

Research On The Sound Visualization Design Of Intangible Cultural Heritage Of The Grand Canal

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Abstract. In the context of rapid globalization and digitalization, intangible cultural heritage (ICH) faces a significant challenge in its transmission and preservation. As a symbolic representation of Chinese historical and cultural identity, the Grand Canal not only embodies rich intangible cultural heritage but also carries a unique auditory culture. However, with the passage of time, these valuable soundscapes are gradually fading from public awareness, necessitating innovative methods for their protection and continuation. This paper focuses on exploring the visualization design of the intangible cultural heritage sounds of the Grand Canal, aiming to facilitate the transmission and innovation of traditional culture within a modern context. By analyzing representative ICH sounds along the Grand Canal, this study applies intelligent digital technologies to transform these sounds into visual patterns that are both artistically valuable and culturally meaningful. The research seeks to promote the creative transformation and dissemination of intangible cultural heritage, injecting new vitality into traditional cultural and creative design.

Keywords: Sound Visualization; Grand Canal Intangible Cultural Heritage; Intelligent Digital Design; Graphic Design; Transmission and Innovation.

1. Introduction

With the continuous advancement of globalization, intangible cultural heritage (ICH) is facing unprecedented challenges. The fast-paced lifestyle of modern society has led the younger generation to gradually distance themselves from traditional culture, resulting in a gradual disconnection in the transmission of ICH. Meanwhile, the advent of the digital age has provided new opportunities for the protection of ICH. The application of modern technological means has made the preservation and dissemination of traditional culture no longer limited to traditional methods. Instead, it can be carried out through more intelligent and innovative pathways for living heritage transmission. Against this backdrop, how to effectively leverage digital technology, especially sound visualization technology, to promote the protection and innovative transmission of ICH has become an important issue that urgently needs to be addressed. The Grand Canal, an important waterway in Chinese history, is not only a significant component of world cultural heritage but also a cradle of abundant intangible cultural heritage. The unique sound culture along the canal banks carries profound local characteristics and historical memories[1]. To further effectively enhance the visibility and sustainability[2] of sound-related ICH in the Grand Canal Cultural Belt and to arouse the public's interest and understanding of traditional culture, this study proposes an innovative method using sound visualization technology to transform the intangible sound heritage along the Grand Canal into visual symbols. Through this approach, we hope to present these precious cultural heritages in an entirely new perceptual manner, allowing the public to feel the cultural connotations behind the sounds through visual patterns.

The study aims to create a brand-new audio-visual fusion experience, enabling people to understand and perceive the unique charm of traditional culture in a more intuitive way. Integrating sound with visual[3] art can not only enrich the design forms of traditional cultural and creative products but also promote the innovative development of traditional culture in modern society, thereby facilitating the protection and dissemination of ICH. While providing new ideas for the

modern transmission of ICH, it injects vitality into the digital transformation of traditional culture and promotes the deep integration of traditional culture and modern technology.

2. The Current State of Cultural and Creative Product Design for Intangible Cultural Heritage (ICH) of the Grand Canal

In the current field of cultural and creative product design for the intangible cultural heritage (ICH) of the Grand Canal, research and practice have mainly focused on the extraction and re-creation of cultural elements related to artifacts, sites, and human figures. The work of Wu Conghao et al. [4] has demonstrated how to revitalize cultural symbols from water-taming objects and present them in modern cultural and creative (CC) products and intellectual property (IP) forms, thereby effectively inheriting and developing the riverine spiritual heritage surrounding water god beliefs. Zhang Xu et al. [5] have concentrated on the morphological characteristics of cultural relics at the Huabei Canal sites, integrating traditional ceramic art with local cultural features to create CC products with regional cultural characteristics. Chen Guofeng et al. [6] have emphasized the importance of historical figures such as Su Dongpo in the dissemination of canal culture, exploring an innovative path for the construction of the Grand Canal Cultural Belt in Changzhou by developing related IP CC products. Relevant literature and practices indicate that in the design expression of visual ICH culture, the design of related CC products has become relatively mature, and the products can effectively excavate and present rich historical and cultural connotations. However, auditory experiences and tangible ICH techniques have not yet received sufficient attention. Therefore, further exploration in the field of multi-sensory dimension expansion will not only enrich the diversity of CC products but also open up new perspectives for the inheritance of ICH.

3. Research Approach

In the process of conducting sound visualization design for the intangible cultural heritage (ICH) sounds of the canal, the paper, based on an in-depth investigation into the value of the canal ICH sounds, further extracts the characteristics of the ICH sounds along the Grand Canal. It transforms these sounds into planar pattern designs through digital and intelligent technologies and carries out research on sound visualization design based on the Grand Canal ICH culture in a more modern dynamic sound visualization form. The research approach is shown in Figure 1.

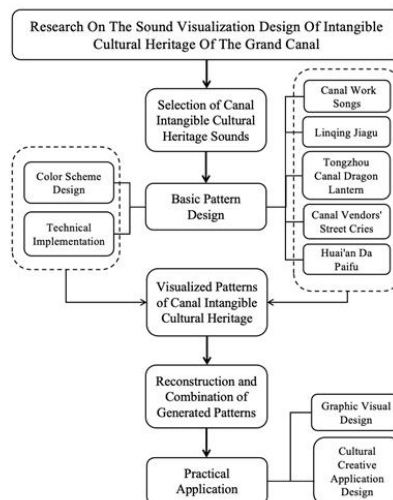


Fig. 1 Research Approach

4. Basic Pattern Design

4.1 Design Positioning

Since the advent of the new media era, technology and art have shown a trend of cross-domain integration, and the exploration of forms of sound visualization has also become more in-depth with the continuous development of media technology [7]. This design digitizes the sound elements of the intangible cultural heritage along the canal and uses the TouchDesigner platform to transform sound into visuals, creating unique patterns. It aims to explore the bridge between traditional ICH and modern technology. This design approach not only provides the audience with a new way of perceiving and understanding these precious cultural heritages but also promotes the innovation and development of cultural and creative products. By selectively extracting representative audio samples of ICH sounds along the canal, including opera, work songs, and drum music, their characteristic values are mapped to particle motion parameters to generate dynamically changing graphics, thus forming a series of patterns that retain the original sound features while being rich in artistic beauty. This process not only enriches the expressive forms of traditional cultural and creative products but also injects new vitality into the protection and transmission of ICH. Ultimately, the design hopes to use digital and intelligent means to better adapt ICH to the needs of modern society, promote its widespread dissemination, and arouse the public's interest and understanding of traditional culture.

4.2 Innovative Points

4.2.1 Innovative Application of Sound-to-Visual Symbol Transformation

This study transforms the intangible cultural heritage (ICH) sounds along the Grand Canal into visual patterns, integrating traditional sound culture with modern visual art through sound visualization technology to create an entirely new perceptual experience.

4.2.2 Application of Digital and Intelligent Tools

This study employs advanced digital and intelligent tools, utilizing digital technology to convert abstract sound information into concrete visual symbols that are rich in artistic and cultural value, thereby expanding the pathways for the dissemination of traditional culture.

4.2.3 New Methods for the Protection of Grand Canal ICH

Through sound visualization technology, this study provides new ideas for the innovative transmission of the Grand Canal's ICH, explores pathways for the living heritage transmission of traditional culture in modern society [8], and offers references for ICH protection in other regions.

4.3 Technical Roadmap

4.3.1 Introduction to the Procedure

TouchDesigner is a development platform for visual programming that can create real-time visual and new media works. It provides a node-based visual programming environment, where the creation of visually striking works can be achieved by generating nodes and connecting them. These nodes are referred to as OPs (Operators), which represent fundamental modules. Each OP functions as an independent processing unit capable of executing a variety of operations, such as geometric processing, image processing, and animation control. By combining different OPs, complex visual effects and interactive experiences can be realized.

4.3.2 Technical Implementation of the Procedure

1. Extracting Audio: Select appropriate segments of intangible cultural heritage sounds from the canal and import them into relevant audio OPs (Operators), as shown in Figure 2.



Fig. 2 Import audio

2. Assigning Particle Movement Parameters: Extract the characteristic values of the audio and use them as dynamic parameters to control particle movement and change paths, as shown in Figure

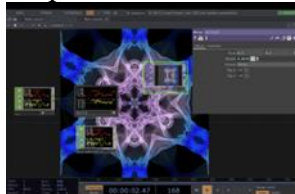


Fig. 3 Assign movement parameters to particles

3. Applying Color OPs: Use color OPs to assign colors to the particles, with color matching referencing the corresponding intangible cultural heritage sound segments, as shown in Figure 4.



Fig. 4 Assign colors to particles

4. Creating Repeating Patterns: Apply multiple translations, rotations, or mirror transformations to the graphics to achieve a seamless repeating pattern, as shown in Figure 5.



Fig. 5 Perform graphical transformations

5. Realizing Dynamic Graphic Changes: Enable the planar graphics to dynamically change in response to audio parameters, as shown in Figure 6.

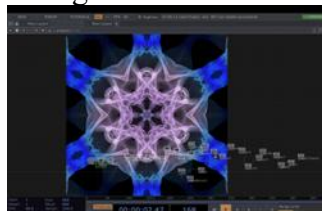


Fig. 6 The overall program

4.4 Pattern Design of Intangible Cultural Heritage Sounds from the Grand Canal

4.4.1 Selection of Intangible Cultural Heritage Sounds

This design selects five representative intangible cultural heritage sounds from the canal area to showcase their rich cultural connotations and historical value. For detailed descriptions, see Table 1.

Table 1. Introduction to Intangible Cultural Heritage Sounds along the Canal

Number	Name	Basic Information and Cultural Value
1	Canal Work Songs	Canal Work Songs, sung by Grand Canal boatmen during sailing or rope hauling, are traditional folk songs with strong rhythms and powerful vocals. They coordinated labor, boosted morale, and reflected the boatmen's resilience and optimism. As intangible cultural heritage, they preserve historical memories, showcase waterway culture, and embody the wisdom of canal communities, holding deep social and cultural significance.
2	Linqing Jia Drum	The Linqing Jia Drum, a traditional percussion instrument from Linqing, Shandong, features a large body, powerful sound, and lively rhythm. Used in festivals and rituals, it symbolizes prosperity and enriches local culture, fostering community unity and preserving historical heritage with unique artistic and social value.
3	Tongzhou Canal Dragon Lantern	The Tongzhou Canal Dragon Lantern, a traditional folk performance art from Beijing's Tongzhou district, involves artists holding colorful lanterns to mimic a dragon's movements, accompanied by gongs and drums, creating a vibrant spectacle. It serves as festive entertainment and symbolizes good fortune, prosperity, and favorable weather. As intangible cultural heritage, it reflects local wisdom, community cohesion, and rich cultural and historical significance.
4	Canal Vendors' Street Cries Sounds	The Canal Vendors' Street Cries are a unique soundscape along the Grand Canal, blending local dialects and melodies to promote goods and attract customers. This oral art reflects the vibrant commercial history and showcases the vendors' ingenuity. As an intangible cultural heritage, it carries a strong sense of historical memory and social emotion, enhances community cohesion, and serves as an important symbol for the transmission of canal culture.
5	Huai'an Da Paifu	The Huai'an Da Paifu, a traditional skill from Jiangsu's Huai'an area, originated from ancient shipbuilding and timber industries. Performers rhythmically strike wood with axes, creating powerful, synchronized sounds that showcase their craftsmanship and teamwork. As intangible cultural heritage, it preserves traditional techniques, reflects the wisdom of laborers, and embodies local cultural identity and historical memory, becoming a vital part of canal culture.

These sounds are not only an integral part of the canal culture but also a bridge connecting the past and the present, carrying profound historical memories and social emotions.

4.4.2 Pattern Design Exhibition

1. Canal Work Songs: This pattern draws inspiration from the audio of canal work songs, transformed through sound visualization technology. It captures the steady rhythm of boatmen's departures, symbolizing determination and courage at the start of a journey. The design features a seamless tiling layout, allowing flawless connections in any direction. The blue and yellow color scheme is consistently applied: blue lines flow gracefully, mimicking the river's meandering and symbolizing the endless extension of waterways; yellow elements, like sunlight shimmering on the water, add brightness and metaphorically express laborers' aspirations for a better life. The

application of this pattern can integrate the essence of intangible cultural heritage into daily life, serving as a bridge between the past and the present, as shown in Figure 7.

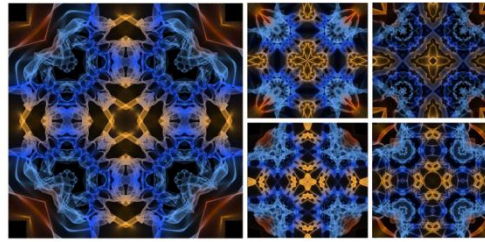


Fig. 7 Sound Visualization Pattern of Canal Work Songs

2. Linqing Jia Drum: Derived from the audio of Linqing Jia Drum, this pattern uses sound visualization to transform drumbeats into a dynamic graphic language. The design captures the rhythm of the drum, symbolizing auspiciousness and prosperity during festive activities. The color scheme combines cyan and pink: cyan represents nature, vitality, and new beginnings, while pink adds warmth and harmonious beauty. This unique combination not only highlights traditional elements but also enables the ancient art form to be passed down in a modern manner, allowing the sound of Linqing Jia Drum to transcend time and space and continue its narrative in a visual form, as shown in Figure 8.

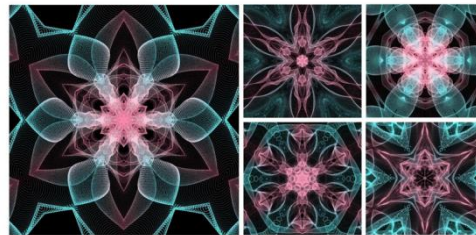


Fig. 8 Sound Visualization Pattern of Linqing Jia Drum

3. Tongzhou Canal Dragon Lantern: Inspired by the performance audio of the Tongzhou Canal Dragon Lantern, this pattern employs sound visualization to create a rhythmic design that reflects the interplay of music and dance. It symbolizes community cohesion and the 传承 of traditional skills. The color scheme features dark blue and lavender: dark blue represents the depth and mystery of the canal, while lavender adds a modern, dreamlike quality. The combination of these two colors not only highlights the uniqueness of the dragon lantern culture but also brings new luster to the ancient ICH elements in modern design, serving as a cultural bridge connecting the past and the future, as shown in Figure 9.

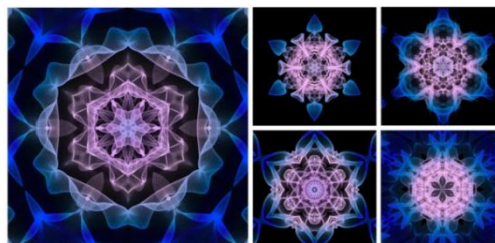


Fig. 9 Sound Visualization Pattern of Tongzhou Canal Dragon Lantern

4. Canal Vendors' Street Cries: This pattern captures the lively audio of canal vendors' street cries, transforming urban hustle into dynamic visual elements. Each cry is converted into graphic components that reflect local dialects and commercial culture, preserving traditional auditory memories in a new visual form. The color scheme uses deep pink and magenta: magenta conveys warmth and enthusiasm, symbolizing the vibrant atmosphere of urban life, while deep pink adds

softness, reflecting the human touch in daily transactions. The ingenious combination of these two colors highlights the unique ambiance of life along the canal while offering a historically flavored pattern choice for modern design, as shown in Figure 10.



Fig. 10 Sound Visualization Pattern of Canal Vendors' Street Cries Sounds

5. Huai'an Da Paifu: Derived from the audio of Huai'an Da Paifu, this pattern uses sound visualization to create a powerful and rhythmic design that captures the essence of traditional shipbuilding techniques. It showcases the wisdom and skill of laborers. The color scheme combines teal and orange-yellow: teal represents the river and timber, essential to shipbuilding, while orange-yellow symbolizes the craftsmen's sweat and passion. The combination of these two colors not only highlights the unique cultural background of Huai'an Plank Axe Striking but also infuses modern design with a vitality from deep within history, serving as a visual bridge connecting the past and the present, as shown in Figure 11.

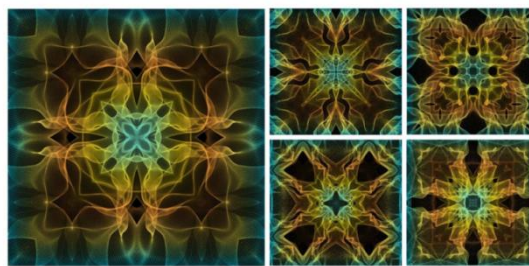


Fig. 11 Sound Visualization Pattern of Huai'an Da Paifu

5. Design Practice: Focusing on the Grand Canal Music Festival

5.1 Design Background —— Tongzhou Grand Canal Music Festival

The 2024 Beijing Grand Canal Music Festival, guided by the Publicity Department of the Beijing Municipal Committee and jointly founded by Beijing Broadcasting Corporation and the Tongzhou District Committee and Government, aims to create an integrated cultural event that combines large-scale open-air symphony, diverse pop music performances, and creative lifestyle markets. The target audience includes music enthusiasts, young people, and family groups with children, who have a strong demand for high-quality cultural entertainment. The design of promotional materials and merchandise will integrate modern aesthetics with traditional cultural elements, emphasizing visual impact and clear information delivery to arouse public interest and participation while highlighting the unique charm and cultural value of the Grand Canal Music Festival.

5.2 Graphic Design

5.2.1 Design Exhibition

In the graphic design display of the Grand Canal Music Festival, the basic pattern graphics previously designed and produced are used as the core. Modern design techniques such as recombination, superimposition, and color adjustment are employed to transform and enrich the original graphic elements, creating a series of new patterns that possess both traditional cultural

connotations and a modern aesthetic. These new patterns are widely applied to festival materials such as tickets, postcards, wristbands, and posters (as shown in Figures 12 and 13). They not only enhance the brand recognition of the music festival but also allow each participant to experience the collision of ancient culture and modern art.



Fig. 12



Fig. 13

5.2.2 Cultural and Creative Application Design

In the cultural and creative extension application section, the pattern designs are skillfully integrated into every detail of the music festival. From the packaging design of the music festival CDs (as shown in Figures 14) to canvas bags, staff badges, commemorative wristbands (as shown in Figure 15), and even the exterior of the music festival buses and the arrangement of the check-in wall (as shown in Figure 16), each element carries a unique story of the patterns.

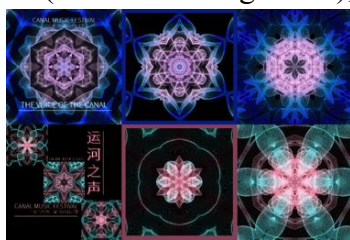


Fig. 14



Fig. 15

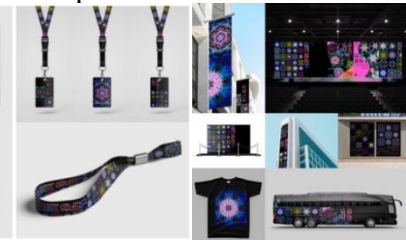


Fig. 16

5.3 Analysis of Design Practice Innovation

5.3.1 Cross-boundary Integration and New Expressions

By combining intangible cultural heritage (ICH) sound elements with visual design, a new design language has been employed. In the promotional materials and merchandise design of the Grand Canal Music Festival, the previously developed pattern graphics were enriched through modern design techniques. This approach addressed the challenge of intuitively presenting ICH sounds, enhanced the expressiveness and appeal of traditional culture, enriched the content of cultural and creative product design, and provided a reference for the practice of integrating traditional patterns with cultural and creative products[9].

5.3.2 Enhanced Interactivity and Experience

The design significantly increased audience participation and depth of experience. By integrating unique sound-visualized patterns into cultural and creative products designed based on the cultural characteristics themselves[10], such as CD packaging, canvas bags, and commemorative wristbands, each product became a bridge for cultural transmission. This provided an immersive cultural experience and stimulated the younger generation's interest in traditional culture.

6. Conclusion

The article employs sound visualization technology to transform the sound elements of the intangible cultural heritage (ICH) of the Grand Canal into visual patterns. This not only provides a

new perspective and method for the modern transmission of traditional culture but also showcases the infinite possibilities of integrating ICH with modern design through practical design practices, such as the graphic design and cultural and creative applications for the Grand Canal Music Festival. These innovative designs enhance the public's awareness and interest in ICH and allow traditional culture to be revitalized in modern society through the dissemination of cultural and creative products. Through this cross-boundary integration and innovative expression, the inheritance and development of Grand Canal culture are promoted, and valuable experience and inspiration are provided for the protection and innovative transmission of ICH in other regions. It is expected that this interdisciplinary design approach, combining technology and art, will be more widely applied to the protection and dissemination of ICH in the future, enabling traditional culture to shine anew in the modern era.

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