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New Charm of Light and Shadow" A Study on the Digital Reconstruction and Dissemination of Shadow Puppetry Animation Based on a 3D Engine

Yutong Sun[1*]

[1] BA+China-Korea Institute of New Media +ZhongNan University of Economics and Law+WUHAN +CN+430010

* **Corresponding Author:** Syt685008@outlook.com

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ABSTRACT

As intangible cultural heritage faces threats of decline in the digital age, there is a growing need to explore innovative methods for preserving traditional art forms. Purpose: This study aims to explore the digital reconstruction and dissemination of traditional Chinese shadow puppetry, focusing on how 3D engine technologies can support its preservation, visual adaptation, and cultural relevance. Method: A qualitative research approach was employed, utilizing secondary data drawn from academic literature, visual materials, and case study analysis. Through thematic analysis, the study examined visual aesthetics, digital adaptation processes, narrative preservation, and dissemination strategies. Cultural Convergence Theory guided the exploration of how heritage content can be faithfully adapted across digital platforms. Results: The findings reveal that maintaining visual symbolism, codified gestures, and narrative structure is essential for authentic digital reconstruction. 3D animation tools, when used with cultural sensitivity, can effectively translate traditional aesthetics and movements. Additionally, digital dissemination—particularly through interactive and educational platforms- significantly improves accessibility and engagement with younger audiences. Implications: The study highlights that digital technologies, when thoughtfully applied, can serve as powerful tools for safeguarding intangible cultural heritage. The approach offers valuable insights for designers, educators, and cultural practitioners aiming to integrate traditional art into modern media while maintaining its cultural integrity.

Keywords: Chinese Shadow Puppetry, Intangible Cultural Heritage, 3D Animation, Digital Reconstruction, Cultural Preservation, Cultural Convergence Theory

1. Introduction

1.1. Research Background

Shadow puppetry, as a time-honoured type of storytelling with light and shadow used together with music and story, is highly culturally relevant in all parts of the world, including China, Indonesia, Turkey, and India. Ramli and Lugiman (2012) point out that shadow puppetry is not only a source of entertainment but also a communal memory and oral culture because of its performance, which is characterised by graphic depiction. In classical arrangements, folk puppets are engineered into highly elaborate puppets, which are operated in front of a source of light to project action images on a screen along with folk tales and songs. These shows used to be an important communal process that supported the same values and past. Nevertheless, the traditions of oral performance have been lost extremely fast, with rapid modernization and the weakening of the practices of shadow puppetry due to the lack of interest and passing down to the new generation (Li, 2022). The interest in using technology to preserve and reinterpret intangible cultural heritage (ICH) has been on the rise with the emergence of digital media among researchers and cultural practitioners. Yuhan et al. (2024) further stressed that immersive

technologies and interactive visualisations are new forms of interaction for the audience and enable cultural artefacts to be perceived in dynamic and multisensory ways, which traditional methods of documentation do not always provide.

Digital reconstruction and animation have emerged as a potential solution in revitalizing the traditional arts. With 3D engines, artists and researchers can reproduce the visual effect, the motion, and the light effect of shadow puppetry in an interactive and flexible digital environment. Zhao (2020) presented the idea of how digital animation could preserve and share the traditional Chinese folk art and allow younger generations to experience the heritage in more accessible formats. Similarly, the study by Wang and Tseng (2023) explored the combination of puppetry and game design methods, demonstrating how online platforms can preserve the spirit of traditional performance and increase its level of interaction and immersion. Such methods do not focus on the preservation of visual aspects alone but also on the conversion of narrative experiences to the formats that can be displayed on the modern medium, such as VR, mobile apps, and digital exhibits. Li, Laoakka, and Champadaeng (2025) suggested that digital preservation should not be just the mere replication of cultural heritage, but that it should adopt approaches that recognise the symbolic and performative elements of cultural heritage.

The distribution of the reconstructed cultural media is of a critical nature when it comes to its effectiveness. According to Psomadaki et al. (2019), effective digital heritage projects are characterised by the integration of narrative-rich and participatory, and interactive user experiences. Cultural expressions can be greatly extended through platforms such as social media, online archives, and virtual museums developed in a careful manner. The situation with shadow puppetry is that its three-dimensional richness of touch, audio-visual imagery needs a delicate grasp of the old aesthetics and the contemporary visual narrative styles to be transfigured into digital platforms. The intersection of visual analysis and performance studies with digital design allows exploring further how traditional puppetry can be redesigned to address wider and more diverse audiences. With the growing interconnectedness between cultural heritage and technology, the interdisciplinary practice is also important in order to make sure that the spirit of the traditional forms is not erased, but can be redesigned in newer forms of cultural meaning and artistic expression.

1.2. Problem Statement

Chinese shadow puppetry has become an important intangible cultural heritage, but is seriously facing the threats of a lack of public interest and integration with modern digital media. Wibawa (2024) considered the opportunities of digital media integration into wayang (Indonesian shadow puppetry) to make the performance more attractive and relevant in modern performance conditions. Although some literature is emerging on the subject of digital maintenance of traditional arts, a dedicated literature on the analysis of the recreation and propagation of Chinese shadow puppetry through 3D engine technologies is very limited. Such insufficient specific exploration restricts the knowledge of how Chinese traditional aesthetics can be projected into the modern visual systems. By sealing this gap, one can make innovative reinterpretations of the Chinese shadow puppetry and, at the same time, aid in the larger culture preservation activities via digital media.

1.3. Research Objectives

1. To analyze the visual and aesthetic characteristics of traditional Chinese shadow puppetry for digital adaptation.
2. To study the application of 3D engine technology in reconstructing Chinese shadow puppetry animation.

3. To evaluate the effectiveness of digital dissemination methods for promoting reconstructed Chinese shadow puppetry.

1.4. Significance of the Study

This research helps to conserve and revive the traditional Chinese shadow puppetry by investigating its computer reconstruction using 3D engine technology. The analysis of the study through the prism of blending Chinese cultural traditions and modern technologies demonstrates that traditional visual storytelling can be transformed to meet the needs of modern people without losing its artistic value. It can also provide information to designers, animators, and cultural practitioners who want to incorporate Chinese culture in the current media formats. Moreover, the research fills a gap in the academic literature because it pays special attention to the visual and technological transformation of Chinese shadow puppetry, thereby encouraging cultural sustainability as well as digital art and animation innovations.

2. Literature Review

2.1. Evolution of Shadow Puppetry as an Intangible Cultural Heritage

Shadow puppetry is among the most ancient theatre forms, which were practised in Asia, the Middle East, and some parts of Europe centuries ago. It is not a mere form of entertainment, but also a way of storytelling that is entrenched in the social, spiritual, and political aspects of the lives of different cultures. As Foley (2016) has remarked, the role of shadow puppetry in South and Southeast Asia has been both performative and didactic throughout history, where both religious values and regional mythology have passed between generations. Piyingxi is the art form that was practised in China since the Han dynasty and became common during the Tang and Song dynasties; it has a complicated quality and storytelling traditions (Huang, 2024). Correspondingly, UNESCO, as a Masterpiece of the Oral and Intangible Heritage of Humanity, with its cultural richness and lasting impact, acknowledges the Wayang Kulit culture of Indonesia.

Although it is a historical show, shadow puppetry has suffered a major setback because of the changes in the entertainment industry, globalisation, and the lack of oral communication between generations. The issue of maintaining audiences and apprenticeships in digital times is problematic for many traditional puppeteers. As stressed by Ramli and Lugiman (2012), the sustainability of traditional shadow puppet theatre lies in its power to adjust to the changing cultural and technological conditions. Such transformations have already started in some regions where modern sound design, lighting, and narrative are combined to keep up with modernity. Cohen (2016) uses the case of contemporary shadow puppet troupes in Southeast Asia that have embraced political satire and pop culture without compromising major core aspects of performance in order to draw younger audiences. These developments suggest a wider understanding of shadow puppetry as intangible cultural heritage (ICH), which requires preservation strategies beyond the need to simply document it, which should also involve adaptation and reinvention. As Greco, Cricelli, and Grimaldi (2013) point out, these strategies should be able to identify both direct elements (puppets, tools) and intangible ones (narratives, performance knowledge) to be preserved in a meaningful way.

2.2. The Role of Digital Media in Cultural Heritage Preservation

Digital media has found its way to the centre of preservation and renovation of cultural heritage in the world, and provides approaches that transcend conventional archiving. According to Carvajal, Morita, and Bilmes (2020), the new opportunities of capturing, representing, and communicating heritage assets that digital technologies offer are virtual reality (VR), 3D modelling, and interactive multimedia. These technologies are not only conducive to conservation, but they also add value to the people by making cultural practices and artifacts available to more people. Li et al. (2025) emphasise that museums in VR provide an opportunity to immerse oneself in a cultural setting, bringing the user

even deeper into the culture, which helps to learn it better and interpret it actively. Long-term preservation is also made possible through digital media, as the expressions of fragile or threatened cultures can be documented in a digital format in case they are no longer in existence in their original form. Digitization is, in most instances, a barrier to physical corrosion, loss of traditional knowledge, or less knowledge dissemination due to socio-cultural change. This convergence of technology and heritage brings on new systems in the material and intangible protection of culture.

The application of digital media has also been constantly developing due to the further development of photogrammetry, 3D scanning, motion capture, and real-time rendering technologies. Malik, Tissen, and Vermeeren (2021) highlight the increased significance of 3D digitization in the cultural heritage that provides quantifiable and reproducible illustrations that aid in research, conservation, and educational efforts. In the meantime, Barone (2024) suggests that the digital heritage projects should focus on the tension between technological innovation and concern for cultural authenticity, especially in the process of transferring the old practices into the digital realm. Digital storytelling has become one of the tools of great significance in cultural preservation; according to Echavarria et al. (2022), interactive digital stories enable the community to share their cultural experiences in personalised and participatory forms. These practices prove this idea of how digital media can help keep not only physical forms but also living traditions, rites, and performance practices more visible in modern contexts. With the growing use of digital tools in cultural institutions and by scholars, digital media is part of the preservation practice and an interpretation medium, which is transforming the ways of cultural heritage recording, perception, and transmission. The digital preservation through such developments also makes the traditional art forms relevant and available to preserve cultural continuity through generations.

2.3. Integration of Traditional Art Forms into Contemporary Digital Platforms

Media convergence of traditional arts into the digital environment is an emerging field of concern in the cultural heritage sector, media invention, and creative economy. According to Georgi (2015), the notion of convergence culture gives a chance to the traditional narratives and aesthetics to cross the borders of media, open up a new space of reinterpretation, interaction, and involvement of the audience. The digital medium of animation software, augmented reality (AR), virtual reality (VR), and mobile applications allows artists, educators, and cultural institutions to think about folk art, dance, music, and performance in a more immersive and interactive way. In this case, Radice (2015) talks about the role of museums and other cultural institutions in embracing participatory digital media, which have helped them rebrand the way visitors experience the content within traditional content by rendering it more accessible and interactive. This trend not only serves to maintain the ancient practices, but it also exposes new people to the ancient practices in ways that are relevant to their cultures.

A number of projects and studies have discussed how the ways in which traditional art forms might be given a second life with the help of digital means. Yusa et al. (2024) reviewed the idea of adapting Balinese dance and visual motifs by moving them into mobile apps and interactive installations and demonstrated how new technologies can preserve the traditional knowledge of the community, but they also open the door to creative reinterpretation. On the same note, Zhang (2013) has stressed the need to engage in collaboration on digital projects between cultural practitioners and technologists, especially when working with indigenous and local communities where the transmission of knowledge is mostly oral and performative. These projects have to be attentive to the authenticity, representation, and cultural ownership. As emphasised by Singh, Roy, and Padun (2024), gamification and interactive storytelling have the potential to make the traditional art much more attractive to younger generations, particularly when presented within the context of social media or as an educational tool or digital

exhibition. These practices enable them to preserve the traditional forms as no longer lifeless any more but turn them into dynamic experiences that can be valued by modern digital viewers.

2.4. Theoretical Framework: Cultural Convergence Theory

Cultural Convergence Theory by Henry Jenkins is the foundation of this study because it describes how older cultural activities are blended with new digital technologies (Georgi, 2015). The theory explains convergence as a process not solely as a technological process, but as a cultural change, in which consumers and creators are engaged by media in various platforms, and in most cases, a combination of both old and new forms of expression. This framework is specifically applicable in the context of how the shadow puppetry, traditional performance-based arts can be reconstituted using digital means and shared using digital platforms such as 3D engines, animations, and interactive mediums. According to Radice (2014), cultural heritage institutions to provide more participatory and immersive experiences that help to re-contextualise older content in the eyes of the modern audience are embracing digital media. The theory assists in understanding how the traditional forms, such as puppetry, can preserve the cultural meaning even in an interactive, digital form.

In line with this framework, other research works stress the need to balance between cultural authenticity and technological innovation. Fauzan (2025) reflects on the importance of adaptation to the digital application of Balinese traditional arts; it is evident that convergence allows culture to persist in the new media setting. Wu et al. (2022) emphasise the potential of gamification and digital storytelling as efficient tools to renew cultural practices among younger generations, especially when integrated into new technologies of mobile applications or VR. Poddar (2024) goes ahead to suggest that the digital expression of traditional arts should consider matters of cultural ownership, identity, and audience context. Regarding the broad topic of Southeast Asian puppetry, Wibawa (2024) indicates that modern puppet performances tend to combine the classical storeys with the contemporary media aesthetics, which supports the dynamic concept of convergence. Cultural Convergence Theory, therefore, offers a solid basis for the analysis of the way in which traditional visual components, storeys, and practices of performance in shadow puppetry are both maintained and developed in digital ecosystems. It allows this paper to take a critical look at how shadow puppetry is changing with the knowledge of 3D engine technologies, not only in the technical performance, but also in the reinterpretation of cultures and interaction with the audience.

2.5. Literature Gap

Although many studies have been carried out on the importance of digital media in their maintenance, they have concentrated on documentation, the digitalization of museums, or broad multimedia use. To illustrate, a study by Grant (2018) points out the application of digital tools in cultural institutions, yet it does not present enough information on the creative process of reconstructing performative arts such as shadow puppetry through the application of 3D engine technologies. In addition, the available literature tends to ignore the way these digital recreations can be successfully shared with contemporary readers. This disparity makes it clear that there is a need to study the area of blending cultural authenticity with 3D-based animation and interactive methods of dissemination.

3. Methodology

3.1. Research Method

The research method used in this study was qualitative. The qualitative research was suitable since the purpose of using qualitative research was to examine the cultural, visual, and technological nature of traditional shadow puppetry and its digital re-creation, but not to test hypotheses or measure outcomes. By conducting interpretive analysis, the study concentrated on gaining insights into meanings,

aesthetics, and the design processes involved in the process of translating a traditional art form into digital format with the help of a 3D engine. This approach has allowed to explore the cultural background and the visual image of shadow puppetry in the digital era more deeply.

3.2. Research Design

It was a secondary based study and employed a descriptive and exploratory study design. Secondary research was apt because there is a lot of academic literature, visual materials and cultural records on the traditional shadow puppetry and there are new publications in digital media and animation. This method enabled the researcher to source out existing data using reliable scholarly sources and use the same in a modern digital reconstruction setting thus making the research time-saving and scholarly-supported.

3.3. Data Collection

Due to this being a secondary-based study, the data was sought in academic publications, journals, theses, and visual archives. These resources offered some information about the ancient aspects of shadow puppetry and the new digital animation technologies. Data collection was performed using the following databases and platforms:

No.	Database/Platform	Type of Sources Found
1	Google Scholar	Peer-reviewed journal articles
2	JSTOR	Cultural studies and historical documentation
3	ProQuest	Theses and dissertations on animation and folklore
4	ScienceDirect	Digital media and animation research
5	ACM Digital Library	Technical papers on 3D engines and interaction design

These sites contained both textual and visual information, which facilitated the case study and visual analysis aspects of the study.

3.4. Study Sample

The case on which this study was based was a traditional Chinese shadow puppetry. This type of puppetry was selected because of its system of visual history, fine skill, and high storytelling, which make it the perfect object of digital reconstruction. Both the visual and thematic analysis were based on the case study, which offered cultural and artistic background to the animation produced with the help of a 3D engine.

3.5. Data Analysis

The data gathered were examined through the thematic analysis. This approach helped to reveal fundamental themes and patterns that were important to the research purposes, including aesthetic features, narrative devices, lighting and shadows, and digital translation practises. The themes were directly based on the goals of the study, and the case study data and visual materials were coded respectively. The thematic approach offered a flexible but well-organised manner in which the re-use of traditional puppetry could be redefined using the 3D animation resources.

3.6. Ethical Considerations

Even though the study used secondary data, ethical considerations were observed. All sources have been cited and referenced adequately to prevent plagiarism and to assure academic integrity. The art forms of the traditional cultures were honoured, especially in the exhibition and transformations of the Chinese shadow puppetry. There was no involvement of any personal or human subject data, so no direct consent was necessary. Nevertheless, the researcher was still conscious of maintaining the originality and cultural worth of the traditional practise when reinterpreting it in the digital form.

4. Findings and Analysis

4.1. Case Study: Chinese Shadow Puppetry

The example of traditional Chinese shadow puppetry also known as piyingxi is a good example of how digital technologies have been used to preserve and rethink intangible heritage. It is a blend of storytelling, music, and multifaceted images where the translucent handmade puppets are employed with the lights on the back surface to create expressive shadows (Wang, 2025). **Figure 1** presents the puppets, and they can be characterised as vibrant, coloured, very detailed, and stylised costumes alluding to regional aesthetics and symbolism. Jie (2019) claims that such puppets were typically of leather and painted in the natural colour, which enabled the light to enhance visual richness on the screen. This art has however had a radical decline in practise due to the socio-cultural transformations and availability of online entertainment. In order to preserve these visual customs, Yawen, Michael, and Abidin (2025) emphasise that using digital tools, such as 3D modelling and virtual archives, is important. The other interesting comment made by Su et al. (2024) is that the gestural language and highly detailed design of piyingxi pose some of the most precise challenges when it comes to adapting to real-time spaces in 3D. Through this, the case gives us some insight into how performance art that has existed since the dawn of time, is connected to the community and craft, can be respectably re-invented using digital technology so that it can be made relevant and accessible.

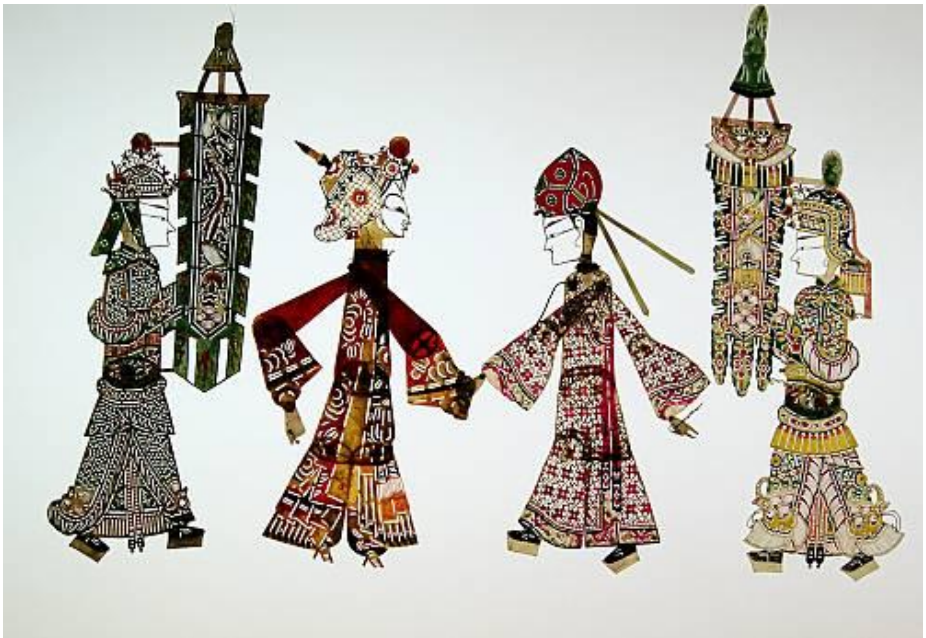

Figure 1: Chinese shadow puppetry

Source: https://ich.unesco.org/en/RL/chinese-shadow-puppetry-00421

4.2. Visual Symbolism and Aesthetic Elements in Chinese Shadow Puppetry

The Chinese shadow-drama (piyingxi) is said to be highly visual in its nature; the puppets are not just a tool of acting; they contain a very deep symbolism in them. They are often founded on typological characters of folklore, mythology and history, distinguished by a particular pattern of costume, features

of facial expression and colour that indicate their ethical intent and social status. Yu (2014) explains the visual codes where red is a symbol of faithfulness and courage, black integrity and white or pallid face, which is considered an indicator of disloyalty among the traditional audience. Puppets are well designed with movable joints to create realistic gestures with emphasis on dance like movements and body language symbolism. **Figure 2** illustrates the dynamic aesthetic: the silhouettes are severely depicted with the backlight, and the cut-out patterns highlight the expression and the movement. Light and richly carved leather counterbalance each other to create a theatrical illusion that borders material craftsmanship and spiritual and narrative depth.

Figure 2: Silhouettes from a traditional Chinese shadow puppet performance

Source: https://www.atlasobscura.com/experiences/making-and-moving-chinese-shadow-puppets

The visual language of piyingxi has changed over time geographically, but the symbolic core has stayed the same. As Tomasic (2023) remarks, the styles of the north are more expressive and ornamental, whereas the southern ones focus on delicacy and finer carving. Gomes, Bellon, and Silva (2014) contend that the presence of these stylistic differences represents the localisation of cultural narratives, important to be maintained in digital recreations. When applying such aesthetics to the 3D engine-based technology, one will face the necessity not only to reproduce the forms but also to support the symbolism implied by a certain design. The elements of the classical puppets, including exaggerated eye forms and decorative headdresses, should be carefully transferred into the computerised models so that the cultural context is not distorted. Further, Lu et al. (2011) note that visual fidelity in online puppetry should apply to lighting effects, since the typical shadows form the focus of the storytelling format. The palette and symbolic profusion of Chinese shadow puppetry not only provide a challenge but also to digital artists seeking to preserve the tradition without necessarily throwing away the modern audience. The comprehension of such visual elements is therefore a preliminary requirement in any significant reconstruction exercise of 3D technologies.

4.3. Translating Chinese Puppetry into 3D Animation Environments

The transformation of Chinese shadow puppetry into 3D animation spaces is not a simple task and involves more than visual reproduction. It involves special concern for the materials, lighting,

gesture, and symbolism of the original form of art to realistically impart the visual and performing essence of the work in the digital space. According to Nasta (2025), the digital tools used to transform traditional performance art have to strike a balance between innovation and cultural integrity. **Figure 3** demonstrates a simplified digitalization of Chinese shadow puppetry, in which contemporary illumination and visual design are based on the traditional aesthetics of strong silhouettes, iconographic myths, and theatrical space. Even digitally augmented in such visual translations, they must have the same symbolic mood and performative richness as traditional piyingxi (Yin, 2024). With the help of modern animation software and 3D game engines such as Unity or Unreal Engine, the designers are able to approximate the puppet joints' behavior and use the abilities of the rigging system and physical motion effects to reproduce the movements of the puppets in the real world.

Figure 3: A stylized digital performance inspired by Chinese puppetry

Source: https://www.ichongqing.info/2019/12/20/large-scale-3d-puppet-shows-change-flying-to-the-moon/

The most important issue in this translation is to preserve the distinctiveness of the shadow play that characterised Chinese puppetry. Conventionally, the performance is guided by some backlighted transparent screens, which add vividness and volume to the silhouettes of the puppets. In digital versions, this is accomplished by using realistic sources of light, casting shadows, and texture maps. According to Tostoes (2018), digital heritage projects can be authentic when they preserve the physical and emotional features of the original medium. In order to recreate the effect of light used in live shadow plays, 3D engines will require digital artists to control light intensity, direction, and transparency to retain the expressive shadows of the art form. Wang (2024) emphasises that, besides being visual, shadow quality is narrative: shadows should move in sync with the storytelling movements, and the emotion and action of the characters are supported. In the meantime, Mohamed and Mohd (2015) describe the way the tempo and rhythm of the puppet movement should be maintained with the help of careful timing of the animation and accuracy of the gestures, because in traditional puppetry, there is no realism, only choreographed symbolism. This interpretive approach is supported by Handi and Noordin (2024), who write that convergence culture suggests the movement of old storeys and art among platforms where they can be reinterpreted without disrespecting their original context. Therefore, the process of translating Chinese puppetry into 3D animation cannot be merely the process of computerising the shape, but it is the process of reconsidering it through the prism of tradition, technology, and narration.

4.4. Narrative Preservation and Cultural Integrity in Digital Formats

In the digitalization of Chinese shadow puppetry, narrative and cultural continuity are core values to keep. In contrast to commercial animation, which tends to focus on action and the spectacle, piyingxi is based on slow, reflective narration that is more concerned with traditional values, mythological characters, and richly meaningful gestures. Such performances are historical epics and moral stories that have been passed through generations. As Chen (2021) describes, the storeys of the Chinese shadow puppetry are directly connected to the shared cultural memory, and every character, gesture, and image is based on the Confucian ethics, ancestral honour, or spiritual lessons. Adapted into digital media, such storeys can be deprived of the symbolic richness of being reduced to superficial images or entertainment.

However, digital animation also creates options to preserve and renew these stories to be consumed by modern spectators. Lin (2013) reminds us that the gestures in the shadow puppetry are not decorative, but they are filled with meaning. Generally, a slight bow could be humility, and a raised hand could be authority or defiance. These ancient motions need to be animated with accuracy and cultural awareness, or they lose their narrative ability. According to Morcillo et al. (2017), authenticity in digital heritage projects depends on the work with original materials like scripts, recordings, and visual references. With convergence culture, the same stories are relayed in different media; however, their cultural integrity should be maintained so that they remain relevant and of honour. Thus, animators have to go even further than aesthetic imitation to reproduce faithfully the rhythmic, tonal, and message of traditional puppet storytelling. According to Ren (2024), interactive digital storytelling, in terms of subtitles, voiceovers, and branching narratives, may be more accessible and still maintain the original plotlines and themes. This enables viewers to be presented with the cultural diversity of shadow puppetry without eroding its foundations. Finally, digital reconstruction should serve as both a creative and a moral act, to keep the original narrative framework, emotional depth, and cultural symbolism, and remake it with the help of new digital perspectives.

4.5. Digital Dissemination and Audience Engagement with Chinese Heritage

With the emergence of digital technologies that shift the way individuals interact with cultural heritage, exposure of traditional art practices such as Chinese shadow puppetry will have to adapt in a way that will make it relevant. The transition of live performances to the digital sphere allows reaching more people, but requires some strategic measures to maintain authenticity and facilitate meaningful engagement. Wang, Wang, and Li (2025) view this development as being a part of the convergence culture in which cultural content is transferred across platforms and reaches a wide range of people with digital involvement. In the case of Chinese shadow puppetry, it would include the concept of converting storytelling, visual, and performance aspects into formats that would be applicable to mobile apps, learning games, virtual exhibitions, and social media posts. These media are not only widening the geographic scope but also putting the tradition in the frame of younger, more technologically advanced generations.

The dissemination process should be done in a way that goes beyond putting the content on the web; it must be interactive, culturally sensitive, and captivating. Nugroho and Kesyafano (2025) stress the need to curate connected experiences, the digital content that retains a sense of narrative and cultural depth of the original tradition. User interaction can be enhanced with voiceovers, through gesture-driven interfaces, or by having behind-the-scenes video of puppet construction. As noted by Khan et al. (2020), automatically embedded cultural learning objectives into gamified experiences are both effective tools to educate users about the heritage and entertain them. In addition, the emphasis is that authenticity should be at the heart of dissemination activities and caution against simplified and over-commercialised images that erode cultural significance. The dissemination has to be participatory and intended, and it

should promote cultural sustainability over time. Manara and Weber (2023) also claim that digital dissemination presents local communities with power by providing them with the means to regulate the representation and sharing of their heritage worldwide. This particularly applies to heritage forms such as piyingxi, which is based on generational transmission and collective memory. Through prudent application of digital tools, practitioners and designers can contribute to the fact that shadow puppetry will be able to keep developing without its cultural base.

5. Discussion

The research discovered that the visual symbolism and aesthetic design of the traditional Chinese shadow puppetry are the key to its cultural value and must be kept in the case of digital reconstruction. The main aspects, including silhouette styling, signifying colours, and details of the costume, were demonstrated to contribute to the identity of a character, morality, and tone of a narrative. The results match Manara and Weber (2023), who observe that the visual language of puppetry is a narrative element that is based on Chinese tradition. Likewise, Li and Cao (2021) note that the specific regional types of puppets have regionalized meanings, which provides even more responsibility to visual accuracy in digital form. This is also supported by Song and Puntien (2024), who state that the shadow and lighting effects have to be digitally recreated accurately so as to retain the expressive nature of a live shadow play. These observations are informed by the Cultural Convergence Theory, in which the traditional content, in case of adaptation into other media outlets, needs to be able to preserve its cultural character to be significant. The incorporation of the visual heritage into the digital space, therefore, is not just an aesthetic continuity but it is also a merging of historical art with new technology.

The second significant result is connected to the fact that gesture, movement, and narrative are preserved in 3D space. Traditional puppet gestures were discovered to be formalised expressions of slow, deliberate gestures like bowing or lifting a hand, which symbolise the meaning that propels the story onward. An analysis of the study revealed that retaining the gestures with digital rigging and animation tools increased the authenticity of the narrative. This would coincide with Zhao (2016), who claimed that puppet gestures belong to a system of movement inherent in culture that must not be ignored in digital adaptation. Likewise, Palombini (2017) stressed that narrative fidelity is a crucial aspect in digital heritage that requires animation to honour not only the form, but also the rhythm of telling the story in the original. This is also supported by the theoretical framework because Yoshinaga (2018) reveals that convergence culture enables the spread of traditional stories to other platforms, and when done with care for the structure of the narrative and the cultural meaning. Here, the 3D technology can be considered as a container of continuity, as opposed to the disruption of narrative, and allows piyingxi to be viewed in new yet respectful forms.

The third important conclusion was that digital distribution enhances cultural accessibility and interaction, especially to younger and more digitally literate users. The research discovered that interactive tutorials, including apps, gamified learning, and learning platforms, increase user participation in traditional shadow puppetry. This is in line with the findings of Lin (2025), who demonstrated that digital connected experiences enhance emotional and educational experiences in cultural institutions. Marques, Pedro, and Araaujo (2023) also observed that gamification promotes long -term engagement with heritage materials. Nevertheless, the risks of oversimplification or distortion of culture in the case of dissemination without authenticity and community involvement were also mentioned in the study. Manara and Weber (2023) cautioned against disengaged digital interpretations that are not rooted in local values or local history. Under the Cultural Convergence Theory, dissemination is not merely content sharing, but it is a bargaining between the old and the new. As is demonstrated in this paper, digital dissemination promotes the survival of Chinese shadow puppetry as long as it is done thoughtfully; however, this medium enables it to develop without forgetting its roots.

6. Conclusion

The present work aimed to examine how the intangible cultural heritage of traditional Chinese shadow puppetry (piyingxi), which is rich and symbolic, can be digitised and shared through the application of 3D engine technologies. With the growing danger of the attachments of the cultural traditions to the contemporary period of decreasing transmission and presence, the issues of the introduction of technologies into heritage preservation have been brought into a new significance. The main aim of the research was to study the visual and aesthetic aspects of the Chinese shadow puppetry, the way of their reconstruction with the help of 3D animation tools, and the extent of the possibility of their sharing and reception via digital channels. With the particular task of filling the gap between ancient culture and modern media conditions, the research dedicated to the work of piyingxi was trying to provide a concept of respectful re-interpretation in digital form.

The research design that was adopted was a qualitative/ secondary research design, which involved a blend of case study, visual analysis, and thematic interpretation depending on the research objectives. The traditional Chinese shadow puppetry was elaborate, and a case study was carried out using reliable academic sources and images. The objectives were translated into four themes of analysis, which were visual symbolism and aesthetics, translating the traditional puppetry to 3D animation, narrative conservation, and digital dissemination practices. Such themes were examined based on the current academic resources, cultural theory, especially Cultural Convergence Theory, and digital adaptation examples. This theoretical lens helped map the context of transformation of heritage content in digital planes and its preservation of its cultural origins. Thematic analysis was employed in the research to extract tendencies and discoveries of secondary data, and thus it became possible to covertly address both the cultural and technical aspects of digital heritage reconstruction.

The results indicated some important findings. In the first place, the visual and symbolic representation of the Chinese shadow puppetry, including silhouette forms, colours, costumes, and codified gestures, should be part of the story and must be saved in the process of digital adaptation. Second, 3D reconstruction would only be successful in the case of technical modelling and profound knowledge of the traditional gestures, the storytelling speed, and the character's symbolism. The elements of rigging and lighting of 3D engines were discovered to be important in the upholding of authenticity. Third, the research discovered that digital dissemination systems are very effective in enhancing accessibility and cultural engagements, particularly when their interactive or educational elements are incorporated. The results of these findings can be uplifted regarding the aspects of digital heritage, animation design, and cultural preservation. According to them, technology may be a great friend in preserving intangible cultural heritage- provided that such use is informed by cultural sensitivity and integrity of narrative. In addition, the paper will show how such old art forms, such as the piyingxi, can be relevantly incorporated into the digital culture, thus guaranteeing their survival and applicability in the 21st century.

6.1. Study Limitations and Future Research Directions

Although this research has some valuable information on the digital reconstruction of the Chinese shadow puppetry, it is restricted by the use of secondary data. The analysis did not involve first-hand accounts of traditional puppeteers or digital animators involved in heritage works without direct fieldwork or interviewing a practitioner. Moreover, the sphere was mostly visual and technological in nature and did not contain the discussion of the audience reaction or the intercultural adaptation. In future studies, primary data, as interviews, ethnographic observation, or participatory design activities with heritage communities, might be a useful approach to data gathering. It can also be further investigated in further research into how digital puppetry content is interacted with by users across different platforms to understand its educational or entertainment influence. By diversifying the scope of

the interest to engagement with other cultures, the value of piyingxi would be learned in a new way in the context of the world. The future trends will be able to enhance the connection between analogous art forms and the changing digital realm.

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