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Evaluating Influencing Factors of Tourists' Experiences with Smart Tour Guide System: A Mixed Method Research

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Abstract: The issue that this study explores is evaluation of tourists' experiences with smart tour guide system (STGS). To address this issue, the purpose of this study is to explore what factors influence tourists' experiences with STGS in four Chinese smart tourism destinations (STDs). An exploratory sequential mixed method was used to collect the data. Tourists who had used STGS in four Chinese STDs participated in the research. In the first and second phase, Semi-structured interviews with 12 interviewees were conducted, and these interviewees put forward six factors affecting tourists' experiences with STGS: approachability, visual, operability, function, offline service, and interactivity. The third phase involved an analysis of a survey of 248 participants who had used STGS in the Chinese four STDs to verify the influencing factors. By using the method of linear regression analysis, we found that approachability, visual, operability, function and offline service have a significant impact on tourists' experiences with STGS while interactivity contributes little impact to tourists' experiences with STGS. The findings will be useful for STDs to explore and promote STGS services, as well as enhancing tourists' smart experiences with STTs.

Keywords: smart tourism; smart tour guide system; tourists' experiences; influencing factors

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1. Introduction

Smart tourism destinations (STDs) are constructed on cutting-edge technology infrastructure, providing technological solutions to boost tourism competitiveness through processes that improve the tourism experience [1]. The smart tour guide system (STGS), one of the up-to-date smart tourism technologies (STTs), is more and more widely used in STDs. STGS delivers intelligent self-service to tourists via a network control system comprised of physical equipment and a central database in the background, with the major display techniques being voice, video, photos, text, and so on [2–4]. Whilst tourists' experiences, as well as tourist satisfaction have altered with the advent of new STTs. For example, tourists have historically relied on human resources, maps, brochures, or tour operators to learn about their location; however, STGS allows tourists to self-guide using smart devices [5]. Jeong and Shin underscored STTs had created memorable tourism experiences and tourist happiness [6,7], while Yoo pointed out different tourists will have different experiences and familiarity with STTs; such differences may lead to tourists' dissatisfaction with STTs [8]. However, what concrete factors affect tourists' experiences and satisfaction with STGS have not been totally explored so far. This study focuses on evaluating what factors influence tourists' experiences with STGS.

Tourists' experiences and satisfaction are always mingling with smart technologies and smart destinations, which have aroused great interest for researchers. STTs have the greatest impact on the customer journey during the prospective and active stages, and the integration of smart technology produces unique degrees of tourism experiences, such as a data-driven approach, which can improve tourists' experiences [9–11]. STT and STD value, that include tourists' perceived experiences, are critical in increasing tourist

satisfaction and destination loyalty [7,12]. Several contributors which influence tourists' experiences have been discussed by previous scholars. Accessibility and interactivity, as well as informativeness, interactivity, and personalization affect tourists' experience, satisfaction, and revisit intentions [13–15]. With regards to smart tourist attractions (STA), smart information system, intelligent tourism management, smart sightseeing, e-commerce system, smart safety, intelligent traffic, smart forecasting and virtual tourist attractions are major assessment aspects for tourists [16,17]. Some studies further demonstrated STTs' attributes, such as the availability of internet of things (IoT) and artificial intelligence (AI), have a favorable influence on smart tourism satisfaction in some cities [11,18].

Despite the prevalence of research on investigating the influencing factors of tourists' experiences in STDs, there is limited research focusing on evaluating tourists' experiences by using concrete smart technologies. Most research came to a halt on an abstract level, pointing out how STTs such as information and communication technologies (ICTs), cloud computing, and the internet of things have influenced tourists' experiences [19,20]. These hi-techs form crucial foundations for smart technologies, but they are intangible, and tourists cannot have a palpable feeling on these hi-techs. Nonetheless, there are few studies investigating the factors which impact tourists' experiences with specific smart technologies. Secondly, there are also limited studies demonstrating the influencing factors of tourists' experiences from the tourists' perspective. Tourists' experiences are essential component of tourism products, and they have a significant influence on tourists' satisfaction as well as the development of STDs [21]. What tourists think and feel have a direct impact on tourists' experiences, which may be favorable or detrimental for STDs. Additionally, there are few studies focusing on tourists' overall travel experiences and future revisit intentions with STGS. Tourists' overall travel experiences and revisit intentions can also be influenced by using STGS. A well-designed STGS can provide rich and efficient services for tourists, as well as high quality travel experiences. With positive travel experiences and satisfaction, tourists are willing to revisit the STDs in the future. Thereby, by focusing on STGS, a representative of concrete smart technology, this study proposes to investigate the influencing factors of tourists' experiences with STGS from the tourists' perspective.

This study aims to evaluate tourists' experiences with STGS in four Chinese STDs. The purpose of this exploratory sequential design will first qualitatively explore influencing factors of tourists' experiences with STGS, and then test these factors out with a large sample by using quantitative methods. The first phase of the study will be a qualitative exploration of influencing factors of tourists' experiences with STGS in which Semi-structured interview data will be collected from 12 people who have experienced STGS in four Chinese STDs. Then based on the first phase's interviews, we will develop a measure instrument in the second phase. In the third planned quantitative phase, evaluation data about tourists' experiences with STGS will be collected from 248 tourists who have experienced STGS in four Chinese STDs.

STGS, one of the most frequently adopted STTs in STDs, is getting more and more popular with tourists and even becomes the first choice for some tourists when they plan their trips in some situations, such as a lack of high-quality tour guide service or for the sake of saving expenses. To widely apply STGS in STDs, it is essential that tourists are willing to accept and use these systems. By evaluating tourists' experiences with STGS, STDs can find out the defects or existing problems in STGS and further improve the tour guide service and provide better experiences for tourists. Furthermore, STGS can reduce face-to-face communication between people and it can also ensure personal health security as much as possible while people visit tourist attractions in the context of COVID 19. Tourists can benefit from a well-designed tour guide system with more satisfaction and convenience. Finally, this study which uses a mixed research method to explore the relevant influencing factors of tourists' experiences with STGS contributes to the current theoretical research on tourists' experiences with STTs from tourists' perspective.

The remainder of the paper is structured as follows. Section 2 reviews the literature related to STDs, STTs and tourists' experiences. And at the end of this section, we put

forward two research questions. Section 3 explains the research method and presents the results of this study. Section 4 discusses the results of analysis of data and the theoretical and practical implications of the findings. Limitations are outlined, and advice for future research is also suggested.

2. Literature Review

2.1. Smart Tourism Destination and Tourists' Experiences

The smart tourism destination based on sensors and advanced information and communication technology (ICT) is the combination of ICT-based tools (machine learning, wireless communication, cloud computing and autonomous systems). These tools are integrated into the physical infrastructure of the destination through technological infrastructure, user service platforms, and big data analytics [21–23]. STDs implement a smart tourism system that leverages technology to create manage and provide smart tourism experiences and services [24,25]. Lopes de Avila [26] defined a STD as "an innovative tourist destination, built on an infrastructure of state-of-the-art technology guaranteeing the sustainable development of tourist areas, accessible to everyone, which facilitates the visitor's interaction with and integration into his or her surroundings, increases the quality of the experience at the destination, and improves residents' quality of life". A successful destination is one that consistently draws the intended tourists by providing quality and unique experiences [27]. According to Zhu, a STD should be equipped with a smart tourism system that centrally regulates all tourist information in a city, resulting in benefits for visitors, tourists, and inhabitants [28]. J.A. Coca-Stefaniak also emphasized that the use of technology for STDs should be more people-centered [29]. Similarly, Lamsfus noted that STDs are not defined just by their use of technology, but rather by their capacity to translate data into deep understandings of human mobility and tourism experiences [30]. Gretzel concluded that most STDs use STTs to deliver technology-enhanced travel experiences to compete and maintain themselves [31].

2.2. Tourists' Experiences with Smart Tourism Technology

Shen highlighted the STT was not the advance of a single technology, but the interconnection and collaborative progress of various advanced technologies simultaneously, and the author further generalized twelve different types of computer and information technologies that have previously been used in STTs, such as internet of things, artificial intelligence, mobile devices and applications, intelligent chat robot and so forth [32]. Chuang used mobile devices in practical guide services to create a model of online purchasing behavior for users of travel apps [33]. Similarly, Ernesto Tarantino demonstrated a prototype of an interactive electronic guide app capable of recommending unique multi-day travel plans to mobile web users [34]. Kang devised the location-based audio tour guide system, which makes use of speech synthesis provided by a server-based text to speech (TTS) engine [35]. STT has also been playing a crucial role in affecting tourists' experiences in STDs as the continuous development of various kinds of smart technology. Gretzel highlighted how AI can assist designers develop products and experiences based on large data analysis [36]. Tussyadiah conducted a study that presented three empirical data to prove the efficacy of VR in altering tourists' experiences in STDs, particularly allowing tourists to participate with interactive computer-supported surroundings [37]. Jeong categorized the most commonly used STTs and analyzed tourists' overall experience and satisfaction with STTs as well as their desire to return based on an online survey with tourists visit the top five US smart cities [6]. In the context of smart tourism destinations, Liberato indicated that tourists' behaviors and experiences are significantly influenced by the availability of ICT by concentrating on the impact of ICT accessibility on tourists' choice of destination, their experiences, and their satisfaction [38]. Moreover, Stefaniak highlighted data-driven tourists' experiences, implying that the most appropriate function for STTs in destinations is in tourism optimization, rather than pushing the incursion of technology into tourists' experiences [39].

Despite the fact that these superb researchers performed a variety of studies on STTs and tourists' experiences, the influencing factors of tourists' experiences with STGS remain unexplored. According to current research, several factors appear to have influenced tourists' experiences with STTs, but particular aspects are not precisely identified. In this study, we first developed a list of influencing factors impacting tourists' experiences with STGS. Then we developed an instrument to test out these influencing factors of tourists' experiences with STGS. We addressed following research questions:

RQ1: What are the influencing factors of tourists' experiences with STGS?

RQ2: To what extent, does each influencing factor affect tourists' experiences with STGS?

3. Methods and Results

This study used an exploratory sequential mixed research method, in which we first explored influencing factors using qualitative data and analysis, then developed a questionnaire based on the influencing factors, and finally evaluated influencing factors in a large sample (Figure 1). Phase one's goal was to address the research issue by defining the influencing factors with STGS. Phase two concerned developing a measurement instrument based on the survey data collected in phase one. The third phase involved conducting a massive survey and validating the questionnaire. We used the method of linear regression analysis to test these six influencing factors on tourists' experiences with STGS in this phase.

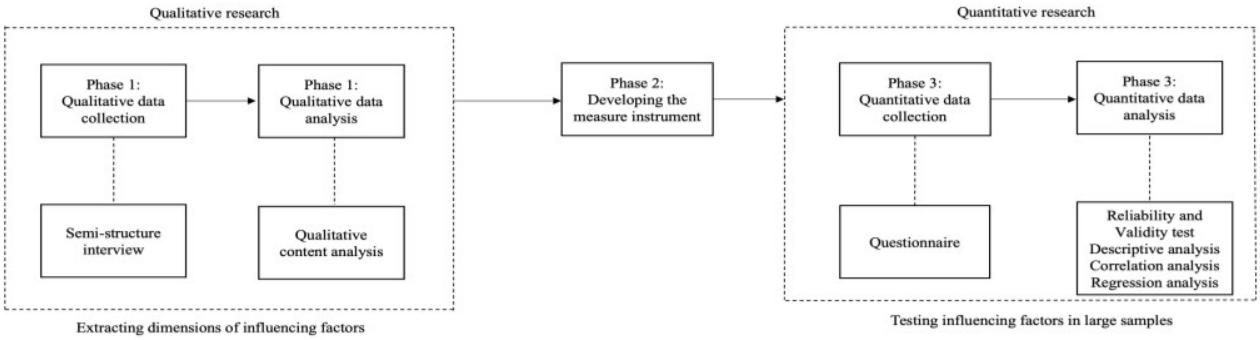

Figure 1. The process of the research.

Mixed methods research is an approach involves gathering both quantitative and qualitative data, integrating the two types of data, and employing unique designs that may include philosophical presumptions and theoretical frameworks. The exploratory sequential approach starts with a qualitative research phase when the researcher examines the perspectives of participants. The information from the data analysis is then utilized to develop the quantitative phase. A mixed research method is used because it has the advantage of combining qualitative and quantitative research while reducing their respective weaknesses. It can help us comprehend study difficulties and topics more thoroughly. By initially gathering and evaluating qualitative data before administering the instruments to a sample, a mixed research method can create better contextualized measuring instruments [40].

3.1. The First Research Phase

3.1.1. Samples

In this phase, we recruited 12 participants (Table 1) who had used the STGS in four Chinese STDs (Table 2) in 2021. The Ministry of Culture and Tourism of China identified these four STDs as typical cases of smart tourism in 2021. They are all equipped with a STGS, however there is no standard version of the STGS in these smart tourist places since these STDs have explored the STGSs themselves. We thoroughly examined each of the four STDs and discovered that, while there are some distinctions between them, they focus on the same content and provide similar services (Figure 2). As a result, we chose samples from people who used STGSs at least once in these four STDs in 2021.

Table 1. The demographic information of research samples in phase one.

No.	Gender	Age	Vocation	Four STDs Visited Times in 2021	STGS Usage Times in 2021
Sample 1	Male	26	worker	1	1
Sample 2	Female	38	teacher	3	2
Sample 3	Female	23	student	3	3
Sample 4	Male	49	manager	3	2
Sample 5	Female	57	retired people	3	1
Sample 6	Male	35	teacher	2	2
Sample 7	Female	40	saleswoman	2	2
Sample 8	Male	32	engineer	2	2
Sample 9	Male	26	unemployed	2	2
Sample 10	Female	35	executive	2	1
Sample 11	Male	29	teacher	3	2
Sample 12	Female	42	self-employment	2	1

Participants were aged between 23 and 57 (M = 36, SD = 10). The number of four Chinese STDs that participants visited varied from 1 to 3 in 2021 (M = 2.33, SD = 0.65), and the number of times participants used STGSs in these four STTs ranged from 1 to 3 in 2021 (M = 1.75, SD = 0.62).

Table 2. Four Chinese smart tourism destinations.

No.	Name of STDs	City	Area
1	Palace Museum	Beijing	North China
2	Niushou Mountain Cultural Tourism Area	Nanjing	Southeast China
3	Huangguoshu Scenic Spot	Anshun	Southwest China
4	Mount Hua Scenic Area	Xi'an	Northwest China

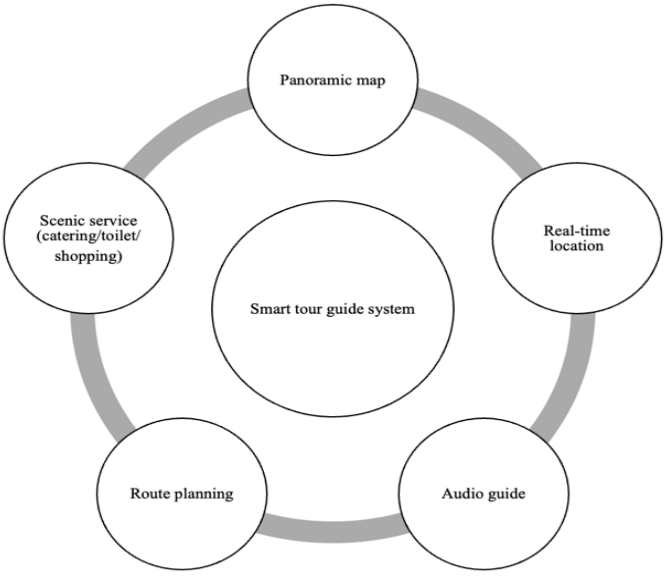

Figure 2. Common services in STGSs of four Chinese STDs.

3.1.2. Data Collection

Interview outline. We designed several questions to assist participants recall how they used the STGS and how they evaluated the STGSs in four STDs they had visited (See Appendix A for the interview outline). The first two questions were aimed to assist participants recollect the most recent occasion in which they used STGS. Then, in Question 3, respondents were asked to describe the entire process of utilizing STGS at one STD, so that interviewers could have a thorough understanding of how interviewees utilized STGS. The following question required interviewers to explain why they opted to use STGS. The respondents were then asked to consider the benefits and drawbacks of STGS (Questions 5, 6). Questions 7 and 8 involved a more in-depth understanding and evaluation of STGS. These questions help to identifying particular influencing factors that had impacted the participants' STGS experiences, as well as the degree of effect.

Interview process. 9 participants were interviewed individually face to face while other 3 participants were interviewed individually over the internet. All the participants were informed before the interview that the purpose of the study was to investigate the influencing factors with STGS and that they could end the interview at any moment if they did not feel comfortable. Furthermore, we made it clear that the interview findings would not be shared with anyone and that, if they were cited in the study results, pseudonyms would be used in place of their real identities. We meticulously recorded each interview. We also utilized cellphones to record the interviews with the consent of all participants. Additional questions were frequently asked to elicit more thorough responses. Interviews were conducted until theoretical saturation [41] was reached. Interviews ranged in length from 10 to 30 min, and each interview was transcribed for the analysis of participant responses.

3.1.3. Data Analysis

After collecting the data, we used qualitative content analysis method to analyze the data (Figure 3). The qualitative content analysis method aims to systematically transform a large amount of text into a highly organized and condensed summary of key findings, as well as analysis of raw data from verbatim transcribed interviews to form abstract categories or themes, with the goal of exploring the latent meanings from the manifest and literal content [42–44].

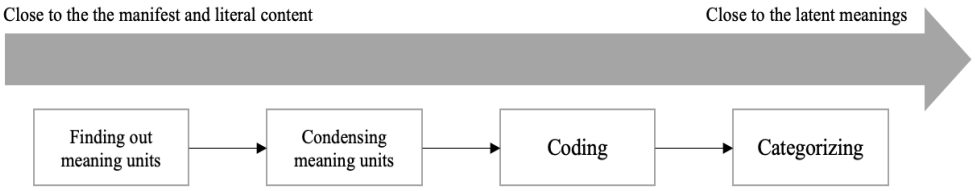

Figure 3. The process of qualitative content analysis in the research.

In order to have an overall impression of what participants had talked about, we firstly read the transcript of the interviews repeatedly. Then we divided up the text into meaning units and condensed meaning units, next we developed codes that were descriptive labels for the condensed meaning units. Finally, we generalized the codes and created several types of categories. The process of analysis was not a one-time event, but a continuous procedure of coding and categorizing then re-turning to the raw data to reflect on our initial analysis.

3.1.4. Results

We extracted six influencing factors through qualitative content analysis: approachability, visual, operability, function, offline service, and interactivity. We chose some samples from a significant quantity of original interview data to showcase our qualitative content analysis process. Table 3 displays some results of the qualitative content analysis.

Table 3. Demonstration of some results of the qualitative content analysis.

	Meaning Units	Condensed Meaning Units	Codes	Categories
–	I used Alipay to search the smart tour guide system APP to enter the smart tour guide system	I used Alipay to enter the smart tour guide system APP	Using Alipay	Approachability
–	I entered WeChat, and then searched the smart tour guide system APP of the scenic spot	I entered WeChat and searched the smart tour guide system APP	Using WeChat	Approachability

Table 3. *Cont.*

	Meaning Units	Condensed Meaning Units	Codes	Categories
–	There were many QR codes of the smart tour guide system APP posted at the entrance of the scenic spot	Many QR codes of the smart tour guide system APP were posted at the entrance of the scenic spot	Using the QR code at the entrance of the scenic spot	Approachability
–	When I entered the scenic spot, I found that there were two large roll-ups at the entrance of the scenic spot to introduce the smart tour guide system APP of the scenic spot, with the QR code of the APP and the introduction of the use.	There were QR codes of the smart tour guide system APP on the roll-ups at the entrance of the scenic spot	Using the QR code at the entrance of the scenic spot	
–	When I bought the ticket online, I found that there was a QR code of the scenic smart tour guide system APP at the bottom of the webpage	There was a QR code of the smart tour guide system APP at the bottom of the webpage	Using the QR code on the ticketing page	Approachability
–	After buying the ticket, I found that there was a QR code of the scenic smart tour guide system APP on the back of the ticket and the introduction of its use.	There was a QR code of the smart tour guide system APP on the back of the ticket	Using the QR code on the ticket	Approachability
–	After I entered the smart tour guide system APP, the background was Huangguoshu Waterfall, which was very beautiful	The background of the system was the beautiful Huangguuoshu Waterfall	Background	Visual
–	The background of the smart tour guide system was light blue, the same as the sky of the ancient town . . .	The background of the smart tour guide system was light blue	Background	
–	Its panoramic map was very clear, and every small spot was dynamic, they were very similar to the real spots	Panoramic map was dynamic and clear	Clarity and emulation	Visual
–	I think its route planning was very good, it was to simulate the real route, and even the small trees by the roadside were displayed	Route planning simulated reality	Clarity and emulation	
–	The resolution of this APP was very high, and the icons of various attractions and service facilities were clear	Resolution was very high, and icons were clear	Clarity and emulation	
–	I opened the panoramic map, and saw all the scenic spots, just clicked on the scenic spots I wanted to go, and the system could automatically plan the route	It was easy to use the panoramic map	Switch on function keys	Operability
–	Entering the Smart Navigation APP, I found that there were many function keys at the top of the APP, and I could enter the function I wanted with a single click.	I could use the function I wanted just with a single click	Switch on function keys	
–	The smart tour guide system was very smooth, and there was no lag, especially when using 3D panoramic maps . . .	The system was very smooth	System fluency	Operability
–	I clicked the human service icon several times but nothing happened, I felt like I was stuck . . .	The system was stuck	System fluency	
–	Switching from the panoramic map to a manual service did not need to exit the map, just clicked the small icon of the manual service below.	It was easy to switch from one service to another	System switch	Operability
–	I added several attractions I wanted to visit to the route planning system, and then the system helped me plan the tour route	The system planned the tour route for me	Customization	Function

Table 3. *Cont.*

	Meaning Units	Condensed Meaning Units	Codes	Categories
–	I wanted to go to the toilet when I entered the scenic spot, so I turned on the smart tour guide system to find the nearest toilet	I used the smart tour guide system to find the nearest toilet	Navigation	Function
–	Every time I came to a scenic spot, the smart tour guide system automatically explained the information of the scenic spot	The system automatically explained the information of the scenic spot	Intelligence	Function
–	The smart guide system automatically pushed me the time and place of the afternoon scenic spot performance	The smart guide system automatically pushed the performance time and location	Intelligence	
–	… I sent my friend my location using the GPS real-time position of the smart tour guide system …	I used the smart tour guide system to locate my real-time position	Real-time location	Function
–	I turned on the system to look for toilets, and I found that the system could not only recommend the nearest toilets but also showed the flow of people and vacancies in the toilets	The system showed the flow of people and vacancies in the nearby toilets	Toilet service	Offline Service
–	… I could use this system to book restaurants in the scenic area and view the menu of the restaurant	The system could be used to book restaurants and view the menu	Catering service	Offline Service
–	I fell on my way down the mountain and scraped my arm, … so I used the system's emergency rescue to send my real-time location to the scenic staff, and the staff quickly found me	I used the system to save myself	Emergency rescue service	Offline Service
–	I found that my car key was lost, so I called the scenic service center, but the phone was always busy, so I used the system's manual service...	I used the system's manual service to look for my car key	Lost item service	Offline Service
–	I thought the road next to the waterfall was too slippery, I made a complaint with the system's complaints service, and they (scenic area staff) came to deal with the problem very quickly	I made a complaint with the system's complaints service	Complaint	Offline Service
–	After the smart tour guide system had introduced the attractions, it asked me if I need a detailed introduction	The system asked me a question	Ask questions	Interactivity
–	When I did not follow the planned route, the system gave a voice prompt to tell me that I did not follow the planned route	The system gave me a voice prompt	Voice prompt	Interactivity
–	After I asked the system where I could send express in the scenic spot, an intelligent dialogue robot emerged and asked me what service I need …	An intelligent dialogue robot answered my question	Answer questions	Interactivity
–	At first, I thought I could have a conversation with the system using the voice announcement feature, but …	I thought I could talk with the system	Communication	Interactivity
–	… but there was no interaction, I followed it intelligently, listening to its introduction	There was no interaction	Communication	

Approachability relates to how tourists gain access to the STGS. We found there were at least three ways that tourists could enter the STGS during the interviews. The first way entailed searching for the STGS applet on Alipay and then entering the guide system through Alipay. Second, two participants utilized WeChat to search the STGS integrated in the WeChat applet for scenic sites, and they accessed the STGS through WeChat directly. Furthermore, the majority of participants accessed the STGS by scanning the QR code of the smart tour guide system, which was presented to tourists in a variety of ways, such as on the booking homepage, on the ticket, or at the entrance.

Visual incorporates not only the overall layout of STGS and the interface of each functional component, but also a series of visual effects provided to tourists. The panoramic map was the most often mentioned component by the participants, and it was highly praised by them. The four STDs have explored their own special panoramic maps, the majority of which applied 3D technology or AI technology. As one of the participants said, "the 3D panoramic map dramatically augmented the map's visual effect, and it was so fascinating". Another aspect was the layout of the STGS, which was noted by half of the participants. Some participants pointed out that they preferred concise and clear layout and back-ground which they could quickly lock on the function keys.

Operability, or manipulating the STGS was the third influencing factor. Interviewees described how they operated the system and how they felt after manipulating the system. Almost all the interviewees talked about the system fluency and one of the interviewees noted that there was a time of delay while switching to another function interface, however others all reported no stuck. Furthermore, several participants mentioned the simple manipulation of the STGS. For example, one interviewee said, "I could enter the function which I wanted with a single click". Another participant similarly informed us that all one needed to do to move from the panoramic map to the manual service was to click the little symbol for the manual service located underneath.

The next category we extracted from the interviews was *function* which was most widely mentioned by the interviewees. According to the interviewees, function meant what kinds of services the STGS provided to tourists and how the system serviced tourists. Some of the interviewees referred to the customized route planning service that could meet the unique tour needs of different guests. "Automatically" and "intelligent" were the frequently used words by the interviewees when they talked about the function of STGS. One participant mentioned, "As long as I turned on the tour guide system, every time I went to a new scenic spot, an automatic voice explanation will be triggered". Another participant recalled, "This was my second visit to the scenic spot, so I wanted to visit the scenic spots that I hadn't been to the last time, then I used the system's intelligent route planning to avoid the scenic spots I had visited before".

Offline service refers to entity services given by scenic spots that can be inquired and booked through the STGS, such as lodging, catering, toilets, emergency services, and so on. Most interviewees used the STGS to look for nearby canteens and toilets. One interviewee remembered, "on my way to the next waterfall, I suddenly wanted to go to the toilet, but I couldn't find the signpost leading to the nearest toilet, so I entered the STGS and searched the toilet". Apart from catering and toilet service, the interviewees suggested the four STDs also offered emergency service, lost and found service, parking, complaint service, accommodation, specialty and souvenir purchase service.

The last factor that emerged from the interviews was interactivity which means how tourists engage with STGS. According to participant descriptions, the most popular interactive way in the four STDs was intelligent voice prompts that could answer visitor queries. "I tried to further explore the history of the Palace, then I asked the system how long the Palace existed. To my surprise, the system answered me . . . " one of the participants said. Another important aspect about interactivity mentioned by the participants was bilateral communication, however, most STGSs in these four STDs could not achieve this goal. What's more, another interviewee recalled, " . . . the big stone there had some special meanings, after introducing the basic information about the stone, the system asked me

to circle around the stone clockwise three times, and then I did so … ". In this case, interactivity also involved the activities that interviewees engaged in while interacting with STGS.

The 12 interviewees narrated their experiences and feelings regarding using STGS in four STDs. Through qualitative content analysis, we categorized six influencing factors the interviewees frequently encountered during the tour. And furthermore, these six influencing factors laid a foundation for developing a measure instrument of evaluating tourists' experiences with STGS. The next phase delves into the process of developing the measure instrument.

3.2. The Second Research Phase

Based on the six influencing factors extracted in the first research phase, we developed 34 items (see Appendix B) which represented six dimensions of the above influencing factors. We invited four experts who are specialized in tourism administration and experience design to explore the 34 items with us. We had several repeated discussion and scrutiny to develop the items and finally we selected these 34 items as our test items. For each item, we attached a five-point Likert scale (1 = strongly agree, 5 = strongly disagree). A Likert scale presupposes that attitudes can be assessed, and that the intensity of an attitude is linear, on a continuum from strongly agree to strongly disagree [45], which is widely used in measuring respondents' attitudes. Consequently, we adopted the form of five-point Likert scale as our measure instrument. Before we used these items to conduct massive investigation, we firstly recruited five graduate students and ten tourists who had been to one of the four STDs to pretest the questionnaire. We took the suggestions from the participants and made some changes to the questionnaire to make it easier for interviewees to understand.

3.3. The Third Research Phase

3.3.1. Participants

To conduct the questionnaire, we recruited four graduate school students as investigators and assigned one to each smart tourist destination. We questioned participants if they had used the STGS in the four STDs before they answered the questionnaire. Those who had not used the STGS were excluded. A total of 266 questionnaires were distributed and we collected 257 questionnaires of which 9 questionnaires were invalid after we collated the answers. Finally, we collected 248 valid questionnaires. Based on the descriptive analysis of demographic information, the number of male and female respondents were almost half of each, and 54.4% respondents were aged between 25–34. Of the total subjects, 51.6% subjects had a university education background and 64.1% subjects used 2 times STGS in 2021. Table 4 illustrates the demographic information of these 248 participants.

Table 4. The demographic information of research samples in phase three (N = 248).

Variables		*N* (%)	Variables		*N* (%)
Gender			Education		
	Male	125 (50.4)		High school	20 (8.1)
	Female	123 (49.6)		Junior College	78 (31.5)
Age				Undergraduate	128 (51.6)
	Under 24	32 (12.9)		Graduate	22 (8.9)
	25–34	135 (54.4)	STGS usage times in 2021		
	35–44	74 (29.8)		1 time	42 (16.9)
	Above 45	7 (2.8)		2 times	159 (64.1)
				3 times and above	47 (19)

3.3.2. The Process of Data Analysis

In this stage, we used the method of linear regression analysis to analyze the data of the questionnaire. The process of data analysis consisted of four steps: reliability and validity analysis, descriptive analysis, correlation analysis and linear regression analysis. These four steps were interrelated, and the latter step was the foundation of the former.

The first step was to verify the data's reliability and validity. Cronbach's coefficient is a set of commonly used methods to measure the reliability of psychological or educational tests. In general, the higher the coefficient, the higher the reliability of the tool. In basic research, the reliability should be at least 0.80 to be acceptable, and in exploratory research, the reliability should be acceptable as long as it reaches 0.70 [46]. To verify the internal consistency of the questionnaire, we also tested the validity of the questionnaire. We verified the validity of the questionnaire by analyzing the KMO value. If the KMO value is higher than 0.8, the validity is high; if the value is between 0.7 and 0.8, the validity is good; when the value is less than 0.6, it indicates poor validity [46].

The items of the six dimensions are all inquired in the form of scales, so the next step was to carry out descriptive analysis of each item. The main indicators used in the analysis are the mean, standard deviation, kurtosis and skewness.

The last two procedures in the analysis were correlation analysis and linear regression analysis. The Pearson correlation coefficient is mostly used in correlation analysis to represent the relationships between different variables [47]. Regression analysis is a statistical method for analyzing data to determine if two or more variables are correlated and the degree of the correlation. The essence of regression analysis is to investigate the impact of one or more independent variables on a dependent variable. [48].

3.3.3. Results

Reliability and Validity Analysis

The results demonstrated that the Cronbach α values of the six dimensions were between 0.742 and 0.855 and the KMO values ranged from 0.777 to 0.845. The results showed that the reliability and validity of the questionnaire were acceptable. Table 5 presented the results of reliability and validity analysis.

Table 5. The results of Reliability and Validity analysis (N = 248).

Dimension	No. of Items	Cronbach α	KMO
Approachability	5	0.759	0.777
Visual	6	0.855	0.845
Operability	5	0.742	0.772
Function	6	0.820	0.821
Offline service	6	0.797	0.813
Interactivity	6	0.755	0.779
Overall items	34	0.959	0.954

Descriptive Analysis

The average value of the survey items is above 3.0, and the average value of the highest item is 4.242. The absolute values of skewness and kurtosis of the variables are above 1.5, so the aggregation of the measurement items is good. Table 6 illustrated the results of descriptive analysis.

Table 6. Description of observed variables (N = 248).

Items	AVG	SD	Kurtosis	Skewness
Approachability				
Q5	3.742	0.894	1.360	−0.975
Q6	3.952	1.056	−0.424	−0.735
Q7	3.677	1.014	−0.786	−0.327
Q8	3.633	1.087	−0.527	−0.489
Q9	3.669	1.078	−0.434	−0.523

Table 6. *Cont.*

Items	AVG	SD	Kurtosis	Skewness
Visual				
Q10	3.609	1.104	−0.476	−0.543
Q11	3.706	1.068	−0.656	−0.436
Q12	3.629	1.138	−0.403	−0.613
Q13	3.544	1.169	−0.480	−0.598
Q14	3.637	1.119	−0.276	−0.645
Q15	3.629	1.120	−0.295	−0.640
Operability				
Q16	3.726	1.148	−0.275	−0.711
Q17	3.661	1.130	−0.305	−0.644
Q18	3.770	1.045	−0.176	−0.643
Q19	3.702	1.080	−0.400	−0.550
Q20	3.645	1.035	−0.232	−0.526
Function				
Q21	3.786	1.116	0.100	−0.855
Q22	3.669	1.111	−0.158	−0.692
Q23	3.742	1.112	0.058	−0.775
Q24	3.589	1.124	−0.483	−0.517
Q25	3.742	1.094	−0.183	−0.689
Q26	3.694	1.092	0.032	−0.758
Offline Service				
Q27	3.706	1.094	−0.238	−0.667
Q28	3.641	1.154	−0.266	−0.683
Q29	3.730	1.085	−0.235	−0.672
Q30	3.730	1.093	0.029	−0.779
Q31	3.766	1.069	0.166	−0.803
Q32	3.746	1.122	0.043	−0.820
Interactivity				
Q33	3.758	1.141	−0.083	−0.784
Q34	3.694	1.118	−0.334	−0.634
Q35	3.677	1.163	−0.328	−0.670
Q36	3.762	1.040	0.132	−0.752
Q37	3.339	1.367	−0.938	−0.554
Q38	4.242	0.871	0.543	−1.084

Correlation Analysis

The results of correlation analysis were demonstrated in Table 7. Function has the largest influence co-efficient among the factors that affect tourists' experiences with STGS, with a correlation coefficient of 0.875; operability comes in second place with a correlation coefficient of 0.862; other factors include visual appeal, interactivity, and offline service, each of which have correlation coefficients between 0.851 and 0.811. Approachability has a correlation value of 0.737.

Table 7. The results of Pearson correlation coefficient analysis (N = 248).

	AVG	SD	1	2	3	4	5	6	7
1. Tourists' experiences	3.460	0.698	1						
2. Approachability	3.735	0.733	0.737 **	1					
3. Visual	3.626	0.853	0.854 **	0.668 **	1				
4. Operability	3.701	0.764	0.862 **	0.669 **	0.794 **	1			
5. Function	3.704	0.804	0.875 **	0.671 **	0.838 **	0.840 **	1		
6. Offline service	3.720	0.777	0.811 **	0.680 **	0.834 **	0.833 **	0.881 **	1	
7. Interactivity	3.745	0.755	0.851 **	0.673 **	0.804 **	0.837 **	0.870 **	0.879 **	1

Note: ** $p < 0.01$.

Linear Regression Analysis

The R-square value of the model is 0.869, which means that approachability, visual, operability, function, offline service, and interactivity can explain 86.9% of the changes in tourists' experiences. When the F-test was performed on the model, the model passed the F value test (F = 266.883, $p = 0.000 < 0.05$), meant that at least one of the six influencing factors would affect tourists' experiences. Table 8 detailed the results of linear regression analysis. According to the coefficient values of the regression, approachability, visual, operability, function and offline service have a significant positive impact on tourists' experiences while interactivity has no significant impact on tourists' experiences.

Table 8. The results of linear regression analysis (N = 248).

Items	Coefficient	t	*p*	95% CI	VIF
Constant	0.086	0.938		−0.094~0.267	-
Approachability	0.140 **	4.375	0.000 **	0.077~0.203	2.081
Visual	0.166 **	4.265	0.000 **	0.090~0.242	4.161
Operability	0.211 **	4.703	0.000 **	0.123~0.298	4.425
Function	0.257 **	5.059	0.002 **	0.056~0.257	6.425
Offline service	0.188 **	3.515	0.001 **	0.083~0.293	6.524
Interactivity	0.051	0.983	0.327	−0.051~0.153	5.852
R squared value			0.869		
Adjusted R squared value			0.866		
F value		F (6241) = 266.883, $p = 0.000$			
Dependent Variable:		Tourists' Experiences			

Note: D-W value: 1.914 ** $p < 0.01$.

4. Discussion

This part reviews the emerged influencing factors in the study and discusses the findings in phase one and phase three. Some theoretical, practical and policy implications are mentioned. Research limitations and future research suggestions are also included.

4.1. Influencing Factors of Tourists' Experiences with STGS

In the first stage of this study, we used a qualitative content analysis approach to extract six influencing factors of tourists' experiences with STGS from the semi-structured interview. A validity and reliability test were conducted to support how these six influencing elements were divided. The results of the extensive survey were further explored by correlation analysis and linear regression analysis.

Among the five significant influencing factors, function had the greatest influence on travelers' experiences. Participants in the study demonstrated that they could find the required services through function. As previous studies demonstrated, it was simple for tourists to broaden the depth and breadth of their experiences by applying STTs, and it was also highly useful to obtain inspiration and enjoy the experience of visiting a destination [49,50]. This study's strong influence of function on tourists' experiences responded positively to previous studies. Operability was found to be the second strongest impact on tourists' experiences. Operability refers to how easily and effectively the system can be used by tourists. According to previous research, operability refers to the notion of ease with which STTs may be used, without the need for complicated procedures or a great deal of effort [51,52]. When participants used STGS, approachability was regarded as the final significant influencing factor. This was consistent with Huang's explanation of how high levels of accessibility to STTs might improve tourists' memorable travel experiences, as well as their happiness with the STD [53]. What's more, Tussyadiah's study also confirmed accessibility of STTs, a significant predictor of memorable tourism experience, can be a positive factor affecting cocreating tourists' experiences [49].

Interactivity presented little impact on tourists' experiences in the massive survey, which was inconsistent with the result of the first phase's interview. Participants regarded interactivity as the interaction between the system and themselves, including the system's response to their inquiries, communication between individuals and the system, and so on. Huang noted interactivity is related to the degree to which STTs can facilitate an immediate and active communication with tourists [53]. With highly interactive STTs, tourists can

obtain immediate responses from STTs. Similarly, Zhang deemed high-level interaction can motivate tourists to use STTs more actively [51]. However, in our third phase of study, interactivity demonstrated little impact on tourists' experiences with STGS. We reread the interview transcript of the first phase and found almost half of the participants expressed negative appraisal on the interactivity in these four smart tourism destinations. Reasons may be that at present the function of interaction in STGS is not totally explored by these four STDs and tourists cannot have a significant experience on interactivity. What's more, Jeong's study formulated that interactive feature of STTs involved tourists' engagement in tourism activities, as well as building social space in a digital environment [6]. Therefore, another reason why interactivity has little effect on tourists' experiences with STGS may be the lack of proper engagement in the four STDs. Consequently, participants in the massive survey have no special sense for the interaction in STGS.

4.2. Implications

The findings of this study both have theoretical and practical implications. This study contributes to our understanding of the influencing factors on tourists' experiences with STGS by adopting an exploratory sequential mixed method and expanded the insight of studies which focus on smart tourism technologies. We created a new measurement instrument to assess tourists' experiences with STGS and shown that approachability, visual, function, operability, and offline service all had a substantial influence on tourists' experiences with STGS. Among the five positive influencing factors, approachability, function and operability parallel with previous studies. The remaining two positive influencing factors, visual and offline service, were rarely mentioned in previous research. These two factors provide us new research directions when we investigate tourists' experiences with STTs. We then used linear regression analysis to determine the influencing degree of each influencing factor, and the results showed that function ranked highest among these influencing factors, whereas interaction had minimal influence on tourists' experiences. The six-factor hierarchical divide provides a fundamental theoretical paradigm for further research.

This study focuses on tourists' experiences and the perspective of our research is based on tourists. Tourists' needs and preferences strongly influence their experiences in STGS, and furthermore tourists' experiences are key factors to tourists' satisfaction which directly leads to the future development of STDs. We gained extensive and deep understanding on tourists' needs in STGS through the study, which provides STDs with practical insights to develop effective STGS for tourists. What's more, STGS is a complicated system that connects to many different STD services. The improvement of STGS can also have a considerable influence on the overall services provided by STDs. For example, it may promote the construction of infrastructure in STDs as well as the enhancement of offline services. All of these will contribute to the improvement of the tourists' experiences.

Furthermore, A well-designed STGS can also enhance tourists' overall travel experiences and future revisit intentions. STGS is not only a single advanced system, but also an aggregation which assembles comprehensive services provided by STDs. By using the STGS, tourists can get easy access to these services. So, an easy, convenient system will have a positive effect on tourists' overall travel experiences on STDs. What's more, tourists' revisit intentions are closely related to tourists' positive travel experiences and tourists' satisfaction with the STDs. A user-friendly STGS can enhance tourists' experiences and satisfaction, ultimately leading to positive tourists' revisit intentions.

Thirdly, with the ravages of COVID 19, most SDTs have adopted some restrictions on the direct contact between people. On the one hand, human tour guide has been canceled or reduced in many STDs; on the other hand, many STDs has encouraged tourists to use the STGS. During our investigation, we found the usage of STGS in these four STDs has an upward trend. However, the service of STGS cannot keep pace with the increasing usage and there exists some problems. So, the six influencing factors provide the STDs some concrete references when they promote the STGS.

Finally, the findings in this research also reveal some policy implications. Smart tourism is recently getting more and more popular in China with numerous tourism destinations upgrading their facilities and services to smart facilities and services. In this process, relevant policies on smart tourism will also be upgraded and optimized. The influencing factors which were demonstrated in this paper have a significant impact on tourists' experiences with STTs. Future policies on smart tourism can refer to these influencing factors when policy makers plan policies or regulations for STDs. What's more, with the emerging STTs which are more and more applied in STDs, there will be many challenges for smart tourism policies, such as ethical problems, privacy issues with STTs. The first step for us to meet the challenges is to ascertain what concrete influencing factors might cause the problems. These influencing factors provide us a good entry point.

4.3. Limitations and Future Research Directions

There are several limitations in this study. Firstly, this study chose four Chinese STDs as our study sites. These four STDs rank the smartest tourism destinations in China, as well as Chinese top five-star tourist attractions. The STGSs in these four STDs have developed several years and are relatively advanced in China. The findings may be different if the research sites were located in less developed tourist attractions. Second, as tourists' experiences are dynamic and changeable, this study's research period was just one year. However, when the number of times tourists visit the SDTs and the number of times tourists use the STGS increases, tourists may express new thoughts on the influencing factors. What's more, we used the method of linear regression analysis to validate the six influencing factors in phase three. However, it may be more reliable by adding some external scales to verify these influencing factors.

Future research can include more research sites to investigate tourists' experiences with STGS, particularly those developing STDs that have been favorably utilizing the STGS. Some comparison research focusing on tourists' experiences with STGS may be undertaken between various types of STDs. A longer time span enables researchers to investigate more people who are proficient with the STGS, which may make research findings more reliable. A longer time span can be set when future research surveys the influencing factors. The final study recommendation refers to the sixth influencing factor. The extensive survey in this study found that while interactivity had minimal influence on visitors' experiences with STGS, it did have a positive association with other factors based on the correlation analysis. Future study could conduct further tests on this component. Finally, future study can add some further controls when researchers investigate tourists' experiences with STGS. The behavior intention can be considered as a factor when conducting the survey. Tourists' behavior intentions can directly influence the usage of the STGS, for instance, different tourists with distinct behavior intentions may select different functions of the STGS. So, future researchers can use the behavior intention as a moderator when conduct the research.

5. Conclusions

As one of the few empirical studies focusing on the STGS, this study used an exploratory sequential mixed method to conduct the research. The purpose of this study is to explore and validate a measurement of influencing factors of tourists' experiences with STGS. We firstly extracted six influencing factors of tourists' experiences with STGS by conducting Semi-structured interviews, then we developed a measure instrument based on the results of first phase of study, and in the third phase of the study we tested the six influencing factors out in a large sample by using the questionnaire. The results of the research showed approachability, visual, operability, function and offline service have a significant impact on tourists' experiences with STGS while interactivity has little impact on tourists' experiences with STGS. The findings are both useful for STDs and individual tourists. On the one hand, STDs can make use of these influencing factors to explore a new STGS or promote their existing STGSs. Since these influencing factors were put

forward and tested by massive tourists, they can be used as guidelines for STDs. One the other hand, the six influencing factors explicitly explained what aspects had a significant impact on tourists' experiences with STGS. Tourists can have better understanding and enhanced overall experiences with STTs, as well as STDs. What's more, it can also provide some reference comments for policy makers when they design and plan for STDs. With the gradual enhancement of tourists' experiences by using STTs, future policies on smart tourism will more and more focus on tourists' smart experiences.

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Appendix A

Interview outline
Gender: Age: Occupation:
Four smart tourism destinations:
1. Palace Museum; 2. Niushou Mountain Cultural Tourism Area;
3. Huangguoshu Scenic Spot; 4. Mount Hua Scenic Area;

1. Which of the above smart tourism destinations have you visited in 2021?
2. How many times have you used STGS in 2021 in the above smart tourism destinations?
3. Please describe your experience of using the STGS in one smart tourist destination.
4. Why did you choose to use the STGS?
5. What aspects of STGS do you find appealing to you?
6. What aspects of STGS do you think are unsatisfactory?
7. If you have a chance to improve the STGS you've used, what would you do?
8. Will you choose to use STGS for your next trip? Why?

Appendix B

Original items for influencing factors in STGS
Approachability

1. I have saw some promotional ads of the STGS before I use the system.
2. I feel it is simple to search for the STGS by using my mobile phone.
3. There are introductions of the STGS at the scenic spot.
4. The QR code of STGS are clearly posted at the scenic spot.
5. I feel it is convenient to access to the STGS.

Visual

6. I like the visual effects of the STGS.
7. I feel comfortable when I look at the interface of the STGS.
8. The color of the system is pleasing.
9. I think the background of the STGS is comfortable.

10. The interface of the STGS looks so great.
11. I appreciate the layout of the system.

Operability

12. When I manipulate the STGS, I feel it is very smooth.
13. It is easy to switch between different functional areas.
14. I can quickly enter the function areas from the main interface.
15. I hardly have a stuck or lagging when using the system.
16. It is easy for me to find the function keys in the STGS.

Function

17. When I walk to a scenic spot, the STGS will automatically start voice explanation.
18. I like the panoramic map provided by the STGS.
19. The real-time location of the STGS is accuracy.
20. The system provides all the functions which I want.
21. I like the smart tour routes suggested for me by the STGS.
22. I am satisfied with the audio guide of the STGS.

Offline service

23. I know what kinds of offline services are provided by the scenic spot in the STGS.
24. I feel it is convenient to reserve a hotel or canteen with STGS.
25. The offline services displayed by the system are consistent with the actual ones.
26. It is easy for me to find a toilet or canteen by using STGS.
27. When I order offline services on STGS, the scenic spot quickly provides relevant services for me.
28. It is time-saving to order an offline service by using the STGS.

Interactivity

29. The system is always responding to me whenever I query it.
30. I think the interaction with the system is wonderful.
31. The system actively recommends some information about the scenic spot to me.
32. I feel the system's response to my question is interesting.
33. I'd rather turn to STGS for help than a real person when I encounter some problems.
34. I think the STGS can understand my inquiry.

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