealing and boosting emotional arousal. Because emotional arousal is a strong indicator of emotional involvement, this can lead to stronger presence perceptions (Diemer *et al.*, 2015). Freeman *et al.*'s (2005) arousal theory on presence highlights the fundamental role of emotional arousal. In particular, emotional arousal represents a "call to action," leading to alertness and greater presence feelings. Zillmann's (1971) excitation transfer theory posits that emotional arousal can be triggered by media content. In the VR tour context, emotional arousal refers to the degree of excitation the user experiences while viewing a VR tour. According to the presence model by Diemer *et al.* (2015), individuals evaluate presence through a feature detection process. The features of media content will be given priority, resulting in emotional arousal. This relevant sensory information, described as emotionally arousing stimuli by Bhandari *et al.* (2017), increases the impact of impressions from various senses. Hence, emotionally arousing stimuli in media content could enhance emotional arousal in VR (Diemer *et al.*, 2015),

Several studies found that emotional arousal could be elicited by informativeness, aesthetics and novelty in media content. Informativeness, which Hew *et al.* (2018) described as system and service quality, could influence tourists' affective reactions. Research in different domains has shown that aesthetics has a positive effect on entertainment (Tom Dieck *et al.*, 2018) and perceived enjoyment (Chung *et al.*, 2018). Aesthetics had a strong halo effect, which might accompany a state of emotional arousal, affecting individuals' overall judgments of presence. Similar to real destinations, virtual destinations can generate high levels of arousal and positive valence (Tussyadiah *et al.*, 2018). The results of Bhandari *et al.* (2017) also confirmed that originality appealed to the arousal dimension of emotion. Therefore, emotional arousal may be induced by media content through the activation of the underlying emotions:

H2. Media content is positively related to users' emotional arousal.

The relationship between emotion and presence has been consistently reported, but the theory connecting emotional arousal and presence needs further examination (Diemer *et al.*, 2015). The interoceptive predictive coding model proposed that presence relied on a continuous prediction of emotional interoceptive states (Seth *et al.*, 2012). When visitors perceive overall quality in a VR world, they will feel more aroused and joyful, interact with

the virtual environment and ultimately feel a greater presence (Wei *et al.*, 2019). Therefore, emotional arousal should elicit a high sense of presence.

Researchers suggested emotional arousal could have an impact on presence. Freeman *et al.* (2005) explained that emotional arousal might increase presence by enhancing attention to VR experience. Without arousal, the user may fail to attend to VR details and not notice what is happening, thereby causing perceived presence to fade. Presence involves continuous responses of the human sensory, affective and cognitive processing systems. The sense of being there can be cognitively and emotionally created by feeling and doing there. Therefore, it is reasonable to assume that if users have a higher sense of emotional arousal, their sense of presence would increase:

H3. Emotional arousal is positively related to users' sense of presence in a VR tour.

The relationship between emotion and behavioral intention has received repeated empirical support. The emotional reactions, including valence and arousal, in the organism drive attitudes and behavioral intentions (Van Berlo *et al.*, 2021). Girish and Chen's (2017) study shows that arousal, but not valence, is positively related to satisfaction and loyalty. Arousal derived from energy mobilization could be a stronger motivator than valence for engaging in virtual destinations (Su *et al.*, 2020). This higher emotional engagement might build an attachment to VR and enhance intentions to revisit and recommend the virtual destination (Kim *et al.*, 2020). Similar to a real tour, a virtual tour along emotional arousal can create emotional bonds to the real destination and influence users' intention to visit and recommend the destination (Güzel *et al.*, 2020). Previous studies have demonstrated that emotional arousal is positively related to approach-avoidance behavior, loyalty and storytelling intentions toward the product people have experienced (Su *et al.*, 2020). Accordingly, this study proposes the following:

H4. Emotional arousal is positively related to behavioral intentions: intention to visit the real destination featured in the VR; intention to recommend the real destination; intention to revisit the virtual destination; and intention to recommend the virtual destination.

Triberti and Riva's (2015) model predicted that when users perceived presence, they were likely to induce strong intentions to visit and recommend the real destination. Previous studies have shown a positive relationship between presence and intentions to visit and recommend tourist destinations (Willems *et al.*, 2019). VR users intend to visit real destinations to feel being present in the destinations. Potential tourists have limited abilities to evaluate their travel experience before visiting a destination. The sense of presence allows them to experience the practical components of a destination in advance (Lee *et al.*, 2020).

Presence can improve advertising effectiveness. Marketing research has shown that presence increases the recall and recognition of advertising and liking of the advertisement. Fang *et al.* (2018) indicated that hedonic benefit perceptions induced through the compelling, immersive experience could explain how presence affected loyalty to the virtual destinations. Similarly, Wei *et al.* (2019) found that users' presence in a VR roller coaster experience could positively influence their overall experience, leading to higher intentions to visit and recommend the VR destination. Another important implication is that VR users may spread positive word-of-mouth or discuss their VR experience with friends and relatives, even if they do not intend to visit the real destination (Griffin *et al.*, 2017). Therefore, presence can determine intentions to revisit and recommend the virtual destination:

H5. The user's presence is positively related to their behavioral intentions: intention to visit the real destination; intention to recommend the real destination; intention to revisit the virtual destination; and intention to recommend the virtual destination.

4. Methods

4.1 Study context

This study focuses on website-based VR because it is widely used for destination marketing (Lee *et al.*, 2020). Website-based VR eliminates the need for specialized equipment, such as customized headsets, making it efficient and user-friendly. It is accessible to a wide range of potential tourists, regardless of geographical location. After reviewing more than 50 websites offering virtual tours of destinations in the USA, this study chose two website-based VR tours: one was a nature destination, Yosemite National Park (www.virtualyosemite.org/), and the other was a city destination, New York City (www.youvisit.com/tour/nyc?facebook=1). The selection criteria for the VR tours were based on their advanced technological features and high-quality media content to ensure a comprehensive examination of their influence.

4.2 Survey design

This research used an online, self-administered field survey to collect data before and after the participants watched a randomly assigned VR tour of the two in a computer lab setting. Participants were required to browse for at least 5 min before completing the questionnaire. A total of 403 participants completed the survey, and they were undergraduate and graduate students at a large southeastern university in the USA. This study chose students for three reasons. First, the use of student samples in a computer lab eliminates potential distractions and interruptions. Second, it increases the likelihood of participants completing the entire survey, providing this study with more robust data for analysis. Third, students exhibit greater receptiveness to new media and technologies (Willems *et al.*, 2019), making them an ideal group to study in relation to the adoption of VR and its impact on destination marketing.

4.3 Measurement items

Adopted from Rahimnia and Hassanzadeh (2013), media content consists of the three first-order constructs, which were measured on seven-point semantic differential scales: informativeness (five items; Cronbach's alpha = 0.89), aesthetics (five items; Cronbach's alpha = 0.92) and novelty (five items; Cronbach's alpha = 0.92). We adopted a three-item subjective presence scale from Usoh *et al.* (2000) that was operationalized on seven-point semantic differential scales (Cronbach's alpha = 0.93). The Slater–Usoh–Steed questionnaire from Usoh *et al.* (2000) is one of the most commonly used presence questionnaires (Skarbez *et al.*, 2017). Emotional arousal was conceptualized as a unitary emotional response dimension ranging from sleep to frantic excitement (Mehrabian and Russell, 1974) and operationalized into a three-item perceived emotional arousal scale based on Mehrabian and Russell (1974) and Wu and Holsapple (2014) (alpha = 0.87). Intention to visit the real destination was measured with a three-item scale adopted from Kim *et al.* (2020) (alpha = 0.91). Intention to recommend the real destination (alpha = 0.93) and intention to recommend the virtual destination (alpha = 0.94) were measured with three items, each adapted from Prayag *et al.* (2017). Intention to revisit the virtual destination was measured with three items from Kim and Hall (2019) (alpha = 0.95) that were anchored on a seven-point Likert-type scale.

This study included technology orientation and prior destination experience as control variables. Technology orientation refers to positive attitude toward technology and inclination toward purchasing advanced technology (Kabadayı and Alan, 2012). It was included because consumers' interests in new innovative technologies were associated with attitudes and behavioral intentions toward technology (Wei *et al.*, 2019). A four-item scale of technology orientation was adopted from Kabadayı and Alan (2012) (alpha = 0.88). In addition, prior destination experience may influence behavioral intentions (Flavián *et al.*, 2021). Respondents were classified as "have not been to the destination in VR" (coded 0) and "have been to the destination in VR" (coded 1).

5. Analysis and results

5.1 Sample characteristics

Table 1 summarizes respondent characteristics. The 403 respondents consisted of 52.4% male and 47.6% female. Their age was reported to be 18–25 years (41.4%), followed by 26–35 years (33.5%). The majority identified themselves as Caucasian (70.2%), followed by Asian or Pacific Islander (13.2%) and African American (10.7%). A significant portion held bachelor's degrees (56.8%), while 19.6% pursued postgraduate education. More than 61% (61.3%) had never been married, while 34% indicated that they were married. The most frequent response to annual household income was more than $125,000 (33.0%), followed by $75,000–$125,000 (28.5%). This high average income for a student sample could be due to the fact that 215 (53.3%) of the participants were enrolled in the professional Master of Business Administration (MBA) program. Some students might have reported their parents' family income, as many of them could still be dependents to their parents. As a result of random VR assignment, 192 (47.6%) respondents were assigned to watch the Yosemite VR, while 211 (52.4%) the New York City VR. About 44% of the respondents reported they had been to the destination shown in their assigned VR.

5.2 Measurement model test

This study followed Anderson and Gerbing's (1988) two-step method to assess the measurement model via confirmatory factor analysis. The measurement model, consisting of 37 observed variables and 10 latent constructs, exhibited an acceptable fit ($\chi^2 = 1{,}305.20$, d.f. = 584, χ^2/d.f. = 2.24, $p < 0.001$; RMSEA = 0.05; CFI = 0.95; and TLI = 0.94). As shown in Table 2, the standardized loadings of all observed variables ranged from 0.74 to 0.96 and significantly differed from zero ($p < 0.001$), thereby demonstrating convergent validity. Each construct resulted in Cronbach's alpha and composite reliability higher than 0.70. The value of the average variance extracted (AVE) was higher than 0.5 as recommended by Hair *et al.* (2019), further evidencing construct validity. All constructs exhibited satisfactory discriminant validity, as the inter-construct correlations were below the square root of AVEs (see Table 3) (Fornell and Larcker, 1981). This research also addressed common method bias by Harman's single-factor test and multiple-method factor technique.

5.3 Structural model and hypothesis testing

Figure 2 depicts the fit indices of the structural model (see Table 4). The goodness-of-fit statistics indicated that the structural model fit the data well ($\chi^2 = 1{,}483.96$, d.f. = 672, χ^2/d.f. = 2.21, $p < 0.001$; RMSEA = 0.06; CFI = 0.95; and TLI = 0.94). As hypothesized, media content was significantly and positively related to emotional arousal ($\beta = 0.78$, $t = 11.51$, $p < 0.001$, $R^2 = 0.61$), providing support for *H1*. Media content ($\beta = 0.50$, $t = 6.13$, $p < 0.001$) and emotional arousal ($\beta = 0.29$, $t = 3.77$, $p < 0.001$) were significantly and positively related to presence ($R^2 = 0.56$), supporting *H1* and *H3*.

Characteristics	Frequency	%
Gender		
Male	211	52.4
Female	192	47.6
Age		
18–25 years old	167	41.4
26–35 years old	135	33.5
36–45 years old	66	16.4
46–55 years old	27	6.7
Over 55 years old	8	2.0
Ethnicity		
Caucasian	283	70.2
African American	43	10.7
Asian or Pacific Islander	53	13.2
America Indian or Native American	2	0.5
Other	22	5.5
Education		
High school graduate	87	21.6
Associate degree (2-year)	8	2.0
Bachelor's degree (4-year)	229	56.8
Postgraduate degree	79	19.6
Household income		
Less than $50,000	97	24.1
$50,000–$75,000	58	14.4
$75,001–$125,000	115	28.5
More than $125,000	133	33.0
Marital status		
Never married	247	61.3
Married	137	34.0
Other	19	4.7
VR type assigned		
Yosemite	192	47.6
New York	211	52.4
Have you been to the destination in VR?		
Yes	177	43.9
No	226	56.1

Source: Created by authors

Table 1. Demographic profile ($n = 403$)

As for behavioral intentions, both emotional arousal ($\beta = 0.27$, $t = 3.75$, $p < 0.001$) and presence ($\beta = 0.23$, $t = 3.31$, $p < 0.01$) were significant and positively related to intention to visit the real destination ($R^2 = 0.25$). Both emotional arousal ($\beta = 0.32$, $t = 4.71$, $p < 0.001$) and presence ($\beta = 0.30$, $t = 4.51$, $p < 0.001$) were significantly related to intention to recommend the real destination ($R^2 = 0.35$); both emotional arousal ($\beta = 0.26$, $t = 4.18$, $p < 0.001$) and presence ($\beta = 0.45$, $t = 6.98$, $p < 0.001$) were significantly related to intention to revisit the virtual destination ($R^2 = 0.46$); both emotional arousal ($\beta = 0.35$, $t = 5.71$, $p < 0.001$) and presence ($\beta = 0.43$, $t = 7.10$, $p < 0.001$) were significantly related to intention to recommend the virtual destination ($R^2 = 0.55$). These results lent support for *H4a–d* and

Construct and measurement items	Mean (SD)	Factor loadings	Skew.	Kurt.
Informativeness (composite reliability = 0.89; Cronbach's $\alpha = 0.89$; AVE = 0.63)				
Not at all informative – extremely informative	5.54 (1.24)	0.77	−0.82	0.66
Extremely cursory – extremely thorough	5.26 (1.26)	0.81	−0.55	−0.03
Not at all personalized – highly personalized	4.45 (1.64)	0.74	−0.24	−0.66
Not at all sufficient – very sufficient	5.16 (1.40)	0.84	−0.59	−0.17
Minimal coverage – extensive coverage	5.20 (1.48)	0.81	−0.68	−0.21
Aesthetics (composite reliability = 0.92; Cronbach's $\alpha = 0.92$; AVE = 0.70)				
Ugly – beautiful	5.83 (1.17)	0.90	−0.74	−0.29
Unattractive – attractive	5.78 (1.22)	0.92	−0.91	0.35
Unclean – clean	5.76 (1.20)	0.81	−0.90	0.42
Rigid design – artistic design	5.31 (1.32)	0.76	−1.06	0.93
Static – vivid	5.64 (1.24)	0.80	−0.48	−0.31
Novelty (composite reliability = 0.93; Cronbach's $\alpha = 0.92$; AVE = 0.71)				
Ordinary – novel	5.20 (1.38)	0.77	−0.74	−0.08
Conservative – innovative	5.42 (1.34)	0.90	−0.66	0.14
Cautious – bold	5.11 (1.35)	0.84	−0.63	−0.16
Unimaginative – imaginative	5.40 (1.39)	0.85	−0.28	−0.58
Conventional – inventive	5.37 (1.34)	0.86	−0.73	0.01
Emotional arousal (Composite reliability = 0.87; Cronbach's $\alpha = 0.87$; AVE = 0.69)				
Dull – lively	5.00 (1.30)	0.90	−0.64	−0.11
Sleepy – wide-awake	4.79 (1.35)	0.85	0.12	0.85
Unaroused – aroused	4.54 (1.44)	0.75	−0.45	0.11
Presence (composite reliability = 0.94; cronbach's $\alpha = 0.93$; AVE = 0.83)				
I had a sense of "being there" in Yosemite/ New York	4.99 (1.58)	0.90	−0.41	0.10
I felt Yosemite/New York was the reality for me	4.56 (1.66)	0.94	−0.77	−0.08
I felt that I was really standing in Yosemite/ New York	4.44 (1.81)	0.90	−0.46	−0.60
Intention to visit the real destination (composite reliability = 0.91; Cronbach's $\alpha = 0.91$; AVE = 0.78)				
I am planning to visit Yosemite/New York someday	5.22 (1.64)	0.84	−0.41	−0.86
I intend to visit Yosemite/New York in the near future	4.65 (1.80)	0.87	−0.47	−0.78
I intend to invest money and time to visit Yosemite/New York	4.67 (1.75)	0.93	−0.48	−0.66
Intention to recommend the real destination (composite reliability = 0.94; Cronbach's $\alpha = 0.93$; AVE = 0.83)				
I will recommend visiting Yosemite/New York to other people	5.01 (1.55)	0.96	−0.71	0.02
I will say positive things about Yosemite/New York to other people	5.13 (1.46)	0.95	−0.82	0.40
How likely are you to recommend visiting Yosemite/New York to friends, colleagues or relatives?	5.10 (1.50)	0.83	−0.83	0.35

Table 2. Results of the measurement model (n = 403)

(*continued*)

Construct and measurement items	Mean (SD)	Factor loadings	Skew.	Kurt.
Intention to revisit the virtual destination (composite reliability = 0.95; Cronbach's $\alpha = 0.95$; AVE = 0.87)				
I will use this Yosemite/New York VR again in the future	4.27 (1.78)	0.93	−0.33	−0.88
I will look for updates to this Yosemite/New York VR in the future	3.92 (1.75)	0.90	−0.09	−0.99
I will search for this Yosemite/New York VR again in the future	4.17 (1.80)	0.96	−0.24	−1.00
Intention to recommend the virtual destination (composite reliability = 0.94; Cronbach's $\alpha = 0.94$; AVE = 0.84)				
I will recommend this VR tour site of Yosemite/New York to other people	4.84 (1.67)	0.94	−0.76	−0.14
I will say positive things about this VR tour of Yosemite/New York to other people	5.02 (1.58)	0.93	−0.89	0.33
How likely are you to recommend viewing this Yosemite/New York VR to friends, colleagues or relatives?	5.02 (1.58)	0.87	−0.81	−0.05
Technology orientation (composite reliability = 0.89; Cronbach's $\alpha = 0.88$; AVE = 0.66)				
It is important for me to keep up with the latest trends in technology	5.34 (1.32)	0.72	−1.00	1.07
When I see a new technology product, I tend to check it out	5.09 (1.35)	0.89	−1.55	4.36
I am often among the first people to try a new technology product	3.80 (1.57)	0.81	−0.75	0.35
I like to try new and different technology products	5.02 (1.34)	0.82	−0.68	0.46

Note: AVE = average variance extracted
Source: Created by authors

Table 2.

Constructs	1	2	3	4	5	6	7	8	9	10
1. Informativeness	0.79									
2. Aesthetics	0.76	0.84								
3. Novelty	0.73	0.79	0.84							
4. Emotional arousal	0.68	0.69	0.67	0.83						
5. Presence	0.71	0.63	0.61	0.69	0.91					
6. Intention to visit the real destination	0.34	0.31	0.30	0.46	0.44	0.88				
7. Intention to recommend the real destination	0.42	0.47	0.42	0.58	0.55	0.82	0.91			
8. Intention to revisit the virtual destination	0.52	0.45	0.46	0.59	0.64	0.58	0.65	0.93		
9. Intention to recommend the virtual destination	0.65	0.60	0.56	0.70	0.70	0.50	0.72	0.84	0.92	
10. Technology orientation	0.16	0.21	0.22	0.15	0.15	0.22	0.20	0.23	0.23	0.81
Mean	5.12	5.66	5.30	4.77	4.67	4.85	4.12	5.08	4.96	4.81
SD	1.40	1.23	1.36	1.36	1.68	1.73	1.78	1.50	1.61	1.40

Notes: Square root of AVE in the diagonal; AVE = average variance extracted
Source: Created by authors

Table 3.
Correlation matrix and discriminant validity

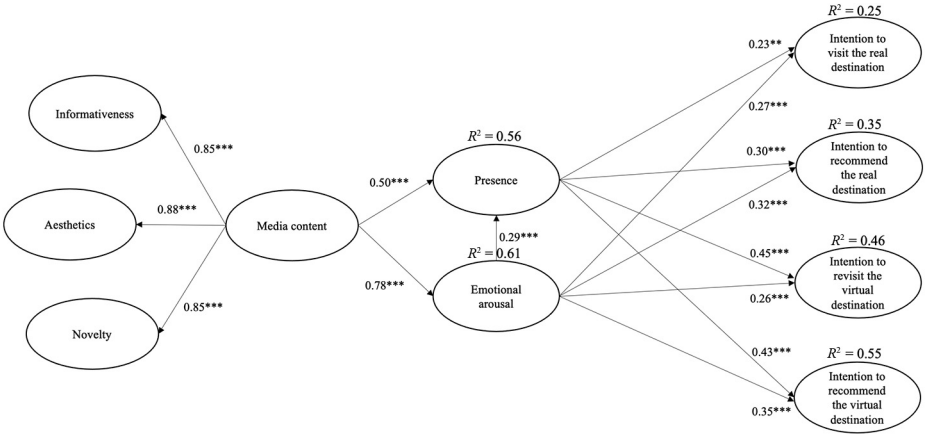

Figure 2.
The structural model

Source: Created by authors

H5a–d. All R^2 values of the endogenous constructs were higher than the 10% benchmark (Hair *et al.*, 2019).

In addition, the control variable of technology orientation has a positive relationship with intention to visit the real destination ($\beta = 0.14$, $p < 0.01$), intention to recommend the real destination ($\beta = 0.094$, $p < 0.05$), intention to revisit the virtual destination ($\beta = 0.120$, $p < 0.01$) and intention to recommend the virtual destination ($\beta = 0.110$, $p < 0.01$). In addition, the control variable of prior destination experience has a positive link with intention to visit the real destination ($\beta = 0.11$, $p < 0.05$) and intention to recommend the real destination ($\beta = 0.20$, $p < 0.001$).

6. Discussion

Several key findings are worthy of discussion. First, our data indicate a significant relationship between media content and presence. When users have a favorable perception of media content, they have a greater feeling of being present in a virtual destination. This result confirms the findings by Lee *et al.* (2020), indicating that media content is a key predictor of presence in virtual destinations. Media content is of vital importance, as it can induce a logical flow of events and keep the user interested, involved and present in the virtual environment (Jiang *et al.*, 2023). To be present in a virtual environment, the user must notice and understand the media content. Therefore, virtual destinations should offer a high level of rich, creative and aesthetically captivating media content that produces a place that the user feels located within.

Second, the effect of media content on presence is partially mediated by emotional arousal. Emotional arousal measures the activation of the pleasure dimension of emotion and, thus, captures more of the impact of media content in terms of how exciting the VR is for users (Bhandari *et al.*, 2017). Media content attracts users' attention, evokes their emotions and involves them in the virtual environment. In this situation, users can more easily and readily feel present in the virtual environment. This finding supports the existing arguments that a high-quality virtual environment creates a stronger sense of emotional arousal (Bogicevic *et al.*, 2019). The strong association between emotional arousal and presence confirms the positive value of presence as a hedonistic experience, thus highlighting the importance of the emotional mechanism of presence.

Hypothesis/path	Path coefficients	*t* value	Support for hypotheses
H1: Media content → presence	0.50***	6.13	Supported
H2: Media content → emotional arousal	0.78***	11.51	Supported
H3: Emotional arousal → presence	0.29***	3.77	Supported
H4a: Emotional arousal → intention to visit the real destination	0.27***	3.75	Supported
H4b: Emotional arousal → intention to recommend the real destination	0.32***	4.71	Supported
H4c: Emotional arousal → intention to revisit the virtual destination	0.26***	4.18	Supported
H4d: Emotional arousal → intention to recommend the virtual destination	0.35***	5.71	Supported
H5a: Presence → intention to visit the real destination	0.23**	3.31	Supported
H5b: Presence → intention to recommend the real destination	0.30***	4.51	Supported
H5c: Presence → intention to revisit the virtual destination	0.45***	6.98	Supported
H5d: Presence → intention to recommend the virtual destination	0.43***	7.10	Supported
Technology orientation → intention to visit the real destination	0.14**	2.77	–
Technology orientation → intention to recommend the real destination	0.09*	2.06	–
Technology orientation→ intention to revisit the virtual destination	0.12**	2.83	–
Technology orientation → intention to recommend the virtual destination	0.11**	2.76	–
Prior destination experience → intention to visit the real destination	0.11*	2.26	–
Prior destination experience → intention to recommend the real destination	0.20***	4.44	–
Prior destination experience→ intention to revisit the virtual destination	0.03	0.65	–
Prior destination experience → intention to recommend the virtual destination	−0.02	−0.62	–

Notes: ***$p < 0.001$; **$p < 0.01$; *$p < 0.05$
Source: Created by authors

Table 4.
Standardized structural estimates and hypotheses tests

Third, this study offers empirical evidence that emotional arousal enhances behavioral intentions toward the virtual destination and the actual destination shown in VR. These findings are consistent with existing research, which shows that a greater level of emotional arousal can induce storytelling (Su *et al.*, 2020) and change behavioral intentions (Güzel *et al.*, 2020). Previous VR tourism studies have found that behavioral intentions are enhanced by diverse affective responses such as enjoyment (Tussyadiah *et al.*, 2018), emotional involvement (Kim *et al.*, 2020), pleasure (Cheng and Huang, 2022) and flow state (Kim and Hall, 2019). The current research further supports the idea that emotional arousal is critical in virtual environment for changing behaviors.

Finally, this research shows that higher presence perceptions prompt users to visit and recommend the destinations shown in VR. This result supports the findings of prior studies that VR commercials displaying a higher level of presence attracted more attention to the destination (Martínez-Molés *et al.*, 2022) and positively influenced attitudes toward the destination (McLean *et al.*, 2023). The findings also corroborate Bigne and Maturana's (2023) work in e-business, demonstrating that presence is a key driver of VR adoption. Hence, the sense of presence is indeed a critical element in eliciting positive behavioral outcomes.

7. Implications and suggestions

7.1 Conclusions

This study is among the pioneering efforts to validate the role of media content in the interoceptive prediction of presence and behavioral intentions. Such an endeavor can contribute to creating a competitive advantage of VR technology and maintaining a sustainable destination advertising business. More importantly, we propose a comprehensive framework to influence potential customers' destination visits after watching relevant VRs. VR producers can design their VR content to be informative, aesthetic and novel so that VR tours can help users obtain excitation, portray the potential product clearly and develop strong intentions to visit the featured destination. In addition, this paper highlights the importance of emotional arousal in VR destinations. Strategies aimed at influencing emotional arousal can help destinations create an emotional link between users and destinations, resulting in actual visits.

7.2 Theoretical contributions

This research contributes to the literature on information technology and tourism management in four facets. First, this study expands our understanding of presence theory and enhances comprehension of the emotional mechanism underlying presence perceptions. The results affirm that VR content enables users to feel present in virtual destinations through the emotional mechanism. Researchers have agreed on the cognitive process behind presence development (e.g. Lee *et al.*, 2020). The immersive experience of feeling a presence in VR tours requires a high emotional engagement, which cannot be determined just by cognitive processes (Bhandari *et al.*, 2017). Thus, this research introduces the interoceptive attribution model of presence constructed by Diemer *et al.* (2015), empirically testing the effect of media content to incorporate the effects of emotionally perceptual stimuli on presence through interoceptive prediction. This significant effect further supports Epstein's (1998) theory that the experiential system is directly tied to affect.

Second, this research confirms that the media content, namely informativeness, aesthetics and novelty, positively affects the interoceptive prediction of presence in virtual destinations. Whereas several studies have recognized the effects of media forms on presence (e.g. Bogicevic *et al.*, 2019), few studies have empirically supported the effect of media content on presence in a hedonically driven context like virtual tourism destinations. In recognition of the importance of media content in tourism contexts, as suggested by Liu and Huang (2023), our findings confirm the significant effect of media content on presence through emotional arousal. This result supports the previous research findings that commercial VR content not only induces positive emotional responses (Yung *et al.*, 2021) but also intensifies emotional responses (Martínez-Molés *et al.*, 2022). Further, VR content and the subsequent emotional arousal are two positive influencers of presence and behavioral intention. Therefore, this study contributes to a better understanding of the emotional mechanism of how specific VR content factors generate a sense of presence in virtual destinations.

Third, emotional arousal is crucial in comprehending the impact of media content on presence. Driven by the need for pleasure in virtual tours, potential tourists may have an affinity to hedonic experience enriched with affection, sensory arousal, empathy and authenticity (Wong *et al.*, 2023). While previous studies have established the association between presence and emotional experience, they predominantly used the consequences of presence. However, there is an urgent need to address the role of emotional factors in shaping presence (Fan *et al.*, 2022). Apart from engagement as a presence determinant, as Yung *et al.* (2021) highlighted, this research identified emotional arousal as an important

mediator that could explain the emotional process of how media content influenced presence in the context of a virtual destination. Therefore, this research builds upon the limited research on the emotional determinants of presence and illustrates the crucial role of emotional arousal in inducing presence.

Lastly, this research reveals the direct effects of emotional arousal and presence on four distinct behavioral intentions in VR tourism marketing. Specifically, we find that an enhanced sense of presence and emotional arousal can positively influence users' intentions to visit and recommend the virtual destination. Past studies investigated the role of presence and emotion in destination selection or intention to visit the VR destination (e.g. Flavián *et al.*, 2021). Recent studies also showed that psychological engagement with AR could transfer users' behavioral intentions toward real destinations (Ahmad *et al.*, 2023). This research sheds light on the benefits of emotional arousal, which intensifies users' intention to visit and recommend real destinations. In addition, we find that presence and emotional arousal could explain 44% of the variance in users' intention to revisit the virtual destination and 55% of the variance in intention to recommend the virtual destination. Accordingly, this research adds meaningfully to the limited studies on the outcomes of behavioral intentions toward VR technology in virtual destinations.

7.3 Managerial implications

From a managerial viewpoint, this research provides practical guidance for VR design and destination marketing. It offers destination managers an enhanced understanding of the impact of emotive VR technology on potential tourists. Through an immersive and enjoyable VR experience, users will feel as if they were in a real destination, which could translate into stronger interests in real-world tourism. While website-based VR services and personal VR devices become more accessible to consumers, investing in emotive VR technology for destination marketing could be an effective marketing tool for destination management.

The key to translating virtual experiences into stronger interests in real destinations is to create emotional content that can heighten emotional arousal and the sensation of being in virtual destinations. Such design can stimulate users to watch the VR tour (Kim and Hall, 2019) and encourage the viewers to visit and recommend both the virtual and real destinations. For instance, VR designers may incorporate local cultural elements, unique experiences or breathtaking scenery to transport users to a sensational image about the destination. Destination marketers can customize VR content according to individual users. Potential tourists hope to experience advanced media forms in the virtual environment and enjoy emotional content. With sufficient system quality, emotional content becomes relevant for differentiating a virtual tour.

Managers should build ways to achieve emotional arousal into their VR to allow users to feel a stronger presence and influence their behavioral intentions. Since users rely on emotions and even rationalize emotions to supersede inconsistent thoughts, strategies aimed at triggering emotional arousal can help destinations create an emotional link between users and destinations. In addition, real-time tracking tools within the VR environment can help solicit and gauge users' emotional arousal. By integrating such tools, destination marketers will gain real-time insights into users' emotional responses, thereby availing adaptive adjustments to the VR experience based on user preferences. While designing a successful VR experience is a complex and comprehensive task, destination managers should explore and deploy the power of emotional experience throughout their design and implementation processes.

7.4 Limitations and future research suggestions

This study needs to be improved on several limitations. First, this research relied on a survey, which could limit strong causal inferences. Future studies can use field studies or experimental designs that combine physiological measures with surveys. Techniques such as electroencephalography or functional magnetic resonance imaging may be helpful for studying the actual emotional responses. The geographical origin of the sample is another potential limitation. Future studies need to sample from more diverse population bases to improve the generalizability of the findings. Another potential limitation is the VR presentation exclusively on devices such as desktop and mobile phones to collect data. More advanced devices, such as head-mounted VR displays, could generate more immersive, instantaneous data on VR experiences and engagement (Flavián *et al.*, 2019a). Future research may also combine large-scale population-based surveys with experimental designs to investigate the emotional processes of presence for stronger causal inferences. In addition, further research should investigate the presence phenomenon by integrating continuous responses of the human sensory, cognitive, behavioral and social processing systems, because the experience of presence is complex and multidimensional (Diemer *et al.*, 2015) and the emotional mechanism of forming presence perceptions does not occur in isolation.

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Supplementary materials

The supplementary material for this article can be found online.

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