Research on Urban Soundscape Elements and Urban Design

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Abstract. From the perspective of urban design, this paper investigates and records the soundscape in city blocks in the use of literature research, acoustic measurement, sound recording, soundscape walk, in-depth interview and other research methods. Based on data analysis, we use "place" concept and spatial analysis method for urban design, put forward to use "soundscape field" to refer to the field domain with integration of sound, sound object and sound environment over a period of time. We also propose to identify sound, sound object, sound environment and sound sustaining time as four elements of urban soundscape, and discuss the relationship among them.

Introduction

A Soundscape is an interdisciplinary science involving in acoustics, architecture, art, ecology, psychology, sociology, geography etc. With the deepening of research on soundscape of city noise, public space and soundscape ecology, it is recognized that soundscape is a resource that is proposed to improve the urban landscape by soundscape, and suggested taking the features of psychoacoustic aspects, as well as social, historic and cultural significance [1].

Urban design has the greatest influence on characteristics of city and urban life. It has many similarities with soundscape, for example, urban design focuses on entirety, soundscape also pays attention to integrity[2], urban design relates to the cultural connotation of the city, and the soundscape is also involved in the perception of local culture, urban design combines characteristics of engineering science and human and social science, the soundscape is also across the characteristics of architectural physical acoustics and social environment acoustics, urban design puts emphasis on people's experience and significance in the city, and the soundscape is also concerned with sound recognition in the environment of different historical periods, as well as image of soundscape[3].

Methodology

Urban Soundscape and Urban Design. When the soundscape design requires to understand the relationship between listeners and environment, and involves in people's psychology and behavior, sound pressure level and spectral indicator and other physical properties will be no longer the main indicators for reference, the designer should pay more attention to the environmental attribute and time property of soundscape from the perspective of urban design, then the soundscape design can be well integrated with urban design [4].

To Put forward the Definition of "Soundscape Field". In urban design, the concept of "place" often appears, first of all, it is the overall environment, second, it contains space and characteristics as the embodiment of space, every "place" is unique and presents the characteristics of surrounding environment [5].

We put forward the definition of "soundscape field" to improve the record and representation of city soundscape, and it refers to a field with a combination of sound, sound object or people and sound environment within a period of time in the city. The four elements of "soundscape field" includes sound, sound object (or person), environment and time which constitute a tetrahedron as shown in the elements of "soundscape field" in Fig.1, and each face has connection with the other three elements, there is a unique "soundscape field" in a particular time period, the sound, sound object and architectural environment in the adjacent space have approximation, the length of time also affects the field. The relationship between time, space and sound object (or person), the relationship between sound, sound object (or person) and time, as well as the relationship between sound, sound object (or

person) and environment should be considered in each "soundscape field", the "field" of these soundscapes are distributed in space and time and appear as array as shown in the array of "soundscape field" in Fig.2. Obviously, not every "field" has effect on the landscape design, so we should first identify those meaningful ones. It is helpful to perfect our expression and analysis of regional soundscape through recording and parsing urban soundscape with "field".
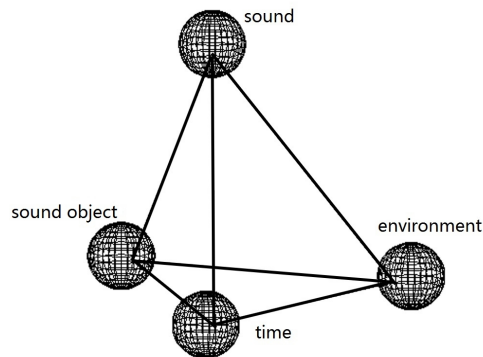
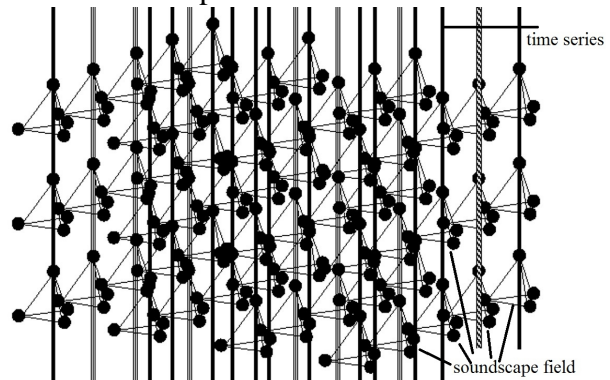Fig.1 Elements of "soundscape field"   Fig.2 The array of "soundscape field"

The Analysis on Relationship between "Soundscape Field" Elements. From the perspective of design, a "soundscape field" must have a combination of sound, sound object (or person), environment and time. To understand a meaningful "soundscape field", the relation between sound and sound object, the relation between sound and environment, and the relation between sound and time will be stated as follows.

(1) The relation between sound and sound object (or person). Here both sound and sound object must be required at the same space, the situation of "singing in the distance" is excluded because there is sound, but the sound object in scene is lacked, here it is limited that the visual sense and auditory sense need to work together in the "field" of soundscape.

Voice can be divided into the voice of the human activities, the voice of the nonhuman activities and traffic sound. The voice of human activities includes on-the-spot voice and the sound played by electronic devices. This division method takes both the physical property of sound and sound body into consideration, and can explain why it is not the same that the band plays at the scene of the square and their music is played in the square. For example, when we hear the sound of bell and drum in the temple, the voice is bell and drum sound, the sound object is bell and drum, the environment is the space surrounded by the temple building, time is the hour to ring, which is the way to describe "soundscape field". Referring to "the midnight clock chimed at my ship ", the voice is the bell ring, clock is the sound object, the environment is the passenger ship, but as the sound object - clock and the environment- passenger ship are not in the same space, it will not constitute a "soundscape field" that meets our definition. When we record the soundscape that "people sing and dance in the square in the morning and evening" by using "soundscape field", the sound is the voice of singing and dancing, sound object is people and stereo equipment, the environment is square, time is a certain exercise time in the morning or evening. When we record "the reading voice in elementary school", the sound is reading voice, the students are sound objects, campus is the environment, reading hour is the time; when a group of people get together to play chess (or cards) in street corner, the "soundscape field" can also be recorded as: sound is conversation and voice of chess, the sound object is people and chess, the environment is street corner, and time is from 9 o 'clock in the morning to 9 o 'clock at night.

The "soundscape field" can contain voices from multiple sources at the same time, some of which are easy to attract people's attention, it not only depends on the physical property of signal (such as speech loudness), but also associated with people around. The sound object in a "field" is not only, the "soundscape field" don't need to distinguish their voices one by one, they and their voice exist in the same "soundscape field" integrally at the same time just like the actors appearing at the same time.

We found the soundmark of a sound has positive significance in the urban design, and it is the most important element to be considered in soundscape design, sound has neither clear boundary nor fixed

marker, soundmark is different from building mark, it is not real and is impossible to be built in the short term, thus the design logic of soundscape is not a structure and more similar to an ecosystem.

(2) The relation between sound and environment. Environment characteristic mainly analyzes the related feathers between environment and sound, here the "field" not only refers to a place or scene, "soundscape field" emphasizes the logic instead of structure, and focuses on people's life style and how people adapt themselves to the environment.

The design of environment can affect people's behavior and activity mode. People will continue to change the environment due to their subjective initiative, the final result may not be the original idea [6,7], we can see the usage mode of some activities and space in the historic district is remained and some had completely disappeared while considering the continuation of time, which is the inevitable result of the urban environmental evolution. In the design of urban soundscape, sound is likely to be generated in any place with human activity in the city, so if we want to change the voice, we can change the place so as to change people's activity pattern and mode of place use, for example, to separate the talking space from singing and dancing space in the open square can change the way to use space, and then change the soundscape in the square. Also, a small pavilion can provide space for people to stop, rest and chat, when people exercise in such a space, it is possible to produce a "soundscape field".

We can easily determine what field can be and worth design through analysis on the environment characteristics, then carry out soundscape planning and design in view of the city space and people's activities, the measurement of sound pressure level can be put after environmental analysis. Some soundscape is unable to be controlled in soundscape design according to the analysis of environment characteristic, for example, the sound of peddling in the street and scrap collecting van is very characteristic, but the sound objects or people are flowing and not affected by the design, we are not sure if such soundscape can be controlled in urban design.

(3) The relation between sound and time. Time is also the element of "soundscape field", especially in the environment like historical block. The time here is distributed on the time axis, the only location should have the only corresponding time axis based on our current understanding of the space and time. Time element contains the length of time duration, different period in the day, different season and so on.

The soundscape has different performance in different space and time, the time element must be considered in a real environment rather than dramatic space. In the historical block, many voices have changed over time [8], for example, the noises of car appear, the sound of horse disappears, people's voices appear and bird's sound disappear, we feel the same in our mind in the past fair and today's commodity trading center, but the soundscape has changed. As for whether it is necessary to restore to the past soundscape, the author thinks that the current soundscape also has its own beauty, we don't have to deliberately return to the past from the point of development.

The voice of history does not only refer to the voice in the history, but also the sound with longer duration time, such soundscape has also been found in our research, the local dialect and traditional opera are considered to be the most important soundmark of soundscape in historic blocks [9].

Some voices in the same "soundscape field" is dominant in a certain period of time, the cycle of change may be one day, one season or one year, a long-term evaluation is needed for them to get the "soundscape field" in different time and provides reference for urban design. Some outdoor activities will be different affected by the season and weather, then different design scheme and matching should be made accordingly [10].

Summary

To use the "soundscape field" in the element analysis of city soundscape, we often need to first record the local voices through the mode of soundwalk to look for soundmark, and observe the environment characteristics of typical study sites at the same time. Second, observe people's response to the environmental noise, understand the relation between voice and people activities through field investigation and in-depth interview, inspect the advantages and disadvantages of voice space, and

finally sort out the voice, related sound object, environmental characteristics of the typical sites, and the time element of sound. Spatial clustering analysis and site analysis are made to different factors of soundscape. Sound environment composition and characteristics, the time information of soundscape should also be recorded in the study at the same time. This research method is also suitable for the analysis of soundscape in the park, school, scenic area and urban public space. We are able to start the urban design based on the understanding of soundscape after research on a regional soundscape, finding the local soundmark and parsing the related "soundscape field", we can increase, decrease or change the sound, sound object in the environment to changing the architectural environment of the city, transform the occurrence and time length of soundscape, change the urban soundscape, improve the acoustic environment of the city and create more livable city space.

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