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Aesthetic Innovation of Heyang String Puppetry Theatre Empowered by Digital Technology

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Abstract: **This study explores the aesthetic innovation of Heyang String Puppetry Theatre through the lens of digital technology. Starting with an analysis of its artistic traditions, aesthetic characteristics, and the opportunities posed by digital advancements, it examines multimedia integration performances and somatosensory interactive applications. Based on these cases, the research identifies specific dimensions, principles, and strategies for aesthetic innovation. Digital technology introduces new aesthetic possibilities, opening fresh ground for exploring the art form in the modern era. To succeed, it must both deeply preserve its unique cultural essence and actively embrace technological opportunities, innovating in form, content, and experiential engagement. This balance ensures the tradition's historical roots remain intact while fostering a dynamic, cross-disciplinary synthesis that reconstructs its aesthetic value for digital audiences.**

Keywords: Heyang String Puppetry Theatre; Digital Technology; Aesthetic Innovation; Implementation Paths; Inheritance and Development

1. Artistic Traditions and Aesthetic Traits of Heyang String Puppetry Theatre

1.1 Historical Origins and Evolution

Heyang String Puppetry Theatre, locally known as "Xianqiang Mu'ou Xi," originated in Heyang County, Weinan City, Shaanxi Province. It traces its roots to Han Dynasty puppet shows, evolving gradually through subsequent eras. During the Tang and Song Dynasties, with socioeconomic growth and the rise of urban audiences, puppetry flourished, driving technical and performative refinements in Heyang's tradition. The Ming and Qing Dynasties marked its golden age: troupes proliferated, performing widely at rural temple fairs, weddings, funerals, and other folk rituals, cementing a distinct artistic style [1]. By the Republic of China period, nearly every village had its own theatre stage, spawning specialized troupes like Minsheng She, Sanmin She, Xinmin She, Nuhu Jushe, and Huayun Jutuan despite political instability. Since 1949, government support has safeguarded and revitalized the art, enabling creative adaptations while preserving its core heritage.

1.2 Traditional Performance Techniques

Strings are the essence of Heyang puppet manipulation [2]. Behind the scenes, performers synchronize finger movements to control threads attached to puppets, animating them through coordinated tension and release (Figure 1: Heyang String Puppetry Performance). This requires precise teamwork to execute complex actions—walking, running, jumping, fighting, or acrobatics—while simultaneously aligning with vocal melodies, musical accompaniment, and character-specific lip-syncing.

Puppet craftsmanship is highly intricate. Heads are carved from willow wood using traditional techniques, featuring broad foreheads, rounded chins, and elongated facial features—particularly graceful for female roles, with delicate noses, smiling lips, and expressive eyes [3]. Skilled carving captures nuanced emotions and traits: loyalty, cunning, or elegance through meticulous detailing. Costumes, crafted from silks, cottons, and fine fabrics, use embroidery and dyeing to distinguish characters: emperors, peasants, and servants each have unique color palettes and designs reflecting social hierarchy.

The performance aesthetic emphasizes. Lifeless puppets gain vitality through performers' skill, transforming scripted narratives into emotionally resonant experiences [4]. Strings (typically 5–10 per puppet) enable dynamic actions—removing hats, carrying objects, or dramatic gestures—via techniques like lifting, pulling, twisting, and shaking [3]. Every movement is clean, fluid, and skeletal precision is often visible, ensuring even minor characters display individuality. Performances seamlessly blend singing, recitation,

and choreography to evoke empathy, merging beauty, truth, and virtue into a unified artistry.

Xian'ou Diao and Luan Tan Diao. Xian'ou Diao is the soul of the tradition, featuring a unique vocal melody accompanied by instruments like the "erxian"and "banhu". Its slow, flowing rhythms transition naturally between tempo variations to mirror emotional arcs [5]. Singers employ falsetto–chest voice blending for soaring yet controlled delivery. Lyrics—7- or 10-character verses—cover historical tales, daily struggles, and philosophical insights, enhancing musical storytelling with vivid imagery.

Figure 1. Heyang String Puppetry Theatre Performance

2. Opportunities and Challenges from Digital Technology

2.1 Digital Technology Trends

Currently, digital technology is developing rapidly, gradually exhibiting the characteristics of intelligence, interactivity, and integration. Technologies such as artificial intelligence, big data, and cloud computing are emerging one after another, and various fields are continuously transforming towards digitalization. Among them, immersive digital technologies like virtual reality (VR), augmented reality (AR), and mixed reality (MR) can create highly realistic virtual scenes, while technologies such as 3D modeling and motion capture are also capable of realistically presenting the shapes or movements of objects [6]. Digital technology also features strong efficiency, convenience, and replicability. It can process massive amounts of data in a short time, break through the limitations of time and space, quickly realize the dissemination and sharing of information, and provide strong technical support in the field of culture and art.

2.2 Opportunities for Innovation

Digital technology has opened a new window for the artistic presentation of Heyang string puppetry. The originality of intangible cultural heritage in the field of arts carries the artistic symbols of its affiliated social and cultural regions; therefore, the protection of the originality of such ICH lies in safeguarding the characteristics that have gradually formed, developed, and been passed down through the long course of history [7]. Traditional puppet images can be digitally reconstructed using 3D modeling and animation technologies, enabling the design of more innovative, aesthetically pleasing, and impactful shapes. This also makes it possible to achieve movements that are difficult for traditional puppets to perform and scenes that cannot be presented in conventional frames—for example, allowing puppets to traverse virtual mythical worlds. Technologies such as VR and AR can provide people with an immersive viewing experience. Wearing such devices, viewers feel as if they have stepped into the puppet show, able to observe various details of the performance from different angles and at close range. This transforms the usually flat performance into a three-dimensional, immersive one, expanding the art of performance and enhancing its aesthetic value.

In the era of the Internet and digital media, in addition to continuing offline performances, Heyang string puppetry can leverage short-video platforms, live-streaming platforms, and new media to allow people to watch exciting performance clips online anytime and anywhere. This breaks geographical barriers, enabling more people to appreciate the art. Moreover, through online self-media promotion, more people can learn about this niche art form, which will undoubtedly greatly expand the audience base. It can also be shared through new media social platforms such as WeChat and Weibo, allowing Heyang string puppetry to be introduced to a wider audience quickly. Online exhibitions and virtual performances developed using digital technology can attract a large number of young people through new media, enabling them to watch or interact at will via mobile phones or computers, thereby enhancing the cultural appeal and influence.

The integration of traditional techniques with modern technology provides an innovative way to showcase and expand traditional art [8]. High-definition video recording, 3D scanning, and other methods can completely preserve the traditional puppet carving techniques, costumes, props, and classic repertoires, preventing endangered cultural heritage from being damaged or lost due to the passage of time or human factors. Furthermore, by establishing a digital database, information such as historical materials, performance techniques, and musical vocals of puppet shows can be classified, entered, and preserved for a long time, allowing relevant

researchers and inheritors to access and study them at any time. The use of digital simulation to revive lost historical performance forms and scripts for creative use plays a role in achieving twice the result with half the effort for the inheritance and development of Heyang string puppetry culture.

2.3 Implementation Challenges

The application of digital technologies may lead people to overly pursue technical effects, easily neglecting the inherent artistic essence of Heyang string puppetry. This can result in a failure to achieve an organic unity between technology and art, thereby compromising the artistic quality of works and the expression of their cultural connotations. The scarcity of interdisciplinary talents who possess both expertise in Heyang string puppetry art and proficiency in digital technologies is another significant factor restricting the innovative development of Heyang string puppetry. Additionally, the research, development, and application of digital technologies require substantial financial investment, which is difficult for puppet inheritance teams with limited funds to afford. Furthermore, another risk in the digitization process is that some cultural traits of Heyang string puppetry may deviate due to various reasons during transformation. This necessitates attention to how the cultural content of Heyang string puppetry can be fully presented in the digitization process.

3. Pathways for Aesthetic Innovation through Digital Technology

3.1 Artistic Expression Innovation

In the process of constructing the aesthetics of digital theater performance and its practical paths, interactive aesthetics stands at the core. Spectacle aesthetics and holographic body aesthetics, as important foundations and supplements to interactive aesthetics, can effectively enhance the sensory immersion and emotional appeal of digital theater [9]. On one hand, we should strengthen the supporting role of interactive aesthetics, spectacle aesthetics, and holographic body aesthetics in digital theater. On the other hand, we can create an immersive performance atmosphere by setting up virtual performance scenes through VR and AR to complement the physical puppet performance. Additionally, we should give play to the role of 3D modeling technology in puppet design—on the premise of retaining traditional carving features, appropriately adding modern elements to endow puppets with more vitality. Furthermore, on the basis of processing the string cavity music with digital audio technology, the processed high-quality sound effects combined with modern-style sound effects can provide a better viewing experience for the plays.

3.2 Digital Platform-Driven Dissemination

A dedicated online exhibition and performance platform should be established to gather high-quality repertoire resources and provide high-definition online viewing functions, facilitating audiences to watch performances at any time. In accordance with different audience groups and the characteristics of various platforms, different communication methods should be formulated. More creative short videos and live broadcasts should be produced and shared with netizens, such as shooting exciting clips of puppet shows, behind-the-scenes footages, or producing story introductions with subtitles to vigorously promote the cultural connotations of puppet shows. Online activities should be carried out to increase interaction with the audience, such as plot voting and role evaluation, so as to enhance the audience's stickiness and emotional connection, make more people fall in love with puppet shows, and further expand the influence and radiation scope.

3.3 Digitally Enhanced Preservation

A digital resource database should be established to digitally collect and store materials such as historical documents of puppet shows, performance videos, and puppet props, with proper management and sharing mechanisms in place. A digital teaching system should be developed to create multimedia teaching courseware and video tutorials, providing convenience for inheritors and learners, facilitating better transmission and dissemination of puppet show techniques, and effectively implementing the inheritance and promotion of such techniques. Big data should be utilized to analyze information including puppet show performance data and audience feedback, thereby grasping the current development status and laws of puppet shows. This analysis will provide a scientific basis for the artistic innovation of puppet shows; on this basis, specific strategies for the inheritance and development of puppet show art should be reasonably planned and deployed according to the results of data analysis.

4. Discussion of Digital Aesthetic Innovation

4.1 Dimensions of Innovation

Building on the traditional expressive forms of Heyang string puppetry, which have evolved from stage performances to multi-media formats, digital technology has broken the boundaries of time and space. Beyond its original stage performances, Heyang string puppetry can now be expressed through diverse forms such as multi-media integrated shows, digital animations, and virtual reality—thus transcending temporal and spatial constraints to present audiences with a more varied range of artistic works. Newly adapted creations that retain the core of traditional stories while integrating contemporary elements and audience-favorite narratives are delivered to viewers, offering works that are both accessible and appealing. From passive viewing to participatory performance, through somatosensory interaction technology or online interactive platforms, the audience is no longer merely a passive spectator of the visual art presented by performers but can also participate in the creation of puppetry. This grants performers and audiences an equal platform for expression, embodying a truly full-screen performance experience. It also transforms the former top-down relationship between performers and viewers, immersing the audience in a richer emotional journey.

4.2 Guiding Principles

In the innovation of digital aesthetics, we must always uphold the cultural roots of Heyang string puppetry, preserve its distinctive artistic and cultural connotations, and protect the essence of its traditions. When introducing digital technologies, we should pay attention to integrating tradition with the present, avoiding excessive pursuit of novelty at the expense of the original cultural core. It is essential to both highlight the characteristics of the times and inherit the essence of traditional culture. Adopting a "culture+" narrative strategy that blends multiple cultural elements, we can organically transform materials such as traditional culture and modern culture contained in opera art into narrative content easily accepted by young audiences [10]. For young audiences, we should develop interesting and interactive digital products; for those who love traditional art, we should provide high-quality and traditional digital repertoires. We should allow technology and art to coexist, strengthen cross-disciplinary cooperation between technology and the art of Heyang string puppetry, and enhance communication and collaboration between technical teams and artistic teams. With technology as a medium to empower artistic creativity, we should promote technological research and development based on artistic needs, facilitate the coordinated development of technology and art, and create works with greater aesthetic value.

4.3 Reconstructing Aesthetic Value

With the advent of the digital age, the aesthetic value of Heyang string puppetry has been recast and innovated. On one hand, digital technology has broken through the existing boundaries of artistic expression, enabling the art form to present its artistic vitality with new aesthetic connotations. On the other hand, the new modes of communication and interaction have enhanced viewers' aesthetic awareness and their level of recognition. Under the governance of the essential characteristic of "liveness" in theatrical art, digital theatrical performances revolve around the real-time "communication-feedback" interactive co-creation mechanism of information between people, as well as between humans and artificial intelligence. This makes each theatrical performance present a unique completed form full of interactivity and uncertainty [9]. Through close integration with digital technology, Heyang string puppetry not only retains the spiritual essence of the traditional craftsmanship inherited from the older generation of artisans but also acquires brand-new and exquisite aesthetic imagery of the times empowered by digital technology. Therefore, the digitized Heyang string puppetry serves as a cultural bridge in contemporary society for promoting the creative transformation and innovative development of excellent traditional culture.

5. Conclusion and Future Directions

5.1 Key Findings

Studies have shown that digital technology brings opportunities for aesthetic innovation in Heyang string puppetry, achieving notable progress in artistic expression, communication channels, and cultural inheritance and protection. However, due to the inherent limitations of aesthetic innovation, efforts must be made to overcome difficulties during the innovation process, such as the inadequate integration of technology and art, a shortage of talents, and the failure to fully digitally express the cultural core. From the perspective of aesthetic innovation, it is necessary to clarify the dimensions and principles of Heyang string

puppetry, adhere to the orientation of preserving its roots and focusing on the audience, and make efforts in interdisciplinary fields. This will enable the aesthetics of Heyang string puppetry to gain new expressions in the digital age, and while promoting innovation, accelerate the pace of inheritance and development of Heyang string puppetry.

5.2 Future Prospects

With the advancement of digital technology, greater space will be opened up for the aesthetic innovation of Heyang string puppetry. For instance, artificial intelligence can be applied to design movements for puppet performances, making them more precise and artistically appealing. The concept of the metaverse will also create new performance and experience models for Heyang string puppetry that integrate the virtual and the real. Beyond relying on promotion led by local governments, we hope more social forces will participate, driving Heyang string puppetry toward digital innovation and development.

5.3 Limitations and Future Research

First, there is a lack of case studies with sufficient breadth and depth, and for specific practical cases, there is a shortage of long-term tracking of concrete effects and detailed feedback from the audience. Second, attempts can be made to expand to more cases, conduct more in-depth analysis of the actual effects achieved by the application of digital technologies, and explore better ways of aesthetic innovation from them. Third, it is necessary to further strengthen research on the mechanisms related to the integration of digital technologies and the cultural core of Heyang string puppetry, so as to provide better theoretical support for the long-term development of Heyang string puppetry.

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