

Would you enjoy virtual travel? The characteristics and causes of virtual tourists' sentiment under the influence of the COVID-19 pandemic

Shu-Ning Zhang^a, Yong-Quan Li^a, Wen-Qi Ruan^{b,*}, Chih-Hsing Liu^{c,d}

^a Research Center of Tourism and Service Management, College of Tourism, Huaqiao University, Quanzhou, Fujian, 362021, PR China

^b College of Tourism, Huaqiao University

^c National Kaohsiung University of Science and Technology, Department of Tourism Management, Kaohsiung, 807, Taiwan

^d Ming Chuan University, Leisure & Recreation Administration Department, Taoyuan County, 333, Taiwan

ARTICLE INFO

Keywords:

Virtual tourism
COVID-19
Crisis situation
Sentiment analysis
Big data
Cause

ABSTRACT

There are numerous arguments regarding the attitudes of different tourists and scenic destination managers regarding virtual tourism. However, it remains difficult to understand the public's attitude towards virtual tourism in a crisis situation. In this way, under the influence of COVID-19, this study explores the public sentiment and drivers of virtual tourism using Python and the grounded theory method. The results reveal that tourists' positive sentiment in virtual tourism dominates, with few tourists showing negative or neutral sentiment polarity. Furthermore, there is an obvious law of time decay in the intensity of public sentiment. Especially as the crisis fades, the supplementary effect of virtual tourism on on-site tourism weakens. Moreover, project design, experience quality, travel convenience, travel cost, travel motivation and destination attractiveness are the critical factors affecting tourist sentiment. The findings provide implications for the sustainable development of both destination and virtual tourism in a new world order post-COVID-19.

1. Introduction

Tourism has a substantial overlap with information science and information technology. Information technology has contributed to the tourism revolution and has transformed the traditional tourism industry and the experience of products (Pedrana, 2014), giving rise to a new model of tourism: virtual tourism. Virtual tourism is based on real tourism landscapes. It presents, simulates and even surpasses the attraction of on-site tourism through the Internet or virtual technology by constructing an online environment that allows participants to experience immersive tourism while remaining indoors (Bogicevic, Seo, Kandampully, Liu, & Rudd, 2019; Hobson & Williams, 1995). Although virtual tourism as a new type of tourism industry has attracted considerable attention, disputes remain about the attitudes and evaluations of this modality. Some scholars believe that virtual tourism has created a new mode of tourism that offers numerous conveniences (Guttentag, 2010), such as restoring a destination's historic original appearance, protecting cultural heritage, and making tourism accessible for tourists with constraints, including physical disabilities, financial difficulties and time constraints (Yung & Khoo-Lattimore, 2017). However, opponents argue that tourists cannot have a high-quality experience online

because all senses must be engaged with the physical environment to be fully awakened (Kim, Lee, & Jung, 2020). Some heritage destination managers also worry that the virtual experience will dilute the destination's objective authenticity and refuse to adopt this approach because the information presented through virtual tourism is considered unreliable and distorted (Dueholm & Smed, 2014), which may weaken the on-site tourism attraction. Thus, opinions on virtual tourism remain mixed, raising a relevant question for tourists: Would you enjoy virtual travel?

Although virtual tourism has been around for more than a decade, it is still relatively unfamiliar to most tourists. The controversies related to virtual tourism have been centred within non-crisis and conventional situations in the previous literature. Due to the sharp distinction between virtual tourism and on-site tourism, their comparison affects tourists' decision-making, evaluation and behaviour. Jung and Dieck (2017) believe that virtual tourism is an effective alternative when it is impossible to access the real environment. In a crisis situation, what is the real attitude of tourists towards virtual tourism? It remains difficult to ascertain a clear response. Importantly, the elucidation of the public's attitude towards virtual tourism will not only provide theoretical insights but also establish practical guidance for the sustainable

* Corresponding author.

E-mail addresses: snz1995@163.com (S.-N. Zhang), lyqax@163.com (Y.-Q. Li), wqr1992@163.com (W.-Q. Ruan), phd20110909@gmail.com (C.-H. Liu).

development of scenic destinations in crisis situations. Therefore, it is urgent to clarify the public sentiment and reasoning regarding virtual tourism experiences, both theoretically and practically.

Since the outbreak of the novel coronavirus disease 2019 (COVID-19), global economic and social development has suffered tremendous impacts. Unlike previous pandemics, COVID-19 has a longer incubation period, fewer symptoms and spreads faster and more widely (Gössling et al., 2002). Avoiding crowds and touching has become a significant measure for preventing the spread of COVID-19. Within a few months, the framework of the global tourism system has changed from one of open tourism (Dodds & Butler, 2019) to restricted tourism as never before, and most countries have introduced travel bans (Gössling et al., 2002). In China, the Ministry of Culture and Tourism has ordered major scenic destinations to close and major cultural and entertainment events to be canceled since January 20, 2020. COVID-19 has posed a massive obstacle to tourists' on-site travel and has also substantially affected destination development (Sigala, 2020; Wen, Kozak, Yang, & Liu, 2020). Table 1 shows that the travel demand for 257 5A-level scenic destinations in China declined after the COVID-19 outbreak (Yang, Ruan, Zhang, & Li, 2021). Among them, the Palace Museum was the hardest hit. To compensate for the inability to conduct on-site tourism during the COVID-19 pandemic, some scenic destinations have developed a new virtual tourism market (Cheng & Li, 2020). The Palace Museum, closed for more than 70 days, launched the "Traveling in the Palace Museum" series for the first time, drawing more than 100 million online tourists. The online experience model transcends the limitations of space and time (Jung & Dieck, 2017) and provides a new opportunity to develop tourism activities that satisfy travel demands during the COVID-19 pandemic. Although virtual tourism has received widespread attention from all walks of life, few studies have systematically explored the public sentiment towards and the causes of this sentiment regarding virtual tourism experiences (Kim et al., 2020; Lin, Huang, & Ho, 2020; Wei, Qi, & Zhang, 2019). Therefore, this study aims to explore the public attitudes towards virtual tourism in the context of COVID-19 and to determine the reasons for these sentiments. These issues have not yet been addressed and therefore need to be further explored.

To address the above issue, taking "Traveling in the Palace Museum" as a case study, this study collects online reviews using Python. Furthermore, we introduce sentiment analysis technology to explore the characteristics and rules of public sentiment towards virtual tourism and analyse the factors that influence these attitudes through grounded theory. This paper specifically accomplishes the following research aims: (1) examines the tendency of tourists' sentiments towards virtual tourism in crisis situations; (2) explores the evolution of the sentiments

Table 1

Top 10 5A-level destinations in tourist demand decline after COVID-19 outbreak.

Number	5A-level destinations	Demand decline	Decrease ratio	Whether to launch a virtual tourism project
1	The Palace Museum	25125	92%	Yes
2	Badaling-Mutianyu Great Wall	4956	88%	
3	Leshan Giant Buddha	3679	83%	
4	The Ancient City of Ping Yao	3933	82%	
5	The Longmen Grottoes	2852	81%	Yes
6	Old Summer Palace	4158	81%	
7	Jiangwan Scenic Area	8767	80%	
8	Kulangsu	4521	77%	
9	The Summer Palace	3399	72%	Yes
10	Jianglang Mountain-Nian Ba Du Tourist Area	3499	72%	

and enthusiasm of tourists in virtual tourism; and (3) investigates the critical factors that affect tourists' sentiments towards virtual tourism and the mechanisms that influence those attitudes. This study answers urgent research issues and provides constructive theoretical contributions. For the first time, this study re-examines the polarity of tourists' sentiments towards virtual tourism from a crisis perspective, thereby responding to the theoretical boundaries of previous arguments on virtual tourism (Wagler & Hanus, 2018; Nolin et al., 2016). Furthermore, our research contributes to clarifying the time decay of the sentiment intensity of virtual tourists and provides a theoretical framework for the formation mechanism of tourists' sentiments. More practically, theoretical guidance from these conclusions can provide a management strategy for virtual tourism in crisis situations. This work also confirms the quality of the experience of virtual tourism in the post-COVID-19 world and highlights the managerial value for both virtual and on-site destination sustainability.

2. Literature review

2.1. Virtual tourism

Virtual tourism is divided into two categories: broad concepts and narrow concepts. In a broad sense, virtual tourism refers to any process of obtaining information and knowledge about tourist attractions using a non-immersive way. In the narrow sense, virtual tourism is a process of experiencing super-real scenes in a three-dimensional virtual environment through various visualization technologies, including virtual reality (VR) and augmented reality (AR). Urry (2000) conceptualized different forms of "travel", such as the physical movement of objects, imaginary travel, and virtual travel, and defined virtual travel as real-time travel that often takes place on the Internet with many other people. It should be noted that the current virtual tourism projects launched by destinations often contain multiple series and introduce multiple technologies. Therefore, we consider that the critical concept of generalized virtual tourism is consistent with this research situation.

In the 1990s, Hobson and Williams (1995) pointed out for the first time that virtual reality technology would inevitably affect the tourism industry, which was entering a new information age: the virtual tourism era. Currently, virtual technology has penetrated many fields, such as tourism planning, heritage protection, entertainment, accessibility, marketing, education and so forth (Guttentag, 2010; Huang, Backman, Backman, & Moore, 2013). Virtual tourism has become an important way to travel in today's society, which not only affects the policy making of tourism governmental departments but has also been used as a means of tourism destination marketing (Tavakoli & Mura, 2015; Lin et al., 2020). Thus, virtual tourism operation status (Hume & Mills, 2011) and virtual tourism destination image (Hyun & O'Keefe, 2012) are widely considered. In addition to the model design and technology research in the virtual tourism development process, most studies have explored the current situation and the influencing factors of tourists' virtual tourism experiences based on experimental methods (Sundar, Go, Kim, & Zhang, 2015), questionnaire surveys (Bogicevic et al., 2019; Lin et al., 2020), virtual ethnography (Tavakoli & Mura, 2015), interview methods (Dieck, Dieck, Jung, & Moorhouse, 2018), etc. The relevant content covers the three stages before, during and after the experience.

Before the experience occurs, the influence of motivation on virtual tourism behaviour decision making is the focus. Social factors (Han, Hwang, & Woods, 2014), technical ease of use (Han et al., 2014), tourist psychology (Sundar et al., 2015) and other factors affect the choice of virtual tourism. In particular, virtual tourism plays a crucial role in enhancing the familiarity of destinations, reducing tourist anxiety or risk, and affecting decision making on travel mode and experience (Lee & Oh, 2007). For example, Tavakoli and Mura (2015) assert that compared with on-site tourism and virtual tourism, virtual tourism may be attractive to young tourists due to differences in affordability. Guttentag (2010) believes that lower costs will lead to tourists' acceptance

of virtual experiences as replacements for on-site travel experiences. In the experience process, the level of virtual tourism experience not only affects tourist attitudes towards on-site tourism (Tussyadiah, Wang, & Jia, 2017; Jung, Dieck, Moorhouse, & Dieck, 2017, pp. 208–210), but also changes some groups' behaviour patterns (Tavakoli & Mura, 2015). Moreover, virtual tourists can obtain a sense of enjoyment and subjective well-being (Sylaiou et al., 2010; Tussyadiah et al., 2018; Kim & Hall, 2019). However, it may also experience physical fatigue and doubts about authenticity (Nolin et al., 2016; Dueholm & Smed, 2014). Therefore, the factors that influence tourists' level of virtual experience have been widely discussed (Bogicevic et al., 2019; Huang, Wei, & Leung, 2020; Martins et al., 2017). For example, social presence and VR technology design can improve travel experience and satisfaction (Jung, Dieck, Lee, & Chung, 2016; Tussyadiah et al., 2018). After the virtual experience, tourists will enable to recall travel memories (Guttentag, 2010). It can provide an effective value co-creation process and affect tourists' continued use intention and their word of mouth (Jung & Dieck, 2017; Wagler & Hanus, 2018; Wei et al., 2019). In conclusion, the current virtual tourism research has formed a certain theoretical system and content framework, but there is still insufficient discussion of the public sentiment and causes of that sentiment towards the virtual tourism experience. In addition, some scholars believe that virtual tourism may alleviate the problem of overtourism in the future (Bec, Moyle, Schaffer, & Timms, 2021), the previous literature emphasizes the controversy that exists about the virtual tourism experience.

2.2. The influence of the crisis on virtual tourism

The COVID-19 public health crisis has not only affected the development, process and sustainability of the tourism industry but also influenced tourists' attitudes, needs and behaviors (Araña & León, 2008; Walters, Wallin, & Hartley, 2019). For example, Sigala (2020) showed that tourists' experience during COVID-19 will have a significant influence on their travel attitudes, travel risk perception, intentions and future behaviour (Neuburger & Egger, 2020). In this context, the COVID-19 pandemic has prevented global movement as never before, which may lead to market changes and the emergence of alternative models (Ioannides & Gyimóthy, 2020; Kwok & Koh, 2020). These changes will encourage managers to take the necessary measures and adopt innovations to support sustainable development (such as virtual tourism and online experiences) (Cardoso, 2020).

Additionally, only a few scholars have examined the relationship between crises and virtual tourism. Some references assert that virtual tourism can evolve into an attraction itself and create another life for destinations experiencing deterioration or risk of future destruction (Wen & Leung, 2021). The COVID crisis accelerated and expanded in response to tourism challenges (Cardoso, 2020; Kwok & Koh, 2020). Destination managers and travel agencies are increasingly considering using virtual travel tools and providing virtual tourism activities to satisfy customer needs (Neuburger & Egger, 2020). For example, based on a quantitative study of 193 participants, Sarkady, Neuburger and Egger (2021) believe that the rapid development of virtual reality provides market opportunities for virtual vacations. For example, social distance can increase (decrease) visitors' intention to use virtual-reality (face-to-face) tours during the COVID-19 pandemic (Itani & Hollebeek, 2021). Virtual wine tour videos are better able to awaken the purchasing desire and willingness of tourists than traditional videos (Wen & Leung, 2021). In addition, the impact of the pandemic crisis has caused more tourists to engage in virtual tourism (Sigala, 2020). Influenced by the pandemic, people are able to consolidate hospitals where virtual tourism can travel to the actual tourism site (El-Said & Aziz, 2021). Moreover, during the quarantine period, people have experienced and become familiar with virtual services in virtual tourism (Sigala, 2020). The pandemic has prompted many scholars to pay attention to the relationship between the crisis and virtual tourism development. However, there are gaps in the tourism and hospitality literature on the attitude of

virtual tourists during crisis situations.

In conclusion, although relevant studies on virtual tourism have formed a relatively complete theoretical framework, it is insufficient for a systematic and comprehensive response to tourists' attitudes and the causes of those attitudes towards virtual tourism. Limitations include the following: First, the current references are controversial regarding virtual tourism, but there are few empirical studies that directly and deeply analyse and discuss virtual tourist attitudes. Our research will analyse public sentiment characteristics and laws to clarify tourists' attitudes towards virtual tourism. Second, questionnaire survey data and interviews have generally been used in previous research for empirical analysis. Nevertheless, big data can provide insights into universal laws from massive samples (Zapata et al., 2019). Thus, this research attempts to combine sentiment analysis with grounded theory methods, further explore the reasons for surface data and reveal the sentiment characteristics and cause logic related to virtual tourism. Third, current discussions on public attitudes towards virtual tourism are mainly based on non-crisis situations. Although some scholars have explored the impact of the crisis on virtual tourism, there is still a lack of in-depth research on the reasons for and causal mechanisms of tourist sentiments. Therefore, our study is a new attempt to explore public sentiment and its influencing path regarding virtual tourism based on the current COVID-19 crisis situation.

3. Research design

3.1. Sample selection

This study selected the virtual tourism project "Traveling in the Palace Museum" as the research object. The reasons for sample selection are as follows: (1) The Palace Museum is one of the five largest palaces in the world and is a UNESCO "World Cultural Heritage" site. It is a favourite attraction for both Chinese and international tourists. However, according to the statistics in Table 1, the tourist demand for the Palace Museum dropped by more than 90% in the early stages of the COVID-19 pandemic, and the site was the first virtual tourism project to emerge in that period (Yang et al., 2021). (2) Since the Palace Museum first developed virtual tourism during the pandemic, selecting it as a case will help to clarify the starting point and nodes of virtual tourists' sentiment changes at this stage. This case will also enable this study to explore the time law of virtual tourists' sentiments. (3) The Palace Museum virtual tourism project attracted more than 100 million online visitors after its launch, reflecting its considerable appeal. This case provides a large sample for responding to the controversy about virtual tourism sentiment in previous studies, which have largely used small samples. (4) Because the COVID-19 pandemic is a common experience worldwide, all countries are faced with the special situation of scenic closures. Importantly, China has a massive tourism market, and previous sentiment studies have also analyzed and explored samples of Chinese tourists as typical cases (Liu, Huang, Bao, & Chen, 2019). Therefore, the Palace Museum is a typical and representative sample case.

3.2. Data collection

Sina Weibo (<http://t.sina.com.cn>) is an important platform for Chinese Internet users to gather and exchange opinions on hot topics. Because of its brief content and obvious pertinence, its users have a strong tendency to praise and criticize, which is suitable for sentiment analysis. To highlight the research purpose, obtain the most extensive user opinions and avoid the randomness and fragmentation of Weibo comment data, the collection object was set to several comments on the topic of "Traveling in the Palace Museum" series. It included #Traveling in the Palace Museum, #Enjoy spring at the Palace Museum and #The Palace Museum. To explore public sentiment at different time periods, this study collected data from the official announcement of the "Traveling in the Palace Museum" experience on April 3 to June 14, 2020. We

used Python programming to simulate the Weibo login and search process, wrote a Weibo crawler, and automatically crawled reviews on Weibo. A total of 10,033 pieces of data were crawled, including Web username, comment time, comment content, and comment method.

3.3. Research methods and measurement

3.3.1. Sentiment analysis

Sentiment analysis is also called tendency analysis or sentiment mining. Its core concept refers to classifying the emotions or attitudes of subjective texts with implicit sentiments (Zapata et al., 2019). This study introduces big data sentiment analysis technology to gain insight into tourists' attitudes towards virtual tourism in crisis situations. The reasons for the study are as follows. First, tourist attitudes have been explored and discussed for a long time, and there are many tools to measure them, the most common of which is the survey method. However, it is well known that survey-based methods have some shortcomings, such as cost and logistics, multiple biases and a lack of comprehensiveness (Alaei, Becken, & Stantic, 2019). Importantly, compared with the traditional measurement of tourist attitudes, sentiment analysis has become a valuable alternative measuring technique to represent tourists' true subjective attitudes and opinions and has often been used in recent tourism research (Liu et al., 2019). Second, sentiment analysis can quantify internet user opinions through big data text processing and summarize general laws from a large amount of data and has the ability to discard biased results caused by small samples. Further, sentiment analysis contributes to measuring real tourist attitudes through standard modelling techniques, overcoming the arbitrariness of individuals filling out questionnaires and avoiding the subjective emotions of qualitative interview data analysis. In summary, big data sentiment analysis provides a new approach to analysing tourist attitudes that is suitable for large samples and can effectively solve the core problem of this research.

This research used a text-mining approach based on natural language processing (SnowNLP) to analyse the reviews. SnowNLP is a Python library for Chinese text segmentation, part-of-speech tagging, text classification, etc. The tool has a universal dictionary, and each term has a partial phonetic code (e.g., noun, verb, adjective, adverb). Based on contextual and semantic information, our text mining automatically structures text into groups of words (Guerreiro & Rita, 2020). The specific sentiment analysis process is as follows: First, we cleaned the Weibo data after the Python crawl to eliminate noisy data, including blank, duplicate and irrelevant data (such as advertising information and junk information). After synonyms with similar meanings were merged, a final total of 9276 pieces of data were obtained. Second, Jieba (<https://github.com/fxsjy/jieba>), a more professional Chinese word segmentation programme, was introduced to segment comment sentences. This programme eliminates words with no actual meanings, such as auxiliaries, prepositions, conjunctions, and punctuation, in the reviews and retains nouns, adjectives, and adverbs that are meaningful for sentiment analysis. Third, we established a sentiment analysis model code and used Python software to score the sentiment polarity of each comment. The final semantic classification accuracy rate exceeded 80% (Zhang, Wang, Duo, & Zhang, 2018).

3.3.2. Grounded theory

It is difficult to offer a thorough explanation of the cause logic of a phenomenon through the big data analysis method alone. To explore the formation mechanism of virtual tourism public sentiment tendency, this study followed 3 coding steps combined with procedural grounded theory. We encoded, summarized, refined and abstracted the original online reviews to form the core influencing factors (Papathanassis & Knolle, 2011). The coding process was conducted by open coding, axial coding and selective coding. (1) Open coding refers to a phenomenon-based generalization of the original content. This process requires the researcher to abandon individual subjective bias and the

theoretical stereotype of the research phenomenon (Alvesson, 2003). We conducted initial coding according to the original information collected and conceptualized and categorized the data verbatim as much as possible (Zhou, Mei, & Hou, 2020). (2) The core purpose of axis coding is to further distinguish the open coding and better develop the main category. That is, after continuous comparison, merging, and classification, the potential logical connections between categories will be discovered and established (Wang & He, 2011). (3) Selective coding needs to further address the relationship between categories. After systematic combing, the "core category" that covers most of the research results is discovered (Strass & Corbin, 1990).

3.3.3. Sentiment orientation

This study introduces the sentiment orientation index to explore the sentiment heat of virtual tourists for "Traveling in the Palace Museum". Specifically, the variance of the sentiment orientation of all the daily users' reviews can reflect the degree of sentiment divergence, indicating their sentiment heat on a topic. Since the small number of reviews on some dates results in a large variance of sentiments, there are drawbacks to measuring heat only by variance (Ren et al., 2019). Therefore, the sentiment heat measurement formula is modified as follows:

$$HOT = \min - \max(\min - \max(num) * q) \quad (1)$$

where *HOT* represents the sentiment heat, *num* represents the number of user reviews, and *q* represents the variance of sentiment orientation. *Min-max* represents the standardized test method.

4. Results

4.1. Sentiment characteristics of virtual tourism

This study used Anaconda 3.0 software to generate a sentiment judgement model. The model analyzed the probabilities of 3 types of virtual tourist sentiment, with values ranging from 0 to 1. Neutral sentiment was represented from 0.4 to 0.6, with scores closer to 0 representing negative sentiment and those closer to 1 representing positive sentiment. Table 2 summarizes a total of 7703 positive reviews, 1244 negative reviews and 329 neutral reviews. Furthermore, positive reviews obviously dominated (83.04%), indicating that tourists showed positive sentiment polarity towards the overall evaluation of "Traveling in the Palace Museum".

To clarify the sentiment development trend of each period before and after the launch of "Traveling in the Palace Museum", a temporal distribution map of the sentiment characteristics was developed, which is shown in Fig. 1. The results displayed a positive sentiment polarity before and during the virtual project. However, over time, more neutral and negative sentiments appeared. Specifically, (1) on April 3, the official Weibo account previewed "Traveling in the Palace Museum", and the first webcast was launched, attracting great attention and discussion from netizens. Affected by COVID-19, people's tourism demand for other places could not be satisfied. In this case, virtual tourism stimulated netizens' willingness to experience a new form of tourism. Thus, netizens at this stage mainly presented positive sentiments such as expectation and curiosity, but some netizens also demonstrated negative attitudes, such as suspicion of strangeness. (2) The live broadcast of "Traveling in the Palace Museum" lasted from April 5 to April 6, during which virtual tourists primarily manifested their specific reviews on the virtual travel experience. The most extensive discussions were on the innovative forms of virtual tourism, the satisfaction of travel demand during the pandemic, and the praise of the Palace Museum, revealing a positive sentiment polarity in general. However, some tourists also showed a negative attitude due to the lack of authentic experience and live broadcasting issues. (3) After the resumption of field tours of the Palace Museum in May, the proportion of negative sentiments regarding the online experience gradually increased, and some tourists chose a

Table 2
Number and cases of sentiment characteristics.

Sentiment characteristics	Quantity/Proportion	Case (Original sentence)	Sentiment scores
Positive	7600 (81.94%)	It's really comfortable to watch the Palace Museum live online, you can lie down and watch it at home.	0.628
		That's amazing. Times are advancing!	0.703
		Flower viewing online is also very good, watching the beautiful scenery.	0.834
		It's really amazing. Although the epidemic does not allow us to go to the Palace Museum, the online flower viewing of the Palace Museum allows us to enjoy its beauty without leaving home! Great!	0.996
		How do I share travel information in WeChat Moments from virtual tourism? I can see the world without going out.	0.453
Neutral	568 (6.12%)	Today I am also a member of online flower viewing.	0.405
		Virtual travel saves money.	0.461
		Xinhua news agency had a good motive for this live broadcast, but the live broadcast was really bad with no Steadicam, and there was noise.	0.016
Negative	1107 (11.93%)	How can I not get in the "Juanqinzhai"?	0.123
		This is really deceiving oneself.	0.102
		It's just a lack of VR.	0.293

field experience. Nevertheless, positive sentiments still dominated. Tourists were still largely unable to experience on-site tourism due to multiple factors, such as the risk of the pandemic, distance, and crowd control in scenic destinations, and therefore, "Traveling in the Palace Museum" still satisfied their travel needs.

To further explore the evolution of public sentiment at different times, the sentiment heat of virtual tourism is calculated according to formula (1). Fig. 2 demonstrates the area chart of sentiment heat over time. The results showed obvious temporal differentiation in the

sentiment heat of tourists for "Traveling in the Palace Museum". The evolution trend was divided into four stages: an anticipation period, high heat period, repeated period, and low heat period.

- (1) The anticipation period appeared before the start of the "Traveling in the Palace Museum" project. The official weibo announced the first virtual tourism information, sparking considerable interest and curiosity among potential tourists. At this stage, potential tourists focused on expectations regarding virtual tourism innovation, which stimulated the tourism demand suppressed by COVID-19, resulting in a short peak in public sentiment heat.
- (2) A high heat period occurred between April 5 and April 9. The first webcast of "Traveling in the Palace Museum" attracted great attention and discussion, peaking on the second day. Because the online tourism experience transcended the boundaries of time and space, tourists could browse at any time. Furthermore, due to the attractiveness of the Palace Museum's excellent tourism resources, many virtual tourists gained significant visual experience through virtual tourism and maintained high sentiment heat.
- (3) The repeated period appeared from April 10 to May 23, in which the sentiment heat of virtual tourism showed a fluctuating development trend. There was a short peak of sentiment heat during the "Palace Museum Opening" preview period and after the May Day holidays. Since the opening information for scenic destinations awakened the tourism demand of potential tourists for the Palace Museum, virtual tourism could enhance individual impressions of the tourist destination. Moreover, most potential tourists were still unable to visit because of the strict restrictions due to pandemic prevention and tourist control. Thus, virtual tourism was still their tourism decision.
- (4) A low heat period appeared after May 24. During this period, tourist discussion of the "Traveling in the Palace Museum" project obviously decreased, and sentiment heat remained low. The reason for this decline is that the destination was open for field tours, diluting some virtual tourist demand. Furthermore, it was difficult for the virtual tourism experience to arouse tourists' willingness to revisit the Palace Museum without new aspects to offer. Therefore, the sentiment heat during this period significantly declined over time.

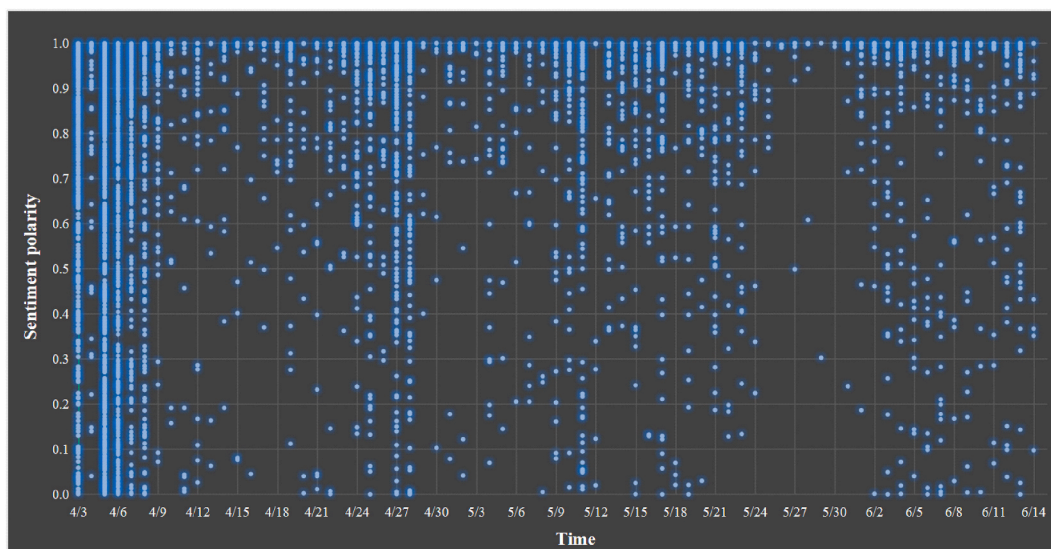


Fig. 1. Scatter diagram of the sentiment evolution of virtual tourism to the Palace Museum.

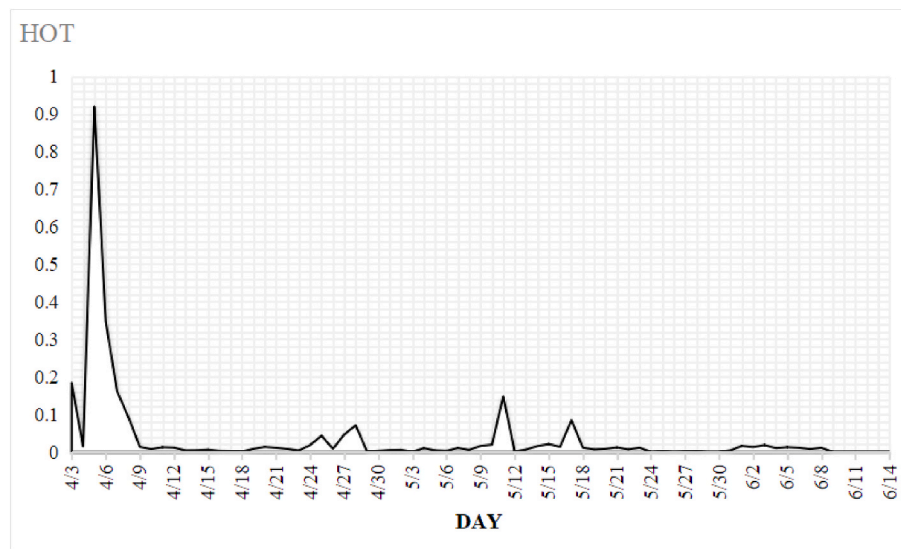


Fig. 2. Time-varying area chart of the sentiment heat of virtual tourism to the Palace Museum.

4.2. Factors influencing public sentiment

4.2.1. Analysis of online reviews

In open coding, our researchers repeatedly read original reviews and coded around the core research issue of “factors influencing public sentiment”. Because not all online reviews contained cause-oriented statements, some sentences that only presented sentiment polarities were not considered in the coding process, such as “Awesome!” or “That is so beautiful”. To improve coding reliability, two researchers used the free nodes in NVivo 11 software to label the initial concepts and categories individually. When there were divergences in coding, the initial coding consistency was ensured through expert review discussion. Ultimately, open coding formed 35 concepts and further summarized 18 initial categories. Table 3 shows the concepts for each category and their original statements.

Second, the axial coding process was conducted. To obtain a more conceptual, refined and directional main category, we analyzed the potential relevance and logical order among the 17 initial categories through repeated comparisons and clarified their unclear internal relations. A final total of 6 main categories were extracted (proportion): project design (14.72%), experience quality (12.73%), travel convenience (19.63%), travel cost (7.06%), travel motivation (33.59%), and destination attractions (12.27%). The specific categories and their connotations are summarized in Table 4.

Third, the selective coding process was based on the analysis of the main categories and selected an outline-based “core category” through abstract thinking (Zhou et al., 2020). The study found that the “influencing factors of virtual tourism public sentiment in crisis situations” can be used to control all other categories; thus, it was set as the “core category”. Fig. 3 shows that the “storyline” constructed by selective coding fully explained the theoretical framework of the public sentiment formation mechanism of virtual tourism. Specifically, travel motivations, costs and convenience are drivers of virtual tourism sentiments. Travel motivation includes tourism preferences, tourism demand and knowledge acquisition. Travel costs involve economic costs and risk costs, and travel convenience includes both time convenience and space convenience. In addition, virtual tourism project design and destination attractiveness constitute pull factors. The project design covered innovation, content setting and technology application, and destination attraction was characterized by architectural attraction, scenic attraction and cultural attraction. In a crisis situation, the supply of virtual scenic destinations met tourist demand, which allowed them to replace on-site tourism to some extent. Finally, experience quality was the

critical mediating factor, consisting of flow experience, authentic experience, unique experience, enjoyable experience and interactive experience. In other words, these factors jointly influenced the formation process of virtual tourism public sentiment in crisis situations.

4.2.2. Influencing factor composition and dimension connotations

This study identified 6 main categories and 18 categories through qualitative analysis, which together constituted the influencing factors of virtual tourism public sentiment. To better highlight the internal mechanism of the six core factors that affect virtual tourist sentiments, this study clarifies the mechanism diagram in Fig. 3 based on push-pull theory (Hsu, Cai, & Li, 2010). Push-pull theory emphasizes that individual attitudes or behaviors are mainly affected by push and pull factors. In a crisis situation, the travel motivation, cost and convenience of virtual tourism in effect push, or drive, active participation and experience evaluation. Further, the project design and attractiveness of the destination provided by virtual tourism can attract tourists to experience and participate. In this study, we assert that the quality of the experience is the most critical mediating factor in the emotional evaluation of tourists, as it guides their positive or negative sentiments. Finally, this study provides dimensional connotations and specific explanations of the six influencing factors:

(1) Push factors. Travel motivation, travel convenience and travel cost were the core driving factors of virtual tourists’ sentiment formation. Motivation is essentially regarded as a cognitive concept, and evidence from previous studies has suggested a close relationship between motivation and attitude (Kim & Hall, 2019). For example, motivation affects tourists’ attitudes and behaviors, including their involvement and revisit intention (Kim & Hall, 2019; Wei et al., 2019). In virtual tourism experiences, motivation remained the initial driving force for the formation of tourist attitudes. However, the differences included that the virtual tourism motivation in this crisis situation was more focused on tourism demand, preference and knowledge acquisition. Some studies posit that the motivation of virtual tourism is curiosity under normal circumstances (Sundar et al., 2015), while our results found that in crisis situations, the motivation for tourists to engage in virtual tourism is more related to the need to release stress and satisfy travel interests that had been restricted by crisis (Cheng & Li, 2020). Furthermore, the positive sentiment polarity of some virtual tourists originated from their distinct preference. Because of tourists’ deep-rooted love and nostalgia for the destination (the Palace Museum), they maintained high stickiness under the new virtual experience mode. Meanwhile, for both onsite and virtual tourism experiences, knowledge

Table 3
Categories formed by open coding.

Number	Category	Concepts	Original representative statement in the online review text
1	Content settings	Background music	I watched the last live broadcast a few days ago. It was really good, especially the music was so good.
2	Technology application	Professional interpretation	There are also professional teachers to explain.
		Internet stabilization	Signals are erratic in some of the Palace Museum's pathways
3	Form innovation	Definition	How to present clear close-ups while ensuring a smooth live broadcast is very important. It seems that this technology has been solved well.
		VR/AR effects	The AR effect is really good. It was so novel to meet the Palace Museum in the form of a live broadcast.
4	Flow experience	Novelty	Half an hour! That's a good idea. That's creative.
		Creativity	This live broadcast is really good. It allows people to experience the scenery of the Palace Museum.
5	Authentic experience	Immersive	Although virtual tourism brings us the experience of emerging tourism, it lacks a trace of personal experience seen and heard in tourism, which may also be the biggest drawback.
		Personal experience	How to travel online? Can only see?
6	Unique experience	A single senses	This online tour of the Palace Museum has a different feeling.
		Different feelings	The Palace Museum live show is really great, too much eye addiction.
7	Enjoyable experience	Visual effect	There is nothing more enjoyable than admiring the deserted Forbidden City under the sunset.
		Enjoyment landscape	It's really comfortable to watch the Palace Museum live online. You can lie down and watch it at home.
8	Interactive Experience	Physical comfort	I can discuss online with everyone.
		Communication	How do I share in moments?
9	Spatial convenience	Share behaviour	We can visit the Palace Museum without leaving home.
		No distance	You can also visit the Palace Museum overseas.
10	Time convenience	Beyond the distance	I have always wanted to go to the Palace Museum, but I have no time. This time, I can watch the Palace Museum live on the Internet. It is really super happy.
		Time constraints	For the first time, I was able to enjoy the flowers directly in the Palace Museum without a ticket.
11	Economic cost	Ticket price	I was originally a train ticket's distance from the Palace Museum, now only a screen distance.
		Transport costs	Now the epidemic is still stuck, many people want to
12	Risk cost	The risk of COVID-19	

Table 3 (continued)

Number	Category	Concepts	Original representative statement in the online review text
13	Travel demand	Congestion risk	go out but do not dare to go out, it is better to use virtual travel.
		Omission of attractions	I don't have to feel the crowded travel, but I can still see such a beautiful spring scenery!
		Travel demand during the epidemic	Today's online tour of the Palace Museum let's us see the scenery we have not seen. Thanks for the experience of visiting the Palace Museum on the Internet on the days when we can't leave home. Finally, I can see the Palace Museum. It's a pity that I have never seen the Palace Museum.
14	Personal preference	Make up for the visit	I especially like to see everything about the Palace Museum, it feels very mysterious.
		Likeability	I really have a lot of feelings for the Palace Museum, since I can't go there in person yet, but this kind of online flower appreciation is also very good.
		Degree of nostalgia	Let's take a quick look at the Palace Museum, which we haven't seen for two months. What will be the change? The Palace Museum, which has been closed for so many days, will have its first online show again. It is really very exciting!
15	Knowledge acquisition	Looking for change	It can let us know more about the culture of the Palace Museum.
		Try new things	Although I haven't been to the Palace Museum, I still learn a lot from watching the live broadcast.
16	Architectural attraction	Cultural knowledge	The Palace Museum is really domineering, there is no building in the world that can compare.
		knowledge learning	It feels like the Palace Museum is really a great cultural place.
17	Cultural attraction	Cultural attraction	The Palace Museum is so beautiful this season.
18	Scenic attraction	Scenic attraction	

acquisition was an important source of and motivation for tourism attitudes. Unlike the on-site tourism experience, virtual travel presents distinct characteristics beyond time and space constraints (Jung & Dieck, 2017), providing the possibility for remote travel even during the COVID-19 pandemic. In a crisis situation, traveling to a destination is difficult to achieve and easily restricted by isolation policies. As a result, tourists' demand for managing risks and decreasing costs will increase. In this way, tourists' requirements for risk reduction, cost savings, time savings and convenience make virtual tourism an option of growing interest during the crisis.

- (2) The project design of virtual tourism and destination attractiveness constitute the pull factors of virtual tourist sentiments. Compared with on-site experience, the content setting, technology application and innovation level of virtual tourism projects have attracted much attention. Because virtual tourism lacks

Table 4
The main results of axial coding.

Fundamental category	Corresponding category	Connotation of category
Project Design	Content settings	The content design of tourism products provided by virtual tourism projects can influence public attitudes, such as background music and professional interpretation.
	Technology application	Technology application refers to the use of Internet live, VR, AR and other technologies to ensure the high-definition and picture effect.
	Form innovation	Virtual tourism uses online travel to change the traditional browsing mode and provide users with novel and creative experience services.
Experience quality	Flow experience	In the virtual travel experience, virtual tourists get a flow feeling.
	Authentic experience	Virtual tourists can get the experience of sensory contact.
	Unique experience	The participating virtual tourism project has a distinctive and differentiated experience.
	Enjoyable experience	The netizen obtains the pleasantness and comfort of mind and body through virtual tourism, which has the function of enjoyment.
Travel convenience	Interactive Experience	Virtual tourists seek an interaction with destinations and other tourists in the process of virtual tourism.
	Spatial convenience	Virtual tourists do not need to arrive at the destination, on the Internet can achieve zero distance and beyond the distance of travel.
	Time convenience	Virtual tourism time is only used in Internet viewing operation, which reduces the time requirements of tourists to travel in other places.
Travel cost	Economic cost	Virtual tourists can get an online-based travel experience without paying for transportation tickets.
	Risk cost	Virtual travel avoids person-to-person contact and reduces the risk of epidemic infection, crowding and accidents.
Travel motivation	Travel demand	Virtual travel can satisfy the travel needs of virtual tourists during the epidemic.
	Personal preference	Virtual tourists' nostalgia, exploration and change seeking of the Palace Museum are likely to form positive sentiments.
	Knowledge acquisition	Virtual tourist experience and learn about culture through a trip to the Palace Museum.
Destination attraction	Architectural attraction	The Palace Museum is currently the most complete and largest ancient palace complex in the world.
	Cultural attraction	The Palace Museum has the extraordinary character and the huge traditional history cultural value.
	Scenic attraction	The Palace Museum shows the landscape changing with the seasons and the growth of flowers and trees.

certain sensory sensations, virtual tourists have higher requirements for innovation and technology. In addition, destination attractiveness also affected the sentiment polarity of virtual tourists, reflecting high-level resource endowment and destination image as the basis of virtual tourists' decision making and experience level. Tourist requirements for virtual tourism projects that are well-designed and attractive in normal circumstances are also considered important in crisis situations.

- (3) Mediating factors. The high experience quality of virtual tourism has been considered a critical and unsolved issue in previous studies. The measurement of virtual tourism experience quality in crisis situations involved five measurement categories: immersive

experience, authentic experience, unique experience, enjoyable experience, and interactive experience. It is worth noting that authentic experience and interactive experience comprised a principal source of virtual tourists' complaints and negative sentiments. Because virtual tourism primarily connected virtual tourists with virtual scenic destinations through the Internet, the involvement of only a single sense made it difficult for virtual tourists to obtain real experiences (reflected in one original review, which asked "Can we only watch?"). In addition, as tourists could not stay in onsite scenic destinations, it was difficult for them to share behaviors during and after tourism (reflected in the original review asking "How can I take pictures and [share in WeChat Moments?](#)").

In general, the sentimental factors of virtual tourism in crisis situations are unique, and individual sentiments are affected by both external environmental factors and internal factors (Yao & Zhong, 2011). The COVID-19 pandemic constitutes an external environment with a sense of crisis. In this case, virtual tourism provides an environment that transcends the limitations of time and space and avoids economic costs and risks. Although tourists in noncrisis situations will consider economic costs, time, and distance when visiting the destination, these factors are not the critical factors affecting the sentiments of virtual tourism. Current research shows that due to the influence of COVID-19, socioeconomic and individual economies have suffered broadly (Qiu, Park, Li, & Song, 2020; Zhang, Song, Wen, & Liu, 2021), individual time pressure has increased (Cheng & Li, 2020), and spatial closeness now sharply increases the risk of exposure (Renaud, 2020; Seyitoğlu & Ivanov, 2021). Therefore, virtual tourists have stronger risk awareness in crisis situations such as the pandemic, and, consequently, they will focus on the travel risks and spatial distance costs of cross-geographical distance and social distance contact. Furthermore, because economic development is restricted by COVID-19, virtual tourists also currently pay extra attention to economic and time factors, and virtual tourism satisfies the need to avoid risks and time and spatial costs in crisis situations.

Second, although virtual tourism has existed for a decade, the general public is still relatively new to it. Therefore, virtual tourism project design and destination attractiveness will become key factors in virtual tourists' positive attitudes. Because virtual tourism projects are novel compared to the conventional tourism experience of onsite visits, factors such as the sense of science and technology, ingenious design and innovation of virtual tourism are different from those involved in onsite visits, such as scenery and interpersonal communication (Zhang et al., 2021). In addition, virtual tourists' experience level and motivation also constitute an important individual internal factor. Current research indicates that virtual tourism experience can effectively alleviate the stress and anxiety of tourists during COVID-19 (Cheng & Li, 2020). Our research results confirm that virtual tourists will not lower their standards for virtual tourism experiences simply because they cannot visit onsite (Sarkady, Neuburger, & Egger, 2021). On the contrary, due to the single sensory experience of the virtual world, virtual tourists will pay more attention to the experience level. When discussing onsite tourism motives, the previous literature has identified factors such as escape from life (Jiang, Ryan, & Zhang, 2018), self-improvement (Zhang & Xie, 2019), and seeking adventure (Kozak, 2002). However, there are obvious differences in tourism motives. The motivation of virtual tourists is more focused on alleviating tourism regrets, knowledge acquisition, etc., which is also the main reason for virtual tourists' positive sentiment towards virtual tourism impacted by COVID-19.

5. Discussion

5.1. Conclusions

First, under the influence of COVID-19, the overall public sentiment of virtual tourism shows a positive tendency. Before and during the

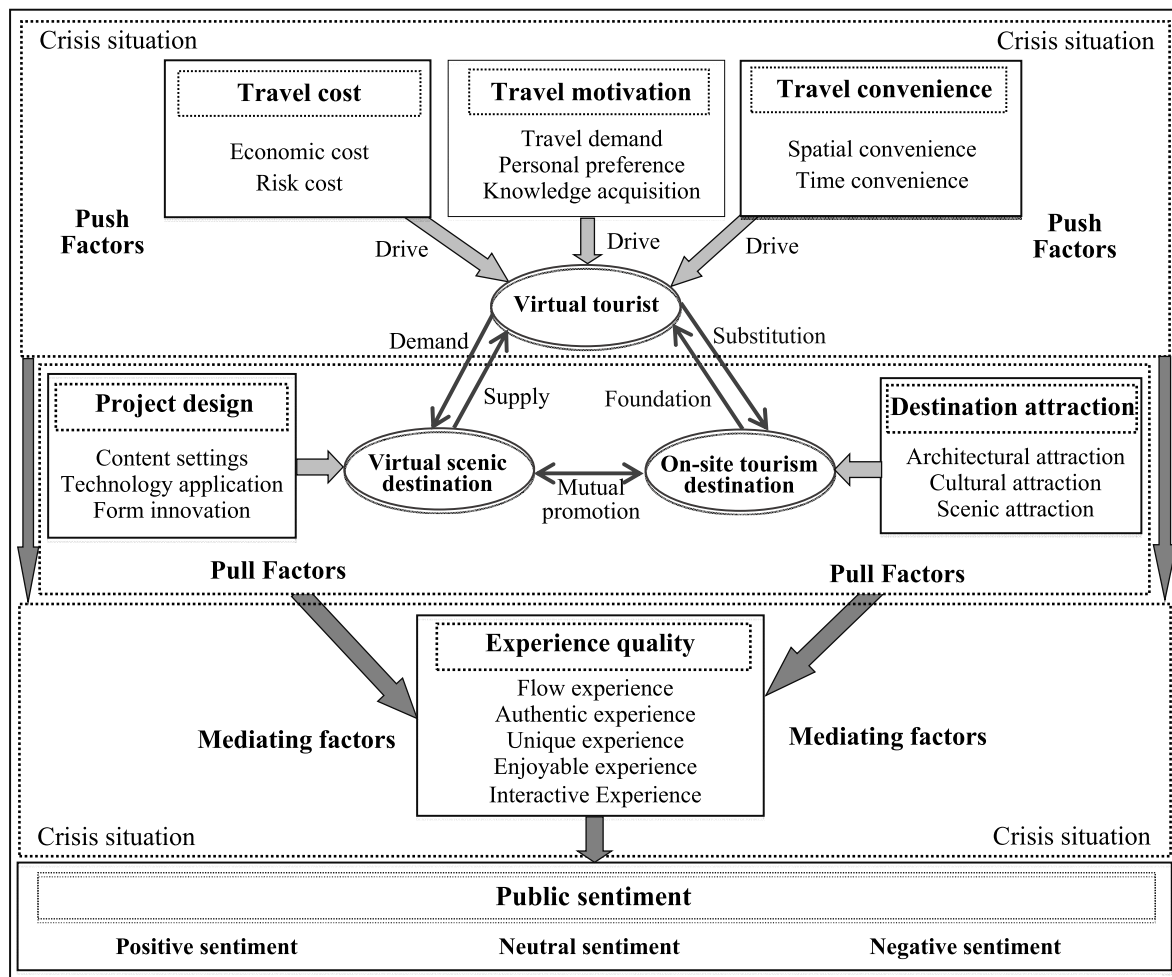


Fig. 3. Model diagram of influential factors of public sentiment in virtual tourism.

launch of the virtual project, it was characterized by obvious positive sentiments. However, with the opening of scenic destinations, although the positive sentiment polarities still dominated the discussion, the proportion of neutral and negative sentiments increased slightly. COVID-19 led to the closure of scenic spots to prevent crisis spread, greatly reducing travel experiences to remote locations. However, virtual tourism projects met the pent-up tourism demand with a new form of experience and won tourists' positive evaluation. During a crisis situation, to a certain extent, virtual tourism is able to replace on-site tourism, which seems to support the viewpoint of [Hobson and Williams \(1995\)](#) that virtual tourism creates an effective alternative when an on-site destination is not accessible. Previous studies have explored different attitudes about virtual tourism during the coexistence of the virtual tourism and on-site tourism models ([Guttentag, 2010](#); [Huang et al., 2013](#); [Kim et al., 2020](#)). These conclusions suggest that virtual tourism attitudes are more controversial, indicating that there are obvious differences in virtual tourism. In contrast, this study provides a new perspective on the predominance of positive sentiments about virtual tourism during crises. However, in a dynamic environment, it is worth noting that these sentiments are unstable and subject to change as the effect of the crisis diminishes. The reason for such instability is that virtual tourism is still not separate from tourists' usual environment and has a very limited ability to engage multiple senses in virtual experiences, which makes it difficult to maintain stable and lasting positive sentiment. Therefore, when virtual tourism and on-site tourism coexist, tourists' sentiments towards virtual tourism will decrease as the crisis gradually disappears, further highlighting the special role of crisis situations and responding to the findings about negative sentiments in the

existing literature ([Cheong, 1995](#); [Nolin et al., 2016](#)).

Second, one interesting finding is that there is an obvious time differentiation in the public sentiment heat of virtual tourism, which has gone through four stages of evolution: anticipation period—high heat period—repeated period—low heat period. Virtual tourism projects under the influence of COVID-19 can quickly meet the public's tourism needs and prompt an explosion of discussions. However, this sentiment heat has immediate signs of rapid accumulation and rapid decline. The sentiment heat is concentrated in the opening stage of the virtual tourism project, and the brief discussion boom formed by the "announcement information" is characterized by the expectation of potential tourists, that is, the anticipation period. The evolutionary characteristics of these two stages fully reflect the rising sentiment heat of virtual tourists. However, for a long period afterwards, the public sentiment heat shows a fluctuating development trend (repeated period). In addition, due to the lack of updates and easy accessibility of virtual tourism projects, it is difficult to maintain sufficient and sustained attention, and attractions quickly enter the "low heat period" of public sentiment. The evolution of the sentiment heat of virtual tourism fully demonstrates its "immediateness".

Third, the public sentiment of virtual tourism under the influence of COVID-19 is mainly affected by factors such as travel motivation, project design, destination attractiveness, travel convenience, travel cost and experience quality, and these 6 core factors and 18 subcategories constitute the causal mechanism of public sentiment. Concretely, travel motivation, travel convenience and travel costs are the push factors of the formation of virtual tourism sentiment. The COVID-19 crisis has obviously impacted the individual economic level and the time-space

cost of cross-regional travel. Compared with tourists' requirements for time and distance in noncrisis situations, virtual tourists are more concerned about how to avoid the risks of cross-spatial geographic distance, social distance (Renaud, 2020), and economic pressure. Furthermore, virtual tourism eliminates the shackles of time and spatial constraints and economics and effectively satisfies individual motivations such as regret over not being able to travel (Cheng & Li, 2020). In addition, virtual tourism project design and destination attractiveness are pull factors, and the quality of the experience is a key mediating factor. Virtual tourism has certain sensory constraints. Therefore, tourists' evaluation of virtual tourism is more inclined towards innovation, design, and technology, rather than escaping from real life (Jiang et al., 2018), self-improvement (Zhang & Xie, 2019), seeking adventure (Kozak, 2002), etc., which dominate onsite tourism. It is possible that certain factors (i.e., the quality of the experience, the design and destination attractiveness) have contributed to the positive evaluation of virtual tourism (Tavakoli & Mura, 2015). Moreover, travel motivation and travel convenience have a greater impact, indicating that the satisfaction of travel needs in crisis situations such as the COVID-19 pandemic and accessibility beyond time and space greatly enhance positive sentiments. However, an important point that needs further consideration is that some influencing factors remain important sources of tourists' sentiments towards virtual tourism in crisis situations but have different emphases. This conclusion provides more perspectives and possibilities for fully examining the causes of virtual tourism sentiments.

5.2. Theoretical contribution

The first contribution of our study is to re-examine the controversial theoretical boundaries of virtual tourism from the new perspective of crisis situations. This study provides specific empirical evidence of sentiment polarity, thereby contributing to the argument over virtual tourism attitudes in different situations and clarifying that the public's positive sentiments dominate in crisis situations. To date, there have been obvious arguments in the current opinions on virtual tourism evaluation (Cheong, 1995; Tavakoli & Mura, 2015). Previous studies have primarily conducted empirical studies on the psychology and experience of virtual tourism (Jung & Dieck, 2017; Sundar et al., 2015) or have theoretically engaged with the concepts and developmental perspectives of virtual tourism (Guttentag, 2010). Relevant research designs have primarily carried out qualitative and questionnaire analyses to determine whether tourists tend to support or oppose virtual tourism (Bogicevic et al., 2019). It should be noted that a common perspective in previous references refers to discussions conducted in a noncrisis context (Lin et al., 2020). Furthermore, these conclusions based on small samples cannot offer broad explanatory power. Importantly, the public's sentiments towards virtual tourism in crisis situations still lack a theoretical response and need to be addressed in the future. In response, this study attempts to measure the polarity of the sentiments of virtual tourists during a crisis situation. The results confirm that the public's positive sentiment towards virtual tourism dominates responses, thereby contributing to our understanding of observations in earlier studies that virtual tourism can replace on-site tourism to a certain extent. This research provides new insight that further clarifies the theoretical boundaries of related disputes. It contributes to a new perspective and theoretical direction for re-examining tourists' attitudes towards virtual tourism.

Second, this work contributes to revealing the time decay law and periodic characteristics of the sentiment heat of virtual tourism and expands the theoretical application of arousal theory in virtual tourism research. Previous studies have analyzed the attitudes towards virtual tourism from a single point in time, ignoring the variability of tourist attitudes (Lin et al., 2020). To address this unsolved issue, this study highlights the sentiment trends and laws of virtual tourism from a dynamic perspective rather than the assessment of a single time point. We

thus provide deeper insight into the evolution of the intensity of sentiment towards virtual tourism in four stages. The arousal theory emphasizes people's perception of novel stimuli, as individuals' perception of novelty and positive sentiments regarding a stimulus will gradually diminish with time and repetition (Reisenzein, 1994). The results highlight that public sentiment towards virtual tourism presents a distinct time decay trend. Virtual tourism, as a stimulus during the crisis, alleviates the individual's travel needs, and this positive sentiment presents a time decay property. This conclusion responds to Hadinejad et al.'s (2021) emphasis on the lack of theoretical discussion in explorations of tourist attitudes. Moreover, these findings will help us transition from the phenomenon of virtual tourist sentiment to an exploration of the rules, thereby dialectically gaining insight into the dynamics and periodicity of sentiments towards virtual tourism. Importantly, our study expands the application of arousal theory and supplements existing information on the boundaries of the arousal effect of virtual tourism on individual attitudes.

Third, our research is a comprehensive survey to determine the factors affecting public sentiment in virtual tourism. The logic behind virtual tourism sentiments in a crisis situation within the framework of push-pull theory is clarified (Hsu et al., 2010). Our research further expands the application of push-pull theory in the formation of virtual tourists' sentiments. Some studies have explored single factors of virtual tourists' satisfaction and attitudes, such as experience level, technical design and presence (Kim & Hall, 2019; Wei et al., 2019). However, there remain gaps in the systematic analysis of which factors affect virtual tourists' sentimental tendency. Moreover, these studies have primarily drawn conclusions from deductive paradigms (Kim & Hall, 2019; Loureiro, Guerreiro, & Ali, 2020), and it may be difficult to analyse the real causes of virtual tourist sentiments from a constructionist perspective. Importantly, this research used big data qualitative coding to determine the driving, pulling and bridging factors that constitute virtual tourist sentiments, thereby consolidating the multidimensional influencing factors, including internal motivation and external conditions. The six major influencing factors obtained from this study consolidate the extension of the push-pull theory framework in the study of virtual tourism sentiments and expand the theoretical scenario of the three-factor theory in the formation of individual sentiments (Lin et al., 2020).

Fourth, the research further highlights the differences in the factors affecting crisis/noncrisis and virtual/onsite tourism attitudes and perfects the framework for the formation of virtual tourist sentiments in crisis situations. Some scholars believe that after the COVID-19 pandemic ends, virtual tourism and face-to-face onsite visits will continue to coexist. It is recommended that tourism researchers consider their respective scenic spot strategy portfolio design under both normal market and crisis conditions (Hollebeek, Clark, Andreassen, Sigurdsson, & Smith, 2020; Itani & Hollebeek, 2021). However, there remains a significant gap in exploration of the factors affecting virtual tourism sentiments in crisis situations (Itani & Hollebeek, 2021). This research highlights the external environmental factors such as time-space limits, economic costs, and risk pressure formed by virtual tourism attitudes in crisis situations and clarifies personal factors such as travel regrets and knowledge acquisition as motivational needs, as well as internal factors such as experience. This conclusion responds to previous scholars' arguments on the design of virtual tourism projects in critical situations and systematically consolidates the explorable framework for virtual tourism development in crisis situations (Itani & Hollebeek, 2021). Furthermore, although onsite tourism also emphasizes the importance of experience and destination attractiveness (Kirilenko, Stepchenkova, & Hernandez, 2019; Richards, King, & Yeung, 2020; Zatori, Smith, & Puczko, 2018), this research proves that common influencing factors still affect tourists' sentiments in crisis situations, and virtual tourists will not lower their standards of virtual travel experience simply because of the crisis. These findings reflect the internal logic among the influencing factors of the formation of tourist sentiment in virtual

tourism and expand the theoretical system and depth of virtual tourism research.

5.3. Managerial implications

These conclusions can lead to two management strategies: a crisis response perspective and a non-crisis (post-pandemic era) development perspective. First, tourism is a sensitive industry and is extremely vulnerable to other factors (Jin, Qu, & Bao, 2019). Although the occurrence of crises (such as COVID-19) is accidental and unpredictable, crises have great negative impacts on the tourism industry (Gössling, Scott, & Hall, 2021; Ritchie & Jiang, 2019). Therefore, managers need to take crisis prevention and responses as key measures of the next unpredictable situation. Under crisis circumstances, managers can focus on providing virtual tourism to relieve destination pressure and satisfy tourist demands. A high-level virtual tourism experience that can promote tourists' positive sentiments still depends on an excellent project design. It is necessary to innovate new experience models, enhance technical accessibility, and strengthen the diversification and fun of project settings. Furthermore, a sufficiently clear and acceptable technical presentation needs to be provided. Especially for virtual tourists who have experienced on-site scenic destination experiences, managers should realize that creating a differentiated, personalized experience can satisfy curiosity and exploration psychology. For example, visual enhancement and brand cultural output can stimulate the enthusiasm of virtual tourists in the short term and be helpful in maintaining long-term relationships.

Second, managers need to understand that virtual tourism sensory enhancement is a critical factor. Since virtual tourists will not lower their evaluation standards of experiences, due to the single sensory experience predominant in virtual tourism, virtual design should further strengthen the multisensory engagement of auditory, visual and associative memory (Itani & Hollebeek, 2021). Therefore, when the sense of touch and smell cannot be accessed, it is necessary to make efforts to enhance the positive effects of vision and hearing. On the basis of on-site scenes, the experience can be enhanced through new, high-tech applications (Bogicevic et al., 2019). Virtual tourism can provide tourists with a unique soundtrack and simulated real-life sound effects. Besides, our results suggest that efforts should focus on enhancing auditory and associative spatial memory. A virtual reproduction project with historical allusions is a critical way to enhance tourists' learning experiences through the output of cultural knowledge. Moreover, it is difficult for virtual tourists to realize interaction and sharing behaviors in the experience process. Currently, virtual tourism is still in a relatively early stage of development, lacking more complex and interesting features to meet the changing needs of tourists. In the future, the virtual experience should include virtual robots and virtual avatars to interact with tourists in real time to attract tourists' attention (Wei et al., 2019). Thus, managers may use online sharing homepages or design appropriate interaction mechanisms to provide a social communication platform for virtual tourists to interact with each other while traveling, thus reducing the loneliness of the solo virtual traveller.

Last and most importantly, managers must clarify the development trends and roles of virtual tourism in the post-COVID-19 world (in non-crisis situations). These results highlight the time decay of tourists' sentiment intensity as the crisis wanes. It is highly necessary to consider how virtual tourism can assist the brand sustainability of tourist destinations after the availability of on-site tourism (Rác & Zilizi, 2019). Therefore, in non-crisis situations, managers should transform the content design of virtual tourism into a guiding and public approach. Virtual tourism can offer a significant way to combine the imagery of on-site tourism destinations and condense the value of brand symbols to create virtual brand benefits (Lin et al., 2020). Moreover, cultivating creative virtual tourism products may extend the meanings and value of their on-site products, which can be effectively transformed and applied in on-site tourism. Tourism managers should pay more attention to

enhancing the role of interpreting the historical development of tourist destinations and the management of positive impressions to enhance tourists' experiences. Consideration should be given to enhancing knowledge acquisition channels in limited experience activities and strengthening multiple types of groups, such as personal virtual tours, parent-child tours, and elderly tours. Managers need to pay attention to the harmony of virtual and onsite tourism post-COVID-19 so that these forms can complement each other and facilitate good management. Therefore, managers should think about the critical attributes of the virtual experience to attract potential tourists in virtual roles, connect internet users with the essence of a destination, and strengthen the sense of attachment and motivation of tourists through the virtual experience.

5.4. Limitations and future suggestions

Combining quantitative analysis of big data and qualitative methods, this study provides theoretical contributions and practical implications for revealing the characteristics and causes of virtual tourism public sentiment, but there are still the following limitations. First, this study uses grounded theory to conduct an exploratory analysis of the influencing factors of virtual tourism public sentiment. Although it strictly follows the qualitative analysis steps of programmed coding, it may be subjective due to theoretical accumulation and knowledge reserves. In the future, the theoretical framework constructed here could be supported by other quantitative research methods. Second, the samples used in this study are appropriate and representative, but it is possible that the sourcing of samples from multiple countries may help enhance the robustness of the results. However, due to differences in the stages of virtual tourism developed in different countries during the pandemic, it is impossible to accurately gain insight into the regularity of multiple samples from the perspective of time (Tavakoli & Mura, 2015). Therefore, future research can collect more than ten samples from various countries to compare groups of virtual tourism attitudes during the pandemic (Shapoval et al., 2021), and explore the formation mechanism under the influence of different cultural backgrounds, economics, technology, tourism development levels, etc. Nonetheless, based on our interview data and qualitative analysis methods (Vatan & Dogan, 2021), we have analyzed the sentiment polarity, time rules and influencing factors of virtual tourist attitudes to verify the robustness of the research conclusions. Finally, the pandemic provides a unique opportunity to re-examine the attitudes of tourists towards virtual tourism. Future research can collect longitudinal time samples and conduct a second natural experimental study after COVID-19 disappears (Deng, Hu, & Ma, 2019). By comparing the sentiment tendencies towards and causes of virtual tourism during and after the crisis, the influences of the crisis on tourists' attitudes can be identified (Jeon & Yang, 2021). This design will further determine the differences in the influence of crises on virtual tourists' sentiments in different periods.

Credit author statement

Shu-Ning Zhang contributed to original idea generation, statistical analysis, wrote a draft of the paper. **Yong-Quang Li** was responsible for paper modification. **Wen-qi Ruan** contributed to original idea generation, literature review, modified a draft of the paper. **Chih-Hsing Liu** was responsible for paper modification.

Impact statement

This research provides empirical evidence for investigating sentiment tendency, evolution law and causal mechanism of tourist attitudes about virtual tourism, and further clarifies the issue of virtual tourism attitudes from phenomenon to essence in crisis situations. Findings show that although tourists' positive sentiments towards virtual tourism are predominant, the sentiment cycle of virtual tourism indicates a distinct time decay law. More importantly, we create a comprehensive

framework of influencing factors, and managers can improve tourists' positive attitudes through critical factors, including project design, the quality of the experience, travel convenience, travel cost, travel motivation, and the attractiveness of the destination. These laws and mechanisms require managers to consider how destinations can effectively respond to crises through virtual tourism models. It helps us understand the positive role of virtual tourism in crisis situations and the auxiliary role in it plays in promoting on-site tourism beyond the COVID-19 pandemic.

Declaration of competing interest

None.

Acknowledgments

This research was supported by Social Science Planning Major Project of Fujian Province, China (Project No.: FJ 2020Z003), and Sichuan Tourism Development Research Center, Key Research Base of Sichuan Federation of Sciences Association (Project No.: LY21-01).

We are sincerely grateful to the editor and three anonymous reviewers for their valuable comments and significant suggestions.

References

- Alaei, A. R., Becken, S., & Stantic, B. (2019). Sentiment analysis in tourism: Capitalizing on big data. *Journal of Travel Research*, 58(2), 175–191.
- Alvesson, M. (2003). Beyond neopositivists, romantics, and localists: A reflexive approach to interviews in organizational research. *Academy of Management Review*, 28(1), 13–33.
- Araña, J. E., & León, C. J. (2008). The impact of terrorism on tourism demand. *Annals of Tourism Research*, 35(2), 299–315.
- Bec, A., Moyle, B., Schaffer, V., & Timms, K. (2021). Virtual reality and mixed reality for second chance tourism. *Tourism Management*, 83(2), 104256.
- 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(5), 55–64.
- Cardoso, C. (2020). The contribution of tourism towards a more sustainable and inclusive society: Key guiding principles in times of crisis. *Worldwide Hospitality and Tourism Themes*, 12(6), 679–689.
- Cheng, X., & Li, J. Y. (2020). The impact of virtual tourism experience on stress and emotion under the stay-at-home restrictions due to COVID-19 epidemic. *Tourism Tribune*, 7(35), 13–23, 2020.
- Cheong, R. (1995). The virtual threat to travel and tourism. *Tourism Management*, 16(6), 417–422.
- Deng, T., Hu, Y., & Ma, M. (2019). Regional policy and tourism: A quasi-natural experiment. *Annals of Tourism Research*, 74(1), 1–16.
- Dieck, T. D., Dieck, M. C. T., Jung, T., & Moorhouse, N. (2018). Tourists' virtual reality adoption: An exploratory study from lake district national park. *Leisure Studies*, 37(4), 371–383.
- Dodds, R., & Butler, R. (2019). The phenomena of overtourism: A review. *International Journal of Tourism Cities*, 5(4), 519–528.
- Dueholm, J., & Smed, K. M. (2014). Heritage authenticities – a case study of authenticity perceptions at a Danish heritage site. *Journal of Heritage Tourism*, 9(4), 285–298.
- El-Said, O., & Aziz, H. (2021). Virtual tours a means to an end: An analysis of virtual tours' role in tourism recovery Post COVID-19. *Journal of Travel Research*, Article 0047287521997567.
- Gössling, S., Hansson, C. B., Hörstmeier, O., Saggel, S., Institutionen, F. S. M. O., Department, O. S. M. A., et al. (2002). Ecological footprint analysis as a tool to assess tourism sustainability. *Ecological Economics*, 43(2), 199–211.
- Gössling, S., Scott, D., & Hall, C. M. (2021). Pandemics, tourism and global change: A rapid assessment of COVID-19. *Journal of Sustainable Tourism*, 29(1), 1–20.
- Guerreiro, J., & Rita, P. (2020). How to predict explicit recommendations in online reviews using text mining and sentiment analysis. *Journal of Hospitality and Tourism Management*, 43(2), 269–272.
- Guttentag, D. A. (2010). Virtual reality: Applications and implications for tourism. *Tourism Management*, 31(5), 637–651.
- Hadinejad, A., Noghian, N., Moyle, B. D., Scott, N., & Kralj, A. (2021). Future research on visitors' attitudes to tourism destinations. *Tourism Management*, 83(1), 104215.
- Han, H., Hwang, J., & Woods, D. P. (2014). Choosing virtual - rather than real - leisure activities: An examination of the decision-making process in screen-golf participants. *Asia Pacific Journal of Tourism Research*, 19(4), 428–450.
- Hobson, J. S. P., & Williams, A. P. (1995). Virtual reality: A new horizon for the tourism industry. *Journal of Vacation Marketing*, 1(12), 124–135.
- Hollebeek, L., Clark, M., Andreassen, T., Sigurdsson, V., & Smith, D. (2020). Virtual reality through the customer journey: Framework and propositions. *Journal of Retailing and Consumer Services*, 55(4), 102056.
- Hsu, C. H. C., Cai, L. A., & Li, M. (2010). Expectation, motivation, and attitude: A tourist behavioral model. *Journal of Travel Research*, 49(3), 282–296.
- Huang, Y. C., Backman, S. J., Backman, K. F., & Moore, D. (2013). Exploring user acceptance of 3D virtual worlds in travel and tourism marketing. *Tourism Management*, 36(3), 490–501.
- Huang, X., Wei, Z., & Leung, X. Y. (2020). What you feel may not be what you experience: A psychophysiological study on flow in VR travel experiences. *Asia Pacific Journal of Tourism Research*, 25(7), 1–12.
- Hume, M., & Mills, M. K. (2011). Building the sustainable iMuseum: Is the virtual museum leaving our museums virtually empty? *International Journal of Nonprofit and Voluntary Sector Marketing*, 16(3), 275–289.
- Hyun, M. Y., & O'Keefe, R. M. (2012). Virtual destination image: Testing a telepresence model. *Journal of Business Research*, 65(1), 29–35.
- Ioannides, D., & Gyimóthy, S. (2020). The COVID-19 crisis as an opportunity for escaping the unsustainable global tourism path. *Tourism Geographies*, 22(3), 624–632.
- Itani, O. S., & Hollebeek, L. D. (2021). Light at the end of the tunnel: Visitors' virtual reality (versus in-person) attraction site tour-related behavioral intentions during and post-COVID-19. *Tourism Management*, 84(3), 104290.
- Jeon, C.-Y., & Yang, H.-W. (2021). The structural changes of a local tourism network: Comparison of before and after COVID-19. *Current Issues in Tourism*, 1–15.
- Jiang, T., Ryan, C., & Zhang, C. (2018). The spiritual or secular tourist? The experience of zen meditation in Chinese temples. *Tourism Management*, 65(2), 187–199.
- Jin, X. C., Qu, M., & Bao, J. (2019). Impact of crisis events on Chinese outbound tourism flow: A framework for post-events growth. *Tourism Management*, 74(5), 334–344.
- Jung, T. H., & Dieck, M. C. T. (2017). Augmented reality, virtual reality and 3D printing for the co-creation of value for the visitor experience at cultural heritage places. *Journal of Place Management and Development*, 10(2), 140–151.
- Jung, T., Dieck, M. C. T., Lee, H., & Chung, N. (2016). Effects of virtual reality and augmented reality on visitor experiences in museum. *ENT*, 621–635.
- Jung, T., Dieck, M. C. T., Moorhouse, N., & Dieck, D. T. (2017). *Tourists' experience of virtual reality applications, 2017 IEEE international conference on consumer electronics (ICCE)* (pp. 208–210).
- Kim, M. J., & Hall, C. M. (2019). A hedonic motivation model in virtual reality tourism: Comparing visitors and non-visitors. *International Journal of Information Management*, 46(3), 236–249.
- Kim, M. J., Lee, C., & 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.
- Kirilenko, A. P., Stepchenkova, S. O., & Hernandez, J. M. (2019). Comparative clustering of destination attractions for different origin markets with network and spatial analyses of online reviews. *Tourism Management*, 72(3), 400–410.
- Kozak, M. (2002). Comparative analysis of tourist motivations by nationality and destinations. *Tourism Management*, 23(3), 221–232.
- Kwok, A. O., & Koh, S. G. (2020). COVID-19 and extended reality (XR). *Current Issues in Tourism*, 1–6.
- Lee, O., & Oh, J. E. (2007). The impact of virtual reality functions of a hotel website on travel anxiety. *CyberPsychology and Behavior*, 10(4), 584–586.
- Lin, L.-P., Lynn, Huang, S.-C., Lucy, & Ho, Y.-C. (2020). Could virtual reality effectively market slow travel in a heritage destination. *Tourism Management*, 78(3), 104027.
- Liu, Y., Huang, K., Bao, J., & Chen, K. (2019). Listen to the voices from home: An analysis of Chinese tourists' sentiments regarding Australian destinations. *Tourism Management*, 71(2), 337–347.
- 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(2), 104028.
- Martins, J., Gonçalves, R., Branco, F., Barbosa, L., Melo, M., & Bessa, M. (2017). A multisensory virtual experience model for thematic tourism: A port wine tourism application proposal. *Journal of Destination Marketing & Management*, 6(2), 103–109.
- Neuburger, L., & Egger, R. (2021). Travel risk perception and travel behaviour during the COVID-19 pandemic 2020: A case study of the DACH region. *Current Issues in Tourism*, 24(7), 1003–1016.
- Nolin, P., Stipanovic, A., Henry, M., Lachapelle, Y., Lussier-Desrochers, D., Rizzo, A. S., et al. (2016). ClinicaVR: Classroom-CPT: A virtual reality tool for assessing attention and inhibition in children and adolescents. *Computers in Human Behavior*, 59(6), 327–333.
- Papathanassis, A., & Knolle, F. (2011). Exploring the adoption and processing of online holiday reviews: A grounded theory approach. *Tourism Management*, 32, 215–224.
- Pedrana, M. (2014). Location-based services and tourism: Possible implications for destination. *Current Issues in Tourism*, 17(9), 753–762.
- Qiu, R. T., Park, J., Li, S., & Song, H. (2020). Social costs of tourism during the COVID-19 pandemic. *Annals of Tourism Research*, 84(5), 102994.
- Rácz, A., & Ziliz, G. (2019, May). Virtual reality aided tourism. In *2019 smart city symposium prague (SCSP)* (pp. 1–5). IEEE.
- Reisenzein, R. (1994). Pleasure-arousal theory and the intensity of emotions. *Journal of Personality and Social Psychology*, 67(3), 525–539.
- Renaud, L. (2020). Reconsidering global mobility—distancing from mass cruise tourism in the aftermath of COVID-19. *Tourism Geographies*, 22(3), 679–689.
- Ren, Z. J., Zhang, P., Li, S. C., Lan, Y. X., Xia, X., & Cui, Y. C. (2019). Analysis of emotion evolution of emergencies based on weibo data mining: Taking “8·12 accident in tianjin” as an example. *Journal of Intelligence*, 38(2), 140–148.
- Richards, G., King, B., & Yeung, E. (2020). Experiencing culture in attractions, events and tour settings. *Tourism Management*, 79(4), 104104.
- Ritchie, B. W., & Jiang, Y. (2019). A review of research on tourism risk, crisis and disaster management: Launching the annals of tourism research curated collection on tourism risk, crisis and disaster management. *Annals of Tourism Research*, 79(6), 102812.

- Sarkady, D., Neuburger, L., & Egger, R. (2021). Virtual reality as a travel substitution tool during COVID-19. In *Information and communication technologies in tourism 2021* (pp. 452–463). Cham: Springer.
- Seyitoğlu, F., & Ivanov, S. (2021). Service robots as a tool for physical distancing in tourism. *Current Issues in Tourism*, 24(12), 1631–1634.
- Shapoval, V., Hägglund, P., Pizam, A., Abraham, V., Carlbäck, M., Nygren, T., et al. (2021). The COVID-19 pandemic effects on the hospitality industry using social systems theory: A multi-country comparison. *International Journal of Hospitality Management*, 94(3), 102813.
- Sigala, M. (2020). Tourism and COVID-19: Impacts and implications for advancing and resetting industry and research. *Journal of Business Research*, 117(117), 312–321.
- Strass, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Newbury Park: SAGE Publications.
- Sundar, S. S., Go, E., Kim, H., & Zhang, B. (2015). Communicating art, virtually! psychological effects of technological affordances in a virtual museum. *International Journal of Human-Computer Interaction*, 31(6), 385–401.
- Sylaiou, S., Mania, K., Karoulis, A., & White, M. (2010). Exploring the relationship between presence and enjoyment in a virtual museum. *International Journal of Human-Computer Studies*, 68(5), 243–253.
- Tavakoli, R., & Mura, P. (2015). Journeys in Second Life'—Iranian Muslim women's behaviour in virtual tourist destinations. *Tourism Management*, 46(1), 398–407.
- Tussyadiah, I. P., Wang, D., Jia, C., & Helen, J. (2017). Virtual reality and attitudes toward tourism destinations. *ENTER* (pp. 229–239).
- Tussyadiah, I. P., Wang, D., Jung, T. H., & Dieck, M. C. T. (2018). Virtual reality, presence, and attitude change: Empirical evidence from tourism. *Tourism Management*, 66(3), 140–154.
- Urry, J. (2000). Sociology beyond societies: Mobilities for the twenty-first century. *Teaching Sociology*, 28(4), 392.
- Vatan, A., & Dogan, S. (2021). What do hotel employees think about service robots? A qualitative study in Turkey. *Tourism Management Perspectives*, 37(1), 100775.
- Wagler, A., & Hanus, M. D. (2018). Comparing virtual reality tourism to real-life experience: Effects of presence and engagement on attitude and enjoyment. *Communication Research Reports*, 35(5), 456–464.
- Walters, G., Wallin, A., & Hartley, N. (2019). The threat of terrorism and tourist choice behavior. *Journal of Travel Research*, 58(3), 370–382.
- Wang, J. M., & He, A. Z. (2011). Psychological attribution and policy paths of consumer's low carbon consumption behavior: An exploratory research based on grounded theory. *Nankai Business Review*, 14(4), 80–89, 2011.
- Wei, W., Qi, R., & Zhang, L. (2019). Effects of virtual reality on theme park visitors' experience and behaviors: A presence perspective. *Tourism Management*, 71(2), 282–293.
- Wen, H., & Leung, X. Y. (2021). Virtual wine tours and wine tasting: The influence of offline and online embodiment integration on wine purchase decisions. *Tourism Management*, 83(2), 104250.
- Wen, J., Kozak, M., Yang, S., & Liu, F. (2020). COVID-19: Potential effects on Chinese citizens' lifestyle and travel. *Tourism Review*, 76(1), 74–87.
- Yang, T.-T., Ruan, W.-Q., Zhang, S.-N., & Li, Y.-Q. (2021). The influence of the COVID-19 pandemic on tourism demand for destinations: An analysis of spatial heterogeneity from a multi-scale perspective. *Asia Pacific Journal of Tourism Research*, 26(7), 793–810.
- Yao, H., & Zhong, C. (2011). The analysis of influencing factors and promotion strategy for the use of mobile banking. *Canadian Social Science*, 7(2), 60–63.
- Yung, R., & Khoo-Lattimore, C. (2017). New realities: A systematic literature review on virtual reality and augmented reality in tourism research. *Current Issues in Tourism*, 22(17), 2056–2081.
- Zapata, G., Murga, J., Raymundo, C., Dominguez, F., Moguerza, J. M., Alvarez, J., & M. (2019). Business information architecture for successful project implementation based on sentiment analysis in the tourist sector. *Journal of Intelligent Information Systems*, 53(3), 563–585.
- Zatori, A., Smith, M. K., & Puczko, L. (2018). Experience-involvement, memorability and authenticity: The service provider's effect on tourist experience. *Tourism Management*, 67(4), 111–126.
- Zhang, H., Song, H., Wen, L., & Liu, C. (2021). Forecasting tourism recovery amid COVID-19. *Annals of Tourism Research*, 87(2), 103149.
- Zhang, S. T., Wang, F. F., Duo, F., & Zhang, J. L. (2018). Research on the majority decision algorithm based on WeChat sentiment classification. *Journal of Intelligent and Fuzzy Systems*, 3(35), 2975–2984.
- Zhang, Y., & Xie, P. F. (2019). Motivational determinates of creative tourism: A case study of albergue art space in Macau. *Current Issues in Tourism*, 22(20), 2538–2549.

- Zhou, Y., Mei, Q., & Hou, B. (2020). Influencing factors of tourism volunteer service behavior based on grounded theory. *Tourism Tribune*, 35(9), 74–89, 2020.



Shu-Ning Zhang is a Ph.D student in College of Tourism, Huaqiao University, China. Her research interests include in tourism culture and innovation, tourism marketing, etc. E-mail:



Yong-Quan Li is a professor of tourism research at Huaqiao University. He also serves as Director of Research Center of Tourism and Service Management, Associate Dean of Tourism Security Research Institute, Deputy Chairman of Youth Federation of Huaqiao University, etc. His research interest focuses on tourism innovation management, the integration of culture and tourism, etc. E-mail:



Wen-Qi Ruan is Ph.D of management, an associate professor of College of Tourism, Huaqiao University, China. His academic research areas cover tourism information, tourism destination management, tourism safety, etc. E-mail:



Chih-Hsing Liu is an associate professor of Department of Tourism Management, National Kaohsiung University of Science and Technology. His current research interests are in the area of tourism management, creativity, knowledge management and social network. Email: