

Soundscape Study of Qinhuai River Cultural Heritage Space: Postprint

Authors: He Jiyang, Fan Xiaowei

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Abstract

【目的】 To provide guidance for soundscape research in Chinese cultural heritage spaces. This paper primarily explores the local characteristics of the Qinhuai River, a Chinese cultural heritage space, from an auditory dimension. The Qinhuai River, as a symbol of Jiangnan water town culture in China, serves as both a carrier of tangible cultural heritage and an important component of intangible cultural heritage. In recent years, soundscape research has offered a new perspective for cultural heritage protection, revealing its unique value in cultural transmission through the analysis of sound elements and their characteristics within cultural spaces.

【方法】 Through field recording and literature review, this study examines both contemporary and historical soundscapes of a place to uncover its sensory culture, sonic identity, and local aurality. From a soundscape perspective, this paper focuses on the Qinhuai River cultural heritage space to explore the composition and significance of its natural sounds, artificial sounds, and historical soundscapes.

【结果】 The soundscape of the Qinhuai River cultural heritage space represents a harmonious interweaving of nature and humanity, as well as a crucial medium for documenting historical transformations and cultural transmission. Research on its natural, artificial, and historical sounds enables a more comprehensive understanding of the multidimensional characteristics of the Qinhuai River as a cultural landmark. However, the impacts of modern urbanization and tourism development on the soundscape cannot be ignored. The intrusion of modern sounds such as traffic noise and electronic sound effects poses a risk of gradual disappearance for traditional soundscapes. Therefore, employing technical methods such as field recording and sound retracing to document and protect these sonic resources is essential for maintaining the cultural integrity and diversity of the Qinhuai River. Simultaneously, as part of intangible cultural heritage, soundscapes can provide richer cultural perceptions and enhance local

identity and cultural pride through multimedia displays, immersive experiences, and other means.

【结论】 Research on the Qinhuai River' s soundscape not only contributes to the protection of local cultural heritage but also provides a new perspective for exploring multisensory research on cultural heritage. Future efforts should further promote interdisciplinary soundscape research and cultural-tourism integration, incorporating sound protection into ecological restoration, cultural education, and community participation to construct a sustainable heritage protection model, thereby making "Qinhuai in Sound" a paradigm and innovative practice sample for cultural heritage protection in the new era.

Full Text

A Study on the Soundscape of Qinhuai River Cultural Heritage Space

He Jiyang, Fan Xiaowei

(Nanjing University of Media and Communications, Nanjing, Jiangsu 211199)

Abstract

This study provides guidance for research on soundscapes in Chinese cultural heritage spaces by exploring the local characteristics of the Qinhuai River from an auditory dimension. As a symbol of Jiangnan water town culture in China, the Qinhuai River serves as both a carrier of tangible cultural heritage and an important component of intangible cultural heritage. In recent years, soundscape research has offered a new perspective for cultural heritage protection, revealing the unique value of sound elements in cultural spaces for cultural transmission.

Through field recording and literature review, this paper examines both contemporary and historical soundscapes of the area to uncover its sensory culture, sonic identity, and local aurality. From a soundscape perspective, we investigate the composition and significance of natural sounds, artificial sounds, and historical sonic landscapes within the Qinhuai River cultural heritage space. The findings reveal that the Qinhuai River' s soundscape represents a harmonious symphony of nature and humanity, serving as a crucial medium for documenting historical changes and cultural continuity. Studying its natural, artificial, and historical sounds enables a more comprehensive understanding of the river' s multidimensional characteristics as a cultural landmark. However, the impacts of modern urbanization and tourism development cannot be ignored. The intrusion of modern sounds such as traffic noise and electronic sound effects poses a risk of gradually eroding traditional soundscapes. Therefore, employing technical methods like field recording and sound retrospection to document and preserve these sonic resources is essential for maintaining the cultural integrity and diversity of the Qinhuai River. Furthermore, as part of intangible cultural heritage, soundscapes can provide richer cultural experiences for the

public through multimedia displays and immersive experiences, thereby enhancing local identity and cultural pride.

This research on the Qinhuai River’ s soundscape not only contributes to the protection of local cultural heritage but also offers new perspectives for exploring multisensory approaches to heritage studies. Future efforts should promote interdisciplinary research on soundscapes and integration with cultural tourism, incorporating sound preservation into ecological restoration, cultural education, and community participation to build a sustainable heritage protection model. This will allow “Qinhuai in Sound” to become an exemplary case and innovative practice for cultural heritage protection in the new era.

Keywords: Soundscape; Ambisonics; Field Recording; Cultural Space Heritage; Digital Interactive Communication

1.1 Historical and Cultural Background of the Qinhuai River

The Qinhuai River has long served as a vital water transport route, with its history traceable to the Spring and Autumn and Warring States periods when it was an important shipping channel for the State of Wu. During the Qin Dynasty, the river was named “Qinhuai” as it flowed through Jinling City. From the Six Dynasties period onward, the riverbanks gradually evolved into political, economic, and cultural centers, attracting numerous literati and scholars. The Tang Dynasty poet Du Mu’ s poem “Mooring at Qinhuai” captures the river’ s water town charm and bustling scenes with the lines “Mist veils the cold water, moonlight shrouds the sand, mooring at Qinhuai near a tavern at night.” During the Ming and Qing dynasties, the Qinhuai River became one of the most prosperous commercial districts in southern China, with restaurants lining both banks and lantern boats cruising the waters, earning it the reputation of “Ten Miles of Pearl Curtains.” At this time, the river was not only a center of economic activity but also hosted rich theatrical, folk, and literary activities, becoming a core area of Nanjing’ s culture.

The Qinhuai River has not only shaped Nanjing’ s geographical pattern but also driven urban economic development. During the Six Dynasties and Ming-Qing periods, both banks of the river became thriving areas for commerce and cultural exchange, establishing Nanjing’ s status as a “cultural capital.” Additionally, the Qinhuai River has been essential for the daily life of Nanjing’ s residents, providing crucial water resources for agricultural irrigation and urban water supply.

1.2 Characteristics and Value of the Qinhuai River Cultural Heritage Space

As an important cultural landmark in China, the Qinhuai River cultural heritage space runs through Nanjing's urban area geographically, forming an integral part of the natural ecosystem while serving as an axis bearing numerous historical buildings and cultural activities. The natural landscape along the riverbanks—including wetlands, forests, and vegetation—intertwines with representative architectural sites from different historical periods such as the Confucius Temple, Bailuzhou Park, and Li Xiangjun's Former Residence. This fusion of nature and humanity embodies the concentrated image of “Jiangnan garden water towns” and endows the space with unique cultural significance [1].

In terms of historical value, the Qinhuai River has witnessed Nanjing's development from the ancient capital of the Six Dynasties to the economic and cultural center of southern China during the Ming and Qing periods. The historical sites and architecture along its banks record urban construction and cultural characteristics across multiple historical eras. During the Ming and Qing dynasties, it became a center for commerce and cultural activities, with scenes of cruising lantern boats and melodious folk music reflecting the prosperity and cultural refinement of urban life at the time. These sites and documents serve as important resources for studying Nanjing's history, regional economy, and cultural evolution.

Regarding cultural value, the Qinhuai River embodies the essence of local culture in Nanjing and throughout China, manifested in literature, art, folk activities, and local opera. For centuries, the river has been celebrated by countless literati, from the melancholic elegance of Du Mu's “Mooring at Qinhuai” to the vivid portrayal of Qinhuai's romantic life in the late Ming Dynasty in “The Peach Blossom Fan.” The Qinhuai Lantern Festival, an important intangible cultural heritage of Nanjing, integrates lantern craftsmanship, folk performances, and traditional festivals, serving as a crucial carrier of regional cultural identity. The banks of the Qinhuai River are also the birthplace of Nanjing Pingtan and Kunqu Opera, with theatrical performances documenting the prosperity of urban culture during the Ming and Qing periods and leaving behind important artistic heritage for future generations.

2. Conceptual and Theoretical Framework of Soundscape

Soundscape, as an important concept in cultural geography and acoustic research, provides a theoretical tool for exploring the interactive relationship between sonic environments and human culture in specific spaces. In the study of the Qinhuai River cultural heritage space, soundscape theory offers a scientific framework for understanding and analyzing natural sounds, artificial sounds, and historical sounds [2].

2.1 Definition of Soundscape

The concept of soundscape was first proposed by Canadian composer Murray Schafer in his 1977 book *The Soundscape: Our Sonic Environment and the Tuning of the World*, where he defined it as “the collection of all sounds in a specific environment.” This concept emphasizes not only the physical characteristics of sound itself but also human cultural perception and social meaning. Soundscape research requires understanding the social environment, cultural background, and significance of what we hear. Therefore, listening requires consciousness—a skill that must be cultivated. Soundscape emphasizes the reconstruction of sound, highlighting the value of listening itself. Here, the boundary between musical sound and noise has dissolved, making all sounds objects of listening, particularly natural and environmental sounds, which can become subjects of study.

Soundscape consists of three elements: person, sound, and environment, with the human factor being the most complex. Human factors include both constant and variable elements. For instance, a healthy adult’s auditory system remains relatively stable over a long period and can be considered a constant factor. However, the listener’s psychology, life experiences, regional customs, ethnic characteristics, and linguistic environment are variable factors.

2.2 Basic Elements of Soundscape

Soundscape comprises three core elements [3]:

Sound Source: The background sounds that continuously appear in a specific space. For example, in the Qinhuai River, the sound of flowing water can be considered a key background sound that provides the foundational sonic environment for other sounds.

Sound Signals: Prominent sounds that attract attention and typically have clear functions. For instance, vendors’ hawking cries or boatmen’s chants were typical sound signals in the daily life of the Qinhuai River during the Ming and Qing periods.

Sound Marks: Unique sounds with local and cultural significance that can evoke memories and emotions associated with a specific space. For example, the gong and drum sounds and opera performances during the Qinhuai Lantern Festival are sound marks.

2.3 Characteristics of Soundscape

Soundscape exhibits temporality, spatiality, and cultural dimensions. Temporally, sound is dynamic and evolves over time. Spatially, sound propagation depends on the environmental context, with the architectural layout and river morphology along the Qinhuai River affecting sound reflection and absorption. Culturally, soundscape is an expression of culture, reflecting social activities and

local characteristics within a space. The Qinhuai River' s soundscape includes both natural sounds and rich local cultural sounds [4].

3. Research on Natural Soundscape of Qinhuai River Cultural Heritage Space

Natural soundscape constitutes an important component of the overall soundscape, serving as the foundational background of cultural spaces and reflecting ecological environments. The natural soundscape of the Qinhuai River is unique and rich, primarily comprising water flow sounds, bird songs, and seasonal natural sounds. These natural sounds not only shape the overall atmosphere of the Qinhuai River cultural heritage space but also profoundly influence the formation and development of local culture [5].

3.1 Water Flow Sounds

Water flow sounds along the Qinhuai River exhibit diversity due to regional characteristics. In slow-flow areas near the Confucius Temple, the river surface is calm, producing gentle, soft water sounds with continuous, low tones that seem to whisper in one' s ear. This water sound, juxtaposed with the historical buildings on both banks, creates a tranquil and distant atmosphere. In rapid-flow areas around Bailuzhou, the river' s drop creates turbulent water sounds accompanied by bubbling and splashing, generating a strong sense of dynamism that adds vitality to the surrounding wetland ecology and attracts water birds such as egrets. After rainfall, the special water sounds formed by accumulated water flowing into the Qinhuai River through drainage outlets create a unique symphony of “dripping” and “gurgling.” Particularly near the ancient city walls, rainwater dripping through gaps in blue bricks onto the river surface echoes through the space, as if narrating the city' s historical changes.

3.2 Bird Songs

Bird songs are dynamic elements of the Qinhuai River' s natural soundscape. In areas such as the Confucius Temple and Bailuzhou Park, birds singing at different times and seasons add rich auditory experiences to the space. In the early morning, egrets taking flight from riverside wetlands emit light, short “caw-caw” sounds that contrast sharply with the quiet river surface. This sound seems to greet the start of the day and has become a familiar background sound for local residents during morning exercises. In summer, cicada songs on willow and elm trees along both banks create high-frequency, continuous sound patterns that complement the low-frequency components of water flow sounds. These cicada songs often intertwine with the crisp chirping of sparrows. In autumn and winter, the low, gentle calls of resident birds such as orioles, often spaced at longer intervals, add a layer of nostalgic atmosphere to the ancient buildings along the riverbanks.

Seasonal natural sounds constitute important variations in the Qinhuai River'

s soundscape. In spring, the sound of rain on the Qinhuai River is most melodious, especially near the Southern Tang Imperial Tombs, where the light tapping of raindrops on the water surface intertwines with the gentle swaying of willow branches, allowing one to feel the vibrant spring atmosphere of the Qinhuai River cultural heritage space. In midsummer, cicada songs dominate the sound field. At noon when sunlight is most intense, the high-pitched, dense cicada songs create a striking auditory contrast with the particularly calm water flow sounds. In autumn, the low, lingering wind sounds along the Qinhuai River, combined with the “rustling” of fallen leaves, create a quiet, nostalgic spatial atmosphere. This soundscape is often used as background sound in film and television works depicting autumn scenes of the Qinhuai River, reinforcing seasonal cultural perception. In winter, when snowfall occasionally occurs, the sound of snow becomes a special element of the natural soundscape. Snowflakes landing on the river surface produce slight “tapping” sounds that contrast with the occasional “cracking” sounds from frozen river sections. This sound represents a rare memory of Jiangnan’s snowless winters, adding seasonal character to the Qinhuai River.

4. Research on Artificial Soundscape of Qinhuai River Cultural Heritage Space

Artificial soundscape refers to sounds produced by human activities that reflect the characteristics of social life and constitute an important component of cultural spaces. In the Qinhuai River cultural heritage space, the artificial soundscape comprises sounds from commerce, transportation, festivals, and music. These sounds not only embody social activities from specific historical periods but also carry unique memories of local culture [6].

4.1 Commercial Sounds

The banks of the Qinhuai River have been bustling commercial districts since ancient times, with commercial sounds reflecting the vitality and characteristics of urban life. Along the river, small vendors traditionally used unique hawking cries to attract customers, such as those selling candied haws, pastries, or handicrafts. These cries, with their distinct rhythms and strong sense of meter, constituted an important component of commercial culture during the Ming and Qing periods. With the development of modern tourism, commercial sounds along the Qinhuai River have changed. Visitors now hear restaurant staff’s calls or recorded loudspeakers repeatedly playing promotional messages. Modern commercial sounds have gradually replaced traditional vendors’ hawking cries, demonstrating the evolution of the soundscape.

4.2 Transportation Sounds

The Qinhuai River has been an important water transport channel since ancient times, with transportation sounds forming a crucial component of its artificial

soundscape. During the Ming and Qing periods, busy commercial and fishing boats on the river created a soundscape characterized by oars splashing water, boatmen's chants, and cargo loading and unloading sounds. Modern transportation sounds, such as car horns from nearby roads and subway operation sounds, have become part of the Qinhuai River's transportation soundscape. While these sounds reflect urbanization, they have also impacted the traditional transportation soundscape to some extent.

4.3 Festival Sounds

The Qinhuai Lantern Festival is the most representative festival activity along the river, with its festival sounds forming a unique cultural expression. During the festival, the riverbanks are filled with gong and drum sounds, fireworks, and folk opera performances. For example, visitors watching lanterns often stop to listen to Kunqu opera singers' clear vocals on stage, with their melodious tunes becoming a core element of the festival's soundscape. As modern lantern festivals have increased electronic equipment usage, such as speakers playing background music and dynamic lighting sound effects in lantern displays, these sounds have merged with traditional gong and drum sounds. While enriching the auditory layers, they have also weakened the dominant position of traditional festival sounds.

4.4 Music and Opera Sounds

The Qinhuai River is an important birthplace of traditional Nanjing opera, with its music and opera soundscape holding significant cultural value. The river was once a major venue for Kunqu performances, especially on lantern boats, where performances attracted countless literati and scholars with their melodious and graceful singing. Pingtan, a characteristic Jiangnan opera form, was also frequently performed in riverside teahouses, adding cultural flavor to urban life. With the development of cultural tourism, modern stage performances and pop music have gradually appeared in Qinhuai River scenic areas. While these new sounds attract younger visitors, they have also diluted the rich cultural atmosphere of traditional sounds to some extent [7].

5. Field Recording and Sound Retrospection in Qinhuai River Cultural Heritage Space

Field recording and sound retrospection are core methods in soundscape research. By recording and reconstructing sounds of specific places, researchers can more intuitively understand the relationship between sound, space, and culture. In the study of the Qinhuai River cultural heritage space, field recording helps capture the dynamic characteristics of modern soundscapes, while sound retrospection reconstructs past sonic contexts based on historical literature and technical means, providing rich materials and new possibilities for cultural heritage protection [8].

5.1 Dynamic Sound Capture

A nighttime field recording project was conducted along the Confucius Temple to Bailuzhou section of the Qinhuai River to document sound characteristics during evening river tours. This river section, dense with tourism and cultural activities, represents the nighttime soundscape of the Qinhuai River. The relatively calm nighttime river allows clear water flow sounds to be heard, with the low-frequency “buzzing” of lantern boat engines intertwining with the “splashing” sounds of boatmen rowing. The recordings captured the subtle sounds of friction between lantern boats and river water, considered a distinctive dynamic cultural background of the Qinhuai River.

The recordings also captured tourists’ laughter and chatter along the riverside walkways, as well as complete documentation of vendors’ hawking cries selling snacks. During the lantern festival, gong and drum performances and Kunqu opera singing became highlights of the recordings. These sounds demonstrated delicate sound quality when recorded at close range, while the use of various omnidirectional microphone arrays captured the sound effects of gong and drum sounds on the river surface, reflecting the Qinhuai River’ s unique acoustic space. These sound data were used to map the nighttime soundscape of the Qinhuai River, helping researchers analyze the impact of tourism activities on the soundscape. Some audio was developed as part of an immersive sound experience for local cultural displays in Nanjing, enhancing visitors’ perception of nighttime tour culture.

5.2 Establishment of Sound Archives: Sound Documentation of Qinhuai Lantern Festival

During the Qinhuai Lantern Festival, sounds from the festival activities were recorded to build a complete festival sound archive. The festival’ s sound elements are extremely rich, representing a concentrated manifestation of the Qinhuai River’ s artificial soundscape.

Gong and Drum Sounds with Dragon Dance Performances: The gong and drum sounds in dragon dance performances are among the festival’ s core sounds, with their rhythmic diversity and volume variations accurately captured in the recordings.

Folk Opera Performance Sounds: The recording team collected sounds from Kunqu and Pingtan performances. Kunqu singers’ clear vocals and instrumental accompaniment were delicately recorded, while Pingtan storytelling combined narrative and melody to vividly demonstrate local cultural charm.

Fireworks and Crowd Sounds: The recordings also captured the “whooshing” sounds of fireworks being launched and their “booming” explosions, along with audience exclamations and applause. By combining omnidirectional microphone arrays with surround microphone arrays, the spatial sense and rich layers of sound were preserved, providing multiple options for post-production.

Equipment and Methods: The author and team used Ambisonic omnidirectional microphone arrays from four brands—Zoom H3-VR, Rode NTFS1, Sennheiser Ambeo, and Zylia ZM-1—as well as DPA 5100 Surround microphone arrays. Recordings were conducted at different times and seasons to demonstrate the dynamic changes in the soundscape. The recording methods combined fixed-point recording with mobile recording. Fixed-point recording captured sound characteristics at specific locations, while mobile recording documented sound variations during tours along the river.

Application Results: These sound archives were used as promotional materials for lantern festival culture. Through analysis and processing of the collected sound data—including spectral analysis, frequency analysis, sample noise reduction, sound feature extraction, and loudness balancing—multimedia displays were created to showcase the festival’s auditory atmosphere. The recorded materials also provide foundational data for the protection and reproduction of future lantern festival soundscapes.

5.3 Sound Retrospection

Sound retrospection, as a method for reconstructing historical soundscapes, combines modern digital technology with historical literature research to provide innovative pathways for multisensory experiences in cultural heritage spaces. In the study of the Qinhuai River cultural heritage space, the aim is to reproduce natural and artificial soundscapes from the Ming and Qing periods and even earlier times. Through sound design based on historical literature and digital audio synthesis technology, new approaches are provided for the dynamic protection and display of cultural heritage, allowing more people to rediscover the Qinhuai River’s history and cultural charm through hearing.

6. Soundscape and Digital Interactive Communication

As a unique form of auditory cultural expression, soundscape demonstrates broad application prospects in the field of digital interactive communication. With the rapid development of digital technologies such as Virtual Reality (VR), Augmented Reality (AR), and Artificial Intelligence (AI) [9], immersive sound technology has gradually become an important support for soundscape communication. Taking the Qinhuai River cultural heritage space as an example, rich soundscape content—including water flow sounds, Kunqu opera singing, and lantern festival sounds—collected through field recording technology can be processed and designed using immersive sound technology to give sound greater emotional impact and communication value. This soundscape content can be used not only for the restoration and display of historical culture but also as creative material for sound art, integrated into sound installations or immersive experience exhibitions. Through dynamic and spatial participation in the communication process, users can enjoy immersive, multisensory, and personalized interactive experiences. Meanwhile, combining the communication characteristics of social media platforms, soundscape content can be digitally recreated

into short videos, sound collections, or interactive guide works. These innovative forms attract the attention of younger audiences, not only enhancing the digital communication effect of Qinhuai River culture but also strengthening audience emotional identification with this cultural heritage [10].

Through the deep integration of soundscape and digital technology, we can not only protect and inherit the Qinhuai River's sound culture but also revitalize it in modern communication environments, promoting innovative development in the dissemination of intangible cultural heritage and the integration of culture and tourism.

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Author Information: He Jiyang (1995–), male, from Shanxi, Master’s degree, full-time faculty, teaching assistant, research direction: recording arts; Fan Xiaowei (1988–), male, from Jiangsu, Master’s degree, full-time faculty, associate professor, research direction: recording arts.

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