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Effects of Soundscape on Place Attachment in International Scenic Resort

[1]Ling Yang[1], Jiang Liu[2]

[1] Ruhr University Bochum, Institute of Geoscience, Bochum, Germany
[2] Fuzhou University, School of Architecture and Urban-Rural Planning, Fuzhou, China

Corresponding author's e-mail address: lingyang0828@gmail.com

ABSTRACT

This study selected Kulangsu as the case study object and explored the effects of soundscape on place attachment through analysis methods such as questionnaire survey and Pearson analysis, and further explores the differences between types of residence. The study was based on the two-dimensional theory of place attachment, and the analysis results showed that natural and mechanical sounds on the island were mostly desired, while the perception of folk activities, music, and conversation sounds among artificial sounds should be regulated and controlled; people have a high degree of place attachment to Kulangsu Island, among which place dependence is stronger than place identity; place attachment is related to the perceived frequency of wave sounds, wind-blown leaf sounds and rain sounds, and the preference of music sounds and guided tour sounds. There is a significant positive correlation between local residents' sense of place attachment and the perception of wind-blown leaves, rain, bird calls, and ocean waves; visitors' sense of place attachment is significantly correlated with the perceived intensity of construction sounds, the preference for music played and guided tours.

Keywords: sound, soundscape, place attachment, urban planning

INTRODUCTION

Related research on the emotional connection between people and place can be traced back to the 1960s, when Wright introduced the concept of “geopiety” [1]. Later, Duan Yifu described the emotional connection, which came from people's total perception in the place, as “topophilia” in 1974 [2]. Subsequently, emotional bonds to place have become a significant research focus, particularly in the fields of human geography and environmental psychology [3]. As a result, the concept of place attachment has been widely utilized as key research finding for analyzing regional shaping and behavioral cognition.

Given the application to multiple subjects, a plethora of definitions of place attachment have been proposed. Typically, Williams and Roggenbuck advanced the notion that place attachment involves emotional, cognitive, and practical connections and proposed a two-dimensional theory of place attachment, namely place identity and place dependence [4]. Since then, many researchers have further analyzed the concept system of place attachment [5-8]. For the most part, researchers have summarized place attachment as an emotional connection established by people in a specific area [9, 10]. This connection is based on subjective perceptions and originates from emotional and functional satisfaction in the area [11]. Thus far, research on place attachment has mainly focused on the exploration of conceptual systems, antecedent analysis, and consequence prediction [5]. The researchers explored the correlation between place attachment and behavior, landscape preference, and visiting experience [12, 13].

The generation and degree of place attachment are inseparable from the interaction and perception between people and the specific place. Audition, as the primary perception organ, contributes significantly to the acquisition and transformation of information in the environment, and further contributes to and improves the visual landscape [14]. Internationally, soundscape is described as the sonic environment perceived by an individual, group, or community in a given scene [15, 16]. In recent years, the applications of soundscape have been fully integrated with many disciplines, such as architecture, ecology, geography, and landscape [17-19]. Furthermore, As an important carrier of people's perception, soundscape has unique advantages over visual landscape in shaping place culture, fostering sense of belonging, and establishing emotional connections with specific locations, especially in the context of historical and cultural scenic areas [20]. Evidently, there could be an important correlation between soundscape and place attachment, yet there are few related studies on this subject. Recent publication revealed that the association between soundscape and place attachment varies among residential and visitor-oriented historic districts [21]. Consequently, it is valuable to analyze the interactions between soundscape and place attachment across residents and visitors for a deeper understanding of the relationship between human and soundscape.

Therefore, this study chose Kulangsu, which is both a residential and tourist area, as study site to investigate the correlation between soundscape perception and place attachment, and further consider the influential role of group factor by means of questionnaire surveys and field investigations. The research questions are:

- How does the perception of soundscape influence the level of place attachment among residents and visitors?
- Are there significant differences in the way that residents and visitors perceive the soundscape and in their level of place attachment?
- How can the findings of this study inform urban planning, environmental management, and tourism efforts?

The research aim of this study is to shed light on the role that sound plays in shaping people’s connection to the environment, and to inform urban planning, environmental management, and tourism efforts.

MATERIALS AND METHODS

Case Study Site

Kulangsu Island is located in Xiamen, China, with a total area of about 1.8839 square kilometers, and is about 500 meters away from the coast of Xiamen Island, which was formerly

named as Yuanshazhou and Yuanzhouzi. "Kulangsu" was named during the Ming Dynasty due to the wind erosion caves on the southwest coast of the island that produced drumming sounds when the tide flowed in. The earliest settlers of Kulangsu can be traced back to the Song Dynasty. Following the Opium War, Xiamen became the second largest port in China, attracting migrants from diverse cultural backgrounds to Kulangsu. This resulted in a transformation of the island's dominant culture from a traditional settlement village culture to a distinctive international community culture, characterized by a fusion of different customs, traditions, and languages.

Apart from its rich cultural resources, Kulangsu Island is also one of the most popular tourist destinations in China, attracting six million visitors annually. With its unique natural landscapes, well-preserved international architectural heritage, and rich soundscapes, Kulangsu has been referred to as the "World Architecture Museum" and the "Island of Music". In 2017, Kulangsu was recognized as an international community and was designated as a World Cultural Heritage site, thanks to its distinctive cultural background and landscape resources. It is evident that Kulangsu embodies the dual characteristics of both a residential community and a tourist destination, with residents and visitors coexisting and occupying equally important positions on the island. As a result, choosing Kulangsu Island as a research subject holds high representation and significance in analyzing and comparing the soundscape perception and local attachment of residents and visitors.

Field Survey

Soundwalks have proven to be a well-established approach in soundscape research, which involves actively listening and taking note of significant sounds encountered during a physical walk through a particular environment [22]. As described by Schafer [23], soundwalks can help identify the main sound resources present in the environment. To account for the island's active visiting period, the soundwalk was conducted over a five-day period (May 26~30, 2019) from 8 to 12 am and 1 to 5 pm, covering the entire island. Our analysis revealed a total of 17 representative sounds, which could be classified into three main categories: artificial sound, mechanical sound, and natural sound (as shown in Table 1) [24]. Among which, the sound of aircraft corresponds to the noise produced by planes flying over Kulangsu Island, and the water sound mainly refers to the acoustic properties of water features, such as fountains.

In addition to sound classification, the soundwalks undertaken by the research team also sought to identify representative samples to provide a comprehensive understanding of the island's soundscape. As a result, a total of five samples were selected based on several factors, including the current distribution of sound sources, the degree of preservation of visual landscapes, and the popularity of each location. Specifically, the selection criteria are:

(1) the soundscape is deemed abundant and representative,

(2) the area is heavily populated during most times of the day and contained various types of living environments

(3) the presence of characteristic buildings or garden landscapes.

The five research samples were strategically distributed along the east southern part of Kulangsu Island, which follows the main distribution of scenic spots (Figure 1).

Table 1 Soundscape composition in Kulangsu

Category	Sound sources
Artificial sound	Surrounding speech, Children frolicking, Folk sound, Playing music, Guide sound, Footstep, Yelling
Mechanical sound	Construction sound, Traffic sound, Airplane sound, Whistle
Natural sound	Birds, Insects, Waves, Leaves rustling, Water, Rain

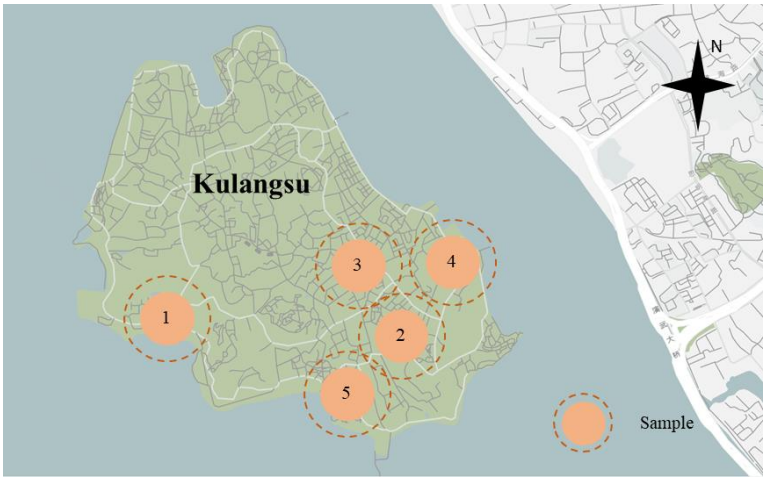

Figure 1 Distribution of typical research samples

Table 2 Characteristics and size of research samples in Kulangsu

Sample	Dominant Landscape Features	Dominant Soundscape	Supplements	Sample size
1	Coastal landscape, Megalithic landscape	Artificial and natural sounds	Around Gulang Stone	41
2	Leisure Square, Rich green landscape and architectural landscape	Broadcasts interviews and natural sounds	--	43
3	Street garden, less green landscape	Artificial sounds and birds	The largest flow of people and the longest stay in the crowd	40
4	Marina leisure square, dominant coastal landscape and historical architectural	Music and natural sound	--	36
5	Abundant architectural landscape, coastal landscape and courtyard landscape	Artificial sound and natural sound	Around Shuzhuang Garden	35

Construction of the Questionnaire

Prior research has demonstrated the utility of employing questionnaires to assess people's perceptions and evaluations of sound environments [25, 26]. In this study, a questionnaire was conducted in the research samples to assess the soundscape and place attachment by employing semantic attributes that are grounded in existing research.

Social and demographical factors

The initial section of the questionnaire collects the interviewee's social and demographic information. The variables inquired include population group (local residents and tourists), gender (male, female), age (≤24, 25~30, 31~40, 41~50, 51~59, ≥60), education background (below elementary school, junior school, high school, university, post-graduate), occupation (student, worker, businessman, retired, and others), visiting frequency (1st time, 2~3 times, once a day, once a week, once a month, and others), and stay time (within a week; one week ~ one month; one month ~ one year; 1~ 5 years; permanent residents).

Sound sources perception

In the second part of the questionnaire, respondents were asked to provide perceptual evaluations of the sound sources based on their actual visiting experiences. This study selected three soundscape perception indicators, namely Perceived Occurrences of Individual Sounds (POS), Perceived Loudness of Individual Sounds (PLS), and Preference of Individual Sounds (PFS), which have been previously used in related research [20, 27], to describe the respondents' perception of the sound sources. To rate their perception of each of the 17 typical sound sources, respondents were instructed to use a Likert five-level scale to describe the degree of POS (1: Very weak, 2: Weak, 3: Normal, 4: Strong, 5: Very strong), PLS (1: Never, 2: Occasionally, 3: Normal, 4: Frequent, 5: Too frequent), and PFS (1: Very aversion, 2: Aversion, 3: Normal, 4: Desired, 5: Very desired).

Soundscape evaluation

The questionnaire aims to gather specific information about the perceived quality of the soundscape in relation to six descriptors: pleasantness, comfort, harmony, liveliness, eventfulness, and variability. Participants were asked to rate each descriptor on a Likert five-level scale, ranging from 1 (Strongly disagree) to 5 (Strongly agree). The collected data was analyzed to better understand how individuals perceive and respond to the soundscape in their environment.

Place attachment

Although there is no agreement regarding the definition and evaluation of place attachment yet [11] . it is highly recognized that the construction of place attachment appears to be two dimensions, place identity (PI) and place dependence (PD) [4, 28]. Specifically, Place dependence refers to the functional attachment between individuals and place, which is defined as “how well a setting facilitates users’ particular activities” [29]. Place identity is theorized to be the spiritual connection, including the emotional level at which individuals perceive themselves during communication and living in a place [30]. In this study, four descriptions were designed for place identity and place attachment according to the two-dimensional classification of place attachment, combined with the previous questionnaire design and field research [9, 13, 30]. As shown in Table 3, respondents were asked to express their level of agreement with each description on a five-point scale ("1" for strongly disagree, "2" for disagree, "3" for neither agree nor disagree, "4" for agree, and "5" for strongly agree) based on their actual travel experience, and the evaluation of place attachment was obtained by averaging the evaluation scores obtained for the two dimensions.

Table 3 Two-dimensional scale of place attachment

Dimensions	Description
Place Identity (PI)	PI-1: I'm part of Kulangsu
	PI-2: Kulangsu is a very special place
	PI-3: I am full of nostalgia for Kulangsu
	PI-4: Visiting experience in Kulangsu means a lot to me
Place Dependence (PD)	PD-1: I tend to go to similar scenic areas for visiting in the future
	PD-2: I like the natural landscape of Kulangsu
	PD-3: The experience at Kulangsu is unique
	PD-4: Compared to other scenic areas, I prefer Kulangsu

Data analysis

A total of 195 valid questionnaires were collected in this study, and the sample size statistics of various samples are shown in table 2. All valid questionnaire information was entered into SPSS 22.0 for statistical analysis. First, the Cronbach’s alpha coefficient was used to test the reliability of the questionnaire, and Spearman's rho correlation analysis was used to test the content validity of the place attachment scale and the correlation between sound source perception and place attachment.

RESULTS

Characteristics of the Sample Population

A total of 160 out-of-town tourists and 35 residents were surveyed, both meeting statistical standards. The difference in numbers between the two groups may be attributed to the efforts to protect the island's landscape resources while promoting tourism, leading to a relatively low number of permanent residents on the island compared to the much larger number of tourists. Additionally, the sample population had a relatively even gender distribution and consisted mainly of young individuals with higher education, with over half of the respondents under the age of 30 and having a college or junior college degree. Retired individuals represented the smallest group among the respondents, with students and employees of various organizations and enterprises comprising the majority (Figure 2).

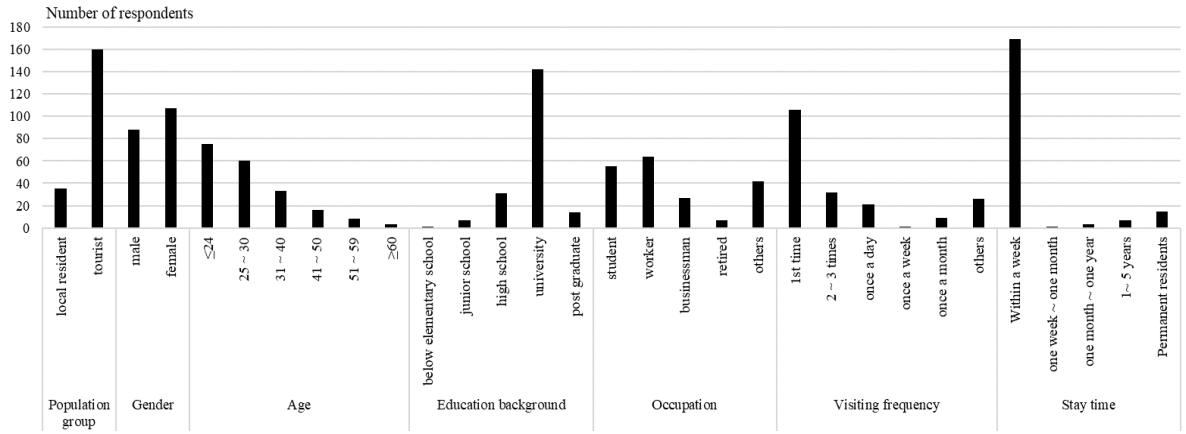

Figure 2 Sample information statistics of respondents

Testing the Reliability and Validity of the Questionnaire

The raw data obtained from the questionnaire survey was subjected to reliability and validity tests using SPSS 22.0. The reliability test involved repeated measurement of the original data, and the obtained results were analyzed for consistency. The Cronbach Alpha analysis revealed that the questionnaire had good reliability, with an overall Cronbach's alpha of 0.848.

Moreover, Cronbach's alpha values for place attachment, PI, and PD were 0.870, 0.817, and 0.768, respectively, all of which were above the acceptable threshold of 0.7. These results indicate that the scale design of the place attachment, PI, and PD sections in the questionnaire was reliable and consistent.

The validity test aimed to verify whether the items in the scale accurately reflected the object being measured. Content validity was assessed by examining the correlation between the average score of each item and the total score, with a significant correlation indicating good content validity. In this study, the validity of PI and PD were tested separately. Table 4 shows that the average score of all descriptions had a significant correlation with the total score in both dimensions, with correlation coefficients exceeding 0.65. These results suggest that the evaluation of questions PI-1 to PI-4 and PD-1 to PD-4 effectively reflected the degree of PI and PD, respectively. Therefore, the questionnaire was deemed to have good content validity.

Table 4 Validity test of two dimensions of place attachment

Dimensions	Description	Correlation coefficient
Place Identity (PI)	PI-1: I'm part of Kulangsu	0.721**
	PI-2: Kulangsu is a very special place	0.763**
	PI-3: I am full of nostalgia for Kulangsu	0.830**
	PI-4: Visiting experience in Kulangsu means a lot to me	0.816**

Place (PD)	Dependence	PD-1: I tend to go to similar scenic areas for visiting in the future	0.741**
		PD-2: I like the natural landscape of Kulangsu	0.689**
		PD-3: The experience at Kulangsu is unique	0.785**
		PD-4: Compared to other scenic areas, I prefer Kulangsu	0.816**

Soundscape Characteristic

As shown in Figure 3, the evaluation trend of POS went in line with that of PLS in all typical sound sources, which indicated that high perception frequency was often accompanied by a larger perception intensity, they were closely related. Corresponding to many previous researches[24, 31-33], interviewees preferred natural sounds most, of which waves were related to the highest mean value both in POS (3.28) and PLS (3.21), followed by the sound of birds and leaves rustling, which are greatly related to the seaside characteristics of Kulangsu Island. At the same time, the preference of mechanical sound was the lowest, which was consistent with their perceive frequency and loudness. The mean value of artificial sound was generally higher than natural sound, and mechanical sound was related to the lowest evaluation value both in POS and PLS. Some artificial sounds like yelling and surrounding speech could be over perceived when compared to their preference degree, while the status of folk sound and playing music was opposite.

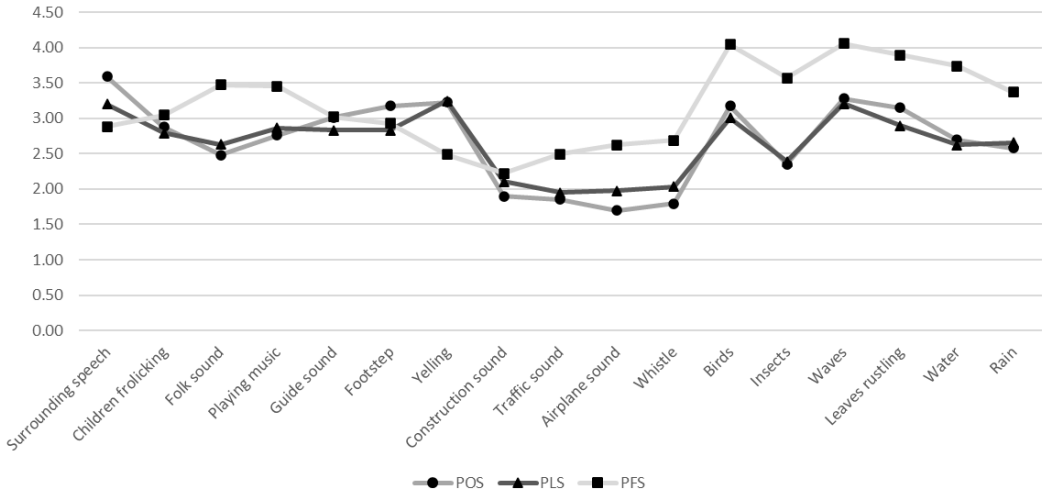

Figure 3. Mean values of the individual sound perception indicators

Characteristics of Place Attachment

As table 5 shown, respondents had a higher degree of attachment to Kulangsu Island (M = 3.79), and the mean value of place identity dimension (M=3.70) was lower than the place dependence dimension (=3.89). It can be seen that people's functional connection on Kulangsu Island was greater than their emotional attachment, and the place attachment was more derived from the well function setting in Kulangsu [1].

In the dimension of place identity, A2 (I feel that Kulangsu is a special place) had the highest average evaluation value (M=4.22), and was the only option that was higher than the average value of place attachment. It showed that Kulangsu Island was highly recognized in the shaping of emotional characteristics. The value of A1 (I'm part of Kulangsu) was the lowest (M = 3.28), probably because most of the respondents were tourists.

In the dimension of place dependency, the average value of all options was higher than 3.50, which showed that facilities in Kulangsu can lead to better connection between users and place.[22]. B2 (I like the natural landscape of Kulangsu) was related to the highest average value (M = 4.33), followed by B3 (the experience at Kulangsu is unique), and B4 (compared to other scenic areas, I prefers Kulangsu) was the option with the lowest mean value (M = 3.60). It can be inferred that the visiting experience in Kulangsu Island is special, especially natural scenery contributes much to its charm.

Correlation Between Soundscape and Place Attachment

To understand how different types of sounds impacted residents' and visitors' attachment to a particular site. We identified the correlation between perception of sound source and place attachment by conducting Spearman's rho correlation analysis. As shown in Table 5, the perception of many sound sources significantly affected the connection between people and the place, but the types of sound sources involved varied between residents and visitors. For residents, the evaluation of place attachment was significantly correlated with the perception and preference of natural sounds, the sound of leaves rustling, rain, and birds could positively influence the ratings of place attachment, encompassing both dimensions of place attachment. Among tourists, the perceived frequency and preference of artificial and mechanical sounds, such as guide sound and playing music, significantly influenced their place attachment ratings. Interestingly, preference for traffic sounds also significantly increased visitors' attachment, while the perceived intensity of construction sounds led to a significant negative effect on visitors' attachment. Across all sound sources, preference for playing music was significantly and positively related to both residents' and visitors' ratings of place attachment.

Table 5. The correlation between soundscape perception and place attachment among residents and visitors

		Resident			Tourists		
Sound Category		PI	PD	Place Attachment	PI	PD	Place Attachment
Artificial sound	POS		Footstep (0.458**)	Footstep (0.430**)	Guide sound (0.212**); Yelling (0.181*)	Surrounding speech (-0.156*)	
	PLS						
	PFS	Playing music (0.390*)	Playing music (0.562**)	Playing music (0.545**)	Playing music (0.163*); Guide sound (0.216**)	Playing music (0.169*); Guide sound (0.164**)	Playing music (0.184*); Guide sound (0.208**)
Mechanical sound	POS	Airplane sound (0.406*); Whistle (0.368*)		Airplane sound (0.388*)			
	PLS				Construction sound (-0.162*)	Construction sound (-0.162*)	Construction sound (-0.174*)
	PFS				Traffic sound (0.206**)	Traffic sound (0.195**)	Traffic sound (0.222**)
Natural sound	POS	Leaves rustling (0.557**); Rain (0.587**)	Birds (0.432**); Waves (0.482**); Leaves rustling (0.622**); Rain (0.529**)	Waves (0.437**); Leaves rustling (0.656**); Rain (0.612**)	Water (0.205**)		Waves (0.160*); Water (0.191**)
	PLS	Leaves rustling (0.443**); Rain (0.557**)	Birds (0.519**); Leaves rustling (0.493**); Rain	Leaves rustling (0.534**); Rain (0.557**)			

		(0.435**)		
PFS	Waves (0.352**)	Birds (0.431**); Leaves rustling (0.386**)	Birds (0.355**); Waves (0.360**); Leaves rustling (0.403**)	Water (0.155**)

∗ P<0.05; ** P<0.01

DISCUSSION

In past studies, soundscape perception has been shown to significantly influence the atmosphere, the visual landscape, preference for the urban places [14, 34]. This research further confirms the significant role of soundscape perception in facilitating the connection between people and place, that is the significant correlation between sound sources and place attachment exists both in residents and visitors. In the meantime, specific sound sources that were significantly associated with place attachment and significant differences between resident and visitor groups were further identified. Length of stay is the most associated sociological factor with soundscape perception, with a significant increase in preference and perception of music and bird sound [14, 35]. Correspondingly, this study found there were more sound sources showed significant effects on place attachment of residents than tourists. It can be seen that the effect of soundscape on place attachment becomes more pronounced with longer stay time, although longer stay time could decrease the sensitivity of soundscape [36]. In the meantime, the results showed place attachment of residents and tourists could be characterized by natural sounds and artificial sounds (including mechanical sound) respectively. This difference may originate from the different motivations and activities of residents and visitors, which result in different expectations and preferences for place. Specifically, tourists with visiting motivations may be more likely to enjoy and expect the excited soundscape linked with activity and attractions, such as guide sound and yelling. Residents may be more familiar with the natural environment and expect peaceful acoustic environment, which explain the strong connections between residents' attachment and natural sounds.

Natural sounds are well recognized as the most preferred sound sources around various environmental contexts, and have been further proven to significantly improve the healing utility, soundscape quality, and visual landscape evaluation [19, 37-39]. The present study found a significant positive effect of natural sound sources in enhancing place attachment, especially for local residents. Namely, increasing perception and preference of natural sound sources including birds, Leaves rustling, waves, and rain could significantly enhance the place attachment of residents. In the other hand, sounds generated by human activities can promote psychological stability [40]. The findings proved the effects of artificial sounds on psychological connections to place of visitors. The level of place attachment and willingness to revisit of visitors can be enhanced by increasing the recreational characteristics of place [41]. It could be the explanation for that higher preference for music and guide sound in artificial sounds could lead to a significant increase in visitors' place attachment. Mechanical sounds also significantly affected the place attachment of visitors. The preference for the sound of traffic showed a significant positive impact on the formation of place attachment in tourists, as private motor vehicles are banned on the island and the sound of tour bus horns is replaced by the sound of music.

CONCLUSION

Soundscapes are regard to exist as a result of human perception and are inextricably linked to the environment and the site [42, 43]. To better understand the significant role of soundscape in shaping human perceptions and connections to place, this study chose Kulangsu Island as the field object to explore the correlation between soundscape perception and place attachment, and further analyzed the difference between residents and tourists. The

following conclusions were obtained.

(1) Soundscape in Kulangsu is rich, but the current perception of artificial sound should be adjusted. This study found that people's preference on natural sound and mechanical sound was in line with their perceived frequency and intensity. The related trend of artificial sound was opposite, of which the perception of folk sound and playing music should be improved, and the perception of Surrounding speech should be controlled.

(2) Place attachment in Kulangsu was generally strong, and place dependence was stronger than place identity. According to the overall evaluation of the interviewees, there was strong attachment between individual and the island. It was proved that the dependence on facilities was deeper than emotional identity, both among local residents and tourists. In local residents, the degree of place identity and place dependence was almost equal, but tourists obviously had a stronger sense of identification with facilities.

(3) The shaping of place attachment of local residents was mainly related to the perception of vehicle sounds and geographical sounds. Specifically, in the sample of local residents, compared with artificial sound and mechanical sound, the establishment of emotional identity and functional dependence between people and Kulangsu Island had a significant positive correlation with the perception of natural sound, including the sound of leaves rustling, rain and waves.

(4) The shaping of the place attachment of tourists had a significant correlation with environmental noise and artificial sound attached to visiting. Compared with local residents, the correlation between sound source perception and place attachment in the tourist group was more reflected in PFS. That was tourists showed different levels of attachment to the place for individual differences in PFS of playing music, guide sound and traffic sound. In addition, along with the changes in POS and PLS of guide sound, yelling and construction sound respectively, tourists' assessment of emotional identity and facility dependence can also change significantly.

The establishment of place attachment is the result of the combined action of multiple factors, and the rich information contained in soundscape is undoubtedly an important part of it. Incorporating soundscape into the related research system of place attachment can broaden the soundscape and place attachment research scope and provide new ideas for them. Due to the limitation of conditions, the amount of sample data collected in this study is small and has certain limitations. The follow-up study considers the comparative study of multiple case areas, and strives to provide more general conclusions for future related research.

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