Cross-cultural understanding of Chinese traditional puppetry: integrating digital technology to enhance audience engagement

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ABSTRACT

The digital heritage sector has become a highly significant part of the development of cultural heritage. Cultural organisations are increasingly using interactive technology to support the understanding of cultural heritage. This research aims to provide an approach for digital cultural heritage researchers and digital museologists to establish an appropriate position within digital cultural heritage. In this paper, the authors have undertaken a qualitative evaluation of data based on interviews, workshops and fieldwork focusing on potential transcultural audiences, and Chinese/non-Chinese puppetry stakeholders. From these findings, the authors have presented several design suggestions for cultural preservation to surmount transcultural barriers.

Keywords

Chinese puppetry, cross-cultural understanding, digital cultural heritage, digital technology, value-sensitive design, Human Computer Interaction (HCI), thematic analysis (TA).

1. Introduction

In recent years, governments, communities, and academics have increased efforts toward preserving their nations' intangible cultural heritage (Beardslee: 2016; Lowenthal: 1998). Traditional Chinese puppetry is a manifestation of intangible cultural heritage passed down partly through oral teaching, or incomplete writings, but many classical puppet shows are preserved only in the practitioners' memories (Xu and Xin: 2007). Recording and conserving this art form is a difficult and complex endeavour. As a result, today the knowledge and skills

needed to create and perform Chinese puppetry is on the brink of extinction (Huang and Lioret: 2013). At the same time, like other forms of Chinese folk art, traditional Chinese puppetry is forced to confront an increasingly diverse audience. Studies have shown that since the 1980s many scripts have been lost due to modern audiences' lack of a basic understanding of the art form (Wu: 2009; Pen and Clark: 2010). Digital technology offers novel possibilities for preserving cultural heritage, disseminating and providing access to it. It also allows for the inclusion of traditionally marginalised voices (Affleck and Kvan: 2008; Giaccardi: 2012; Kenny: 2009; Liu and Huang: 2005; Nitzky: 2013; Stevens and Shepherd: 2010). Its rise has led to the creation of a new interdisciplinary domain, known as the 'digital heritage sector' (Petrelli *et al.*: 2013), which addresses the interaction with, and the visualisation, preservation, and documentation of cultural heritage (Bonn and McDonough: 2016).

Meanwhile, the development of this new field has not gone unnoticed by Human Computer Interaction (HCI) researchers, who have applied it to countless issues, specifically in the enhancement and enrichment of visitor experiences and engagements (Fraser *et al.*: 2003). Such researchers argue that aspects of intangible heritage require a specific approach and technology for supporting audiences' appreciation and experience of the element (Bonn and McDonough: 2016). However, despite this, few studies have investigated, through contextual, in-depth activities and analyses, just how digital technologies support audiences' understanding and appreciation of heritage. Therefore, before incorporating digital technology into the presentation of traditional Chinese puppetry, it is necessary to analyse the opinions of puppetry stakeholders and audiences to develop potential design insights that support the cultural significance of traditional Chinese puppetry.

Giaccardi (2011) said that each individual brings their own emotional, social, and cultural understanding to their experience of cultural heritage. Several studies have also examined how digitisation may support such emotional experiences of intangible culture (Bai *et al.*: 2015). For example, Shi *et al.* (2013) use electrocardiogram (ECG) signals to construct a somato-sensory system based on emotional interaction. Martínez (2014), meanwhile, has created a tangible puppet with an interactive digital interface to support children while they are learning about emotions. In both these examples, however, the emotions expressed are those of individual users, and there is little connection to the emotions inherent in traditional puppetry. Participants' understanding of puppetry performance has been at best, rudimentary.

Other projects have focused more on using digital technology to provide audiences with an immersive experience of traditional puppetry and an aesthetically-pleasing environment (Zhu *et al.*: 2003; Wan *et al.*: 2015). However, most of these research projects have focused on delivering experiences to users who have the same or similar cultural backgrounds, or who already appreciate the aesthetics of puppetry. The cultural relevance of a puppetry narrative and the in-depth meaning of puppetry movements were less effectively interpreted for the audience (Giaccardi: 2011). Little research has been done on how foreign users may experience or understand other cultures using these tools (Hickey: 2012).

Based on the above efforts, the authors noticed that the design strategy and concept of communication and collaboration with traditional artists or stakeholders has been ignored in these design processes. Ideally, both artists' experience and audiences' thoughts should play a significant role in the process of designing digital heritage tools. Thus, a central consideration of this study was to determine the needs of various relevant communities and how to integrate them into the design (Fox and Dantec: 2014). Few previous design case studies (Güdükbay and Erdoğan: 2000; Hsu and Li: 2005a; Hsu and Li 2005b) incorporate users or audiences into the design strategy; while these groups may assist with testing prototypes, they are unable to express their needs before design commences.

However, approaches such as value-sensitive design exist, where an iterative and explicit consideration of values used to ensure reflective engagement with *direct and indirect stakeholders*. (Friedman: 1996) demonstrates that the stakeholders' role should not be limited to that of counsellor or tester. In addition, studies have not fully examined just how digital technology can engage audiences in a traditional puppet theatre or how communication with puppeteers, stakeholders, and cross-cultural audiences can be integrated into practical design strategies (Carroll and Rosson: 2007;

Hayes: 2011). This study attempts to rectify these shortcomings.

To this end, this study aims to reveal the cultural barriers affecting peoples' experiences of Chinese puppetry and to determine how to engage puppeteers and stakeholders to overcome these barriers. This paper focuses on the role digital technology plays in supporting the intangible cultural heritage of Chinese puppetry, with a particular emphasis on supporting cross-cultural understanding. Specifically, the authors utilise cross-cultural audiences and puppetry stakeholders as logical and critical tools for questioning and problematising the barriers within the cross-cultural spread of intangible cultural heritage and traditional Chinese culture, bringing together experienced professionals, learners, and amateurs. Inspired by value-sensitive design (Le Dantec, Poole and Wyche: 2009), the authors use workshops, fieldwork, and in-depth interviews to engage professionals' perspectives and cross-cultural audiences' experiences in order to create potential design concepts.

The remainder of this paper is structured as follows. The authors first summarise their own qualitative fieldwork in both the UK and China, and describe the methods employed for this study. Then, using thematic analysis (TA) of the interview data, the authors suggest feasible design concepts to support cross-cultural understanding, illustrate important design approaches that support cultural preservation, and explore the role of digital cultural heritage research. The final section reflects on this study's findings, and outlines implications for both design researchers in digital cultural heritage and digital museum professionals.

2. Fieldwork

The principal author conducted a series of fieldwork sessions in order to better frame the cross-cultural appreciation of Chinese traditional puppetry and explore the possibilities of digital technology to support such appreciation. He first attended a puppetry workshop to familiarise himself with puppetry performance, and conducted interviews with cross-cultural audiences in order to determine the barriers to their understanding. Several fieldwork studies were conducted with professional puppeteers from diverse cultural backgrounds in order to explore potential design concepts supporting cross-cultural

Table 1
Overview of data collection methods in fieldwork with specialists and cross-cultural audiences.

Date	Number of participants	Participant code	Participant background	Data collection methods
Feb 2016	5	SH-A	Puppeteers (3 British and 2 Italian)	Fieldwork (Norwich workshop with puppetry stakeholders)
Apr–Aug 2016	12	CA	Cross-cultural puppetry amateurs (5 British, 2 Russian, 2 Spanish, 2 ethnic Chinese, 1 Danish)	In-depth one-on-one interviews with cross-cultural audiences in Newcastle
Feb 2017	2	SH-B	Puppeteers (1 British and 1 Italian)	Fieldwork and semi-structured interviews in Garlic Theatre, Norwich
March-April 2017	10	SH-C	Puppetry educators and students (Chinese)	Fieldwork and in-depth semi-structured interviews at Shanghai Theatre Academy
April 2017	3	SH-D	Puppeteers, cross-cultural audiences (Chinese)	Fieldwork and in-depth semi-structured interviews at Edinburgh International Festival
May 2017	3	SH-E	Researchers, theatre staff (British)	Presentation at Puppetry Research Conference in Newcastle

Plate 1
Workshop with puppetry stakeholders in Norwich.
Photo: Shichao Zhao, February 5, 2016.

appreciation. Finally, the principal author attended a puppetry research conference in order to discuss the topic with experts in the field.

These studies were undertaken during five separate occasions spanning 42 full days between September 2016 and May 2017, and consisting of six different activities (Table 1). There were 18 male and 17 female participants from eight European and Asian countries. The authors received informed consent from every respondent in order to conform to ethical guidelines.[1]

Throughout this entire process, data was collected using two methods: design ethnography (Dijk: 2011; Raijmakers *et al.*: 2007) and semi-structured interviews (Charmaz: 2014; O'Sullivan *et al.*: 1996). Working with both the Shanghai Theatre Academy and Garlic Theatre was interesting for several reasons. First, participants at these locations had an in-depth understanding of both traditional Chinese puppetry and British puppetry. Second, local commercial theatres and national educational puppetry theatres bring different perspectives to the digital preservation of puppetry; including both kinds of institutions in the data collection allowed for a broader and more forward-thinking perspective. The results of this extensive fieldwork and in-depth interviews provided a unique cross-cultural perspective on the potential ways digital technology could be used to support Chinese puppetry.

2.1. Puppetry workshop

The principal author participated in and observed a puppetry workshop entitled 'Explorations with Everyday Materials and Objects Animating the Inanimate', which included participating in a group performance and having informal conversations with organisers and other participants. He went on to interview three British and two Italian respondents. All were professional practitioners in puppetry and have previous experience of manipulation in traditional Chinese puppetry (Plate 1). Interviews included information on participants' experiences performing for cross-cultural audiences and their thoughts on how technology can support the transmission of puppetry. Respondents provided information on the main issues in puppetry techniques and live animation and how to bring the inanimate vividly to life through collaborative improvisation.

2.2. One-on-one interviews

30–40 minute one-on-one in-depth interviews were conducted by the principal author that included audio recordings and observation notes. Respondents were recruited via an announcement on a student forum for a university's student union and student society website. The announcement explained the study process and asked for input from participants interested in traditional Chinese puppetry (excluding any professional puppeteers). The final participants were twelve puppet amateurs from five distinct

cultural backgrounds; their interviews were recorded, transcribed, and analysed.

These interviews covered three main topics: their appreciation of traditional Chinese culture, the extent to which they understood traditional Chinese puppetry, and their opinions on four videos. These videos contained excerpts from four different traditional Chinese puppet shows: a Quanzhou puppet show recorded from a TV programme; a live marionette performance that displayed the puppeteers' gestures; a silent episode from Daming-Zhangzhou puppet movie; and a scene from the Heidelberg Taiwanese Budaix, which had English subtitles. Asking respondents to reflect on these clips provided an insight into how digital media might help audiences better appreciate traditional Chinese puppetry. Finally, these interviews also solicited participants' suggestions and thoughts on the relationship between traditional puppetry and technology (i.e. their experience with any applications that use interactive media to perform traditional Chinese puppetry and their feedback).

2.3. Garlic Theatre

The next step for this study involved semi-structured interviews at the Garlic Theatre with two British professional puppeteers who had experience with traditional Chinese puppetry (Plate 2). Garlic Theatre is a British visual theatre company that uses images, puppet animation, movement, and live music to create artistically excellent theatre productions.

The principal author used three DSLR cameras to film the puppeteers' performances and the audiences' reactions continuously over the course of three days. After filming, he invited two professional puppeteers from the theatre to provide a workshop that covered five different topics: the experience of local performances, performing in other countries, learning Chinese traditional puppetry, digital puppetry, and the development of puppetry shows. Participants shared their experience with puppetry performance and digital applications, discussed the advantages and disadvantages of each digital technology used to support Chinese puppetry (i.e. 3D animation puppetry performance, immersive theatre experiences, and puppetry tablet applications), and explored trends in the development of Chinese puppetry. During the workshop, the participants also used the different types of performances, videos and some photographs as reference material to spark further inspiration. This workshop was intended to explore the current trends in puppetry performance and two participants' thoughts about the use of digital technology in traditional puppetry.

Plate 2
Semi-structured interviews and gesture filming, Garlic Theatre, Norwich.
Photo: Shichao Zhao, February 16, 2017.

Plate 3
Fieldwork, Shanghai Theatre Academy.
Photo: Shichao Zhao, March 28, 2017.

Plate 4
Fieldwork and in-depth semi-structured interviews, Edinburgh International Festival.
Photo: Shichao Zhao, April 8, 2017.

2.4. Shanghai Theatre Academy

Fieldwork and in-depth, semi-structured interviews were next conducted by the principal author at the Shanghai Theatre Academy, whose Department of Puppetry Performance is dedicated to dramatic art education. In 2003, they developed a puppetry performance curriculum, allowing undergraduate students to take classes in general puppetry and relevant theory. The department is also actively engaged in performing overseas, presenting abundant opportunities for cross-cultural performances. The goal of this fieldwork was to gather a collection of puppetry gestures, with input from the Dean of the Academy of Arts, the puppetry department lecturer, and nine puppetry performance students (Plate 3).

The principal author again used three DSLR cameras to continuously film puppetry students' performances and practice sessions over a five-day period and interviews with study participants. The puppetry students were asked about their learning experiences in the field of traditional puppetry and any previous experience they had of using technology in puppetry performance. The Dean of the Academy of Arts and the puppetry lecturer, meanwhile, were asked about the barriers to cross-cultural transmission of traditional Chinese puppet shows and the role of technology in Chinese puppetry. Both types of interviews provided data on teaching methods in traditional Chinese puppetry and on the preservation of traditional puppetry. More specifically, they allowed participants to reflect on the relationship between traditional Chinese puppetry and interactive digital media.

2.5. Edinburgh International Festival

During the next stage of the study, the principal author attended the Edinburgh International Festival, where he observed a cross-cultural audience's reaction and got feedback about a traditional Chinese puppet show, performed by three Chinese puppeteers from the Shanghai Theatre Academy (Plate 4).

After the show finished, the principal author conducted in-depth semi-structured interviews with the three Chinese puppeteers. Participants were asked to reflect on the following two questions: 1) Based on their experiences during the performance, what are the main barriers with which cross-cultural audiences are confronted while watching Chinese puppetry? and 2) What methods did respondents normally use to support audiences in overcoming cultural barriers (e.g. language, dialect, and local culture), and what were the results?

2.6. Puppetry research conference

During the final stage of the study, the principal author solicited opinions and feedback from other puppetry stakeholders, including academic researchers, script writers, and master puppeteers, during a puppetry research conference. Using the previously described

Plate 5
Puppetry research conference presentation.
Photo: Kamarin Merritt, May 1, 2017.

fieldwork to develop some initial design concepts, he conducted a series of discussions on how digital technology can support the cross-cultural understanding of Chinese puppet shows. He also outlined the relationship between traditional puppetry and digital technology in order to develop further discussions (Plate 5).

3. Data analysis

This research uses thematic analysis (TA) to analyse recordings of semi-structured interviews with Chinese and non-Chinese participants to explore their understandings of traditional Chinese culture and puppetry. All the interviews were recorded, transcribed, and anonymised, and are hereafter denoted by the prefix CA (cross-cultural audience) or SH (stakeholder). The data also includes field notes, which documented observations and interactions throughout the process. This approach aims to identify how participants create meaning through their own understandings (Braun and Clarke: 2006). Previous research using this method suggests targeting fluent writers to elicit more detailed and, thereby more meaningful, data (Creswell: 2002; Glaser and Strauss: 1998).

To analyse the interview data, the authors used a five-phase thematic analysis to identify coherent themes (Vivien: 2003). A combination of inductive (coding from the participants' responses) and deductive (literature used to construct the interview questions and to identify latent meanings) thematic analyses were used when analysing interview data, which allowed specific themes to develop.

4. Results

The analysis of the data resulted in three overarching themes which are discussed in the following sections.

4.1. Barriers to the appreciation of Chinese puppetry

The results show that there are four main barriers to a cross-cultural appreciation of traditional Chinese puppetry: incomprehension of the background stories, linguistic barriers, lack of adequate subtitles, and inadequate supplementary knowledge.

4.1.1. Incomprehension of the background stories

Most scripts in Chinese traditional puppetry derive from fairy-tales or folk stories. Understanding the background to these stories plays a significant role in the audience's experience and comprehension; however, cross-cultural audiences lack this background knowledge. SH-C2, a Chinese traditional puppetry lecturer and researcher, expresses this viewpoint:

> *For Chinese traditional puppetry, like this marionette, lots of scripts are derived from Chinese fairy-tales, for example the 'Legend of the White Snake'* [a Chinese folktale describing the White maiden locked for eternity in the Leifeng Pagoda]; *we normally select a small paragraph to adapt for our performance. But most foreign audiences have never heard of this story. This causes them to not understand that this is an anthropomorphic performance telling a story about a snake and a human being.*

Interviews with cross-cultural audiences further support this viewpoint. CA6 explains that because audiences lack background knowledge of the stories, their appreciation of the diverse characters is considerably hindered:

> *Actually, I didn't realise that there is a triangular relationship here. After you told me* [both characters] *are snakes, then I understood more details in the*

story, like why they walk like that... But to be honest, due to not knowing the context of the story, it was pretty difficult for me to understand the main characters.

4.1.2. Linguistic barriers

In addition to audiences lacking knowledge of the stories and characters in Chinese puppetry, their understanding was further hindered by the Chinese dialogue and arias. CA12 told the authors:

I am afraid to say that I seriously have no clue about this performance [the silent episode from the Zhangzhou puppet movie]. *Because there was a lot of dialogue, even monologue, in the show, I couldn't understand it. So I could only watch some of the dancing movements and listen to some of the background music.*

Observations recorded during fieldwork at the Edinburgh International Festival reflect this finding. Authors noted that when the two puppeteers engaged in long stretches of dialogue, most of the non-Chinese audience lost focus and began fidgeting or talking to one another. They paid significantly less attention during these scenes than during acrobatic fighting scenes, for example. A professional Chinese puppeteer with considerable experience in overseas performance, SH-D3 explained this by saying:

I remember when we talked to audiences after finishing our UK performances, they asked us to use English during the show's dialogue, because they literally did not understand what we were singing or talking about in the show. Actually, even most Chinese audiences cannot understand the dialogue well, because the scripts are classical Chinese rather than vernacular, and sometimes we do not speak the lines, but sing the dialogue in traditional opera style. I think all of these reasons led to the audiences' incomprehension.

4.1.3. Lack of adequate subtitles

During the one-on-one interviews with cross-cultural audiences, the fourth video included English subtitles to help all the interviewees understand the storyline. The subtitles did help the audience to understand the story; however, it greatly reduced their appreciation of the puppetry due to the distracting nature of the subtitles. One interviewee, CA7, explained:

I didn't have time to watch [the puppeteers'] *beautiful gestures: that's a shame. Also, I wish there was another way to let me understand this: subtitles are not the best method.*

In other instances, subtitles are used to support live or TV performances of Chinese puppetry. SH-D1, a professional Chinese puppeteer working in theatre, gave his opinion on this trend:

Honestly, subtitles are absolutely not the first choice, because puppetry, being a kind of stage art, is different from movies or TV shows. Although we offer a projection [system] *to display subtitles beside the stage, the audiences find it very difficult to watch the show and check the subtitles at the same time. I mean, they cannot focus on the performance.*

4.1.4. Inadequate supplementary knowledge

Puppetry stakeholders shared methods to support cross-cultural audiences in their understanding, for instance, by using advertising videos or booklets that provide context and background to the performance. However, each of these methods has its own deficiencies. SH-B2 described his opinions of past performances by saying:

Every time we go to other countries to do a performance, we always make an English booklet to introduce the traditional puppetry and the background stories and to provide some introduction to the puppeteers. This is a kind of traditional method, but actually, from my personal observations, most of the audience do not read the booklet, or sometimes they just browse it randomly, hold it in their hands, or simply discard it.

Moreover, CA2, a cross-cultural audience member, expressed her own understanding of booklets' shortcomings:

I saw they offered us that kind of booklet, but I don't think that is enough to support our understanding of the puppetry performance; it is just a limited offering of a few keywords and normally doesn't mention the movements, music, etc.

SH-A1 also shared his concern about how to help audiences achieve a comprehensive understanding of Chinese puppetry:

The audience finds it very easy to ignore this kind of information [advertising videos and introductory booklets], *unless they are seriously obsessed with puppetry. So how to attract audiences with this kind of supplementary knowledge or what kind of methods could support them to understand more useful puppetry information is what we* [puppetry stakeholders] *need to explore.*

4.2. Preference for gestural interactions

The third video was the silent episode from the Zhangzhou puppet movie. This video tells a classical Chinese story with a humorous storyline through acrobatic puppetry movements and without any dialogue. During the interviews, it became clear that some participants were deeply attracted to the complex gestures and technical skills of the puppeteers. For example, CA11 was particularly interested in puppetry gestures and how these gestures helped audiences understand the story:

It seems a bit more detailed where he's, like I just told you, with the hand gestures and stuff. I'm impressed by how detailed his whole movement and structures are. He seems quite alive, the middle puppet.

Despite there being no dialogue, all Chinese and non-Chinese interviewees could understand the storyline relatively well, and the video's comprehensibility was much higher than that of the other videos. For example, CA10 described feeling affection towards the video and that being able to pay attention to the gestures rather than the dialogue improved the information he took in:

If [a performance is] *in a language you don't understand, then you've got that sense that you're missing out on something. Whereas if there is no language, you're not missing out on it.*

Respondents' interest in the performances' movements were not limited to the puppets' gestures, but also included the puppeteers' gestures. As CA8 explained, some even thought the puppeteers' movements were more interesting than the puppets':

This video demonstrates all of the movements of puppeteers, this is so interesting. This is so cool, because I really enjoyed watching how [puppeteers] *manipulate the puppets. It was literally different than I previously imagined; it's much more complex. Normally, we cannot see this kind of movements and gestures, so I am super curious.*

Other interviewees confirmed this opinion. CA7, for example, expressed her preference for gestural movements in puppetry performance:

I think there are lots of ways to appreciate puppetry, but for me I prefer to watch how they are doing the performance. This includes puppeteers' movements, especially marionette puppets, where even three puppeteers manipulate one puppet together. There are so many more details that could be appreciated from there.

SH-E2, a puppetry researcher, reflected on this trend through the lens of his study on the appreciation of Chinese traditional puppetry:

The enchantment of Chinese traditional puppetry is not only about puppets' movements; every detail conveys the implications of the whole show. For instance, the cooperation of different puppeteers is also a good way to appreciate Chinese traditional puppetry. And the gestures of puppets, the movements of puppeteers, any other interaction in the show as a part of puppetry passes information to the audience.

4.3. Digital technology in puppetry

As the rapid development of network and commercial films shook traditional arts, puppeteers and puppetry researchers remained positive in attempting to use digital technology to enhance audiences' experiences. However, Chinese traditional puppetry is a sort of sacred activity which originated in Chinese agricultural society (Pen *et al.*: 2010). And though most Chinese puppetry described Chinese folktales, the main audiences are adults. Although current digital technology has played a significant role in the entertainment value of performances, the traditional cultural meanings of the Chinese folktales did not arouse enough attention.

The digital design and development of Chinese traditional puppetry is therefore a special case study. Despite this, both puppeteers and audience members have thoughts on using digital technology to support puppetry performance. SH-E1, for example, shared the

fact that he and his colleagues had attempted to use 3D technology to enhance their performances:

> *We tried to use 3D animation in our performances, like we would interact with some virtual characters, but I don't think we obtained positive feedback. I mean, at the beginning, the 3D animation attracted audiences, but I found that they did not understand the stories, and plenty of the puppets' movements or gestures were simplified during the interaction.*

CA9 also expressed the fact that while digital technology, in this case puppetry games, could enhance users' entertainment, it also simplified or even reduced their understanding of Chinese traditional puppetry:

> *I think the game was so cool; I could even use the gamepad to control the movements of shadow play, as if playing a video game. But to be honest, I think that kind of game was for entertainment. Because it doesn't seem to have connections with Chinese traditional shadow play: the game used the same characters from shadow play, but that's it. I didn't get any knowledge about Chinese shadow play or Chinese culture. The movements were just like normal game characters' movements.*

In a similar vein, SH-A4, a contemporary puppeteer, was concerned that on a framed, digital screen audiences would not know how big the original puppet was; they could only judge size based on the pendular speeds of the 'loose' elements. The puppeteer is not able to perfectly control each pendular element, so the digital simulation will give conflicting data regarding a puppet's size which may make the viewers dismiss the digital animation as nonsense or unreal. When audiences watch a marionette perform in the theatre, they accept the pendular speeds of the puppet's various elements because they know its original size. The digital animation process, therefore, literally destroys the magic of puppetry, as SH-A4 expressed:

> *Whilst string puppets are often very magical when seen in the theatre, they can be easily stripped of their magic when recorded. This is because of the way the brain processes the data they express, depending on the context and framing in which they are seen.*

Other puppeteers, SH-B2 for example, expressed similar concerns and offered opinions about how to better integrate digital technology into puppetry performance:

> *I think digital entertainment is good for engaging audiences, but we should realise that Chinese traditional puppetry is an area of cultural heritage. Audiences are supposed to get to know the traditional stories and cultures. Unfortunately, I think most digital design studies ignore this crucial point.*

Regarding the cultural implications of Chinese traditional puppetry, SH-D2 suggested that combining digital technology with gestural expression could be used to support audiences' appreciation:

> *Some of the puppetry gestures and movements are derived from Chinese traditional opera and contain a large amount of cultural implications and symbolic significance. I think the technology could specially develop some applications to support audiences to appreciate these details and acquire an in-depth understanding of the stories.*

5. Discussion

Over the past few decades, digitisation initiatives have led to a tremendous increase in digitised cultural heritage objects (Seifert *et al.*: 2017). By conducting interviews with potential cross-cultural audiences and Chinese/non-Chinese puppetry stakeholders, as well as by analysing feedback about participants' understandings of different kinds of puppetry performances, this study offers a series of conceptual designs that use digital technology to enhance and present a better understanding of the cross-cultural appreciation of traditional Chinese puppetry.

5.1. Overcoming cultural barriers through gesture

The findings of this study reflect previous research, in that different languages or dialects were identified as the main barriers to understanding (Xu and Xin: 2007). Despite methods such as providing background information on a performance, character analysis, and English/Mandarin subtitles, cultural barriers still remained and overall feedback was unsatisfactory. The main reason for this is that traditional Chinese puppetry originates from Chinese agricultural culture and

opera, with much of the dialogue (classical Chinese) being taken from ancient Chinese operas or novels. This makes the art form fundamentally different from Western puppetry, which focuses on concise forms of storytelling (Proschan: 1981; Zhao: 2016).

The interviews conducted in this study reflect that: while some respondents (e.g. CA12 and CA7) commented on the viewing environment or background music, they failed to understand the metaphorical elements of these narratives, which further led to the fact that the interviewees were not able to have a coherent understanding of puppetry characters and stories. In the case of complex puppets such as marionettes, helping the audience develop a complete understanding is crucial.

However, the authors considered that in Chinese opera puppetry, improved use of gestures can help break down language barriers for non-Chinese audiences and provide a more accurate understanding of traditional Chinese cultural heritage. The findings showed that enhancing the gestural understanding could potentially support participants to acquire a coherent appreciation of puppetry stories, and increase their interest in the performance. For example, when the authors showed the participants an episode from the Zhangzhou Puppet movie, the movie did not include any dialogue, and it turned out to be more meaningful to many of them. The majority described this video as their favourite because the story was understandable; the story was interesting, and they were curious about how the puppeteers accomplished the complex acrobatics in the clip.

Their response (e.g. CA11) also demonstrates that technical gestures and movements can support a deeper and more complete understanding of storylines and characters, but the use of subtitles may detract from a performance rather than helping viewers to understand it better. Specifically, they preferred to see detailed gestures with explanations when they were watching a puppet show. And gestural understanding could be utilised as an acceptable strategy to support audiences to acquire complementary knowledge of puppetry.

Meanwhile, digital design may also be used as a tool for integrating the gestural resources that support audiences in forming a more systematic understanding of puppetry. For example, demonstrating elemental gestures to audiences, and describing how they reflect each puppet's emotion or motivation may improve the audiences' understanding of puppetry storylines and better convey a sense of traditional Chinese aesthetics and metaphor.

5.2. Dimensions of appreciation

Despite the fact that cross-cultural audiences lack an adequate understanding of traditional Chinese stories and the cultural implications of Chinese puppetry performances, few studies have examined how digital technology can support the aesthetic appreciation and cultural conservation of puppetry performances (Pen *et al.*: 2010). Digital technology offers a possibility for potentially helping audiences not only to better interpret gestures, but also to better understand Chinese culture overall (Zhao: 2019). The results of this study suggest that showing audiences different gestures or movements from different visual dimensions could help viewers from different cultural backgrounds to accurately interpret puppets' gestures.

Moreover, appreciating performance details in Chinese traditional puppetry may improve audiences' understanding of puppetry stories. Surveyed audience members expressed the desire for an in-depth knowledge of puppetry movements and a better understanding of the puppeteers' performance (i.e. their gestures). The authors suggest that gaining this knowledge not only increases audiences' interest, but also gives them a deeper appreciation of the details of puppetry performance. For instance, better understanding the interactions between puppets and puppeteers, or how different puppeteers cooperate to manipulate a single puppet, may allow audiences to develop a more comprehensive understanding of the power of stage magic and to better understand Chinese puppetry as a whole, rather than simply focusing their attention on specific movements. More importantly, this further integrates the methods described in the first section of the Discussion and offers additional resources for cross-cultural audiences to understand traditional Chinese puppetry and opera gestures and engender deeper cultural awareness.

Digital technology has a role to play in bringing these two layers of meaning together. For instance, scholars

have suggested building a digital archive of video resources on the gestures of puppets, puppeteers, and the entire stage (Zhao *et al.*: 2018). Digital technology may also support more flexible operations (e.g. allowing the audience to view a gesture's dimensions from different perspectives), thereby allowing viewers to appreciate the art form based on their own understanding.

5.3. The role of digital cultural heritage

Finally, the results of this study show the conflicting perspectives of puppeteers, educators and stakeholders on how digital technology is changing traditional puppetry performance. Most Chinese puppeteers based in theatres strongly support digital puppetry performance as a tool to improve audiences' entertainment through electronic art forms. They are anxious to make changes to current performance methods to accelerate the development of Chinese puppetry.

On the other hand, some traditional puppetry educators and researchers insist on preserving traditional performance methods (Bonn and McDonough: 2016). They believe that puppeteers are not able to perfectly control each pendular element of the puppet, so digital simulations will seem unrealistic. Animations will also result in conflicting movement data, preventing audiences from determining a puppet's size and as result, dismissing a digital animation as nonsense.

Determining the correct role and positioning of technology is a complicated and controversial topic, and puppetry stakeholders are often critical in questioning and problematising the status of technology (Lawson *et al.*: 2015). Therefore, examining the possible relationships between traditional Chinese puppetry and digital technology brings up questions as to whether digital puppetry performances may threaten traditional performance and skills or other intangible elements.

Additional questions remain regarding whether changing audiences' perception of Chinese puppetry will potentially decrease audiences at traditional theatres. The current study cannot determine whether digital technology can ethically and reasonably be integrated into intangible Chinese cultural heritage; designers are currently exploring different approaches to this question. However, the findings of this study suggest that shifting the emphasis of digital technology in puppetry from entertainment to the support of audiences' appreciation and understanding, would not threaten traditional performances. Future research should examine how interactive technology assists cross-cultural audiences in overcoming cultural barriers and further engages their interest.

5.4. Limitations

In closing, the authors acknowledge that this study engaged some representative samples that were not all-inclusive. However, the findings offer a series of feasible design concepts to support the cross-cultural understanding of Chinese traditional puppetry and illustrate important design approaches that support engagement with puppetry. However, the authors also recognise the need, in future work, to conduct broader participatory fieldwork which includes more kinds of Chinese traditional puppetry, especially endangered forms such as herb/chemical operated puppets (worked by means of gunpowder, which was widely used then, and their performance involved the use of fireworks), water puppets, and flesh puppets (performances by child actors, perhaps acting in the stiff mechanical manner of puppets) (Dolby: 1978).

6. Conclusions

This research is intended to explore how digital technology can support cross-cultural audiences in experiencing intangible Chinese heritage. There are currently no conclusive findings on how interactive digital media can reconstruct traditional Chinese puppetry performance, as intangible cultural heritage. To this end, this study offers suggestions for how digital design may foster cross-cultural audiences' understanding of puppetry gestures and multiple performance dimensions, thereby helping audiences from different cultures to interpret puppets' gestures more accurately. Furthermore, this study revealed that interactive digital technology is better used to support basic and symbolic understanding of intangible cultural heritage, rather than being directly combined with traditional performance.

ENDNOTES

1 This study was approved by the University Faculty of Science, Agriculture and Engineering ethics committee of Newcastle University, Newcastle upon Tyne.

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