Illusion and Reality

How the Chinese Artform of Shadow Puppetry Can Be Innovated Through Media Design

Yaolin Chen

Master of Design

Massey University, Wellington, New Zealand.

2021

ACKNOWLEDGEMENTS

ABSTRACT

Chinese shadow puppetry is a type of classical performance opera with 2,000 years of history (Jin, 2011). Cultural heritage is a cultural achievement of a nation and an important symbol of cultural identity (Feather, 2006). Unfortunately, the complicated artform and lack of innovation means that Chinese shadow puppetry has gradually declined in recent years. This increases the urgency of addressing the issue of preservation and the maintenance of cultural heritage (Chen, 2007). Nowadays most knowledge of the art of shadow puppetry is disappearing with master artists aging, and the younger generations not having a good knowledge of these skills, which has resulted in cultural heritage facing extinction (Rollins, 2015). Protecting cultural heritage has positive effects on studying the development of human civilization and cultural progress (Feather, 2006). With traditional artists aging, it is necessary to make a younger generation aware of the problems of cultural loss and the importance of cultural heritage (Rollins, 2015).

This project aims to explore shadow puppetry art through digital media design, progressing and disseminating traditional culture in a modern environment. It also aims to educate the audience about Chinese shadow puppetry and encourage them to enjoy shadow puppetry traditions through interactive design and digital media.

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1.0 Introduction

As a designer, I have always been interested in the study of cultural topics. I grew up in an international port city in south China, which has a strong traditional cultural history and trendy contemporary culture. I still remember that in my childhood I very much enjoyed Chinese lion dances and shadow puppetry in traditional festivals, playing Japanese Nintendo games with friends, watching American Disney cartoons and Japanese animation on television; moreover, KFC and McDonald's were the most famous fast foods when I was a child. The environment that I grew up in was a culturally diverse melting pot that gave me chances to interact with different cultures. After high school, I came to New Zealand to do my university study. This helped me meet friends with cultural backgrounds from different countries all over the world, which gave me a greater interest in studying my personal Chinese cultural identity. For my undergraduate research project, I designed graphic novels to explore my personal cultural identity in the multi-cultural environment of Auckland. For my postgraduate research, I aimed to explore a cultural research topic in more depth, which has helped me to learn about my personal cultural background and traditional Chinese culture. I used Chinese shadow puppetry as a research topic and studied how I can use digital design techniques to help revitalize this cultural tradition.

Chinese shadow puppetry is a type of classical performance opera. Its origin can be traced back to the Chinese Han Dynasty (206BCE–CE220) which has more than 2,000 years of history (Jin, 2011). Chinese shadow puppetry was enrolled on the *Representative List of the Intangible Cultural Heritage of Humanity* in 2011. Cultural heritage is a cultural achievement of a nation and important symbol of cultural identity (Feather, 2006). Unfortunately, the factors of the complicated artform, lack of innovation, and the development of the film industry means that the Chinese shadow puppetry industry has gradually declined in recent years. This increases the urgency of addressing the issue of preservation and the maintenance of cultural heritage (Chen, 2007). Nowadays most knowledge of shadow puppetry art is disappearing with master artists aging, and a new generation without a good knowledge of these skills has resulted in cultural heritage facing extinction (Rollins, 2015). Protecting cultural heritage has positive effects for studying human civilization development and cultural progress (Feather, 2006).

My project aims to explore the shadow puppetry artform through digital media design, progressing and disseminating traditional culture in a modern environment. It also aims to educate audiences about Chinese shadow puppetry and encourage them to enjoy shadow puppetry traditions through interactive design.

1.1 Research Question

The research question of this project is: How can shadow puppetry be maintained and innovated through the integration of digital media art forms?

Figure 1: Screenshot of Mulan storytelling in shadow puppetry video on YouTube.

2.0 Context

2.1 What is Chinese Shadow Puppetry?

Chinese shadow puppetry (a.k.a. Pi Ying Xi) is a storytelling artform using leather figures to create moving images in front of a luminescent background, combined with operatic song or folk music. Furthermore, shadow puppetry can be considered to be the origin of modern Chinese film and contemporary opera (Chen, 2007). The figures used in shadow puppetry are usually made from carved paper, donkey hide, or cattle hide. They are usually comprised of eleven movable parts, depending on the performance role of the character. Generally, there are three bamboo sticks that are fixed on the figures' two hands and neck which supports the figures' activities (Jin, 2011).

Chinese shadow puppetry art is similar to Chinese paper-cut art, both using negative carving and positive carving technique to show the character's visual style. The characteristics of shadow puppetry creations are also similar to wall murals, sculpture, and mask opera artforms. Shadow puppets use different face identities to present different characters' roles in the plays, which are: male role (a.k.a. Sheng), female role (a.k.a. Dan), rough or mighty male (a.k.a. Jing), and minor role (a.k.a. Chou) (Wei, 2007). Most shadow puppets' faces are designed in profile and in a few special roles the front views of faces are presented. For example, most of the roles involving good characters are presented in profile, and most evil roles are presented in three-quarter profiles (Wei, 2007).

Most shadow puppetry performances are inspired by legends and mythology. Common classical stories include *Water Margin* (a.k.a. *Shui Hu Zhuan*), *Records of the Three Kingdoms* (a.k.a. *San Guo Yan Yi*), *Journey to the West* (a.k.a. *Xi You Ji*), *Strange Stories from a Chinese Studio* (a.k.a. *Liaozhai Zhiyi*), and *Investiture of the Gods* (a.k.a. *Feng Shen Yan Yi*) (Tang, 2018).

The musical instruments that accompany shadow puppetry are Chinese double reeded horns (a.k.a. Suona), Chinese two-stringed bowed instruments (a.k.a. Erhu), cymbals, gongs, and drums (Tang, 2018). A traditional shadow puppetry troupe usually includes a conductor (a.k.a. Qianshou), a main puppeteer (a.k.a. Dengdixia), two musicians (a.k.a. Shangdang, Xiadang), and stagehands (a.k.a. Houcao). The success of a shadow puppetry show depends on the degree of collaboration between these five performers. Therefore, shadow puppetry is also known as "Five Person Performance" in Northern China (Wei, 2011).

Figure 2a: Shadow puppet "good" role profile.

Figure 2b: Shadow puppet three-quarters profile.

2.2 Different Types of Chinese Shadow Puppetry

Varying shadow puppet art styles were developed in different regions of China throughout its 2,000 years of development. There are seven main types of shadow puppetry art centres, which include southern China region style (a.k.a. Caozhou style), south-eastern China region style (a.k.a. Xianggan style), south-western China region style (a.k.a. Chuanedian style), eastern China region style (a.k.a. Hanzhou style), northern China region style (a.k.a. Shandong style), north-eastern China region style (a.k.a. Luanzhou style), and middle China region style (a.k.a. Qinji style) (Jiang, 2015).

Figure 3: Map of China and its provinces.

For example, the carving style of Guangdong shadow was developed from the southern China region style puppet system. In early stages of development, sheep leather was the main material used to make shadow puppets, then paper became a popular material during the Qing Dynasty (CE1644–CE1911). After that, artists usually used yellow straw board or kraft paper to create shadow puppets; furthermore, cattle hide is another ubiquitous material in the historical development of the artform (Jiang, 2015). Shadow puppet characters are usually nineteen centimetres tall and have clear facial features with similar proportions to real people. The female role's (a.k.a. Dan) arms are made of cloth, there are a few joints, and therefore the puppet's movements can be smooth and changeable (Jiang, 2015).

The shadow puppet art style in Shaanxi was developed in the puppet style system of central China. It takes influence from the Han Dynasty (206BCE–CE220) and Tang Dynasty's (CE618–CE907) figurine pottery. The characters have simple facial lines and evidently recognisable identities. The Dan puppet's forehead is high and bulging, the nose is straight, the eyes are long, the face is round, both the brows thin, and the corners of the eyes and lips are detailed. These characteristics are similar to the baby face style makeup of the Tang Dynasty (Jiang, 2015).

Figure 4: Female role's puppet profile from Shaanxi region.

2.3 Historical and Cultural Development of Chinese Shadow Puppetry

Chinese shadow puppetry originated in the Han Dynasty (206BCE–CE220) which has 2,000 years of history. According to the biographies of *Empresses and Imperial Affines* from the *Book of Han*, Emperor Wu of Han Dynasty very much missed his wife Li who died of an incurable illness. Minister Shaowen found an idea to help Emperor Wu. He used cotton to make a silhouette figure of Empresses Li, set the screen and lit the candle at night, letting Emperor Wu sit in front of the screen to watch the shadow play, which is the original prototype of the shadow puppetry. The Chinese shadow puppetry artform was introduced to Malaysia, Indonesia, and other Southeast Asian countries from the 13th century, then moved west to Persia, Turkey, Egypt, and European countries by way of military expeditions and economic exchanges (Jin, 2011). Subsequently, shadow puppetry developed different characteristics in different nations. For example, shadow puppetry is known as *Wayang kulit* in Indonesia, Malaysia, and some Southeast Asian countries. The puppets are usually designed with long, thin hands with a big head, which is inspired by religious characters, being originally part of a religious ceremony (Mrázek, 2002). Chinese shadow puppetry reached its cultural peak in the Qing Dynasty (CE1644–CE1911). After the invasion of the Japanese army, shadow puppetry began to decline because of social unrest and war during the era of the Republic of China (CE1912–CE1949). With the establishment of the People's Republic of China in 1949, shadow puppetry artists and troupes from all over China began to re-energise (Wei, 2009).

Shadow puppetry is similar to other forms of opera around China. It is not only a performance artform, but also a platform of enlightenment. Ordinary people in China did not have a chance for education before 1952, and these operas including shadow puppetry were the platform to help them gain knowledge of culture and morality (Chen, 2007). For example, Records of the three kingdoms storytelling is the classical story theatre of shadow puppetry which teaches people the principles of benevolence, righteousness, courtesy, wisdom, and loyalty (Tung and Besio, 2007). As another example, during the War of Resistance against Japanese Aggression (World War II), artists in the city of Zhangzhou used shadow puppetry to disseminate and promote anti-Japanese sentiment and national salvation. It was performed throughout Zhangzhou and was very popular (Wei, 2007).

There were limited options for entertainment, and opera performances were the only entertainment available for people in China for long periods. Shadow puppetry was most popular around the country because of its more flexible performance spaces and because it was a simpler type of theatre than other forms of opera (Jin, 2011). Shadow puppetry is seen as a symbol of Chinese traditional culture and identity representation; therefore, it is an inseparable part of traditional Chinese culture and we have a responsibility to protect this heritage from generation to generation (Tang, 2018).

2.4 The Current Situation of Chinese Shadow Puppetry

For a long time in the past, the original purposes of shadow puppetry performances were entertainment and education. With the increase in varying forms of entertainment, such as the development of the film industry, television shows, and the videogame industry since the 20th century in China, the glamour of shadow puppetry is declining fast (Jin 2011). Moreover, the purpose of shadow puppetry has changed from entertainment and education to appreciation in recent years (Wei, 2011).

According to the statistical data from Chinese National Academy of Arts, there are a total of 3154 artists that are "living national treasures" in 2019, but only 50 masters are working in the shadow puppetry industry and their average age is 70 years old. The masters are aging, and currently there is not enough income for shadow puppetry artists to support themselves, which has resulted in them looking at other careers. The effect is that fewer young people are going into the shadow puppetry industry. It is resulting in a shortage of talents in the shadow puppet industry, which will create a loss of cultural heritage (Rollins, 2015).

2.5 Case Study Analysis

2.5.1 Exhibition of Digitalised Mogao Cave 220

The exhibition of 3D digitised Mogao caves (cave No.220) exemplifies how digital techniques can bring cultural heritage to life and educate people. The Mogao Caves are known as the Thousand Buddha Caves and were enrolled on the UNESCO's *Representative List of the Intangible Cultural Heritage of Humanity* in 1982. It is located in northwest China–Dunhuang city. There are more than 700 caves, 492 of which still feature murals and sculptures; furthermore, cave No.220 was built during the Tang Dynasty (CE618–CE907) and is one of the most well-preserved caves in Mogao (Dunhuang Academy, 2008). The exhibition project took six months to complete and more than thirty experts from Dunhuang Academy (a.k.a. Dunhuang Art Research Institute) and City University of Hong Kong participated in it. Visitors stand in front of the 360-degree screen, wearing 3D glasses to get a vivid and immersive view of the screen. This exhibition, through the use of interactive design, displays this site of cultural heritage, educating people about the history and art of the Mogao Caves.

This served as inspiration for me as to how digital techniques could be used to encourage visitors to interact with an interface as a way of learning.

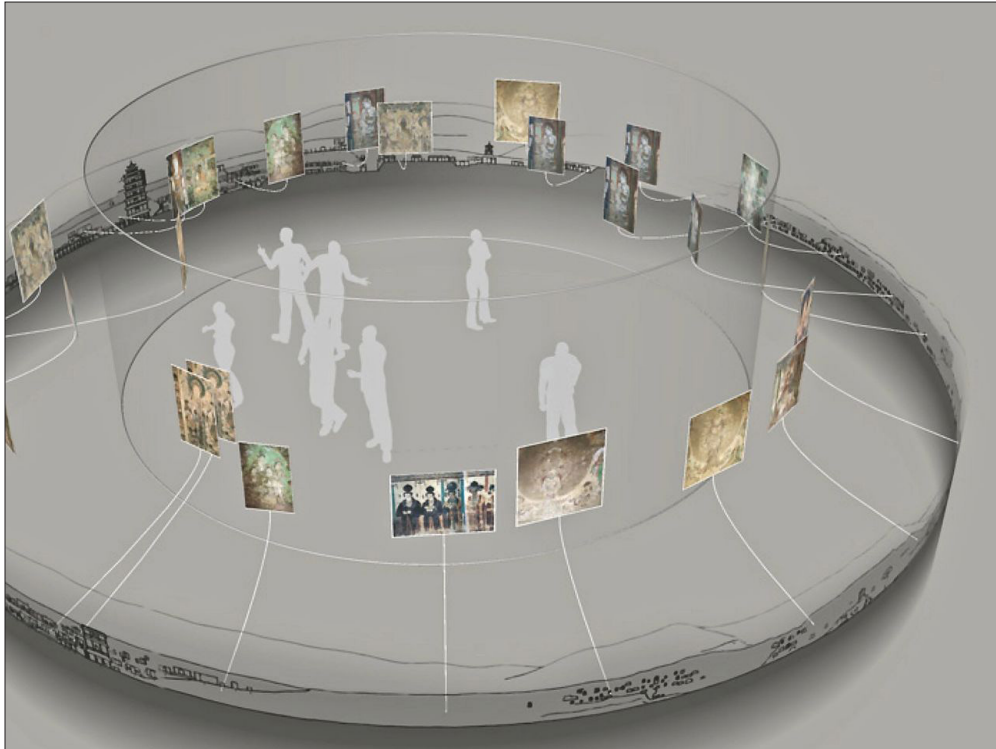Figure 5a: Photo of the north wall in cave 220 at Mogao grottoes.

Figure 5b: Exhibition idea of digitalised Mogao cave 220.

Figure 5c: Exhibition of digitalised Mogao cave 220.

2.5.2 Interactive Painting of "Along the River During the Qingming Festival"

The digitised exhibition of the heritage painting *Along the River During the Qingming Festival* is a useful case study on how museums can use new technology to progress traditional art into digital artform. *Along the River During the Qingming Festival* is a painting by Zhang Zeduan who was a painter of the Song Dynasty (CE960–CE1279). This painting captures the landscape and the life of people in the capital city Bianjing at the Qingming festival. The palace museum in Beijing cooperated with more than twenty artists using digital techniques to make this heritage painting come to life. These exhibitions create an interactive world for viewers, which helps people explore the capital city of the Song Dynasty in a new and engaging manner. Viewers are able to enter a space and feel part of the city.

Figure 6a: A part of the painting "*Along the River During the Qingming Festival*".

Figure 6b: Interactive painting of "*Along the River During the Qingming Festival*" ver.2.0.

Figure 6c: Interactive painting of "*Along the River During the Qingming Festival*" ver.3.0.

2.5.3 Shadow Puppetry Performance of Michael Jackson's Dances

The shadow puppetry performance of Michael Jackson's dances is an example of how traditional shadow puppetry can be used in contemporary culture. Young artists in the shadow puppetry industry transformed Michael Jackson's dancing into a traditional shadow puppetry performance with remixed operatic background music. The progression of shadow puppetry by incorporating new performance ideas from contemporary arts or stories has a positive effect on the dissemination of the artistic values of shadow puppetry. New performance forms using popular culture help the younger generation enjoy shadow puppetry traditions of controlling figures and movement. This performance represents the idea of young shadow puppetry artists maintaining traditional performance techniques and music with contemporary characters.

Figure 7a: Shadow puppetry performance of Michael Jackson's dances.

Figure 7b: Shadow puppetry performance of Michael Jackson's dances.

2.5.4 Beijing Shadow Puppetry Troupe and Game Company Co-Creation Show

Fate Grand Order (a.k.a. FGO) is a Japanese online mobile game which is popular among young people. It was developed by Delightworks studio and published by Bilibili. In 2019, Beijing Shadow Puppetry Troupe produced a advertising campaign in collaboration with video game company Bilibili about the new updated content of the FGO video game. Animation, video games, and shadow puppetry have many similar characteristics in art style processing. The cooperative project between traditional shadow puppetry and the FGO video game is another example of innovation and the protection of traditional culture within contemporary society. This case also demonstrates the similarities between shadow puppet art and digital animation art from an artistic performance.
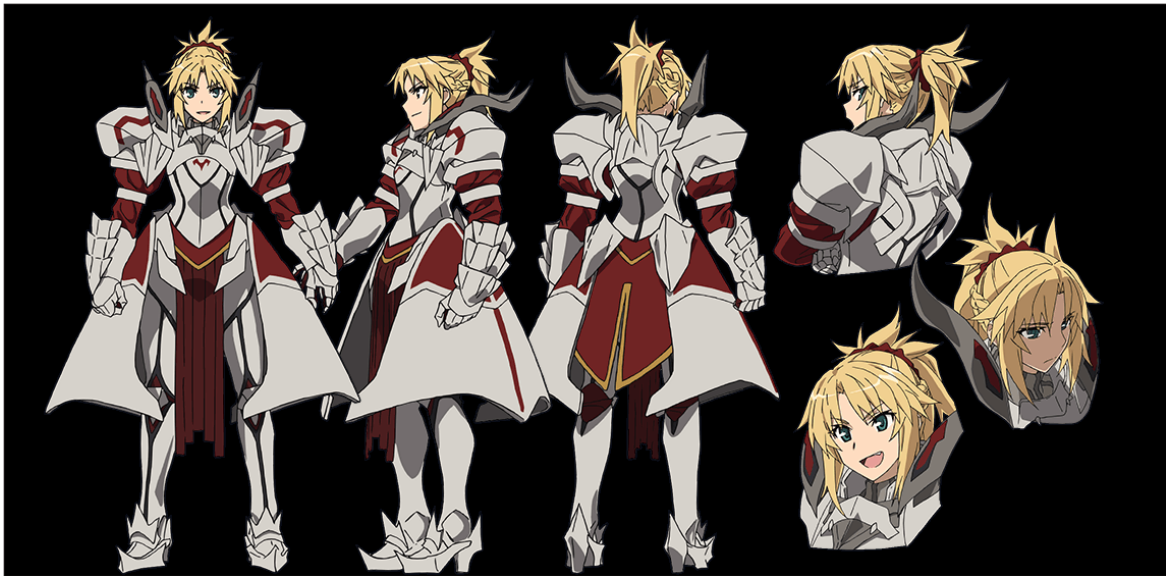

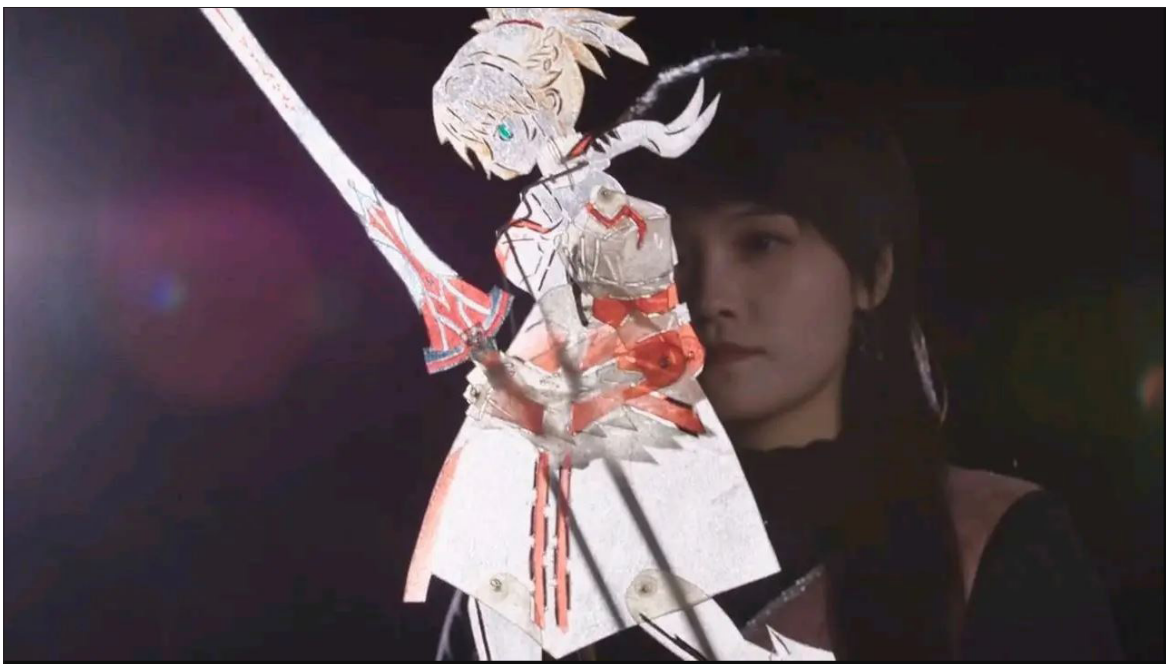Figure 8a: Character Mordred concept art in Fate Grand Order animation.

Figure 8b: Shadow puppetry character Mordred.

2.5.5 Animation of Chinese Myth Story Demon Queller Zhong Kui Giving His Sister Away in Marriage

The animated short film, *The Demon Queller Zhong Kui Giving His Sister Away in Marriage*, created by Lu Yue, is based on a myth that concentrates on benevolence and righteousness (Little, 1985). Lu uses elements from traditional shadow puppetry and classical stories, then utilises the shadow puppetry artform to redesign the storytelling through the medium of digital animation; moreover, this animation's background music and operatic song was created by traditional shadow puppetry artists. Lu breaks the rules of the traditional live performance platform and innovates using a new art platform with a high level of sophistication. This animated film has strong appeal to a new, younger generation.

Figure 9a: Screenshot from *Demon Queller Zhong Kui Giving Away His Sister in Marriage*.

Figure 9b: Screenshot from *Demon Queller Zhong Kui Giving Away His Sister in Marriage*.

2.5.6 Case Study Reflection

The cases of 'exhibition of digitalised Mogao cave 220' and 'interactive painting of "*Along the River During the Qingming Festival*"' are representative of how digital techniques can bring cultural heritage to life and educate people, also interactive techniques can close the distance between the public and history by way of entertaining experiences. This inspired me to look further into interactive-experiences design. The cases of 'shadow puppetry performance of Michael Jackson's dances' and 'Beijing shadow puppetry troupe co-creation show' present the idea of innovation which involves the incorporation of contemporary art to attract the attention of younger generations. It inspired me to design creative hand craft, with the intention of helping my audiences enjoy shadow puppetry. '*The Demon Queller Zhong Kui Giving His Sister Away in Marriage*' animated short film is another innovative performance that contributes to the increase in popularity of the shadow puppetry artform. This film transformed the traditional shadow puppet performance through digital animation, which allowed it to spread widely and garner greater interest by younger generations. Moreover, it has given inspiration to my own animation and poster design style of art.

It is important to engage with a new generation who is excited by digital forms of media. Exhibition spaces were effective by encouraging immersion and participation. This can be developed though physical and digital engagement. I feel it is important to tell stories from a culture to maintain meaning and understanding from traditions. The examplar case study of Micheal Jackson's dances move though shadow puppetry is engaging but debateable in cultural relevance and learning.

The research indicates that there are two possible ways to ensure the progression of the shadow puppetry arts. One is exhibition and education through institutions such as Museums, the other is by incorporating digital and contemporary creative ideas into traditional shadow puppetry performances. Contemporary techniques can also help shadow puppetry have various functions to further aid the art's dissemination and also to help with preservation. The performance of shadow puppetry is traditionally shown to a small audience which has natural limitations relating to venues. However, digital performances are not limited by the venue and it can improve cultural communication. These innovations can help the artform reach wider, richer, and more extensive audiences, in doing so reaching a greater level of education for the public (Du et al., 2010). From a macro perspective, it has promoted people's exploration and understanding of their own traditional culture and increased their attention to cultural heritage.

3.0 Methodology

I followed reflective practice methods with reference to *Double Diamond* research methods to conduct design research.

Reflective practice is the ability to reflect on actions in the process of learning. The reason for reflecting on practices is that experience cannot make learning happen by itself, and it is necessary to reflect on the experience while gaining experience. Reflective practice can become one of the most important tools in practice-based professional learning (Schön, 2017).

Double Diamond is a comprehensive, intuitive, and clear description of the design process. The insights gathered from the discovery phase help define ideas. The explorations outcome involved testing different solutions on a small scale, rejecting those ineffective solutions and then improving the feasible works. It was not a linear process, but cyclical in discovery and development (Den-Dekker, 2020).
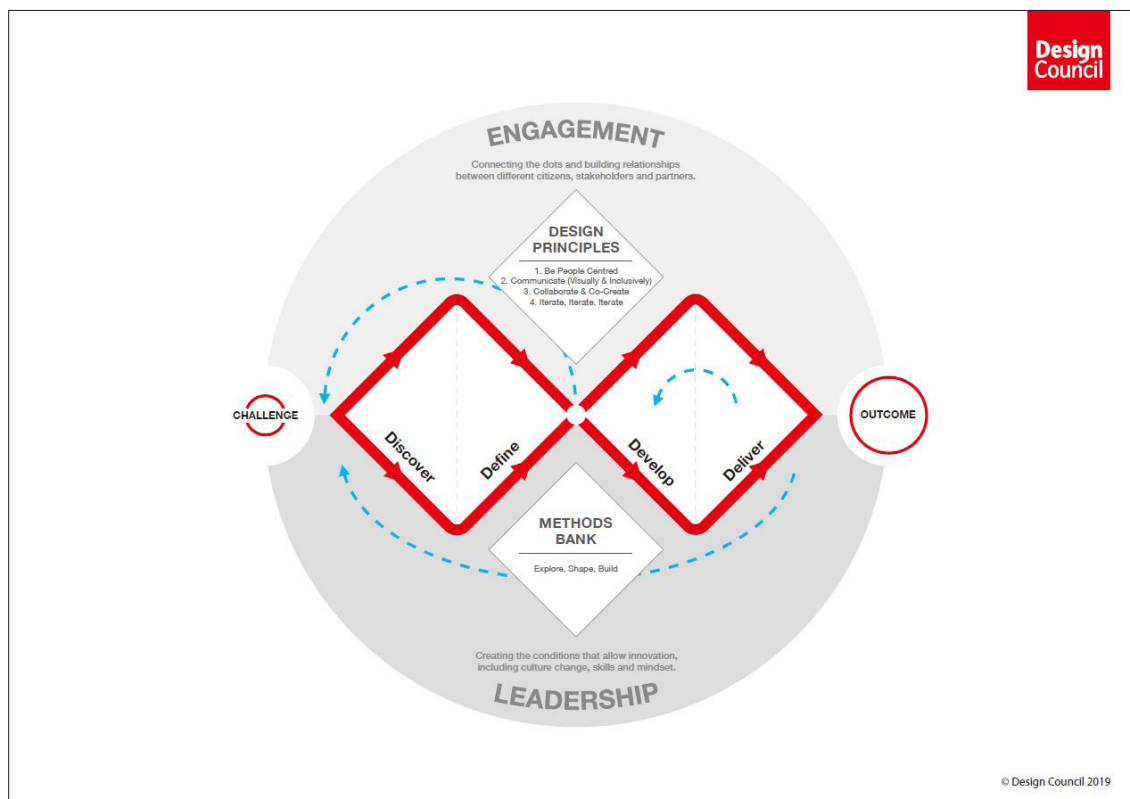

Figure 10: *Double Diamond* design process.

When I started this research project, I brainstormed a range of design problems relating to cultural heritage topics. After studying the history of Chinese shadow puppetry and the current situation, I found the specific problem of Chinese shadow puppetry is the lack of innovation and limitations in artform. It was important to consider the audience and their needs using design knowledge to solve this problem. Surveying and data collection allowed me to gain a better understanding of audience data (Refer Appendix 8.1) and design construction. I investigated moving images with interactive functions to solve the design problem of how Chinese shadow puppetry can progress as a media artform in contemporary life. A higher level of engagement and interactivity was needed for audience to learn about the craft of puppetry storytelling and technique.

My first design output was an animated character design based on the silhouette figures of shadow puppetry. I made a short frame-by-frame stop motion animation to test my project feasibility. I designed the character inspired by the Chinese mythology story of *Kua Fu Chasing the Sun*. This story is inspired by *Classic of Mountains and Seas* (a.k.a. *Shan Hai Jing*) and *Master Lie-The Questions of Tang*, encouraging people to be brave and to pursue truth.
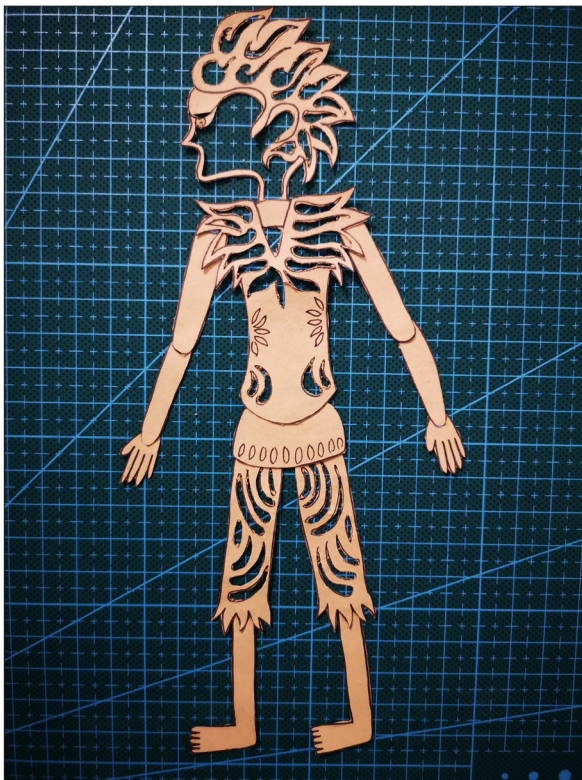

Figure 11a: Image for Kua Fu character design.   Figure 11b: Image for Kua Fu character design.

In alignment with studies of original Chinese shadow puppetry figures, I started to create animations based on the story of *Dreaming Butterfly*. Chuang Tzu (a.k.a. Zhuang Zi) dreamed of becoming a butterfly, only to find out that he was Chuang Tzu after waking up. Chuang Tzu did not know whether a butterfly had been dreaming that it was Chuang Tzu, or whether Chuang Tzu had been dreaming that he was a butterfly (Si, 2013).

Storytelling aspects of intrigue and wonder, identity is highlighted with the characters. Furthermore, storytelling is one of the primary ways we express the world, telling a story by using data is a common set of principles in developing interactive visualizations (Ferster, 2013).
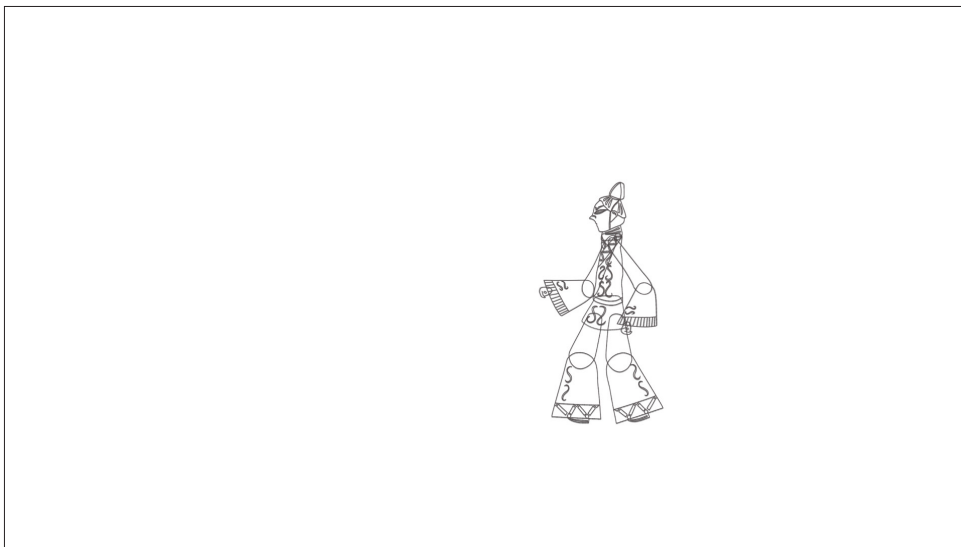

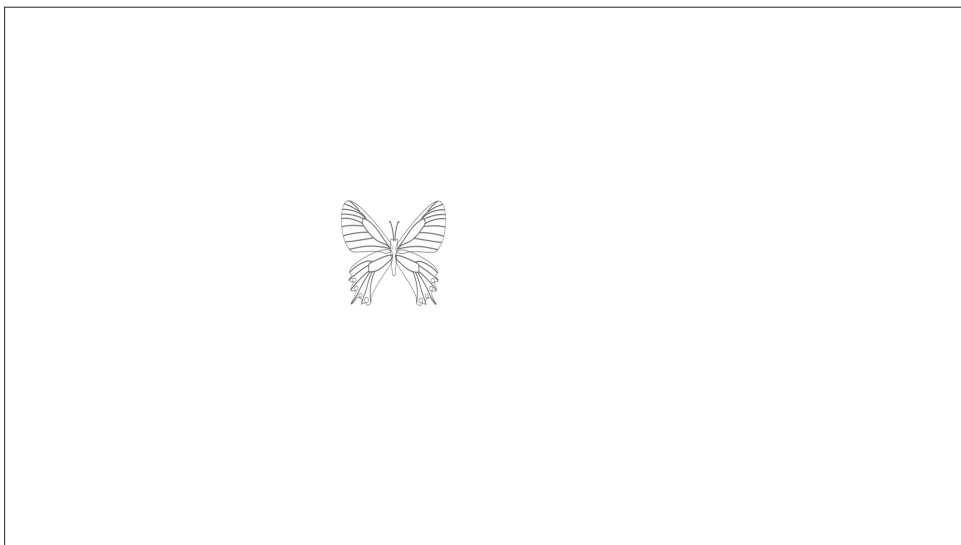Figure 12a: Screenshot of *Dreaming Butterfly* animation.

Figure 12b: Screenshot of *Dreaming Butterfly* animation.

I tested this initial animation design with a small group of 15 participants, who were in the age group of 20–35 years-old. Most feedback comments on the animation were positive, for example, "the animation is short and rich in storytelling", "the information on animation is easy to understand" and "the animation story is clear". However, there was feedback for more interactive design rather than this passive visual presentation. After reflection and more research about shadow puppetry as an artform, the next series of designs focused on the exhibition experience, which combined four media design elements; augmented reality animation, sensor triggered animation, interactive face-controlled character and creative collection booklet. These aimed to create a mixed experience of learning and engagement.
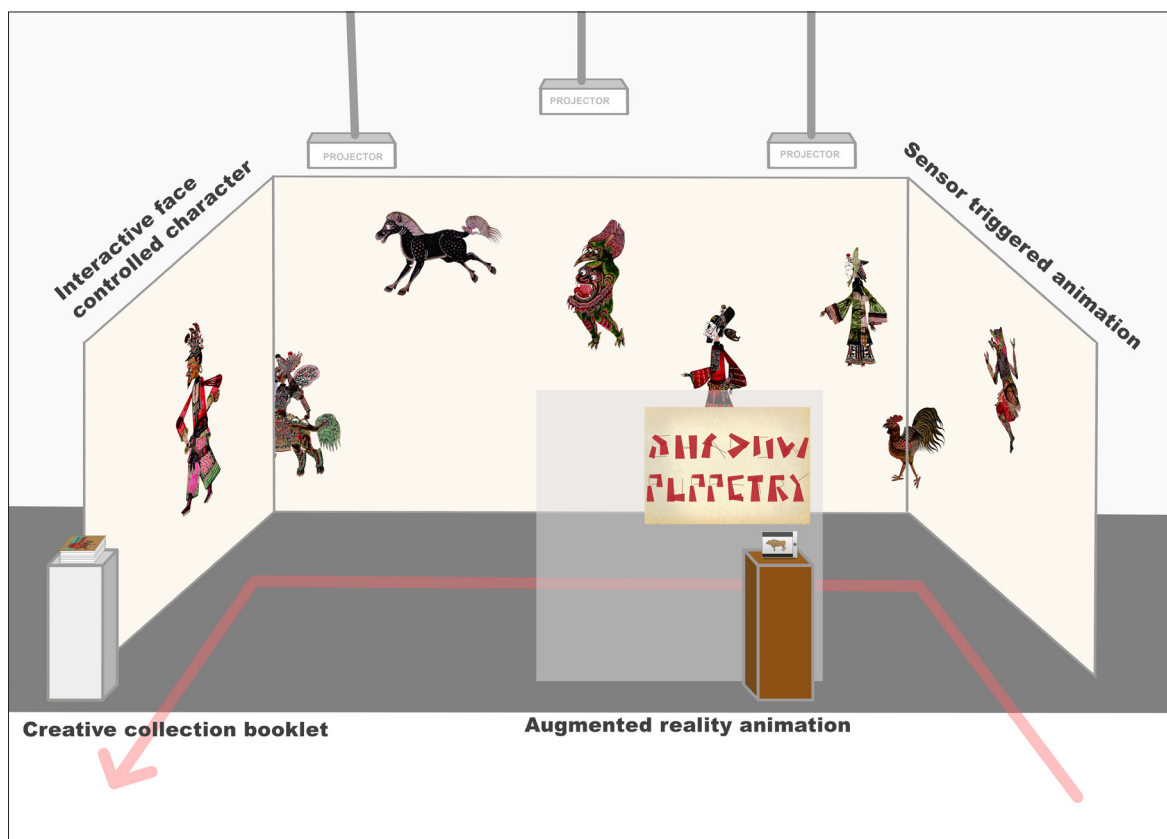

Figure 13: Exhibition design.

4.0 Design Outcome

The characteristics of shadow puppetry by my definition are: artistic, colourful, participatory, and storytelling.

My design outcome is an exhibition experience which combines four media design elements. These are: augmented reality animation, sensor triggered animation, interactive face-controlled character and creative collection booklet. They provide cultural dissemination benefits and exhibit the characteristics of modern art.

The first media design element is an augmented reality animation which shows the process of creating traditional Chinese shadow puppetry. The animation serves to inform visitors about what the exhibition is, and to provide a quick understanding of shadow puppetry; moreover, the design characteristics in this part are artistic and storytelling.

The second media design element is sensor triggered animation. Different classical shadow puppetry characters are animated when a motion sensor detects movement. The characters are traced from existing traditional shadow puppets, converted to digital using Photoshop and animated using After Effects. The main concept behind the motion background is to create a sympathetic feeling for audiences and help them obtain clear and concise information about classical shadow puppetry movement, improving the visitor's experience; moreover, the design characteristics in this part are artistic, colourful, and participatory.

The third element is an interactive face-controlled character which helps visitors gain an in-depth understanding of shadow puppetry play and shadow puppet mechanics, for example, helping visitors understanding how the puppet's joints work. In this experience, a visitor can personally control a character after enjoying the previous puppet character performance. It can create a delight feeling for visitors and improve visitor experiences of exhibition; moreover, the design characteristic in this part is Participatory.

The fourth element is a creative collection booklet. It can be defined as a conclusion of the entire experience. This element allows the visitor to continue the experience after seeing the exhibition by making their own miniature shadow puppetry stage to take home. The hand-made collections have a compact size that can contribute to the spread of shadow puppet culture. The creative hand-making collections can be seen as a concept inspiration and a new attempt for cultural heritage development; moreover, the design characteristics in this part are: artistic, colourful, participatory, and storytelling.

Figure 14a: Exhibition concept.

Figure 14b: Exhibition concept.

Exhibitions are a form of communication which can explore all sorts of creative ideas (Steeds, 2014). The exhibition is a space to celebrate human achievements, spread ideas, and creativity. Presentations and exhibitions in a space allow different creative ideas to connect to one another. For example, a unified colour can help audiences gain a sense of how exhibits in the space are integrated (Locker, 2011).

My design is divided into four experimental parts, three different design mediums combinations which are animation, interaction, and graphic design elements. Using a quiet space to exhibit the creations can enable a framework that unifies design themes, creating a sense of integrated design feeling and expressing design emotions. The tone of the entire exhibition interprets the Zen in Chinese culture from static to dynamic. I am planning to use a quiet space to create the serious environment, and the surrounding sound from visitors' interactive actions can increase vitality of space, producing a harmonious feeling to visitors through an active element and a quiet element.
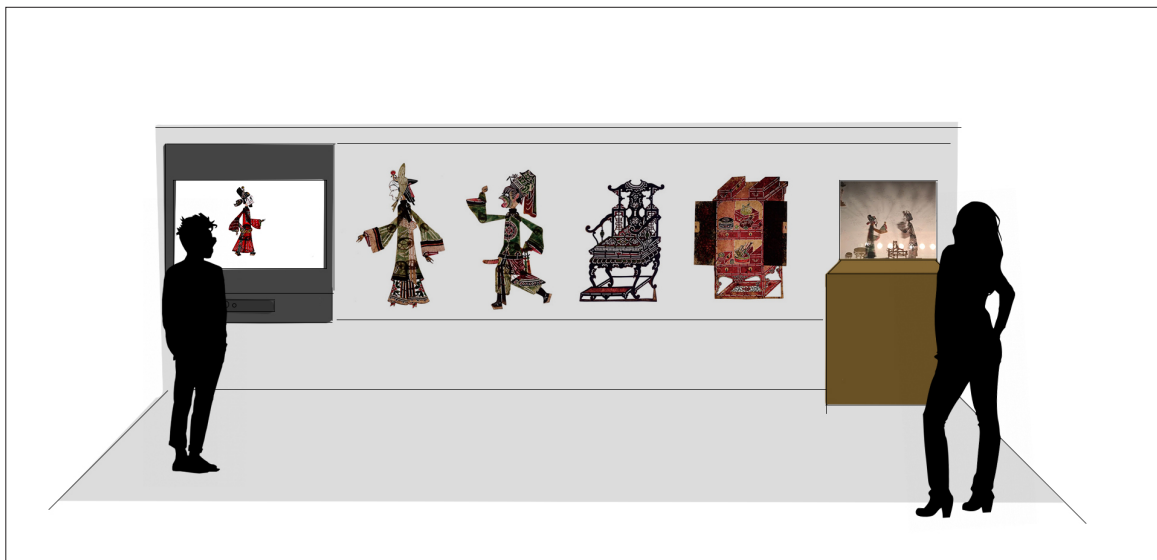
Figure 15a: Exhibition design draft idea A.

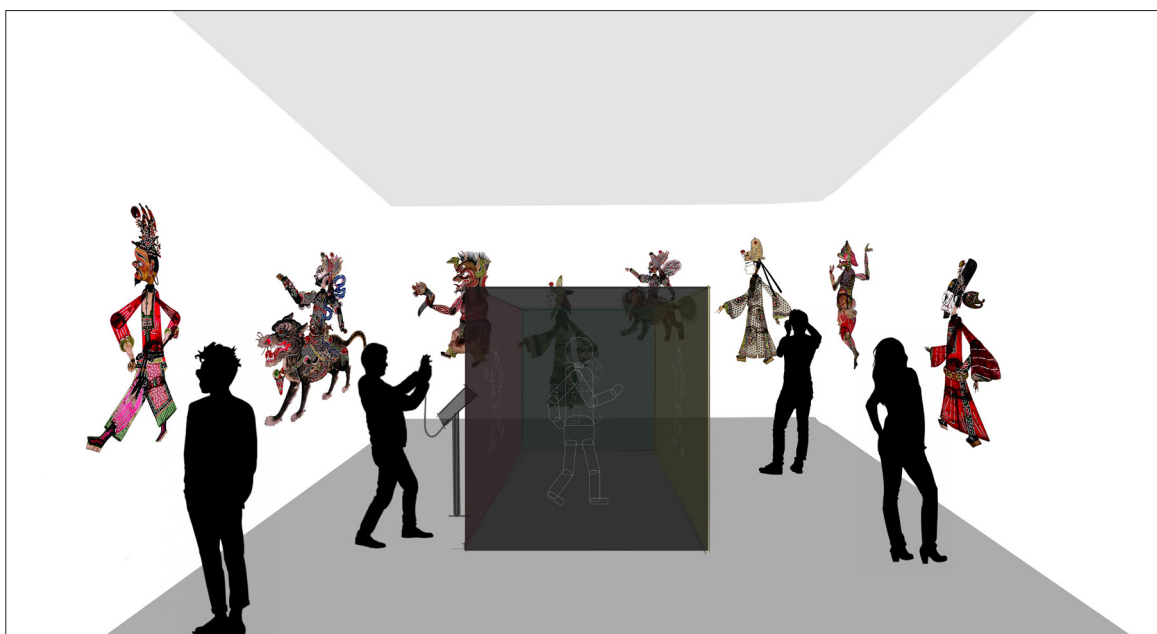Figure 15b: Exhibition design draft idea B.

Figure 15c: Exhibition design draft idea C.

4.1 Process and Design Outputs

4.1.1 Animation Creation and Poster Design

Animation is an artistic expression method that turns the impossible into possible, it is a limitless storytelling medium and it is a carrier that can freely express design concepts and ideas (Blazer, 2020); therefore, I chose animation to show my audience the process of making traditional shadow puppets.

The eight steps process of creating traditional shadow puppetry figures are: material selection (a.k.a. Xuanpi); material processing (a.k.a. Zhipi); draft designing (a.k.a. Yangpu); tracing (a.k.a. Guogao); carving (a.k.a. Louke); colouring (a.k.a. Fucai); ironing (a.k.a. Fahan Tangping); and assembling (a.k.a. Gufeng) (Zhu, 2019).

For material selection, Chinese shadow puppets are generally made from 4–6 year-old Qinchuan cattle hide. For material processing, there are two ways to make leather. The first way is by taking hide out from water and shaving off the cow hair after soaking the cattle hide in water for 2–3 days, then unfolding and air drying. The other method is adding chemical reagents when the cattle hide is soaking in the water, which results in leather being more suitable for subsequent carving. For the process of draft designing and tracing, the large cattle hide has to be cut into suitable pieces, then polished with oil liquid to make the leather surface smoother. After that, the transparent cattle hide is put on top of the drawing then the outline is traced with the tip of a needle. For the colouring process, firstly, the paint is put into the container and the transparent leather glue is added, then the alcohol lamp is lit under the container, making the glue and pigment melt into a paste, and finally this can be used to paint the shadow puppets. The colours of shadow puppets are generally red, yellow, green, black and white. The high temperature used when ironing causes the colour to penetrate the leather and evaporate the water at the same time. The final step is assembling all the parts together then inserting the stick (Jiang, 2015).

Shadow puppets have colourful appearances which can attract people's attention. The shadow puppet's colour is inspired by the traditional five elements method (Chinese philosophy) and five colour principle. The five colours of red, yellow, green, black and white are interspersed and juxtaposed, creating a colourful visual style. In fact, there are only three colours used in shadow puppets, red, green and black. Yellow is the raw colour of the shadow puppet itself, and white is the colour of the curtain that is exposed after the shadow puppet is hollowed out. The art style of shadow puppets is concise but rich in detail. Shadow puppetry is the art which is represented by light and shadow. Its display requires the effect of light. No matter how obsolete the shadow puppets have been, no matter how strong the oil lamps smoked, shadow puppets always can present their gorgeous appearance with the shining of light (Wei, 2007).
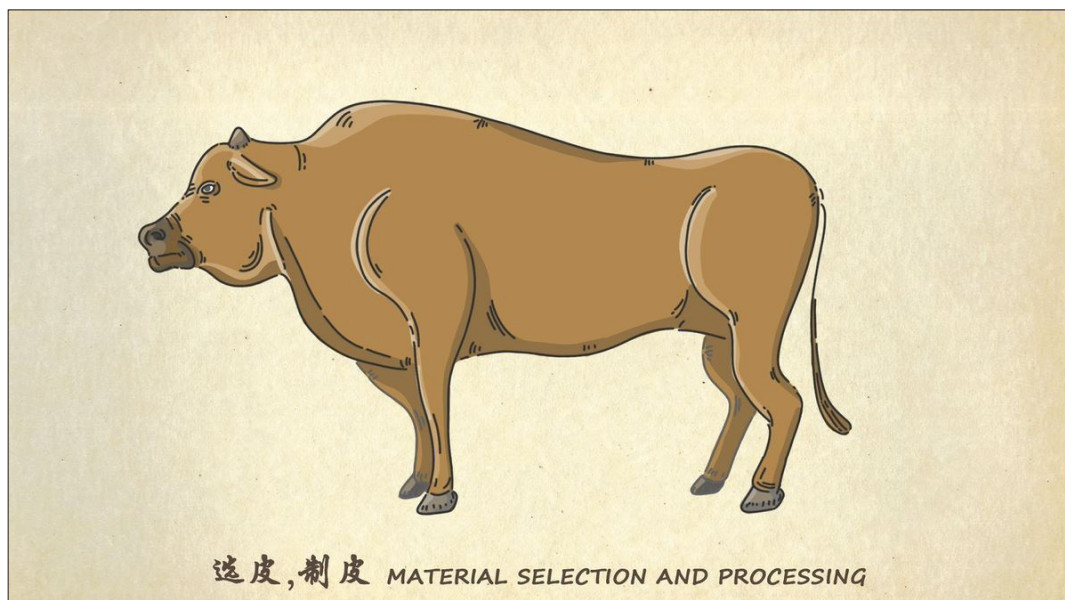
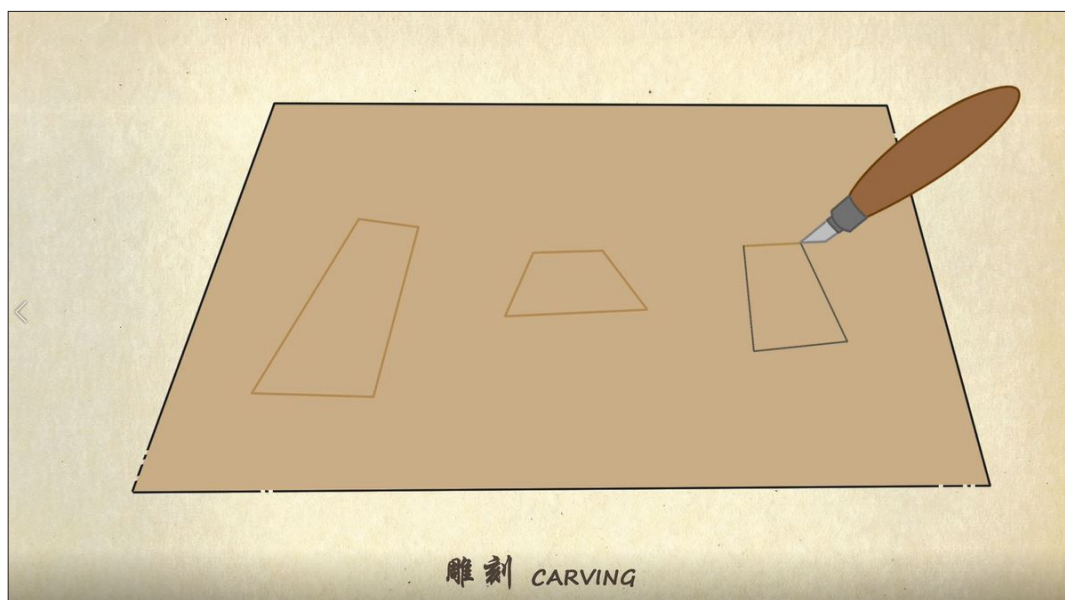Figure 16a: Animation key frame screenshot.

Figure 16b: Animation key frame screenshot.

Figure 16c: Animation key frame screenshot.

In the poster colour tone design, I faithfully restored the classical colour of shadow puppets which is red. For typography design, I aimed to help the audience understand the design content and expression style of the object; therefore, I used a realistic style to design it. I designed the typeface, printed it out and then cut it out, combining photography techniques to produce the final poster layout.

For the final outcome of this part, visitors are able to use an iPad to scan the typographic poster via the Artvive app, and the animation will play on screen; moreover, the display layout of the video is based on the poster outline though augmented reality. This solution can help visitors understand the shadow puppetry creation progress through the animation artform. The animation ends in the poster frame which can create a link between physical poster and digital animation for users.
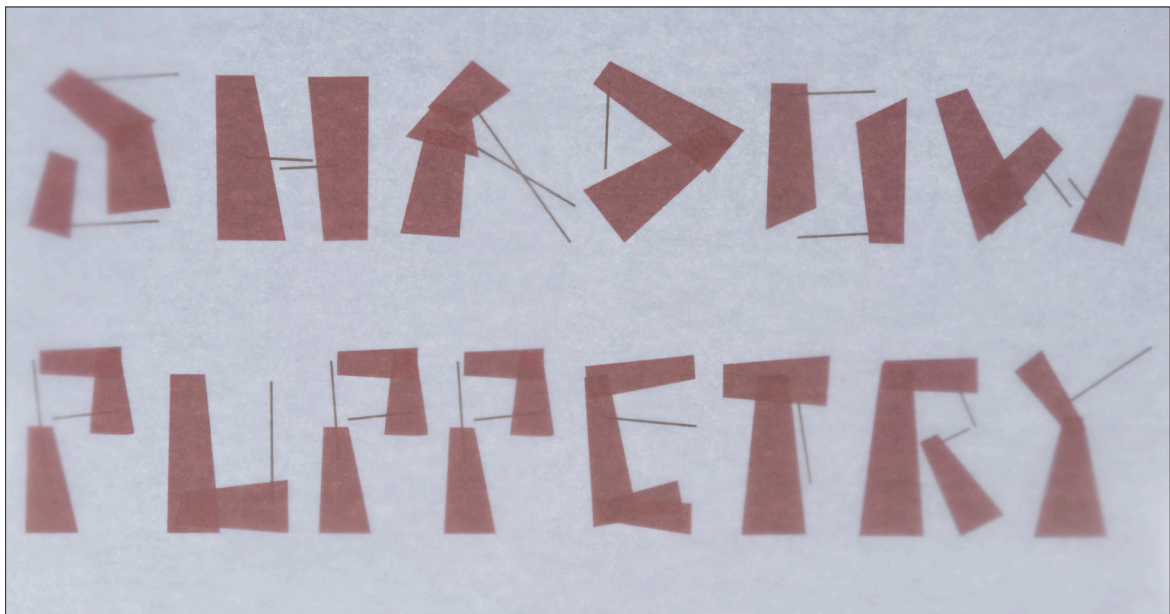

Figure 17a: 'SHADOW PUPPETRY' typography poster design.

Figure 17b: Photo for user testing.

4.1.2 Digitalised Traditional Shadow Puppetry Motion Design

Traditional shadow puppets are increasingly being collected in museums for people to visit. It is a pity that many shadow puppets that were created for performance are only displayed in museum windows.

In the shadow puppet exhibition hall of Chengdu Museum, the exhibition designer used a lot of modern museology design concepts, combining physical artefacts and digital media to educate audiences about shadow puppetry. My design idea absorbed the concept of interactive design for exhibitions. I used Adobe Photoshop software to create joints for the traditional shadow puppets which were scanned and collected from the Chinese Shadow Puppetry Museum, then I used the Adobe After Effects software to create a moving image of shadow puppets.

The movement of the object in the animation needs to be expressed in combination with the actual movement trajectory (Blazer, 2020). For example, stone and cotton have different qualities, and their movement trajectories are different. The movement of digital animation objects is often inseparable from the observation of real objects (Blazer, 2020). In the same way as traditional shadow plays, the quality and weight of the weapons in the character's fighting storytelling also determines the movement of the performer. I digitalised traditional shadow puppets and made them into moving animations, thus studying the possibility of traditional culture's innovation in the digital medium development.
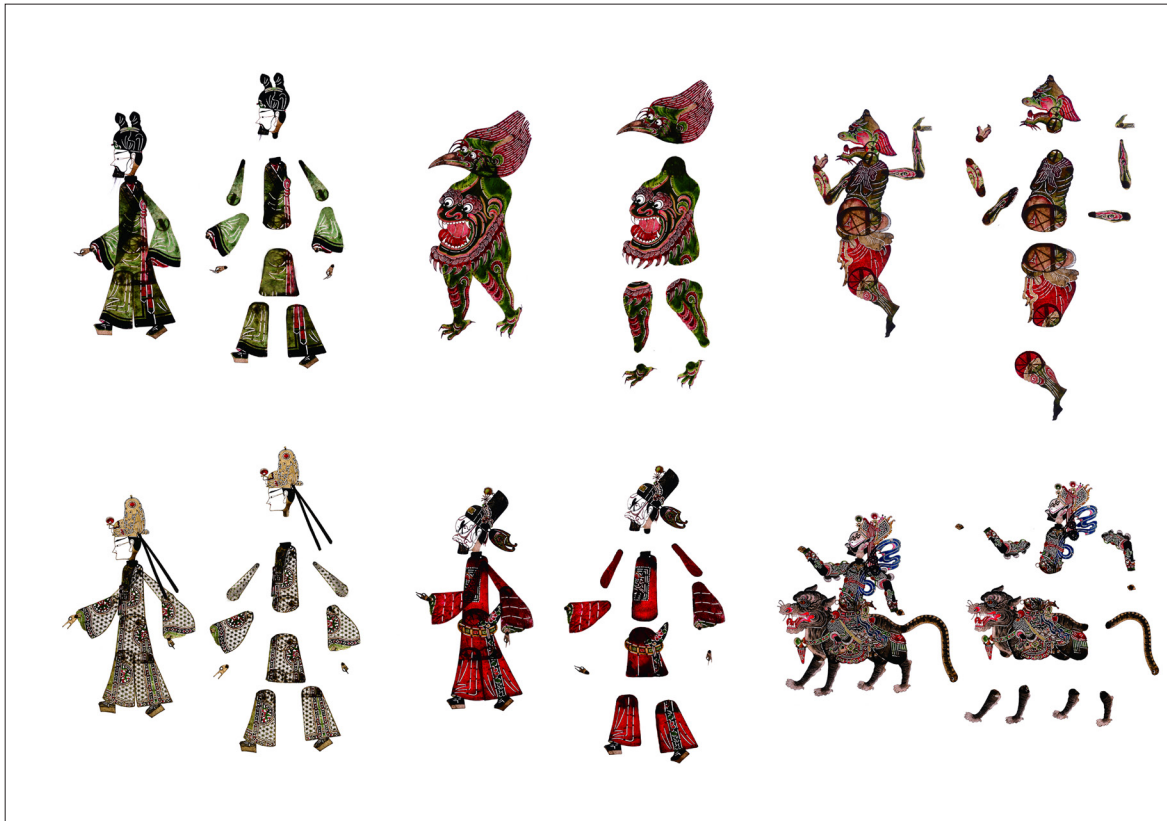

Figure 18a: Samples of shadow puppets active parts building.

Figure 18b: Samples of digitalised shadow puppets motion frames.

Figure 18c: Image of user testing.

After watching the animation, the audience can better appreciate the digital moving shadow puppet characters after they understand its production process. I used Processing and Arduino for coding tools and a passive infrared sensor (a.k.a. PIR sensor) to achieve the interactive functions, which realise the possibility of triggering the demonstration of each puppet character separately. Whenever an audience member passes by the sensor, a character will walk out. This communication experience makes audiences move forward into the environment and improves interactive experiences. The data library for digital puppets can support the diversity of digital shadow puppets and improve user experiences; moreover, this idea can help me create a rich resource library for the traditional shadow puppetry characters to become digitised artforms in the future.
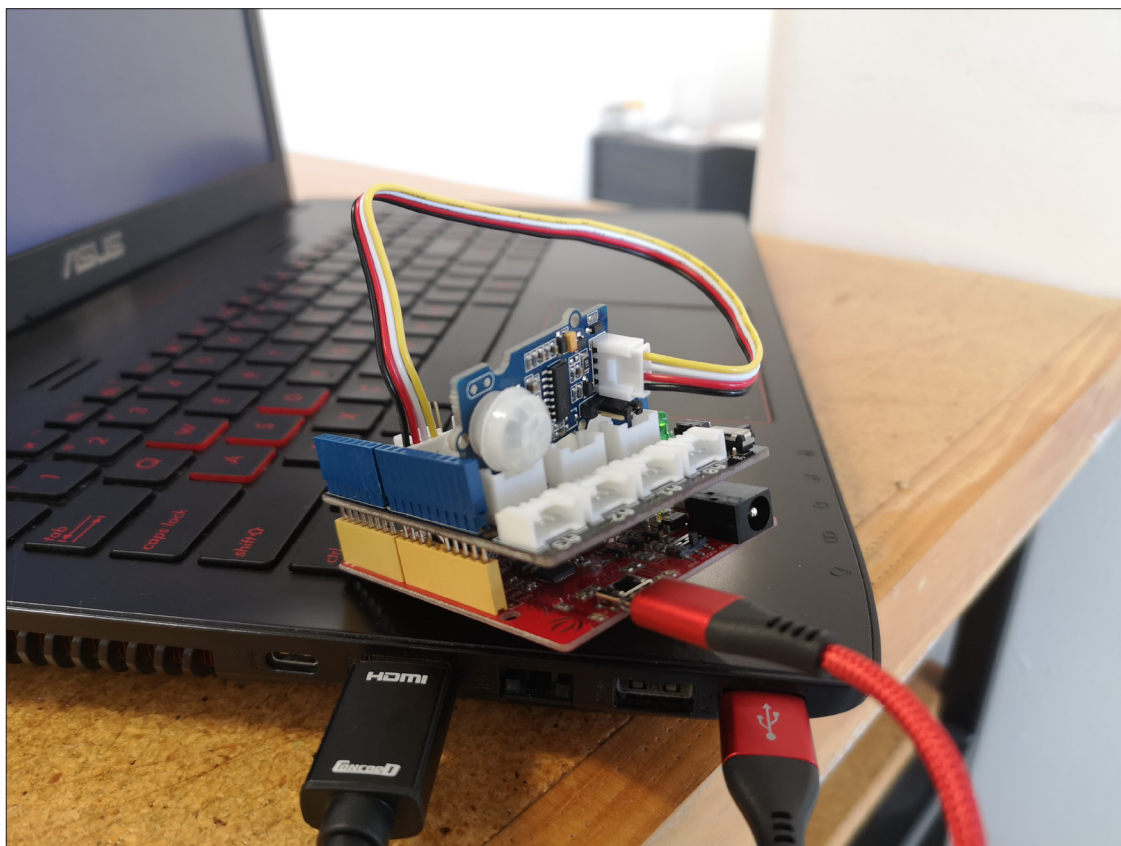

Figure 18d: Photo of PIR sensors hardware.

4.1.3 Traditional Shadow Puppetry Character Interactive Design

The visual and interactive experiences show the possibility of digital techniques to transform traditional shadow puppetry. The current interactive function mainly focuses on controlling and emphasizing the element of control for the artistic expression of shadow puppetry. This element makes the interactive function particularly important to express shadow puppetry's identity for audiences.

We regard the interaction between any two systems as dialogue, including language, body actions, expression, image changes, and perceivable movement. Interactive design must create a better mode of communication between two systems. In a broad sense, the method of design is to process the relationship in advance. The interactive design, subordinate to the design field, is mainly concerned with how to create better communication between people and the system (Pratt and Nunes, 2012). For example, when people are dealing with a system, the information they receive, how they do it, and how they feel are all interactions that designers have to consider. If people cannot quickly grasp and understand design objects, then these design systems will lose their value. Getting people to quickly grasp these design objects in line with the creative intention of these design objects, requires a variety of communication mechanisms to achieve connection. A design system is very complicated, and the human brain cannot understand it, we need interaction design to help us control this system (Pratt and Nunes, 2012).

Currently the most somatosensory interactive design solution is a combination of a Microsoft Kinect sensor and Processing coding. Unfortunately, this solution technique is difficult for most designers without a coding experience background. After researching and discussing with my supervisor, I decided to use Adobe Character Animator to produce interactive designs. This software can produce the interaction with the characters by human face interaction, which greatly reduces the time I had to spend on learning code. I am creating a connection between audiences and digital shadow puppets which assists audiences to understand my design intent easily. Audiences begin with the viewing of animation, followed by the trace interaction of shadow puppets, then interacting with the shadow puppetry characters. This experience enhances the development possibilities of exploring traditional cultural heritage through digital solutions.
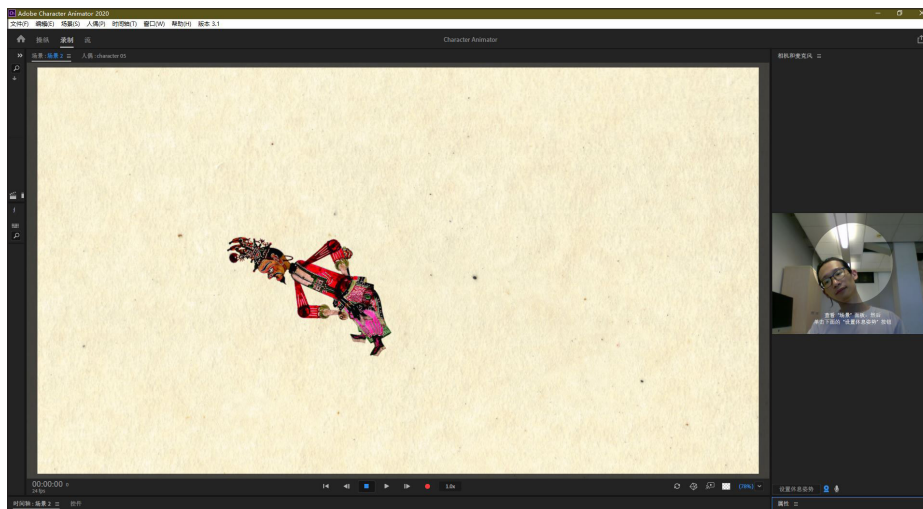
Figure 19a: Screenshot of Adobe Character Animator working states, human face interacting with character.

Figure 19b: Image of user testing.

4.1.4 Creative Collections Booklet Design

"Love is a better teacher than duty." -- Albert Einstein

When you have an interest and passion about something, you will enjoy spending the time to understand and learn it.

Audiences can collect the physical creative product, continuing their experience when they exit the exhibition. The booklet is the best summary and exploration of my primary design idea of promoting traditional culture. It allows audiences to summarise the exhibition experience after browsing. This creation booklet is the link to the information about the traditional shadow puppetry production process, which forms a connection from the beginning to the end, unifying the exhibition's theme. Furthermore, visitors can download the Artvive app from Google Play or Apple Store, and scan the illustration on the back cover of the booklet, watching an augmented reality animation after experiencing the exhibition.

At the beginning, I considered the idea of using 3D pop-up books to realise the themes of publicity and collection and combined the design creativity of physical interaction with the purpose of visual appreciation. This product realises the possibility of continuing the user experience for the audience. Reflective practice can generate more knowledge and develop experiences (Schön, 2017). The amount of information obtained through personal practice is higher than by pure visual appreciation. Therefore, I shifted design direction from a pop-up book design to handcrafted, in order to introduce the shadow puppetry performance stage. Audiences have an experience for assembly of the handmade shadow puppet performance stage by playing with this handcrafted product, which will let them understand the composition of the shadow puppet stage. According to the data obtained from the questionnaire survey, most of my audiences are older than 20, so I was able to have a higher level of complexity.

This handmade collection is ornamental and interactive. The front of the finished product is printed with a stage composed of curtain patterns, and the back is a pattern of musical instruments required for traditional shadow puppet performances. The finished product uses a three-dimensional folding design, which is beneficial for folding and storing; moreover, it can work as a new artistic ornament when it is folded up and framed. I iterated my design through three rounds of user testing. For the first user test, I invited eight participants to test the handcrafted construction, six participants finished between 10 minutes to 15 minutes, only two participants were finished around seven minutes. I found the participants were comfortable with the handcrafted construction times being under 15 minutes. Initially I used A5 sized paper to design the booklet, however, it was too small to build, therefore I improved the second version designs using A4 sized paper.

For the second user test, I worked with different quality paper materials and the 170gsm paper was considered the best choice for the product; It was most highly rated by 14 users. Moreover, many of the users said some detail patterns were hard to cut out, so I used pre-cut techniques to solve this problem. For the third user test, 11 participants gave positive feedback and said the introductory texts of Chinese shadow puppetry aided their understanding of shadow puppetry, improving the handicraft making experience. Additional feedback showed preference for colour paper rather than pure white paper for the original background; therefore, I chose brown paper for the final design version. All participants enjoyed the brown paper material version, noting the brown paper designed booklet had a classical feeling and greater visual impact for them.
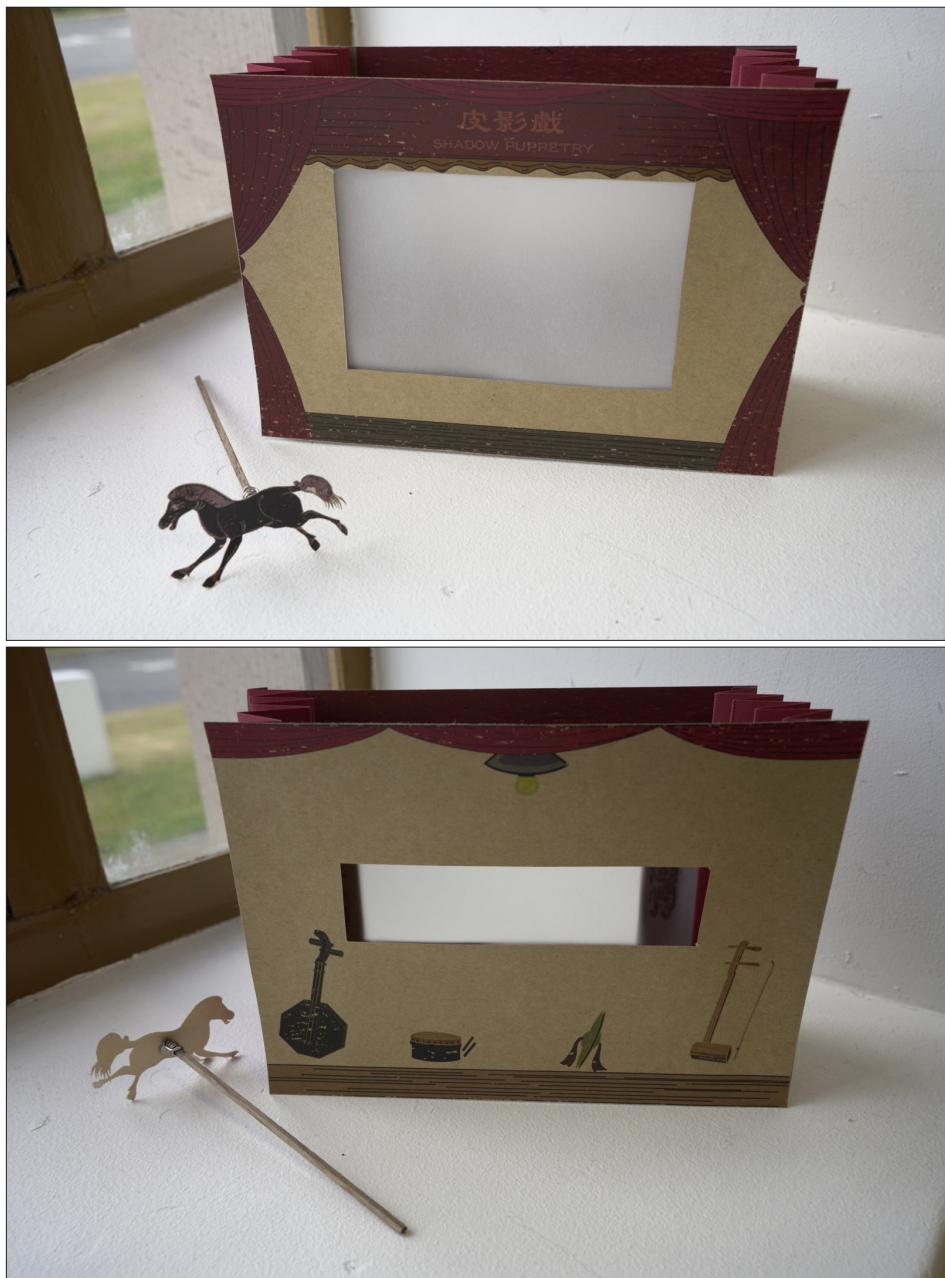

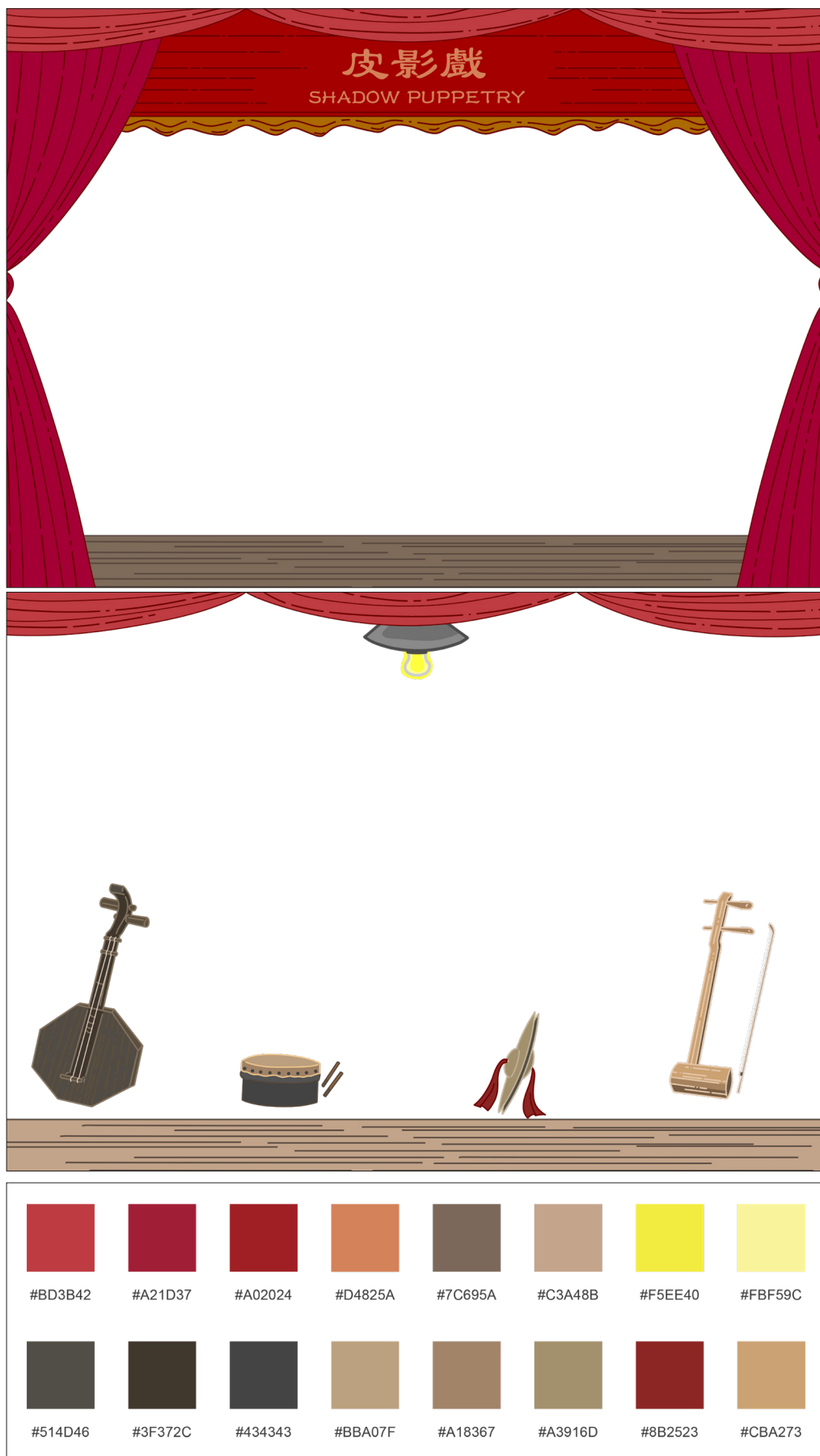Figure 20a: Images of handcraft.

Figure 20b: Images of creation booklet.

Figure 20c: Images of creation booklet.

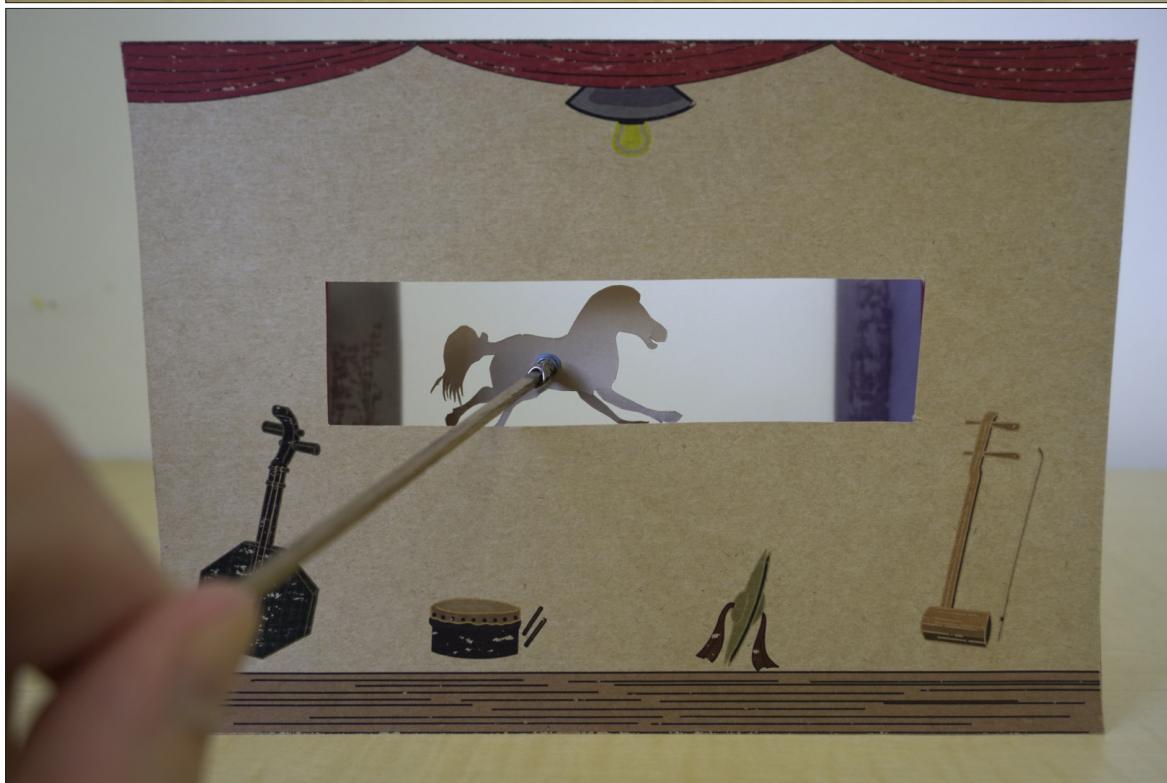Figure 20d: Image of creation booklet.

Figure 20e: Images of handcraft user testing.

Figure 20f: Images of creation booklet AR animation user testing.

5.0 Conclusions

Chinese shadow puppetry (a.k.a. Pi Ying Xi) is a classical style of performance opera with over 2,000 years of history (Jin, 2011). Chinese shadow puppetry being enrolled on the *Representative List of the Intangible Cultural Heritage of Humanity* shows how important this artform is as a symbol of cultural identity. Nowadays most knowledge of shadow puppetry arts is disappearing with master artists aging. Newer generations do not have good knowledge of these skills which has resulted in this artform facing extinction. With traditional artists aging, it is necessary to make younger generations aware of the problems of cultural loss and the importance of cultural heritage (Rollins, 2015).

The research question of this project was: How can shadow puppetry be maintained and innovated in new artforms through digital media design?

The starting point of study was to help audiences become aware of cultural heritage loss, promoting Chinese shadow puppetry culture to younger generations. Based on this starting point, I began researching and learning more about Chinese shadow puppetry culture, its value, and its current situation.

In order to achieve the design goal, I used visual communication design knowledge to produce creations and design an exhibition presentation, combining reflective practices and the *Double Diamond* design method. I used digital animation design, interactive design, and previous expertise and knowledge in graphic design. These allowed me to explore the new possibilities of innovation and dissemination of traditional shadow play culture in contemporary society. This design outcome popularises the artistic value of traditional Chinese shadow puppetry for audiences. Furthermore, it helps audiences to understand shadow puppetry through the interactive function, which creates a link between the digital and the physical.

For exhibition testing, nine 20–30 year-old participants who expressed having a Chinese cultural background or interest in Chinese culture were invited to give feedback of their experience. Most feedback in user testing was positive. The participants said they enjoyed the visual artform and were excited to see the physical shadow puppets come to life using digital techniques. However, there were four people who said they would prefer if the puppet body's interactive function could be improved in the future. Most of the viewers learned more about Chinese shadow puppetry through this experience, for example, the nature of the artform and the creation steps. Moreover, seven of the participants were interested in doing more research about shadow puppetry after their

experiences. After user testing, the highly positive feedback shows the design outcome was able to generate a high level of enjoyment and inspiration for exploring the disseminated idea of shadow puppetry.

6.0 Reflection and Future Development

On a technical design level, this exhibition opens up possibilities for further design ideas for integrated digital techniques. It was important to engage viewers with varied modes of activity for learning and enjoyment. The quiet, harmonious space allowed the viewer to create their own stories with the characters or play out the traditional myths.

The exhibition solution could be more completely finished with more time. For example, the numbers of digital shadow puppets in the data library would be increased, and the Adobe Character Animator interactive solution would be improved to the Processing coding solution which allowed visitors to have more interactive engagement with digital shadow puppets. There is also the possibility of collaborating in the future with others to bring together varied expertise as shown in other larger scale digital exhibitions.

After this research project, I have a much clearer understanding of Chinese shadow puppetry and the importance of Chinese cultural heritage. I regret the erosion of traditional national culture that is happening. Working in the design industry, I always question how to carry traditional culture forward with new artistic techniques and design. Many older artists feel sadness for the cultural loss and lack of successors working in the shadow puppetry field. As a designer, I am always thinking about my personal design identity. What are we discussing in design? I respect the traditional culture that has traversed thousands of years, because those primitive elements which have been deposited over time can provide a foundation to design. At the same time, I am also obsessed with the unconstrained modern elements, because these modern elements, with unlimited imagination, can make the designs colourful in every aspect. We can learn different emotions in the designs through the integration and collision of tradition and modernity. This research topic helped me to study the Chinese cultural heritage of shadow puppetry in more depth. The issues of how to balance tradition and modernity into design and how to develop and innovate traditions within a contemporary societal environment are the design questions which I need to constantly explore in the future.

7.0 References

Ban G. (2007). Book of Han. Zhonghua Publishing House, 150(1).

Chen, F. (2007). Chinese shadow theatre: History, popular religion, and women Warriors. McGill-Queen's University Press. http://www.jstor.org/stable/j.ctt80q3q .

Chinese National Academy of Arts (2020). Statistics on the list of inheritors of national intangible cultural heritage. http://www.ihchina.cn/representative#target1 .

Blazer, L. (2020). Animate storytelling: simple steps for creating animation & motion graphics. Peachpit Press.

Den-Dekker, T. (2020). Design thinking. Taylor & Francis.

Du, W.& Li, Z.& Gao, Q. (2010). Analysis of the interaction between digital art and traditional art. 2010 International conference on networking and digital society. Networking and Digital Society (ICNDS), 441.

Feather, J. (2006). Managing the documentary heritage: issues for the present and future. Preservation management for libraries, archives and museums. (pp. 1-18).

Ferster, B. (2013). Interactive visualization: Insight through inquiry. The MIT Press.

Gimemo-Martinez, J. (2016). Design and national identity. Bloomsbury.

Jiang, Y. (2015). Zhong guo ying xi de liu pai ji gen bu di yu (Different styles of Chinese shadow play and distribution area). Zhong guo ying xi yu min su (Chinese shadow play and folklore). Sichuan People's Publishing House.

Jin, Z. (2011). Chinese folk arts. Cambridge University Press.

Little, S. (1985). The demon queller and the art of qiu ying (Ch'iu ying). Artibus Asiae. 46(1/2), 5-128.

Locker, P. (2011). Exhibition design. AVA Publishing SA.

Pratt, A. & Nunes, J. (2012). Interactive design: An introduction to the theory and application of user-centred design. Rockport Publishers.

Reason, M. (2003). Archive or memory? The detritus of life performance. New Theatre Quarterly, 19(1), 82-89.

Mrázek, J. (2002). Puppet theater in contemporary Indonesia: new approaches to performance events. University of Michigan, Centers for South and Southeast Asian Studies.

Rollins, A. (2015). Chinese Shadow Puppetry's Changing Apprentice System: Questions of Continuance and a Survey of Remaining Shadow Puppet Practitioners in Mainland China, 2008–2013. Asian Theatre Journal, 32(1), 295-318.

Schön, D. A. (2017). The reflective practitioner: How professionals think in action. Taylor & Francis.

Si, L. (2013). Zhuang zi quan shu. The Chinese Overseas Publishing House.

State Council (2009). China arts and crafts industry census. Beijing Arts and Crafts Publishing House.

State Council (2011). The third national census of cultural relics. State Administration of Cultural Heritage People's Republic of China.

Steed, L. (2014). Exhibition. The MIT Press.

Tang, R. (2018). The heritage of wang piying troupe: shadow puppetry in north Sichuan. Asian Theatre Journal, 35(1), 53-69.

Tung, C.& Besio, K. (2007). Three kingdoms and Chinese culture. State University of New York Press.

Wei, L. (2007). Zhong guo pi ying yi shu shi (Chinese shadow puppetry art history). Cultural Relics Press.

Wei, L. (2011, April). Zhong guo pi ying tian ye diao cha (Field investigation of Chinese shadow puppetry situation and protection). Xiqu Yanjiu (Drama Study), 83.

Zhu, J. (2019). Yi qi lai kan pi ying xi (Let's watching shadow puppetry). Shanghai Education Publishing House.

7.1 Video References

China Puppet and Shadow Art Society (2011, November 22). Chinese shadow puppetry (video). Edited by United Nations Educational, Scientific and Cultural Organization. YouTube, https://www.youtube.com/watch?time_continue=56&v=8-mzqxZNp2g .

Lu, Y. (2011). The Demon Queller Zhong Kui Giving His Sister Away in Marriage (video). YouTube, https://www.youtube.com/watch?v=c6FizeUHo8w .

7.2. Image List

Figure 1: Screenshot of Mulan storytelling in shadow puppetry video on YouTube. Retrieved from https://www.youtube.com/watch?v=dB80nedojvc&ab_channel=meixianli. Accessed 11 January 2020.

Figure 2a: Shadow puppet "good" role profile. Retrieved from http://www.shadowpuppetart.com/p_cangpin_touca_001.html. Accessed 30 January 2021.

Figure 2b: Shadow puppet three-quarters profile. Retrieved from http://www.shadowpuppetart.com/p_cangpin_shenguai_001.html. Accessed 30 January 2021.

Figure 3: : Map of China and its provinces. Retrieved from https://www.travelchinaguide.com/map/china_map.htm. Accessed 21 December 2020.

Figure 4: Female role's puppet profile from Shaanxi region. Retrieved from http://shadow.caa.edu.cn/#/gczp/puppet. Accessed 21 December 2020.

Figure 5a: Photo of the north wall in cave 220 at Mogao grottoes, Dunhuang Academy China. Retrieved from http://public.dha.ac.cn/Content.aspx?id=596158218037&Page=10&types=1.Accessed 30 January 2021.

Figure 5b: Exhibition idea of digitalised Mogao cave 220, 24th Hong Kong Book Fair, 2013.

Figure 5c: Exhibition of digitalised Mogao cave 220, 24th Hong Kong Book Fair, 2013.

Figure 6a: A part of the painting "*Along the River During the Qingming Festival*".

Figure 6b: Interactive painting of "*Along the River During the Qingming Festival*" ver.2.0 in World Expo Shanghai China, 2010.

Figure 6c: Interactive painting of "*Along the River During the Qingming Festival*" ver.3.0 in The Palace Museum, 2018.

Figure 7a: Shadow puppetry performance of Michael Jackson's dances, 2017.

Figure 7b: Shadow puppetry performance of Michael Jackson's dances, 2017.

Figure 8a: Character Mordred concept art in Fate Grand Order animation, Type-Moon Studio, 2017.

Figure 8b: Shadow puppetry character Mordred, Beijing Shadow Puppetry Troupe, 2019.

Figure 9a: Screenshot from *Demon Queller Zhong Kui Giving Away His Sister in Marriage*, 2011.

Figure 9b: Screenshot from *Demon Queller Zhong Kui Giving Away His Sister in Marriage*, 2011.

Figure 10: *Double Diamond* design process. Retrieved from https://www.designcouncil. org.uk/news-opinion/what-framework-innovation-design-councils-evolved-double-diamond. Accessed 21 December 2020.

Figure 11a: Image for Kua Fu character design, Yaolin Chen, 2020.

Figure 11b: Image for Kua Fu character design, Yaolin Chen, 2020.

Figure 12a: Screenshot of *Dreaming Butterfly* animation, Yaolin Chen, 2020.

Figure 12a: Screenshot of *Dreaming Butterfly* animation, Yaolin Chen, 2020.

Figure 13: Exhibition design, Yaolin Chen, 2020.

Figure 14a: Exhibition concept, Yaolin Chen, 2020.

Figure 14b: Exhibition concept, Yaolin Chen, 2020.

Figure 15a: Exhibition design draft idea A, Yaolin Chen, 2020.

Figure 15b: Exhibition design draft idea B, Yaolin Chen, 2020.

Figure 15c: Exhibition design draft idea C, Yaolin Chen, 2020.

Figure 16a: Animation key frame screenshot, Yaolin Chen, 2021.

Figure 16b: Animation key frame screenshot, Yaolin Chen, 2021.

Figure 16c: Animation key frame screenshot, Yaolin Chen, 2021.

Figure 17a: 'SHADOW PUPPETRY' typography poster design, Yaolin Chen, 2020.

Figure 17b: Photo for user testing, photo by Yaolin Chen, 2021.

Figure 18a: Sample of shadow puppets active parts building, Yaolin Chen, 2020. Original sources of shadow puppets is collected on Xi'an Shadow Puppet Art Museum, http://www.shadowpuppetart.com/p_cangpin.html .

Figure 18b: Samples of digitalised shadow puppets motion frames, Yaolin Chen, 2020.

Figure 18c: Image of user testing, photo by Yaolin Chen, 2021.

Figure 18d: Photo of PIR sensors hardware, photo by Yaolin Chen, 2020.

Figure 19a: Screenshot of Adobe Character Animator working states, human face interacting with character., Yaolin Chen, 2020.

Figure 19b: Image for user testing, photo by Yaolin Chen, 2021.

Figure 20a: Images of handcraft, Yaolin Chen, 2020.

Figure 20b: Images of creation booklet, Yaolin Chen, 2020.

Figure 20c: Images of creation booklet, Yaolin Chen, 2021.

Figure 20d: Image of creation booklet, Yaolin Chen, 2021.

Figure 20e: Images of handcraft user testing, Yaolin Chen, 2021.

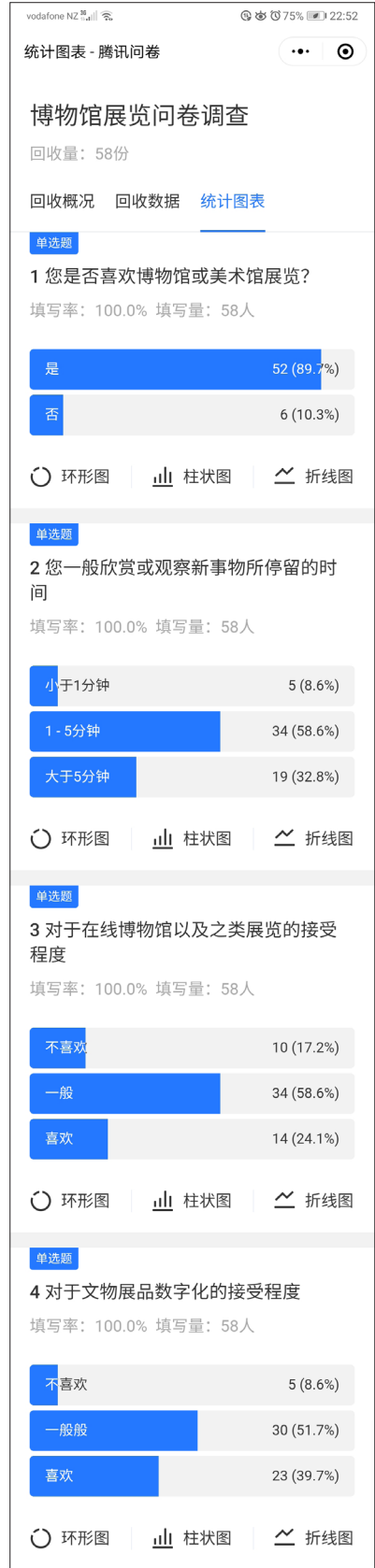Figure 20f: Images of creation booklet AR animation user testing, Yaolin Chen, 2021.

8.0 Appendix

8.1 Survey and Data Collection

Online Survey A screenshot (Chinese version)

Online Survey B screenshot (Chinese version)

I sent out an anonymous Chinese survey on my social media account. The subjects were people with a Chinese cultural background, and the required survey data was used to support my design works and verify the feasibility of the designs. The online survey system was provided by Tencent Questionnaire. This survey was considered under Low-Risk Ethics & Human Participant, Massey University.

In the early stages, I thought about the design direction with the following survey questions:

1. Your age range?

• *Under 20-years-old;*

• *20–25 years-old;*

• *25–30 years-old;*

• *30–35 years-old;*

• *35–40 years-old;*

• *40–45 years-old;*

• *Over 45-years-old.*

2. How good is your understanding of traditional culture (0–10, 10 points is the best)?

*3. Do you know about shadow puppetry or watched a shadow puppet show before?*

4. How good is your understanding of shadow puppetry (0–10, 10 points is the best)?

The age group data allowed me to better grasp the distribution of my audience and locate my design style. Asking how good people's understanding of traditional culture was helped me to find out how deep my audience's understanding was of their personal cultural background. This data can support my exploration of the values and current states of shadow puppetry.

Data Diagram of Survey A

Your age range?
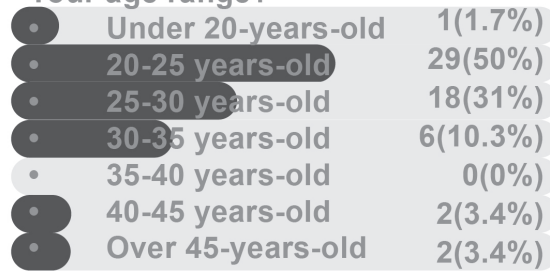
Under 20-years-old	1(1.7%)
20-25 years-old	29(50%)
25-30 years-old	18(31%)
30-35 years-old	6(10.3%)
35-40 years-old	0(0%)
40-45 years-old	2(3.4%)
Over 45-years-old	2(3.4%)

How good is your understanding of traditional culture (0-10, 10 points is the best)

0	1(1.7%)
1	3(5.2%)
2	3(5.2%)
3	14(24.1%)
4	7(12.1%)
5	15(25.9%)
6	9(15.5%)
7	1(1.7%)
8	4(6.9%)
9	1(1.7%)
10	0(0%)

Do you know about shadow puppetry or watched a shadow puppet show before?

Yes	31(53.4%)
No	27(46.6%)

How good is your understanding of shadow puppetry (0-10, 10 points is the best)

0	6(10.3%)
1	13(22.4%)
2	9(15.5%)
3	6(10.3%)
4	6(10.3%)
5	9(15.5%)
6	3(5.2%)
7	2(3.4%)
8	4(6.9%)
9	0(0%)
10	0(0%)

The survey ended on 7 December 2020, there were 58 anonymous responses. The data showed only 1 person in the age group under 20-years-old; 29 people in the age group between 20-years-old to 25-years-old; 18 people in the age group between 25-years-old to 30-years-old; 6 people's age between 30 to 35-years-old; 2 people in the group of 40 to 45-years-old; only 2 people over the age of 45. 98.3% of the respondents believed that they had good knowledge about Chinese national culture. Thirty-one people knew or had personally watched a traditional shadow puppet show before, 53.4% of the total data population. The data showed that 89.7% of the respondents had knowledge about traditional Chinese shadow puppetry. It can be concluded that most people who fall under the Chinese cultural background demographic still had knowledge about cultural and historical heritage. The cultural influence of shadow puppetry for people with Chinese cultural background still exists. The survey data for the question of "how good is your understanding of shadow puppetry (0-10, 10 points is the best)?" showed the largest proportion was 22.4% of the one point section, which was a total of 13 people. The rest of the large proportions were distributed between 2 points to 5 points sections. This prompted me to try to use education as a design purpose, use digital media to innovate the artistic expression of shadow puppetry, then use design exhibitions to promote shadow puppetry culture. Therefore, people had the opportunity to understand more about shadow puppetry and pay attention to cultural heritage.

Data Diagram of Survey B

Do you enjoy art galleries or museums?
- Yes — 52(89.7%)
- No — 6(10.3%)
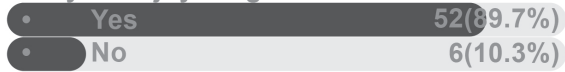
The time it takes you appreciate a new object:
- Less than 2 minutes — 5(8.6%)
- 2-5 minutes — 34(58.6%)
- More than 5 minutes — 19(32.8%)

What do you think of digital exhibitions?
- Dislike — 10(17.%)
- Middling — 34(58.6%)
- Like — 14(24.1%)

What do you think of the digitalisation of cultural relics exhibits?
- Dislike — 5(8.6%)
- Middling — 30(51.7%)
- Like — 23(39.7%)
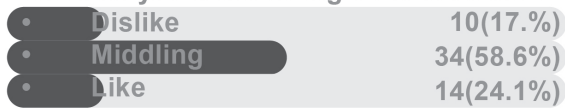
Following this stage, I decided on combining media design into a multimedia exhibition. I asked the following questions through surveys to define the audience's acceptance and the revision of my design direction.

1. Do you enjoy art galleries or museums?

2. The time it takes you appreciate a new object:

- *Less than 2 minutes;*

- *2–5 minutes;*

- *More than 5 minutes.*

3. What do you think of digital exhibitions?

4. What do you think of the digitalisation of cultural relics exhibits?

The questionnaire data survey ended on 7 December 2020, there were 58 anonymous responses.

Fifty-two out of 58 people liked to visit museums or art galleries, which was 89.7%. In the survey, on the time spent to stay and appreciating art crafts, 58.6% of the respondents showed that they stayed about 1 to 5 minutes, and 32.8% spent more than 5 minutes to appreciate and explore exhibits. Because of the issue of COVID19 in 2020, the trend of online exhibition development has increased, especially in China. For the concept of online exhibitions, 82.8% of the respondents expressed acceptance. Under the digitisation and globalisation trend, the digitisation of traditional cultural relics has gradually accelerated in popularity. Only five people said they do not enjoy digitalisation of cultural heritage, which represented 8.6% of respondents. On the other hand, 91.4% of the respondents said they enjoy the digitisation of cultural relics.

8.2 Code

8.2.1 Processing Code Detail

AnimatedSprite:
```
/**
 * Animated Sprite (shadow puppetry)
 */
Animation animation1, animation2,
animation3, animation4, animation5,
animation6,
   animation7, animation8,
animation9,animation10, animation11,
animation12,animation13,
  animation14;
import processing.serial.*;
Serial myPort;
int val;
//String[]vid = {
// "animation1", "animation2",
"animation3",
// "animation4", "animation5",
"animation6", "animation7",
"animation8", "animation9"};
// vid[int(random(1, 9))];
PImage img;
void setup() {
  size(3840, 1200);
  //background(255);
  img = loadImage("paper.jpg");
  image(img,0,0);
  frameRate(25);
  String CMO6 = Serial.list()[0];
  //println(Serial.list()[0]);
  myPort = new Serial(this, CMO6,
9600);
  animation1 = new Animation("01",
29);
  animation2 = new Animation("02",
29);
  animation3 = new Animation("03",
25);
  animation4 = new Animation("04",
38);
  animation5 = new Animation("05",
25);
  animation6 = new Animation("06",
57);
  animation7 = new Animation("07",
46);
  animation8 = new Animation("08",
25);
  animation9 = new Animation("09",
50);
   animation10 = new
Animation("23",75);
   animation11 = new
Animation("16",50);
   animation12 = new
Animation("12",30);
   animation13 = new
Animation("13",50);
   animation14 = new
Animation("14",24);
  animation1.dx = -1;
  animation2.dx = -2;
  animation3.dx = -3;
  animation4.dx = -4;
```

```
  animation5.dx = -2;
  animation6.dx = -1;
  animation7.dx = -4;
  animation8.dx = -3;
  animation9.dx = -2;
  animation7.scale = 0.7;
  animation8.scale = 0.7;
  animation9.scale = 0.7;
  animation9.scale = 0.7;
  animation13.scale = 0.6;
  animation14.scale = 0.7;
}
void draw() {
  if (myPort.available() > 0) {
   val = myPort.read();
   println(val);
   myPort.clear();
  }
  //background(255);
  image(img,0,0);
  if (val == 1) {
   //println("displaying");
   animation1.start();
  }
  if (val == 2) {
  animation2.start();
}
if (val == 3) {
  animation3.start();
}
if (val == 4) {
  animation4.start();
}
if (val == 5) {
  animation5.start();
}
if (val == 6) {
  animation6.start();
}
if (val == 7) {
  animation7.start();
}
if (val == 8) {
  animation8.start();
}
if (val == 9) {
  animation9.start();
}
if (val == 10) {
  animation10.start();
}
if (val == 11) {
  animation11.start();
}
if (val == 12) {
  animation12.start();
}
if (val == 13) {
  animation13.start();
}
if (val == 14) {
  animation14.start();
}
  animation1.display();
```

```
  animation2.display();
  animation3.display();
  animation4.display();
  animation5.display();
  animation6.display();
  animation7.display();
  animation8.display();
  animation9.display();
  animation10.display();
  animation11.display();
  animation12.display();
  animation13.display();
  animation14.display();
}
```
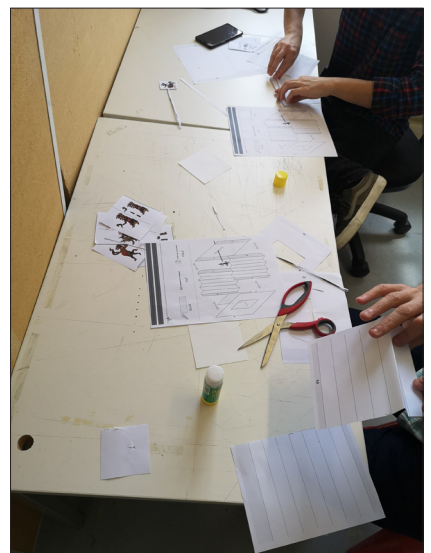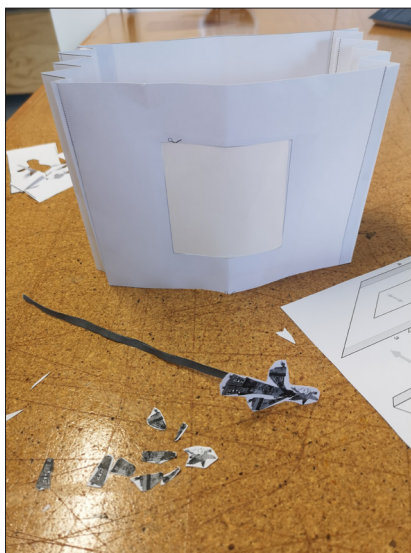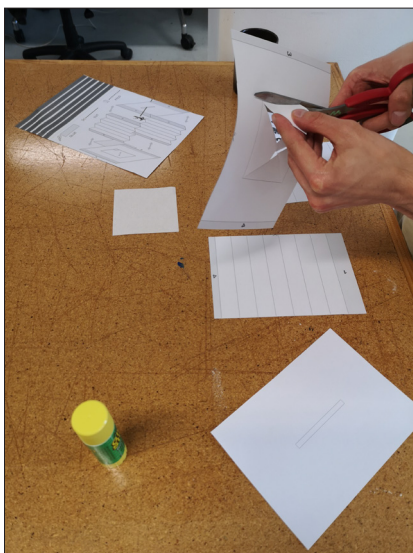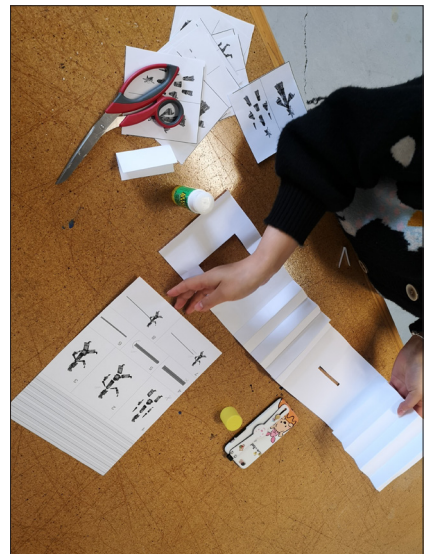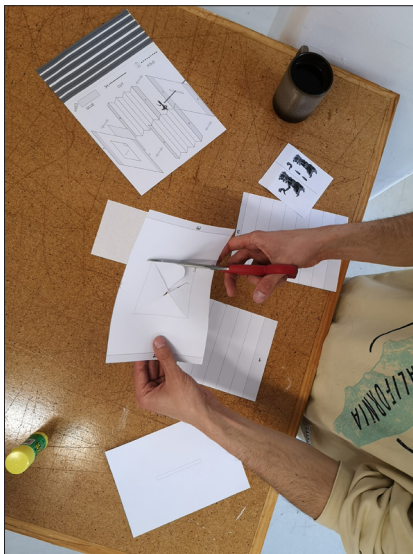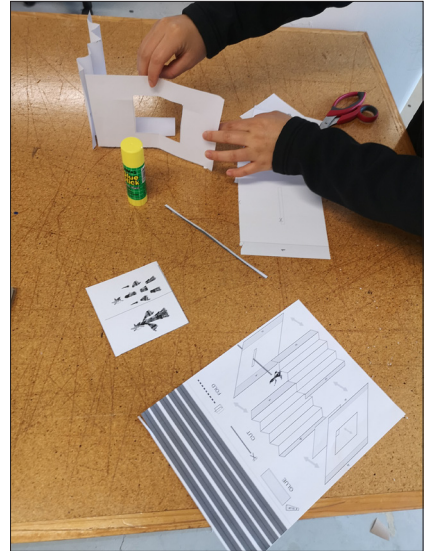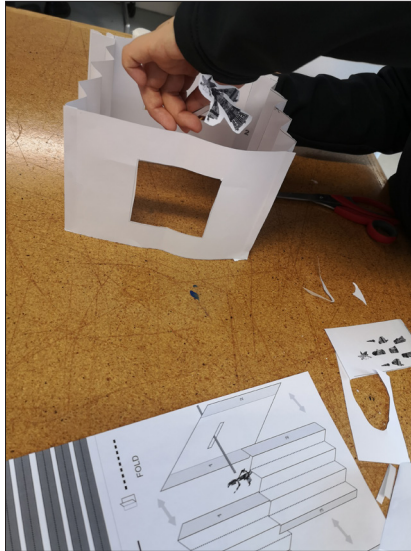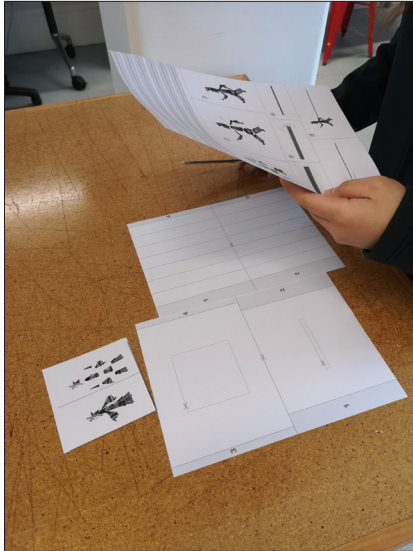
Animation:
```
// animation
class Animation {
  PImage[] images;
  int imageCount;
  int frame;
  float xpos = width;
  float ypos = random(height);
  float dx = -5;
  float scale = 0.5;
  boolean display = false;
  Animation(String imagePrefix, int
count) {
    imageCount = count;
    images = new PImage[imageCount];
    for (int i = 0; i < imageCount; i++) {
      // Use nf() to number format 'i' into
four digits
      String filename = imagePrefix +
nf(i, 2) + ".png";
      println(filename);
      images[i] = loadImage(filename);
    }
  }
  void start() {
    if (!display) {
      xpos = width;
      display = true;
    }
  }
  void display() {
    if (display) {
     push();
     scale(scale);
     xpos = xpos + dx;
     frame = (frame+1) % imageCount;
      image(images[frame], xpos/scale,
ypos);
     pop();
    }
    if (xpos<-getWidth()) {
     display =false;
    }
  }
  float getWidth() {
    return images[0].width*scale;
  }
}
```

8.2.2 Arduino Code Detail

```
// the setup function runs once when you press reset or power the board
long randomNumber;
bool lastState = 0;
void setup() {
  pinMode(2, INPUT);
  Serial.begin(9600);
  randomSeed(analogRead(0));
}
void loop() {
  bool sensorTripped = digitalRead(2);
//  Serial.println(sensorTripped);
  if (sensorTripped != lastState) {
    if (sensorTripped){
      randomNumber = random(1,15);
      Serial.write(randomNumber);
      //Serial.println("Trigger");
      lastState = true;
    }
    else{
      Serial.write(0);
      //Serial.println("No Trigger");
    }
    lastState = sensorTripped;
  }
  delay(1100);
}
```
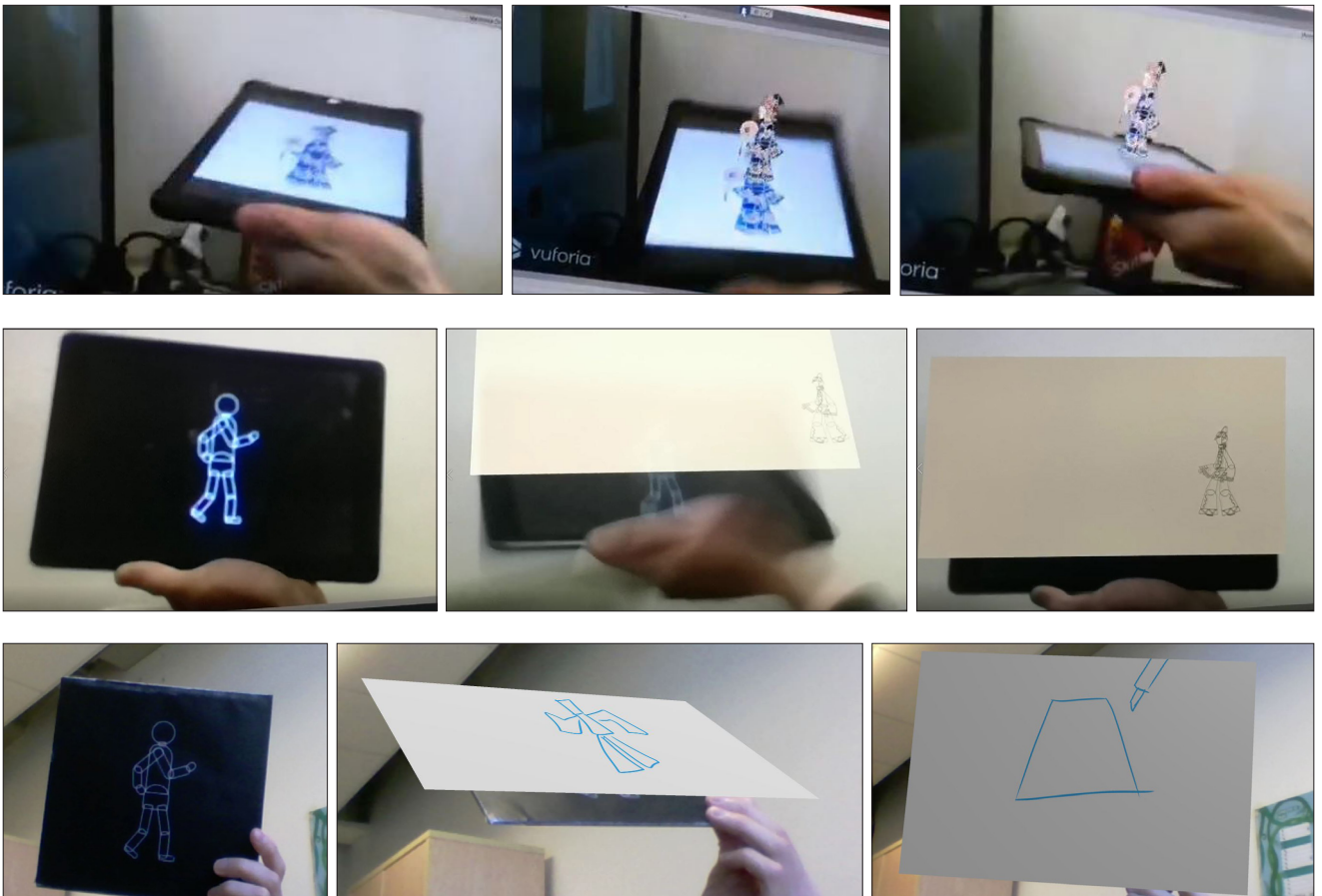
8.3 Images of User Testing

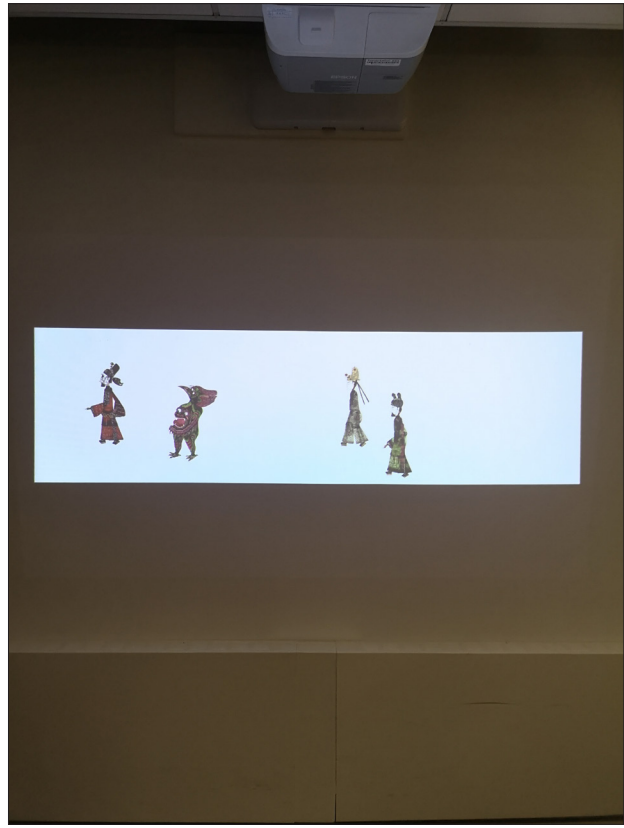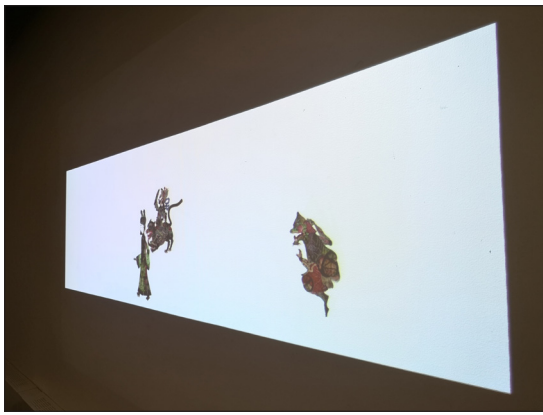## 8.3.1 Images of Hand Craft User Testing
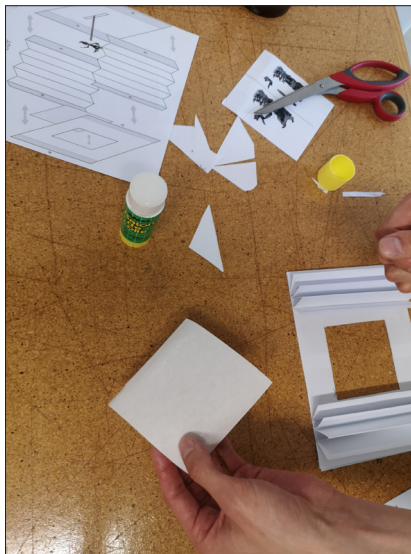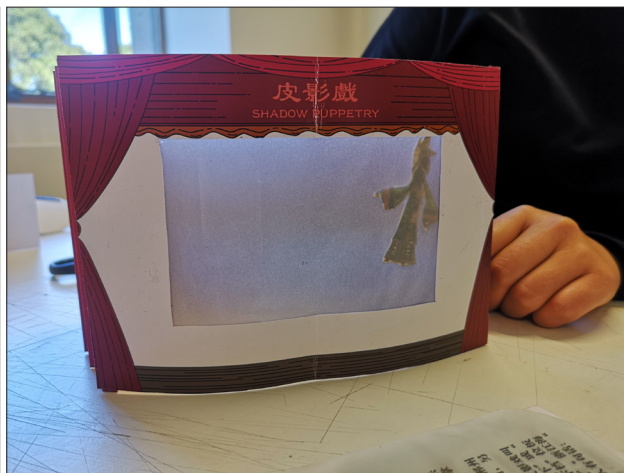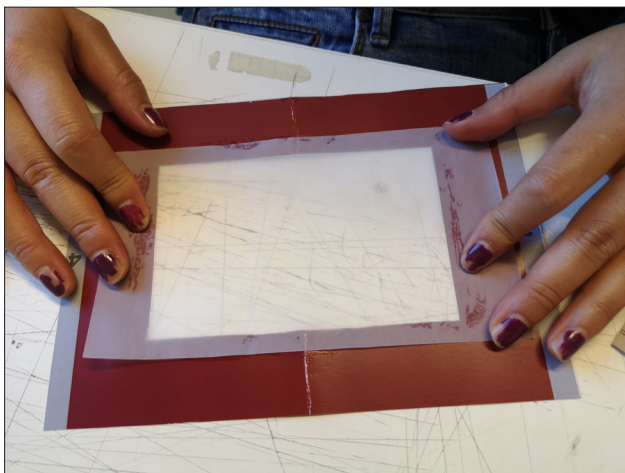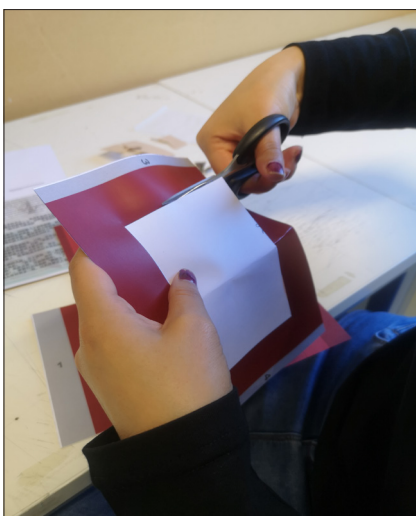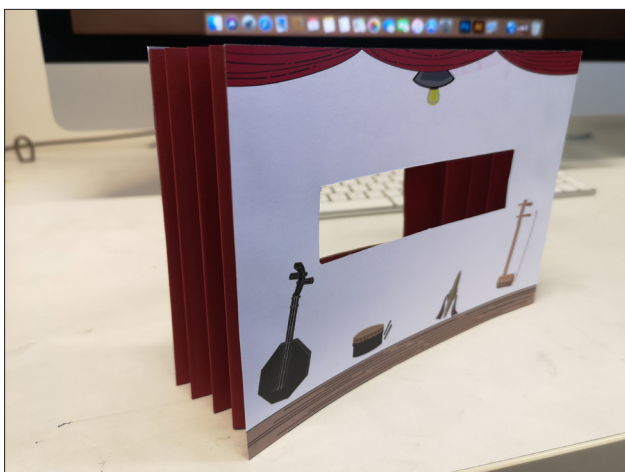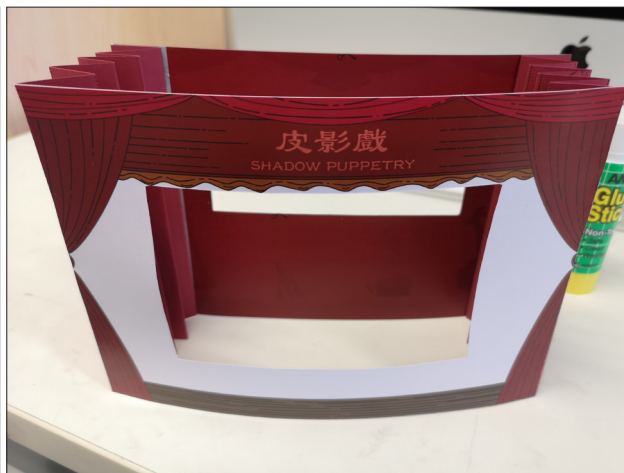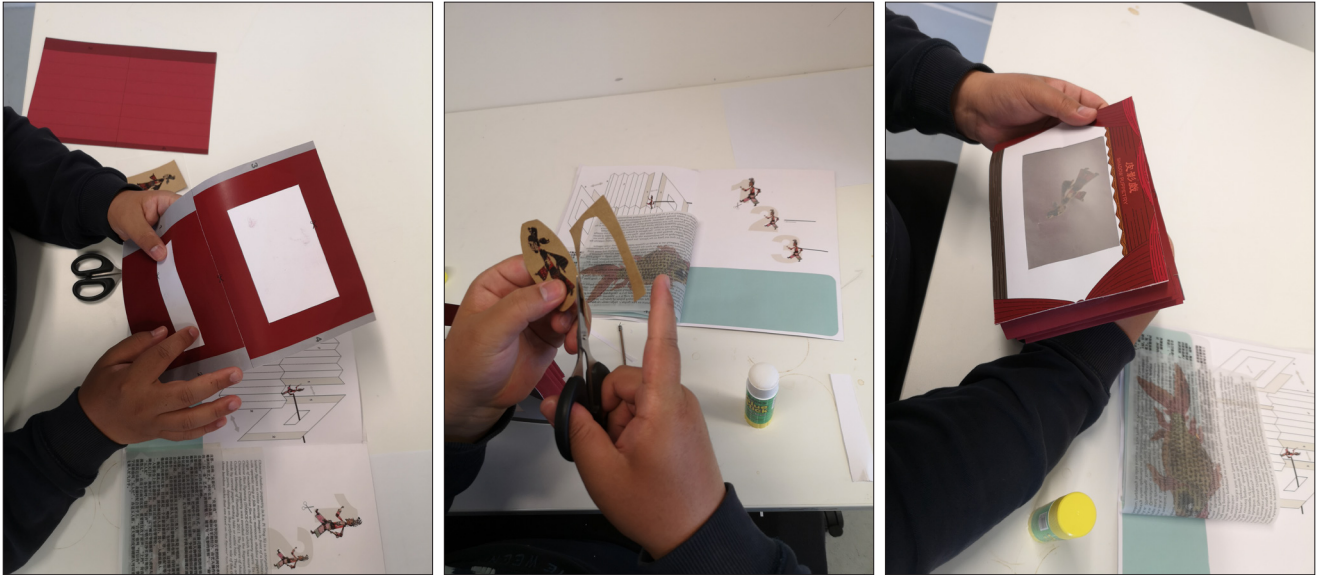
8.3.2 Images of AR Animation User Testing

8.3.3 Images of Interactive Motion User Testing

8.4 Images of Poster Design