

The Effects of Virtual Reality Tourism Involvement on Place Attachment and Behavioral Intentions: Virtual Reality Tourism of the Yellow Crane Tower in Wuhan

Abstract

The main purpose of this research was to explore the relationships among virtual reality tourism involvement (VRTI), place attachment, and behavioral intentions. Based on involvement theory, VRTI was defined as user experiences of the landscape and activities of tourist attractions in an immersive way beyond time and space with the help of virtual reality (VR) technology at home through the Internet. The VR panoramic video of the Yellow Crane Tower in Wuhan, Hubei Province, China was the context, and 693 valid questionnaires were analyzed through AMOS 24.0. VRTI (pleasure, sign, and centrality) had significant positive effects on place attachment. Pleasure and sign had significant positive influences on behavioral intentions, while centrality had a significant negative effect. Place identity had a significant positive effect on behavioral intentions, whereas place dependence had no effect. Place dependence had a partial mediating effect between pleasure, centrality, and behavioral intentions, as well as a complete mediating effect between sign and behavioral intentions. Place identity played a partial mediating role between pleasure, centrality, and sign and behavioral intentions. VRTI explores the three-way interaction of "virtual tourism destinations - tourists - real tourism destinations", a novel human-place relationship of emotional attachment. This study expands the research on place attachment and tourist behavioral decisions, enriches the contents by applying involvement theory, proposes management strategies for VR tourism development, and provides new insights for destination marketing.

Keywords: VR technology; VR tourism; virtual reality tourism involvement (VRTI); place attachment; place dependence; place identity; behavioral intentions; willingness for virtual reality tourism; intention for real travel destinations; Yellow Crane Tower in Wuhan

Introduction

The advances in information communication technologies (ICTs) and new media have integrated virtual reality (VR) technology into computers, smartphones, and tablets, producing highly engaging user experiences. Yung and Khoo-Lattimore (2019) define VR as "the use of the computer-generated 3D environment, that the user can navigate and interact with, resulting in real-time simulation of one or more of the user's five senses". VR now enables people to sample tourism destinations and attractions without leaving home. Studies present VR as a new technology that is immersive and interactive, where individuals choose and tailor travel experiences and in which VR tourism positively moderates the tourist experience (Bogicevic et al., 2019; Wu, Ai, & Cheng, 2019). Thus VR tourism can be a successful tool for destination marketing and promotion.

The Coronavirus Disease 2019 (COVID-19) pandemic made Wuhan the hardest-hit area in China and the world's first disease hot spot at the end of 2019. Governments introduced severe lockdowns and travel restrictions (UNWTO, 2020a) which greatly reduced people's mobility and caused major declines in domestic and international tourism (UNWTO, 2020b). Ironically, COVID-19 brought new opportunities for VR applications in tourism (Yung, Khoo-Lattimore, and Potter, 2020). Several destinations, museums, heritage, and cultural sites, hotel chains, and others began promoting online through VR formats.

As VR is becoming a more popular application tool in tourism, explorations of how VR tourism experiences affect consumer attitudes and behavior are continuing from multi-disciplinary perspectives. Earlier derived from the ICT viewpoint, VR in tourism has primarily been tested with the Technology Acceptance Model (TAM) (Munoz-Leiva, Hernandez-Mendez, & Sanchez-Fernandez, 2012), examining the influence of perceived usefulness and ease of use on intentions to experience VR tourism and visit destinations (Chung, Han, & Joun, 2015). The Stimulus-Organism-Response (S-O-R) framework is another approach used in VR studies in tourism, where stimuli lead to emotional and cognitive internalization and consequently to behaviors (Mehrabian & Russell, 1974; Yeh, Wang, Li, & Lin, 2017; Kim, Lee, & Jung, 2020). The S-O-R model has been extended to incorporate responses, namely attention, interest, desire, and action (AIDA) (Yeh, Wang, Li, & Lin, 2017). Different variables have been tested and future studies need to focus on

extending the adaptation of well-known models like TAM, S-O-R and develop a specific framework for VR technology, which can be used to better comprehend the associated visitor behavior (Loureiro, Guerreiro, & Ali, 2020).

Involvement has cognitive and emotional significance and plays a critical role in tourist behavior and decision-making (Broderic & Mueller, 1999). There is considerable research on involvement, concerning behavior in tourism, recreation, and leisure (Gursoy, & Gavcar, 2003, Yuan et al., 2019). However, there is a lack of research integrating involvement theory with VR in tourism. Greater mobility has strengthened the bond between place attachment and involvement theories in tourism. Place attachment is an individual emotional tendency related to specific places and represents the emotional interactions between people and places (Hernández et al., 2007). Previous studies have examined tourist decision-making behavior from the combined perspective of involvement and place attachment (Williams et al., 1992; Moore & Graefe, 1994; Bricker & Kerstetter, 2000; Kyle et al., 2000; Gross & Brown, 2008; Santos et al., 2021). The relationships among involvement, place attachment and behavioral intentions have been confirmed (Li et al., 2019; Liu & Yue, 2019), although never in the context of virtual reality.

Previous studies on tourism involvement were mostly about realistic tourism involvement, with a sense of physical experience, which can readily arouse place attachment and behavioral intentions (Tsung et al., 2013; Liu & Yue, 2019). The tourism involvement relevant studies also have involved movies (Shao, 2012) and music (Wang et al., 2020), but these were two-dimensional tourism perceptions where the arousal of place attachment is relatively weak. Recent studies have begun to explore the human-space relationships in virtual tourism. Zhang and Huang (2020) pointed out that the arrival of the information age has endowed relationships with a new "tri-space" composed of "humans - environments - information" in tourism; Wu, Ai, & Cheng (2019) explored VR experiences, attachment and experiential outcomes in tourism; Li et al. (2021) analyzed consumer behavior in VR tourism using the theory of planned behavior (TPB); Kim, Lee, & Jung (2020) investigated consumer behavior in VR tourism using an extended Stimulus – Organism - Response model. This accumulating research literature suggests that virtual reality tourism destination arouses human-place emotional attachment and VR tourism affects user experiences, attitudes, and

behavior (Jung et al., 2015; Chung et al., 2015; Tussyadiah et al., 2018). However, it is still unclear how VR tourism influences human-place emotional attachment between users and real tourism destinations and attractions, it is necessary to explore the relationships between human-place emotional attachment and behavioral intentions generated by VR tourism.

With the COVID-19 pandemic, the traditional binary space of "tourists - real tourism destinations" converted into a new three-way interaction of "virtual tourism destinations – tourists - real tourism destinations", a novel human-place relationship. However, there are some critical gaps in the knowledge about VR tourist attitudes and behaviors. Based on involvement theory, this research constructed a Virtual Reality Tourism Involvement (VRTI) framework to explain how VRTI affects people's place attachment and behavioral intentions. VRTI means that users experience the landscape and activities of tourist attractions and destinations in an immersive way beyond time and space with the help of VR technology at home through the Internet. VRTI explores the new three-way interaction of "virtual tourism destinations – tourists - real tourism destinations".

Literature review and hypotheses

Involvement theory

VRTI is conceptualized based on the involvement theory. Involvement is connected with the ego involvement concept and social judgment theory proposed by psychologists Sherif and Cantril (1947). Ego involvement is an attitude structure, including what is important, meaningful, and relevant, often employed by individuals to make judgments about themselves and others, and it exerts an influence on behavioral decisions (Wiley, Shaw, & Havitz, 2000). Herbert (1965) introduced involvement theory to consumer behavior by putting forward the concept of consumer involvement. Stone (1984) proposed that involvement includes psychological and behavioral involvement. The former refers to the arousal of cognition and interest in an activity and its related products, demonstrated by psychological reactions; the latter is the time and energy invested by an individual for a specific activity, which is shown externally. Zaichkowsky (1985) defined involvement as the degree to which people perceive the relevance of objects based on their own needs, interests,

and values. Selin and Howard (1985) were among the first to research involvement theory in leisure and tourism, indicating that ego involvement is the identification of individuals with specific leisure and tourism activities. Thereafter, Havitz and Dimanche (1990) put forward the concept of leisure and tourism involvement - the individual motivation, arousal, or interest caused by leisure activities, travel destinations, and their associated products. Havitz, Green, and McCarville (1993) pointed out that leisure involvement is inspired and driven by specific stimuli or contexts. Since then, involvement theory has been extensively applied to leisure and tourism research (Park et al., 2002). For example, scholars have investigated involvement in ecological tourism, cultural tourism (Wang et al., 2013). and film tourism (Shao, 2010).

Involvement can be measured in various frameworks. Laurent and Kapferer (1985) developed the five-dimensional consumer involvement profile (CIP), including pleasure, importance, sign, risk importance, and risk probability. The multi-dimensional involvement construct has been increasingly adopted in consumer behavior and leisure studies. McIntyre and Pigram (1992) applied the CIP scale to leisure and found only three dimensions of leisure involvement (attraction, self-expression, and centrality) but did not detect risk importance and probability. Due to the greater diversity in destinations than exists with leisure activities, tourism decision-making is thought to be of higher involvement (Havitz & Dimanche, 1997) and contains more risk factors. Gursoy and Gavcar (2003) tested Laurent and Kapferer's CIP scale in the context of international leisure tourism in Turkey and determined that the three dimensions of involvement were pleasure/interest, risk probability, and risk importance. Considering the features of VR tourism is an online tourism experience that does not require leaving one's home, risk factors are not prevalent, and it is more akin to leisure involvement. Therefore, this research selected the three dimensions of pleasure, centrality, and sign to measure VRTI.

Relationships among VRTI, place attachment and behavioral intentions

VRTI and place attachment

Place attachment is based on the relationship between people and places and represents positive emotional bonds between people and places (Gieryn, 2000). With VR technology's strong intervention, the three-way interaction of "humans – environments - information" is a novel human-place relationship of place attachment from virtual place attachment to physical place attachment (Zhang & Huang, 2020). Place attachment is generally considered to include place dependence and place identity (Williams et al., 1992). Place dependence is a functional attachment between people and places; place identity is an emotional attachment between people and places (Huang, Bao, & Wall, 2006). In studies of human geography, it has been found that involvement has a direct and positive effect on tourist place attachment.

Research combining involvement and place attachment has been conducted since the 1990s. Williams et al. (1992) found a positive relationship of involvement and attachment for visitors to four U.S. wilderness areas. The conceptual framework was thereafter adapted for recreation trail users, whitewater rafters, hikers, and national park visitors. Wiley et al. (2000) found that the degree of involvement determined the emotional perceptions of pleasure and excitement from tourist activities, which influenced attachment levels to scenic areas. Kyle et al. (2003) suggested that involvement was an antecedent of place attachment when examining the relationship between involvement and place attachment for mountaineering tourists. Gross and Brown (2008) reviewed five tourism destinations in Australia and discovered a significant positive influence of involvement on attachment to places. Wang et al. (2013) determined that centrality/sign, pleasure, and risk had significant positive impacts on place dependence and place identity for visitors to the Han dynasty cultural tourism area in Xuzhou, Jiangsu Province, China. Based on the findings of the aforementioned studies, this research proposed the following first hypothesis:

- H₁: VRTI has a positive effect on place attachment – the pleasure, centrality, and sign of VRTI influence place dependence and place identity.

VRTI and behavioral intentions

Behavioral intentions are personal subjective judgments of future action tendencies (Kozak, 2001); the stronger the behavioral intentions, the more likely people will engage in the

behavior. Thus, surveys of behavioral intentions can sharpen the predictions on follow-up consumer behavior. Behavioral intentions refer to the willingness to participate in certain types of tourism activities, to revisit the same destinations (Kozak, 2001), or to pay higher prices based on greater loyalty (Baker & Crompton, 2000). Consumer behavior research has shown that involvement has a positive relationship with information attention and collection, and product repurchase (Ajzen, 1991). Behavioral intentions in tourism reflect people's willingness to make efforts to engage in travel behavior (Dimanche, Havitz, & Howard, 1991). Slama and Tashchian (1985) found that involvement affected recommendation intentions through experience quality and satisfaction when investigating cultural tourism in Istanbul. Baloglu (2000) suggested that involvement predicted the behavioral intentions of tourists through the combination of specific information stimuli, psychological factors, and destination image perception. Gursoy and Gavcar (2003) explored the relationships among involvement, vacation decisions, and destination choices. Iwasaki and Havitz (2004) determined significant positive effects among leisure involvement, psychological commitment, and behavioral loyalty. Li, Long, and Cheng (2012) found that centrality and pleasure involvement significantly positively influenced post-tour behavioral intentions. Filo et al. (2013) also discovered that involvement had a crucial influence on tourist behavioral intentions. Based on these findings, this research proposed a second hypothesis as:

- H₂: VRTI has a positive impact on behavioral intentions – the pleasure, centrality, and sign of VRTI influence behavioral intentions.

Place attachment and behavioral intentions in VR tourism

The influence of place attachment on tourist behavioral intentions mostly has been tested in physical environments. Alexandris, Kouthouris, and Meligdis (2006) found that place identity and place dependence played an important role in predicting the willingness of Greek skiers to revisit a resort. Kil et al. (2013) found a functional relationship between tourist place dependence and place identity and willingness to revisit a U.S. national forest park. Lee and Shen (2013) determined that the place dependence and place identity of urban park recreational users had significant effects on their behavioral intentions. Xu and Zhan (2016)

found place identity played an important role in tourist intentions to visit Hangzhou, and place dependence had a positive effect on their willingness to revisit. Plunkett, Fulthorp, and Paris (2019) examined the relationship between place attachment and behavioral loyalty within urban parks, indicating frequent use of specific parks contributed to stronger place attachment. Place dependence is tested as an antecedent variable for place identity, which place dependence has a positive effect on place identity (Vaske & Kobrin, 2001). Fan (2014) explored the effect relations among tourist destination image, place attachment, and tourists' environmentally responsible behavior, found that place dependence had a positive effect on place identity. Su & Hsu (2019) determined that place dependence directly and significantly affected place identity, furthermore, place dependence and place identity have a positive effect on behavioral intention of marathon tourists in Taiwan. It is assumed that within a VR context, the influence of place attachment on behavioral intentions is similar to physical environments. the influence of place dependence on place identity is similar to physical environments, too. and this research proposed a third hypothesis as:

- H₃: Place attachment has an impact on behavioral intentions - place dependence and place identity influence behavioral intentions in VR tourism; place dependence influences place identity in VR tourism.

VRTI, place attachment and behavioral intentions

Previous studies have explored the relationships among involvement, place attachment, and behavioral intentions. Mowen, Graefe, and Virden (1997) examined the relationships among tourist involvement, place attachment, and interpretation satisfaction. Hwang, Lee, and Chen (2005) verified that visitor involvement and place attachment had positive and direct impacts on the perception of service quality of interpretation in a national park, and place attachment had an indirect impact on the satisfaction with interpretation through visitor involvement. Prayag and Ryan (2012) tested a theoretical model based on the hypothesized relationships among four constructs (destination image, place attachment, personal involvement, and satisfaction) as antecedents of loyalty and found that personal involvement and place attachment were the antecedents of loyalty. Lee and Shen (2013) analyzed the influence of leisure involvement and place attachment on destination loyalty among recreationists walking

their dogs in urban parks. Yuan et al. (2019) explored the roles of involvement and place attachment in determining resident support of industrial heritage tourism in a resource-exhausted city in China. Ge (2019) reviewed the relationship of visitor leisure involvement, place attachment, and behavioral intentions taking the Sangua community in Chaohu, Anhui Province as an example. The results indicated that place attachment exerted a mediating effect between leisure involvement and behavioral intentions; specifically, place dependence and place identity were mediators in the relationships among pleasure, centrality, sign, and behavioral intentions.

The relationships among VRTI, place attachment and behavioral intentions remain to be verified. Li and Chen (2019) explored the effect of VR on travel intentions and provided evidence that VR will inhibit travel intentions under certain conditions. Lin, Huang, and Ho (2020) determined whether VR could effectively market slow travel in a heritage destination, and found it was important to understand the associations among VR use, destination marketing, and travel intentions, particularly when the city is relatively unknown. Tussyadiah et al. (2018) investigated the relationships among VR, presence, and attitude change, and provided empirical evidence confirming the effectiveness of VR in shaping consumer attitudes and behavior. Wei et al. (2019) examined the effects of VR on theme park visitor experiences and behaviors and confirmed that VR presence had positive impacts on overall satisfaction, willingness to revisit, and willingness to recommend. However, according to other researchers, VR cannot only be used to shape attitudes, enhance experiences, and complement real experiences but can also create virtual experiences that visitors may accept as substitutes for real visits. Cheong (1995) highlighted the potential future threat of VR as the technology becomes more affordable and engaging, in becoming a substitute for travel. Therefore, the fourth hypothesis was proposed as:

- H₄: Place attachment plays a mediating role between VRTI and behavioral intentions - place dependence and place identity play a mediating role among pleasure, centrality, and a sign of VRTI and behavioral intentions.

Based on the four hypotheses, a VRTI model was developed to examine the relationships among VRTI, place attachment, and behavioral intentions and to explore how

VRTI affects people's attitudes and behavioral intentions (Figure 1).

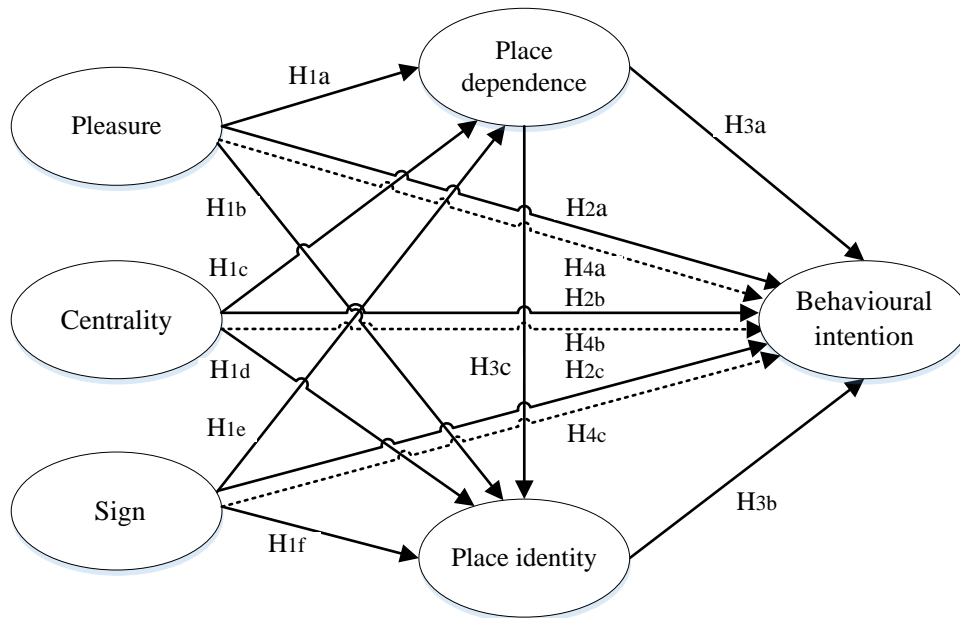


Figure1. Virtual reality tourism involvement (VRTI) model

Research design

Research location

The VR panoramic videos of the Yellow Crane Tower in Wuhan were selected as the subject for this research (http://www.quanjingke.com/dest/scenic_huanghelou). Yellow Crane Tower is a landmark building in Wuhan, located at the top of Snake Mountain, near the Yangtze River; It was built in 223 of The Three Kingdoms and has been repaired repeatedly in successive dynasties. The existing building was designed as the prototype of the Tongzhi Building in the Qing Dynasty and was rebuilt in 1985. It became famous for the poem "Yellow Crane Tower", which was written by Cui Hao, a poet in the Tang Dynasty. Yellow Crane Tower, together with Yueyang Tower and Tengwang Pavilion, is reputed as "the three famous towers in the South of the Yangtze River" and it is known as "the first building in the world". The Yellow Crane Tower inspires place sense especially because of its geodetic authenticity.

This heritage tourism site is famous in Central China and is one of Wuhan's major attractions. The location in Wuhan was especially appropriate during COVID-19 as the city's tourism was ravaged by the epidemic. It was assumed that VR experiences of this famous landmark overlooking the Yangtze River would foster more place attachment for Wuhan and promote the recovery and revitalization of its tourism sector after COVID-19. The VR panoramic videos were produced by Panoramic Virtual Travel Network and are accessible on China's largest VR tourism e-commerce platform and can be used to show the landscape scenery and cultural customs of tourist attractions with high definition, vivid scenery, and 3D effects combining immersion, interactivity, and imagination. The VR of the Yellow Crane Tower not only provide information including a scenic area introduction and destination guide, but also has a panoramic route and 360-degree views, and virtual roaming "walking" in scenic areas and bringing visitors a real feeling of being in the tourist attractions through the Internet without leaving home.

Measurement scale

The survey questionnaire consisted of two parts. The first part was composed of six latent variables (pleasure, centrality, and a sign of VRTI; place dependence and place identity (place attachment); and behavioral intentions). Previously verified scales were used for variable measurement and items were rated on Likert seven-point scales. The Consumer Involvement Profile Scale (CIP) of Laurent and Kapferer (1985) and the leisure involvement scale of McIntyre and Pigram (1992) were the basis for the measurement of VRTI. The three dimensions were pleasure, centrality, and sign. Pleasure referred to the degree of interest in VR tourism destinations, including as being "attractive", "pleasant" and "enjoyable" (Zhang & Lu, 2010). Centrality was the importance of VR tourism in an individual's life and the questions included "most of life is organized around it", "being central in life ", "other things can be compromised" (Watkins, 1986). Sign referred to the self-image that an individual conveyed to others through VR tourism, and the questions included "conveys what I am", "how I want to be evaluated by others". Following Brown, Raymond, and Corcoran (2015), place attachment was measured with the two dimensions of place dependence and place identity. Place dependence relied on four items: "more desirable as a tourist destination", "no other tourist attractions are comparable", "more engaging tourism

attraction" and "better travel experience". Place identity included "having special meaning", "knowing yourself", "being a part of a destination", and "intimate emotional connection". Behavioral intentions were measured from four aspects: willingness to visit, willingness to recommend, willingness to publicize, and willingness to choose first (Moutinho, 1987). The second part of the questionnaire collected the demographic characteristics of the respondents, including gender, age, education, occupation, monthly average income, and frequency of experiencing VR tourism.

Survey administration

The questionnaire survey had screening conditions and questions. The participants were first guided to watch the VR panoramic video of the Yellow Crane Tower for at least one minute (including the condition "whether to experience virtual tourism sites" and the question of time length), excluding visitors who had gone there and then asked to complete the online questionnaire.

A pilot survey was first conducted with 123 valid questionnaires being collected (effective response rate of 78.3%). SPSS 22.0 was used for reliability testing and exploratory factor analysis on the pilot study data. The Cronbach's α coefficients of the six dimensions of pleasure, centrality, sign, place dependence, place identity, and behavioral intentions were 0.809, 0.851, 0.957, 0.969, 0.896, and 0.918, respectively. These reliability scores were all greater than 0.7, indicating that the questionnaire had good reliability. An exploratory factor analysis (EFA) was then performed. The KMO value was 0.954 and the six dimensions were successfully extracted, explaining 72.26% of the variation. According to the results of common factor extraction and better fit, the context of VRTI for the Yellow Crane Tower, minor revisions were made to VRTI items, and the final questionnaire was designed.

The main survey fielded an online questionnaire from April 20 to May 10, 2020. A total of 972 questionnaires were collected, and those with a fill-in time of fewer than 90 seconds and a large number of answers with the same option were excluded. Finally, 693 valid questionnaires were obtained, with an effective rate of 71.3%. The demographic characteristics of the respondents are shown in Table 1. The ratio of male to female was relatively balanced, at 44.9% and 55.1% respectively; The majority were 18-29 years old, accounting for 64.4%. This may suggest that younger people are likely to pay more attention

to VR tourism options. Education levels and income distribution were relatively balanced.

Table 1. Respondent demographic characteristics

Category	Dimension	Frequency	%	Category	Dimension	Frequency	%	
Gender	Male	311	44.9	Age	18 and below	25	3.6	
	Female	382	55.1		18-29	446	64.4	
Education	High school and below	155	22.4		30-39	76	11.0	
	College	123	17.7		40-49	89	12.8	
	Undergraduate	395	57.0		50-60	52	7.5	
	Master's and above	20	2.9		60 and above	5	0.7	
Occupation	Company staff	112	16.2		Average income monthly	Less than 2,000	342	49.4
	Government employee	13	1.9			2000-4999	223	32.2
	Educational researcher	25	3.6	5000-7999		80	11.5	
	Self-employed persons	36	5.2	8000-9999		28	4.0	
	Soldier	4	0.6	10000-19999		14	2.0	
	Student	315	45.5	More than 20,000		6	0.9	
	Professional technical personnel	20	2.9	Frequency of participating	Rarely	382	55.1	
	Freelancers	56	8.1		Occasionally	213	30.7	

	Retirees	3	0.4	in VR tourism	Often	75	10.8
	Others	109	15.7		Frequently	23	3.3

Results

Descriptive statistics and factor analysis

The Cronbach's α coefficients for pleasure, centrality, sign, place identity, place dependence, and behavioral intentions were 0.897, 0.936, 0.903, 0.947, 0.943, and 0.925, respectively. The Cronbach's α coefficient for the overall questionnaire was 0.97, indicating that the reliability of questionnaire items was acceptable with good internal consistency.

EFA was used to test the structural validity of the overall scale and determine whether it was necessary to eliminate redundant items. The factors were extracted by principal components analysis with orthogonal rotation and maximum variance. The factors had to have a characteristic root greater than one. The KMO value of the questionnaire was 0.962 and the significance level of the Bartlett's test was $p = 0.000$, indicating suitability for factor analysis. Any item with a factor loading less than 0.4 or cross-loading on two factors greater than 0.5 was eliminated. Six factors were obtained that were measured by 18 items, namely, pleasure, centrality, sign, place identity, place dependence, and behavioral intentions. The factor loadings of the items were all greater than 0.6, and the factor characteristic roots were all greater than one. The cumulative explanatory variance was 87.74%, indicating that the scale had good structural validity. The EFA results are shown in Table 2.

Table 2. Exploratory factor analysis

Latent variable	Item	Factor loading	Characteristic root	Cumulative explained variance (%)
Pleasure	VR tourism of the Yellow Crane Tower appeals to me	0.866	3.385	18.804

	VR tourism of the Yellow Crane Tower is enjoyable	0.863		
	VR tourism of the Yellow Crane Tower is one of the things I do that makes me happiest	0.800		
Centrality	Most of the arrangements in my life revolve around VR tourism of the Yellow Crane Tower	0.873	3.101	36.031
	VR tourism of the Yellow Crane Tower is central to my life	0.908		
	Everything else can give way to VR tourism of the Yellow Crane Tower	0.895		
Sign	Choosing VR tourism of the Yellow Crane Tower conveys what kind of person I am	0.857	2.846	51.841
	I can judge people by whether they are willing to experience VR tourism of the Yellow Crane Tower	0.871		
	VR tourism of the Yellow Crane Tower can make others see me the way I want them to	0.823		
Place dependence	I prefer VR tourism of the Yellow Crane Tower to other activities	0.915	1.973	66.381
	Compared to other activities, VR tourism of the Yellow Crane Tower is more satisfying to me	0.905		
	VR tourism of the Yellow Crane Tower is more important to me than other things	0.899		

Place identity	VR tourism of the Yellow Crane Tower means a lot to me	0.894	2.617	77.344
	VR tourism of the Yellow Crane Tower has a special meaning to me	0.907		
	VR tourism of the Yellow Crane Tower is a part of my life	0.893		
Behavioral intentions	If conditions permit, I will travel to the real Yellow Crane Tower presented by VR tourism	0.864	1.871	87.739
	I will recommend relatives and friends to VR tourism of the Yellow Crane Tower or travel to the real Yellow Crane Tower presented by VR tourism	0.887		
	I will spread VR tourism positive information which is presented in the real Yellow Crane Tower	0.873		

To further test the relationship between the scale and the measured latent variables, AMOS 24.0 was used for confirmatory factor analysis (CFA). The goodness of fit indicators of the measurement model, chi-square degree of freedom ratio (CMIN/DF), goodness of fit index (GFI), adjusted goodness of fit index (AGFI), root mean square error of approximation (RMSEA), standard root-mean-square residual (SRMR), comparative fit index (CFI), incremental fit index (IFI), and Tucker–Lewis Index (TLI) all met the required standards, indicating an acceptable overall fit of the model (Table 3).

Table 3. Model adaptation index

Index	CMIN/DF	GFI	AGFI	RMSEA	SRMR	CFI	IFI	TLI
Suggested	< 3	> 0.9	> 0.9	< 0.08	< 0.05	> 0.9	> 0.9	> 0.9

Standard								
Model indicators	2.785	0.949	0.927	0.051	0.0269	0.985	0.985	0.980

The reliability of the latent variable scale was tested by composite reliability (CR) and average variance extracted (AVE). The results are shown in Table 4. The CRs of each latent variable was from 0.901 to 0.948, greater than the standard of 0.7. The AVEs were from 0.7523 to 0.8490, and above the standard of 0.5. Thus, the latent variable scale had good reliability.

Convergent and discriminant validity were tested. It is generally believed that standardized factor loadings of items greater than 0.4 with significance at p-value at 0.01, indicates good convergent validity of a measurement model. The standardized factor loadings of items were from 0.835 to 0.934, all reaching the standard of 0.7, and all were significant ($p = 0.000$), which indicated that the measurement model had good convergent validity.

Table 4. Confirmatory factor analysis

Latent variable	Parameter significance estimation				Topic reliability		Composite reliability	Average variance extracted
	uStd.	S.E.	Est./S.E	p	Std.	SMC	CR	AVE
Pleasure	1				0.866	0.749	0.9011	0.7523
	0.974	0.032	30.457	***	0.871	0.759		
	1.152	0.040	28.896	***	0.865	0.747		
Centrality	1				0.909	0.825	0.9374	0.8332
	1.071	0.026	41.096	***	0.934	0.873		
	1.078	0.029	36.766	***	0.895	0.801		
Sign	1				0.835	0.697	0.9032	0.7569
	1.153	0.039	29.351	***	0.882	0.778		

	1.131	0.038	29.613	***	0.892	0.796		
Place dependence	1				0.931	0.866	0.9478	0.8581
	1.025	0.022	45.650	***	0.931	0.868		
	1.032	0.024	43.195	***	0.917	0.841		
Place identity	1				0.930	0.865	0.9440	0.8490
	.989	0.022	45.225	***	0.931	0.866		
	1.010	0.025	40.879	***	0.903	0.815		
Behavioral intentions	1				0.856	0.733	0.9254	0.8055
	1.038	0.031	33.205	***	0.920	0.846		
	1.051	0.032	32.626	***	0.915	0.838		

Finally, correlation and discriminant validity were tested. The square roots of the main variables were from 0.867 to 0.926. The correlation coefficients of the main latent variables were from 0.510 to 0.855. The six main variables of pleasure, centrality, sign, place identity, place dependence, and behavioral intentions had significant correlations. Among them, pleasure, centrality, and sign were the three dimensions of VRTI with strong relevance, as also did place identity and place dependence. The square roots of the AVEs between any two variables in this study were higher than the correlation coefficients between the two. Thus, the discriminant validity of the model data was established (Table 5).

Table 5. Correlation and discriminant validity analysis of main variables

Latent Variable	Pleasure	Centrality	Sign	Place dependence	Place identity	Behavioral intentions
Pleasure	0.867					
Centrality	0.724**	0.913				
Sign	0.735**	0.842**	0.870			

Place dependence	0.796**	0.851**	0.855**	0.926		
Place identity	0.819**	0.851**	0.845**	0.919**	0.921	
Behavioral intentions	0.682**	0.510**	0.608**	0.632**	0.660**	0.897

Note: The bold numbers on the diagonal are the square root of the AVE; ** means $p < 0.01$, * means $p < 0.05$.

Direct effect test

The structural equation model was constructed through AMOS 24.0, and the maximum likelihood estimation method was selected to iterate estimated parameters, and the direct effects of the proposed hypotheses were tested (Table 6). The results showed that pleasure had a significant positive effect on place dependence (uStd. = 0.300, $p < 0.001$), and H_{1a} was supported. Pleasure also had a significant positive effect on place identity (uStd. = 0.155, $p < 0.001$) and H_{1b} was supported. Centrality had a significant positive effect on place dependence (uStd. = 0.270, $p < 0.001$), supporting H_{1c} ; and had a significant positive effect on place identity (uStd. = 0.155, $p < 0.001$), supporting H_{1d} . Sign had a significant positive effect on place dependence (uStd. = 0.548, $p < 0.001$), giving support to H_{1e} ; and had a significant positive effect on place identity (uStd. = 0.227, $p < 0.001$), supporting H_{1f} . Thus, VRTI had a significant positive effect on place attachment and hypothesis H_1 was supported.

Pleasure had a significant positive effect on behavioral intentions (uStd. = 0.438, $p < 0.001$) supporting H_{2a} . Centrality had a significant negative effect on behavioral intentions (uStd. = -0.273, $p < 0.001$), supporting H_{2b} . Sign had a significant positive effect on behavioral intentions (uStd. = 0.203, $p < 0.05$) and H_{2c} was supported.

Place dependence had no effect on behavioral intentions (uStd. = 0.062, $p > 0.05$) and H_{3a} was not supported. Place identity had a significant positive effect on behavioral intentions (uStd. = 0.284, $p < 0.01$) and H_{3b} was supported. Place dependence had a significant positive effect on place identity (uStd. = 0.460, $p < 0.001$) and H_{3c} was supported. Therefore, place attachment had a partial influence on behavioral intentions, and H_3 was partially supported.

Table 6. Direct effect verification results

Hypothesis		Path			uStd.	S.E.	C.R.	P	Test result
H ₁	H _{1a}	Place dependence	<---	pleasure	0.300	0.040	7.486	***	Supported
	H _{1b}	Place identity	<---	pleasure	0.155	0.041	3.782	***	Supported
	H _{1c}	Place dependence	<---	centrality	0.270	0.044	6.152	***	Supported
	H _{1d}	Place identity	<---	centrality	0.155	0.041	3.782	***	Supported
	H _{1e}	Place dependence	<---	sign	0.548	0.056	9.753	***	Supported
	H _{1f}	Place identity	<---	sign	0.227	0.060	3.775	***	Supported
H ₂	H _{2a}	Behavioral intentions	<---	pleasure	0.438	0.064	6.797	***	Supported
	H _{2b}	Behavioral intentions	<---	centrality	-0.273	0.062	-4.380	***	Supported
	H _{2c}	Behavioral intentions	<---	sign	0.203	0.091	2.224	*	Supported
H ₃	H _{3a}	Behavioral intentions	<---	place dependence	0.062	0.094	0.664	0.507	Not supported
	H _{3b}	Behavioral intentions	<---	place identity	0.284	0.096	2.954	**	Supported
	H _{3c}	place identity	<---	place dependence	0.460	0.056	8.425	***	Supported

Note: * means $p < 0.05$, ** means $p < 0.01$, *** means $p < 0.001$.

Mediation effects

The mediating effects of place dependence and place identity (H₄) were tested. The Bootstrap method was used to test the mediation effect with a sampling number of 2,000 and a deviation corrected by a 97.5% confidence interval. The results are shown in Table 7. The mediating effect of place attachment between pleasure, centrality, and the sign of and behavioral intentions were all verified. There was a partial mediating effect between pleasure

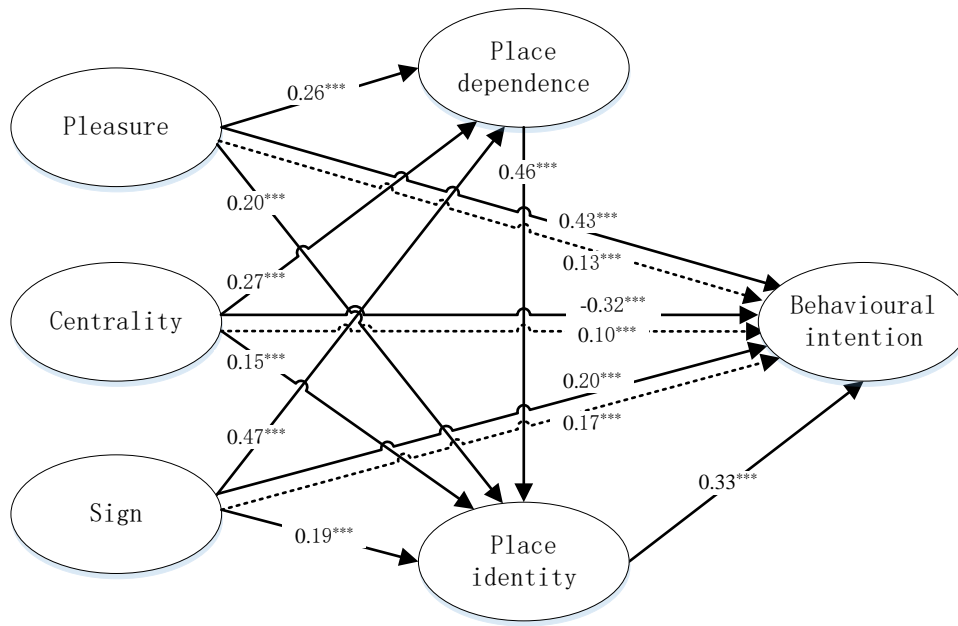
and behavioral intentions (uStd. = 0.126, $p < 0.001$), with a 97.5% confidence interval (0.044, 0.224), and hypothesis H_{4a} was supported. There was also a partial mediating effect between centrality and behavioral intentions (uStd. = 0.096, $p < 0.001$), with the 97.5% confidence interval (0.025, 0.196), and hypothesis H_{4b} was supported. There was a complete mediating effect between sign and behavioral intentions (uStd. = 0.170, $p < 0.001$), with a 97.5% confidence interval (0.043, 0.324) and hypothesis H_{4c} was supported.

Table 7. Mediation effect verification results

Hypothesis	Paths		Effect	uStd.	S.E.	C.R.	P	97.5% Boot		Mediating Role
								CI		
								LLCI	ULCI	
H _{4a}	Pleasure	→ Behavioral intentions	Direct effect	0.438	0.078	5.615	/	0.268	0.623	Partial mediation
	Place attachment		Indirect effect	0.126	0.040	3.150	***	0.044	0.224	
H _{4b}	Centrality	→ Behavioral intentions	Direct effect	-0.273	0.062	-4.403	/	-0.429	-0.146	Partial mediation
	Place attachment		Indirect effect	0.096	0.037	2.595	***	0.025	0.196	
H _{4c}	Sign	→ Behavioral intentions	Direct effect	0.203	0.111	3.383	/	-0.042	0.457	Fully mediation
	Place attachment		Indirect effect	0.170	0.060	2.833	***	0.043	0.324	

Note: * means $p < 0.05$, ** means $p < 0.01$, *** means $p < 0.001$.

The revised and final VRTI model is shown in Figure 2.



Note: * means $p < 0.05$, ** means $p < 0.01$, *** means $p < 0.001$.

Figure 2. Modified VRTI model

Conclusions, discussion, and implications

Conclusions

This research explored the relationships among VRTI, place attachment, and behavioral intentions based upon involvement theory. The main conclusions were as follows.

First, the three components of VRTI (pleasure, sign, and centrality) had significant positive effects on place dependence and place identity. Overall, this demonstrates that VRTI can positively influence place attachment. This is consistent with the findings on the positive impacts of involvement on place attachment in real physical spaces (Wiley et al., 2000; Kyle et al., 2003; Gross and Brown, 2008; Wang et al., 2013). This suggests that place attachment not only exists in real physical spaces but also with VR tourism experiences.

Second, VRTI had significant positive effects on behavioral intentions. This confirms that pleasure and sign motivate people to travel to the real places they experience through VR tourism. When individuals cannot personally participate in the actual activities because of time, money, physical conditions, or risks, they may be inclined to obtain these experiences through the VR landscape. However, when centrality becomes very important, people may

engage in VR tourism and even think that virtual experiences can replace real ones. Centrality was found to have a significant negative effect on behavioral intentions, and this differs from Iwasaki and Havitz (2004), Slama and Tashchian (1985), and Li, Long, and Cheng (2012) who determined that pleasure, centrality, and sign all had significant positive effects on behavioral intentions. Therefore, cautious application of the VR tourism model for destination marketing is needed since not all aspects of VRTI may lead to beneficial results.

Third, place dependence did not have a significant effect on behavioral intentions, whilst place identity did have. Previous studies have found that place dependence has a significant positive effect on place identity, and this research also confirmed that place dependence had a significant positive effect on place identity in VR tourism. It has also been determined that place dependence influences behavioral intentions through place identity, and this research found that place dependence affected behavioral intentions through the intermediary of place identity.

Fourth, place attachment had a partial mediation role between pleasure and centrality and behavioral intentions, and place attachment had a complete mediating role between sign and behavioral intentions. Thus, place attachment had a mediating effect between VRTI and behavioral intentions. These results are consistent with the research of Mowen, Graefe, and Virden (1997), Lee and Shen (2013), and Yuan et al. (2019) who found that involvement affected behavioral intentions through place attachment in real tourism and leisure situations. The results also showed that in VR tourism, place attachment is affected by VRTI, and this has an influence on the outcome variable of behavioral intentions.

Contributions to knowledge

First, this study constructed a framework to explain how VRTI affects people's attitudes and behavioral intentions. This complements previous studies using the TAM, S-O-R, and AIDA models, and the VRTI model enriches the research on VR tourism.

Second, based on involvement theory, this study explored the effects of VRTI on place attachment and behavioral intentions. Previous research deals with involvement in tourism, leisure, destinations, and consumption, all in real physical spaces under conventional circumstances. It is also used with film tourism and music tourism involvement. However,

the exploration of involvement in VR tourism is lacking. This study took VRTI as its starting point and applied involvement theory to explore attitudes and behavioral intentions in a VR environment, which extends the research using involvement theory.

Third, previous studies mostly explore the relationships between tourism involvement and place attachment from the human geography perspective, focusing on the interactions of people with real physical spaces. However, it is unclear whether people develop place attachment as a result of VR tourism experiences. This research adopted a novel approach by investigating place attachment in VR tourism, thereby extending "human - place" relationships from real physical spaces to VR environments, forming the three-way interaction of "virtual tourism destinations – tourists - real tourism destinations", and extends the research scope of place attachment theory.

Finally, VR tourism can create a link between visitors and destinations, playing an important role in guiding visitors to better appreciate destination attractions and inspiring behavioral willingness. Previous studies have mostly explored the relationships among tourism involvement, place attachment, and behavioral intention under conventional circumstances, as well as the impacts of VR tourism marketing on destination selection and decisions. However, few researchers have paid attention to attitudes and behavioral intentions in a VR context, especially for decision-making through the intermediary role of place attachment in VR tourism. This study explores the impact of VRTI on place attachment and behavioral intentions, expands the research scope of tourist decision-making, and provides new implications for destination marketing.

Practical implications

VR tourism with its super-temporal, interactive, and economic features has gradually entered popular life as a new type of leisure activity. In 2020, the COVID-19 pandemic has caused major trauma and losses for global travel, but it also has brought new opportunities for VR tourism. This, in turn, is creating novel challenges for destination marketing and management.

First, VR technology needs to be further improved to enhance its accessibility, convenience, realism, and interactivity. The accessibility and convenience of VR tourism

should be improved through more advanced Internet technology, which can bring more people to participate in VR tourism. Realism should utilize Internet technology (4D effect of VR) to present VR tourism more realistically so that people experience VR tourism as if they were on the real scene. Interaction should be stimulated to encourage visitors to participate in tourism activities, stroll in the VR tourism landscape space, enhance experience quality and satisfaction, and attract revisits to VR tourism. Virtual tourist attractions should be vigorously marketed, such as inviting celebrities and influencers to endorse them, thereby enhancing people's familiarity with VR tourism technology, and popularizing VR tourism, especially for the younger and middle-aged groups.

Second, the pleasure and sign of VRTI should be enhanced, and centrality should be appropriately managed. VR tourism should be enriched to present the landscapes of tourist attractions with 360° unobstructed perspectives, making people feel like they are at the actual destination. VR tourism activities should be increased to attract people to participate and interact with each other.

Third, VRTI can and should be employed to enhance place attachment. Through VRTI, dependence on VR tourism is increased. For example, VR tourism shows beautiful natural scenery and the cultural heritage of attractions sets up rich and diversified tourism activities and experiences and provides clear online tourism routes and high-quality audio guide services. Second, people's emotional reliance on VR tourism is enhanced, such as setting up a "visit here" travel signature, creating opportunities for visitors to interact with residents, and providing free mailings of travel souvenirs. VR tourism can bring a special meaning to people, which generates a sense of place identity. In short, VRTI promotes the interaction of "humans-places" in the VR environment, enhances emotional connections, and increases place attachment.

Fourth, people are encouraged to have stronger travel intentions by integrating VRTI and place attachment. The VR tourism chain should be extended, and a VR tourism complex should be established. A global VR tourism sharing platform should be set up to enrich the choices of tourism destinations. Tourism shopping should be integrated into VR tourism to stimulate more consumption. VR tourism remains a marketing tool for real destinations, and the ultimate goal is to make people more willing to go to the destinations through VR tourism

experiences.

Limitations and future research directions

There are certain limitations to this research that must be acknowledged. First, this analysis adopted an online questionnaire for data collection. Most respondents were younger or middle-aged, while older age groups were not well represented. Although this is in line with the reality that middle-aged and younger people use the Internet more frequently, other age groups still could be consulted with offline research for additional model verification.

Second, this research selected the Yellow Crane Tower in Wuhan, which was more severely affected by the COVID-19 epidemic and less-impacted areas should be sampled by other researchers. Future research should choose other virtual tourism destinations for further model testing, especially world-famous attractions, and destinations. Also, other VR methods such as virtual conferences and exhibitions (e.g., through Zoom, Teams, and WeChat), tourism broadcasts, and tourism commentaries should be analyzed.

The comparative study of respondents who have visited virtual reality tourism destinations and those who have never been there is worth exploring. The novel three-way interaction of "humans – environments - information" relationship of place attachment from virtual place attachment to physical place attachment merits greater research attention. Other variables can and should be introduced into the VRTI model. For example, experience quality and satisfaction with involvement in VR tourism can be incorporated. Frequency of participation in VR tourism and demographic characteristics are other variables that potentially can deepen and refine this research field.

References

- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179-211.
- Alexandris, K., Kouthouris, C., & Meligdis, A. (2006). Increasing customers' loyalty in a skiing resort: The contribution of place attachment and service quality. *International Journal of Contemporary Hospitality Management*, 18(5), 414-425.

- Baker, D. A., & Crompton, J. L. (2000). Quality, satisfaction and behavioral intentions. *Annals of Tourism Research*, 27(3), 785-804.
- Baloglu, S. (2000). A path analytic model of visitation intention involving information sources, socio-psychological motivations, and destination image. *Journal of Travel & Tourism Marketing*, 8(3), 81-90.
- Bogicevic, V., Seo, S., Kandampully, J. A., Liu, S. Q., & Rudd, N. A. (2019). Virtual reality presence as a preamble of tourism experience: The role of mental imagery. *Tourism Management*, 74, 55–64.
- Bricker, K. S., & Kerstetter, D. L. (2000). Level of specialization and place attachment: An exploratory study of whitewater recreationists. *Leisure Sciences*, 22 (4), 233-257.
- Bristow, R. S. (1999). Commentary: Virtual reality tourism - the ultimate ecotourism? *Tourism Geographies*, 1(2), 219-225.
- Broderic, A., & Mueller, R. (1999). A Theoretical and empirical exegesis of the consumer involvement construct: The psychology of the food shopper. *Journal of Marketing Theory and Practice*, 7(4), 97-108.
- Brown, G., Raymond, C. M., & Corcoran, J. (2015). Mapping and measuring place attachment. *Applied Geography*, 57(2), 42-53.
- Cheong, R. (1995). The virtual threat to travel and tourism. *Tourism Management*, 16(6), 417-422.
- Chung N., Han H., & Joun, Y. (2015). Tourists' intention to visit a destination: The role of augmented reality (AR) application for a heritage site. *Computers in Human Behavior*, 50, 588-599.
- Dimanche, F., Havitz, M. E., & Howard, D. R. (1991). Testing the involvement profile (IP) scale in the context of selected recreational and touristic activities. *Journal of Leisure Research*, 23(1), 51-66.
- Fan J., Qiu H.L., Wu X. F. (2014). Tourist destination image, place attachment and tourists' environmentally responsible behavior: A case of Zhejiang tourist resorts. *Tourism Tribune*, 2014, 29(1):12.
- Filo, K., Chen, N., King, C., and Funk, D. C. (2013). Sport tourists' involvement with a destination: A stage-based examination. *Journal of Hospitality and Tourism Research*,

37(1), 100-124.

- Ge, L. Q. (2019). A study on the relationship between leisure involvement, place attachment and behavioral intention of tourists -- A case study of "Sankua Community" in Chaohu city [Dissertation]. Anhui University.
- Gieryn, T. F. (2000). A space for place in sociology. *Annual Review of Sociology*, 26, 463-496.
- Gross, M., & Brown, G. (2008). An empirical structural model of tourists and places: progressing involvement and place attachment into tourism. *Tourism Management*, 29(6), 1141-1151.
- Gursoy, D., & Gavcar, E. (2003). International leisure tourists' involvement profile. *Annals of Tourism Research*, 30(4), 906-926.
- Havitz, M. E., & Dimanche, F. (1990). Propositions for testing the involvement construct in recreational and tourism contexts. *Leisure Sciences*, 12(2), 179-195.
- Havitz, M. E., & Dimanche, F. (1997). Leisure involvement revisited: Conceptual conundrums and measurement advances. *Journal of Leisure Research*, 29(3), 245-278.
- Havitz, M. E., Green, T. R., & McCarville, R. E. (1993). Order effects and the measurement of enduring involvement. *Journal of Applied Recreation Research*, 18(3), 181-195.
- Herbert, E. K. (1965). The impact of television advertising: Learning without involvement. *Public Opinion Quarterly*, 29(3), 349.
- Hernández, B., Hidalgo, M. C., Salazar-Laplace, M. E., et al. (2007). Place attachment and place identity in natives and non-natives. *Journal of Environmental Psychology*, 27(4), 310-319.
- Hidalgo, M. C., & Hernández, B. (2001). Place attachment: Conceptual and empirical questions. *Journal of Environmental Psychology*, 21(3), 273-281.
- Hobson, J. P. (1995). Virtual reality and tourism: Fact or fantasy?. *Tourism Management*, 16(6), 423-427.
- Hobson, J. P., & Williams, A. P. (1995). Virtual reality: A new horizon for the tourism industry. *Journal of Vacation Marketing*, 1(2), 125-127.
- Huang, X., Bao, J. G., & Wall, G. (2006). Place attachment: A conceptual framework for understanding recreational behavior. *Tourism Tribune*, 21(9), 19-24.

- Hwang, S. N., Lee, C., & Chen, H. J. (2005). The relationship among tourists' involvement, place attachment and interpretation satisfaction in Taiwan's national parks. *Tourism Management, 26*(2), 143-156.
- Iwasaki, Y., & Havitz, M. E. (2004). Examining relationships between leisure involvement, psychological commitment and loyalty to a recreation agency. *Journal of Leisure Research, 36*(1), 45-72.
- Jung T, Chung N, Leue M C. (2015). The determinants of recommendations to use augmented reality technologies: The case of a Korean theme park. *Tourism Management, 49*:75-86.
- Kil, N., Holland, S. M., Stein, T. V., et al. (2012). Place attachment as a mediator of the relationship between nature-based recreation benefits and future visit intentions. *Journal of Sustainable Tourism, 20*(4), 603-626.
- Kim, M. J., Lee, C. K., & Jung, T. (2020). Exploring consumer behavior in virtual reality tourism using an extended stimulus-organism-response model. *Journal of travel research, 59*(1), 69-89.
- Kozak, M. (2001). Repeaters' Behavior at Two Distinct Destinations. *Annals of Tourism Research, 28*(3), 784-807.
- Kyle, G., Graefe, A., Manning R., and Bacon, J. (2003). An examination of the relationships between leisure activity involvement and place attachment among hikers along the Appalachian Trail. *Journal of Leisure Research, 3*, 249-273.
- Laurent, G., & Kapferer, J. (1985). Measuring consumer involvement profiles. *Journal of Marketing Research, 22*(1), 41-53.
- Lee, T. H., & Shen, Y. L. (2013). The influence of leisure involvement and place attachment on destination loyalty: Evidence from recreationists walking their dogs in urban parks. *Journal of Environmental Psychology, 33*(3), 76-85.
- Li, H. Y., Long, J. Z., & Cheng S. S. (2012). A study on the impact of tourist involvement on post-tour behavioral intentions based on the museums' situation: Mediating effect of tourist experience quality. *Journal Beijing International Studies University, (3)*, 54-63+
- Li, T., & Chen, Y. (2019). Will virtual reality be a double-edged exploring sword? the

- moderation effects of the expected enjoyment of a destination on travel intention. *Journal of Destination Marketing & Management*, 12, 15-26.
- Li, W. M., Yin, C. Q., Tang, W. Y., et al. (2019). Place attachment and pro-environmental behaviors of bird-watching tourists: taking natural empathy and perception of environmental education as mediating variables. *Economic Geography*, 39(01), 218-227.
- Li, X. J., Li, Z. R., Song, C. Y., Lu, W. L., Zhang, Q. (2021). Exploring consumer behavior in virtual reality tourism using the theory of planned behavior. *Tourism Tribune*, 36(8):12.
- Lin, L. P., Huang, S. C., & Ho, Y. C. (2020). Could virtual reality effectively market slow travel in a heritage destination? *Tourism Management*, 78, 1-11.
- Liu, J., & Yue, M. T. (2019). Relationship between tourists' involvement, place attachment and willingness to pay of tourism eco-compensation: A case study of Wuyishan national park. *Areal Research and Development*, 38(02), 112-116+128.
- Loureiro, S. M. C., Guerreiro, J., & Ali, F. (2020). 20 years of research on virtual reality and augmented reality in tourism context: A text-mining approach. *Tourism Management*, 77, 1-21.
- McIntyre, N., & Pigram, J. J. (1992). Recreation specialization reexamined: The case of vehicle-based campers. *Leisure Research*, 14(1), 3-15.
- Mehrabian, A., & Russel, J. (1974). *An approach to environmental psychology*. Cambridge, MA: MIT Press.
- Moore, R. L., & Graefe, A. R. (1994). Attachments to recreation settings: The case of rail-trail users. *Leisure Sciences*, 16(1), 17-31.
- Mowen, A. J., Graefe, A. R., & Virden, R. J. (1997). A typology of place attachment and activity involvement[C]. *Proceedings of the 1997 Northeastern Recreation Research Symposium*.
- Munoz-Leiva, F., Hernandez-Mendez, J., & Sanchez-Fernandez, J. (2012). Generalising user behavior in online travel sites through the travel 2.0 website acceptance model. *Online Information Review*, 36(6), 879-902.
- Park, M., Yang, X., Lee, B., et al. (2002). Segmenting casino gamblers by involvement profiles: a Colorado example. *Tourism Management*, 23(1), 55-65.
- Plunkett, D., Fulthorp, K., & Paris, C. M. (2019). Examining the relationship between place

- attachment and behavioral loyalty in an urban park setting. *Journal of Outdoor Recreation and Tourism*, 25, 36-44.
- Prayag, G., & Ryan, C. (2012). Antecedents of tourists' loyalty to Mauritius: The role and influence of destination image, place attachment, personal involvement, and satisfaction. *Journal of Travel Research*, 51(3), 342-356.
- Santos, V., Sousa, B., Ramos, P., & Valeri, M. (2021). Emotions and involvement in tourism settings. *Current Issues in Tourism*, 1, 1-6.
- Selin, S., & Howard, D. (1988). Ego Involvement and Leisure Behavior: A Conceptual Specification. *Journal of Leisure Research*, 20(3), 237-244.
- Shao, J. (2010). Study on destination intervention of movie tourists based on the internet [Dissertation]. Peking University.
- Sherif, M., & Cantril, H. (1947). *The Psychology of ego-Involvements: Social attitudes and identifications*. New York: John Wiley.
- Slama, M. E., & Tashchian, A. (1985). Selected socioeconomic and demographic characteristics associated with purchasing involvement. *Journal of Marketing*, 49(1), 72-82.
- Stone, R. N. (1984). The marketing characteristics of involvement. *Advances in Consumer Research*, 1, 210-215.
- Su, W. S., & Hsu, C. C. (2019). examining how place dependence and place identity affect behavioral intention of marathon tourists in Taiwan. *International Journal of Organizational Innovation (Online)*, 12(1), 145-161.
- Tussyadiah, I. P., Wang, D., Jung, T.H., et al. (2018). Virtual reality, presence, and attitude change: Empirical evidence from tourism. *Tourism Management*, 66, 140-154.
- UNWTO. (2020a). UNWTO travel restrictions report. Madrid, Spain: UNWTO.
- UNWTO. (2020b). UNWTO world tourism barometer. Madrid, Spain: UNWTO.
- Vaske, J.J. & Kobrin, K.C. (2001). Place attachment and environmentally responsible behavior. *The Journal of Environmental Education*, 32(4): 16-21.
- Wang, K., Huang, Z. F., Fang, Y. L., et al. (2013). Impacts of tourist' involvement on place attachment in cultural tourist attractions. *Human Geography*, 3, 135-141.
- Watkins, M. N. (1986). The influences of involvement and information search on consumers'

- choices of recreation activities [Dissertation]. Eugene: University of Oregon.
- Wei, W., Qi, R., & Zhang, L. (2019). Effects of virtual reality on theme park visitors' experience and behaviors: A presence perspective. *Tourism Management*, *71*, 282-293.
- Wiley, C. G. E., Shaw, S. M., and Havitz, M. E. (2000). Men's and women's involvement in sports: An examination of the gendered aspects of leisure involvement. *Leisure Sciences*, *22*(1), 19-31, DOI: 10.1080/014904000272939.
- Williams, D. R., Patterson, M. E., Roggenbuck, J. W., et al. (1992). Beyond the commodity metaphor: Examining emotional and symbolic attachment to place. *Leisure Sciences*, *14*(1), 29-46.
- Wu, H. C., Ai, C. H., & Cheng, C. C. (2019). Virtual reality experiences, attachment and experiential outcomes in tourism. *Tourism Review*, *75*(3), 481-495.
- Xu, Z., & Zhang, J. (2016). Antecedents and consequences of place attachment: A comparison of Chinese and Western urban tourists in Hangzhou, China. *Journal of Destination Marketing & Management*, *5*(2), 86-96.
- Yeh, C. H., Wang, Y. S., Li, H. T., & Lin, S. Y. (2017). The effect of information presentation modes on tourists' responses in Internet marketing: The moderating role of emotions. *Journal of Travel & Tourism Marketing*, *34*(8), 1018-1032.
- Yuan, Q., Song, H. J., Chen, N., and Shang, W. (2019). Roles of tourism involvement and place attachment in determining residents' attitudes toward industrial heritage tourism in a resource-exhausted city in China. *Sustainability*, *11*.
- Yung, R., and Khoo-Lattimore, C. (2019). New realities: a systematic literature review on virtual reality and augmented reality in tourism research. *Current Issues in Tourism*, *22*(17), 2056-2081, DOI: 10.1080/13683500.2017.1417359
- Yung, R., Khoo-Lattimore, C., and Potter, L. E. (2020). Virtual reality and tourism marketing: conceptualizing a framework on presence, emotion, and intention. *Current Issues in Tourism*, <https://doi.org/10.1080/13683500.2020.1820454>.
- Zaichkowsky, J. L. (1985). Measuring the involvement construct. *Journal of Consumer Research*, *3*, 341-345.
- Zeithaml, V. A., Berry, L. L., & Parasuraman, A. (1996). The behavioral consequences of service quality. *Journal of Marketing*, *60*(2), 31-46.

- Zhang, C., Huang Z. F. (2020). Constructing the theoretical model of "tri-space" interaction in the tourism context. *Geographical Research*, 39(2): 232-242.
- Zhang, H. M., &Lu, L. (2010). Impacts of tourist involvement on destination image: Comparison between inbound and domestic tourists. *Journal of Geography*, 65(12), 1613-1623.