

The Dissemination Mechanism and Innovative Path of the Digital Reproduction of the Cantonese Opera Princess Chang Ping

Jieren Xiao

*Guangzhou Institute of Science, Guangzhou, China
M193840@outlook.com*

Abstract. In the context of new media, although Kunqu Opera, Peking Opera and others have been included in the Representative List of the Intangible Cultural Heritage of Humanity and dominate the national list in China, Cantonese opera is still trapped in the predicament of a shrinking market and a gap in the audience. This study takes the digital reproduction of the imperial daughter flower as the core case, uses literature analysis and deeply describes the "AI Cantonese Opera Spatio-temporal Theater", combines the theories of media convergence, cross-cultural communication, cultural adaptation and innovative diffusion, systematically sorts out the protection policies of intangible cultural heritage operas, the literature on the dissemination and technological application of Cantonese opera, and dissects the paths such as virtual set production, real-time motion capture, multilingual subtitles and immersive interaction. The results show that this set of technology can translate stylized operas into cross-media, cross-language and cross-cultural digital narratives, and promote the diffusion of technological innovation to cultural identity through digital collectibles and trend derivatives. It can thus be concluded that digital technology not only "reproduces" but also "reinterprets" the core essence of traditional opera. This has enabled Cantonese Opera to achieve a transition from a "local intangible cultural heritage" to a "global cultural language," providing a replicable paradigm for addressing challenges such as geographical limitations, language barriers, and cultural discount.

Keywords: Digital technology, cantonese opera, princess chang ping, communication strategy, culture.

1. Introduction

This study focuses on the communication transformation of China's intangible cultural heritage (ICH) traditional operas in the new media era. A multitude of traditional operas, such as Kunqu Opera and Peking Opera, have been inscribed on the Representative List of the Intangible Cultural Heritage of Humanity. Moreover, within China's National List of Representative ICH Items, traditional opera categories occupy a dominant position, which fully demonstrates their pivotal value in the ICH system. The advent of the new media era has provided new media channels for the communication of Cantonese Opera, and against this backdrop, the communication advantages of

Cantonese Opera have become more prominent [1]. However, as a classic symbol of Lingnan culture, Cantonese Opera still struggles to adapt its traditional communication methods to modern needs. The digital reproduction of Princess Chang Ping is precisely a crucial practice to address this contemporary challenge.

This study holds significant implications for the inheritance of Cantonese Opera, the "going global" initiative of Chinese culture, and the digitalization of traditional operas. It can help Cantonese Opera break through geographical and language constraints, reduce cultural discount, and avoid cultural alienation. Additionally, it provides a new pathway for the international communication of Chinese culture and serves as a reference for the digitalization practices of other traditional operas.

Centering on the reproduction of classic Cantonese Opera culture through virtual technology and digital technology, this study focuses on exploring how the digital reproduction of Princess Chang Ping adapts to the modern communication environment, overcomes geographical and language limitations, and the insights it offers for the "going global" of Chinese culture.

This paper adopts a literature analysis method, searching and reviewing literature including policies on the protection of traditional opera as China's ICH, research findings on Cantonese Opera communication, and case studies of the cultural application of virtual and digital technologies. This method enables the sorting out of the theoretical foundation for the digitalization of traditional operas, the summarization of practical experiences and shortcomings, and the clarification of the cultural connotation of Princess Chang Ping and digital technology pathways, thereby providing solid support for the study.

The ultimate research objective of this study is to provide theoretical references and practical pathways for the digital inheritance and communication of classic Cantonese Opera and other traditional operas. To achieve this objective, the study conducts an analysis of the application logic of virtual technology and digital technology, an in-depth decomposition of the digital reproduction case of Princess Chang Ping, and a discussion on its role in cultural inheritance and international communication.

2. Literature review

Taking the classic Cantonese Opera Princess Chang Ping as a starting point, this study investigates how virtual set design, real-time motion capture, multilingual subtitles, and immersive interaction translate stylized opera in the context of new media. It also examines the actual effectiveness of these technologies in breaking down geographical and linguistic barriers, reducing cultural discount, and facilitating the "going global" of Chinese culture. A comprehensive literature review reveals the following gaps: Jenkins' theory of media convergence explains multi-platform distribution but fails to address the micro-level translation from "stylized movements to digital symbols" [2]. Shan Bo and Chang Yanrong's cross-cultural communication model focuses on symbolic dialogue yet lacks high-context samples from traditional opera [3,4]. Rogers' diffusion of innovations framework accounts for technology adoption but overlooks the unique manifestation of the dual barriers of "usage cost and emotional identification" in traditional opera [5]. Existing studies have not integrated these four theories, lack empirical data on the translation chain, and fail to establish hierarchical interaction strategies targeting Generation Z, veteran opera fans, and international audiences. Using the "AI Cantonese Opera Time-Space Theater" as a case study, this paper constructs an integrated "Technology-Symbol-Audience" framework to fill theoretical gaps and provide replicable pathways for policies on opera digitalization and content planning.

3. The current communication status and development prospects of Cantonese Opera in the digital age

With the acceleration of social development and pace of life, coupled with the increasing diversification of cultural and entertainment options in the internet era, the inheritance and development of traditional Chinese opera face a less optimistic outlook. It is primarily confronted with challenges such as a shrinking market, an audience gap, and growing alienation from young people [6]. According to communication principles outlined in relevant research, the communication process is bidirectional rather than a one-way indoctrination [7]. The lack of understanding of Cantonese Opera among audiences does not stem from its artistic value itself, but rather from the disconnection between the traditional one-way communication model and the interactive habits of contemporary audiences.

In the digital age, information recipients are also content producers and disseminators; they crave participation, feedback, and even secondary creation. Therefore, if the communication of Cantonese Opera remains limited to traditional forms such as stage performances or TV live broadcasts—lacking real-time interaction and in-depth dialogue with the audience—it will be difficult to arouse resonance and interest among the new generation. These predicaments not only restrict the widespread communication of Cantonese Opera but also pose a certain threat to its inheritance and development. The decline of traditional opera art has become an undeniable fact [6].

In recent years, with the advent of the digital age, digital technologies—characterized by their cutting-edge nature—have not only made positive contributions to the inheritance and protection of intangible cultural heritage (ICH) but also significantly transformed the communication methods and channels of ICH [8]. These digital technologies have opened up new paths for the communication of Cantonese Opera and injected new vitality into it. This infusion of vitality is particularly evident at the level of technological empowerment: the in-depth integration of digital technologies is fundamentally changing the presentation logic and development path of Cantonese Opera. Innovations in communication methods are not only an inherent demand for the inheritance and development of traditional opera art but also an inevitable reality of the new media era [6].

3.1. Media convergence

With the rapid advancement of emerging media technologies, research on the spatio-temporal orientation of emerging media has begun to emerge continuously [9]. Against this backdrop, the theory of media convergence emphasizes breaking down media barriers through technological integration to achieve multi-channel and multi-form distribution of content. Meanwhile, as Henry Jenkins pointed out, convergent culture is not merely an innovation at the technological level; its essence lies in promoting the cross-boundary generation and reconstruction of cultural practices and meanings, with the core being the creative transformation of different cultural elements in an interactive context and the formation of participatory culture [2]. Compared with traditional mass communication, the relational connections in convergent media communication are more manifested as weak ties. The role of weak ties is characterized by ubiquity and fragmentation, with aggregation and fragmentation being its main forms of function [9]. First of all, convergence acts not only at the media technology level but also at the cultural level [10]. Jenkins' theory further holds that media convergence is a catalyst for cultural convergence. It is not just the superposition of channels, but the in-depth integration of cultural symbols, narrative methods, and aesthetic experiences. The combination of traditional Yueju Opera (Cantonese Opera) performance conventions, musical elements with modern film and television languages, and virtual images is a typical practice of

convergent culture. New media technologies have subverted traditional media communication methods. Media communication means have evolved from single media to interconnection across multiple platforms and terminals, and media convergence has increasingly penetrated into daily life [6]. The new media environment emphasizes the reconstruction of an "interpersonal communication relationship" between communicators and audiences, thereby realizing the dissemination of "relational messages" [9].

Supported by digital technology, the "AI Yueju Opera Spatio-Temporal Theater" has built a three-dimensional communication matrix and serves as a key engine for the digital communication of Princess Chang Ping. In terms of content production, it digitally translates six classic acts of the play. By virtue of Midjourney, it converts concrete elements such as water sleeves and pheasant feathers (a prop used in traditional Chinese opera) into abstract symbols with emotional tension. For example, in the "Xiang Yao" (The Final Embrace) segment, AI presents the scene of the lovers' joint suicide through burning phoenix patterns and flowing color blocks. This not only preserves the emotional core of the original work but also creates a modern aesthetic language, promoting the transformation of traditional opera into digital cultural symbols.

At the level of communication channels, the theater uses RUNWAY to achieve real-time interaction between character movements and the environment, where the prolonged notes of the singing trigger a ripple effect on the screen. Offline holographic projections create an "interweaving of virtual and real" experience. Digital content is distributed through multiple channels such as short video platforms and VR exhibition halls, forming an "online-offline" closed loop and breaking the constraints of time and space. Its "AI Reconstruction of Princess Chang Ping" series on Bilibili has achieved over 5 million views, effectively expanding the audience base.

This practice is in line with the "media convergence" theory. Through the in-depth coupling of technology, platforms, content, and audiences, it reconstructs the communication form of Yueju Opera, forming a positive cycle of "online feeding back to offline and offline empowering online". It injects new vitality into Yueju Opera and provides a path for its sustainable digital development.

3.2. Intercultural communication

The core of Intercultural Communication theory lies in achieving meaning sharing among different cultural systems through symbol reconstruction. In his Basic Theoretical Propositions of Cross-Cultural Communication, Shan Bo proposed that there is an isomorphic relationship between culture and communication, stating that "culture is communication, and communication is culture". Communication serves not only as the form through which the landscape of culture unfolds, but also as a "factory" for cultural production. Effective cross-cultural communication, on the basis of respecting differences, requires establishing mutual understanding through symbol translation and dialogue [3]. This perspective provides key guidance for the cross-cultural communication of intangible cultural heritage (ICH). As a living culture that relies on the innovation of communication mechanisms to achieve dynamic inheritance, the essence of ICH communication lies in the interaction, adaptation, and co-construction of meanings between cultural symbols and other cultural systems [3]. In her discussion of the three models of cross-cultural communication, Chang Yanrong further divides cross-cultural communication into the Behavioral Model of Intercultural Communication (BMIC), the Cognitive Model of Intercultural Communication (CMIC), and the Interpretive Model of Intercultural Communication (IMIC). The behavioral model focuses on the comparison of cultural communication rules and non-verbal symbols; the cognitive model concerns the impact of psychological factors such as individual anxiety and uncertainty on communication; and the interpretive model emphasizes the negotiation of meanings and interactive construction

between communication parties. These three models build a theoretical framework for ICH communication from the dimensions of "behavior-psychology-interaction".

From the perspective of the communication characteristics of traditional opera (a form of ICH), some scholars argue that the repertoires of traditional opera as ICH can be divided into traditional repertoires and innovative ones. Performances of traditional repertoires, which aim to preserve the traditional memories and expressive techniques embedded in them to the greatest extent, must maintain the "original flavor" of their stage form [4]. As a core carrier of Lingnan culture, the classic Princess Chang Ping of Yueju Opera (Cantonese Opera) embodies the historical narrative of the late Ming and early Qing dynasties, Lingnan's aesthetic paradigms, and the spiritual core of "patriotism and family devotion". However, due to barriers such as the Cantonese dialect and the limitations of traditional stage spaces, it has long struggled to break through the regional cultural circle and achieve in-depth meaning resonance with diverse global audiences. In contrast, the digital practice of the "AI Yueju Opera Spatio-Temporal Theater", guided by cross-cultural communication theory, has helped Princess Chang Ping break through the Lingnan cultural circle and gain broader cultural recognition through the de-regionalization of visual symbols.

At the level of symbol translation, the "AI Yueju Opera Spatio-Temporal Theater" strictly follows the logic of "the isomorphism of culture and communication". While preserving the essential characteristics of Yueju Opera—such as the melody of its singing, role types, and core narrative—it carries out the international translation of cultural symbols [1]. Its specific practice is in line with the "etic research" of the Behavioral Model of Intercultural Communication (BMIC): for example, it transforms the bold color and powder application techniques of the Lingnan School of Painting into high-saturation color block collisions via AI, eliminating the cognitive threshold of region-specific artistic language. Through audio-visual interaction, it converts the traditional "ban yan" (rhythmic patterns) of Yueju Opera into universal emotional rhythms, allowing audiences unfamiliar with the musical theory of Yueju Opera to perceive the sorrow and joy of the plot through rhythm alone. For overseas promotion, an instrumental solo segment from "Zhuang Tai Qiu Si" (Autumn Thoughts at the Dressing Table) was selected. With AI-generated abstract landscape paintings matching the melody of the pipa (a traditional Chinese plucked string instrument), the traditional Chinese sentiment of "longing" is transformed into a borderless visual rhythm [11]. The effectiveness of this symbol translation strategy was verified at the 2023 Venice Biennale: the relevant segments resonated widely with international audiences, and the number of discussions under the corresponding Twitter hashtag exceeded 100,000, confirming the cross-cultural communication law that "communication creates shared culture" [3].

Leveraging international communication platforms has further expanded the cultural influence of Princess Chang Ping and constructed a diverse dialogue field from the perspective of "intersubjectivity". Shan Bo pointed out that in cross-cultural communication, "the relationship between the self and the other is by no means that of a communication subject and a communication object, but rather two subjects coexisting in the same communication activity". Effective communication requires establishing "mutual understanding" through dialogue [3]. Based on this, the "AI Yueju Opera Spatio-Temporal Theater" has collaborated with YouTube to launch AI-based act analyses of the opera with multilingual subtitles, and invited sinologists and theater critics to conduct cross-cultural interpretations. Sinologists explain the cultural origins of "patriotism and family devotion" from a historical context, while theater critics connect the love narrative of "Princess Changping and Zhou Shixian" in Princess Chang Ping with the motif of "love and sacrifice" in Western classics such as Romeo and Juliet, realizing a dialogue between local cultural themes and globally shared emotions [3]. At the same time, its digital collectibles are sold on

overseas NFT platforms, with buyers including Yueju Opera enthusiasts and groups interested in Eastern culture. This forms a two-way empowerment of "cultural communication - market value" and provides a replicable practical path for the cross-cultural communication of ICH.

3.3. Cultural adaptation

The theory of cultural adaptation requires communicators to adjust their communication strategies according to the cultural backgrounds of the audience, and achieve effective communication through dynamic adaptation [12]. The hierarchical content design of the "AI Yueju Opera Spatio-Temporal Theater" is exactly consistent with the "intersubjectivity" construction logic in this theory—communicators and audiences, as interdependent subjects, reach "reciprocal understanding" through differentiated content, realizing accurate access to different groups [3].

For the domestic young audience, the theater launched the "AI Princess Chang Ping Re-creation" challenge on Douyin, providing simplified AI tools to generate "abstract paintings of Yueju Opera characters", with the number of topic participants exceeding 3 million. This model of "deconstructing classics + user creation" conforms to the participatory needs of Generation Z and also adapts to the characteristics of new media, such as "mediated communication scenarios and popularized content". It transforms Yueju Opera elements into social symbols for young groups [13]. For Yueju Opera enthusiasts, the theater launched the "AI-restored version" of classic videos, restoring the stage details of the 1959 version. This not only solves the problem of spreading historical videos but also meets the nostalgic needs of senior audiences through clear and interpretable presentation, which is in line with the adaptation principle of "respecting the audience's cultural cognitive level" [14].

For the international audience, the theater transformed the historical background of Princess Chang Ping into a visual timeline through AI animated short films, and set up an interactive device of "Yueju Opera Costume Disassembly" in the V&A Museum in London to help the audience understand the meaning of the costume patterns. This design of "superficial cognition + immersive experience" draws on the logic of metaverse technology to "construct a media space", solves the cross-cultural "knowledge gap", and enables foreign audiences to gradually understand the cultural connotation of the play. It conforms to the adaptation logic of "starting from the audience's cognitive starting point" [15].

3.4. Diffusion of innovations

The Diffusion of Innovations theory reveals the process by which new things evolve from adoption by a minority to widespread popularity. Rogers pointed out that the diffusion of innovations is influenced by four core factors: the characteristics of the innovation, communication channels, time, and the social system. In the context of developing countries, an additional key variable—cost of use—needs to be supplemented [5]. The communication path of the "AI Yueju Opera Spatio-Temporal Theater" perfectly exemplifies this law: by lowering the threshold for technical experience and aligning with the needs of traditional cultural inheritance, it has achieved a leap from technological innovation to cultural recognition, while avoiding the inhibitory effect of use costs on diffusion [15].

Innovators and early adopters form the first circle of communication. According to the Diffusion of Innovations theory, this group typically possesses sensitivity to new technologies and a willingness to explore, serving as the initial builders of the innovation's reputation [15]. Technology enthusiasts and art practitioners were the first to recognize the innovative value of AI in reconstructing traditional opera: the digital restoration of detailed Yueju Opera stage elements by AI

not only demonstrates relative advantage but also is highly compatible with the needs of traditional cultural preservation. With low complexity and high trialability, these characteristics enabled the theater to quickly gain recognition from this group [16]. They shared their exhibition experiences on professional forums and social platforms, laying the foundation for the first round of word-of-mouth communication. During the theater's trial operation in 2022, most related notes on Xiaohongshu (Little Red Book) came from groups such as designers and programmers. Their professional interpretations not only enhanced the innovation's observability but also established a cognitive foundation for subsequent diffusion [16].

With the involvement of mass media, the innovation entered the early majority adoption stage. Rogers argued that mass media serves as a key channel in the mid-term of innovation diffusion, enabling rapid expansion of the innovation's reach [15]. The rise of new media has further supplemented the communication path—its two-way interactive nature facilitates acceptance at both the cognitive and skill levels [16]. In-depth reports by mainstream media on the theme of "AI activating intangible cultural heritage," combined with the interactive function of AI-generated Yueju Opera characters on the theater's online platform, turned the theater into a cultural hotspot, with daily offline visit numbers exceeding 2,000. At this stage, interpersonal communication and mass communication formed a synergy: AI-generated stage photos shared by audiences on Moments (a social feature on WeChat) reinforced the media's coverage of the "digitalization of traditional culture" topic. This not only lowered the cognitive threshold of ordinary audiences regarding the technology but also enhanced the innovation's observability through social scenarios, prompting more people to take the initiative to learn about Princess Chang Ping.

The practice of the "AI Yueju Opera Spatio-Temporal Theater" demonstrates that the digital communication of traditional culture must be based on media convergence, adopt cross-cultural communication and cultural adaptation as strategies, and ultimately achieve living inheritance through the diffusion of innovations. This path not only provides insights for the development of Yueju Opera but also points out a direction for all traditional cultures to break through in the digital age—only by adhering to their cultural core and making good use of communication laws can classics maintain their vitality through innovation.

4. Conclusion

The findings of this study are derived from a systematic analysis of the digital reproduction pathways of the classic Cantonese Opera Princess Chang Ping. It reveals that by leveraging core technologies such as virtual set design, real-time motion capture, multilingual subtitles, and immersive interaction, the stylized performances of traditional opera have been successfully translated into digital narratives that are cross-media, cross-linguistic, and cross-cultural. This transformation has significantly enhanced the reach and favorability of Cantonese Opera among younger audiences and international viewers. From these findings, the study draws the following conclusion: Digital technology not only "reproduces" traditional opera but also "reinterprets" its cultural core. This enables traditional opera to achieve a transition from a "local intangible cultural heritage (ICH)" to a "global cultural language" in the context of new media, providing a replicable paradigm for addressing geographical barriers, language obstacles, and cultural discount.

This study offers valuable references for future research in this field, with key implications for three aspects: the formulation of policies for the digital preservation of traditional opera, the design of technology pathways for the integration of culture and technology, and the content planning and narrative strategies for the international communication of Chinese culture. Future research should focus on in-depth exploration of three directions: the theoretical construction of the intersection

between "digital humanities" and "opera aesthetics," innovations in AI-driven immersive interaction, and the audience psychological mechanisms underlying the cross-cultural translation of "Chinese stories."

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