



MiniMuseum: Connection

An Interactive and Immersive Museum Exhibition Design

Major Qualifying Project Report in partial fulfillment of the Bachelor of Arts Degree at
Worcester Polytechnic Institute

This report represents the work of one or more WPI undergraduate students submitted to the faculty as evidence of completion of a degree requirement. WPI routinely publishes these reports on the web without editorial or peer review.

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Abstract

This exhibition is designed to look at the needs of a museum media designer while creating interactive and immersive elements to convey narrative to visitors. Many museums are challenged by the interest to add interactive elements to their exhibitions, but many museum media designers and curators are concerned that they may not be able to keep up with the installation's maintenance. This project aims to share ideas and methodology with cultural institutions to learn how they can include these types of experiences within their design and skills expertise.

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Authorship

Hannah Goodsell wrote the majority of this MQP report.

The only exception being Appendix A, which was written by Katherine Valery.

Table of Contents

1. Introduction and Motivations	8
2. Background	9
3. Requirements	12
3.1 Production Cost	12
3.2 Technology and Maintenance	13
3.3 Audience Engagement	13
4. Installation Designs	14
4.1 Murder of Edith Cavell, Shadow Box	14
4.1.1 Materials and Design	16
4.1.2 Technology Implementation	17
4.2 The Story of Layla and Majnun, Paper Theater	19
4.2.1 Materials and Design	21
4.2.2 Technology Implementation	22
4.3. Xi Shi: One of the Four Beauties of China, Interactive Canvas	22
4.3.1 Materials and Design	24
4.3.2 Technology Implementation	24
4.4 Red String of Fate, Severed Globe	25
4.4.1 Materials and Design	26
4.4.2 Technology Implementation	27
4.5 Greek Tragedies, Double Sided Frame	28
4.5.1 Materials and Design	29
4.5.2 Technology Implementation	30
5. Post Mortem	30
5.1 Successes	31
5.2 Improvements	31
5.3 Future Considerations	32
Bibliography	33
Photo Credit	37
Appendix A: Interactive Canvas Report, written by Katherine Valery	39
Appendix B: Feedback Questions and Responses	41

Appendix C: Promotional Poster

49

Appendix D: Interview with Erin Corrales-Diaz, former curator at the Worcester Art Museum
and current curator at the Toledo Museum of Art

50

Table of Figures

Figure 4.1.1: Murder of Edith Cavell Lithograph	14
Figure 4.1.2: Shadow box display case	15
Figure 4.1.3: Rough sketch and photo of the shadow box	15
Figure 4.1.4: Circuit diagram of the shadow box	18
Figure 4.2.1: Illustration of Layla and Majnun	19
Figure 4.2.2: Paper theater	19
Figure 4.2.3: Rough sketch and photo of the theater	20
Figure 4.3.1: Depiction of Xi Shi	22
Figure 4.3.2: Rough sketch and photo of the interactive canvas	23
Figure 4.3.4: Circuit diagram of the interactive canvas	25
Figure 4.4.1: Rough sketch and photo of the severed globe	26
Figure 4.5.1: Painting of The Judgment of Paris	28
Figure 4.5.2: Tapestry of The Abduction of Helen of Troy	28
Figure 4.5.3: Rough sketch and photo of the double sided frame	29

1. Introduction and Motivations

This project resulted in the design, prototyping, and execution of an interactive and immersive museum exhibition in WPI's Higgins House Great Hall from March 29th, 2022 to March 31st, 2022. Through the duration of the project, Hannah Goodsell acted as the lead researcher, prototype and installation designer, organizer, and user testing facilitator. In this project, Katherine Valery prototyped the technical design of the shadow box lighting system as well as the interactive touch canvas's circuit system as an independent study project. This project was designed by an Interactive Media and Game Development major and executed with the help of two Robotics Engineering majors.

There were two motivators at the core of this project. The first motivator: to challenge how museums and institutions present media to their audiences. Museums and cultural institutions have become known as quiet spaces for personal reflection. In history, museums and private collections used to allow audiences to interact with the artifacts to create personal connections. Technology can be incorporated to create interactive experiences to foster intimate connections between audience members and the collections while preserving the artifacts.

The second motivator: to open a conversation about the cross design and implementation of technology and art. Many jobs have combined technology and art to create a deliverable. However, more research and development in interactive media and artistic technology is needed to break down the divide between the two disciplines.

This project was organized in phases to try to emulate what it would be like for a curator to design an interactive and immersive exhibit.

1. Research and Exhibition Theme

- a. The exhibition had to first select its theme and what pieces were going to be shown. Using databases provided by museums from around the world, the artworks shown in this exhibit were shared under open commons rights. This allowed for the pieces to be used and "remixed", repurposed for a new medium, for personal and education use.

2. Initial Installation Design

- a. After the theme and artworks were chosen, paper designing and prototyping began. Mock ups, small descriptions, and initial supply lists were created to have an understanding of how much each installation would cost to produce.
3. Material Collection and Prototyping
 - a. Using the initial design, physical prototyping began. This started the iterative design process where the prototype was polished each week to eventually be used as the final version.
4. Technology Implementation
 - a. With an understanding of the prototype's technological needs, purchasing and reserving the necessary equipment was scheduled. This phase focused on any technological changes or adaptations required before loading into the space or conducting work on the space to accommodate the technology.
5. Exhibition Space Design
 - a. In this phase, the designer and/or curator toured the space to ensure that there was room for both the installations' physical components as well as the technological components.
6. Maintenance
 - a. During the exhibition's occurrence, there needed to be a person or a group of people responsible to keep the installations safe and running. This entailed stopping any unexpected interactions with the installations, theft, debugging software issues, or fixing hardware issues.

Thinking of the exhibit's design in these phases allowed for the project to work towards the exhibition week in manageable tasks during the seven week term system.

2. Background

Museums were originally interactive and immersive in their experience design from the 1600s to the 1800s, which was when the traditional museum experience became popular in practice. Some of the earliest museum-like experiences during the 1600s to 1700s were private collections, where the owners invited guests or hosted public showings (Classen, 2007). The immersive design focused on the experiences' locations. Before or after the collection tour, visitors were encouraged to roam around the grounds and buildings. This built a personal connection to the leisure experience. Including the physical activity of strolling within the gardens and collections, the owners integrated physical movement within the experience's design to create a sense of exploration.

Collections were spaces that allowed people to see more of the world rather than to preserve the artifacts (Classen, 2007). In the middle of the 1800s, collection owners invited visitors to handle the artifacts and used their other senses to understand the object more than they would with sight alone. By weighing the artifact or smelling it, the visitor gained more context, like what kind of material it was made of or how heavy it was, which created a deeper connection. However, in the later part of the century, this practice went out of style. Sensory observation became less accepted and seen as primitive compared to new research methods (Classen, 2007). Without the scientific community's support in this practice, collectors and museums no longer allowed their visitors to directly interact with artifacts. This began the shift to the common museum experience where visitors are only allowed to view collections behind glass cases and roped off areas (Hooper-Greenhill, 2013).

By the early 1900s, museums and curators focused more on research and preservation rather than engaging with their audiences (Hooper-Greenhill, 2013). With artifacts out of reach and no longer available as an interaction, visitors began to acclimate with a static museum experience. Museums and collections now valued research and scholarship over public education and engagement. In the later part of the century, closer to the 1980s, museums realized how much they disconnected from their audiences and what effect it had in their relationships (Hooper-Greenhill, 1999). Now wanting to rebuild their relationships with visitors, museums began to invest in new interactions and attractions to interest diverse visitor groups and foster

their community relationships (Hooper-Greenhill, 2013). During the 1990s, museums installed kiosks as their first attempt at interactive experiences within exhibits (Chang, 2006). In this attempt, museums hoped that by incorporating emerging technology that they would attract visitors. Instead, visitors found them to be overly educational in delivery and limited in their interaction design (Leong & Chennupati, 2008). The kiosks lacked a personal connection to the visitor. There was no motivation for the visitor to interact with kiosks since they could not save their progress, access their progress across multiple kiosks, or print out their work to share with their friends and family.

During the 2000s and through the 2010s, there was a rapid change in technology with updates in the Internet and developments in personal computers and phones (Marty, 2007). Technology began to be used in everyday activities, but this was also a period of rapid development and confusion. Many museums in this time tried to separate their experience design from technology as a way to promote interactions between visitors, visitors and artifacts, as well as visitors and staff. However, as online communities and platforms became popular forms of communication between users, museums needed to recognize technology as a means to connect with returning and potential visitors (McRainy, 2013). Recognizing the popularity of these online communities, museums rushed to create profiles and their own online presences to foster interactions outside of the museum's physical boundaries. With these spaces, museums reached their already established connections with returning visitors as well as established new connections with potential visitors. Within the next decade, 2010 to 2021, museums began to broaden their types of interactions through social media, virtual reality, and apps to engage with their growing audiences (Home, 2016)(Kidd, 2017)(Goodsell, 2021).

Virtual reality experiences began to appear in museum experiences as a means to put the visitor in the context and setting of the artifacts (Home, 2016). This type of technology created a deeper connection with the visitor and artifacts by using immersive design. Though these experiences were extremely effective, they were only effective if well produced and managed. Majority of staff did not have prior experience or knowledge about these technologies to be able to develop, run, and manage these experiences long-term (Kidd, 2017). At the same time, museums began to use social media as a marketing method to interest potential visitors rather than using it to foster closer relationships with them (Kidd, 2017). They developed their own

online identities and profiles on platforms like Twitter and Instagram, but not to their fullest extent; rather, it came across like they were trying to stay relevant in a growing digital age. In 2018, virtual tours were incorporated as a way to provide access to cultural sites to those who may not be able to travel to them as well as interest potential visitors who would be able to travel (Dwason, 2018). These tours also acted as a way to preserve the cultural sites as some began to face concerns of funding, climate change, and accessibility. During the 2019-2020 COVID-19 Pandemic, museums shifted to more interactive social media presences than what was expected in their now established educational roles (O'Neill, 2020a)(O'Neill, 2020b). Museums created hashtags to promote audience engagement through Twitter wars and provided print-out sheets for at home lessons. In addition to these social media experiences, museums spent lockdown developing additional virtual tours of the institutions and cultural sites (Bianchini, 2021). Museums designed and released apps to provide supplementary information to go alongside exhibits as another way to introduce new types of interactions during the pandemic (Goodsell, 2021). With these combinations of online experiences, museums used the pandemic lockdown as a time to learn about popular technology and emerging communication methods to provide experiences that fostered their relationships through their roles as public educators and entertainers.

Museums have already begun to intentionally design exhibits to incorporate multiple sensory experiences to foster deeper connections between their audiences and their institutions (Peabody Essex Museum, 2021a)(Peabody Essex Museum, 2021b)(Peabody Essex Museum, 2022). Interactive and immersive media can be incorporated from large scale projects, like developing a virtual reality experience or app, to the internal exhibit layout design, including ambient light or providing multiple types of media. The experience design can even be applied to how museums present their artifacts. This project aimed to provide ideas on how museums can design their displays to provide supplementary experiences alongside the artifact or design a display that holds the artifact to create interactive and immersive experiences.

3. Requirements

Understanding the history and limitations of museums and cultural institutions, the installations were designed understanding that institutions may not be ready to completely integrate interactive and immersive media.

3.1 Production Cost

The cost to design, create, install, and maintain these experiences needed to be flexible for a range of budgets. Many museums have been registered as nonprofits with limited budgets (American Alliance of Museums, 2014). When designing these installations, the materials were chosen with the three criteria in mind: its performance, necessity, and cost. These installations were designed with a smaller budget to provide an idea of what these installations could look like, as well as suggest affordable equipment that performed well for the installation's needs.

3.2 Technology and Maintenance

The technological design of this project was made with the knowledge that there was a limited budget as well as limited access to technology support. To run the exhibition, I used my three personal devices to playback three of the soundscapes as well as host the user testing form, and I reserved two additional laptops to control the programs and one of the soundscapes. In total there were four bluetooth speakers used for the installations that have soundscapes. With these technological aspects of the project, two people needed to maintain this exhibition. One person with coding experience checked the programmed installations to ensure they were correctly running, and one other person needed to be at the exhibition to check the speaker batteries, facilitated user testing, and troubleshoot any issues that may have arisen.

3.3 Audience Engagement

To begin building a relationship between the exhibit and the visitors, sensory experiences and visitor feedback were incorporated into the experience design. By using sensory experiences such as sight, hearing, smell, taste, touch, visitors became more immersed in the installation by engaging with a combination of multiple senses. When visitors took part in user feedback testing,

they took part in participatory design. This collaboration between designers and visitors allowed for the needs, interests, and feedback to be recorded and incorporated into future iterations of the design (Brandt, 2006). Participatory design and multi sensory interactions allowed for visitors to feel immersed in the exhibition's narrative as well as design.

4. Installation Designs

Each of these installations aimed to relay the artwork's narrative in an engaging format by using interactive media and game development tools and techniques. By using these tools and methodologies, more interactive and immersive experiences may be incorporated in exhibitions and shared with institutions' audiences. Each installation was designed with a limited budget and with the idea that cultural institutions may be inspired from these in how they present their collections.

4.1 *Murder of Edith Cavell*, Shadow Box

The first installation was a shadow box with a copy of George Bellows' *Murder of Edith Cavell* lithograph from 1918, which is currently held in the Smithsonian American Art Museum's collection (Smithsonian American Art Museum, 2022). Edith Cavell was a British nurse during World War I, stationed in Brussels, Belgium and decided to stay when Germany invaded (The National WWI Museum and Memorial, 2020). During her time in occupied Belgium, Cavell aided captured soldiers back to England. She was arrested and sentenced to death by Germans not for aiding soldiers during escape, but aiding soldiers back to a country that Germany was at war with.



George Bellows' *Murder of Edith Cavell*, Lithograph
Figure 4.1.1
(Smithsonian American Art Museum, 2022).

With this installation piece, I wanted the visitor to feel as if they were looking into this room and watching Cavell walk to her execution. I focused on the dark and somewhat claustrophobic feeling of the jailing area as the main design. To achieve this feeling, I drew



Shadow box display case
Figure 4.1.2
(Displays2go, 2022).

inspiration from shadow boxes, which are a type of frame that is deep set to display small objects (Merriam-Webster, 2022).

Using the depth of a shadow box rather than a traditional frame, I was able to match the lithograph's atmosphere inside the box by using audio and visual technology.

The shadow box I helped build is made out of plywood and the front has a cut out to look like a crack in the wall for visitors to peer into and trigger the technology. Inside the box there were layers that add more depth and texture to the experience in addition to hiding the audio-visual components. When the visitor looked into the box, an ambient soundscape began to play through a small bluetooth speaker and ambient lighting began to shift from both the roof and floor of the box.

To achieve the feeling that the visitor was peering into the scene, the aesthetic of the box needed to match the setting of the print.

Murder of Edith Cavell - Shadow Box Experience

Materials List

Paint + brushes (grey, red, black)	→ already have
Foam blocks	→ amazon: 19/121 99
Print (18 x 24 in)	→ staples: \$11
speelless	→ amazon: 2/828
wooden box	
sensor	
wiring	
knives	→ amazon: \$8.00

Estimated Price



Shadow Box Rough Sketch and Prototype
Figure 4.1.3
(Goodsell, 2021-22c)

4.1.1 Materials and Design

Below are the materials (with costs) used to create this installation:

- Paint and brushes
 - I already had these supplies from previous projects.
 - These can be bought at art or craft stores, and the prices will vary between stores and brands.
 - The carpenter I worked with also painted the structure the main color, inside and out, and this was included in the project price later list.
- Print of the artifact, if the artifact is not accessible
 - I printed an 18 inches by 24 inches from Staples for \$15.
- Wooden box sized to the artifact's dimensions
 - I contracted this part of the project to a carpenter, Hot Corner Carpentry, for \$250.
 - This was a reduced price to cover the cost of materials, but normally it would have included the cost of production as well.
- Sliders system
 - This was also included in the project price with the carpenter.
- Mini bluetooth speaker
 - One speaker cost \$15.49 from Amazon.
- Light sensor (CdS photoresistor)
 - This was purchased for 95 cents from Adafruit.
- Dupont cables
 - A three pack was purchased on Amazon for \$7.99.
 - A different type of cable would work better for this system.
- Tiny Breadboard
 - This was purchased for \$4 from Adafruit.
- Arduino UNO
 - One system cost \$14.99 from Amazon.
- 4 NeoPixel LED lights
 - These were purchased for \$5 from Adafruit.
- Arduino and Max languages

- Both languages are open source and free to download.

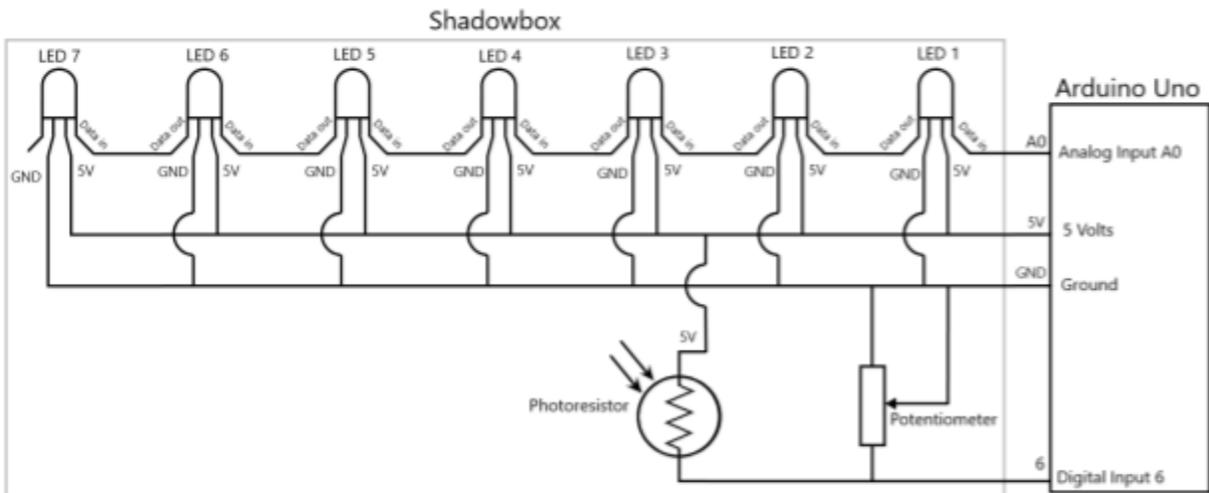
Designers can work within their budget to create these types of installations. If they do not have the specific expertise and have the budget to hire an outside contractor. Their deliverable is handled from the prototyping phase through the installation and debugging/feedback period. This option allows designers to act as a sponsor and not work directly on the project. Rather, they provide project assets (text, artifact dimensions, installation layout information, etc.) and feedback on the current iteration of the deliverable. However, if they cannot afford hiring an outside contractor, then they need to look internally for staff with these skills to make a team. Since this installation includes many electronics and programming, the exhibition designer would look for individuals with a familiarity of electrical engineering or design and programming. This doesn't have to be a formal background either; look for individuals who might have a hobby that uses these skills. This installation was completed in total of about \$314 and 80 hours of work.

4.1.2 Technology Implementation

Inside the shadow box, there is a light sensor, bread board, and system of LED lights that connect to an Arduino UNO to run the program through a laptop to achieve this immersive experience. Arduinos are an open source hardware (we used a microcontroller) and software system where the hardware is able to receive signals from sensors to trigger code. Max is an open sourced programming language. It is a visual programming language used within music and visual media to create digital art, and it can also be edited in real time while the code is running. Here is a walkthrough of the system to explain how it works:

- On the laptop, there is a patch of Max code with the commands to trigger the soundscape to start and stop playing when a certain range of darkness occurs in front of the light sensor. There is also Arduino code with the commands to trigger the LED lights to turn on and off when the same range of darkness occurs.
- Connected to the laptop is the Arduino UNO that stores the Max. The Arduino code needs to be uploaded to the microcontroller directly once finalized. Once it is uploaded, the software does not need to run on the laptop for it to work. However, it does need a power source to plug into.

- The Arduino is connected to a breadboard which acts as the main connector between both the Arduino and light sensor as well as the Arduino and LED lights. There is also a potentiometer to adjust the light range in which the code will be triggered.
- Hidden near the cut out on the front panel is the light sensor which is connected to the breadboard with a path of wires. This was originally inside the box, but for the exhibition showing, it needed to be moved due to the location's lighting.
- Hidden in the two upper corners and two bottom corners of the shadowbox closest to the lithograph print, there are small LED lights connected to the breadboard through a path of wires.
- Secured on the floor of the shadowbox and hidden behind one of the additional layers is the bluetooth speaker to play the ambient soundscape. The volume can be adjusted through both the input and output, but I would recommend keeping the input at half volume while adjusting with the speaker. This will ensure less of a chance of breaking the speaker.



Circuit Diagram of the Shadow Box
Figure 4.1.4

4.2 The Story of Layla and Majnun, Paper Theater

The next installation designed was a larger scale, paper theater to create the intimate scenery of Layla and Majnun’s love story. This interpretation of the story was illustrated by Edmund Dulac, a French illustrator, for a picture book published by the Red Cross. Layla was a princess of a Persian tribe, and Qays (later named Majnun) was so enamored by her beauty that he wrote her love poems (University of Michigan, 2016). He recited them to her publicly, and Layla’s family was alarmed by his passion. When Qays asked for her hand in marriage, her family refused, leading Qays to wander into the desert. He was driven by his love for Layla and refused to come back to the tribe even when extended an invitation. Qays became known as Majnun, which roughly translates to “mad” or “possessed”. Majnun had learned that Layla married another man, and did not want to return to see her with another lover. This illustration depicted their last meeting where Layla visited Majnun in the desert and reaffirmed her devotion to only him.



Illustration of Layla and Majnun from the Picture Book for the French Red Cross

Figure 4.2.1
(Pook Press, 2017)

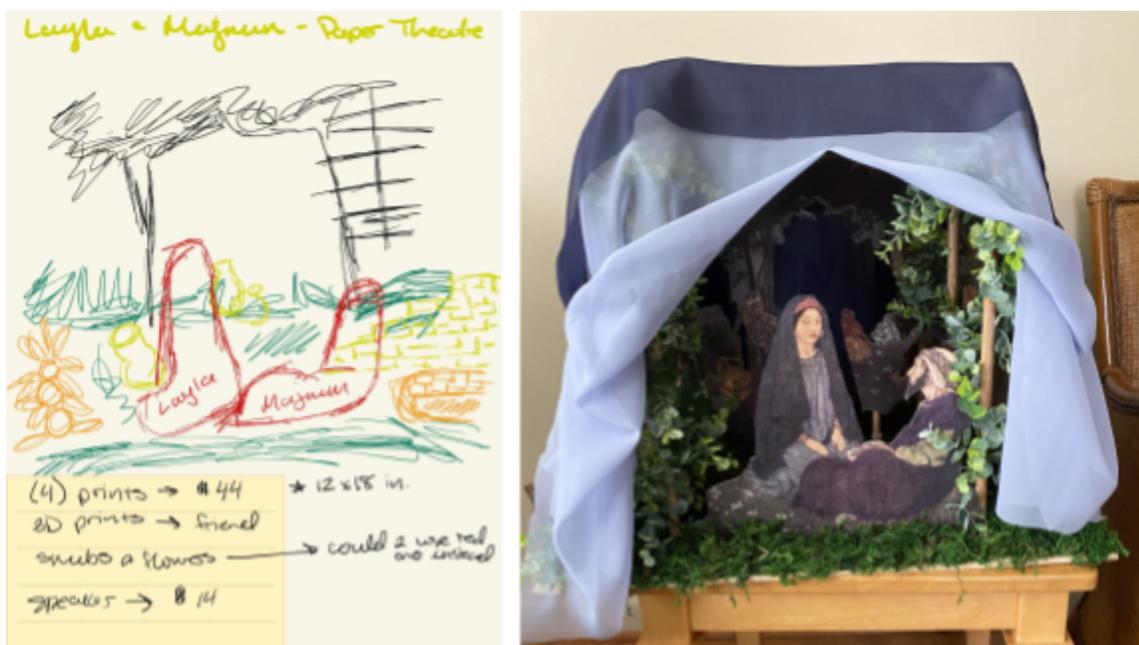


Nineteenth Century Paper Theater
Figure 4.2.2
(Soth, 2019)

I drew inspiration from paper theaters, also known as toy theaters, which were created in the nineteenth century by toymakers to bring a theater experience to the homes of children (Soth, 2019). These paper theaters were illustrations of palaces and affluent settings. They also came with

scripts for children to perform their own shows, but they then also created their own stories from their imagination. The theaters had layers like an actual production set would have on stage, and the illustration of Layla and Majnun was an ideal piece to show dimension and scenery through this design. Rather than a script, I wrote and produced an audio soundscape of what it would sound like to observe their last conversation.

The reimagined paper theater allowed the scene to still feel private between the lovers and created the sense that the visitor was peering into this scene, almost as if they were intruding on the pair. Each layer in the sketch was color coded based on its contribution to the composition. Green represented greenery and plants that I wanted to incorporate life-like or fake versions of greenery. Red was the cut out of the lovers from a print of the artwork that I then cut into sections to create the depth. Yellow objects were pieces that I had 3D printed (except the wall, I decided to just use a paper cutout from the print). Orange represented objects that I did not know how I could incorporate, so I purchased a fake cactus and left the well as a part of the paper cut out. There are three layers in the actual installation that are made out of cutouts from the print that are accompanied by the additional materials: 1) the fabric enclosure, 2) the vines and arching leaves, 3) the background shrubs, and 4) the 3D printed vases. I glued wooden dowels onto a sheet of plywood in the front, middle, and back side to create the height and length needed to glue the printouts to. From there, I glued down the additional materials to build the scene and then draped blue fabrics over the dowels to create an enclosed feeling of intimacy.



Rough Sketch and Prototype of the Theater
Figure 4.2.3
(Goodsell, 2021)

4.2.1 Materials and Design

Below are the materials (with costs) used to create this installation:

- Prints of the image
 - I printed four 12 inches by 18 inches prints from our on campus print services for free.
 - Staples prints the same size for \$11, \$44 for four prints.
- 3D prints of additional set pieces
 - A friend printed the two vases for me, so I was able to make these for free.
 - There are services for 3D print projects, so the cost would vary on the service, size of the project, and type of filament used to print.
- Mini bluetooth speaker
 - One speaker cost \$14.95 from Amazon.
- Sheet of plywood
 - I purchased an imperfect 4 feet by 4 feet sheet of plywood for \$7.95 at Home Depot.
 - The cost will vary depending on the supply and demand of plywood as well as the size of the sheet needed.
- Wooden dowels (or support beams depending on the size of the theater)
 - I purchased a total of four $\frac{3}{4}$ inch wooden dowels, \$5.95 each, and three $\frac{1}{2}$ inch wooden dowels, \$2.39 each, from Home Depot.
- Wood glue
 - One small container cost \$7.89 from Home Depot.
- Fake plants
 - A pack of two fake vines cost \$14.99 from Amazon.
 - One fake cactus cost \$14.99 from Amazon.
- Preserved moss
 - Eight ounces cost \$12.99 from Amazon.
- Three yards of three types of fabric (two shades of blue and one mesh of brown)
 - Each fabric was on sale, and in total cost \$66.

This would be an easier project to create within a small budget and limited expertise. In total, this project cost around \$140.75 and took around 41 hours to create. Designers could either outsource this work to an artist, or they could look for internal staff who have a familiarity with crafts, carpentry, and sound design. The longest part of this process was allowing the glue to cure before I could continue working.

4.2.2 Technology Implementation

To play the soundscape, the designer needs a bluetooth speaker and a device that is capable of playing audio through bluetooth. I used an iPhone with the app called Go Button to control the audio loop. Go Button is an app that many theater companies use to control their audio ques and playback. It features a looping system that plays the audio until told to stop. The audio input is the phone while the output is the bluetooth speaker, which can be connected through the app to control. The volume can be adjusted through both the input and output, but I would recommend keeping the input at half volume while adjusting with the speaker. This will ensure less of a chance of breaking the speaker.

4.3. Xi Shi: One of the Four Beauties of China, Interactive Canvas

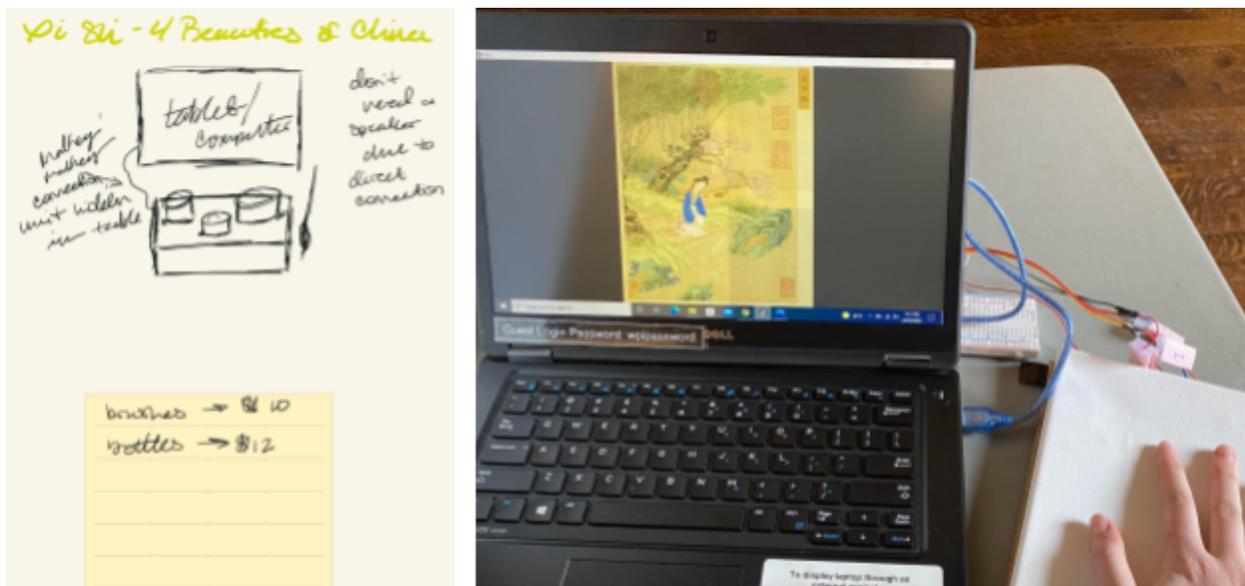


Depiction of Xi Shi from the album *Gathering Gems of Beauty* (畫麗珠萃秀).
Figure 4.3.1
(Wikipedia Foundation, 2022).

This installation was the other interactive experience. He Dazi painted this artwork of Xi Shi during China's Qing Dynasty, circa 1644-1912 AD. In 494 BCE, two Chinese states, Wu and Yue, were at war with one another, because they carried tensions over from when they broke away from Chu (Milburn, 2013). King Fuchai of Wu state defeated Yue, and he worked their king, King Gou Jian, and his wives as slaves to Wu. Humiliated by his defeat and treatment, King Gou Jian and his adviser began to plan their revenge on Wu. They decided to find the most beautiful woman and send her as a marriage offer in hopes that the relationship would distract King Fuchai enough, so Yue could launch a revenge attack. They found Xi Shi and

brought her to court to be trained in seduction and court etiquette. When she entered King Fuchai's court, Xi Shi became his favorite and led to the destruction of the Wu state. He was so distracted and enamored by her company, that King Fuchai tended to her needs rather than the state's needs. She then returned home to Yue and reunited with her lover.

I wanted to include a tactile, interactive installation for this exhibition to show how exhibitions can find inspiration from early private collections. It was common practice for collectors to allow their visitors to touch the artifacts to create an intimate connection (Classen, 2007). In this installation, I wanted the visitor to feel as if they were painting the piece of art rather than only observing it.



Rough Sketch and Photo of the Interactive Canvas
Figure 4.3.2
(Goosell, 2021-22b).

4.3.1 Materials and Design

Below are the materials (with costs) used to create this installation:

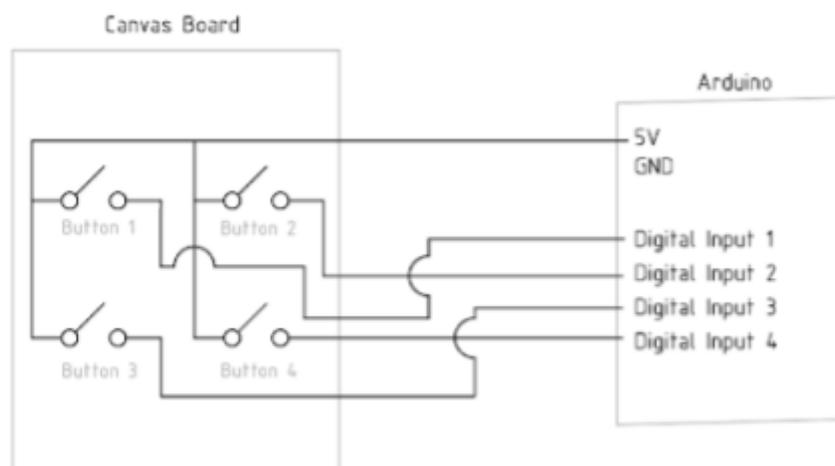
- A canvas sized to the project specific needs, we used an 8 in. by 10 in.
 - A ten pack can be purchased from Amazon for \$19.98.
 - Higher quality canvases can be purchased elsewhere, but for prototyping purposes, it may be better to start with one that is less expensive or easier to replace.
- A back piece to go behind the canvas.
 - Cardboard is an easy and affordable material to use for prototyping.
 - To polish this further, you can use an acrylic or 3D printed back piece to attach the copper tape to.
 - This piece acts as the connection between the canvas and the Arduino to trigger the code.
- Copper tape.
 - A roll can be purchased from Amazon for \$12.99.
- Conductive paint.
 - A fifty milliliter pot can be purchased from Amazon for \$ 32.49.
- Dupont cables, but a different type would work better.
 - A three pack can be purchased on Amazon for \$7.99.
- Arduino UNO.
 - This can be purchased from Amazon for \$14.99.
- A Laptop with HDMI capabilities.
 - The price will depend on the type of laptop purchased.

This was the most complicated installation in the exhibition. To create this type of experience, individuals with a familiarity in electrical engineering and programming are needed. In total this installation took around 35 hours and cost \$88.44 to produce.

4.3.2 Technology Implementation

On the back of the canvas, there were four quadrants where the dupont cables connected from the canvas to the Arduino UNO microcontroller for the 5 volt output. On the back piece, there were four quadrants with copper tape with dupont cables that connected the dupont cable inputs to the bread board. Using the flexibility of the pre-stretched canvas, the switches stayed open when no pressure was applied and closed when pressure was applied to then trigger the code. In figure 4.3.4, created by Katherine Valery, the circuit diagram of the technological detailed how to wire this installation. For a more in depth explanation of how this installation worked, refer to Appendix A. Here is a walkthrough in how this installation works:

- When pressure was applied to the surface, the Arduino system read the values to trigger the on screen experience. The wiring connected to the back of a pulled canvas in a grid system that was programmed to a corresponding section of the on screen painting.
- There was a back plate underneath the pulled canvas with copper tape that connected the circuit. The circuit points were in the same location as the ones on the top of the pulled canvas to ensure that they line up.
- As the visitor continued to apply pressure to different sections of the surface, the corresponding sections of the painting appeared on screen as if the visitor was painting the artwork themselves.



Circuit diagram of the Interactive Canvas
Figure 4.3.4

4.4 Red String of Fate, Severed Globe

The red string of fate, also known as the red string of destiny, connected two individuals together by an invisible red thread to indicate that they were fated to be lovers (Jisho, 2022). During an unprecedented time, I wanted to show that love and devastation still occurs today. With this installation, the visitor looked into a severed globe where there are printouts of news articles reporting on different types of love in times of crisis in modern times. On the outside of the globe, pieces of red thread connected different parts of the world to show that regardless of distance, love connected individuals to one another especially in times most needed. I expanded on the red string of fate's original definition to include the following types of love: community, cultural identity, familial, friendship, national identity, romantic, and solidarity. However, there are relationships that end or have been severed. To represent this, there were pieces of red thread that were not attached to another part of the globe.



Rough Sketch and Photo of the Severed Globe
Figure 4.4.1
(Goodsell, 2022).

To make this installation more immersive and interactive, there were QR code tags attached to the connecting red threads. When the visitor scanned the code with a smart device, it led them to a news article or video on that connection. This installation aimed to make people stop and recognize what is occurring in the world. When the news is filled with loss and devastation, it's important to not get lost in it and celebrate the good in the world as well.

4.4.1 Materials and Design

Originally, I was going to paper maché a large globe, but it was not working as well as I had hoped. Midway through the process, the mold was not forming as it should have, so I had to change the design to meet the project's schedule. Below are the materials (with costs) used to create this installation:

- Globe bar cart
 - I purchased this on Amazon for \$200.
 - There are vintage carts that could be purchased and repurposed for this type of installation.
- Printed out articles
 - This is the cost of printer paper and ink, which will depend on the type of printer on hand.
- Red thread
 - This cost \$8 from Amazon.
- Paper tags with the QR codes printed on them
 - This is the cost of printer paper and ink, which will depend on the type of printer on hand.
- Fake flowers
 - I purchased a variety for \$80 from Micheals.
 - Some of these were used for the Double Sided Frame installation.
- Mounting putty
 - I purchased this for \$5 from Micheals.

- Paint and paint brushes
 - I already had these supplies from previous projects.
 - These can be bought at art or craft stores, and the prices will vary between stores and brands.

4.4.2 Technology Implementation

QR codes can be created for free and there are many websites that allow you to generate them with some personalization. For a basic code, the only component necessary is a link to the media. I use a website called QR Code Generator, and once the link is pasted into the generator, it will automatically create a code to use (QR Code Generator, 2020). If an institution wants to add their branding to the QR code, that is possible with many of the available websites without an additional cost. Logos, text, and colors can be customized to fit with the institution's already existing branding. The codes can then be printed out, or used online depending on the need, for visitors to scan allowing them to interact with the installation without actually touching the artifact. This installation cost about \$293 and took 10 hours to implement.

4.5 Greek Tragedies, Double Sided Frame



Painting of The Judgement of Paris
Figure 4.5.1
(MET Museum, 2022b).

For the final installation, I focused on how there are two sides of the same story and created a physical embodiment of that idea. This frame was created to store two artifacts, one on each side. On one side holds a print out of the painting, *The Trial of Paris*. The other side holds a print out of a tapestry, *The Abduction of Helen of Troy*. Before Paris was crowned Prince of Troy, he was approached by three goddesses when he was a shepherd (Editors of Britannica Encyclopedia, 2019). Zeus chose him to judge which of the goddesses, Hera, Athena, and Aphrodite, was the most beautiful. Each offered a favor to Paris, and he accepted Aphrodite's bribe to help him find the most beautiful wife which led to the beginning of the Trojan War.

The tapestry was embroidered in China and has been dated close to the first half of the 1600s (MET Museum, 2022). In this depiction, Helen is abducted by Prince Paris of Troy's men to bring her back as his bride. King Agammemnon, Odysseus, and many other of her suitors worked to bring her back to Greece and Menelaus, her betrothed (Editors of Britannica Encyclopedia, 2020).



Tapestry of The Abduction of Helen of Troy
Figure 4.5.2
(MET Museum, 2022a).

This installation focused on how there were multiple perspectives to a story and they determined its interpretation. The frame was meant to be looked at by both sides to physically embody this theme, and it made the visitor change their movement as well as their perspective of the content. The frame was also designed with a built-in shelf and it was set deeper into the frame. This allowed the frame to hide a bluetooth speaker, as I did, and include similar artifacts to design an immersive experience using different media. Visitors would be able to see multiple artifacts from the same time period to understand the content and history as a whole.



Rough Sketch and Photo of the Double Sided Frame
Figure 4.5.3
(Goodsell, 2021-22a)

4.5.1 Materials and Design

Below are the materials (with costs) used to create this installation:

- Double sided frame
 - I contracted this part of the project to a carpenter, Hot Corner Carpentry, for \$250.
 - This was a reduced price to cover the cost of materials, but normally it would also include the cost of production as well.
- Print of the artifact, if the artifact is not accessible
 - I printed both the prints from Staples as 24 inches by 36 inches for \$30 each.
- Large bluetooth speaker
 - I purchased a slightly larger speaker for \$19 from Amazon.
- Mini bluetooth speaker
 - One speaker cost \$14.95 from Amazon.
- Large ceramic apple
 - I purchased this for \$15 from HomeGoods.
- Fake flowers
 - I purchased a variety for \$80 from Micheals.
 - Some of these were used for the Severed Globe installation.

4.5.2 Technology Implementation

To play the soundscape, the designer needs a bluetooth speaker and a device that is capable of playing audio through bluetooth for both sides of the installation. I used an iPad with an app called Go Button to control the audio loop. Go Button is an app that many theater companies use to control their audio ques and playback. It features a looping system that plays the audio until told to stop. The audio input is the iPad while the output is the bluetooth speaker, which can be connected through the app to control. The volume can be adjusted through both the input and output, but I would recommend keeping the input at half volume while adjusting with the speaker. This will ensure less of a chance of breaking the speaker. This installation cost about \$439 and took about 20 hours to implement.

5. Post Mortem

After designing, building, installing, and maintaining the exhibition, I will detail what should be considered for future iterations of these types of interactive and immersive media. This discussion is based on the observations during the exhibition and findings from Appendix B, which includes the user testing form and responses.

5.1 Successes

Visitors enjoyed the multisensory exhibition experience. The questions and responses can be reviewed in Appendix B. Overall, visitors felt that the additional sensory experiences drew them further into the artworks and enjoyed how the exhibit felt more explorative. When asked if they had an idea what interactive and immersive exhibits were or prior experience with these exhibits, most of the comments fell into two responses: 1) that they had not and were curious about what it would entail and 2) they did and did not expect it to be applied within art museums. The majority of visitors noted that their favorite installation was the shadowbox and expressed that the experience of peering in a dark, underground room was translated well, which they then felt more drawn into. The overall tone of the feedback and conversations expressed visitor interest and excitement to see future designs and applications of these interactions.

5.2 Improvements

Visitors provided insights on what it was like to receive multiple sensory stimuli at once, and some expressed that it felt overpowering at times. The exhibition was located in a smaller space, so visitors noted that they could sometimes hear multiple of the soundscapes at once and it distracted them from the installation they were focused on. With a larger space, there would be opportunity to separate the soundscape pieces from one another and allow them to be fully engaged with the installation. In addition to this, the speakers used in the double sided frame overlapped sometimes due to a volume change. By providing enough space and permanently setting the volume, the audioscape pieces could be improved. Although a majority of visitors expressed that they would consider these types of museum experiences more interesting than a traditional experience, some voiced that a combination of the two experiences would work better. By having a combination, the soundscape pieces could be positioned away from one another and

create a more of a sense of exploration within the exhibit. In addition to the previous exhibit layout concerns, installation didactics were not included in this exhibit due to time constraints. Visitors thought that the non-traditional installations would have been easier to immerse themselves in the narrative with the addition to these didactics. They would also be an appropriate space to provide any guidance for the experience, so visitors could still feel like they were exploring the piece and have some guidance if needed.

5.3 Future Considerations

With both the successes and improvements in mind, these would be the next design considerations for future iterations:

- Didactics are necessary. They provide the artworks' information to ground the visitor in its composition, and they would be an appropriate space to provide brief guidance for any interactions that may be unclear.
- The space of the exhibition room affects the visitor's experience. With the smaller space, the audioscapes sometimes overlapped one another. It could be difficult for visitors to fully immerse themselves in a piece if there are outlier sound effects interrupting the experience.
- A combination of both traditional and non-traditional installation styles could work for the experience's overall design. By including both traditional and non-traditional experiences, that would engage with a larger audience base as well as provide space for any audio to not overlap with others.

Designers can use this project as a reference in their attempts at beginning to incorporate these types of interactions into the museum-scape. Fostering relationships with their audiences and trying to include new exhibition styles, museums can learn from game development practices to slowly expand their exhibition designs.

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Appendix A: Interactive Canvas Report, written by Katherine Valery

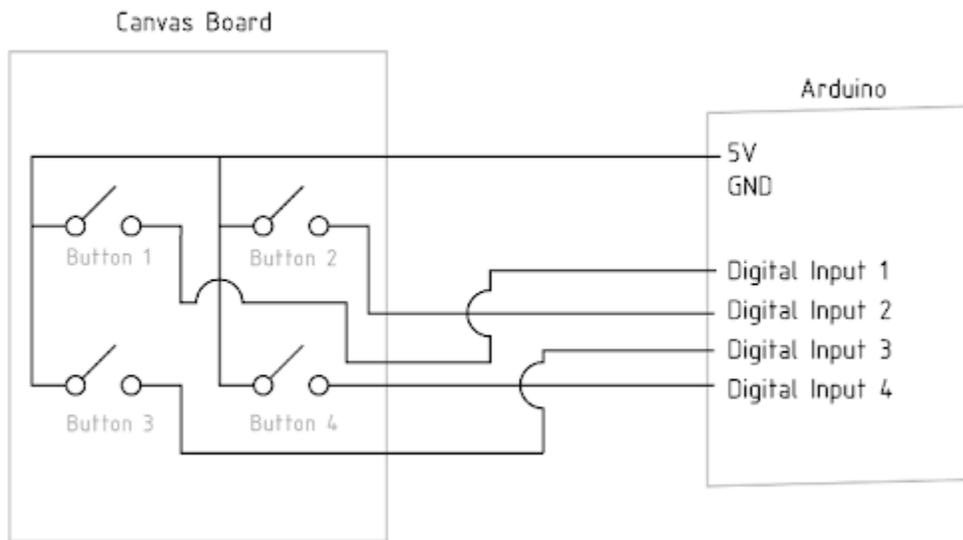
For the interactive painting, a custom controller needed to be created so that the user would feel as if they were “painting” was on screen. This would be done by the user using a physical paintbrush and pressing onto a canvas.

The initial concept for the interactive painting controller was that the user would be hooked up to a Makey Makey electronic controller. The Makey Makey relies on “bridging” the gap between a specific input and ground. It has specific inputs that are mapped to common keys that are used on a keyboard, such as WASD. The standard set up for this is that objects would be hooked up to the inputs of the Makey Makey and the user would be connected to ground. Thus, when the user would touch a certain object, the current from that object would cross over to ground causing a key to be “pressed”. The current version of the interactive painting relies on a similar concept, but with different execution due to the limitations of the microcontroller that was used.

The current controller relies on an Arduino microcontroller that relays encoded information to the computer running the rest of the interactive installation. Compared to the use of the Makey Makey, this piece does not require the user to be grounded to any portion of the piece. Instead, the canvas board relies on homemade switches that are integrated into a pre-stretched canvas. So, when the user presses down on the canvas controller with anything, “keys” are pressed that indicate a certain location of the canvas being pressed.

On the back of the pre-stretched canvas, conductive electric paint was applied and connect to the 5 volt (5V) output of the Arduino microcontroller. Directly underneath the canvas, on a separate board, an array of copper tape pads were individually hooked up to inputs on the Arduino. This set up relied on the flexibility of the canvas to keep switches open when there was no pressure applied on the top of the canvas, and for the pressure applied to the canvas to stretch it just enough so that the conductive electric paint would bridge the connection of 5V to the corresponding input on the Arduino. Figure 1 provides the electrical diagram of how this controller functions in its most basic configuration.

Figure 1: Circuit Diagram of the Canvas Board



The canvas used was 8 by 10 inches, and the switches on the board were spaced evenly from each other and the edge of the canvas. To reduce the chance of any press on the canvas not registering, the pads on the underside of the canvas were painted as large crosshairs with the paint being raised so that a push with decent pressure would register. On the lower plate of the interactive canvas, the copper tape plates were about 1 and half inches squared.

The design allows for the user to interact with the canvas either by directly pressing on it or by using a paintbrush to apply pressure. This allows for a more immersive experience as it hides all of the electronics that are used to relay information allowing the user to focus more on the presented message.

Appendix B: Feedback Questions and Responses

1. On a scale of 1-7 , how immersive are the audio experiences?
2. What were your thoughts while listening to the audio scapes? (ex. It was too much and distracting, Worked well with the artwork, Maybe they could have tried this instead, etc.)
3. What were your thoughts while listening to the audio scapes? (ex. It was too much and distracting, Worked well with the artwork, Maybe they could have tried this instead, etc.)
4. Did you have any expectations for what an interactive and immersive museum exhibit would include?
5. If in an actual gallery setting, would you find this installation more interesting than a traditional museum experience? (i.e. standing in front of the art with no audio or looking into a shadowbox)
6. If you answered no to the previous question, how could this experience be more interesting?
7. What are three words you would use to describe this experience?
8. Did you have a favorite installation?
9. If you answered none of the above, could you comment on your choice?
10. If you answered none of the above, could you comment on your choice?
11. Is there anything else you would like to suggest or comment on, that was not covered in this survey. If not, please respond with N/A. Thank you for your time and feedback!

Timestamp	On a scale of 1-7, how immersive are the audio experiences?	What were your thoughts while listening to the audio scapes? (ex. It was too much and distracting, Worked well with the artwork, Maybe they could have tried this instead, etc.)	Did you have any expectations for what an interactive and immersive museum exhibit would include?	If in an actual gallery setting, would you find this installation more interesting than a traditional museum experience? (i.e. standing in front of the art with no audio or looking into a shadowbox)	If you answered no to the previous question, how could this experience be more interesting?	What are three words you would use to describe this experience?	Did you have a favorite installation?	If you answered none of the above, could you comment on your choice?	Could you tell what the theme of the exhibition was? If you answered none of the above, could you comment on your choice?	Is there anything else you would like to suggest or comment on, that was not covered in this survey. If not, please respond with N/A. Thank you for your time and feedback!
2022/03/29 2:09:21 PM AST	6	Worked well, really like the double frame of the calm and war of the double frame as well as the sensor to the shadow box	n/a, haven't really experienced anything irl before but has read articles about what it could be	Yes	n/a	interesting, different, modern	Double Sided Frame	n/a	humans suffering versus humans/gods leisure	add extra dimension to the exhibit, room lighting to integrate
2022/03/29 5:14:32 PM AST	5	shadowbox-vibes of a cave, double frame-sounds of	n/a	Yes	n/a	different, creative, 3-Dimensional	Severed Globe	interesting with the QR codes, more of a story	perspective on the world	n/a

		chaos and battle, compliments the artworks						than the others		
2022/03/29 5:20:08 PM AST	5	wasn't distracting, didn't expect it at first, makes the environment of art more lively	sand- more kiddish activities and interactions	Yes	N/a	creative, informative, confusing	Interactive Painting	n/a	relating to around the world, sensory experiences	could be a lot more confusing if expecting traditional experience
2022/03/30 12:25:13 PM AST	6	theater: set the scene, war frame: good representation, paris: not much you could have done to make it immersive	musician exhibit for jazz: blow into bells of instrument, it uses a different rift, interactive swing	Yes	n/a	interesting, intuitive, fascinating	Shadowbox	n/a	war and peace	wanted there to be a sensor for the paper theater similar to the shadowbox, needed guidance to the canvas (was unsure that it was a part of the frame or not), instructions would have to be put up to guide the visitor, likes the sensors most for it's overall interactiveness, thought that the theater and the box were paired together

2022/03/30 12:28:16 PM AST	5	worked well with the double frame: noticed the blocked sound, worked well with the theater	immersive = more tactile and manipulating it versus listening to audio	Yes	n/a	peaceful, relaxing, immersive	Shadowbox	n/a	peace and destruction	fun experience and would do more interactive experiences that you could touch and react with
2022/03/30 12:33:13 PM AST	6	worked well and fit into the visual experience, especially impressive with the spatial audio	plaques with questions to lead thoughtful conversation with answers from the curator, tactile manipulation, stuff like the museum of science	Yes	n/a	unique, cultural, immersive	Shadowbox	n/a	focus on different cultures and world events	use of audio, light and space makes it more interesting, wasn't sure what everything was so didactics would be helpful
2022/03/30 12:48:50 PM AST	6	worked well with the art	no, v curious of what/how the immersion would be conveyed	Yes	n/a	expanded curiosity, explorative, a part of it/drawn in	Paper Theater	n/a	people going about their everyday lives to suddenly being severely changed and possibly having it taken away	liked being drawn into the art with the use of space
2022/03/30 12:53:35 PM AST	7	worked well and drew them into what you were seeing, felt v organic	larger scale like the Frida Kahlo, this felt more personal in the experience execution	Yes	n/a	intriguing, engaging, organic (didn't feel forced, felt natural)	Paper Theater	n/a	love and war, peace and chaos, universal extremes that people experience-through all their senses	another word: timely with the current world events happen at the same time

2022/03/30 1:11:16 PM AST	6	helped them get into the mindset of the artwork and understand what was going on	mostly more like screen interaction with a controller	No	think it would be more immersive, a combination of both would be interesting	evocative, immersive, confusing	Shadowbox	n/a	revolution, protesting, medieval theme	n/a
2022/03/30 4:16:00 PM AST	7	the overlapping sounds are a little jarring from the close range of the installs	n/a	No	the 3d pieces (theater, frame, and canvas) evokes more curiosity	alive, loud, pleasant	Interactive Painting	n/a	religion	also really liked the theater with the shrubs and relaxing
2022/03/30 5:20:06 PM AST	6	worked well with the art	came pretty open minded	Yes	n/a	cool, pretty, fun	Shadowbox	n/a	n/a, couldn't put their finger on it	n/a
2022/03/30 5:22:10 PM AST	6	good, the volume of the trial of paris was little too quiet with the other side playing as well	n/a	Yes	n/a	interactive, new, fun	Shadowbox	n/a	n/a, couldn't put their finger on it	n/a
2022/03/31 12:36:52 PM AST	5	You can hear the other sounds while listening to the other installs.	Tactile and touch screens, moving things around yourself - which might apply more to a science museum rather than art museum	Yes	n/a	whimsical, fantastical, gritty	Shadowbox	n/a	death, ethereal	n/a

2022/03/31 12:40:23 PM AST	5	you can hear them while listening to other installations, loop on the theater	kids museum, history/nature subjects, did not expect interactive art	Yes	n/a	creative, interesting, immersive	Double Sided Frame	n/a	contrast between peace and conflict	n/a
2022/03/31 12:44:38 PM AST	6	like the spacial change in the double frame, most immersive with the cave and echo	none, n/a	Yes	n/a	meditative, open, creepy (in a good way)	Shadowbox	n/a	nature/natural imagery, village/pasture, engagement with the natural world, life and the transition into afterlife	two people provided feedback with this response
2022/03/31 12:53:32 PM AST	6	subtly to it, not a clear story/narrative with it, effective is more poetic than narrative, invites them to tune in to the art and let it wash over/absorb the vibe	responsive in to the visitor's prescience, multi-sensory experience with my project	Yes	n/a	natural, synthetic, investigation/speaking	Shadowbox	n/a	nature, historical aspect, stories (dramatic/mythical) happening in the artwork	invites a whole new type of interaction, appreciate the box and how it invites visitor to peek into the peep hole and hang out, interested in the uniqueness of the touch component, interesting, clear style and vibe to it, clean integration between install styles

2022/03/31 1:31:20 PM AST	4	frame is dominating, feels like it's all about crowded spaces, the shadowbox invited them in and could only hear that one	no	No	differently interesting, attracted to figure out what's happening, especially with the one bend down and look at	hidden, nostalgic, victorian	Shadowbox	n/a	theater	some were more immersive than other (shadowbox)
2022/03/31 1:43:05 PM AST	7	enhanced the art work, felt like you were in the art more	not really, walking through things	Yes	n/a	iconic, sensory, educational	Paper Theater	n/a	twining of fate and good intentions, try to do something good but other stuff gets in the way	sound pulls you in more
2022/03/31 5:25:38 PM AST	7	worked well with the art	n/a	Yes	n/a	captivating, immersive, interesting	Shadowbox	n/a	dark ages religious paintings	n/a
2022/03/31 5:27:59 PM AST	7	worked really well	n/a	Yes	n/a	cool, creative, new	Shadowbox	n/a	playing with lighting, renaissance related	n/a
2022/03/31 5:30:57 PM AST	7	made them look more at the piece actually	n/a	Yes	n/a	unique, innovative, interesting	Double Sided Frame	n/a	duality, sound manipulation	n/a
2022/03/31 5:34:06 PM AST	7	cool sound (brain go brrr), like the spacial engineering with movement	AR not well executive, touchscreen, not interactive audio or the use of sensors	Yes	more so that other interactive experiences, reactive in a passive way that is calm and intentional	n/a	Shadowbox	n/a	same general vibe	this is very cool

2022/04/04 4:57:22 PM AST	5	The audio was amazing when I could hear it, which has more to do with the space than the quality of the sound. The painting with the flowers in front was incredible, the audio provided the movement for the static image.	Yes, I have experience with immersive and interactive works, I feel this one did a great job of making the technology feel background rather than pushing it forward in ways that lean heavily on the tech. The one where it lights up as you get closer was an amazing example of subtle but effective tech in art.	Yes	I would say yea and no, in current state maybe no because changes would need to be made to accommodate the sound levels in a public space, also I think piece where you press the canvas could be staged differently to lead the viewer to interact without prompts	New, Unique, conceptual	Shadowbox	I actually don't remember the name of the works but I liked the one where the lights adjusted via distance and the static painting with sound.	Seemed to be set in a specific time period more than anything, like a call back to a time that if far different than the way we live today but the tech made it feel very contemporary in a non aggressive way. It did not seem like you were trying to make old style of art better but rather enhanced	I would love to see this works again in the future, the concepts behind them I think can be used any many ways by the artist on different scales smaller and larger. Definitely concepts that can also be built upon and added to other ideas
2022/04/05 2:15:14 AM AST	7	It really enhanced the experience.	Not really	Yes	n/a	Immersive, engaging, entertaining	Shadowbox	N/A	Sound enhancement of classic art	N/A

Appendix C: Promotional Poster



Mini Museum: Connection Created by Hannah Goodsell

Special thank you to Hot Corner Carpentry in Greenville, RI. for their help building the shadowbox and frame.

Hosted in Higgins House, Great Hall

WPI MQP Exhibit Dates

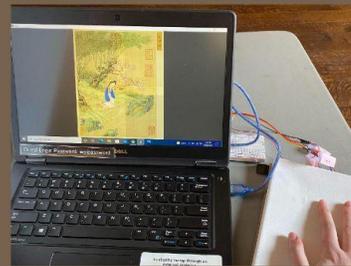
Tues., March 29th: 12-4pm & 5-6pm

Wed., March 30th: 12-2pm & 5-6pm

Thurs., March 31st: 12-3pm & 5-6pm



Edith's Final Walk
Shadowbox



Xi Shi, China's Beauty
Interactive Touch Painting



Layla & Majnun's Last Love
Paper Theater



Tragedy of Troy
Double Sided Frame



A Connected World Separated
Red String of Fate Inspired
Transmedia Presentation

Appendix D: Interview with Erin Corrales-Diaz, former curator at the Worcester Art Museum and current curator at the Toledo Museum of Art

1 September 2021

I met with a curator from the Worcester Art Museum, Erin Corrales-Diaz, to discuss exhibition design and interactive exhibitions. I started the meeting by explaining the low level scope of the project. Ms. Corrales-Diaz and I worked together previously where I worked on a student development team who created an app for the WAM's exhibition on the history of the baseball jersey, so we referenced that in trying to understand how to design an exhibit.

E: One of the challenges that curators keep in mind while designing exhibitions are modes of access and different types of audiences. People learn from different facets: some people are very visual and some will read every didactic provided. Soundscapes will appeal to other learners and senses, which can enrich the experience for some as well as touch. Those allow for the person to dive deeper into the experience and be more appealing to a wider range of learners and audiences.

The challenge is determining the target audience. Is it the traditional museum goer, who tends to be a bit older, more educated, white? Are you trying to cater to, the hardest demographic to reach are teenagers, family oriented or all ages? Are you trying to target some new audience? You want to try and get as large of a range as possible, but that may not always be feasible. Thinking about how that may align with what kinds of objects and theme, because if you want something family oriented, how do you talk about war to a 10 year old? That could be something really interesting, but also something to consider.

In terms of the didactics, and when I say didactics it could be something like a label or something much more digital in that respect. That's usually when I will work hand in hand with our education team. They are very attuned to trends in museums and kinds of new forms of

learning. I think one of the challenges that not only I as a curator face, but also most museums do these days is how we stay relevant in our current century and trying to move away from a museum that's like a mausoleum. Something that's just static and always there, it's cool that you get to travel through all these different time periods and regions, but it's meant to be more like a quiet retrospection. And there is more of a shift to something that's a bit more about innovation, a bit more about a laboratory, and I think that's where some of these aspects come into play.

H: Have you personally ever experienced design limitations while designing exhibits, like working in a space that you may not be able to change physically? You have to come in and put on your exhibition without changing the environment.

E: Absolutely, that's another regular challenge. You're dealing with the space you're allotted, which can sometimes come with some really challenging architectural constraints. For instance, the baseball exhibition is in our large, temporary exhibition space, which is a long narrow space. It's not like a really large square where you could manipulate the walls and stuff; you're kind of constrained to what you got, which as a curator makes you really think about the flow of movement. Also for instance in our permanent exhibition galleries, we're thinking of changing those up a bit, but we have some challenging architecture: very high ceilings, columns, you got everything that you really imagine as an old time picture gallery. And yet when you're trying to change it to something a bit more intimate, perhaps a little more engaging, you have to work with that. How can you change this limitation into something that's really beneficial to you? There's always the budgetary constraints, but we'll operate under the assumption that you have an unlimited balance. There's also just some things that you cannot physically do. We'll write the vinyl [for the wall text] and our exhibition team will design the pattern for that, then it gets shipped out to a vinyl production company. Each company is a little bit different, and with the one we work with, there are limitations on how small the letters can be. We actually faced that in [the baseball exhibit] where we had the introductory text with a welcoming section then all the sponsors and their logos. Some of those logos had really small [punctuation marks], and the

vinyl company said they couldn't make it that small. We had to make our design a little bit larger, because they had their own technological limitations.

With [the baseball exhibition] this was another interesting challenge, not only is that space really long and narrow, but before the pandemic it was meant to hold another exhibition that was on a really old kimono house from Chizu. The construction had started and the cases for the kimono were made, and suddenly we couldn't have that exhibition. As a way to save some funding, we decided to repurpose those cases for [the baseball exhibition]. It turned out seamless, you really couldn't tell. Those cases are very tall and very wide; we could not get a solid piece of [plexiglass]. That was nearly impossible and costly, so we used separate sheets with a clear tape to seal everything in a climate control space. There are only a couple of moments when looking at a government, you can see a seam. That's kind of another moment of where you have to work with what you've got.

Another challenge is building the room in regards to how it is wired for any electronics or digital media. There is a film showing in [the exhibit], and we were really lucky that there was already a wall mount to put a projector. That's a whole other challenge, and given that we're a historic structure, that makes it difficult to go in there and add things like outlets and stuff like that.

H: What didn't you expect you needed to keep in mind while designing any of your exhibitions? Was there anything that you realized would improve it or maybe was not necessary?

E: Something that I don't know if we implemented very well, and it came later since we were working on an accelerated timeline is accessibility needs. We have created things in place, like the size of text for those who have some sort of visual impairment. One thing that I didn't really think about until we started putting things into the space, it's one thing to look at your CAD drawing with where everything is and it's all scaled out, it's another thing to be in that space and moving around to then realize there might be some really tight corners that lead to places for people to congregate or is perhaps difficult for someone in a wheelchair to access. Those were challenges that sometimes you can't fathom until you're in there. There's always going to be that

bit of refinement at the final stage. You have it all laid out and look great, but you may then realize that that frame is a little different than I had anticipated or was just a hair larger, we didn't have quite the right measurements. Always factor in a little wiggle room towards the end if you can for those last minute sort of changes. Recognizing that is inevitable; it's going to happen, and try to allow that to happen.

H: So going back to the idea of moving around the exhibition, I know the eWAM has a no backpack policy. Have you found a way to communicate to visitors to hold their bags by their sides even without guards or staff to verbally tell them?

E: It's a huge challenge. We don't have guards in every space. Some museums are able to do that, unfortunately our guards have multiple rooms to handle. I also agree- a pamphlet, you want it to be short, so anything lengthy, I don't think visitors will tend to read. That said, transparency is a really good thing. We have a little touch area outside the exhibition, not inside because that may cause mixed messages: you can touch some things and not touch other things. It has different types of materials, like marble and wood, where one side is covered and the other is not, which shows what years of touch does to the material. There's an understanding. You're educating your audience as to why this is happening rather than just simply saying "no". It's something that's coming out of education. Signs that say "don't touch" or "don't do that" really create a negative feel and perhaps aren't very welcoming to visitors either. There is a Twitter feed of museum educators sharing their favorite sign, and they're fun. They make you smile and sort of change your mood and perspective if you can do that.

H: With your supplemental information, like the wall vinyl or a pamphlet, how do you decide what is the best way to convey that information, and what language you use?

E: For someone who has written a dissertation and a book now, that is some of the most challenging writing I have done. For museum labels, we just have the tombstone information: name, date, material - what you would find on a tombstone. The label itself may only be 75 words. When you're talking about stuff on the wall, that could be closer to 100-150 [words]. They're a little bit bigger, and there's a sense that you are encompassing a larger scope. Your wall text tends to be something that is more broad, drawing you to a particular theme or period that helps the visitor orient themselves. If you've got things divided by theme, time period, geographical region then your small label would gesture to that. MOMA had come out with a slideshow for curators and museum educators about how to write these things especially in our current days with some examples. It's almost that you can't say everything, or even three things - it's just not going to happen. You have to zero in on "what is the most essential thing that I want the visitors to walk away from". You make a list about what you want people to take away from: it is related to the theme, is it a stand alone label, it's usually one major take away. You don't want to dwell on biographies too long, and quotes are sometimes great.

One of my colleagues, Corey, at another museum has taken a different track with these labels. Usually, it's in a little paragraph written in perfect prose. What he found, and this depends on how people learn (whether they will read the entire label or not), rather than having a perfect paragraph of prose after the tombstone information there is a bulleted list of complete sentences. Basically, there are three key ideas that he wanted to be taken away. In the visitor feedback bucket, Corey found that visitors really like the lists, because it was immediately clear. Rather than wading through those 75 words, you've got the key information laid out for you. I've only seen it done at a few places, but it's something to think about with its positive appeal.

H: For you, what has been the best piece of advice or feedback you have gotten for your work?

E: Probably, less is more. I wouldn't say anyone explicitly said that to me, but I think in all of my projects I've almost always had to whittle down the check list even more. Having fewer objects, fewer text, I think can enhance the experience and make it less overwhelming.

H: That's really good to hear. I got one of the main social halls in the campus center, so I got excited thinking about how much I could fit in there. But the more we thought about movement and possibly manipulating the movement of visitors, we were trying to figure out how to do that or if we would have to put the objects leaning against the wall since we can't hang anything. So hearing that maybe I shouldn't have as many pieces and having them more impactful, that's really helpful to hear right now.

E: Yeah, and it's something I'm struggling with in our reinstallation of our American gallery. We have such good stuff in storage that we wanted on show, but we had a consultant come in and they said that we're going to remove a 1/3 of what we pulled. It's just too much.

Also going to the idea of visitor path, people are going to go where they want to go. I think with most galleries, most people start with the left, but some people will start at the right or in the back, particularly if you have multiple entrances. Sometimes if you have multiple entrances, you reproduce the same intro text, so regardless of where the person is coming from, they are still engaging in that.

H: The last question I wanted to ask you, because you've covered everything I wanted to chat with you about, was what iterations or changes have you seen in museums? Whether at the WAM or visiting colleagues or visiting museums just for fun.

E: What we started doing in our curatorial department, we have regular meetings, is that when we go museums we'll take photos of case layouts, heights of pedestals, or wall colors. We're going to share that with the rest of the curators and staff to talk that through.

I've definitely seen more of a shift towards the digital or touch screen and videos. I think there's a greater emphasis on the process of the object and that there is a trend for greater community engagement. Whether that be community written labels, including more contemporary local artwork in your exhibition that relates to some of the other stuff. I think there is a move away from very heavy, traditional period rooms to something that's a little bit lighter.

It varies from institution to institution, like the MET or MFA in Boston or the Smithsonian sometimes. They're slower to change. They're bigger, and it takes longer to change. There are smaller institutions, like the WAM, who can be a little more nimble. If you had to twist my arm to answer who is an institution you're really inspired by their design, it would be the Peabody Essex Museum. They are not over the top, like they have a section for sound. There's a whittled object that a sailor had made, and it's put into this alcove that's lit in a way that makes this seemingly ordinary object really special. If you move towards it, there's the sound of the waves and stuff, so you really get an experience of what that may be like. But that's not done throughout [the museum], so I think they're just really careful in how they work with that. They do fun things that are really innovative.

E: I would also say there's just a greater awareness in social justice when you're designing an exhibition or talking about certain objects. And of course an emphasis on accessibility. You want all of your visitors, as many as you can, to enjoy your exhibition. Can you offer text in braille? Can you offer something for the more vision impaired?

It's less of just putting a painting on a wall or putting a piece of furniture into a cramped room. The Barnes Foundation is an example of that actually. It's interesting how this collector put together a traditional African object with really modern art. But it's all over the place with minimal didactics. It's just meant for you to go in and make your own connections, there really isn't any guidance. The Isabella Stewart Gardner Museum is kind of like that too. These are collectors who have really interesting juxtapositions in mixing up different time periods or cultures. It doesn't matter that it's not set up like a traditional museum with didactics and stuff.

The other trend that I'm seeing, in regards to objects at least, is cross cultural heritage.

Also if you're thinking about 3-D work, try to make it more visible. Like pedestals in the round or perhaps trying to display the object in the way that it was in its original context rather than something that has been extracted and seen completely differently.

H: Is there anything that I didn't ask that you think is definitely important in curating or designing exhibitions?

E: The magic of lighting, definitely that would change everything. That could be really dramatic and change things. Do not underestimate the public's desire to touch things. When you're thinking about space, you can think about how sound travels. If you've got wood flooring and really high ceilings, the sound might echo in a way that's uncomfortable. Or if you've got a video piece, and the sound is being looped over and over again.

Common museum hanging height for works: 60 - 62 inches. It's basically always going to be a bit lower than what you think.

If it's 3-D objects, try to have labels that are at an angle for accessibility purposes.