Designing Interactive Technology for Cross-cultural Appreciation of Intangible Cultural Heritage: Chinese Traditional Painting and Puppetry

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To my Mam

Abstract

Digital heritage is becoming a significant component of cultural heritage, and cultural organisations are increasingly using interactive technologies to showcase and safeguard heritage assets. However, few studies focus on using interactive technology to enhance the appreciation of Intangible Cultural Heritage (ICH) amongst cross-cultural audiences.

This dissertation explores the design of interactive technologies to support the cultural appreciation, learning, and experience of Chinese ICH. In addition, the research seeks to explore the value of Human-Computer Interaction (HCI) design strategies in supporting the appreciation of ICH. The research uses HCI design strategies to specifically explore how interactive technology might be effectively utilised in two case-study contexts, supporting traditional Chinese painting and traditional Chinese puppetry.

To this end, in stage one of the research, a qualitative study involving interviews, workshops, and fieldwork for design was undertaken with potential cross-cultural audiences and both Chinese and international painting and puppetry practitioners. Based on the results of these studies, several suggestions were developed for safeguarding ICH across cultural boundaries.

In the next stage of the research, two interactive applications were designed and deployed that supported cross-cultural audiences' appreciation of traditional of ICH. One application explored Chinese painting, the other Chinese puppetry. Using both qualitative and quantitative methods, studies were conducted that examined the efficacy of both applications and offered suggestions for a holistic approach to cross-cultural appreciation through the use of interactive applications. The analysis focuses on the use of element-based archiving to increase aesthetic appreciation, gestural/tangible interfaces for cultural engagement, and the use of interactive access to inspire self-expression and collaborative appreciation.

Finally, this research relies on practical methods to deconstruct cultural elements from the HCI perspective and enhance the cross-cultural appreciation of Chinese ICH. It thus provides a framework for assisting non-Chinese people to better understand the cultural significance of Chinese ICH. The findings have design implications for both HCI researchers and digital heritage researchers.

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Publications

Aspects of the research presented in this thesis have been published in peer-reviewed conferences and journals prior to the submission of this thesis. In particular, the material discussed in Chapter 2, Chapter 4, Chapter 5, Chapter 6 and Chapter 7, as well as some parts of the findings in Chapter 8 have been published in papers, these are outlined below:

Zhao, S. & Kirk, D., 2016. 'Using interactive digital media to support transcultural understanding of intangible Chinese cultural heritage', in *Proceedings of CHI 2016 Conference Workshop—Involving the CROWD in future MUSEUM experience design*, San Jose, CA.

Zhao, S., Kirk, D., Bowen, S. & Wright, P., 2018, 'Enhancing the appreciation of traditional Chinese painting using interactive technology', *Journal of Multimodal Technologies Interact*, vol. 2, no. 2.

Zhao, S., Kirk, D., Bowen, S. & Wright, P., 2019, 'Cross-cultural understanding of Chinese traditional puppetry: Integrating digital technology to enhance audience engagement', *International Journal of Intangible Heritage*, vol. 14, pp. 140–154.

Zhao, S., 2019, 'Exploring how interactive technology enhances gesture-based expression and engagement: A design study', *Journal of Multimodal Technologies Interact*, vol. 3, no. 1.

Zhao, S., 2019, 'An analysis of interactive technology's effect on the appreciation of traditional Chinese painting: A review of case studies', *The International Journal of New Media, Technology and the Arts*, vol. 14, no. 3.

Zhao, S., Kirk, D., Bowen, S., Chatting, D. & Wright, P., 2019, 'Supporting the cross-cultural appreciation of traditional Chinese puppetry through a Digital Gesture Library', *ACM Journal on Computing and Cultural Heritage (JOCCH)*, vol. 12, no. 4.

Zhao, S., 2020, 'A Methodological Reflection: Deconstructing Cultural Elements for Enhancing Cross- cultural Appreciation of Chinese Intangible Cultural Heritage' in M. Rauterberg (eds), *Culture and Computing*. HCII 2020. Lecture Notes in Computer Science, vol. 12215, Springer, Cham, pp. 450–459.

Zhao, S., 2020, ‘A Review of Case Studies: Analysing the Interactive Technology within the Appreciation of Traditional Chinese Puppetry’ in A. Brooks, E. Brooks (eds) *Interactivity, Game Creation, Design, Learning, and Innovation*. ArtsIT 2019, DLI 2019. Lecture Notes of the Institute for Computer Sciences, Social Informatics and Telecommunications Engineering, vol. 328, Springer, Cham, pp. 496–505.

Zhao, S. & Merritt, K., 2020, ‘An Investigation of What Factors Determine the Way in Which Customer Satisfaction Is Increased through Omni-Channel Marketing in Retail’, *Journal of Administrative Sciences*, vol. 10, no. 4.

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Chapter 1. Introduction

1.1 Research Overview

The goal of this Ph.D. research is to identify interactive technologies that, when combined with Chinese Intangible Cultural Heritage (ICH) (utilising traditional Chinese painting and puppetry as two case studies), support cultural appreciation, learning, and experiences. The research also seeks to explore the role and position of HCI (human-computer interaction) research in this complex and developing field; such an investigation will have design implications for researchers who are working in the domains of HCI and digital heritage. Based on these findings, which revealed the barriers that affect the cross-cultural experiences of Chinese painting and puppetry, I designed a series of interactive technologies to enhance cross-cultural appreciation of these art forms. I sought the opinions of cross-cultural audiences and related stakeholders to problematise the obstacles preventing the cross-cultural spread of Chinese Intangible Cultural Heritage, bringing together experienced professionals, amateurs, potential audiences of Chinese puppetry, and viewers of Chinese painting. Inspired by experience-centred design (ECD) (Wright and McCarthy 2010) and the designed interactive applications, I relied on workshops, fieldwork, questionnaires, focus groups and in-depth interviews to shed light on professionals' perceptions and cross-cultural audiences' experiences in order to create potential design concepts. I examined the interactive engagement approach – which is specific to supporting cross-cultural engagement – in addition to interactive design suggestions that could assist in the development of cultural appreciation. Ultimately, the study offers various transferable insights for those involved in the field of HCI.

1.2 Context and Motivation

The safeguarding of cultural heritage has long been the goal of international institutions such as the United Nations Educational, Scientific, and Cultural Organisation (UNESCO) (Kuah and Liu 2016). In 2003, UNESCO adopted the Convention for the Safeguarding of the Intangible Cultural Heritage, which defines ICH as 'the practices, representations, expressions, knowledge, skills – as well as the instruments, objects, artifacts and cultural spaces associated therewith – that communities, groups and, in some cases, individuals recognize as part of their cultural heritage' (Convention for the Safeguarding of the Intangible Cultural Heritage 2003). More specifically, ICH is mainly manifested in the following five categories:

(1) *oral traditions and expressions*, including language as a vehicle of ICH;

(2) *performing arts*;

(3) *social practices, rituals, and festive events*;

(4*) knowledge and practices concerning nature and the universe*; and

(5) *traditional craftsmanship*.

In general, cultural heritage consists of the products and processes of a culture that are preserved and passed on through the generations. However, there are plenty of cultural heritages that are not tangible, such as skills, festivals, dance, cuisine, music, scripts, songs, and crafts. These forms of ICH can be recorded but not touched or stored physically, like in a museum; they can only be experienced through vehicles giving expression to them. In the above-mentioned definition (Convention for the Safeguarding of the Intangible Cultural Heritage 2003), the convention adopted the term 'safeguarding' rather than 'protection' for the first time. Based on this definition of ICH, further description and classification, and different safeguarding methods and measures adopted by countries and communities, UNESCO's report also categorises the safeguarding of ICH into nine dimensions: 'Safeguarding means measures aimed at ensuring the viability of the intangible cultural heritage, including the identification, documentation, research, preservation, protection, promotion, enhancement, [and] transmission, particularly through formal and non-formal education, as well as the revitalisation of the various aspects of such heritage'. To be more specific, for instance, in the domain of folk literature, *documentation*, *preservation* and *protection* are often employed as primary procedures, while traditional practises and handicrafts frequently utilise *enhancement*, *transmission* and *revitalisation*. The safeguarding of ICH focuses not only on preservation but also on sustainability; and the viability of ICH is tremendous significant. According to Zhou (2015), 'The core content of safeguarding ICH involves supporting its continued existence, as well as maintaining its vitality' [from Chinese translation].

1.2.1 Development of ICH in China

In recent years, the exhibition of ICH has attracted increased attention from pertinent organisations (Logan 2007); at the same time, however, globalisation and modernisation threaten the safeguarding and development of various aspects of ICH, such as cultural customs, practises, artistic expression and knowledge. The recognition and safeguarding of Chinese ICH has gone through a winding mileage of development. Before the foundation of the People's Republic of China (New China), from the beginning of the 20th century, traditional Chinese culture was considered to be a formidable obstacle to the development and realisation of modernisation (McLaren 2010). Due to the long-term 'eradicating superstition', there is a misunderstanding of traditional Chinese culture, and cultural treasures are regarded

as ‘cultural rubbish’ (Lin 2017). Especially because of the cultural devastation during the ‘Cultural Revolution’, Chinese ICH was in a danger of extinction (Liu 2014). Following market reforms instigated by Deng Xiaoping in the post-Mao era, China entered a new period of reform and opening up and has since witnessed unparalleled acceleration in economic growth. This allowed cultural heritage studies to break free from the ‘Left-leaning’ politics and the so-called ‘Four Olds’ ideological constraints and become an independent discipline in Chinese academia (Yu 2010). At present, China is in the early stages of industrialisation and informatisation development; the development of Chinese cultural and folk cultural heritage is being rapidly rejuvenated.

On the other hand, the modernisation of China’s infrastructure and economy has heavily affected its cultural ecology (State Council of the People’s Republic of China 2010). The Chinese government and academics have stepped up efforts to safeguard ICH (Lu et al. 2019), but despite these efforts, many cultural practices are in danger of being lost or completely forgotten. There are plenty of areas within Chinese ICH, such as traditional handicraft skills, folk acrobatics, minority music and dance, and sacrificial activities, that are becoming endangered. Furthermore, these traditional art forms often face rapid decline if they do not keep pace with a changing society (Zhang et al. 2020). In an increasingly internationalised world, exposure to ‘international’ art forms is becoming more common, and there is broad interest in maintaining such creative practices that might otherwise die out. Chinese ICH reflects great diversity in the realms of philosophy, morality, etiquette, religion, and aesthetics of the Chinese nation from different eras, regions, and ethics. Due to different reason, for instance, religious elements, ideological difference, language barriers, etc., the global spread and communication of Chinese ICH are facing a great challenge. In earlier research, I found that delivering cultural education to younger generations, as well as promoting it abroad, is critical to safeguarding Chinese ICH (Zhao and Kirk 2016). Chinese ICH can also form and improve the development of Chinese folk culture's international image, which may also shape national identity and strengthen nationalism (Yang et al. 2008; Sun et al. 2017). Meanwhile, compared to the practice of Chinese ICH, I suppose that its appreciation is a more appropriate approach to engage audiences with Chinese ICH in their initial experience and potentially attract their interests to Chinese ICH itself (Zhao et al. 2018; Zhao et al. 2019). However, for foreign audiences, cultural differences bring about specific challenges for the appreciation of Chinese ICH. It needs to be emphasised that this Ph.D. research focuses on how best to support cross-cultural appreciation of ICH. One of the basic steps to cultural appreciation and understanding is cross-cultural knowledge. Cross-cultural appreciation is based on sharing

ideas, knowledge and experiences related to the diversity of cultural expressions. To be more specific, enhancing understanding of the aesthetics and significance of Chinese ICH, as well as implied historical stories and folk customs in Chinese ICH, and problematising non-Chinese audiences' and viewers' obstacles and incomprehension during the appreciation of Chinese ICH, all potentially support cross-cultural appreciation of Chinese ICH.

1.2.2 Subjects Selection and Definitional Expansion

From China's rich cultural traditions, I chose painting and puppetry as the subjects for this Ph.D. research. These two customs respectively represent China's folk art and high art or 'literati' art. The first reason for choosing them as case studies is that traditional Chinese painting and Chinese puppetry represent distinct dimensions of Chinese culture. From the perspective of Chinese literatus, paintings serve as records of the nation's vicissitudes, philosophical thought, religious customs, and values (Fong 2003). Traditional Chinese puppetry reflects the lives of historical China's working-class people and integrates extensive folk culture (e.g. sacrificial activities), music and fairy tales from different eras (Fong 1971). Ink painting has an extensive past and is one of the country's most significant cultural heritages. The Chinese painting tradition has gone through thousands of years and several dynasties (since the Wei, Jin and Southern and Northern Dynasties). Throughout all this time, dramatic changes have taken place in terms of subjects, expression methods, perspectives, colours and canvas materials (Wei 2017). In other words, the different styles of painting reflect China's changing social history from an aesthetic angle. As this art form contains the essence of Chinese culture, there is a need to investigate how to facilitate more widespread appreciation of it among a greater number of ethnic groups from other countries, helping them to explore its humanistic spirit.

Most of the Chinese cultural heritage originated in traditional agricultural communities, and Chinese puppetry is a type of ICH and one of the most significant elements of Chinese local opera (UNESCO 2018). More importantly, traditional Chinese puppetry also reflects the Chinese culture of folk religion and integration of the multi-national Chinese culture that built the unique folk history narrative, and these precious reflections cannot be found in historical records that are written in a biographical style. Like many kinds of opera, this art form has been threatened by linguistic and dialectal differences in the libretti that have created barriers between audiences and the bearers of the tradition (Xu and Xin 2007).

The second reason for choosing these two customs is they respectively represent the different stages of safeguarding of Chinese cultural heritage. To be more specific, traditional Chinese puppetry (as one of the subjects in traditional Chinese drama) has been included in the List of ICH in China by the Ministry of Culture and Tourism of the People's Republic of China since 2006 (The Ministry of Culture and Tourism of the People's Republic of China 2006). Traditional Chinese painting has not yet been included in the list, but Chinese calligraphy (UNESCO 2009b) and the art of Chinese seal engraving (UNESCO 2009b) have been included in the list of the ICH of Humanity by UNESCO. Chinese calligraphy, Chinese seal engraving and Chinese painting are inseparably intertwined; according to historical records, these three arts were described as coming from the 'same source' (Zhang 2013), and Chinese calligraphy and Chinese seal engraving are elements that have been used in traditional Chinese painting. Therefore, the techniques, composition and specific mineral pigment of Chinese painting should be considered ICH and in need of safeguarding. According to the ICH law of the People's Republic of China published in 2011, Article 2 mentions that traditional art, calligraphy, music, dance, drama, folk art and acrobatics should be considered Chinese ICH (The second session of the 11th National People's Congress 2011).

Therefore, I believe the efforts to safeguard the textures, techniques, composition, specific mineral pigment and other elements of traditional Chinese painting inherited from ancient China should be considered safeguarding of Chinese ICH. Based on a wider definition of ICH from Harrison (2010), the intangibility of knowledge and authority is the determining factor of cultural heritage. However, the practice of safeguarding ICH needs continuity, and the dynamics and sustainability in the cultural community are also significant features of ICH; thus, the understanding of ICH should be based on people's subjective experiences rather than the immateriality of cultural expression (Seitel 2001). Within this Ph.D. research, I expand Chinese ICH to include the promotion and enhancement of traditional Chinese painting. Kirshenblatt-Gimblett (2004) argues that artefacts and cultures are not valuable in and of themselves, and it is upon professional observation by anthropologists, historians or archaeologists that these artefacts and cultures become precious. Although traditional painting is not included in UNESCO's list of Chinese ICH (UNESCO 2018), one can sense China's humanistic spirit through the combination of exquisite techniques that produce realistic illustrations, the unity of form and spirit of freehand painting, and the various colours used to reflect the stories behind the images. Viewers must acquire extensive intangible knowledge to understand a painting's history and grasp the artist's emotions. Although a painting is tangible, its background and artistic value are not. This has led to the perception that Chinese

painting, as a form of heritage, is extremely important and needs to be safeguarded (Zhao 2019b). Moreover, this Ph.D. research also expects to potentially contribute towards promoting the inclusion of traditional Chinese painting in the list of Chinese ICH. This potentially promotes Chinese culture internationally, helping non-Chinese people form an interest in the country's culture, art and history.

1.2.3 Digitisation and Interaction

In recent years, the field of heritage studies has been discussed extensively in the domain of HCI (Davison 2002; Kalay et al. 2007; Parry 2010; Lyman and Besser 2013; Petrelli et al. 2013). Its rise has led to the creation of a new interdisciplinary domain known as the 'digital heritage sector', which addresses interactions with and visualisation, preservation, and documentation of cultural heritage (Giaccardi 2008; Shankar and Hooee 2013; Hennessy and Lyons 2016; Muntean et al. 2017). According to the interpretation of 'Concept of Digital Heritage' from UNESCO documents (UNESCO 2009), 'Digital heritage is made up of computer-based materials of enduring value that should be kept for future generations.' Pescarin (2016) believes that the main methods that have typically been utilised in the domain of digital heritage include: digitisation and acquisition; computer graphics and interaction; analysis and interpretation; standards and policy; theory and methodologies; preservation and safeguarding; digital heritage projects and applications. Digital heritage emanates from different communities, industries, sectors and regions. Not all digital materials are of enduring value; therefore, to maintain the continuity of digital heritage, active preservation approaches are required. However, the specific nexus of ICH and interactive technology remains underexplored in HCI, especially in the appreciation of ICH (Bonn, Kendall and Mcdonough 2016). The technologies should not focus solely on exploiting the preservation of tangible heritage objects, but also address the endeavour of safeguarding ICH (Kurin 2004). On the other hand, interactive technologies have vast potential to help safeguard ICH, both in China and on an international scale (Fraser et al. 2003; Kortbek and Grønbæk 2008; Huang and Huang 2013; Candy and Ferguson 2014; Huang 2015; Chang et al. 2017). Researchers have used them to virtually represent tangible cultural artefacts; this has often involved digital augmentation to support audience involvement. An important outcome of digitisation is a greater potential to promote cultural artefacts among audiences; another is the creation of new forms of cultural interactivity. Following this radical design evolution, many interactive projects have been developed to disseminate the objectives of experiencing traditional cultures (Lombardo et al. 2016; Maye et al. 2017; Lu et al. 2019). However, limited attention has been paid to actual, in-depth interpretations and engagement regarding the aesthetics of

these artefacts (Champion 2016). Carefully applying interactive technologies enhances artistic appreciation and the delivery of cultural meaning; however, further exploration is needed to understand how to best support such an agenda for Chinese ICH (Pujol and Champion 2012).

1.3 Research Objectives and Questions

The overarching goal of this Ph.D. research is the design and use of interactive technologies to support cross-cultural appreciation of and desire to safeguard ICH, specifically traditional Chinese painting and puppetry. I utilised the perspectives of cross-cultural audiences and puppetry stakeholders to problematise the barriers that hinder the transmission of Chinese culture. Thus, potentially creating opportunities for cross-cultural audiences and viewers to engage with these aesthetically and historically valuable cultural forms.

This Ph.D. research addresses three main questions:

(1) What barriers do cross-cultural viewers/audiences face in appreciating Chinese painting and puppetry?

(2) What opportunities do interactive technologies present for cross-cultural appreciation of these art forms?

(3) How should interactive technologies be designed to enhance cross-cultural appreciation of intangible cultural heritage?

These three questions represent three phases of the Ph.D. research; the answers to each are based on analysis from the previous stages. Answers to the first question, combined with knowledge generated by the literature review and fieldwork, provide a foundation on which to build a potential design scheme to boost audiences' cultural understanding. The second question seeks to integrate suggestions from stakeholders and audience feedback into design concepts that help audiences overcome challenges to cultural exchanges (e.g. language, dialect, custom). The design scheme will enable audiences to appreciate Chinese painting and puppetry at a more meaningful level as well as to encourage intangible cultural transmission. Based on an in-depth investigation of the first two questions, the answer to the third question reveals specific interactive technologies adopted based on the design process and evaluates users' experiences. In addition, I explore how to utilise the findings to form a series of design methods that enhance cross-cultural engagement with similar forms of heritage. Finally, I reflect on interactive design suggestions to foster aesthetic appreciation, offering various transferable insights to the HCI community.

1.4 Thesis Outline

Chapter 2 explores the core literature on Chinese cultural heritage practices with a focus on painting and puppetry, with a focus on safeguarding practices, policy approaches to ICH, and central institutional developments. Chapter 2 also considers research on the use of current interactive and gestural technologies to aid the appreciation of Chinese painting and puppetry.

Chapter 3 describes the research methods that were employed in this Ph.D. research. This chapter provides a theoretical framework for the analysis of cultural heritage, taking account of existing theories regarding the element-based deconstruction and classification of traditional Chinese painting and puppetry. In addition, the chapter provides a detailed description of the design and user methodologies adopted during the fieldwork, which are subsequently applied in Chapters 4 and 5.

Chapters 4 and 5 present a case study on how to design interactive technologies to enhance cross-cultural appreciation of traditional Chinese painting. These two chapters report the findings of two correlative studies that examine how non-Chinese audiences appreciate this art form and describes the design of fieldwork conducted with non-Chinese participants based on the mobile application developed as a result of this study.

Chapters 6 and 7 review a case study on how to plan interactive technologies to enhance cross-cultural appreciation of Chinese puppetry. It qualitatively evaluates data collected from the interviews, workshops and fieldwork, centred on the views of potential transcultural audiences and Chinese/non-Chinese puppetry stakeholders. A mixture of questionnaires, focus groups and workshops are employed through an interactive system to promote reflection on certain aspects of audience members' experiences.

Chapter 8 contains the viewpoints gathered from the previous two case studies. It describes the opportunities and challenges for transferring the insights derived from this project's design and user studies related to the interactive application of Chinese painting and puppetry to other ICH settings. In addition, Chapter 8 discusses the study's contribution to the HCI community.

Chapter 9 concludes by summarising the major findings and proposing paths for future work.

1.5 Thesis Contributions

In answering the research questions outlined above, the study endeavours to make three research contributions:

(1) Based on the findings of the two case studies in Chapters 4, 5, 6, and 7, a targeted description of the barriers to cross-cultural appreciation of Chinese ICH based on extensive ethnographic fieldwork, investigational activities, and other engagement with ICH stakeholders was described. Specifically, for instance, deciphering how to improve the understanding of Chinese painting's colour among non-Chinese observers could enhance their appreciation of traditional Chinese painting; despite methods such as providing a puppet show's background information, character analysis, and English/Mandarin subtitles, cultural barriers still remained and overall feedback was unsatisfactory. Description of these barriers allows for the development of specific approaches that can be adopted by non-Chinese viewers/audiences in their appreciation of ICH, improved analysis of these barriers from various perspectives (viewers/audiences vs. professionals), and value-sensitive design (VSD) suggestions from stakeholders.

(2) Based on the methodical reflection in Chapter 8, a practical method of deconstructing cultural elements based on the HCI perspective to enhance cross-cultural appreciation of Chinese ICH was developed. I pioneered this approach during this research as a means to enhance appreciation and engagement with Chinese ICH, such as the extraction of elements from traditional Chinese painting and puppetry with potential to support cross-cultural appreciation, as well as the establishment of an elements archive. Through integrating a series of HCI research methods, this approach provides a specific foundational framework that assists non-Chinese people to better understand the cultural significance of Chinese ICH.

(3) Based on the findings of the two case studies in Chapters 4, 5, 6, and 7, as well as the discussion of Chapter 8, a set of strategies that can be used to design technology to enhance the cross-cultural appreciation of Chinese ICH were developed. The study introduces a holistic engagement approach and a series of interactive design suggestions to encourage cross-cultural appreciation during the development of an interactive application. The analysis focuses on the use of element-based archiving to increase aesthetic appreciation, gestural/tangible interfaces for cultural engagement, and the use of interactive access to inspire self-expression and collaborative appreciation. The ultimate objective of this is to offer

valuable, transferrable insights into the design of interactive technologies that can stimulate a greater appreciation of Chinese ICH.

Chapter 2. Intangible Cultural Heritage in the Era of Digitisation

2.1 Introduction

This literature review lays the conceptual foundations for this research and discusses interactive technology related to painting and puppetry in order to explore potential directions of design. This chapter consists of six parts.

Section 2.2 introduces the issue of safeguarding ICH, and analyses the cultural diffusion and dilemmas of traditional Chinese painting and puppetry, as a basis upon which to understand the challenges of preserving and conveying these art forms.

Section 2.3 introduces the historical background, genres, colours, and line styles of traditional Chinese paintings, as well as the categories and performance modes of traditional Chinese puppetry.

Section 2.4 examines the use of interactive technology to enhance public interactions with paintings, and investigates the extensive case studies on appreciation and engagement in relation to them. Using these case studies, the study aims to derive insight for potential designs in Chapter 5.

Section 2.5 reviews studies showing that interactive technology has effectively supported the experience of puppetry and how traditional puppetry has been utilised to engage the public with videogame entertainment and social learning. Here, the study examines how emotional expression, digital storytelling and other methods are used in conjunction with interactive technology to help cross-cultural audience members understand traditional Chinese puppetry.

Section 2.6 investigates case studies on gesture-based interaction and expression in order to explore potential designs for cultural enhancement.

2.2 Safeguarding Chinese Intangible Cultural Heritage

The importance of ICH is not the cultural manifestation itself but rather the wealth of knowledge and skills that are transmitted through it from one generation to the next (UNESCO 2011). ICH is a form of global wealth that contains and embodies the extensive cultural and spiritual heritage of all humans. ICH, transmitted across generations, is constantly recreated by communities and groups in response to their environment, their interactions with nature, and their history; in addition, ICH provides them with a sense of

identity and continuity, thus promoting respect for cultural diversity and human creativity. UNESCO launched its Memory of the World Programme to promote the digitisation of cultural heritage around the world in order to safeguard humanity's documented heritage in an electronic format. The efforts of this initiative included 23 new inscriptions on the Memory of the World Register of Documentary Collections in 2003 (UNESCO, Memory of the World: documentary heritage in Asia and the Pacific 2016). In 2005, the General Office of the Chinese State Council issued a report (State Council of the People's Republic of China 2010) on how to enhance the safeguarding of Chinese ICH. The report indicates that China has a huge amount of tangible and ICH, and also that the modernisation of China's infrastructure and economy has heavily impacted its cultural ecology; thus, strengthening its ICH protections has become critical. The report points out that 'the work of cultural safeguarding needs to use text, audio- and video-recording, as well as digital media to make real, comprehensive and systematic archives and databases'. Furthermore, the report also emphasises the urgency of conducting the safeguarding works: 'The safeguarding of Chinese [ICH] needs to include immediate actions [related to] recording vanishing [ICH]'.

The conceptualisation of cultural heritage embraced in this research is externally attributed, rather than intrinsic (Smith 2006). Some researchers have argued that all heritage should be considered intangible (Smith 2006; Smith and Akagawa 2009); Harrison (2010) explained the reason for this perspective: the intangibility of knowledge and authority is the determining factor of cultural heritage. In essence, artefacts and cultures are not exactly valuable. It is upon professional observation by anthropologists, historians or archaeologists, that these artefacts and cultures become precious (Kirshenblatt-Gimblett 2004; Giglitto 2017). For instance, because traditional Chinese painting was not included in the list of Chinese ICH (UNESCO 2018), most researchers believe that Chinese paintings exist on paper, silk and other tangible materials, which people can touch directly (Zhao 2019b). However, touching tangible art is not the main method of appreciating traditional Chinese paintings, and viewers are not able to touch most of the ones in galleries and museums. The viewers must instead acquire intangible knowledge to understand the history behind the paintings and to grasp the artists' emotions. Although a painting is tangible, its story is not. The cultural significance and artistic value behind the stories are reflecting the essence of traditional Chinese painting. This fact has led to the perception that Chinese paintings as a form of Chinese cultural heritage are extremely important and need to be safeguarded. Based on the fuzzification of the definition of ICH and referring to the techniques and background of traditional Chinese painting, this chapter examines the safeguarding of the country's ICH.

In recent years governments, communities and academics in many countries have increased efforts to maintain national ICH (Lowenthal 1998; Beardslee 2016). Interactive technology offers novel ways to preserve, disseminate and provide access to cultural heritage; it also allows for the inclusion of historically marginalised voices (Liu and Huang 2005; Affleck and Kvan 2008; Kenny 2009; Stevens, Flinn and Shepherd 2010; Giaccardi 2012; Nitzky 2013). Its rise has led to the creation of a new interdisciplinary domain known as the 'digital heritage sector', which addresses interactions with and visualisation, preservation, and documentation of cultural heritage (Petrelli et al. 2013; Bonn, Kendall and Mcdonough 2016). Human–computer interaction (HCI) scholars have applied developments in their field to enhance the visitor experience in various ways (e.g. virtual reality and augmented reality etc.) (Fraser et al. 2003; Shi et al. 2013; Bai, Blackwell and Coulouris 2015). Researchers argue that safeguarding aspects of ICH require a specific approach and technology to facilitate audience appreciation and the public's experience (Bonn, Kendall and Mcdonough 2016); yet despite this, few studies have investigated how interactive technology supports audiences' understanding and appreciation of heritage through contextual, in-depth activities and analyses. Hence, before incorporating interactive technology into Chinese heritage, it is necessary to examine the opinions of professionals, stakeholders, and audiences in order to gain insight into what designs have the potential to support the cultural significance of traditional Chinese ICH.

Next, the study considers the current state and dilemmas of safeguarding of Chinese painting and puppetry.

2.2.1 The Safeguarding and Diffusion of Traditional Chinese Paintings

Painting has existed since the beginning of civilisation and before. In China, the Han dynasty (206 BC–220) emerged between the Yangtze and Yellow river basins, absorbing a wide range of cultures (Zhou 2011). Han culture developed a unique form of painting that was revealed to the wider world by Western missionaries during the Ming dynasty (1368–1644).
Chinese painting has different characteristics (e.g. painting tools; mounting methods; perspectives) from Western painting (Zhang 2014); in addition, Chinese painting tends to express national autonomy and a sense of patriotism in relation to Chinese culture (Xiong 2007). Compared to European and, later, American states, China has lagged behind economically and scientifically since the 14th century. China viewed the West as a model to aspire to for nearly 200 years, which led the country to neglect its own culture (Chen 2006).

Some researchers, like Liu and colleagues, expressed a feeling of cultural anxiety both at home and abroad with regard to Chinese painting in particular (Liu and Liu 2003). Lin and Lian (2018) also mentioned: 'the crisis that Chinese painting faces can be attributed to people's insufficient understanding of national culture and weak sense of protection.' From a domestic perspective, the safeguarding of traditional Chinese painting is potentially inheriting the "cultural veins" of the Chinese nation. Chinese painting needs to be understood and perpetuated as part of passing on the country's heritage to future generations and to develop a sense of innovation. From a foreign perspective, it is also significative to determine how to bring traditional Chinese painting as a sort of symbol of Chinese culture to different societies (Gan 2011). In this light, it is necessary to safeguard the original elements of traditional Chinese painting and to scrutinise the methods used to spread it.

As early as the 1970s, UNESCO had already emphasised the significance of 'culture and self' in one of its cultural education programmes. Liu and Liu (2003) mention that the World Alliance for Arts Education (InSEA), one of UNESCO's subordinate organisations, was implemented in 1985, they emphasised that: 'Developing countries are facing the decline of indigenous traditional cultures and a humanistic spirit'. Hence, the safeguarding of traditional Chinese painting should move beyond the established focus on technical repairs and the occasional exhibit (S. Zhang 2012). With traditional painting as the essence of Chinese culture. I believe that investigating into how to facilitate appreciation of Chinese art among a greater number of ethnic groups, and to help them explore the humanistic spirit of traditional Chinese painting could be appropriate research aspects for safeguarding Chinese painting.

Using Ma's analysis of traditional Chinese painting, I believe that the diffusion of this art form needs to be based on an understanding of traditional Chinese colours, textures, and composition (Ma 2005). However, such aesthetic knowledge is disconnected from daily life, especially for non-Chinese viewers. Thus, helping viewers grasp the aesthetic meaning of traditional colours and other relevant elements is a promising starting-point to help them understand the cultural significance of traditional Chinese paintings.

2.2.2 The Dilemmas Facing Traditional Chinese Puppetry

Traditional Chinese puppetry is one of the most significant components of Chinese opera. Like other traditional art forms, the opera has been passed down through face-to-face teaching and aging text sources, and sometimes the generation inheritors cannot reach the same level of technique as the original puppeteers did. Furthermore, many performance repertoires of

puppetry classics are only safeguarded in the memories of elderly folk artists; therefore, these techniques and knowledge are in danger of fading (Öztürk 2006; Huang and Lioret 2013). After 1949, the formats of Chinese puppetry became richer (Chen and Clark 2010); apart from preserving traditional opera, puppetry began to mix with other media and began to appear in contemporary plays, TV series, and movies. This not only maintained the historical element of puppetry, but also expanded it to new audiences. However, just like other Chinese folk art forms, puppetry has been going through a type of culture shock as it has encountered this variety of entertainment channels and different target audiences. For example, take the famous marionettes from the city of Quanzhou in Fujian Province; there, the government failed to pay enough attention to safeguarding the craft, and traditional puppetry has since come under threat (Chen and Clark 2010). These days, Quanzhou puppetry can only be seen at festivals or sacrificial ceremonies. Less money is invested in the support of professional puppeteers and artists; some have had to abandon their careers, making their art form a dwindling branch of Chinese puppetry.

ICH, including traditional Chinese puppetry, is mainly passed down through oral teachings and incomplete writings, making recording and conservation more complex. A plethora of classical puppet shows are only maintained in the memories of practitioners, rendering these skills and knowledge on the verge of extinction (Xu and Xin 2007). Historically, scripts, photographs, and video-recordings have been the most frequently used media for conservation. Although photography and videography have begun to make the safeguarding of traditional puppetry and other types of ICH easier and more effective, these approaches do not cover every aspect of conservation, especially in regards to recording the subtlety of puppetry gestures. Moreover, with accelerating globalisation and constant socioeconomic development in China, it is getting more difficult to rely on traditional media (e.g. television and online video) to attract audiences who have different cultural backgrounds (Lin and Lian 2018). Previous research on individual puppeteers and other institutions also shows that many photographs and audio or videotaped scripts have decayed due to their inadequate storage environment, as well as climate change since the 1980s. Undoubtedly, this represents a huge loss for Chinese ICH (Wu 2009).

Technology can facilitate cultural safeguarding. The development of digital techniques (e.g. the use of digital video cameras or mobile devices to record puppetry) has made the conservation of traditional Chinese puppetry more convenient. Digital databases have provided better environments for data recovery and storage. All of these technologies have

helped to safeguard and spread traditional Chinese puppetry; however, none of them offer ways to edit or utilise digital content for audience interactions, and thus, the content remains largely invisible to the general public. Linear video-recordings also provide only limited scope for interactive digital setups. Combining interactive digital media and traditional puppetry could improve the recording, teaching, editing, development, and performance of the latter.

2.3 An Introduction to Traditional Painting and Chinese Puppetry

Next, this study reviews the background on traditional Chinese paintings from different perspectives: historic background, stylistic category, colours, and lines; it also introduces the stylistic categories and performance praxis of traditional Chinese puppetry. Through reviewing and analysing the extensive literature on these topics, my intention is to gain further understanding of these two different traditional cultural phenomena and provide a well-informed theoretical basis for the following sections, which involve the relevant interactive technology with these two traditions.

Figure 1. An example of realistic painting (Gongbi).

2.3.1 The Categories of Traditional Chinese Painting

Traditional Chinese painting mainly consists of three key styles. The first is a realistic style known as Gongbi, which utilises subtle brushstrokes to depict images in meticulous detail

(see Figure 1). The second is a freehand style known as Xieyi, which literally means writing ideas. This was formed in a long period of artistic activities and was promoted by the literati for expressing essential spiritual characteristics (see Figure 2). The third is Jian gong dai xie, an integrated style that blends a realistic style with freehand brush work in the same painting (see Figure 3). In Figure 3, it is worth mentioning that the realistic style was mainly utilised when drawing the dragonfly and other objects were drawn with a freehand brush, thus forming a unique contrast.

Figure 2. An example of freehand brush work (Xieyi).

A cavalier perspective is also widely adopted, especially in landscape painting, painters generally incorporate their personal feelings into an image, instead of just portraying the authentic details and appearance of the object itself (see Figure 4). To put it into more simpler terms, Chinese landscape painting is a manifestation rather than reappearance (Rawson 2007; Liu et al. 2013). Figure 5 shows work by Chinese ink painter Zhu Da. The piece integrates his personalised Buddhist thought with calligraphy techniques for the landscape rather than a sketch from nature. Interestingly, the perspective of traditional Chinese landscape painting does not follow the realistic perspective relation. For instance, the trees are disproportionate in size with the other objects of reference (e.g. the mountains). Da-Wei provided a further

explanation of the different perspectives between Chinese painting and Western painting: 'The Chinese concept of perspective, unlike the scientific view of the West, is an idealistic or suprarealistic approach, so that one can depict more than can be seen with the naked eye. The composition is in a ladder of planes, or two-dimensional or flat perspective' (Da-Wei 1990). At the heart of freehand painting (i.e. impressionistic), also known as ink-wash painting or literatus painting, is 'emptiness' with considerable vacant space left to display cultural symbols that create an aesthetic atmosphere and express the philosophical thought of artists (Masuda et al. 2008).

Figure 3. An example of integrated style (Jian gong dai xie).

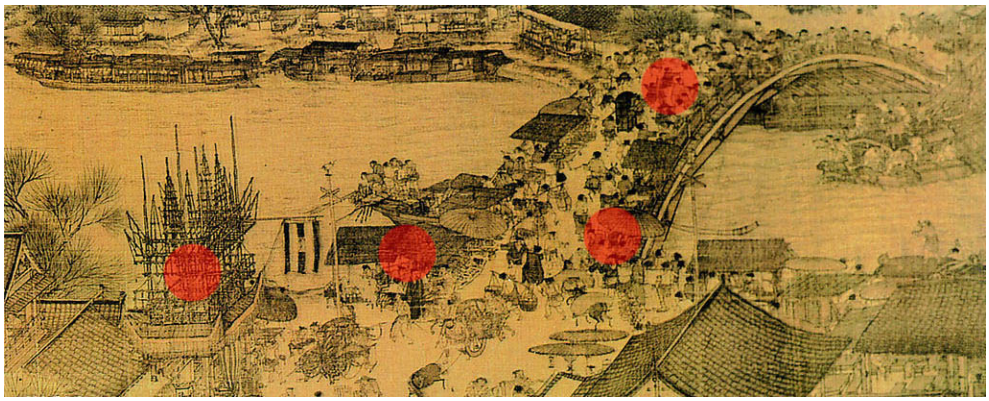

Figure 4. The portion of Along the River During the Qingming Festival.

Figure 5. The landscape painting of Zhu Da.

The Colours of Traditional Chinese Painting

Throughout history, the Chinese literatus' understanding of colours has been highly influenced by philosophical reflection and symbolism, rather than pure colour expression. Every colour in traditional Chinese painting reflects the ethnic cultures and historical background of a given time. As early as the Sui and Tang dynasties (581–907), the ink of traditional Chinese painting was categorised into five basic colours (Zhang 2013). From a philosophical point of view, the colours in traditional Chinese painting represent a sort of metaphysical ideology. The colour takes its meaning from the mind, and the colours of Chinese paintings work to express symbolic images or subjective emotions, providing a significant difference between traditional Chinese and Western paintings. The theory of

colours in ancient China is also influenced by the 'five elements theory', in which the five basic colours – green, red, yellow, white, and black – are formed from nature. These five colours are adopted to express various artistic conception and spirituality (L. Zhang 2012). In this way, the creation of traditional Chinese paintings is a kind of process of re-innovating a spiritual understanding through colour.

The Lines of Traditional Chinese Painting

The use of lines in traditional Chinese painting is distinctively different from that in Western paintings, and rooted in Chinese aesthetics (Xiong 2007; Xu 2008). Specifically, Western painting uses 'point, line and plane' as a basis for the understanding of lines – a point of view based on knowledge of geometry and mathematics (Da-Wei 1990). However, in Chinese painting, the line is the 'soul'; lines are utilised to express the strength of the literatus and symbolise vitality. Figure 6 shows four examples of the common classic lines of traditional Chinese painting. One key feature of the lines is that they should have been endowed with more expressiveness. In other words, the lines have dominated the main style, emotions and expressions of the paintings rather than being hidden under the pigment and only used for the sketching of structures of the objects depicted. Thus, traditional Chinese paintings are also called the 'art of lines', and the lines of Chinese paintings are in this way also seen as tool that reflects and generalises the subjective consciousness of the artists themselves.

Figure 6. Four examples of lines in traditional Chinese painting.

2.3.2 The Categories of Traditional Chinese Puppetry

Chinese puppetry is a type of opera performance within the broader field of traditional Chinese theatre. It emerged during the Han Dynasty (206 BCE–220 CE), then flourished during the Qing Dynasty (1644–1912). Different kinds of puppetry developed in several regions during this period, such as Liaoxi—Zhangzhou budai (budai is a kind of Chinese

glove puppetry); Quanzhou—Jingjiang budai; Shaoyang budai; Gaozhou—Chaozhou iron branch; Chuanbeid; Shiqian; He Yang; Taishun fireworks and the Lingao puppet show (Sun 1965; Dolby 1978). Based on their presentation, these puppets can be classified into five general categories (including shadow play shows): (1) Zhang Tou (杖头傀儡) or 'staff-head puppets'; (2) Xuan Si (悬丝傀儡) or 'string-/wire-hung puppets'; (3) Yao Fa (药发/药法傀儡) or 'herb/chemical operated puppets' or 'gunpowder operated puppets'; (4) Shui (水傀儡) or 'water puppets'; (5) Rou (肉傀儡) or 'flesh puppets'; and (6) Pi Ying Xi (皮影戏) or 'shadow plays' (Dolby 1978). What follows describes these types.

The Zhang Tou (staff-head) puppet's head rests on a single wooden (bamboo) stick, with two curved sticks (its arms) projecting outward from the left and right sides of its torso. It does not have legs; if kicking a foot outward or raising a leg is required, the puppeteer (or an assistant) brings out his/her hand with a false foot on it. This puppet is able to turn its head and stretch its arms upwards, downwards, backwards, and forwards (see Figure 7).

Figure 7. Staff-head puppet.

The Xuan Si (string-/wire-hung) puppet usually has five, six, or seven strings/wires. Occasionally it may have as many as eight, with two connected to the head, two to the

elbows, two to the wrists, and two to the bottom of the legs. The puppeteer is able to shake its head, bend its elbows and wrists, and raise its feet (see Figure 8).

Figure 8. The Xuan Si puppet.

Figure 9. Herb/chemical operated puppets in Lang Qiao (photo by Xia Kangsheng).

Figure 10. All of the theatres have a body of water centre stage, where fish and dragons share the scene with the puppets.

Herb-/chemical- or gunpowder-operated puppets (Yao Fa) function by means of gunpowder, which was widely used for sacrificial activities in rural China. Their performances involved the use of fireworks (see Figure 9). Dolby (1978) further explained that: 'this kind of puppet must only have been used as a rather limited and inflexible kind of spectacle, going through a fairly restricted series of mechanical or chemically predetermined movements'.

Water puppets were used in a wooden pond or trough resting on benches, possibly at the foot of steps with the audience looking down. They were operated in water contained in a boat afloat on a lake, with the spectators on shore (see Figure 10).

Flesh puppets represented youth and were used in a stiff mechanical manner (see Figure 11). Sun (1952) highlighted that flesh puppets are performed by young human beings acting in the stiff mechanical manner similar to that of a puppet, rather than being performed by models of humans.

Figure 11. Flesh puppets at Shan Xi.

Shadow shows are recognised as ‘the ancestor of the movie’ in international film history (Santos et al. 2007). In shadow shows, a semi-transparent leather silhouette with decorative patterns, including puppet-like characters and scenes, is projected onto a white screen (see Figure 12).

Figure 12. Shadow play show.

Each of these puppet types has different material restrictions on performance. Water puppets need to be operated in a wet setting, and flesh puppets were not suitable for exploring the relationship between puppets and puppetry. Chemical-operated puppets require an outdoor environment to keep the performance safe, while shadow plays focus more on shadow movement, which is not convenient for capturing gestures with digital devices. Given the interest in gestures and movements, staff-head and string-/wire-hung puppets are most adequate for this research project, and are the ones considered here. These two kinds of puppetry are quite similar to each other, despite coming from different cultures.

Puppetry performances can be traced back to the imitation of human behaviour. Through operation by puppeteers, puppets can represent human mannerisms and movements. The more realistically a puppet behaves, the more it is considered artistic. If puppets are able to capture

the main features of the subject being imitated – making the inanimate animate – along with a smart structural design, a show could make a very strong impact on the audience. In traditional puppet shows, some puppeteers use hanging wires or wooden/iron sticks to operate the puppets; others use their fingers to hold puppets up (Sadoul 1946). All puppet shows need an operational way to give the puppets vitality. The main artistic features of Chinese puppet shows are the plasticity of shape of the puppets and the sense of realism created.

The Structure of Traditional Chinese Puppetry

I conducted research and analysis on the structure of traditional Chinese puppetry, especially in terms of the laws of motion, which will inform the designing of prototypes in the design phase. I chose Quanzhou as my training project.

Traditional puppetry consists of a head and limbs; the expressions of a puppet are based on this structure, which can promote or restrict its performance. The plasticity of puppets can lend itself to different types of performance, story and stage. However, the structure of early string puppets did not have much change, so this limited the development of the demonstration. After 1949, more puppet sculptors and puppeteers began improving and updating the structure of the head, shoulders, chest, abdomen, waist, buttocks, arms and legs of the traditional puppet. For instance, the feet and hands of the puppet followed real human joints and movements. Some of the legs were made with foamed plastic to lessen the weight, making the puppet's operation easier. These kinds of progress not only kept the features of traditional puppetry but also strengthened the operation.

The top of the puppet connects its head and neck to the body. For instance, the Quanzhou puppet is made of two materials, which include wood and Famille Rose (a type of Chinese porcelain). Through wires, the puppeteers can control the puppet's eyes and the facial expressions. Generally, the main characters in puppetry (Sheng and Dan, male and female leads) are made without movable facial parts to maintain a sense of beauty and integrity of the face. The heads of contemporary puppets are mostly made with a focus on the practical and technical aspects of their performance on stage in relation to the stage lighting.

Another part of the puppet is the limbs. Early marionettes were jointed puppets manipulated from above by strings or wires attached to their limbs. Taking the Quanzhou puppet as an example, its chest and abdomen are separate yet connected, covered by linen with a plaited shape. Its legs do not have moveable knees and the feet are made from carved wood (Wu 2009). This type of structure can make the movements of puppetry more real and the body easier to move and twist for performance (see Figure 13).

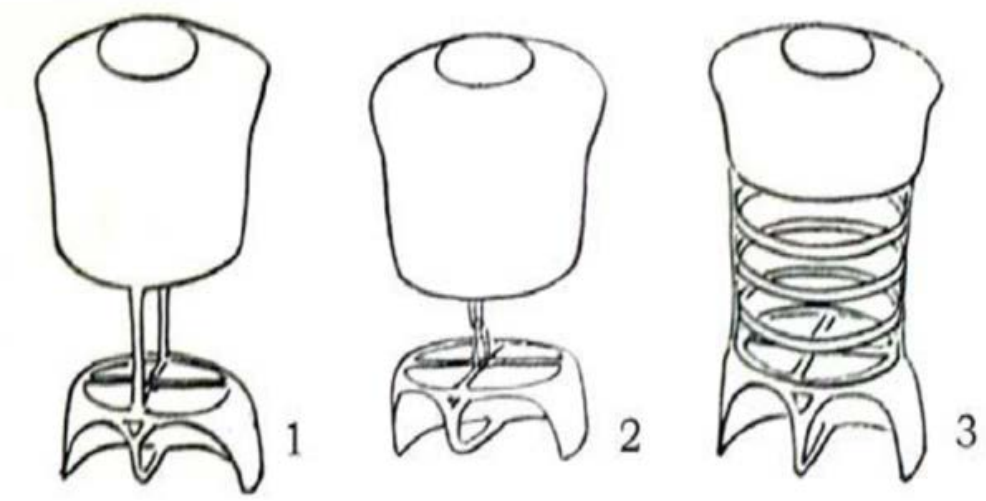

Figure 13. Chest and abdomen of the Quanzhou puppet (Wu 2009).

Early string puppets did not have a knee joint and their feet were carved from wood. The puppets' arms were made with paper that was divided into two parts, their hands carved from wood that was divided into one moving hand (see Figure 14) and a gripping hand (see Figure 15). The moving hand is used for different movements, while the thumb and palm are fixed the other fingers are retractable. The moving hand is used for touching, catching and other gestures, while the holding hand is a fist with gap in the middle which is used for holding weapons or tools. In later puppets, parts of the arms did not connect to each other. Instead, puppet builders use barbed wire to make a joint that allows the elbow to only curve inward. Arms are made using two cylinders, and the forearm can twist up to 180° up or down to make sure puppets can perform different powerful movements.

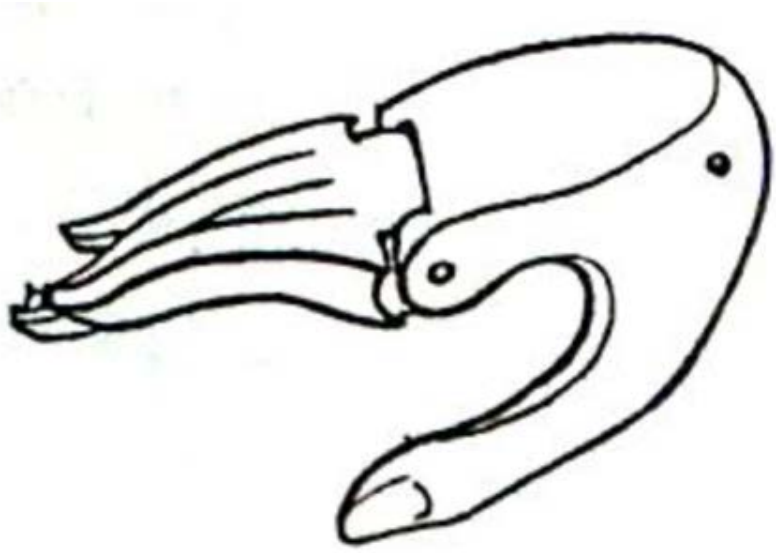

Figure 14. Moving hand of the Quanzhou puppet (Wu 2009).

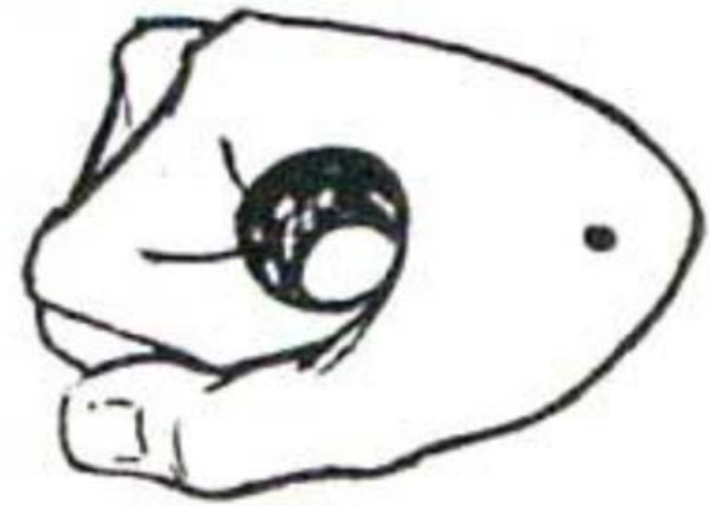

Figure 15. Gripping hand of the Quanzhou puppet (Wu 2009).

The Mechanics of Quanzhou Traditional Puppetry

The elaborate structure and exquisite performance are dependent on a proper and accurate setting of the different positions of lines. Reasonable positions of strings can support puppets represent different movements such as exquisite gestures and dance. Very accurate positions of lines could make the performance become more lively and vivid. The number of strings used in Quanzhou puppetry is the most amount of strings used in any kind of Chinese traditional puppetry, there are thirteen fundamental positions of these strings and eight appropriative positions (see Figure 16). Every traditional Quanzhou puppetry has at least sixteen strings and at most nineteen. From the figure we can see some features about the law of motion which include: 1. They have familiar joints to that of humans; and 2. The positions in the head, chest and back form two balanced symmetrical fulcrums and stable equilateral triangles, allowing the puppets to bend forward and backward, and allowing for the puppets to dynamically balance.

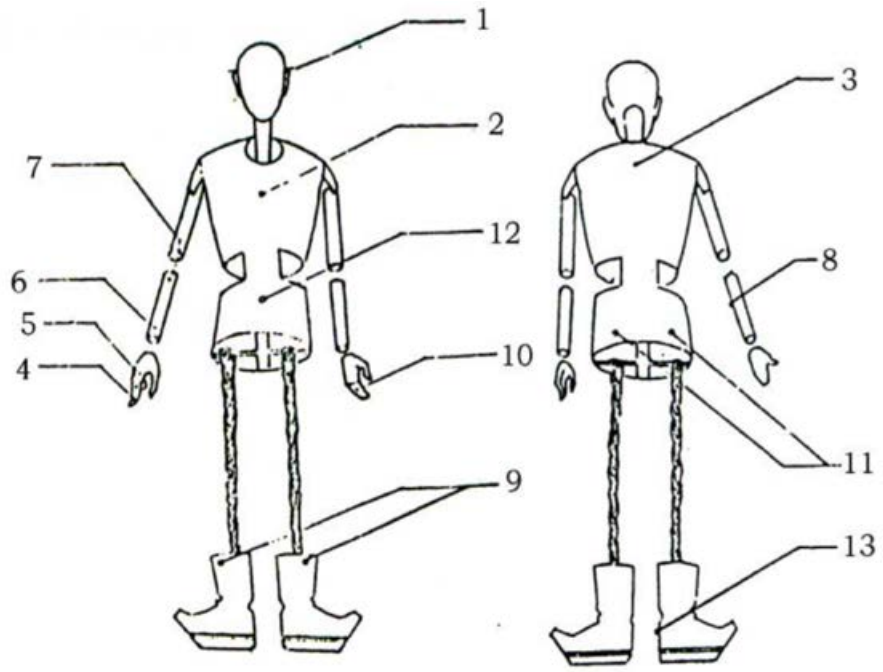

Figure 16. Traditional Quanzhou puppet positions strings (Wu 2009).

2.4 Interactive Technology in Traditional Chinese Paintings

Here the study explores the extensive research showing that using interactive technology supports appreciation of and engagement in paintings. The goal is to reveal insights for potential application designs in Chapter 5.

2.4.1 Interactive Technology to Support Appreciation of Paintings

Previous research has shown how interactive technology can be developed to aid in the general appreciation of paintings. This section presents immersive exhibits and cultural information-sharing as two appreciation methods that involve different interactive technologies; these two different methods are interrelated in many ways, however. Based on appreciation at both general and specific levels, what follows discusses potential designs that could facilitate the appreciation of traditional painting.

Integrity and Authenticity in Immersive Exhibits

The Authorized Heritage Discourse designed by Laurajane Smith has been widely applied as a tool in critical heritage studies, supporting the thinking about, talking about and identifying of the heritage sector (Smith 2006). In recent years, some issues (e.g. reconstruction, interpretation, authenticity, integrity and management) have provoked extensive discussion in the domain of critical cultural heritage studies (Winter 2013; Winter and Waterton 2013; Khalaf 2016; Paddock and Schofield 2016; Su et al. 2019). However, the above-mentioned

issues should be discussed individually from the perspectives of different cultural and historical backgrounds, especially non-European ones (Winter 2014; Su et al. 2019). To be more specific, the integrity of traditional Chinese painting should offer the viewers a more well-rounded perspective of the artworks rather than merely displaying the simplified images or traces, which could potentially discourage the viewers' comprehension, appreciation and engagement. Similarly, the representative elements (e.g. composition, texture) should be more embodied in the appreciation and engagement for maintaining the authenticity of traditional Chinese painting. As well as distinguishing those elements from other categories of Chinese painting (e.g. modern paintings and the artworks of amateur painters) would also be supportive for the appreciation of Chinese painting. Most interactive art exhibits are shown in museums and galleries. A prime example is an exhibition of the Chinese scroll painting *Along the River During the Qingming Festival* (Lin et al. 2009), which depicts a panorama and contains a multi-finger, tangible user interface (TUI), allowing viewers to browse the entire painting. A steerable projector offered a 360-degree perspective with high resolution to portray the original painting to the fullest extent possible. The integrity and authenticity of the painting as presented provided viewers with a sense of reality, creating an immersive appreciation experience. Indeed, digitised replicas of traditional Chinese paintings have become a common alternative means of showcasing them; since 2001, multi-perspective modelling techniques have been used to re-display various Chinese paintings (Chu and Tai 2001; Zhu et al. 2004). Likewise, the Bian River Scroll system exploited high-resolution gigapixel images, annotated with stereo sounds from nature, to create a sense of 3D space for viewers (Ma et al. 2011). The combination of sound and animation has also been widely used; for one example, using 42 projectors, the exhibition *Landscape Transformed* applied simple 3D animation and music to describe the seasonal transitions of the painting *Huang Gongwang and Dwelling in the Fuchun Mountains* (Huang and Lioret 2013). All of the abovementioned paintings in their interactive systems are long scrolls or similar to them in form; for instance, *Along the River During the Qingming Festival* is a scroll 35.6 x 1152 cm (see Figure 17). The painting's shape and length provided enough detail and content to support a 360-degree perspective and an immersive 3D experience. However, long-scroll paintings are not very common in traditional Chinese painting, which limits the adaptability of a 360-degree perspective for displaying other types of Chinese paintings.

Figure 17. The portion of Along the River During the Qingming Festival (photograph by Baidu Tieba, 12th century, Song Dynasty).

In the abovementioned cases, as noted, the interactive technology used for immersive experience focused on digitised replicas. Viewers' visual and acoustic enjoyment was improved to a certain extent, giving them more opportunities to appreciate the authentic details and content of ancient Chinese paintings. However, instilling background knowledge (Foni et al. 2010) and conveying the aesthetic meaning of the ancient Chinese paintings were somewhat disregarded. Moreover, the paintings examined in these case studies were all elaborate ones, rather than freehand brushwork. Elaborate paintings, which display specific characters, magnificence buildings, or subtle environments, differs from that of freehand brushwork which carries much more symbolic significance, conceptualised cultural meaning and metaphorical emotions. Thus, the ways of revealing cultural and aesthetic knowledge in an immersive experience remain undeveloped, the experience of viewers is only staying at a simple browsing and superficial understanding. In other words, the implied significance of Chinese paintings supports viewers' appreciation; hence, it is necessary to emphasise aesthetic meaning. Regarding the design process of these studies, there is a lack of relevant research content, whereby discussions occur between professional painters and amateurs during the phase of conceptual design.

Aesthetics in Cultural Information—Sharing

Some research focuses on the dissemination of cultural information about paintings, such as the graphic nuances of paintings, relevant historical details, and information on the artists. The digital table-top is one of the most common interactive technologies that have been used

to help viewers acquire cultural knowledge. For instance, Hsieh et al. (2013) designed an interactive table-top that offered viewers a platform with which to browse different paintings. The viewers could flip left or right to choose different pieces, just like when reading a book. Based on foveal area technology, the system helped viewers use multi-touch gestures to enlarge sections of paintings by three or four times in order to reveal their subtlety (see Figure 18). Background information (the name of the painting, information on the artists, the era in which the painting was made) was shown on the interface; however, the information provided by the system mainly focused on graphic details (Pan, Lu and Zhai 2003; Li, Wang and Sate 2003; Hu, Bao and Lou 2009), and relevant cultural information was basic, though more than in the immersive experience. For instance, Hsieh et al. (2013) reported the following viewers feedback: 'The interactive table-top provides a comfortable way to view paintings. Now we can see details that were neglected before….This application would benefit researchers'. It is not hard to see that the main reflection from the viewers is involving the usability of the system and the resolution of paintings. However, the details of the paintings' aesthetic meaning and cultural significance has not been mentioned or discussed in the viewers' evaluations.

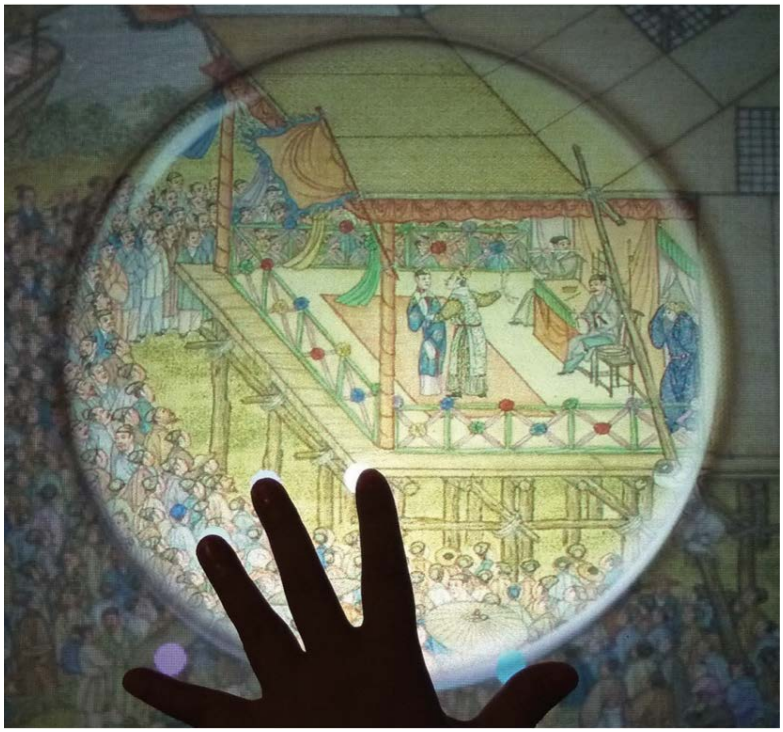

Figure 18. An example of foveal area technology (Hsieh et al. 2013).

Figure 18 shows another example of an art installation with multi-touch screens embedded in the gallery space, so that viewers could browse different paintings and gain a relevant

introduction to each (Alexander, Barton and Goeser 2013). In this installation, the artworks were grouped under themes (*chronology* and *culture*) for browsing. Furthermore, the classification of the art offered viewers the opportunity to browse and explore relationships between paintings categorised under the same theme. A prototype called the interactive art installation (IAI) also used a series of themes to integrate art, literature, and music related to traditional Chinese paintings, which demonstrated not only how to help viewers stay in the 'browsing' or 'watching' stage but also how to facilitate the spread of Chinese culture and philosophy (Huang and Lioret 2013). Thematic classification not only made browsing more convenient but also imperceptibly encouraged viewers to follow their curiosity to explore aesthetic information about the artworks. Providing factual information through interactive technology is thus feasible. However, another important element of this interactive technology is helping viewers to appreciate the subtlety of paintings (Hudelot 2008). Although above-mentioned research has been valuable, I assumed that digital appreciation should incorporate introductory aesthetic knowledge and participatory expression – not only displaying or interpreting a painting's details; the appreciation of traditional Chinese paintings should not be oversimplified (Jin 2017). To this end, Miyashita (2009) offered an approach called *the awareness of the visual characteristics* whereby a painting's characteristics help viewers develop visual awareness. Furthermore, Miyashita also mentioned that observing features of multiple paintings could enhance viewers' appreciation of the paintings' historical context. In sum, I believe in an alternative approach that uses interactive technology to present the elements and imagery of Chinese paintings, potentially facilitate greater viewer appreciation of their aesthetic principles.

2.4.2 Interactive Engagement with Paintings

HCI has long been employed in design and research in traditional cultural domains. It encompasses digital enhancement, exhibition aids, and interactive engagement. Some research has examined how to use interactive technology to improve viewers' experience of traditional Chinese paintings, including through digital drawing, tangible touching, and other methods. This section discusses case studies where digital tools were exploited to support users' digital drawings or where other forms of engagement were conducted via interactive technology.

The Operation of Digital Tools

Many case studies have centred on the paint brush and canvas (the most important tools of painting) and applied interactive technology; their main goal has been to provide users with a

more realistic drawing experience. CoolPaint uses digital paint brushes with a prop-based system to facilitate drawing on a table-top interface (Lang, Findlater and Shaver 2003). The prototype allows users to directly interact with the surface of the screen using brushes with different patterns or effects, drawn from Adobe Photoshop. Like CoolPaint, IntuPaint also utilises electronic brushes, with a tangible interface to capture subtlety (Vandoren et al. 2008), and offers realistic results that help professional artists to develop more elaborate work. Furthermore, Vandoren and colleagues' FluidPaint allows real wet brushes to interact with a surface, thus getting even closer to the normal traditional method of painting (Vandoren et al. 2009). Unlike these two systems, MAI (MR-based Artistic Interactive) involves a mixed-reality (MR) system that allows for the use of a digital brush to draw on physical objects (e.g. plate; wood and human body) in the real world (Otsuki et al. 2010). To simulate live painting, Park (2006) created digital canvases with real brushes to facilitate an authentic drawing experience; his findings highlight the interaction of real ink brushes with a digital screen, and his creation offers a tangible platform for users to experience line art in Chinese painting.

Figure 19. Selected artworks by research participants, made with IntuPaint (Vandoren et al. 2008).

All of the above systems' target users were professional artists or users with a satisfactory understanding of digital sketching applications (such as Adobe Illustrator). Users' artwork in research conducted by Vandoren (2008) and colleagues reflects their skill in employing the brush and its direct impact on their experience (see Figure 19). I wondered whether supporting amateurs without the skills to aesthetically appreciate or even create a drawing is a potential direction for design made possible by enhancing users' operation of digital tools. In particular, current digital tools do not help users engage with elaborate paintings, which have more complex colour assortments and compositions.

Combining Painting with Other Artforms

Engaging with paintings is not limited by the functions of digital drawing tools; other studies have focused on using interactive technology to integrate painting with other kinds of art (such as music and calligraphy) to create a complete painting experience. For instance, Melodic Brush creates a cross-modal musical system that combines Chinese ink-brush calligraphy and music to give its users a novel auditory experience (Huang et al. 2012). The system does not require users to be skilled at painting; they can combine their understanding of art with their knowledge of painting and music to exercise creativity. However, users need to understand the aesthetic meaning of a painting and traditional music. As the third theme of their IAI (interactive art installation) project (Huang and Lioret 2013), *Secrets to Depicting Landscapes* allows users to interact (i.e. puzzles mode) with different parts of a painting in order to create their own piece of art. In the fourth theme, *Listening to a Painting*, projective paintings are animated with different kinds of music to display the harmony of space and time. The spatial atmosphere of the mountains are constructed by projective animation on an acrylic screen. Users have more autonomy to engage with the paintings based on their own understanding. According to Huang and colleagues (2012), Chinese ink painting does not merely require imitation; rather, it involves conveying the painter's thought and spirit. Thus, the key goal of designing for engagement is to help users understand the culture and spirit behind traditional paintings. Several other studies link drawing and music using cross-modal mappings, thereby leading to the development of new art forms (Jo 2008; Yeom and Lee 2012; Kang, Gu and Gay 2013); according to this research, music and other kinds of art fostered a sense of participation among users. For combination of alternative art forms to effectively improve user participation, however, users need to have a basic understanding of the art in question. Furthermore, drawing with brushes is not the only way of helping users to experience a painting; for example, combining an element-based painting with interactive technology could ensure the integrity of users' artwork.

Most research has focused on delivering experiences to users with the same or similar cultural backgrounds as the artworks and/or to users that may already have common knowledge of the aesthetics of painting. To the best of my knowledge, no research has explored how to help amateurs from different cultural backgrounds engage with traditional paintings from a particular culture. For this reason, this Ph.D. research could survey cross-cultural viewers, who are less likely to share aesthetic principles with each other.

2.4.3 Summary

How potential users (visitors/viewers) interact with the interactive applications and systems has already been extensively discussed by HCI researchers, and the actual environments of the experiences have been expanded from museums and galleries to outdoor public spaces (Lehn et al. 2003; Hornecker 2008; Giaccardi and Palen 2008; Wouters et al. 2016). In these case studies, discovering the novel features of the interface, engaging more users to form a collaborative experience, creating dialogue between different users, and enriching visitor experiences of curated digital replicas are all embodied in the user experience of the systems; however, the challenge articulated by vom Lehn et al. (2003): 'How can systems be designed to establish clearer links between interactives and the original artworks?' has still did not been adequately problematised. In the recent studies, the interaction between users and interfaces occurred solely in the digital systems, with less of a focus on exploring how to encourage users to extend their interest from systems to the heritage per se, as well as how to specifically enhance the aesthetic appreciation of heritage (Heath and vom Lehn 2009). Therefore, enhancing the aesthetic and cultural appreciation by encouraging the potential users to experience the interactive applications and systems imperceptibly is a vital target of future design studies.

Based on the findings described in 2.4.1 and 2.4.2, I summarise four aspects of enhancing appreciation of and engagement with traditional Chinese paintings: (1) embody the significance of the aesthetics in the appreciating; (2) offer simple operating experiences of digital tools (i.e. brushes); (3) enhance the integrity of artworks; and (4) facilitate the collaborative appreciation.

First, it is crucial to investigate ways to help potential users grasp the aesthetics of traditional Chinese paintings before they appreciate the artwork, especially for users from different cultural backgrounds. Deepening their aesthetic appreciation of traditional Chinese paintings should not be neglected in the design process of the digital applications.

Second, recent case studies have not considered distinguishing user experience between professional artists and amateurs (who are unskilled at painting). Plenty of studies have tried to improve the authenticity of interactive equipment but have ignored ways to support amateurs using digital equipment. In particular, if users are not well-skilled enough to use ink brushes, their operation of digital tools will be restricted.

Third, helping users create more complete artworks during their interactions with traditional Chinese paintings is important. The integrity of users' artwork directly affects their interest and experience with an artistic tradition. It is vital to properly exploit interactive technology to improve integrity, as well as to retain authenticity.

Last of all, the user experiences described in the case studies presented here reveal that users did not collaborate or communicate with their peers. Interactions only took place between users and systems; thus, the value of employing interactive systems to involve users in participatory appreciation (whether by encouraging them to talk about art or to discuss their understanding of it) will be one of the insights regarding design offered by this Ph.D. research.

2.5 Interactive Technology in Traditional Chinese Puppetry

Chapter 2.5 investigates research on using interactive technology to enhance puppetry performances and on appreciation of these performances, in order to derive insights for design in the case studies. The goal is to reveal insights for potential application designs in Chapter 7.

2.5.1 Interactive Systems for Puppetry Performance

This section delves into some case studies on using interactive technology to support puppetry performances. As early as 1998, motion capture systems were devised to transfer puppetry gestures into a digital/virtual form (Sturman 1998). This created more possibilities for using digital puppetry gestures to aid puppetry performances. Shin and colleagues explored computer puppetry by capturing gestures and fully visualising them in real time; thus, tools used to create animation extended the availability of puppetry gestures in the entertainment industry, such as in performances broadcasted on television (Shin et al. 2010).

A number of interactive systems have been developed that enable users to create digital puppets and puppetry roles. For instance, as early as 2002, PUPPET, an autonomous agent, populated virtual environments to support children in exploring and creating the different roles in a puppetry performance. This system lets children interact with digital puppets in a virtual environment to understand the narrative and characters of a performance. The virtual environment allows them effectively to physically interact with the characters (Marshall et al. 2002). In contrast to Marshall and colleagues, Cutout Animation adopted a video-based paper tracking technology to create cut-out-style animations, rather than specific puppetry roles

(Barnes et al. 2008). Users could make physical puppets by cutting them out of paper; their movements were captured by an overhead camera and rendered into animation on the screen, with the option to choose from different backgrounds. In 2011, a digital system called Shadow Story integrated digital puppet-making and puppetry roles, providing children with an interface that lets them employ their own gestures to perform stories (Lu et al. 2011). They could also use a pen and tablet input to create digital shadow puppetry.

Numerous case studies on digital puppetry systems focus on puppetry performances (which I will not review one by one here). The creation of digital and physical puppets and puppetry roles has given users greater autonomy and the capacity to exercise their creativity (such as learning about the characters or becoming familiar with puppetry performance); users then have the opportunity to collaborate in order to experience different puppetry roles. Based on the analysis of these studies, I summarised four features of current digital puppetry performance: (1) oversimplified performances; (2) simplified puppetry characters; (2) simplified gestures; and (4) cultural significance.

Oversimplified Performances

The puppetry performances in these studies have been excessively simplified by movement-capturing and animation rendering. For instance, a study on Cutout Animation reported limitations of the digital equipment (Barnes et al. 2008), whereby the system was unable to capture all puppetry gestures or other fast movements, as Barnes and colleagues mentioned:

> *Unfortunately, our system is not capable of handling every puppet or action a user may wish to animate … puppets cannot be moved too quickly, as the Kanade-Lucas-Tomasi (KLT) algorithm assumes that the optical flow between frames is well approximated by small displacements without rotation*.

Users thus do not have the chance to experience authentic historic puppetry performances, which include complex operatic gestures, and current interactive technology could mislead users to an oversimplified understanding of puppetry performance.

Simplified Puppetry Characters

In the third case study, of shadow stories (Lu et al. 2011), the interactive interface of the puppetry characters – which simplified the characters of traditional shadow puppetry – only offered a simple digital pen and basic colours for users to create the characters. Figure 20

shows clearly that the users' characters lacked the basic elements of traditional puppetry; thus, it is crucial to provide users with a more accurate understanding of the characters. Developing ways of using interactive technology to enhance the creation of shadow puppets could be a direction for future design.

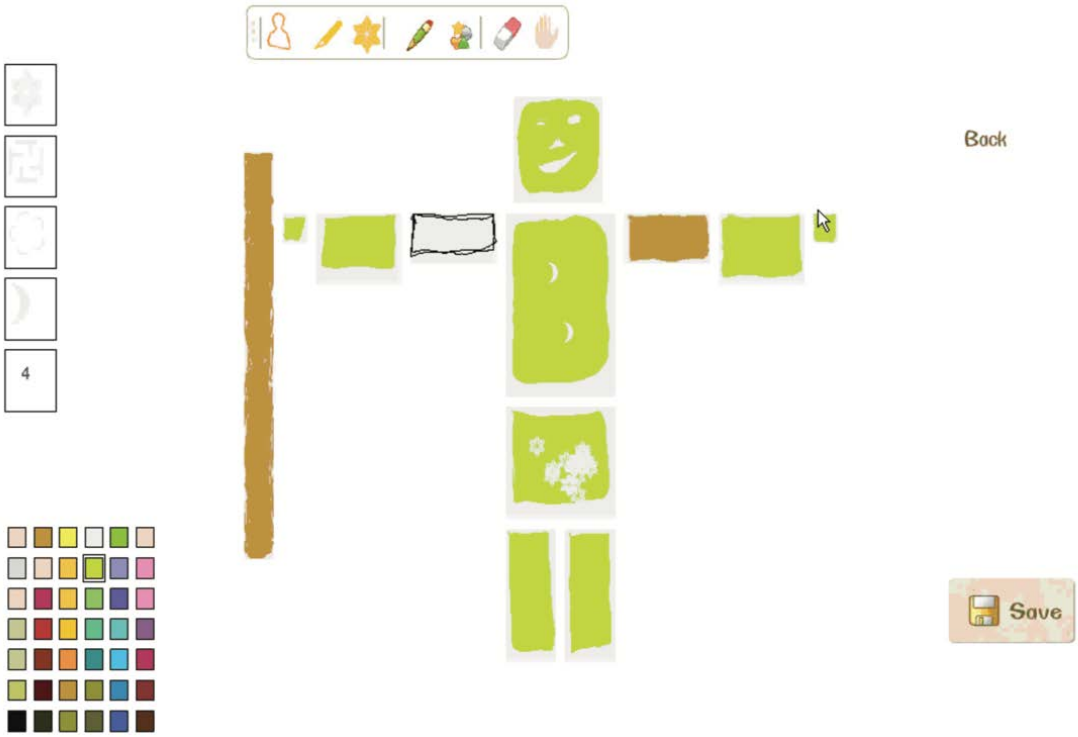

Figure 20. Interface of the 'design' mode for creating characters (Lu et al. 2011).

Simplified Gestures

As noted above, gestural performance was incompletely captured or simplified by the digital systems (Kim et al. 2004; Zhao 2019a). System interactions in user engagement and the actual operation of the puppets are visibly divergent, but prior research has not deeply explored the implications. For instance, the Shadow Story system offers users handheld sensors to conduct gestural interactions rather than letting them have physical interactions with shadow puppets. Although Wan and colleagues exploited a Kinect-based system to support users in personally manipulating shadow characters with their own gestures (Wan et al. 2015), those gestures still differed greatly from the gestures of traditional shadow play. Furthermore, while Liang and colleagues developed a hand-gesture-based interaction and animation data repository to generate interactive animations using shadow play (Liang et al. 2016), the gestures were only classified by the roles of the shadow play, and the users were not invited to aspire to and did

not have chance to take part in real shadow play, as the gesture-based interactions were simplified to fit with the game experience.

Cultural Significance

Last, cultural appreciation (e.g. the cultural meaning of gestures and stories) of puppetry is not well supported by technology, as most prior research is entertainment oriented. For instance, current digital systems do not portray traditional Chinese puppetry as part of ICH (Xu and Xin 2007) in the sense of helping users learn about the relevant history and customs by experiencing a digital puppetry performance. However, Lu and colleagues (2011) tried to work with professional traditional Chinese shadow puppeteers in order to classify the characters as elements to be used in a digital system. This collaboration resulted in a series of traditional cultural characters as available design elements for the digital system; however, for the puppetry gestures, no relevant identification work was carried out. Thus, conducting fieldwork with professional puppeteers to gather puppetry gestures or other elements from traditional puppetry can provide a cultural reference for the design phase of this Ph.D. research.

2.5.2 Interactive Technology for Puppetry Appreciation

This section focuses on some interactive digital systems intended to support the appreciation and understanding of puppetry. Current research has mainly adopted emotional expression/involvement and storytelling as methods to facilitate understanding and appreciation.

Emotional Expression

As early as 1978, Dolby mentioned that audiences' emotional expression could act as one of the main entry-points to improve their appreciation of traditional Chinese puppetry. Bai and colleagues (2015) designed an interactive prototype called Fing Augmented Reality (AR), which aimed to enhance children's complex cognitive and social development. Through a series of puppetry games, children acted out their emotions, beliefs, and desires, and interpreted the roles based on their experience with the game. In this project, AR was exploited to help children understand the emotions of the puppetry characters during the game. Another, similar project is called emoPuppet; it is an interactive digital-physical puppet that helps children to clearly express and understand emotions (Martínez 2014). Using a smartphone application, children observe and appreciate simple puppetry characters to learn about facial expressions. They were engaged effectively in the experience and developed a

basic understanding of puppetry, and the interactive technology also improved their creativity and social skills. Shi and colleagues adopted characteristics of Chinese folk culture to design a digital shadow puppet and developed an interactive system that exploited Kinect-based interactions and sensors to capture children's movements, the goal being to help them express their emotions with shadow puppets (Shi et al. 2013). Their assessment showed that the system helped children develop a fundamental understanding of shadow puppetry.

However, in these studies, emotional expressions and experiences did not integrate the features of puppetry characters or specific classical stories. In other words, users' emotional expressions were disjointed from the puppetry itself; the characters and enjoyment were not embodied. Therefore, oversimplified gestures and basic emotional expressions seem to have limited the cultural appreciation of puppetry shows in such cases.

A potential direction for design in this Ph.D. research is thus how to systematically display highly complex gestures in an interactive system to create a richer experience for users. In addition, while using emotions to enhance children's puppetry appreciation is worthwhile, a large number of audiences of traditional Chinese puppet shows are adults; hence, there is an opportunity to explore how puppet gestures support deeper cultural appreciation among adult audiences as well. Traditional Chinese puppetry is a sort of ritual activity that originated in Chinese agricultural society (Proschan 1981), most Chinese puppetry describes folktales. Therefore, I believe it is necessary to explore how to use emotional expressions to engage these audiences in order to help them appreciate the cultural significance of traditional Chinese puppetry.

Digital Storytelling

Some research has focused on using storytelling with digital animation to boost appreciation of traditional puppetry. For instance, based on the photon mapping method (Jensen 2001), Zhu and colleagues developed a prototype that turned traditional shadow plays into electronic forms that provided the audience with immersive stories (Zhu et al. 2003). They offered delicate lighting effects and realistic martial arts sequences to reproduce the classical Chinese folk story *The Butterfly Lovers*. However, the digital animation only focused on reproduction, and the subtle meanings of the shadow play gestures were not well explained. The background, dialogue and traditional music of this story were not included at all, missing an opportunity to support users' appreciation. Another shadow play animation system exploited the Rapidly-exploring Random Trees—Connect algorithm to capture the characteristics of

motion from traditional Chinese shadow play, and depicted the resulting 'emulational' animation for audiences (Hsu and Li 2005a; Hsu and Li 2005b). The animation system recreates realistic shadow character movements and provides an aesthetically pleasing environment. Although Hsu and Li further explored how to use delicate animation to develop an original story, their research only centred on delivering experiences to users with the same or similar cultural backgrounds, or those who already appreciated the aesthetics of the puppetry.

Indeed, prior research in general has failed to investigate how to narrate traditional Chinese shadow puppetry stories to audiences from different cultural backgrounds. Using interactive technology in storytelling to enhance its appreciation by cross-cultural audiences from a perspective should be explored (Hickey 2012). Furthermore, the cultural relevance of puppetry narratives and the in-depth meaning of puppetry gestures need to be effectively interpreted for audiences (Giaccardi 2011; Hawkins et al. 2011). Although expressing emotions through interactive technology is a valuable way of increasing audiences' appreciation of puppetry, there are other important opportunities for interactive technology to help audiences bridge cultural differences that have not been deeply examined. These include digital systems that use gestures to enhance cross-cultural audiences' appreciation of puppetry and its deeper relationship with Chinese culture.

2.5.3 The Digital Archive of Heritage and Motion Capture

Both tangible and intangible heritage possess vital cultural and historical significance, and initially, the digital archive is designed to help people objectively understand history and preserve the data of heritage for long-term use (Baker and Cantillon 2020; Brusaporci 2020a; Król and Hernik 2020). The types of data in the digital archive of heritage include texts, databases, still and moving images, audio, graphics, software, web pages and others among a wide and growing range of formats. At the same time, the digital archive also provides multiple possibilities for changing and exploring people's access to and experience of heritage. Narrativity, as one of the new attributes of the digital archive, may potentially facilitate the sustainability of digital projects and further engage visitors (Brusaporci 2020b).

Furthermore, digital documentation has achieved significant technical advances, such as laser scanning, stereographic photography, photogrammetry, and motion capture. The gigapixel resolution camera with 360-degree panoramic and 720-degree spherical imaging has tremendously improved motion capture. One example is the Kung Fu archive (Shaw and

Kenderdine 2016; Hincks 2017), which adopted a ‘prosthetic’ technique to utilise infrared cameras to track and collect the reflective traces from the movements of the kung fu performers (see Figure 21). A motion-data archive has also been built based on these captured motions to provide the digital contents for immersive and interactive systems.

Figure 21. The capturing of Kung Fu motion from the Hong Kong Martial Arts Living Archive (Shaw and Kenderdine 2016).

The above-mentioned case study offered a feasible design scheme (motion-data archive) and technique (motion capture-prosthetic), to a certain extent. The motion capture could potentially collect movements and provide extensive data to safeguard movement-based and craftsmanship-based ICH. Moreover, the design scheme of the motion-data archive could also offer abundant content for interactive systems and equipment. This potentially engages the visitors with opportunities for further experiences and interaction with the movement and skill of ICH. However, in the case of traditional Chinese puppetry, there are several technical challenges and limitations worth discussing:

(1) Common traditional Chinese puppetry, such as staff-head puppets, string-/wire-hung puppets and shadow plays utilise plenty of cotton thread, iron wires, wooden sticks, as well as the combination of shadow lighting. And the physical movements of puppeteers when they are performing are very subtle, sometimes consisting of just finger gestures. The existing technologies, such as motion capture in the Kung Fu project, may struggle to capture the subtleties. For instance, in Figure 22 (Shaw and Kenderdine 2016; Hincks 2017), the subtleties of gestures in the performances were not embodied in the traces of the movements.

Figure 22. Selected photo from the Kung Fu Visualization (Shaw and Kenderdine 2016).

(2) One significant feature and part of the true essence of Kung Fu is the classical imitation routine; however, traditional Chinese puppetry is based on puppets simulating human behaviour and sometimes exaggerating the human being's movements. Thus, capturing the movements of a traditional Chinese puppet in the form of digital traces or animating the puppet to interact with visitors could potentially constitute cultural appropriation and put ICH at risk. Furthermore, using the cotton thread, iron wires, and wooden sticks to interact with the puppet involves a unique performance method that imitates human movement without replicating it. In other words, the gestures and movements of traditional Chinese puppets that are replicated as other images or animations will potentially cause the visitors to misunderstand traditional Chinese puppetry, which might eventually break the authenticity of the art form (Smith 2006) and hamper the safeguarding of ICH.

(3) Another challenge worth considering is how to re-utilise the extant linear and non-linear video resources of traditional Chinese puppetry. Safeguarding traditional Chinese puppetry has gone on for more 30 years (Chen and Clark 2010), but there are extensive existing video-based resources that have not been fully utilised. Using these resources with interactive technology to support the appreciation and experience of traditional Chinese puppetry is a possibility that needs to be explored.

2.5.4 Summary

I reviewed different research projects that used interactive technology to enhance the performance and appreciation of puppetry. Current studies have effectively supported users in experiencing puppetry briefly, and traditional puppetry has also been utilised to convey culture to engage users in game entertainment or social learning. However, the following points need to be considered:

(1) Traditional puppetry performances (e.g. gestures, movements) are oversimplified in interactive systems, which may lead users to have an incomplete understanding of traditional Chinese puppetry. Maintaining originality is necessary in the design phase.

(2) In most of the case studies, children were the main target audience. Yet in traditional Chinese puppetry, a large number of audiences are adults. Thus, it is crucial to explore how to use interactive technology in order to design a way for adults to appreciate this art form.

(3) Based on the findings from the point above, it is also necessary to determine ways to support adult audiences in grasping the cultural significance and folk customs of traditional Chinese puppetry. However, cultural significance is not embodied in current digital systems.

(4) No particular case study has focused on supporting cross-cultural users in appreciating and experiencing traditional Chinese puppetry. One of this study's main research goals is to investigate ways to use emotional expressions, digital storytelling and other methods in conjunction with interactive technology to help cross-cultural users understand traditional Chinese puppetry.

2.6 Gesture Technology

Gestures are the cultural essence of traditional Chinese painting and puppetry, and gesture-based interactions are the main method that has been utilised to help audiences experience these two different cultural aspects. Thus, I now analyse some case studies on gesture-based interactions and expressions to explore insights into potential designs.

2.6.1 Gesture-Based Interactions

Gesture-based interactions have been widely realised in different areas, breaking down barriers between users, devices (such as gloves and trackers) (Efron 1941; Khoshelham and Elberink 2012; Dias et al. 2014), and image-processing or detection techniques (Zhao et al. 2006; Grigoriou et al. 2010). Typical examples of gesture-based interactions can be found in

both the digital arts and technological applications (Van den Hoven and Mazalek 2011). Furthermore, gesture-based interactions are embodied in support for users' operation of interfaces or systems; for instance, some studies have investigated the use of simple gestures and audio-only feedback to control music playback in devices (Pirhonen et al. 2006), head gestures to operate auditory menus (Brewster et al. 1991), and gestures to rotate a physical pen and determine how a user may grip it to improve flexibility and control (Song et al. 2011).

Some applications have aided user operations grounded in gesture-based interactions, such as GestureTek's interfaces and visual conducting interfaces (Segen et al. 2000). The applications can accurately execute operational commands given by users; however, the interactions are limited to few a gestures controlled by a fairly small number of simple operations; furthermore, users' autonomous experiences are limited to a library of standard gestures. In addition to tangible and wearable technologies (Harris et al. 1989; Tikander 2009), another type of technology does not require either a wearable device or specific markers to interact with a system, and is designed according to the 'come as you are' principle (Wachs et al. 2011; Dover et al. 2016). Some of these devices, such as the Xbox Kinect, Leap Motion and Myo Armband, have become very popular and are frequently utilised by researchers. For instance, an optical motion-capture device based on a Web3D platform was developed to support user interactions with animated dancers (Magnenat-Thalmann et al. 2018); another study used the Wii Remote or Sony PS Move to animate different objects on a screen through gestures (Vaucelle and Ishii 2008). In these case studies, the gestures successfully expressed and aided animatic movements; however, the movements were limited by the nature of the animated characters, which did not provide the users with a creative engagement to express their own emotions or stories. Therefore, my goal is to explore how to employ gesture-based interactions to facilitate creative experiences.

2.6.2 Gesture-Based Expressions and Creations

The application domains of gesture-based interaction have become quite many, broad, and complex, regardless of whether the interaction involves touch or is touchless. Some studies have examined creative expression with gesture-based interactive technology, especially in digital art and related cultural industries (Zhao et al. 2007; Vandoren et al. 2009); other studies have used multi-touch pens and digital brushes to augment gesture-based interaction. A comparative report on a the 'five-mode switching technique' concluded that clicking a mechanical button on a digital stylus is not the optimal solution (Li et al. 2005). Various other

projects have proposed the idea of finger touch gestures to enhance art creation; for example, some studies have investigated pen rolling and shaking as a type of interaction (Suzuki et al. 2007). Furthermore, some projects have demonstrated that grip can be leveraged as a medium allow a user to interact with a digital device (Taylor and Bove 2009; Wimmer and Boring 2009); however, operation requirements were high for naive users who did not possess any painting skills, and therefore the completeness of these users' experiences was relatively low. Meanwhile, tangible technology – which is often based on embodied interfaces for use in artistic exhibits (Valdes et al. 2014) – has been designed, integrated into smartphones and tablet devices, and incorporated into AR applications in order to explore the intuitiveness of gesture-based expressions (Lagerstam et al. 2012). Given the outcomes of the abovementioned studies, users' gesture-based expressions were viewed in my design process as affiliated functions in the interactive experience. I suppose that the main design targets could involve gesture-based operation or learning, without emphasising creativity directly, as during the experience, the availability of only stereotypical gestures was what limited users' artistic expression and creativity. For these reasons, support for users' self-expression and enhancing their artistic creativity needs to be considered in the design process of the case studies.

Chapter 3. Methodology

3.1 Introduction

I structured the methodology of this Ph.D. research in order to answer two main questions:

(1) What barriers do cross-cultural viewers/audiences face in appreciating Chinese painting and puppetry?

(2) How can interactive technology help cross-cultural audiences understand Chinese intangible cultural heritage?

The results of the investigation into these questions are addressed respectively in Chapters 4, 5, 6 and 7. This chapter looks in detail at the methods used in each case study (see Figure 23). In addition to this introduction, the chapter is broken down into two sections. The second section introduces a theoretical basis for the practical design work (see Chapters 4, 5, 6 and 7), to explore the element-based deconstruction and classification of traditional Chinese painting and puppetry. In the third part, I provide a detailed description of the methodologies adopted in the fieldwork, design, and evaluation study in Chapters 4, 5, 6 and 7.

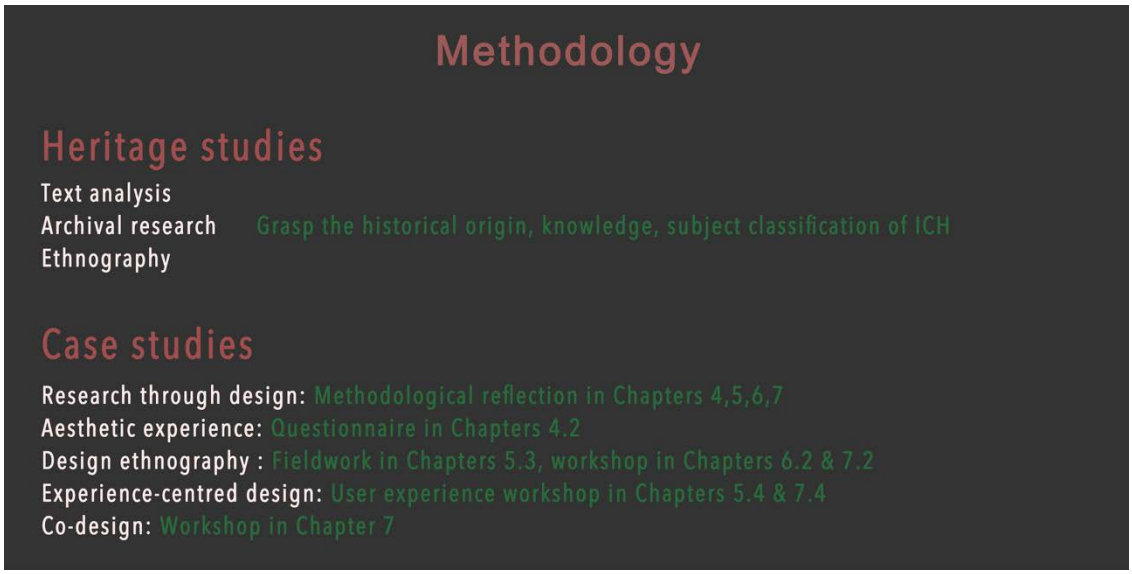

Figure 23. Methodology review.

From an interdisciplinary perspective, this chapter is mainly meant to offer the theoretical foundation to support me in conducting the heritage studies and two case studies, as well as reflect upon the design portion of the entire research process to explore how to design interactive technology to support the cross-cultural appreciation of ICH (see Figure 24). In section 3.2 Research Methods in Heritage Studies, I discuss text analysis, archival research and ethnography. These three methods are frequently adopted in heritage studies. They help me grasp the historical origin, background, subject classification, and other information

related to aesthetics literature on traditional Chinese painting and puppetry. In other words, these three methods offer me a way as a heritage researcher to further understand ICH's significance. Based on a multi-disciplinary perspective, the Research Method in Case Studies (in section 3.3) reflects five methods (i.e. Research through Design; Approaches for Aesthetic Experience; Design Ethnography; Experience-centred Design; Co-design) that provide a theoretical basis for the practical design work in Chapters 4, 5, 6 and 7. To be more specific, Approaches for Aesthetic Experience helps me understand the viewers' aesthetic appreciation and experience of traditional Chinese painting in which aims to promote cultural appreciation in the Cultural Appreciation study in Chapter 4. In the two case studies, Design Ethnography allows me to have a sense of being part of the non-Chinese audience so as to potentially eliminate my own worldview/cultural background. It has also been employed to collect data from the professionals and stakeholders of two artforms to explore the design concepts and insights that support cross-cultural appreciation. Experience-centred Design is utilised as a technique to obtain deep and targeted understanding of the audiences'/viewers' user experiences of the interactive application in Chapters 5 and 7. Co-design is specifically adopted to support me in conducting a series of co-design activities in Chapter 7. This method helps me easily follow the perspectives of the professionals and probe the subtle design details of their communication and interactions during the co-design activities. Last but not least, Research through Design is utilised as a speculative method to conduct a series of practise-led case studies in Chapters 4, 5, 6 and 7, which helps me reflect on the design process model of the entire research process and deconstruct cultural elements to enhance cross-cultural appreciation of Chinese ICH.

Figure 24. Different methods from an interdisciplinary perspective.

3.2 Research Methods in Heritage Studies

In this section I discuss the methods that have been traditionally used in heritage studies. Since the 1980s, heritage studies have become a well-defined, independent research area (Sørensen and Carman 2009). Text analysis and archival research are frequently used techniques to grasp the essence of past occurrences and to trace the changing meanings of heritage (Soderland 2009). In particular, they are used to analyse relevant historical records and archives to aid the introduction of traditional Chinese painting and puppetry (see Sections 4.2 & 7.2) and foster cultural and aesthetic appreciation of these art forms among cross-cultural interviewees (see Section 4.2); in this study, these methods were also used in the fieldwork, to analyse the data from the interviews with professionals and stakeholders (see Section 6.2).

The Convention for the Safeguarding of the Intangible Cultural Heritage (2003), established by the United Nations Educational, Scientific and Cultural Organisation (UNESCO), highlights the importance of community production, safeguarding, maintenance, and re-creation of ICH, as well as the rise of heritage-from-below practices. Hence, the research focus of ICH has transferred from specific cultural products to excavating the wealth of knowledge and skills held by artists and local communities (Giglitto 2017). Some scholars have adopted investigative techniques from other realms, such as sociology, psychology, art and anthropology, to support their research on ICH. Ethnography is a primary social–anthropological approach that is frequently employed in combination with in-depth interviews, workshops, or other techniques to examine the significance of traditional ICH (Palmer 2009). Some scholars believe that ethnography is the study of heritage (Travis and Hodgson 2019). This method originates in the late 19th century, when academics ventured out into colonies to study cultures, human behaviour, and social relations (Van Dijk 2011). As a social science research approach, ethnography integrates observation, up-close/personal experiences, and sometimes direct participation. Ethnography uses three kinds of data collection: (1) interviews, (2) observations, and (3) documents; each produces a different data type: (1) quotations, (2) descriptions, and (3) excerpts of documents (Mabson et al. 2016).

For this Ph.D. research, the purpose of ethnography is to grasp the artists' point of view and vision of their world (Malinowski 2005), as well as to help me understand the bigger picture of traditional ICH. Specifically, I used ethnography in the fieldwork to gain familiarity with the performance of traditional Chinese puppetry, as well as to become involved with the puppetry lectures and the performing experiences outside China of professionals and

stakeholders. The method of the fieldwork, in Section 6.2, explains how I used ethnography to conduct the fieldworks and interviews and how I collected the data. Meanwhile, the extensive partnering of interviews and video-/audio-recordings is also a supportive technique to make use of features of traditional Chinese puppetry to overcome barriers to its appreciation.

3.3 Research Method in Case Studies

This section provides a detailed description of the methodologies adopted in the two case studies (Chapters 4, 5, 6 and 7), which includes research through design (RtD) to form the theoretical basis; aesthetic experience approaches and design ethnography for use in the fieldwork; as well as experience-centred design (ECD) for design and evaluation studies and co-design for exploring the future design studies.

3.3.1 Research Through Design (RtD)

Research about design by engaging in that very activity has become widely recognised and utilised in the field of HCI and interaction design. Frayling (1993) provided an interpretation in 'Research through Art and Design': '*research where the end product is an artefact – where the thinking is, so to speak, embodied in the artefact, where the goal is not primarily communicable knowledge in the sense of verbal communication, but in the sense of visual or iconic or imagistic communication*'. In short, the process of making artefacts or designing systems should all be regarded as various outcomes of design research. Frayling generalises three aspects of this method:

(1) *Materials research*: Exploring the possibility of material projects.

(2) *Development work*: Exploiting a piece of new technology that no one has considered previously.

(3) *Action research*: Recording the design process of a practical experiment and contextualising the subsequent report.

From the perspective of HCI, Zimmerman (2007) and Gaver (2012) identified their works as 'research through design' (RtD). Zimmerman, Stolterman, and Forlizzi (2010) defined RtD as '*a research approach that employs methods and processes from design practice [sic] as a legitimate method of inquiry*'. Zimmerman and his colleagues further explained that RtD satisfies the following characteristics:

(1) As prototypes, the created artefacts should include potential design insights and usability of new materials.

(2) The design insights offer guidelines and sensitising frameworks to the design research community.

(3) The main goal of all of documented projects is to achieve multidisciplinary outreach.

Pierce (2014) proposed the following three common categories of forms and functions of design research artifacts: operational design prototypes and products, conceptual and material design studies and experiments, and design proposals. Furthermore, RtD has been frequently adopted as a constructive design research method for reflecting on design processes and rationales, supporting deployment in the end-user study, designing and forming conceptional theories, proposing and advocating design agendas, and displaying produced forms (Stolterman 2008; Nelson and Stolterman 2012).

From HCI to the digital heritage sector specifically, RtD is utilised as a methodology to place the heritage value as research and digital technology as design, to potentially support digital heritage researchers to examine disparities and ambivalent conditions found in digital heritage (Aydin and Schnabel 2015). Endemic to digital heritage, disparities of applications are attractive problems to seek creative design solutions for (Rahaman and Tan 2011). More importantly, RtD offers the potential to preserve the authenticity of heritage in a digital environment and facilitate new insights through design practice for complex and future-oriented issues in digital heritage (Lowenthal 1999; Peirce and Putnam 2014; Vannucci et al. 2019). Conducting design to have a better understanding of design research is one feature of RtD; thus, the achievement or potential contribution of the research project is from the designer's reflection before, during and after the design of the design process, as well as within the resulting design artefacts themselves (Bowers 2012).

In summary, this Ph.D. research utilises this approach to conduct a series of practise-led case studies in order to understand how cross-cultural viewers/audiences engage with ICH. More importantly, support me in reflecting the design process model of the entire research process (for instance, from 4.2 Cultural Appreciation Study to 5.2 Study on Transferable Design Elements to 5.3 Interactive Design Study) to explore how to design interactive technology to support cross-cultural appreciation of ICH, and also maintain the authenticity of ICH during the experience (Schnabel and Aydin 2015). The expected contribution of the design study not only seeks using the specific interactive technology as a strategy, but also directly revealing design considerations and opportunities for enhancing cross-cultural appreciation of ICH. This Ph.D. utilises this approach to conduct a series of practise-led case studies in order to understand how cross-cultural viewers/audiences engage with ICH. As an overarching

technique, RtD pursues several ends within this research. Fundamentally, RtD offers a mode of generative inquiry: to conduct heuristic work; to review existing research with a critical eye; and to seek the possibilities and design insights of the cross-cultural appreciation of Chinese ICH. Furthermore, RtD provides an efficient theoretical foundation and framework for linking various research methods in a coherent manner in order to contribute to research questions. Thus, the contribution of this Ph.D. is not merely based on the evaluation of two interactive applications; rather, fieldwork that engaged with ICH stakeholders and cross-cultural viewers/audiences is also part of the holistic design process. The findings from the fieldwork also formed the design insights, which are reflected in the prototype design. In addition, the understanding of deconstructing cultural elements (see Section 8.5) is based on a review of the entire design process. As an overarching tool, RtD offers a comprehensive perspective to integrate diversified research methods from multiple disciplines.

3.3.2 Approaches for Aesthetic Experience

The study adopts a series of methods as a theoretical foundation to understand the viewers' aesthetic appreciation and experience of traditional Chinese painting, as well as to reflect the content of the workshop and questionnaire*,* in *Study 1: Cultural Appreciation* (Chapter 4). What is aesthetic experience? There are various conceptions or definitions of aesthetic experience from different perspectives. Cupchik and Winston (1996) offered a general definition from the psychology of art. They believed that aesthetic experience is a sort of psycholinguistic activity in which people give their attention to a specific object and also suppress all other objects, events and concerns. Markovic (2010) believed this is an exceptional state of mind in which people could obtain an exceptional emotional experience and psychologically feel themselves integrating into the objects. Similarly, inspired by the relationship of subject-object, Ognjenović (1997) articulated aesthetic experience as a sort of interaction in which the exclusive object dramatically interacts with the subject and other objects and events are neglected. Maslow (1968) described aesthetic experience as peak experience that can make people become literally disoriented in time and space when they fully concentrate on specific objects. Apter (1984) further added that, generally, the aesthetic experience is more focused on the activities or objects pe se, but when people have an aesthetic experience, they do not have a distinctive goal or purpose. The art museum educator Patterson B. Williams expounded his understanding of the aesthetic experience in museum settings. He assumed that every viewer has an individual understanding of the significance or value of the museum experience, and that the personal emotion aroused by artwork or artefacts can be a kind of aesthetic experience (Williams 1984). The production of artwork

concretises the artist's personal emotions and values, as well as the historical background and symbolic significance of the era in which it was created. Thus, whether the audience/viewer has or acquires enough traditional and cross-cultural knowledge to understand history and symbols across societies and time periods could be a potential determinant of their aesthetic experience (Vivas 1937). In fact, however, Williams's experience with museum visitors indicated that most of them feel confused or embarrassed because they do not know how to appreciate the artwork in front of them. Therefore, this kind of experience also offers a challenge, which is how to enhance one's appreciation with a series of meaningful activities and relieve anxiety (Csikszentmihalyi and Hermanson 1995). It is worth mentioning that normal viewers (who are not trained in visual art) are more likely to obtain pleasure or joy from their appreciation. Furthermore, Cupchik and Gebotys (1988) and Winston and Cupchik (1992) believed the appreciation of artwork has substantial differences between trained and untrained viewers. In other words, the appreciation of normal/untrained viewers can be potentially enhanced by giving them a joyful experience. Lankford (2002) also believed that the aesthetic experience could be enhanced or trained, like any other skill: 'People may be born with the capacity to contemplate, but that "skill of contemplation" must be developed, just as any other skill needs considerable honing before a level approaching expertise can be attained'.

Markovic (2008) referred to the tentative three-component model (i.e. evaluating emotional response, enhancement of early visual processing, decision-making) from Nadal et al. (2008), which was designed to integrate emotional and cognitive processes into aesthetic experience. Markovic adopted 9 descriptors of aesthetic experience (i.e. fascinating, irresistible, unique, eternal, profound, exceptional, universal, unspeakable, and I would like to have this painting) and 22 descriptors of the emotional content (i.e. cheerful, sad, appealing, disgusting, angry, scary, surprising, anticipating, delightful, hateful, awing, erotic, proud, timid, trustful, disappointing, tragic, humorous, lovely, charming, jealous, pitiful) to gain a better understanding of the relationship between aesthetic experience and other affective qualities experienced during the appreciation. This Ph.D. research explores how to learn about cross-cultural appreciation of traditional Chinese painting rather than specifically focusing on discussing the general relationship between aesthetic experience and the elementary affective tone. Differing from the theoretical framework for basic cognitive functioning mentioned above, some psychologists provided another modern, psychological version of the philosophical perspective of disinterest in which they believed the aesthetic experience should be distinguished to the everyday experience (Beardsley 1982; Csikszentmihalyi 1990).

Therefore, to obtain a further understanding of the constituents of aesthetic experience, I refer to the five attributes of an aesthetic experience from Beardsley (1982):

(1) *Object focus:* The viewers spontaneously invest their attention in the art;

(2) *A sense of freedom:* The viewers feel free while engaging with the art, but differ in terms of their daily observation;

(3) *A detached affect:* The viewers' experience is not taken literally, and the viewers like to reflect on their aesthetic appreciation of the art;

(4) *Active discovery:* The viewers gain visual stimulation and have an enjoyable experience; and

(5) *Wholeness:* The viewers obtain a sense of integration and self-identity from the experience.

Cupchik et al. (2009) believed Beardsley's theory as a distinct process is the most fully developed concept of aesthetic experience. Following Beardsley, a study by Levi and Smith (1991) highlighted that while only the first attribute is necessary per se for aesthetic appreciation, at least four of them must be present. Based on the interviews with museum professionals and other relevant stakeholders on their thoughts about aesthetic occurrences, Csikszentmihalyi (1990) developed the theory of optimal experience, also known as 'flow' experience, which integrates knowledge, memory, emotion, sensation, and perception . This theory also borrowed directly from philosophy and referred to several attributes of an aesthetic experience from Beardsley (1982). In this theory, the aesthetic experience was informed by several aspects (i.e. perception, emotion, intellect and communication) from a multidimensional perspective; this theory also identified the critical role of the process of discovery in the appreciation of artworks. Csikszentmihalyi developed questionnaires based on his four dimensions of the aesthetic experience through open-ended discussion with professionals and stakeholders. He also emphasised that subjective interpretation is key in understanding the aesthetic experience, explaining that art museum visitors (for example) have more expectations in terms of opportunities to embed their personal thoughts or emotions into the artwork, however, such expectations also entail that visitors themselves need to have a greater understanding of cultural and historical context, which should be presented to them. Csikszentmihalyi also mentions that 'aesthetic experience is a species of the genus optimal experience', in which the visitors detach from the world around them and often lose track of time. Lankford (2002) commented that flow experience stresses holistic engagement and thus is more suitable for a global cultural experience. In my study on cultural appreciation (see Section 4.2), I adopted Beardsley 's five criteria (1982) and flow experience (Csikszentmihalyi and Robinson 1990) as theoretical references to design the workshop and

questionnaire. It is noticeable, however, that both Beardsley's and Csikszentmihalyi's research targets were museum stakeholders and visitors, whereas this study aims to promote cultural appreciation (see Section 4.2) using these two methods to focus more on integrating the reflections of cross-cultural viewers.

3.3.3 Design Ethnography

As one of the main methodologies from anthropology, ethnography is often employed to understand cultures and folk customs—rooted in and reproducing how people live—in cultural studies. The purpose of using design ethnography in particular is to obtain design insights; Rothstein (2010) comments that 'design ethnographic research produces better results not only because it puts designers in touch with users, but also because it encourages open-ended thinking that results in more innovative solutions'.

Thus, unlike traditional ethnography, design ethnography integrates design and ethnography to form a specific method that transfers users' perceptions into design insights. As Genzuk (2003) explains, 'the key aspect of adopting ethnographic practice in design is to ultimately understand more of the user's perception of the object, environment, system, or service the user is engaged with'. The timescale of design ethnography is normally limited to only a few days (or an even shorter period of time). Traditional ethnographers more intend to engage with societies and become a part of them; meanwhile, design ethnographers are more focused on observing and interviewing people from outside. Design ethnography does not require researchers to collect and build an enormous dataset, but only to create a 'just enough' analysis to test risky assumptions (Travis and Hodgson 2019). Blomberg (1993) suggests that actively participating in fieldwork will help designers formulate an explicit goal for the design process that will make users' behaviour and experiences more relevant to the design itself. Blomberg also states that designers should bring their knowledge of design strategies and methods to collaboration within fieldwork: 'User partnership in developing and evaluating the technology in relation to current and imagined work activities should be aided by designer participation'. In addition, the understanding and findings of design ethnography can potentially be reflected in design artefacts even if they cannot be embodied in written statements.

In the Puppetry Research Conference (see Section 6.2), this study employs design ethnography to collects data from traditional puppetry professionals and stakeholders to explore the design concepts and insights that may support cross-cultural appreciation of the

art form. In Section 7.3, on data collection for design, the study collects the puppetry gestures that supported the non-Chinese audience's cross-cultural appreciation of the art forms. Furthermore, the study uses design ethnography to carry out in-depth observations and understand the user experience of digital applications in the design study (see Section 5.3) in Chapter 5 and the user study (see Section 7.4) in Chapter 7.

The reasons for choosing design ethnography as the main method of carrying out the studies presented in this dissertation are:

(1) *To delve into the barriers encountered during cross-cultural appreciation of traditional Chinese culture*. Since I do not have experience of puppetry manipulation, it is necessary to develop an understanding of the cross-cultural obstacles encountered by puppetry stakeholders during performance experiences, as well as to collect the potential design ideas to overcome these barriers.

(2) *To eliminate the author's own worldview/cultural background.* The author of this research is Chinese, and very much familiar with Chinese folk customs and folklore. Thus, observing non-Chinese audiences'/viewers' feelings and gathering their feedback and perspectives can lead to new potential design insights.

(3) *To better grasp the context of use*. In understanding that the use of interactive applications is inextricably linked to the user's environment, technology tested in a more traditional human–machine dyad may fail to capture their experience accurately.

3.3.4 Experience-Centred Design (ECD)

I adopted ECD, developed by Wright and McCarthy (2010), to conduct the design study for two case studies. This method helped obtain deep and targeted understanding of the audiences'/viewers' user experience from the angle of ICH. The aesthetic appreciation of the cross-cultural viewers/audiences is the key theme of this holistic Ph.D. research. The design process, which is supported by interactive technology, is used as a tool to understand how these viewers engage with traditional Chinese heritage—the main principle for this Ph.D. research. This entails the need for a technique to aid in capturing and analysing audiences'/viewers' experience and putting the findings into practise.

Wright and McCarthy believe that understanding users' experiences requires not only designers' observations but also their involvement, values, and sensibilities. Kearney (2002) argues that 'when the events of our lives, our experiences, are transformed into story … we

become agents of our history'. Different types of stories have been used in many different ways within ECD projects. For instance, scenarios can reflect the motives, feelings, or other complexities of human activity (Carroll 1995). Personas can replace users' personal histories, goals, and feelings (Cooper 1999), and pastiche can the discussion more vivid and identify significant issues (Blythe and Wright 2006). Stories also build a starting-point for face-to-face dialogue between the author and viewers/audiences and can reflect lived experiences in dialogue. Ochs and Capps (2001) argue that building a dialogue to engage people in sharing their stories is important in particular to help researchers pinpoint deep or obscure experiences. Not only is dialogue necessary between researchers and users, the understanding of the dialogue should be intersubjective (rather than objective). This sort of dialogical mode can also be applied to artistic or cultural projects that foster collaborative relationships between designers and audiences or designers and local communities. According to Kester (2004), the dialogical mode can bring 'unlikely groups together in novel settings to engage in dialogue about how to improve people's experience by intervening in a particular social situation'. In dialogue between artist and audience/viewer, the latter can be understood as the 'user' in ECD.

Wright and McCarthy (2010) explain several other frequently used methods that are employed in ECD. For instance, *cultural probes* are a strategy for experimental design to explore people's lives, cultural environments, and technology (Gaver et al. 1999). The *experience prototype* helps designers understand, explore, and communicate with the product, space, or system of the prototype (Buchenau and Suri 2000). It can also engage users and designers to experience the application directly, which potentially avoids forming the indirect user experience (e.g. hearing about or seeing somebody else's experience of it). *Fictional inquiry* uses shared narratives to create fictional settings, artefacts, and circumstances (Dindler and Iversen 2007), as do *drama and role-play* (Newell et al. 2006) and *technology biographies* (Blythe et al. 2002).

In the two case studies in Chapters 4, 5, 6 and 7, storytelling and cultural probes are adopted to help cross-cultural viewers/audiences integrate experience from their personal lives, cultural context, aesthetic habitus and feelings to describe the challenges of appreciating traditional Chinese heritage, in preference to just developing abstract descriptions to summarise their experience. This gave me a needed opportunity to delve into cross-cultural appreciation and determine the reasons for the challenges. Furthermore, drawing on ethnographic tools (such as participant observation, interviews, and video-recording), the

experience prototype and fictional inquiry are both used to engage traditional heritage stakeholders in the design phase and elicit their perspectives for the evaluation of the interactive applications.

3.3.5 Co-design

Co-design has been employed in various realms of human–computer interaction, for instance, persuasive technology design (Davis 2012), design for social innovation (Meroni and Sangiorgi 2011), design for students with multidisciplinary backgrounds (Haetzer et al. 2011), public government services (Mol 1999; Anthopoulos et al. 2007), pervasive health (Clemensen et al. 2007; Huldtgren and Endter 2014), and cultural studies (Claisse 2017; Ferretti and Gandino 2018). In digital heritage studies, co-design is often applied by designers to enhance museum visiting experiences based on reflections emerging from participatory development of interaction concepts and prototypes with cultural heritage professionals (Ciolfi et al. 2016). Co-design also carries a wide range of resources around shared cultural, historical, and thematic interests to contribute ideas and offer creative input (Popple and Mutibwa 2016). In general, co-design is used to form and assess prototypes, systems, and services; it may involve the opinions of users, designers and stakeholders, applying them to improve the accessibility and usability of digital applications. The key point of co-design is to focus on identifying common values and gather feedback (rather than pursue agendas and solutions) (Ferretti and Gandino 2018).

In the case study of traditional Chinese puppetry in Chapter 7, my responsibility as designer was to participate in, organise, and facilitate a series of co-design activities with professional puppeteers and puppetry stakeholders. The co-design activities are interspersed into the puppetry fieldwork. As a participant and organiser, I engaged and conducted a series of co-design activities with Chinese and European puppetry professionals and researchers in the UK and China. I used this interspersed approach as I believed that the special features of Chinese puppetry performance could help me easily to follow the perspectives of the professionals and probe the subtle design details of their communication and interactions during the co-design activities.

In the design phase of Chapters 4, 5, 6 and 7, I chose an intermittent ongoing strategy to conduct the co-design activities (rather than successive, intensive). In general, through puppetry workshops with puppetry stakeholders, I sought out initial opinions about involving interactive technology to support the appreciation of puppetry. Afterwards, a series of open-

ended activities (such as brainstorming keywords around existing examples) were held with puppetry educators and students to explore feasible design schemes strategically and to confirm the initial evaluation of design ideas from the professionals' standpoints. Based on follow-up fieldwork (performances abroad) with puppetry professionals, I used a digital prototype to concretise the design directions and use feedback. The overall goal of this series of activities was to empower puppetry stakeholders to engage with the design process in their encounters with the art form; hence, I focused strongly on integrating the views of puppetry professionals and examples of their performances abroad, representing their design process, in order to reflect their design expertise and knowledge of cross-cultural appreciation.

3.4 Conclusion

This chapter presents a set of techniques that were utilised during the author's heritage studies, fieldwork, and design studies. It provides a theoretical framework for approaches that were imported from other disciplines to HCI and digital cultural heritage studies. It also offers a valid set of frameworks for examining the cross-cultural appreciation of Chinese ICH. This chapter explores the literature with a focus on (1) the understanding of Chinese ICH; (2) the potential barriers to appreciation from the viewpoint of stakeholders and cross-cultural viewers/audiences; and (3) design strategies through a review of the design process of two interactive applications. Finally, this chapter lists a series of reasons that justify the application of particular strategies in order fully to answer the research questions.

Chapter 4. Understanding Cross-cultural Appreciation: Traditional Chinese Culture and Traditional Chinese Paintings

4.1 Introduction

For most amateurs, appreciating Chinese painting is an appropriate first step prior to learning more deeply about the topic. Compared to acquiring drawing skills, disseminating awareness of aesthetic forms and disciplines is in this sense a more suitable approach for engaging the public in the arts (Ryokai, Misra and Hara 2015), as knowledge of a given field can deepen one's understanding of its cultural meaning and humanistic background (Zhao et al. 2018). Artistic appreciation and interaction also emphasise the unity and diversity of traditional art (Beardsley 1982). Furthermore, the structure of aesthetic participation implies focused attention in response to a visual stimulus (Csikszentmihalyi and Robinson 1990). In other words, the features and form of aesthetic appreciation provide a specific design direction to support viewers' experience. However, cultural diversity entails specific challenges for viewers from outside a given artistic discipline's cultural background of origin (Csikszentmihalyi and Robinson 1990). Diverse understandings and multiple cultural backgrounds influence people's aesthetic awareness of (for example) traditional Chinese painting in different ways. Therefore, this chapter discusses methods to help non-Chinese viewers overcome barriers to their appreciation of traditional Chinese art. This chapter first posits that Chinese and non-Chinese viewers have different habits in terms of grasping traditional Chinese painting. Next, the chapter compares their individual approaches through a study on cultural appreciation, and explores the non-Chinese participants' understanding of colours in traditional Chinese painting and the meanings of the paintings' elements.

4.2 Aims and Rationale for Studying Cross-cultural Appreciation of Traditional Chinese Paintings

I investigated the aesthetic appreciation of traditional Chinese culture and painting through a series of data-collection activities (workshops, questionnaires and semi-structure interviews) with cross-cultural viewers. I asked them about their interpretations of the art. The specific study objectives were (1) to explore methods of cross-cultural awareness in relation to traditional Chinese painting and (2) based on the first objective, to discuss the non-Chinese participants' understanding of colour in traditional Chinese painting and of the meaning of the corresponding elements. To meet these goals, I utilised questionnaires and in-depth interviews to examine approaches to appreciation, which I expected to be more fruitful than considering how interactive technology alone can support Chinese painting. Through the findings of this study, my aim is to aims to outline and justify the primary design elements of the tablet

application prototype (which include colours and relevant subjects), as well as the appreciation of emotional imagery for the study on design in the next section.

4.2.1 Methods

As a theoretical underpinning to its main technique, the study on cultural appreciation adopted Beardsley ‘s five criteria (1982) and flow experience (Csikszentmihalyi and Robinson 1990). To identify the specific appreciation methods of the culturally diverse viewers, firstly, I referred to Beardsley’s five criteria of aesthetic appreciation: (1) *object focus:* viewers spontaneously invest their attention in the art; (2) *sense of freedom:* viewers feel free while engaging with the art, but differ in terms of their usual observation; (3) *detached affect:* viewers maintain a cognitive-emotional distance from their appreciation of the art, which mediates their aesthetic experience; (4) *active discovery:* viewers can experience visual stimulation and have an enjoyable experience; and (5) *wholeness:* viewers can obtain a sense of integration and self-identity from the experience (Beardsley 1982). Then, based on the flow experience (Csikszentmihalyi and Robinson 1990), I also included perception, emotion, intellect and communication as the main perspectives to learn about the people's aesthetic experiences of traditional Chinese painting. This had the potential to help me have a critical role of discovery in the appreciation of traditional Chinese painting. I employed these two methods in order to integrate the participants’ prior knowledge and the talks they had while engaging with the art so as to examine the habits, assumptions, and frames through which they appreciate traditional Chinese painting. In the first phase, I hypothesised that the Chinese and non-Chinese viewers had different habits. Through workshops with the culturally diverse participants to discuss and compare how Chinese and non-Chinese people appreciate traditional Chinese painting, I sought to determine their specific methods of appreciation. Following up on the findings from the first phase (specifically focusing on the methods as to how non-Chinese people appreciate traditional Chinese painting), in the second phase, I used questionnaires and semi-structured interviews to further explore participants’ understanding of colours and other elements utilised in traditional Chinese painting. I elicited the target viewers’ colour preferences to investigate how they perceived the symbolisation of traditional Chinese colours and images.

4.2.2 Phase 1: Appreciation of Traditional Chinese Painting

Beardsley’s five criteria and flow experience are reflected in the seven questions used in the three parts of the workshop. Part 1 targets *object focus*, while Part 2 centres on *sense of*

freedom, *detached affect*, and *active discovery*, and Part 3 involves *wholeness*. Table 1 shows each question discussed with the participants.

Part 1	**First impressions**
Q1	How do you begin to appreciate traditional Chinese painting, and what is your starting-point for doing so?
Q2	What is the first point or element of the painting that you focused on while engaging with the art?
Part 2	**During the process**
Q1	Do you enjoy the process of appreciation, and was there any form of visual or sensorial discomfort during your experience?
Q2	Were there any experiences or understanding in the process of appreciation that you find hard to describe?
Q3	Do you have any interesting findings that you would like to share with others?
Part 3	**After the activity**
Q1	Do you have any thoughts/images you recollected after you finished?
Q2	Describe the method (steps/elements) you followed and explain how it supports your approach to appreciating Chinese painting.

Table 1. The list of the main questions.

Figure 25. The participants in the workshop.

Based on the idea of comparative experiments, I intended to compare the differences between the appreciation felt by non-Chinese and Chinese people toward traditional Chinese painting. Two workshops were held separately in the UK and China. The workshop in the UK focused

on exploring how non-Chinese people normally appreciate traditional Chinese painting. The one held in China was for discussing the ways Chinese people appreciate Chinese painting. Before the workshops were carried out, I posted an announcement on a student forum from a university's student union (in China) and student society website (in the UK) that explained the main process of the activities and called for novices or amateur painters who might be interested in traditional Chinese painting (no professional painters). Twelve participants were chosen, ranging in age from 20–40, consisting of six Chinese and six non-Chinese individuals; these participants were later divided into two groups: Chinese and non-Chinese. The participants were mainly undergraduate and postgraduate students. Figure 25 shows their ages and nationalities. Eighty samples of Chinese paintings were presented, falling under four main categories respectively representing various aspects of the works:

(1) *Time periods* (Figure 26) which encompassed the Sui and Tang dynasties (581–907); the Liao, Song, Jin and Yuan dynasties (907–1368); and the Late Imperial China period (1368–1895).
(2) *Techniques* (Figure 27) which encompassed the quality of boneless, splash colour, and splash ink.
(3) *Colours* (Figure 28), which encompassed gold and green, a green landscape, a light crimson landscape, line sketching, strong colour, and water and ink.
(4) *Themes* (Figure 29) which encompassed birds and flowers, figures, and landscapes, for each group to use as a source of material.

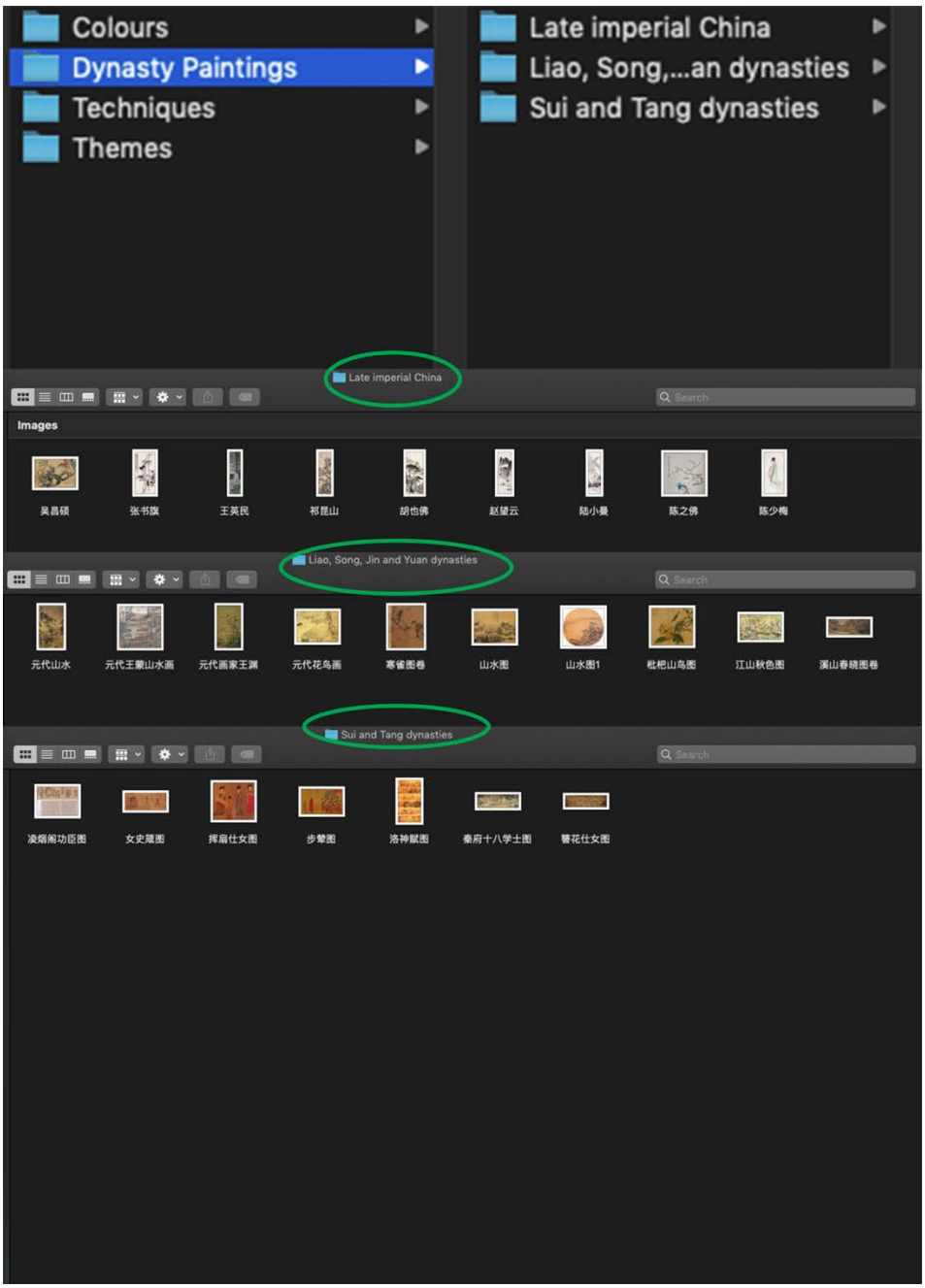

Figure 26. Traditional Chinese painting reference: Time periods.

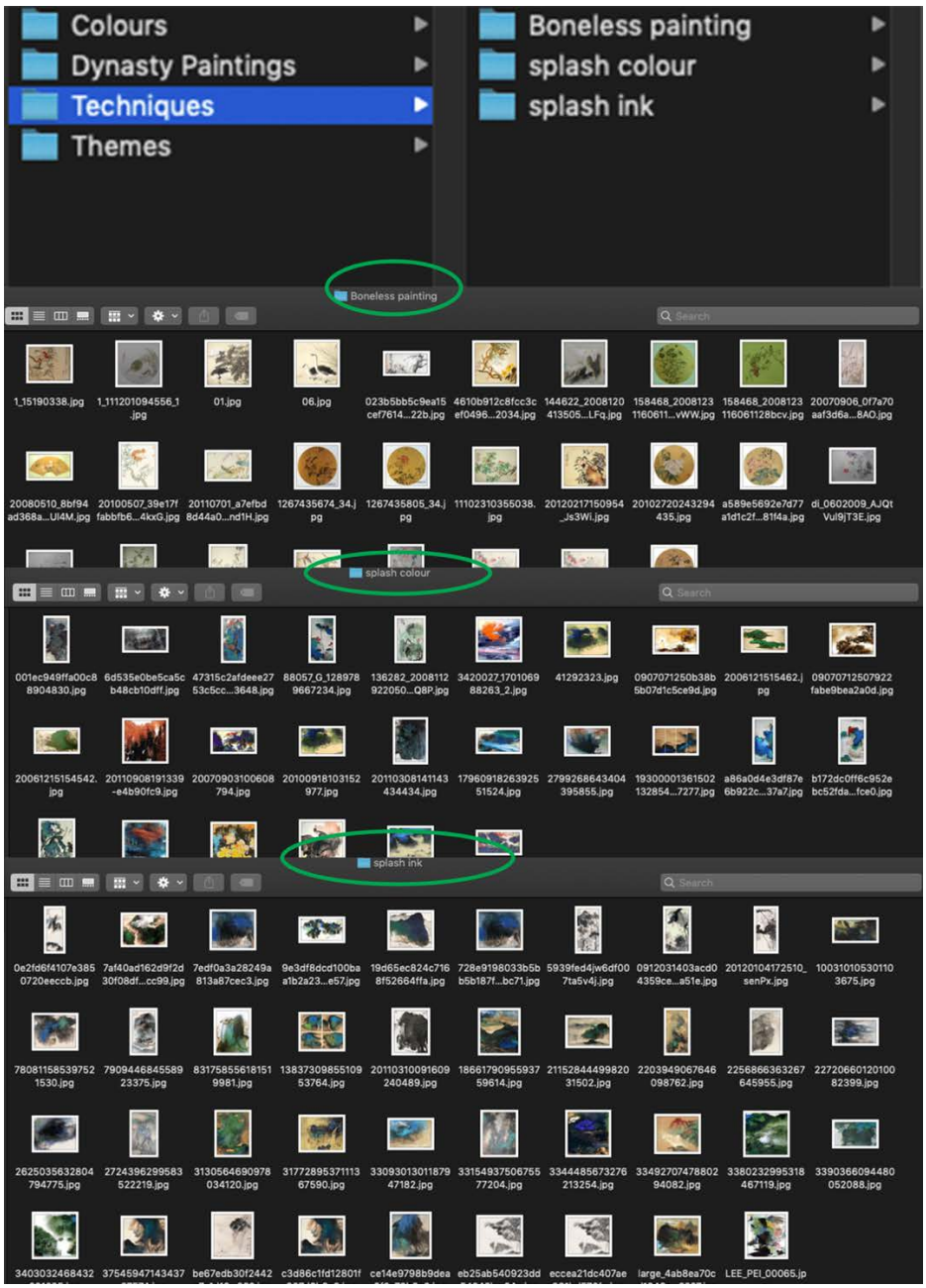

Figure 27. Traditional Chinese painting reference: techniques.

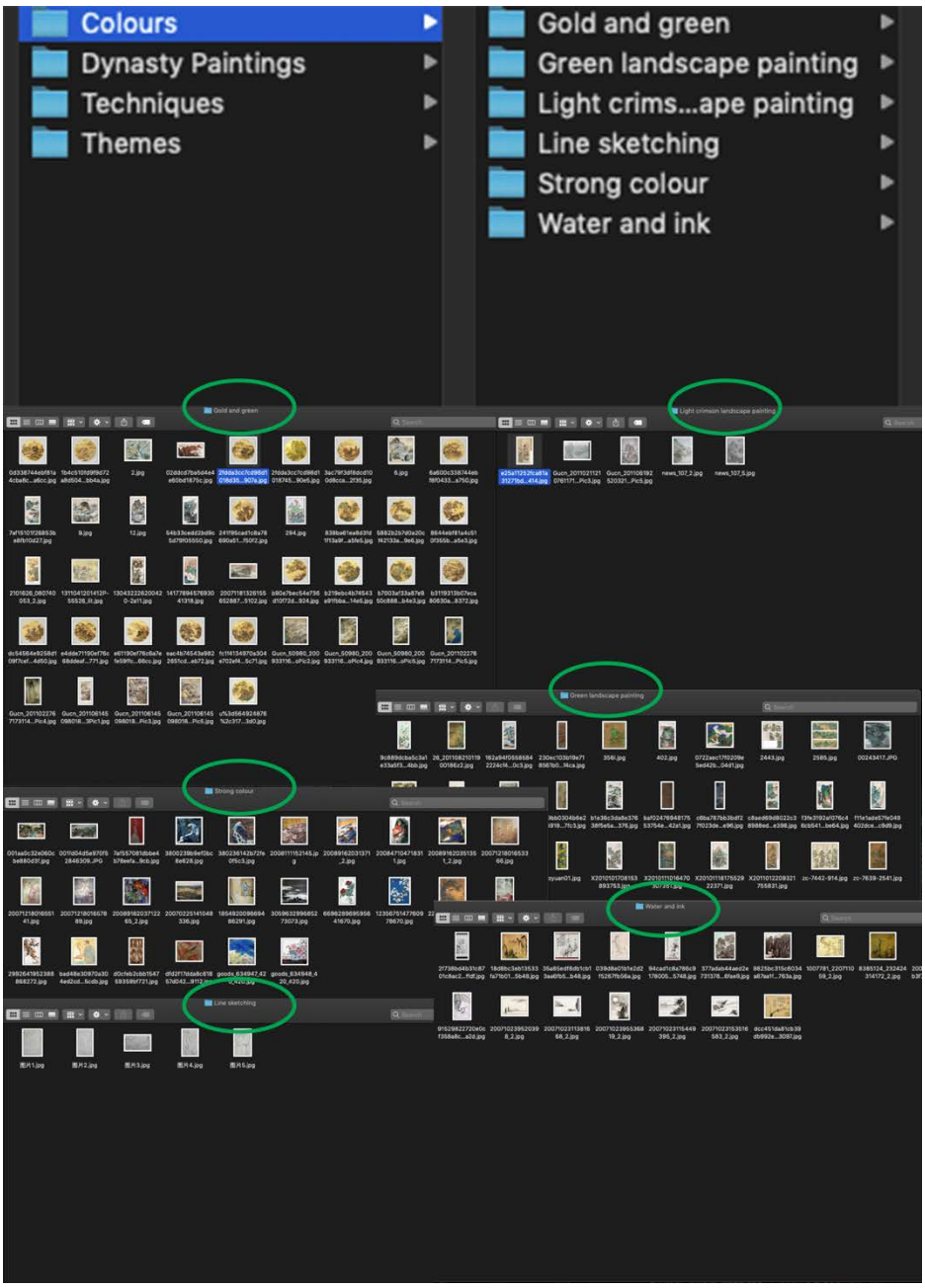

Figure 28. Traditional Chinese painting reference: colours.

Figure 29. Traditional Chinese painting reference: themes.

Based on Beardsley's criteria, the seven questions were divided into three parts: Part 1: *First impressions*; Part 2: *During the process*; and Part 3: *After the activity*. In Part 1, I focused on how viewers begin appreciating Chinese painting. In this part, I intended to explore participants' first impressions of the traditional painting, especially as to how they began to appreciate the artworks. In Part 2, I investigated the viewers' experiences engaging with Chinese painting. Gaining a better understanding of their appreciation and their previous experiences of appreciation were the key goals in this part. Upon completing these two parts, I summarised the methods the viewers used. By browsing and attempting to understand each painting, the participants talked fruitfully about each question with their group members. This

part focused on summarising and reflecting on the non-Chinese and Chinese people's personalised appreciation methods. All the above-mentioned questions in these three parts were open-ended, which allowed the participants as groups to discuss their personalised answers. I as the organiser hosted the workshops, helped participants fully understand the process in each part, and answered their questions. I asked the participants each question and the participants expressed their thoughts one by one; then they had time for group discussions. In Part 3, the discussions then deepened as each participant wrote a few key words (representing an element) on sticky notes to share with each other their own experiences and steps of appreciation. In both groups, each participant was required to consider and outline the intercommunity revealed by the key words; this process led to the creation of group appreciation methods, derived separately from the non-Chinese and Chinese participants and showing separate characteristics. At the end of the two workshops, the participants were required to reflect and summarise a set of steps that could describe how they appreciate traditional Chinese painting. These steps were based on their group discussion to reach a consensus.

In this phase, I compared and refined the aesthetic appreciation approaches of the non-Chinese and Chinese viewers. The next phase aimed to expand on the habits of the non-Chinese.

4.2.3 Phase 2: Interpreting Traditional Chinese Colours and Painting Themes

Based on the aesthetic appreciation methods described by the non-Chinese participants as obtained in Phase 1, I proceeded to scrutinise the subjective interpretations of visual elements (colours and subjects of traditional Chinese painting) at this stage. Given the main research target (cross-cultural appreciation), all of the respondents and interviewees were non-Chinese; however, they were different people from those who had taken part in Phase 1, and hence were not influenced by the results. The (questionnaire) respondents and (semi-structured interview) interviewees did not need to have any previous experience in drawing or appreciating Chinese painting. All of the questionnaires and semi-structured interviews were conducted on the street based in China and UK. Ninety questionnaires were administered during an 18-month period (45 in Shanghai (China) and another 45 in Newcastle (UK)), for a total of 44 effective questionnaires based in Newcastle (Appendix A.1.1).

1. Below are some references of Chinese traditional colours. Please choose which colours you think could represent Chinese traditional colours (multiple choices)? And if you do not mind, please state your reason why on the next page.

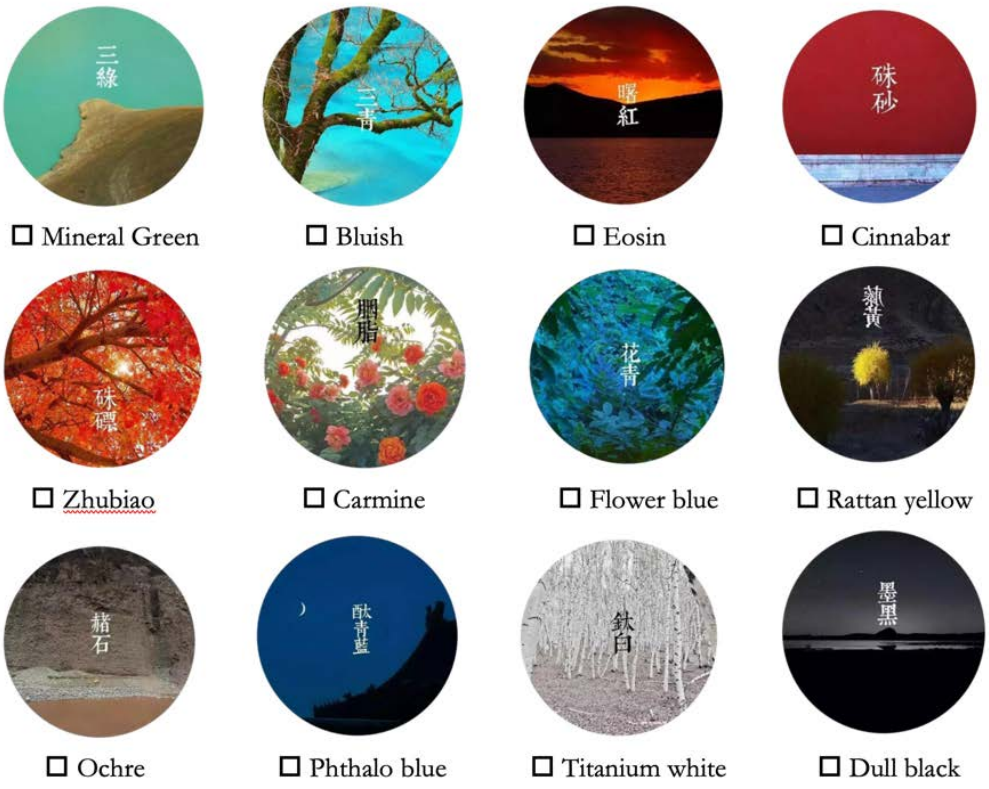

Figure 30. The first question of questionnaire and the options of 12 colours of traditional Chinese painting.

2. Below are some subjects. Please choose which subjects you think could represent Chinese traditional painting (multiple choice)? And if you do not mind, please tell your reason.

☐ Rhododendron ☐ Osmanthus ☐ Plum blossom ☐ Camellia ☐ Daffodil
☐ Lotus ☐ Penoy ☐ Orchid ☐ Prunus mume ☐ Chrysanthemum

☐ Chinese cabbage ☐ Pakchoi ☐ Radish ☐ Pine ☐ Bamboo ☐ Willow

☐ Dog ☐ Cat ☐ Cow ☐ Sparrow ☐ Tiger ☐ Horse ☐ Goldfish
☐ Money

☐ Brook ☐ Sea ☐ River ☐ Mountain

☐ Chinese Lady ☐ Buddha

Figure 31. The second question of the questionnaire and options/subjects that offered for participants.

Those who answered the questionnaire could choose from an atlas of 12 traditional Chinese colours (Yu 2013) to answer the following question: '1. Below are some references of Chinese traditional colours. Please choose which colours you think could represent Chinese traditional colours (multiple choices)? And if you do not mind, please state your reason why on the next page; 2. Below are some subjects. Please choose which subjects you think could represent Chinese traditional painting (multiple choice)? And if you do not mind, please tell your reason.' There were 12 representative colours of traditional Chinese painting as options for participants to choose from (see Figure 30). Multiple common subjects (frequent and infrequent subjects of traditional Chinese painting) were also provided to participants in the second question to aid them in expressing their understanding of the questionnaire (see Figure 31). It is also worth mentioning that the participants were welcomed to name subjects that were not listed in the question. These locations were considered suitable for finding respondents with varied cultural backgrounds (the actual respondents were German, British, Russian, Japanese, Korean, and Spanish) and ages (18–48). Figure 32 shows their ages, nationalities, and occupations. Afterward, semi-structured interviews were conducted with 10 interviewees (selected from those who had answered the questionnaire) to discuss their reasons for their choices. The semi-structured interviews were designed to further probe the interpretations of colour and subjects of Chinese paintings. The interviewees were mainly asked two questions: 1. Why did you choose these colours? 2. Why do you think the subjects you chose represent traditional Chinese painting? During the interviews, the respondents had more time to use online photos/images and their own sketches as tools to help them explain their understanding of the colours and subjects.

Figure 32. Brief introduction to the questionnaire respondents.

Based on Yu's study on colours in traditional Chinese painting, I used 12 hues characteristic of the discipline, to gain an understanding of them as well as the imagery they tend to accompany and symbolise (Yu 2013). Interpreting colours across cultures is much more complex and difficult than simply naming colours in different societies (Baranauskas et al. 2007). I used a questionnaire to determine the main genres, which are mostly related to traditional Chinese culture (Chen and Huang 1996; Saito 1996). During the questionnaire, each respondent was offered cards that displayed the 12 colours (Appendix A.1.1). In order to help the non-Chinese respondents to grasp them, I also offered brief write-ups of the colours and intuitively pictorial resources, through which the respondents had the opportunity to obtain more specific knowledge of colours in Chinese painting and thus answer the questionnaire more accurately. Semi-structured interviews have previously been used as a way to explore interviewees' reasoning for choosing colours (Camgöz et al. 2002).

4.2.4 Data Analysis

The data collected from Phase 1 (Appreciation of Traditional Chinese Painting) included audio data recorded and transcribed, and the key words (representing elements) on sticky notes were analysed. The transcription and initial analyses took place concurrently, which encouraged me to remember the connection between the notes and participants' discussion. Based on the three parts of the workshops in 4.2.2 (Phase 1: Appreciation of Traditional Chinese Painting), I adopted different methods to analyse the data. In the first part (i.e. First impressions), I collected the most frequently mentioned words to integrate with corresponded descriptions to form different topics. Then I created initial notes and comments alongside the transcript and collated the notes and comments into emerging themes or more meaningful statements. This content potentially reveals how participants started their appreciation. The interviews and discussion in the second part (i.e. During the process) elicited different stories and relevant quotes to be collected and analysed. The third part (i.e. After the activity) adopted a similar method as the first part. The summarised keywords and interpretations were blended as themes to describe participants' idiomatic appreciation.

It is vital to mention that the set of steps that could reveal how non-Chinese and Chinese participants appreciate traditional Chinese painting were also summarised. These steps with keywords were provided by participants rather than analysed by me subjectively. Based on the discussion during the workshop and the keywords that were written down by the participants, other keywords that were discussed in the three parts were all recorded as well.

However, the frequency of the mentioned keywords has not been reflected in the findings since it is not relevant in answering the research question.

In Phase 2 (Interpreting Traditional Chinese Colours and Painting Themes), the collected data consisted of 87 effective questionnaires (with 44 participants based in Newcastle and 43 based in Shanghai) and audio recordings of the workshops. For the first question in the questionnaire, I gathered statistical data and determined the frequency with which each colour was chosen. The distribution of respondents' ages, nationalities, and occupations are shown in Figure 32. Given the relatively small number of questionnaires, I performed the statistical analysis manually. For the second question, I recorded all options that were chosen more than three times and summarised those options as various themes. It is necessary to mention that because the frequency of those options is not relevant to the main point of this study, it has not been reflected in the findings. I also recorded and reflected on the respondents' sketches, as well as the photos/images mentioned by the interviewees and the consent form (Appendix A.2). The keywords in Figures 33 and 34 were only mentioned verbally by respondents. Therefore, I analysed these keywords and connected them to photos of the traditional Chinese paintings myself for further understanding.

For the analysis of the two questions in the interview, I adopted the same method as Phase 1. I transcribed 10 individual interviews in full. The transcriptions have also been summarised as different keywords and the specific interpretations. Then, through comments and notes that were analysed by me, I formed the new themes to answer the study's research question. During the two studies on cultural appreciation of traditional Chinese culture and traditional Chinese paintings, I obtained direct data that presented a distribution of colours and elements in traditional Chinese painting. In addition, I investigated the respondents and interviewees' reasoning and interpretations. Thus, ultimately, I had the chance to capture information on the appreciation of traditional Chinese painting from non-Chinese individuals, helping to support the broader understanding of cross-cultural appreciation.

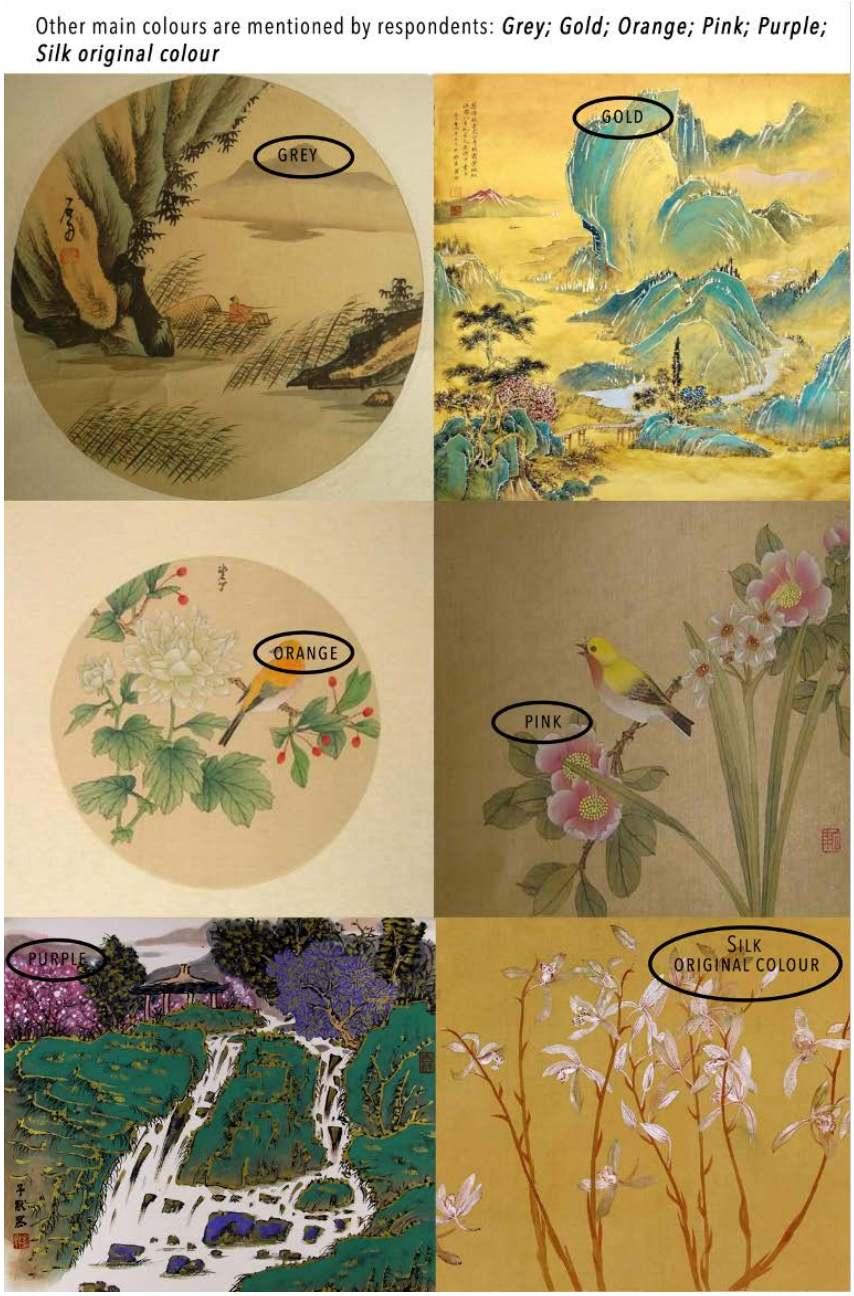

Figure 33. Sample colour cards from the Questionnaires. I sorted them and designed it as a graphic.

Figure 34. Sample colour cards from the Questionnaires. I sorted them and designed it as a graphic.

4.2.5 Findings

Through the workshop in Phase 1, I identified two overarching themes related to the understanding of Chinese traditional colours and themes in painting. The analysis focused on the appreciation methods of the non-Chinese viewers and how the traditional colours and

subjects affected their understanding. I outlined themes and interpretations from the transcripts produced. To maintain the respondents' anonymity, I refer to the participants as FP (participants from Phase 1/first phase) and SP (participants from Phase 2/second phase), with numbers.

The Methods of the Non-Chinese Viewers

From the analysis in Phase 1, I observed a notable difference in the way that the non-Chinese and Chinese participants talked about the paintings. The non-Chinese participants focused more on their visual experience and representational observations. Their starting points often centred on colours, textures, or themes in the paintings; based on these observations, they pondered the meaning. In contrast to the non-Chinese participants, the Chinese participants spent more time during the workshop exploring personal interpretative meaning, imagery, and philosophical reflections. Following the three parts of the workshop (1: First impressions; 2: During the process; 3: After the activity), I analysed high-frequency keywords and topics derived from the discussions, using them as themes to characterise the appreciation methods of the participants. Figure 35 presents the main themes generalised from the workshop. Three different colours represent three phases. Dark red was collected from phase 1 (i.e. First impressions); Blue was collected from phase 2 (i.e. During the process); and Green was collected from phase 3 (i.e. After the activity). This figure not only illustrates the set of steps (colours-subjects-interpretations; genres-imagery-philosophy) that were summarised by the non-Chinese and Chinese participants; I also reflected upon other keywords that were discussed in the different phases during the workshop. Specifically, for the non-Chinese participants, colours were the main theme from their first impressions of Chinese paintings; during their appreciation, the subjects emerged as the most frequent theme. The non-Chinese participants believed the colours of the painting were the first elements they would observe; subjects also typically were integrated with colours to help them summarise and interpret their understandings of the paintings. The non-Chinese participants preferred to use their understandings of colours and subjects to appreciate and interpret traditional Chinese painting.

Genres were the first elements Chinese participants thought about during their appreciation; in other words, they tended to think of the painting as realistic, freehand brush work, or some other genre. Imagery was also another significant element. Chinese participants speculated about and described the stories, emotions, and atmosphere conveyed by the imagery of the painting. The philosophy as the distillation of understanding the imagery was also frequently

discussed, and Chinese participants widely believed understanding the philosophy of the painting was closely linked to the overall appreciation.

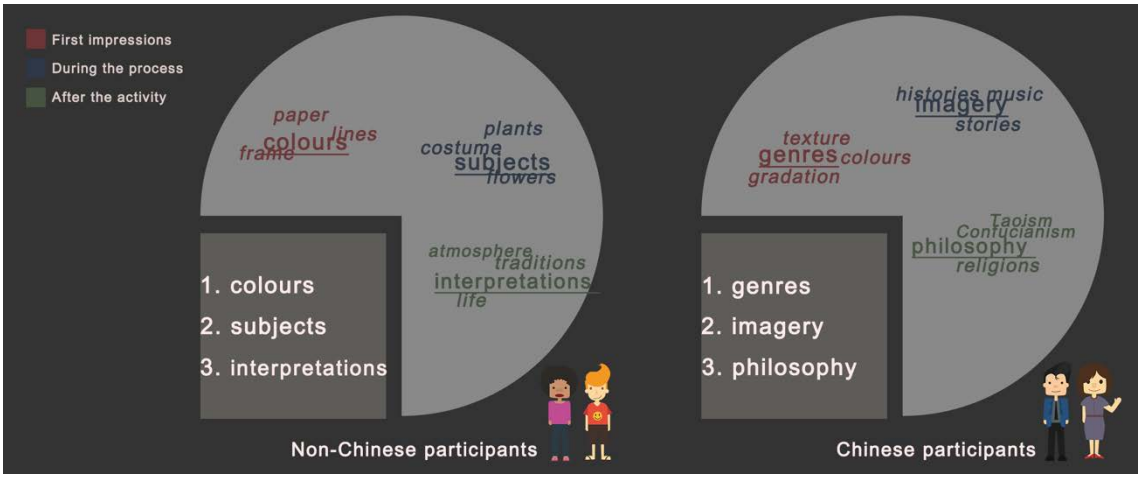

Figure 35. High-frequency keywords and themes from the workshop discussions.

The main structures and elements of the two groups' discussion can be seen in their group presentations. In the first stage, the findings focused on primary impressions of traditional Chinese painting. The colours were the first element noticed by the non-Chinese interviewees, who saw them as a basis to affirm the identity of Chinese painting. For instance, FP5 stated:

> *I think for me, it's really hard to describe Chinese paintings, so the colours are the first thing I managed to appreciate.*

In contrast, Chinese interviewees found that genres, such as elaborate painting or freehand brushwork, were the first element of their appreciation, rather than the colours of the painting itself. During the second stage of the non-Chinese participants' appreciation, the majority of them recognised the thinking underlying the themes in the paintings (based on the colours). FP2 remarked:

> *We found the subjects of Chinese painting to be very interesting. It's obvious that not just any random subject can be [included]. I think this is good as a basic starting-point to appreciating [it].*

By combining the understanding of each painting's genre, the Chinese participants wanted to become familiar with the expression of imagery and emotions in Chinese painting, in the second stage.

In the third stage, the non-Chinese interviewees emphasised their interpretations, developed based on their understanding of colours and themes. FP6 commented:

> *I think this painting is trying to create a peaceful atmosphere here, from the green mountains, [the] streams, to the village…. I can feel the interpretations of the subject from these*.

However, the degree of interpretation depended on their understanding of the colours, subjects and other elements. According to FP1:

> *I won't say I am guessing the meaning of this painting, because I try to find the meaning from the colours, the bamboo and also the orchid*.

This differed from the Chinese interviewees, who focused more on the philosophical meaning during the third stage, in combination with their personal understanding derived from the first and second stages.

A Complementary Understanding of Colours and Subjects

I analysed the non-Chinese respondents and interviewees' understanding of the 12 colours in Phase 2 (see Section 4.2.3), as well as their interpretations of the themes they identified in the paintings. Figure 36 shows the frequency of occurrence of the colours mentioned in the questionnaire and the corresponding interpretations of each colour by the respondents. The frequency rate of six of the colours (*zhubiao*, carmine, eosin, flower blue, bluish, and dull black; see Figure 36) was less than 25%, and the rate of four colours (carmine, flower blue, bluish, and dull black) was less than 10%. Among all 12 colours, only rattan yellow, cinnabar and phthalo blue were mentioned by over 50% of the respondents; however, their main reason for mentioning phthalo blue was due to a focus on genres of Chinese porcelain (such as blue-and-white porcelain) rather than on the paintings. Phthalo blue is normally used to fill in details in traditional Chinese painting. Flower blue is a basic, frequently used tone, but was only mentioned by 6% of the respondents; and mineral green, which tends to be used in blue-and-green landscapes, was only mentioned by 27% of the respondents. Thus, the respondents did not accurately recognise more than half of the traditional colours.

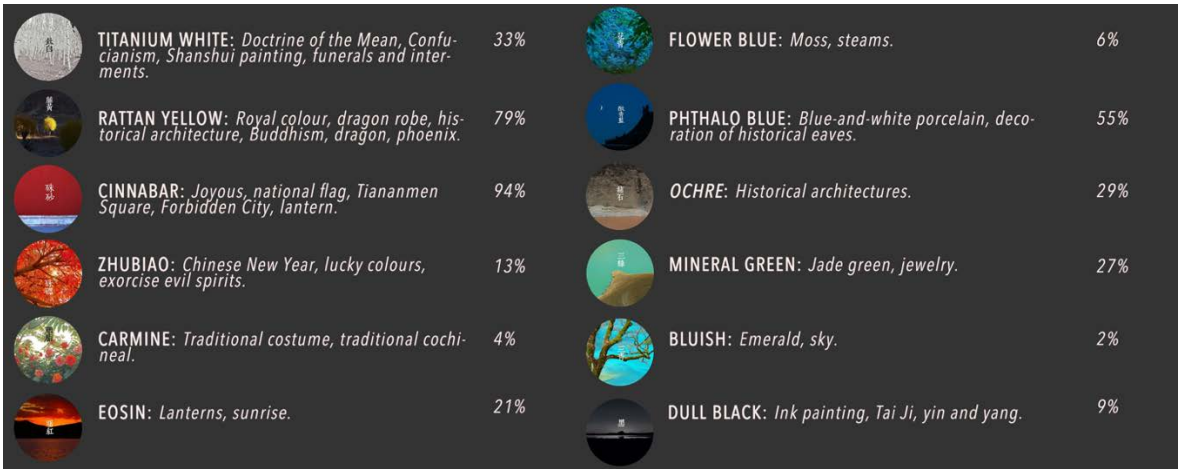

Figure 36. Frequency of occurrence of the 12 colours mentioned.

Based on these data, I found that incomprehension of traditional colours caused deviation from the established tradition of appreciation and interpretation of Chinese painting. SP3 said:

> *Actually, I just thought that red, yellow, black and white were colours used in Chinese painting. But, you just told me that most of my own understanding wasn't that close to the true meaning of these colours used in Chinese painting. And to be honest, I have never seen more than half of these colours, so I can't really say or describe their meaning.*

SP4 added:

> *For me, these are only colours. As a foreigner, it's difficult to understand the meaning behind them*.

Most of the interviewees were confused about the meaning of some analogous genres, which led to an incorrect understanding of the genres, stories, and emotions involved in traditional Chinese painting. SP2, SP10, and some other interviewees said they were confused about how to understand the differences in meaning between flower blue, phthalo blue, mineral green, and bluish, although they used to see these colours in Chinese paintings. SP10 explained:

> *I thought that these colours [flower blue, phthalo blue, mineral green, and bluish] were fluorescent colours that would normally be used in contemporary Chinese painting rather than traditional [Chinese paintings]*.

These colours were used in the genre of traditional blue-and-green landscape paintings from the Tang dynasty (618–907). In the present case, simply by describing and discussing these hues, the interviewees become more interested in the meaning behind the colours. This was further reflected in the appreciation methods of the non-Chinese viewers. SP1 remarked:

> *Is it a kind of mineral pigment? What is it normally used to paint?*

Some other interviewees said they would like to obtain more knowledge about traditional Chinese painting through learning about these colours, and also described their preferences regarding how best to acquire such knowledge. For example, SP7 mentioned:

> *I'd like to know how people normally use these colours, and of course I want to [understand] them from [a] graphical introduction rather than read some words about them*.

The themes of traditional Chinese painting, requiring an understanding of the colours, play a complementary role in the appreciation of this art form. Four different types of subjects are classified in Figure 37, corresponding to the interviewees' description (from Phase 2). The non-Chinese respondents (from Phase 2) mentioned landscape and flower–bird paintings numerous times. These two styles include four types of subjects: (1) flowers, (2) leafy plants, (3) birds, and (4) landscapes (mountains and rivers). In contrast, Chinese portrait painting was barely discussed; only women's portraits were mentioned on a few occasions. When the non-Chinese interviewees (from Phase 2) described their understanding, they always mentioned colours along with the subjects, such as two birds with golden feathers, implying something auspicious, or red peonies, which indicate wealth. These colours and subjects informed these interviewees' understanding of traditional Chinese painting, and they accepted the themes as entry-points to learn how to appreciate traditional Chinese painting.

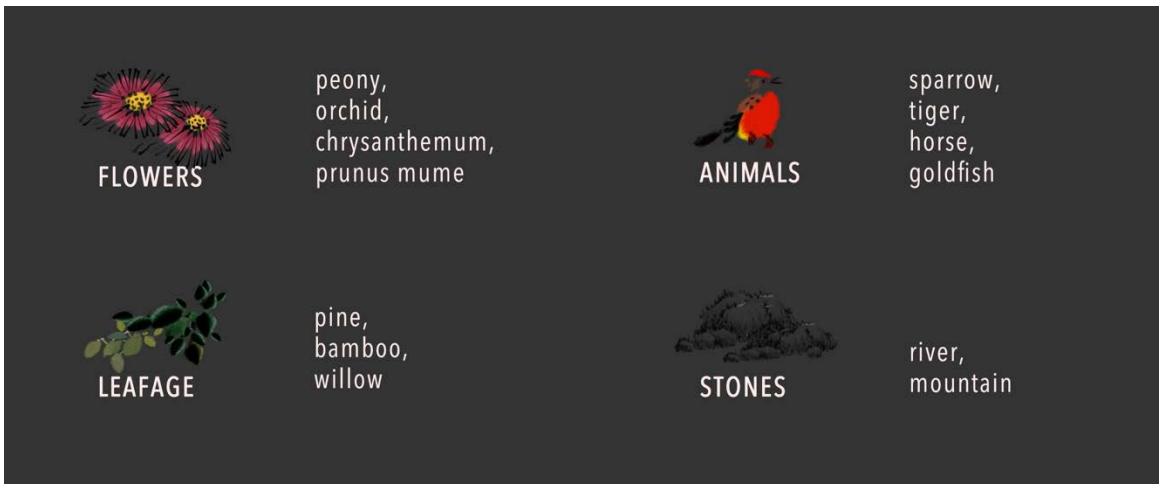

Figure 37. Interpretations of Chinese painting elements.

FP4 stated:

> *The subjects of Chinese painting are really helping me to understand what the painters want to actually express, and also to [understand] traditional Chinese culture*.

The subjects of Chinese painting also involve the incomprehension of colours. For example, according to SP7:

> *I can't say that I am guessing this. I am trying to use my understanding of these animals and plants to guess the meaning. As I said before, I don't know the meaning of this specific colour*.

SP1 stated:

> *If I browse more paintings, then I can easily classify them based on the subjects shown*.

Participatory Appreciation

During the workshop and semi-structured interviews with the non-Chinese participants, I found that they also expressed their requirements when it came to engaging with traditional Chinese painting. The workshop participants provided their perspectives on the difference between individual and participatory appreciation; FP5 said:

I think this workshop is very different from the experience I had when I went to galleries to appreciate paintings by myself. I prefer to have talk with people who are interested in this area as well. We can also obtain aesthetic knowledge about Chinese painting from our discussion.

Likewise, participant FP3 also supposed that the discussion in the workshop fostered participatory appreciation:

I really enjoyed talking with them. This is much better than having a rough viewing. For us, as foreigners, culturally [speaking] we are not that close to Chinese painting, so we need to engage a lot more to be able to appreciate [the art].

In the semi-structured interviews, 6 interviewees (60%) mentioned that they preferred to talk with their friends about the artworks, especially when they became confused about the colours or subjects. SP5 said:

I think it's a bit hard to … explain these. I am not Chinese. Therefore, I'd like to talk with my friends. I think it would be more fun to learn if we could have a discussion in this interview. I normally like to discuss my thoughts with people when we are viewing paintings, just like when you want to talk about the movie when are you watching it.

4.2.6 Reflections on the Cultural Appreciation Study

Conducting the workshops (participants), questionnaires (respondents) and interviews (interviewees) with cross-cultural viewers yielded a productive design framework.

(1) *Appreciation method:* Using the visual stimulus of colours associated with common themes in Chinese painting to support a series of aesthetic interpretations is an acceptable method for use with non-Chinese participants. During the workshop in Phase 1, I compared the different appreciation methods of the Chinese and non-Chinese participants. The non-Chinese participants (colours–subjects–interpretations) focused more on logic and cultural background, rather than highlighting the uniqueness of this approach. I chose high-frequency keywords from the non-Chinese participants' discussion; however, other keywords could still be found to serve as complementary elements that support their appreciation of Chinese painting.

(2) *Cultural Barriers and Design potential:* Some degree of incomprehension of colours and subjects remains within the process of appreciation. An element-based archive of colours and subjects may offer a way to supplement understanding and reach a reasonable understanding which might potentially overcome the incomprehension of the cultural elements in traditional Chinese painting. Moreover, I supposed that colours, as one of the components of a non-Chinese viewer's appreciation approach, would not conflict with their incomprehension of genres; instead, figuring out how to improve the understanding of Chinese painting's colour among non-Chinese observers could enhance their appreciation of traditional Chinese painting. This art form is incredibly different from Western oil painting. Some typical colours with Chinese themes and other relevant aspects, as established collections, formed the specific styles and aesthetics of the genres in traditional Chinese painting. Therefore, I believe that integrating the colours and subjects as elements could help non-Chinese viewers develop a more reasonable understanding and appreciation of them. This mapped out a conceptual direction for the design study, which allowed me to further explore how to use interactive technology to boost appreciation based on these elements.

(3) *Colour–subject–interpretation:* These three elements are reversible and complement each other in the process of appreciation. I noted that these three aspects were not always followed in this order; they were also sometimes compounded, for instance, discussing subjects with colours. During appreciation, the process of one element transforming another had the potential to create an interaction between the viewer and the painting.

(4) *Discussing appreciation:* Compared to individual appreciation, participants and interviewees expected to come up with some interesting topics to discuss their appreciation of traditional Chinese painting. However, the topics had to be chosen randomly. Another target to be explored in the following studies (Chapter 5) was how to develop topics that encourage viewers to share their aesthetic knowledge. The aesthetic experience should not be limited to visual viewing; non-Chinese viewers are more expecting to have interactive expression. These design reflections are embodied in the design study.

Chapter 5. Exploring Interactive Technology as a Means toward Cross-cultural Appreciation: Traditional Chinese Paintings

5.1 Introduction

This chapter discusses how to use interactive technology to spread cross-cultural knowledge of the subject matter. Based on the findings of the three initial activities (the workshop, the questionnaire, and the in-depth interviews) of Chapter 4, Chapter 5 will now describe the design study. The research questions were: (1) How can interactive technology (tablet devices) help cross-cultural viewers to understand Chinese heritage?; (2) What function should interactive technology play to help observers overcome barriers to cross-cultural appreciation when attempting to grasp Chinese ICH? Through a study on transferable design elements, I re-analysed and extracted the main colours and subjects from an extensive array of conventional Chinese paintings, using various genres to glean available transferable elements so as to build an element-based archive for the design study. Then I explored the available transferable design elements for the design study, and developed a prototype application intended for use on a tablet-style device and conducted workshops using the prototype to explore potential design challenges. Based on the findings of the two studies from Chapter 4, on cross-cultural appreciation as well as the transferable design elements, I then developed a tablet application grounded in an iOS system as a prototype tool to advance understanding of the use of interactive technology to support cross-cultural knowledge of traditional Chinese art.

5.2 Study on Transferable Design Elements

Before beginning to examine design, I explored the available transferable design elements for the design study. According to the classification method of traditional Chinese painting, I classified colours and subjects and expanded the contents of each category. Based on the appreciation habits of non-Chinese participants (colour–subject–interpretation), I aimed to acquire the available combinations (CMYK) of colours that could be used when re-drawing the painting elements in the design study; furthermore, I intended to gather sufficient graphical sources of painting themes to offer a categorised reference for element-based archives in the design study.

5.2.1 Extracting the Colours of Traditional Chinese Painting

The application of colour techniques in traditional Chinese painting has evolved over thousands of years of cultural accumulation (Xu 2008). The colours not only relate to the shapes of objects, but are also closely connected to the artists' emotional expression (Zhang

2010). Semantic expression, storytelling, and emotions combine to form the colour choice and scheme for traditional Chinese paintings (Chen et al. 2008). I compared a number of paintings to derive transferable, element-based colours and subjects. I selected 80 paintings from different dynasties in four types of genres: *gold and green*; *light crimson*; *Chinese ink*; and *line sketching*. In order to precisely utilise the representative colours of Chinese painting in the design study, each hue in these four genres are represented by a CMYK (cyan–magenta–yellow–black) numerical value. It is important to mention that the collection and choice of CMYK are just for seeking out the example colours which could be adopted in the design process, therefore the data from CMYK is not exclusive to representing any specific colours in Chinese painting – but for reference only.

Figure 38. The CMYK of gold and green.

Gold and green contains gold dust, mineral green, and azurite as its three primary colours (Figure 38). In traditional Chinese painting, this genre is normally used to represent ancient Chinese architecture and to outline mountains and stones. The CMYK of gold and green is gold dust (C: 18, M: 25, Y: 63, K: 0), mineral green (C: 69, M: 5, Y: 48, K: 0) and azurite (C: 76, M: 53, Y: 41, K: 0).

Light crimson includes light ochre, light flower blue, and light malachite green (Figure 39). Light crimson is often used in landscape scenes, and is normally used to portray settings in late autumn and early spring or the setting sun. It is simple but elegant, sprightly and limpid.

The CMYK of light crimson is light ochre (C: 18, M: 34, Y: 38, K: 0), light flower blue (C: 26, M: 17, Y: 19, K: 0), and light malachite green (C: 52, M: 30, Y: 49, K: 0).

Figure 39. The CMYK of light crimson.

Chinese ink mainly includes light black, rich black, and dull black (Figure 40). It does not require the blending of colours, and is normally used to illustrate meaningful philosophical and artistic concepts. This kind of presentation technique focuses on sketching, brushing, and dotting the form of the structure and texture of objects in the painting. The CMYK of Chinese ink is light black (C: 30, M: 22, Y: 25, K: 0), rich black (C: 73, M: 65, Y: 62, K: 18) and dull black (C: 93, M: 88, Y: 89, K: 80).

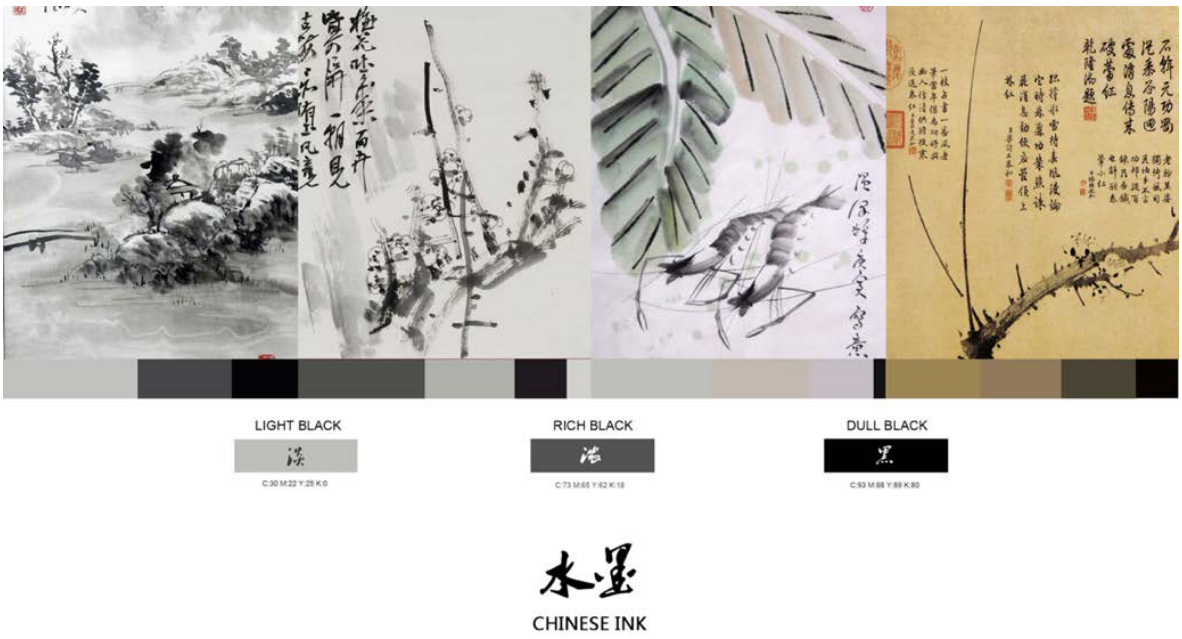

Figure 40. The CMYK of Chinese ink.

Line sketching differs from the previous three genres in that it only uses line art, without adding colours (ink is used on rare occasions), to outline objects in the painting (Figure 41). The shapes of line sketching include four kinds: gossamer, rotten firewood, pinpoint and rat tail sketch, and bamboo leaf sketch.

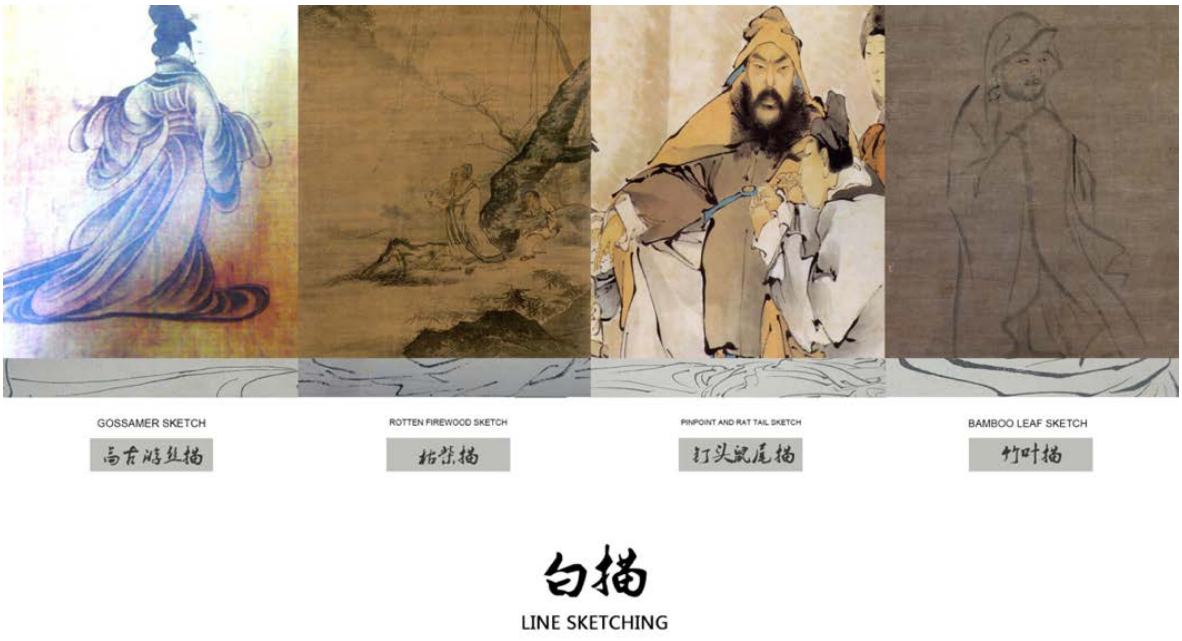

Figure 41. Line sketching.

As for other main elements, subjects depicted are primarily related to contour features and artistic conception. Based on the 80 traditional paintings (flower–bird, landscape, and figure paintings) and the findings from the cultural appreciation study, I extracted six main types of subjects: leaves, flowers, birds, mountains and stones, rivers, and human figures. The colours and genres were combined in order to re-draw the subjects of traditional Chinese painting for the design study.

5.2.2 The Subjects of Traditional Chinese Painting

Based on the classification of the themes and techniques of traditional Chinese painting, I explored suitable subjects to form the elements in the element-based library for the design study. Traditional Chinese painting encompasses three themes: (1) flower–bird, (2) landscape, and (3) figure paintings. Other than birds and flowers, subjects like goldfish and butterflies are shown in flower–bird paintings. Landscape paintings primarily include steep cliffs, small cloud-wrapped bridges, murmuring brooks, and rural cottages. Human figure paintings mostly contain portraits of noble ladies and of Taoist and Buddhist figures (Wei 2017). The techniques of traditional Chinese painting include realistic painting, freehand painting, and realistic with freehand painting. Freehand painting derives from the Late Imperial China period (1368–1895); before this time, paintings were chiefly realistic in nature (Wang 2008). I collected 100 traditional paintings featuring different themes and techniques to extract and analyse their elements, which I divided into *flowers*, *foliage*, *animals*, *mountains*, and *water*. This classification of images served as a reference for the development of the element-based library in the design study.

5.3 Interactive Design Study

This section described the details of the interactive applications that were inspired by the outcome of the study of Understanding Cross-cultural Appreciation in Chapter 4. Based on the designed application I also intended to probe how to enhance cross-cultural appreciation of traditional Chinese painting with the support of interactive technology through the user-experience-based workshop.

5.3.1 Methods

Grounded in the findings of the analyses in the previous cultural appreciation study, I prepared content suitable for a tablet app. This app integrates the colours, genres, and subjects of traditional Chinese painting (based on the earlier findings) and re-draws these elements digitally to build a simple digital archive for browsing and interactive engagement. I aim to use this app to explore design insights and challenges that aim to help cross-cultural viewers

appreciate traditional paintings. Using aspects of experience-centred design (Wright and McCarthy 2010), storytelling and cultural probes were adopted to help cross-cultural viewers integrate experience from their personal lives, cultural contexts, aesthetic habitus and feelings to describe the challenges of appreciating traditional Chinese heritage. This gave me a needed opportunity to delve into cross-cultural appreciation and determine the reasons for the challenges. Furthermore, I utilised experience prototypes (Buchenau and Suri 2000) and fictional inquiry (Dindler and Iversen 2007) to grasp the participants' experiences and contexts, as well as to evaluate the app. Furthermore, I carried out interviews with focus groups to communicate with the participants about their cross-cultural aesthetic appreciation and engagement and capture the results as data. I explored the app with culturally diverse participants through a series of user tests and interviews, in order to allow them to experience the app and share stories about the artwork they observed. Participation involved an introductory session run by me to investigate different techniques for engaging with traditional painting, followed by a tutorial on how to use the app and a group interview to compare various methods and their outcomes. For a subset of participants, this was followed by an extra, in-depth group interview to discuss the features of the design and its interface. Design ethnography (Genzuk 2003; Rothstein 2010) was adopted to help me carry out in-depth observations and understand the user experience of digital applications. RtD (Zimmerman et al. 2010; Gaver 2012) was also integrated with design ethnography for reflecting the design process model of the entire research process and seeking the possibilities and design insights of the cross-cultural appreciation of traditional Chinese painting.

5.3.2 The Details of the Prototype Design

In the previous chapter, I summarised the findings on interpretative techniques used by non-Chinese participants and their understanding of colours and subjects, which guided me in designing the primary prototype. The design utilises the cross-cultural appreciation approach (colour–subject–interpretations) with element-based expression (see 5.2 Study on Transferable Design Elements) to help participants appreciate and experience the paintings. With consideration of affordances for the operability and portability of gestures, I chose to develop a tablet application based on the iOS and Android system. A key design feature was the use of colours and subjects as two key representative elements which were extracted from the data from the cultural appreciation study with tangible interaction to support culturally diverse participants. Accordingly, I involved participants of different cultural backgrounds, ages, and degrees of proficiency with the art form. To address the research questions, the tablet-based application needed: (1) to integrate the colours and subjects to build an element-

based archive able to provide multiple colours, themes, and styles; (2) to offer users diverse elements from the archive to encourage them to create their own artwork; and (3) to serve as a platform that would motivate users to make collaborative artwork and share their artistic thinking of traditional Chinese painting.

Figure 42. Re-drawing elements of traditional Chinese painting.

The Content of the Elements in the Application

The app was installed on a tablet and given to each group for exploration. It included an interface with various types of Chinese painting elements, alongside PNG (initially no background) images without a background; the purpose of these was to help the user develop a piece of artwork. In order to ensure that the resolution and integrity of the elements were high quality, I referenced the relevant drawing skills based on Adobe Photoshop and Adobe Illustrator (Wang 2010) to re-construct all of the element-based images into vector images (rather than bitmap scans) based on the original paintings (Figure 42). Figure 42 also demonstrates that the element-based images were constructed by multiple layers that offered the possibilities to modify the colours, shapes or other details of the images. Therefore, these adaptable elements could potentially support the flexibility and individuality of element-based images and expand the content of the digital archive. The reconstruction of the element-based images also referred to four types of genres: *gold and green*; *light crimson*; *Chinese ink*; and *line sketching* from the study of *Extracting the Colours of Traditional Chinese Painting* in

Chapter 4.2.1. Meanwhile, the corresponding CMYK (cyan-magenta-yellow-black) numerical values of the four above-mentioned genres were also utilised in drawing the element-based images. This detail of design further potentially maintained the authenticity of traditional Chinese painting. There were 40 pieces of imagery used as different subjects in the elements of the library, and three different functions were used on the main interface (Figure 43a), which participants could use as a canvas. It is worth mentioning that the categories of the imagery were referred from the study of *The Subjects of Traditional Chinese Painting* in Chapter 4.2.2. This further reflected the findings of the subjects that are summarised in Figure 37.

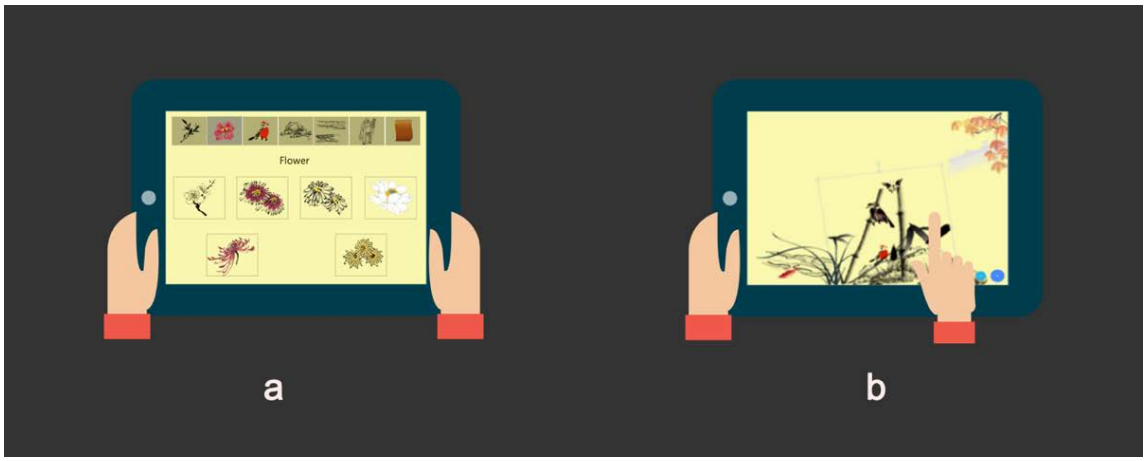

Figure 43. (a, b) Interpretations of Chinese painting elements.

Figure 44. Four functional icons from left to right: saving a current canvas as an image; removing an element; adding another element; and empty the current canvas.

The Functionality of the Interactive Interface

On the interface, I displayed one icon in the right corner; upon use, four more icons were displayed: saving a current canvas as an image; removing an element; adding another element; and empty the current canvas (Figure 44). Elements can be added individually or together from the built into element-based archive; with the multiple-choice option, different

elements are shown on the canvas each with their own individual layer, depending on which element is added first – this layered concept is convenient for participants to collaborate and change elements with ease. Users are able to remove any element from the canvas individually by simply selecting the corresponding tooltip; for any selected element, they are able to use multi-touch functions to adjust its position, size, and proportions and to mix it with other elements interpretively, forming a piece of digital artwork (Figure 43b). Meanwhile, all of the elements have a transparent background to offer participants further possibilities for complex, multi-layered artwork. After the participants finished a piece of artwork, they needed to use the *save* icon to save the current canvas as a JPEG on the device. After saving, participants were still able to add new elements to the canvas and save again if desired. The use of JPEGs allowed the participants to print images or easily post them online.

5.3.3 Participants

Recruitment was undertaken in Newcastle and its surrounding areas (i.e. Gateshead, Jarrow and South Shields) via adverts in local galleries, adverts on university campuses, mailing lists, social media and word of mouth. Ten participants (5 male and 5 female) were recruited as a group from four countries to test the app, ranging in ages from 8–46 years with an average age of 29.8 years. All lived in Newcastle and its surrounding areas. They were divided into four groups: (1) a British family of three (two parents and an 8-year-old child); (2) three British and Spanish students in university; (3) two staff, Korean and Irish, from a gallery; and (4) a middle-aged British couple. All participants described themselves as having experience appreciating traditional Chinese painting in the local galleries and online. The members of the third group (i.e. two staff, Korean and Irish, from a gallery) stated they had engaged with Chinese painting or calligraphy using an ink brush prior to the workshop. In accordance with the various occupations, cultural backgrounds, ages, and daily living and working environments, the participants chose their preferred spaces (family living rooms, a gallery, and a studio) to engage in the workshops. Based on their preferences, this potentially allowed for a personalised scenario for conducting the workshops. Table 2 shows the participants' ages, genders, cultural backgrounds, occupations and preferences of environment.

	Age	**Gender**	**Cultural background**	**Occupation**	**Preference of environment**
Group 1	35, 36, 8	2 male and 1 female	British	Engineer, nurse, primary school student	Family living room
Group 2	21, 22, 21	2 female and 1 male	British, Spanish	Students in the subjects of design and history	Studio

Group 3	35, 28	1 female and 1 male	Korean, Irish	Gallery staff	Gallery
Group 4	45, 47	1 female and 1 male	British	Teacher and architect	Family living room

Table 2. The participants' ages, genders, cultural backgrounds, occupations and preferences of environment.

5.3.4 The Workshop Procedure—Two Forms of Appreciation

In order to provide the non-Chinese participants with a situation facilitating two different forms of appreciation, I realised a series of contrasting experiences with them. The goal of this contrastive experience was to seek to understand how interactive technology can help cross-cultural viewers understand traditional Chinese painting, based on the participants' feedback. The first form consisted of reading a written introduction and browsing paintings in order to develop the main appreciation methods. During appreciation, drawing with a traditional ink brush was also an option. The second form, based on the findings and critical reflections from the cultural appreciation study, had participants use digital tablets with an element-based interaction application to engage with the artwork, as introduced above, and to interact with their peers.

Now, the details of these two forms of appreciation will be described. The ten participants were arranged into four groups (as per their grouping above) to attend the full-day workshop over four different days. It is important to stress that the timescale of the participants' experience was limited to a few hours; this sort of experience differs from normal training or professional courses in Chinese painting. The limited time period was not enough to offer participants the chance to gain a comprehensive understanding of the art form; hence, when the participants experienced it during the activity geared at the second form of appreciation, they were not expected to be affected by prior knowledge gained from the first appreciation. I chose different locations for the workshops: family living rooms, a gallery, and a studio; the appropriateness and features of each for appreciation activity were considered. Before the workshop began, I conducted an introductory session with each group, in which I explained the workshop procedure and that the participants would be able to appreciate Chinese painting in two different ways.

The First Form of Appreciation—Website Browsing and Painting

For the first form of appreciation (Figure 45), I provided the participants with a website including descriptions of various genres and dynasties, translated into English (http://www.cityu.edu.hk/lib/about/event/ch_paint). Each group of participants was given two

hours to experience the website and another hour to discuss their experiences with their peers. After utilising the website, they were provided with ink brushes, pigment for Chinese painting, Chinese art paper, and ink stones; they were given one hour to explore the materials and attempt to draw a Chinese painting.

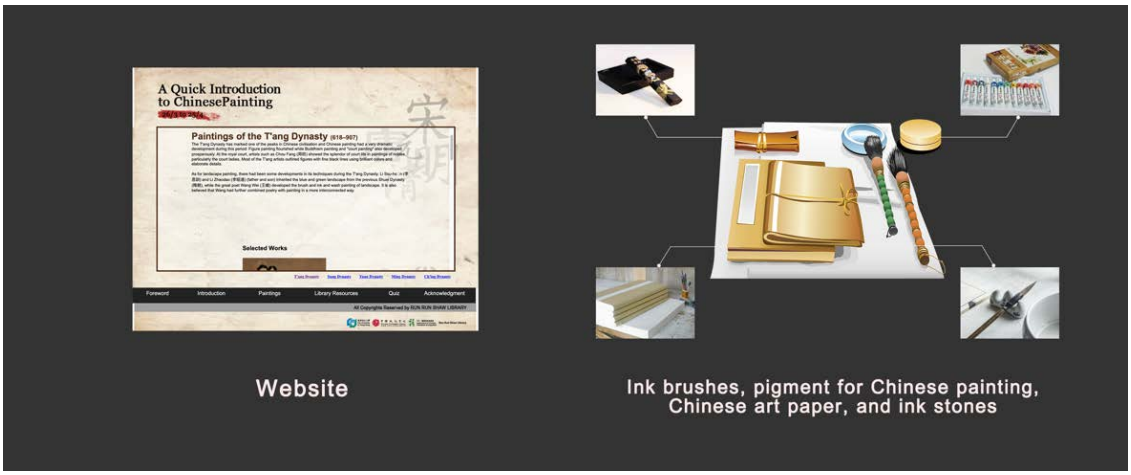

Figure 45. The first form of appreciation.

The Second Form of Appreciation—App Experience

For the second form of appreciation, in groups, the participants were given a tablet with the application pre-loaded. They received an explanation of how to use it, including the concept of the element-based archives, as well as a chance to ask questions about it. Afterward, they looked at the app together, and each group spent some hours experiencing the tablet app by browsing the element-based archive, creating their artworks and having discussions and other spontaneous activities. Figure 46 shows two participants from one of the groups creating their artworks and discussing their ideas.

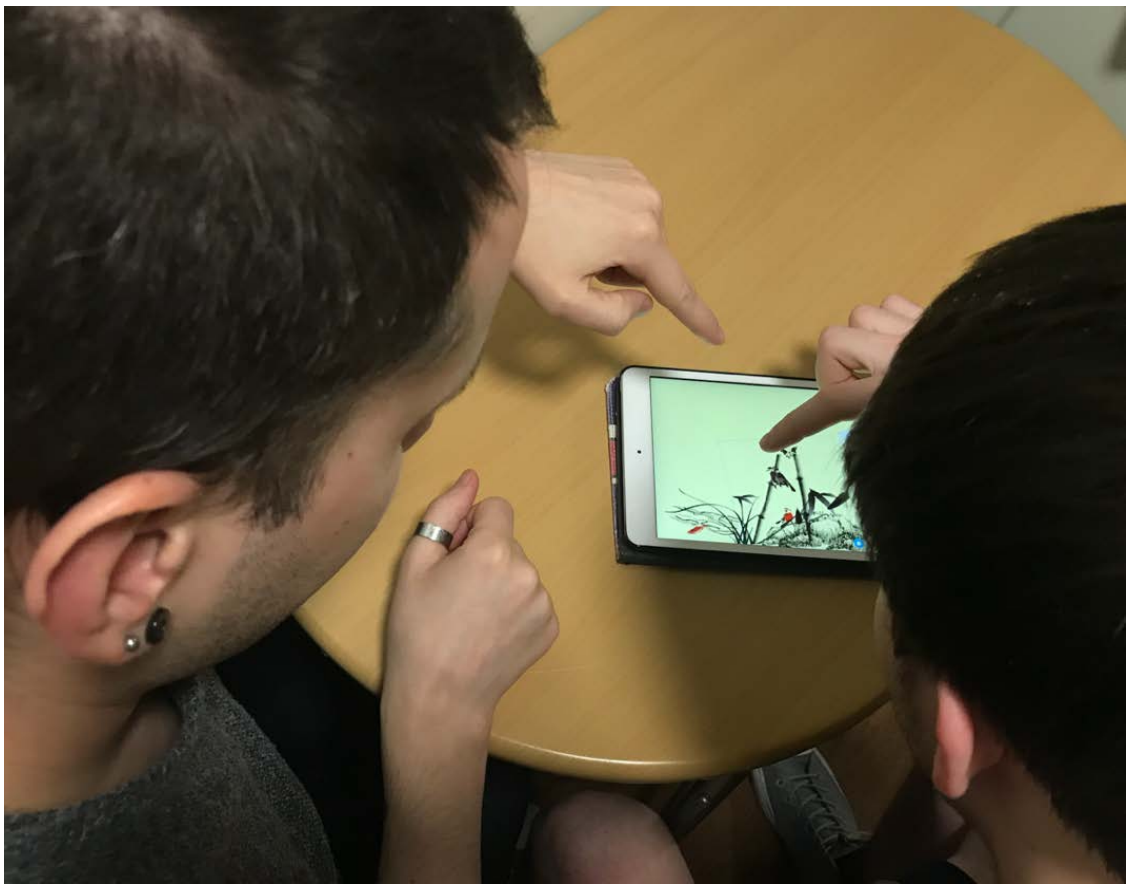

Figure 46. Participants experiencing the tablet app and having a discussion.

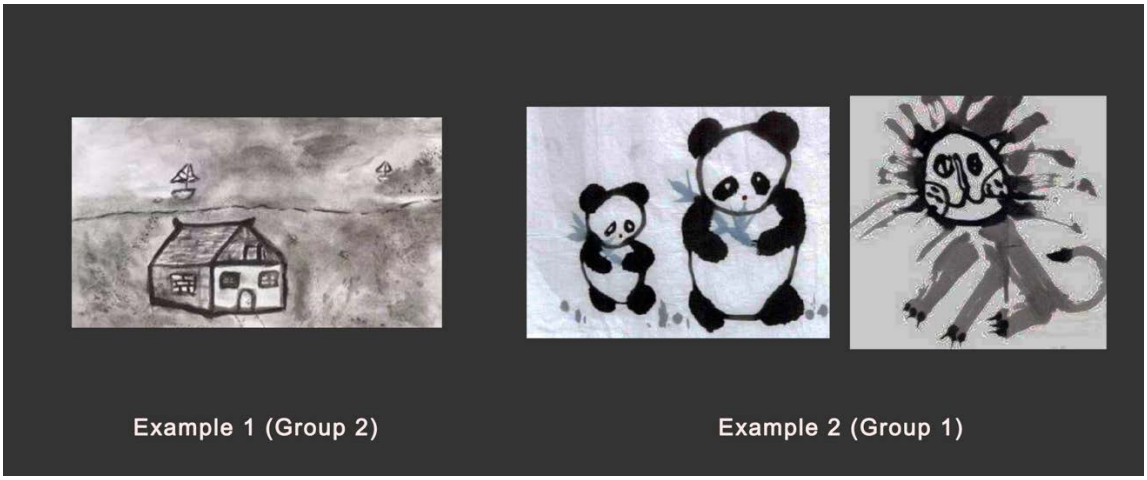

Figure 47. Artworks from the first form of appreciation.

Figure 48. Artworks from the second form of appreciation.

After each group finished exploring the two forms, the participants were asked to take part in group interviews to describe their experiences and recognise and express the pros and cons of the two forms of engagement. The questions aimed to capture their understanding of traditional Chinese painting and their experiences with the two different appreciation formats, as well as the differences and their preferences between the two formats in relation to engagement with traditional painting. Figure 47 demonstrates three artworks drawn by groups 1 and 2 during the first form of appreciation and Figure 48 demonstrates two artworks saved by groups 2 and 3 during the second form of appreciation. The comparison and analysis will be specifically discussed in the following section of findings.

Following the four group workshops, I conducted an extra semi-structured interview, inviting one participant from each group to take part. These participants talked about their experience using the application. Many of the questions were oriented towards the user experience, while other questions prompted a conceptual discussion of the effects of interactive technology on the cross-cultural appreciation of traditional art. This conversation included discussion of how to engage participants in experiencing Chinese painting; in addition, it addressed their self-expression in art and how this impacted their engagement with and experience of traditional painting. They also reflected critically on design and usability, which supported this study in iterating the design of the application. Table 3 shows each question asked in Phases 1 and 2. All interviews were audio-recorded with the participants' consent.

Phase 1	**Group Engagement**

Q1	Do you think these two methods of experience [*1. reading a written introduction and browsing paintings; 2. experiencing digital tablets*] are different for you? If so, why?
Q2	Which method do you prefer and why?
Q3	Can you talk about your paintings/artwork?
Q4	Do you have any issues/problems when you are doing this?
Q5	Which painting are you most satisfied with and why?
Q6	Do you want to share your artwork or talk about it with others?
Q7	What have you achieved through these two activities?
Phase 2	**User-Experience Interview**
Q1	Do you understand the main function and purpose of this application?
Q2	Do you think this application helps you to understand Chinese painting?
Q3	If you think this application is useful, which part of your experience was your favourite?
Q4	If you were the designer, would you add anything to the application (i.e. new interactions or operations)?
Q5	Do you think this application could help you to develop an in-depth appreciation of Chinese painting?

Table 3. The questions asked in the two phases.

5.3.5 Data Analysis

The data consisted of consent form data (Appendix A.2) and audio recorded during the interviews. All interviews were transcribed in full. The artwork (the paper paintings from *The First Form of Appreciation—Website Browsing and Painting* and *The Digital Artworks from The Second Form of Appreciation—App Experience*) were all collected and fully analysed as relevant material. Based on different focuses and topics, the data from these two interviews were analysed separately. I analysed the data using thematic analysis (TA) (Braun and Clarke 2006). Initial codes were generated using iterative analysis to produce coherent themes, which were then refined to establish findings that would contribute to the exploration of cross-cultural appreciation of traditional Chinese painting using interactive technology. Furthermore, the analysis of different collected artworks was utilised to further explain and expand upon the themes from the thematic analysis. The transcription and the initial analyses took place concurrently with the reviewing and analysing of the artworks from the two forms

of appreciation. From the two interviews (semi-structured and group interviews), I classified the data as GE (data from group engagement with the application) or UX (data from the interviews about user experience). Below is a discussion of the four main themes that emerged from this data: (1) preferences and barriers to appreciation, (2) self-expression in the appreciation of artwork, (3) collaborative engagement, and (4) exploratory thinking about the painting application.

5.3.6 Findings

This section covers some of the key features of the participants' experiences while using the prototype application as well as their reflections on using interactive technology to support cross-cultural appreciation of traditional Chinese painting. The findings relate to four areas of interest. First is the discussion of their experiences and feedback regarding the cross-cultural appreciation approach to Chinese painting. Second, based on their practice and responses to using the application, I investigated the participants' self-expression. Third, I contemplated the participants' thoughts on mobile-access artistic appreciation, which focuses intently on the gestural interactions between mobile technology and collaborative artwork. Last, I examined the participants' opinions on how to involve the application in traditional Chinese painting in the public sphere and how to better integrate traditional Chinese painting into the application.

The Elements in the Appreciation

The participants often discussed the barriers they encountered during the process(es), based on a comparison of the two different engagement approaches. One of these obstacles was how to seek a starting point for appreciating something. Firstly, I compared the collected artworks from the two forms of appreciation. There were two interesting findings gleaned from these materials and their discussion. First, from an aesthetic perspective of traditional Chinese painting, the paper drawings from the first form of appreciation did not reflect many elements of traditional Chinese painting. More specifically, the subjects, colours, or skills did not demonstrate traditional Chinese painting. One of the artworks from Figure 47 shows a panda, because the participants from group 1 stated that the panda is a significant symbol of Chinese culture. However, the panda is not suitable for traditional Chinese painting and has never been drawn or used in traditional Chinese painting; it has only been used in modern and contemporary Chinese painting. Furthermore, the panda and lion in the participants' painting had not been demonstrated in the website (from the first form of appreciation). In other words, there is a disconnect between the content from the website browsing and the artwork. Thus, the participants' drawing did not reflect what they understood or saw on the website. On

the contrary, the digital artworks (i.e. Figure 48) maintained the basic symbolistic elements of traditional Chinese paintings. For instance, every subject retained and reflected the features (i.e. colours, skills, and textures). This leads to the second findings, namely that the attention of participants in the second form of appreciation was more focused on the elemental understanding. For instance, they discussed the composition and style of their digital artworks. This differs from their paper drawings, which heavily focused on how to use the ink brush. Maintaining the basic features of traditional Chinese painting also encouraged participants to think in-depth about how to appreciate the elements of traditional Chinese painting.

During the activity, the images described under the first appreciation method were not found to offer an appropriate starting-point for the non-Chinese participants. However, the application offered GE3 and GE4 another approach, which supported them in accordance with their usual habit of understanding. Through the elements, themes can be detailed by the use of colours, shaping and meaning providing a reasonable starting-point to enhance the non-Chinese participants' understanding of Chinese painting, as GE3 explained:

> *I was confused because I don't know much about Chinese painting, so the website gave me some rough knowledge on the topic. To be honest, I don't even know where I should start … so I just started with some very random browsing. I do quite like this application. I gather that I should start from these elements, even though they didn't show me a direct description of a Chinese painting. I feel as though the elements of these subjects are presenting the meaning. I think it is useful for non-Chinese viewers as I think we need these elements to have a basic cultural understanding if there is nothing else to build this understanding on*.

Some of the participants believed that cross-cultural appreciation required prior steps (e.g. getting to know basic knowledge of the Chinese aesthetical conception) to develop understanding as a type of support. The separate elements helped the participants to properly interpret the potential meaning of a painting's elements but also safeguarded their imaginative scope for appreciating the paintings as a whole. In GE10's words:

> *I think this is very different from the way we approached appreciation beforehand. Using elements as an explanation point can help us understand the painting much more easily. For example, it's telling us this flower is from a Chinese painting, and*

this is what it looks like in the Chinese painting per se. The elements did not limit our own imagination and understanding; the elements are supporting our understanding rather than telling us how to appreciate the painting itself.

In the discussion on the relationship between elements and traditional Chinese painting, the participants collectively voiced that, as an approach, the subjects also offered a progressive appreciation that extended their understanding of Chinese painting to traditional Chinese culture. GE7 said:

I enjoyed learning Chinese painting through this route. While showing me some parts of Chinese painting, I was also introduced to thinking about the special meaning behind the elements themselves, for example plums, orchids, bamboo, and chrysanthemums. This informs me of what the interpretations of these are in Chinese culture. Now, my appreciation is not only limited by visual senses, but through many other methods as well.

The participants also mentioned the matter of multiple dimensions of the elements numerous times. To aid in the interpretation of Chinese painting, some participants suggested that adding texture and composition as a feature to each element would be helpful. For example, GE5 explained:

Obviously, adding more subjects to this archive would help us to achieve a much more in-depth meaning [underlying] this painting. But in all honesty, I really want to understand the composition of Chinese painting, which is very difficult to grasp from a canvas. Nonetheless, I hope the archive can add something like this (the relevant knowledge of the composition of Chinese painting), as it would help support not only mine, but also a lot of other people's appreciation of Chinese painting.

Self-Expression for Supporting the Appreciation of Artwork

As a tablet-based application was used, I designed a framed platform that would boost the combination of the interactive elements derived from digital archives, helping the participants to express their understanding. The participants' expectations of appreciation were limited to browsing paintings or learning related skills; participant UX4 supposed that self-expression in painting appreciation could also be used as a reasonable approach to understanding traditional Chinese painting:

I think it's good to combine these elements in order to express myself, I can put my own stories into this. But this does ask me to have a satisfactory understanding of Chinese painting. However, when experiencing this, I am also having an inner drive of artistic knowledge.

Compared to the first approach, in which the participants experienced and engaged with Chinese painting using an ink brush, which emphasised the experience of drawing, the participants were clearly interested in self-expression using the elements from the archive instead. However, while the application offered only weak opportunity to improve painting skills, it did in fact strengthen operability. GE9 gave feedback on self-expression and learning skills:

The first method leans more towards learning Chinese painting rather than appreciating it. I prefer the self-expression method based on the appreciation and not drawing. Just like when I go to a gallery to talk about a painting, it doesn't mean I want to learn how to actually do it.

Self-expression was closely connected to the participants' interest in Chinese painting, which in turn was related to their skills. A lack of painting skills resulted in participants easily losing interest, discouraging their entire process of self-expression. UX1 shared her thoughts:

As a foreigner, it's very hard to express something with an ink brush; I can't even draw a straight line here…. I think this is the reason why I give up so easily.

While using the application, the method of element-based combination ensured the integrity of the artwork, as well as providing feasible operation with an ink brush. As UX3 explained:

This way is more of a specific design approach for self-expression while appreciating something. Maybe this is because it closes the gap between us and Chinese painting. The painting is not out of reach anymore. We can share our emotions and stories within the painting [drawn by the participants], which is a fantastic experience.

When I asked the participants for their interpretations of their emotional expressions, they provided more details about their artworks and discussion. UX3 further explained sharing emotions and stories regarding the painting from the last quote:

> *I think we did not only mean happy or sad. These sorts of emotions have been expressed in our artworks, it is more complex. We tried to utilise those elements to create an atmosphere which reflected or maybe showed that kind of calming sense in the artworks. When we are looking at our artworks we seriously want to engage with the traditional Chinese culture, for example, the mountain or brook, to experience the atmosphere*.

UX4 described this kind of emotional expression as:

> *A sense of substitution to bring them into the imagery.*

The participants discussed self-expression in appreciation, which they distinguished from learning a skill. This supported the study's inference that that the design direction aided the appreciation of Chinese painting.

Collaborative Engagement

Considerable feedback focused on collaborative engagement with traditional Chinese painting. In the discussion, the participants stated they could use the application to form a collaborative piece of artwork; in line with this, interactive technology was specifically mentioned as meaningful in the in-depth interviews, as the application used multi-touch technology to support participatory group work. Collaborative artwork could be used as an appreciation approach, more specifically to increase involvement in the process of appreciation. In this light, the interaction was not only between the participants and the paintings; the approach also expanded the interaction between participants.

For GE6, the collaborative engagement offered a form of communication between him and his child (also a participant), rather than educational guidance regarding painting appreciation:

> *You know it's really hard to teach him how to appreciate painting … if I just read some books or showed him some paintings, he might just get distracted and go away. But this is fascinating; we can talk about this, we can even touch it and check the details of it*.

From the in-depth interviews, I found that collaborative artwork could be seen as an 'adhesive' to connect the details of the element-based archive with appreciation or open space for appreciation. The participants discussed more specific and concrete rather than general or abstract content as they expressed personal stories and ideas. UX2 said:

> *I think when we draw together, it's more like a form of artistic communication. Through this, we can talk about composition, colours and also the meaning of the painting. It's not like a professional discussion, but so many details are covered; in [all] honesty, it's quite emotional*.

Other participants reflected on their expectations of the collaborative engagement, or what they would like to see. They stated that graphical representations and/or interactive notes would be helpful to a larger number of aesthetic interpretations. For example, GE7 mentioned:

> *If we could have more graphical suggestions to [explain] how to experience this particular application, it would be more effective. What I mean is, different participants perceive different graphical targets in the engagements; therefore, we could talk about it through discussion*.

The participants also expressed more technical needs, such as multi-touch and gestural adjustment of the elements to give them additional interactive possibilities. Most importantly, the connection with social media was mentioned. UX1 commented:

> *I would like to share this and post it on my social media, because if I do, it might encourage more engagement and interest in this application, expanding the discussion and making collaborative artwork more meaningful and appreciated on a greater scale.*

Explorational Thinking Through the Painting Application

Based on the user experience, the participants offered their views on the space where they used the application and engaged with the art. One group was in the meeting room of a gallery; a participant from this group remarked on how to harness the application in conjunction with an arts environment such as a gallery or museum when engaging with the

art, especially when connecting an artistic collection (such as this one, of traditional Chinese painting) to the application. This issue was raised in the context of creating an immersive experience of traditional Chinese painting for viewers. According to UX2:

> *I think we should make this application separate from traditional Chinese painting as a collection. What I mean is, why not combine them to create a new experience that crosses different time periods and cultures? However, for me, it needs to have an order, like we should browse the Chinese paintings first, then play with this application, as this seems more reasonable – or even use this application first, then appreciate Chinese paintings*.

UX1 supplemented this view by commenting on the two different orders laid out (experience the application then appreciate the paintings or appreciate the paintings then experience the application). He supposed that, depending on the non-Chinese viewers' degree of understanding of traditional Chinese painting, they could choose their own method. However, for most Chinese viewers, grounded in their basic knowledge of Chinese history, culture, and philosophy, they go to a gallery to appreciate traditional art first, then experience the application, which appears to be more reasonable for them. UX1 explained:

> *The main point of their experience could be the creative participation. But for us, as non-Chinese amateurs, we should use the elements in the application to map out a basic understanding of Chinese painting. This way is more similar to our approach of appreciation*.

Based on the idea of cross-cultural diffusion, UX3 expressed his opinion on this stance. Considering the different paintings and collections in a given gallery or context, the application could highlight more relevant elements (such as colours, subjects, textures, and composition modes) specifically to help unschooled foreign viewers obtain knowledge of the gallery's paintings. UX3 mentioned that updating the elements of the application to work with paintings from different galleries would enhance appreciation:

> *Before we go to look at paintings, we could update this application to obtain knowledge of them from the element-based archive. Then, when we go to the gallery, we will have an understanding like we do today. We have more information, and we*

can talk about [the art], share our thoughts … we will not browse the paintings without thinking anymore.

On the other hand, I obtained some interesting findings by observing the participants' behaviour after they finished experiencing the app and discussing it with their peers. Their initial lack of experience did not stop them from investigating and talking about traditional Chinese painting, after which they had gained a basic understanding of the elements of the art form. They started to compare specific painting elements and became curious about the underlying reasons for differences. They also explored relevant knowledge by searching online; interestingly, the focus of what they were searching based on colours and themes led them to background knowledge of Chinese painting, philosophy, and religion. For instance, GE7 and his group member mentioned the implied meanings of different flowers in the flower elements and the religious significance of women's portraits, as well as Taoist and Buddhist figures. UX2 said that:

Experiencing the application has increased my interest in Chinese painting and prompted me to find out more around it. I did not expect this to happen. I think that the elements from different dimensions in the application caused us to be more curious as to why these elements are represented in Chinese painting. This sense of curiosity is very important for us to continue to explore.

UX3 added:

Searching for aesthetic knowledge actually changed our thoughts on traditional Chinese painting. To be honest, I don't feel like I am that much of a foreigner anymore. Before we experienced this element-based app, we did not know how to specify our interest in Chinese painting; for example, before, we were not aware of what we most wanted to know. However, founded on this basic understanding, we are able to identify more interesting things in Chinese painting such as the stories, philosophy, and philosophical thoughts of Taoism….

5.4 Reflections on the Appreciating Traditional Chinese Painting via Interactive Technology

Based on the findings from the cultural appreciation and design studies, the main contributions of this Ph.D. research to the digital cultural heritage community are

(i) A set of findings yielding a specific engagement approach to the cross-cultural appreciation of traditional Chinese painting and

(ii) A series of interactive design suggestions and challenges regarding the development of the aesthetic appreciation of Chinese painting.

The aim for the case study was not only to develop and implement an application that could reflect and represent the findings of the cultural appreciation study but also to review the design suggestions and comments from the evaluation of that application. The contribution is thus grounded in the qualitative and quantitative findings and the values and concerns communicated through users' experiential reflections on the application.

5.4.1 Features of Cross-cultural Appreciation in the User Study

The user study, centred on the designed application, demonstrates how cross-cultural application users engage in appreciation of traditional Chinese painting as well as their level of understanding of it. The study adopted two forms (the first form consisted of reading a written introduction and browsing paintings, during appreciation, drawing with a traditional ink brush was also an option; the second form, had participants use digital tablets with an element-based interaction application to engage with the artwork, and to interact with their peers) of appreciation and compared them; the application-based approach clearly attracts users' interest much more easily and motivates them to discover more knowledge on traditional Chinese painting. The facts that the discussions included stated that the users spent more time experiencing the application and thereby appreciating the subtlety of Chinese painting. They were more willing to talk about Chinese painting, and their discussions included more and more relevant content, including discussion of colours, subjects, genres, and other elements. This reflection unfolded according to the high-frequency keywords and themes identified by the non-Chinese participants (colours–subjects–interpretation), which are addressed in the findings on cultural appreciation (see Section 4.2).

I summarise two features of appreciation in the user study as follows:

(1) Whilst users experienced the app, they started to analyse the meaning of colours and subjects, which they connected together in order to express their understanding of Chinese painting, rather than randomly choosing colours or subjects to guess the painting's significance. And this feature also corresponds to the previous results which are reflected in Section 4.2 Cultural Appreciation. The change is not because the application offers a verbal introduction to the colours or subjects, but rather, based on the observation notes, because, viewing and

comparing the elements presented in the application, users were able to form their own sense of appreciation, which is significant for increasing their interest in Chinese painting.

(2) While the users were using the application, they actively explored relevant knowledge through discussions with other users or searched for information online, including information on the artists' background story, Chinese history, and Chinese religions. In contrast, this active search did not emerge in the first form of appreciation (reading a written introduction and browsing albums filled with paintings). Surprisingly, some areas of the knowledge search overlapped with the Chinese participants' high-frequency keywords and themes from their discussion. Thus, cross-cultural users of the application gained two benefits: while the similar content of the talk to that among Chinese participants represents this approach as a 'correct' way to appreciate Chinese painting, the active knowledge search broadens the dimension of appreciation and arouses interest in Chinese painting. The application's function is to offer a comprehensive understanding of the pertinent aesthetics and history by appreciating Chinese painting, and potentially supporting users to generate interest in it.

5.4.2 Elements Archive: Engagement Approach for Cross-Cultural Appreciation

A key area of concern for cross-cultural appreciation is the method used and the understanding of it by an audience with a different cultural background. The understanding of colours is an appropriate starting-point to guide non-Chinese viewers, as colours can connect to the cultural meaning of the subject(s) within the painting, convey the aesthetic value of the work to viewers, and inspire them to understand traditional culture through interpretation (Chen et al. 2008; Ji 2013). In the following sections, I explore how to combine and connect these elements as an engagement approach.

I performed an in-depth analysis based on the workshop participants' understanding of the elements in Chinese paintings (from the cultural study). In general, the participants deeply accepted colour-symbolic subjects. The interviews revealed that the colours chosen were described in terms of figurative themes and personal experiences. By grouping several colours together, the participants gained impressions of traditional Chinese culture, architecture, and other, figurative topics that could also be used to support Chinese and non-Chinese viewers' understanding of Chinese painting and the culture behind it. Conceptualising colours into subjects, and concentrating subjects back to colours are both iterative processes; therefore,

using only colours to grasp traditional Chinese painting is unreasonable for non-Chinese viewers. However, combining understanding of the colours used in traditional painting with the expression of subjects could potentially map out a technique of appreciation (Zhang 2012). Collectively, the participants argued that the elements archive could offer an approach to combining different elements (i.e. colours, subjects, etc.) to aid cross-cultural appreciation. The non-Chinese viewers did not easily accept holistic, aesthetic appreciation; the elements archive offers a more flexible method to guide audiences in independently exploring the different dimensions of Chinese painting, and not limiting their own understanding and imagination.

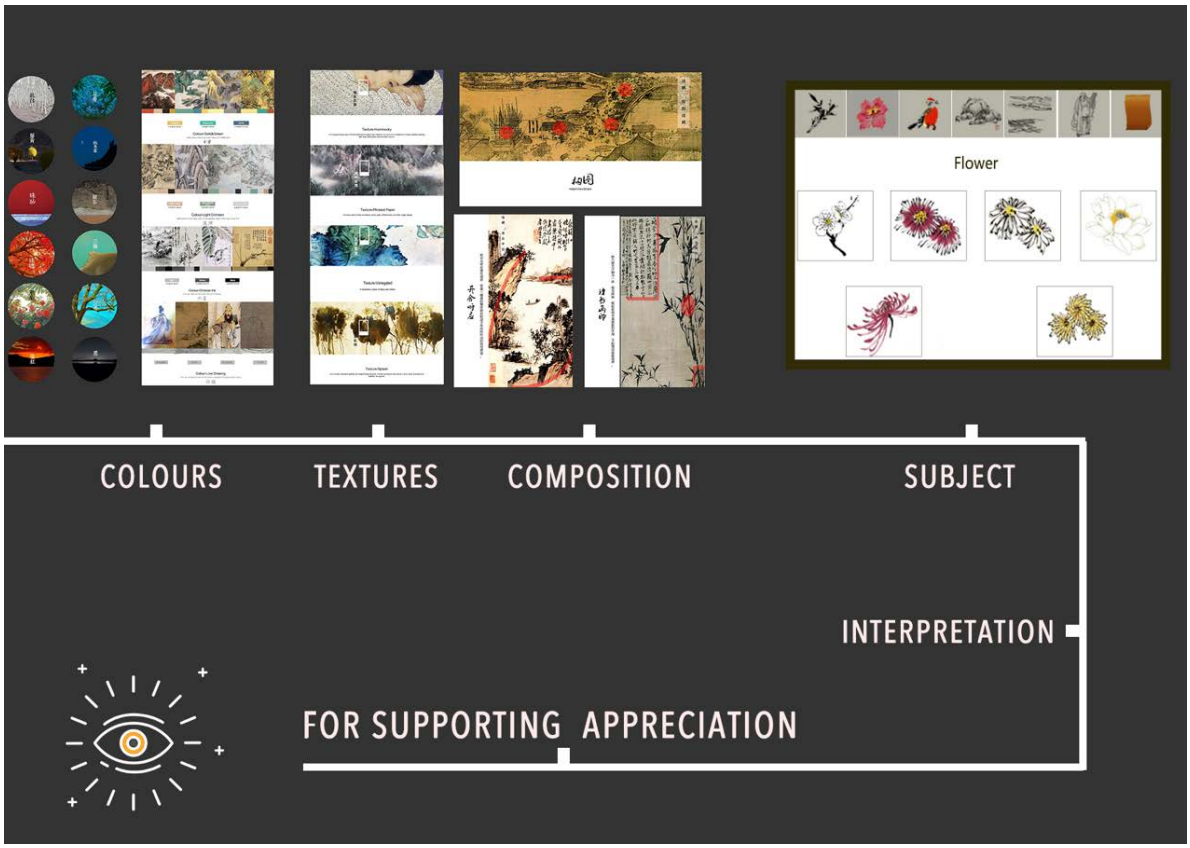

Figure 49. Interpretations of Chinese painting elements.

Based on the participants' experiences and engagement with the application that I created in the design study, they discovered even more dimensions to the use of the element archive that boosted its value. Colour–subject–interpretation was just one among several techniques available. By combining the findings, I categorised these three elements (colour, composition, and texture) for the archive. First, the interpretation of traditional Chinese colours was found to differ from the Western interpretation of similar hues. Hence, the integrated visual interpretation of Chinese colours provides an opportunity to support appreciation. Second,

composition of Chinese paintings has its own theory, similar to the perspective and inverse perspective effects (Zhao 2019b); understanding the composition of Chinese paintings enhances appreciation dramatically. Third, understanding textures in Chinese paintings offers the audience an in-depth method of appreciation (Zhao 2019a). Overall, grasping the subjects or themes may be strengthened by understanding these elements, facilitating viewers' understanding of the subtle aesthetics of Chinese painting (Figure 49).

In conclusion, using the elements archive as an engagement strategy could foster non-Chinese audiences' aesthetic appreciation. This is a potentially very rich area of cross-cultural art appreciation.

5.4.3 Gestural Engagement and Multi-Touch in Chinese Painting

The design study participants initially distinguished between learning about Chinese painting and appreciating it. They believed that:

(1) Gestural engagement offered them more opportunities to appreciate the subtlety of the paintings. Through gestural movements (zoom in, zoom out, shifting, etc.), they were able to check out the details of the colours through tracing, shades of ink, and the nuanced textures in traditional Chinese painting. Users could employ different gestural movements to observe the delicateness of the painting, such as rapid changes in lines and variation in ink shape. Gestural movements are crucial when observing realistic Chinese paintings; the subtle brush strokes reveal the essence of such works. However, this aspect is normally missed when viewing the art in galleries (a finding reflected in the literature review on interactive technology in traditional Chinese paintings in Section 2.4). The 'zoom out' feature is also critical, and provides a broader perspective that removes the need to physically step back in order to observe the composition of a painting. The gesture of 'shifting' offers app users convenience and flexibility while operating elements to create artwork. Figure 50 presents the gestures utilised numerous times by participants. The participants did not simply observe a piece of art being made or read some related information but gained a greater understanding of Chinese paintings thereby.

(2) By learning how to draw a Chinese painting, the participants became more inclined to use multi-touch tools to engage in painting, instead of a traditional

ink brush. They believed their main purpose was to appreciate the traditional features and culture of Chinese painting, rather than actually learning the skills. Sometimes, in fact, technical skills with an ink brush greatly reduced engagement and also the participants' effort. During the workshop, participants stated that archival elements with gestural operation sharply increased the integrity of their appreciation, offering them a general understanding of the art form's various dimensions. During the workshop conducted for the user study, two types of appreciation were adopted to focus on unique emphases: the first one (reading a written introduction and browsing albums filled with paintings) was a learning-based experience, while the second one involved utilising an application with a multi-touch technique. The application experience provides users with a very simple and approachable operation that ensures completeness and quality of users' artworks. Users can also employ the application to jointly create works of art.

(3) The participants discussed and highlighted the multi-touch gesture design on numerous occasions. They expressed a desire for multiple users to be able to handle graphic elements and to interact with each other using different kinds of digital equipment (e.g. tablets, mobile phones). This expands the locations supporting the application experience. It also removes the requirement for collaborative artwork to use the same digital equipment; interoperability and compatibility of multi-gestural operations could be another design area for future development. It is necessary, however, to further define the design direction of multi-touch experience, especially in terms of distinguishing between improving a drawing per se and enhancing appreciation. For instance, in order to strengthen appreciation, a digital system needs to advance communication among users by creating a platform to help them share their thoughts during co-creation.

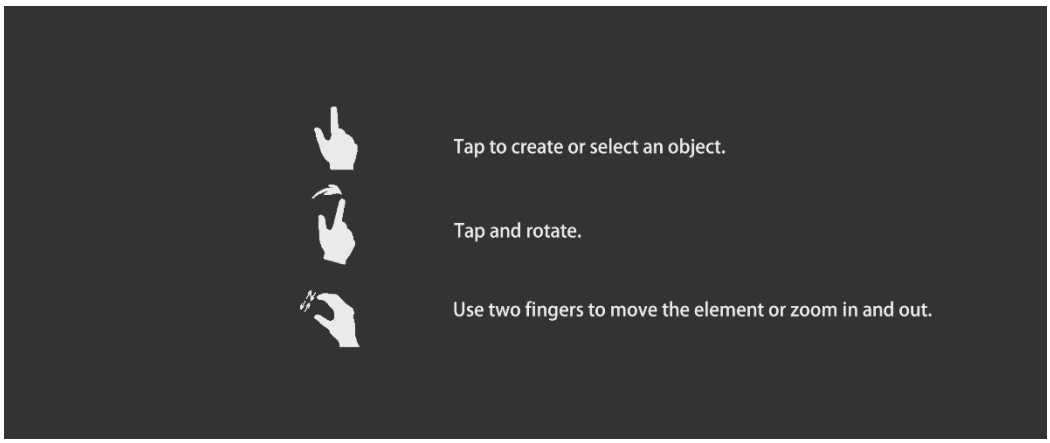

Figure 50. Three main gestures mentioned by the participants.

5.4.4 Artwork Based on Mobile Access

Another design insight regards aiding viewers to achieve self-expression and engage cooperatively with paintings. Based on the two previous activities, which integrate the element archive and gestural operations, the design study participants indicated their demands through the author-designed application. They preferred to utilise elements to convey their own understanding and thoughts in interaction with peers.

(1) Self-expression

After the participants gained a basic grasp of Chinese painting elements, encouraging them to create art helped them develop in-depth appreciation based on their own creative expression and artistic collaborations. When they created artwork using the application, the process of their appreciation became more active. Browsing the elements archive and investigating the subtleties of the various elements formed an approach that facilitated self-expression, in contrast to another appreciation approach I put forward, where participants checked out websites or annotations passively and randomly. Participants wanted to communicate their own stories and thoughts within the art. They created art other than drawings, because the form of engagement was not focused solely on painting skills; and their art pieces not only reflect their own understanding of Chinese painting, but also their personal feelings and recollections. The functionality of the application simplifies traditional painting and drawing somewhat, which combined with participants' self-expression based on the element-based artwork leads to a specific output mode. All in all, through communication with peers, more participants will gain better results in terms of aesthetic appreciation and grasping the stories behind paintings.

(2) Collaborative appreciation

Different groups of participants (families, university students, and amateurs) shared their thoughts about joint interactions using mobile devices. The participants wished for multiple user interactions not limited by specific occasions, for instance, to be able to interact with others in real time to employ elements in creating art founded on their interactions and communication, no matter where they were located. Using graphic components from the archive during cooperative efforts helped the participants discuss aesthetic appreciation and understanding. Forms of appreciation should not be not limited by personal reading material or knowledge of teaching; participants are highly expecting the process of their collaborative appreciation and engagement to be flexible. Joint appreciation has also been addressed; sharing art and engaging more participants within already existing structures of engagement serves as an important technique of appreciation. Hence, joint appreciation activity contributes to participants' understanding and appreciation in three ways: it: (1) reflects users' understanding of Chinese painting; (2) offers them an environment in which to exchange knowledge of Chinese painting; and (3) boosts their participatory appreciation.

5.5 Conclusion

This chapter has reported field studies of a prototype interactive tablet application for the cross-cultural appreciation of traditional Chinese painting. I conducted a study on cultural appreciation with non-Chinese and Chinese participants in order to reveal the engagement approaches of (in particular) the non-Chinese participants. To enhance the prototype design, I analysed traditional colours and subjects and transformed them into available, interactive elements in the app. Based on these two studies, I designed an application targeted towards non-Chinese participants to explore how interactive technology supports their appreciation and engagement with the art. The findings encompass the participants' experiences and feedback on cross-cultural appreciation as well as their self-expression during appreciation. I examined the participants' thoughts on artistic appreciation by mobile device, and how to use this application to understand traditional Chinese painting in the public sphere. This case study aims to offer valuable transferrable insights into the design of interactive technology in order to support the cross-cultural appreciation of Chinese traditional art.

Chapter 6. Understanding Cross-cultural Appreciation: Traditional Chinese Puppetry

6.1 Introduction

This chapter involved interviews, investigations, prototype design, and evaluation. By understanding the experiences with ICH in China of artists, (other) stakeholders (e.g. puppetry researchers and puppetry students), and cross-cultural audiences, this fieldwork looks to provide design ideas to support cross-cultural aesthetic appreciation and help improve engagement with these cultural traditions among multiple audiences. Combining the perspectives gained from cross-cultural audiences and stakeholders will allow an exploration of the experience of professionals, learners, and amateurs in hybrid activities (fieldwork, workshops, interviews, surveys, etc.), which can provide an arena to generate an understanding of their aesthetic appreciation. Through interviews and fieldwork, barriers to understanding when cross-cultural audiences watch Chinese traditional puppetry are identified. This fieldwork also draws on data regarding the cross-cultural performance experience of professional puppetry artists to inform ways of supporting multicultural appreciation and appreciation. In addition, the advantages and disadvantages of the relationship between Chinese ICH and interactive technology will be discussed with a focus on the puppetry context.

Ideally, both artists' experience and audiences' thoughts should play a significant role in the process of designing digital heritage tools. Thus, a central goal of this fieldwork was to determine the needs of various relevant communities and how to integrate them into designs (Fox and Le Dantec 2014). Few previous digital design case studies of ICH (Gudukbay et al. 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 thus largely unable to express their needs before design commences. However, approaches such as value-sensitive design, where explicit, iterative consideration of values is used to ensure reflective engagement with the values of 'direct and indirect stakeholders' (Friedman 1996), do exist, and demonstrate that these stakeholders' role should not be limited to that of counsellor or tester. In addition, few studies have examined how interactive technology can engage audiences in 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 part of my work attempts to address these gaps.

I conducted a series of fieldwork investigations along with semi-structured interviews (Allison et al. 1996; Charmaz 2014) in order to better frame the cross-cultural appreciation of traditional Chinese puppetry and explore the potential of interactive technology to support it. First, I attended a puppetry workshop to familiarise myself with puppetry performance and conducted interviews with cross-cultural audiences to determine the barriers to their understanding and appreciation. Next, several fieldwork studies were conducted with professional puppeteers from diverse cultural backgrounds in order to explore potential design conceptions supporting cross-cultural appreciation. Finally, I attended a puppetry research conference in order to discuss the topic with experts in the field.

6.2 Methods

These studies were undertaken on five separate occasions (spanning 42 full days) between September 2016 and May 2017 and consisted of six different activities (Table 4). There were 19 male and 19 female participants, from eight European and Asian countries. I received informed consent from every respondent in order to conform to this study's ethical guidelines (Appendix B.1). This case study was approved by the Newcastle University Faculty of Science, Agriculture & Engineering ethics committee (Appendix B.2).

Throughout this entire process, ethnography and a series of ethnographic fieldwork was utilised to offer me first-hand experience interpreting the points of view of those being studied (Atkinson et al., 2001). And I employed design ethnography (Raijmakers et al. 2006; Van Dijk 2011) to collect data through fieldwork from traditional Chinese puppetry professionals and stakeholders to explore potential design conceptions and insights supporting cross-cultural appreciation of traditional Chinese puppetry. As well, I got through observation that from engaging the relevant puppetry activities to identify barriers to non-Chinese amateurs' appreciation.

Working with the two puppetry institutions where I sited the studies – Shanghai Theatre Academy and Garlic Theatre – was interesting for several reasons. First, participants in these locations had in-depth understandings of both traditional Chinese puppetry and European puppetry. The results of the fieldwork and in-depth interviews provided a cross-cultural perspective on potential ways interactive technology could be used to support the appreciation of Chinese puppetry. Second, local commercial theatres (Garlic Theatre) and national educational puppetry theatres (i.e Shanghai Theatre Academy) bring different perspectives to the digital safeguarding of puppetry; including both institutions in this study's data collection

allowed for a broader and more forward-thinking perspective. The results of the fieldwork and in-depth interviews provide a unique cross-cultural perspective on ways interactive technology could be used to support Chinese puppetry.

Time	Number	Cultural background & code	Data collection methods
Feb 2016	5	Puppeteers (3 British and 2 Italian) – SH-A	Fieldwork (workshop with puppetry stakeholders in Norwich)
Apr–Aug 2016	12	Cross-cultural puppetry amateurs (5 British, 2 Russian, 2 Spanish, 2 ethnic Chinese, 1 Danish) – CA	In-depth one-on-one interviews with cross-cultural audiences in Newcastle
Feb 2017	2	Puppeteers (1 British and 1 Italian) – SH-B	Fieldwork and semi-structured interviews in Garlic Theatre, Norwich
March–April 2017	10	Puppetry educators and students (Chinese) – SH-C	Fieldwork (brainstorming workshop) and in-depth semi-structured interviews at Shanghai Theatre Academy
April 2017	6	Puppeteers – SH-D, cross-cultural audiences (non-Chinese) – SH-E	Fieldwork and in-depth Workshop with semi-structured interviews at Edinburgh International Festival
May 2017	3	Researchers, theatre staff (British) – SH-F	Presentation at Puppetry Research Conference in Newcastle

Table 4. Overview of data collection methods in fieldwork with specialists and cross-cultural audiences.

6.2.1 Puppetry Workshop

I participated in a workshop titled 'Explorations with Everyday Materials and Objects: Animating the Inanimate' as a step to immerse myself in puppetry with other puppetry stakeholders. As a participant in the workshop, I also adopted the ethnographic principle of participant observation for this study, which helped me become aware of the transformation of my multiple identities from observer to learner to participant.

Firstly, I participated in and observed this puppetry workshop titled 'Explorations with Everyday Materials and Objects: Animating the Inanimate' in Norwich, UK, which included participating in a group performance and undergoing informal conversations with organisers and other participants. I recorded the workshops (video data) and informal conversations (audio data) in full. Through this workshop, I became familiar with puppetry performance and learned the basic practices of performance in multiple sorts of puppets and puppetry. For

instance, I experienced making my own puppets with different materials and learned how to manipulate the paper puppet, object puppet and marionette. I also collaborated with other workshop participants to organise puppet shows with different themes. During the workshop, I had opportunities to acknowledge the theoretical and practical aspects of performing puppet shows from the puppetry masters. I also built connections with professional puppeteers so I could open a dialogue with them and conduct subsequent interviews and ethnographic filming. After finishing the workshop, I invited 3 British and 2 Italian respondents to be interviewed; all respondents were professional practitioners in puppetry who had previous experience manipulating traditional Chinese puppets (Figure 51). Interviews included information on participants' experience 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 on how to bring the inanimate vividly to life through collaborative improvisation.

Figure 51. Workshop with puppetry stakeholders in Norwich.

6.2.2 One-on-One Interviews

I conducted a series of one-on-one, in-depth interviews with cross-cultural puppetry amateurs who have diverse cultural backgrounds so I could probe 'What barriers do cross-cultural audiences face in appreciating traditional Chinese puppetry?' I also intended to reflect upon those interviewees' previous experiences with any applications that use interactive media to perform traditional Chinese puppetry and their feedback. As mentioned in Chapter 5,

recruitment was undertaken via an announcement in Newcastle and its surrounding areas (i.e. Gateshead, Jarrow and South Shields) via adverts in local galleries, adverts on university campuses, mailing lists, social media and word of mouth. The announcement explained the study process and asked for input from participants interested in traditional Chinese puppetry (excluding any professional puppeteers). Twelve participants from five countries (i.e. 5 British, 2 Russian, 2 Spanish, 2 ethnic Chinese, 1 Danish) were recruited for the one-on-one, in-depth interviews, ranging in age from 25–38 years. Each interview was conducted for around 30–40 minutes, which yielded data in the form of audio recordings and observation notes. The final participants were 12 puppet amateurs from five distinct cultural backgrounds; their interviews were recorded, transcribed, and analysed. The schedule of the interviewing process can be found in Appendix B.3. These interviews covered three main topics: respondents' appreciation of traditional Chinese culture, the extent to which they understood traditional Chinese puppetry, and their opinions on four videos presenting 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 a Daming-Zhangzhou puppet movie; and a scene from the Heidelberg Taiwanese Budaix, which had English subtitles. Asking respondents to reflect on these clips provided insight into how interactive technology 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).

6.2.3 Garlic Theatre

Through this activity, I intended to specifically explore professional puppeteers' experiences with puppetry performance and digital applications. The next step of this study involved semi-structured interviews at the Garlic Theatre with two British professional puppeteers who had experience with traditional Chinese puppetry (Figure 52). This was a follow-up activity which connected to the first activity (i.e. Puppetry Workshop). During the ethnographic fieldwork in the first activity, I built good relationships with two professional puppeteers from the Garlic Theatre, Norwich, and I obtained their permission to conduct video-based ethnographic fieldwork and a workshop in their theatre. Garlic Theatre is a British visual theatre company that uses images, puppet animation, movement, and live music for its shows. It is also worth mentioning that both puppeteers had training involving traditional Chinese painting.

I utilised three DSLR cameras to film puppeteers' performances and the audiences' reactions continuously over the course of three days. After filming, I invited two professional puppeteers from the theatre to conduct a workshop covering five different topics: experiencing local performances, performing in other countries, learning traditional Chinese puppetry, digital puppetry, and developing puppetry shows. Participants shared their experience about puppetry performance and digital applications, discussed the advantages and disadvantages of each interactive technology used to support Chinese puppetry (3D-animated puppet performance, immersive theatre experiences, and puppetry tablet applications), and explored trends in the development of Chinese puppetry. During the workshop, participants also used different types of performance, videos, and photographs as reference materials to spark further inspiration. This workshop was intended to explore the current trends within Chinese puppetry performance and two participants' thoughts about the use of interactive technology in traditional puppetry.

Figure 52. Semi-structured interviews and gesture filming, Garlic Theatre, Norwich.

6.2.4 Shanghai Theatre Academy

In this activity, I utilised design ethnography as the main method to reach potential design insights on how to integrate interactive technology into traditional Chinese puppetry from the perspective of puppetry educators. The fieldwork, a brainstorming workshop, and in-depth

semi-structured interviews were conducted through my facilitation at the Shanghai Theatre Academy, whose Department of Puppetry Performance is dedicated to dramatic-arts education. The brainstorming was intended to discuss the experience of integrating technology into the puppet show from a puppetry student-oriented perspective, and the in-depth semi-structured interviews with puppetry lecturers and other relevant educators were conducted to identify the barriers of cross-cultural transmission of traditional Chinese puppetry, as well as the ethical issues embodied in the current digital applications. In 2003, the department 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 abroad, presenting abundant opportunities for cross-cultural performance. 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 lecturers, and seven puppetry performance students (Figure 53).

Again, I used three DSLR cameras to continuously film seven puppetry students' performances and practice sessions over a five-day period and interviews with the study participants. I also organised a brainstorming workshop that integrated their learning experiences in the field of traditional puppetry and any previous experience they had had using technology in puppetry performance to excite potential design ideas for supporting digital puppetry appreciation. All the students (participants) were also encouraged to discuss their expectations as to how interactive technology could support their puppetry performances. Their discussions were based on their previous performances, but they also were encouraged to discuss any forms of digital performance regardless of the limitations of current technology. This workshop was meant to create spaces for discussion and debate to inspire and encourage imaginations to flow freely. Through this speculative design-based workshop, I resolved to explore and capture design ideas based on puppeteers' imaginations and experiences. Furthermore, the Dean of the Academy of Arts and the puppetry lecturers also took roles as workshop organisers, to offer professional feedback on the design ideas from the workshop. On the last day of this activity, I conducted the in-depth, semi-structured interviews with the Dean of the Academy of Arts and the puppetry lecturers. The topic mainly focused on the barriers facing cross-cultural transmission of traditional Chinese puppet shows and the place of technology in Chinese puppetry, as well as the current ethical issues of using interactive technology to enhance Chinese puppetry. Both types of activities 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 technology from a multi-faceted perspective.

Figure 53. Fieldwork, Shanghai Theatre Academy.

6.2.5 Edinburgh International Festival

Based on the established connection with Shanghai Theatre Academy in the last activity, I followed their performance group and attended the Edinburgh International Festival to conduct ethnographic fieldwork. This puppet show was performed by three professional puppeteers who were from the Shanghai Theatre Academy, and this performance lasted 1.5 hours. Figure 54 shows two of the puppeteers performing at the festival. Before the performance, every audience member was given a booklet that briefly introduced the background story of the performance, and a projection screen on the right side of the stage with English subtitles was also offered to help support cross-cultural appreciation.

Ethnographic fieldwork included three main steps. The first step was the observation-based ethnographic fieldwork, in which I observed how the cross-cultural audiences appreciated the traditional Chinese puppetry during the performance. For instance, did audiences check the booklets that were offered prior to performance? How did they appreciate the puppetry? Were they more focused on the show or the subtitles? What is the thought and reaction during their appreciation? And how do the current methods provided by the performance potentially support their appreciation? I recorded my observations in detailed notes. In the second step, I interviewed a random number of audience members (3 non-Chinese people) after the show.

The questions were mainly focused on whether they enjoyed the show, whether they understood the plot and story, whether they experienced any barriers to appreciating the show, and what they thought about the booklets and subtitles. The responses from the interviewees were recorded in detail. In the third step, which was conducted after the show finished, I organised a workshop and several in-depth, semi-structured interviews with the three puppeteers. Participants were asked to reflect on the following three topics: Based on their experiences during performances, what are the main barriers face cross-cultural audiences while watching Chinese puppetry? What methods do they normally use to help audiences overcome these cultural barriers (e.g. language, dialect, local culture)? And what have been the results? Moreover, I introduced the design idea of the gesture library, demonstrated the paper prototype, and asked about their feasibility and usability. The interviews were recorded by audio.

Figure 54. Two puppeteers performing at the Edinburgh International Festival.

6.2.6 Puppetry Research Conference

During the final stage of the study, I solicited and collected opinions and feedback from other puppetry stakeholders, including an academic researcher, a script-writer, and a master puppeteer, during a puppetry research conference. Using the previously described fieldwork to develop some initial design concepts (i.e. using puppetry gestures to encourage cross-cultural audiences' appreciation), I also demonstrated the video-based ethnographic work

from previous fieldwork with different puppeteers to further explain the gesture-based design concept. During this conference, I conducted a series of discussions on how interactive technology can support cross-cultural appreciation of Chinese puppet shows. I also outlined the relationship between traditional puppetry and interactive technology in order to develop further discussions (Figure 55). The discussion and reflection helped me critically review my initial design insights from an academic perspective.

Figure 55. Puppetry research conference presentation.

6.3 Data Analysis

This Ph.D. research involved plenty of ethnographic fieldwork (e.g. semi-structured interviews and workshops) that produced abundant video and audio data as qualitative data for analysis. The video-based analysis as a common supportive method has also been frequently utilised in the HCI sector (Heath et al. 2010; Heath 2010), and the video-based analysis helped me capture the interactive details, such as the interactions between puppets and puppeteers; between audiences and puppet shows; between digital application and users; and between different users were all recorded in a variety of physical settings. Capturing the data by video also allowed me to quickly revisit them multiple times. To be more specific, the fieldwork for this chapter includes various activities in multiple places over a long period of time (over one year). During the fieldwork, the video-based analysis allowed me to grasp the overall structure of these activities. The video data not only provided a transcriptional text in detail, but also a timely understanding of the fieldwork in general to help me adjust the details of the later activities. Moreover, revisiting the video data also helped me supplement my notes

at each step of the fieldwork, and these notes were blended with transcripts for the thematic analysis. In this chapter, I also used thematic analysis to analyse recordings of semi-structured interviews with Chinese and non-Chinese participants to explore their understandings of traditional Chinese culture and puppetry (see Appendix B.7). Thematic analysis has been described as 'a method of identifying, analysing, and reporting patterns (themes) within data' (Braun and Clarke 2006), and it is commonly utilised as an approach to qualitatively analyse data that can include interview transcripts, newspaper articles, questionnaire responses, diaries, videos, images, and field observations (Braun et al. 2019). All the interviews were recorded, transcribed, and anonymised, and are hereafter denoted by the prefix CA (cross-cultural audience) or SH (stakeholder of Chinese puppetry). The data also includes field notes, which documented observations and interactions throughout the process. This approach is used 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 (Glaser et al. 1998; Creswell 2002).

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

6.3.1 Results

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

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 background stories, linguistic barriers, lack of adequate subtitles, and inadequate supplementary knowledge.

(1) Incomprehension of background stories

Most scripts in traditional Chinese puppetry derive from Chinese fairy-tale or folk stories. Understanding the background to these stories plays a significant role in the audience's experience and understanding; however, cross-cultural audiences lack this comprehensive

background knowledge. SH-C2, a traditional Chinese puppetry lecturer and researcher, expresses this viewpoint:

> *For traditional Chinese puppetry, like this marionette, lots of scripts are derived from Chinese fairy-tales, for example the, 'Legend of the White Snake' [a Chinese folktale about 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 both 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.*

(2) Linguistic barriers

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

> *I am afraid to say that I seriously have no clue about this performance [a 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 the fieldwork at the Edinburgh International Festival reflects this finding. I 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 performance outside China, 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.

(3) Lack of adequate subtitles

During the one-on-one interviews with cross-cultural audiences, one topic raised was the English subtitles included in the fourth video 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.

Subtitles are increasingly 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.

The subtitles issue was also highlighted during the Edinburgh International Festival. The organiser offered a projection-based screen with English subtitles on the right side of the stage, but the screen partially distracted the audiences. The screen was set up beside the main stage; thus, the audience members kept turning their heads between the main stage and screen. In the last half of the show, some of audiences reduced the amount of time they focused on the subtitles. SH-E2 explained her reason for doing so:

At the beginning, I was trying to watch the performance and the subtitles simultaneously, then I got frustrated about this. Because I do not have enough time to turn my head, the subtitle seriously distracted my focus from the show.

SH-E1 agreed with SH-E2's reflection. He posited that the theatre-based performance should provide a different method to encourage cross-cultural audiences' appreciation:

I do not think that subtitles were a good idea for us to understand the puppet show. The gestures and the movements are the real taste of the Chinese puppetry, but if we wasted too much time to turn our heads between the stage and screen, the charms of this sort of art disappeared. In the end, we still do not know the plot or the story of the show. And I hope they can provide some other method to help us understand the show in the future.

(4) Inadequate supplementary knowledge

Puppetry stakeholders discussed methods to support cross-cultural audiences' understanding, for instance using advertising videos (e.g. trailers) 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 his group's 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 does not read the booklet, or sometimes they just browse it randomly, hold it in their hands, or simply discard it.

SH-3 expressed her experience with the booklets during the performance at the Edinburgh International Festival:

To be honest, we did not check the booklets really carefully. I don't think it can provide significant knowledge to enhance our appreciation. The booklets just introduced us to a very basic story. I know they could offer much more information than this, but I don't think we will check it. Because we prefer to understand the puppetry through our own appreciation rather than reading the supplementary knowledge provided.

Moreover, CA2, a cross-cultural audience member, expressed her own understandings of such 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.*

Preference for Gestural Interactions

The third video was a silent episode from the Zhangzhou puppet movie. This video tells a classical Chinese story with a humorous storyline through acrobatic puppetry movements, 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. Indeed, CA10 described feeling affection towards the video and finding 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. My favourite [video] is the third one; it was really clear to watch.

Respondents' interest in the movements used in the performances was 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 those of 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 [the 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 include puppeteers' movements, especially marionette puppets, where [as many as] three puppeteers manipulate one puppet together. There are so many more details that could be appreciated from there.

During the Edinburgh International Festival, some of the cross-cultural audiences I interviewed also confirmed the above-mentioned view: the puppets' gestures and the puppeteers' movements were what attracted their attention, and more importantly, they preferred to understand the puppetry through those gestures and movements. SH-E1 explained this by saying:

The gestural performance of the puppetry was amazing, I think that's the best part of the show. Of course, I am also very interested in the movements of these puppeteers. It was fascinating to watch their (the puppeteers) interaction with puppetry. For me, I think if we could know much more about what do those gestures mean, this would be much more helpful than the subtitles to understand the puppetry. The key thing is we are interested in the gestures.

SH-F2, a puppetry researcher, reflected on this trend through the lens of his own work on the appreciation of traditional Chinese puppetry:

> *The enchantment of traditional Chinese 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 traditional Chinese 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.*

Interactive Technology in Puppetry

As the rapid development of network television and commercial films shook the traditional arts, puppeteers and puppetry researchers have remained positive and attempted to use interactive technology to enhance audiences' experiences. However, Chinese traditional puppetry is a sort of quasi-sacred activity which originated in Chinese agricultural society (Pen et al. 2010), mainly directed at adults, though most Chinese puppetry describes Chinese folktales. Although current interactive technology has played a significant role in enhancing the entertainment value of performances, the traditional cultural meanings of the Chinese folktales have not aroused 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 interactive technology to support puppetry performance. SH-F1, 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 puppets' movements or gestures were simplified during the interaction.*

CA9 similarly expressed the fact that while interactive technology, in this case puppetry games, could enhance the entertainment value for users, it also simplified or even reduced their understanding of traditional Chinese 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 cultures. 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, and would only be able to judge size based on the pendular speeds of the 'loose' elements. As 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 inaccurate 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 interactive technology into puppetry performance:

> *I think digital entertainment is good for engaging audiences, but we should realise that traditional Chinese 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 traditional Chinese puppetry, SH-D2 suggested that combining interactive technology with gestural expression could be used to support audiences' appreciation:

Some of the puppetry gestures and movements are derived from Chinese traditional opera, which contains 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.

6.4 Reflection

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

6.4.1 Overcoming Cultural Barriers Through Gesture

The findings of this study reflect previous research in which 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 and Kirk 2016).

The interviews conducted in this study reflect that while some respondents (e.g. CA12, CA7) commented on the viewing environment or background music, they failed to understand the metaphorical elements of these narratives, which prevented them from gaining 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.

In addition, however, I investigated whether, 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 ICH. The findings showed that enhancing

gestural understanding could potentially support participants to acquire a coherent appreciation of puppetry stories as well as increasing their interest in the performance. For example, the episode from the Zhangzhou puppet movie the participants were shown did not include any dialogue, and it turned out to be more meaningful to most of them, because the story was (nevertheless) understandable and interesting, and they were curious about how the puppeteers accomplished the complex acrobatics in the clip.

Their responses (e.g. CA11) demonstrate that while 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 (e.g. the name of the puppetry gestures) when watching a puppet show; and such gestural understanding should be utilisable to support audiences to acquire complementary knowledge of puppetry.

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

6.4.2 Dimensions of Appreciation

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

Moreover, appreciating performance details in Chinese traditional puppetry may improve audiences' understanding of the puppetry stories as well. 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). It seems likely 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 reflection and offers additional resources to help cross-cultural audiences understand traditional Chinese puppetry and opera gestures and engender deeper cultural awareness.

Interactive 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 its overall characteristics (Zhao et al. 2018). Interactive 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.

6.4.3 The Role of Interactive Technology in Traditional Chinese Puppetry

This part of the study was developed to reveal the conflicting perspectives of puppeteers, educators, and stakeholders on how interactive technology is changing traditional puppetry performance. Most Chinese puppeteers based in theatres strongly support digital puppetry performance as a tool to increase audiences' entertainment. 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 are particularly concerned with preserving traditional performance methods (Bonn, Kendall and Mcdonough 2016). They believe that as puppeteers are not able to perfectly control each pendular element of the puppet, digital simulations will seem unrealistic. Digital animation will also result in conflicting movement data, preventing audiences from determining a puppet's size and, as a result leading them to dismiss a digital animation as nonsense.

Determining the correct role and positioning of technology is a complicated and controversial topic, and puppetry stakeholders often critically question and problematise the status of technology (Lawson et al. 2015). Therefore, examining the possible relationships between traditional Chinese puppetry and interactive technology brings up questions as to whether

digital puppetry performances may threaten traditional puppetry performances and skills or other intangible elements.

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

6.5 Conclusions

This chapter was meant to explore how digital technology can help cross-cultural audiences experience traditional Chinese puppetry. There are currently no conclusive findings on how interactive digital technology can reconstruct traditional Chinese puppetry performances as ICH. To this end, this chapter 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 interpret puppets' gestures more accurately. Furthermore, this chapter reveals that interactive digital technology is better used to support basic and symbolic understanding of ICH rather than being directly combined with traditional performance.

Chapter 7. Exploring Interactive Technology as a Means toward Cross-cultural Appreciation: Traditional Chinese Puppetry

7.1 Introduction

In the research presented in the previous chapter, I utilised cross-cultural audiences and puppetry stakeholders as a logical and critical tool to question and problematise barriers to the cross-cultural spread of ICH and traditional Chinese culture generally, bringing together experienced professionals, learners, and amateurs. Inspired by value-sensitive design (Le Dantec et al. 2009), I incorporated workshops, fieldwork, and in-depth interviews to engage professionals' perspectives and cross-cultural audiences' experiences in order to create design ideas. Based on these ideas, in this chapter, I designed and developed an interactive system called the Digital Gesture Library, presented in this chapter, which uses a three-perspective archive of puppetry gestures and a tangible interface to support cross-cultural audiences' appreciation of puppetry and encourage further exploration of Chinese culture. The design of the Digital Gesture Library was guided by insights from prior fieldwork and interviews with professional puppeteers. I also used a mixture of questionnaires, focus-groups, and workshops to gather reflections upon aspects of the audience experience.

7.2 Data Collection for Designing

In this section, I followed the connection that was built up from the fieldwork in the last chapter to conduct a series of data collections with puppeteers who are from two professional puppetry institutions. This data collection was meant to further collect the gestures of puppets and movements of puppeteers from various dimensions of traditional Chinese puppetry. The data were collected via multiple perspective filming, according to different sorts of puppetry, and emotion-based gestures from puppeteers of differing cultural backgrounds. I filmed a series of gesture- and movement-based data to offer abundant resources for expanding the content of the initial design concept – the gesture library from the last chapter. During the fieldwork, I introduced this research to participants and invited them to contribute to it through workshops and discussions. I obtained permission to create a video library of puppet gestures and make it available to participants and the general public along with information about the puppeteers and theatres (Glaser et al. 1998). In order to collect puppetry gestures that would support the non-Chinese audiences' cross-cultural appreciation, I collaborated with several British puppeteers who possessed abundant experience performing traditional Chinese puppetry in Europe. During the puppetry fieldwork in Norwich (UK), I filmed staff from Garlic Theatre, a British visual theatre company that uses images, puppet animation, movement, and live music to create theatrical productions of artistic excellence. As

professional puppeteers, the staff of Garlic Theatre engaged in the filming process, which I chose to carry out in the theatre itself. The puppeteers possessed plenty of performing experience abroad, as well as having received some professional training in traditional Chinese puppetry. In the data, I intended to record puppetry gestures from different practitioners, and hence also decided to contact Shanghai Theatre Academy (China), which conducts academic research in the 'Performance of Traditional Chinese Puppetry.' After the discussion about 'what kind of gestures could potentially support the cross-cultural appreciation fundamentally' with the professional puppeteers, they suggested I film several sets of basic and common gestures from traditional Chinese puppetry. It is also worth mentioning that those collected gestures also referred to the theory of traditional Chinese opera to maintain the authenticity of traditional Chinese puppetry. The subsections that follow provide more detail about data collection in both settings.

Figure 56. The overall scene of the recording, Norwich, UK.

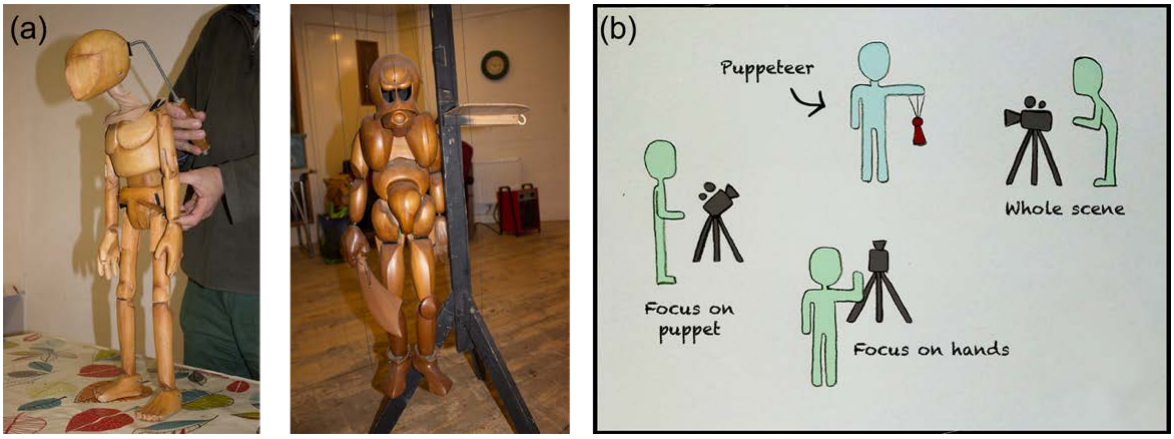

Figure 57. (a) Table-top puppet and marionette; (b) map of positioning, Norwich, UK.

7.2.1 Filming in Garlic Theatre, Norwich

Three cameras (a Nikon D3200 and two Canon EOS 600Ds) were used to capture puppetry movements as effectively as possible (Figure 56). The three cameras were set up to record three different aspects of the movements: (i) the movements of the puppet, (ii) the gestures of the puppeteers, and (iii) the overall scene of the puppet and puppeteer (see Figure 57b). The content of the videos was determined through collaboration with two professional puppeteers. I offered some initial thematic prompts for a performance, and then the puppeteers decided for themselves how they would respond. For this recording, I chose two types of puppets: a table-top puppet and a marionette. After discussions with the puppeteers, their performance were also recorded.

First of all, I recorded a performance passage that includes the expression of different emotions. For table-top puppetry (see left panel in Figure 57a), I did two single-puppeteer recordings of a puppeteer demonstrating a very simple interaction with one table-top puppet to deliver a series of emotions and two double-puppeteer interactions, in which they cooperated with each other to control one puppet to deliver a series of emotions from the puppet. With a marionette puppet (see right panel in Figure 57a), I made a single recording in which puppeteers demonstrated a very simple interaction to deliver a series of emotions.

I then recorded emotional and behavioural gestures separately; for the recording of the emotions, I captured three groups of movements from the table-top puppet, which was found to be more appropriate for the performance of the emotions themselves. Taking advice from the puppeteers, I decided to capture a set of three-emotion sequences: 1. happy, excited, and sad; 2. shy, anxious, and angry; and 3. laughing, shocked, and crying. I went on to conduct the recordings of the behaviours of each table-top puppet: 1. getting up, sad walking, and happy walking; and 2. jumping, dancing, and flying. Third, for the marionette, I outlined and organised another three groups of behaviours: 1. getting up, sad walking, and happy walking; 2. jumping, dancing, and flying; and 3. getting ready, sliding, and fighting.

To support the audience's understanding of movements of marionette , I also recorded movements focused specifically on a puppet's legs in the third phase, to gain insight into the subtlety and intricacy of these puppetry movements.

7.2.2 Filming in Shanghai Theatre Academy

For the second field site, recording locations were set in the puppetry studio within Shanghai Theatre Academy. I again used three cameras (3 Canon EOS 5D Mark III) to capture three aspects or perspectives (see Figure 58b). To avoid the puppets' outfits potentially covering the lens of the cameras when the puppeteers were manipulating the puppets, I changed the hand recording to the right side, ensuring that the quality of the recording was of a good standard. Again, I chose two types of puppets for this recording: (simple) traditional staff-head puppets demonstrated by puppetry students, and (more complex) string-/wire-hung puppets (traditional marionettes) demonstrated by one of Shanghai Theatre Academy's puppetry lecturers. All of the content of these recordings was discussed with the puppeteers to clarify the name of each gesture in their instructional system for puppeteers.

First, I recorded the gestures of the Chinese staff-head puppets (Figure 58a). I combined suggestions from discussion with the puppeteers and a professional instructional system to select a series of gestures for the digital library. All of the gestures in this phase were performed by two Chinese puppetry students who were then doing their undergraduate study. The gestures recorded are different from the previous recording in Norwich, UK, as all of these gestures derive from opera puppetry, which has a strict standard of performance. I present both the original Chinese names and the English translations to support more accurate understanding of the original meaning. The gestures were recorded in this phase were: *Flipping the sleeve; Cloudy hands; Hand on sleeve; Scavenging ragged clouds; Rest the arms on the hips; One hand in front and one behind; Twisting of the hand; Young man's steps; Older man's steps; Black cloth's (Tsing Yi) steps; Male character (Huanglian) steps; A flag following the wind; Fast-paced step; Resting one arm on the hips; Placing one hand behind; and Cast sleeve*.

Second, I recorded gestures from a string-/wire-hung puppet/marionette (Figure 58a), the most complex type of Chinese traditional puppet. I recorded four kinds of gestures: 1. Breathing (inhalation and exhalation); 2. Raising a foot and moving it; 3. Arm movement; and 4. Flipping a sleeve to reveal a hand. As noted, the gestures performed were recorded by a puppetry lecturer from Shanghai Theatre Academy; during the recording, he explained roughly what was happening, to support the understanding of each gesture. The gestures are focused towards the movements of the arms and legs.

I also recorded a demonstration and step-by-step approach to Chinese puppetry performance during the puppetry course, while the lecturer was teaching his students. This too supported me to gain an in-depth understanding of the characteristic gestures in traditional Chinese puppetry.

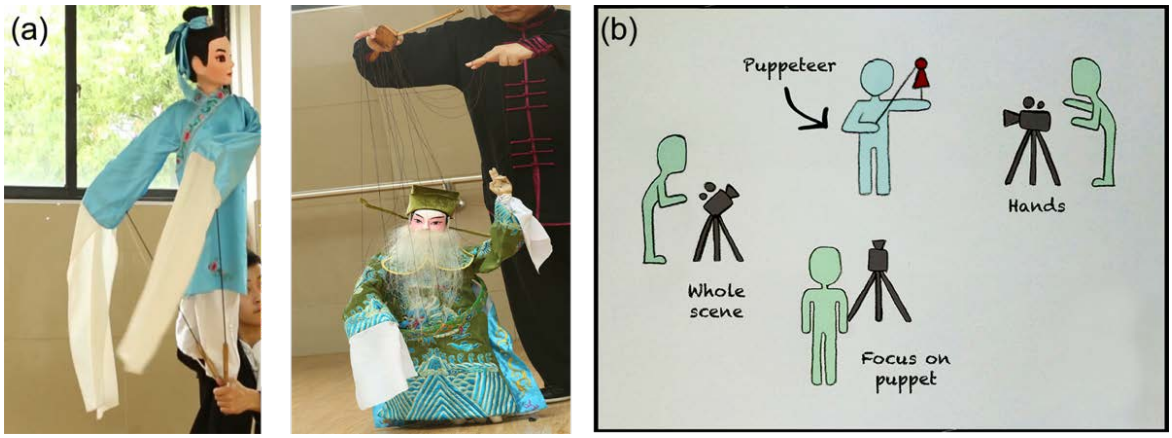

Figure 58. (a) String/wire puppet and marionette; (b) map of positioning, Shanghai, China.

7.3 Digital Gesture Library System

Based on the fieldwork and data collected in the previous section, I designed and developed the Digital Gesture Library, an archive that displays Chinese traditional puppet shows as linear multi-perspective videos (puppetry gestures, puppet movement, and the whole performance) and multi-dimensional videos (gestures, genres, information about theatre and puppeteers). This prototype gestural archive supports audiences with varied cultural backgrounds to cross cultural barriers (e.g. language, dialect, local background) to understanding and appreciating the performance. It also allows participants to appreciate the gestural repertoire of Chinese puppetry and engages participants to interact using a multimedia system. The application is composed of two parts: (1) the multimedia system and (2) a tangible interface.

7.3.1 Multimedia System

The recorded gestures and performance details were integrated into a multimedia system, browsable using an application. The entire multimedia infrastructure (videos, images, and texts) was developed on an OS X system and implemented using standard, well-supported technologies, making the entire digital infrastructure portable, easily replicable, and easy to install in different venues. It was structured as follows:

Navigation Interface

The menu interface of the system provides a brief introduction to the gestures, categorised into sub-groups which include various types of video-recorded puppetry gestures (Figure 59a). A brief introduction offers clear directions for users that guide them to watch specific gesture videos. Meanwhile, I designed the video display to show the three different perspectives in a format that fits the entire screen to help users to browse more effectively; by clicking on any video, one can browse through the three different perspectives (Figure 59b). When users hold the mouse cursor over any video, it will trigger an interaction, playing a 5-second preview of the video – I intended for this to help users correctly make their intended choices when browsing through the system and determine which videos they wanted.

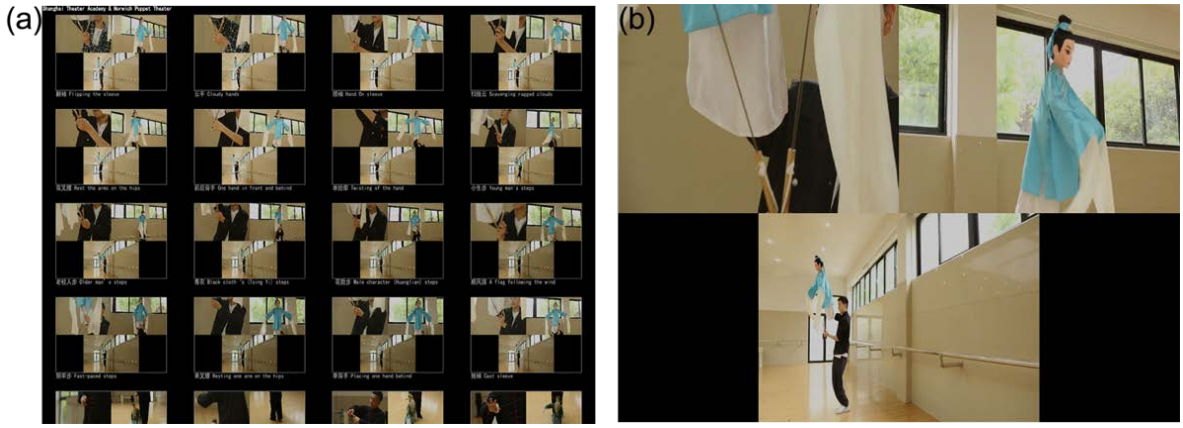

Figure 59. (a) The main interface (sub-groups) of the Digital Gesture Library; (b) three different perspectives of the gestures.

Individual Gesture View

The elements of both single gestures and grouped gestures were combined and placed onto a page where they could be viewed. Through discussions with the puppeteers during the fieldwork, I grouped various gestures together based on the order in which they are usually performed, providing a systematic experience and guide for users. On this page, the three different perspectives were presented: the movements of puppeteers, the gestures of puppets, and the overall scene of the performance. These three perspectives allowed users to have a vivid experience of the puppet shows and to view details of the operation of puppets and interaction between puppets and puppeteers. More importantly, the users could gain a direct understanding of how to match gestures with movements. Three grouped videos were played simultaneously and without interruption by default, but users could choose specific perspectives and switch to full screen view to watch the details of a specific gesture or movement more closely.

Gesture Duration and Repetition

The length of each gesture video is quite short relative to a complete puppet show. Thus, I implemented a setting that would allow for the system to repeatedly play a video for 5 seconds by default, rather than offering a pause option. Meanwhile, users can also utilise the left and right arrow keys to increase or decrease the speed the video is playing at by increments of 1 second. This repetition enables users to explore each movement and gesture more in depth.

7.3.2 Tangible User Interface

I developed a tangible user interface (TUI) for the Digital Gesture Library using Chinese characters and digital tagging on physical gesture cards read by sensor-augmented Chinese puppets. The use of cultural artefacts was intended to offer users a more flexible means of interacting with the gesture library and Chinese culture. Furthermore, the gesture cards were designed to help users develop a more visualised understanding so they could form their personalised appreciation of traditional Chinese puppetry.

Digitally Tagged Gesture Cards

All of the gestures in the system were abstracted and illustrated with Chinese/English titles on palm-sized gesture cards. Each card/sensor matched an appropriate video resource ready for playback in the multimedia system. I designed the set of cards so that users could select, group, and rearrange them according to their developing interests. Each card contains a plastic digital tag that connects to an appropriate video resource for playback. Figure 60 shows one of the plastic digital tags. The Arduino microcontroller (Figure 61), HC-06 (ZG-B23090W) uses a regular SMD Bluetooth module based on the CSR BC417 chip with a MX 29LV800CBXBI-70G flash memory chip. The next paragraph will discuss how gesture cards were used to interact with the puppet.

Figure 60. One of the plastic digital tags.

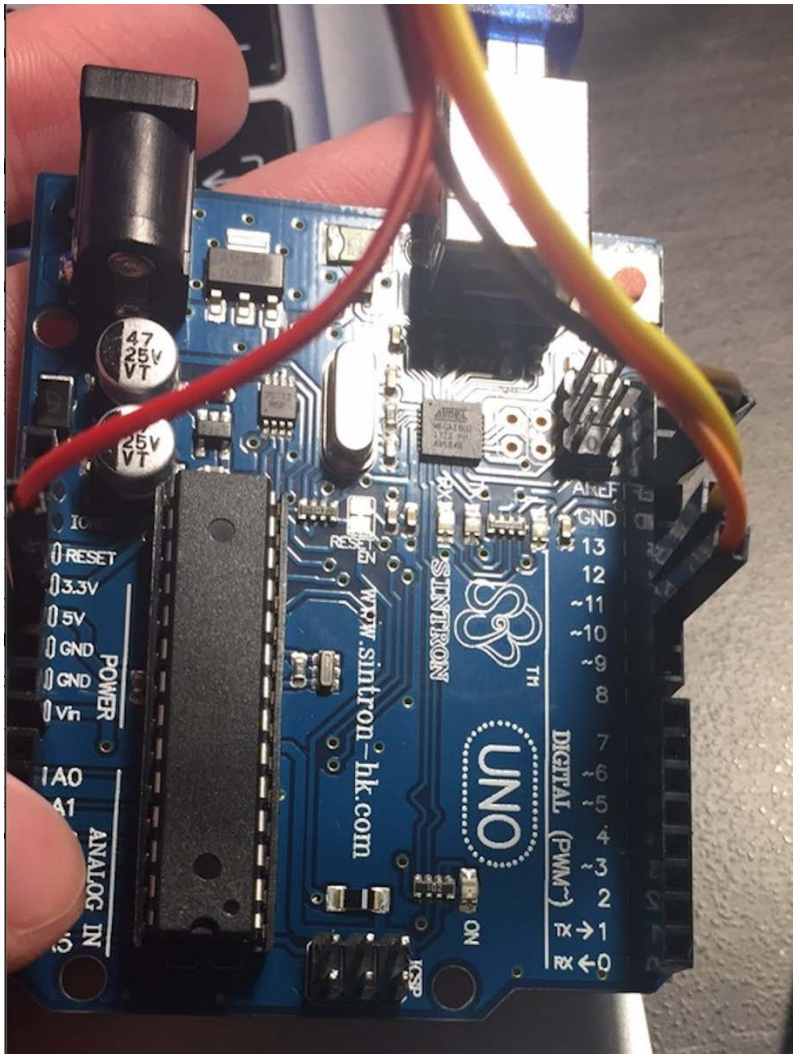

Figure 61. The Arduino microcontroller.

Sensor-augmented Chinese Puppets

I chose two classic puppet characters, Tang Monk (staff-head puppet) and Monkey King (string-/wire-hung puppet) from the Chinese traditional folk story 'Journey to the West', for the tangible interface. These two puppets were hand-made in Zhangzhou, China. I placed an Arduino single board microcontroller inside the puppets, as it could interact with the gesture cards to connect to the gestural videos in the system. When the participants held a gesture card and touched the outfit of the puppet, the system played a corresponding gesture that matched with the gesture card. When a gesture cards is moved away, the video will stop playing. Participants randomly chose different cards to interact with two Chinese traditional puppets, as well as to watch gestural videos (see Figure 62).

Figure 62. Tangible puppet device.

7.4 User Study

Following the design of the Digital Gesture Library, I conducted user studies with the system. The main research questions were: (1) How does the Digital Gesture Library enable cross-cultural users to understand Chinese puppetry? and (2) How could such interactive technology encourage cross-cultural audiences to further explore Chinese puppetry? To address these questions, I deployed the Digital Gesture Library in a public setting to obtain quantitative data on user experience; and conducted a series of workshops with cross-cultural stakeholders, to gather qualitative and quantitative data on their engagement with Chinese puppetry through the system.

7.4.1 Methods

I used a mixture of both qualitative and quantitative approaches, to support me in exploring system usability of the Digital Gesture Library and participants' cultural appreciation of Chinese puppetry using interactive technology (Glaser et al. 1998; Creswell 2002). I utilised experience prototypes and interviews with focus groups, adopting an experience-centred design perspective, which enabled me to capture qualitative data on cross-cultural appreciation and engagement (Wright and McCarthy 2010), as well as adopted an interpretative, phenomenological method for analysing the data. In the Storytelling Workshop, I also applied the storytelling and cultural probes to help cross-cultural users integrate their experiences from their personal lives, cultural contexts, aesthetic habitus, emotions and feelings to describe the achievement of appreciating traditional Chinese puppetry. Furthermore, drawing on ethnographic tools (such as participant observation, interviews, and video-/audio-recording), the experience prototype and fictional inquiry were used to engage users in the design phase and elicit their perspectives for the evaluation of the interactive applications.

With this objective, I presented the Digital Gesture Library, not so much as an innovative technology per se, but as a device to push certain features and strategies of interaction on the participants to explore how they would respond. This section of the study was undertaken in three separate parts, from January to June 2018, across three British towns and three British cities —Newcastle and the surrounding areas (Gateshead, Jarrow and South Shields), Sunderland and Norwich. The three activities include: (1) deploying the system in a public area and gathering users' responses via questionnaires to collect quantitative data; (2) a workshop and in-depth interviews with puppetry amateurs about their understanding of Chinese puppetry for collecting qualitative data; and (3) a workshop with cross-cultural puppetry amateurs using the Digital Gesture Library and Chinese traditional puppets for storytelling to collect qualitative data.

7.4.2 Recruitment

For the *public deployment*, I installed the Digital Gesture Library in an entertainment room in a student accommodation building in Newcastle, UK. 62 visitors (28 male and 34 female) completed questionnaires; 42% of the visitors were undergraduate students, 37% were college students, and 21% were postgraduate students. The visitors all spontaneously engaged the questionnaires without any selection by me. For the *puppetry workshop and interviews*, I recruited five puppetry amateurs as participants (two British, two Spanish, and one British-

born Chinese) and split them into two groups for the workshop, ranging in age from 18 to 32 years. As in the previous chapters, the recruitment was undertaken via an announcement in Newcastle, its surrounding areas and Norwich via adverts in local galleries, social media and word of mouth. The announcement explained the design process and asked for input from participants interested in traditional Chinese puppetry (excluding any professional puppeteers). In the *storytelling workshop*, six participants (four male and two female) took part. They were allocated into three groups: (1) one British and one Portuguese university student; (2) two British artists who worked in a gallery; and (3) a middle-aged British couple. All of the visitors who attended the public deployment were random visitors. Using a snowballing method, the recruitment was performed via an announcement in Newcastle and its surrounding areas (Gateshead, Jarrow and South Shields), word of mouth and the connections made with participants of previous workshops (i.e. the six activities in Chapter 6, Puppetry Workshop and interviews). All workshop participants described themselves being interested in puppetry, with five stating that they had experienced puppetry previously; however, none of the participants had experience with traditional Chinese puppet shows. I hoped to analyse diverse users who had different cultural backgrounds, age groups, and proficiencies, to gather and explore their valuable critical accounts. It is also worth to mention that all of participants from these three activities were non-repetitive.

7.4.3 Procedure

Public Deployment

The chosen entertainment room has a certain number of visitors every day, so I did not make the extra announcement to attract potential participants. During this public deployment, the average visitor attendance in the entertainment room was approximately 8 people per day during the working week and 15 people per day during the weekend for a total of approximately 80 visitors in 7 days. I used a TV screen (1080p resolution, 16:9 aspect ratio) to display the interface of the Digital Gesture Library. A Chinese traditional puppet and element-based gesture cards were placed on the right side of the display table. The questionnaires were placed on the left side of the table. The installation of the Digital Gesture Library was displayed in the front of the entertainment room to ensure every visitor could easily see it when they came into the room. Moreover, for maintaining objectivity in the questionnaire answers, I did not show up around the installation to monitor the progress of their experiences. Thus, experiencing the Digital Gesture Library and answering the questionnaires were done spontaneously by the visitors.

Figure 63 shows the original sketches of the installation layout. The questionnaire used nine questions, of which three covered the usability of the system (intuitiveness, ease of use, and responsiveness), another three focused on the use of the interactive device and interactive engagement (vision, touch, and interaction), and another three touched upon the quality of the digital content (clarity, understanding, and continuity of interest). Table 5 shows nine questions were inquired to the visitors by questionnaire. The full edition of questionnaire can be found in Appendix B.4. Answers were given on a four-point Likert-type scale (Bertram 2015) to analyse and rank the questions: strongly disagree, disagree, agree, and strongly agree. I intended to apply this activity to reflect the intuitive data of user experience of the Digital Gesture Library.

#	Question	Survey Scale: 1= Strongly Disagree 2=Disagree 3=Agree 4=Strongly Agree
1	I easily understand the main purpose of this digital device in a short time.	1☐2☐3☐4☐
2	I easily understand how to operate this digital device.	1☐2☐3☐4☐
3	The system and interface work well.	1☐2☐3☐4☐
4	The puppets and element sensor cards are exquisitely crafted.	1☐2☐3☐4☐
5	The touch of the puppet's outfit and element sensor cards are comfortable.	1☐2☐3☐4☐
6	The interactive mode of this digital device is vivid.	1☐2☐3☐4☐
7	The quality of the videos is clear and the description is easily understood.	1☐2☐3☐4☐
8	All the videos are understandable with no barrier in the appreciation.	1☐2☐3☐4☐
9	I would like to learn more about this and want more time to experience this.	1☐2☐3☐4☐

Table 5. The questionnaire's nine questions.

Puppetry Workshop and Interviews

In this activity, five participants were invited to attend a 15-minute introductory session and split into two group, the first group has two participants, the other one has three participants. In this introductory session, the main purpose of this research and design features were introduced, as well as the video-based data collection and the operation of the Digital Gesture Library. During the session, participants experienced the system and browsed each video resource in it. Every group took 1–1.5 hours to carefully review the gestures and movements via the *Navigation Interface.* Then I showed four videos of Chinese puppet shows directly on a laptop (not via the Digital Gesture Library) for participants, which lasted roughly 30–35 minutes, and conducted in-depth interviews about their understandings of the videos. The four videos were the same as those used in Section 6.2.2 One-on-One Interviews, which include: a Quanzhou puppet show recorded from a TV programme; a live marionette performance that displayed the puppeteers' gestures; a silent episode from a Daming-Zhangzhou puppet movie; and a scene from the Heidelberg Taiwanese Budaix, which had English subtitles. However, the participants who engaged in this activity were different from the participants who previously engaged in the activity in Section 6.2.2.

The in-depth interviews mainly focused on probing the extent to which the participants understood traditional Chinese puppetry and their opinions on the four videos. The participants were asked to describe their understandings of these puppet shows in detail, as well as discuss the connection between the content of the Digital Gesture Library and the videos (e.g. were the video resources in the Digital Gesture Library helpful to your appreciation of those four puppet shows, if so, could you specifically describe how?). The group-based interviews were conducted for around 40–50 minutes and yielded data in the form of audio-recordings and observation notes. Although I chose different participants from the ones in the activity in Section 6.2.2, I intended to value the understanding of puppet shows by encouraging participants to describe the plots and stories. Therefore, this activity potentially allows me to evaluate the content of gestural elements and movement-based videos in the Digital Gesture Library and whether they can enhance cross-cultural appreciation. Furthermore, enhancing appreciation is the specific goal of this activity.

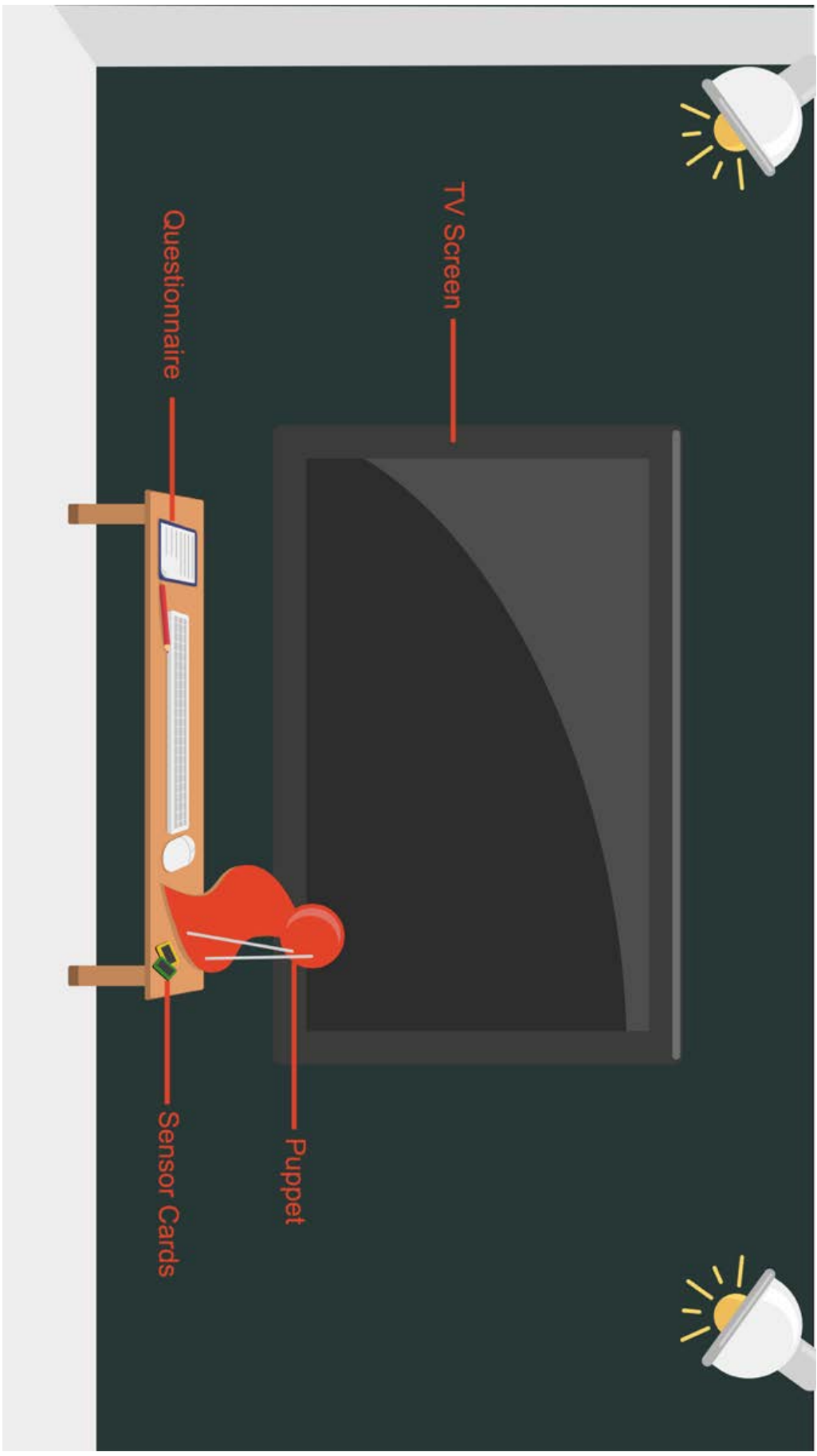

Figure 63. The original sketch of the scheme deployed.

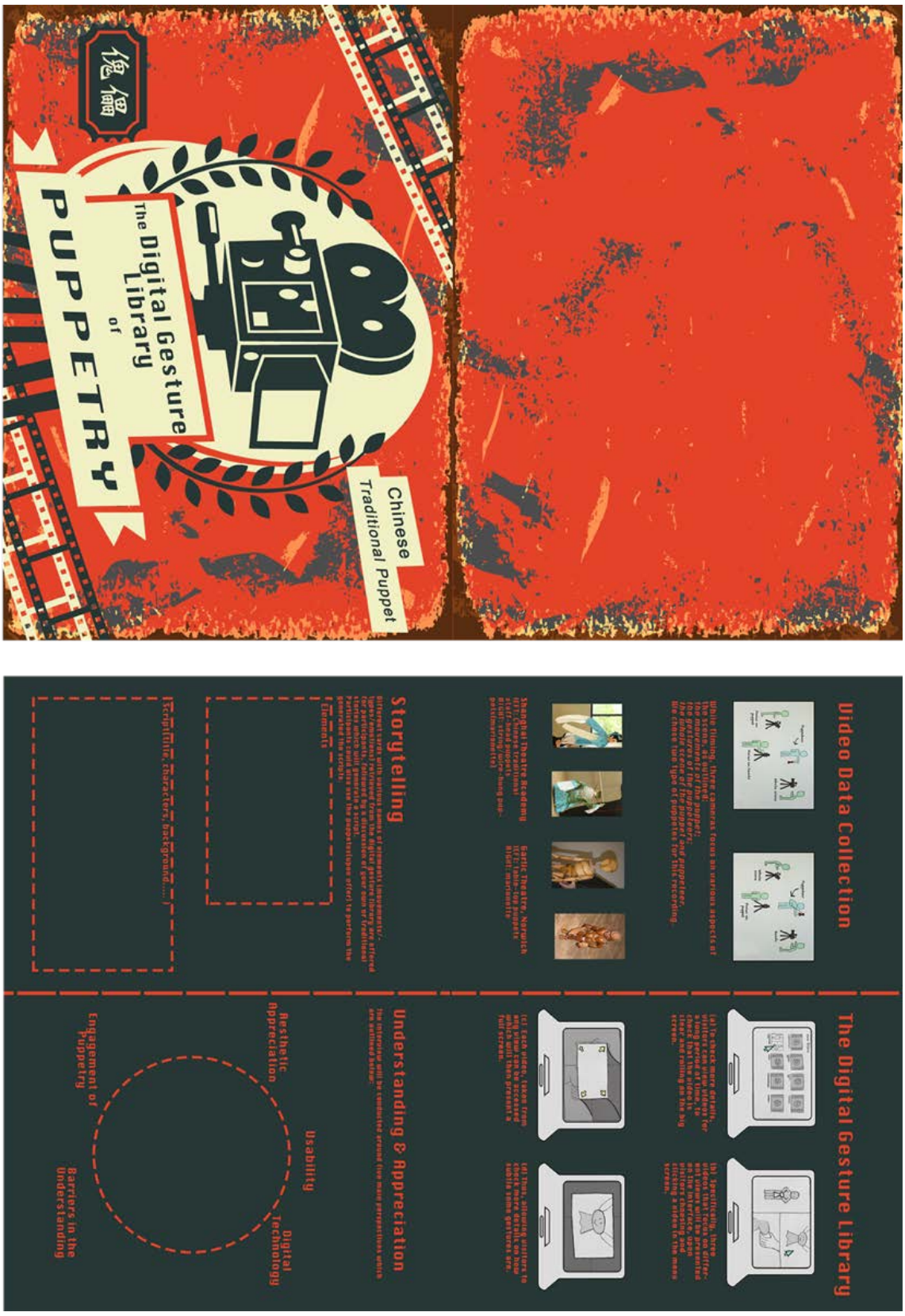

Figure 64. The brochure designed to advertise the storytelling engagement workshop.

Storytelling Workshop

In this activity, participants created their own stories using the Digital Gesture Library. Based on the connections made with participants from previous workshops (i.e. the six activities in

Chapter 6, Puppetry Workshop and Interviews), six participants (four male and two female) were recruited and divided into three groups for this activity. These groups were placed in different environments. One British and one Portuguese university student were put in a group and engaged in the workshop in their residence; two British artists who worked in a gallery formed a group and engaged in the workshop in their studio; and a middle-aged British couple engaged in the workshop in their living room.

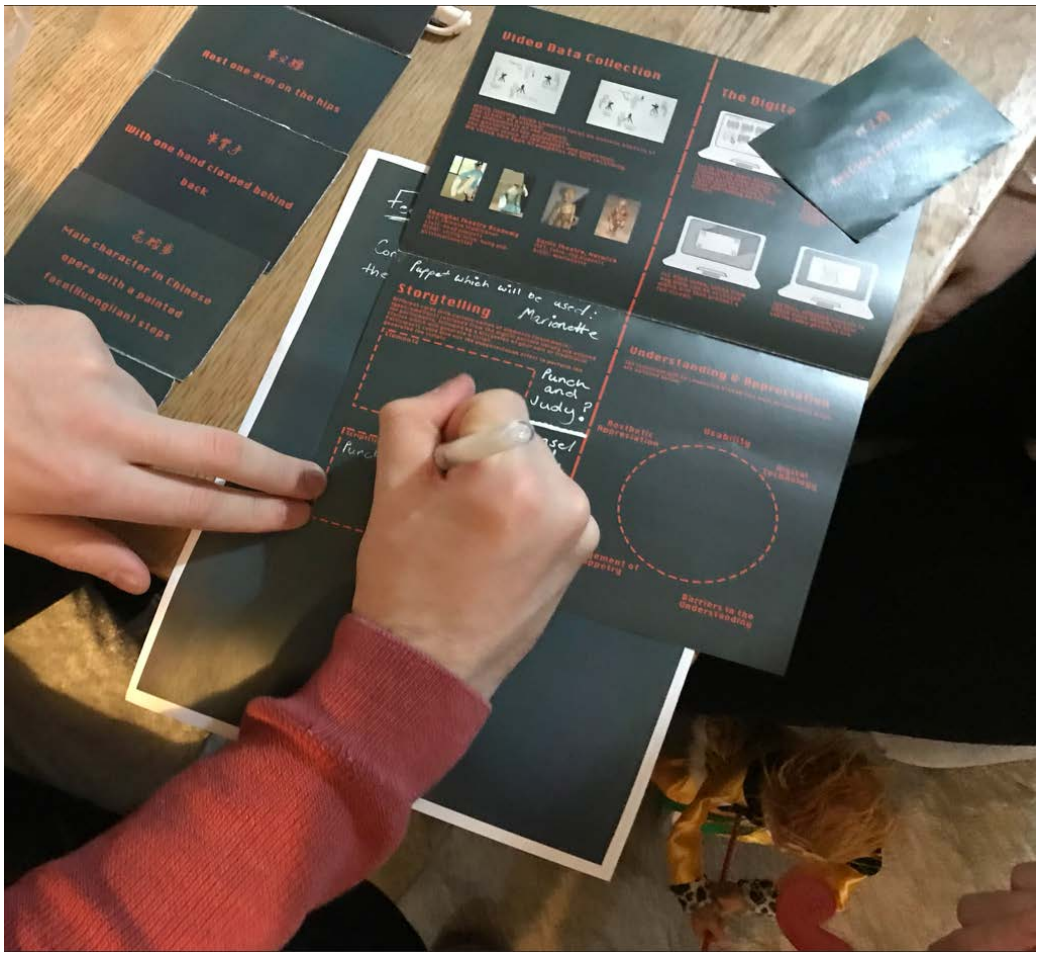

Figure 65.Two participants utilised the brochure to record their conception of their own script and potential ideas.

Before each group started their experience, I spent 30–40 minutes expounding on the purpose of this workshop and demonstrated how to operate the Digital Gesture Library. Each participant was also provided with a brochure that used images and descriptions to ensure they understood the Digital Gesture Library (see Figure 64). The workshops mainly contained four steps: experience the Digital Gesture Library, explore the puppetry stories, play their own puppet show, and reflect on and discuss their experiences and puppet shows. Participants took part in pairs. Different gesture cards with names of elements (such as movements, types, and emotions) were offered to the participants to allow them to experience the Digital Gesture

Library. Each group was offered 40–50 minutes to experience the Digital Gesture Library, which included experiencing how to use the Digital Gesture Library and spending time watching the gestures and movements of the videos. Through discussion about their own or traditional stories, participants were encouraged to follow the steps in the offered brochure to talk about and construct a puppet show script. They also utilised the brochure to record their conception of their own scripts and potential ideas (see Figure 64). Meanwhile, two traditional Chinese puppets were provided to participants so they could make a short play (approximately 20–30 mins) by combining their previously discussed stories. To help participants have immersive experiences with traditional Chinese culture, both puppets were from one of the Four Great Classical Novels of Chinese literature. From *Journey to the West*, one of puppets was a staff-head puppet based on the character Tripitaka. Another was a string-/wire-hung puppet based on the Monkey King (see Figure 66). This story would thus connect with their own previous understanding rather than what they had gained from the Digital Gesture Library.

Figure 66.Participants performing their puppet show with Tripitaka and the Monkey King.

After the workshop, I conducted an in-depth interview with each group. The questions were mainly proceeded in four parts. The first explored the barriers to their previous appreciation, the second intended to evaluate the functionality of and preferences in the Digital Gesture

Library, the third discussed the participants' interactions with the Digital Gesture Library, and the fourth involved asking them to reflect on their experiences with and appreciation for traditional Chinese puppetry. The schedule of the Storytelling Workshop and each question can be found in Appendix B.5. The process of each group was recorded as video data and observational notes as well, generating significant supplementary resources to support the data analysis.

7.4.4 Data Analysis

The collected data consisted of 62 questionnaire responses collected from the public deployment, 10 hours of audio data recorded during the two workshops, 2 hours of video data from the storytelling workshop, and participants' brochure sketches (Appendix B.6), as well as my observation notes (Appendix B.8) during the two workshops. I transcribed all of the interviews in full. First, I analysed the questionnaire data in an attempt to evaluate the usability of the Digital Gesture Library. Second, from the interview audio data, I generated codes relating to participants' understanding of Chinese puppetry and the Digital Gesture Library. Third, I analysed the video data and brochure notes as supplementary interaction notes to further understand how participants interacted with the Digital Gesture Library and how they interacted with other participants during the experience.

As before, I utilised video analysis to support my efforts to capture the interactive details during their experiences (Heath et al. 2010; Heath 2010). As there were plenty of puppetry performance-based interactions without linguistic communication in the Storytelling Workshop, I collected extensive video data that recorded the interactions among the participants, the Digital Gesture Library and the puppetry, as well as the spontaneous reactions of and discussions among participants. During the three fieldwork-based activities, video as qualitative data helped me revisit the recorded data multiple times and preserve a level of authenticity in their representation of the activities captured (Chen 2019). Furthermore, the observational notes also played a significant role in helping me have a comprehensive understanding of their user experiences. The audio and video data were analysed using thematic analysis (Braun and Clarke 2006). The observational notes as part of the transcripts were also analysed with audio and video data together. All themes were supported by data excerpts. Initial codes were generated and refined using iterative analysis to produce coherent themes that were then further refined to establish useful findings. These codes were then used to recode the data, which were subsequently clustered to create a

thematic structure. All of the data were transcribed, with participants given pseudonyms for anonymity. Below, I discuss the four main themes that emerged from the data.

7.4.5 Findings

Questionnaire responses suggest that the digital system was perceived as easy to use, intuitive, and responsive by most respondents. All of the questions in the questionnaires are shown in Figures 67 (system usability), 68 (interaction), and 69 (content). In all, 77% of respondents quickly understood the main purpose of the Digital Gesture Library (35% agree, 42% strongly agree). A similar number (79%) found the system responsive (50% agree, 29% strongly agree), while 85% rated the system easy to use (48% agree, 37% strongly agree). Respondents rated digital content both clear (33% agree, 51% strongly agree) and understandable (24% agree, 46% strongly agree). Taken together, these data confirm that visitors perceived the system as sufficiently usable. In the following sections, I explore in more depth some of the key features of the participants' experiences of using the Digital Gesture Library and provide some reflections on the use of interactive technology to support the cross-cultural appreciation of traditional Chinese puppetry.

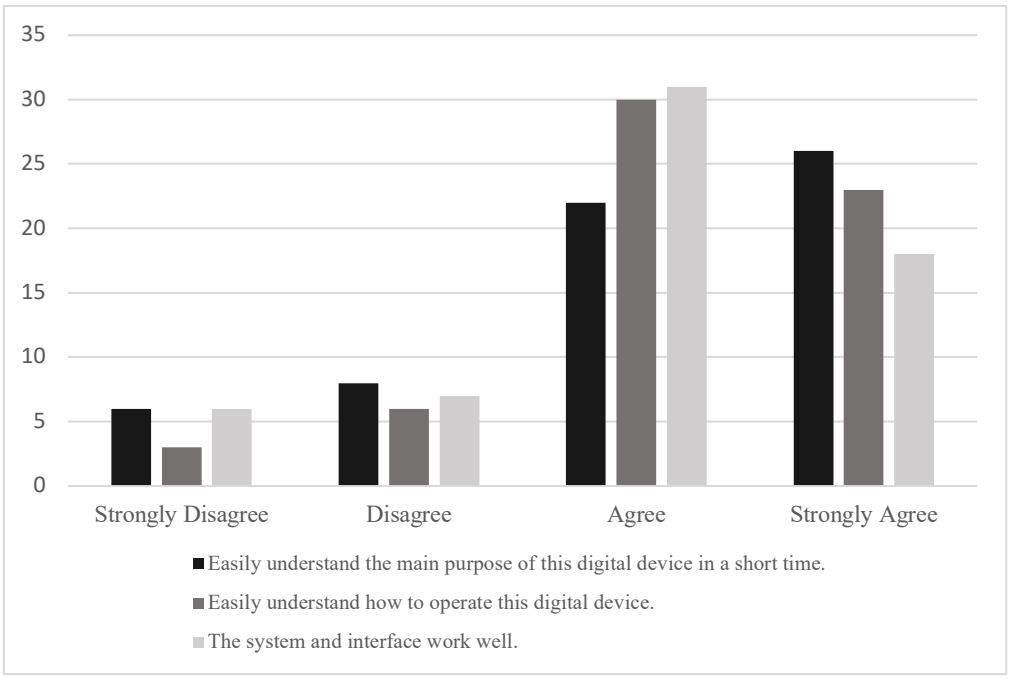

Figure 67. Part of the questionnaire content.

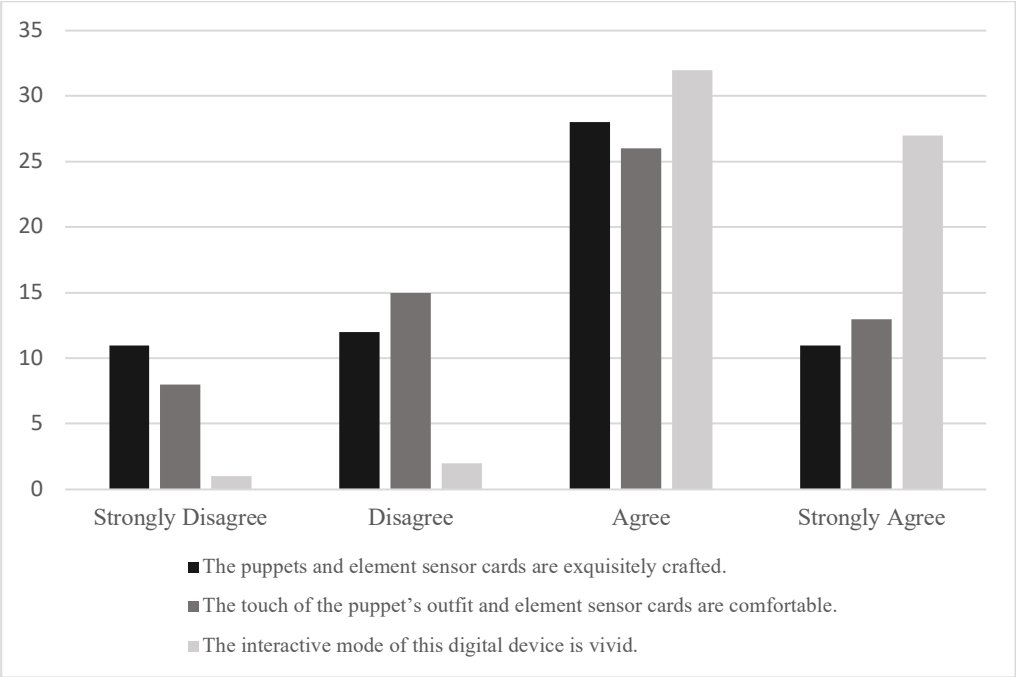

Figure 68. Part of the questionnaire content.

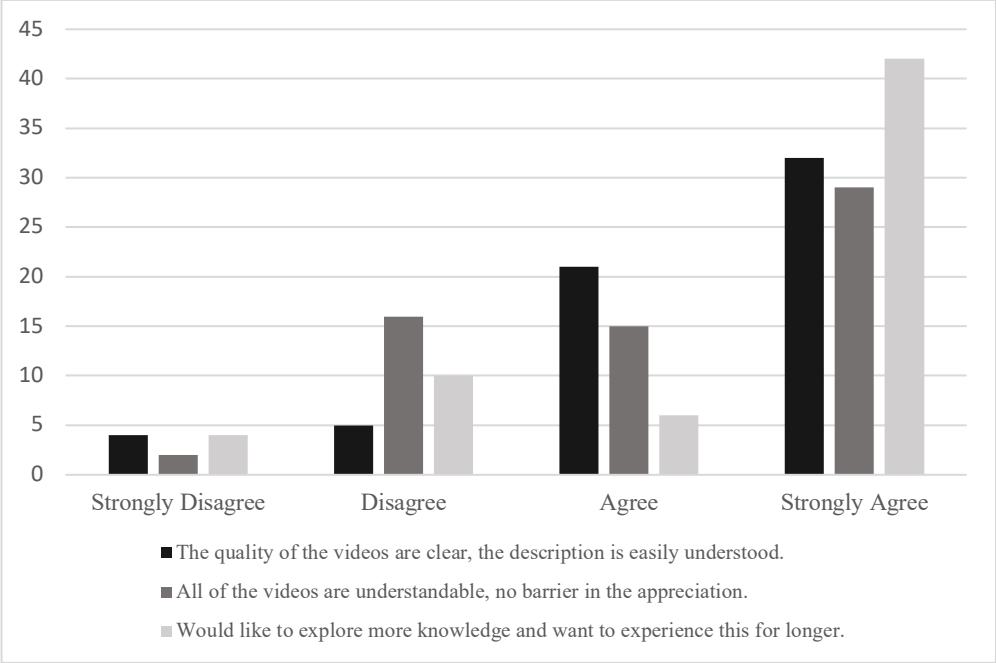

Figure 69. Part of the questionnaire content.

The Comparison of Two Activities—One-on-One Interviews & Puppetry Workshop and Interviews

I chose the same four videos of Chinese puppet shows in the Puppetry Workshop and Interviews and the activity of section 6.2.2 One-on-One Interviews for comparing and probing the extent to which interviewee understood traditional Chinese puppetry and their opinions on the four videos. For maintaining the objectivity of the result, the participants in these two

activities were different, but all were non-Chinese. To avoid confusing these two activities, section 6.2.2 One-on-One Interviews will be called the first activity and the Puppetry Workshop and Interviews will be called the second activity.

First, the fluency of appreciation in the second activity was much higher than that in the first activity. During the first activity, I was asked numerous times by participants to explain the content of the puppetry. David, one participant from the second activity, shared his experience:

> *I quite like to watch the puppet show. I seriously did not expect I could understand the content after you told me my description of this puppet show was basically very close to the real story. The gestural library helped me a lot, to be honest, because plenty of gestures in the puppet show I watched were interpreted by the gestural library before. I just wish I could spend more time to experience it first, which could probably make my watching much more enjoyable.*

Second, the sharing content and the descriptions of the puppet shows from those two activities were notably different. The differences not only included that the descriptions provided by (the second activity) participants were much closer to the real story, but also that the participants in the second activity were more enthusiastic about sharing their appreciation. I excerpted a phrase of description from Chris, a participant from the second activity:

> *This is a tragic story I think. The guy in the middle obviously is a criminal. However, in contrast, I do not think he is a bad character, I mean I am just wondering if he might be wronged. Those two prison guards looked like harsh people, because they were torturing him and forcing him to walk.*

The third interesting finding is that the understanding of the Digital Gesture Library did not distract the participants. In other words, the experiences with the Digital Gesture Library imperceptibly enhanced their appreciation of traditional Chinese puppetry. As Rachel from the second activity explained:

> *I think I spent an appropriate amount of time experiencing the Digital Gesture Library. Thus, when I started to watch the second video, I had already engaged in the performance fully without having to keep reviewing the meaning of every gesture,*

which is amazing. It is so much better to appreciate a puppet show like this rather than being confused for most of the time.

Characteristic Gestures as Ways in to Chinese Puppetry

Traditional Chinese puppetry can seem mysterious to cross-cultural audiences. The focus on gestures within the Digital Gesture Library seems to be a useful 'way in' or starting-point from which users can decrypt this unfamiliar and seemingly complex cultural artform. During their experiences of the Digital Gesture Library, the participants expressed that elements such as puppetry gestures or body language could be seen as a potential pathway to helping people understand the cultural relevance of Chinese puppetry more precisely. Especially for non-Chinese participants, the element-based gestures convey to them the clear relevance of puppetry movements. Here, participant Brian had expressed his experience:

For me, prior to this, as a foreigner, I couldn't understand this at all … but everything is different now, I clearly know the meaning of the movements. Like some body language that's used in puppetry is not international. So, it might be some internal language that they use.

The participants' understanding of the storyline was also supported by element-based gestures, which may potentially allow the non-Chinese audiences to have an enjoyable and fluent puppetry experience. For instance, participant Alex shared his thoughts:

These elements are like separated letters or words, which I can combine to be a sentence, then I can understand the story. Even though I can't speak Chinese, I still can understand this story.

Meanwhile, the focus of the participants' experience was changed by briefly observing the puppet's outfit and the background music, which enabled an in-depth understanding of the puppetry's emotions to be gained from the puppet show, which effectively dissuaded participants from failing to understand the puppet show giving up on watching it. In Sarah's words:

I watched the Chinese puppet show before, just checked some nice outfits, and some noisy music, then I stopped the watching. Because I don't understand the dialogues, this makes me feel bored. But this time, after I observed the element-based gestures, I

felt the emotions from the puppets and even from the puppeteers. I don't even remember how long I watched this show, I was really enjoying it.

Sarah further explained understanding the emotions of the puppet show:

I think the (Digital) Gesture Library was really helpful in enhancing my understanding of the emotions from the puppet show, (be)cause the gesture-based elements can precisely offer me the interpretations of basic puppetry gestures. Then I just realised how traditional Chinese puppetry normally conveyed the desperation in the show. This helps me have a much more empathic experience during my appreciation, because I can feel the emotions that puppetry expressed.

Decrypting Chinese Puppetry Through Examining Gestures

Participants' curiosity around Chinese traditional puppet shows was stimulated by their experience of viewing gestural videos presenting different perspectives. Some participants had said that they did not notice the gestures of the puppeteers themselves, and similarly had overlooked the interaction between the puppet and the puppeteer in their previous experiences. However, it is the 'secret (i.e. how to manipulate puppetry)' behind the puppet shows that the majority of the participants were genuinely interested in.

The participants often discussed their sense that the experience of the multi-perspective view provided a more comprehensive understanding of puppet shows. The attentions of the participants were not only focused on the performance of the puppets, as participant Thomas mentioned:

I think it's the three perspectives as well on some of them, so from all the different perspectives it gives you an idea of how puppetry looks from all different angles and how you can do it from just looking at those different angles.

In the Digital Gesture Library, the three different perspectives from the three different camera positions can be switched randomly, and any video can be displayed in full screen mode, allowing participants to explore the details of specific videos and concentrate more on a particular gesture or movement. This feature received great praise from the participants. For participants such as Paul, this type of interaction helped them to form a self-exploration approach to the puppetry experience:

I think it's a quite good function. I like how it gives you the option to have a look at three different screens. Especially, I can choose any viewpoint by myself, step by step, some of them I watched for so many times until I found the secret.

The ability to move between gestures and to explore each gesture from three perspectives, enabled users to examine gestures in greater detail, which supported their process of 'decryption'. In this process, as noted, the participants' exploration was not limited to the gestures of the puppets but also included observing how puppeteers manipulate the puppets.

Tangibility of Chinese Puppetry

The different interactive approaches supported by the Digital Gesture Library encouraged participants to spend more time exploring the subtleties of traditional Chinese puppetry.

(1) Card Support Interactions and Storytelling with Multiple Gestures

By analysing participants' feedback from the workshop, I found that their expectations of the puppetry experience were not limited to simply watching a puppet show. Participant Jade, for instance, explained that she enjoyed reading the Chinese and English explanations on the cards, which helped her gain a rough understanding of the gestures and how to create a sequence through the different element-based cards to record her progress:

With the library you could put lots of different videos together and make a story, like the randomisation of the cards. Read the meaning first. Also, when I used the cards it would remind me of what video you've watched so you can keep going back and forwards without forgetting what the movement was or what video it was that you were on.

The element-based also gesture cards connected personal stories or emotions to the puppet show, as shared by participant Brian, who explained that this type of interaction offered him an immersive experience:

I think after using the element cards and building my story I think it was quite fun. And just feel like I am being a part of a Chinese story. I would say the element cards are the tools that helped me engage me in the scene of the puppet show, and when we were doing our own puppet show we also used this tool to integrate our personal

emotions within the gestures. I think this is a real experience of (traditional Chinese) puppetry, because we are using the specific gestures from (traditional) Chinese puppetry to express our own emotions and our stories.

(2) Puppets Develop Understanding Through Sensory Experiences

Holding the gesture card to touch the Chinese puppet was also discussed on numerous occasions by participants, such as Alex, who displayed interest when interacting with the puppet:

I prefer scanning it than actually going through the videos by themselves. Cos it's like I can touch the puppet and have an interaction with it. I haven't experienced this before.

In addition, the puppet display and interactions with it could also encourage the participants to closely explore the mechanisms and movements of the Chinese puppets themselves. The participants enjoyed getting to know the subtler details of the puppets, as Thomas described:

We think this puppet looks gorgeous, we observed how they were moving the arms, it's different [from] my previous imagination. Not like just watching it, I never thought I could actually really play this.

Moving Between the Parts, the Whole, and Elsewhere to Develop Understanding

I found that 77% of the respondents expressed that they want to explore more knowledge after this experience (45% agree plus 32% strongly agree). During the workshop, I noticed that participants interacted with the application based on their personal understanding of the gestural elements. For instance, Thomas did not go straight to viewing the gestures in the digital library first, but only after he watched the puppet show, which meant he was generating questions. that could be answered when using the library:

So, for me, the step one is you watch your puppet show and then step two is you use the library to recap the movements. Then following on from that maybe you re-watch the puppet shows so you can understand the dialogue and what's happening. I think this process is helping me get familiar with the gestural language. If I understand the 'language' then I can understand the plot and explore the cultural significance. Otherwise, I can't seriously appreciate puppetry.

Moreover, as seen in the interaction within Group 3, participants searched the different relevant elements of the gestures initiatively through comparison to explore and discuss their in-depth meaning. For instance, Sarah paused the video of the 'Flipping the sleeve' gesture, and began watching the 'Hand on sleeve' and 'Cast sleeve' gestures, and elaborated from this:

> *I compared those similar gestures which was able to help me understand the accurate meaning, I think this is really important for understanding the whole plot of the story.*

From Group 2's interaction notes, I found that participants used their mobile devices to search online for more background information on Chinese puppet characters and Chinese traditional folk stories whilst using the digital library. This activity was based on their group discussion during their engagement, which guided them to explore more aesthetic knowledge from a lower to higher scale:

> *During the discussion, they used the internet to search Chinese traditional stories to get to know the background stories, and grasp some knowledge of the character of the puppets.* (workshop observation notes)

Meanwhile, when the participants in Group 1 were performing their own puppet show, they also combined their personal emotions and stories to match the Chinese characters. For instance, they listed a series of emotional words from the element cards as notes to form the main scene of their script and then further developed their story for their performance:

> *Paul and Jade researched Chinese folk music as background to help themselves in the cultural atmosphere. They first chose the elements cards of sad walking, dancing, shocked, and crying, jumping, and anxious to form the main atmosphere and scene of their story. Then they wrote these elements on the brochure I offered them to facilitate a discussion of the overall plot and online searching to explore the Chinese folk opera to match it with their performance.* (workshop observation notes)

Their understanding of the puppet show was then not only limited to the gestural meaning but also extended to relevant Chinese cultural background and interpretations:

> *We found a very common example of Chinese folk music to use as background music, we like to discover more relevant knowledge to make us more connected to the show, and we can get to know so much more Chinese traditional cultures at the same time. The process of searching was really interesting as well, because it's a good process to support us in acknowledging the Chinese culture.*

After participants finished their engagement, I found that they did not stop their discussion with each other at this point, but recorded elements and developed a script for another spontaneous performance, eager to continue to explore Chinese poetry. Further activities from Group 1 were as follows:

> *After they finished their performance, they still talked about their stories and immersion in the stories. They asked me where they can watch the puppet show with string-/wire-hung puppets, and surprisingly, they mentioned the Quanzhou puppet in their discussion, which I did not mention to them previously. Also, they talk about wanting to let their kids experience this in order to allow them to get to know Chinese traditional cultures.* (workshop observation notes)

7.5 Co-Design Workshop

After completing the series of activities from the user study (see Section 7.4.3), some participants expressed the desire for more discussion or further activities engaging audiences with Chinese puppetry using multimedia systems (see Section 7.3.1) and tangible user interfaces (Section 7.3.2). To explore the potential of these systems, I organised a co-design workshop including voluntary participants from previous user studies (see Section 7.4.5). Participants discussed the following two questions: how and where they would like to utilise any such prospective interactive applications and the functions they would include in the design of such applications.

The workshop included five participants from the user studies. Two, both British amateur puppeteers, participated in the puppetry workshop and the interviews, while the other three (two British/Portuguese university students and one British artist who worked in a gallery) participated in the storytelling workshop. The data collected included brainstorming sheets, design posters, wireframes, prototypes, and notes.

7.5.1 Procedure

Figure 70 shows the procedure of the co-design workshop. The first step was an introductory session to initiate the project and explain the workshop's main purpose. Each participant talked about their personal puppetry experience: whether they had been audience members or puppeteers, what types of puppets they were familiar with, and where and under what circumstances they had experienced puppetry. They also shared their personal appreciation of puppetry and their complex and multivalent experiences with it. Based on this discussion, participants wrote down specific keywords encapsulating their thoughts on sticky notes. They then classified each keyword based on type (e.g. marionette; string puppet), location, occasion, and experience method (e.g. live performance; online videos) and attached them to a whiteboard (Figure 71).

In the second stage of the workshop, I introduced two sections of the Digital Gesture Library to participants (the multimedia system and the tangible user interface). Participants were given time to experience the library and ask questions on its functionality; they then discussed their impressions of the system, including (1) the most appropriate atmosphere, environmental setting, target users, and (2) the missing functions they would like to add.

Based on this discussion, participants then developed two design ideas for further developing the Digital Gesture Library. They brainstormed suggestions for the future design, considered feasibility, and wrote ideas out as mind-maps and wireframes.

In the final stage of the workshop, participants made paper or other prototypes to present their initial design ideas, focusing on design needs and details. Figure 72 shows one of the paper prototypes designed by the participants. They designed the interfaces that integrated the Digital Gesture Library with the Chinese whisper game to explore how to make gesture-based appreciation become a family game app. They also shared their thoughts on future work.

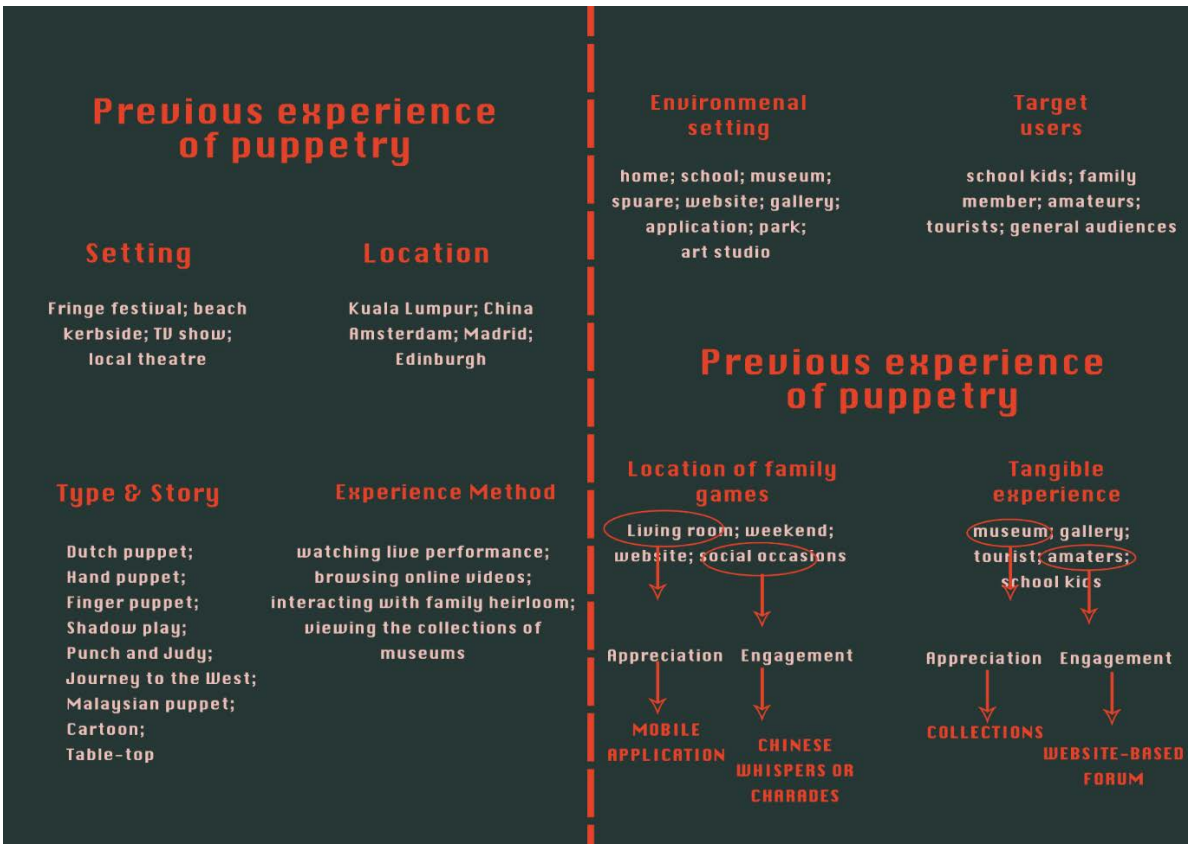

Figure 70. Co-design workshop procedure and summary of main findings.

Figure 71. Paper notes of the co-design process.

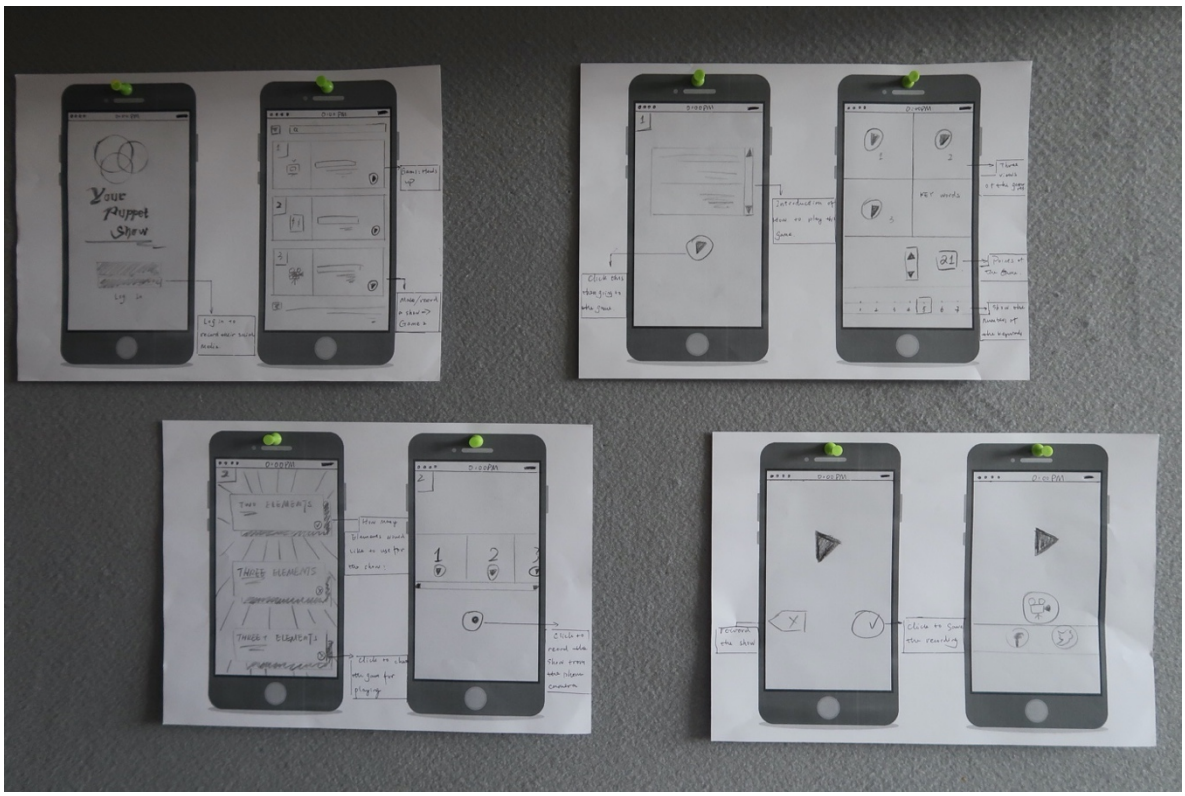

Figure 72. One of the prototypes of the participants' initial design idea.

7.5.2 Findings

Based on participant discussions, this section offers some reflections on where workshop participants had previous experienced puppetry and the Digital Gestural Library: in educational experience based on family games and in displays in public spaces.

Educational Experience Based on Family Games

This section discusses how interactions between parents and children can convey the educational significance of traditional puppetry. When discussing their previous experience with puppetry, participants highlighted 'school kids' and 'family members' as target users. They believed that if the elemental archive could be utilised on mobile devices, it could provide a participatory learning environment that would enable and encourage children to learn about traditional culture with their parents. Participants preferred using their smartphone or tablet to browse the Digital Gesture Library with their children, as this offered the convenience of viewing it anywhere and at any time. Participant 3 emphasised:

> *I think learning local and foreign cultures is instructive for children's education. We can use our phone or iPad to check this archive, which would be great and really convenient.*

They also highlighted the importance of making the Digital Gesture Library fun. In other words, interactive devices are not only for displaying knowledge, and, as they suggested, future design work should focus on adopting interactive methods to engage children and encourage them to explore cultures using the Digital Gesture Library through such means as educational games. For instance, participants talked about integrating videos from the gesture library with the Chinese whispers game or charades to engage children and parents (see Figure 72). Participant 1 said:

> *I think we could design some games based on the mobile devices with some educational significance. So the parents can also engage in games with their children to create an edutainment environment during family times.*

Displays in Public Spaces

Participants also reflected on how to display the Digital Gesture Library in public spaces. Ideas included museum collections, theme-based experiences, and an online forum.

In terms of the former two ideas, participants suggested that the gesture-based archive could be combined with the puppets from a museum collection, and that viewers could watch the puppetry gestures of historical puppets in museums, as expressed by Participant 5:

> *So, the puppets from the museum will become vivid, rather than just being displayed in there, which is quite boring*.

When discussing design ideas, they suggested that professional puppeteers could be invited to manipulate the collection of puppets and that their recorded gestures and movements could then be input into the Digital Gesture Library. Museum viewers browsing the Digital Gestures Library could then play with replicas of the collection's puppets to experience the puppetry directly and tactilely themselves. Participants also highlighted the fact that theme-based experiences could support museum viewers' understanding of puppetry cultures. For instance, some mentioned that the museum could offer each puppetry collection a digital screen to display specific gestures. Museum viewers would thus have an opportunity to acquire knowledge (e.g. regarding characters or literary quotations) about the historical puppets. Participant 4 offered her thoughts:

The individual digital screen could specifically display those puppetry gestures, so at the same time we can get to know about the local cultures or other foreign cultures through these puppets.

Participants also discussed how to display professional puppetry through an online forum with the support of the Digital Gesture Library and how to continuously supplement the gestural data to expand the database and help amateurs and hobbyists enhance their puppetry skills and knowledge. The participants supposed that puppetry amateurs would like to upload their own gestural videos to the Digital Gesture Library, forming an online forum to gather puppetry professionals and amateurs and facilitating communication among them.

Participants came up with two more specific design suggestions: multifunctional watching and commenting on gestural videos. In the former, website users could edit online gesture videos to connect with different gesture videos, combining them to form a series of videos based on their individual demands or understanding. The edited videos could be used as video resources to support users rehearsing their own puppet shows, for example. As for website-based comments (such as message boards), they could be used to engage puppetry amateurs, bringing them together, generating discussion on puppetry, and allowing users to broaden their appreciation of different puppetry performances.

7.6 Reflections on Appreciating Traditional Chinese Puppetry via Interactive Technology

Based on the data gained from designing the Digital Gesture Library and studying its use, I will elaborate on the contributions of this Ph.D. research to HCI and the digital heritage community.

7.6.1 Reflections on the Puppetry Study

The design of the Digital Gesture Library was strongly informed by the fieldwork with puppetry stakeholders, which enabled me to incorporate their professional expertise into the content of the archive and determine how it should be organised and interacted with.

The puppeteers advised me on what significant, characteristic gestures to record and how to categorise them. This helped me gain an in-depth understanding of traditional puppetry that was faithful to the original purpose of the performance (Levoy et al. 2000). It also helped me accurately extract distinctive elements. Traditional puppetry is a form of gestural art, and

puppetry gestures have thus played a vital role in communicating cultural significance and traditional storylines (Convention for the Safeguarding of the Intangible Cultural Heritage 2003). Although some digital applications manage to increase users' entertainment considerably, the performance and gestures themselves also become over-simplified. Between design for entertainment-oriented puppetry and design for puppetry learning, supporting cross-cultural audiences' appreciation of – and engagement with – traditional Chinese puppetry could stand as a further design opportunity. Thus, I conceived of a Digital Gesture Library representing gestures from multiple viewpoints in order to most effectively communicate the typical gestures of puppets, those of puppeteers, and the overall performance scenes and retain them in a digital archive. Supported by the Digital Gesture Library, the participants took part in storytelling and initiated self-expression through their own puppet shows while exploring traditional Chinese culture.

During the fieldwork, I only collaborated with a few puppeteers and was only able to record a small number of gestures. In addition, the videos only covered three types of traditional Chinese puppetry; this limited fieldwork restricts the meaning of the findings to a certain extent. However, as evidenced by the participants' reflections, the current content of the Digital Gesture Library still effectively enhanced their cross-cultural appreciation of traditional Chinese puppetry. Moreover, there are other perspectival possibilities that could be designed and developed; for instance, one that allows for a first-person view, which will offer audiences the chance to observe puppetry from the puppeteer's standpoint. I perceive this scope for expansion as an explicit strength of the approach.

Like many traditional qualitative research methods, there is specific value in idiographic case studies (detail over generalisability). In this research, the methods of the fieldwork and design, as well as the interactive technology I used and created, all constitute an additional form of critical reflection embodied within the application's development and deployment, regardless of the findings.

7.6.2 Interactive Technology for the Cross—Cultural Appreciation of Chinese Puppetry

A major barrier to cross-cultural audiences' appreciation of Chinese puppetry is a lack of familiarity with the Chinese language and culture (Xu and Xin 2007; Zhao et al. 2018). Although the puppets' gestures are derived from human movements, they have also been heavily influenced by traditional Chinese opera (Chen and Clark 2010). Therefore, a key

question for the user study became: How does the Digital Gesture Library enable cross-cultural users to understand Chinese puppetry?

The Digital Gesture Library recorded the features of gestures involving different types of puppets, characters or roles, and emotions. This gave the participants a clear and concise synopsis of the relevant background knowledge. From the analysis of the questionnaires and workshops, I noticed that the participants understood the puppet show they saw well and were able to retell its main storyline. They also shared their thoughts on the subtle differences between puppets' emotional expressions, rather than relating only a rough experience of the story. To be more specific, the emotional expressions of the gestures accurately delivered the main content of the puppet show, as well as the role-related characteristics, which further enhanced the appreciation. The gesture library goes a long way to overcoming the linguistic barriers faced by cross-cultural audiences. Although the gesture library did not convey the complete plot of the puppetry performance to the participants, they did obtain a general understanding of the story's thread, such as the representative qualities and emotions of the puppetry roles. In addition, they were interested not only in the puppets' gestures but also in the interactions between the puppets and puppeteers and the scenes and settings of the performance as a whole.

(1) The three-perspective view

Compared to the traditional way of watching a puppet show, the three-perspective view offered participants the opportunity to explore the mystery of puppet performance themselves and gain a deeper and broader understanding of puppetry performance and gestures. The participants experienced multiple operational modes (such as switching angles, pausing, and replaying a gesture) in watching element-based puppetry performances. The performance of traditional Chinese puppetry includes the puppeteers' gestures, movements, facial expressions, steps, and interactions on stage with other puppeteers, all of which facilitated the participants' understanding of the performance and their ability to engage with the story. Indeed, it is uncommon for 'actual' audience members to be able to observe the subtlety of puppeteers' gestures, which indicates an added affordance of the three-perspective approach. Furthermore, the three-perspective view can also improve the autonomy of participants' puppetry appreciation, allowing them to alternately choose to appreciate the subtlety of gestures, take in the entire performance, or both, based on their own understanding. The unrestricted switching of the three-perspective view and engagement with element-based puppetry gestures offer participants a new way of appreciating traditional Chinese puppetry,

which differs from the appreciation of conventional, theatre-based puppetry (to which I do not think the Digital Gesture Library poses a threat, however). The three-perspective view offers participants understanding-based appreciation rather than mere plot-based observation, and it may be quite helpful and constructive to expose cross-cultural puppetry audiences to understanding-based appreciation before they go to the theatre, as it may help them effectively integrate their appreciation there with the traditions and traditional knowledge of Chinese puppetry.

(2) Gesture cards and tangible interface

The participants stated that using the gesture cards to interact with sensor-augmented Chinese puppets enabled them to act out gestures associated with the cards, greatly increasing their interest in interacting with the puppets. While using the gesture cards, the participants thought about and appreciated the puppets' actions more logically. According to their own understanding of puppetry gestures, they were able to place the gesture cards in the narratively meaningful and aesthetically effective order to record a personal document of their appreciation. For instance, they used gesture cards to record which puppet gestures they would like to watch again or wanted to discuss with other participants. Furthermore, they could select cards and combine them to create a gestural template to support them in conducting their own puppetry performance. Beyond that, the participants repeatedly mentioned that they enjoyed interacting (e.g. touching) with the puppets' outfits. This interaction encouraged them to be more curious when exploring the mystery of Chinese puppetry and allowed them to more closely observe the nuances of the puppets themselves (for example, appearances, outfits, characters represented, etc.). Prior to engaging with the puppets, it would be beneficial for participants to interact with the puppets in order to gain familiarity with these affordances as well as gestures (Martínez 2014). This would narrow the gap between audiences and puppetry practice. Also, a tangible interface could be entertaining and encourage users to engage with the Digital Gesture Library.

After analysing the cross-cultural participants' experiences of the Digital Gesture Library, I found that it effectively helped those from different cultural backgrounds overcome language barriers. The participants were able to gain in-depth artistic knowledge of puppetry performance. Extracting the multi-perspective gestures as an element-based library was not intended to (and, I think, did not) reduce the complexity of this cultural artform, but to identify key components that characterise the complexity of the artform, while not exhaustively representing the culture itself.

7.7 Conclusion

This chapter has presented an in-depth description of a case study using interactive technology to support cross-cultural appreciation of traditional Chinese puppetry. First, I summarised my own qualitative fieldwork with professional puppeteers in both the UK and China and described the methods employed for this study. Then, using thematic analysis of interview data, I suggested feasible design conceptions to support cross-cultural appreciation, illustrate important design approaches that support ICH safeguarding, and explore the role of digital ICH research. To this end, I developed an interactive system called the Digital Gesture Library, whose design was guided by insights from prior fieldwork and interviews with professional puppeteers. I also used a mixture of questionnaires, focus groups, and workshops to gather reflections upon aspects of the audience experience. Specifically, the findings explore how the Digital Gesture Library used characteristic gestures as 'ways in' to appreciating complex performances; a dynamic interface and three-perspective view to enable users to examine gestures in detail; a card-based, tangible interface to help users appreciate multiple gestures and their place in performance narratives; and physical Chinese puppets as part of the interface, to deepen appreciation and encourage further exploration via sensory experience.

Chapter 8. Discussion

8.1 Overview

This Ph.D. research focuses on the role of interactive technology in supporting appreciation of Chinese ICH to further its safeguarding. It employs perspectives offered by cross-cultural audiences and ICH stakeholders as a logical, critical tool to problematise barriers to the cross-cultural appreciation of Chinese cultural heritage and traditions. The motivation for this research is to create a space in which to combine interactive technology with Chinese ICH to further support (cross-)cultural appreciation, learning, and experiences, as well as to explore the role and position of HCI research in this complex and controversial realm, yielding design implications for HCI researchers and digital heritage researchers.

This discussion consists of six parts that elaborate on the respective contributions of this Ph.D. research to HCI and the digital heritage community. In 6.2 and 6.3, the study addresses the usability and efficacy of interactive applications, based on the investigation of users' experience in two case studies (Chapters 4, 5, 6 and 7). In addition, it reflects on a series of interactive design strategies and challenges related to fostering the aesthetic appreciation of Chinese painting and puppetry. To explore how to integrate interactive technology into the safeguarding of Chinese ICH, 6.4 looks at the entire Ph.D. research and on its basis presents two targeted design suggestions. From the angle of fieldwork, data collection, and design, 6.5 discusses the limitations of the current study and offers a conceptual direction for future research. Last, 6.6 offers a novel method for deconstructing cultural elements based on the HCI perspective to enhance cross-cultural appreciation of Chinese ICH.

8.2 Reflection on Research Questions

Here, I would like to review the three research questions that represented the three phases of this Ph.D. research: 1. seek the potential barriers to cross-cultural appreciation; 2. integrate knowledge generated by the literature review and suggestions from ethnographic fieldwork with design concepts that help audiences overcome challenges to cultural exchanges (e.g. language, dialect, custom). 3. reveal the specific interactive technologies adopted based on the design process and evaluates users' experiences to form a series of design methods that enhance cross-cultural engagement with similar forms of heritage. The answers to each are based on analysis from the previous stages. In this section, I will review the process of this Ph.D. research by discussing each research question. Three keywords were used to describe and summarise the main target of each question: *barriers*, *opportunities* and *design*.

8.2.1 Barriers to Cross-cultural Appreciation

In the case study of traditional Chinese painting, specifically in Chapter 4, I conducted the study to probe how non-Chinese viewers appreciate Chinese painting. Through evaluating their understanding of some representative elements of traditional Chinese painting, such as interpreting traditional Chinese colours and painting themes, I analysed their incomprehension (barriers) factors toward traditional Chinese painting and their habits during the appreciation. More importantly, the assessment process also helped me explore how to use colours, subjects and interpretations to create a sense of participatory appreciation with supplementary aesthetic knowledge to facilitate non-Chinese viewers' appreciation. To be more specific, the non-Chinese participants (colours–subjects–interpretations) focused more on logic and cultural background rather than highlighting the uniqueness of this approach. I chose high-frequency keywords from the non-Chinese participants' discussion; however, other keywords could still be found to serve as complementary elements that supported their appreciation of Chinese painting. On the other hand, some degree of incomprehension of the colours and subjects remains within the process of appreciation.

In Chapter 6, I conducted extensive ethnographic fieldwork to reveal the cultural barriers affecting peoples' experiences of Chinese puppetry and to determine how to help puppeteers and stakeholders to overcome these barriers. The findings were analysed and involved multiple perspectives that were collected from experienced professionals, learners, amateurs and cross-cultural audiences. The barriers cross-cultural audiences faced were diverse and complicated. The different languages or dialects were identified as the main barriers to understanding (Xu and Xin: 2007). Despite implementing methods such as providing background information on a performance, character analysis, and English/Mandarin subtitles, cultural barriers still remained and overall feedback was unsatisfactory. Moreover, plenty of puppetry dialogue was presented in classical Chinese language, and a better appreciation experience required audiences to have a basic understanding of Chinese agricultural culture and opera (Proschan: 1981; Zhao: 2016). Furthermore, a lack of understanding of the metaphorical elements of the narratives in the show also further led to the interviewees not being able to coherently understand puppetry characters and stories.

However, the literature review in Chapter 2 and ethnographic fieldwork during these two case studies not only revealed the barriers embodied in the cross-cultural appreciation, but also offered the speculative design thinking as to what opportunities interactive technologies present for cross-cultural appreciation.

8.2.2 Potential and Opportunities

Regarding the second research question—what opportunities interactive technologies bring to these art forms—integrating the reflection from reviewing the previous case studies with the findings from ethnographic fieldwork helped me form the initial design concepts.

Storytelling is an effective method that engages people to experience heritage; however, the technique, craftsmanship, and other aesthetic knowledge also embody the significance of ICH. Thus, how to embody the significance of the aesthetics in the appreciation is one of the significant findings from reviewing the previous case studies, especially for helping the viewers/audiences who are not familiar with these artforms. Furthermore, maintaining the integrity and originality of the artforms during the appreciation and experience is also crucial. For instance, the digital tools might diminish the interest in the artistic tradition if the essential characteristics of traditional Chinese painting are not preserved. Gestures and movements of traditional Chinese puppetry may be oversimplified in interactive systems, which may lead users to have an incomplete understanding of traditional Chinese puppetry. Seeking an answer to this issue would require me as the researcher to conduct extensive fieldwork to analyse and deconstruct the artforms per se. The representative cultural elements could enhance cross-cultural appreciation effectively and accurately. Textual analysis and archival research helped me grasp the historical origins, background knowledge, subject classifications, and other information related to aesthetics literature on traditional Chinese painting and puppetry. Moreover, ethnographic fieldwork further helped me seek the potential design opportunities.

First of all, based on the Appreciation method (colours–subjects–interpretations) analysed in Chapter 4, I supposed that an element-based archive of colours and subjects may offer a way to supplement understanding and overcome the incomprehension of the cultural elements in traditional Chinese painting. Moreover, I supposed that colours, as one of the components of a non-Chinese viewer's appreciation approach, would not conflict with their incomprehension of genres; instead, I focused on figuring out how to aid non-Chinese observers in understanding and appreciating traditional Chinese painting's colour. Some typical colours with Chinese themes and other relevant aspects, as established collections, formed the specific styles and aesthetics of the genres in traditional Chinese painting. Therefore, I believed integrating the colours and subjects as elements could help non-Chinese viewers develop a more reasonable understanding and appreciation of them. This mapped out a conceptual

direction for the design study, which allowed me to further explore how to use interactive technology to boost appreciation based on these elements.

Second, in the case of complex puppets such as marionettes, helping the audience develop a complete understanding is crucial. I 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 in Chapter 6 showed that enhancing the gestural understanding could potentially help participants acquire a coherent appreciation of puppetry stories and increase their interest in the performance. Most of the participants described this video as their favourite because the story was understandable and interesting; they were curious about how the puppeteers accomplished the complex acrobatics in the clip. Their reflection also demonstrated 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 help viewers understand it better. Specifically, they preferred to see detailed gestures with explanations when they were watching a puppet show. Gestural understanding could be utilised as an acceptable strategy to help audiences acquire complementary knowledge of puppetry.

With the above-mentioned opportunities, in the following section I will discuss the specific design strategies and techniques that were reflected in the design studies in Chapters 5 and 7.

8.2.3 Strategies, Techniques and Design Process

I will try to answer the third research question from two different perspectives. One is from the design strategies utilised, and the other is from the specific interactive technology that could achieve the design strategies. In both case studies (traditional Chinese painting and puppetry), I designed the aesthetic element-based digital archives to aid cross-cultural viewers/audiences in appreciating these two artforms. Based on this design (element-based digital archive), I applied multiple interactive technology (e.g. gestural engagement and multi-touch-based mobile access, and gesture cards with tangible interface) to further enhance cross-cultural appreciation.

Using the digital archive to offer people insight into an objective understanding of the history and to preserve the data of heritage for long-term use, in section 2.5.3 The Digital Archive of Heritage and Motion Capture I reviewed case studies that use digital archives in the digital

heritage sector and digital humanities (Baker and Cantillon 2020; Brusaporci 2020a; Król and Hernik 2020). With the goal of preserving heritage and supporting education and scholarly research, digital archives commonly utilise texts, databases, still and moving images, audio, graphics, 3D models, software and web pages as metadata in order to collect and manage heritage for museums and libraries (Clark 2001; Koller et al. 2010; Page 2011; Jarlbrink and Snickars 2017). Moreover, digital technology enhances the accessibility and multiplatforms of the archives (Bogdanova et al. 2010). However, digital archives are currently primarily focused on collecting and preserving the information of heritage rather than communicating and fostering appreciation for the heritage. Maina and Suleman (2015) believed that digital archives have largely become collections of work by professionals in the domain; the highly specialised nature of these environments makes it much more difficult for viewers/audiences to engage and interact with the contents (Hampson et al. 2012). Specifically, from a perspective of safeguarding ICH, the questions of how to collect intangible cultural significance and reflect it to overseas-viewers and how to utilise the content of digital archives with the support of interactive technology to engage the interest of viewers have not been well discussed in the existing case studies. Therefore, I designed the aesthetics element-based archive that integrates interactive technology to support cross-cultural appreciation of ICH. Based on the perspectives of heritage stakeholders (e.g. professionals and practitioners) and potential cross-cultural viewers/audiences, I conducted extensive ethnographic fieldwork to collect and design the content of the archive.

In the case study of Chinese painting, I utilised the extracted elements (e.g. colour and subjects) of traditional ink painting to combine an understanding of the colours with the expression of subjects to potentially map out a technique of appreciation. The digital archive also effectively integrated and reflected these aesthetic elements, which offered a more flexible method to guide audiences in independently exploring the different dimensions of Chinese painting without limiting their own understanding and imaginations. Furthermore, I extracted and collected gesture-/movement-based elements of traditional Chinese puppetry into the designed digital archive (Digital Gesture Library) as a three-perspective view to be demonstrated. Based on the reflections on the user experiences in Chapter 8, the autonomy of participants' puppetry appreciation was improved via the Digital Gesture Library. During the experience, the users were aided in choosing to appreciate the subtlety of gestures, take in the entire performance, or both based on their own understanding. Cross-cultural appreciation rather than mere plot-based observation was offered by the Digital Gesture Library, and it

may be helpful and constructive to expose cross-cultural puppetry audiences to understanding-based appreciation before they go to the theatre.

For these two artforms, I integrated different interactive technology with digital archives to further enhance cross-cultural appreciation. Most of the case studies I reviewed in the literature review in Chapter 2 adopted digital inkbrush or digital canvas to help users experience Chinese painting. However, for non-Chinese users, if they do not understand the essential skills of Chinese painting, it might affect their experience and appreciation. More importantly, whether the aesthetic significance successfully imparted to the users to become the focus in this design study. Therefore, I created the subject-based digital elements of traditional Chinese painting with multiple gestural engagement (e.g. zoom in, zoom out, shifting) to offer users more opportunities to appreciate the subtlety of the paintings. This gestural engagement helped users check the details of the colours through tracing, shades of ink, and the nuanced textures in traditional Chinese painting. In addition, using multi-touch tools instead of a digital inkbrush or other digital tools facilitated the appreciation of the paintings. The archival elements with gestural operation sharply increased the integrity of appreciation, offering the users a general understanding of the artform's various dimensions. More importantly, it provided users with a very simple and approachable operation that maintained completeness and quality of the artworks. Multi-touch also allowed the users to create works of art.

In the case study of traditional Chinese puppetry, I designed gesture cards and a tangible interface integrated with a digital archive to create the Digital Gesture Library. The gesture cards as supplementary tools let users think about and appreciate the puppets' actions more logically. For instance, according to their own understanding of puppetry gestures, they were able to place the gesture cards in narratively meaningful and aesthetically effective orders to record personal documents of their appreciation. The understanding of puppetry gestures also helped them find an entry point to start their appreciation rather than be confused about the meaning of the plot and story. Furthermore, engaging users' interest to use these gesture cards inspired me to further design the tangible interface that created the interaction between the users and the puppetry. To be more specific, using the gesture cards to interact with sensor-augmented Chinese puppets enabled them to act out gestures associated with the cards, greatly increasing their interest. The interactive engagement was not limited to an interaction between the content of the archive and the users; it also included an interaction between the users and the sensor-augmented Chinese puppets. In general, based on the reflections on the

user experiences in Chapter 8, the gesture cards and the tangible interface integrated with the digital archive to help those from different cultural backgrounds overcome language barriers. The participants gained in-depth artistic knowledge of puppetry performance.

8.3 Reflection and Inspiration for the Safeguarding of Intangible Cultural Heritage

In this section, I reflect on a series of design suggestions derived from the two case studies.

8.3.1 The Comparison of and Connection between the Two Case Studies

Here, I would like to reflect on the comparison of and connection between these two case studies. Traditional Chinese painting and puppetry represent distinct dimensions of Chinese culture. From the perspective of Chinese literati, traditional Chinese painting as one of the crucial representatives of Chinese fine arts reflects the lives of historical China's working-class people and blends extensive folk culture (e.g. sacrificial activities), music and fairy tales from different eras (Fong 1971). Traditional Chinese puppetry as one of the most significant elements of Chinese local opera and China's folk art reflects the Chinese culture of folk religion and integration of the multi-national Chinese culture that has built the unique folk history narrative. These reflections would not have been found in historical records written in a biographical style.

This Ph.D. research intended to explore how to help cross-cultural viewers/audiences appreciate the aesthetic significance of these two customs. Both case studies began by probing the barriers to cross-cultural appreciation and collecting aesthetics-based elements with extensive ethnographic fieldwork. However, based on the different elements, I designed and developed different interactive technologies to display these aesthetics-based elements and engage viewers/audiences. During the ethnographic fieldwork, I integrated different research methods to explore the representative aesthetics-based elements that potentially enhanced non-Chinese participants' appreciation, using a similar design strategy (i.e. element-based archive) to further understand how to design the corresponding interactive technology. The interactive technologies might also be utilised in similar categories of ICH, such as wood-engraving pictures, Chinese papercut, Kunqu opera and Chaozhou opera. From the arts and opera these two different perspectives, as well as using RtD as the fundamental method, I intended to summarise the design process with the relevant methods (e.g. deconstructing cultural elements) by conducting these two case studies, which potentially supported other research within similar categories of ICH. On the other hand, individually, these two case studies also provided various interactive technologies that aim at different sorts of Chinese

ICH; the gestural engagement and multi-touch tool could support other traditional arts, and the three-perspective view with gesture cards and a tangible interface could be utilised in other traditional Chinese operas.

8.3.2 Interactive Technology for Cross-Cultural Appreciation of Other Relevant Intangible Cultural Heritage

This study of the Digital Gesture Library for Chinese puppetry suggests that such interactive technology could support cross-cultural audiences in exploring the artistic subtleties of traditional Chinese culture (Zhao 2019a) and ICH more broadly. There are many aspects of traditional puppetry (e.g. movements, music, stories) that originate in other forms of ICH, such as folk stories, conventional opera (and its gestures), and folk dance. For these kinds of ICH, non-linear video resources are frequently collected to safeguard cultural heritage, but the possibilities here are under-explored (Linaza et al. 2014; Liang et al. 2016). Nevertheless, video data collection serves as a standard method to safeguard the performative cultural heritage and skills of craftspeople (Zhao and Kirk 2016). In this study, I recorded multiple perspectives to build an element-based gestural archive and offered users the option to switch between the videos to view a gesture from different angles. The findings imply that the use of interactive technology to redesign and newly develop non-linear video resources could boost audiences' understanding, broaden the usability and communicability of non-linear videos, and constitute a design approach combining traditional Chinese culture and interactive technology.

Furthermore, this design study suggests how interactive systems of this sort could help cross-cultural audiences overcome cultural barriers during appreciation and deepen their interest in a form. The general design idea presented here (a digital archive to display gestures from multiple perspectives) and the interface (gesture cards and tangible cultural artefacts) could also support cross-cultural audiences' appreciation of and engagement with similar ICH traditions in the realm of the performing arts (that is, those based on gestures or movements, for instance traditional dances and operas). The interviews showed that for the participants, HCI-based engagement with characteristic gestures would never replace a traditional Chinese puppetry performance in the theatre (which, as mentioned, I would also never advocate for). However, conversely, before cross-cultural audiences go to the theatre to watch a show, distinctive gestures in a digital archive could offer them a comprehensive, in-depth way to grasp the relevant culture. During their experiences with the system, the participants' knowledge of the storylines of Chinese fairy-tales increased greatly. Hence, interactive

technology, using a multi-perspective archive of characteristic elements and relevant cultural artefacts (through a tangible interface), could facilitate cross-cultural appreciation of ICH in other settings.

8.3.3 Distinguishing Between Learning and Appreciating Intangible Cultural Heritage in the Initial Design Stage

How best to promote audiences' or viewers' interest in ICH is a key aspect of safeguarding it. After extensive review and analysis of case studies (mainly from Section 4.2 Study 1: Cultural Appreciation and 6.2 Method) that integrate interactive technology in ICH, I believe that they do not make a clear distinction between *learning* and *appreciating* ICH, which may leave audiences or viewers prone to misunderstanding the cultural significance of ICH or lose interest in it. Most digital applications place too much emphasis on improving ICH-specific skills to better understand ICH, but most cross-cultural audiences or viewers do not have professional knowledge of a form, and their only experience with it is generally random or incidental. The design key to the appreciation of ICH is instead the enhancement of viewers' understanding of its cultural significance, also incorporating participants' own stories or thoughts into their appreciation. In addition, based on extensive fieldwork with ICH professionals and stakeholders as well as joint investigations with cross-cultural audiences or viewers, is necessary to identify additional barriers to appreciation and how to overcome them. Data collection for these activities before the design and development phase could provide a theoretical foundation for new efforts and tools for the appreciation of ICH and help designers avoid integrating their subjective opinions into the design stage.

8.3.4 Maintaining the Aesthetic and Cultural Significance

In integrating interactive technology into the appreciation of ICH to safeguard it, it is crucial to maintain its aesthetic and cultural significance. Based on the results from my two case studies, I do not believe that interactive technology has to provide a comprehensive interpretation of all dimensions of ICH. Regarding the experience of the application in the Chinese painting case study, the elements archive adopts diverse themes to support the participants' engagement with paintings based on participants' own understanding. However, it is impossible to record all relevant elements of Chinese painting in the digital archive, and the Digital Gesture Library application founded on the elements archive only offers users an entry-point to enable them to acquire some limited aesthetic knowledge of the art form and potentially arouse their deeper interest in it. In addition, the gesture library utilises a tangible interface to enhance participants' understanding of puppetry gestures and overcome the

gestural and language barriers faced by cross-cultural audiences. Based on the workshop data from the user study, it is clear that the understanding of element-based gestures offers participants a method to experience the aesthetic and cultural significance of this art form. From the current data, it is difficult to conclude clearly that interactive technology directly safeguards Chinese ICH; however, using the elements archive with a tangible interface as a design strategy seems to have great potential to encourage participants to explore the aesthetic and cultural meaning of Chinese ICH further themselves. The logic for how this Ph.D. research was designed can be schematised as follows:

(1) Help participants understand the culture.

(2) Help them appreciate the culture.

(3) Engage them to talk about the culture.

(4) Encourage them to be interested in the culture.

All of this supports the promotion, enhancement, and transmission of ICH. This design logic has been tested and validated by this Ph.D. research.

8.4 Limitations and Future Work

There are limitations to this research and much scope for future work in designing interactive technology to support the cross-cultural appreciation of Chinese and other ICH. First, both case studies incorporate some of the more common types of Chinese painting and puppetry (respectively) into the elements archive, but neither includes all relevant art forms. For instance, I chose six different painting subjects, each of which only has a few element-based templates. In addition, the Digital Gesture Library only contains the gestures of table-top puppets, string/wire puppets, and marionettes, due to time and budget constraints; a similar observation is true for puppetry. This might yield only an incomplete or distorted understanding of Chinese painting and puppetry. There is clear opportunity for future work addressing this issue, and the elements archive is a sustainable data collection tool. Deconstructing cultural elements, carrying out fieldwork, accumulating data, and building the elements archive could be combined into a standard but relatively comprehensive technique for other kinds of Chinese painting and puppetry. In addition, as mentioned in the reflection on using interactive technology for cross-cultural appreciation of other relevant ICH in Section 8.3.3, this standard procedure could also be employed for other gesture- or craft-based forms of ICH. Significant challenges may arise, however, in terms of importing more videos or graphics into the archive, providing a smooth user experience for the archive, expanding its capacity, and building a platform to exhibit and share users' artwork. Essential details for future investigations include how to conduct fieldwork with professional puppeteers and

stakeholders in endangered ICH to gather data, as well as ethical and copyright issues. This Ph.D. research also does not make any explicit connection between the two case studies, despite discussing them together at many points; future work should aim to create a platform that links the elements of Chinese painting, puppetry, and other Chinese ICH to present a more holistic framework for cultural understanding. Finally, the dimensions of the elements archive are limited in terms of reflecting on specific historical backgrounds or cultural settings of ICH, which could also be incorporated explicitly as independent dimensions to enable greater appreciation and help users gain a more comprehensive knowledge of the Chinese humanistic traditions and spirit.

8.5 Reflections of Methodologies and Design Process

Last, I shall review some methodological considerations. Throughout this Ph.D. research, I adopted a practical method of deconstructing cultural elements based on the HCI perspective to enhance cross-cultural appreciation of Chinese ICH. First, I analysed traditional literature and traditional cultural materials such as performance repertoire to become familiar with certain forms of ICH. During this step, I employed text analysis and archival research as my two main strategies to grasp the historical origin, background knowledge, subject classification, and other information related to aesthetics literature on traditional Chinese painting and puppetry. Second, I conducted a series of investigation-based activities with potential cross-cultural audiences and amateurs to explore how they appreciate Chinese painting and puppetry, as well as the barriers they face. I intended to extract the cultural elements from the first step and gather elements that would be easier for cross-cultural audiences to understand. Third, I carried out a series of fieldwork activities with ICH stakeholders and professionals. Fieldwork is commonly used to research a specific event or population in anthropology, psychology, and HCI. During this step, I utilised fieldwork to achieve three main goals:

(1) Classify the components of Chinese painting and puppetry based on suggestions from stakeholders and professionals in order to explore representative elements.
(2) Reflect upon the findings from the investigation-based activities (which were conducted with potential cross-cultural audiences and amateurs) to the stakeholders and professionals. Then integrate and summarise the constructive design strategies derived from the stakeholders and professionals' suggestions.
(3) Discuss and select elements that could deepen cross-cultural audiences' understanding of aesthetic meaning.

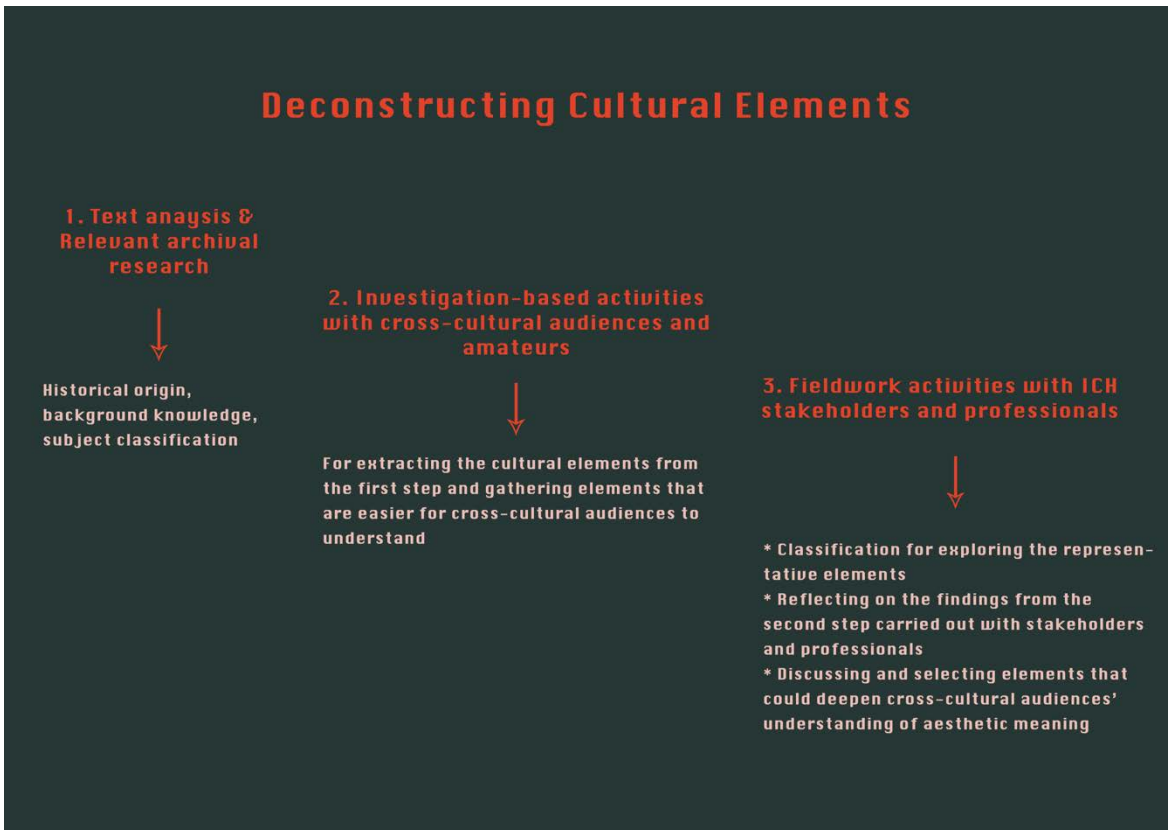

Figure 73. Steps of the method for deconstructing cultural elements.

Through these three steps, I deconstructed Chinese painting and puppetry based on the criterion of cross-cultural appreciation, and applied the results to the elements archive in order to integrate into it interactive techniques using digital devices. These three steps also provide a template that can be adapted to other kinds of ICH. Although this approach refers to other research methods, such as participation design and co-design in HCI, the deconstruction of cultural elements offers not only a design strategy but one that incorporates multidisciplinary research techniques to deconstruct ICH. This method is centred on exploring the theoretical foundations of a design strategy; in other words, it requires the designer and researcher to take on an additional role as aesthetic researchers throughout the entire design project. Figure 73 shows each step of the method of deconstructing cultural elements.

Furthermore, my role transformations as a researcher are tremendously critical in the process of elemental deconstruction. Based on the theoretical framework of RtD, I conducted at least four role transformations and role advancements within this research: 1. layman; 2. cross-cultural viewers/audiences and amateurs; 3. reflective thinker and coordinator; and 4. designer. Each role change provided a variety of research aims and achievement of specific research targets. For most of the researchers in digital cultural heritage, it is productive to be a layman-researcher of ICH to spend more time immersed in external literature, and as a

beginner, to get familiar to a specific area of ICH. In this Ph.D. research, I adopted analysing the traditional literature with plenty ethnography experience of ICH, in order to support myself to finish the role of 'layman of ICH'. While implementing the investigation with cross-cultural viewers/audiences and amateurs, my role as a researcher grew from 'layman' to 'potential cross-cultural viewer of traditional Chinese painting and audience of traditional Chinese puppetry'. This role transformation potentially engages me so that I may experience how to appreciate ICH from the perspective of cross-cultural viewers/audiences and amateurs. It is worth mentioning that this role also helped me (as a Chinese person) to abandon the conventional understanding of traditional Chinese cultures. More importantly, this role also helps me to perceiving the barriers in their appreciation, as well as their habitual appreciation methods.

The next role transformation is from 'cross-cultural viewers/audiences and amateurs' to 'reflective thinker and coordinator'. This role also offered a directive strategy for conducting the fieldwork with professionals and stakeholders of Chinese ICH. By directly collaborating with professionals and stakeholders, I might obtain a more professional and accurate element deconstruction, as well as avoid the oversimplified ICH (that has been mentioned in section 2.5.1 Interactive Systems for Puppetry Performances) to a certain extent. However, as a reflective thinker and coordinator, it is extremely significant to reflect the barriers of cross-cultural appreciation with professionals and stakeholders and engage in a discussion with them. More specifically, as the 'reflective thinker and coordinator', I also have the opportunity to be more practically involved with the barriers of cross-cultural appreciation as an aspect to be considered in the deconstructing of cultural elements. As a representative of a cross-cultural viewer/audience, I could now understand the deconstruction of elements, and could therefore communicate with professionals and stakeholders to adjust the acceptability of cultural elements.

The last role transformation is me as a 'designer' to explore the potential design strategies and techniques based on the frameworks of element deconstruction. In this role, I as the designer of this research would still be affected by subjective and individual understandings of traditional Chinese painting and puppetry, however, the previous roles with a series of relevant activities, fundamentally offered me opportunities to explore how to design the interactive technology to support the appreciation of ICH from a cross-cultural perspective, which also avoids the esoteric or oversimplification of cultural elements.

The RtD approach in this thesis pursues several ends: to generate inquiry, probe the design strategy for overcoming cross-cultural barriers, and gauge whether the research represents a sustainable method. The exploration of one or several design techniques is not the only purpose of this Ph.D. research, especially, considering the integrity and authenticity of ICH. Although traditional Chinese painting and puppetry potentially represent certain similar customs of ICH, determining how to summarise and reflect the design process and determining a series of steps that boost each research question could support a more extensive study in the domain of digital heritage.

This research of digital heritage involved various researchers from various subjects (Aydin and Schnabel 2015), as discussed previously. I applied multiple methods from different subjects. For instance, the aesthetic experience approach is a frequently-used method in aesthetics and philosophy (Beardsley 1982), and ethnography is an approach used by cultural anthropologists and sociologists (Malinowski 2005). Moreover, my role in this research changed multiple to help me engage with different stages of the research.

Figure 74 shows the five steps I took when I conducted this research. For most digital heritage researchers or HCI researchers, getting to know the ICH practically and theoretically is necessary for conducting the project (step 1). For instance, having a better understanding of the structure and mechanical theory of traditional Chinese puppetry is very useful for elemental collection in the follow-up study. Secondly, I conducted a series of interview-based investigations with cross-cultural viewers and audiences to seek the barriers to their appreciation (step 2). I also did extensive ethnographic fieldwork involving ICH stakeholders (i.e. professionals, practitioners, educators) to explore the speculative design insight based on their practical experience. Based on the built-up connections with ICH stakeholders, I further analysed ICH by deconstructing and extracting element-based data to form transferable design elements that were implemented into the initial stage of design (step 3). In the design study (step 4), according to different sorts of ICH, the corresponding interactive technologies were designed to support cross-cultural appreciation and inquire about the further user experience. In step 5, multiple investigational activities were instituted to obtain the quantitative and qualitative data that reflect the user experience.

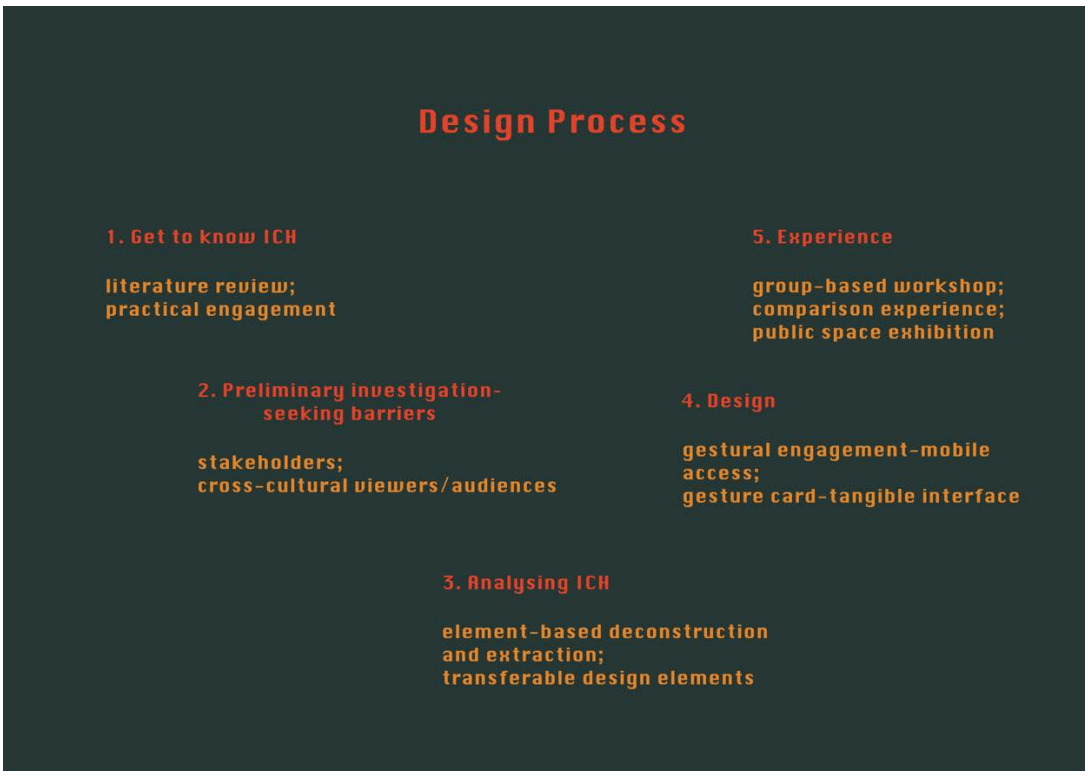

Figure 74. Reflection of the design process.

Chapter 9. Conclusion

In this Ph.D. research, I set out to investigate how to design interactive technology to reinforce the cross-cultural appreciation of Chinese ICH, adopting a series of conceptual, empirical, and speculative viewpoints.

I chose painting and puppetry as two themes (respectively representing Chinese folk and literati art) to investigate Chinese ICH. In Chapter 2, I summarised the primary literature on Chinese cultural heritage practises in relation to painting and puppetry, with a focus on safeguarding practises, policy approaches to ICH, and central institutional developments. I also considered the research on the use of current interactive and gestural technologies to aid the appreciation of Chinese painting and puppetry. Recent digital case studies and existing technologies and approaches have oversimplified the interpretation of Chinese ICH (such as Chinese painting and puppetry) in interactive systems, which may lead users to have an incomplete understanding of traditional Chinese puppetry. Maintaining the integrity and authenticity of ICH is necessary in the design phase; simultaneously, it is crucial to support potential users in grasping the aesthetics of traditional Chinese painting before they appreciate the artwork, especially users from different cultural backgrounds. However, digital case studies have not examined how to strengthen cross-cultural appreciation, nor have they considered distinguishing the user experience between professional artists and cross-cultural amateurs (who are unskilled at painting or puppetry).

Against this background, the study settled on three central questions:

(1) What barriers do cross-cultural viewers/audiences face in appreciating Chinese painting and puppetry?

(2) What opportunities do interactive technologies present for cross-cultural appreciation of these art forms?

(3) How should interactive technologies be designed to enhance cross-cultural appreciation of ICH?

With these questions in mind, in Chapter 3, I discussed methodological approaches to carrying out fieldwork with ICH professionals, stakeholders, and cross-cultural amateurs. Beyond that, I developed a theoretical basis for supporting the element deconstruction and classification of traditional Chinese painting and puppetry, and provided a detailed description of the methods used in the design and evaluation study for the two case studies.

In Chapters 4 and 5, I described the qualitative and quantitative fieldwork undertaken in the study on Cultural Appreciation (see Section 4.2). This study was inspired by Beardsley's five criteria (1982) and flow experience (Csikszentmihalyi and Robinson 1990) to illustrate that using visual stimulation of colours associated with common themes in Chinese painting in order to support a series of aesthetic interpretations is an acceptable technique for conveying the meaning of these works to non-Chinese viewers. Rather than emphasising the uniqueness of this approach, non-Chinese viewers focused more on logic and cultural background (colours–themes–interpretations). In the study on Transferable Design Elements (see Section 5.2), I classified colours and subjects and expanded the content of each category to explore the available transferable design components for the design study. Based on the studies in Sections 4.2 and 5.2, I then designed a mobile application incorporating the elements archive with multi-touch engagement to support cross-cultural appreciation of traditional Chinese painting. Based on the user experience study, which was inspired by experience-centred design (ECD) (Wright and McCarthy 2010), I relied on contrastive workshops and in-depth interviews of focus groups to consider the design suggestions and comments from the evaluation. The findings illustrated that the elements archive combines with multi-touch gestural engagement to effectively help application users analyse the meaning of colours and themes in order to express their understanding of Chinese painting. As well as this, they actively explored relevant knowledge through discussions with other users or searched for information online, including the artists' background story, related Chinese history, and material on Chinese religions.

In Chapters 6 and 7, I adopted an approach that utilises design ethnography (Raijmakers et al. 2006; Van Dijk 2011) and co-design (Ciolfi et al. 2016; Popple and Mutibwa 2016) to conduct fieldwork with Chinese puppetry professionals, learners, and amateurs. I gained insight into the barriers between puppetry performance and cross-cultural audiences; different languages or dialects were identified as the main obstacles to understanding (Xu and Xin 2007). I found that in Chinese opera puppetry, improved use of gestures can help break down these language barriers for non-Chinese audiences and provide a more accurate understanding of traditional Chinese ICH. Based on this idea, I designed and developed an interactive system called the Digital Gesture Library, which uses a three-perspective archive of puppetry gestures and a tangible interface to support cross-cultural audiences. Through this interactive system, I employed a mixture of questionnaires, focus groups, and workshops to promote reflection on certain aspects of audience members' experiences.

Reflection on these two case studies has allowed me to answer the first two research questions and contributed to investigations of cross-cultural appreciation in HCI, heritage studies, Chinese studies, and related fields. The study posits a series of fundamental design strategies addressing revealed hindrances to the cross-cultural appreciation of Chinese painting and puppetry. First, integrating the colours and themes of Chinese painting as design elements could help non-Chinese viewers develop a more reasonable knowledge of them and ability to appreciate them. Moreover, colours – being a component of a non-Chinese viewer's appreciation approach – would not conflict with their inability to understand the genres (see Section 4.2.6). Second, for the appreciation of puppetry, digital design may be used as a tool to integrate gestural resources that support audiences in forming a more systematic understanding of puppetry. Furthermore, showing audiences different gestures or movements from various visual dimensions could help viewers from distinct cultural backgrounds accurately interpret puppets' gestures (see Section 6.4.1).

Across both studies, I found that integrating design insights from ICH professionals, stakeholders, and cross-cultural viewers/audiences was meaningful, helping me, as a designer, to consider when and how to maintain the originality of ICH and enhance cross-cultural appreciation. The current study cannot determine whether interactive technology can ethically, reasonably be integrated into Chinese ICH; designers are currently exploring different approaches to this question (Lin and Lian 2018). However, the findings in Sections 5.3.6 and 7.4.5 suggest that shifting the emphasis of interactive technology in puppetry from entertainment to supporting audiences' appreciation and understanding would not threaten traditional performances. Importantly, the relationship between interactive technology and ICH should thus be perceived as complementary rather than conflicting, and HCI designers should design tools to empower – rather than replace – ICH.

In Chapter 8, I described at length design strategies and interactive techniques that can be utilised to strengthen the cross-cultural appreciation of Chinese ICH. The elements archive, as a kind of interactive design technology and engagement approach, has great potential to support the cross-cultural appreciation of Chinese ICH. A key area of concern for cross-cultural appreciation is the particular method used and the understanding of it on the part of audiences from different cultural backgrounds. For instance, the understanding of colours is an appropriate starting-point to guide non-Chinese viewers – the three-perspective view offers audiences the chance to explore the mystery of a puppet show by themselves and to gain a deeper understanding of puppetry gestures. Furthermore, according to the different kinds of

ICH or art forms, the elements archive also needs to utilise different interactive techniques to embody appreciation. For the appreciation of Chinese painting, the elements archive integrates multi-touch techniques based on a mobile application, which offers users more opportunities to appreciate the subtlety of paintings. In the appreciation of Chinese puppetry, the Digital Gesture Library employs gesture cards to interact with sensor-augmented Chinese puppets; this enables users to act out a gesture associated with the card, greatly increasing their interest in interacting with the puppets. Both case studies incorporate some more common types of Chinese painting and puppetry into the elements archive, but do not include all relevant art forms. Hence, there is an opportunity for future work to address this issue, and explore the nature of the elements archive as a sustainable data collection task.

Beyond that, I reflected on a series of design strategies and suggestions derived from the two case studies for the safeguarding of ICH. The current case studies do not make a clear distinction between learning ICH and appreciating ICH, which may indirectly lead audiences or viewers to misunderstand the cultural significance of ICH or to lose interest in it completely. Moreover, when integrating interactive technology into the appreciation of ICH, it is crucial to maintain and safeguard its aesthetic and cultural significance.

At the end of Chapters 8, I reviewed the holistic fieldwork, design study, and user experience study to devise a method for deconstructing cultural elements based on the HCI perspective in order to enhance cross-cultural appreciation of ICH. The deconstruction of cultural elements not only offers a design strategy, but focuses on incorporating multidisciplinary research techniques to deconstruct ICH. It is worth emphasising that the elements archive (i.e. the Digital Gesture Library) is only one design possibility derived from deconstructing these cultural elements; this approach could also be adopted for other forms of ICH and specific relevant interactive technology.

There is always room for improvement, and this research has implications for future work. The safeguarding of ICH requires sustained efforts. As such, this Ph.D. not only focuses on the evaluation and iterative design of interactive applications. Supported by the theoretical framework of RtD, this research is also dedicated to constantly enhancing the cross-cultural appreciation of ICH with the support of interactive technology. This research does not intend to directly design interactive technology to safeguard ICH. Compared to the protection of tangible cultural heritage (TCH), promotion, enhancement and transmission are more significant for safeguarding ICH and for understanding how to appreciate it. Deconstructing

cultural elements based on the HCI perspective provides potential sustainability for safeguarding ICH, as well as avoiding the threat that interactive technology might simplify the original forms of ICH. Although the I adopted a low-cost design strategy instead of creating complex interactive technology, users' appreciation of the application was still enhanced effectively. This research does not stop here. For example, based on deconstructing cultural elements, I may wish to draw from sustainable research to inform the curatorial practises of other ICH, or to foster RtD-based discussions on concerns surrounding cross-cultural appreciation.

I conclude this thesis with a reflective account of its production. My reason for writing this section is because I think it is significant that I reflect upon my experience and role as a researcher studying Chinese ICH and HCI in a European academic environment. I have been asked numerous times why it is important and necessary to support cross-cultural appreciation of Chinese ICH. In addition, during my Ph.D. study, I tried to publish the content of my research in every phase, and I commonly received comments along the lines of: 'the paper is well-written; however, it is hard to see how it will generate an extensive discussion'. And others have asked me to expand upon my research, specifically regarding the discussion of how to reflect the contributions to other Western ICH to make this research more 'contributive'. Furthermore, as a Chinese Ph.D. student and researcher, it is extremely hard to describe the neglect I experienced when conducting a research project that focused on Chinese ICH in the HCI department of a European academic environment, even though the focus of the research is cross-cultural and about interactive technology. Those comments and experiences raised a question: can this research be applied to Western ICH and would it affect the quality of this research? Based on my Ph.D. research, my answer is no. On the other hand, it also keeps reminding me to continue exploring cross-cultural appreciation with the support of interactive technology.

I believed that one of the considerations/conditions of conducting this research is to keep the uniqueness and authenticity of ICH as a means respecting traditions, thus supporting the promotion of ICH, which is one of the factors that is included in the Convention for the Safeguarding of the Intangible Cultural Heritage (2003). As the researcher of this study, I feel a sign of the case study's success is the participants saying that they are interested in Chinese painting or puppetry and that the app/tangible interface experience encourages them to learn about these artforms. The original motivation for starting this research was that I intended to change common views of audiences (i.e. help them gain a superficial understanding of ICH

through cursory observation) to accurately demonstrate the aesthetic significance. Moreover, this research was meant to support and enhance cross-cultural appreciation of Chinese ICH. As stated in the previous discussion in section 8.3, the logic for how this Ph.D. research was designed included helping participants understand the culture, helping them appreciate the culture, encouraging them to talk about the culture, and encouraging them to be interested in the culture. Interactive technology played multiple roles in these four steps. In other words, every step has the potential to involve interactive technology. And this potential and the above-mentioned logic are also part of the findings I would like to impart to the readers of this research.

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Appendices

Appendix A: Study One Materials

Appendix A.1 Activities Reference

Appendix A.1.1 Sample Questionnaire Schedule—the colours and subjects of traditional Chinese painting

QUESTIONNAIRES

Thank you very much for your taking part, if you could answer the following questions as accurately as you could it would be much appreciated.

Personal Information

Gender: ☐ Male ☐Female

Age: ☐ 18-25 ☐ 26-40 ☐ 41 and over

Occupation: ☐ Student ☐ Tourist ☐ Employed (please specify): _____ ☐ Unemployed

Nationality: _____

How do you feel about the colours and subjects of Chinese traditional painting?

1. Below are some references of Chinese traditional colours. Please choose which colours you think could represent Chinese traditional colours (multiple choices)? And if you do not mind, please state your reason why on the next page.

☐ Mineral Green

☐ Bluish

☐ Eosin

☐ Cinnabar

☐ Zhubiao

☐ Carmine

☐ Flower blue

☐ Rattan yellow

☐ Ochre

☐ Phthalo blue

☐ Titanium white

☐ Dull black

Reason:

2. Below are some subjects. Please choose which subjects you think could represent Chinese traditional painting (multiple choice)? And if you do not mind, please tell your reason.

   ☐ Rhododendron ☐ Osmanthus ☐ Plum blossom ☐ Camellia ☐ Daffodil
   ☐ Lotus ☐ Penoy ☐ Orchid ☐ Prunus mume ☐ Chrysanthemum

   ☐ Chinese cabbage ☐ Pakchoi ☐ Radish ☐ Pine ☐ Bamboo ☐ Willow

   ☐ Dog ☐ Cat ☐ Cow ☐ Sparrow ☐ Tiger ☐ Horse ☐ Goldfish
   ☐ Money

   ☐ Brook ☐ Sea ☐ River ☐ Mountain

   ☐ Chinese Lady ☐ Buddha

Reason:

Appendix A.2 Consent Forms

Participant Consent Form

Project Title: Interactive Appreciation of Chinese Traditional Painting

The purpose of this consent form is to check that you understand what will be required of you if you agree to take part in our research study and how any information that you give or that is collected from you will be used.

[Please tick the boxes as appropriate]

1. I confirm that I have had the aims and objectives for the above named study explained to me. ☐

2. I agree to participate in this study and I understand that my participation is *voluntary*. ☐

3. I understand that I have the right to *withdraw*, without giving reasons for this, at any point during the study. ☐

4. I agree for this interview to be *recorded* (via video and/or audio). ☐

5. I agree that any quotations from what I say during the interview, or user study, can be used in publications. I understand that my quotations will be used *anonymously*. ☐

6. I understand that any personal data I provide will be retained and processed by the researcher in accordance with the Data Protection Act 1998. ☐

Participant's signature: _____

Researcher's signature: _____

Date: _____

Shichao Zhao (PGR) S.Zhao11@newcastle.ac.uk
(Supervisor) Peter Wright p.c.wright@ncl.ac.uk**; Simon Bowen** simon.bowen@ncl.ac.uk**; David Kirk** david.kirk@northumbria.ac.uk

Appendix B: Study Two Materials

Appendix B.1 Consent Forms

Participant Consent Form

Project Title: Perceptions of Traditional Chinese Puppetry

The purpose of this consent form is to check that you understand what will be required of you if you agree to take part in our research study and how any information that you give or that is collected from you will be used.

[Please tick the boxes as appropriate]

1. I confirm that I have had the aims and objectives for the above named study explained to me. ☐

2. I agree to participate in this study and I understand that my participation is *voluntary*. ☐

3. I understand that I have the right to *withdraw*, without giving reasons for this, at any point during the study. ☐

4. I agree for this interview to be *recorded* (via video and/or audio). ☐

5. I agree that any quotations from what I say during the interview, or user study, can be used in publications. I understand that my quotations will be used *anonymously*. ☐

6. I understand that any personal data I provide will be retained and processed by the researcher in accordance with the Data Protection Act 1998. ☐

Participant's signature: _____

Researcher's signature: _____

Date: _____

Shichao Zhao (PGR) S.Zhao11@newcastle.ac.uk
(Supervisor) Peter Wright p.c.wright@ncl.ac.uk**; Simon Bowen** simon.bowen@ncl.ac.uk**; David Kirk** david.kirk@northumbria.ac.uk

Appendix B.2 Ethics Form

PDF export

Survey name (ID): University Ethics Form Version 2.1 (865378)

Date submitted submitdate	08/03/2017 15:40:59
Applicant Details	
Is this approval for a:	Student Project [A2]
What type of degree programme is being studied?	Postgraduate Research (e.g. PhD) [A3]
Name of Principal Researcher:	Shichao Zhao
Please enter your email address	s.zhao11@newcastle.ac.uk
Please select your school / academic unit	School of Computing Science [A6]
Please enter the module code	
Please enter your supervisors email:	p.c.wright@ncl.ac.uk
Please select your supervisor's school/unit:	School of Computing Science [A6]
Project Details	
Project Title	Using Interactive Digital Media to Support Transcultural Understanding of Intangible Chinese Cultural Heritage
Project Synopsis	This research aims to use interactive digital media to support transcultural understanding of intangible Chinese cultural heritage. The prospective outcome will be stronger transcultural appreciation of Chinese intangible culture by weakening the transcultural barriers to understanding and by engaging audiences more deeply in a critical reading of traditional Chinese cultures. I am going to interview puppeteers via semi-strutured interviews, and I will be video recoding puppeteers' movements for a digital archive.
Project start date	01/02/2017
Project end date	01/07/2017
Is the project externally funded?	No [A3]
Does your project involve collaborators outside of the University?	No [N]
Existing Ethics, Sponsorship & Responsibility	
Has ethical approval to cover this proposal already been obtained?	No [N]
Will anyone be acting as sponsor under the NHS Research Governance Framework for Health and Social Care?	No [N]
Do you have a Newcastle upon Tyne Hospitals (NUTH) reference?	No [N]
Will someone other than you (the principal investigator) or your supervisor (for student projects) be responsible for the conduct, management and design of the research?	No [N]
The Animals (Scientific Procedures) Act defines	

protected animals as: 'any living vertebrate other than man…in its foetal, larval or embryonic form……from the stage of its development when — (a)in the case of a mammal, bird or reptile, half the gestation or incubation period for the relevant species has elapsed; and (b)in any other case, it becomes capable of independent feeding'.	No [N]
In practice 'Protected' animals are all living vertebrates (other than man), including some immature forms, and cephalopods (e.g. octopus, squid, cuttlefish). Using this definition, does your research involve the observation, capture or manipulation of animals or their tissues?	
Will the study involve participants recruited by virtue of being NHS patients or service users, their dependents, their carers or human tissues or the use of NHS & Health/Social Care Facilities or otherwise require REC approval?	No [N]
Does the research involve human participants e.g. use of questionnaires, focus groups, observation, surveys or lab-based studies involving human participants?	Yes [Y]
Does the study involve any of the following? [a. The study involves children or other vulnerable groups; as defined in **Section 59 of the Safeguarding Vulnerable Adults Act 2006** as those who are relatively or absolutely incapable of protecting their own interests, or those in unequal relationships e.g. participants who are subordinate to the researcher(s) in a context outside the research?]	
Does the study involve any of the following? [b. The study requires the co-operation of a **gatekeeper** (defined as someone who can exert undue influence) for initial access to the groups or individuals to be recruited e.g. students at school, members of a self-help group, or residents of a nursing home? NB. The IoN & School of Psychology volunteer pools are not considered gatekeepers in this case.]	
Does the study involve any of the following? [c. It is necessary for participants to take part in the study without their knowledge and consent e.g. covert observation of people in non-public places?.]	
Does the study involve any of the following? [d. Deliberately misleading participants in any way?]	
Does the study involve any of the following? [e. Discussion of sensitive topics e.g. sexual activity or	

drug use?]	
Does the study involve any of the following? [f. The administration of drugs, placebos or other substances (e.g. food substances, vitamins) to the study participants.]	
Does the study involve any of the following? [g. Invasive, intrusive or potentially harmful procedures of any kind?*]	
Does the study involve any of the following? [h. Obtaining blood or tissue samples?*]	
Does the study involve any of the following? [i. Pain or more than mild discomfort?]	
Does the study involve any of the following? [j. Psychological stress, anxiety, harm or negative consequences beyond that encountered in normal life?]	
Does the study involve any of the following? [k. Prolonged or repetitive testing i.e. more than 4 hours commitment or attendance on more than two occasions?]	
Does the study involve any of the following? [l. Financial inducements (other than reasonable expenses and compensation for time)?]	
Does the research involve the viewing, usage or transfer of Sensitive Personal Data as defined by the Data Protection Act 1998 or data governed by statute such as the Official Secrets Act 1989 / Terrorism Act 2006, commercial contract or by convention e.g. client confidentiality? (If you are unsure please tick YES and complete the sub-questions).	No [N]
Will the study cause direct or indirect damage to the environment or emissions outside permissible levels or be conducted in an Area of Special Scientific Interest or which is of cultural significance?	No [N]
Will the research be conducted outside of the European Economic Area (EEA) or will it involve international collaborators outside the EEA?	No [N]
Next Steps	
Based on your responses your project has been categorised as (ethically) low risk and no further review is required before you start work. You will receive a formal approval email on submission of this form. Should your project change you may need to apply for new ethical approval.	
Supporting Documentation	
Please upload any documents (not uploaded elsewhere in the application) which you think are relevant to the consideration of your application.	

filecount - Please upload any documents (not uploaded elsewhere in the application) which you think are relevant to the consideration of your application.	0
Thank you for completing the University's Ethical Review Form. Based on your answers the University is satisfied that your project has met its ethical expectations and grants its ethical approval. Please be aware that if you make any significant changes to your project then you should complete this form again as further review may be required. Confirmation of this decision will be emailed to you. Please complete the declaration to submit your application.	Yes [Y]
Declaration I certify that: [the information contained within this application is accurate.]	
Thank you for completing the University's Ethical Review Form. Based on your answers the University is satisfied that your project has met its ethical expectations and grants its ethical approval. Please be aware that if you make any significant changes to your project then you should complete this form again as further review may be required. Confirmation of this decision will be emailed to you. Please complete the declaration to submit your application.	Yes [Y]
Declaration I certify that: [the research will be undertaken in line with all appropriate, University, legal and local standards and regulations.]	
Thank you for completing the University's Ethical Review Form. Based on your answers the University is satisfied that your project has met its ethical expectations and grants its ethical approval. Please be aware that if you make any significant changes to your project then you should complete this form again as further review	

may be required. Confirmation of this decision will be emailed to you. Please complete the declaration to submit your application.	Yes [Y]

Declaration

I certify that:

[I have attempted to identify the risks that may arise in conducting this research and acknowledge my obligation to (and rights of) any participants.]

Thank you for completing the University's Ethical Review Form. Based on your answers the University is satisfied that your project has met its ethical expectations and grants its ethical approval. Please be aware that if you make any significant changes to your project then you should complete this form again as further review may be required. Confirmation of this decision will be emailed to you. Please complete the declaration to submit your application.	Yes [Y]

Declaration

I certify that:

[no work will begin until all appropriate permissions are in place.]

Newcastle University Ethics Form Version 2.2

Date submitted
04/05/2017 00:31:37

Applicant Details

Is this approval for a:
Student Project [A2]

What type of degree programme is being studied?
Postgraduate Research (e.g. PhD) [A3]

Name of project lead:
Shichao Zhao

Please enter your email address
s.zhao11@newcastle.ac.uk

Please select your school / academic unit
School of Computing Science [A6]

Please enter the module code

Please enter your supervisors email:
p.c.wright@ncl.ac.uk

Please select your supervisor's school/unit:
School of Computing Science [A6]

Project Details

Project Title
Using Interactive Digital Media to Support Transcultural Understanding of Intangible Chinese Cultural Heritage

Project Synopsis
This research aims to use interactive digital media to support transcultural understanding of intangible Chinese cultural heritage. The prospective outcome will be stronger transcultural appreciation of Chinese intangible culture by weakening the transcultural barriers to understanding and by engaging audiences more deeply in a critical reading of traditional Chinese cultures. I am going to interview puppeteers via semi- strutured interviews, and I will be video recoding puppeteers' movements for a digital archive.

Project start date
05/05/2017

Project end date
31/12/2017

Is the project externally funded?
No [A3]

Does your project involve collaborators outside of the University?
Yes [Y]

Please provide a list of the collaborating organisations?
Puppetry department of Shanghai Theatre Academy

Existing Ethics, Sponsorship & Responsibility

Has ethical approval to cover this project already been obtained?
No [N]

Will anyone be acting as sponsor under the NHS Research Governance Framework for Health and Social Care?
No [N]

Do you have a Newcastle upon Tyne Hospitals (NUTH) reference?
No [N]

Will someone other than you (the project lead) or your supervisor (for student projects) be responsible for the conduct, management and design of the research?
No [N]

The Animals (Scientific Procedures) Act defines protected animals as: 'any living vertebrate other than man…in its foetal, larval or embryonic form……from the stage of its development when— (a)in the case of a mammal, bird or reptile, half the gestation or incubation period for the relevant species has elapsed; and (b)in any other case, it becomes capable of independent feeding'. In practice 'Protected' animals are all living vertebrates (other than man), including some immature forms, and cephalopods (e.g. octopus, squid, cuttlefish). Using this definition, does your project involve the observation, capture or manipulation of animals or their tissues?
No [N]

Will the project involve participants recruited by virtue of being NHS patients or service users, their dependents, their carers or human tissues or the use of NHS & Health/Social Care Facilities or otherwise require REC approval?
No [N]

Does the project involve human participants e.g. use of questionnaires, focus groups, observation, surveys or lab-based studies involving human participants?
Yes [Y]

Does the project involve any of the following? [a. The project involves children or other vulnerable groups, as defined in Section 50 of the Safeguarding Vulnerable Adults Act 2006 as those who are relatively or absolutely incapable of protecting their own interests, or those in unequal relationships e.g. participants who are subordinate to the researcher(s) in a context outside the research?]

Does the project involve any of the following? [b. The project requires the co-operation of a gatekeeper (defined as someone who can exert undue influence) for initial access to the groups or individuals to be recruited e.g. students at school, members of a self-help group, or residents of a nursing home? NB. The InN & School of Psychology volunteer pools are not considered gatekeepers in this case.]

Does the project involve any of the following? [c. It is necessary for participants to take part in the project without their knowledge and consent e.g. covert observation of people in non-public places? Except if the project only involves non-identifiable observations of people in public places and does not include observations of potentially vulnerable subjects e.g. children. N.B. some seemingly public places may require permission e.g. shopping centres, rail stations.]

Does the project involve any of the following? [d. Deliberately misleading participants in any way?]

Does the project involve any of the following? [e. Discussion of sensitive topics e.g. sexual activity or drug use?]

Does the project involve any of the following? [f. The administration of drugs, placebos or other substances (e.g. food substances, vitamins) to the project participants.]

Does the project involve any of the following? [g. Invasive, intrusive or potentially harmful procedures of any kind?]

Does the project involve any of the following? [h. Obtaining blood or tissue samples?]

Does the project involve any of the following? [i. Pain or more than mild discomfort?]

Does the project involve any of the following? [j. Psychological stress, anxiety, harm or negative consequences beyond that encountered in normal life?]

Does the project involve any of the following? [k. Prolonged or repetitive testing i.e. more than 4 hours commitment or attendance on more than two occasions?]

Does the project involve any of the following? [i.e. Financial inducements (other than reasonable expenses and compensation for time)?]

Does the project involve the viewing, usage or transfer of Sensitive Personal Data as defined by the Data Protection Act 1998 or data governed by statute such as the Official Secrets Act 1989 / Terrorism Act 2006, commercial contract or by convention e.g. client confidentiality? (If you are unsure please tick YES and complete the sub-questions).
No [N]

Will the project cause direct or indirect damage to the environment or emissions outside permissible levels or be conducted in an Area of Special Scientific Interest or which is of cultural significance?
No [N]

Will the project be conducted outside of the European Economic Area (EEA) or will it involve international collaborators outside the EEA?
Yes [Y]

Please answer the following: [Will there be an increased risk to project team and / or participants where they are working remotely?]

Please answer the following: [Will the project involve political sensitivities e.g. offend specific public interests or the rights and reputations of others?]

Please answer the following: [Are the ethics review procedures for any international partner(s) outstanding and / or will NOT be met?]

Please answer the following: [Will the work undertaken overseas be governed by standards which are NOT equivalent to those in the EEA?]

Next Steps

Based on your responses your project has been categorised as (ethically) low risk and no further review is required before you start work. You will receive a formal approval email on submission of this form. Should your project change you may need to apply for new ethical approval.

Supporting Documentation

Please upload any documents (not uploaded elsewhere in the application) which you think are relevant to the consideration of your application.

filecount - Please upload any documents (not uploaded elsewhere in the application) which you think are relevant to the consideration of your application.
0

Summary and Submission

Thank you for completing the University's Ethical Review Form. Based on your answers the University is satisfied that your project has met its ethical expectations and grants its ethical approval. Please be aware that if you make any significant changes to your project then you should complete this form again as further review may be required. Confirmation of this decision will be emailed to you. Please complete the declaration to submit your application.

Declaration

I certify that:

[the information contained within this application is accurate.]

Yes [Y]

Thank you for completing the University's Ethical Review Form. Based on your answers the University is satisfied that your project has met its ethical expectations and grants its ethical approval. Please be aware that if you make any significant changes to your project then you should complete this form again as further review may be required. Confirmation of this decision will be emailed to you. Please complete the declaration to submit your application.

Declaration

I certify that:

[the project will be undertaken in line with all appropriate, University, legal and local standards and regulations including the Data Protection Act.]

Yes [Y]

Thank you for completing the University's Ethical Review Form. Based on your answers the University is satisfied that your project has met its ethical expectations and grants its ethical approval. Please be aware that if you make any significant changes to your project then you should complete this form again as further review may be required. Confirmation of this decision will be emailed to you. Please complete the declaration to submit your application.

Declaration

I certify that:

[I have attempted to identify the risks that may arise in conducting this project and acknowledge my obligation to (and rights of) any participants.]

Yes [Y]

Thank you for completing the University's Ethical Review Form. Based on your answers the University is satisfied that your project has met its ethical expectations and grants its ethical approval. Please be aware that if you make any significant changes to your project then you should complete this form again as further review may be required. Confirmation of this decision will be emailed to you. Please complete the declaration to submit your application.

Declaration

I certify that:

[no work will begin until all appropriate permissions are in place.]

Yes [Y]

Thank you for completing the University's Ethical Review Form. Based on your answers the University is satisfied that your project has met its ethical expectations and grants its ethical approval. Please be aware that if you make any significant changes to your project then you should complete this form again as further review may be required. Confirmation of this decision will be emailed to you. Please complete the declaration to submit your application.

Declaration

I certify that:

[Where the project involves participants (in anything more than purely non-intrusive observations in a public place) then;

- they will be appropriately informed about the project before deciding whether or not to participate

- they will be free to decide whether or not to be involved and will not face any adverse consequences for not doing so,

- and appropriate consent will be obtained.

]

Yes [Y]

Appendix B.3 The schedule of the interviewing process

INTERVIEW

Preamble

My research aims to use interactive digital media to support transcultural understanding of intangible Chinese cultural heritage. The prospective outcome will be stronger transcultural appreciation of Chinese intangible culture by weakening the transcultural barriers to understanding and by engaging audiences more deeply in a critical reading of traditional Chinese cultures. I will take the traditional Chinese puppet show as my research subject. Traditional Chinese puppetry is a kind of intangible cultural heritage, which mixes music, art, theatrical staging, shadow, movement, performance, etc. There are also familiar traditions of puppetry in other Asian and European countries, knowledge of which could be successfully leveraged to support audiences' understandings of traditional Chinese puppetry. Through analysing both cultural and artistic dimensions of puppetry such as meaning, shape, visual arts, colour, dynamic performance, stories, national music, etc., and combining with different interpretations, attitudes and emotional responses of both Asians and Westerners, it will be possible to explore how interactive digital technologies might support interaction between puppeteers and audiences in transcultural contexts. This will help to find innovative ways of increasing the longevity and inheritance of intangible cultural heritage.

Get them to sign a consent form

First Questions

1. What do you think or when I use the term 'Chinese traditional culture?' What does it make you think of?
2. Colour Associations

-What colours do you associate with China + Chinese things?
-Why?

3. What aspects of traditional Chinese culture have you experienced in the past?

-Food
-Architecture,
-Painting,
-Dancing,
-Music,
-Metrical arts,
-Stories,
-Puppetry (last prompt)

Puppetry Questions

1. Have you experienced CTP?

-have you watched it?
-have you performed it?

2. Do you know any classical puppetry stories?

-If yes, what/which?

Show examples

1. 泉州提線木偶戲《三打白骨精》Quanzhou Puppet "Monkey Subdues White-Skeleton Demon" https://www.youtube.com/watch?v=-QUA176h75c
2. 泉州提線木偶戲經典劇節目 《水滸傳》玉麒麟盧俊義 《押解》Quanzhou Puppet "Heroes of the Marshes-escort" https://www.youtube.com/watch?v=7YdSGXeaMVo
3. 漳州布袋戲《大名府》Zhangzhou Puppet "Daming" https://www.youtube.com/watch?v=jPq7jii1PlI
4. 台語布袋戲 白蛇傳 Heidelberg Taiwanese Budaix "Legend of the White Snake" https://www.youtube.com/watch?v=mkC9YUUuOCU
5. 猪八戒背媳妇 Pig the General carrying his wife on his back 杖头木偶 https://www.youtube.com/watch?v=mj-ZvwspQ0A

For each clip:

1. Did you understand what was going on?

2. Try to explain
3. What do you think of this type of puppetry?

After all clips:

1. Which was your favorite type of puppetry and why?

Questions after video watching

1. Are there traditional forms or puppetry in your country?
2. How do they differ from CTP?
3. What do you think the barrier are to engaging with CTP?
4. What would make CTP more accessible to non-Chinese audiences?
5. Do you know about any forms of non-Chinese (Western) puppetry?
6. What experience of non-Chinese puppetry do you have?

Demographic— (At end)

1. How old are you?
2. What nationality are you?
3. Where do you live?
4. What job do you have?
5. Gender-male/female?
6. What is your highest level of academic qualification?

   -High school
   -Undergraduate degree
   -Post-graduate degree

Appendix B.4 The schedule of the interviewing process

Questionnaires

Thank you very much for your experience, if you could answer the following question as accurately as can you can that would be much appreciated.

Gender: Male☐ Female☐
Education: College☐ Bachelor☐ Master/PhD☐
Age: 15-19☐ 20-25☐ 26-30☐

#	Question	Survey Scale: 1= Strongly Disagree 2=Disagree 3=Agree 4=Strongly Agree
1	Easily understand the main purpose of this digital device in a short time.	1☐2☐3☐4☐
2	Easily understand that how to operate this digital device.	1☐2☐3☐4☐
3	The system and interface are well-worked.	1☐2☐3☐4☐
4	The puppets and element sensor cards are exquisitely crafted.	1☐2☐3☐4☐
5	The touch of puppet's outfit and element sensor cards are comfortable.	1☐2☐3☐4☐
6	The interactive mode of this digital device is vivid.	1☐2☐3☐4☐
7	The quality of the videos is clear, the description is easily understood.	1☐2☐3☐4☐
8	All of the videos are understandable, no barrier in the appreciation.	1☐2☐3☐4☐
9	Would like to explore more knowledge and want to experience this for longer.	1☐2☐3☐4☐

Appendix B.5 The schedule of the Storytelling Workshop and questions

STORYTELLING WORKSHOP

Introduction

Storytelling through the gestural library. Each participant is provided with a brochure which use images and descriptions to make sure participants can understand the gestural library. An aide memoire also be included in this brochure, participants can use this for recording their notes and questions.

Different cards with names of elements (movements/types/emotions) offer to participants, through discussion with their own or traditional stories to talk about a puppet script. Two Chinese traditional puppets are provided to participants, they could use two puppets to make a play-let (around 2-3mins) through combining their stories that been discussed before. The story would connect with their understandings rather than from the gestural library.

In-depth interviews. The questions in the interview will around the usability, glitches, technology, appreciation and understanding.

Ps: in this section, the participants are not the same participants in the evaluation, as well as did not attend any activity of this puppetry project before.

Get them to sign a consent form

Questions

Where are you from?
Do you have any barriers when you watch puppet show?
How do you try to remove these barriers normally?
What do you think that what is the platform of the puppetry appreciation?

Do you understand the main function and purpose of the digital library?
Do you prefer the gesture library to present subtitles or no subtitles?
Do you think that this digital library is helpful in your understanding of puppetry gestures?
If you think this library is useful, which part is of your experience was your favourite?
Do you have any suggestions for us to add into the digital library? i.e. new interactions or operations.
Do you think this library could support you to develop an in-depth appreciation of puppetry and puppet shows?

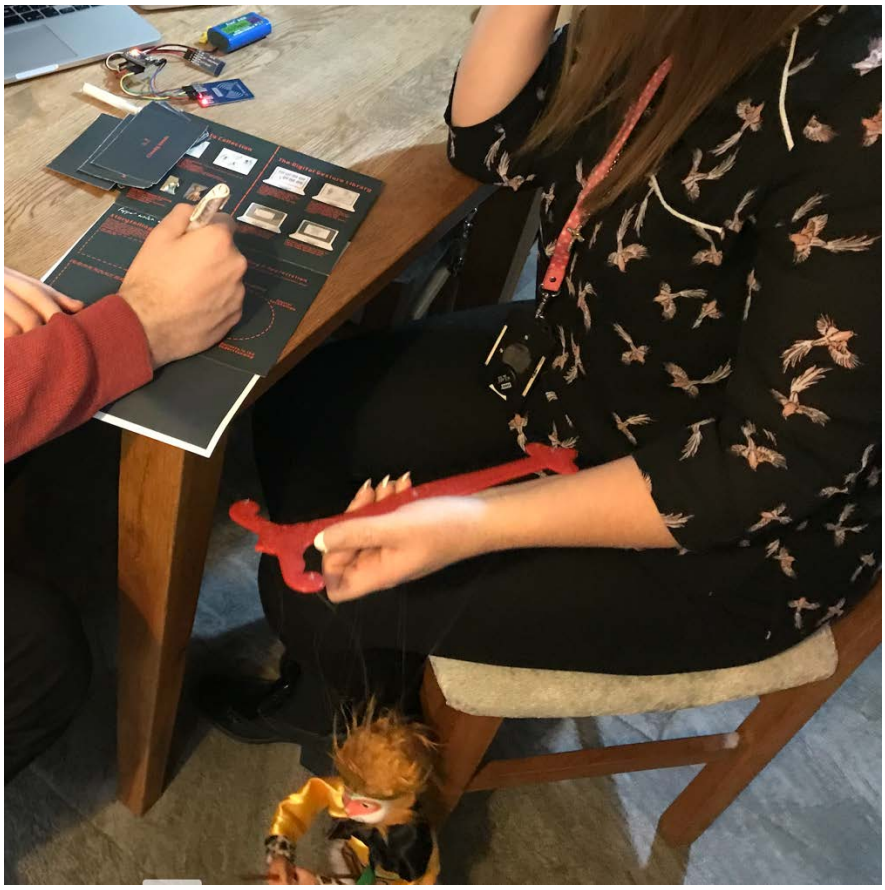
Do you enjoy the engagement with the element cards?
Do you think this pattern support you want to engage the show?
Do you have any other suggestions for us about how to engage the show?

Do you want to use this system again or next time, if yes, what occasion do you think you want to experience again?
Would you go to theatre to watch a puppet show, knowing that you have gained a new perspective and understanding of puppetry through this digital gestural library and the experience??

Data Analysis

6participants as three groups, data include interview audio, performance videos and notes.

Appendix B.6 Examples of the sketches of participants' brochure



Appendix B.7 Selected coding from transcripts

A PORTION PAGE OF SNIPPETS FROM INITIAL ASSIGNED CODES ARE ILLUSTRATED BELOW:

Cameron: erm... it basically, it, just reminds me of china town. **Cameron**: Like Chinese new year as well, when they have the dragons they have the fire crackers and everything I just think of culture…	• Dragons and fire crackers (from Chinese new year) are the first things about Chinese traditional culture.
Cameron: eh, the colour I would associate is red. **Cameron**: And gold. **Cameron**: erm... I'm not sure really, just gold and red just cause kind of... **Cameron**: the flag, also when you see the Chinese arches, they're red and gold and the detailing is usually gold, like the writing. And also **Cameron**: so there's elements of gold and... red…	• Gold and red can represent Chinese colour. • Understanding of Chinese traditional colour is stereotype.
Cameron: just like the architecture, the, like… the different society really. The way they act. **Cameron**: I think the language mainly, but also attitude, of people. Just basically interacting with them when I'm at the airport, need, or I need to get a taxi. But, just communicating with the different language and different culture is really interesting…	• Mandarin could be an interesting element in Chinese traditional culture.
Video1: **Cameron**: yeah, there's not a lot of movement. Usually it's just their hands, their legs… but actually the Chinese puppetry there's a lot more, you could say strings connected to the puppet. So there's a lot more movement in each different area of the body rather than just hands and legs. **Cameron**: with this one, it's kind of like a movie, like a story **Cameron**: rather than just a little play. So there's a lot more, there's a lot more detail, there's a lot more information to take in while watching that…	• Puppetry should have more movements rather than only focus on legs and hands.
Video2: Shichao: ok. So obviously you prefer the, this one more than the first one	• Interesting puppetry story would be more relaxed, reasonable.

Cameron: its more interesting, because its more relaxed, reasonable…	
Video3: **Cameron**: the previous feels like they have more of a story to them, whereas this one just seems a lot of people doing different things, there's no storyline to be honest. **Cameron**: that's just my opinion I guess, feels like there's no story line of structure, just they're doing random things for no reason…	• Puppet story should have a clear story for audience especially for transcultural audience.
Video4: **Cameron**: obviously it's like a class act, like what do you do, like when you're in primary school and you do a performance… like maybes something to do with the birth of god or Christ or whatever, but i feel like this one is just, they need to study this as part of their education and they didn't do it professionally and it's just really bad… I think **Cameron**: this one's narrated. Like there's some kind of text there **Cameron**: it's not really traditional...	• Professional puppeteers and more intact performance could be more attractive for audience. • Subtitles are not necessary even superfluous.
Cameron: I just think movements overall, to be honest and the outfits and obviously the story line… because we have different culture and obviously with china there's a lot of tradition following up to now, rather with English there's not much tradition to be **Cameron**: because obviously, in china the culture and the heritage stays throughout, you carry that over, it's a strong element throughout the years. But with English, you have just the different stages of the 1800's, 1900's the history just changes so obviously things don't carry over… but with the puppetry, Chinese puppetry, it feels like it did carry over – people still take a lot of interest in that...	• Main difference between Chinese and British Puppetry are outfits and story lines. • Chinese puppetry lack of connections between traditional story and real life.
Cameron: and obviously, its heritage people want to keep that. Shichao: so what do you think the barriers to engage with Chinese traditional puppetry **Cameron**: I think have puppeteers trained in that area, who want to perform that, I think keeping that is really difficult… like teaching that to someone.	• Technical operation limited the development of Chinese traditional puppetry. • Advance with the times keep Chinese traditional puppetry get more attention.

Cameron: keeping it up to date **Cameron**: and just keeping that element of puppetry in their life…	

PREVIOUSLY CODED TABLES WERE ANALYSED TO IDENTIFY CANDIDATE THEMES, WHICH ARE ILLUSTRATED BELOW WITH THE RESPECTIVE DATA EXTRACTS:

Spreading of Chinese traditional impression	**The source of the understanding of Chinese traditional colours.**	**Story choose, suitable Chinese story for audience**	**The barrier between CTP and non-Chinese/Chinese audience**	**The elements and ways could engage non-Chinese audience interested in CTP and understand it**
Cameron: erm... it basically, it, just reminds me of china town. **Cameron:** Like Chinese new year as well, when they have the dragons they have the fire crackers and everything I just think of culture. **Kimberley:** Costumes, traditional music, painting. **Alex:** Chinese food, products, movies. **Alex:** Travelling (Singapore, Malaysia), food, friends...pictures, temple's, movies.	**Cameron:** eh, the colour I would associate is red. **Cameron:** And gold. **Cameron:** erm... I'm not sure really, just gold and red just cause kind of... **Cameron:** the flag, also when you see the Chinese arches, they're red and gold and the detailing is usually gold, like the writing. And also **Cameron:** so there's elements of gold and... red. **Kimberley:** Jade, green, dark blue on the pottery and red from traditional buildings.	**Cameron:** just like the architecture, the, like… the different society really. The way they act. **Cameron:** I think the language mainly, but also attitude, of people. Just basically interacting with them when I'm at the airport, need, or I need to get a taxi. But, just communicating with the different language and different culture is really interesting Video2: **Shichao:** ok. So obviously you prefer the, this one more than the first one?	**Cameron:** I just think movements overall, to be honest and the outfits and obviously the story line… because we have different culture and obviously with china there's a lot of tradition following up to now, rather with English there's not much tradition to be. **Cameron:** because obviously, in china the culture and the heritage stays throughout, you carry that over, it's a strong element throughout the years. But with English, you have just the different stages of the 1800's, 1900's the history just changes so obviously things	Video4: **Cameron:** obviously it's like a class act, like what do you do, like when you're in primary school and you do a performance… like maybes something to do with the birth of god or Christ or whatever, but i feel like this one is just, they need to study this as part of their education and they didn't do it professionally and it's just really bad… I think. **Cameron:** this one's narrated. Like there's some kind of text there. **Cameron:** it's not really traditional**.**

	Kimberley: Food, watching Chinese opera, kung fu. **Alex:** Color: yellow(skin), red and green (palace, clothes).	**Cameron:** its more interesting, because its more relaxed, reasonable. Video3: **Cameron:** the previous feels like they have more of a story to them, whereas this one just seems a lot of people doing different things, there's no storyline to be honest. **Cameron:** that's just my opinion I guess, feels like there's no story line of structure, just they're doing random things for no reason**.** **Kimberley:** Journey to the West, Dream of the Red Chamber. Glove puppetry which is a sort of traditional puppetry from her dad. Just for festivals indoor to watch and watch TV with effects. And for mandarin Chinese puppet show just watched in outdoor.	don't carry over… but with the puppetry, Chinese puppetry, it feels like it did carry over – people still take a lot of interest in that. **Cameron:** and obviously, its heritage people want to keep that. **Shichao:** so what do you think the barriers to engage with Chinese traditional puppetry. **Cameron:** I think have puppeteers trained in that area, who want to perform that, I think keeping that is really difficult… like teaching that to someone. **Cameron:** keeping it up to date **Cameron:** and just keeping that element of puppetry in their life. **Kimberley:** I think it's kind of old fashion now, it's not popular, I was surprised that someone still watch it on TV cos I thought no	Video3: **Kimberley:** I knew this character before so I can understand this. **Kimberley:** And this is for TV, more comedy. **Kimberley:** Favorite one. Video4: **Kimberley:** I like all of them, like the first one changed the face also, the last one is speak my mother language. **Kimberley:** Languages or have a book to read the backgroud storyline. **Kimberley:** Sound of the music. **Alex:** It's like comedy with Chines traditional story which are different with the previous two. **Alex:** More focus on conversations. It's a comedy cos the audiences were laughing. And

		Kimberley: Yeah, I can, cos I have some background, I think I understand that she is a sort of fliting character. **Kimberley:** Yeah, like the music and costumes especially the colour. **Alex:** No Chinese traditional story. Watch local puppet show on tv in childhood. **Alex:** Very oriental. Background, music, colour and everything look like Chinese traditional culture.	one watch it anymore. **Kimberley:** Cos the movies like Hollywood, Korean drama, Japanese drama. The storied are quite old and not related to our life. Change the story would be helpful to make it popular again. **Kimberley:** They can understand it, like they can understand sadness, happiness. Maybe they will wrong cos we have different culture background. **Alex:** The puppetry videos are not for children, from the stories, music...I have never seen any Spanish puppet show are for adults. Especially, the contexts are for kids to let them learn something or laugh in Spain. The structures of Chinese puppetry are much complex than Spanish puppet. **Alex:** Languages, culture	the subtitles are useful for understanding.

			background, gesture and contexts.	

DEVELOPED THEMES AND DATASET WERE RECURSIVELY REVIEWED TO ENSURE THE DATA EXTRACTS RELATE COHERENTLY AND MEANINGFULLY TO EACH IDENTIFIED THEME:

Chinese traditional elements and Chinese impression *Chinese traditional impression* **&** *Chinese traditional colours*	**The suggestions of how to *experience CTP*** *Story choose* ***&*** *barrier* ***&*** *interesting elements*
[The spreading of Chinese traditional impression] **Cameron**: Like Chinese New Year as well, when they have the dragons they have the fire crackers and everything I just think of culture. **Kimberley:** Costumes, traditional music, painting. **Alex**: Chinese food, products, movies. Travelling (Singapore, Malaysia), food, friends...pictures, temple's, movies.	**[Suitable Chinese story for audience]** **Cameron**: its more interesting, because its more relaxed, reasonable. **Cameron:** the previous feels like they have more of a story to them, whereas this one just seems a lot of people doing different things, there's no storyline to be honest. **Cameron:** that's just my opinion I guess, feels like there's no story line of structure, just they're doing random things for no reason. **Kimberley:** Yeah, I can, cos I have some background, I think I understand that she is a sort of fliting character. Like the music and costumes especially the colour. **Alex:** Very oriental. Background, music, colour and everything look like Chinese traditional culture.
[The source of the understanding of Chinese traditional colours.] **Cameron:** the flag, also when you see the Chinese arches, they're red and gold and the detailing is usually gold, like the writing. **Kimberley:** Jade, green, dark blue on the pottery and red from traditional buildings.	**[The barrier between CTP and non-Chinese/Chinese audience.]** **Cameron:** I think have puppeteers trained in that area, who want to perform that, I think keeping that is really difficult… like teaching that to someone. **Cameron:** keeping it up to date and just keeping that element of puppetry in their life. **Kimberley:** I think it's kind of old fashion now, it's not popular, I was surprised that

Alex: Color: yellow(skin), red and green (palace, clothes).	someone still watch it on TV cos I thought no one watch it anymore. **Kimberley:** Cos the movies like Hollywood, Korean drama, Japanese drama. The stories are quite old and not related to our life. Change the story would be helpful to make it popular again. **Alex:** The puppetry videos are not for children, from the stories, music...I have never seen any Spanish puppet show are for adults. Especially, the contexts are for kids to let them learn something or laugh in Spain. The structures of Chinese puppetry are much complex than Spanish puppet. **Alex:** Languages, culture background, gesture and contexts. **[The elements and ways could engage non-Chinese audience interested in CTP and understand it.]** **Cameron:** this one's narrated. Like there's some kind of text there, more comedy. **Kimberley:** Languages or have a book to read the backgroud storyline. **Alex:** It's like comedy with Chines traditional story which are different with the previous two. **Alex:** More focus on conversations. It's a comedy cos the audiences were laughing. And the subtitles are useful for understanding.

Appendix B.8 Observation notes of Storytelling Workshop

SELECTED NOTES FROM ENGAGEMENTS

Group1

Discussing:

1. Review and searching the elements for numerous times.
2. The attention from archive to elements cards then go back to archive for double check then go to have discussion with each other.
3. Pause for many times.
4. Writing stories with discussion of the meaning of movements.
5. One participant writing script and another one is check the element cards to write down which elements are for the script.
6. The scripts are involved participants' personal life stories and their emotions.
7. The graphical booklet is connecting the digital gestural library with their ideas.
8. The graphical booklet is help participants to understand the process of this engagement and inspire them to divergent their imagination.
9. The participants ask to add the progress bar to choose the specific paragraphs of the videos.
10. When the participants discussing the scripts, they also consider the looks/types/personalities of the puppets.

Performance:

1. The participants try two forms of experience, one is two participants play one puppet together, another one is two participants play two puppets.
2. At the beginning/ the first performance, the movements are all from the same kind of puppet. But in the second time, participants use different sort of puppets with the elements they need to conduct their performance.
3. Watch their performance with each other, learning from each other, and share the understanding and subtle movements.
4. Check the video archive and switching different view of the video reassures.
5. Still have some questions or technical barriers when they were doing the performance.
6. There are lots of dialogue in their performance. And the participants are more focus on the interaction with the puppets rather than the completeness of the performance.
7. Marionette experience are cost more time to experience, and participants are spending more time to discuss their gestures.
8. During their performance, they changed different movements from the digital gestural library because they need to find out the appropriate movements based on their engagement.
9. While the participants playing the puppets while they were checking the digital gestural library also while discussing their script.
10. They researched Chinese folk music as background to help themselves in the cultural atmosphere.
11. After they finished their performance, they still talk about their stories and immerse in the stories/emotions.
12. After they finished their performance, they still talked about their stories and immerse in the stories/emotions. Also, they talk about wanting to let their kids experience this in order to allow them to get to know Chinese traditional cultures.

Group2

Discussing:

1. Participants spent lots of time to play the digital gestural library together, and through the discussion to figure the meaning and types of the movements.
2. After 60mins gestural library experience, participants held puppets to imitate the movements from the library spontaneously.
3. One participant was imitating the movements and gestures from the digital library, then sharing the thought about the ideas of their script, another participant was working on the script writing.
4. Participants would like to use two different kinds of puppets to create the dialogue which mix different puppets in one story.
5. During the discussion, they used internet to search Chinese traditional sorties to get to know the background stories, and grasp some knowledge of the character of the puppets.
6. The scripts were combine by the digital library, background stories, character feature and their personal stories/understanding.

7 During the discussion, they used the internet to search Chinese traditional stories to get to know the background stories, and grasp some knowledge of the character of the puppets.
8. Based on participants' script, they developed some their own movements for supporting their stories, but before they create the movements, they reviewed the digital library many times.
9. Participants made elements-sensor lines that followed by their scripts, this which support them to have a clear understanding of their stories.
10. The discussion includes: experience digital library-discussion-experience puppets-reviewing-stories discussion-background search-character research-reviewing-puppets experience-elements discussion-scene discussion-script writing.

Performance:
1. Participants conduct two phases in this section, which include rehearsal and formal performance.
2. In the rehearsal phase, participants reviewed the gestures in the digital library many times and did some subtle amendment of the script based on the reviewing.
3. In the performance phase, participants did not check the digital library, but they used the element-sensor to review the gestures.
4. Participants searched Chinese folk music as background to help themselves to immerse the cultural atmosphere.
5. When participants using element-sensor, they keep sharing their own thought of the performance.
6. One participants used marionette and another one used stick puppet to engage the show.
7. The precision of the gestures and movement been declined, participants were more focused on use elements-sensor, background stories and imagination to explore the Chinese traditional cultures and stories.
8. The performance was included different scenes that connect the Chinese stories and English stories together. (In-depth understanding)

Group3

Discussing:
1. Through random browsing of element-sensor to explore different gestures and movements.
2. After initial browsing, participants had discussion about their ideas.
3. During the discussion, participants also shared their pervious personal puppet experience, this which support them to have more discussion of cross-cultural stories thinking.
4. Participants sorted elements by their understanding and scenes.
5. After browsing and discussion, participants experience two puppets together.
6. During the experience of puppets, participants did changes of the orders of elements which change the script as well.
7. After experience the puppets, participants decided to focus on "double form" as their main performance way to conduct their performance. Because they thought this way could be easier for the beginners.
8. Based on marionette and stick puppet, participants made specific element-sensor group to form the script.
9. Process: Browsing-discussion-ideas of script-reviewing-discussion-experience puppets-elements order-reviewing.

Performance:
1. Participants followed their elements-sensor order to practise the movements one by one.
2. Two participants cooperatively played one puppet to conduct the performance, one participant played the arms, another one played the legs.
3. During the practising, the sensor was being used for many times.
4. The dialogue was completed by discussion, and more emotions were involved into the script.
5. Because the puppet been offered was different with the one in digital gestural library, participants had discussion and search to explore the methods of how puppet performed?
6. Element-sensor been used for reviewing in this stage, participants intent to pursue to have accurate gestural performance.
7. After the performance, one of participant has already played the marionette expertly.

SELECTED NOTES FROM ENGAGEMENT—INTERVIEW

Group 1

Thomas: We think this puppet looks gorgeous, we observed how they were moving the arms, it's different [from] my previous imagination. Not like just watching it, I never thought I could actually really play this.
Alex: The only barrier that I could possibly have is obviously the use in a different language, in which I don't understand.
Thomas: like body language. I think it's the three perspectives as well on some of them, so from all the different perspectives it gives you an idea of how puppetry looks from all different angles and how you can do it from just looking at those different angles.
Alex: if we recognise it then we can react to it. Usually in these kinds of things what I do is I just focus on the things that I understand, so if I don't understand the language obviously then I would pay more attention to other things, like he said, the music or the environment or who the characters are.
Alex: I would just focus on the things I can understand and things that make me enjoy the piece of work in this case. I prefer scanning it than actually going through the videos by themselves. Cos it's like I can touch the puppet and have an interaction with it. I haven't experienced this before.
Thomas: I think that's one of the things you'd focus on if it was a public platform but if it's online you can browse through a lot of different things because it's not going to cost you time, you're not going to be paying for it. So I think it depends which platform you're wanting to appreciate it through, so I think a public platform you think about it more, so if you're going to watch it in the theatre you're going to think about all the different aspects.
Thomas: how it's broken up into the different videos I think it helps you focus more on what you're looking for because of the different videos and it's easy to understand the main functions. So if you went onto it to find this kind of movement you could just use the titles to narrow it down.
Thomas: Like some body language that's used in puppetry is not international. So it might be some internal language that they use.
Alex: It could be more like some sort of text, or floating text, that tells you what's going on in the scene because if this is meant to be shown in public, technically people who have no idea about puppetry want to use it, therefore it has to be as accessible as possible.
Thomas: We can't watch a Chinese puppet show with these movements if we don't know what the movements mean.
Thomas: I think it's the three perspectives as well on some of them, so from all the different perspectives it gives you an idea of how puppetry looks from all different angles and how you can do it from just looking at those different angles.
Thomas: I think for me it was having the three different perspectives because you can gain an insight into what the puppeteer sees, what the audience sees and how the puppeteer moves the puppet, I think it's a really good idea.
Thomas: maybe if the library was broken down into different types of puppets, I know there were some, like a table top puppet and then a string puppet, if it was broken down into different categories it would be easier to find out what you were looking for rather than scrolling in and out. So maybe a genre library or something where it breaks it down into the different forms.
Alex: Exactly because if I were to buy a puppet and I only had one type I would like to easily find the ones that relate to my puppet.
Thomas: So, for me, the step one is you watch your puppet show and then step two is you use the library to recap the movements. Then following on from that maybe you re-watch the puppet shows so you can understand the dialogue and what's happening.
Alex: It should have a scroll option, yes. I think the functionality, and I know that's not mentioned on there, but I think the functionality could be improved just so navigating through it would be a lot easier, again with the structure where it's like a library or it could be formatted in a way that's like a website. So you've got all the different functions, you've got going back and forward, I think you'd try to step away from using the keyboard unless you were searching for something. So I'd try and incorporate the use of a mouse more because it's easier to navigate for everyone and it's quicker.
Alex: really it feels like it needs to be for someone who has no idea about computers and be more accessible.
Thomas: I think so but I think I need an introductory session on what Chinese puppetry was and what each movement meant. So maybe if I watched a puppet show and then used this library to see what

kind of movements were happening then I'd be able to understand the story, so I'd be able to have more of an in-depth appreciation of the puppet show.
Alex: I think something very similar, I think the library on its own doesn't really work, this library needs to be in a context. So in order for me to develop an interest I will have to go through the whole process. Maybe if this was shown in some sort of exhibition about puppets or about the history of the puppeteers.
Thomas: So maybe just on the puppet show or the library you could have a few different sections, so you could have an index where it outlines, "Watch this," or, "Use this part of the website", before you use the library. If you go straight in the library without doing anything the movements aren't going to mean anything.
Thomas: You could watch a puppet show and then watch the movements to see what the story actually meant and then re-watch the puppet show but if you're watching this first and then going secondly onto the puppet show you're going to have no idea what you've just watched really.
Alex: If I was to just be thrown into the engagement I don't think I would have enjoyed it that much. It was the fact that I got the proper introduction and a proper play with the system first.
Thomas: With the library you could put lots of different videos together and make a story, like the randomisation of the cards. Also when I used the cards it would remind me of what video you've watched so you can keep going back and forwards without forgetting what the movement was or what video it was that you were on.
Thomas: I think after using the elemental cards and building a story I think it was quite fun because I was building the story just based on four different movements from a video. I think building a story through the four different movements was quite interesting.
Alex: It could even be turned to be part of some sort of learning programme, so someone who wants to learn about the puppets, it could be a good way to start really.
Alex: This is a product that works in the context, it doesn't work on its own. So in order for you to start using it and for you to get engaged in it you need to be.
Thomas: I think you need the experience of a previous puppet show before you go in to using the library. You need to be in the context.
Thomas: So step one is you watch your puppet show and then step two is you use the library to recap the movements. Then following on from that maybe you re-watch the puppet show so you can understand the dialogue and what's happening.
Thomas: the next time I would use it is probably after watching a few more puppet shows, Chinese puppet shows specifically, just so I can grasp a story without acknowledging subtitles or the background music and actually utilise the movements myself to gain the knowledge of what the story is about.
Alex: We found a very common example of Chinese folk music to use as background music, we like to discover more relevant knowledge to make us more connected to the show, and we can get to know so much more Chinese traditional cultures at the same time.
Thomas: Like I've just said I would want to watch a few more puppet shows before I used the system again, so yes, I'd go to watch a puppet show knowing that I'd gained the perspective of puppetry through the library.
Alex: Yes, so I'm going to appreciate more the movement of the puppets and when something is happening can appreciate what's happening in the background as well of the performances of the puppets.

Group 2

Paul: The only barrier for me is that, since I'm not that old, a lot of the stories presented are ones that I don't actually know.
Paul: I think if I was watching a foreign one, the only barrier I have would be the language barrier.
Jade: Yes, but a lot of British puppet shows, compared to Chinese puppet shows, have a lot of ones that are aimed at different audiences. So, say if you go to the theatre and they do puppet shows, you've got Peter Pan, which is aimed at young children, so you can understand it more. Whereas obviously with the traditional Chinese ones they are aimed at more older people, I would say, as well. Especially with the music, because obviously a lot of them are into tradition.
Paul: So, usually people focus on the story, but I focus more on the music and the outfits. Since I haven't really seen that many puppet shows, that's the only thing I can pull from, because I don't know the stories, to be honest. I just know the sounds and the outfits, and I can try and make the story from that.
Jade: Sometimes music is what makes a story, though, I think. Even if there are no words, or no emotions or anything, I think sometimes you can actually relate through music. Especially with certain

instruments. Yes, I think certain instruments express emotions. Like if it's a piano it could be sadness, or it could be happiness. It's things like that.
Paul: I understand the main function, and I think it's a quite good function. I like how it gives you the option to have a look at three different screens, so you can choose from a range of different viewpoints, but I think that the main function is really understandable.
Jade: Yes. I would say with that that you wouldn't know how to use them. You wouldn't know how to use the puppets without watching those. With the library you could put lots of different videos together and make a story, like the randomisation of the cards. Read the meaning first. Also, when I used the cards it would remind me of what video you've watched so you can keep going back and forwards without forgetting what the movement was or what video it was that you were on.
Paul: I think it does give you a bit of an idea of all the different viewpoints, and that puppets, you don't just focus on moving the puppet. You focus on how the puppeteer does it, the subtlety of the gestures, how they're performed, how the strings move, and how the puppet performs.
Paul: So, a lot of the sentences can't really translate into English, depending on the movement. So, it's a bit hard to understand what it means without the subtitles.
Paul: I think so. For me, I could look at it from three different viewpoints. So I could see how the puppet moves, how the puppeteer moves, and how they move together to make a story. I think it's a quite good function. I like how it gives you the option to have a look at three different screens. Especially, I can choose any viewpoint by myself, step by step, some of them I watched for so many times until I found the secret.
Paul: I think being able to go through a catalogue of three different puppets and see how the puppeteers can perform differently depending on the puppet. So, even some moves are similar, it could be totally different with a different puppet and a different puppeteer. So, while I could perform happiness and someone else could perform happiness, it could look completely different.
Jade: I would say maybe just a little bit of music, because like I say, again, as you were saying before about the subtitles, sometimes you don't actually need subtitles if you add music in.
Paul: if you have subtitles it distracts you too much, but if you have the music it puts you in kind of a trance. So, you're focusing on the movements, but then the music is behind you, and then you're making your own story.
Paul: I could appreciate it in the theatre. Whereas if I went to a theatre, to be honest, I wouldn't be interested because I wouldn't know what was happening.
Paul: Sometimes, not all puppet shows, have silent puppet shows. So, I've got no idea what's going on, but if they have, after having reviewed the gesture library, it's helped me understand from three different aspects how it's performed, and from three different puppets how it can be performed too.
Jade: I sometimes think it's much easier to watch than it is to read, because you can learn more, understand more from watching.
Paul: but in the library you've got everything sitting in front of you.
Paul: if you want to engage in a show there should be some random selection. So you could click shuffle and it would choose five different movements for you, and that obviously you wouldn't be choosing the movements, but the system would. Therefore, you'd have to make a story from that.
Jade: Most children learn from things like that. They learn from, say, building blocks, or they would learn from a toy that you could chew on. Same way with puppets, because you'd learn how to move, and when she looks at things like that she gets an idea of how she should move. So, say if a puppet is moving their arms, she'll move her arms.
Paul: I think if it was aimed towards young children, it could engage them in learning how to grow, learning how to become.
Jade: Could be emotions, could be movement.
Paul: I think that through the library there are plenty of different approaches to many different elements of life, appreciation, puppetry and art.
Paul: it can be used as a social learning, say in a library or something, or in a museum. I think at home it can be used for a form of education and appreciation. While at first it's not going to let you appreciate it.
Paul: I think it's going to be a lot easier to acknowledge, say, the puppeteer's movements, the puppet's movements, and the overall scene to try and understand.

Group 3

Brian: For me, prior to this, as a foreigner, I couldn't understand this at all … but everything is different now, I clearly know the meaning of the movements. Like some body language that's used in puppetry is not international. So, it might be some internal language that they use.

Sarah: Hmm. I think you could watch it once without, and if it interested you that much to try and find out what the basic storyline was about, you could then put it with the subtitles. So, there are two versions. So if you didn't have subtitles the first time you might have thought it was about a certain thing, but then when you watch it with subtitles it could have been about something totally different. So, a bit of both.
Brian: Otherwise it's just going to be easier for you to learn, where they should be learning it from understanding the movement rather than reading about it.
Sarah: Also the actions, when you showed all the different types of actions, they were certain gestures within puppetry. In other types of shows, that could be interpreted as something else.
Brian: because you should try and guess what it means before you actually know what it means. So, that's going to help your understanding. It's going to help you appreciate puppetry movements more.
Sarah: Therefore getting to know, from the view of the hands, the overview, and then the view of the puppet, I think that's quite interesting. I watched the Chinese puppet show before, just checked some nice outfits, and some noisy music, then I stopped the watching. Because I don't understand the dialogues, this makes me feel bored. But this time, after I observed the element-based gestures, I felt the emotions from the puppets and even from the puppeteers. I don't even remember how long I watched this show, I was really enjoying it.
Brian: because it presented three different views, didn't it? So, you understand puppetry from various perspectives.
Brian: It could be an option, so you could say, "Oh, well I'll try and learn it without the music just to try and understand it" Then I'll do it with the subtitles to then see if it's correct. Then I'll try and put it with the music to make sure that the concept of it is right.
Sarah: That's a good thing, because if it's the first time watching something like that you might think you understand it, but you don't actually really understand it until you've got to the add the music, add the subtitles process. I compared those similar gestures which was able to help me understand the accurate meaning, I think this is really important for understanding the whole plot of the story.
Sarah: It's similar to opera, I mean, it's nothing to do with puppetry, but tones in the music. If it's a traumatic thing it goes really, really deep, and then you know what it's about. So, say you're doing puppetry and you wanted to show that the puppet was angry, and he was making a forceful hand gesture or something, it would be like a banging of a drum. As if he was going to be on the edge. So if you added that music into it you would know that scene was coming up where it was going to be dramatic.
Brian: I think just understanding where the storyline comes from through movement, therefore it's easier to get the same feeling from different movements too. I think after using the element cards and building my story I think it was quite fun. And just feel like I am being a part of a Chinese story.
Sarah: Then to have a little bit of knowledge, it makes it a bit more entertaining to put those cards in, and it makes it more interesting. So you want to take part.
Brian: if you recap the videos then just remember the titles and look at the cards as an easier way to structure your storyline.
Sarah: Once you know the storyline, it's easier for you to remember.
Brian: I prefer scanning it than actually going through the videos by themselves. So, I'd prefer to choose one, two, three, four of the cards to scan it, because I think it's a quicker way, and it's easier to find each different video rather than flicking through the videos.
Sarah: I disagree, actually, because I think it makes it more entertaining, makes you want to involve yourself more by having to search and look for certain things. I think also if someone was sitting with you, "Come and sit and watch this puppet show," if I watched it and really enjoyed it I'd think, "Oh, how do they do that?" I would like someone to say to me, "Well, they've got a workshop afterwards," and to explain what we did.
Brian: So, in the end, whoever reaches, say, a certain amount or number of movements, they've got to make the story first. Then everyone has got to make their own interpretation of it.
Sarah: you could then get someone to interact, but then you could develop a game out of it.
Sarah: I would probably use it every time the kids come over.
Brian: So I could then, from now, have a chance to understand puppetry just from what I've learned today, but then come back later to understand it even more after watching the performance where I've slightly understood it a bit more. So, getting a bit of knowledge, watching it, then getting a bit more knowledge, then watching it. Then in the end watching another one and having a full understanding of it.
Sarah: I would show the videos showing all the movements on how the puppets work and things, then I would get the kids to sit own, and out of the game place the cards to whatever show they want to make out of it. So, it can be anything of those cards. It might be, "I take the dog down to the park." So,

really the cards could be the dog, the park, whatever, and when they put them together then let them have the puppet to do it themselves.
Brian: A bit more confidence to understand it, not just based on acknowledging the music and the sounds.
Sarah: I would definitely go and see a puppet show again, but I'd also encourage others to do it. Just because, like I say, you're forgetting how good an activity a puppet show was way back.