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A summary of the spatial construction of soundscape in Chinese gardens

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Abstract

The Chinese garden is a landscape garden style that has evolved over three thousand years. An idealized miniature landscape was created by Chinese emperors, scholars, former government officials, and merchants to express the harmony that should exist between man and nature. As an important component of the Chinese garden, the soundscape can embody the artistic conception and design skills of garden designers. This paper aims to investigate the development and strategies of soundscape design in Chinese gardens, through a systematic review of famous soundscape attractions from the perspective of spatial construction. In total, 62 soundscape attractions met the inclusion criteria, comprising specific sound sources and receiver points. The soundscape design of Chinese gardens matured in the Qing dynasty (1636 AD-1912 AD), the last dynasty in China. The majority of included soundscape attractions are located in royal and private gardens in Northern and Southern China, whereas there are few in public and temple gardens. In terms of dominant sound sources, the natural soundscape accounts for approximately 90% of the total attractions, waterscape being the main type of natural soundscape. Although the number of artificial soundscapes is smaller, they offer a wide variety of vivid sound sources, such as the temple bell, the paddle, and Chinese traditional musical instruments.

Keywords: Chinese garden, soundscape, spatial construction, landscape

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1 Introduction

Aesthetics-based soundscape design is a unique characteristic for many Chinese classical gardens. 28% of the first collection of poetry in China, entitled *The Book of Songs (诗经)*, *770 B.C. – 476 B.C.*, is related to soundscape [1]. The first monograph on Chinese garden art, *Yuan Ye (园冶), 1631 A.D.,* also contains notes on garden soundscape construction. At the end of the last century, the concept of 'soundscape', which was proposed by Canadian composer, Schafer Murray, was introduced into China, which refers to the landscape captured by the ear. Western soundscape theory mainly studies the acoustic influence of natural and artificial sounds (sounds including a humanistic connotation), and clear design methods based on acoustic theory can be found within it, which is different from traditional research. This provides a new entry point for the study of the Chinese classical garden design.

In recent years, Chinese scholars in the field of garden soundscape have achieved several results, including the analysis of aesthetics and cultural value of the garden soundscape [2], social mechanism [3], and cultural motivations in garden soundscape with examples and classification of the concept of garden soundscape [4].

However, most current researchers try to analyse the artistic conception of the Chinese classical garden from the viewpoint of aesthetics and human nature, which results in the lack of systemic exploration of soundscape design from the perspective of spatial construction. Therefore, this article selects typical cases of soundscape design in Chinese classical gardens and aims to explore the history, classification, regional characteristics, and naming characteristics of Chinese classical gardens. To learn the ancient design wisdom, discovering their soundscape construction techniques will provide essential guidance for future soundscape practice of Chinese classical gardens.

2 Methods

2.1 The criteria of soundscape screening

All the selected soundscape attractions in Chinese gardens must have a clear sound source, propagation route, and receiver point. Moreover, the main intent of creating a soundscape can be reflected from names, couplets, plaques, and related poetry descriptions of those attractions.

2.2 The scope and procedures of literature review

Firstly, we chose the most authoritative Chinese gardening books for preliminary screening, including *The History of Chinese Classical Gardens* by Zhou Weiquan, *The History of Chinese*

Traditional Gardens by Wang Juyuan, *The Garden Art in Lingnan* by Lu Qi, *The Memorial Gardens in Xishu* by Zhao Changgeng, *The Garden Art in Bashu* by Zeng Yu, and *The Gardens in Xishu* by Chen Qibing. Then we conducted secondary literature review, supplying the information for the initial retrieval soundscape and deleting the soundscape that did not meet the screening criteria, by means of intensively reviewing all the relevant books, periodicals, dissertations, etc. on the wide topic of Chinese classical gardens, garden aesthetics, the artistic conception of gardens, and soundscape research. During the review process, we found that the following six types of soundscape should be excluded.

a. *The name of the scenic spot seems to be related to the sound, but actually it was not soundscape.*

For example, the Minghe Zhou (Boat of listening to the crane singing) of the Jianzhang Palace in the Western Han dynasty is just a kind of boat. The Songyin Mianqin (Listening to the sound of Qin while sleeping under the pine tree) in Huiyin Yuan in Suzhou, of the Ming dynasty, is only a name of a place for playing a traditional Chinese mustical instrument. The Tingfasong (The pine tree listening to the Buddhist Dharma) of the Qing dynasty in Jingming Yuan in Beijing, is an old pine tree named by Emperor Qian Long according to mythical story.

b. *The name of the scenic spot only expressed a kind of aspirations or attitudes towards life of the people*

Chang Yinge (House of longtime chanting) of Jinling Yuan, Nanjing, during the Ming and Qing dynasties expressed the master's feelings that he wanted to release. There are similar examples such as Jixiao Shanzhuang (Wuthering Heights) in Yangzhou during the Ming and Qing dynasties, the Chanye Zhai (House of listening to the cicadas chirping) in Fenggang, Wanxiang Lin, Suzhou during the late Yuan dynasty and early Ming dynasty.

c. *Too large scope of soundscape*

The Xu Shenzhi Yuan in Yangzhou, Song dynasty, is famous for its music, but at the same time its range is too big to identify clear sound source and receiver point. Similar examples include the Qinyin Yuan (Garden of listening to the Qin) and Minghe Yuan (Garden of listening to the crane singing) in Nanjing during the Ming and Qing dynasties, the Liebo lake (Lake of listening to the silk cracking) in Jingming Yuan in Yuquan Mount, Beijing, during the Ming and Qing dynasties.

d. *No clear receiver point*

The Geyun Zhong in Jingming Yuan in Yuquan Mount, Beijing, during the Ming and Qing dynasties, is famous for its bells but there is no clear receiver point.

e. *The name of the scenic spot was related to the sound, but it was mainly based on the function of the place.*

The Xiaosheng Guan (House of listening to the Xiao) in Xi Garden, Yangzhou, during the Ming and Qing dynasties, only refers to the place where the owner, Mr. Hu Xianbo, and his friends played vertical flute.

f. The scenic spots were not built by the ancients, or were just named by the descendants

The Yuyuan Quliu Shiqu (House of listening to the streaming) of the Nanyue Palace of the Xihan dynasty does not have relevant historical records and was named only after it was unearthed.

3 Results

After the systematic review as mentioned above, this study concluded a list of 62 soundscape attractions in Chinese traditional gardens (see Table 1 below) and five features of those attractions through comparison and analysis.

3.1 Time periods

More than 80% of soundscape attractions were built in the Ming and Qing dynasties from 1368 A.D. to 1912 A.D., which indicates that soundscape was valued and applied into practice gradually in gardening, contributing to the development of garden skill. Xiangdie Lang, located in Suzhou in the Warring States Period (475 B.C. to 221 B.C.), is the oldest soundscape attraction in the list, proving that the construction of soundscape in China can be traced back to 2,000 years ago.

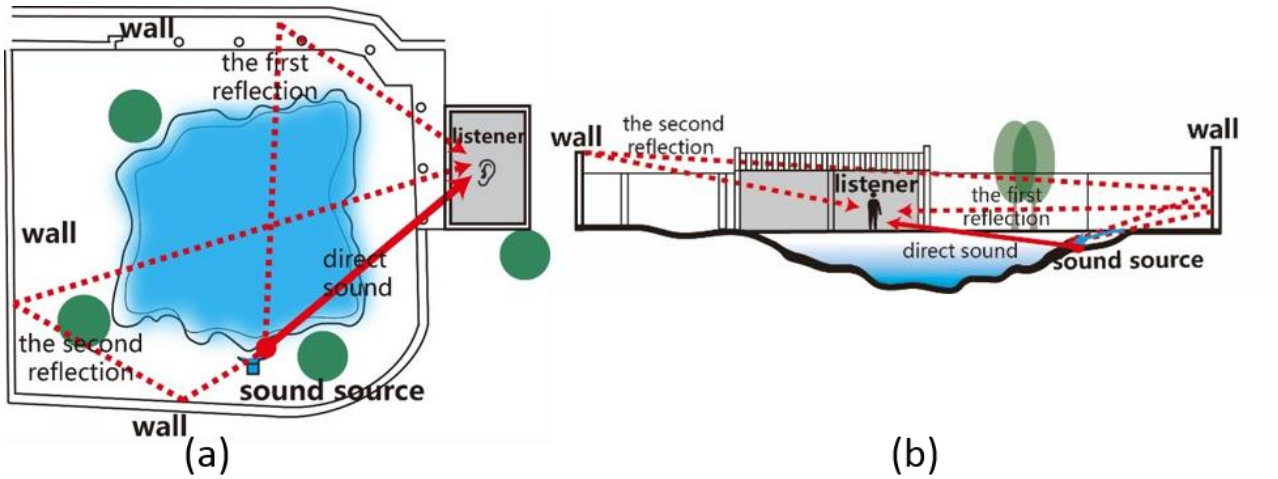
3.2 Locations

Soundscape attractions of Chinese gardens are mainly found in four districts in China: Northern China, Jiangnan (including Suzhou, Hangzhou, Yangzhou, etc.), Lingnan (South of the Five Ridges), and Bashu (including Sichuan and Chongqing). The majority of the included soundscape attractions are located in Northern China and South of the Yangtze River, which account for approximately 80% of the total attractions.

3.3 Sound sources

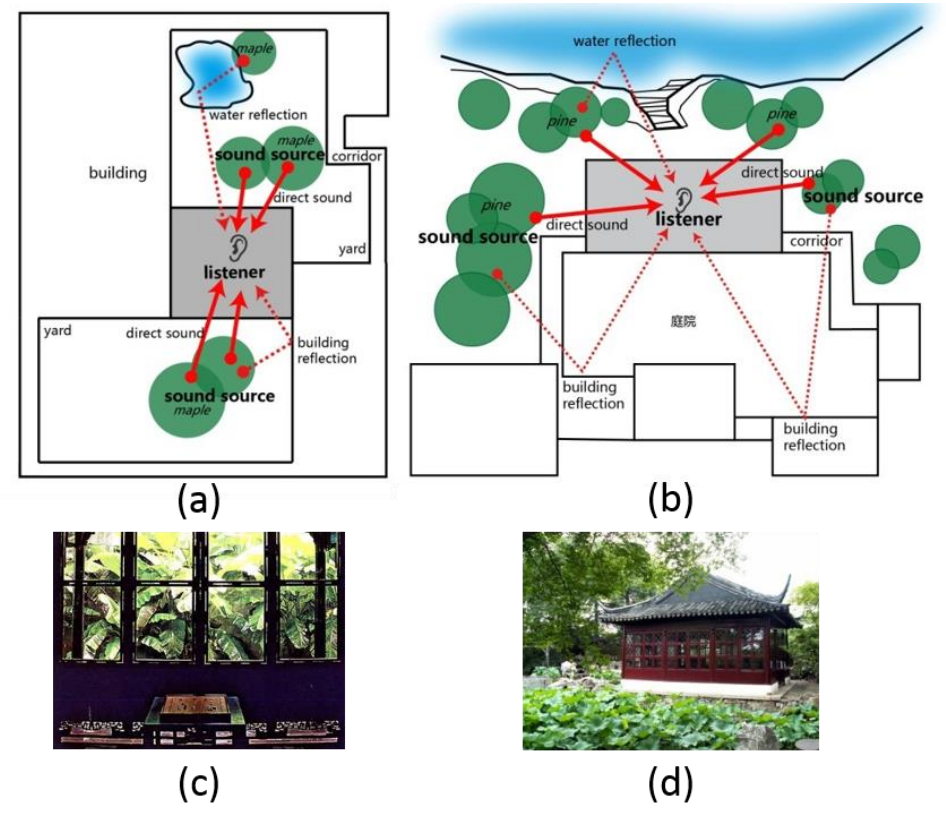
There are generally two kinds of dominant sound sources in Chinese traditional garden [5]. One is natural sound in 55 attractions, whereas the other is artificial sound identified in 7 attractions. Natural sound can be divided into four types: waterscape, rain, wind, and birdsong, and waterscape is more commonly used in 35 attractions in total, following by wind sounds.

Different types of soundscapes are built in different ways. Waterscape can be further subdivided into four forms, namely waterfalls, cascades, streams, and fountains. Depending on the surrounding environment, gardeners usually design water in various forms and use plants, walls, stones or other interface elements to affect the propagation of water sounds, so that it can match the expected artistic conception more. Taking Yunqin Zhai, a reading place for the emperor in the Qing dynasty, for instance, the sound pressure level of water sound is decreased by reducing the height of falling water, which sounds soft and faint. At the same time, the attraction is surrounded by walls, therefore the water sound propagation is limited by the enclosed space, and external noises are insulated as well (Figures 1). What gardeners did, as said above, not only helps to provide a quiet ambient environment, but also approaches the expected artistic conception.



Source: ((a), (b) Author, 2016.)

Figure 1: Yunqin Zhai

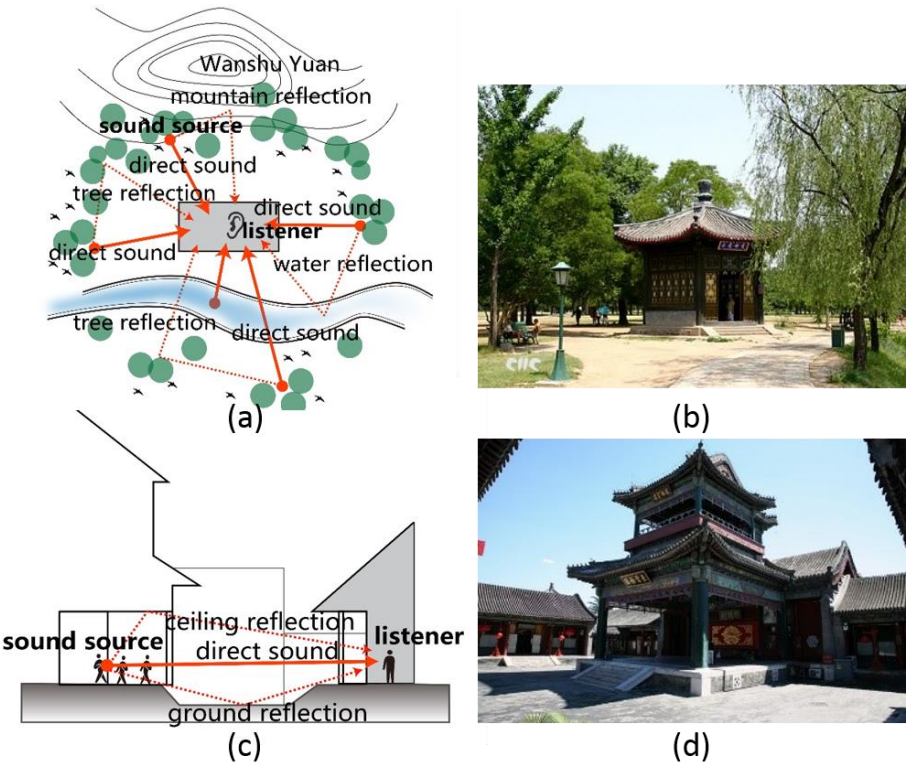


Source: ((a), (b) Author, 2016. (c), (d) baidu.com, 2016)

Figure 2: (a) Tingfeng Xianguan (b) Wanhe Songfeng (c) Tingyu Xuan (d) Liuting Ge

Similarity can be found in wind and rain sound design methods. In order to make the sound be easily perceived, gardeners usually adopt plants, structures, or buildings to amplify or stress sound. Buildings at both wind and rain attractions are relatively enclosed. Bamboo, pine, and maple are commonly used in creating wind sound, while design of rain normally prefers plantain, bamboo and lotus. Varied trees are planted in the appropriate density. For example, maples planted in Tingfeng Xianguan are more like point sources (Figures 2(a)), while pine plants in Wanhe Songfeng tend to be area source (Figures 2(b)). Furthermore, building structures can be used to change the air flow, such as the caves for wind sound in Ge Yuan. A special type of window, called 'Jiao Chuang', with irregular and artistic small holes, is observed to assist the rain sound perception, as shown in Tingyu Xuan (Figure 2(c)) and Liuting Ge (Figure 2(d)).

Compared with other natural soundscapes, the birdsong is a resort from the sound source. To attract a variety of birds, a good living environment with a lot of trees or water for birds is the basis, such as Yingzhuan Qiaomu (Figures 3(a) and (b)) in Mountain Resort, Chengde. The artificial sound is mainly produced by human activities, which are relatively easy to control, and can be generated at any time and at any place. Although the number of artificial soundscapes is much smaller than natural, the categories of artificial sounds are diversiform, including the footsteps, bells, opera, paddles, xiao (Chinese traditional musical instrument, a vertical bamboo flute), guqin (Chinese traditional instrument, a seven-stringed plucked instrument in some ways similar to the zither), as shown in the Tingli Guan (Figures 3(c) and (d)) of the Summer Palace in Beijing.



Source: ((a), (b) Author, 2016. (c), (d) baidu.com, 2008, 2011)

Figure 3: (a) (c) Tingli Guan, (b) (d) Yingzhuan Qiaomu

3.4 Names of soundscape attractions

Not only watching the scenery but also understanding Chinese characters can help visitors approach the core question of the garden's artistic conception [6]. The name of attraction is an important criterion to decide whether it is a soundscape attraction or not, in the process of soundscape selection. By analysing all the names of soundscape attractions, as follows.

Using "**ting**" (means "listening" in Chinese) in the soundscape attraction's name is a direct way that can guide visitors to pay attention to hearing. 27 soundscape attractions have done so, e.g. Liu **ting** Ge (The stay-to-listen pavilion) in the Humble Administrator's Garden in Suzhou, **Ting** quan Lou (The tower of listening fountain) in "Plank between Two Mountains" in Yangzhou, Fengquan Qing**ting** (garden of echoing breeze and stream) in Chengde Mountain Resort, Heibei. Likewise, using **"yin", "xiang", "li", and "ming"**, which are related to listening indirectly in Chinese, in soundscape attractions' names can work as "**ting**" do. There are 25 soundscape attractions using indirect words in their name, e.g. Youyou Ting (The pavilion of listening to birdsong). What' more, it is interesting that "**qin**", which means "musical instrument" in Chinese, is usually used to refer to water in the waterscape name, e.g. Yun tian**qin** in Yuanming Yuan (Qing dynasty), and Yun**qin** Zhai in Jingqing Zhai (Qing dynasty).

Meanwhile, information about the sound source can be included in the attraction's name directly or indirectly. The source name, nickname, or onomatopoeia included in the attractions' name can make it clear what the source is. Taking the Tingsongfeng Chu (Listen to the sound of wind breezing in pines) for instance, "**feng**", which means "wind" in Chinese, clarifies the sound source by its name. Part of attractions' names may point out the sound source indirectly by adopting another feature which has similar characteristics of the sound source visually or acoustically. Taking Ting Xue Ge in Suzhou for instance, "**Xue**" (means "snow" in Chinese) is similar to the waterfall when the snow is falling down from the top of the mountain.

3.5 The building styles of receiver points

There are always some buildings for visitors enjoying soundscape around. However, the building style might be different in every attraction. Gallery, pavilion, house, tower, hall and hathpace are common and always used in attractions' name to specify the building style, corresponding.

4 Conclusions

This study analyzed the time periods, locations, sound sources, and other characteristics of soundscape attractions in Chinese classical gardens, and provided a basis for further research on the relationship between soundscape and spatial construction in Chinese gardens. In addition, due to the difficulties in reviewing Chinese historic documents and records, more soundscape attractions might be added and analyzed in the future.

References

[1] Shuoxian Wu. Soundscape described in the book of poetry, *Architectural Journal*, 2012(S1), 109-113 (in Chinese).

[2] Xiuping Cheng. Study on the Construction of the Artistic Conception of Soundscape in Chinese Traditional Gardens. Huazhong Agricultural University. 2008 (in Chinese).

[3] Xiaomei Yuan. The formation and evolvement of soundscape thought of Chinese classical garden, *Chinese Landscape Architectural*, Vol25 (7), 2009, 32-38 (in Chinese).

[4] Junling Zhang; Xijuan Liu, Discuss on the constitution of Chinese traditional garden. *Chinese Landscape Architectural*, Vol28 (2), 2012, 63-65 (in Chinese).

[5] Binyi Liu; Dan Chen. Review on the soundscape pattern and design methods, *Landscape Architecture*, 2009(1), 96-99 (in Chinese).

[6] Weiquan Zhou. *The History of Chinese Traditional Garden*, Tsinghua University, Beijing(China), 3rd edition, 2008 (in Chinese).

Table 1: The list of soundscape attractions in Chinese gardens

Time period	Location	Name	Type of sound source
Warring States period	Guanwa Gong, Lingyan Mount., Suzhou	Xiangdie Lang (Corridor of dancing in clogs)	Artificial sound-footsteps
5 Dynasties & 10 Kingdoms period	Xi Yuan, Chengdu	Chanyu Ting (Pavilion beside stream in bamboo forest)	Natural sound-waterscape
Tang Dynasty	Emei Mount., Leshan	Qingyin Ge (House of water sound)	Natural sound-waterscape
Song Dynasty	Gen Yue, Kaifeng	Yongyong Ting (Pavilion of birdsong)	Natural sound-birdsong
Song Dynasty	Yanxia Ling, Hangzhou	Shuiledong Yuan (Pavilion of water sound from cave)	Natural sound-waterscape
Song Dynasty	Shuangfeng Yunzhan, Yangzhou	Tingquan Lou (Tower of listening to the fountain sound)	Natural sound-waterscape
Ming Dynasty	Yugong Gu, Wuxi	Tingquan Shanfang (House of listening to fountain sound in mounts)	Natural sound-waterscape
Ming Dynasty	Hanshan Bieye, Suzhou	Tingxue Ge (House of listening to the snow sound)	Natural sound-waterscape
Ming Dynasty	Zhuozheng Yuan, Suzhou	Liuting Ge (House of staying to listen)	Natural sound-rain
Ming Dynasty	Zhuozheng Yuan, Suzhou	Tingsongfeng Chu (House of listening to wind sweeping pines)	Natural sound-wind
Ming Dynasty	Zhuozheng Yuan, Suzhou	Tingyu Xuan (House of listening to the rain)	Natural sound-rain
Ming Dynasty	Zhuozheng Yuan, Suzhou	Yiyu Xuan (House of listening to wind sweeping bamboos)	Natural sound-wind

Ming Dynasty	Taying Yuan, Hu hill, Suzhou	Songfeng Qin (Room of listening to wind in pines)	Natural sound-wind
Ming Dynasty	Jichang Yuan, Wuxi	Qingxiang Zhai (House of listening to rain)	Natural sound-rain
Ming Dynasty	Donggao Caotang, Changshu	Zhange Tingying (House of listening to birdsong)	Natural sound-birdsong
Qing Dynasty	Jingming Yuan, Beijing	Xiaxue Qinyin (House of listening water sound from gorege)	Natural sound-waterscape
Qing Dynasty	Jingming Yuan, Beijing	Fenghuang Qingting (Hall of listening to wind sweeping bamboos)	Natural sound-wind
Qing Dynasty	Jingming Yuan, Beijing	Qingyin Zhai (House of water sound)	Natural sound-waterscape
Qing Dynasty	Jingyi Yuan, Beijing	Qingyin Ting (Pavilion of water sound)	Natural sound-waterscape
Qing Dynasty	Jingyi Yuan, Beijing	Lishuang Gao (Marsh to listen to crane sound in autumn)	Natural sound-birdsong
Qing Dynasty	Yi Yuan, Beijing	Tingtao Xuan (Room for the waves sound)	Natural sound-waterscape
Qing Dynasty	Yi Yuan, Beijing	XiangQuan Ting (Pavilion beside a spring)	Natural sound-waterscape
Qing Dynasty	Shuqing Yuan, Xi Yuan, Beijing	Liushui Yin (pavilion beside a river)	Natural sound-waterscape
Qing Dynasty	Shuqing Yuan, Xi Yuan, Beijing	Qianchi Xue (Thousand-feet snow)	Natural sound-waterscape
Qing Dynasty	Jingqing Zhai, Beijing	Yunqin Zhai (Room beside a pond)	Natural sound-waterscape
Qing Dynasty	Winter Palace, Beijing	Shuimu Mingse (Sound of water and wood like the clear Se)	Natural sound-waterscape
Qing Dynasty	Winter Palace, Beijing	Yuntian Qin (Pavilion beside a river)	Natural sound-waterscape
Qing Dynasty	Winter Palace, Beijing	Jiajing Mingqin (Pavilion sorrounded by lake and waterfall)	Natural sound-waterscape
Qing Dynasty	RuYuan,ChangchunYuan, Beijing	Tingquan Xie (Room beside a spring)	Natural sound-waterscape
Qing Dynasty	Summer Palace, Beijing	Tingli Guan (House for opera performance)	Artificial sound-opera
Qing Dynasty	Huishan Yuan, Summer Palace, Beijing	Shuiyue Ting (Pavilion of listening water sound)	Natural sound-waterscape
Qing Dynasty	Huishan Yuan, Summer Palace, Beijing	Yuqin Xia (Gorge in bamboos)	Natural sound-waterscape
Qing Dynasty	Jiqing Xuan, Summer Palace, Beijing	Qingqin Xia (Gorge of elegant qin)	Natural sound-waterscape
Qing Dynasty	Jingji Mount, Tianjin	Qianchi Xue (Thousand-feet snow)	Natural sound-waterscape
Qing Dynasty	Jingji Mount, Tianjin	Zhongyin Songchui (Pavilion of listening wind sound in pines)	Natural sound-wind
Qing Dynasty	Jingji Mount, Tianjin	Xieyin Shuwu (House of listening stream beside)	Natural sound-waterscape
Qing Dynasty	Mountain Resort, Chengde	Yingzhuan Qiaomu (Nightingales twittering in arbores)	Natural sound-bird
Qing Dynasty	Mountain Resort, Chengde	Yuese Jingsheng (Sound of river under moonlight)	Natural sound-waterscape

Qing Dynasty	Mountain Resort, Chengde	Yuanjin Quansheng (Murmuring of streams far and near)	Natural sound-waterscape
Qing Dynasty	Mountain Resort, Chengde	Songhe Qingyue (Melodious resonance of pines and cranes)	Natural sound-bird
Qing Dynasty	Mountain Resort, Chengde	Fengquan Qingting (Garden of echoing breeze and stream)	Natural sound-waterscape
Qing Dynasty	Mountain Resort, Chengde	Qianchi Xue (Thousand-feet snow)	Natural sound-waterscape
Qing Dynasty	Mountain Resort, Chengde	Yuqin Xuan (House of jade harp)	Natural sound-waterscape
Qing Dynasty	Mountain Resort, Chengde	Wanhe Songfeng (Pine-Soughingfrom ten-thousand ravines)	Natural sound-wind
Qing Dynasty	Xi Yuan, Nanjing	Tongyin Guan (House of listening to the Chinese parasol tree)	Natural sound-rain
Qing Dynasty	Jichang Yuan, Wuxi	Bayin Jian (Eight-pitch mountain stream)	Natural sound-waterscape
Qing Dynasty	Ou Yuan, Suzhou	Tinglu Lou (House of listening to the oars sound)	Artificial sound-oars
Qing Dynasty	Huiyin Yuan, Suzhou	Pingshan Tingpu (Listening to the waterfall in pingshan)	Natural sound-waterscape
Qing Dynasty	Tingfeng Yuan, Suzhou	Tingfeng Xianguan (House of listening to the maple tree)	Natural sound-wind
Qing Dynasty	Gengyu Xuan, Guangfu Zhen, Suzhou	Tingzhong Tai (Hathpace of listening to the bell)	Artificial sound-bell
Qing Dynasty	Ge Yuan, Yangzhou	Fengyin Dong (Cave of listening to the sound of wind)	Natural sound-wind
Qing Dynasty	Tingxiao Yuan, Yangzhou	Tingxiao Yuan (Garden of listening to the xiao)	Artificial sound-Xiao
Qing Dynasty	Chengyin Qingfan, Yangzhou	Tingtao Ting (Pavilion of listening to the waves sound)	Natural sound-waterscape
Qing Dynasty	Qingyun Pu, Nanchang	Woting Songqin (Listening to the sound of qin while lying under the pine tree)	Artificial sound-Qin
Qing Dynasty	Wangsong Yuan, Guangzhou	Tingtao Lou (House of listening to the waves sound)	Natural sound-wind
Qing Dynasty	Wangsong Yuan, Guangzhou	Tingzhong Lou (House of listening to the bell)	Artificial sound-drum
Qing Dynasty	Yuyin Shanfang, Panyu, Guangzhou	Tingyu Xuan (House of listening to the rain)	Natural sound-rain
Qing Dynasty	Beiguo Yuan, Xinzhu	Xiaolou Tingyu (House of listening to the rain)	Natural sound-rain
The Republic of China period	Shizi Lin, Suzhou	Tingtao Ting (Pavilion of listening to the waves sound)	Natural sound-waterscape
Unknown	Wenjun Jin, Chengdu	Tingyu Xuan (House of listening to the rain)	Natural sound-rain
Unknown	Dufu Caotang, Chengdu	Tingsu Ge (House of listening to the leaves with wind)	Natural sound-wind
Unknown	Qingcheng Mount, Chengdu	Tinghan Ting (House of listening to the waterfall)	Natural sound-waterscape