



Comparisons of Soundscape at Inland and Coastal Public Spaces in Northeast China

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ABSTRACT

There are similarities and differences between open public space soundscape evaluation in different countries, mainly due to the influence of cultural background. This paper compares inland and coastal soundscape of urban public open spaces in China. Six typical squares were selected. A series of questionnaire surveys within the soundscape framework were carried out during summer season, and gathered data were analysed. The result shows that the relationships between SPL and satisfaction are different at inland and coastal places. Importance of quietness is associated with education. Natural sound and children have mainly positive correlations to sound satisfaction especially at coastal place.

1. INTRODUCTION

Soundscape and sound satisfaction are important parts of the overall physical environmental satisfaction [1]. The study of urban soundscape, as well as of urban public open spaces has been very extensive [2-3]. Throughout the soundscape research of public open spaces with different functions and in different regions, the soundscape framework has been gradually established, in terms of sound, space, people and environment. The soundscape paradigm recognizes the environmental, social, and cultural significances and importance for a given places [4]. The evaluation of how sound influence people depends primarily on subjective response, rather than merely based on objective parameters [5]. The effect of demographic and social factors on sound evaluation and perception in urban public open spaces have been studied as well [6].

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However, the integral studies of soundscape for coastal places are still limited. Moreover, the comparisons between inland and coastal spaces have not been carried out systematically within the soundscape framework, which include contexts of environment indicators, social/demographical factors and sound sources. The aim of this paper is to focus on comparison between two types of inland and coastal places. More specifically, comparisons of general satisfaction, effect of social/demographical factors on quietness importance, and effect of people characteristics and sound sources on soundscape perception have been done. Three public open squares for inland spaces and three coastal places were selected for comparison. Questionnaire surveys have been used to study the subjective evaluations.

2. METHOD

2.1. Sites

Two cities and six urban public open spaces in total were chosen in northern China. Three inland squares were selected in Harbin, namely Gexin Square, Sidalin Park, and Zhaolin Park; three coastal squares in Huludao, namely Longwan seaside, Dongdaihe Seaside, and Xingcheng Seaside. Those are all well-known sites. They have different spatial shapes and are typical multi-functional urban open public spaces, including activities such as tourism, relaxation, recreation, resident, culture, commerce, and sport. The squares are all conveniently located and rich in sound sources, such as natural sounds, human sounds, electronic sounds and mechanical sounds.

2.2. Questionnaire Survey

The comparative study was conducted through an on-site questionnaire survey during the summer period. The respondents were asked about their gender, age, education level, living place, visit frequency and visit purpose. A database was established with demographic / social information, including gender (male and female), age (groups 18-24, 25-34, 35-44, 45-54 and 55-64), education level (primary, middle, undergraduate and postgraduate), living place (local and non-local), visit frequency (first time, rarely, sometimes, often and very often) and visit purpose (travel, leisure, passing by, working and other).

To examine the evaluations on sound environment satisfaction, linear scales were generally employed in the questionnaire. A five-point scale was used for sound satisfaction, from -2 (very dissatisfied), to 2 (very satisfied). Additionally, the differences of quietness importance were also examined. Five-point linear scale has been used for it, namely from -2 (not very important), to 2 (very important). To examine the relationship and differences between perceived sound and satisfaction evaluation, the respondents were also asked to describe the noticed sounds they heard in public open spaces during the interview period. The sound sources were listed depending on each of the case study sites, including natural sounds (water, wind and animals), human sounds (talking, walking, selling and children), electronic sounds (broadcast, music and phone), and mechanical sounds (traffic, horn sound and mechanical source). A five-point linear scale has been used, namely: 1, do not hear at all; 2, a little; 3, moderately; 4, a lot and 5, dominates completely.

2.3. Data Analysis

The software SPSS 18.0 was used to calculate statistical parameters based on the collected data of questionnaire surveys. Main statistical methods used in this study include Spearman's rho correlation analysis for detecting the relationship among soundscape evaluation and social factors, as well as sound sources.

3. RESULTS

3.1. General Sound Environment and Satisfaction

Average sound pressure level and sound satisfaction of inland and coastal public spaces for Northeast China is shown in Figure 1. The overall trend is that when the sound pressure level is greater than 50dBA, sound satisfaction decreases with the increase of sound pressure level. However, with similar range of sound pressure levels, the sound satisfaction is different. The sound pressure levels of inland places are between 50-60 dBA, and scores of sound satisfaction are between 2.7 and 3.2. Meanwhile, the scores of sound satisfaction of coastal places are between 3.3 and 3.6. It is illustrated that between 50-60 dBA, the sound satisfaction of coastal places is better than that of inland places. The result is consistent with another research [7], which examined the relationship between people’s visit motivation and soundscape experiences in terms of the perceived occurrences in Germany.

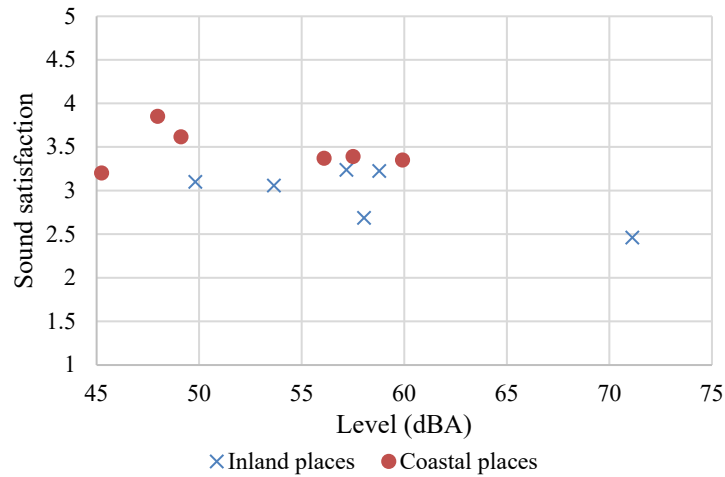


Figure 1: Average sound pressure levels and satisfaction of six places of inland and coastal places

Relationships between sound and overall environment satisfaction were analyzed as shown in Table 1. For inland open public spaces, the correlation coefficients of relationships between sound and overall satisfaction are from 0.49 to 0.57, which are very close. For coastal open public spaces, the correlation coefficient is 0.384 for Longwan seaside, which is lower than that of 0.678 for Xingcheng seaside. It is illustrated that acoustic environment is positively correlated with overall environmental satisfaction for inland and coastal places in northern China, except Dongdaihe seaside.

Table 1: Spearman’s rho correlations between sound and overall environment satisfaction in inland and coastal public open spaces

Open public spaces		Correlation coefficients	Sig.
Inland spaces	Gexin Square	0.494	0.000**
	Sidalin Park	0.545	0.000**
	Zhaolin Park	0.568	0.000**
Coastal spaces	Longwan seaside	0.384	0.000**
	Dongdaihe seaside	0.260	0.105
	Xingcheng seaside	0.678	0.000**

3.2. Importance of Quietness

Evaluations on importance of quietness from respondents for inland and coastal spaces were

analysed. The average scores of evaluations are 3.69, 3.86, and 4.03 of Gexin Square, Sidalin Park and Zhaolin Park respectively for inland spaces. Meanwhile, the average scores of evaluations are 3.71, 3.88, and 3.87 of Longwan seaside, Dongdaihe and Xingcheng seaside respectively for coastal spaces. Significance of importance of quietness are analysed. It is illustrated that there is significance of quietness importance for inland spaces, and no significance for coastal spaces.

Relationships between quietness importance and demographic / social factors were analysed as shown in Table 2. For most places, level of education is positively correlated with quietness importance ($p < 0.05$), except in the public space of Xingcheng seaside. For visit duration, it is negatively correlated with quiet importance in Gexin square, however, it is positively correlated with quiet importance in Zhaolin Park. It is mainly because that respondents felt loud when they just entered the Gexin square, as high sound pressure level. As the stay time increases, they mainly gradually adapted to the sound environment and joined in some activities on the square, like square dancing. In Zhaolin park, most respondents were walking or sitting, and they felt comfortable and quietness importance with the relatively quiet environment in the green place in an urban park.

Table 2: Spearman's rho correlations between quietness importance and demographic / social factors

Public spaces		Age	Gender	Education	Visit duration	Visit frequency	Visit purpose	Living place
Gexin Square	Cor	-0.129	-0.056	0.430**	-0.213*	0.279**	0.151	0.061
	Sig.	0.211	0.619	0.000	0.036	0.006	0.164	0.618
Sidalin Park	Cor	-0.065	0.018	0.231*	-0.05	0.165	0.011	0.007
	Sig.	0.495	0.867	0.023	0.602	0.091	0.909	0.952
Zhaolin Park	Cor	-0.033	-0.187	0.248*	0.230*	0.069	-0.268*	-0.115
	Sig.	0.738	0.088	0.017	0.02	0.492	0.01	0.361
Longwan seaside	Cor	0.152*	-0.001	0.207**	0.034	0.125	-0.113	0.187*
	Sig.	0.014	0.989	0.002	0.621	0.057	0.088	0.019
Dongdaihe seaside	Cor	0.138	0.218	0.337*	-0.084	0.056	-0.121	-0.016
	Sig.	0.317	0.149	0.022	0.557	0.691	0.393	0.923
Xingcheng seaside	Cor	0.13	0.021	0.159	-0.036	0.012	-0.135	0.07
	Sig.	0.169	0.84	0.109	0.718	0.901	0.172	0.56

3.3. Effect of Sound Sources

Relationships between sound sources and sound faction were analysed as shown in Table 3. For inland spaces, sounds from water, animals and walking all positively relate with sound satisfaction ($p < 0.05$). For coastal spaces, sounds from water and wind as natural sounds positively relate with sound satisfaction ($p < 0.05$). Especially, sounds from children are positively related with satisfaction ($p < 0.01$) for coastal places. The result is consistent with other research [8], which indicated that natural sounds were related to positive perception of the urban soundscape. It is interesting to find that music has negative correlation mainly because of square dance both in inland spaces and coastal spaces, which is a special activity in China.

Table 3: Spearman's rho correlations of sound source and sound satisfaction

Public spaces	Water	Wind	Animals	Walking	Children	Music
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Inland spaces	Cor	0.153*	0.13	0.251**	0.146*	0.02	-0.151*
	Sig.	0.031	0.061	0	0.036	0.774	0.03
Coastal spaces	Cor	0.124*	0.127*	0.07	-0.081	0.175**	-0.165**
	Sig.	0.034	0.03	0.23	0.167	0.003	0.005

4. CONCLUSIONS

In the comparison of sound environment satisfaction for the inland and coastal open public spaces, it is interesting to find that the satisfaction evaluation of the coastal open space is better than that of the inland evaluation based on the similar sound pressure level. This may be due to the different purposes of visiting, as travelling or playing with families and friends in coastal places, and physical activities as walking or sitting in inland spaces, which makes the subjective evaluation of the interviewee's sound environment different.

Education level is positively correlated with evaluations on quietness importance at most places. It is illustrated that the higher the education level, the higher the need for the importance of quietness. Construction of quiet spaces is very important and has to be taken into account when designing urban open public spaces, especially for people with higher education level, such as leisure spaces in university campus. Additionally, it is also necessary to create some quiet spaces for lighter physical activities in urban parks.

In terms of sound sources for open public spaces in China, the main factors associated with sound environment satisfaction are natural and children sounds which are considered positive and should be used appropriately when designing soundscapes at coastal places, while music has to be controlled as it negatively relates to satisfaction.

5. ACKNOWLEDGEMENTS

This research was funded by Natural Science Foundation of China, grant number 51778169, Heilongjiang Province Postdoctoral Science Foundation in China, grant number LBH-Z17078, Heilongjiang Province Philosophy and Social Science Project, grant number 18SHC229, and Intergovernmental Science and Technology Cooperation Project, grant number 7-19.

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