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The WeChat Mini Program for Smart Tourism

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A B S T R A C T

The WeChat mini program is an application embedded in WeChat that users can use without downloading and installing. After it was officially released in 2017, many travel enterprises have launched their own mini programs on the WeChat platform. This study applies affordance theory to investigate the WeChat mini program's role in tourism activities through social network analysis using the R programming language. The authors searched the topic of "how do you perceive the travel-related WeChat mini program" and then crawled the 200 comments found; 180 comments were analyzed after data cleansing. The results show that travel-related WeChat mini programs play a very important role in Chinese social network tourism activities. This paper found that WeChat played a more active role in various tourism-related interactions with Chinese social networks. Moreover, the results show how affordance theory is applied to the use of WeChat mini programs.

Keywords: WeChat Mini Program, Affordance Theory, Social Network Analysis, R Programming Language

Ⅰ. Introduction

In recent years, the rapidly spreading use of smartphones is pushing the mobile apps market to become a fast-paced media outlet in the field of consumer technology (Charles, 2011; Kennedy-Eden and Gretzel, 2012). In the tourism field, with the increasing popularity of smartphones, tourists are widely using mobile applications to book accommodations, transportation tickets, tourist attraction tickets, and more. In the mobile apps market, travel-related apps ranked seventh among the most popular downloads (Mickaiel, 2011). TripAdvisor found that 60% of smartphone users have downloaded travel apps, and 45% of those individual users plan to use apps to plan their trips (Kennedy-Eden and Gretzel, 2012; Mickaiel, 2011). Mobile apps have changed the way Chinese tourists travel, and those statistics demon-

strate the importance of mobile apps in the travel field. According to a TripAdvisor report, US, UK, and Italian travelers are the top online booking users, whereas the Chinese are the most likely to make bookings via mobile apps (TripBarometer, 2016).

Previous research has also studied smartphone app usage patterns, and most of those studies present recommendations on how to design apps to attract users (Baltrunas et al., 2015; Hwang et al., 2016; Li and Lu, 2017; Qiao et al., 2016; Santo et al., 2017). However, it is well known that travel-related apps have a low frequency of use and quite high development costs (e.g., Booking.com, Airbnb, and Ctrip). Additionally, travel apps often consume a lot of phone memory. According to reports by Flurry, a mobile apps analytics firm, travel apps are used an average of only 2.6 times per week and retain 45% of their users over a 90-day period (Michelle, 2018).

In light of this, the author thought of the WeChat mini program, which was released in 2017 by WeChat, the giant of Chinese instant messaging and social media. It received much attention from various fields after its release, including the tourism industry. Some researchers believe that WeChat mini programs not only have most of the functions of the original app but also integrate the four advantages of authentication, payment, sharing, and communication (Guo, 2017). Surprisingly, the WeChat mini programs have abandoned the cumbersome procedures of the past Internet products and improved its user experience to be better than a website and other general apps (Yang and Zhang, 2017). In the tourism field, online travel agents (OTAs) and other travel companies have launched their own mini programs to attract travel users (e.g., Booking.com, Airbnb, Ctrip, Qunar.com, and Tongcheng Lvyou).

Since the WeChat mini program has not been released for very long, there are few academic studies related to it. The few existing studies have examined the construction of a school's teaching model based on the WeChat mini program (Liang and Chang, 2019) and the design and implementation of a college online learning system based on the WeChat mini program (Wu et al., 2018). Additionally, a study based on the Unified Theory of Acceptance and Use of Technology (UTAUT) analyzes factors affecting user acceptance of the WeChat mini program (Ma et al., 2018). However, there have not been many studies that look at the WeChat mini program in a tourism context. Therefore, this study uses travel-related WeChat mini programs as examples to explore their role in the tourism field.

From a theoretical point of view, the theory of affordance was introduced to the field of human-computer interaction (HCI) by Donald Norman in 1988 to improve the comprehension and usability of artifacts, especially user interfaces (Bærentsen and Trettvik, 2002). A growing number of scholars then began to use affordance theory to study the uses and consequences of information technology (IT) (Pozzi et al., 2014). This study intends to explore the role of travel-related WeChat mini programs in tourism by understanding their interactions with users. To achieve this goal, this study applies affordance theory. Hence, the following research question can be proposed:

Research Question: From the perspective of affordance theory, what kind of affordance can a travel-related WeChat mini program provide to users?

Ⅱ. Theoretical Background
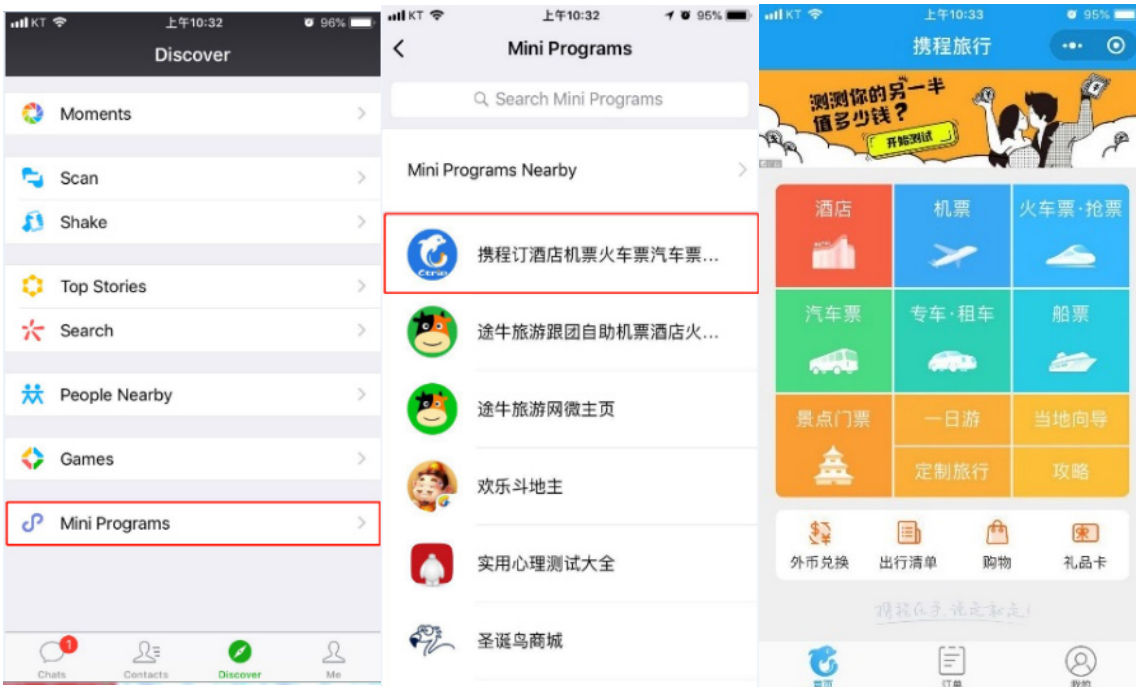
2.1. WeChat and WeChat Mini Programs

China has become a huge, global domestic and

international tourism market. In a changing yet stable economic and social environment, demand for domestic tourism is soaring and Chinese tourism consumption continues to heat up. As stated by the "2016-2017 China Tourism Consumer Market Development Report" published by the China Tourism Academy, there were 4.7 billion tourists in China's domestic, inbound, and outbound tourism markets in 2016, and the tourism consumption exceeded 800 billion US dollars (2016-2017 China Tourism Consumer Market Development Report, 2017).

Moreover, with the rapid development of mobile smart devices such as smartphones, Chinese tourists have become very accustomed to planning travel and communicating with Chinese social networks via mobile phones for a better user experience (TripBarometer, 2016). According to Travelport, the

average British traveler uses 14 smartphone apps while traveling, with maps and weather-related apps being the most widely used (Simon, 2017). Chinese travelers use an average of 20 Apps (Simon, 2017). In such an environment, industry investment and innovation have become extremely active, and one can imagine the profit margins to be had. As one of the giants of China's Internet industry, Tencent has also earned high profits in the travel industry.

WeChat is a free application launched by Tencent in 2011 to provide instant messaging services for smart terminals. As of the second quarter of 2016, WeChat has been installed on more than 94% of the smartphones in China, with 806 million monthly active users (Tencent Big Data, 2016). A few years later, the WeChat mini program was released in 2017, officially launching the first batch of WeChat sub-applications for users (see <Figure 1>). WeChat mini

<Figure 1> WeChat Mini Programs

programs are similar to general apps, but there is no need to install or uninstall them on a smartphone. They are embedded in WeChat and do not consume any mobile storage space. WeChat users can directly access the mini programs within the WeChat app. According to the latest report from Tencent, more than 1 million mini programs have been launched with nearly 400 million users; WeChat users open mini programs four times a day, 54% of which are active uses (TechWeb, 2018).

2.2. Affordance Theory

The phrase "rhetoric of inevitability" makes users feel that technological change is not controllable, that they are powerless to affect technology or unable to choose from a variety of technologies (Sadler and Given, 2007). Travel-related apps not only change how travelers plan their trips, but they may also change which online travel agency (OTA) is chosen, how often they travel, and their travel destinations.

The theory of affordance is different from existing theories of value and meaning and begins with a new definition of value and meaning (Gibson, 1977). Gibson proposed the concept of affordance in 1977, which not only represents individuals and their environments but also the interactions between them. Gibson believed that affordances are not only phenomenal qualities of subjective experience but also properties of the environment in relation to an animal (Zhao et al., 2013). That is, affordance reflects the reciprocity of an organism and the characteristics of the environment and can guide actions. Gibson (1979) defined affordance as:

An affordance casts across the dichotomy of subjective-objective and helps us to understand its inadequacy. It is equally a fact of the environment and a fact of behavior.

It is both physical and psychical, yet neither. An affordance points both ways, to the environment, and to the observer (p. 129).

Gibson suggested that affordance can be directly perceived when it exists, and information in the environment can indicate affordance (Zhao et al., 2013). As stated by Gibson, individuals are animals cognizing and acting in a specific environment (Pozzi et al., 2014). Gibson (1977) proposed the concept of affordance to encompass both the individual and the environment, as well as the interaction between them. The central idea of the affordance concept is that capabilities for action are offered by the environment.

Ecological psychology and the affordance concept have influenced many fields (Sadler and Given, 2007). Most of the relevant previous studies have examined general information systems design based on affordance (Beynon-Davies and Lederman, 2017; Lintern, 2000; Maier and Fadel, 2009) and social media affordance (Cabiddu et al., 2014; Majchrzak et al., 2013; Treem and Leonardi, 2013). Hutchby (2001) applied the concept of affordance to technology and studied the functional aspects of affordance as possibilities for action. Cabiddu et al. (2014) studied the affordance of social media and identified three distinctive social media affordances. Leonardi (2011) investigated the relationship between human and material agencies in an environment of flexible routines and technologies. Majchrzak and Markus (2012) discussed the importance of technology affordance and the theory of constraints in management information systems. Faraj and Azad (2012) argued that the affordance perspective is a promising approach for studying the importance of organizational technology.

Norman (1988) first applied affordance theory to the HCI field. He viewed affordance as the design

aspect of an object that shows how the object should be used. Norman (1988) thought that affordance relies more on the actor's experience and knowledge and that it can predict an actor's behavior, suggesting a range of possibilities. The most important difference between Gibson and Norman regarding affordance is that Gibson sees affordance as possibilities for action, while Norman is more concerned with whether the possibilities for action can be conveyed. In other words, Gibson is mostly interested in how we perceive the environment, whereas Norman is more focused on how to manage and design the environment to facilitate the perception of the utility (Zhao et al., 2013).

Therefore, Norman (1988) attempted to research how individuals can interact with thousands of other objects. Norman (1988) argued that affordance provided by an object should be regarded as "real affordance" and "perceived affordance". A coffee cup, for instance, could provide a function for pouring coffee, pouring popcorn, decorating, and could even be used as a weapon. All of those kinds of functions can be considered as perceived affordances by people using the coffee cup for different purposes. However, this does not change the real affordance of a coffee cup - that it is a container for coffee.

WeChat, as an affordance provider, is essentially an instant messaging tool. However, it provides many other embedded functions, such as a payment service, a charity service, financial management, hospital registration, etc. For people using WeChat, the instant messaging service can be viewed as the real affordance from the perspective of affordance theory. On the other hand, for people using the payment service provided by WeChat for shopping, the payment service can be regarded as a perceived affordance. The WeChat mini program can be seen as an affordance offered by WeChat. Interestingly, the WeChat mini

program has been extended to other purposes by the interaction between Chinese social networks, which can be considered as affordance subproviders. The WeChat mini program provides a platform for others to release their own mini programs in order to access the huge number of WeChat users. At the same time, it also offers a way for WeChat users to more easily achieve their goals. These mini programs can provide an intermediary function in travel by simplifying some unnecessary aspects of the travel process. For example, travelers can easily book hotel and transportation tickets through specific interactions with mini programs without downloading and installing all kinds of apps. From the affordance theory perspective these kinds of booking services can be considered as real affordances. If a travel-related mini program provides a service such as food delivery or a social function, then these kinds of services will be regarded as perceived affordances when used in some specific contexts.

Therefore, in this study, travel-related mini programs are viewed as affordance subproviders. The authors attempt to apply the perceived affordance and real affordance approach suggested by Norman (1999) to analyze the kinds of affordances that a travel-related WeChat mini program provides to users.

Ⅲ. Methods

The authors adopted a network analysis approach, which is an appropriate method for conducting a social network analysis of posts related to the use of WeChat mini programs. Moreover, text mining and social network analysis enable researchers to study the various topics that appear in the posts, taking into account large amounts of text data (Eddington, 2018). Therefore, to investigate user

posts after using WeChat mini programs, the data were analyzed using R, a free and open source statistical programming language.

3.1. Data Collection

The data were crawled from Zhihu.com, a popular question-and-answer website where questions are asked, answered, edited, and organized by its user community. Zhihu.com is more like an Internet forum where users engage in relevant discussions around a topic of interest. The topic of "how do you perceive a travel-related WeChat mini program after using it" was searched, and then 200 posts were crawled; the corresponding data were stored in Excel. A review of the data found some duplicate posts and advertisements that use the mini program to attract attention. Therefore, 20 posts were removed and 180 posts were analyzed after data cleansing.

3.2. Analysis Method

The network is delineated using a network analysis method, which is constructed by calculating the betweenness centrality of each node. This study adopted betweenness centrality to calculate the network centralization index.

where denotes the betweenness centrality of node ; denotes the total number of shortest paths from node to node, whereas denotes the total number of the shortest paths via node. In addition, a clustering method was adopted to group the extracted words in order to make the visualization more intuitive. The three clusters were obtained based on a Walktrap algorithm proposed by Pons and Latapy (2006). It is an algorithm that computes communities (dense subgraphs of sparse graphs) in large networks using random walks.

IV. Data Analysis and Results

Before conducting the social network analysis, the authors implemented a word segmentation process for the collected comments written in Chinese. The segmentation process was conducted using the "jiebaR" package (Qin and Wu, 2019), a Chinese text segmentation package written in the R programming language. In the preprocessing step, a user-defined stop-word list was employed for the removal of stop words. Then, the social network analysis was implemented using the "igraph" package (Csardi and Nepusz, 2006), a graph and network analysis package written in R to find relationships among the terms used in the reviews. The top 150 words (see <Table 1>) were extracted to provide a visual interpretation of the importance of WeChat mini programs. The authors found that the terms used in all the reviews were clustered into three subgroups, which were indicated in three colors (see <Figure 2>). The network was outlined by calculating the betweenness centrality of each node. The nodes with betweenness centrality greater than 500 were labeled as key nodes in a larger font size. Additionally, regarding the Walktrap algorithm, the authors set the number of random walk steps to 30. When the steps exceed 30, it is allocated to another group. As such, there are less than 30 steps between any two nodes. This threshold value resulted in three clusters.
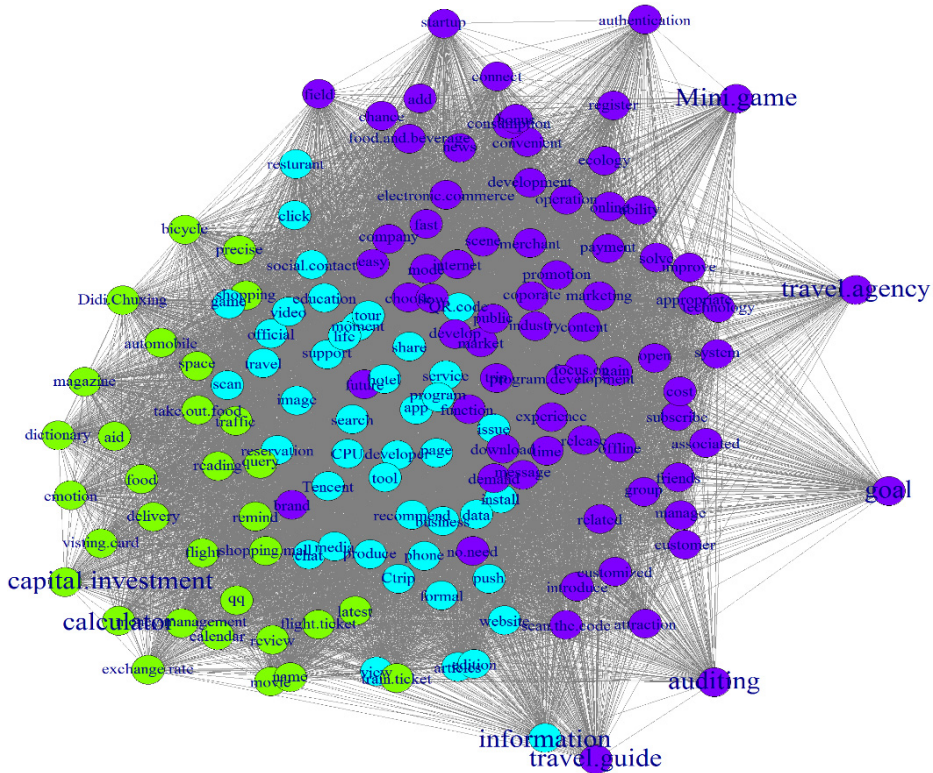
First, the graph revealed the key functions of mini programs for travelers. These functions are indicated in green in <Figure 2>. Many reviewers have experienced the original functions of WeChat mini programs, which itself can be viewed as an affordance aspect. Likewise, WeChat mini programs have mapped the functions of many apps. For example, travelers are very accustomed to using mini programs for travel activities such as bike-sharing, shopping,

\<Table 1\> Frequency of the Top 150 Words

qq	28	calendar	24	reading	33	fast	53	future	62
startup	24	ecology	33	technology	31	install	43	demand	61
appropriate	31	chance	30	delivery	24	moment	44	no need	53
produce	29	chat	26	system	25	development	48	Tencent	48
convenient	26	visiting card	20	related	41	ability	36	offline	49
associated	28	take-out food	34	Ctrip	37	operation	48	download	65
authentication	12	business	35	attraction	23	program development	42	time	65
auditing	12	formal	38	CPU	36	easy	56	phone	61
group	25	subscribe	24	Mini-game	20	open	36	query	44
information	22	exchange rate	20	latest	34	developer	48	tour	76
view	29	calculator	19	movie	25	payment	45	Internet	54
venture capital investment	17	website	27	customized	25	choose	51	company	59
money management	24	bicycle	32	name	25	game	41	message	63
field	26	traffic	35	shopping	38	social contact	58	QR code	57
improve	31	food	30	education	56	recommend	48	share	74
articles	27	dictionary	20	media	43	promotion	49	tool	67
connect	24	image	39	release	39	issue	60	experience	65
remind	29	flight	26	cost	37	mode	62	scene	60
food and beverage	38	travel agency	11	news	31	data	56	industry	70
automobile	33	register	28	official	47	support	57	hotel	66
add	25	Didi Chuxing	24	consumption	38	electronic commerce	52	corporate	64
magazine	21	click	34	online	33	video	46	search	78
travel guide	17	edition	27	focus on	45	marketing	49	flow	74
train ticket	30	emotion	19	bonus	38	reservation	34	public	81
scan the code	32	manage	30	space	35	page	53	develop	84
scan	27	solve	39	travel	47	aid	22	function	103
restaurant	28	introduce	32	friends	32	content	45	trip	119
review	22	push	34	shopping mall	35	life	60	service	111
precise	37	flight ticket	29	customer	31	merchant	52	app	117
goal	10	brand	26	gain	48	market	63	program	173

hotel booking/reservation, take-out food, train or flight ticket booking, calling taxis, etc. Furthermore, Didi Chuxing (China's Uber), the most popular ride-sharing platform, is widely used in WeChat. Thus, in many Chinese cities, this mini program plays a critical role for Chinese tourists. In addition,

<Figure 2> Network Visualization

the results also showed that many travelers have also used mini programs related to reading or language dictionaries on a trip. These function-based nodes are connected through two nodes ("venture capital investment", "calculator") with the higher betweenness centrality of the traveler clustering group.

Second, the WeChat mini programs provide travelers with on-demand necessary information on a trip. These keywords are indicated in pale blue in <Figure 2> and are connected through the "information" node in the network. In general, people search for information about a destination's hotels, restaurants, and attractions through images and videos on websites, posts by friends, and online travel agencies such as Ctrip.com. <Figure 2> enables us

to understand that these travel-related mini programs can share all the information (e.g., routes, guides) needed by travelers. This is another affordance aspect in which an object (WeChat) is actionable by the travelers instantly and on demand.

Third, the extracted keywords indicated in purple in <Figure 2> represent the suggestions made by travelers and their expectations regarding the development of WeChat mini programs. Theoretically, actionable affordance is thereby produced. These words were connected over key nodes: travel agency, travel guide, mini-games, goal, and auditing. (1) Travel agencies and attractions were expected to develop their own WeChat mini programs in order to provide a contextual situation for travelers to enjoy

more convenient trips. Travel agencies could promote their business through a well-developed mini program. (2) The graph shows that more mini games appear in many comments, implying that game-related mini programs should be developed or embedded in the future. Many travelers hope to fill their extra time on a trip playing mini games. (3) Travel agencies are recommended to have an official WeChat account so they can promote more travel-related news, guides, and their own businesses. Travelers could subscribe to the official accounts of the travel agencies to obtain more suitable travel-related information. (4) They also suggested that the mini programs should simplify auditing and authentication procedures. However, the security and convenience of the payment system should be guaranteed, while problem-solving features should be further improved. These suggestions were connected over the two key nodes "auditing" and "goal." In general, travelers pursue convenient, fast, and easy payment and customized trips via WeChat mini programs.

Fourth, many reviewers believed that the mini program development is beneficial for a startup business. It can be regarded as another perceived affordance from the perspectives of entrepreneurs and their enterprises. By taking advantage of the huge numbers of WeChat users, entrepreneurs and tourism organizations can receive alerts and attention from their target customers relatively easily. In addition, for developers, the threshold for developing a WeChat mini program is relatively low, as it is not as difficult as creating general apps. The WeChat mini program can fulfill simple, basic applications and is suitable for offline service shops and applications with varying demand and low frequency of use, such as travel-related applications.

Ⅴ. Discussion and Conclusion

WeChat mini programs can be regarded as a more convenient way for travelers to plan a customized trip since mini programs do not need to be downloaded and installed. Moreover, WeChat mini programs begin in an offline mode, and online connections can be made using a simple QR code. In addition, by relying on WeChat's huge database, mini programs can better combine both online and offline modes. For example, travelers can search for nearby mini programs when traveling to other cities or scenic spots. Mini programs can also be shared with WeChat friends and can forward valuable information. General travel apps lack an effective social channel, user-sharing behavior is limited, and the penetration range is small. However, WeChat is installed on more than 94% of the smartphones in China, with 806 million monthly active users (Tencent Big Data, 2016). Due to the strong WeChat ecosystem, information is more easily disseminated in WeChat, and mini programs also benefit from this advantage. Moreover, because travel has strong social aspects, the WeChat ecosystem is very suitable for the development of the tourism industry.

Therefore, this paper applies affordance theory to examine travel-related WeChat mini programs. Norman (1988) argued that affordance offered by an object should be regarded as "real affordance" (i.e., functioning services) and "perceived affordance" (i.e., various actionable services via the functions). In the context of travel-related WeChat mini programs, these mini programs are tools that provide travel services similar to general apps, and the "real affordances" they offer are travel services such as hotel bookings/reservations, and train or flight ticket booking. For example, travelers can use the Airbnb mini program to search listings, communicate with

hosts, and make and pay for the reservations. All of those functions can be viewed as real affordances provided by the Airbnb mini program. Meanwhile, "perceived affordances" would be a slightly different perspective. From the analysis results, we know that some travel-related mini programs integrate functions like dictionaries and social functions. Travelers can use a dictionary while traveling abroad and can share useful information with friends such as discount information. In addition, development of some other mini program functions were suggested that could be embedded in travel-related mini programs to pass the time on a trip. Furthermore, mini programs can also be viewed as a kind of perceived affordance for startups since they can reduce development costs and rely on the existing WeChat ecosystem. WeChat mini programs have been demonstrating the important role of the tourism industry and can more actively create potential tourism activities through various interactions within the WeChat mini programs. WeChat's role in the tourism ecosystem has become essential due to the interaction within WeChat mini programs, which has expanded beyond tourism function services. Thus, like Google's function in the environment of global tourism, WeChat was found to play an important role in the Chinese tourism ecosystem.

Based on the analysis results, the research question posed by this study can be investigated and answered. From the perspective of affordance theory, both perceived affordance and real affordance can be provided to users via a WeChat mini program. Previous studies focused on the role of affordance in HCI design. For example, the influence of motivational affordances on information and communication technologies (ICT) design and use have been studied (Zhang, 2008); the affordances of ICT have been researched (Conole and Dyke, 2004); technology affordances

and constraints in management information systems (MIS) have been considered (Majchrzak and Markus, 2012); and functional affordances of information systems in green transformations have also been investigated (Seidel et al., 2013). Unlike these previous studies, this paper applies social network analysis to study the affordances offered by travel-related mini programs by adopting the real affordance and perceived affordance approach developed by Norman.

In addition to its practical contributions, this study also provides some theoretical implications. For users, the WeChat mini program can be viewed to some extent as a technology. This paper is focused on travel-related mini programs. Regarding the acceptance and use of new technologies, most of the previous research applied the technology acceptance model (TAM) (Pavlou, 2003; Vijayasarathy, 2004; Wu and Wang, 2005), the unified theory of acceptance and use of technology (UTAUT) (Carlsson et al., 2006; Im et al., 2011; Zhou et al., 2010), or other models derived from those two. This study analyzed the acceptance and use of travel-related mini programs by travelers from a new perspective that emerged from the theory of adoption. The results prove that the affordance theory is in line with the objective of this study. Moreover, it also verifies that the affordance theory can be applied in relevant research regarding the acceptance of smart technology. Therefore, the author hopes that this research can inspire future studies.

Since this paper is still an exploratory study, it also has limitations. First, because the object of analysis is the 180 comments written by users who have experience with travel-related WeChat mini programs, it could be very subjective and biased. Thus, future studies should be conducted using a large volume of data. Second, since affordance is a broad concept to some extent, many scholars tried to explain

it from many different perspectives. Gaver (1991) focused on the strength and weakness of technologies with respect to the possibilities they provide their users. He further developed the concept of affordance by defining it in four parts: false affordance, perceptible affordance, correct rejection, and hidden affordance. McGrenere and Ho (2000) focused on the misuse and confusion of terms and clarified the concept for effective communication among researchers and practitioners. They classified the concept as affordance, perceptual information about an affordance (also apparent affordance), and indirectly included in perceptibility of an affordance. Hartson (2003) defined and used four complementary types of affordance in the context of interaction design and evaluation: cognitive affordance, physical affordance, sensory affordance, and functional affordance. Hence, future scholars can undertake new studies from other different perspectives of affordance theory.

Acknowledgements

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