

Multiple Possibilities for the Realization of Immersive Worlds

by

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Thesis submitted in partial fulfillment of
the requirements for the degree of
Master of Arts in the Department of
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ABSTRACT

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Abstract

In recent years, discussions about immersive experiences have become ubiquitous, but there have been vague definitions of immersion. This thesis aims to explore multiple possibilities to realize immersive worlds and conduct user experience research to think about the diverse dimensions of immersion. As a result, I created two projects—a digital project named “A VR Trip to a Chinese Courtyard in Mid-Autumn Festival” and an art installation called “Land of Idyllic Beauty”—and I gathered audience feedback on how audiences perceived immersive experiences. The findings indicate that users’ perceptions of immersion are highly overlapping, but there is still opportunity for both digital and physical initiatives to improve users’ immersive experiences, therefore further research is worthwhile.

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Introduction

The term “immersion” intrigues and mystifies me. In the Oxford English Dictionary, initially, immersion is dipping or plunging into water or other liquid, and transferred into other things,¹ so what does it mean if we do not submerge in a liquid now but still reach this state? Immersion, as I understand it, which uses multimedia to create a special environment or space that offers a multisensory experience throughout a journey or event, is contextually relevant, and creates value for the user on an intuitive and emotional level through a variety of interactions.

In the design of traditional Chinese architecture, there has always been an intentional sense of immersion, and Yijing (意境) is a Chinese term used to describe this, also known as “artistic mood”. Imagine entering an exhibition space, you are immediately taken aback by the grandeur of the installation before you. Images project before your eyes, and you can hear the rustle of the fallen leaves at your feet. Ambient music fills the atmosphere, creating an alternate world that transports you to a fictional reconstruction of a traditional Chinese garden. As you navigate through the space, you are increasingly drawn into the installation. You are surrounded by the sights, sounds, and textures of the arch,

¹ Oxford University Press, “Immersion,” in *Oxford English Dictionary*, 2023.

completely immersing you in the experience. This experience appeals to your senses, including your eyes, ears, nose, and even your sense of touch. The scent of flowers and plants permeates the air, while the sound of running water adds an extra layer of immersion. Upon leaving the exhibition, you feel transformed by the experience. You are filled with a sense of wonder and inspiration, having become part of something truly remarkable.

Or consider putting on a VR headset, and feeling a sense of anticipation and excitement. The world around you disappears, replaced by a digital landscape that is both familiar and alien. You find yourself standing on the center of a Chinese courtyard, overlooking the spectacular architecture and natural scenery before you. You move forward, accompanied by cheerful music; the landscape comes alive around you. You pick up the lantern to illuminate your surroundings and observe the meticulously carved architecture. You are curious to find more details and constantly interact with the scene. The experience is completely immersive, engaging all your senses in a way that feels almost real. You can feel the ground beneath your feet, and you can switch your position at will. As you continue your journey, you will encounter other digital beings who interact with you in unexpected ways. The experience is dynamic and unpredictable, keeping you fully engaged and immersed in the journey. As you

remove the headset, you feel a sense of awe and wonder at the experience you have just had.

In the context of technology, immersion often refers to virtual and augmented reality experiences, where the user is transported to a computer-generated environment that simulates a real-world experience. However, immersion can also be achieved in various physical contexts, such while attending live music performance or touching the materials of a themed attraction as described above.

The key aspect of immersion is the creation of a sense of presence, where the user feels as though they are physically present in the environment or experience. This can be achieved through a combination of visual, auditory, and tactile stimuli that are contextually relevant and engaging. Accordingly, immersion is about creating an experience that is more than just a passive observation or interaction. It involves creating a space that is engaging and interactive, evokes emotions, and provides a sense of presence that allows the user to feel fully involved in the experience.

My goal in this research project was therefore to consider the qualities of immersive experiences that users enjoy and create a series of digital and physical artworks that convey a sense of artistic mood with reference to traditional Chinese

architecture and gardens. My thesis has seven main sections. Chapter one is an analysis of immersion, and chapters two through four introduce my project themes. Chapter five describes my efforts to implement immersion, both digitally and physically. Chapter six is an analysis of the user immersion experience, and chapter seven concludes the thesis with a summary and next step.

1. An Analysis of Immersion

1.1 What is Immersion

While the definitions of immersion are diverse, I can still strive for more than a simple definition that sets the terms for my thesis exploration. First, I want to acknowledge that the experience of immersion is historical. Although many people think of immersive as a brand-new concept, it really has roots in a long tradition of visual art and the pursuit of illusionary visual space dates to ancient times. In the book *Virtual Art from Illusion to Immersion*, Oliver Grau argues that immersion has been a key aspect of art throughout history, and that it has played a particularly important role in the development of virtual art. He writes:

*The evolution of media of illusion has a long history, and now a new technological variety has appeared; however, it cannot be fully understood without its history.*²

Accordingly, immersion is an historical experience because it has been a consistent theme throughout the history of art, evolving and developing alongside new technologies and media that what we experience as immersive (as physical presence, flow) changes over time.

² Oliver Grau, *Virtual Art: From Illusion to Immersion*. (Cambridge, Mass.; London: MIT, 2004), 3.

Grau suggests that immersion has always been a way for artists to create a sense of presence and participation in their works, and that this has been achieved through a variety of techniques and media. For example, in the Renaissance, artists used perspective and illusion to create the illusion of depth and space in their paintings.³ This technique allowed viewers to feel as though they were part of the scene depicted in the painting, rather than simply looking at it from a distance. Similarly, half-figures that emerge out of the frescoes on the wall and into the observer's space blend two-dimensional space with a third dimension, this technique developed in the Baroque era and utilized often in panoramas from 1830.⁴ Grau argues that in the 20th century, this trend towards immersion continued with the development of new technologies, such as film and television.⁵ These media allowed artists to create immersive experiences that went beyond what was possible with traditional painting or sculpture. With the advent of virtual reality technology, artists have been able to take immersion to new levels, creating fully interactive and immersive environments that allow viewers to explore and interact with a virtual world.

³ Oliver Grau, *Virtual Art: From Illusion to Immersion*. (Cambridge, Mass.; London: MIT, 2004), 37.

⁴ Oliver Grau, *Virtual Art: From Illusion to Immersion*. (Cambridge, Mass.; London: MIT, 2004), 44.

⁵ Oliver Grau, *Virtual Art: From Illusion to Immersion*. (Cambridge, Mass.; London: MIT, 2004), 146.

Grau argues that immersion is undoubtedly key to any understanding of the development of the media.⁶ Throughout the book, Grau emphasizes the importance of immersion in virtual art. He describes that the most successful virtual artworks are those that fully engage the viewer, creating a sense of presence and participation in the virtual world. This statement undoubtedly guided me to go beyond my current perception to understand the phenomenon of virtual reality and to find my own unique understanding of immersion.

The experience of immersion is often associated with pleasure and play. In “Fundamental components of the gameplay experience: analyzing immersion”,⁷ Ermi and Mäyrä introduce the player, experience and fun as three key factors which are significant in the gameplay experience, with a special emphasis on immersion. They write:

Human experiences in virtual environments and games are made of the same elements that all other experiences consist of, and the gameplay experience can be defined as an ensemble made up of the player's

⁶ Oliver Grau, *Virtual Art: From Illusion to Immersion*. (Cambridge, Mass.; London: MIT, 2004), 13.

⁷ Laura Ermi and Frans Mäyrä, “Fundamental Components of the Gameplay Experience: Analysing Immersion,” in *Digital Games Research Conference 2005, Changing Views: Worlds in Play, June 16-20, 2005, Vancouver, British Columbia, Canada*, vol. 3, 2005, <http://www.digra.org/wp-content/uploads/digital-library/06276.41516.pdf>.

*sensations, thoughts, feelings, actions and meaning-making in a
gameplay setting.*⁸

In other words, Ermi & Mäyrä suggested human experience in virtual worlds and in video games is composed of the same aspects as all other experiences, and gaming experience is an amalgam of the player's perceptions, ideas, emotions, reactions, actions, and sense-making in a gaming environment.

This can be elaborated further. In his article “Art of Emotion - Norman's 3 Levels of Emotional Design”, Baker argues that before people can fall in love with a gaming experience, they need to first desire the experience that will give them something new or something they will miss. Then, people need to play the game and get some desired value out of it. If the value is amazing, players will learn to trust the game product and have a growing desire for the experience. Finally, if the experience evokes positive behavioral, visceral, and reflexive emotional responses, people will love the product and generate delight.⁹Therefore, people like playing video games, in part, because they get an immersive experience while gaming. In other words, the ultimate emotional state that players want to

⁸ Laura Ermi and Frans Mäyrä, “Fundamental Components of the Gameplay Experience: Analysing Immersion,” in *Digital Games Research Conference 2005, Changing Views: Worlds in Play, June 16-20, 2005, Vancouver, British Columbia, Canada*, vol. 3, 2005, 2, <http://www.digra.org/wp-content/uploads/digital-library/06276.41516.pdf>.

⁹ Justin Baker, “The Art of Emotion — Norman’s 3 Levels of Emotional Design,” Medium (Muzli - Design Inspiration, January 28, 2019), <https://medium.muz.li/the-art-of-emotion-normans-3-levels-of-emotional-design-88a1fb495b1d>.

experience through play is enjoyment, and this is where a game's value proposition lies.

Game experiences can also be expanded to include immersive experiences in a broad sense, an amalgamation of senses, thoughts, feelings, actions and meaning-making of the user in the designer-created environment. Users can only achieve being immersive through participation. Making participants think about Chinese culture and feel immersed like they are experiencing a real place is the outcome I expect from my projects, and fun is the ultimate emotional state of an immersive experience.

1.2 The Phenomenology of Immersion

Second, I draw on several phenomenological studies of immersion. The phenomenology of immersion refers to the subjective experience of being fully absorbed or engaged in an activity or environment. When we are fully immersed in something, we often lose our sense of self-awareness and become completely focused on the task at hand. This observation is important for my user experience study because it can greatly enhance the user's enjoyment and engagement. I want to highlight how immersion is fundamentally phenomenological -- it's the *feeling* of being absorbed, a feeling that is simultaneously embodied and

disembodied, according to Geniusas.¹⁰ Based on Alfred Schutz's approach to the experience of multiple realities,¹¹ Geniusas creates a phenomenological idea of immersion. He contends that this kind of immersion is a hybrid phenomenon, one that has some elements in common with immersion in analog games and others in common with other forms of digital media. He continues to demonstrate how a certain function of embodiment defines immersion in video games. Finally, Geniusas concludes his research by establishing a contrast between real and virtual embodiment that is phenomenologically founded. This helps to distinguish in what sense immersion in digital games is an embodied and which is a disembodied experience. I agree with the idea that immersion is a hybrid phenomenon, in my opinion, embodiment refers to the involvement of our bodies in our experiences and interactions with the world around us, and disembodiment refers to the fact that we can also be immersed in experiences that do not involve our bodies. For example, we might be immersed in a book or a video game where our attention is focused entirely on the content of the experience rather than our physical environment. Therefore, I hope to delve into the phenomenality that comes with immersive experiences, compare the

¹⁰ Saulius Geniusas, "What Is Immersion? Towards a Phenomenology of Virtual Reality," *Journal of Phenomenological Psychology* 53, no. 1 (June 17, 2022): 1–24, <https://doi.org/10.1163/15691624-20221396>.

¹¹ Michael Barber, "Alfred Schutz," ed. Edward N. Zalta, *Stanford Encyclopedia of Philosophy* (Metaphysics Research Lab, Stanford University, 2020), <https://plato.stanford.edu/entries/schutz/#PheSocWor>.

experience of immersion in an exclusively digital environment to that in a constructed physical environment.

O'Shiel draws on the concept of embodiment to explore the ways in which virtual, augmented, and mixed reality technologies can alter our perception of our own bodies and the physical world around us.¹² He argues that “because they are unreal, digital realms they can be fascinating mixtures of both perceptual and fantasy elements – in short ‘superreality’.¹³ For instance, in virtual reality, users wear a headset that fully immerses them in a digital environment, replacing their physical surroundings with a simulated world. In this context, users may experience a sense of disembodiment, as their visual field is dislocated from their physical body and they may perceive themselves as being located within the virtual environment. On the other hand, in augmented reality, users are presented with digital information that is overlaid onto their physical surroundings. This can create a sense of hyper-embodiment, as users may feel more acutely aware of their physical body as they move through the real world while simultaneously interacting with digital content.

¹² Daniel O'Shiel, *The Phenomenology of Virtual Technology* (Bloomsbury Publishing, 2022), 188-194.

¹³ Daniel O'Shiel, *The Phenomenology of Virtual Technology* (Bloomsbury Publishing, 2022), 190.

It reminds me that *Ready Player One*¹⁴ was the first work that took me into an immersive virtual world. It is possible that, in the not-too-distant future, VR body suits and treadmills like those in *Ready Player One* will become available, elevating the level of immersion and completeness of visual, sound, some touch, and different physical motions. It is unknown where the advances will go from there, but if they follow this logic, they will attempt to progressively catch up with the perceptual world's capabilities, including those of taste and smell simultaneously.

If immersion is embodied, it is multisensory, especially when it involves the experience of architecture. Useful here is Juhani Pallasmaa's work on the multi-sensory experience of architecture. In his book The Eyes of the Skin: Architecture and the Senses, Pallasmaa describes the multi-sensory experience of architecture. He believes the body and the other senses work together with the eye. This ongoing connection strengthens and clarifies one's perception of reality. He writes, "Every touching experience of architecture is multi-sensory; qualities of space, matter and scale are measured equally by the eye, ear, nose, skin, tongue, skeleton,

¹⁴ Steven Spielberg et al., "Ready Player One," IMDb, March 29, 2018, https://www.imdb.com/title/tt1677720/?ref_=ttqt_qt_tt.

and muscle.”¹⁵ In other words, when entering a building, our senses are engaged, allowing us to assess the size of the space, the quality of materials, and the overall scale. This phrase prompted me to carefully consider my installation material choices, my choice of ambient background sounds and scents, and encouraged me to reflect on the built environment’s multisensory experience more thoroughly while planning the art installation and putting up the exhibition. “Vision reveals what the touch already knows.”¹⁶

Here Pallasmaa claims that sensory presence arises from the interaction between the built environment and our embodied experience of it. In essence, the quote suggests that our different senses work together to create our perception of the world, and that touch plays an important role in this process. By drawing attention to the relationship between touch and vision, the quote highlights the complexity and richness of our sensory experience and emphasizes the importance of considering the interplay between different senses in our understanding of the world. For example, if we were to touch a rough surface, our sense of touch would give us a more immediate and direct understanding of the texture

¹⁵ Juhani Pallasmaa, *The Eyes of the Skin: Architecture and the Senses* (London: Academy, 1996), 45.

¹⁶ Juhani Pallasmaa, *The Eyes of the Skin: Architecture and the Senses* (London: Academy, 1996), 46.

than our visual perception alone. Our vision may provide additional information, such as the color and shape of the object, but the sense of touch is what provides the more immediate and intimate knowledge of the texture.

In his chapter “Landscape Archeology in Skyrim VR” from *The Phenomenology of Real and Virtual Places*, driven by curiosity, Reinhard started this experimental case study which includes archaeology, phenomenology, psychogeography, and GIS in a VR wrapper.¹⁷ And in this study, he recorded his observations of the Village of Rorikstead and Valley and Ruined Fort within the game *Skyrim VR*, with screen and video capture. He even exported and edited scenes into 360-degree panoramic images and immersive 3D video to consider if these media forms can give us a historical sense of “having been there.” It is evident that recording the real world through virtual panoramas is also a way to create immersive experiences, allowing people to “travel” to specific real-life scenarios and simulate action. Reinhard’s screenshots show farms and villages in a staggered pattern, with different vegetation and houses according to the terrain, as if we were back in this historical period, with real scenes in front of us. He has crafted both the timeline and distance in a way that not only facilitates

¹⁷ Andrew Reinhard, “Landscape Architecture in Skyrim VR.” In Erik Champion (Ed.). *The Phenomenology of Real and Virtual Places* (London: Routledge, 2018), 24-37.

interactions that advance the game's action but also helps players learn new things.¹⁸ In light of this, mobilizing the user's perception to learn novel information might also be helpful in transporting them into a specific immersive experience.

1.3 Measuring the Experience of Immersion

I am pursuing a career as a UX designer, so it is my goal to master qualitative and quantitative analysis of user experience. I think both qualitative and quantitative questionnaires are important to UX designers because they provide different types of data that can be used to inform the design process and improve the user experience. Qualitative questionnaires can provide rich, in-depth data that helps UX designers understand user behavior, motivations, and needs. By using open-ended questions¹⁹, designers can identify user pain points, gather feedback on design concepts, and create user personas. Quantitative questionnaires, on the other hand, provide numerical data that can be analyzed using statistical methods, which can help designers ensure our data is broadly

¹⁸ This reminds me of the content of the previous proseminar class, documenting, creating Panoramic Tour Authoring, exporting and experience and representing space through imagery, representing geographic space through mapping.

¹⁹ Susan Farrell, "Open-Ended vs. Closed-Ended Questions in User Research," Nielsen Norman Group, May 22, 2016, <https://www.nngroup.com/articles/open-ended-questions/>.

applicable to a large number of people.²⁰ And asking for an overall rating is a great way for qualitative feedback data.²¹

In “Measuring and defining the experience of immersion in games”²², Jennett led a research team in University College London using a mixture of qualitative and quantitative research to describe three experiments to further explore immersion by examining whether immersion can be defined quantitatively. The first experiment looked at how well participants could transition from one type of task to another by using computer games and control task methods. The second experiment looked at whether participants’ eye movements changed while completing an immersive task. The third experiment looked at how immersion and affective measurements were affected by an externally imposed tempo of interaction, for instance, state anxiety, positive affect, or negative affect. Essentially, the results indicated that immersion can be assessed both objectively using task completion time and eye movements tracking, and subjectively using questionnaires.

²⁰ Susan Farrell, “28 Tips for Creating Great Qualitative Surveys,” Nielsen Norman Group, 2016, <https://www.nngroup.com/articles/qualitative-surveys/>.

²¹ Meena Toor, “Three Tips for Effectively Designing Rating Scales,” Qualtrics, January 15, 2021, <https://www.qualtrics.com/blog/three-tips-for-effectively-using-scale-point-questions/>.

²² Charlene Jennett et al., “Measuring and Defining the Experience of Immersion in Games,” *International Journal of Human-Computer Studies* 66, no. 9 (September 2008): 641–61, <https://doi.org/10.1016/j.ijhcs.2008.04.004>.

Given my interest in phenomenology, I measured immersion through user questionnaires designed to solicit user description of their subjective experiences. To gain valuable insights that inform the design process, improve the user experience and make data-driven design decisions, I consulted several sources to develop my questionnaires, which I include in Appendix B: Immersive Exhibition User Survey and Appendix C: Immersive VR User Survey. An important source was from a user experience researcher team in Virtual Reality lead by Katy Tcha-Tokey. In their research article “A Questionnaire to Measure the User Experience in Immersive Virtual Environments”,²³ Tcha-Tokey *et al* demonstrated an interactive smart computer-based system that offers a three-dimensional virtual world is known as an Immersive Virtual Environment (IVE). In previous work²⁴, they described the UX in the IVE system a comprehensive manner. When conducting experiments, these researchers used physiological indicators like skin conductance and heart rate as well as performance indicators like level completion time, level score, level reached, and number of level failures to collect both subjective results (components measured by questionnaire) and objective

²³ Katy Tcha-Tokey et al., “A Questionnaire to Measure the User Experience in Immersive Virtual Environments,” Proceedings of the 2016 Virtual Reality International Conference on - VRIC '16, 2016, <https://doi.org/10.1145/2927929.2927955>.

²⁴ Katy Tcha-Tokey et al., “Towards a Model of User Experience in Immersive Virtual Environments,” Advances in Human-Computer Interaction, 2018, <https://www.hindawi.com/journals/ahci/2018/7827286/>.

results. And in their holistic User Experience in Immersive Virtual Environment model, presence, engagement and immersion, flow, skill, emotion, usability, technology adoption, judgment and experience consequences make up the UX questionnaire review.

One of the strengths of Tcha-Tokey *et al*'s questionnaire is its clear and concise language. The items are written in a way that is easy to understand and interpret, making it accessible to a wide range of users. The questionnaire also includes clear instructions and definitions of key terms, further facilitating ease of use. For example, they modified most of the words they chose so that they fit perfectly with the theme, such as "I appreciate being in class" becomes "I enjoyed being in the virtual environment".²⁵

Another notable strength of their questionnaire is its ability to capture both subjective and objective aspects of the user experience. It includes questions that assess not only how the user feels but also their objective perceptions of the

²⁵ Katy Tcha-Tokey et al., "A Questionnaire to Measure the User Experience in Immersive Virtual Environments," *Proceedings of the 2016 Virtual Reality International Conference on - VRIC '16*, 2016, 3, <https://doi.org/10.1145/2927929.2927955>.

virtual environment.²⁶ This allows for a more complete understanding of the user experience.

This in-depth examination has provided me with a deeper three-dimensional understanding of the multidimensional nature of immersion. As I created surveys, I endeavored to use a combination of both objective and subjective methods to get more reliable results and more exact in my wording and to keep my questionnaire closely matched with the topic. For example, as you can see in Appendices A and B, I used different referent subjects in different projects, such as this art installation/exhibition and this VR session/project/trip; and I selected different types of overall rating, the exhibition is on a five-point slider scale and the VR as a polished project after user experience research is on a ten-point slider scale so that the respondents can choose any point on this scale that best captures their perspective between the two points of measurement, giving them complete flexibility of interpretation.

In conclusion, digital VR experience and physical exhibition experience come in my participant study. For the VR experience, participants were recruited via email and scheduled individual appointments to complete the study. The

²⁶ Katy Tcha-Tokey et al., "A Questionnaire to Measure the User Experience in Immersive Virtual Environments," *Proceedings of the 2016 Virtual Reality International Conference on - VRIC '16*, 2016, 5, <https://doi.org/10.1145/2927929.2927955>.

physical installation was on view on December 7, 2022, at the Rubenstein Art Center. Participants in either experience each signed a consent agreement before starting the experience. They were then asked to spend approximately 5 minutes exploring the project, and after which they were asked to complete an online questionnaire designed to gather information on their previous experience related to immersive media, their experiences of immersion and their evaluations of the user experience of my two installations.

In the next three chapters, I will introduce the traditional Chinese cultural reference resources that appear in my projects, starting with my understanding of traditional Chinese architecture, including the architectural craftsmanship and artistic attainments of courtyards in Qing Dynasty architecture, and then the Chinese landscape garden, and finally, I explain some basic philosophical concepts in traditional Chinese culture.

2. Traditional Chinese Architecture Theme

The creation of traditional Chinese architecture has consistently aimed for a deliberate sense of immersion, which is referred to as Yijing (意境) in Chinese, which can be translated roughly to “artistic mood”. In constructing both virtual and physical immersive experiences of traditional Chinese architecture I sought not so much history accuracy as I aimed to pay homage to the artistic mood of Chinese-style immersive experiences. In “Miscellany of Pingjiao Architecture”, Chinese architects Sicheng Liang and Huiyin Lin creatively proposed the concept of “architectural meaning” to express the artistic conception in Chinese traditional aesthetics, and they believed that the beauty of architecture goes beyond poetic and pictorial meaning to the affective dimensions of architectural pleasure.²⁷ Before Sicheng Liang and Huiyin Lin began documenting China’s historic architectural treasures in the 1930s, many of the country’s ancient architectural treasures had fallen to dust. In China, historical constructions were typically treated as any other building, rather than being conserved and researched as they are in many Western countries.²⁸ That’s why I chose the concept of traditional Chinese architecture, intending to create a unique

²⁷ Sicheng Liang and Huiyin Lin, “平郊建筑杂录 (Miscellany of Pingjiao Architecture),” *Buddhist Culture* 1, no. 6 (2015): 108–13.

²⁸ “Overlooked No More: Lin Huiyin and Liang Sicheng, Chroniclers of Chinese Architecture,” *The New York Times*, April 12, 2018, sec. Obituaries, <https://www.nytimes.com/2018/04/11/obituaries/overlooked-lin-huiyin-and-liang-sicheng.html>.

immersive experience in Chinese culture. I believe it is critical for me to learn the characteristics of traditional Chinese architecture to create a better physical and virtual environment.

In reference to Pang's article, Chinese architecture has a distinctive and storied history that dates to the Zhou dynasty, some 2,500 years ago. From the dawn of civilization, mankind has erected timber structures, rammed earth buildings, and buildings and structures made of stone or brick. These distinct building types each have unique characteristics.²⁹ The structures were constructed to be more easily rebuilt and to withstand China's regular earthquake, typhoon, and flood calamities.³⁰ In addition to being durable and simple to renovate, structures expressed and supported social order and religion.

In *Liang Sicheng Tan Jian Zhu*, Sicheng Liang explained that Chinese buildings typically consist of three main components: the lower platform, the middle house itself, and the upper wing-like stretched roof. He hand-painted the Chinese and English names of the main names of Chinese buildings on the symbol of traditional Chinese buildings (see Figure 1). Figure 1 can help us form our initial perceptions and conceptualizations of Chinese architecture and serve as

²⁹ Kelly Pang, "Chinese Architecture," China Highlights, August 23, 2021, <https://www.chinahighlights.com/travelguide/architecture/>.

³⁰ Kelly Pang, "Chinese Architecture," China Highlights, August 23, 2021, <https://www.chinahighlights.com/travelguide/architecture/>.

a strong starting point for the subsequent architectural elements. In my 3D model design, I refer to the overall structure represented by Liang, working from the bottom-up to create the platform of stylobate, wall columns, tou-kung (dougong), a four-cornered roof framework, including a main ridge, chin wei, steps and other elements.

2.1 Qing Dynasty is an Important Stage in the Development of Chinese Architectural History

During China's history, the Qing Dynasty was the final feudal dynasty to rule for over two centuries. Despite its brief duration relative to other Chinese dynasties, it made significant progress in architecture, surpassing previous eras in terms of construction speed, number of structures built, artistic quality, and scope of architectural styles. In the prosperous era of Kangxi and Qianlong, gardens, Buddhist temples, and residential buildings showed an enthusiasm of development that has not appeared in previous dynasties. According to *Buildings of Qing Dynasty*, the statistical materials show that:

“at the end of Qianlong (the fifty-ninth year of Qianlong), the inventory warehouse in all provinces reached 45 million stones (1 stone \approx 100 kilograms); in the thirty-ninth year of Qianlong, the household department had 74 million taels of silver(1 teal \approx 50 grams), compared

with only 2 million taels in the first year of Kangxi, indicating that the strength of the national economy at that time was unprecedented.³¹

Economic prosperity will often trigger growth in the construction industry. This statement can further be illustrated by a quote from Sicheng Liang:

The peak of the Qing Dynasty architecture and a certain degree of creativity mainly in the Qianlong era "peace and prosperity". Emperor Hongli went on eight southern tours to bring architecture Jiangnan style; vigorously build the Yuanmingyuan (Old Summer Palace), Chengde Mountain Resort, the Summer Palace, Qianlong Garden. Each of these gardens has its own architectural details of excellent craftsmanship. Particularly noteworthy is that the palace of this era absorbed a large number of folk architectural style of Jiangnan to build the garden. After the Qianlong period, Qing dynasty architecture became relatively subdued.³²

Precisely for this reason, most of the architectural achievements we see today are based on the Kangxi and Qianlong period, which can be said to be the representative of the architecture of the Qing Dynasty.

³¹ Dazhang Sun, *Ancient Chinese Architecture History Series Buildings of Qing Dynasty* (China Architecture & Building press, 2009), 515. Translation mine.

³² Sicheng Liang, *Liang Sicheng Tan Jian Zhu* (Beijing Shi: Dang dai shi jie chu ban she., 2006), 293. Translation mine.

As a result, I design my architecture models by drawing inspiration from the architectural styles of the Qing Dynasty, expecting to show the peak state of traditional Chinese architecture to enable viewers to better understand and perceive the artistic mood of the period.

2.2 Courtyard Compounds

When researching the characteristics of Chinese architecture, Liang explained that

the layout of Chinese architecture, which is called a 'house' in China, is actually made up of a number of associated buildings, such as cloisters, huts, compartments, ears, halls, etc., built around one or several courtyards or patios. In this arrangement, it is often symmetrical and constitutes a significant axis. The main houses are generally oriented to the south to get the most sunlight. Although trees and plants are often planted in the courtyard or patio, the main part of the house is usually covered with masonry, making it a common outdoor space for daily life, or an outdoor living room³³.

A building with above characteristic is Siheyuan, the Chinese courtyard. In *The Chinese House*, Knapp also illustrates the architectural principles of the courtyard

³³ Sicheng Liang, *Liang Sicheng Tan Jian Zhu* (Beijing Shi: Dang dai shi jie chu ban she., 2006), 308. Translation mine.

house: "The full flowering of Chinese architecture is epitomized by the north courtyard style where the principles of axiality, balance, and symmetry are well developed and clearly represented."³⁴

In ancient China, courtyard enclosures were a common feature of residential architecture. Pang describes the initial design purpose of Chinese courtyard is "these structures were typically built by clans or extended families and were designed to be easily adaptable for multiple generations of occupants. The use of wood as a primary building material allowed for flexibility in design and construction, as well as a certain degree of insulation from the outside world."³⁵ And this also coincides with Knapp's argument:

In accordance with Sun's overview about *Construction Methods*, I learn that in the twelfth year of Yongzheng (1734), the Qing government, in order to facilitate the review of official practices around the government and further strengthen the management of construction projects, the Ministry of Industry formulated and promulgated an engineering book - engineering practices,³⁶ which is an important document for me to understand the architecture of the Qing Dynasty and comprehensively reflects many aspects of the engineering and

³⁴ Ronald G Knapp, *The Chinese House* (Oxford University Press, USA, 1990), 11.

³⁵ Kelly Pang, "Chinese Architecture," China Highlights, August 23, 2021, <https://www.chinahighlights.com/travelguide/architecture/>.

³⁶ Dazhang Sun, *Ancient Chinese Architecture History Series Buildings of Qing Dynasty* (China Architecture & Building press, 2009), 385.

decorative techniques of the Qing Dynasty palace buildings. As in Figure 2, a section of a Qing Dynasty high-rise is drawn, with a symmetrical and smooth house, in which I noted that the constructed roof was built in a stable structure of isosceles triangle.

2.3.1 Curved Roof Construction

According to *A pictorial history of Chinese architecture*,³⁷ Liang provides a detailed description of traditional Chinese curved roof construction, including its structural components and decorative features. He explains that the roof structure is based on the Dou-gong system, which consists of a series of interlocking wooden bracket sets that support the roof beams and purlins.

As depicted in the Figure 3, there are five variations of roofing available for single-story buildings during the Qing Dynasty. The two types of single-story buildings on the left are mostly accessory buildings, while the two types on the right are mainly used for the main hall building. And the two types on the right-hand side appear to have a more intricate and appealing design, indicating superior craftsmanship. Consequently, my 3D model will employ the rightmost type to evaluate the design.

³⁷ Ssu-cheng Liang, *A Pictorial History of Chinese Architecture*, ed. Wilma Fairbank (Cambridge, Mass: MIT Press., 1984), 11,17.

In addition to this, Liang also categorized the roof as one of the characteristics of Chinese architecture in another book *Tian Jian Zhu*, mentioning that in his system of architecture, the roof is generally the least valued part, however, in China, the wise craftsmen of ancient times brought into play the great ornamentation of the roof section very early.³⁸ As a result, roof have always played an extremely important role in Chinese architecture (see Figure 4).

2.3.2 Timber Frame

In *A pictorial history of Chinese architecture*, Liang describes the timber frame structure as a defining characteristic of Chinese traditional architecture. He notes that this frame structure is used in most Chinese buildings, from small houses to grand palaces, and that it allows for flexible and adaptable construction.³⁹ He also notes that the timber frame structure allows for the use of large and heavy roof structures, as the weight is distributed evenly across the supporting columns.⁴⁰ As shown in the cross-sectional view of the structure (See Figure 5), the beam frame structure consists of wooden beams and columns that interlock without the use of nails or screws. This type of construction is known as "Dougong" (bracket set), and it is unique to Chinese architecture.

³⁸ Sicheng Liang, *Liang Sicheng Tan Jian Zhu* (Beijing Shi: Dang dai shi jie chu ban she., 2006), 310-311.

³⁹ Ssu-cheng Liang, *A Pictorial History of Chinese Architecture*, ed. Wilma Fairbank (Cambridge, Mass: MIT Press., 1984), 8.

⁴⁰ Ssu-cheng Liang, *A Pictorial History of Chinese Architecture*, ed. Wilma Fairbank (Cambridge, Mass: MIT Press., 1984), 15-18.

It seems to me that perhaps the beam frame structure can also reflect the cultural and philosophical beliefs of traditional Chinese society. The interlocking beams and columns are said to symbolize the harmony and balance between man and nature, and the importance of balance in all aspects of life. Hence, in my digital 3D model, I also utilize the beam structure, especially the Dougong in the roof part of the architecture, and the columns and beams in the body part of the architecture to connect the roof to the ground (see Figure 6 and 7).

2.4 Art of Architecture

To create a profound Yijing conception within a narrow space, it is essential to employ more techniques to enhance the feeling of space and heighten the fine details. Applying bright colors to tall buildings to achieve a luxurious and rich effect is one of the important features of ancient Chinese architecture, and it is also one of the outstanding achievements in architectural art process. According to Lin, the color painting pattern is relatively simple at the beginning. At first, it was for practical use. In order to meet the actual needs of anti-corrosion and anti-slip in the wood structure, it was generally decorated on the wood structure with paints such as mineral raw materials such as Dan or Zhu and black lacquer tung oil. Later, it gradually met the requirements of art. Unification has become

complex and has become a unique method in Chinese architectural decorative arts.⁴¹

The decorative art of architecture during the Qing Dynasty was characterized by its use of vibrant colors and intricate designs. In *Ancient Chinese Architecture History Series Buildings of Qing Dynasty*, Sun indicated that, “during the Qing dynasty, the decorative arts of architecture were rich and colorful, reaching an unprecedented level of prosperity. This can be considered the pinnacle of feudal society, leading traditional Chinese architecture towards a self-expressive era of dazzling beauty and diversity. There were abundant innovations in form, color, texture, craftsmanship, composition, and artistic concept, representing the aesthetic tendencies of the time. In turn, these innovations had a positive impact on the development of architecture.”⁴²

Overall, the decorative art of the Qing Dynasty was a significant contributor to the overall development of Chinese architecture, and it remains a cherished part of the country's cultural heritage.

⁴¹ Huiyin Lin, *Lin Huiyin Jian Zhu Wen Cui* (Shanghai Sanlian Shudian, 2006), 205.

⁴² Dazhang Sun, *Ancient Chinese Architecture History Series Buildings of Qing Dynasty* (China Architecture & Building press, 2009), 439. Translation mine.

2.4.1 Architectural Color Painting

According to the description of Lin, the color painting was at first for utilities and for anti-corrosion and insect prevention, but later it gradually unified with the requirements of fine arts and became colorful.⁴³ That is why we see the application of distinctive colors on tall buildings to obtain the effect of luxury and opulence, and it is one of the important features of ancient Chinese architecture and one of the particularly remarkable achievements in the processing of architectural art (see Figure 8).

Qing Dynasty architectural decoration and decoration have various distinctive achievements, one of the most important being color painting. According to Sun,

Architectural color painting is a decorative and preservation technique that has evolved through the development of ancient traditional wooden architecture, and has endured for thousands of years, becoming a symbol of great national character in Chinese architectural art. In the Qing Dynasty, the artistic achievements of architectural color reached their zenith. New varieties of color continued to emerge, the standards became

⁴³ Huiyin Lin, *Lin Huiyin Jian Zhu Wen Cui* (Shanghai Sanlian Shudian, 2006), 205.

*more stringent, and the sense of tone and decoration was greatly enhanced, resulting in extraordinary artistic accomplishments.*⁴⁴

Given the importance of standardized color articulated above, from the book *Qing Dynasty official architecture painting techniques*⁴⁵, I learn that among the multitude of architectural colors, the pattern layout and theme of its main body—that is, the Liang Fang purlin part—can be summarized into three art styles. The figure below shows these three types of Qing dynasty color painting: Hexi color painting, Xuanzi color painting and Su-style color painting. As we can imagine, Hexi style of painting is characterized by its use of bright colors, intricate designs, and a glossy finish. Xuanzi style of painting involves a multi-step process of carving, layering. Su style of painting involves using fine silk threads to create intricate and colorful designs, often featuring nature, such as flowers, birds, and landscapes.

According to Jiang, “the architectural paintings of the Qing dynasty were initially dominated by Xuanzi style, but since the creation of the HeXi paintings, the HeXi style were ranked as the most prominent and the Xuanzi paintings

⁴⁴ Dazhang Sun, *Ancient Chinese Architecture History Series Buildings of Qing Dynasty* (China Architecture & Building press, 2009), 441. Translation mine.

⁴⁵ Guangquan Jiang, *Qing Dynasty Official Architecture Painting Techniques* (China Building Industry Press Pub, 2005), 19-170.

dropped to a secondary position.”⁴⁶ Therefore, I applied the Hexi painting in my model design, expecting to give the audience a more immersive Chinese concept experience.

Concerning the content of the colorful paintings, I noticed that color painting is applied to numerous parts of traditional Chinese architecture, of which ceiling painting is a unique category. The ceiling paintings in Hexi style are mostly found in the key areas of Tibetan Buddhist architecture, and the six-character truth (Om Mani Padme Hum) ceiling painting are used here (see Figure 9). I borrow the ceiling design of the Six-character truth and incorporate it into my work in order to convey to the public a certain atmosphere in traditional Chinese architecture, a synthesis of influences in the culture of ancient architectural styles (see Figure 10).

2.4.2 Stone Carving

Stone carvings have been used for the longest time in architectural decoration. Stone sails, stone chambers and portrait stones of the Han Dynasties are highly artistic carvings.⁴⁷ After that, with the introduction of Buddhism, there were countless carved Xumi Buddhas, lotus oil columns, pagodas and Jingqi. In

⁴⁶ Guangquan Jiang, *Qing Dynasty Official Architecture Painting Techniques* (China Building Industry Press Pub, 2005), 15. Translation mine.

⁴⁷ China Daily, “Han Dynasty Stone Carvings, Witness of Ancient History - Shandong Culture,” www.chinadaily.com.cn, October 22, 2018, http://www.chinadaily.com.cn/m/shandong/shandongculture/2018-10/22/content_37123998.htm.

the Song Dynasty, the stone carving techniques can be categorized into four types: starting from other places, crushing the ground, reducing the flat mouth, and plain flattening, summarizing the engraving level at that time.⁴⁸ As stated by Sun,

since the Ming and Qing Dynasties, stone carvings have been a common decoration method for palace buildings, temples and ancestral halls and rich merchants with their strong moisture-resistant durability, noble textures and bright colors. In addition to stone Buddha statues, stone pagodas, stone buildings, cliffs, stone carvings are generally used for column bases, stone whiskers and stone railings, stone archways, stone flower platforms, stone coupon faces, stone lions, door pillow stones of residential houses, clamp stones of wooden archways, royal roads, etc., and stone pillars and stones are also carved in the later period.⁴⁹

Thus, the use of stone carving gradually became more widespread during the Qing Dynasty and penetrated into the daily architecture of the general public. In keeping with stone carving, my digital 3D model also included a great deal of stone art, such as the design of stone floors, stone stairs, and

⁴⁸ National Museum of China, "Stone Carving Art of the Song Dynasty | National Museum of China," en.chnmuseum.cn, accessed February 28, 2023, https://en.chnmuseum.cn/exhibition/exhibition_series/special_exhibitions/201911/t20191120_171615.html.

⁴⁹ Dazhang Sun, *Ancient Chinese Architecture History Series Buildings of Qing Dynasty* (China Architecture & Building press, 2009), 459. Translation mine.

stone gateposts in courtyards, all of which reference this traditional fine craft (see Figure 11).

3. Chinese Landscape Garden Theme

The Chinese garden is a profound and meticulous cultural construction. To create traditional Chinese Yijing and a sense of poetic immersion, understanding how Yijing functions in Chinese gardens is an essential step (see Figure 12). In *The Great Gardens of China: History, Concepts, Techniques*, Fang asserts that “gardens, in Chinese culture, have always been more than simple combinations of flowers, trees, and miniature landscapes; they are places that can create poetic and painterly concepts.”⁵⁰ The construction of gardens in the Qing Dynasty can be said to be the collection period of Chinese classical garden art, and the last dense period in the history of the development of ancient Chinese social gardens.

In “Origins of Garden Design,” Ebrey described that “early proponents of the idea of withdrawing from society, such as the fabled Seven Sages of the Bamboo Grove during the Six Dynasties, simply found their own retreat in a naturally occurring place, like a forested area or mountain stream.”⁵¹ After extending to the past, it can be said that traditional Chinese gardening art has accumulated rich experience and theory, and has a wide range of functions, which

⁵⁰ Xiaofeng Fang, *The Great Gardens of China: History, Concepts, Techniques*, ed. Janet Wheatcroft (New York: Monacelli Press, 2010), 9.

⁵¹ Patricia Buckley Ebrey, “Origins of Garden Design,” [depts.washington.edu](https://depts.washington.edu/chinaciv/home/3garhist.htm), n.d., <https://depts.washington.edu/chinaciv/home/3garhist.htm>.

has set a rich foundation for the further development of garden art. When it comes to the meanings of the Chinese garden, Keswick writes: “A garden would be used for solitude as well as entertaining friends, for study as well as the occasional dalliance, for quiet intoxication as well as cultivation, for composing poetry and meditating as well as family outings or boat-parties and, on an Imperial scale, even for war games.”⁵²

Therefore, without certain conditions for political stability and a strong material foundation, it is not easy to develop. And during my research, Beijing Half Acre Garden and Suzhou Museum offered important references for further reflection.

3.1 Beijing Half Acre Garden

Half Acre Garden is a classical garden building built in the Qing Dynasty and is in Huangmi Hutong in the east of Beijing, of which only the remnants remain today (see Figure 13). Linching Wanyan recorded the scene of the half-acre garden in his Hongxue Yinyuan illustrations book and asked the artist to accompany it with drawings (see Figure 14). The picture below is a line drawing of Beijing Half Acre Garden, from which we can see the structure of the courtyard, the smooth design of the roof, and the hexagonal shape of the door. At the same time, you can also see the layout of the garden. Different varieties of

⁵² Maggie Keswick, Alison Hardie, and Charles Jencks, *The Chinese Garden: History, Art, and Architecture* (Cambridge, Mass.: Harvard University Press, 2003), 212.

flowers and plants are placed in the courtyard, and tall trees are also planted, which is very ornamental.

3.2 Suzhou Museum

In the last chapter I described there were a large collection of Jiangnan style gardens in Qing Dynasty, and Suzhou is the “ultimate” in Jiangnan style. Suzhou has three of the six ancient towns in Jiangnan - Zhouzhuang, Tongli, and Luzhi, and two of the four famous gardens in Jiangnan - Humble Administrator's Garden and Liuyuan Garden, so this attracted me to explore the Suzhou Museum, an architectural masterpiece that combines the ancient with the modern.

In traditional Chinese architectural and garden design, meaning and form, and meaning and environment are integrated to create a state of harmony and forgetting oneself in the scene, allowing viewers to transcend the scene and appreciate the aesthetic sentiment. The Suzhou Museum, designed by world-renowned architect I.M. Pei, fully demonstrated the charm of landscape in Chinese garden culture (see Figure 15). Located in the heart of Suzhou, a city known for its classical gardens and historic architecture, the museum is housed in a modern building. I think this work is an exemplary example of modern and ancient design colliding, and it also makes me think about how to achieve this Chinese immersion through digital and modern means while ensuring the presentation of traditional culture, and to create a space where visitors can

experience the beauty and richness of China's cultural heritage in a modern context.

I appreciate the idea of bringing the natural environment into the architecture, and the architecture and landscape design of the Suzhou Museum are interdependent. According to the museum's introductory website, a common element in Pei's works is the incorporation of inner courtyards that connect interior and exterior spaces, and Pei paid great attention to the layout of the main courtyard and several smaller inner courtyards. He sought inspiration for the garden design from ancient Chinese landscape calligraphy and painting and collaborated with local craftsmen in Suzhou to produce an innovative Suzhou Garden, avoiding the use of traditional materials such as Taihu stone or limestone that he had previously employed in other projects. He said,

*For example, I don't use the traditional Taihu stone, nor the limestone I used in Xiangshan. I hope to find inspiration for garden design from ancient Chinese landscape calligraphy and painting and cooperate with local skilled craftsmen in Suzhou to create an innovative Suzhou Garden.*⁵³

⁵³ Suzhou Museum, "I.M. Pei and Suzhou Museum," www.szmuseum.com, September 6, 2015, <https://www.szmuseum.com/Other/MuseumIntro>. Translation mine.

The boldness to experiment with novel techniques and approaches and avoid being constrained by past practices is an admirable quality for modern designers to emulate, as it embodies an innovative mindset and a willingness to break away from conventional routines. The following quote from Janet Wheatcroft serves to further clarify this point, she praised the Suzhou Museum designed by I.M. Pei in the foreword to Fang Xiaofeng's book *The Great Gardens of China: History, Concepts, Techniques*:

*I. M. Pei oversaw every step of the creation of the museum gardens, even choosing individual trees. Although the end result is entirely classical in concept, consisting of rock, water, trees, bamboo, and paving, it is at the same time utterly modern. Unlike some re-creations of Chinese gardens, it never descends into pastiche. It is rather a classical Chinese garden for a new century.*⁵⁴

The center garden in Suzhou Museum provides multiple pathways for visitors to experience the modern interpretation of Jiangnan Garden's water scenery from different perspectives. Along the northern wall, a distinctive rockery made from sliced stones stands out as a unique piece of art (see Figure 16). Its

⁵⁴ Xiaofeng Fang, *The Great Gardens of China: History, Concepts, Techniques*. (New York: Monacelli Press, 2010), 7.

mountain and river landscapes are clearly defined, producing a silhouette effect that seamlessly blends with the nearby Humble Administrator's Garden.

According to Fang, the arrangement and layout of stones is inspired by Mi Fu's landscape painting in Song dynasty.⁵⁵ The figure 17 shows his masterpieces of landscape painting -- *Auspicious Pines in Spring Mountains*. We can see the level of control exhibited in the execution of the brushwork and the expressiveness of the strokes and notice the harmony or contrast of colors and the use of light and shadow to create depth.

I.M. Pei put considerable effort into the composition of the rockery wall, using stones of varying depths and shades to create a misty, ink and wash painting effect. Each stone was carefully selected to achieve this artistic impression. The resulting effect is reminiscent of the misty mountain landscapes of southern Yangtze River, and it further adds to the seamless blending of old and new landscapes. I was inspired by this and decided to pay tribute to this landscape-inspired artwork in my art installation project (see Figure 18), while using it to increase the audience's understanding of traditional Chinese gardens.

⁵⁵ Xiaofeng Fang, *The Great Gardens of China: History, Concepts, Techniques*. (New York: Monacelli Press, 2010), 13.

4. Traditional Chinese Philosophical Concepts

Understanding traditional Chinese philosophical concepts can certainly be beneficial in understanding Yijing and infusing depth and meaning into my work. Chinese philosophy has a long and rich history, spanning thousands of years, and it has had a profound influence on Chinese culture and society. And in my design, Confucianism and Yinyang theory give me the main immersive atmosphere.

4.1 Confucianism

Chenyang Li stated in his article “The Confucian Ideal of Harmony” that He (harmony, harmonization) is undoubtedly the most valued idea in Chinese culture⁵⁶. Confucianism has had a significant impact on Chinese architecture, particularly in the design and construction of traditional Chinese buildings. A key principle of Confucianism is the importance of balance and harmony in all aspects of life. This is reflected in the design of traditional Chinese buildings through the use of symmetry, proportion, and the careful placement of elements such as doors, windows, and decorative features. Traditional Chinese buildings often feature a symmetrical layout with a central axis, which is believed to promote

⁵⁶ Li, Chenyang. “The Confucian Ideal of Harmony.” *Philosophy East and West* 56, no. 4 (2006): 583–603. <http://www.jstor.org/stable/4488054>.

balance and harmony. This is my original intention of designing the courtyard, reflecting the balance and symmetry of harmony.

4.2 Yinyang

Yinyang is a fundamental concept in Chinese philosophy and culture. In the West, the Bagua symbol is the most popular representation of Yinyang.

According to Knapp⁵⁷, Fengshui played a significant role in shaping the design and layout of traditional Chinese houses, which may be spoken of at an elementary level as exemplifying either Yin or Yang characteristics. Fengshui's fundamental concept involves the dynamic interplay of yin and yang within the universe, where the intangible force of air, also called Cosmic energy or breath of life, imbues a location with personality and significance.

Robin R. Wang explains in her book, *Yinyang: The Way of Heaven and Earth in Chinese Thought and Culture*, that there are many ways to understand the Yinyang symbol, such as the confluence of two rivers (Chaotianmen, the confluence of the Jialing and Yangzi rivers), or the image of two fish chasing each other, or the general formula of binary thinking.⁵⁸ The symbol, also known as Bagua, is intended to demonstrate the concept of constant change. Furthermore,

⁵⁷ Ronald G Knapp, *The Chinese House* (Oxford University Press, USA, 1990), 54-55.

⁵⁸ Robin Wang, *Yinyang: The Way of Heaven and Earth in Chinese Thought and Culture* (Cambridge: Cambridge University Press, 2012), 201-202.

Wang suggested that the interaction between yin and yang in the Yinyang symbol is not limited to being complementary and mutually supportive, but it extends beyond that.⁵⁹ That means the dynamic interplay between yin and yang in the Yinyang symbol leads to the creation, existence, and continuity of all things. It's a very profound concept, magically associated with immersion, and I think immersion is also a perpetual process, a flow, for designers to not just think about how to interact, but also consider how to facilitate their perception and understanding of the world in a three-dimensional space.

In general, my project is to create a traditional Chinese immersion, with “the unity of heaven and man” as advocated by Confucianism, and the Bagua of the Yinyang theory as a supplement (see Figure 18).

⁵⁹ Robin Wang, *Yinyang: The Way of Heaven and Earth in Chinese Thought and Culture* (Cambridge: Cambridge University Press, 2012), 222-224.

5.Project

My architectural model aims to create an immersive experience of traditional Chinese Yijing, demonstrating artistic mood or conception through various digital and physical displays of architecture and gardens. It is a fictional paradise, a metaphor for an imaginary place rather than a tangible historic site. To help the audience better understand this mood, creating a sense of realism in the model is the primary method I use. To showcase the expertise of traditional cultural craftsmanship and architectural details, my first digital project was a VR tour of the courtyard during the Mid-Autumn Festival, featuring user interaction and education. Through this project, I hoped to highlight the pursuit of peace and beauty in traditional Chinese thought. As for my second physical project, I designed a space for Chinese garden using projectors and art installation to create a captivating and immersive environment for the audience.

Regarding research, I conducted user research to gather insights into the audience's understanding of immersion and their experience with my two projects. This research will involve gathering feedback from participants to help improve the design and execution of my projects.

In this chapter, I will introduce my VR project and exhibition project, including their respective backgrounds, design processes, documentation, and summaries.

5.1 Physical Project: Land of Idyllic Beauty

5.1.1 Installation Making Process

Land of Idyllic Beauty is my final assignment in the class Expanded Cinema. After confirming the theme of my project, the first thing I thought about was the overall layout of the exhibition. The exhibition is divided into two main sections, the first is the physical garden at the entrance, where I used projection, refractive lighting, real fallen leaves (because in my model, the courtyard is surrounded by trees), and other materials to create a corner of the garden. The second is the projection-based visual garden, where visitors can experience by walking between the two spaces through hollow doors.

From digital to physical, I started to collect suitable materials. Based on my ability, I chose the workable foam board as the main material for the doorway when it was difficult to find the right size of curtain and drawing board. Then, I tried three kinds of glue and finally found the most solid glue to stick the foam board and iron surface. I wanted to use mirrors to make the audience feel the extension and expansion of space, so I spent a lot of time searching for suitable mirror materials, such as mirror spray paint and plastic sheets, and finally chose metallic materials to simul metallic materials ate the texture of ancient bronze mirrors.

In the chapter 2.4.2 above, I discussed the craft of stone carving, therefore rocks are an indispensable part of my garden. Since the massive rocks are difficult to obtain, not to mention transport to my exhibition space, I opted to make them out of paper. I crumpled brown heavy weight paper up into a tight ball, the tighter the better since it can give me more folds in the paper which increases the realism of the rocks. Then I unfolded the paper back up and turned it upside down, after that, I started to gather the edges, holding them in place with staples. When all four sides had been successfully stapled, I turned the paper right side up and then shaped the fake rock by hand. At this point, the fake rock had taken shape, and I used a paint spray that resembles the texture of the stone surface to add texture and realism. The same technique was also used in the production process of the Rockery Wall (see Figure 20).

I used three projectors to create a more comprehensive sense of immersion. The main projector displayed the main scenes of the garden, including the Gate Tower, steps, garden terraces, and trees. The second, the ground projector (see Figure 21), displayed the combination of stone carvings and vegetation on the ground. These projected images were covered with real fallen leaves. The third is the pond surface projector, which is a mini projector that transmits a watery blue image onto the reflective material on the pond surface, creating a tranquil and ethereal atmosphere in a corner of the garden.

5.1.2 Exhibition Elements

Before visitors enter the exhibition, a wall tag greets them at the entrance, introducing my study and a request to complete a user survey on their experiences (see Figure 22). The exhibition itself was introduced as follows:

Land of Idyllic Beauty

An immersive traditional Chinese garden. Experience the exquisite craftsmanship of ancient architecture in sunrise and sunset. Understand the wisdom of courtyard culture with physical and digital presentations.

5.1.2.1 Vision

I made the framed arch that mimics ancient Chinese doorway by hand-cutting from white foam panels (see Figure 23). Then, I used the shelf in the studio as the base, glued the foam board and filled the space between the foam, making sure to put together all the foam to make it stand up properly. The main projector projected the sunrise and sunset animations from my 3D digital model directly across from this doorway, an attempt to produce visual continuity between the two immersive experiences (see Figure 24).

The projector hanging from the ceiling showed the pavement with stone carving and grass. At the same space, I also spread real fallen leaves to enhance the sense of realism (see Figure 25). In the corner of the garden, I created a pond using metallic material that reflected blue light, mimicking the play of light on

flowing water. As discussed earlier, I also used brown heavy weight paper and spray paint to create fake rocks (see Figure 26).

Another component of the exhibition was the rockery wall, inspired by the Suzhou Museum. Keeping with the process of making fake stones, the mountain peaks were created through paper cutting and the texture of the mountain was enhanced with spray paint. At the center of the wall is a column of blurred ancient bronze mirrors, implying that the visual effect of space is expanded through mirrors (see Figure 27), another technique of creating “artistic mood.”

5.1.2.2 Proprioception

When visitors stepped on the real leaves, they heard the crisp sound which resonated with being outside in nature. Since I had constructed a garden, I used fragrance to bring the floral scent and included recorded nature sounds (for instance, flowing water and insects chirping) as a background sonic landscape.

Rocks, ponds, leaves, and tree all carry spiritual meanings in Chinese culture. For example, pond can reflect moon, flower, trees and architectural details to create a feeling of expanded space.

5.1.2.3 Imagination

When the projected sunrise and sunset scenes pass through the doorway, they leave a shape on the wall after being obscured, and this shape is similar to the shape of traditional Chinese porcelain -- blue-and-white porcelain (see Figure

28, 29), at least for those familiar with the form. It was my hope, at least, to evoke that image in their imagination.

5.2 Digital Project: A VR Trip to a Chinese Courtyard in Mid-Autumn Festival

5.2.1 Project Purpose

The study of Chinese architecture is against the times. In recent years, Chinese life has tended to westernize amidst dramatic changes, and society in general has destroyed China's inherent architecture. The historical landmark buildings that have been standing for hundreds of years and the local color that are full of special artistic interest are a remarkable manifestation of a country's culture, but they are also often sacrificed under the flag of "improvement" and "innovation".

While urbanization conflicts with traditional architecture, those ancient Chinese buildings that witness the history and wisdom of the nation are in danger of disappearing and gradually fading out of sight. Based on the characteristics of ancient Chinese architecture and the intuitiveness of historical culture, this project creates a fictitious traditional Chinese architectural scene, and uses VR to allow users to experience the beauty of a Chinese courtyard and also learn about the knowledge about Chinese traditional culture.

This second project, entitled "A VR Trip to a Chinese Courtyard in Mid-Autumn Festival," is an expanded work from my Constructing Immersive Virtual

Worlds class. After two rounds of revisions, I finally developed this project into an exploratory learning VR application.

5.2.2 The Prospect Narrative

For the digital project, I was again inspired by a Chinese idiom of Shi Wai Tao Yuan (Land of Idyllic Beauty). It comes from Yuanming Tao's prose. This idiom originally refers to the ideal realm where people live in peace and happiness, isolated from real society. Nowadays, it also refers to a place where the environment is quiet, and life is peaceful. It is used as a metaphor for an imaginary, isolated place.

In addition to this idiom, I was also inspired by the Mid-Autumn Festival. One of the most significant holidays in Chinese culture, the Mid-Autumn Festival is as well-known as Chinese New Year. The Mid-Autumn Festival has a more than 3,000-year history. On the 15th day of the 8th month of the Chinese lunisolar calendar, which corresponds to mid-September to early October on the Gregorian calendar, the event is celebrated under a full moon at night. The Chinese think that the Moon is at its brightest and largest on this day, which also happens to be harvest season during Autumn.

Lanterns were once employed as lighting devices; today, they are handicrafts and ornaments, and people light them during the Mid-Autumn Festival to represent family reunions and to pray for good fortune, illuminating

their way to success and fortune. Therefore, I will combine my research on traditional Chinese architecture, especially the architectural style of the Qing Dynasty, to create a purely virtual paradise, hoping that users can stroll through this courtyard, holding lanterns, exploring and appreciating the beauty of traditional Chinese architecture.

5.2.3 Design Process

First, I used MAYA to build my 3D model for courtyard, and to design Yijing and create mood in the scenes, I shaped my model by closely adhering to what is known about actual historical buildings. Then I selected suitable texture to apply in different areas in the model, such as stone floor, color painting door, tile roof. I added more details and patterns to the texture, enhancing its vividness and realism. Based on the traditional Chinese landscape style, in Unity I built the courtyard in a mountainous setting surrounded by a variety of flowers and trees to create a tranquil and remote atmosphere.

To ensure that the overall courtyard could be seen clearly, I set the overall setting at dusk by setting the directional light color to a darker bluish hue that also accentuated the illumination of the lantern. In the lantern geometry, I placed a point light source at the bottom so the lantern would illuminate objects like a real lamp. By adding a scale corrector and an attachment point to the lantern's

handle XR Grab Interactable, the user can grab the lantern in the center of the handle and orient in a desirable direction.

Based on feedback from class, I first modified the original model to make the VR scenes more realistic. Specifically, I made adjustments such as changing the sky from daytime to an evening setting for admiring Mid-Autumn full moon, adjusting the ratio of the user to the building to make it more reasonable, fixing the overlay effect of leaves to make the visual effect more realistic, and tweaking details such as the user's perspective.

Then, based on feedback from user research in this study, I upgraded the original format by adding a teleportation function that allows users to switch locations and informational popups that convey the details of traditional Chinese architecture, enhancing the project as an exploratory learning VR application.

5.2.4 Experience Process

In the final version of the VR project, before the experience begins, users need to watch a VR device introductory video.⁶⁰ In the video, I mainly explain how to put on the headset correctly, adjust the earphones, use controllers for interaction and other steps, to help users better familiar with the equipment and operation process, which is beneficial to get a better user experience.

⁶⁰ Sunny Gao, "VR Introductory Video," *www.youtube.com*, March 29, 2023, <https://youtu.be/N32LYNy0acM>.

After user watches the introductory video, I leave them with a task prompt: pick up the lantern. Upon picking up the lantern, a pop-up window tells the user the current scene setting, and their VR exploration begins: “Suppose it's in the twilight of the traditional Chinese Mid-Autumn Festival and you come to visit a peaceful and isolated Chinese courtyard, feel free to explore and try to grab each lantern!” Once users click to “Let’s go”, they can use the controller to navigate and relocate within the courtyard, and they also have the option to interact with every lantern in front of certain architectural elements in the scene to gain knowledge about Chinese ancient building and culture (see Figure 30). It is worth mentioning that the background music is from a young Chinese artist’ work⁶¹, and I hope that the younger generation can work together to preserve and promote the traditional culture.

The first thing that catches the attention is the garden located directly in front of the user. When the user touches the lantern in the garden, there is an elaboration about the Chinese garden Yijing (see Figure 31). The user can then walk around the garden and see the architectural details, such as timber frames, windows, and doors, and stone carvings of the stairs (see Figure 32). Various plants bring nature to garden, symbolizing life, growth. The garden is surrounded

⁶¹ Mengyuan Xu, *China-X*, 2016.

by a variety of trees designed to create a Fengshui treasure. It is also the demonstration of the unity of heaven and man.

After users have enjoyed the view of the garden, they can choose to return to the main scene of the courtyard. At this time, they notice the lantern located in the middle of the Siheyuan. When they grab this lantern, a narrative focused on the Yinyang symbol Bagua will appear, introducing the role of the Yinyang philosophical concept in traditional Chinese culture (see Figure 33). And Bagua also equal to a compass used to position a building.

Once users learn the meaning of Bagua, they can freely move about by teleporting using the controller. When they teleport to one end of the courtyard, the lantern in front of the door will display background knowledge about the courtyard to help users better understand the symmetric building they are in its relation to Chinese-style immersion (see Figure 34).

Users are likely to notice the painting on the door frame when admiring the traditional doorway, so when they touch this lantern placed in front of the door, according to the pop-up introduction, they can have a more in-depth understanding of this architectural color painting (see Figure 35).

When traveling through the courtyard, users can also look up at the sky. Because the scene is set in the evening of the Mid-Autumn Festival, there is a full moon, representing a wonderful reunion (see Figure 36). In the traditional Mid-

Autumn Festival, people hold lanterns to enjoy the moon, so users can also have the same experience in VR.

Finally, the user teleports to the other end of the courtyard, where a lantern is placed on the ground. When the user touches this lantern, they are prompted to look at the beautiful stone carving on the ground (see Figure 37). At the same time, users can use the lantern to illuminate the building to see the details and can also place the lantern in any position they like, making the exploration journey full of interactivity (see Figure 38).

6. User Research Analysis

With the purpose of measuring immersion both subjectively and quantitatively, I designed two user questionnaires of approximately 15 questions. In this chapter, I will present my research questions and analysis results in detail.

My first goal for the questionnaire was to understand the users personas by asking about visitors' backgrounds. User personas are important in user surveys because they help UI/UX researchers gain a deeper understanding of the identities and personal histories of study participants. Personas are fictional representations of different types of users, based on real data and insights gathered from user research. They help to humanize user data, making it easier for me to empathize with and design for the needs, goals, and behaviors of different user groups.

Then I sought to learn each user's definition of immersion. By asking specific questions about what aspects of my project made users feel more immersed, I hoped to gain valuable insights into what elements of my project were working well and what areas needed improvement. Next, my surveys asked questions about participants' familiarity with traditional Chinese culture to see if my immersive experiences might enhance their interest in exploring more information about Chinese architecture. Finally, I asked each user for a numerical rating of their experience so that I could get an overall sense of user satisfaction.

6.1 User Persona

Are you a student/faculty/staff?

If you are student, what's your major?

How did you first learn about my project?

Did you know anything about Chinese traditional culture before?

From the above questions regarding the users' background, my survey sought to obtain information on my users' identities, which I hoped to analyze for the purposes of abstracting a "typical" user persona. In the exhibition, the most typical audiences were students of art and media-related majors, among which undergraduate and graduate students predominated. In the VR experience, most of my users were students majoring in computer science and art, and nearly 89% of them had had experiences with virtual reality before.

Gratefully, 35 visitors participated in the surveys, 86% of them are students, and 14% of them are faculty and staff. And most of the users (73%) know something about traditional Chinese culture, and only a few do not know anything at all.

The source of my visitor pool came primarily from my own invitation (64%) but also included my Expanded Cinema classmates (19%) and 15% participated on a friend's recommendation. Only one participant spontaneously decided to attend the exhibition.

Based on personas, I can revise my project to yield richer insights into user needs, behaviors, and preferences. This can lead to more user-centered and successful designs.

6.2 User Journey

Figure 39 is a user journey map I created through Figma, illustrating my thinking and logic in conducting user research. In my user experience research, the first step is to solicit participation, I use email, poster, and verbal invitation to find users who are willing to be in my research.

Because my project involves human subjects, my user research was subject to University IRB review. For this reason, I spent a lot of time considering a series of issues such as user privacy and security. Because of human subject research protocols, before starting my research questionnaire, the user needs to acknowledge that they understand my student and explicitly agree to participate in it.

Once exhibition visitors consented to the study, they were asked to spend approximately 10 minutes in my art installation and then to scan the QR code at the exit to take the Qualtrics survey. This survey included a question at the end inquiring whether or not they wished to participate in virtual reality component of my study. If they answered yes and left their contact email address, I invited them to take part in the virtual reality component.

A similar process was undertaken for the VR component, with users first learning about the nature of my study and consenting to participate. They each had approximately 5-10 minutes to explore the VR experience. Upon completion of that exploration, users were asked to complete another online survey about their feelings while experiencing the virtual reality Chinese courtyard. Those interviewees who participated in both projects allowed me to compare the differences in immersive experience between the digital and physical versions.

6.3 User's Definition about Immersion

In both user surveys, I asked users about their first impression of immersion: *When it comes to Immersive Experiences, what is the first thing that comes to their mind?* Some visitors wrote about virtual reality, and one specifically mentioned a way to make virtual reality more realistic: in ultra-wide screen ratio. Another part of the users mentioned multi-sensory experiences (complete usage of the senses with an experience), something that “takes you to another world. An experience that generates feelings or emotion in another space or memory (emotional arouse)”. And there are some other answers that are also worthy of mention, such as a sense of presence, a “sound bath,” nature trees, “all around interaction” and even murder mystery game!

Regarding the definition of immersion, the responses from participants in the VR trip were generally more in favor of virtual than those from the exhibition,

and when they talked about immersion, their first responses referenced the idea of “flow”. One visitor wrote: “Going to a place where the surroundings mimic a different location and let you look around and interact with things, like Disney World or a game room that has obstacles and things.”⁶²

How would you describe or define an immersive experience? Digital, practical, participatory, physical, site-specific, and embodied are the users’ understanding of the characteristics of immersion. Some people considered being deeply engaged to the point of losing track of time and space as an immersive experience. And they believed a full experience combined with different sensory stimulus including tactile, smell, sound, and other interactive components to help recreate a space or feelings. And making people feel like they are exactly in an environment that created by the creators, involves being transported to a different reality to gain new knowledge and understanding. Also, mutual communication, there is a two-way interaction between the audience and the scene rather than the audience acting as passive learner.

Therefore, immersion refers to the feeling of being fully involved or absorbed in an experience. It can be achieved using various mediums, including

⁶² A response in the Immersive VR Trip User Survey

multimedia, to create a sensory-rich environment that engages the user's emotions and senses.

6.4 User Feedback in the Exhibition

6.4.1 User Experience

Tell me about your experience in this art installation. And which part(s) of your experience with my installation would you describe as "immersive"? Why?

Two responses stood out to me, and I include them in their entirety here. One user wrote:

The art installation is great for visitors who are interested in Chinese traditional architecture or Chinese gardens. The design of the pavement, which is probably designed in 3D models and is projected on the floor of the room, helps me be immersed in the scene as if I am walking in a virtual place. The animation in the scene also persuades me that the objects are real in some virtual space because they are moving.⁶³

For this user, the fine design of the 3D model, the animation of sunrise and sunset, the rich projection and other digital means enabled immersion in the Chinese garden scenery.

⁶³ A response in the Immersive Exhibition User Survey

A second visitor wrote: “The modeling scene is fantastic, the background sound is very real, other auxiliary decorations also help the environment more immersive. I wasn’t sure if I was supposed to walk through it. I was fooled by the Styrofoam; I thought it was wood.”⁶⁴ This answer made me sure that the auxiliary decorations were crucial, since I used a sonic background that mimicked a real garden and some electronic candles to render the atmosphere in the scene. At the same time, the use of projection introduced a deliberate visual distortion of the material that is appropriate to the context, resulting in an enhanced sense of immersion for the user.

In addition to these two responses, the feelings of other visitors can generally be divided into three groups. Some said they enjoyed the tea lights and the feeling of looking through the archway, the elaborate physical structure plus the digital experience. They thought it was amazing to get to experience tangible media and experience it in real time, contributing to the feeling of being in an actual garden. Some thought the full-sized projection was effective at creating an immersive world because it blurred the line between reality and fantasy. Others liked the interaction of the visuals with the physical objects such as the leaves and pond. The audio and real shadows overlapping the video projections helped

⁶⁴ A response in the Immersive Exhibition User Survey

making the space more immersive for some visitors. Other visitors commented that the installation was “[a] wonderful combination between sound visuals and smell. The dimensionality of the space is well thought and interesting to engage with,” indicating to me the importance of multisensory engagement.

If the above represents the positive feedback from participants, what elements were seen as detracting from an immersive experience? There were three factors that people thought diminish their experience of immersion (see Figure 40). First, the doorway material. “The arch which is made of foam board may diminish my experience of immersion. The reason is that I know the arch is made of wood generally. So, when I was walking in this room, the material of the arch stood out for me.” Since they felt that the Styrofoam was very different from what a wooden arch looks in natural world, their experience of immersion was reduced. I definitely considered this material factor but was limited by the fact that I had no background in construction engineering, so instead of carving wood, I chose to cut and put together foam boards that were within my ability to work with. Even so, I share visitors’ dissatisfaction with some material selections.

The second detracting element was the shadow left by the projector. Some visitors wrote that projection was blocked by the door, leaving a strange shadow on the main projection visuals that prevented seeing the full visual image. An item set in front of the projection on the floor also rendered part of the

background in black. However, for me, the contrast between light and shadow was precisely a mood that I had aimed to achieve. I intended to position the projection directly opposite the door, so that its light would shine directly over the framed arch, casting a shadow resembling that of a Chinese vase. While this setup was somewhat abstract, I am thankful that some of the audience members accurately guessed my intentions in their feedback. Additionally, the projector hanging from the ceiling was added specifically for my exhibition at a later stage, and as a result, it used an extended cantilever. Consequently, the projected image could not occupy the entire floor space, leaving a black area.

The final detractor was the fact that my installation co-existed with others in a larger exhibition space. One visitor said that they would prefer to experience it in a room free of other distractions and objects and other exhibits. He/she indicated that they were unsure where my installation ended, and the others started. This objective factor indeed affected the immersive experience, but space limitations required me to share the Ruby painting studio with another student. Unfortunately, we both experienced sound and light overlap, which inevitably affected each other. However, in reality, it is often challenging to achieve perfection and allocate resources efficiently. In these situations, all we can do is strive for subjective creation under objective conditions.

6.4.2 Review

Another aspect of my study sought to understand how immersion relates to a desire to learn more about Chinese culture. *Do you think this exhibition will encourage you to seek out more information about Chinese traditional culture?* 38% of audience replied, “definitely yes,” and 17% of them said “probably yes,” while 38% of visitors were lukewarm in their response. 8% of visitors said that the exhibit did not increase their interest at all. Users who felt more immersive were more likely to want to seek out more information about how to construct the architectural elements and the cultural meanings behind them. Overall, the predominance of affirmative voices highlights the significance of pleasure for prompting the desire to learn more. This is important to me because, as stated earlier, drawing interest in and attention to traditional Chinese architecture - a treasure that is rapidly disappearing in many places, particularly in today's modern urban era - may well be necessary for wider public support for its preservation.

Additionally, I surveyed the audience to determine if they had encountered a similar art installation previously. The most popular answer was the Van Gogh exhibit, which can be considered as the audience's prior experience for my study even though they think it contained fewer physical aspects.

Accordingly, positive feelings about immersion can be related to users' prior comparable experiences. If users have had positive immersive experiences in the past, they were more likely to appreciate and recognize immersive elements in a new experience, leading to a greater sense of pleasure and enjoyment. The final two questions were the audience's recommendation of my exhibition and the rating column. I am grateful to have 62% of them extremely likely to recommend my project to a friend and 25% Somewhat likely. What's more, 62% of the visitors gave a perfect score of 5 and 38% gave a score of 4.

In summary, users' prior immersive experiences can significantly influence their perception and enjoyment of immersive elements. The feeling of immersion can contribute to pleasurable emotions and a greater sense of engagement, resulting in an overall positive user experience.

6.5 Usability Testing in VR Trip

This usability study used questionnaires to investigate user feedback on VR trip. Since it is applicable to VR usage, it is more like a product, an application. Therefore, I think using the term "usability testing" to collectively refer to the research results in the context would be more professional and accurate. Before moving on to the final version of VR trip, I conducted a usability test after the first revision to evaluate my project's performance and spot any improvements. I

received constructive feedback through questions that focused on which settings could improve or be changed to enhance the immersive experience for visitors.

The initial enhancement was to address the issue of users' lack of familiarity with VR equipment. During the experience, I noticed that even though I had explained how to use the controller for interaction beforehand, many users were completely unaware of its functions, making it difficult for them to understand the purpose of the various buttons, leading to unsuccessful interactions halfway through the experience. To solve this problem, I designed and edited an introductory video for my project to allow users to understand how to use the VR device before they start the experience, driving the subsequent immersive experience. Specific video introduction please see Chapter 5 VR project experience process.

The second issue I attempted to mitigate was the sense of danger that arises from users' unfamiliarity with the physical space in which they are standing when wearing VR headsets. Unfamiliar with and unable to see their actual surroundings, the experience of immersion can significantly be diminished by apprehension. For example, users may become anxious about accidentally encountering obstacles such as tables, chairs, or walls while exploring with the headset blocking visual access to the actual room. At the outset, I aimed to create a simulation of the real world, where people could walk around the courtyard to

appreciate the beauty of traditional architecture. However, after conducting tests, I realized that this original intention was challenging to accomplish. Therefore, I opted to increase the usage of the controller to allow users to switch views and positions conveniently without having to walk around themselves. This approach ensured users' safety while still providing an immersive experience.

The third discovery was that users tended to become disoriented within the VR scene. As a result, I concluded that it was necessary to incorporate more guided interactions to help users navigate the experience. For instance, I added a lantern that could serve as a guide and prompt users along the way, providing them with cultural insights and reminders about key features of traditional Chinese gardens.

The feedback likely came from users who had previously experienced the setting and were able to identify areas for improvement based on their own experiences. By considering that feedback, I made informed decisions on how to optimize the setting to create a more engaging and immersive experience for users.

6.6 Reflection

Based on two separate user studies, I discovered that the concept of immersion remains consistent across different scenarios. Participants generally view immersion as the capacity to transcend time and space and escape from the

real world, requiring the integration of multiple senses to achieve a complete experience. As such, we can conclude that the ultimate goal of achieving immersion remains consistent across various contexts.

When comparing digital VR experience and physical exhibitions, I noted several significant differences. In terms of scale, the physical space of the two projects is approximately the same, but VR provides a greater expansion of space. VR also offers a higher level of realism, akin to flat animation, and more interactive possibilities, which allows users to experience the scene as a character. The virtual world boasts more intricate building and visual details, and the interactive lighting creates a more engaging experience than physical exhibitions.

On the other hand, the physical exhibition was tactile, allowing the audience to touch real materials and feel the physical texture, which is not possible in VR. While VR art installations emphasize creating a sense of atmosphere and evoke emotions, they usually do not include physically interacting with actual objects. Instead, they rely on a more vague sense of haptic feedback, if at all. Additionally, the most significant difference between physical exhibitions and VR is the lack of a head-worn device, allowing for sensory stimulation without the need for any special equipment like the headset. And physical approach will be more accessible for people without VR experience.

However, when experiencing VR, users are aware of their actual surroundings, even when they are facing a landscape or an ancient courtyard, they can feel that they are actually standing on a wool carpet. They may attempt to touch ordinary objects such as tables and chairs, but they are ultimately in a laboratory, which alters the overall experience. Therefore, the feeling in VR differs from that of a physical exhibition.

Simultaneously, the two presentation methods are suitable for different circumstances. When the availability of real-life settings is restricted and users face challenges in overcoming objective constraints such as time and space, digital approaches can offer significant advantages. For instance, during the COVID-19 pandemic, offline meetings have become challenging. However, to establish a conducive environment for collaborative learning or brainstorming, students or professionals can don VR headsets from the comfort of their homes and enter virtual classrooms or conference rooms. This digital approach provides a sense of immersion as if they were present in the actual setting, surrounded by classmates or colleagues and instructors.

Nevertheless, in my opinion, to establish a profound sense of immersion, physical presentation should be the primary means, with digital methods serving as supplementary means to achieve this goal. Even if the virtual world is designed to resemble reality, the user's awareness that it is not genuine. This psychological

implication can greatly reduce the sense of being fully immersed in the experience. As a result, only when the user is surrounded by the physical world can he or she truly enter a state of complete immersion.

7. Conclusion

After conducting user research in the last chapter, I gained numerous new experiences and developed several aspirations for the future of immersion.

Primarily, the majority of respondents in this survey were directly invited by me, and many were already familiar with me. This made me recognize how difficult it can be to conduct a user survey without a pre-existing connection even though we handed out more than 100 flyers on the day of the exhibition.

Considering ways to expand the scope of user research is an important question.

However, my projects are typically based on research conducted within Duke, so many respondents are Duke students. Nevertheless, I was fortunate to be able to invite friends from UNC to participate in the questionnaire. If in the future, I need to obtain user research data on a larger scale, distributing invitations to various communities and using social media platforms, such as Instagram, Twitter, Facebook, and Reddit, would be a viable solution. This approach could lead to a more diverse database and enhance the overall applicability of the final research.

Adding more user interaction can enhance the immersive experience and make it more engaging for the users sounds like a great idea for the next step of my digital VR project. The idea of incorporating plot settings is an excellent way to create a more immersive experience. By providing users with special role-playing tasks, you can allow them to become more involved in the story and feel

like they are part of the experience. Additionally, traveling through different courtyards to collect evidence can make the experience more dynamic and interesting, while also allowing users to learn more about traditional Chinese architecture.

The use of digital technology, such as AR, can also enhance the user's experience in my physical exhibition. By incorporating AR, I can provide audiences with additional information about Chinese traditional architecture or interactive elements that they can access through their mobile devices. User can be in the physical environment, but also through the screen zoom in and out to see more digital details.

Based on the above reflections, if users desire to achieve a higher level of immersive experience, I look forward to designing a series of immersive role-playing games in the future. After arriving at the game location, players will need to choose their preferred script and then prepare by dressing up and applying makeup before entering a small space. The game will start with a VR experience, aimed at separating users from the real world and immersing them in a virtual Chinese courtyard scene, allowing them to feel attracted and better enter the role-play. After a short time in the VR experience, users will take off their headsets and, with guidance, open the door in front of them to enter the real courtyard space. At this point, they will be introduced to use AR to search for more

information in the real-life venue, as AR can allow players to notice more details and increase interaction with the physical environment. Finally, players will achieve an unparalleled immersive experience.

If users expect to have a long-term and personalized immersive experience, daily experiences can also be a great way to achieve this goal. Users can customize their preferences and the platform will provide daily experience tasks based on user data analysis. For example, today's task could be to experience socializing and creating poetry in a virtual courtyard, while tomorrow's task could be to build an archway, and so forth. At the same time, players can also choose their mood to obtain corresponding environmental sounds, weather settings, and even seasons.

Regarding the multiple possibilities to achieve an immersive world, there are in fact many more than just Virtual Reality and Exhibition, including but not limited to Augmented Reality, Mixed Reality, Holographic Displays and Brain-Computer Interfaces. In today's fast-paced world, designers face a challenge to create immersive experiences that captivate their audience's attention, whether it's through digital or physical mediums. To attain this goal, designers must be flexible and use multimedia strategies to compensate for the limitations of one medium by taking advantage of the capabilities of another medium, in order to produce more immersive artworks.

Designers need to consider various factors such as the audience, space, and resources available to them to create an engaging and meaningful experience. For instance, a designer creating an immersive installation for a museum exhibition needs to adapt their design to fit the physical constraints of the space, consider the exhibit's theme, and accommodate the audience's preferences and comfort levels. For example, the use of MR in the exhibition, the use of high-resolution large screen, offers designers exciting opportunities to create immersive experiences that break down the barriers between the virtual and physical worlds.

Similarly, a digital designer creating an immersive game or app needs to break through the limitations of the digital medium to create a more realistic and engaging experience. They need to consider the user's device, the user interface, and the user's interaction with the digital environment. Perhaps, the future of VR will become more lightweight, users do not need to carry heavy headgear, which can greatly enhance the immersive experience of users.

In summary, to create immersive artworks that stand out in the modern age, designers need to be adaptable and innovative. By breaking through the limitations of some medium and keeping the local conditions and audience needs in mind, designers can push the boundaries of creativity and create truly

immersive and impactful artworks that leave a lasting and pleasurable impression on their audience.

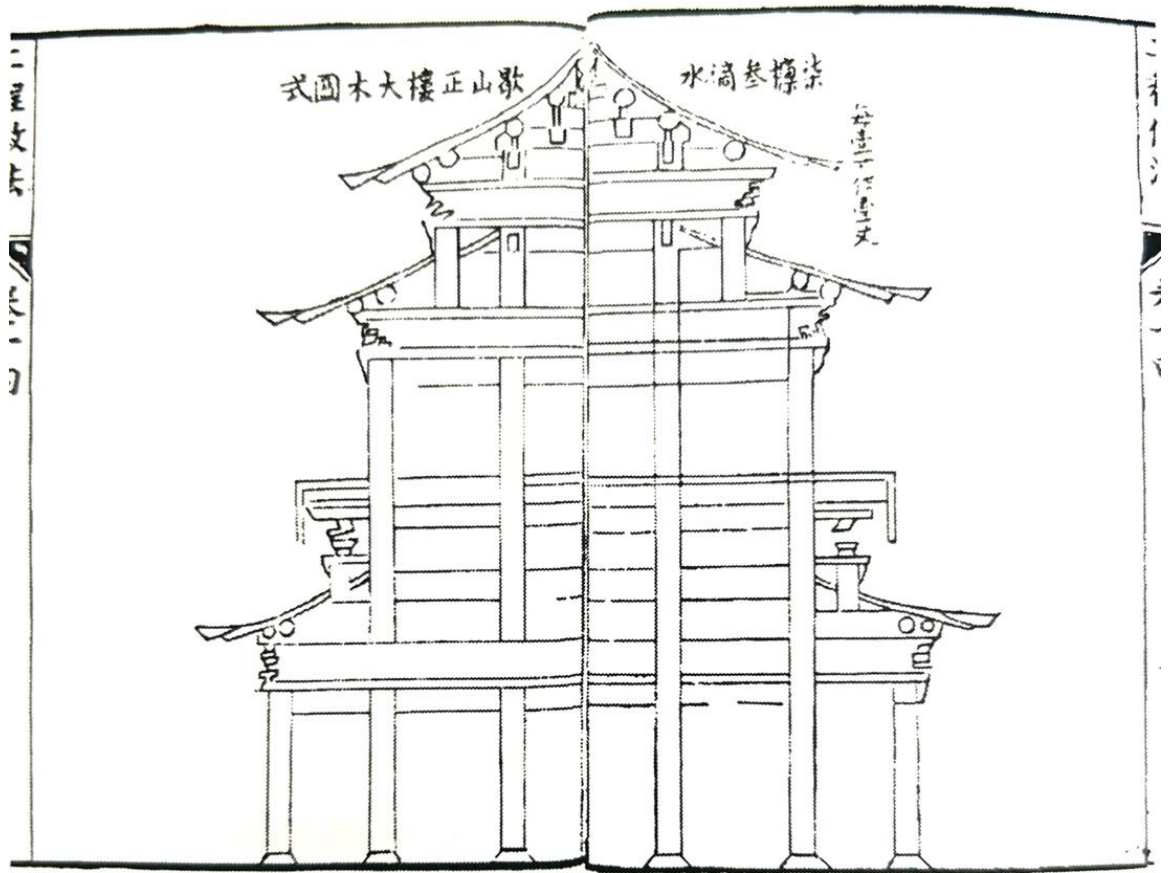


Figure 2: The Qing building style.⁶⁶

⁶⁶ Qing Gong Department, *工程做法* (Construction Methods), vol. 14, 1734.

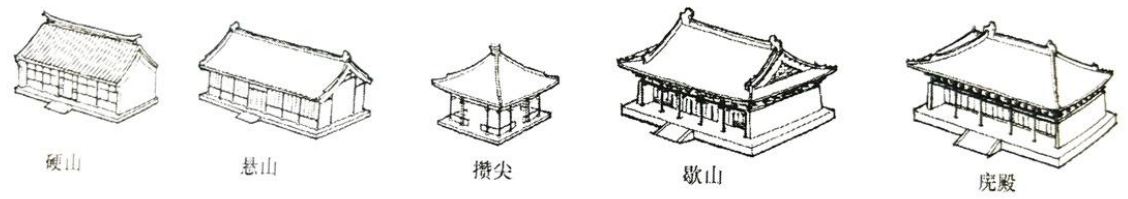


图 8-4 清官式五种基本屋顶类型图

Figure 3: Five basic roof types of Qing official style diagram.⁶⁷

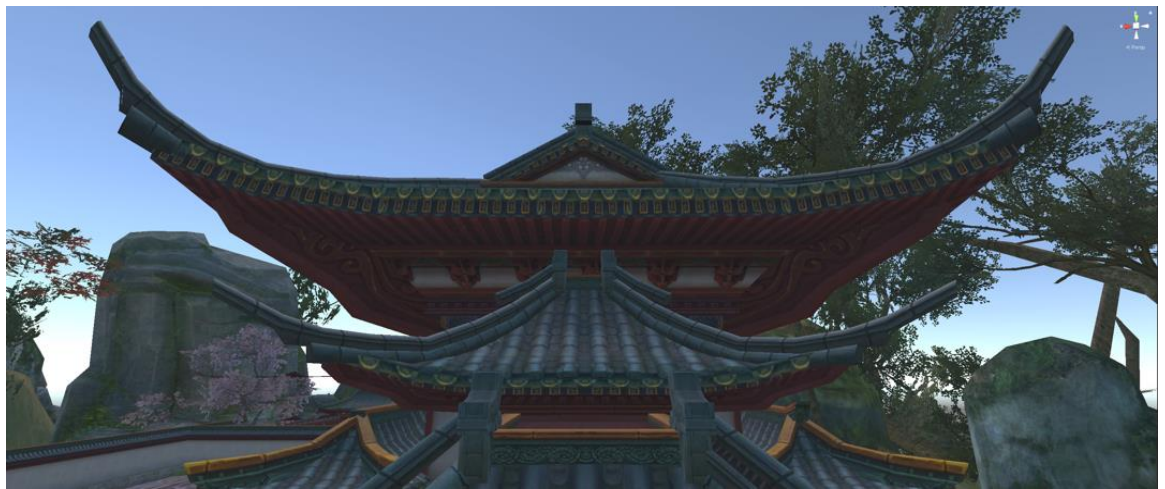


Figure 4: Curved roof in my model.

⁶⁷ Dazhang Sun, *Ancient Chinese Architecture History Series Buildings of Qing Dynasty* (China Architecture & Building press, 2009), Figure 8-4.

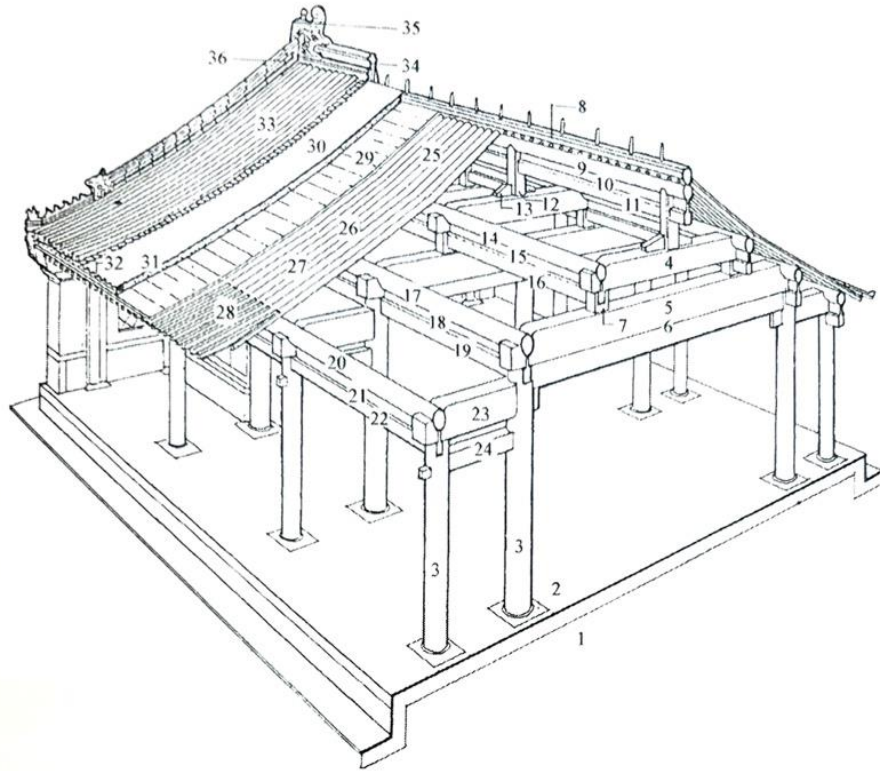


图 8-5 清官式一般房屋构架剖视图

- | | | | | | | | |
|---------|----------|---------|---------|---------|---------|----------|---------|
| 1. 台基 | 2. 柱础 | 3. 柱 | 4. 三架梁 | 5. 五架梁 | 6. 随梁枋 | 7. 瓜柱 | 8. 扶脊木 |
| 9. 脊檩 | 10. 脊垫板 | 11. 脊枋 | 12. 脊瓜柱 | 13. 角背 | 14. 上金檩 | 15. 上金垫板 | 16. 上金枋 |
| 17. 老檐檩 | 18. 老檐垫板 | 19. 老檐枋 | 20. 檐檩 | 21. 檐垫板 | 22. 檐枋 | 23. 抱头梁 | 24. 穿插枋 |
| 25. 脑椽 | 26. 花架椽 | 27. 檐椽 | 28. 飞椽 | 29. 望板 | 30. 苫背 | 31. 连檐 | 32. 瓦口 |
| 33. 筒板瓦 | 34. 正脊 | 35. 吻兽 | 36. 垂兽 | | | | |

Figure 5: Qing government-style general house structure cross-sectional view.⁶⁸

⁶⁸ Dazhang Sun, *Ancient Chinese Architecture History Series Buildings of Qing Dynasty* (China Architecture & Building press, 2009), Figure 8-5.

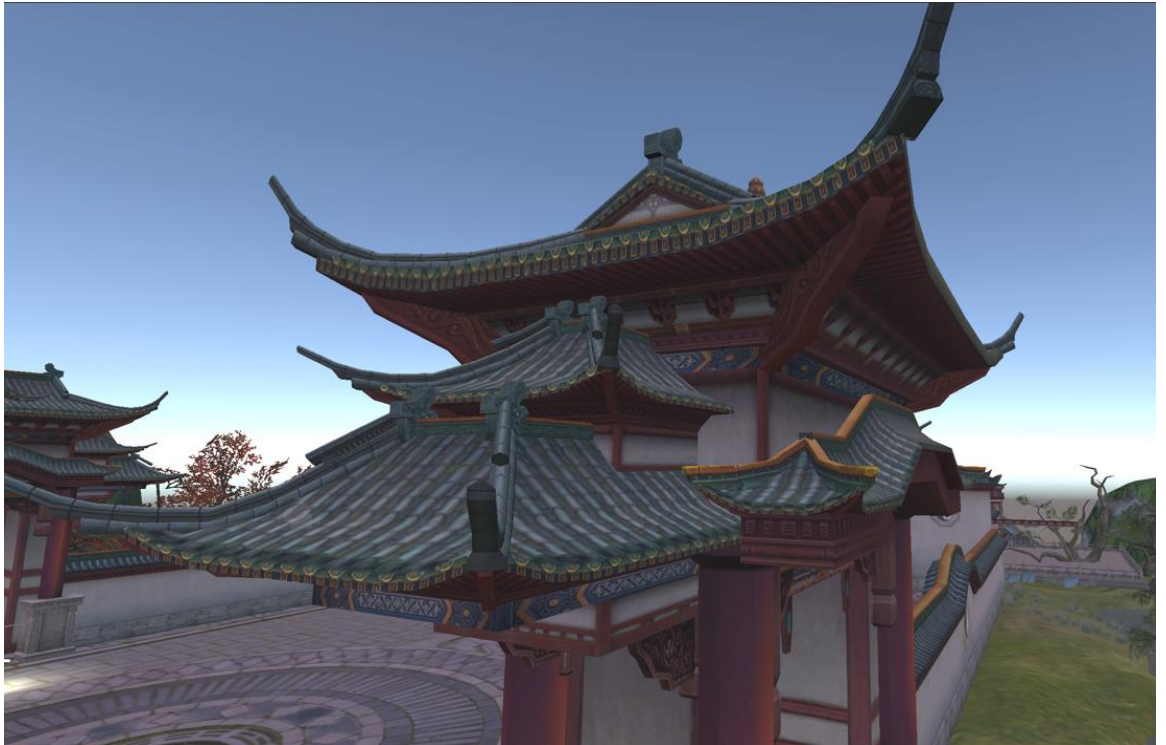


Figure 6: Dougong in my model.



Figure 7: Timber frame in my model.



Figure 8: Color painting in my model.



Figure 9: Six-character truth ceiling color painting.⁶⁹

⁶⁹ Guangquan Jiang, *Qing Dynasty Official Architecture Painting Techniques* (China Building Industry Press Pub, 2005), 266.



Figure 10: Ceiling color painting in my model.



Figure 11: Stone carving in my model.



Figure 12: Garden scene in my model.



Figure 13: Beijing Half Acre Garden Real Photo.⁷⁰

⁷⁰ Dazhang Sun, *Ancient Chinese Architecture History Series Buildings of Qing Dynasty* (China Architecture & Building press, 2009), Figure 4-79.

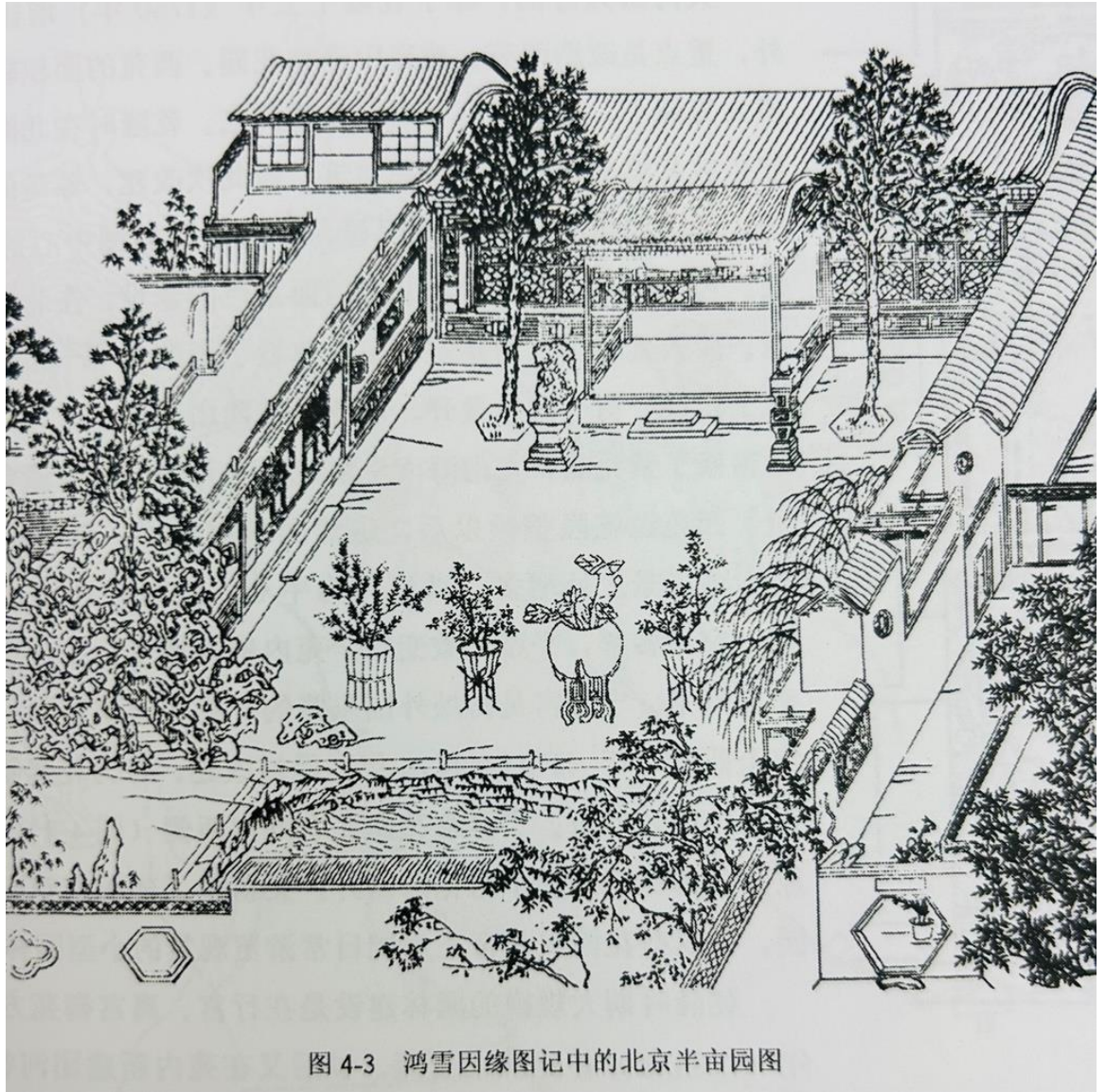


图 4-3 鸿雪因缘图记中的北京半亩园图

Figure 14: Beijing Half Acre Garden Diagram.⁷¹

⁷¹ Linching Wanyan, *鸿雪因缘图记* (*Hongxue Yinyuan Tuji*), vol. 14, 1849.



Figure 15: Panorama of Suzhou Museum.⁷²



Figure 16: Rockery Wall.⁷³

⁷² Suzhou Museum, *Panorama of Suzhou Museum*, 2015, *Suzhou Museum*, 2015, <https://www.szmuseum.com/Other/BuildingMito>.

⁷³ Suzhou Museum, *Rockery Wall*, 2015, *Suzhou Museum*, 2015, <https://www.szmuseum.com/Other/BuildingMito>.



Figure 17: Auspicious Pines in Spring Mountains.⁷⁴

⁷⁴ Fu Mi, *Auspicious Pines in Spring Mountains*, n.d., *China Online Museum*, n.d., <https://www.comuseum.com/painting/masters/mi-fu/>.

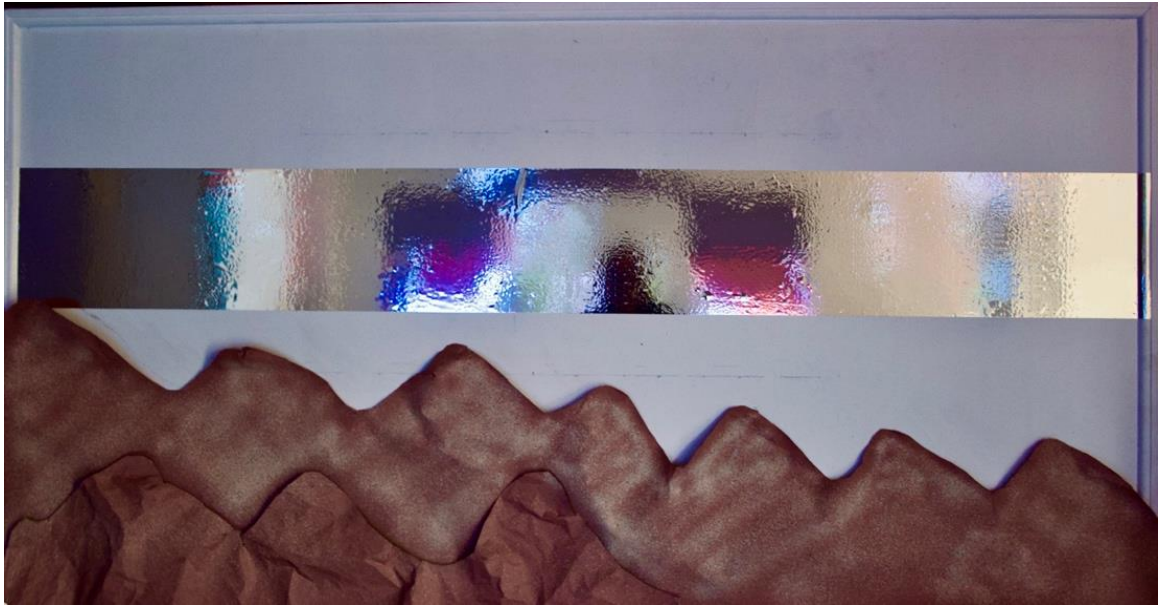


Figure 18: Rockery Wall in my exhibition



Figure 19: Yinyang symbol in my model.



Figure 20: Rockery wall production process.



Figure 21: Hanging projector.

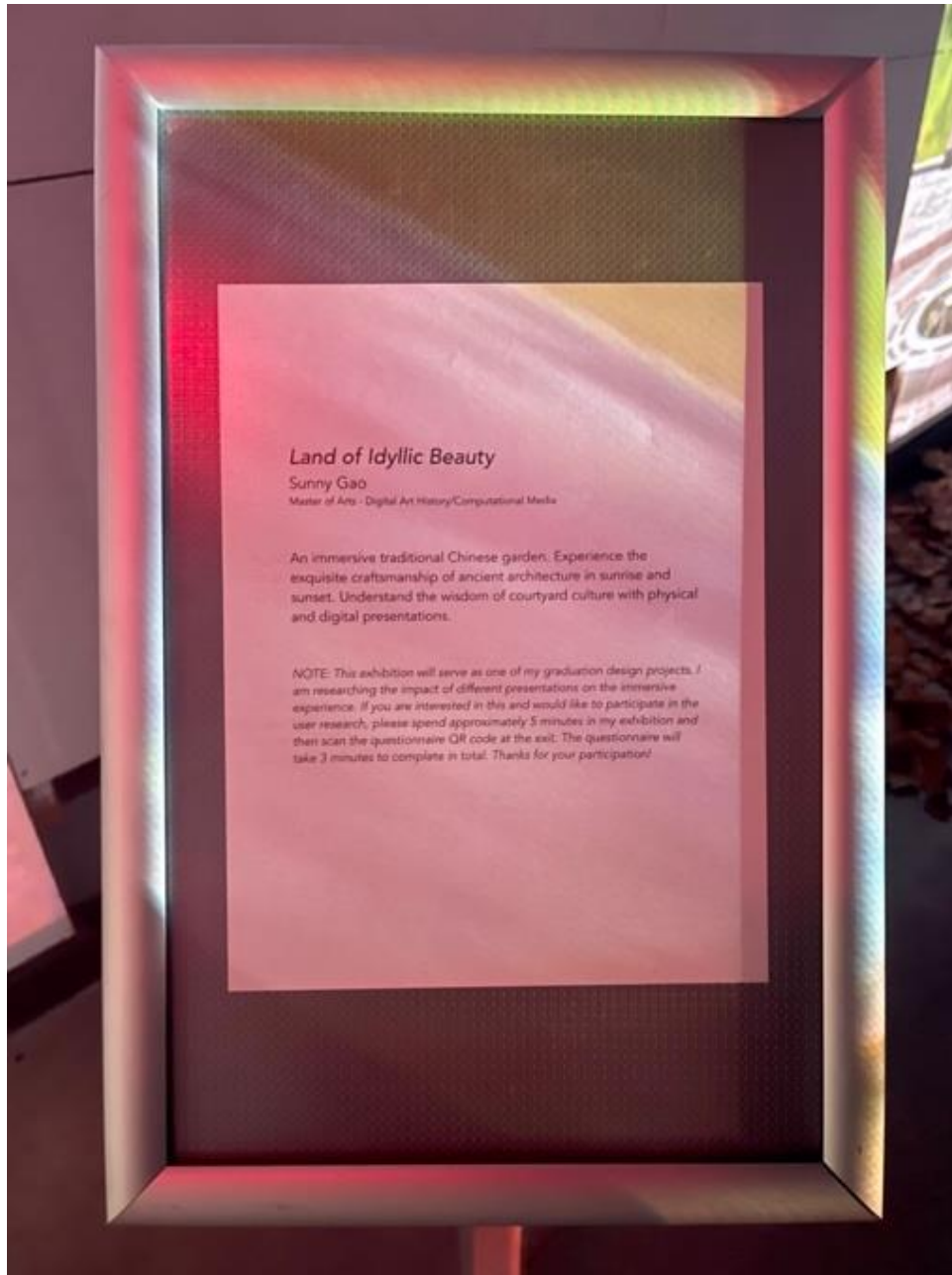


Figure 22: Wall tag.



Figure 23: Ancient Chinese doorway.⁷⁵

⁷⁵ Maggie Keswick, Alison Hardie, and Charles Jencks, *The Chinese Garden: History, Art, and Architecture* (Cambridge, Mass.: Harvard University Press, 2003), 119.



Figure 24: Doorway in my exhibition.



Figure 25: Ground.

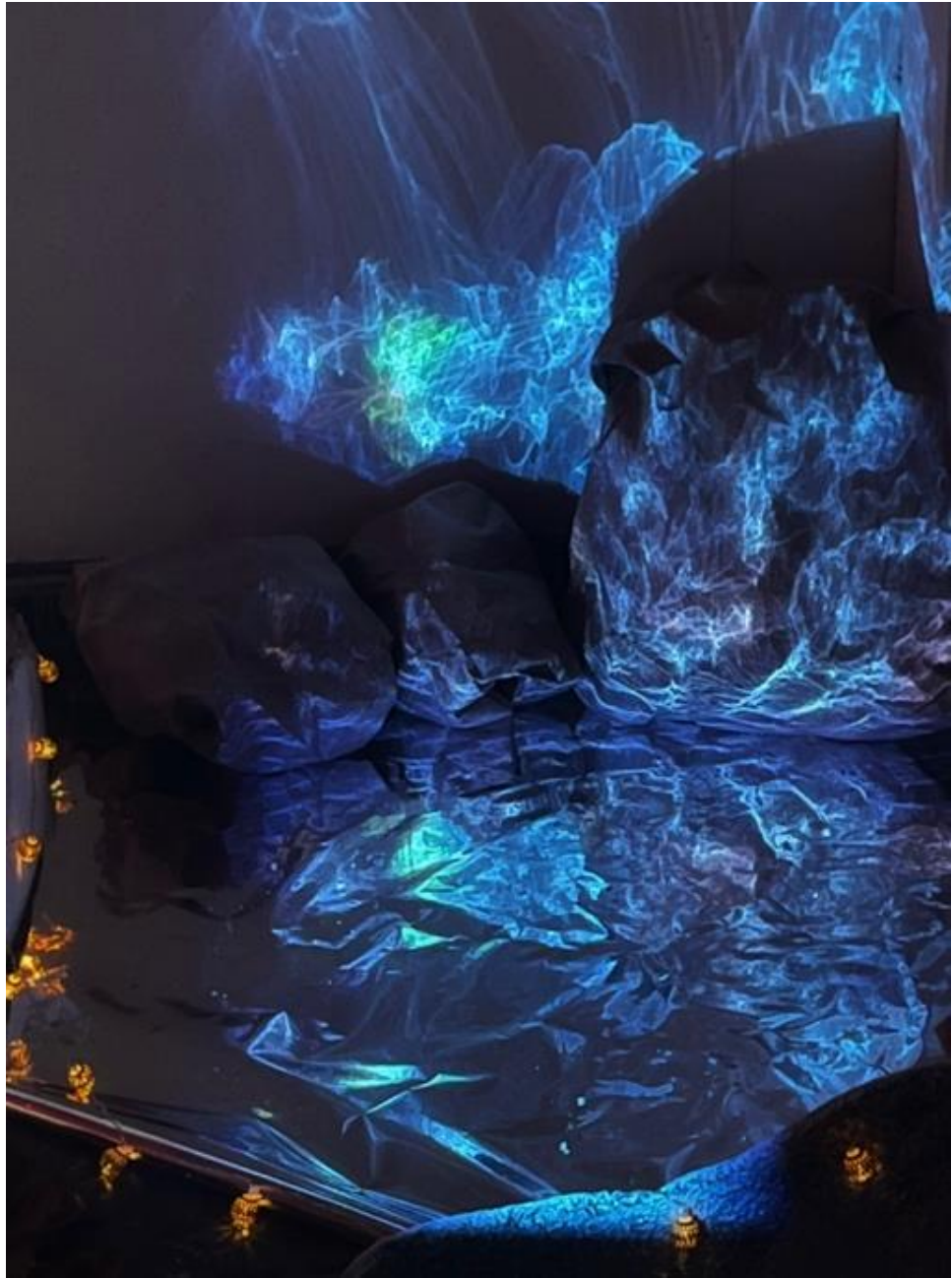


Figure 26: Pond.



Figure 27: Mirror & Rockery Wall.



Figure 28: Sunset Scenarios.



Figure 29: Sunrise Scenarios.



Figure 30: Trip introduction text pop up.



Figure 31: Garden introduction text pop up.

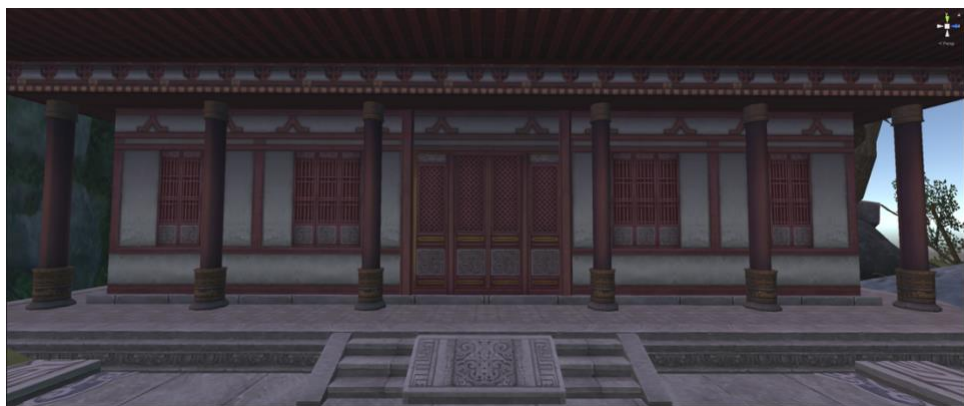


Figure 32: Close view of the building.

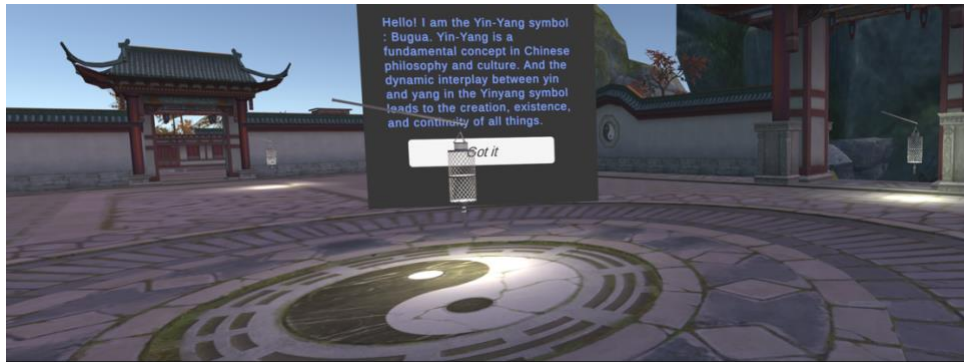


Figure 33: Yinyang symbol introduction text pop up.



Figure 34: Courtyard introduction text pop up.



Figure 35: Color painting introduction text pop up.



Figure 36: Elevation view with moon.



Figure 37: Stone carving introduction text pop up.



Figure 38: Lantern placed on stone carving.

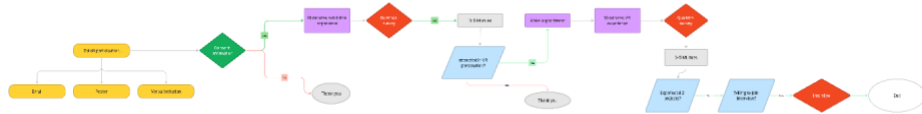


Figure 39: User journey map.



Figure 40: User survey report.

Appendix B: Immersive Exhibition User Survey

Please read the information below carefully and then click next, which indicates your consent to participate in this research study.

1. This survey is part of my thesis research on the multiple possibilities for the realization of immersive world. I am interested in learning the impact of different presentations on the immersive experience.
2. Participation is voluntary. This survey includes questions about your experiences from the exhibition. Answering the survey should take 3 minutes.
3. You may not personally benefit from our research, but I hope my findings will help improve our knowledge and understanding of multiple possibilities for the realization of immersive world.
4. All data used in reports will be presented in groups and averages so individual respondents will not be recognized. Collected data may be made public or used for future research purposes.
5. Your email address may be used to connect your responses to my survey and to a potential invitation to a follow-up interview. I will discard all email addresses once all research data are collected.
6. For questions about this study, please contact me xinyue.gao@duke.edu or my advisor, Professor Mark Olson at mark.olson@duke.edu.

7. For questions about your rights, please contact the Duke University Campus Institutional Review Board at 919-684-3030 or campusirb@duke.edu. It will be helpful if you include Protocol ID#2023-0169 in your communication.

If you agree to participate in this research study, please click the → button below. Thanks for participating.

Q1 - Are you a student/faculty/staff?

Q2 - If you are student, what's your major?

Q3 - How did you first learn about my project?

Expanded Cinema Course

Poster Card

Friend's Recommendation

My Invitation

Occasionally Seen in Ruby

Q4 - How likely is it that you could recommend my project to a friend?

Extremely likely

Somewhat likely

Neither likely nor unlikely

Somewhat unlikely

Extremely unlikely

Q5 - Did you know anything about Chinese traditional culture before?

Yes

Maybe

No

Q6 - When it comes to Immersive Experiences, what is the first thing that comes to your mind?

Q7 - How would you describe or define an immersive experience?

Q8 - Tell me about your experience in this art installation. Please be as descriptive as possible.

Q9 - Have you ever experienced a similar art installation before?

Q10 - If yes, could you please describe it and compare it to my installation in a detailed way (similarities, differences).

Q11 - If review my project with a score out of 5, how would you rate your overall experience with my installation?

Q12 - Which part(s) of your experience with my installation would you describe as "immersive"? Why?

Q13 - What elements of the installation, if any, diminish your experience of immersion? Why?

Q14 - Do you think this exhibition will encourage you to seek out more information about Chinese traditional culture?

Q15 - Are you interested in experiencing another digital project on the same topic as part of my thesis research?

Q16 - If yes, please leave your email address, and I will be in touch with more information.

Appendix C: Immersive VR User Survey

Please read the information below carefully and then click next, which indicates your consent to participate in this research study.

1. This survey is part of my thesis research on the multiple possibilities for the realization of immersive world. I am interested in learning the impact of different presentations on the immersive experience.
2. Participation is voluntary. This survey includes questions about your experiences from the exhibition. Answering the survey should take 3 minutes.
3. You may not personally benefit from our research, but I hope my findings will help improve our knowledge and understanding of multiple possibilities for the realization of immersive world.
4. All data used in reports will be presented in groups and averages so individual respondents will not be recognized. Collected data may be made public or used for future research purposes.
5. Your email address may be used to connect your responses to my survey and to a potential invitation to a follow-up interview. I will discard all email addresses once all research data are collected.
6. For questions about this study, please contact me xinyue.gao@duke.edu or my advisor, Professor Mark Olson at mark.olson@duke.edu.

7. For questions about your rights, please contact the Duke University Campus Institutional Review Board at 919-684-3030 or campusirb@duke.edu. It will be helpful if you include Protocol ID#2023-0169 in your communication.

If you agree to participate in this research study, please click the → button below. Thanks for participating.

Q1 - Are you a student/faculty/staff?

Q2 - If you are student, what's your major?

Q3 - How did you first learn about my project?

In last semester Ruby exhibition

Friend's Recommendation

My Invitation

Q4 - How likely is it that you could recommend my project to a friend?

Extremely likely

Somewhat likely

Neither likely nor unlikely

Somewhat unlikely

Extremely unlikely

Q5 - Did you know anything about Chinese traditional culture before?

Yes

Maybe

No

Q6 - When it comes to Immersive Experiences, what is the first thing that comes to your mind?

Q7 - How would you describe or define an immersive experience?

Q8 - Tell me about your experience in this VR session. Please be as descriptive as possible.

Q9 - Have you ever experienced a similar VR session before?

Q10 - If yes, could you please describe it and compare it to my installation in a detailed way (similarities, differences).

Q11 - Which part(s) of your experience with my VR project would you describe as "immersive"? Why?

Q12 - What elements of this VR project, if any, diminish your experience of immersion? Why?

Q13 - Do you think this VR trip will encourage you to seek out more information about Chinese traditional culture?

Q14 - If review my project with a score out of 10, what score would you give me?

References

- Bachelard, Gaston. *The Poetics of Space: The Classic Look at How We Experience Intimate Places*. Translated by Maria Jolas. Boston: Beacon Press, 1994.
- Baker, Justin. “The Art of Emotion—Norman’s 3 Levels of Emotional Design.” *Medium. Muzli - Design Inspiration*, January 28, 2019.
<https://medium.muz.li/the-art-of-emotion-normans-3-levels-of-emotional-design-88a1fb495b1d>.
- Barber, Michael. “Alfred Schutz.” Edited by Edward N. Zalta. *Stanford Encyclopedia of Philosophy*. Metaphysics Research Lab, Stanford University, 2020. <https://plato.stanford.edu/entries/schutz/#PheSocWor>.
- Boot, Walter R., Daniel P. Blakely, and Daniel J. Simons. “Do Action Video Games Improve Perception and Cognition?” *Frontiers in Psychology* 2 (2011). <https://doi.org/10.3389/fpsyg.2011.00226>.
- China Daily. “Han Dynasty Stone Carvings, Witness of Ancient History - Shandong Culture.” *www.chinadaily.com.cn*, October 22, 2018.
http://www.chinadaily.com.cn/m/shandong/shandongculture/2018-10/22/content_37123998.htm.
- De Castell, Susanne and Jennifer Jenson. *Worlds in Play: International Perspectives on Digital Games Research*. New York: Peter Lang, 2007.
- Ebrey, Patricia Buckley. “Origins of Garden Design.” *depts.washington.edu*, n.d.
<https://depts.washington.edu/chinaciv/home/3garhist.htm>.
- www.oed.com*. “Environment, N.: Oxford English Dictionary,” n.d.
<https://www.oed.com/viewdictionaryentry/Entry/63089>.

- Ermi, Laura, and Frans Mäyrä. "Fundamental Components of the Gameplay Experience: Analysing Immersion." In *Digital Games Research Conference 2005, Changing Views: Worlds in Play, June 16-20, 2005, Vancouver, British Columbia, Canada*, Vol. 3, 2005. <http://www.digra.org/wp-content/uploads/digital-library/06276.41516.pdf>.
- Fang, Xiaofeng. *The Great Gardens of China: History, Concepts, Techniques*. New York: Monacelli Press, 2010.
- Farrell, Susan. "28 Tips for Creating Great Qualitative Surveys." *Nielsen Norman Group*, 2016. <https://www.nngroup.com/articles/qualitative-surveys/>.
- . "Open-Ended vs. Closed-Ended Questions in User Research." *Nielsen Norman Group*, May 22, 2016. <https://www.nngroup.com/articles/open-ended-questions/>.
- Gao, Sunny. "VR Introductory Video," *www.youtube.com*, March 29, 2023, <https://youtu.be/N32LYNy0acM>
- Geniusas, Saulius. "What Is Immersion? Towards a Phenomenology of Virtual Reality." *Journal of Phenomenological Psychology* 53, no. 1 (June 17, 2022): 1–24. <https://doi.org/10.1163/15691624-20221396>.
- Grau, Oliver. *Virtual Art: From Illusion to Immersion*. Cambridge, Mass.; London: MIT, 2004.
- Hauser, Sabrina, Doenja Oogjes, Ron Wakkary, and Peter-Paul Verbeek. "An Annotated Portfolio on Doing Postphenomenology through Research Products." *Proceedings of the 2018 Designing Interactive Systems Conference*, June 8, 2018. <https://doi.org/10.1145/3196709.3196745>.

- Jennett, Charlene, Anna L. Cox, Paul Cairns, Samira Dhoparee, Andrew Epps, Tim Tijs, and Alison Walton. "Measuring and Defining the Experience of Immersion in Games." *International Journal of Human-Computer Studies* 66, no. 9 (September 2008): 641–61.
<https://doi.org/10.1016/j.ijhcs.2008.04.004>.
- Jiang, Guangquan. *Qing Dynasty Official Architecture Painting Techniques*. China Building Industry Press Pub, 2005.
- www.yadao8.com. "Kangxi Blue and White Porcelain Characteristics in Qing Dynasty," n.d. <https://www.yadao8.com/ciqi/4625.html>.
- Keswick, Maggie, Alison Hardie, and Charles Jencks. *The Chinese Garden: History, Art, and Architecture*. Cambridge, Mass.: Harvard University Press, 2003.
- Knapp, Ronald G. *The Chinese House*. Oxford University Press, USA, 1990.
- . *The Chinese House*. Oxford University Press, USA, 1990.
- Li, Chenyang. "The Confucian Ideal of Harmony." *Philosophy East and West* 56, no. 4 (2006): 583–603. <http://www.jstor.org/stable/4488054>.
- Liang, Sicheng. *Liang Sicheng Tan Jian Zhu*. Beijing Shi: Dang dai shi jie chu ban she., 2006.
- Liang, Sicheng, and Huiyin Lin. "平郊建筑杂录 (Miscellany of Pingjiao Architecture)." *Buddhist Culture* 1, no. 6 (2015): 108–13.
- Liang, Ssu-cheng. *A Pictorial History of Chinese Architecture*. Edited by Wilma Fairbank. Cambridge, Mass: MIT Press., 1984.
- Lin, Huiyin. *Lin Huiyin Jian Zhu Wen Cui*. Shanghai Sanlian Shudian, 2006.

- Lindner, Philip, Alexander Miloff, Simon Fagernäs, Joel Andersen, Martin Sigeman, Gerhard Andersson, Tomas Furmark, and Per Carlbring. “Therapist-Led and Self-Led One-Session Virtual Reality Exposure Therapy for Public Speaking Anxiety with Consumer Hardware and Software: A Randomized Controlled Trial.” *Journal of Anxiety Disorders* 61 (January 2019): 45–54. <https://doi.org/10.1016/j.janxdis.2018.07.003>.
- Mi, Fu. *Auspicious Pines in Spring Mountains*. n.d. *China Online Museum*. <https://www.comuseum.com/painting/masters/mi-fu/>.
- National Museum of China. “Stone Carving Art of the Song Dynasty | National Museum of China.” [en.chnmuseum.cn](https://en.chnmuseum.cn/exhibition/exhibition_series/special_exhibitions/201911/t20191120_171615.html). Accessed February 28, 2023. https://en.chnmuseum.cn/exhibition/exhibition_series/special_exhibitions/201911/t20191120_171615.html.
- The New York Times. “Overlooked No More: Lin Huiyin and Liang Sicheng, Chroniclers of Chinese Architecture,” April 12, 2018, sec. Obituaries. <https://www.nytimes.com/2018/04/11/obituaries/overlooked-lin-huiyin-and-liang-sicheng.html>.
- O’Shiel, Daniel. *The Phenomenology of Virtual Technology*. Bloomsbury Publishing, 2022.
- Oxford University Press. “Immersion.” In *Oxford English Dictionary*, 2023.
- Pallasmaa, Juhani. *The Eyes of the Skin: Architecture and the Senses*. London: Academy, 1996.
- Pang, Kelly. “Chinese Architecture.” *China Highlights*, August 23, 2021. <https://www.chinahighlights.com/travelguide/architecture/>.
- Qing Gong Department. *工程做法* (*Construction Methods*). Vol. 14, 1734.

- Reinhard, Andrew. "Landscape Architecture in *Skyrim VR*." In Champion, Erik Malcolm (Ed.). *The Phenomenology of Real and Virtual Places*. Routledge Studies in Contemporary Philosophy, 2018.
- Rosenberger, and Peter-Paul Verbeek. *Postphenomenological Investigations*. Lexington Books, 2015.
- Satava, Richard M. "Virtual Reality Surgical Simulator." *Surgical Endoscopy* 7, no. 3 (1993): 203–5. <https://doi.org/10.1007/bf00594110>.
- Spielberg, Steven, Zak Penn, Ernest Cline, Tye Sheridan, Olivia Cooke, and Ben Mendelsohn. "Ready Player One." IMDb, March 29, 2018. https://www.imdb.com/title/tt1677720/?ref_=ttqt_qt_tt.
- Sun, Dazhang. *Ancient Chinese Architecture History Series Buildings of Qing Dynasty*. China Architecture & Building press, 2009.
- Suzhou Museum. "I.M. Pei and Suzhou Museum." www.szmuseum.com, September 6, 2015. <https://www.szmuseum.com/Other/MuseumIntro>.
- . *Panorama of Suzhou Museum*. 2015. *Suzhou Museum*. <https://www.szmuseum.com/Other/BuildingMito>.
- Tcha-Tokey, Katy, Olivier Christmann, Emilie Loup-Escande, Guillaume Loup, and Simon Richir. "Towards a Model of User Experience in Immersive Virtual Environments." *Advances in Human-Computer Interaction*, 2018. <https://www.hindawi.com/journals/ahci/2018/7827286/>.
- Tcha-Tokey, Katy, Emilie Loup-Escande, Olivier Christmann, and Simon Richir. "A Questionnaire to Measure the User Experience in Immersive Virtual Environments." *Proceedings of the 2016 Virtual Reality International*

Conference on - VRIC '16, 2016, 5.

<https://doi.org/10.1145/2927929.2927955>.

Toor, Meena. “Three Tips for Effectively Designing Rating Scales.” Qualtrics, January 15, 2021. <https://www.qualtrics.com/blog/three-tips-for-effectively-using-scale-point-questions/>.

Vindenes, Joakim, and Barbara Wasson. “A Postphenomenological Framework for Studying User Experience of Immersive Virtual Reality.” *Frontiers in Virtual Reality* 2 (April 29, 2021).

<https://doi.org/10.3389/frvir.2021.656423>.

Wang, Robin. *Yinyang: The Way of Heaven and Earth in Chinese Thought and Culture*. Cambridge: Cambridge University Press, 2012.

Wanyan, Linching. *鸿雪因缘图记 (Hongxue Yinyuan Tuji)* . Vol. 14, 1849.

Xiaofeng Fang. *The Great Gardens of China: History, Concepts, Techniques*. Edited by Janet Wheatcroft. New York: Monacelli Press, 2010.

Mengyuan Xu, *China-X*, 2016.