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The relationship between perception of soundscape and visitor experience of the Great Wall Badaling Section

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ABSTRACT

It is important to preserve the soundscape and landscape of UNESCO World Cultural Heritage Sites, where the vision and auditory acquisition of information plays a major role in human perception. The Great Wall Badaling section, a World Cultural Heritage Site, was selected for this study. A field questionnaire survey with 107 respondents was carried out, aiming to examine the acoustical characteristics of the Great Wall and the relationship between the perception of soundscape and the public visiting experience, measured by the degree of soundscape tranquility (STD), the degree of landscape aesthetic (LAD), and the degree of visiting satisfaction (VSD). The results indicated that: STD showed significantly negative relationship with the perceived frequency, loudness and dominance of surrounding speech. LAD was significantly positively associated with perceived occurrences, loudness, dominance and harmonious of music sounds. And VSD was significantly positively correlated with the perceived frequency and harmony of music and broadcasting sounds.

Keywords: Soundscape, Visiting experience, The Great Wall

1. INTRODUCTION

World cultural heritage sites have great value and significance in cultural, educational, scientific and artistic aspects, so their protection is of the utmost importance(1). The environment of a World Heritage Site is complex and multifaceted, and require protection through a multidisciplinary protection approach(2).

However, current World Heritage sites face high tourism pressure, rapid urbanization and the resulting growth and transformation of global cities(3). Historic heritage conservation challenges have increased dramatically. For the visual aspect of a World Heritage Site, the value and significance of the site is threatened due to the loss of visual integrity on the List of World Heritage in Danger(4). On the other hand, the rapid development of tourism has introduced various anthropogenic sounds, such as a large number of tourists, loudspeakers and traffic sound, which affect the experience of tourists and reduce the cultural value of the soundscape(5, 6).

Travel experiences are complex and include visual, gustatory, tactile and sound elements(7). Visitors' assessments of a place can be improved if soundscape and landscape are in harmony(8). Among them, the soundscape is not only an inseparable part of the landscape, but also an important supporting part to improve the tourist satisfaction of tourists and cultivate the local characteristics of residents(9, 10). Consequently, research into the protection of soundscapes at sites of world cultural heritage is of great importance.

At the same time, the environment of the Badaling Great Wall faces natural degradation and is affected by tourism(11). This study offers theoretical references for soundscape and landscape

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protection at the Great Wall Badaling Section by exploring how soundscape perception interacts with public visiting experiences of the Great Wall.

2. METHODOLOGY

2.1 Study Area

The Great Wall is the most representative and largest extant cultural heritage in China, and it is also the symbol of the Chinese spirit(11). In Chinese history, Badaling is considered the most important part of the Great Wall, which lies in mountainous regions northwest of Beijing City (116°65' E longitude, 40°25' N latitude). In 1987, the World Heritage Committee included the Great Wall on the World Heritage List (12). We selected the scenic opening area for investigation (Fig. 1).

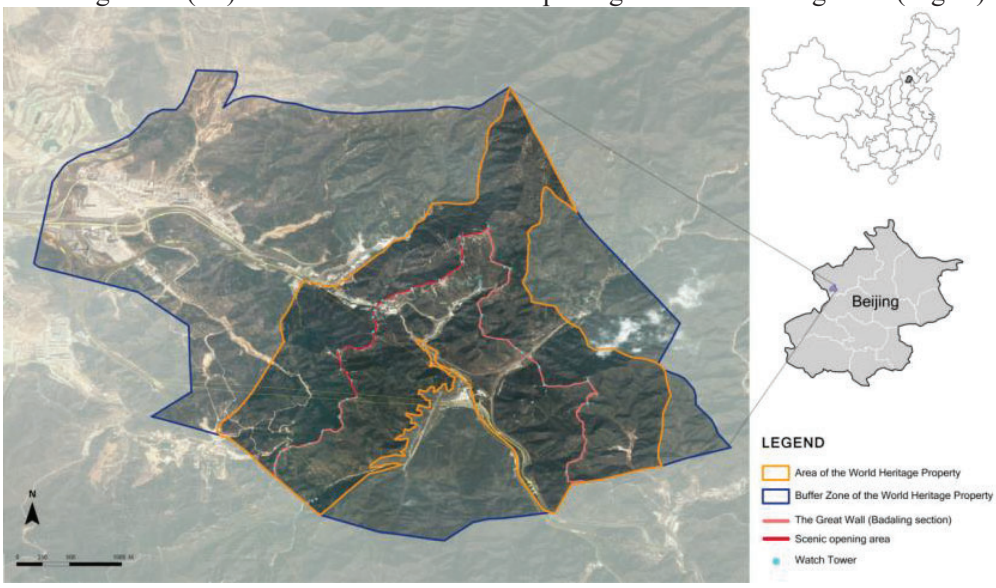

Figure 1 – Location of the Great Wall Badaling Section

Before a formal investigation could be conducted, a pilot study was conducted to assess the current state of soundscapes in the Great Wall Badaling Section. According to Table 1, 15 different kinds of sounds were recognized by participants (subjective perceptual frequency greater than 50%), which served as the basis of the following questionnaire survey. A total of 107 valid questionnaires were collected over six days in January, 2022.

Table 1 –the Great Wall Sound types

Sound type	Code	Sound type	Code	Sound type	Code
Cable car sound	CC	Gasps	GP	Singing	SI
Traffic sound	TS	Hawking	HW	Playing children	PC
Construction sound	CS	Footsteps	FS	Bird song	BS
Music	MS	surrounding speech	SS	Wind blowing	WB
Broadcasting	BR	Laughter	LA	Tree rustling	TR

2.2 Questionnaire Design

2.2.1 Participant Information

In the first part of the questionnaire, participants were asked for demographic and behavioral characteristics, such as their gender, age, education, occupation and frequency of visits.

2.2.2 Indicators of soundscape perception

Participants assessed the 15 sounds identified in the pilot study based on their previous Great Wall experience, and performed a perceptual evaluation of the sound, namely the perceived occurrences of the sound(POS), Perceived loudness of the sound (PLS), and preference of the sound (PRE), all using a 5-point Likert scale(13, 14). In the function: An audible sound's dominant position depends

on how loud it is perceived and how often it occurs. According to the formula: Dominant degree of sound (SDD) = POS*PLS. And the harmonious degree of sound (SHD) is determined by the perceived occurrence and preference of a sound, as shown in the formula: SHD = POS*PFS.

2.2.3 Indicators of the Visiting Experience

The visiting experience is a multifaceted process that involves a number of factors, including aesthetic and functional qualities of the landscape, as well as soundscapes(14). In order to calculate the visiting experience, we selected the following indicators: Among these degrees are soundscape tranquility (STD), landscape aesthetics (LAD) and visiting satisfaction (VSD). Using a five-point rating scale, all three indicators were evaluated (1=very bad to 5=very good).

2.3 Data Analysis

Participants were chosen randomly from the area. It was determined that 107 questionnaires were effective, including 45.8% males and 54.2 % females with normal hearing. We performed Spearman's correlation statistical analysis using SPSS 25.0.

3. RESULTS

3.1 Soundscape Perception

The figure shows a mean value for each sound perception indicator for each source in the Great Wall Badaling Section. The sound sources perceived by people in the Badaling section are mainly human activities sounds (i.e., music, broadcasting, children playing, laughter, singing, gasping, hawking, footsteps, and talking), followed by the sounds produced by facilities (i.e., the sound of cable cars, traffic and construction) and natural sounds (i.e., bird song, wind blowing and tree rustling).

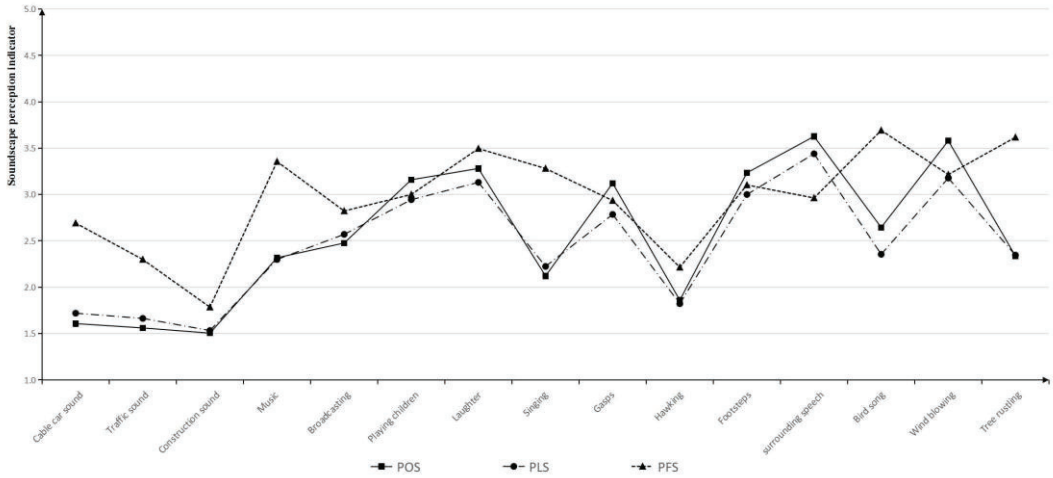

Figure 2 – Sound sources in the Badaling section of the Great Wall with average perception indicators

Most commonly perceived sound sources in POS are surrounding speech (3.63), and wind blowing (3.58). There was the highest mean value among all sounds for the PLS of the surrounding human sound (4.34), followed by laughter (3.13) and footsteps (3.00). In terms of geophysical sounds, wind blowing (3.18) was the most commonly perceived. There was no discernible loudness in any of the facility sounds, with cable car sound (1.72) getting the highest value, and construction sound (1.53), getting the lowest. In terms of PFS, the top two natural sounds with the highest values are birdsong (3.70) and tree rustling (3.62). Laughter (3.50), Music (3.36) and singing (3.28) were the most preferred human activity sounds. Sound from facilities such as construction (1.79), traffic (2.30) and the cable car (2.70) received fairly low preference values.

3.2 Relationships between perception of soundscape and visiting experience

In Table 2, individual sound perception indicators are correlated with soundscape tranquility degrees (STD). POS of surrounding speech and playing children sound showed negative relationships with STD. PLS showed that footsteps, surrounding speech, children playing and laughter were negatively related to tranquility. In terms of PFS, only the sound related to human activities, specifically speech and laughter, were associated with tranquility. SDD presented similar results as PLS. In the scenic area, the frequency and loudness of children's play sounds can be appropriately

reduced, the perceived frequency and dominance of speaking sounds, and the dominance of footsteps can be reduced, which can create a quiet acoustic environment in the scenic area.

Soundscape aesthetic degree (LAD) is analyzed using Correlation analysis based on Spearman's rho to determine the relationships between individual sound perception indicators (Table 2). There were significant relationships between POS and LAD in music and broadcasting. Only the PLS of music showed a positive effect on LAD. However, PLS of footsteps and playing children sound showed negative relationships with LAD. As for PFS, laughter and singing demonstrated positive relationships. Playing children and music were the only significant negative and positive relationships with LAD observed for SDD. A significant and positive relationship was found between SHD of three different types of sound, including laughter, music, and broadcast. Therefore, in order to improve the aesthetics of the scenic spot, it is possible to reduce the dominance of children's playing sounds by increasing the frequency, loudness, and harmony of the musical sound in the scenic spot, as well as the perceived frequency of the broadcast sound.

A correlation analysis using Spearman's rho shows that sound perception indicators and visiting satisfaction degree (VSD) are correlated (Table 2). The degree of visitor satisfaction was positively correlated with music and broadcasting at POS. According to PLS, too much footsteps impacted the visitor experience negatively. Three SDD indicators, including footsteps (-0.218), surrounding speech(-0.191), and playing children(-0.229), showed statistically negative correlations with VSD. In order to improve people's satisfaction with the visit, it is necessary to appropriately increase the frequency and harmony of music sound, and appropriately increase the frequency, dominance and harmony of broadcast sound.

Table 2 –The relationships between perceptions of typical sound sources and visiting experience indicators

Indicator	POS	PLS	PRE	SDD	SHD
STD	SS (-.303**)	FS (-.254**)	SS (.229*)	FS (-.240*)	-
	PC (-.231*)	SS (-.285**)	LA (.220*)	SS (-.314**)	
		PC (-.274**)		PC (-.304**)	
		LA (-.194*)			
LAD	MS (.277**)	FS (-.210*)	LA (.340**)	PC (-.205*)	LA (.244*)
	BR (.219*)	PC (-.201*)	SI (.202*)	MS (.261**)	MS (.273**)
		MS (.204*)			BR (.230*)
VSD	MS (.237*)	FS (-.235*)	FS (.195*)	FS (-.218*)	MS (.195*)
	BR (.287**)		LA (.256**)	SS (-0.191*)	BR (.291**)
				PC (-.229*)	
				BR (.238*)	

* ($p < 0.05$), ** ($p < 0.01$)

4. CONCLUSIONS

A study involving the Badaling section was conducted in order to determine the acoustical characteristics of the Great Wall and the relationship between the soundscape perception and the public visiting experience. To summarize, STD is more prone to being affected by POS, PLS, and SDD of surrounding speech, so controlling sound volume and frequency will be vital to maintaining tranquility. LAD was significantly positively associated with perceived occurrences, loudness, dominance and harmonious of music sounds. And VSD was significantly positively correlated with the perceived frequency and harmony of music and broadcasting sounds. The results show that the Badaling Section should control a certain crowd density and appropriately increase the occurrences and loudness of music sounds to obtain a better soundscape experience. The findings suggest that rational control of human-related sounds is critical to the soundscape and landscape experience, and has important implications for the Great Wall landscape and soundscape management.

Nonetheless, due to the large size and wide distribution of the World Heritage site, the Great Wall is distributed in many provinces and cities in China. Therefore, the Great Wall in each region has

different landscape and functional characteristics. In the future, different parts of the Great Wall should be compared.

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