



Faculty of Applied and Creative Arts

The Digital Art Scene of Public Spaces in the Age of the Metaverse: Case Study of Ooeli Art Park, Hangzhou, China

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The Digital Art Scene of Public Spaces in the Age of the Metaverse: Case
Study of Ooeli Art Park, Hangzhou, China

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A thesis submitted

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DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Malaysia Sarawak. Except where due acknowledgements have been made, the work is that of the author alone. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.



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ABSTRACT

This PhD thesis examines the uniqueness of the digital art scene in the virtual space and its influence on traditional public art spaces and audience engagement. The study examines the digital art scene as a connection between reality and virtual environments, offering novel methods for art engagement. This paper employs qualitative research methods to examine how digital art may transform art presentation through technological innovation, act as a connection between virtual and public spaces, enhance art accessibility and innovation, and facilitate entry into the virtual realm to bolster the growth of associated industries. The study utilized the Ooeli Art Park project in Hangzhou, China, to gather interview data from artists, technology companies, art institutions, and visitors, highlighting critical factors and obstacles to the incorporation of digital art in public spaces. The findings indicate differing degrees of awareness and involvement within the digital arts community, highlighting the necessity for inclusive and accessible programming. The study thoroughly examines the influence of the digital art scene on urban environments and mass cultural communication from the viewpoints of urban research, art theory, and technology research. It offers guidance for global cities to enhance public spaces through digital technology, advocates for the convergence of art and technology, and introduces innovative concepts for the advancement of the cultural industry. The study forms a basic framework that suggests the digital art scene is a unique link between public art spaces and the virtual world. It also stresses how important interactive relationships are and provides a new way to understand and evaluate the progress of urban ecology and social dynamics.

Keywords: Digital art scene, Metaverse, public art space, contemporary urban culture

***Seni Digital Ruang Awam dalam Era Metaverse: Kajian Kes Taman Seni Ooeli,
Hangzhou, China***

ABSTRAK

Tesis PhD ini mengkaji keunikan seni digital dalam ruang maya serta pengaruhnya terhadap ruang seni awam tradisional dan penglibatan audiens. Penyelidikan ini meneliti seni digital sebagai hubungan antara realiti dan persekitaran maya, yang menawarkan pendekatan baharu untuk berinteraksi dengan seni. Penyelidikan ini juga menggunakan kaedah kualitatif untuk mengkaji bagaimana seni digital dapat mengubah cara seni dipersembahkan melalui inovasi teknologi, berfungsi sebagai penghubung antara ruang maya dan ruang awam, meningkatkan aksesibiliti dan inovasi seni, serta mempermudah akses ke dunia maya bagi menyokong perkembangan industri berkaitan. Kajian ini menggunakan kajian kes di Ooeli Art Park di Hangzhou, China, untuk mengumpulkan data temu bual daripada artis, syarikat teknologi, institusi seni, dan pengunjung, dengan menilai faktor kritikal dan cabaran dalam penerapan seni digital di ruang awam. Dapatan kajian menunjukkan tahap kesedaran dan penglibatan yang berbeza dalam komuniti seni digital, serta menekankan keperluan untuk program yang inklusif dan mudah diakses. Kajian ini secara mendalam meneliti pengaruh seni digital terhadap persekitaran bandar dan komunikasi budaya dari perspektif penyelidikan perbandaran, teori seni, dan teknologi. Kajian ini menyediakan panduan kepada bandar-bandar global untuk meningkatkan ruang awam melalui teknologi digital, menggalakkan penyatuan seni dan teknologi, serta memperkenalkan konsep inovatif untuk kemajuan industri budaya. Kajian ini membentuk kerangka asas yang mencadangkan bahawa seni digital adalah penghubung unik antara ruang seni awam dan dunia maya. Selain itu, kajian ini menekankan kepentingan hubungan interaktif dan menawarkan

pendekatan baharu untuk memahami serta menilai kemajuan ekologi bandar dan dinamik sosial.

Kata kunci: *Seni digital, Metaverse, ruang seni awam, budaya bandar kontemporari*

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LIST OF ABBREVIATIONS

AR	Augmented Reality
VR	Virtual Reality
MR	Mixed Reality Technology
HMD	Head-Mounted Display
PSVR	PlayStation Virtual Reality
PC	Personal Computer
UNESCO	United Nations Educational, Scientific, and Cultural Organization
JNBY	Jiangnan Buyi
NFT	Non-fungible token

CHAPTER 1

INTRODUCTION

1.1 Background of Study

In recent years, there has been widespread use of the Internet, personal computers, mobile phones, and other gadgets around the world. Today, a majority of us spend most of our time staring at two-dimensional screens on our smartphones or other devices. As technology advances, most users are looking for greater engagement in the digital environment. The next stage of the digital revolution is called the Metaverse. We can now see and feel this change from a two-dimensional to a three-dimensional space by utilizing a more realistic and natural user interface. The technology of virtual display has fast replaced more traditional ways and become the top choice for breakthrough advances in a wide variety of sectors, terminals, and presentation formats around the world. The digital realm is referred to as the Metaverse. The term Metaverse comes from the combination of the words meta and universe. Another interpretation of the meta-universe refers to it as the virtual reality that exists within the human mind (Diodato, 2022).

The meta-world is neither a singular software application nor a physical product. It is an idea that is carried by a digital parallel reality. The way virtual art is created in the Metaverse era is also undergoing revolutionary changes, which follow the general trend of how people interact with public space. Additionally, it can create new forms and authorizations for public space communication within the context of human society. A recently developed research issue aims to create new kinds of social structures and non-traditional art, to fully exploit the potential of digital virtual media, and to create a new global culture of pluralism (Mills & Brown, 2022).

Simultaneously, the emergence of the pandemic on a global scale, as well as the apparent long-term impact on human lifestyle, will lead to a new situation of isolation of human contacts. This new situation will have long-term effects on the operation of various types of spatial locations, as well as traditional modes and means of transmission. The traditional public space, which is based on the epidemic situation and the traditional means to limit the display of the status quo, relies on the medium of the virtual display method to the traditional means of communication. On the other hand, public art space research virtual display technology is used in a variety of new communication forms and innovations of space design, neither of which have ever been seen in the past under the conditions of human society.

This suggests that while the physical presence of visitors is essential to some experiences, the function of a public art space in a physical space like a museum can also be achieved through other forms, such as virtual reality, augmented reality, and other digital mediums. The state and design of museums often reflect an emphasis on contemporary media and cultural trends. As technology advances, the physical spaces of museums are also adapting to new forms of media that are changing not only how works of art are displayed but also how audiences engage. Public art spaces in real spaces are increasingly being designed with digital interaction and multimedia displays in mind to adapt to a more connected and technology-driven world. When these virtual displays get over their technological barriers, it is possible that the deployment of immersive online technology will be able to replicate an actual museum visit. It is possible, on the basis of the logic of digitalization itself, that the elements of content editing, space management, cost accounting, audience visitation, education, and guidance in future museums will be radically different from the current mode of traditional museums, which must be adapted to a new system.

These changes will have to be made because the current mode of traditional museums must be adapted to a new system. All art museums and galleries will inevitably have their standard objectives questioned. The shift in presentation style will change perceptions of aesthetics and knowledge transfer, conceptual clarity and educational involvement, and other related aspects. It could be argued that museum visits are no longer seen as leisure activities. The goal for art museums today is to clearly acquire personalized knowledge and aesthetics, rather than just holding onto art-historical visual representations and hoping for passive aesthetic transmission. Future museum experiences might revolve around these requirements. This kind of exhibition may be standard practice in museums in the future. At the same time, all kinds of social public spaces in the city are transforming into digital spaces in the context of the Metaverse. At the same time, the city is seeking to identify a mode of public space presentation that is more suitable for the context that we find ourselves in at this point in the evolution of embodied existence.

1.2 Global digitization

The global digitization process is swiftly transforming conventional practices and institutions across multiple domains, with the implementation of digital technology enhancing efficiency, accessibility, scalability, and speed while also significantly affecting cultural heritage preservation, art exhibitions, legal practices, and other areas. In the domain of cultural heritage, virtual reality (VR) and augmented reality (AR) technologies are extensively employed to safeguard and enhance cultural assets. In the Romanian city of Oradea, digital technology has enhanced accessibility to Jewish cultural heritage within Art Nouveau architecture, hence augmenting public awareness and appreciation of cultural heritage through virtual tourism (Caciora, 2023). Digital technology has enabled internet access to and preservation of art archives. Virtual reality technology enables museums to

transcend conventional constraints of geography and time, progressively actualizing digital archives. This not only offers novel opportunities for the preservation and exhibition of artworks but also equips art researchers, archivists, and artists with innovative tools to confront future difficulties and needs. Museums and art organizations throughout are adopting digital technologies to enhance and promote art. For instance, the Municipal Gallery of Ancona in Italy permits visitors to engage with digital artworks via virtual tours (Renato Angeloni, 2022); the Louvre Museum in France provides an online virtual tour; in the United States, the Museum of Modern Art (MoMA) in New York employs augmented reality technology to augment the exhibition experience (Giannini T, 2023); Japan's MORI Building DIGITAL ART MUSEUM: teamLab Borderless establishes an immersive art experience environment; the British Museum in the United Kingdom utilizes virtual reality to showcase historical artifacts.

The integration of digital art in public spaces is a significant facet of digital art's evolution, transforming both the exhibition of artworks and the interactive dynamic between the audience and the art. Digital technologies are transforming the exhibition of museums and public art spaces, emphasizing the influence of digital identities and cultural tensions within the framework of globalization (Giannini, 2023). Cultural and artistic innovation in digital media is contesting the dominance of conventional art, while the use of digital art in public spaces offers a novel platform for artistic advancement (Sugita, 2021). Subsequent analysis of the influence of digital technology on art history research and public art exhibitions suggests that the digital transition has compelled art history scholars to reevaluate the definitions and methodologies of the discipline (Naslund, 2021). Collectively, these documents demonstrate that the integration of digital art within public art spaces presents novel opportunities and challenges for artistic creation and exhibition. By merging

technological innovation with artistic ingenuity, public art spaces can serve as significant platforms for fostering cultural exchange and social engagement.

In summary, global digitization is infiltrating all human activities and establishing itself as an irreversible trend. It has altered conventional operational methods while also aiding in the preservation of cultural heritage, the promotion of art, and the evolution of legal practices worldwide. As technology progresses, digitalization will persist in influencing our environment, presenting new opportunities and challenges. The utilization of digital technology is significantly transforming the domain of cultural heritage and art exhibition, facilitating worldwide cultural interchange and creativity.

1.3 Hangzhou Geography and Culture

Hangzhou's geographical location strategically boosts its appeal as a hub for cultural interchange and artistic collaboration. Situated in close proximity to Shanghai, a major global metropolis, Hangzhou serves as the entry point to the fast-growing Chinese market. The comprehensive transportation infrastructure, encompassing high-speed rail and an international airport, facilitates convenient movement for artists, collectors, and art enthusiasts from both domestic and foreign locations. Hangzhou's geographical advantage fosters a dynamic convergence of artists and audiences from many cultural backgrounds, facilitating cross-cultural discussion and nurturing a wide range of artistic perspectives in the realm of digital art. Hangzhou serves as the administrative center of Zhejiang Province in China. Zhejiang, China's wealthiest province, serves as the hub for politics, economics, culture, technology, education, and finance. It is a major transportation centre and a populous metropolis located in the Yangtze River Delta region of China. The permanent population of Hangzhou in 2022 has reached 12.376 million, as indicated by data (Hangzhou Statistics

Bureau, 2023). Hangzhou has long been renowned globally for its exquisite landscapes, abundant resources, and its esteemed reputation as a heavenly haven. Hangzhou was renowned as the most opulent celestial metropolis throughout ancient times. Marco Polo, a historical figure from the 13th century AD.

Hangzhou is a city that holds great significance in human civilization due to its rich representation of various historical and cultural aspects. These include the Liangzhu culture, silk culture, tea culture, traditional Chinese medical culture, as well as the art forms of calligraphy, painting, and seal cutting. Throughout many historical epochs, Hangzhou's abundant folklore, theatrical performances, and artworks have endured as a significant cultural center and have taken center stage in numerous narratives. Hangzhou's extensive cultural heritage and longstanding traditions position it as a leader in the advancement of contemporary culture and art.

Hangzhou's rich cultural legacy has facilitated the city's establishment of a dynamic and contemporary Hangzhou with distinct characteristics in the modern period. This city is a hub for the coexistence of various art forms. Hangzhou's ongoing process of urbanization and modernization has elevated its global significance. The city aims to establish a contemporary and environmentally friendly urban setting and has been granted a UNESCO World Treasures designation for its commitment to safeguarding cultural treasures (Liuzza, 2020). Hangzhou endeavors to achieve a harmonious equilibrium between tradition and innovation, thereby cultivating a distinctive ambiance that seamlessly integrates the old and the contemporary. The combination of modernity and history creates a rich environment for the creation of innovative digital art, enabling artists to derive inspiration from cultural landmarks and historical narratives while also exploring novel artistic potentials.

1.4 Recognition of Hangzhou Internationally

The 2016 G20 conference in Hangzhou earned the city international recognition. The designation of Hangzhou as the host city for the 21st Asian Games in 2023 has significantly enhanced its global awareness and deeper comprehension. This esteemed athletic competition garners the interest of millions worldwide and offers a significant platform for Hangzhou to exhibit its cultural variety, artistic excellence, and technological progress. By embracing digital art, Hangzhou can capitalize on the international focus during the Asian Games, offering a valuable opportunity to introduce and popularize digital art among a wider audience (Thuermel, 2022). Digital puppets ignited a flame that captivated the globe at the inaugural ceremony of the Hangzhou Asian Games. The digital character, consisting of 1,200 radiant dots, showcases Hangzhou's dedication to pushing the limits of conventional creative genres. This flawless integration of technology and art delivers a captivating and engrossing experience to all individuals in attendance. Whether you are physically present or watching from a television screen, you will be able to witness the remarkable display of a three-dimensional digital character without the need for any special equipment.

This character illuminates the primary torch with 1,200 bright points of light. The period during which the Hangzhou Asian Games take place is the ideal time for observing tides on the Qiantang River (Liu, 2023). To enhance the audience's experience of this magnificent spectacle, Hangzhou employed digital technology, including three-dimensional perspective projections and ground screens, to simulate the Qiantang River tidal at the Big Lotus, the main stadium of the Asian Games (Liu, 2023). Generate a simulated representation of the Qiantang Tidal using digital painting techniques. We have enhanced the Gongchen Bridge in Hangzhou with naked-eye 3D visual effects, utilizing advanced technological capabilities. This juxtaposition of antiquity and modernity at both ends of the

bridge showcases the historical evolution of Hangzhou and ignites the Hangzhou Tide. The combination and implementation of several advanced technologies result in the vibrant display of digital fireworks in the sky, producing a magnificent spectacle. The opening ceremony of the event showcased the convergence of digital art and traditional Chinese art in Hangzhou, a city known for its embrace of advanced technology. Through the use of digital art techniques and the presentation of traditional Chinese art scrolls, the audience witnessed a captivating display of Chinese-style romance and digital Hangzhou romance.



Figure 1.1: Hangzhou Asian Games opening ceremony (Source: <https://www.hangzhou2022.cn>)

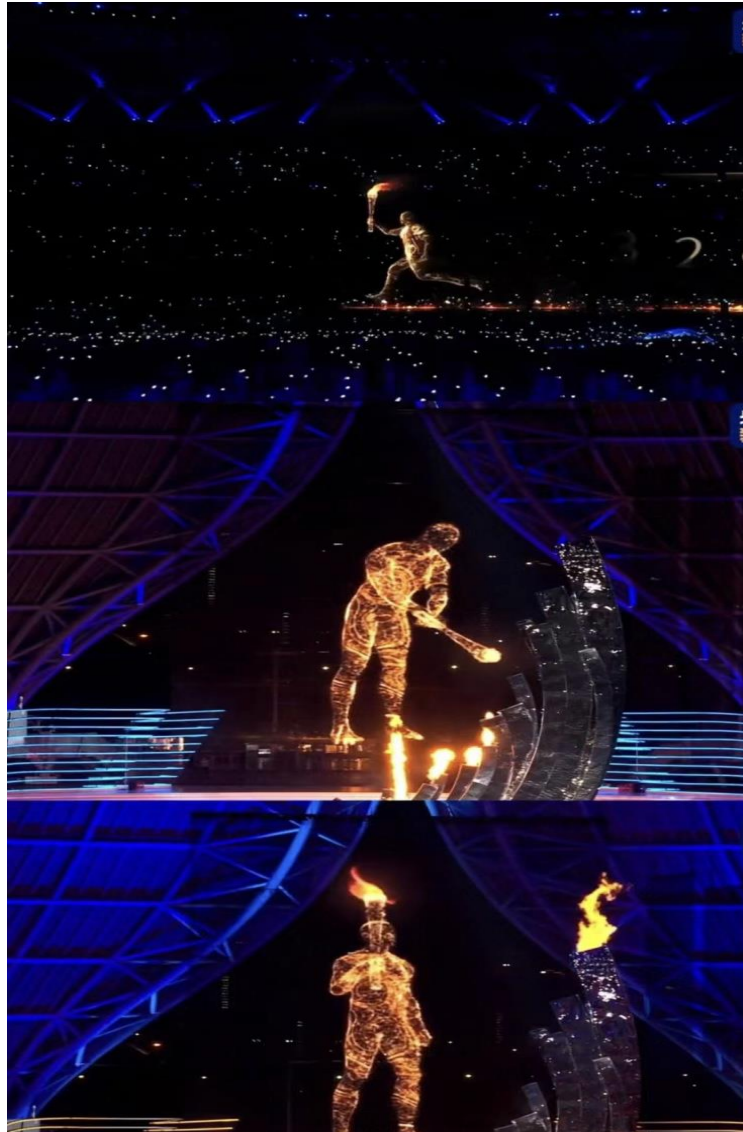


Figure 1.2: Digital torchbearers at the opening ceremony of the Hangzhou Asian Games
(Source: <https://www.hangzhou2022.cn>)

The digital revolution in Hangzhou is actively contributing to urban development. Hangzhou entices globetrotters and entrepreneurs from across the globe with its extensive historical background and rich cultural legacy. Hangzhou, amidst the digital revolution, successfully preserves its ancient allure while seamlessly integrating new technology and urban progress to offer a distinctive digital tourism encounter. Both residents and international tourists can experience the city's extensively digitalized, top-notch

infrastructure and exceptionally personalized urban services. The tourism industry in Hangzhou extensively employs digital technology. Using the mobile phone application, tourists may get comprehensive information about the history, culture, and geographical location of a specific picturesque area, as well as details about transportation, housing, and dining options.

Additionally, they can also receive up-to-date tourism information in real time. Virtual reality technology allows users to immerse themselves in a simulated environment, providing a lifelike experience and a detailed representation of the historical and cultural aspects of a certain location. Utilizing digital interactive features facilitates a more comprehensive exploration of a place for travelers. Hangzhou has achieved significant progress in the advancement and establishment of artificial intelligence, big data, the Internet of Things (IoT), intelligent transportation, and intelligent manufacturing (Zhu & Chen, 2022).

Hangzhou's inaugural artificial intelligence development research institute aims to advance the research and implementation of artificial intelligence technologies. Hangzhou is now constructing a city brain to effectively merge data and intelligent technology for the purpose of enhancing city management and services. The implementation of digital smart city service systems, including digital payment, digital space, digital media, digital exhibitions, digital city management, and intelligent transport systems, has significantly enhanced the convenience of travel for both citizens and tourists in Hangzhou. As a result, the city's overall quality has significantly improved. These characteristics have emerged as crucial elements for Hangzhou, a contemporary metropolis, in its efforts to entice individuals to relocate for employment, entrepreneurship, tourism, and residency purposes. Furthermore,

digital technology also fosters creativity and entrepreneurship. The advent of the digital revolution has created favorable platforms and prospects for young entrepreneurs, particularly in urban centers like Hangzhou. We should not overlook Hangzhou's significance in this development, given its recognition as the Silicon Valley of the East. This title emphasizes Hangzhou's pivotal role in shaping China's digital landscape and its status as a worldwide frontrunner in technological innovation.

Hangzhou has become an internationally recognized center for innovative digital culture. Through the use of digital technology, Hangzhou successfully integrates traditional culture with contemporary technology, producing unique cultural products and immersive venues. This initiative aims to enhance the growth and success of the local cultural business. Future chapters will provide a comprehensive introduction to the Oeli project, a representative commercial complex within the Hangzhou Cultural and Creative Centre.

As mentioned earlier, Hangzhou, a city in China, has achieved notable advancements in the realm of digital technology. Hangzhou, as a significant center of the digital economy, has proactively facilitated the contemporary advancement of the city by spearheading scientific and technological innovation. Hangzhou has become a global leader in a number of industries, including technology, art and culture, and commerce, due to its innovative use of digital technology. It has successfully undergone urban digital transformation, making it a prime example of success in this area.

1.5 Hangzhou Oeli Art Park

Hangzhou's residents have more free time to enjoy the city's artistic and natural attractions. As a result, Hangzhou locals are inclined to spend more money visiting and appreciating public art spaces. Hangzhou boasts several prominent museums, including

Zhejiang Museum, Hangzhou Arts and Crafts Museum, Zhejiang Art Museum, West Lake Museum, China Silk Museum, Hangzhou Arts and Crafts Museum, Natural History Museum, and Science and Technology Museum. In addition to several urban complexes resembling Ooeli in the study case, Hangzhou also boasts public art venues and social art parks that seamlessly blend business, culture, and the arts in a setting reminiscent of Ooeli. It is common for people to go to these public art locations in the afternoon to participate in the exhibitions while enjoying time with a cup of coffee. Alternatively, one might participate in the fairs and community engagements organized by these public art venues. The establishment of these autonomous public art venues also facilitates the enhancement of the overall public art environment in Hangzhou.

Hangzhou, a city known for its rich history, lively culture, and beautiful surroundings, has more to offer than just the typical tourist attractions, like the West Lake. Due to Hangzhou's recent globalization, both foreign visitors and locals have expressed interest in the city's numerous modern, expansive complexes that combine commercial, cultural, and artistic elements. This thesis focuses on Ooeli, a vast and intricate complex located in Hangzhou, which serves as a novel urban spatial paradigm for our discussion. This research will focus on examining potential uses of digital art installations in public spaces of this specific size and type, even though the exact impact of digital art in urban environments is still uncertain. Therefore, the selection of Ooeli as a case study to investigate more effective methods of integrating and leveraging digital art within an urban environment holds significant importance in this research.

Ooeli is located in Hangzhou's central area, west of the renowned West Lake. The complex spans a total area of 230,000 square meters (Hu, 2020). The building is a

collaboration between the renowned local designer brand Jiangnan Buyi (JNBY) and the fashionable enterprise Goa Design Company. It aims to create an artistic living environment and enhance the quality of creative life. The architectural design industry in Asia is renowned for its exceptional quality and is at the forefront of shaping the region's residential environment and lifestyle. Renzo Piano, a renowned Italian architect and recipient of the prestigious Pritzker Prize, is the mastermind behind the architectural design of the expansive space collection. He guided the execution of this multi-year project. This multifaceted commercial and art park is a prominent feature in the metropolitan landscape. The park encompasses an artist residency center, office complexes, art galleries, art centers, exhibitions, theaters, design hotels, and brand-occupied enterprises, constituting a vast and versatile contemporary public area.

Ooeli showcases a glyph-shaped arrangement of 17 buildings, encircling a central square that serves as a communal gathering space known as the city living room. In the center of the square there is a central garden, a square with a water-retaining mirror, and a variety of trees scattered throughout. The square creates a distinct physical boundary from the external environment while also establishing a harmonious relationship with the many interior spaces and exteriors of the buildings. The motion is intriguing and seamless. Architect Renzo Piano designed Ooeli Art Park as a tribute to Hangzhou, a region known for producing premium Chinese green tea under the registered tea brand Longjing. The rooftop of the fifth floor is home to two varieties of valuable tea trees, Anji White Tea and Longjing No. 43, both of which are highly adaptable. The tea tree forms the basis of the landscape design around the complex. Several customary holidays transform these tea plants and other trees into creative displays, an essential part of decoration. During cultural events such as the Lantern Festival and Dragon Boat Festival, these trees serve as a means to

suspend fabric or paper strips adorned with printed inscriptions. These slips may contain enigmatic puzzles or poetic lines pertaining to the festival inscribed on them (Qingzhou, 2021). Visitors can use the QR code on the note to solve lantern puzzles or view the original poem. This digital interactive technology is definitely a novel and beneficial way to use vegetation in public art spaces. By examining the functioning of Ooeli, we can contemplate the correlation between the novel architectural spatial model and its impact on urban environments, human behavior, ways of living, artistic expression, and the advancement of digital technology in contemporary cities.

By utilizing Wertheimer's (1910) grounded theory, this study is able to make sense of the relationship that exists between the Ooeli buildings and the community and surrounding environment. This knowledge will be useful in determining the most effective way to implement the buildings' interactions and relationships with the community. Two busy six-lane roads in Hangzhou, Tianmushan Road and Gudun Road, border one side of the location. The Science and Technology Park in the western part of Hangzhou connects it to the other side. To the north lies Xixi National Wetland Park and Huanglong Business District, while the Yanshan River, a tiny river, flows through it to the south. The architectural design of Ooeli incorporates Piano's geographical deconstruction concept, which is based on the pattern of European city squares.

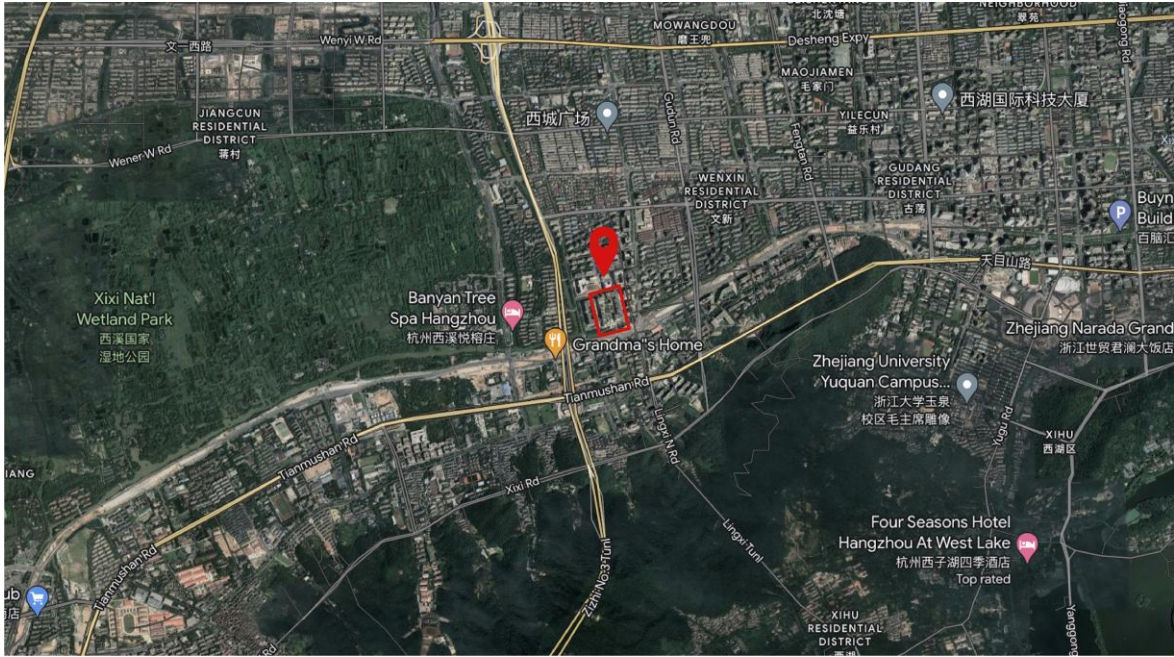


Figure 1.3: Oeli location (Source: Google Map 2024)

The Oeli architectural complex has a strong connection with its surrounding environment, as shown in Figure 1.3. This design approach ensures that the building follows a set of well-defined criteria, resulting in a unique structure in the bustling urban setting. The regional context of Oeli has a significant role in shaping its economic and creative milieu. The proximity to technology parks in this area results in a greater demand for digital public art venues compared to other locations. The individuals in this location exhibit a higher level of flexibility and reliance on digital applications. Viewed from an alternative standpoint, the likelihood of embracing the establishment of a digital art community in this location will be greater, thereby increasing the potential for success.

Oeli's initial objective was to establish a large-scale urban living environment that would serve as an exceptional hub for artistic communities. The public art space brings together many urban aspects from three dimensions: community users, art formats, and commercial formats. Oeli Art Museum serves as the focal point of energy in the public art

space. The building was built in compliance with internationally recognized standards for art museums. Aside from the permanent classic collection area, it also offers a prestigious public art space consortium for international artists, which includes exhibitions, collaborations, and the showcasing of their work. Furthermore, apart from the art museum, the entire Oeli area has established a dedicated platform to facilitate the creation of multimedia artists and designers by utilizing the virtual reality technology.

Two design firms, Jiangnan Buyi Group and Elephant Design, manage the Oeli complex. The complex project, designed for both creation and operation, incorporates a unique marketing strategy and innovative model that seamlessly blends art and commerce. Currently, the Oeli Complex is undergoing continuous iterative development, offering consumers a wide range of novel experiences to cater to the unique spiritual and material requirements of consumers of all ages and social strata.

The Oeli Art Park not only attracts corporate customers and generates commercial value, but also garners the admiration of many art artists and designers. The Oeli commercial complex utilizes artistic design elements to create a new urban public art space that seamlessly combines art exhibition, aesthetic experiences, commercial displays, and resource sharing. This has led to the creation of an innovative operational framework for public art venues.

The operational framework of Hangzhou Oeli Art Park has stimulated the industry and academia to broaden their perspectives and explore new possibilities for creating innovative urban public art spaces. This includes redefining value notions, consumption concepts, cost concepts, and boundary concepts. The boundaries between enclosed public spaces and their surroundings are similar in Oeli Complex and European city squares, as

depicted in Figure 1.4.

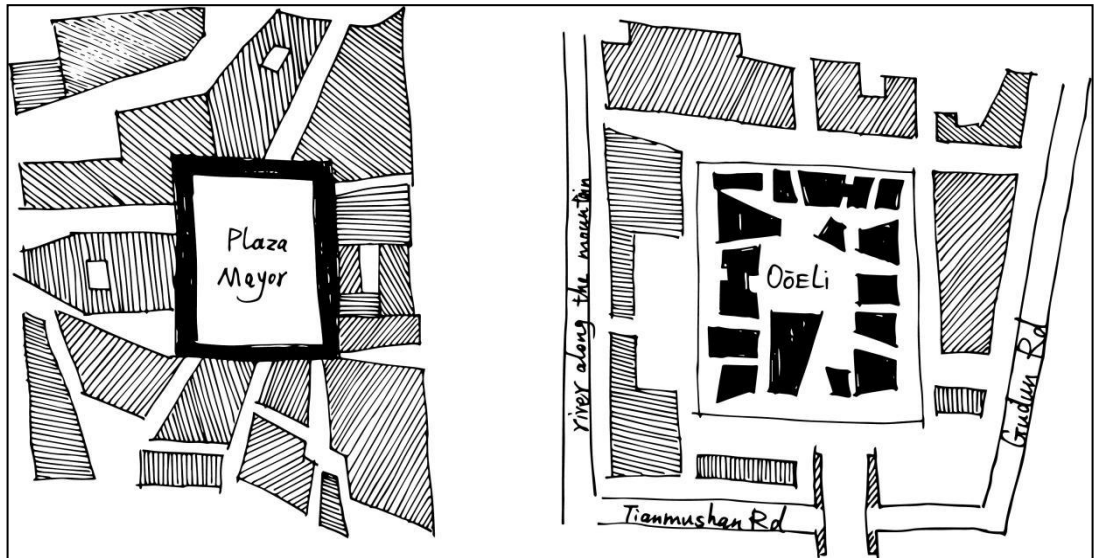


Figure 1.4: European city squares is compared to Ooeli Art Park (Author's illustration)

1.6 Overview of Digital Technology

Both the development of current digital technology and the evolution of Internet technology are not processes that are mutually exclusive. People all over the world are enthusiastically accepting the third generation of the Internet, also known as Web 3.0. The rapid evolution of Internet-related technology is a well-known fact. This provides evidence that recent shifts in computing platforms have had an effect on the digital technology that underpins the Internet. The computer is the basis for the development of digital technology for the Internet, which then progresses to the mobile phone and, finally, the currently developing technologies for augmented reality and virtual reality.

We have no choice but to passively accept the structure and limitations of the early Internet, which only permitted users to read and investigate content. Today, with the majority of people owning their own personal computers, this is no longer feasible. When you navigate to a new page, begin reading it, find the information you need, and then cease your

web browsing, your time on the Internet ends. Take, for instance, the exhibition introduction that was composed specifically for a certain art space as an illustration. You can only read a limited amount of relevant information on a single web page, and the interface struggles to deliver accurate and genuine value information that aligns with your wants, preferences, and the specific information needs of your environment. The term "first-generation Internet" refers to a period of time when users accessed information on the Internet in a more passive manner.

The mobile phone is the next platform, and it is probably the most well-known and the one that makes the most use of digital technology. This generation is commonly referred to as Web2.0, as it aligns with the second generation of the Internet. People in China use the WeChat functions on their mobile phones quite frequently for a wide variety of purposes, including social chatting, the transmission of microblogs, the browsing of short video websites and short video mobile apps, the viewing of television shows and movies on video websites, and the posting of user-created videos on video websites. At this point, the Internet's forms and functionality can adapt to meet the demands of content production. The platform generates content that every user can access. Conversely, the platform, not the customers who create the content, holds ownership of both the data and the revenue generated by the content. China consistently ranks as one of the world's most technologically advanced countries due to its advanced Internet application economy based on mobile computing platforms. The emergence of digital technology development in China has led to the popularity of a novel method of buying and selling goods via mobile phone terminal lines.

This approach has the potential to result in a significant amount of disruption. Because of the accurate positioning capability of digital mobile phones, we can visit various online shopping platforms such as Alibaba, complete the purchase, order, settlement, and other operations on our mobile phones, and then have the items delivered to our homes via express delivery. Digital mobile phones enable this capability. In China's developed trade sectors, the quickest delivery time for online shopping is one day after placing the order. The Chinese online shopping experience is still incomplete. Mobile terminals equipped with a locating feature allow local businesses like restaurants, pharmacies, and supermarkets to provide delivery services within a three-kilometer radius or within half an hour of an online purchase. Users can obtain the most up-to-date information on a variety of art exhibitions and cultural events taking place in their immediate area with the assistance of mobile phones and the Internet. Users can also access this information through the Internet. This information encompasses not only the topic of discussion, but also the event's date, time, and location, along with comprehensive details about online registration. This significantly reduces the difficulty of living in the modern world. The function of the short board was rendered irrelevant by the development of computers, so it is now considered obsolete. This essay concentrates on a specific type of computing platform known as a centralized Internet form.

The widespread use of augmented reality and virtual reality devices will be a defining characteristic of the next generation of mobile computing platforms. Furthermore, this digital computing platform operates on a decentralized model. The new Internet, also known as Web 3.0, represents the third generation of the Internet. The evolution of 3D imaging in augmented reality and virtual reality devices progresses to the point where users will be able to create their own unique digital avatars thanks to the availability of this capability. Through

the use of virtual reality, people of a new parallel universe are able to hold face-to-face conversations with one another. Changes will occur in human navigation, social networking, online commerce, way of life, and applications that are based on information exchange and interpersonal communication.

The decentralized third generation of the Internet has provided an answer to the question of data ownership, which arose during the second generation of the Internet. In the metaverse era, every user owns their own data, and if they wish to, they can also own the value and revenue that their data generates. Consequently, as Figure 1.5 illustrates, when we examine the evolution of the Internet, we can clearly see the shift from Web 1.0 to Web 2.0. In the Web 1.0 era, we utilize personal computers to browse the Internet and passively get information. Mobile phones, which are on the rise thanks to Web 2.0, put the Internet in a more centralized position. Web 2.0 is a significant development in the Internet's evolution. In comparison to Web 1.0, Web 2.0 places more of an emphasis on user-generated content and social media use, which highlights the connection and cooperation of the Internet. During this period, the Internet underwent a transformation from a static information delivery system to a dynamic, user-active network environment. However, several Internet platforms have progressively monopolized user data, management rights, and content delivery in the Web 2.0 period. Due to the concentration of data and power brought on by this centralized internet architecture, problems like algorithmic bias and data centralization arise. As a result, Web 3.0 emerged as the next stage in the decentralized Internet's development. The decentralized Internet or distributed Internet, also referred to as Web 3.0, intends to address the issues with centralized platforms and data concentration in the Web 2.0 era. Augmented reality (AR), distributed networks, encryption technology, digital

identity verification, and blockchain technology are designed to create a more democratic, open, and safe online environment.

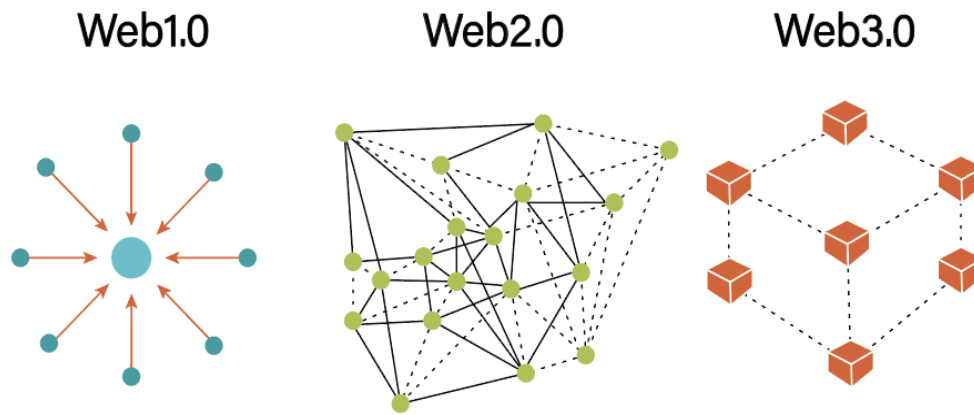


Figure 1.5: Development of Internet trend (Author's illustration)

Ideally, Web 3.0 remains an evolving concept. This is precisely the overarching significance of the topics we are talking about today. Future digital technologies, through the development of new platforms, new features, and new data models, will offer human artistic lives and users of public art spaces an unparalleled experience. In conclusion, we can say that the Web 3.0 product represents a transition from the passive acceptance of information in the PC era to the centralized Internet in the mobile phone period and finally to the decentralized Internet. In the future, the new platform and features, along with new digital technologies, will enable a new data model that will transform and enhance public art spaces and the human artistic lifestyle in unprecedented ways. We will be able to build a more welcoming, interesting, and safe online space. In summary, we can get a figure like this: as shown in Figure 1.5, our Web 1.0 era is the PC era of passive information collection, Web 2.0 is the era of Internet concentration, and the era of smart phones. Web 3.0 is the era of decentralized information and virtual reality. On the other hand, Figure 1.6 illustrates the

changes in Internet processing through the evolution of the Internet's shape. From one-way to complex to decentralized community-based Internet processing models.

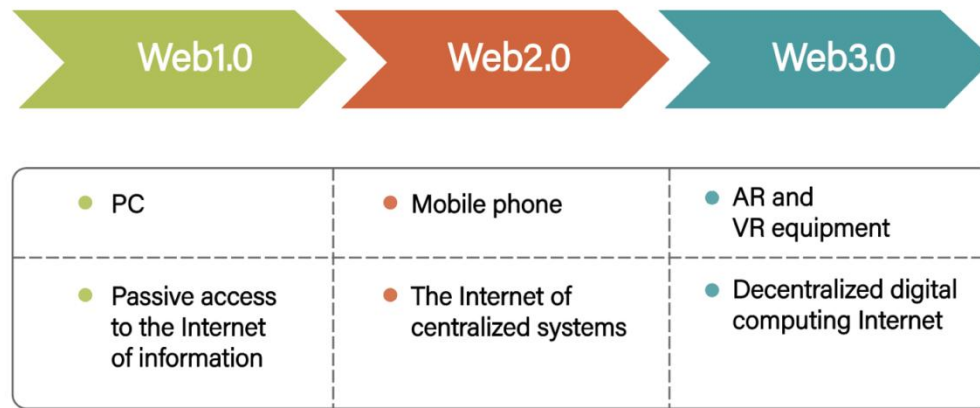


Figure 1.6: Different stages of Internet computing(Author's illustration)

Virtual reality technology has progressed through a number of stages of development since its early computer simulations of the real-world environment. Currently, virtual reality technology combines virtual reality (VR), augmented reality (AR), mixed reality (MR), and other related technologies to create a comprehensive and participatory virtual reality experience.

While Ivan Sutherland was performing research on panoramic display systems in the 1960s and 1980s, he invented the Head-Mounted Display (HMD), which enables users to interact with a computer-simulated representation of the real environment (Pestana, 2023). Technology that simulates reality and is compatible with head-mounted displays (HMDs) is currently the subject of research and development efforts. In the 1990s, when commercialization of the technology was beginning to advance, PL Research and Sega, respectively, first offered other forms of interactive virtual reality technology, such as head-mounted displays and interactive handles, to the gaming industry.

Virtual reality has not yet seen widespread application in the marketplace or active consumer marketing due to its high manufacturing costs. Oculus VR's launch of the Oculus Rift virtual reality head-mounted display in 2010 marked a watershed moment in the development of virtual reality technology, which has seen substantial progress since that year. Following that, the Oculus Rift, a virtual reality head-mounted display, and the virtual reality game EVE: Valkyrie became available. In 2016, both HTC and Valve collaborated to release the virtual reality head-mounted display known as the HTC Vive. Furthermore, they aim to enhance the tracking and control performance of the device. In the same year, Sony released the virtual reality head-mounted display known as the PlayStation VR (PSVR). This head-mounted display for virtual reality helped the virtual reality game reach new heights, which led to the game's overall success (Nguyen et al., 2020). Recent years have seen a strong promotion of the metaverse concept across a wide variety of application domains, leading to the modification and iteration of the virtual reality head-mounted display and interactive operation equipment. Additionally, there has been active promotion of the metaverse concept in recent years. As a direct result of Apple releasing the Vision Pro, there has been a recent surge in the popularity of virtual reality. The Ecology of IOS Vision Pro is a revolutionary product that boasts a sizable user base and is poised to attract more customers in the future. The progress in virtual reality technology is facilitating the development of new applications for virtual reality hardware and the rapid growth of the adaptation industry.

1.7 Problem Statement

This PhD thesis investigates the distinctive characteristics of the digital art landscape within the virtual realm and its influence on conventional art aesthetics, urban identity formation, and audience engagement. The swift advancement of digital technology has rendered the virtual realm increasingly captivating, offering audiences a novel artistic

viewpoint, allowing artists to surpass the constraints of conventional art, and fostering a symbiotic relationship between technology and art. In the Web 3.0 era, the decentralized network facilitates a decentralized method of artistic interaction. Virtual and augmented reality technologies offer artists innovative methods of creation, thereby enhancing the connection between the form of artistic expression and the audience's experience. In the metaverse, artworks transcend traditional two-dimensional and static formats, manifesting in three-dimensional and dynamic forms. Users evolve from passive observers to active participants in the artistic creation process, engaging with both artworks and artists, collaboratively exploring the virtual environment, and producing customized artworks, thereby significantly broadening the scope of artistic expression. Artists are prompted to reconsider the relationship between their work and the audience by the emotions evoked by avant-garde art, which in turn encourages the development of more interactive digital art. Nonetheless, it introduces novel obstacles for artists, who must acquire multidisciplinary skills in virtual creative representation, realistic methodologies, interface design, and more to produce captivating new artworks and transform audience perceptions of art.

Moreover, the digital art landscape can transcend the actual art space by incorporating emotional and cultural elements into the virtual domain. The swift advancement of virtual digital technology has introduced unparalleled problems and opportunities for artists in both the creative process and the distribution of their works. The emergence of the digital era has established an extensive platform for the dissemination of artistic creativity and diverse modes of communication. The advent of the "metaverse" has created new opportunities in the art world, offering audiences novel artistic viewpoints and allowing artists to transcend the constraints of conventional art. Nonetheless, there remains

inadequate knowledge regarding the influence of this digital ecosystem on artistic aesthetics and audience involvement.

This study aims to investigate the distinct characteristics of digital art in the virtual domain and its influence on the art business, with the objective of filling the knowledge gaps related to the digital art environment in the virtual sphere. China's digital advancement has designated Hangzhou as a significant development and experimentation zone. Ministry of Industry and Information Technology of China, 2023. This project will investigate the connection between public art spaces and virtual environments in Hangzhou, analyzing how digital art scenes serve as a conduit between reality and virtuality, thereby transforming the role of traditional public art spaces and audience engagement. The project will examine how the digital art scene might surpass the constraints of time and geography to augment the emotional connection and interaction between individuals and art.

This study will examine the impact of the digital art scene on the local art sector in Hangzhou, China, and provide innovative concepts for cities aspiring to enhance digital creative innovation and cultural transmission on a worldwide scale. This thesis seeks to address knowledge deficiencies about the digital art landscape in the virtual realm and to deepen the comprehension of the significance and role of the digital art scene within the evolving art milieu.

This study discusses the unique characteristics of the digital art scene in the virtual realm and its impact on traditional art public spaces and audience engagement. It emphasizes the digital art realm as a connection between physical and virtual environments, providing innovative methods to engage with art.

1.8 Research Questions

When we consider the different characteristics and functions of public space, what contributions can participants, developers, and artists offer to it? Thus, this research aims to ascertain the connection that exists between participants, developers, and producers and the public space, as well as what consumers, developers, and producers can give to the public space and what participants want from the public area.

The following is a list of specific research questions that will serve as a roadmap for further investigation:

- i. What are the embodied interconnection between the public art spaces and the Metaverse ?
- ii. What are the practical context of digital art scenes needed for different public spaces to enhance the aesthetic feeling and practical sense of the space?
- iii. How can artists and policymakers enhance the multidimensional digital art scene in Hangzhaou city in the future?

1.9 Research Objectives

One aspect of the practical sense of contemporary public space is the integration of digital technology and art. The goal of this integration is to foster interaction between people and space scenes, while also offering them a vivid artistic experience and an innovative information experience. In this design concept, the phrase "public space" functions as a metaphor for the information age, and the creation of a digital scene is a crucial element of public space, influencing its experience, practice, and service technique. The digital scene has sparked a fresh perspective on art, shaped modern designers' visual perception,

influenced their design thinking and working processes, and significantly influenced the dissemination of art in public spaces. When designing specific digital art scenes for various public spaces to enhance their aesthetic feeling and sense of practice, it is necessary to have a clear theoretical background and framework for specific design operations. This is due to the fact that the particular design of the digital art scenes that are needed for different public spaces depends on the specific design of those scenes.

Interacting with public space inspires people to transcend the boundaries of time and space in the current dimension. It infuses diverse creative ideas and art forms into space; it also inspires people to think about and perceive the multidimensional digital life that will exist in the future. I will discuss the specific research objectives in the following section, outlining the steps the research will take to accomplish its overall objectives.

- i. To analyze the digital display forms of urban public art spaces and the Metaverse
- ii. To evaluate the practical context of the digital art scenes in public art spaces.
- iii. To propose a framework for developing public art spaces that enhance the multi-dimensional digital art landscape of Hangzhou city in the future.

1.10 Scope of Research and Limitation

Evidently, the connotation and extension of virtual space will receive more attention and research, continue to develop, and present a wider prospect for application. The present research solely examines and discusses the subsystems of the digital art scene, public art spaces, and the immersive interaction between audiences and practitioners in virtual spaces.

In this complex and diverse digital virtual world, I will focus on these specific components to deeply explore their role and influence in the Metaverse.

The digital art scene, as a subsystem of virtual space, is the main focus of this study. The focus is on the impact of the digital art scene on contemporary artistic expression rather than exploring the wider social consequences of virtual worlds. I will discuss the digital art scene, the public art space, and the interaction between the audience and practitioners. Explore how these factors interact in the metaverse with real public spaces. It anticipates the potential for innovative methods of art expression and reception in the context of contemporary art creation.

The study acknowledges certain limitations, including time constraints and challenges in data acquisition, which may restrict the depth of some analyses. Despite these limitations, efforts are directed towards maintaining academic rigor and precision to provide valuable insights into the influence and linking functions of digital art scenes and public art spaces within the context of the Metaverse.

This research aims to explore the reimagining and connectivity of public art spaces in virtual environments, emphasizing the critical role of the digital art scene in the Metaverse. Although the scope of the study is constrained, the objective remains to comprehensively understand the contributions of these elements to contemporary art practices and urban development. This investigation aspires to offer significant insights and inspiration for future advancements in art and innovation, as well as urban digital evolution. Furthermore, the study seeks to elucidate the intricate connections between the Metaverse and public art spaces, fostering a deeper appreciation of their transformative potential.

1.11 Significance of the Study

This study discusses more in depth the digital art scene in the Metaverse era, a new technological field. It has enriched our understanding of the technical system of public art space displays and the integration of art and technology. We have deepened our understanding of the role of digital art scenes in the Metaverse, and also expanded our understanding of contemporary art creation methods and display methods. This research result will contribute to the application and development of digital art scenes in the metaverse era in the present and future.

For artists or even designers seeking new ways of creative expression, these insights will provide them with paths to artistic inspiration and new ways of creation that are achievable under new technological conditions. These insights may inspire artists to produce more revolutionary creativity in the digital art scene compared to traditional methods. In the virtual space of the Metaverse, artists will be able to express their creativity in unprecedented ways, furthering the development of contemporary art. With the continuous understanding of the Metaverse and the development of technology, the interweaving of the virtual world and real life will become more and more closely. While embracing the richness and diversity of artistic practices, creation, and viewing experiences in the Metaverse, it is essential to address the protection of artists' intellectual property and audience rights in this new technological environment. This approach aims to foster a sustainable and ethical art ecosystem in the virtual world. For managers of art institutions and curators of virtual exhibitions, the limitations of physical space no longer dictate the type of exhibition in the virtual world. The research results mentioned above will provide inspiration and aid in the planning and design of a more interactive new art exhibition mode, which not only complements the limitations of real space but also enhances it through digital virtual space

technology. Science and technology's blessing will unleash the industry's imagination, fostering creative and novel interactive exhibitions that offer a refreshing new artistic sensory experience to modern audiences.

The results of this research will also serve as valuable references for institutions and organizations dedicated to constructing urban experience value in virtual space through digital technology. In the construction of digital cities, the development of new tourism types, and the creation of new city images, all directions have the significance of opening up ideas, and there is no shortage of models for reference.

To sum up, this research result should add a new dimension of understanding to the research and application of digital art scenes in the Metaverse. It also provides a wealth of imagination for the current situation and prospects of public art spaces and the integration of art and technology to create new possibilities. It will open an entrance of enlightenment and guidance for artists, curators, and digital city construction institutions in the practice of art and communication in the digital age.

1.12 Organisation of Thesis Structure

This PhD thesis offers an extensive research foundation examining the influence of digital technology on contemporary society and its significant effects on the realm of art. The background part will delineate the progression of digital technology and its use in urban public art spaces. Subsequently, I will elucidate the problem statement of the research, present the fundamental questions that this research seeks to tackle, and enumerate specific research questions and aims to steer the research's trajectory. The scope and constraints part of the research will delineate the parameters of the study, ensuring that the focus remains clear and controllable. The paper will subsequently address the importance of the research,

emphasizing its contributions to both academic and practical domains, particularly through a comprehensive examination of the history and evolution of Hangzhou, with a focus on its digitization process and global recognition, alongside the attributes of Hangzhou Ooeli's digital art scene and the necessity for further investigation.

Chapter 2 will provide a comprehensive literature review exploring the intersection of digital art, public art spaces, and the Metaverse. This chapter will draw upon various theoretical frameworks, including New Media Theory, Social Media and Interaction Theory, Space Shaping and Identity Theory, Virtual Space and Environment Theory, Technology and Social Change Theory, and Cultural Consumption Theory. These theories will be utilized to highlight existing gaps in research, particularly emphasizing the need for future public spaces to expand their objectives to include contemporary domains such as digital art, education, human identity, and existence. The chapter will also suggest that further research could build on our initial findings by examining how exposure to virtual art influences consumers' perceptions and understanding of digital art and the core concepts of the Metaverse.

Chapter 3 will delineate the qualitative research methodologies employed in the study, encompassing study design, data collecting, and analysis utilizing NVIVO. I employed a qualitative research methodology, incorporating observation and interviews. Observation is categorised into participatory and non-participatory types, whereas interviews encompass on-site and semi-structured formats.

The fourth chapter will delineate the findings and data analysis of the research, examining the influence of digital art scenes on community dynamics. It will encompass a

thematic analysis of aesthetic experience, the community dynamics fostered by digital art scenes, and the interrelation of theoretical concepts.

Chapter 5 will delineate the principal findings of the study, propose recommendations for subsequent research, and encapsulate the study's conclusions. This chapter will articulate the research objectives, emphasising the significant contributions of this study to comprehending the interaction between the digital art scene and the community. I will offer ideas for the future advancement of the digital art landscape, assess the present condition and constraints, and encapsulate the general findings of the study in the conclusion section.

1.13 Chapter Summary

This chapter delves into the significance of previous research on this subject, as well as its historical background. Take into consideration the past of Hangzhou, China, which is a well-known picturesque tourist destination, as well as the potential for the city's development in the years to come. It recognizes the need for scientific and technological knowledge to support the development of urban public art spaces within the specific constraints of the global pandemic. The aim is to bolster the growth of urban public art spaces. Depending on the context, China's extensive history allows for a variety of displays of its captivating culture and art. Museum organizations can only offer audiences a limited experience, even though they are the transmitters of cultural and artistic exhibitions in physical space. This is a result of the limited experiences that museum organizations are able to offer their visitors. When it comes to scientific research, art exchange, historical preservation, the dissemination of culture, and other aspects of modern society, traditional art spaces are not up to the demands of the public in the Web 3.0 era.

New forms and functions in the art scene, such as digital art, align with diverse types of public art. The surrounding environment enhances the sense of practice in contemporary public art spaces. The use of virtual reality technology in the experience area of exhibition design opens up new possibilities for the practical sense of public art spaces. This practical sense refers to the development and application of virtualization technology as well as the expansion of function. One way to experience the exhibition space is through virtual reality technology. This new opportunity demonstrates the potential to expand the goal of public art spaces to include more. This sense of routine is going to go through significant changes as we move into the Web 3.0 era. Simultaneously, we must consider the internal needs of artists and other pertinent practitioners, starting with an exploration of demand-oriented design's potential to establish public art spaces capable of growth. We should expand the non-linear and non-traditional components of the digital art scene by considering a feasible framework for a new public art space. In the next chapter, more details on the specific location selected, Hangzhao City, China, will be elaborated.

CHAPTER 2

LITERATURE REVIEW

2.1 Overview

This chapter provides an in-depth analysis of the current state and focal areas in existing research while introducing theories and concepts that establish the academic foundation and contextual relevance of this PhD study. Key terms and definitions central to the study are thoroughly explored, offering clarity and elucidating their significance within the research. The chapter also traces the historical progression and acknowledges the established recognition of these principles within the field.

The discussion begins by defining and explaining fundamental terms such as digital art, public space, and the Metaverse. This is followed by an expanded overview of the conceptual framework underpinning the research. This framework not only delineates the scope and direction of the study but also facilitates a more precise engagement with these foundational concepts. The formation process of this theoretical framework and its role as a guiding principle for the research are outlined in detail.

The chapter proceeds to explore the relevant digital technologies, including virtual reality, augmented reality, and other innovative tools central to the study. The progression of these technologies and their integration within digital art and public spaces are critically examined. Emphasis is placed on their transformative impact on artistic creation, audience interaction, and the conceptualization of public spaces. The artistic contributions and achievements of notable practitioners in this domain are also reviewed, with a focus on how their work leverages digital technologies to create novel art forms and enhance audience

engagement. The analysis extends to the implications of these works on public spaces and their significance for the research.

The chapter concludes by highlighting how this study addresses existing gaps and contributes to advancing knowledge in this specialized field. The discussion encompasses the study's novel insights and its potential to inform and influence future research and practice, thereby enriching the discourse surrounding digital art, public spaces, and the Metaverse.

2.2 Digital Art Scene

Today, as digitization, dataization, and informatization continue to advance, the art profession is also seeing significant transformations. The field of digital art has developed into an internationally recognized and distinctive artistic form. It employs digital technology, such as virtual reality, augmented reality, and interactive or mobile gadgets, to generate novel art forms and enhance audience experiences. This art's evolution is also fostering the alteration of public space. The advent of digital technology is altering the structure and purpose of public space, transforming it into a novel medium for individuals and communities to convey, exchange, and engage with one another. In light of this context, the notion of the Metaverse has come to the forefront. This phenomenon introduces a novel digital realm that is abundant with limitless potential and prospects. It has significantly influenced the advancement of digital art and the public domain.

Furthermore, China's digital infrastructure has exerted a significant influence on a worldwide level, advancing the process of global digitization and playing a crucial role in the advancement of digital art. China is a prominent global leader in terms of internet usage, boasting a substantial user population. The Chinese government dedicates itself to fostering

the advancement of the digital economy. The establishment of Digital China has facilitated the extensive distribution and advancement of digital art (Wang et al., 2020), enticing a greater number of producers and artists to dedicate themselves to digital art creation. It has also stimulated the growth of the digital art industry.

With an emphasis on the Metaverse era, this study aims to investigate how digital art is used and what effect it has in public art spaces. This study examines the ways in which digital art creates links between the real and virtual worlds and evaluates the consequences for the development and transformation of public art spaces as well as Metaverses. Through the digital art scene, additional validation will be carried out to determine whether there is a possible unique relationship between the public art space in the physical world and the Metaverse in the virtual.

Since digital art scenes are currently limited in their presence in public art spaces, a more thorough analysis of their interaction model with the Metaverse is required. This study aims to address existing limitations and advance knowledge in this particular research domain by offering new insights and knowledge. The aim of this study is to provide theoretical and practical recommendations regarding the use of digital art in public areas and Metaverses. Additionally, the study aims to provide significant insights into the development of digital infrastructure in China as well as globally.

2.3 Hangzhou's Digital Art Scene

Hangzhou, a leading hub of digital technology and art in China, is at the forefront of integrating artistic creativity with the Metaverse, particularly through its digital art scene and events like the Hangzhou Asian Games. The city has demonstrated the immense potential of

digitalization and intelligence in culture, sports, and art, showcasing its unique cultural appeal and technological prowess to a global audience.

In education, Hangzhou University of Electronic Science and Technology has developed a VR course titled "Language and Intercultural Communication Training for International Volunteers of the Asian Games." This course uses augmented reality to enhance language and intercultural communication skills, providing an immersive learning experience. The Edu-Metaverse model supports smart education by integrating technologies like VR/AR, IoT, and blockchain to create interactive and collaborative learning environments (Xiaoyang Shu,2023).

In the realm of art and design, the application of Metaverse technology, such as the XiRang game, is explored to provide immersive and imaginative experiences. This approach is seen as a potential direction for future teaching methods, surpassing traditional modes and fostering creativity and innovation in art design education. The use of virtual conference platforms in XiRang games offers a new way to engage users through dynamic and interactive elements (Yang Jin,2023).

The Hangzhou Asian Games further exemplify the city's commitment to digital innovation, utilizing smart technology in the smart viewing zone to provide participants with a preview of the event's smart viewing experience. Platforms like the Intelligent Asian Games One-Stop Pass and Asian Games Panoramic VR Platform offer spectators a diverse digital experience, allowing them to fully engage with the event's scenes and experience the excitement of the tournament (Hu Jiali,2023). Moreover, Hangzhou's digital art scene extends beyond mere information transmission, offering a holistic and immersive experience that transports spectators into a virtual world. The city has introduced digital innovations

such as the world's first Asian Games digital torch and digital mascots, expanding the concept of torchbearers from the physical to the digital realm, thus inviting global participation (Hongyu, 2023).

The digital art brand ATOM SPACE has established the inaugural Metaverse Cafe + Art Museum in Hangzhou, known as ATOM SPACE&X2 GALLERY, blending traditional social settings with digital art to create a unique Metaverse ambiance. This platform collaborates with new media artists to showcase a wide range of digital art, broadening the audience for digital art and highlighting Hangzhou's innovative approach to creativity and technology.

Through these initiatives, Hangzhou not only enhances its reputation as a contemporary city of technological prowess but also as a renowned cultural hub, infusing its international reputation with energy and innovation. The seamless integration of culture and technology creates greater potential for the development of the city's creative and digital technology sectors, demonstrating Hangzhou's active commitment to the digital age and its support for the digital technology and creative industries (Hongyu, 2023).

2.4 Development of Digitalization in Hangzhou

The progress of Hangzhou in the realm of digital technology is noteworthy. Hangzhou, being a prominent hub and innovation center of China's digital economy, persistently pursues exploration and innovation propelled by digital technology, resulting in numerous accomplishments across various domains.

Established in 1999, Alibaba is a renowned Chinese internet enterprise that has gained global recognition. Hangzhou is the birthplace of Alibaba Group. Global recognition

of the technological industry has significantly influenced the growth and development of Hangzhou. Presently, Hangzhou has transformed into a metropolis that extensively utilizes digital technology. The role of the city has undergone a revolutionary transformation. Alibaba is a multi-sector company that offers services in B2B, online retail, semiconductor technology, cloud computing, shopping search engines, and third-party payment. Alibaba Group's businesses offer a wide range of services, including catering, shopping, logistics, fresh food, mapping, travel, life services, education, medical care, and new energy. These services cater to Internet users from over 200 countries and regions (Schmuck, 2020). In Hangzhou, the availability of cloud services allows individuals to fulfill nearly all their material and spiritual requirements from the comfort of their own homes, without any dramatization. Hangzhou possesses a robust capacity for digital technology innovation and has emerged as a significant catalyst for the worldwide digital economy.

Two renowned universities, Zhejiang University and the China Academy of Art, facilitate Hangzhou's proactive promotion of the digital culture economy. Hangzhou consistently supplies exceptional individuals for its development, showcasing dynamic artistic ingenuity and innovation. The establishment of the digital creative industry park and the organization of events like digital cultural and creative exhibitions in Hangzhou have gained significant attention, particularly in recent years (Wu, 2022). The annual graduation exhibition of the China Academy of Art has become a popular national art festival in Hangzhou, attracting active participation from citizens. Hangzhou's public art spaces showcase exhibitions of diverse themes in various formats. The inclusion of these activities has transformed the public art spaces of Hangzhou, a contemporary city, into a visually captivating landscape.



Figure 2.1: Hangzhou's natural scenery and modern city (Photo source: Author, 2023)



Figure 2.2: Hangzhou's modern city light show (Photo source: Author, 2023)

2.5 Evolution of Digital Art

In the 1960s, artists began using computer-generated graphics technology to create artistic creations, marking the genesis of digital art (Van der Meulen, 2019). During the

1980s, the range and variety of digital art expanded, leading artists to heavily rely on computer software for image manipulation and digital synthesis in order to produce more intricate and diversified artworks. In the 21st century, the Internet and mobile devices have facilitated the dissemination of artists' works worldwide via the Internet and social media platforms (Mulyana et al., 2020), enabling more profound engagement with viewers. This worldwide communication approach not only expands the artistic possibilities for creators but also facilitates the accessibility and admiration of diverse digital artworks by audiences. Furthermore, such diffusion also facilitates alterations in the art market. With the growing acceptance of digital art in the market, there is a progressive emergence of digital art platforms and online galleries. This affords artists increased sales and exhibiting prospects while simultaneously offering audiences a wider and more convenient avenue to access and admire digital art.

Currently, digital art is undergoing ongoing growth as artists strive to seamlessly merge it with developing technologies like virtual reality and augmented reality, aiming to produce a more immersive artistic encounter. For instance, digitalization has become an essential part of the infrastructure of public places, museums, and humanities. The recent advancements in computer recognition technology and artificial intelligence present novel prospects for inventive and unified procedures encompassing many media formats such as photos, text, music, video, 3D, virtual reality (VR), augmented reality (AR), and mixed reality (MR) (Giannini & Bowen, 2022).

Furthermore, a comprehensive aesthetic description is insufficient to encompass the vast array of artistic practices that collectively constitute digital art. Nevertheless, we can broadly divide it into two distinct groups: art that utilizes digital technology as a medium to

create conventional artworks like pictures, prints, or sculptures, and computational art, which entirely generates its own artwork through digital technology. both of these art forms fall under the umbrella of digital art, their techniques of creation and means of expression differ significantly (Paul, 2023).

Digital art utilizes various capabilities of digital technology as its primary medium for creating and exhibiting artwork, which is facilitated by the widespread availability and use of digital technology (Taipale, 2021). This innovative approach utilizing digital technology not only expands the range of creative techniques and forms of artistic expression but also facilitates the alignment of artistic works with the communication paradigm of contemporary society.

The term digital art currently refers to the creation of artistic works using cutting-edge information technologies, including 5G, VR, AR, artificial intelligence, cloud computing, and big data (Qu et al., 2022). Due to its capacity to make effective use of contemporary digital technologies and a variety of art communication channels, digital art has grown significantly since its inception. This is characterized by the use of various digital technology functions for both creation and presentation. We refer to this artistic medium as digital art. Digital art extends beyond the confines of two-dimensional space. Public areas have utilized digital art during the metaverse age through virtual art exhibitions, digital sculptures, and various other forms (Paul, 2023). The spatial characteristics of this art form elucidate how we can engage with intricate three-dimensional virtual environments and objects in a completely immersive setting, utilizing multiple modes of perception and sensory input, such as sight, sound, touch via haptic interactions, and movements of the head

and body (Papadopoulos, 2021). There is an apparent distinction between this experience and watching an avatar in a virtual world while sitting in front of a computer screen.

We can refer to this type of place as a digital art scene, where technology, including various modes like images, audio, and haptics, facilitates the creation of meaning across many sensory modalities (Mills & Brown, 2022). The concept of digital art, a multi-sensory interactive form of art that can function as an autonomous element in public settings, centers the authors' study. Hence, a digital art scene can be defined as a milieu or ambiance where individuals can admire art forms produced using digital technology, engage in artistic expression, and interact. Within this simulated realm, spectators have the opportunity to engage with and perceive the ingenuity of artistic expression. This setting not only offers a novel means of artistic manifestation but also affords the spectators a fresh approach to encountering art.

2.6 Public Art Spaces

To accurately define the term public art space, it is necessary to examine and analyze the development of this notion across time. Prior to the 1950s, the concept of public space received minimal or no acknowledgement, and it did not receive any scholarly focus. Academic discourse rarely employs the phrase "public space" with a well-defined meaning. In the 1950s, people commonly derived the definition of public space from the concept of the public sphere. The German philosopher Habermas of the Frankfurt School is the key thinker responsible for the inaugural description of this notion in modern times. He holds the view that the term "public sphere" refers to the realm where individuals can engage in open discussions about matters of public concern and actively participate in political activities, considered a fundamental requirement for democratic governance, separate from the realm

of political authority. The introduction of this concept significantly influences the perception of public space. During this period, the public sphere engaged in discussions pertaining to individuals' public and private rights (Habermas, 2020) while also serving as a cultural platform with significant communication value. Currently, the public domain is more closely aligned with the notions and components of public space in contemporary urban areas that we are currently debating. The concept of public space is defined by the degree of accessibility and the emphasis on the unrestricted nature of the physical environment (Katumpe, 2022). In 2021, Van Nes suggested employing the concept of accessibility as a means of assessing the degree of openness in public spaces. He asserts that the economic foundations and management forms of cities influence the openness of public spaces.

This encompasses not only the architectural element, but also the ways in which a city's society utilizes public spaces, the characteristics of its visitors, and the behaviours that are acceptable there. Urban areas have long established the significance of public space. Kevin Lynch is a prominent theorist in the field of urban studies. In his article on the openness of open space, he briefly mentioned the concept of open space, stating that if an area permits unrestricted movement for individuals, it can be considered open (Lynch, 1995). It is also in line with Hannah Arendt's concept of maximum open freedom of action (Hirsch, 2020). During that time, it was characterized by the emergence and growth of a public sphere centred around citizen participation. The notion and role of urban public space have gained attention in global academic research due to the emergence of inclusive urban spaces and the active participation of urban people in these spaces.

It is possible to discuss and define various levels of accessibility. The level of accessibility of a public location to society is indicative of its public visibility. Social groups

exhibit their social behaviour within a shared area, creating a functional environment that allows for easy social interaction and unrestricted movement. In modern times, this field expands into metropolitan areas, showcasing a more advanced public space. The contemporary world is predominantly characterized by urbanization. Urbanization is a prevailing global trend, with over half (56.16%) of the world's population residing in cities, and this proportion continues to grow annually (United Nations, Department of Economic and Social Affairs, 2019).

Public spaces serve as repositories of shared memories and have the potential to facilitate ongoing social engagement. Urban centres exhibit distinct manifestations of urban identity through their individualized urban design (Abusaada & Elshater, 2021). Cultural disparities influence the perception of urban areas, the behaviour of individuals in public places, and the physical design of public spaces. Various regional cultures exhibit distinct approaches to managing urban space. The configuration of urban public space mirrors the cultural disposition of each metropolis. Urban environments greatly value public space. Public space undergoes a process of creation, formation, and utilization. Different cultural contexts will shape people's behaviours and perceptions of public spaces (Parker & Saker, 2020). The role that urban public spaces have played in shaping our understanding of them has had a significant impact on future design. Discussions around urban art, which serves to define and enhance the spatial qualities of cities and promote economic and social development, clearly demonstrate this effect (Carmona, 2021).

Art is crucial in the development and diverse promotion of urban public areas. Art frequently serves as a means of urban rejuvenation by intervening in public places and thus contributing to the creation of a new condition of public space (Campos & Barbio, 2021).

The presence of art in urban public places engenders a novel realm, fostering a dynamic interplay between art and individuals, individuals and society, and society and art, thereby disrupting conventional modes of spatial communication and social interaction. It expands urban public areas to fulfill social requirements and heightens people's perception of being present in the city. Artistic intervention in urban nodal areas stimulates their activation, resulting in a radiation effect on public space. This, in turn, enhances commerce, residence, and the overall quality of the surrounding public space environment. There are numerous potential avenues for growth and advancement, which can concurrently enhance the efficiency of services related to the public domain (Campos & Barbio, 2021). Although public art spaces greatly improve urban settings and cultural identity, they are frequently disputed areas where social inclusion, economic priorities, and power relations overlap. Socioeconomic disparities may have an impact on these areas' accessibility and use, benefiting some groups while marginalising others. According to scholars, the commercialisation of public art spaces due to urban economic goals may compromise their democratic potential by transforming them into tools of cultural capital rather than venues for inclusive participation and expression. In addition to actively addressing concerns of accessibility and representation, this highlights the urgent need to construct public art venues that blend aesthetic, cultural, and social functions. Such factors are necessary to guarantee that these areas actually function as forums for public discussion and engagement.

2.6.1 Public Art in Urban Environment

Based on the analysis of relevant literature, numerous definitions of public art space exist. However, public institutions install art in public spaces and fund it with public resources, making this the most prominent definition (Hein, 1996). However, many view this description as overly simplistic and restrictive. Public institutions differ in their level of

engagement and the allocation of public funds, while the areas classified as public vary in their accessibility to all individuals. While there may be more comprehensive definitions of public art, they differ significantly in their approach and content (Yarchi et al., 2021).

Independent art venues offer enhanced artistic autonomy and ample opportunities for innovation, surpassing conventional artistic standards and bridging the gaps across artistic domains. Therefore, they can serve as a catalyst for artistic creativity by introducing novel visual languages in the field of art. Scholars recognize artistic exhibitions as a tool for democratizing culture, as they foster a direct and intimate connection between art creators and enthusiasts. Various scholars have acknowledged this integration of art production and display (Elleström, 2021). Thus, they could be viewed as expressions of artistic nonconformity and independence within the art realm, in contrast to the conformity and distinctiveness embodied by public and commercial arts institutions that uphold conventional conceptions of art and established norms. Over time, certain autonomous arts venues may gain recognition and gradually integrate into the institutional or market-driven aspects of the arts system (Buchholz, 2022). Consequently, they serve as a benchmark for upcoming artists and unconventional art venues.

Current study indicates that public art places, including museums, art galleries, and exhibition halls, not only serve as platforms for art but also enhance the creative value of public spaces. These spaces not only enhance the visual appeal and organization of the city but also serve as areas for individuals to unwind. The presence of nearby art galleries has served as a catalyst for the development of diverse installations, performances, and street art (Ioannidis & Kontis, 2023). Public art spaces create aesthetically pleasing public areas by offering a wide range of artistic expressions. Globally, art serves as a method of creating and

enhancing urban spaces to stimulate urban renewal and foster social connections (Sharp et al., 2020). These areas not only enhance the urban landscape, bolster the local economy, and attract tourists, but also elevate the local environmental quality and overall economic status. Art, as an intangible communal asset, serves as a crucial resource that draws the attention of artists and urban development policymakers who are interested in the creation of public spaces. Art producers recognize that public art possesses both intrinsic and instrumental value (Matthews & Gadaloff, 2022).

The present research focuses on implementing public art spaces to create a public space that adapts and responds to the unique regional attributes of each city. This encompasses strategies for enhancing public spaces and fostering urban culture through the utilization of public art, with a focus on improving people's well-being and promoting the growth of public spaces. Thus, we can deduce that the notion of public art spaces is diverse and encompasses not only artwork exhibited by public institutions in public areas and funded by the public but also autonomous art venues that offer more artistic liberty and room for innovation. These venues go beyond conventional creative conventions, traverse the barriers between different artistic disciplines, and can serve as a catalyst for artistic innovation by introducing novel visual art languages. Simultaneously, they serve as a means to democratize culture by merging art creation and display, fostering enhanced engagement between artists and enthusiasts.

The contemporary urban environment is an intricate amalgamation of media and physical dimensions (Rani, 2021). The digital art scene, extending from the city, offers an exceptional creative function as the largest public space. The 20th century saw the emergence of development patterns strongly linked to the growing utilization of digital

media as urban infrastructure. Digitization enables the integration of previously distinct media components by establishing the necessary technical circumstances. When the media adopts computational and networked capabilities, it brings about substantial changes to the communication process, as well as the architecture and communication inside the city. The concept embodies the convergence of three key attributes: widespread presence, precise location determination, and instantaneous data updates (Rani, 2021). Public art spaces expand the digital art scene, and these attributes succinctly describe it.

2.7 The Concept of Metaverse

The concept of a virtual environment varies among fields, lacking a definitive and globally recognized description. The phrase Metaverse derives from the amalgamation of "Meta" and "Universe," with "Meta" originating from the Greek word signifying "beyond" or "change," and "universe" denoting the aggregate of stars, planets, and other celestial entities beyond our spatial realm. The amalgamation of these two terms generates a novel, optimized, unknown domain.

In 2021, the concept of the Metaverse attracted a lot of attention due to several significant advancements. The first Metaverse stock, Roblox, was successfully listed on the New York Stock Exchange in March 2021 (Far et al., 2023), which sparked further interest in the Metaverse. The American social media company Facebook announced later that year, in November, that it was changing its name to Meta. This strategic move generated a lot of discussion and marked a change to a new organizational paradigm that was focused on the Metaverse.

The fundamental concept of the Metaverse pertains to virtual reality, denoting a digital domain that amalgamates virtual and actual components. In order to create a unique

virtual reality that surpasses gaming, we must build a digital ecosystem and incorporate the virtual self (character) into it (Hein, 2020). Despite being in its nascent phase, the Metaverse's evolution has sparked considerable discourse and examination and is anticipated to be a significant trajectory for the advancement of virtual reality and Internet technologies.

This idealistic portrayal of the 3D virtual world overlooks the inherent risks and uncertainties associated with the unrestricted movement of identity and financial assets (Andrew, 2022). The Metaverse is defined as a communal virtual shared area in which users can interact, engage, and create virtual avatars and environs (Mozumder et al., 2022). However, the process frequently disregards users' privacy and data security concerns.

The emergence of the Web 3.0 period positions the Metaverse as a decentralized trend in the future evolution of the Internet. However, the genuine achievement of this decentralization ideal remains uncertain. Although the Metaverse presents novel potential for exploration, creation, and connection, it is uncertain whether the concept of public art can be effectively integrated into the representation of digital identities and experiences. The potential for the digital art scene to evolve into the virtual public art space of the Metaverse requires additional discourse. The notion of "parallel virtual worlds" introduced by Meta (previously Facebook) aims to position virtual environments as a substitute for forthcoming smart cities (Allam et al., 2022). Nonetheless, the potential of this situation to genuinely enhance urban efficiency and performance quality remains uncertain. Currently, the majority of studies emphasize the exclusive social purpose of the Metaverse, while overlooking the urban desire for a virtual art environment. While emerging technologies provide prospects for the advancement of digital art, their influence on artistic creativity requires thorough scrutiny.

Decentralization serves as a fundamental principle in the Web 3.0 era, facilitating global information sharing and exchange (Lai, 2023). However, it remains uncertain whether a decentralized framework can adequately resolve the constraints of the existing Web 2.0 architecture, such as restricted user rights, data privacy issues, and dependence on third-party platforms. We need to further examine the potential for decentralization to dismantle the monopoly and obstacles established by centralized art institutions in the realm of virtual art. In what ways might artists exhibit and disseminate their digital art more directly, circumventing established centralized platforms? Will this transition result in new obstacles and issues?

The decentralized social communication model necessitates a fundamental shift, encompassing not just technological advancements but also a deliberate and efficient communication and collaboration framework among the audience, artists, art institutions, technology firms, and municipalities. However, numerous obstacles still exist regarding the feasibility of a seamless transition.

This research will critically examine the Metaverse virtual environment via the lens of digital art. I will demonstrate how the digital art landscape can serve as a conduit between physical public art spaces and the Metaverse, and how this linkage might promote the achievement of decentralization. The conventional concept of public art spaces must adapt to the dynamic interplay between the physical and virtual worlds. Public spaces need to be reimagined as hybrid spaces that blend digital art and urban planning due to the rapid urbanisation and technological advancement of the current world. While the Metaverse holds great promise for creating open, participative, and decentralised art venues, its integration of digital art raises significant issues with accessibility and equality. As recent debates on the

Metaverse have highlighted, the decentralisation paradigm has challenges in ensuring broad access and avoiding the monopolisation of digital art platforms. The potential for virtual venues to replicate existing socioeconomic inequalities could result in the marginalisation of artists and under-represented groups. Therefore, this PhD thesis will examine the growing companies and social arts services resulting from this and its possible impact on smart cities. Nonetheless, the actual realization of these prospective contributions requires verification through practical investigation and critical analysis.

2.7.1 The Intersection of Digital Art and Metaverse

The expansion of the Metaverse depends on a multifaceted technological infrastructure, encompassing third-generation Internet, cloud computing, big data, virtual reality technology, artificial intelligence, and other pertinent technologies. Individuals progressively acclimate to this innovative digital landscape (Bingham, 2020). Virtual reality (VR) and augmented reality (AR) generally include visual simulations, whereas mixed reality (MR) integrates virtual and real aspects to provide a cohesive user experience that incorporates real-world content. A recent study indicates that the Metaverse is defined by cross-platform interoperability, digital virtual economy business models, social collaboration, and participatory content production experiences.

The primary objective of the Metaverse is to attain interoperability, interconnection, and compatibility among various platforms, thereby disrupting the existing service models in specific areas of the Internet and facilitating cross-platform services and operations. The Metaverse presents a variety of experiences that integrate advanced technology with refined intermediary services. These experiences encompass the theoretical and practical aspects of blockchain technology, digital identity, and digital asset management. The emergence of

NFTs has conferred acknowledged status upon digital art through authentication and uniqueness. Nonetheless, although these technologies present novel prospects for the exhibition and advancement of digital art, they simultaneously introduce new obstacles and threats. Consequently, digital art will proliferate numerous new sectors within art and technology. Which industries would those be? Influencing the evolution of art requires our focus.

The Metaverse is an expansive virtual community that surpasses physical, temporal, geographic, national, cultural, and language limitations to facilitate social contact and collaboration. This capability, although presenting a specific risk to the social security of the Metaverse, also necessitates the enhancement of ethical conduct among Metaverse avatars in the physical realm. We must diligently strive to safeguard, meticulously observe, and potentially augment the integrity and humanity of the virtual domain (Khang et al., 2023). A defined process framework is necessary to mitigate risks in the design of digital art scenes.

Nonetheless, although the Metaverse provides novel platforms and opportunities for the exhibition and distribution of digital art, it is imperative to critically assess its potential constraints and obstacles. The essence of virtual art is in its capacity to transcend conventional art exhibition limitations, fostering a more accessible and inclusive artistic milieu. This transparency may result in excessive commercialization and uniformity in artworks, diminishing their originality and profundity. Consequently, we must examine its connection to the authentic public art environment.

Consequently, it is significant and relevant to examine the digital art landscape as a conduit between tangible public art environments and virtual realms. We must acknowledge the novel options offered by the Metaverse while sustaining a critical viewpoint regarding

its significant influence on the creation, presentation, and enjoyment of art. This approach enables a deeper comprehension and use of the Metaverse in the digital era, paving new avenues for the future evolution of art.

2.8 Impact of Digital Technology in the Art Field

There are three main areas of academic research on how digital technologies are affecting the art world. First, the focus is on understanding why virtual technology needs to be developed and exploring the theoretical aspects of the Metaverse. Two key theories that address this topic are the VR Compensation theory and the World Simulation theory. The former believes that individuals strive to compensate for the shortcomings they face in the real world by seeking satisfaction in the virtual world. The latter, on the other hand, sees the impulse to create virtual worlds for compensatory purposes as an enduring aspiration of civilization. Therefore, higher-level designers will inevitably create virtual worlds in the long run.

Secondly, the research explores the artistic effects and aesthetic tendencies of digital technology, as well as the audience's acceptance and experience. Understanding how digital technologies deliver artistic results and audience acceptance and engagement is critical to analyzing their impact on the arts sector.

Thirdly, we examine the workings of virtual reality technology and its role in immersive communication. For example, augmented reality (AR) technology can overlay virtual objects onto the physical environment in real time, whether on a screen or in physical space (Arena, 2022). The development of the digital economy, e-commerce, blockchain, online gaming, and smart cities, among other digital technologies, has boosted the economy and society in all directions and supplied the technical infrastructure required for the

Metaverse's creation. This makes the birth of a virtual universe a natural and ideal outcome (Baía Reis & Ashmore, 2022).

Augmented reality (AR) has emerged as a major digital art tool in recent years, and it has the ability to completely change how people interact with data. Previously, AR was not considered a viable solution for a variety of critical needs. However, through its ability to evolve and innovate, AR has become a transformative force that bridges the gap between users and data. The evolution of technology is the result of the accumulation and superposition of previous advances (Aslam, 2020). In other words, technological innovation and creativity are born from existing technological elements. In this case, the creation of new elements or possibilities within a technological framework results from existing technologies. In essence, we are creating representations of technology through the technology itself (Mihai, 2022). The fusion of augmented reality and digital technology with art paves the way for a paradigm shift in user-data interaction. With the continuous advancement of technology, the influence of digital art has become increasingly prominent. Academic research in this field focuses on understanding the theoretical basis of virtual technology, exploring the aesthetic effects and audience acceptance of digital art, and analyzing the mechanisms of virtual reality technology and immersive communication.

Digital technological advancements such as blockchain, e-commerce, online gaming, the digital economy, and smart cities serve as foundational pillars for the emergence of virtual spaces. However, while modern technologies provide unparalleled creative dimensions and new possibilities for artistic expression, they also pose complicated challenges. The incorporation of these technologies raises worries about the commodification of art, the demise of traditional creative techniques, and the ethical

implications of digital ownership and authenticity. Furthermore, relying on such infrastructures risks increasing existing disparities in access to technology, restricting chances for marginalised artists and audiences. As virtual spaces increasingly dominate the art world, it is vital to investigate the broader socioeconomic and cultural implications of these technologies, ensuring that their adoption promotes inclusive and sustainable artistic innovation rather than reinforcing structural injustices.

2.8.1 The Connection between the Metaverse and Real Space

The significance of the Metaverse lies in its ability to amalgamate one's identity in the physical realm with their digital persona (Dwivedi, 2022). The Metaverse serves to encapsulate and replicate a wide range of human survival behaviours from the physical world into a digital realm, thus establishing a parallel and more convenient digital space system. The Metaverse, being an expansive digital realm, necessitates active involvement and support from individuals in the physical world to aid in its growth. It is important to recognize that the Metaverse is not merely a passive space. The Metaverse is envisioned as a publicly accessible digital environment that incorporates three-dimensional depth. The ultimate advancement of this space system hinges upon the involvement and assembly of innumerable entities and individuals (Hofer, 2020).

According to Baudrillard (1998), the initial stage of imitation holds significance solely within the realm of reality, while fictional challenges must strive to emulate, replicate, and mirror nature. There exists a distinct boundary separating the genuine from its replication. In the second stage of manufacturing, the value is determined by market forces, and the objective is to generate a financial gain. Mass-produced replicas establish a symmetrical association with genuine prototypes. The third level of simulation engenders

hyperreality by fully incorporating reality within itself, resulting in the dissolution of the boundary between the two. With the absence of the original object of imitation, the imitation itself becomes a model, and the distinction between illusion and reality gets blurred. Thus, the theory of virtual reality compensation emerged. The core concept of the argument is that individuals would endeavor to make up for what they lack in the physical realm by seeking fulfilment in the digital realm (Kljajevic, 2021).

Furthermore, the advancement of human society consistently seeks to offset this by generating novel virtual realms (Allam, 2022). The emergence of a virtual realm is inevitable (Lee, 2020). Currently, academia is exploring two theories, namely virtual reality compensation theory and world simulation theory, to understand the connection between the Metaverse and real space. The virtual reality compensation theory posits that virtual reality serves as a supplementary and expansive counterpart to the physical environment. Virtual reality can compensate for the deficiencies of the physical world and offer a more immersive encounter. This is a novel artistic realm, where virtual space showcases artistic encounters that are unattainable in the physical world. Within the realm of simulation theory, virtual reality serves as a replication and imitation of the tangible world. It offers a secure setting for individuals to carry out diverse experiments and investigations. Although immersive digital environments undeniably expand the boundaries of artistic expression, they also demand critical scrutiny to address issues such as digital access disparities, the commodification of virtual experiences, and the potential homogenization of artistic diversity. Therefore, the application of these theories must go beyond idealized representations, engaging with the broader socio-cultural and ethical consequences of integrating virtual spaces into artistic and cultural domains.

2.9 Construction of Theoretical Framework

The integration of the four key theoretical frameworks—digital art theory, public art space theory, virtual reality theory, and social interaction theory—forms the foundation for a comprehensive analytical framework. This framework serves multiple purposes in the context of this study, bridging theoretical insights and practical applications. As illustrated in Figure 2.3, the interconnected deduction of these theories allows for the development of more nuanced and complex perspectives that inform the study's objectives.

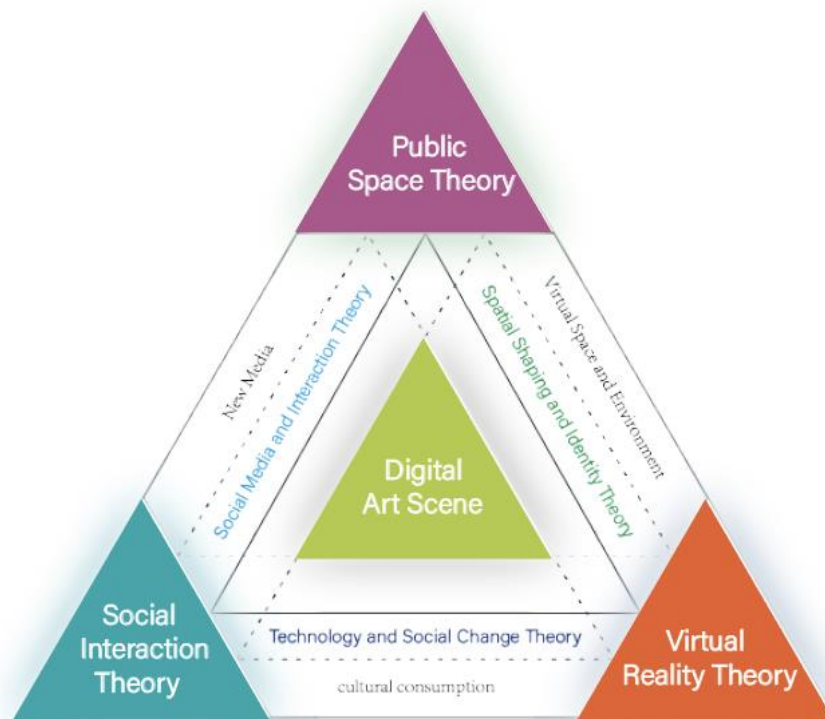


Figure 2.3: Theoretical framework (Author's illustration)

2.9.1 New Media Theory, Social Media and Interaction Theory

New media theory examines the social repercussions of new media, the correlation between new media and culture, and the aesthetic and artistic manifestation of new media. From a media standpoint, digital art scenes represent artists' innovative endeavours to distribute their artistic creations. New media theory employs concepts such as interactivity,

networkability, and virtuality to scrutinize the attributes and operations of digital art scenes (Pual, 2023). Thus, it is significant to conduct a study on the impact of digital art on the audience's creative experience and its influence on the communication of art.

The interplay of functionalities is a key characteristic of modern media. The field of social media and interaction theory primarily examines the impact of social media on individuals' interactive behaviours and social relationships. This idea posits that social media serves not just as a means of disseminating information but also as a platform for facilitating social interaction. Social media platforms facilitate the dissemination of information, enable the expression of viewpoints, facilitate discussions, and provide a means for organizing events and movements (Sinpeng, 2021). Given its interactive nature, social media is an important public space where people can participate in a variety of social activities.

Social media can serve as a platform for a public art space, allowing artists to showcase their works and enabling audiences to admire and provide feedback on them through social media. This approach facilitates the widespread and expedited distribution of artistic creations. Social media can be integrated into the Metaverse, enabling individuals to establish their own social media platforms and engage in diverse social interactions. This strategy enhances the richness and diversity of the Metaverse.

Social media and interaction theory allow for the analysis and understanding of the digital art scene. This research examines the cognitive processes of artists in utilizing social media as a platform for artistic creation, explores the ways in which audiences engage with and perceive artworks on social media, and investigates the impact of social media on the distribution and reception of artworks. How can we utilize the interactive and networking features of social media to enhance the appeal and engagement of digital art communities,

and how can we use social media data to evaluate and enhance the design of digital art platforms.

2.9.2 Space Shaping and Identity Theory, Virtual Space and Environment Theory

The theory of spatial formation and identity primarily examines the impact of geography on the development and configuration of individual and social identities (Bentley, 2020). This theory posits that space serves as both the framework and the essential component of identity. Individuals inhabit, labor, and engage in recreational activities within distinct environments; the attributes and regulations of these environments impact individuals' conduct and perspectives, thereby molding their sense of self.

Within the scope of this research, it is evident that public art venues hold significant value as locations for the expression and exploration of identity. Artistic endeavors and creative pursuits have the ability to both mirror and influence the culture and values of a certain area, thereby impacting the sense of identity among local residents. For instance, the establishment of a public art venue showcasing Hangzhou-themed artworks could enhance the city's sense of identity by promoting its local culture.

Similarly, the Metaverse and the digital art scene provide novel realms for self-expression and identity formation. Within the Metaverse and digital art realm, individuals have the opportunity to manifest and encounter their identity through novel means. For instance, individuals have the opportunity to examine and communicate their own identity and surroundings through simulated avatars and online communities (Maloney, 2021). Additionally, they can validate and immerse themselves in their virtual persona by engaging with specific genres or forms of artistic expression.

According to Manovich (2021), the application of space shaping and identity theory extends to the analysis and design of digital art scenes. It involves utilizing space design and art activities to mold and reinforce particular identities. Additionally, it explores the creation of an inclusive and diverse identity space within the Metaverse and digital art scenes. Examine its suitable framework as a tangible link between the Metaverse and public art space is also very significant in this study.

The theory of virtual space and environment primarily examines the structure and attributes of virtual space, as well as its influence on human behaviour and social structure. People perceive virtual space not only as an extension or duplication of physical space, but also as a distinct social environment with its own unique structure and culture (Vink, 2021).

Artists have the ability to produce their own artistic creations in a digital environment, while audiences can engage with these creations in public art venues and admire them within the digital realm. Virtual space systems enable the display and sharing of artistic creations without the constraints of physical locations. Artists can leverage the interactivity and networking capabilities of virtual space to create visually appealing and engaging public art places and digital art scenes. Once digital art scenes reach a state of wealth and maturity, the methods for creating and developing digital art scenes in the Metaverse will be unveiled. Researchers utilize virtual space data to assess and enhance the design and functioning of art scenes in public art locations. Scavarelli (2021) originally coined the framework of virtual space and environment theory, which this study also considered for further investigation.

2.9.3 Technology and Social Change Theory , Cultural Consumption Theory

The field of technology and social change primarily examines the ways in which technology facilitates and advances social change and development. This idea posits that

technology serves not just as a means for social change but also as a catalyst for it. Emerging technologies have the potential to revolutionize individuals' lifestyles, work methodologies, and cognitive processes, consequently instigating societal transformations.

The utilization of digital technology has the potential to instigate transformation and progress in public art settings. The utilization of virtual reality technology can enhance the convenience and prevalence of creating, exhibiting, and distributing digital artworks (Xiong, 2021). Furthermore, it can also augment the immersive and interactive nature of the art experience.

The Metaverse and the digital art scene serve as significant embodiments of technology that foster societal transformation. In 2022, Dwivedi stated that within the Metaverse and digital art realm, individuals have the opportunity to engage in artistic endeavors and encounter artworks in novel ways, perhaps altering their artistic perceptions and behaviors.

Cultural consumption theory primarily examines how consumers express and shape their identity, values, and social standing by selecting and utilizing cultural objects (Eco, 2020). This idea posits that cultural consumption encompasses not just economic behavior but also social and cultural behavior. Public art locations, Metaverses, and digital art scenes serve as significant venues for cultural consumption. At these locations, individuals have the option to select and engage in a diverse range of artwork and artistic endeavors. The emergence of novel consuming patterns and ecosystems has significantly influenced contemporary human values and identities (Sutrisno, 2023). These choices and applications can both mirror and shape their aesthetic preferences, comprehension of art, and engagement in artistic activities.

The evolution and conversion of public art spaces, Metaverses, and digital art scenes have the potential to alter the approaches and patterns of cultural consumption. For instance, digital technology enables art consumption to be more convenient and tailored to individual preferences, while virtual reality technology enhances the art experience by making it more immersive and interactive. This, in turn, may give rise to novel cultural consumption models and cultural consumption demands.

The application of cultural consumption theory can be extended to analyze and comprehend the economic ramifications of public art venues, Metaverses, and digital art scenes. For instance, we can analyze the consumption behavior and its impact on economic value and prospects in these locations, as well as strategies to foster the growth and prosperity of associated industrial economies. In 2016, a professor at the University of Chicago named Terry Nichols Clark established scene theory, which is based on the idea that scenes are symbolic (Donahue, 2021). On the other hand, many consumer actions, including the concept of community, generate spaces (Morgan-Thomas, 2020). Professor Terry Nichols Clark broadened research on urban public space by using the ecological and sociological aspects of cities as her basis. It enhances one's comprehension of the prevalent consumption practices within the local culture. Modern information systems no longer solely reflect the present, as digital technology now dominates our world (Benbya, 2020). Professor Terry Nichols Clark of the University of Chicago has developed the scene theory, which offers valuable insights into new models for urban digital public spaces. Scene theory comprises at least five components: data migration, atlas connection, sensory imitation, small data, and the final scene (Li, 2023). In the era of big data, we can establish human life trajectories and an individual's likes and dislikes by conducting an analysis of big data (Ianni, 2021). Smart phones, which have the highest adoption rate of all mobile technology devices,

have the ability to store data in the cloud and perform data transfer while the user is on the move. As a result, the smart phone has emerged as the most effective experience carrier in the scene. It should come as no surprise that wearable virtual reality technologies are also able to transmit data and provide an exceptional scene experience. The essence of scene theory is the intelligent coupling of soft element data with scene synthesis and distribution (Loschky, 2020).

Analyzing urban public art space and the impact of digital technology on modern life offers a fresh outlook on urban ecological development and social interaction. This theory underscores the significance of data and technology in contemporary urban living, as well as the concept of intelligently combining soft element data with scene synthesis and distribution. Thus, this study will delve deeper into the distinctive function of the digital art scene, bridging the gap between public art space and the virtual realm. This role offers a fresh viewpoint for examining the relationship between public art spaces and digital technology, as well as establishing a conceptual foundation for linking public art spaces with the virtual realm. This section presumes that the digital art scene can act as a distinctive connection between public art space and the virtual world by establishing a preliminary conceptual framework. It aims to delineate the study's scope and emphasize the significance of the interaction relationship, thereby establishing a conceptual basis for the study.

2.10 Conceptual Framework Construction

Upon creating a precise and comprehensive theoretical framework, we proceeded to define the research scope and theoretical importance. Throughout this research, we hypothesized that the digital art scene could act as a distinct link between public art space and the Metaverse, thus establishing the conceptual foundation for this study as shown in

Figure 2.4. As a nexus, it facilitates the adoption of novel operational frameworks and enables the flow of traffic for both parties.

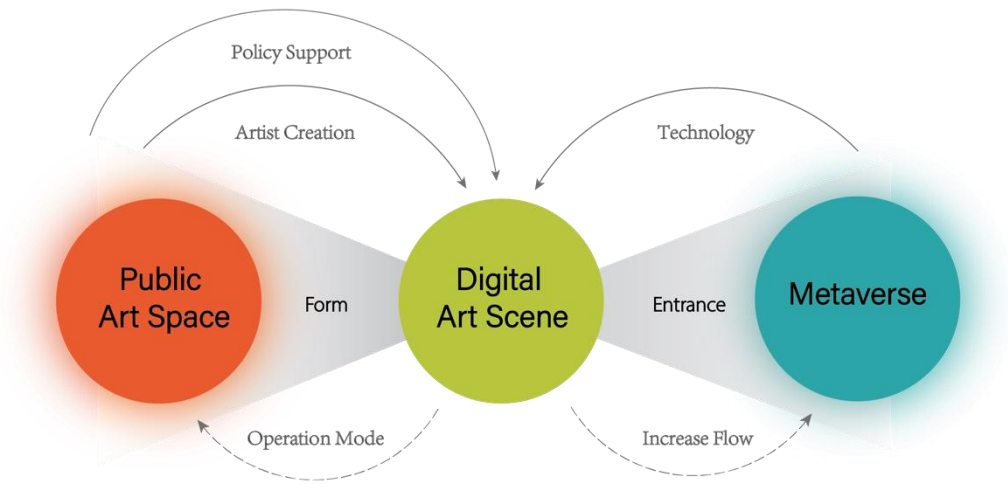


Figure 2.4: Conceptual framework (Author’s illustration)

The digital art scene represents a transformative mode of display within public art spaces, utilizing advanced technologies to enhance both visual and sensory experiences. This innovative approach creates a more engaging and participatory encounter with art, bridging the gap between traditional exhibitions and dynamic, interactive platforms. By leveraging digital technology, public art spaces are able to showcase artworks that captivate audiences through enriched sensory experiences.

Additionally, digital art scenes introduce new operational frameworks for public art spaces, such as online exhibitions, virtual tours, and immersive virtual reality experiences. These frameworks not only attract broader and more diverse audiences but also improve operational efficiency and generate significant economic benefits. The integration of digital art scenes provides public art spaces with a competitive edge in terms of accessibility and interactivity.

Furthermore, the digital art scene serves as a critical interface between public art spaces and the expansive virtual realm of the Metaverse. Enabled by Web 3.0 technologies, these scenes allow for the seamless incorporation of the Metaverse into physical art environments, offering audiences an extensive and unrestricted platform for artistic exploration. At the same time, the digital art scene draws visitors with shared virtual identities into the Metaverse, increasing user engagement and enhancing the platform's overall influence. This dual functionality not only expands the user base of the Metaverse but also bolsters its vitality and impact, establishing a synergistic relationship between physical and virtual art spaces.

The development of digital art scenes operates within an interconnected ecosystem rather than in isolation. Public art spaces and the Metaverse play a significant role in providing essential support. Public art spaces offer a physical platform for artists to showcase their creations, while art institutions lend crucial backing to the digital art sector by fostering innovation, offering resources, and supporting creative venture. These combined efforts facilitate the integration and advancement of digital art within both physical and virtual environments. Artists can showcase their artwork through digital art platforms, engage and connect with their audience, and gain creative inspiration and feedback. Art institutions can utilize the digital art scene to advertise their events and projects, entice and nurture audiences, and bolster their impact and reputation. The technology of the Metaverse, network connectivity, and virtual gadgets offer technical assistance for digital art environments. Digital art scenes can employ these digital technologies to augment the visual presentation of artworks, intensify the engagement and interaction of the art experience, and facilitate more straightforward and accessible art communication.

This study has established a conceptual framework that emphasizes that the digital art scene is the result of the convergence between the Metaverse and public art spaces, as well as their distinct correlation. This study also examined the practical significance of the interconnections between the three instances. By leveraging digital art scenes, public art spaces, and the Metaverse, there is potential for both public art spaces and the Metaverse to mutually benefit and accomplish positive outcomes. This collaboration can foster the advancement and creativity of smart cities and digital art. This offers crucial theoretical frameworks and viewpoints for comprehending and creating public art venues, Metaverses, and digital art scenes in the future.

Many art institutions, including art galleries, museums, and other exhibition venues, have made significant progress in their design research. Nevertheless, there is a scarcity of research on the operational framework of public art spaces. This study addresses the lack of research by examining how digital art scenes affect the operational framework of public art spaces. Both public art spaces and the Metaverse aim to increase their social and artistic worth by attracting a larger number of visitors (Allam, 2022). Hence, conducting research on one of the fundamental techniques for gathering user data and analyzing their behavior in the Metaverse would yield novel insights. This study addresses the lack of research in this field by examining how digital art scenes affect the number of users and their engagement in the Metaverse.

In order to establish a thriving digital art community within the Web 3.0 Metaverse, it is imperative to examine the correlation between virtual and physical art spaces, as well as their interaction with individuals within these spaces. By utilizing the principles of virtual reality compensation theory and world simulation theory, we may devise a solution to

address the situation at hand. The advent of the metaverse has presented virtual reality technology with vast opportunities and propelled the groundbreaking growth of public art places and individual artists within this realm. This topic is also suitable for research. Through this research, our aim is to offer novel theoretical frameworks and viewpoints that can enhance comprehension and facilitate the design of public art spaces, Metaverses, and digital art scenes. Additionally, we seek to foster the growth of digital art within urban environments while also inspiring artists with fresh concepts for their creations in virtual digital art spaces. Ultimately, our objective is to expand the realm of artistic possibilities and provide a platform for personalized artistic expression.

2.11 Chapter Summary

This chapter focuses on elucidating and delineating the fundamental principles of the digital art scene, public art space, and Metaverse. These concepts served as the guiding principles for my theoretical framework, research inquiries, and research methodologies. This study aims to broaden the definition of art space within the framework of public space aesthetics and the concept of a digital scene as a platform for displaying digital art. It further suggests the practical use of public art space within the emerging environment of the Metaverse.

This chapter begins by introducing the theoretical framework applicable to the examination of public art spaces, Metaverses, and digital art scenes. It then identifies specific public art spaces within urban architecture as empirical examples and examines the significance of these spaces within the broader context of urban multi-dimensional media digital art architecture. The expansion of the theoretical framework was organized and deliberated.

In order for digital public art spaces to fully harness the transformative potential of modern digital technology, it is imperative to establish a robust digital art scene as a technical requirement. This will enable the realization of the revolutionary changes facilitated by the new spatial attributes and expanded functions offered by digital simulation technology. While the concept of digital art scenes needs more clarification, it offers the potential for creating smart cities that enable symbiotic interaction between humans and machines. This facilitates meeting the expectations of relational aesthetics. Hence, it is worthwhile to delve into the prospects of the digital art scene. We should concurrently conduct a review of the current technological development status and search for answers based on the aforementioned theoretical foundation. This is crucial as it pertains to the innovative techniques that artists may employ in a virtual digital art environment and also influences the artistic character within such a space. Studies have discovered that digital art scenes can function as a tangible link between public art locations and the Metaverse, offering fresh operational frameworks and sources of traffic for both. Digital art scenes are a novel format for showcasing public art places while also introducing a fresh operational framework for such spaces. Simultaneously, the digital art scene serves as the interface for the Metaverse in the realm of public art, granting Metaverse visitors a shared identity and enhancing the user base, engagement, and impact of the Metaverse. Furthermore, the study will investigate methods to improve the visual appeal and practicality of urban areas based on various requirements for public spaces. It will also examine how artists and policymakers may advance the city's multifaceted digital art scene in the next few years.

In summary, this research offers novel theoretical frameworks and viewpoints that enhance our comprehension and facilitation of public art spaces, Metaverses, and digital art scenes. This research significantly contributes to the advancement of digital art in urban

environments. This study addresses the lack of research on the relationship between public art space and the Metaverse. While there has been much research on both public space and the Metaverse individually, there is a scarcity of research on their junction. This study addresses the lack of research by examining the interrelated functions of digital art scenes.

This chapter provides a concise overview of the theories utilized in the aforementioned research. Furthermore, it provides instructions on how to address the voids in academic research. Simultaneously, we have seen that the role of public art space is an ongoing and evolving process, which has made significant advancements in contemporary times. In recent times, digital technology has rapidly advanced and greatly enhanced public art places. Hence, investigating the digital landscape of public art places holds practical value in the contemporary era.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This chapter provides a comprehensive explanation of the research technique employed in this study. The primary objective of the study is to investigate whether the digital art scene may serve as a means to establish a direct connection between physical public art spaces and the Metaverse. The research aims to establish a correlation between public art spaces and the Metaverse by conducting a comprehensive analysis and gaining a thorough understanding of the functioning of digital public art spaces and their interaction with the Metaverse.

This study employs qualitative research methodologies to examine the interaction correlation between digital art scenes and the Metaverse. This study chose its research method based on its ability to conduct a thorough investigation of the issue and reveal the connections and underlying relevance of the research subject. The study will use methods including document analysis, observation, and interviewing to collect and analyze data in order to verify its validity. The sample will encompass diverse constituents of the digital art sector, including artists, audiences, art institutions, businesses, and managers.

3.2 Research Design

The study employs a grounded theory approach in a qualitative research design to understand the perspectives and lived experiences of people interacting with digital arts in public spaces. This design is in line with the research objective, which is to investigate the complex relationships that exist between digital art, aesthetics, and community interactions.

The research design is guided by the grounded theory framework as established by Glaser and Strauss. The goal is to develop theory based on people's experiences and interactions with digital art in public settings. The method is selected to facilitate an adaptable, iterative, and inductive investigation of the studied phenomenon. The qualitative research design, specifically a grounded theory approach was chosen, to understand the lived experiences and perceptions of individuals interacting with digital arts in public spaces (Charmaz, 2020). This design aligns with the research goal of exploring the intricate interplay between digital art, aesthetics, and community interactions.

3.2.1 Qualitative Research

Qualitative research focuses primarily on the interpretation and comprehension of meaning within a particular situation. This research methodology prioritizes meticulous depiction of behaviours in order to precisely convey and elucidate the significance of such actions (Khoa, 2023). The primary objective of qualitative research is to get comprehensive elucidations and ultimately intricate significances, both of which offer a more lucid and accessible explication for the research.

Various forms of qualitative research exist, such as phenomenological research, case studies, action research, historical research, and grounded theory. For this study, grounded theory is used as the primary research approach to thoroughly depict the interactive connection among the digital art scene, public art space, and the Metaverse. The aim of the method is to uncover the underlying significance and potential future connections among these three entities.

The advantages of qualitative research reside in its capacity to offer comprehensive and meticulous depictions and justifications, its potential to uncover concealed significance,

and its aptitude to comprehend and elucidate phenomena in particular situations. Furthermore, qualitative research possesses the capacity to address intricate and nuanced human behaviours and societal events, a task that proves challenging for quantitative research.

Nevertheless, qualitative research is not without its constraints. Qualitative research findings are frequently challenging to extrapolate to broader groups or settings because of their reliance on small sample sizes. Furthermore, the researcher's subjectivity may influence the outcomes of qualitative research, as it depends on the researcher's interpretation and comprehension. Moreover, qualitative research frequently requires a substantial amount of time and effort to gather, differentiate, and scrutinize data.

Notwithstanding these constraints, the researcher maintained the conviction that qualitative research was the most suitable approach in this study. Qualitative research is well suited for achieving a thorough understanding of the interaction dynamics between the digital art scene, public art space, and the Metaverse. Its strength lies in uncovering hidden meanings and exploring potential interactive formats for future developments.

To ensure the quality of qualitative research in this study, the researcher adhered to eight key standard models of excellent qualitative research (Hollin, 2020). These models encompass valuable topics, rich rigor, sincerity, credibility, resonance, significant contributions, ethics, and coherence. These guidelines serve as a framework for our study design and implementation, ensuring the integrity and reliability of our findings.

3.2.2 Grounded theory

Grounded theory necessitates the emergence of conceptual frameworks through continuous comparison with facts (Birks, 2020). This approach employs a methodical process of gathering and examining evidence to develop theories, making it especially well-suited for investigating new, intricate, and under-researched domains. Grounded theory offers the advantage of theory generation, facilitating the comprehension and elucidation of patterns and mechanisms in nascent domains. Grounded theory enables researchers to adapt their study objectives and methodologies during the data collection and analysis process. This flexibility helps researchers adapt more effectively to the swift shifts and complexity of the research domain. Simultaneously, grounded theory can offer a comprehensive comprehension of the experiences and viewpoints of research participants, aiding researchers in attaining a profound insight and elucidation of phenomena. Grounded theory prioritizes the discovery of ideas based on evidence rather than preconceived hypotheses, making it particularly well-suited for emergent domains like the digital art scene and the Metaverse.

This study adhered to grounded theory research techniques. Initially, an unrestricted data-gathering process was carried out. Preliminary unstructured data were collected through brief, random interviews with individuals visiting Ooeli, the subject of the investigation. Pertinent concepts were categorized and recognized throughout the interview process. Following this, visitor behaviour in the Ooeli instance was closely observed to gather data on passenger flow, routes, duration of stay, visit preferences, behavioural patterns, and forms of engagement. This information was subsequently utilized to further consolidate and interconnect significant themes. Interviews were conducted with artists, leaders from technology companies, and representatives from art institutions to obtain additional

information and deeper insights. These interviews were categorized according to their themes and subjects.

Subsequently, a process of coding was undertaken to discern pertinent concepts from the gathered data, including public art spaces, social roles of public spaces, operational frameworks of public art spaces, digital art scenes, and Metaverses. These concepts were categorized and labelled accordingly. Spindle-coding was then employed to identify the relationships between these concepts, aiming to create more complex categories or themes. Through the use of this framework, a focused study was conducted, leading to the identification of three core concepts: the Metaverse, the digital art scene, and public art space. A theoretical integration process was conducted, incorporating all concepts and classifications into a comprehensive theoretical framework through selective coding. Finally, the theory was substantiated and refined through additional data gathering and analysis until it effectively explained the evidence.

This technique generates a theoretical framework that aids in comprehending and elucidating the structures and mechanisms of the digital art scene as a tangible interconnection between a public art venue and the Metaverse. This theory offers a comprehensive framework for comprehending the role of digital art scenes as linking nodes for showcasing public art spaces in the Metaverse, as well as examining user interactions and the potential for urban development.

3.3 Ethical Considerations

This PhD research emphasizes the interrelationship between the digital art scene, public art space, and the metauniverse. Thus, this research adheres rigorously to the protocol for safeguarding human subjects as stated by Yin (2017). This commitment aims to

guarantee the complete protection of the rights and well-being of research participants while also ensuring compliance with ethical and regulatory obligations. This study employs a distinct set of ethical guidelines for our interviewees, who consist of ten artists, five representatives from technology companies, and five from arts organizations. These guarantees include the following:

Knowledge-based consent: Prior to the interview, each participant will receive a thorough explanation of the study, including its goals, methods, potential benefits and risks, etc., to ensure their full understanding and voluntary participation. I took measures to mitigate any research methodologies that could potentially harm participants to ensure their well-being.

Sensitivity issue: A crucial aspect of conducting an interview is to refrain from addressing sensitive or potentially uncomfortable subjects. To guarantee the confidentiality and anonymity of the data, it is imperative to implement rigorous data management and protection protocols while exclusively using it for research objectives.

Anonymization of participants: In order to enhance the safeguarding of participants' privacy, all interview data underwent anonymization. The principles of fairness and equity encompass the guarantee of equal opportunities for all participants to engage in the research, the avoidance of any bias or prejudice, and the establishment of selection and treatment procedures that adhere to impartial and transparent standards throughout the research process.

The reliability and validity of data require exhibiting integrity and openness, refraining from manipulating or deceiving data. Ensuring the reliability and validity of research necessitates the transparent dissemination of research methodologies and methods.

This action aims to enhance the transparency and credibility of the research, as well as foster communication and collaboration within the industry. The data collection procedure continues to maintain a close relationship with our participants and continuously evaluates our ethical assurance procedures to ensure their effective implementation and thorough protection of the rights and interests of each participant. This collection of indicators demonstrates our dedication to upholding research ethics and our commitment to showing respect for participants. The objective is to guarantee that our research not only yields excellent academic outcomes but also adheres to the principles of responsibility and impartiality toward the relevant stakeholders involved in this study.

3.4 Sampling

3.4.1 Participants

Purposive sampling is a way of selecting a sample that is not based on probability. The researcher chooses particular individuals as samples according to the research's objectives and inquiries. Chain or snowball sampling is particularly useful for researchers seeking to acquire insights on specific individuals, groups, or occurrences. Utilizing interviews as a means of gathering data has been demonstrated to be a very effective approach to accessing data (Adeoye-Olatunde & Olenik, 2021).

3.4.2 Selection Criteria

The participants selected for this study include artists, art institutions, and technology enterprises in Hangzhou, China, who are actively engaged in the digital art industry and represent diverse age groups. Additionally, visitors of Ooeli public art spaces were chosen as the focus for data collection and interviews.

In examining the digital art scene, it is crucial to integrate the practice of combining digital art, which employs digital technology for the creation and exhibition of artistic works. By merging elements of the Metaverse and physical public art spaces, digital art scenes utilize digital technology to create a compelling fusion. The analysis of digital artists' works provides valuable insights into their use of digital technology to shape artistic production, as well as their aspirations to exhibit their artworks in both the Metaverse and physical public art venues in the future.

Since the study focuses on Hangzhou City, China, the selected artists primarily include those based in Hangzhou or those who have previously collaborated on art creation and exhibitions in the city. This approach facilitates an examination of the most recent advancements in digital art, highlighting dynamic phenomena and contemporary trends within the art communities in Hangzhou, China.

3.5 Data Collection Methods

The primary techniques employed in qualitative research include observation, interviews, focus groups, document analysis, narrative research, and various other methodologies. In this research, two methods were employed: participant observation and non-participant observation. Participant observation involves researchers' direct engagement with digital exhibitions and public art spaces to gain insights into the dynamics of these environments. Non-participant observation, on the other hand, is used to collect data on visitors' behaviour, activities, and interactions, enabling an external analysis of their experiences and reactions.

In terms of interview methods, on-site interviews and semi-structured interviews were conducted. On-site interviews consist of brief interactions with visitors at Ooeli to

gather basic information and immediate feedback. Semi-structured interviews target specific participants, collecting detailed data on their thoughts, experiences, and emotions through open-ended questions. This approach enables an in-depth exploration of the participants’ perspectives and personal experiences while maintaining flexibility in the interview process. The research method conducted in this PhD thesis is illustrated in Figure 3.1 below.

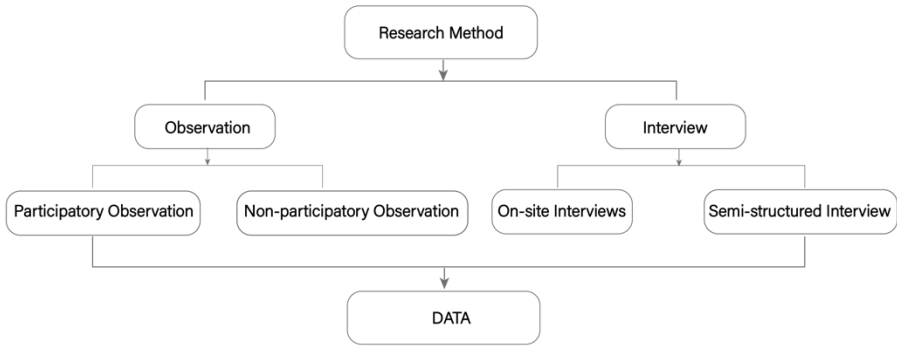


Figure 3.1: Research Method (Author’s illustration)

Based on the research methods outlined for this study, the data collection steps are divided into three main steps as illustrated in Figure 3.2.

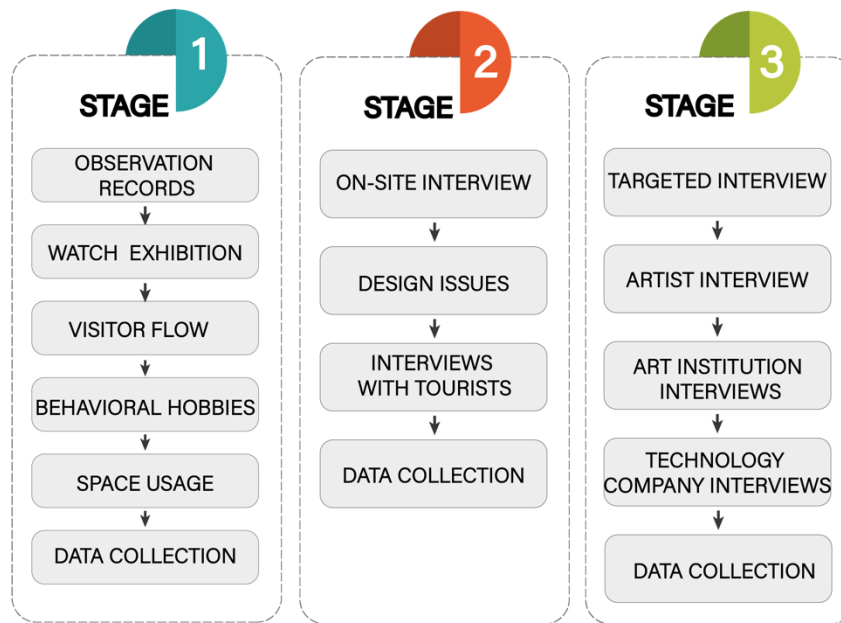


Figure 3.2: Data collection stages (Author’s illustration)

The first step involves employing the non-participatory observation method to observe individuals' usage habits, preferences, and walking routes in public art spaces. Subsequently, participatory observation is applied, including planned participation in exhibition activities within public art spaces, particularly digital exhibitions, over the course of a year to gather first-hand participatory observation data. During the observation process, any arising issues are synthesized and documented.

The second step focuses on on-site interviews. At this stage, brief interviews are conducted with tourists. A tablet device is utilized to present the questions summarized from the first step, allowing tourists to provide responses by selecting answers on the device. Additional short questions are posed to collect more personalized and detailed data.

The third step entails conducting semi-structured interviews. In-depth interviews are carried out with representatives from three primary fields: artists, technology enterprises,

and art institutions. This phase aims to obtain detailed data on perspectives and experiences across various fields, providing a comprehensive background and deeper insights to support the research.

3.5.1 Observations

This investigation employed two distinct observing strategies: participatory observation and non-participatory observation. Participatory observation allows researchers to fully engage in the research setting and take an active role in the activities of the study subject, leading to a more profound comprehension of the subject's behaviour and responses. Researchers participate in digital art exhibitions to study their personal experiences and viewpoints on digital art scenes and locations, as well as the viewer's enjoying.

Research data collected by participatory observation comprises data on space use experience analysis and data gained by observing users after physically experiencing a specific public art space. Researchers collected data on the mobile lines of Oeli visitors, the geographical distribution of visitor traffic, the impact of virtual reality applications, and the traffic patterns of Oeli visitors. Non-participatory observation allows researchers to objectively observe and record the behaviour and reactions of study subjects by monitoring from a distance without directly participating in the research activity. Examines participants' outcome data regarding their experiences in the digital art sector. Examine the practical behaviour of tourists and their involvement in the Oeli public art area. I used non-participatory observation during the interview to get additional information on the interviewees.

3.5.1.1 Observational Design Phase

The observation design phase began with defining the goal of the study: to understand

the quantity, behaviour, responses, interactions, and perceptions of individuals visiting public art spaces and digital art scenes. The observational strategy was carefully planned to align with these objectives. This included selecting appropriate observation methods, identifying specific subject areas corresponding to each method, and preparing the necessary observation tools and equipment.

Subsequently, a preliminary examination of the target of observation is carried out to verify both the observation objective and the methodology. The study determines its suitability and the feasibility of obtaining the required observational data. Figure 3.3 shows the observation design methods and steps taken in the process of data collection.

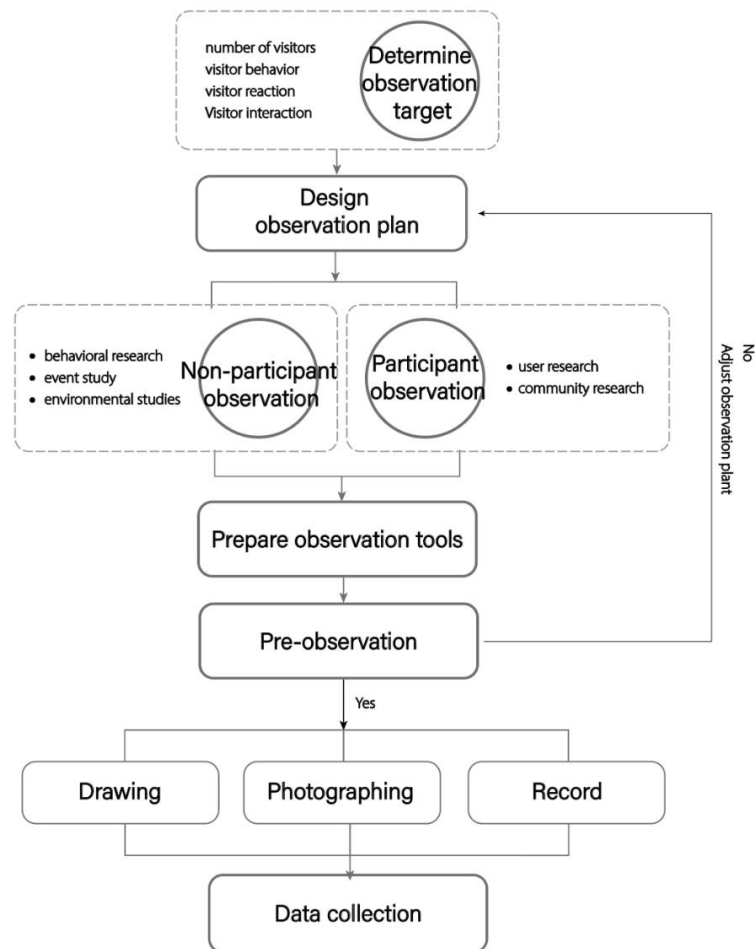


Figure 3.3: Observation design methods and steps (Author’s illustration)

3.5.1.2 Observation Implementation

The researcher implemented the observation procedure using two distinct methodologies: non-participant observation and participant observation.

Researchers mostly used Ooeli Art Park, a public art venue, for event research, behavioural research, environmental studies, and non-participant observation. The researcher closely examined the characteristics and transformations of digital art scenes and public art spaces, including aspects such as spatial organization, art exhibition methods, the number and distribution of visitors, and more. The researcher meticulously documented the exhibition of the digital art scene, capturing individuals' experiential responses, including their emotional fluctuations, facial expressions, and nonverbal cues.

Behavioural studies investigate the behavioural patterns that individuals exhibit in public art spaces and digital art scenes. This includes analyzing their movement trajectories, duration of stay, utilization of public art spaces, and engagement with artworks, among other factors. I recorded the interaction between the participants and the digital art scene as well as the public art space during the data collection and observation process. This involved analyzing the various ways that different groups engaged with the artworks and whether there were interactions with other audiences or artists.

Participant observation involves conducting user research and community research by immersing oneself in the position of the experiencer (Jorgensen, 2020). The researcher systematically recorded their actions as well as those of the other participants in the study, taking into consideration variables like path, duration of stay, use of public art spaces, and interaction with artistic works. Additionally, it documents the responses of individuals, including themselves, to public art places and digital art scenes, encompassing emotional,

cognitive, and behavioural reactions when engaging with digital art. The observation involves the participation and involvement of the researcher and other individuals with public art venues and digital art scenes. This includes examining various methods of observing, engaging, and interacting with other viewers or artists.

Participants in user research are people who actively participate in digital art scenes and public art spaces. Through analyzing their individual experiences, I can gain a thorough understanding of the actual desires, expectations, and satisfaction of those who have gone through these experiences in public art spaces and virtual art environments. I also carefully consider the behavioural patterns, emotions, and interactions of the experienter to gain a deeper understanding of their method of experiencing and perception. Figure 3.4 shows the observation method conducted for this study.

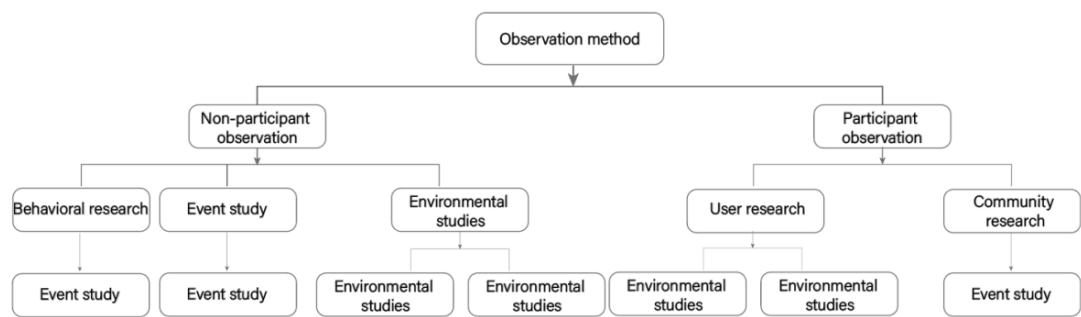


Figure 3.4: Observation method (Author’s illustration)

This study focused on the communication and interaction between participants and public art spaces, specifically the annual Dragon Boat Festival. When the participants come to a consensus on a specific instance, this gives us insight into what they need in terms of art spaces. Additionally, this study focuses on their attitudes and viewpoints regarding public art spaces and the digital art scene, as well as their sense of identity and engagement with public art spaces within specific festivals.

By utilizing the aforementioned two observation methods, this study thoroughly investigates public art spaces and digital art scenes from various perspectives and depths. This allows for a more comprehensive and precise understanding of the behaviours, reactions, interactions, and perceptions of individuals experiencing these art forms, as well as their connection to public art. This shows the correlation between the realms of space and digital art movements.

Simultaneously, observation methods serve as a valuable adjunct in interview research, successfully enhancing researchers' understanding and thorough explanation of the research subjects. Throughout the interview process, the researcher had the ability to observe and analyze the interviewee's non-verbal behaviour, including facial expressions, body language, gestures, and other cues. This additional information goes beyond the content of the interview itself and aids the researcher in gaining a deeper understanding of the interviewee's feedback and attitude. Reassessing their observations can reveal biases or misconceptions that may have influenced their questions. This type of introspection can assist researchers in enhancing the precision of their own observations and comprehensions, as well as facilitating deeper knowledge and interpretation of the viewpoints and encounters of interviewees. Table 3.1 illustrates the observation questions design.

Table 3.1: Observation questions design

	Behavior	Reaction	Interactions	Perception
Viewer/ Visitor	What is their behavior when viewing an art exhibition?	What is their reaction to art exhibition?	How do they interact with art exhibitions?	What do they think of art exhibitions?
	What did they behavior when they stopped in ooli?	What is their reaction in digital art interaction?	How do they interact with digital art?	How do they view digital art interaction?

Table 3.1 continued

	What is their behavior when participation in digital art interaction?	How did they react to ooeli?	How do they interact with ooeli?	What do they think of ooeli?
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By conducting these observations, researchers can gain insights into how individuals perceive the current state of public art spaces and digital art scenes, as well as how people engage with these two places. This study aims to investigate the potential for the digital art scene to serve as a distinct link between the Metaverse and physical public art places. Additionally, it explores the various forms and effects of this relationship.

3.5.1.3 Sample Size of Observed Objects

The observational research procedure was conducted consistently and periodically at the Oeeli Art Park between 2022 and 2023. To ensure the unpredictability of observations and to adhere to the principle of selection, specific exhibitions were chosen, including the HOLODECH digital exhibition on November 26, 2022, the Wallpaper Archive Oeeli Special Exhibition on July 24, and the China Academy of Art Graduation Exhibition AR in Oeeli on June 1. Additionally, the VR exhibition was monitored on May 27, 2023, alongside the digital interactive exhibitions Cross-server Chat and 9189 Kilometres, Maps, and Borders Game, at four specific time intervals. The number of visitors was tallied at consistent observation points on each day of the exhibition, starting at 10 a.m. and ending at 7 p.m.

This research, through comparison analysis, has found a significant difference in the number of passengers during periods with digital art exhibitions versus those without. This finding increases the certainty that the attractiveness of the digital art scene to tourists

contributes to the increase in pedestrian activity rather than other factors. This data supports the overwhelming influence of digital art exhibitions in attracting visitors and boosting the profile of art parks.

Simultaneously, the researcher conducted random interviews with visitors to the Ooeli Art Park. The researcher randomly selected participants for questionnaire interviews at various time intervals throughout the day. The aim of this is to obtain a more comprehensive and inclusive sample, given that individuals who visit at different times may have different characteristics and needs. The duration of each interview was approximately 3-5 minutes. This duration gives visitors enough time to respond to the questions without taking up too much of their time. I gathered information about the research case of Ooeli Art Park, the visitors' motivations for visiting, and their impressions and feedback on the park.

The researcher chose to conduct path observation on five distinct visitor groups in the case study of Ooeli Art Park. I randomly selected these visitors to ensure that the observations accurately represented the overall visiting population. The objective of path observation is to examine the behavioral patterns of individuals visiting public art spaces, encompassing their preferences and utilization of the area. The researcher conducted observations of the subjects' movement throughout the complex, documenting the locations where they spent the most time and their specific interest in artworks or venues. I also observed their interactions with fellow visitors and their use of the complex's amenities and resources.

Furthermore, the researcher documented and monitored the movement of the selected visitors. The researcher selected various distinct time intervals, such as weekends and holidays, morning, noon, and afternoon rush periods, to monitor and document the

movement of visitors in the area. This data can facilitate comprehension of visitor traffic patterns and the distinguishing features of visitors throughout various time intervals.

The researcher additionally monitored the activities of visitors. The observations captured a range of activities, including art appreciation, active participation in classes, and observations of consumer behaviour in restaurants and retails. This data enables the researcher to comprehend the requirements and inclinations of our guests, as well as their utilization of public art venues.

3.5.1.4 Study Size for Samples

Renzo Piano, a renowned contemporary Italian architect, is widely recognized for his iconic design of the Pompidou Center in Paris. The Ooeli Art Park, viewed from above, is characterized by its lack of enclosing walls and multiple entrances seamlessly connecting it to the surrounding communities. This design exemplifies the essence of a public space, fostering accessibility and inclusivity. The map of its functional area reveals that it encompasses a diverse range of artistic functional units, including art galleries, cinemas, bookstores, art studios, and design offices, offering significant benefits for the study of digital scenes in public art space and serving as an ideal observation case.

Several factors, including the traffic volume of the target group, the size of the expected effect, the tolerable error rate, and the statistical efficacy, influenced the selection of the questionnaire's sample size at Ooeli Art Park. In general, increasing the sample size can improve the accuracy and reliability of the research results. However, the goal of the study was to focus on exploratory investigations rather than drawing definitive conclusions about Ooeli Art Park. The expected effect size is also relatively large. At the same time, this study mainly adopts a qualitative research method. The researchers conducted interviews

while observing the visitor behavior and space environment of Ooeli Art Park. This type of raw data serves as a complementary tool for qualitative research to meet the research needs.



Figure 3.5: Ooeli Art Park bird eye view and perspective view
(Source: <https://www.ooeli.com> & Author's photo)

During the interview research, the observation method acts as a valuable supplementary tool, enriching the researcher's understanding and offering a more comprehensive perspective on the subject under investigation.

Simultaneously, five groups of visitors were randomly selected to observe their behavior in the public art space, ensuring that the observations accurately represented the overall visitor population. While the sample sizes may be considered small, large samples are not required in qualitative research. Instead, qualitative research emphasizes achieving a detailed understanding and interpretation of visitor behavior phenomena within a specific environment rather than seeking broad generalizations. Therefore, it is essential to ensure the appropriateness of the selected sample size (Skinner et al., 2020).

Visitor activities and behaviors in the Ooeli Art Park were monitored at various times, without quantification, to capture behavioral trends among visitors in public art spaces. The primary observation areas for data collection are illustrated in Figure 3.6.



Figure 3.6: Ooeli floor plan and main observation areas (Author's illustration)

3.5.2 Interview

3.5.2.2 Interview Types and Selection

When research objectives and inquiries are clearly defined, structured and semi-structured interviews emerge as essential methodologies. Structured interviews utilize a standardized set of questions, ensuring consistency across all interviews. This approach is particularly beneficial for comparing responses from individuals with diverse backgrounds, as it guarantees uniformity in the data collected. For example, questions such as "How do you evaluate the artistic evolution of Ooeli's public spaces in relation to other parks in Hangzhou?" are directed to each participant to gather relevant insights into enhancing public art areas.

Semi-structured interviews, on the other hand, combine predefined questions with flexibility for spontaneous dialogue. This method allows interviewees to express their thoughts and emotions more openly, providing deeper and more comprehensive insights. Questions like "What specific digital art scene is essential for the space?" encourage participants to share their perspectives on the theoretical and practical elements required to improve the aesthetic appeal of public spaces.

By integrating structured and semi-structured interviews, researchers can leverage the strengths of both methods. This hybrid approach ensures comprehensive data collection while allowing respondents ample opportunity to articulate their views. Such an approach is particularly valuable for examining the relationship between virtual and public art environments and establishing both theoretical and practical foundations for digital art scenes in public venues. The careful planning and execution of these interviews are crucial to ensuring the reliability and relevance of the data obtained. The steps involved in conducting the interviews for data collection are outlined in Figure 3.7.

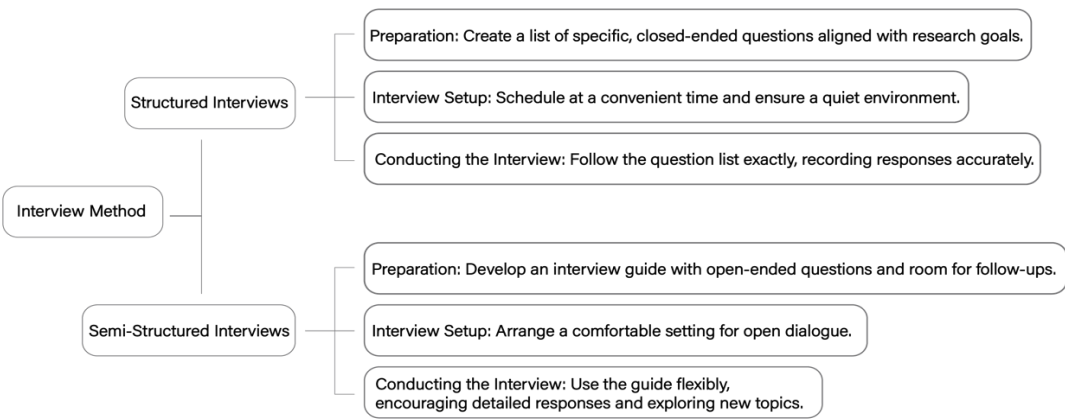


Figure 3.7: Steps in structured and semi-structured interviews (Author’s illustration)

3.5.2.3 On-Site Interview

In public art spaces, live interviews play a crucial role in gathering immediate and relevant data about tourists, as illustrated in Figure 3.2 (Data Collection Stage 2). This method involves conducting brief interviews with visitors to capture their initial impressions and experiences. A tablet serves as the primary tool for this process, displaying a carefully curated list of questions developed during the initial observation phase. The questions are designed to be straightforward and engaging, encouraging visitors to reflect on their experiences in the art space. Insights from the observation phase are used to ensure the questions are comprehensive and relevant. Both interviewers and participants can easily access and interact with the questions on the tablet, facilitating an efficient and interactive data collection process.

During the interview process, visitors were approached in a friendly and non-intrusive manner. The purpose of the interview was explained, and assurances regarding the confidentiality of their responses were provided. Visitors were invited to participate in brief interviews, with an emphasis placed on the value of their feedback in enhancing the art space experience. A tablet was utilized, enabling visitors to select questions relevant to their experiences, thereby engaging them and allowing them to guide the conversation.

As visitors selected and answered questions, follow-up inquiries were posed to gain deeper insights into their responses, capturing personalized and nuanced data. The tablet facilitated real-time recording of feedback, ensuring accuracy and efficiency in data collection while minimizing the risk of data loss or misinterpretation. With participants' consent, recordings were made to capture the tone and context of responses, which added valuable depth for subsequent analysis.

Live interviews offered immediate feedback, capturing the genuine reactions and thoughts of visitors. The use of tablets made the interview process dynamic and flexible, adapting to the natural flow of the conversation and the interests of the participants. By allowing visitors to select questions and providing opportunities for follow-up, the collected data was rich in personal insights and perspectives. This approach proved to be an effective method for qualitative data collection, reflecting the direct experiences of visitors in a public art space.

3.5.2.4 Semi-structured Interviews

When designing an interview, it is essential to establish a clear and precise objective. The primary objective of this interview is to improve and validate the proposed theoretical framework, with a specific focus on examining the digital display format employed in urban public art spaces. The conceptual and methodological foundations are analyzed to evaluate the current status of digital art. Additionally, a comprehensive framework for public art venues is recommended to enhance the multi-faceted nature of Hangzhou's digital art scene, targeting both policymakers and artists. The selection of structured and semi-structured interviews necessitated the development of a comprehensive set of questions aligned with the study's objectives. The identification of interviewees and the design of the questions were guided by the research aims. The feasibility of conducting interviews and the relevance of potential interviewees were carefully evaluated to ensure they adequately represented the research subject. Factors such as the interviewees' educational background, artistic experience, and artistic perspectives were considered in the selection process.

The researcher scheduled interviews based on the selected content and respondents, directly contacting participants to arrange a mutually convenient location and time. Careful

planning ensured that the timing and setting facilitated productive discussions and effective communication. A semi-structured interview approach was employed to develop clear and focused questions, guiding the flow of the interview while allowing flexibility for in-depth exploration. The structured elements of the interview process ensured accurate documentation of participants' perspectives and opinions. This combination of approaches effectively directed interviewees toward providing responses relevant to the research objectives.

3.5.2.5 Interview Questions Design

The research objectives were initially developed to clarify specific themes and areas of investigation before formulating interview questions. These objectives primarily focus on the following topics: understanding the concept of digital art scenes, investigating the cognitive differences between digital artists and traditional art producers, examining the impact of digital technology on the interaction between individuals and art, exploring the core purpose of creating virtual spaces, analyzing their economic benefits, and assessing the positive effects of the digital art scene on urban development.

Preliminary research and analysis were conducted to identify suitable respondents, including the identification of relevant keywords to finalize interview subjects. The interviewees primarily consist of digital artists, traditional art practitioners, art curators, pioneers in urban digital beautification, representatives from art institutions, and technology businesses. Their perspectives and firsthand experiences provide valuable insights and inspiration for the research. Figure 3.8 illustrates the design and procedures of the interview questions.

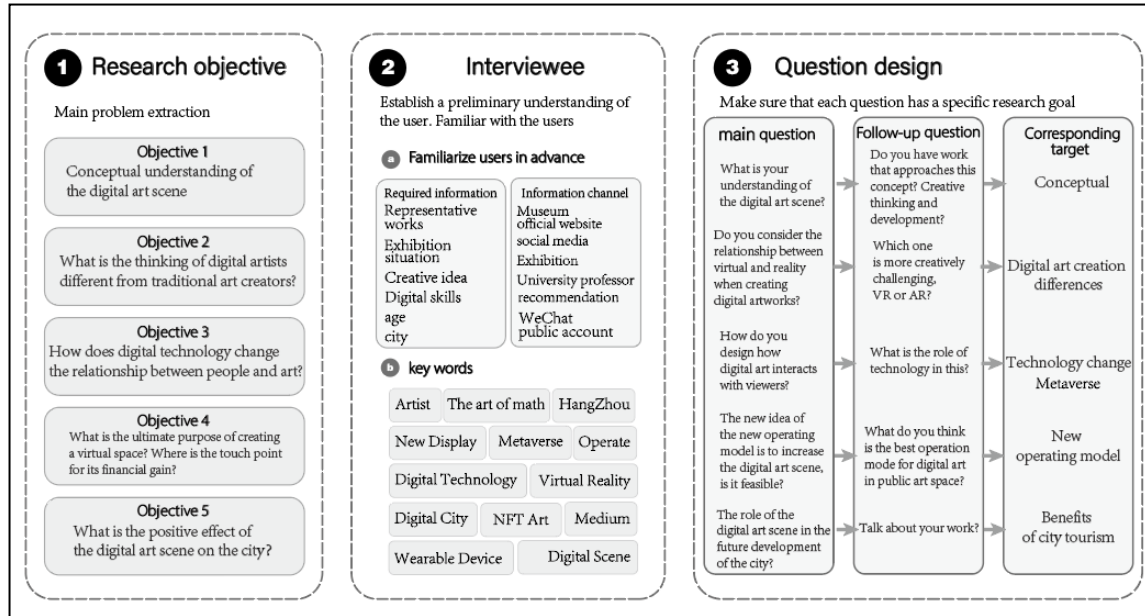


Figure 3.8: Interview question design and procedures (Author's illustration)

A set of interview questions was generated during the question design phase, guided by the research objectives of the study. For example, respondents were asked about their understanding of the digital art scene, their perspectives on its future role in urban development, their approaches to designing interactions between digital art and audiences, and the feasibility of implementing a new operational model involving a digital art scene.

3.5.2.6 Sample size of interviewees

When doing qualitative research, determining the proper sample size sometimes relies on the researcher's discretion (Bazen, 2021), since the desired level of saturation can differ (Guest, 2020). Various factors, such as population heterogeneity, the number and nesting of selection criteria, groups of special interest, sample size, and the methods and resources used for data collection, can influence sample size (Lobe, 2020). In addition to the study design, other factors that influence sample size include topic matter knowledge, interview approach, and research breadth (Leung, 2021).

The determination of sample size in qualitative research typically relies on the study's objectives, the extent and comprehensiveness of the investigation, and the attainment of data saturation. Data saturation occurs when the collecting of new data ceases to yield novel knowledge or viewpoints. This is commonly regarded as an indication to cease the collection of data.

For this study, a sample of 10 artists was chosen, taking into account the following criteria; first is the level of research comprehensiveness. The research objective is to gain a comprehensive understanding of the interacting dynamics between the digital art scene and the Metaverse. Digital artists are commonly categorized into two distinct groups. There are two types of artists: one who only creates digital art and another who has transitioned from conventional art to digital art. The researcher required concentration on locating artists from both categories for comprehensive interviews and observations. Small-sample research affords them the opportunity to dedicate more time and attention to comprehensively grasp the perspectives and experiences of each artist, in contrast to large-sample research.

For this interview, ten artists were carefully selected, including two veteran artists over the age of 50—one from Taiwan and the other from Shanghai—both with extensive experience in digital interaction design. Additionally, several middle-aged digital artists from Hangzhou were included, recognized for their exceptional contributions in fields such as digital interactive display, public art space installations, media app interaction design, and urban digital image design. Middle-aged artists bring a wealth of design experience and are well-positioned to explore the prospects and directions of digital art from both experienced and emerging perspectives. The majority of digital art practitioners are younger, typically between the ages of 20 and 35, often in the transition from college graduation to doctoral

studies. These young digital artists contribute fresh design concepts and innovative ways of thinking, offering valuable insights into both the current challenges and future possibilities of the digital art scene.

The selection of the ten artists considered factors such as their urban background, educational qualifications, current positions, and primary fields of study. Most of the selected artists have strong educational backgrounds, including one holding a doctoral degree, three with master's degrees, and the remainder having received high-quality art education at the university level. Among the veteran artists, two have become professors, while four of the other participants are founders of independent art studios or companies. The remaining participants work as independent artists, contributing diverse perspectives and expertise to the study.

The benefit of this selection method lies in ensuring that the group of artists interviewed is diverse, encompassing representatives of different age groups, educational backgrounds, and areas of expertise. This diversity provides a more comprehensive perspective on the current and future trends in digital art. The combination of the experience and wisdom of older artists with the innovation and energy of younger artists generates a wealth of insights and inspiration, contributing to a deeper understanding of and advancements in the development of digital art.

Another aspect requiring consideration is the saturation of data. After the tenth artist was interviewed, it was observed that additional data collection no longer yielded new insights or perspectives, indicating that a point of data saturation had been reached. Thus, a sample size of 10 artists was deemed adequate for this research. Furthermore, the selected artists maintain strong connections to Hangzhou, either by residing there, working in the city,

or collaborating extensively on artistic projects. This ensures that the research offers a comprehensive understanding and examination of Hangzhou's digital art landscape and Metaverse from various perspectives and levels of depth.

A predetermined list of questions or topics, aligned with the research objectives and focus areas, is typically incorporated into the interview process for the 10 selected artists. An interview protocol is used as a structured tool to ensure that all essential information is systematically collected while allowing researchers to maintain control over the flow and progression of the interview. Prioritizing the depth and quality of insights over the breadth of data, this study determined that a sample size of 10 artists was appropriate for conducting the primary interviews. Table 3.2 illustrates the demographic information of the artists interviewed including their age, location, education, profession and the expertise field.

Table 3.2: Demographic information of artists interviewed

No.	Age	Location	Education	Profession	Main field
1	50 above	Taiwan	Other	Professor	Digital interactive design of works of art
2	50 above	Shanghai	Master	Professor	Digital re-creation of traditional art
3	36-45	Hangzhou	Master	Co-founder	Digital interactive exhibitions in public Spaces
4	36-45	Hangzhou	Other	Co-founder	App media design

Table 3.2 continued

5	36-45	Hangzhou	Other	Other	Urban digital image design
6	20-35	Hangzhou	Master	Other	Urban digital image design
7	20-35	Hangzhou	Other	Co-founder	Digital media communication of we media
8	20-35	Hongkong	Phd	Co-founder	Digital interactive design of works of art
9	20-35	Hangzhou	Other	Other	Digital media communication of we media
10	20-35	Hangzhou	Other	Other	Modern digital art design

In addition, five art institutions and five technology companies were selected as part of the study's sample. This selection aligns with the qualitative research approach, which emphasizes gaining an in-depth understanding of specific events and dynamics rather than striving for broad generalizations. This method allows for a comprehensive exploration of the unique interactions and trends within each field.

The selection of these organizations was guided by considerations of diversity and representation within the arts and technology sectors. By including a balanced representation from both fields, the research aims to gain deeper insights into their operational frameworks and the innovative trends shaping their practices. This approach provides a nuanced

understanding of the interplay between the arts and technology in the context of digital art and public spaces.

Art institutions can be broadly categorized into five types: traditional art museums, contemporary art centers, online art institutions, art management companies, and we-media art organizations. These categories reflect the diverse approaches and operational models within the art sector, encompassing a wide spectrum of artistic expressions ranging from traditional to modern and physical to digital. Traditional art galleries and contemporary art centers offer unique perspectives on classical and modern art, highlighting the evolution and current state of artistic development. Meanwhile, online art institutions and media art organizations exemplify emerging digital-age trends, showcasing innovation and the dissemination of art through digital platforms. Art management companies provide valuable professional insights into the operation and management of the arts sector, shedding light on the mechanics of the art market.

For this study, a representative institution from each category was selected for in-depth interviews. These include Zhejiang Provincial Museum, Zhejiang Provincial Art Museum, Hangzhou Yixianghui Art Gallery, XOSMO Digital Design Services, and Xiaolai Culture Communication Co., Ltd. Interviews with curators and principal directors of these institutions offer first-hand insights into the operation and developmental trajectories of art institutions, providing valuable context for understanding the interplay between tradition and innovation in the arts.

In terms of technology enterprises, the research focuses on the five most relevant categories in the market today: technology development, technology equipment provision, software engineering, AR/VR construction, and digital art scene creation. These categories

represent different aspects of the application of technology in the arts. Technology development and equipment provision are the foundation of digital art creation, and software engineering is the key to realizing complex interactions and functions. The construction of AR/VR offers a fresh perspective on art, and the creation of digital art scenes closely aligns with the artistic expression form.

The selection of technology companies for this study was guided by two key factors. Firstly, prior collaborations or established contacts with these companies have provided insights into their industry standing and influence. Secondly, direct exposure to digital art projects involving these companies has allowed for a firsthand evaluation of their technical expertise and innovative capabilities. Based on these criteria, five technology companies were selected: EZVR Technology Co., Ltd., XunCai Technology Co., Ltd., Chamlu Information Technology Co., Ltd., XiaoPai Technology Co., Ltd., and Hatu Technology Co., Ltd. Each of these companies has demonstrated exceptional technical proficiency and innovative approaches within their respective domains.

This selection aims to facilitate an in-depth understanding of the application and advancement of technology in the digital art field. EZVR Technology Co., Ltd. is recognized for its leading role in AR/VR construction, offering immersive art experiences. XunCai Technology Co., Ltd. specializes in technical equipment, contributing significantly to the execution of numerous digital art projects. Chamlu Information Technology Co., Ltd. excels in software engineering, developing intricate interactive functionalities. XiaoPai Technology Co., Ltd. continues to innovate in technological development, establishing a robust foundation for digital art creation. Hatu Technology Co., Ltd. has extensive experience in creating digital art environments, enriching the diversity of artistic expression.

In-depth interviews with these companies provide valuable insights into how technology supports and drives the evolution of digital arts. These organizations not only offer technical expertise but also revolutionize the creation and experience of art through innovative solutions and products. Combined with interviews conducted with art institutions, this research seeks to uncover the intersection between art and technology, exploring its future potential and development trajectory. By adopting a diversified research approach, this study aims to provide a comprehensive perspective on the innovation and progression of digital art.

The selection of companies and institutions across these five categories enables an exploration of the intersection of art and technology from multiple perspectives. This diverse sample selection provides valuable insights into the unique challenges and opportunities within each field while also highlighting the synergies and potential for innovation between them. Ultimately, this approach offers a more holistic perspective to support the integration and advancement of art and technology. Tables 3.3 and 3.4 provide a summary of the companies and arts organizations interviewed as part of the study.

Table 3.3: List of technology companies interviewed

Company	Interview Location	Interviewee	Business Form
EZVR Technology Co., Ltd	Company	Founder	Metaverse Internet Virtual Reality

Table 3.3 continued

XUNCAI Technology Co., Ltd	Company	Founder	Metaverse Internet Virtual Reality
CHAMLU Information Technology Co., Ltd	Company	Founder	Internet Virtual Reality
XIAOPAI Technology Co., Ltd	On-line	Manager	Internet Virtual Reality
HATU Technology Co., Ltd	Company	Founder	Metaverse Virtual Reality

Table 3.4: List of art institutions interviewee

Art Institutions	Interview Location	Interviewee	Business Form
Zhejiang Provincial Museum	Company	Curatorial Department	Traditional Art Museum
Zhejiang Provincial Museum Art	Company	Curatorial Department	Contemporary Art Center
Hangzhou Yixianghui Art Gallery	Company	Curatorial Department	Self-media Art Organization

Table 3.4 continued

XOSMO Design Design Services	On-line	Curatorial Department	Online Art Organization
Xiaolai Culture Communication Co., Ltd.	Company	Curatorial Department	Art Management Company

In addition, the selection of this sample size was based on considerations of data saturation. Data saturation refers to the stage at which gathering further data ceases to provide any novel insights or information (Islam & Aldaihani, 2022). Therefore, upon achieving data saturation, we can determine that the sample size is appropriate for addressing the research questions and objectives.

The researcher employed an interview protocol during the interviews. Researchers often establish a predetermined series of questions or themes in an interview protocol, which aligns with their research objectives and questions. An interview protocol serves as a tool for researchers to effectively gather all necessary information during an interview while also allowing them to maintain control over the interview's direction and pace. Generally, the selection of this sample size and the data gathering method are reasonable and suitable. They can assist researchers in resolving research difficulties and attaining research objectives.

3.5.3 In-depth Interviews

The process of identifying respondents begins with utilizing existing social networks and pre-established approaches to locate suitable candidates. Subsequently, individuals who meet the research criteria and have connections to the specified research subjects are selected as potential participants.

Potential participants were contacted through various communication channels, including WeChat and telephone, with invitations extended for their involvement in the interviews. In instances where candidates declined to participate, they were encouraged to recommend other qualified individuals who met the research criteria and were willing to contribute. This cascading recruitment strategy proved effective in establishing communication and securing suitable participants for the study. The eligibility criteria for participants included individuals actively engaged in projects such as organizing virtual reality art exhibitions in Hangzhou, leaders of art institutions, chief executive officers of technology companies, and virtual reality technologists within corporate settings.

3.5.4 Artist Interview Data Collection

The interviews were scheduled for 2023, taking place between the end of March and the beginning of July, with mutual agreement established between the researcher and participants regarding the day, time, and location. All interviews were conducted in person, either through direct interaction or via video conferencing using Tencent Meeting, adhering strictly to the specified interview protocol. Each interview was conducted without any external interruptions or interference. To ensure the accuracy of the discussions and avoid disruptions, permission to record the interviews was obtained in advance.

A combination of structured interviews, questionnaires, and informal surveys was used to facilitate the data collection process. Each interview lasted a minimum of one hour, and the materials were preserved in audio, video, and written formats. In addition to conducting interviews, relevant online information regarding digital art exhibitions and artists' works was gathered from personal websites, public profiles, and participation in relevant public events. This additional data supplemented and enhanced the information

obtained during the interviews, ensuring accuracy and comprehensiveness. Finally, the NVIVO software was employed to analyze the collected data, enabling the identification of coding and thematic structures. This approach ensured a rigorous and systematic analysis of the sample material.

3.5.4.2 Technology Company Interview Data Collection

The interview activities were conducted from March to May 2023, spanning a period of two months. Priority was given to companies with prior collaborations and emerging firms recognized within the industry for their innovative and exploratory approaches. Interviews were conducted with five prominent technology companies specializing in the production of virtual reality equipment and the development of virtual reality Internet environments.

Following the interviews, the equipment used by these companies was closely examined, and their virtual environments were accessed using the provided devices. The interviews were transcribed, and the data was analyzed using a thematic analysis approach. This process facilitated the identification of significant themes and perspectives expressed by the participants. The key themes included the technological advancement of virtual reality (VR) equipment, the creative design of VR environments, the challenges and opportunities faced by the industry, and the participants' expectations regarding future developments in VR technology.

3.5.4.3 Art Institution Interview Data Collection

The interviews were scheduled between early April and the end of May in 2023. Selecting appropriate art institutions for participation posed a significant challenge due to the limited number of active organizations in the field of digital art. The primary objective was to include a diverse range of institutions in the research, encompassing self-media art

organizations, conventional art museums, contemporary art centers, online art institutions, and art management corporations.

To identify suitable candidates, a thorough investigation was conducted by leveraging existing professional networks and establishing connections with potential institutions. Invitations were extended to art institutions meeting the study's requirements via social media platforms. Responses were followed by preliminary online interactions through social networks to confirm the final selection of interview participants.

Interviews were conducted either in person or via video conferencing using Tencent Meeting, strictly adhering to a predetermined interview protocol. The interviews were guided by the concept of knowledge creation, which emphasizes the generation of information during the research process rather than relying on pre-existing knowledge (Morgan, 2022). Each interview lasted a minimum of one hour. In-person interviews were conducted following visits to various digital art exhibitions and art institutions, ensuring a comprehensive understanding of the field.

3.6 Data Analysis Tools

Braun & Clarke (2022) describe thematic analysis as a qualitative method tool that facilitates the identification, analysis, and reporting of patterns (themes) in data, enabling the investigation of underlying meanings and experiences. Within grounded theory, thematic analysis serves as a foundational step in the iterative process of theory development. Themes emerge organically from the data, guiding subsequent data collection and analysis. Thematic analysis aligns well with the principles of grounded theory, particularly its emphasis on inductive reasoning and the generation of theory from empirical data. By adopting a flexible and iterative approach, thematic analysis allows researchers to explore the complexity and

richness of qualitative data, uncovering emergent patterns and relationships without imposing preconceived categories or theoretical frameworks. This method focuses on the intricacy and profundity of data and is adept at deriving significance from many data sources, including interviews, observation recordings, and textual materials. The process of topic analysis in this study involves the following steps:

1. Familiarize with the data: In the initial phase of the research process, it is essential to become acquainted with the substance of the data materials acquired from the interview recordings by reading them repeatedly. At this stage, the potential ideas and conceptual topics were transcribe directly from the interview notes.

2. Develop preliminary code: At this phase, the data is meticulously encoded, highlighting the fundamental elements from the interview or data segment related to artists, art institutions, and technological businesses. Coding is the systematic arrangement and categorization of data with the go a lot recognizing significant characteristics within.

3. Identify the theme: Begin by coding to uncover and summarize potential topics. This stage entails consolidating pertinent codes into a list of possible themes and analyzing how these topics represent the overall attributes of the dataset.

4. Theme Review: The selected themes were assessed and scrutinized during this stage to verify their alignment with the dataset. This process required merging related subjects, dividing several topics, or redefining topics to more accurately represent the data.

5. Define and label the theme: After examining and adjusting the theme, it is crucial to provide a precise definition and suitable name for each topic. At this stage, a detailed explanation of each topic's substance was provided to ensure a clear and descriptive label.

This facilitates subsequent data analysis and report writing by offering a clear understanding of each issue's representation..

6. Report preparation: This is the ultimate phase of the thematic analysis. The report outlines the study procedure, analytical techniques, and main discoveries. Text data is provided for each topic, demonstrating how the topics were retrieved and study conclusions were explained. The paper should address the study's limitations, its impact on current literature, and potential avenues for future research.

During thematic analysis, maintaining critical thinking and continuously reviewing assumptions and explanations is essential to ensure the objectivity and accuracy of the analysis. It is important to acknowledge the diversity and complexity of the data, avoiding the risk of overlooking crucial information for the sake of simplicity. Thematic analysis is a suitable approach for exploring a wide range of social science inquiries. By following the outlined procedures, significant themes can be efficiently identified from qualitative data, including the collected interview data, to derive profound insights into the intricate relationship between public art spaces and the virtual world.

3.6.1 Coding

The initial open coding phase systematically analyzes data to identify concepts and categories. Line-by-line coding is employed to capture participants' experiences, interactions, and expressions related to digital arts in public spaces. Spindle coding is then utilized to explore the connections between these concepts, facilitating the construction of more advanced categories or themes. Following this, selective coding is conducted to pinpoint fundamental concepts and develop a theoretical framework centered on these core ideas. A theoretical integration process is then carried out to consolidate all concepts and

classifications into a comprehensive theoretical framework, with selective coding serving as the foundation. NVIVO software supports the coding process for this study.

The interview data undergo cross-validation to ensure the accuracy of interpretations. For instance, perspectives from digital artists, arts organizations, and technology corporations are juxtaposed to determine whether their perceptions align or diverge. Employing qualitative analytic techniques is essential for coding and categorizing interview responses, extracting relevant themes and concepts, and conducting a thorough analysis and interpretation of these findings. Critical thinking skills are applied throughout this process to identify and address the research questions based on participant responses.

The results of this research aim to develop a comprehensive understanding of the relationship between the Metaverse, public art spaces, and the digital art landscape. This understanding enhances knowledge in the field and provides a foundation for effectively developing and designing creative solutions. The coding and analysis processes are based on Charmaz's (2021) Grounded Theory, as illustrated in Figure 3.9.

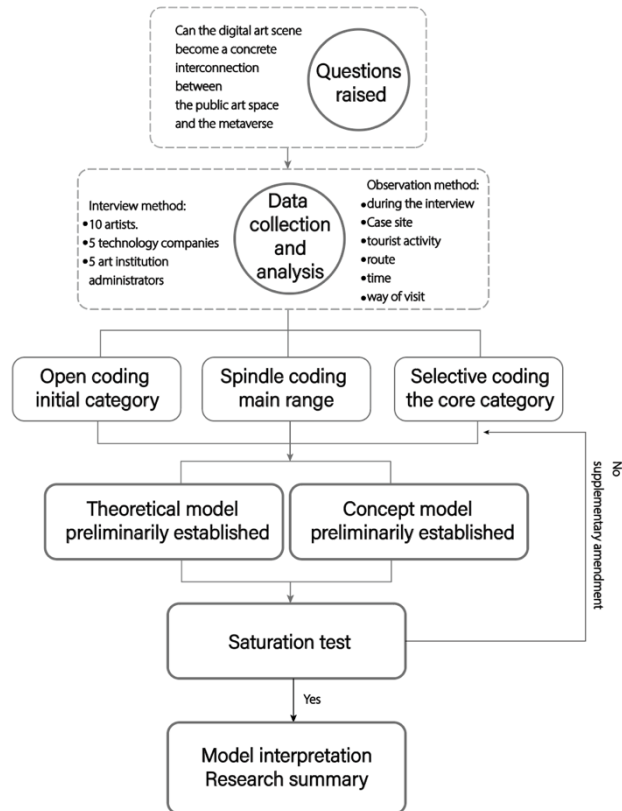


Figure 3.9: Grounded theory steps (Author’s illustration)

3.6.2 Constant Comparison

The constant comparison approach is employed to analyze the relationship between public art spaces and the Metaverse, offering a unique perspective and methodology to thoroughly examine their intricate interactions. By consistently analyzing data across and among individuals, it becomes possible to identify the key factors influencing the interaction between these two domains and to understand how they mutually affect one another. This adaptable analysis process allows for adjustments to the study’s direction and focus based on initial findings, ensuring that the research topic remains closely aligned with the data and yields significant insights.

This approach simultaneously broadens the scope of inquiry. Continuously analyzing data to uncover new facts and perspectives facilitates a deeper exploration of the connection between public art spaces and the Metaverse, leading to a more comprehensive understanding. The iterative process of reflection and analysis enhances the collaborative nature of the research, fostering active engagement and critical contemplation throughout. This consistent reassessment and refinement of assumptions and insights improves the quality and depth of the research, enabling the detection of subtle changes and emerging patterns in the data. As a result, the relationship between public art spaces and the Metaverse can be better understood.

Through the constant comparison approach, the theoretical connection between public art spaces and the Metaverse can be comprehended, alongside the practical mechanisms of interaction and influencing factors. This thorough understanding provides valuable insights and support for artists, curators, technology developers, and policymakers, enabling them to design and implement art projects and activities that effectively bridge the gap between reality and virtual reality.

3.6.3 Theoretical Sampling and Saturation

The theoretical sampling process was continued until data saturation was reached, ensuring that the grounded theory was comprehensive and adequately developed to address the research questions. Interviews were conducted with 10 artists who had organized digital art exhibitions in Hangzhou, China. The group included 4 male and 6 female artists, with 5 participants aged between 20 and 35, 3 aged between 36 and 45, and 2 aged over 50. Artists were selected from diverse age groups based on their varied artistic backgrounds. For younger artists, digital art has often been their preferred medium since the beginning of their

careers, while a number of established artists are transitioning from traditional mediums to digital and cross-disciplinary art. Among the ten artists, three specialized in cross-disciplinary art, while seven focused primarily on digital art. Their interviews provided valuable perspectives on the diverse approaches and techniques employed by artists of different ages and backgrounds in creating and presenting digital art. Recognizing the distinctions between digital and traditional art is essential for understanding the broader impact and application of digital art in the artistic community.

To explore how digital art scenes might act as a bridge between physical public art spaces and the Metaverse, the role of art institutions was emphasized. Five art institutions in Hangzhou were selected as research samples to deepen understanding of this relationship. Interviews were conducted to gather critical primary data from a range of institutions representing conventional art museums, modern art centres, virtual art institutions, art management firms, and self-media art organizations. These interviews provided direct insights into how these institutions operate within the digital art landscape. Questions focused on their use of new platforms and technologies for showcasing artwork, the establishment of virtual exhibition spaces in the Metaverse, the challenges encountered, and the expected outcomes of their operations.

In addition, five technology firms based in Hangzhou were chosen for their openness and willingness to explore digital art technologies, representing industry leaders in the Metaverse space. These companies possess advanced expertise in digital displays and the development of the Metaverse, including applications in Metaverse social networking and art exhibitions. Analyzing the technological advancements made by these firms offers insights into the integration of digital art scenes with real-world public art spaces. This

analysis highlights the factors that shape how technology influences digital art and its application in broader artistic contexts.

3.7 Summary of Chapter

Art has transcended the traditional confines of galleries and museums in the digital era, progressively integrating into the realm of digital art and extending its presence into the Metaverse. This innovative artistic medium and exhibition approach offer a new perspective to explore the dynamic interaction between public art spaces and the Metaverse.

This chapter provides a comprehensive explanation of the research methods utilized in this study. Extensive qualitative research was conducted to assess whether the digital art scene can serve as a bridge connecting physical public art spaces and the Metaverse. The research aims to understand the role of the digital art scene in fostering this connection, with the objective of comprehensively examining the relationship between these two domains and the impact of their interconnectedness on the interaction among various stakeholders.

To investigate this relationship in detail, qualitative research methods, including partial analysis and grounded theory, were employed. Unlike data collection and analysis based on pre-existing theories, grounded theory emphasizes the development of theory derived from empirical evidence. Data was gathered through observation, interviews, and document analysis, forming the foundation for developing a theory on the interaction between the Metaverse and the digital art scene.

The study's sample includes several key components of the digital art scene, such as artists, audiences and visitors, art institutions, corporations, and managers. A comprehensive

and focused examination of these samples was conducted to better understand their roles and influence on the interaction between the digital art scene and the Metaverse.

Interviews were meticulously recorded and transcribed, and the transcriptions were uploaded into NVivo 11 software for coding and thematic analysis. The research emphasizes ensuring credibility, dependability, transferability, and confirmability throughout the investigation. The qualitative research approach acknowledges the subjectivity inherent in real-world case scenarios. Furthermore, a single-case research design, combined with purposive sampling, data collection, and analytical procedures, was deemed appropriate to achieve reliable results. Limitations of the study include challenges in replicating findings, limited generalizability of results, and potential bias in participants' responses due to social desirability.

In summary, the research methods and sample selection detailed in this chapter, alongside the validation of findings, underscore the scientific rigor and practical value of the study. This research not only elucidates the connections between public art spaces, digital art scenes, and the Metaverse but also offers novel insights and theoretical frameworks for future studies. The goal is to provide meaningful insights for the development and management of public art spaces and for the research and application of the Metaverse. The findings further validate the theoretical and conceptual framework, particularly the structural aspects of public art spaces and the virtual space model, with the digital art scene serving as a connecting element. Public art spaces, supported by regulations and artistic contributions, are posited to promote the growth of digital art communities, enhancing the functionality of public art venues and encouraging the development of related business sectors.

CHAPTER 4

RESEARCH METHODOLOGY

4.1 Introduction

The design of this study reflects the diversity and complexity inherent in the digital art environment. Artists serve as the primary contributors to digital art creation and are fundamental to the convergence of art and technology. Their practices and works represent the most practical avenue for fostering this integration. The active participation and reactions of audiences or visitors to the interactive elements of digital art exemplify the dynamic nature of the public space digital art scene. Positive audience reception and interactive engagement play a significant role in driving the development of the digital art scene.

The infrastructure provided by art institutions, enterprises, and government policies is crucial in supporting and promoting innovation within digital art spaces and the Metaverse. Policies, funding, operational strategies, and decisions made by these entities directly influence the sustainability and growth potential of the digital art scene. Qualitative research methods were chosen for this study due to their capacity to provide a comprehensive analysis of research questions, particularly when examining complex social phenomena and human behaviour. This approach focuses on understanding behaviours, motivations, and objectives, as well as the ways individuals construct meaning within specific social and cultural contexts. The qualitative method is especially advantageous in exploring the digital art landscape, as it reveals nuanced interactions between art, technology, and social dynamics.

Most artists rely on the support of organisations and art institutions to realize their creative visions and experiment with emerging technologies and media. Simultaneously, the

rules and regulations established by managers significantly influence the feasibility and creative potential of artistic projects. Audience opinions and reactions directly shape the decisions of artists and art institutions, creating a dynamic ecosystem where each element impacts the evolution of the art scene and the Metaverse. This study underscores the value of qualitative research methodologies in examining and understanding the complex relationships within the digital art scene. Through detailed analyses and diverse perspectives, the research provides critical insights for artists, art institutions, companies, and policymakers to better adapt and shape the future of digital art. Moreover, the methodology lays a foundation for exploring other domains, particularly those involving human behaviour, social interactions, and technological integration. The breadth and adaptability of qualitative research make it a valuable tool for investigating these intricate processes.

The study acknowledges the limitations of qualitative research, particularly in terms of generalizing findings to a broader context. However, these limitations do not diminish the importance of qualitative research in offering profound insights into individual experiences. Instead, they highlight the need for supplementary quantitative studies to validate and extend qualitative findings, thereby establishing a robust foundation for future research at the intersection of art and technology.

The data analysis approach employed in this study demonstrates the significant contributions of qualitative research in exploring the interaction between digital art scenes and the Metaverse. Through an in-depth examination of the diverse sample and partial analysis, the study illuminates the intricate relationships among artists, audiences, art institutions, corporations, and management. These interactions are essential for understanding and shaping the evolving landscape of digital art. Despite rapid technological

advancements and shifting social and cultural contexts, qualitative research continues to provide valuable insights into the dynamics of the digital art environment.

4.2 Data Analysis

4.2.1 Observation Data Analysis

Observation is employed as a research method in the study of Ooeli Art Park to meticulously document people's behaviors, activities, interactions, and other significant features within a natural environment. In the case of Ooeli, the collection of descriptive observational data involves systematically recording visitor behavior patterns, interaction dynamics, spatial usage, aesthetic preferences, and body language. This data is gathered through various methods, including photographing real-life activities, documenting observed details in writing, and creating illustrative sketches of scenes and emotions.

Additionally, the physical model of Ooeli's spatial architecture was recorded through field notes, with annotations added to highlight its diverse annual exhibitions and community events. This comprehensive approach aims to provide deeper insights into participants' behavior and their interaction with the space, offering valuable context for understanding how the environment influences and shapes user experiences.

The application of multidimensional recording strategies provides the researcher with a wealth of data to analyze the interactions and experiences of visitors in Ooeli Art Park. This approach facilitates an understanding of visitors' behavioural patterns and preferences. As illustrated in Figure 4.1, specific locations of representative digital art scenes within the park are marked. Ooeli, as a public art space, often utilizes various indoor and outdoor areas for digital art exhibitions, including its art gallery, mirrored waters, green spaces, building facades, and spatially varied staircases. These examples highlight the importance of practical

planning to ensure a harmonious integration of digital art with physical space when presenting digital art scenes in public environments.

Through multidimensional observation and recording, researchers are able not only to capture the behaviors and preferences of visitors but also to gain a deeper understanding of effective strategies for displaying digital art in public spaces. This comprehensive insight contributes to the planning and implementation of digital art exhibitions in similar public art spaces, enhancing the potential for successful and impactful presentations in the future.

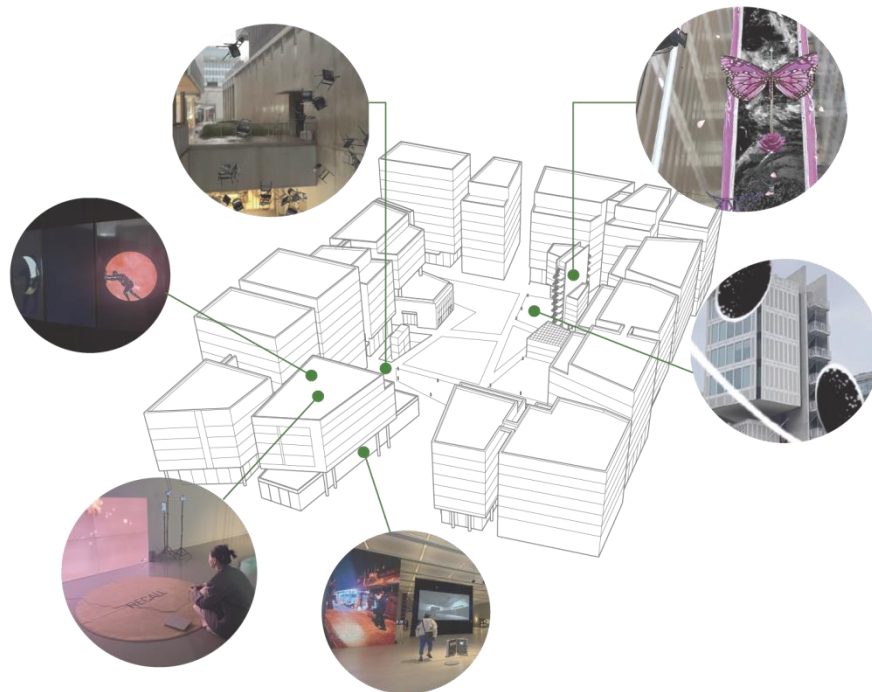


Figure 4.1: Exhibitions in Ooeli Art Park (Author's illustration)

4.2.2 Coding of Data

Semi-structured interviews were conducted using open-ended questions to explore participants' views and experiences (Moustakas, 1994). This interview format is particularly suitable for qualitative research, as it allows participants the freedom to articulate their perspectives and experiences in detail (Creswell, 2012). The data collection process involved

a single interview with each participant, consisting of a predetermined set of questions designed to capture their experiences and understanding (Rubin & Rubin, 2005). Based on participants' responses to the primary interview questions, additional follow-up questions were introduced when necessary to further clarify or elaborate on specific points.

This approach was deemed appropriate for the study of digital art spaces, as it enabled the collection of detailed and relevant information. All interviews were conducted face-to-face, with participants' consent obtained prior to recording the sessions. To ensure the relevance and effectiveness of the interview data, the study selected participants who were closely involved in the field: artists experienced in digital art design, representatives from technology enterprises providing technical support for digital art, and leaders of public art institutions. This selection ensured that the insights gathered reflected a comprehensive understanding of digital art spaces and their intersections with technology and public art environments.

During the interview process, in-depth interviews were chosen due to their open and exploratory nature, providing a means to uncover the perspectives, experiences, and emotions of the participants. These interviews typically involve a pre-prepared question outline tailored to the specific interviewees. While the list of questions remains flexible and lacks extensive detail, the outline is designed to guide participants toward comprehensive and candid discussions through open-ended questions and dialogue, fostering a detailed and nuanced understanding. Respondents are encouraged to freely articulate their perspectives, thereby generating a wealth of detailed and valuable information.

By conducting structured, step-by-step, and targeted conversations, the interview process enables a deep exploration of the participants' thought processes, motivations, and

interpretations. In-depth interviews are particularly effective for gathering detailed and insightful data relevant to the study. The grounded theory approach guided the in-depth interview process, with each interview lasting no less than 1.5 hours.

For data analysis, the transcribed interviews were imported into NVivo 11 software for systematic coding. Open coding, axial (spindle) coding, and selective coding were employed to address the research questions, following the grounded theory methodology. To ensure data saturation, a saturation test was conducted, verifying the completeness and reliability of the collected data. This rigorous process facilitates a thorough understanding and robust analysis of the research themes.

4.2.2.1 Open Coding

To comprehensively construct a digital art scene as a bridge between public art spaces and the virtual space model, the research meticulously analyzed data through a systematic coding process. The research material was scrutinized sentence by sentence, resulting in the identification of 193 primary codes. These primary codes, sharing similar meanings or attributes, were synthesized into new, consolidated codes, ultimately reducing the total to 156. Semantic contradictions within these codes were identified and addressed through iterative refinement and generalization, resulting in the formation of 106 initial concepts. These concepts were subsequently categorized into 18 distinct categories, capturing the multidimensional nature of the digital art scene.

The process reflects a rigorous approach to open coding, ensuring the generation of meaningful and actionable categories that align with the research objectives. The detailed steps involved in the open coding process are presented in Table 4.1, illustrating the structured methodology employed to ensure reliability and depth in data analysis. By

adhering to such a meticulous process, the research not only enhances the theoretical framework but also contributes critical insights into the intersection of public art spaces and virtual environments, solidifying its value in advancing the field of digital art studies.

Table 4.1: Key steps in open coding process

Criteria	Description
Reading of Transcribed Materials	The research materials, consisting of texts and sentences, were read thoroughly for coding.
Total Primary Codes	A total of 193 primary codes were identified during the coding process.
Summarization of Similar Codes	Primary codes with similar meanings or attributes were summarized to create new codes.
Total Codes after Summarization	After summarization, the number of codes reduced to 156.
Identification of Semantic Contradictions	Semantic contradictions within codes were identified, leading to a new round of collation and generalization.
Final Number of Codes after Collation	After collation and generalization, a total of 106 initial concepts were derived.
Classification into Different Categories	The 106 initial concepts were categorized into 18 distinct categories based on their thematic relevance and attributes.

4.2.2.2 Spindle Coding

Using spindle coding, this research identifies five primary categories—meaning, virtual space, public art space, public digital art scene, public space, artist, and government agency—by establishing relationships between the initial conceptual categories derived from open coding. Spindle coding serves as a critical step in identifying and organizing these interrelated categories, highlighting their connections and interdependencies within the broader framework of the study. This process ensures a logical structure that emphasizes the

dynamic interplay among these categories, which is essential for understanding the intricate relationship between public art spaces, digital art scenes, and virtual environments.

4.2.2.3 Selective Encoding

The core category, identified as "the structural dimension of public art space and virtual space model with the digital art scene as the connecting element," emerged through the processes of open coding and axial coding. A critical narrative was constructed around this core category, emphasizing the dual role of artists and policy frameworks in fostering the development of public art spaces. This narrative highlighted the multifaceted functions of such spaces, including their contributions to social interaction, entertainment, cultural exchange, and urban identity. By leveraging these dimensions, the research proposes a novel operational model for public art spaces, which not only enhances their cultural and social relevance but also stimulates growth in adjacent industries.

The digital art scene is positioned as a pivotal gateway for audiences to transition into the Metaverse, introducing dynamic energy into virtual environments. This connection enables audiences to engage in activities such as social interaction, virtual entertainment, cultural exchange, and virtual travel. Furthermore, the immersive experiences provided by the Metaverse are significantly enriched through the advanced technological support embedded in virtual spaces. This relationship underscores the transformative potential of the digital art scene in bridging the tangible and virtual realms, redefining audience engagement and the operational framework of public art spaces.

4.3 Thematic Analysis of Aesthetic Experiences

4.3.1 Space Use Experience Analysis

Periodic observations of visitor patterns at Ooeli revealed that the majority of visitors consisted of young individuals engaged in the fashion industry, art and design professions, as well as local residents. These observations were conducted during weekdays, public holidays, and cultural celebrations to ensure a comprehensive understanding of visitor demographics and behavior. The spatial organization of Ooeli was analyzed and categorized into several functional modules, including office spaces, temporary display areas, leisure and dining zones, art exhibition spaces, and commercial areas.

The temporary exhibition area was identified as the primary venue for interactive events such as festivals and art fairs, significantly influencing the activities and dynamics of the other functional sections over varying time periods. Ooeli's temporary exhibition spaces are characterized by their diverse formats and adaptability, allowing for seamless expansion to accommodate a range of artistic and cultural activities. This flexible spatial arrangement highlights the multifunctional and dynamic nature of Ooeli as a public art space, contributing to its role as a hub for creative and community engagement.

The observations findings presented in Figure 4.2 highlight that the area primarily serves as a hub for art exhibitions and market activities. These locations underscore the validated social role of public art spaces and reflect the dynamic spatial attributes inherent to public spaces. Visitors can freely explore and relax in this expansive area without restrictions. The park functions as more than just a public green space for leisure; it incorporates small lakes and meandering pathways that provide a sense of tranquility amidst the urban environment. Integrating the architectural framework with the realm of digital art

significantly enriches the interactive environment, effectively dissolving the traditional boundaries of engagement.

The findings indicate that while some visitors may remain unaware of the unique exhibitions or commercial activities within the Ooeli Museum, they consistently take time to enjoy the inviting atmosphere of this public space. Due to its versatile nature, the site is highly suitable for showcasing digital art scenes. In the future, this area holds the potential to act as a gateway, guiding casual visitors and passersby into the immersive virtual realm of the Metaverse. By strategically merging physical and digital elements, the space can foster a more engaging and immersive environment.

This area represents more than just an exhibition venue; it functions as a creative hub, a social gathering point, and a platform for intercultural collaboration. Visitors are offered unparalleled opportunities to engage in interactive and innovative experiences, emphasizing the transformative role of public art spaces in bridging the physical and virtual worlds.

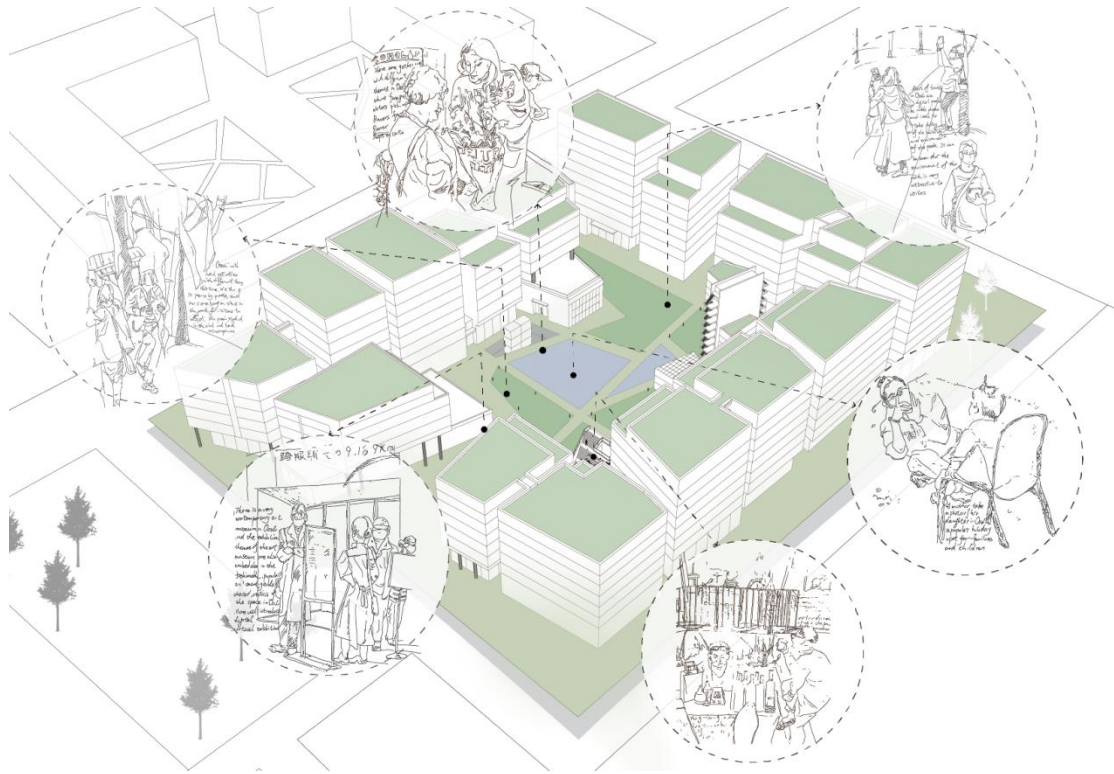


Figure 4.2: Space usage in Ooeli (Author's illustration)

The Ooeli Art Museum's art park, especially the theater and library study rooms within the main building, creates a cohesive cultural environment that plays a pivotal role in fostering artistic immersion, intellectual discourse, and scholarly exploration. As a central hub for art exhibitions, this location attracts a substantial number of visitors, with many spending over 40 minutes on-site. A significant portion of these visitors is drawn by targeted social media campaigns, which promote the exhibitions. The reliance on online reservations and ticket purchases has shaped a visitor demographic that primarily includes professionals and art enthusiasts. Their behavioral patterns and engagement levels reflect the elevated expectations of this audience segment. Consequently, both physical and digital art exhibitions are required to meet rigorous academic standards and quality benchmarks to address the specific demands of this target demographic.

The design and execution of exhibitions must meticulously consider the historical context, cultural significance, and situational relevance of the artworks, particularly within the academically enriched and creatively demanding environment. A well-curated exhibition is expected to function as a research-driven artistic presentation, offering an abundance of knowledge and critical insights that inspire visitors to engage in thoughtful analysis and dialogue.

The emergence of digital art has further redefined the role of the Ooeli Art Museum, transforming it from a traditional exhibition venue into an experimental platform for exploring artistic innovation and audience interaction in the digital age. These exhibitions often incorporate advanced technologies such as virtual reality (VR), augmented reality (AR), interactive multimedia, and data visualization. This integration provides a medium to investigate how digital tools are reshaping artistic creation and the aesthetic experience, thereby positioning the museum as a cutting-edge laboratory for the intersection of art, technology, and audience engagement.

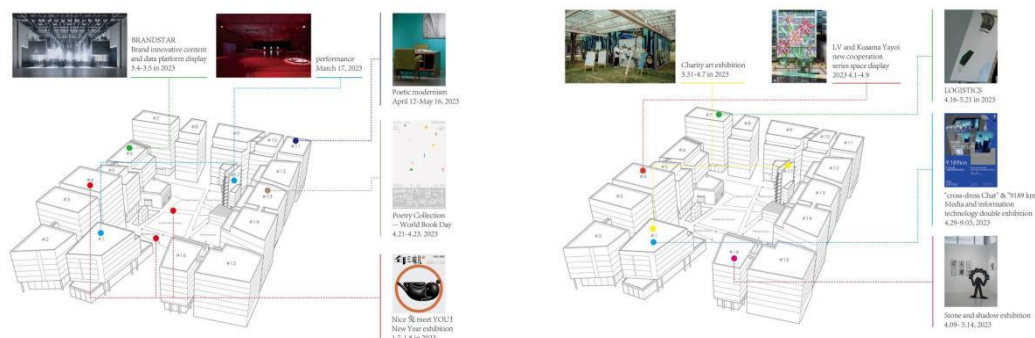




Figure 4.3: Annual Exhibitions and Events in 2023 (Author's illustration)

Over the course of a year-long observation and documentation of Ooeli's exhibition activities, the space has demonstrated exceptional performance in fostering both intellectual and personalized dimensions of these events, as illustrated in Figure 4.3. Several key criteria were identified based on insights derived from detailed field notes collected during the observation process. These criteria provide a comprehensive framework for understanding and evaluating the unique characteristics and effectiveness of the exhibitions conducted within this space.

Space utilization: The strategic use of public green areas for art fairs during various festivals effectively attracts visitors, underscoring the flexibility and adaptability of Ooeli's public art spaces. These findings suggest that Ooeli is highly conducive to integrating digital

art scenes and Metaverse applications. The space not only offers the physical conditions necessary for such initiatives but also boasts an established audience base, indicating a promising trajectory for future development.

Market dynamics: Ooeli's organization of 11 market events annually demonstrates the robust demand and economic viability of the digital art market. This data provides critical insights into the potential influence of digital art on the broader art market economy, positioning Ooeli as a pivotal player in this emerging field.

Socio-cultural impact: The high level of interactivity inherent in Ooeli's activities, coupled with the diverse socio-cultural backgrounds of its participants, establishes a solid foundation for advancing the digital art scene. These events offer valuable insights into how the digital arts sector fosters inclusivity and cultural diversity, contributing significantly to the socio-cultural fabric of the community.

Organizational and curatorial approaches: The exhibitions and events at Ooeli exemplify a modern and innovative curatorial style. The curatorial strategies reflect a deliberate embrace of diverse artistic disciplines and modes of expression. By seamlessly blending traditional and contemporary, as well as local and global, artistic elements, Ooeli's curators create unique exhibition experiences. These experiences not only captivate diverse audiences but also set a benchmark for curatorial practices, showcasing the transformative influence of digital art on exhibitions and fairs. This approach offers new paradigms for the art world to consider and integrate into future practices.

Cross-disciplinary collaboration: Ooeli demonstrates a pioneering approach to cross-disciplinary collaboration, particularly in merging art with technology and integrating artistic concepts into business contexts. These efforts highlight the discovery and

advancement of digital art through interdisciplinary synergies. Such collaborations not only enhance the multidimensional attributes of the artwork but also create a dynamic platform for artists and technologists to co-develop innovative solutions. This exemplary case of cross-disciplinary engagement underscores Ooeli's significant potential in fostering the integration of digital art scenes with diverse sectors, further validating its role as a catalyst for interdisciplinary innovation.

The successful execution of these events provides valuable insights to the art world while offering researchers crucial indications about the future trajectory of the digital art domain. To further understand the spatial dynamics of Ooeli, an analysis of the functionality and usage of individual spaces within the site was conducted. A systematic observation and detailed examination were performed, tracking the behaviors of five distinct groups over the course of a day at Ooeli. This approach involved plotting the movements of individuals based on time and location within the space.

The analysis revealed that the primary areas frequently occupied by visitors were the public green spaces and the art museum. These spaces are notable for their provision of food and beverage services, which contribute to their popularity. The categorization of visitors' spatial usage patterns identified five distinct groups based on their interactions and behaviors within the Ooeli space. Table 4.2 outlines these visitor categories, offering a structured understanding of how different groups engage with the environment. This detailed categorization provides a foundation for evaluating the impact of spatial design and functionality on visitor experience and engagement.

Table 4.2: Categories of Visitors

Category	Visitor Profile
A	Designers
B	Couples who are tourists
C	Family
D	Professionals or Office Workers
E	Groups of individuals college or university students

The analysis of each category was conducted utilizing field notes meticulously recorded during the observation process. Figures 4.4 to 4.8 provide a comprehensive examination of the findings, offering a detailed analysis of each category. These analyses explore the profiles of visitors, their courses of action within the space, and the key attractions that draw their attention. This approach ensures a thorough understanding of visitor behaviors and preferences, thereby contributing to the overarching objectives of the study. The description for each category of visitors are explained in detail below:

Category A: Designers

Visitor Profile: Group A consists of a male designer who possesses a camera and sketchbook and exhibits a strong passion for architecture and design.

Course of action: He selected a vantage point from which he could capture the entirety of the Ooeli architectural facade, seeking inspiration and documenting the building's aesthetic allure. Following his visit to the Art Museum, he proceeded to T-Site with the specific intention of immersing himself in photography and design literature. He sought to

derive inspiration by perusing, gathering, photographing, and documenting these publications.

Attraction: The Art Museum and T-Site serve as reservoirs of inspiration for him, and the entire public area provides him with the opportunity to immerse himself in art and cultivate creativity.

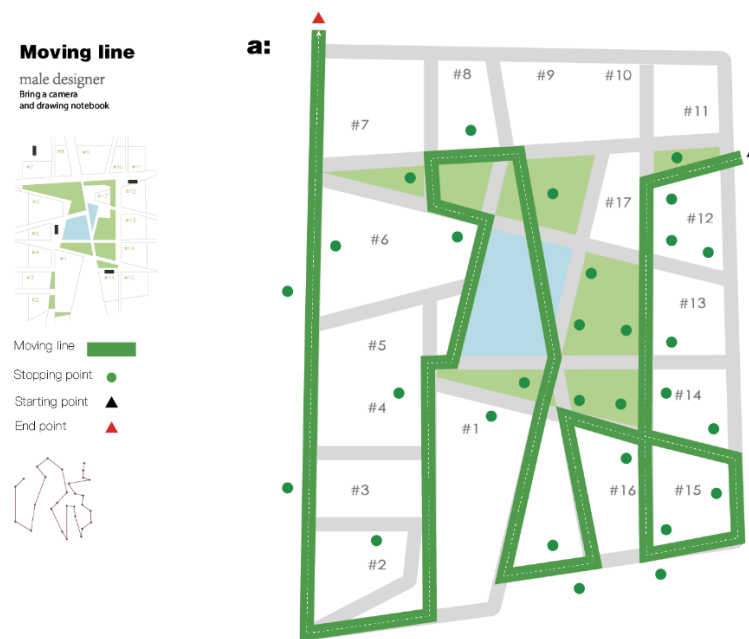


Figure 4.4: Ooeli visitor moving line for category A (Author's illustration)

Group B consists of couples who are tourists

Visitor Description: Group B includes a couple who are well-prepared with a camera and a notebook, and they exhibit a strong passion for art merchandise.

Course of action: They devoted a significant amount of time to investigating shop spaces, exhibition halls, art museums, and T-Site bookshops that specialize in selling merchandise related to the art industry. Additionally, they diligently documented

comprehensive records of the products found in these establishments. The individuals demonstrate a strong interest in the art items and products showcased in the windows of Ooeli, as seen by their frequent presence in public green spaces.

Attraction: The shops and art goods display windows hold a strong appeal for them, prompting them to collect the artworks they find interesting through meticulous documentation and photography.

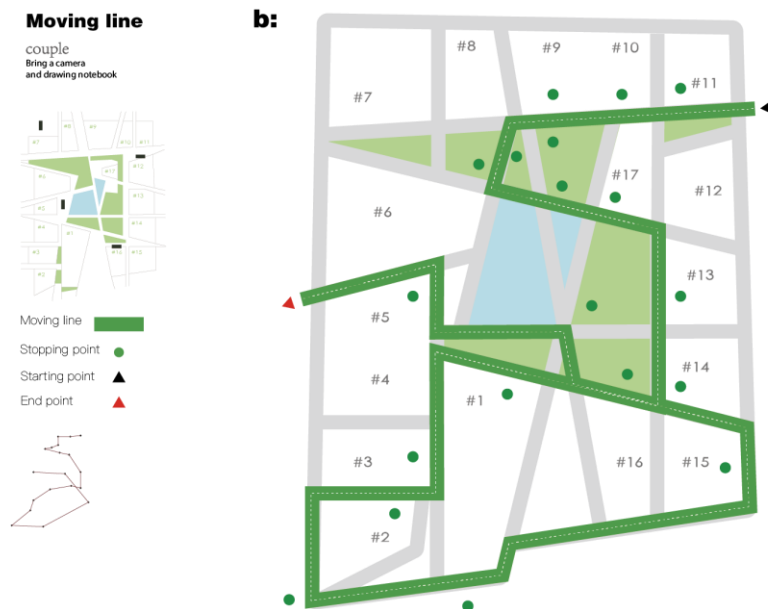


Figure 4.5: Ooeli visitor moving line for category B (Author's illustration)

Category C: Family

Visitor Profile: Group C consists of a nuclear family including two parents and a 3-year-old daughter. Their selection of activities is based on the child's needs.

Activity route: They primarily frequent public green spaces that permit youngsters to disembark from their strollers and engage in play on the premises. Additionally, they

explored the art museum and dedicated additional time to the children's books and derivatives section of T-Site.

Attraction: The public green space offers a child-friendly setting for families, while the children's areas of the Art Museum and Daikanyama T-Site give an educational and entertaining experience.



Figure 4.6: Ooeli visitor moving line for category C (Author's illustration)

Category D: Professionals or Office Workers

Visitor Profile: Group D consists of white-collar professionals who carry laptops and have a keen interest in art and design.

Activity Route: His actions included visiting art shops, spending time at the art museum, and exploring T-Site. Subsequently, he revisited the verdant expanse situated at the heart of the campus to appreciate the intricate architectural layout of the communal area.

Attraction: The art shop, art gallery, and T-Site held significant importance for him as they offered the necessary artistic inspiration and intellectual resources. Additionally, the architecture itself supplied him with an aesthetic experience and potential career inspiration.

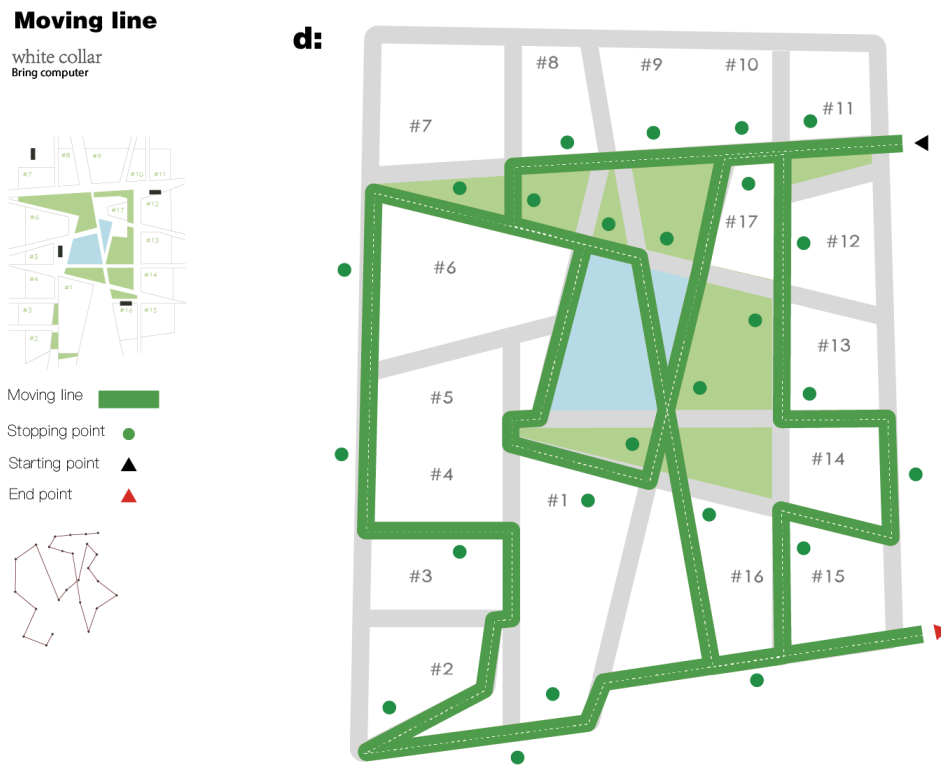


Figure 4.7: Ooeli visitor moving line for category D (Author's illustration)

Group E: Groups of individuals college or university students

Visitor Profile: Group E comprises five inquisitive college students with a keen interest in temporary exhibitions and innovative merchandise.

Activity route: They focused their efforts on the green area, which housed temporary Brutalist exhibitions. They were particularly interested in stores that specialized in selling artsy and creative items, and they dedicated a significant amount of time to exploring these

establishments. In addition, they explored the Art Museum and T-Site.

Attraction: The temporary exhibitions and innovative retail stores located in the green area are highly attractive to young individuals in this category. They actively seek inspiration and derive pleasure from the artistic ambiance offered by these establishments. The Art Museum and Daikanyama T-Site serve as significant venues for individuals to study and acquire knowledge and culture.

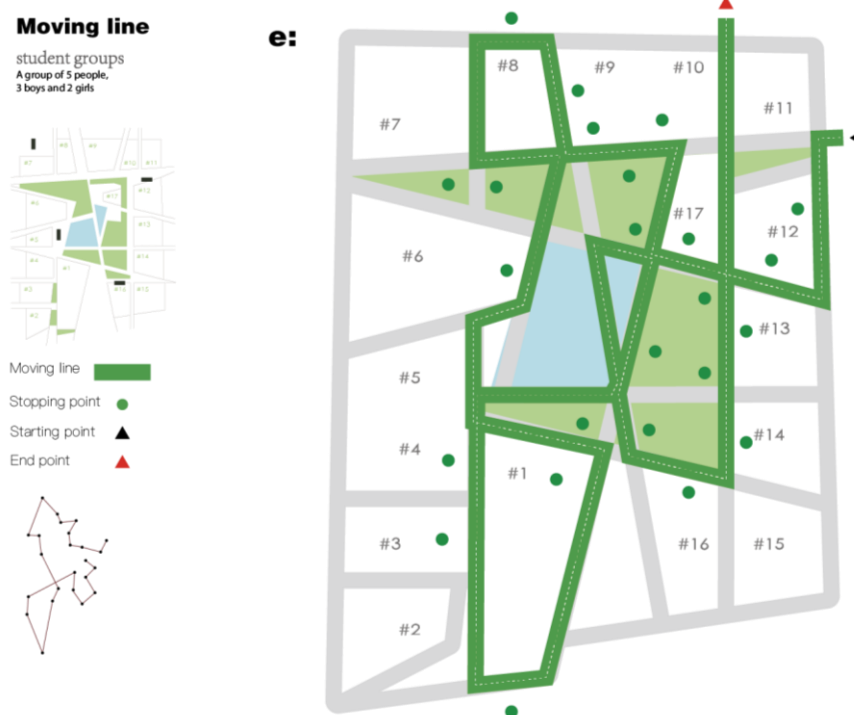


Figure 4.8: Ooeli visitor moving line for category E (Author's illustration)

The examination of movement patterns and visitor profiles across the identified categories reveals the multifaceted appeal of the public art space within Ooeli. The art museum serves as a pivotal venue for showcasing diverse artworks, successfully attracting visitors from a broad spectrum of backgrounds. Similarly, T-Site, with its extensive collection of books and resources, acts as a critical hub for designers, families, professionals,

and students, offering a blend of intellectual and visual enrichment. These highlighted spaces not only enhance the cultural and functional versatility of Ooeli as a public art destination but also effectively draw individuals with varied interests and preferences.

Visitors are provided with immersive art experiences and opportunities for knowledge exchange through the presence of key establishments, such as art galleries, bookstores, and specialty shops focusing on creative design products. These favorable conditions significantly contribute to the advancement of the digital art scene and underscore the importance of thoughtful integration when connecting the space with the Metaverse virtual environment. To effectively present this evolving art form and meet the diverse spatial needs of its users, Ooeli must consider the following significant factors:

Diverse interactive experiences: Designers of digital art scenes and young students may be more inclined to engage in highly interactive digital art works, while family groups may prefer child-friendly and educational interactive experiences.

Adaptable exhibition space: Digital art shows should offer a versatile spatial arrangement to cater to the requirements of various activities, such as workshops, seminars, or interactive exhibitions, in order to appeal to both professionals and popular audiences.

Integration of technical facilities: To deliver top-notch art experiences, the digital art scene must incorporate sophisticated technical facilities, given the elevated demands of professionals such as white-collar workers and designers.

Safety and accessibility: Considerations are crucial when it comes to digital art scenes for families with small children. It is important to prioritize security by avoiding installations that could potentially endanger children. Additionally, the venue should be built.

This should be done in a way that is easily accessible to guarantee that everyone can participate without difficulty.

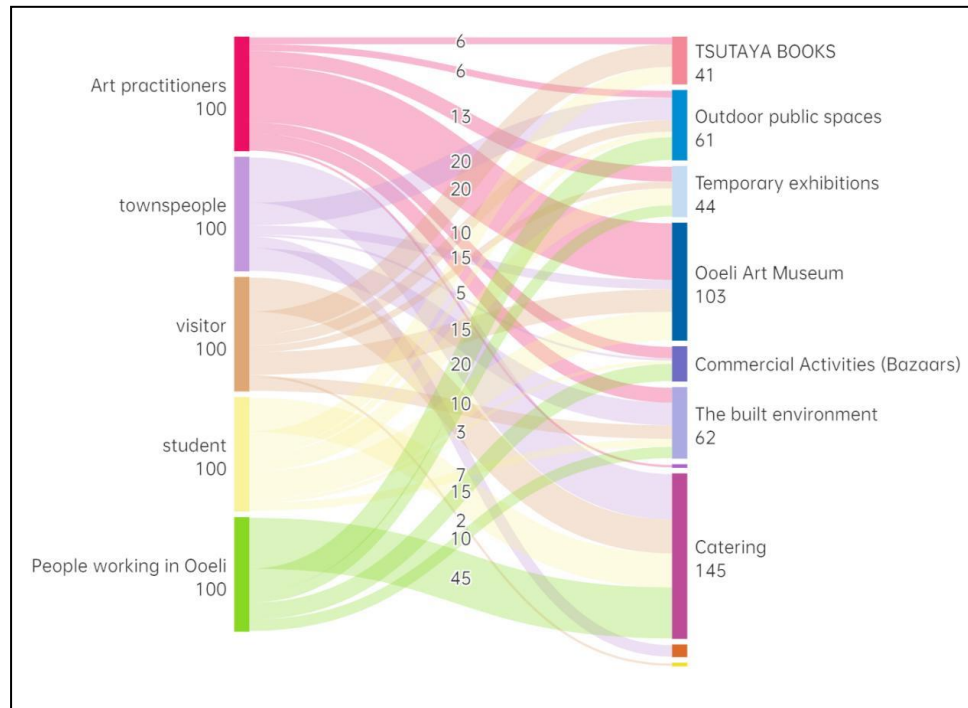


Figure 4.9: Traffic distribution of Ooeli space visitors percentage% (Author's illustration)

Observing different visitor identities reveals a diversified trend in the proportion of Ooeli functional areas. Specifically, Ooeli's cuisine approach plays a significant role in drawing and retaining customers. The elegant aesthetic environment of the dining area and the exceptional quality of the food contribute to this. In Ooeli, visitors have the opportunity to enjoy a cup of coffee outdoors, engage in conversation with friends, take in the temporary outdoor exhibition, take in the environment reflected by the shallow pool in the park, and take in the park's scenery. Additionally, they can use their mobile phones to scan the Ooeli landscape through a mini program and watch a virtual reality mobile phone animation, as

illustrated in Figure 4.9. This experience is also a fundamental aspect that future public art spaces should possess.

Based on the pattern of visitor flow distribution, it is evident that the Ooeli Museum and its surrounding physical environment are highly appealing. This not only demonstrates the exceptional caliber of the museum's exhibitions but also highlights the significance of the architectural design of the public space as a vehicle for artistic aesthetic qualities. Furthermore, the temporary exhibitions showcase an interactive character to the public, providing visitors with a diverse and immersive encounter.

Upon examining the patterns of visitor flow and space utilization at the Ooeli public art space, it is evident that Ooeli possesses not just artistic qualities but also a distinctive design and adaptability that enable it to serve as a nexus linking the physical world with the meta-universe. Through the utilization of cutting-edge technology, particularly virtual and augmented reality, Ooeli has the capability to provide visitors with a highly immersive art environment by means of digital exhibitions and interactive experiences.

The production of a digital art scene within Ooeli Art Park, as illustrated in Figure 4.10, incorporates augmented reality (AR) technology, enabling interactive engagement for visitors. Observations shown in Figure 4.9 highlight a notable preference among tourists for dining areas within Ooeli, particularly Western restaurants and cafes offering outdoor seating. These spaces present an opportunity for the integration of exclusive digital art scenes, allowing visitors to interact with their surroundings from innovative perspectives while dining or enjoying coffee.

This forward-thinking approach to blending digital art with the physical environment aims to enrich the sensory experiences of visitors, significantly enhancing the appeal of

Ooeli Art Park. By merging artistic expressions with the spatial context, visitors are provided with an immersive environment where art, food, and dynamic spatial transformations harmonize seamlessly. This integration not only elevates visitor engagement and satisfaction but also positions Ooeli as a pioneering and interactive public art space that redefines the boundaries of traditional art experiences.



Figure 4.10: Virtual reality applet effect in Ooeli Art Park

4.3.2 Evolving Aesthetic Preferences

The study observes visitor traffic based on the criterion of whether the public art space is presenting digital art shows on the day of observation. The researcher attended several exhibitions, including the AR\VR display at the graduation display of China Academy of Art in Ooeli on June 1, 2022, the Wallpaper volume special show in Ooeli on July 24, the HOLODECH digital exhibition on November 26, and the "cross-dress chat" and

"9189 km" on May 27, 2023. As part of the filed notes, "I witnessed the digital interactive installation "Map and Boundary Game" at four specific moments in time. I consistently monitored the visitor traffic by observing the same points between 10 a.m. and 7 p.m. on every day of the show".

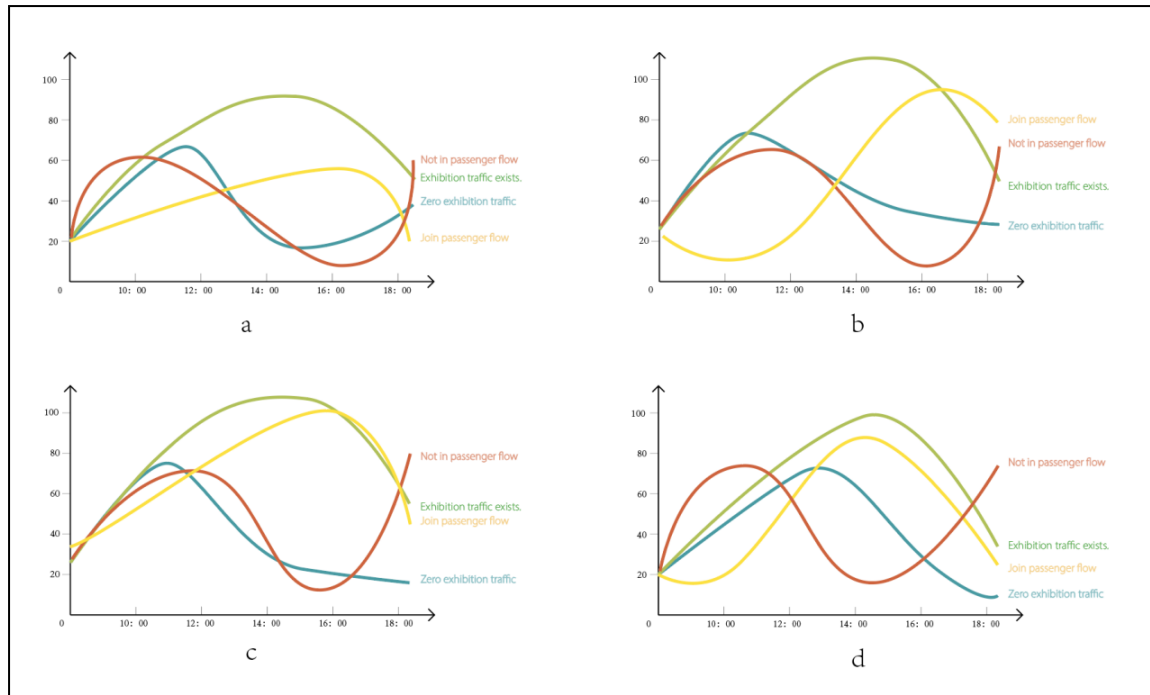


Figure 4.11: Visitor traffic in Ooeli (Author's illustration)

Figure 4.11 categorizes the visitor traffic into a, b, c, and d. The AR/VR display of the graduation display at the China Academy of Art is represented by the letter "a". In the analysis chart, the red curve represents the flow trend of visitors who did not participate in digital exhibitions, while the yellow curve represents the flow trend of visitors who did participate in digital exhibitions. It is worth noting that there is a close correlation between the yellow curve and the green curve, which represents the number of visitors when there is an exhibition. This shows that digital exhibitions have a significant impact on attracting visitors, and the number of visitors participating in digital exhibitions indicates a high

correlation with the overall visitor flow during the exhibition. The blue curve shows the change in visitor traffic when there is no exhibition. The comparison reveals a significant increase in visitors, particularly those who participated in digital exhibitions, when exhibitions were present. This trend highlights the important role of digital exhibitions in attracting and sustaining visitor interest while also providing us with valuable insights when planning and implementing exhibitions in the future. By further optimizing and promoting digital exhibitions, I can effectively increase the attractiveness and visitor engagement of Ooeli Art Park.

On the other hand, Ooeli presents the unique exhibition known as Wallpaper Volume, which includes the HOLODECH digital exhibition, the digital interactive exhibition "Chat across Clothing," and the "9189 km, Map and Border Game." Investigate the impact of digital art exhibitions on the influx of visitors to public art spaces. I discovered intriguing phenomena and trends by conducting comparison analysis during comparable time periods, contrasting digital exhibitions with those without them.

There is a notable surge in traffic during the digital art display. These findings indicate that digital art shows have a beneficial impact on visitor attraction, either by providing unique experiences or by generating more attendance through publicity and word-of-mouth. The observation also highlighted four other aspects, including peak hours, the presence of interactive visitors, the presence of non-participating visitors at digital art exhibitions, and the overall experience of the community atmosphere. The findings are shown below:

Peak hours: The highest volume of passenger travel typically occurs between 13:00 and 17:00 PM. This time period may be attributed to those seeking recreational pursuits

following their midday meal, to the leisure time of office employees after their work hours, or to out-of-town tourists who require a period of respite before arriving at this location. The local work, traffic, and lifestyle patterns in Hangzhou may also contribute to the high volume of passengers during this time.

Interactive visitors: The highest percentage of visitors that are willing to participate in digital exhibition interaction occurs during the afternoon peak. The participatory nature of the exhibition attracts individuals seeking social engagement and novel experiences.

Non-participating visitors at digital art exhibitions: The study revealed that individuals who refrained from engaging in digital art shows primarily consisted of local community members, such as pensioners and stay-at-home mothers. Their activities typically occur from 10:00 am until 12:00 pm. The presence of retirees and stay-at-home mothers seeking recreational activities in the morning, when there are fewer domestic tasks or familial obligations, may account for this time period. They may be more motivated to attend public art spaces during off-peak hours to escape the busy afternoon period.

Non-participating visitors are more likely to experience the community atmosphere that digital art displays foster. This demonstrates that the digital art display not only actively involves the participants but also indirectly impacts the entire ambiance of the public area, allowing even non-participating visitors to perceive the transformation and energy brought out by the exhibition.

When studying the influence of digital art exhibitions on the number of visitors to public art spaces, I observe a substantial transformation in visitors' aesthetic preferences following the introduction of digital art exhibitions. Throughout the duration of the digital exhibition, the audience showed a heightened level of attention and involvement in the

interactive and technology-infused artworks. The novelty of digital art and the allure of multimedia features, which offer a captivating and immersive experience distinct from traditional art forms, could be the reason for the shift in preference. Captivating elements like dynamic displays, sound interactivity, and touch screens attract visitors and allow them to engage with art in unprecedented ways. Furthermore, the influence of social media is undeniable, drawing numerous individuals to capture and share these unique experiences. Consequently, digital art exhibitions not only enhance the number of visitors but also prompt a change in aesthetic tastes toward contemporary, interactive, and technology-driven art forms.

Visitors were surveyed regarding their expectations for the evolution of digital art scenes in public art spaces. This inquiry was conducted alongside observations of both digital and non-digital art exhibitions, aiming to capture insights into visitor perspectives on the potential integration and future direction of digital art within public art environments.

4.3.3 Visitors' Expectations of the Digital Art Scene

The observation and random interviews with the visitors conducted in Ooeli reveal that the public holds elevated expectations for the digital art scene in public art spaces. The most highly anticipated digital art experience is the utilization of augmented reality technology to incorporate an interactive element into conventional artworks. This enables spectators to engage with art content beyond the limitations of physical space by using smart devices. Furthermore, the audience demonstrated a notable inclination toward actively engaging with artworks via touch screens, motion sensors, facial recognition, and other technological advancements. These innovations have the potential to greatly amplify their level of involvement and overall experience.

The third-ranked attraction is an art show that offers a fully immersive experience through the use of virtual reality (VR) technology. This enables guests to freely navigate and study various artworks inside a virtual environment. These findings indicate a significant public desire to combine modern technology and art and offer a distinct path for the digitalization of the art industry. Visitors also mentioned digital interpretation, which involves providing digital educational resources and explanations, such as background information and explanations of artworks, through an app or interactive screen. Social media integration encourages audiences to share their art experiences, thereby enhancing the artwork's impact and engagement.

These findings also demonstrate a novel anticipation from the audience regarding the art encounter, wherein they are not solely content with conventional ways of observation but actively seek more vibrant and engaging creative engagement. This trend indicates that art organizations and designers should prioritize the incorporation of technology and interactive components in their artistic creations and displays. By adopting this approach, art can enhance its vibrancy and allure, thus broadening its appeal to a larger audience. This inclination toward digital art experiences also exemplifies the present societal tendency to incorporate technology into daily life. The digitalization of the art space encompasses not just technological considerations but also reflects cultural and social trends. The art world must adapt to the changing needs of the public and actively explore methods to translate these needs into innovative artistic expressions.

Regarding the digital art scene, the survey and communication outcomes indicate that when the digital art scene is integrated with the Metaverse, the public's most anticipated experience is to actively engage in the artistic creation within the virtual realm. Visitors

desire the capability to utilize virtual tools within the Metaverse for collaborative creation with artists or for independent completion of extensive virtual art projects. This anticipation signifies individuals' fervent yearning for interactive and innovative encounters, as well as their inclination to venture into novel avenues of artistic manifestation.

Persistent virtual exhibitions are accessible to viewers at any time, regardless of their physical location or time. The function and significance of visitors' important expectations are outlined below:

Global Art Interaction: Art lovers from all over the world meet, communicate, and collaborate in virtual space.

Virtual art creation: Artists and audiences can use virtual tools to create art in the Metaverse, and can even collaborate to create large-scale virtual art projects.

Virtual Art Market: You can conduct the buying and selling of artworks in the Metaverse, including digital versions of traditional artworks and native digital artworks made especially for virtual spaces.

Personalized virtual space: Audiences can create or customize their own virtual art space in the Metaverse to display their collections or design their own art gallery to share their artistic taste and creativity with others.

Personalized virtual space: Audiences can create or customize their own virtual art space in the Metaverse to display their collections or design their own art gallery to share their artistic taste and creativity with others.

Virtual art performances: Art museums can host virtual concerts, dance performances, or theater performances, and audiences can experience performing arts in a new way in the Metaverse.

Cross-border art projects: Metaverse provides a platform where artists can collaborate with game developers, animators, musicians, and other cross-field creators to create unique artistic experiences.

Virtual art community: Establish a virtual art community so that artists and audiences can establish networks in the Metaverse, share resources, hold activities, and form an art ecosystem.

Virtual Reality Tourism: Through the Metaverse, viewers can take virtual tours and explore art galleries and exhibitions around the world without leaving their homes.

Display and trading of digital collections: Using blockchain technology, art museums can display and trade digital collections, such as NFT artworks, in the Metaverse to ensure ownership and authenticity.

Personalized virtual experience: Audiences can customize their virtual art experience based on their interests and preferences, including choosing to visit the works of specific artists, exhibitions of specific art genres, or participate in interactive projects on specific themes.

Another significant aspect is the potential to generate or personalize individual virtual art environments within the Metaverse. The audience desires a dedicated platform to showcase their collection or create a distinctive art gallery in order to express their creative preferences and inventiveness. This requirement highlights the significance of customization

and social engagement in the artistic encounter, as well as individuals' inclination to express themselves and establish connections with others through art.

The findings indicate that the rise of novel platforms such as Metacom is altering the public's expectations for creative encounters. How can we utilize Metacom and other technological advancements to meet the public's evolving demands for creative experiences? In order to investigate the creation of significant artistic interaction and engagement opportunities in virtual environments such as the Metaverse, it is imperative for art institutions, artists, and technology developers to collaborate. The pursuit of interactive and personalized experiences also signifies the independence of audiences in the digital era. Within the Metaverse, individuals possess the capacity to become creators and exercise their creative prowess by establishing a personalized artistic realm. This will not only unleash the creative capacity of a larger number of individuals, but it may also lead to a democratization of the art world, allowing for the showcase and acknowledgement of a greater variety of voices and viewpoints.

In addition, the data indicates a potential future shift in the art industry. The growing number of individuals producing and exhibiting art in the Metaverse could potentially disrupt traditional methods of art exhibition and sale. The realm of art collecting and trade can include virtual art, potentially introducing new processes for art authentication and copyright management. It is clear that the audience's formal and aesthetic preferences for art display are undergoing a significant shift.

As indicated by Table 4.3, the primary demographics of the virtual space audience include enthusiasts for games, art and entertainment, virtual sociability, business and investment, technology, and practitioners in the creative and artistic domains. The virtual

technology and interactivity of the Metaverse attracts tech and game enthusiasts. They like to try out new technologies and experience the possibilities of virtual worlds, and the rich digital art, entertainment, and cultural experiences in the Metaverse attract art and entertainment enthusiasts. They can explore various fields of creativity and expression within the Metaverse. Since the Metaverse is characterized by social interaction, it attracts virtual social enthusiasts who want to connect, collaborate, and communicate with others, satisfying their need for social interaction. Businesses and investors may look for opportunities in metaverses, such as virtual real estate, virtual commodity trading, etc., since they may involve virtual economic and commercial activities. Technology enthusiasts and digital natives make up a portion of this audience, as using Metaverses typically requires a certain level of technological adaptability and digital skills. In addition to serving as an audience for technology enthusiasts, the Metaverse also offers a platform for individuals in the creative and artistic fields to create and showcase their work and talent.

The NVIVO software's analysis of the interview materials yielded the numbers corresponding to the encoding in Table 4.3 below, which is helpful for the research's classification.

Table 4.3: The main types of virtual space

Encoding	Category	Initial Concept	Raw Data
5	Audience Type	• Game lovers; • Art and Entertainment Lovers; • Virtual Social Enthusiasts; • Business and Investors; • Technology	Arts and entertainment enthusiasts: The abundance of digital art, entertainment, and cultural experiences in the Metaverse attracts arts and entertainment

Table 4.3 continued

		Enthusiasts; • Creators and Creative Workers; • Practitioners in the creative and artistic fields	enthusiasts. In it, they can explore creativity and expression in different fields.
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4.3.4 Multi-Sensory Engagement

The public digital art scene connects the virtual space and the public art space and is the port of entry to the virtual space. Unlike the traditional public art space, the public digital art scene offers a new mode of operation for the public art space, which typically refers to physical spaces like museums, art galleries, and public squares, where people can appreciate and participate in art activities. The digital art scene, on the other hand, refers to bringing artworks and art experiences to the public through digital technology and online platforms. Digital art scenes display artworks in digital form, enabling audiences to access and participate in art activities anytime, anywhere, through tools like the Internet and mobile devices. The digital art scene can provide a wider audience base, breaking through the limitations of time and space, enabling more people to access and enjoy art, and establishing a new operating model for public art spaces. This new mode of operation stimulates the growth of tourism, industry, and other sectors, thereby contributing to the city's development. Additionally, it offers a fresh form of entertainment, fosters social interaction, disseminates culture through these interactions, and subtly enhances public literacy. The new mode of operation preserves digital artworks through digital storage, shielding them from the limitations and environmental damages of time. Viewing at any time is the most essential state of digitized artworks. Therefore, the digital display of artworks greatly reduces or even

completely disappears the cost of logistics, transportation, and exhibition space, which is conducive to the green and sustainable development of the environment. Table 4.4 illustrates the functions of public digital art scenes.

Table 4.4: The functions of public digital art scenes

Encoding	Category	Initial Concept	Raw Data
13	Features	• It provides a new operating model for public art spaces; • Bridging virtual spaces and public art spaces; • It has driven the development of the industry; • Social interaction; • Cultural communication; • Amusement; • Improving public literacy; • Promoting tourism development; • Promoting urban development; • Promote green and sustainable development of the environment.	A connection point is a domain, a domain that functions in various styles and categories.

4.3.5 Integration of Physical and Digital Realms

Digital art expands the boundaries of art, particularly in areas such as digital identity display, cross-border integration, enhanced interactivity, creative expression, innovation and experimentation, and immersive experience, as illustrated in Table 4.5.

The audience can use the digital art scene as a platform to showcase their digital identities. Audiences can create virtual images in the virtual world to express their personalities and ideas; at the same time, digital technology makes it possible to integrate elements from different fields, such as science and technology, music, and games. The digital art scene becomes a space where different fields meet, creating a unique cross-border art experience; the digital art scene not only integrates elements from different fields but also usually has stronger interactivity. The audience can interact with the works through gesture, sound, touch, etc., from passively observing to actively engaging, so that the audience becomes part of the works. Digital art expands creative expression while being more interactive, and digital technology provides artists with more ways and tools to express their creativity. Through technologies such as virtual reality, augmented reality, and computer graphics, artists are able to create unique works of art that are difficult to realize in traditional art spaces. Because of these diverse viewpoints, the expansion provides the audience with a more intense and immersive art experience, demonstrating how digital technology fosters a deeper and more immersive experience. Through virtual reality technology and other technologies, the audience can experience the three-dimensionality and emotion of the artwork, an experience that is not possible in traditional art spaces.

Table 4.5: Digital art expands the boundaries of art

Encoding	Category	Initial Concept	Raw Data
2	Digital art expands the boundaries of art	• Expansion of digital identity presentation • The expansion of cross-border integration; • Enhanced interactivity;	Innovation and experimentation: Digital technology gives artists greater freedom to innovate and experiment.

Table 4.5 continued

		• The expansion of creative expression; • Innovative and experimental expansion; • Expansion of immersive experiences	Artists can experiment with new mediums, technologies, and forms in digital art, creating visual and sensory experiences like never before.
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Digital art expands the boundaries of art, and it breaks the limitations of traditional art forms through the use of emerging technologies to create a new way of artistic expression, as shown in Table 4.6. Digital art can utilize virtual reality, augmented reality, artificial intelligence, and other technologies to create interactive and participatory art works with the audience, expanding the boundaries of art and creating a richer and more diverse art experience. The sustainability of digitalization refers to the preservation, inheritance, and display of art works through digitalization, which protects and continues the cultural heritage of art. Digital media preserves digital art without temporal or spatial constraints, allowing more people to appreciate and disseminate it, thereby promoting the sustainable development of art. Interactivity means that viewers can interact with digital artworks through interactive means. Through virtual reality, augmented reality, and other technologies, digital art enables the audience to participate in the art work and become the creator and participant of the art. Viewers can interact with artworks through gestures, sounds, body movements, and so forth to get a more personalized and rich art experience. Interactive art

works can enhance the audience's sense of participation and experience and improve the interactivity and attractiveness of art.

Table 4.6: Digital art expands the boundaries of art

Encoding	Category	Initial Concept	Raw Data
1	Significance	• Provides opportunities for the digital economy • Digital art expands the boundaries of art • Sustainability of digitalization • Interactivity	"Meaning" refers to the importance and value of digital art. In other words, the positive impact and significance of digital art on art creation, art communication, and art experience.

4.4 Community Dynamics Facilitated by Digital Art Scene

4.4.1 Fostering Social Interaction

Table 4.7 illustrates the significance of interactivity in the public art space, which connects to the digital art scene and virtual space. This interactivity primarily manifests in the integration of cultural heritage and technology, socialization and interactivity, and the integration of urban aesthetics and technology.

Digital technology facilitates the exchange and transmission of artistic expressions from various cultures in public spaces, thereby fostering the spread of cultural diversity. Digital technology can integrate history, culture, and tradition into public art spaces, making them carriers of cultural inheritance and conveying cultural values and historical memory to the public. Therefore, digital technology facilitates the digital preservation and inheritance of cultural heritage, enabling the presentation and dissemination of traditional cultural

elements, thereby fostering the creation of new forms of culture and art. At the same time, digital technology brings socialization and interactivity to public art spaces. Digital technology gives art works more interactivity. Interactive art works encourage the audience to actively participate and interact with the works through various mediums such as touch, sound, and movement, thereby involving them in the creative process. Digital technology therefore makes public art spaces a platform for social interaction, where people can share artworks in the space on social media to communicate and interact with others. Expanding to the urban perspective, digital technology makes public art space a meeting point of urban aesthetics and technological innovation. Digital artworks can add a unique visual icon to the city while also injecting elements of technology and innovation into the city.

Table 4.7: The integration of urban aesthetics and technology

Encoding	Category	Initial Concept	Raw Data
4	Interactivity	• Cultural inheritance and integration of science and technology; • Social and interactive • Urban aesthetics and technology integration	Integration of urban aesthetics and technology: Digital technology has made public art spaces the intersection of urban aesthetics and technological innovation. Digital artworks can add a unique visual identity to a city, while also infusing the city with an element of technological innovation.

Table 4.8 illustrates the main interactive features of virtual space, which include autonomous creation interaction, real-time interaction, social interaction, economic interaction, personalized interaction, and multidimensional interaction.

Autonomous creation interaction is mainly reflected in the fact that users can create virtual identities, virtual objects, virtual scenes, etc. in the Metaverse, thus participating in the construction and development of the meta-universe, which promotes creative interaction. Real-time interaction is manifested by the fact that interactions in the Metaverse are real-time, and users can instantly interact with other users, virtual environments, and digital content, creating a more immersive experience. Users can interact, chat, and collaborate with real-life users (friends, family, strangers around the world, etc.) in the virtual space to co-create and experience content, thereby manifesting social interactions. Economic interaction also occurs in the Metaverse, where there is a virtual economic system that allows users to engage in economic activities such as virtual commodity trading and service purchasing, which to a certain extent simulates economic activities in the real world. Metaverse interactions are also reflected in personalized interactions, where Metaverses usually provide personalized interactive experiences, presenting different contents and experiences according to users' interests, behaviors, and preferences, making users feel more personal and relevant. In addition to this, Metaverse interactions are multidimensional, as they are not limited to sight and sound but also include multidimensional experiences such as touch and motion. Users can interact with the content in the Metaverse through gestures, sound, touch, and so forth.

Table 4.8: The interactive features of virtual space

Encoding	Category	Initial Concept	Raw Data
7	Interactive features	• Self-created interactions; • Real-time interaction • Social interaction; • Economic interaction;	Virtual retail: People can purchase virtual and physical goods in a virtual space, bringing new channels and experiences to the retail

Table 4.8 continued

		• Personalized interactions; • Multi-dimensional interaction	industry.
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Through digital technology and online platforms, digitized art scenes create a virtual space that offers a new way for people to participate in and experience the arts. It breaks the limitations of time and space, expands the opportunities for public participation in the arts, and promotes the development of social interaction, entertainment, tourism, and cultural exchange. Therefore, Table 4.9 primarily reflects the functions of virtual space in the areas of virtual entertainment, virtual tourism, cultural exchange, and social interaction.

Digital art scenes provide opportunities for various entertainment activities. In the virtual space, people can participate in virtual reality games, art experience activities, concerts, and dance performances. Digital technology supports these entertainment activities, ensuring an immersive experience and enjoyment. In addition to offering virtual entertainment functions, users can also embark on virtual tours within the virtual space, exploring digitized art scenes. Virtual visits to art museums, cultural sites, and places of interest around the globe eliminate the need for actual travel. This virtual tour experience broadens the user's horizons to learn about the art and culture of different regions. The virtual space promotes cultural exchange and social interaction while providing the functions of virtual entertainment and virtual tourism. Digital art scenes provide a platform for people to communicate across regions and cultures.

In the virtual space, people can communicate and share with artists, audiences, and cultural enthusiasts from all over the world. This opportunity for cultural exchange promotes

understanding and cooperation between different cultures and enriches people's cultural experience. On the other hand, virtual space reflects social interaction by providing a platform for interaction and communication with others. Through digital art scenes, people can visit art exhibitions, watch performances, and engage in real-time text chat, voice, or video communication with other participants in the virtual space. This social interaction enhances the connection and communication between people and promotes social interaction.

Table 4.9: The functions of virtual space

Encoding	Category	Initial Concept	Raw Data
8	Function	• Virtual Entertainment; • Virtual Tour; • Cultural Exchange; • Social Interaction	Cultural exchange: The digital art scene provides a platform for people to communicate across regions and cultures. In the virtual space, people can communicate and share with artists, audiences, and culture lovers from all over the world. This opportunity for cultural exchange fosters understanding and cooperation between different cultures, enriching people's cultural experiences.

The digital art scene attracts visitors to the virtual space primarily due to several factors. These include the increased digitalization of the art process, the creation of more

interactive, immersive, and personalized artworks by artists, the provision of new creative media and forms of expression to artists, the interaction between viewers and artworks for an immersive experience, and the creation of a digital art scene by viewers with the aid of digital technology, as illustrated in Table 4.10.

Digital technology allows the art creation process to be more digital and visualized. Artists can use computer software to carry out the preliminary design, layout, and editing of works, which improves the efficiency and accuracy of creation. Enhanced creative precision attracts more users into the virtual space at the same time. Artists should strive to create more interactive, immersive, and personalized works of art, allowing both the audience and the artwork to interact and have an immersive experience. The audience is willing to consume such an experience, which in turn attracts traffic to the virtual space. Not only can the audience interact with the artwork, but they can also utilize digital technology to create a digital art scene. This means that in the future, the threshold of digital technology will decrease, allowing the user to take on the roles of art creator, participant, and even the art itself. Digital technology empowers the user to assume the roles of creator, participant, and even the art itself. This implies that the threshold of digital technology will continue to rise in the future, granting users the roles of creators, participants, and even the art itself.

Table 4.10: The digital art scene draws traffic to the virtual space

Encoding	Category	Initial Concept	Raw Data
12	Digital art	- Artists are creating the art - process more digitally; - Artists create more	Digital technology is the creator participant who can turn everyone into art, and even art itself.

Table 4.10 continued

	scene drives traffic to the virtual space	• interactive, immersive, and personalized artworks; • Providing artists with new creative mediums and forms of expression; • The audience interacts with the artwork for an immersive experience; • The audience uses digital technology to create a digital art scene	In the future, the threshold of digital technology will be lower and lower, so that everyone can use different digital technologies to create digital art scenes, and complete a public art space with multi-role interconnection and interaction.
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4.4.2 Digital Art Scene as a Cultural Connector

Table 4.11 primarily reflects the functions of public art space in entertainment, cultural exchange, social communication, city image, and economic development. Public art space provides people with rich and diverse entertainment. Art performances, exhibitions, and cultural activities bring joy and enjoyment to people and provide spiritual fulfillment. The creativity and uniqueness of artworks can also stimulate the curiosity and imagination of the audience, providing opportunities for entertainment and recreation. Public art space not only provides rich and diverse entertainment but also creates opportunities for cultural exchange. A public art space is a place where different cultures meet and collide. Art works and cultural activities can demonstrate the artistic expressions and cultural characteristics of different regions, nationalities, and historical backgrounds. Through artistic contacts and exchanges with different cultures, people can enhance their understanding of and respect for other cultures and promote cultural diversity and cultural exchanges.

The process of cultural exchange also embodies social interaction, and public art spaces provide places for people to meet and communicate. Artworks and cultural activities can become a common topic of conversation, promote social interaction, and enhance interpersonal connections and understanding. People can increase their social connection and community identity by participating in artistic activities, which also helps them meet new people and widen their social circles. In general, established cities determine the availability of public art spaces. Space dedicated to public art improves the city's attraction and image. Art works and cultural activities add a unique artistic atmosphere and cultural heritage to the city and become the city's iconic attraction and an important factor in attracting tourists. The development and operation of public art space demonstrates the city's emphasis on culture and art and its ability to innovate, and it enhances the city's international influence and competitiveness. In general, public art space offers entertainment, serves as a platform for cultural exchange and social communication, and plays a significant role in shaping the city's image. In turn, it promotes economic development.

The digital art scene acts as a cultural bridge, connecting various generations and cultural legacy. Amidst the advanced digital age and widespread use of the Internet, digital art captivates diverse audiences of all ages and backgrounds through its inventive and interactive nature. By integrating contemporary scientific advancements and technological innovations with artistic expression, it transcends the limitations of conventional art and offers individuals a novel avenue for artistic engagement and aesthetic pleasure. Digital artworks frequently possess a pronounced visual effect and a sense of engagement, which can incite the audience's inquisitiveness and inclination to investigate, motivating them to actively interact with the artworks in order to gain a profound comprehension of the artist's creative and cultural message.

Moreover, the digital art scene serves as a global hub, exhibiting diverse artistic styles from various areas and nationalities, enabling the audience to immerse themselves in the cultural essence of different parts of the world inside a single venue. These cross-cultural interactions and clashes not only enhance the audience's cultural perspective but also foster mutual comprehension and admiration across other civilizations. Hence, the digital art scene serves as both a platform for contemporary art and a significant means of fostering cultural variety and social cohesion.

Table 4.11: The functions of public art space

Encoding	Category	Initial Concept	Raw Data
9	Features	• Entertainment; • Cultural Exchange; • Social Interaction; • City image • Economic development	Social interaction: Public art spaces provide places for people to meet and communicate. Artworks and cultural events can be common topics, promote social interaction, and increase human connection and understanding. By participating in the arts, people can meet new people and expand their social circles, which can enhance social cohesion and community identity.

The interview text above analyzes the digital art scene as a gateway to the Metaverse, with the Metaverse (virtual space) offering technical support. This support includes technologies like 3D modeling and rendering, digital art technology for digital painting and image processing, AR, VR, interaction design, and artificial intelligence (AI), as illustrated in Table 4.12. The virtual space body utilizes technologies like virtual reality, augmented reality, and 3D modeling to craft a distinctive digital art scene for public art spaces, thereby

offering users a fresh artistic experience. This not only meets the needs of the market but also promotes the business development of enterprises, art organizations, exhibition halls, etc., further promoting the development of digital art and public art and creating value for society.

Table 4.12: Metaverse provides technical support for the digital art scene

Encoding	Category	Initial Concept	Raw Data
15	Virtual spaces provide technical support for the digital art scene	• 3D modeling and rendering techniques; • Digital painting and image processing, digital art technology; • AR technology; • VR technology; • interaction design technology ; • Artificial Intelligence (AI)	As far as the development trend is concerned, the virtual reality technology under the concept of Metaverse has already influenced and inevitably led to the presentation of a revolutionary new way of experiencing The traditional art space. From some of the projects we have developed together, the use of digital technology has become one of the symbols of competitiveness in the operation of public art spaces.

Function defines the dimension of public art space within the structure of the digital art scene, as illustrated in Table 4.13. The role and usage of a location or space in the public domain that is devoted to exhibitions, displays, and promoting art is referred to as a public art venue's function. In addition to enriching the public sphere's cultural life and improving

the city's and its residents' sense of wellbeing, public art spaces serve to offer audiences a variety of services and experiences, including art experiences, cultural exchanges, social interaction, and educational inspiration.

Table 4.13: Function forms the dimension of public art space

Encoding	Category	Initial Concept	Raw Data
3	Public Art Space	Features	A public art space is a place that is open to the public and used to display and experience works of art. These spaces can be museums, galleries, art districts, parks, squares, etc. The purpose of the public art space is to allow more people to contact, appreciate and participate in art, and to promote the dissemination and exchange of art. In the public art space, people can view various art forms, including paintings, sculptures, photography, installations, etc., and participate in art activities and interactive exhibitions. The existence of public art spaces not only enriches the cultural life of the city, but also provides a platform for artists to showcase their

Table 4.13 continued

			works and communicate and interact with the audience.
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4.4.3 Impact on Perceived Community Identity

The operation and development of the public digital art scene cannot be separated from different role identities in their respective roles, as shown in Table 4.14. For example, public space provides a place for urban residents to socialize and have cultural exchanges, which promotes interactions between different communities while enhancing the social cohesion of the city. Through their artwork, artists raise public awareness, encourage social change, and make society think critically about certain issues. Government agencies formulate policies to support artistic and cultural activities in public spaces, creating an environment that fosters artist development. Additionally, the government can consider the artistic elements of public spaces in urban planning and design, thereby enhancing the richness and diversity of urban spaces.

Table 4.14: Different role identities in their respective roles

Encoding	Category	Initial Concept	Raw Data
16	Role	• Policy development and support - government; • Cultural Displays & Experiences - Public Spaces;	Cultural and social intersections: Public spaces are places for social and cultural exchange among city residents, which can

Table 4.14 continued

		• Cultural and social intersections - public spaces; • Cultural Heritage and Innovation - Artists ; • Solving social problems - government; • Presentation and Discussion of Social Issues - Public Space; • Social Critique and Consciousness Arousal - Artist; • Creation and Expression - Artists; • Urban Planning and Design – Government	promote interaction and exchange between different communities and enhance the social cohesion of the city. Cultural and social intersections: Public spaces are places for social and cultural exchange among city residents, which can promote interaction and exchange between different communities and enhance the social cohesion of the city.
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4.4.4 Facilitate the amalgamation of urban and artistic elements

The following are the main ways to enhance the digital art scene in the future city: Integrate digital art with urban planning and introduce innovative displays such as augmented reality (AR) and virtual reality (VR). Establish and promote digital arts platforms to provide arts education and engagement opportunities. Organize digital art events and

exhibitions, build digital infrastructure, strengthen cooperation and exchange, and actively use audience data. Table 4.15 outlines the ways in which art institutions are enhancing the public art experience by applying innovative technology, offering unique digital art forms and performances, creating virtual art communities to facilitate interaction between artists and audiences, offering unique digital art content, and matching digital art content. Integrating digital art with urban planning is a trend that aims to enhance the digital art scene in future cities. Urban planning must consider the integration of digital art scenes, such as setting up digital art installations and interactive artworks in public spaces to enhance the artistic atmosphere and cultural quality of cities. The introduction of augmented reality (AR) and virtual reality (VR) technologies can enhance the future urban digital art scene, using AR and VR technologies to bring the digital art scene into the real urban environment. Through AR and VR technologies, audiences can experience virtual art exhibitions, public art installations, etc. in the city, enhancing audience participation and interactivity. Establishing and promoting digital art platforms can also enhance the future urban digital art scene.

The establishment and promotion of digital art platforms encompass platforms like virtual galleries, online art markets, and art work sharing. These platforms offer artists and creators the chance to showcase and sell their works, thereby increasing the number of people who can view and purchase art works. Various stakeholders can also offer opportunities for art education and engagement, thereby enhancing the digital art scene in future cities. Art organizations can offer educational and training programs focused on digital art to enhance the public's understanding and ability to create digital art. This approach not only improves skills but also fosters greater engagement with digital art. Additionally, the art organizations can play a vital role by encouraging and guiding

community participation. Their efforts aim to involve more individuals in the creation and experience of digital art while promoting meaningful interactions among artists, audiences, and viewers..

On the other hand, companies can organize digital art workshops to teach participants how to utilize digital tools for creating art. They can also involve the public in the design and management of art spaces, enabling active participation in the development and operation of these spaces. Similarly, art organizations can offer educational and training programs on digital art, aimed at enhancing the public's understanding and creative skills. These efforts collectively foster greater interest and engagement in digital art.

Artists provide opportunities for art education and engagement through digital art platforms and online resources. This includes online art courses, artist workshops, and digital art creation competitions, all of which encourage more people to participate in art creation and appreciation. In addition to providing opportunities for art education and participation, it is important for various stakeholders to enhance their cooperation and communication. Enterprises should seek to establish partnerships with artists, designers, technology companies, educational institutions, etc., to jointly promote the innovation and development of the digital art scene in public art spaces and virtual worlds. Enhancing the digital art scene in future cities is also inseparable from the construction of digital infrastructure, which can provide cities with high-speed and stable network connections to support the display and interaction of digital art scenes. For instance, public places, art institutions, and cultural centres provide free Wi-Fi services.

Technology plays a crucial role in the construction of digital infrastructure, necessitating innovation from technology companies. These technologies, such as artificial

intelligence, big data, and Internet of Things, capture audience data to enhance the public art space experience. This includes analyzing the audience's behavioral data to identify popular works of art and the most appealing display modes, which in turn optimizes the layout and display of the art space. Through these technologies, it is also possible to deepen our integration with art and explore new forms of artistic expression and creation methods. For instance, we can utilize virtual reality technology to create artworks that surpass the confines of physical space, and artificial intelligence technology to craft pieces capable of self-learning and evolution.

Table 4.15: Integrating digital art and urban planning

Encoding	Category	Initial Concept	Raw Data
10	Measures to enhance the digital art scene of the city of the future	- Integrating digital art with urban planning; - The introduction of innovative presentation methods such as augmented reality (AR) and virtual reality (VR); - Establishing and promoting digital art platforms; - Providing arts education and engagement opportunities; - Organizing digital art events and exhibitions; - Building digital infrastructure, strengthen cooperation and	Promote digital art platforms: Establish and promote digital art platforms that provide artists and creators with opportunities to showcase and sell their work. These platforms can include virtual galleries, online art marketplaces, and artwork-sharing platforms so that more people can view and buy artworks.

Table 4.15 continued

		• exchanges; • Enhance the experience of public art space with the help of audience data; • art space with the help of audience data; • Innovative technology application of science and technology enterprises; • Offering unique digital art forms and representations; • Art institutions establish virtual art communities to enable artists and audiences to interact; • Art institutions offer unique digital art content; • Art institutions provide matching digital art means	
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The applications of digital technology or digital art in urban operations are mainly in the areas of urban intelligence and sustainable development, urban culture and socialization, urban tourism development, urban transportation and logistics, urban planning and design, and urban management and operations, as shown in Table 4.16.

Smart city systems can apply digital technology for intelligent management of urban infrastructure and optimal resource utilization. Digital art can advocate environmental

awareness and the concept of sustainable development through forms such as environmental art and sustainable artworks. Digital art has the functional attribute of socialization, so digital technology can also provide digital cultural resources and social platforms where urban residents can communicate and interact culturally. Digital art creates a unique cultural atmosphere and social place for the city through public art works and interactive installations. Digital art can be found throughout the city, with prominent locations such as art tubes, museums, and parks. The application of digital art contributes to the growth of urban tourism, as exemplified by the virtual billboard of the Asian Games, which creates digital postcards for city operations that mirror the physical city. Urban tourism development is inseparable from orderly and interesting traffic, leading to the application of digital art in urban transportation and logistics, enabling intelligent traffic control and vehicle management. For example, digital art can add artistic elements to the urban transportation space through digital installations and public art works to enhance the experience of residents and tourists.

The application of digital art to urban transportation and tourism is, to a certain extent, similar to the application of urban planning and design, as well as urban management and operation. Urban planners can utilize digital technology, such as modeling, simulation, data analysis, and other tools, to enhance their understanding of the city's development needs and challenges. Digital art can present planning and design to the public through virtual reality technology to help them better understand and participate in the urban planning process. Similar digital technologies can provide real-time data monitoring and analysis to help city managers better understand how their cities are functioning so that they can make more effective decisions. Digital art can add beauty and artistic atmosphere to cities through various forms, such as digital installations and interactive artworks.

Table 4.16: Digital technology or digital art in urban operations

Encoding	Category	Initial Concept	Raw Data
11	Application of digital technology or digital art in urban operations	• Intelligent and sustainable urban development; • Urban culture and socialization; • Urban tourism development; • Urban transport and logistics; • Urban planning and design; • City management and operations	Urban culture and social interaction: Digital technology can provide digital cultural resources and social platforms to promote communication and cultural interaction among urban residents. Digital art can create a unique cultural atmosphere and social place for a city in the form of public artworks and interactive installations.

4.4.5 Promote a New Model of Industrial Growth

The application of digital technology in public art spaces can enhance the communication power and influence of art and promote public participation and understanding of art. Digital technology can achieve the sustainable development goals of public art through digital display and interaction, energy saving and environmental protection, and educational participation, as illustrated in Table 4.17. This manifests as a reduction in environmental impact, energy saving and environmental protection, and educational participation.

Digital display and interaction reduce the impact on the environment. Digital technology provides a wider range of display platforms for public art, such as digital screens, virtual reality, and augmented reality technologies. These mediums enable the presentation

of artworks to a broader audience through digital media, be it in art galleries, public squares, or online platforms. This digital presentation reduces the environmental impact of traditional art exhibitions by using less physical materials and energy, such as large amounts of paint, canvas, sculptural materials, printing, and exhibition space. Digital technology minimizes the expenses associated with artwork storage and transportation in the process. Digital technology can also increase the opportunities for education and participation in public art spaces. Through digital displays, for instance, viewers can engage with artwork and discover more about the intentions and creative process of the artist. Digital technology can also provide an online learning platform, enabling more people to access and learn about art. Such educational engagement can promote public understanding and appreciation of the arts and inspire concern and action for sustainable development.

Table 4.17: Digital technology in public art space can enhance

Encoding	Category	Initial Concept	Raw Data
3	Sustainability of digitalization	- Digital displays and interactions reduce environmental impact; - Energy conservation and environmental protection; - Educational Engagement	Digital display and interaction: Digital technology can provide a wider display platform for public art, such as digital screens, virtual reality and augmented reality technology, etc. In this way, artworks can be presented to a wider audience through digital media, whether. in art galleries, public

Table 4.17 continued

			squares, or online platforms. This digital display reduces the impact on the environment by reducing the material resources required for traditional art exhibitions, such as paper, printing, and exhibition space.
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The digital art scene serves as a connecting point between the public art space and the virtual space, thereby providing digital economic opportunities. The digital art works in the public art space hold a certain commercial value, which the audience trades through online or offline platforms. The application of digital technology and digital platforms generates economic opportunities and revenues for various participants, including artists, curators, exhibition organizations, and digital platforms. It creates revenue for artists while promoting the prosperity of the digital art market and the growth of the digital economy, as shown in Table 4.18. The application of digital technology provides new ways and tools for artists to create. Digital display platforms allow artists to display and sell their digital artworks, which they create using digital software and devices. The application of digital technology has broadened the boundaries of artistic creation, stimulated artists' creativity, and brought them more creative opportunities and sources of income.

Digital platforms provide artists and exhibition organizations with channels to display and promote their works. Through digital display platforms, artists can display their works

to a global audience, no longer limited by traditional exhibition venues and geographical locations. This expands the audience for artists and increases the exposure and sales opportunities for their works. At the same time, exhibition organizations can also use digital platforms to organize online exhibitions and art events to attract more audience participation and increase revenue. The digital platform facilitates the trading of digital artworks. Through the digital artwork trading platform, artists and collectors can conduct transactions directly, eliminating the intermediate links and costs in the traditional art market. This promotes the development of the digital art market and creates more business opportunities for artists and collectors.

Table 4.18: The digital art scene as the connecting point between the public art space and the virtual space

Encoding	Category	Initial Concept	Raw Data
1	Provides opportunities for the digital economy	• The application of digital technology provides new ways and tools for artists to create; • The digital platform provides a channel for artists and exhibition institutions to showcase and promote their work; • The digital platform facilitates the trading of digital artworks	First of all, the application of digital technology provides new ways and tools for artists to create. For example, artists can utilize digital software and devices to create digital artworks that can be displayed and sold through digital display platforms. The application of digital technology has broadened the boundaries of artistic creation, stimulated the creativity of artists, and brought them more creative

Table 4.18 continued

			opportunities and sources of income.
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Interviews with artists, art organizations, etc. revealed that in the Metaverse, the economic revenue touch points are mainly in virtual retail, virtual events and entertainment, virtual services and consulting, the digital economy, advertising, and branding, as shown in Table 4.19. Virtual retailing in the Metaverse is specified by the fact that people can buy virtual and real goods in the virtual space, which brings new channels and experiences for retailing. Users can not only do virtual retailing in the Metaverse but also provide or receive virtual services and consulting, i.e., in the virtual space, people can provide a variety of virtual services, consulting, and training. Businesses can offer these services on a fee or subscription basis, generating a financial return. At the same time, the Metaverse as a platform brings together different groups of people, in which virtual stores, billboards, etc. can be set up to attract users to shop or interact with brands. Through advertising and sales activities, companies can open up new market channels in the virtual space and gain economic benefits.

Table 4.19: Economic gain touchpoint

Encoding	Category	Initial Concept	Raw Data
6	Economic gain touchpoint	• Virtual Retail • Virtual Events & Entertainment • Virtual Services & Consulting; • Digital Economy; • Advertising & Branding	Virtual retail: People can purchase virtual and physical goods in a virtual space, bringing new channels and experiences to the

Table 4.19 continued

			retail industry.
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As seen in Figure 4.20, the digital art scene serves as the connecting element between the public art space and virtual space model, while also offering opportunities for the digital economy, expanding the boundaries of art, and promoting digital sustainability. Interactivity also forms the "meaning" dimension in this framework. Public digital art spaces can provide opportunities for the digital economy. The term "digital economy" refers to an economic activity that uses digital technology to support production, exchange, distribution, and consumption. In the public digital art space, artists can gain economic income through the sale, exhibition, and authorization of digital art works, and at the same time, digital art can also lead to the development of related industries, such as digital art platforms, digital art sales, and so on, thus creating digital economic opportunities.

Table 4.20: Providing opportunities for the digital economy

Encoding	Category	Initial Concept	Raw Data
1	Significance	- Digital art expands the boundaries of art - Sustainability of digitalization	"Meaning" refers to the importance and value of digital art. In other words, the positive impact and significance of digital art on art creation, art communication, and art experience

4.4.6 Digital Art and the Digital Economy: Opportunity and sustainability in public art Spaces

As illustrated in Figure 4.21, digital art provides opportunities for the digital economy by expanding the boundaries of art, promoting digital sustainability, and fostering

interactivity. This interactivity forms the "meaning" dimension in the structure of the public art space and virtual space model, with the term "digital economy opportunity" refers to the potential opportunities that the public digital art space can offer for the digital economy. hat can provide opportunities for the digital economy. The digital economy is an economic activity that relies on digital technology, encompassing production, distribution, exchange, and consumption through digitalization. In the public digital art space, artists can generate income through the sale, exhibition, and authorization of their digital art works. Simultaneously, digital art can stimulate the growth of related industries such as digital art platforms, digital art sales, and so on, thereby creating digital economic opportunities.

Table 4.21: Providing opportunities for the digital economy

Encoding	Category	Initial Concept	Raw Data
1	significance	Provides opportunities for the digital economy	"Meaning" refers to the importance and value of digital art. In other words, the positive impact and significance of digital art on art creation, art communication, and art experience

As seen in Figure 4.22. The "virtual space" dimension in the model structure of public art space and virtual space is shaped by various types of audience groups, economic gain touch points, interactivity features, and functions, with the digital art scene serving as the connecting point. Audience type refers to the different audience groups that digital art attracts. Digital art can attract a variety of audience segments, such as those interested in gaming, art and entertainment, virtual sociability, business investing, technology, and digital

art creators and practitioners. The economic gain touchpoints refer to the economic gains and opportunities that digital art can bring. Digital art can bring economic opportunities in the following areas: Virtual retail refers to the sale of digital artwork and goods through digital platforms. Virtual event entertainment involves the organization of virtual events, such as exhibitions, concerts, and performances, with the aim of attracting audiences to pay for their participation. Virtual service consulting: Provide virtual art guidance, art appraisal, and other services and collect consulting fees. Digital economy and advertising brand promotion: Collaborate with digital platforms to promote brands and products through digital advertising. Interactivity features refer to the interactive nature of digital art. Digital art has the following interactive features:

Autonomous creation allows audiences to participate in the process of art creation and create personalized artworks.

Real-time interaction: audiences can interact with digital artworks in real time, generating instant feedback. Social interaction: audiences can share and discuss digital artworks with others on virtual social platforms.

Economic Interaction: Audiences can interact with digital art economically by buying and selling digital artworks. The audience can customize digital art based on their individual preferences and requirements.

Multi-dimensional interaction: A variety of media and technologies enable multi-dimensional experiences with digital art. These features make digital art more participatory and interactive, providing audiences with richer experiences and ways of taking part.

Table 4.22: Opportunity and sustainability in public art Spaces

Encoding	Category	Initial Concept	Raw Data
2	Virtual Space	• Audience type • Economic gain touchpoint • Interactive features • Function	In digital art space, virtual space refers to a virtual art environment or place created through computer technology and virtual reality technology. This virtual space can be a virtual exhibition hall, a virtual art installation, a virtual artwork, or a virtual art experience, among other things. Through the virtual space, artists can create digital artworks that are different from traditional art forms, and the audience can enter them as virtual identities to interact, explore, and experience the artworks. Virtual space provides new possibilities for art creation and appreciation, breaking the limitations of time and space, and making art more diverse and interactive.

4.4.7 Social Roles and Development

As Table 4.23 demonstrates, it is impossible to separate the operation and development of the public digital art scene from the synergistic development of various role identities. The synergistic development of public space, artists, and governmental agencies fosters effective cooperation and interaction, exemplified by the government's establishment of the Art Creation Fund, which provides financial support to artists. In addition, the government can establish an art award program to incentivize artists to create outstanding works in public spaces, collaborate with government agencies and cultural departments, urban planning departments, and foster cross-departmental cooperation to ensure that the artistic elements of public space align with urban planning, all while supporting the participation of artists. The government establishes artist-in-residence programs that invite artists to create works in specific public spaces, thereby integrating art into the urban environment. The government can also set up artist-in-residence programs to invite artists to create works in specific public spaces, thereby integrating art into the urban environment.

Table 4.23: Good cooperation and interaction model

Encoding	Category	Initial Concept	Raw Data
17	Good cooperation and interaction model	• Government funding support and incentive schemes; • The government has set up an artist-in-residence program; • The government has set up an artist-in-residence program; • Public Engagement	Public Participation: The government can ensure that the artwork meets public expectations by organising public engagement activities to solicit residents' opinions and suggestions on art projects in public spaces.

Table 4.23 continued

		(CSP) organised by the Government; • Regular government exhibitions and events; • Cross-departmental collaboration	
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The public space, artists, and government agencies all play crucial roles in the operation and development of the public digital art scene, forming a stable triangular relationship that mutually reinforces each other, as illustrated in Table 4.24. That is, government agencies are the guarantee and driving force for the smooth progress of the project. For instance, to ensure the smooth progress of the project, art organizations must maintain continuous communication and consultation with the government and urban planning departments, explaining the project's value and addressing any potential problems or concerns. Government agencies, artists, and art organizations form a mutually reinforcing partnership; public space provides a platform and tool for government and artists to cooperate in promoting urban development; artists use public art space as a background for creating digital art scenes; from the perspective of public space, public space provides a platform and tool for government and artists to cooperate in promoting urban development; from the perspective of artists, creators use public art space as a background for creating digital art scenes; and from the perspective of artists, creators use public art space as a background for creating digital art scenes. From the artist's perspective, public art spaces, such as parks, squares, streets, and other public areas, serve as the backdrop for the creation of digital art scenes. Artists use these spaces as the background for their creations, and they

use technology and media to create art scenes through digitalization. The audience can experience the artworks through participation and interaction.

Table 4.24: All social roles develop in concert

Encoding	Category	Initial Concept	Raw Data
18	Relationships	• Government agencies are the guarantee and driving force for the; • The smooth progress of the project; • Government agencies, artists, and art institutions form mutually reinforcing partnerships; • Public space provides a platform tool for governments and artists to collaborate to promote urban development • The artist uses the public art space as the background to create digital art scenes	Government agencies are the guarantee and driving force for the smooth progress of all projects

As seen in Figure 4.25. Roles, collaborative efforts, interaction patterns, and relationships comprise the dimension of "connection between public space, artists, and government agencies". The model of public art space and virtual space identifies the digital art scene as the connecting point. Positive relationships developed between public space, artists, and governmental organizations are a positive example of cooperation and interaction as they enable the realization of shared artistic objectives and societal values. Public spaces, artists, and governmental institutions can all work together to grow the arts, support cultural

innovation and inheritance, and improve society's aesthetics and level of enlightenment by using this effective model of cooperation and engagement.

Table 4.25: Connections between public space, artists, and government agencies

Encoding	Category	Initial Concept	Raw Data
5	Connections between public space, artists, and government agencies	Role Good cooperation and interaction model Relationships	The connection between public space, artists, and government agencies refers to their interaction and partnership in the public digital art scene. The connection between public spaces, artists, and government agencies is to work together to create an artistic atmosphere, provide an artistic experience, and promote cultural exchange and artistic development. Their cooperation and interaction can make the public digital art scene richer and more diverse, so that more people can benefit from the charm of art.

4.5 Cross-Cutting Themes and Theoretical Connections

4.5.1 Word Frequency Analysis

To demonstrate the validity of the research used in this study, this PhD thesis presents the most frequently used words by participants in a series of interviews, and the researcher conducted a word frequency analysis using NVivo11. The criteria for this analysis involved searching for exact matches of the 100 most common words, with a minimum length of 3 characters, while excluding items that were deactivated. Figures visualize the most commonly used words. The most commonly used words were numbers, art, and space, matching the theme. I analyze the words using the word tree, as shown in Figure 4.12, to more intuitively observe the most frequent and least frequent words. The word tree clearly and intuitively reveals that "art" holds the highest frequency, followed by "digital" in the upper left corner, "product" in the lower left corner, and "future" in the lower left corner. "Product" is located right below, and "future" is in the lower right corner, indicating that among the 100 commonly used words, the least frequent word is "future." The word "future" is in the bottom right corner.

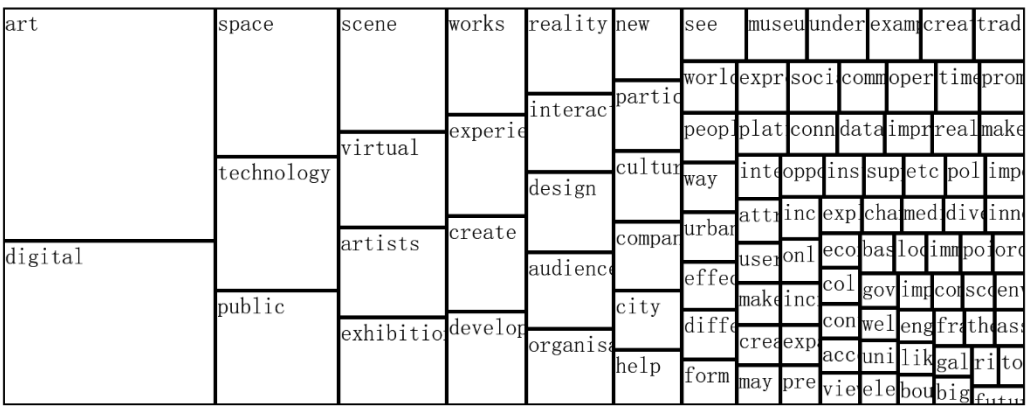


Figure 4.12: Word tree diagram (Author's illustration)

To quantify the frequency and percentage of common words in the interview data, this research has selected 20 common words with a minimum length of three, as shown in Table 4.26. The word with the highest frequency is "art," which occurs 1807 times, accounting for 8.17% of the frequency of 100 common words; "digital" is the second most frequent word after "art." With 1,272 occurrences in the interview data, "digital" is the second most frequent word after "art," accounting for 5.78% of the total occurrences in the common 100 words. "Space" is the second most frequent word, with a total of 685 occurrences in the interview data, accounting for 3% of the total occurrences in the common 100 words. The frequency of "technology" is 3.03%; it appears 644 times in the interview data, representing 2.76% of the frequency of 100 common words; "public" is 5.78%; and "space" is 5.78%. which appeared a total of 626 times in the interview data, or 2.32% of the 100 common words, and "scene," which appeared a total of 541 times in the interview data, or 2.23% of the 100 common words.

The frequency of the word "virtual" in the interview data totaled 383 times, which is 1.72% of the common 100 words, and the frequency of the word "artists" in the interview data totaled 358 times, which is 1.72% of the common 100 words. The frequency of the word "artists" in the interview data totaled 1.72% of the common 100 words, and the frequency of the word "artist" in the interview data totaled 2.23% of the common 100 words. The frequency of the word "artists" in the interview data totaled 358 times, which is 1.63% of the common 100 words; the frequency of the word "exhibitions" in the interview data totaled 338 times, which is 1.57% of the common 100 words; and the frequency of the word "experiences" in the interview data totaled 1.57% of the common 100 words. : The frequency of occurrence of the word "experience" in the interview data totaled 347 times, which is 1.35% of the common 100 words, and the frequency of occurrence of the word "create" totaled 320

times in the interview data. The frequency of the word "create" in the interview data totaled 320 times, which is 1.27% of the common 100 words; the frequency of the word "development" in the interview data totaled 351 times, which is 1.24% of the common 100 words; the frequency of the word "reality" in the interview data is 1.24% of the common 100 words; the frequency of the word "development" in the interview data totaled 1.25% of the common 100 words; the frequency of the word "development" in the interview data totaled 320 times, which is 1.27% of the common 100 words. The frequency of occurrence of the word "reality" in the interview data totaled 393 times, which is 1.22% of the common 100 words, and the frequency of occurrence of the word "interactive" totaled 25% of the common 100 words, which is 1.22% of the common 100 words, and the frequency of occurrence of the word "interactive" totaled 1.22% of the common 100 words. The frequency of the word "interactive" in the interview data totaled 253 times, which is 1.15% of the common 100 words; the frequency of the word "design" in the interview data totaled 237 times, which is 1.13% of the common 100 words; and the frequency of the word "audience" in the interview data totaled 393 times, which is 1.22% of the common 100 words.

The frequency of occurrence of the word "audience" in the interview data totaled 226 times, representing 1.12% of the frequency of occurrence of the common 100 words. Similarly, the frequency of occurrence of the word "organizations" in the interview data was also 1.12%. The frequency of the word "organizations" in the interview data totaled 209, which is 1.09% of the common 100 words; the frequency of the word "participation" in the interview data totaled 189, which is 0.81% of the common 100 words; and the frequency of the word "culture" in the interview data totaled 1.12%. The frequency of occurrence of the word "cultural" in the interview data totaled 189 times, which is 0.81% of the frequency of occurrence of the common 100 words, and the frequency of occurrence of the word

"companies" totaled 184 times, which is 0.81% of the frequency of occurrence of the common 100 words. The frequency of the word "companies" in the interview data totals 184 times, representing 0.78% of the frequency of the common 100 words, and these common words align with the theme.

Table 4.26: Categories to which the initial concept belongs

Word	Length	Count	Weighted Percentage (%)
art	3	1807	8.17
digital	7	1272	5.78
space	5	685	3.03
technology	10	644	2.76
public	6	646	2.32
scene	5	541	2.23
virtual	7	383	1.72
artists	7	358	1.63
exhibitions	11	398	1.57
experience	10	347	1.35
create	6	320	1.27
development	11	371	1.24
reality	7	393	1.22
interactive	11	253	1.15
design	6	467	1.13
audience	8	256	1.12
organisations	13	389	1.09
participation	13	256	0.81
cultural	8	189	0.81
companies	9	184	0.78

4.5.2 Theoretical Concept Connections

The digital art scene serves as a bridge between public art and the meta-universe, surpassing the limitations of traditional art spaces with the aid of digital technology, as shown in Figure 4.13. The figure shows the extended conceptual framework which was first illustrated in this thesis in Chapter 2. The extended version enables a larger audience to engage in art and fosters the advancement and integration of artistic creation across different domains.

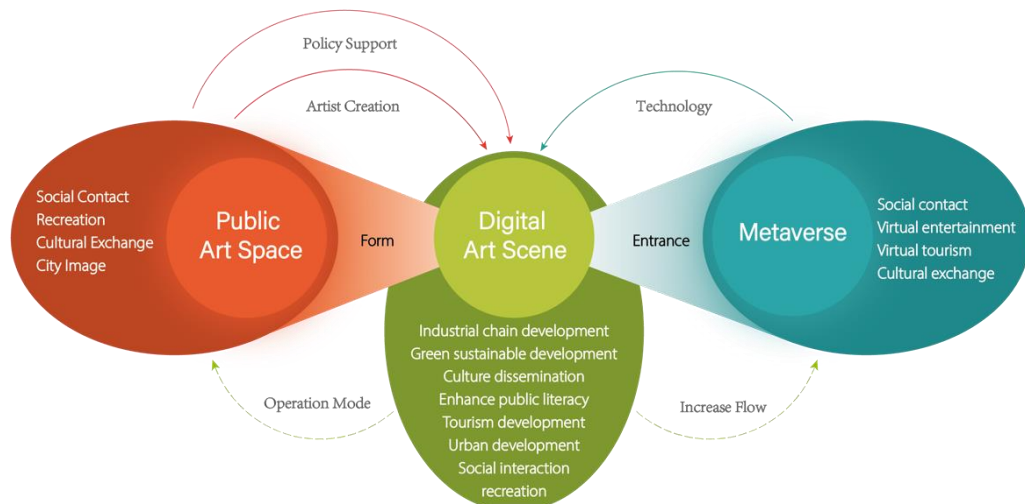


Figure 4.13: Extended conceptual framework (Author's illustration)

The features of public art space encompass social communication, entertainment, cultural exchange, and the enhancement of a city's image. Typically, these spaces function as venues for public utilization and involvement, showcasing art, hosting cultural activities, and fostering social contact. Public art spaces have the ability to foster digital art scenes through the collaboration of artists and policy support. The digital art scene employs digital technology and the Internet to showcase artworks in a digital format, offering the public a

novel art encounter and operational framework.

The digital art scene not only introduces a novel method of operation to the public art space but also fosters the growth of the surrounding industry. The digital art scene has garnered more attention and engagement, generating opportunities and energy for adjacent sectors such as hospitality, catering, tourism, and other related industries. The digital art scene serves as a crucial gateway for the viewers to access the meta-universe realm. The meta-universe is a digital realm that encompasses multiple dimensions, allowing individuals to partake in virtual social interactions, entertainment, and travel. The digital art scene brings fresh dynamics and substance to the meta-universe realm, opening up novel avenues for its advancement. Metaverse space offers technical assistance for the digital art community. Viewers can get a heightened level of immersion in digital art works through the utilization of virtual reality, augmented reality, and other similar technology. Simultaneously, the meta-space also affords the audience the chance to engage in social, entertainment, tourism, and cultural interchange.

The integration of public art spaces and internet art scenes offers viewers a more comprehensive and varied art encounter while concurrently fostering the growth of adjacent enterprises. The synergy between the digital art scene and the meta-space enhances the engagement and involvement of the audience while also introducing novel prospects in the realms of social interaction, entertainment, tourism, and cultural exchange. Assist me in transforming it into a conceptual framework.

In comparison to the conceptual framework outlined in Chapter 2, the analysis of interview data has led to an extension and expansion of the initial framework, highlighting the differences between the original and the final conceptual frameworks. The expanded

content is as follows:

A Framework for the Expansion of Functional Public Art Spaces: Initially, public art spaces were designed to fulfill traditional objectives such as facilitating social contact, providing entertainment, fostering cultural exchange, and enhancing urban image. However, the integration of digital technologies like virtual reality (VR), augmented reality (AR), and Internet platforms has revolutionized the digital art scene. This transformation has expanded the potential of public art spaces, creating new opportunities for artistic engagement and involvement. The interactive layer now plays a crucial role in facilitating exchange and collaboration between artists, audiences, and technology, fostering innovation and integrating artistic creativity across borders.

Assessing the Influence of Digital Art on Industry: The digital art scene has emerged as a novel hub for artistic experiences, influencing various industries. The radiation effect of digital art events is evident in their ability to attract visitors and participants, stimulating the growth of nearby businesses, tourism, and other industries. This sector's expansion generates economic advantages that, in turn, foster and facilitate ongoing advancement and technological creativity within the digital art scene.

The Digital Art Scene and the Meta-Universe Framework: The digital art scene complements the framework of a meta-universe by serving as an access point for spectators to explore this new realm. meta-space offers technology platforms, such as VR and AR, that enhance the immersion of the art experience, allowing audiences to engage more deeply with the artwork. The interactive layer supports social, entertainment, tourist, and cultural exchange activities within the meta-space, offering novel opportunities for audience engagement and experiential immersion. The content layer contributes abundant artistic

content and fosters creative expression within the meta-universe, thereby enhancing the diversity of its content ecosystem.

The Sociocultural Influence Framework Characterized by Circularity: Cultural communication, defined as the exchange of information, ideas, and values between individuals or groups from different cultural backgrounds, is facilitated by the digital art scene. This novel platform for cultural transmission enables the widespread dissemination and popularization of art and culture. Social participation is broadened, allowing individuals from diverse backgrounds to easily access and participate in artistic experiences, promoting cultural inclusivity within society. The use of novel technology has advanced artistic forms of expression, equipping artists with fresh creative instruments and means of communication. This technological advancement has filled previously empty areas in the artistic landscape, providing new avenues for expression and interaction. The requirements for social and cultural advancement, in turn, stimulate the progress and enhancement of the digital art scene and meta-cosmic technology. This cyclical relationship underscores the dynamic interplay between digital art and societal development, highlighting how each drives the other forward, leading to continuous innovation and cultural enrichment.

4.5.3 Consistency checks

Reliability testing is essential for ensuring the consistency and validity of coding in qualitative research. In this study, the kappa consistency method is employed as the primary reliability test. Utilizing NVivo 11 software, the reliability of coding is analyzed through two key measures: the coding agreement percentage and the kappa coefficient. These metrics are widely recognized in NVivo's general code reliability analysis framework.

The coding agreement percentage is calculated as the ratio of the number of codes that are consistent (i.e., agreed upon) to the total number of codes. This measure provides an indication of the reliability of the coding process. To assess consistency, two separate coding sessions are conducted. These sessions may involve different investigators or the same investigator coding at different intervals. The agreement between the two coding results is then compared. A coding agreement percentage exceeding 70% is considered indicative of a high level of consistency between the two sets of codes.

To improve reliability, NVivo allows for the modification of user profiles and re-coding of nodes with updated user information. This process ensures that any discrepancies in coding are minimized. The re-encoding steps, as implemented in this study, are illustrated in Figure 4.14.

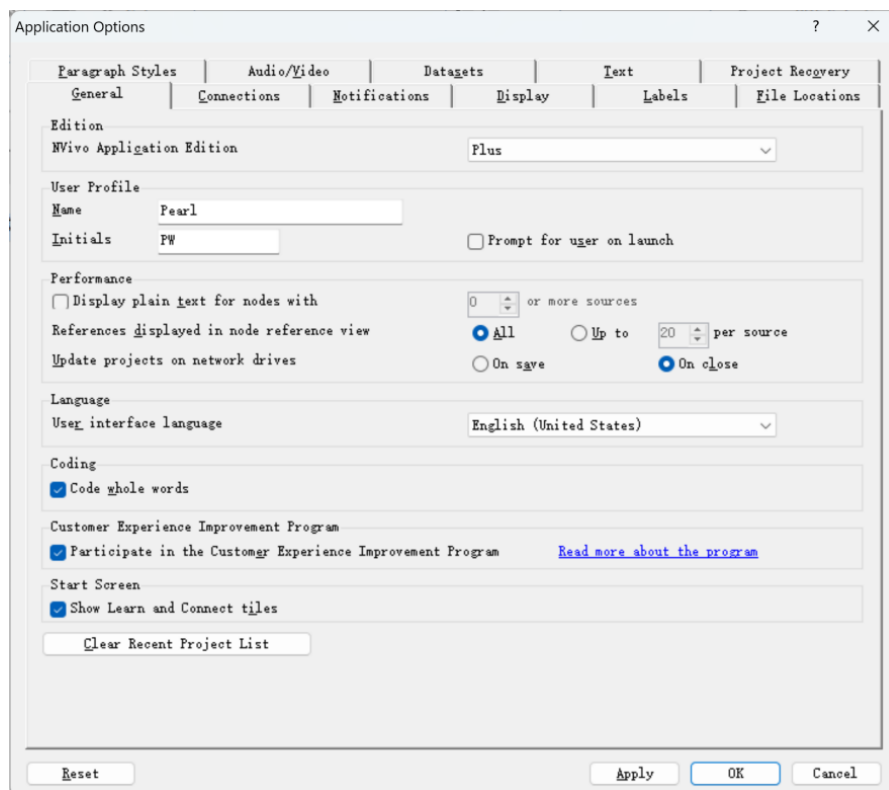


Figure 4.14: Consistency checking modifies the coder information in NVIVO

The analysis results are shown in Figures 4.15, and the coding kappa coefficients of all nodes are greater than 80%, and the coding consistency of each node is greater than 70%, which also meets the acceptance standard of 80% specified by Huberman and Miles (1994). It indicates that the consistency (reliability) of the two codes of the material is relatively high.

	Node	Source	Source Folder	Source Size	Kappa	Agreement (%)	A and B (%)	Not A and Not B (%)	Disagreement (%)	A and Not B (%)	B and Not A (%)
	Digital art scene	b1 THE INTERVIEW	internal material	4208 chars	1	100	0	100	0	0	0
	Digital art scene	b10interview	internal material	716 chars	1	100	0	100	0	0	0
	Digital art scene	b2 THE INTERVIEW	internal material	2844 chars	1	100	0	100	0	0	0
	Digital art scene	b3 THE INTERVIEW	internal material	3220 chars	1	100	0	100	0	0	0
	Digital art scene	b4 interview	internal material	2461 chars	1	100	0	100	0	0	0
	Digital art scene	b5 the interviewer	internal material	3623 chars	1	100	0	100	0	0	0
	Digital art scene	b6Adam Interview	internal material	7045 chars	1	100	0	100	0	0	0
	Digital art scene	b7 Interview	internal material	5194 chars	1	100	1	99	0	0	0
	Digital art scene	b8interview	internal material	2975 chars	1	100	0	100	0	0	0
	Digital art scene	b9interview	internal material	650 chars	1	100	0	100	0	0	0
2	Digital art scene	b1 THE INTERVIEW	internal material	4208 chars	1	100	0	100	0	0	0
3	Digital art scene	b10interview	internal material	716 chars	1	100	0	100	0	0	0
4	Digital art scene	b2 THE INTERVIEW	internal material	2844 chars	1	100	0	100	0	0	0
5	Digital art scene	b3 THE INTERVIEW	internal material	3220 chars	1	100	0	100	0	0	0
5	Digital art scene	b4 interview	internal material	2461 chars	1	100	0	100	0	0	0
7	Digital art scene	b5 the interviewer	internal material	3623 chars	1	100	0	100	0	0	0
7	Digital art scene	b6Adam Interview	internal material	7045 chars	1	100	0	100	0	0	0
9	Digital art scene	b7 Interview	internal material	5194 chars	1	100	1.19	98.81	0	0	0
9	Digital art scene	b8interview	internal material	2975 chars	1	100	0	100	0	0	0
1	Digital art scene	b9interview	internal material	650 chars	1	100	0	100	0	0	0
2	Digital art scene	b1 THE INTERVIEW	internal material	4208 chars	1	100	0	100	0	0	0
3	Digital art scene	b10interview	internal material	716 chars	1	100	0	100	0	0	0
4	Digital art scene	b2 THE INTERVIEW	internal material	2844 chars	1	100	0	100	0	0	0
5	Digital art scene	b3 THE INTERVIEW	internal material	3220 chars	1	100	0	100	0	0	0

Figure 4.15: The node codes compare the consistency test results in NVIVO

4.5.4 Saturation test

In order to verify the saturation of the open coding and principal axis coding conducted earlier, the remaining three profiles were coded to ensure the theoretical model was fully saturated. One respondent profile was selected as a representative example for the saturation test to illustrate this process.

According to "digital artworks do not require large amounts of physical materials and energy to produce and display" (B3 Sustainability of digitization-A11 Energy conservation

and environmental protection), "creators and creative workers can display their works in them" (B5 Audience types-A21 creators and creative workers), "digital technology can be applied to smart city systems" (B11 digital technology or digital art in city operations-A56 smart and sustainable cities), "create more interactive, immersive and personalized artworks" (B12 Digital Art Scene for Virtual Space Diversion-A63 Artists Create More Interactive, Immersive and Personalized Artworks), "Digital Technology Provides Artists with More Ways of Creation and Expression" (B12 Digital Art Scene for Virtual Space Diversion-A64 provides artists with new creative mediums and forms of expression), "the latter two should be a mutually reinforcing partnership" (B18 Relationship-A106 Government agencies, artists, and art organizations constitute a mutually reinforcing partnership), "public space serves as a cooperation between the two to jointly promote the development of urban platform tools" (B18 Relationship-A107 Public space provides a platform tool for government and artists to collaborate to promote urban development). By applying open-ended and spindle coding to the remaining three respondents, no new coding nodes emerged. According to Pandit (1996), the theoretical model of the structural dimensions of digital leadership for corporate executives, which was constructed in this paper, passed the saturation test.

4.5.5 Member Checking

Member checking, also known as participant or respondent validation, provides us with a valuable understanding of the long-term viability of the digital art community. These observations reinforce the significance of participant validation in the literature, highlighting that involving participants actively in the study process can decrease the chances of investigator bias (Miles & Huberman, 1994; Mason, 2002). Nevertheless, the practice of member checking is not without its difficulties. Studies have demonstrated that participants'

experiences and interpretations might evolve over time, thereby impacting the reliability of the validation process (Bergold & Thomas, 2012). Member checking is an essential stage in the research process, serving not only to validate the findings but also to collaboratively construct knowledge with the participants. It allows study participants to engage in introspection and assess research findings, thereby enhancing the comprehensiveness and quality of the study (Candela, 2019). In our future research, we will further investigate the most effective methods of member checking to ensure that our research findings accurately capture the intricacies and variety of the digital art scene.

Member checking is a multifaceted process that encompasses contact and communication between the researcher and the participant rather than just being a technical tool. Researchers must demonstrate openness and flexibility in the research process to effectively respond to participants' input and adjust to changes in the research environment. Simultaneously, it serves as a reminder that researchers must uphold study quality while also valuing the viewpoints and experiences of participants (Walther et al., 2013).

Member checking plays a crucial role in validating research findings and promoting discourse among artists, viewers, and researchers in the digital art scene. This collaborative process contributes to the advancement and creativity of the art scene. Implementing this methodology offers us a beneficial framework to comprehend and assess the digital art landscape.

4.6 Challenges and future implications

Although the public digital art scene is quite functional, it still faces some challenges in the process of development, such as the risk of audience data leakage, the existence of over-reliance on technology and neglect of real artistic innovation, technical limitations, cost

constraints, the risk of loss of the effect of the digital art scene, and the digital art scene picks the audience, etc. Table 4.27 illustrates the challenges of digital art. AAs previously discussed, the digital art scene leverages audience data to enhance the public art space experience. However, the collection and analysis of this data carries the risk of audience data leakage, necessitating careful attention to audience privacy to prevent data leakage or abuse. The public digital scene employs artificial intelligence, big data, the Internet of Things, and other technologies to create captivating images, necessitating a significant investment in human, material, and financial resources for their operation. It invariably increases the cost, and in the process there may be scenes that rely too much on technology and lack true artistic innovation, so the issue of balancing artistry and technology is a challenge.

While public digital scenes require the use of advanced technology to showcase the final product, operators often hesitate to invest in this technology due to cost concerns, potentially leading to a loss of impact. Following the integration of technical investment and artistic creativity, the digital art scene becomes accessible to users. However, the audience's response has fallen short of expectations due to the lack of widespread acceptance across various age groups. Although the digital art scene can provide a richer art experience, not all audiences can accept or adapt to this new art form. Therefore, the expansion of user volume and user types will take time. The increase in user volume will undoubtedly bring space and economic benefits to the development of public art scenes, but the current relative limitation of users, the high cost of technology, manpower, and material resources invested in the early stage, and the dynamic cost of maintenance, personnel training, and salary in the later stage inevitably have a certain impact on the development of public art scenes.

Table 4.27: The challenges of digital art

Encoding	Category	Initial Concept	Raw Data
14	Challenge	• There is a risk of audience data breaches; • There is a suspicion of over-reliance on technology and neglect of true artistic innovation; • Technical Limitations; • Due to cost constraints, the effect of digital art scenes is at risk of loss; • The digital art scene picks the audience; • The technical threshold of digital art is high, and the upfront investment cost is high • Maintaining a digital art scene is costly;	But there will be a question of the balance between artistry and technology. When creating works of art using new technologies, the balance of artistry and technology can arise

Table 4.28 lists the measures to improve the digital art scene in the future city. They include the use of digital technology or digital art in urban operations, the role of the virtual space in drawing traffic to the digital art scene, and the challenge of establishing a digital art scene as a point for communication between the public art space and the virtual space model

force structure of the "public digital art scene" dimension. Public digital art spaces support the purposes of fostering interactivity, expanding creative possibilities, boosting sustainability, and offering digital economic prospects. Digital art spaces can draw in a variety of audience groups, including those interested in gaming, the arts, entertainment, virtual sociability, business investing, technology aficionados, creators, and artists. Through digital art spaces, these audiences can participate in autonomous production, real-time interaction, social contact, personalized interaction, and multi-dimensional connection. At the same time, virtual space provides technical support for digital art scenes, and the digital display form of public art space offers a more diverse and immersive experience for the audience. Digital technology can transform the public art space into a virtual art world, allowing the audience to enjoy and participate in artworks anytime, anywhere. Technology companies, artists, and others can use virtual reality (VR) and augmented reality (AR) technologies to bring more vivid, interactive, and personalized forms of display to public art spaces.

Technology companies, artists, and others can develop advanced digital art technologies and innovative display means to combine public art spaces with virtual world digital art scenes to provide richer, more diverse, and innovative visual, auditory, and tactile experiences. For example, by utilizing big data analysis and artificial intelligence technology, it is possible to create adaptable and highly interactive digital art scenes based on the characteristics of different public spaces and the needs of the crowd. While the digital art scene serves as a mode of operation for public art spaces and a gateway into the metaverse, and its significance and commercial value are evident, it encounters several challenges in its development process. These challenges include the reliance on heavy equipment and content, which often compromises its effectiveness to control costs. Additionally, the use of digital

art technology often necessitates specialized technical knowledge and equipment, posing a challenge for some art organizations. Investment in human, material, and financial resources is necessary. That is to say, there is a cost problem. Although digital art has not yet achieved multi-age popularity, not all viewers are able to accept or adapt to this new form of art. Additionally, when using new technology to create art works, there may be a balance between artistry and technology.

Table 4.28: The future of digital art development

Encoding	Category	Initial Concept	Raw Data
4	Public Digital Art Scene	• Technology or digital art in urban operations • Digital art scene drives traffic to the virtual space • Features challenge • Virtual spaces provide technical support for the digital art scene • Good cooperation and interaction model Relationships	facilities, etc. Through the application of digital technology and the Internet, artists can integrate digital artworks into public spaces in the form of virtual or augmented reality, interacting and integrating with the urban environment. The purpose of the public digital art scene is to provide a new artistic experience for the public, make the urban space more rich and diverse, and stimulate the creativity and imagination of the audience. These scenes can be interactive, and viewers can interact with the artwork through a mobile device or touch screen;

Table 4.28 continued

			It can also be real-time, where the artwork can change and present in real-time based on the environment and feedback from the audience. The emergence of the public digital art scene has made art more popular, allowing more people to access and enjoy art in their daily lives.
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4.7 Summary of Chapter

This chapter uncovers the various dimensions of aesthetic experience and community dynamics influenced by digital art in public spaces through thorough data research. We can learn more about how people see and interact with art by looking at data analysis and using coding methods like open coding, spindle coding, and selective coding. This will help us understand how people use space, develop their aesthetic preferences, and use more than one sense to interact with art. These findings demonstrate the impact of the merging of the physical and digital domains on viewer perception and interaction.

The thematic analysis examine deeper into the ways in which the digital arts scene promotes social connection, serves as a cultural bridge through art, and influences community identity. The incorporation of digital art not only facilitates the fusion of urban and artistic components but also facilitates the harmonious advancement of diverse societal roles, thereby enhancing the quality of communal existence.

The study's findings emphasize the significance of digital art in influencing contemporary public spaces, as well as its capacity to promote community involvement and cultural interchange. Digital art not only alters individuals' aesthetic encounters, but it also broadens the limits and potential of art by offering novel interactive methods and immersive encounters. The emergence of this artistic medium exemplifies the fusion of technical progress and cultural customs, resulting in novel methods of utilizing public spaces and fostering social engagement.

This study offers a complete view on the distinctive role of digital art in public space, achieved via painstaking data analysis and theoretical exploration. These findings have significant ramifications not only for the art world but also for urban planning, community development, and cultural policy making. As digital art gains more prominence in public spaces, it will continue to influence our social surroundings, enhance our cultural encounters, and propel communities toward enhanced connectedness and creativity.

The subsequent chapter will engage in a comprehensive discussion of these findings, contextualizing them within the broader literature and theoretical framework.

CHAPTER 5

DISCUSSION AND CONCLUSION

5.1 Overview

This study aimed to explore the evolving public art scene and the transformative potential of the metaverse, focusing on Hangzhou City, China, specifically using Oeeli Art Park as the case study. The city serves as an ideal case study due to its unique intersection of public spaces, digital art, and metaverse integration, offering a novel and dynamic area of investigation. This chapter presents the key findings and insights derived from the research. It includes an in-depth discussion of the research objectives, theoretical contributions, practical implications, and potential future applications. This chapter concludes with a series of recommendations and a summary of the overarching conclusions drawn from the study.

5.2 Key Findings and Insights

The digital art scene is a part of the cultural mechanism of modern public space and offers a creative medium for interaction between cultures. The artists and the audiences are the two main actors interacting in this scene. We can interpret the digital art scene in urban settings either as a manifestation of the virtual meta-space or as an extension of public art into the real world of time and space. This study has developed a framework that positions the digital art scene as the meeting point between public art space and meta-space. It facilitates the interplay between these two spatial dimensions and acts as an important platform for art experiences. This platform not only offers the audience a novel way to experience art but also creates a fresh avenue for artistic expression.

This interaction makes it easier for the virtual and physical realms to advance simultaneously within cities. In terms of cultural communication, the rise and application of the digital art scene has given modern urban development a new life. It provides a new operational paradigm for modern tourism, social engagement, and the rise of new economic development. Digital art space has revolutionized cultural communication in the realm of public art, offering a novel means of expressing content and facilitating interactive experiences. The future development of the virtual space known as the metaverse suggests that human social interaction will have a new and distinct space compared to the past. The modern era will greatly enhance the traditional experience of artistic expression in the physical world, bringing about a revolutionary transformation in the way humans create and appreciate art.

During the co-construction of cultural values and social meanings, the nature of contact undergoes transformation. Digital technology in human artistic expression broadens the audience's experience, facilitating individual and collective sharing. It will significantly influence the social organization and cultural environment of contemporary urban areas. In social and physical spaces, barriers no longer separate the artistic creation object from the audience. By doing this, art communication and reception will be able to grow more sustainably and nationally. In the context of urban planning and cultural policy, the digital arts scene's proposed framework offers a novel perspective, highlighting the importance of creating inclusive spaces and the potential to strengthen urban identity and community integration through artistic expression. Cities can leverage the digital arts scene as a strategic instrument to entice visitors, stimulate economic activity, improve a city's reputation, and adapt to swift social transformations and technical advancements. Hence, the digital art scene plays a crucial role in facilitating rapid social change and technological advancement

in the design of modern cities.

5.3 Discussion on Research Objectives

This study aims to investigate the impact of multidimensional digital art scenes during the metaverse era on public spaces in Hangzhou, China specifically around Oeli Art Park. The study's main objective was to acquire more about the various methodological approaches that artists, decision-makers, and visitors use to design creative urban public spaces. The discussion that follows is based on the data gathered for the specific objectives of the research.

5.3.1 Research Objective 1: To analyze the digital display forms of urban public art spaces in Oeli Art Park, Hangzhou, China.

This section explores the digital display forms of urban public art spaces within the Oeli Art Park, based on empirical findings. The analysis specifically focuses on key attributes such as digital art events and exhibitions, integration with urban planning, immersive technologies, digital art platforms, digital methods for art education, digital infrastructure, the role of technology companies, virtual art communities, and audience data feedback. These attributes collectively provide a comprehensive understanding of the evolving dynamics of the digital display forms in the urban public art spaces.

Digital Art Events and Exhibitions: Utilizing digital arts events and exhibitions is a highly efficient method to actively involve the audience. Based on the interview data and observation data on Oeli, it was evident that the audience showed significant enthusiasm for engaging in these events, particularly those that offer interactive experiences. The observational data also suggests that these activities have the potential to foster a sense of community and engagement, facilitate discourse between artists and audiences, enhance

communication among audiences, increase foot traffic in public art spaces, and consequently stimulate both the digital and physical economy.

Combining digital art with urban planning: Based on data gathered from interviews with artists and arts institutions, urban planners are currently exploring ways to integrate digital art installations and interactive artworks into public spaces, with the aim of enhancing the cultural atmosphere of cities. This practice is gaining popularity as a prevailing trend. Interview data revealed that the general public exhibited significant enthusiasm and inquisitiveness over the prospect of seeing digital art installations in various public spaces, including parks, squares, and even subway stations. Observational evidence further validates that the interactive and visual influence of digital art pieces can greatly augment the appeal of public spaces.

Immersive Technology: The incorporation of augmented reality (AR) and virtual reality (VR) technologies has introduced a novel aspect to the exhibition of art. These technologies enable works of art to transcend physical limitations and exist in both the real and virtual realms. According to the interview data, the audience expressed that AR and VR technology allows them to encounter art in a novel manner, resulting in a heightened sense of immersion that enhances the liveliness and emotional impact of the artwork. Empirical evidence further indicates that art exhibitions incorporating augmented reality (AR) and virtual reality (VR) technologies have a greater appeal to younger demographics and elicit increased levels of engagement and social media sharing from interviews with technology companies.

Create a digital art platform: Digital platforms serve as a venue for artists to showcase and market their artwork, while also offering the general public the convenience

of accessing and purchasing art at any time and from any location. The interview data indicated that both artists and buyers hold a favorable view of this uninterrupted access to the art market. The empirical evidence additionally demonstrates that digital art platforms have the capacity to broaden the viewership of artistic creations, transcend geographical and physical limitations, and promote the democratization and liberalization of art.

Participation in art education: Art institutions enhance the impact of art aesthetic education by utilizing digital methods, which is also a significant approach to enhancing urban public art spaces. Based on the interview data, participants conveyed their enthusiasm for enhancing their art education by means of online courses, virtual workshops, and digital art production competitions. Empirical evidence indicates that these aesthetic teaching options not only enhance the general public's comprehension of digital art but also foster their active participation and ingenuity.

Digital infrastructure: The establishment of digital infrastructure is essential for the advancement of these art forms. Both viewers and artists in the interview data highlighted the significance of rapid Internet connectivity for the appreciation and production of digital art. Empirical evidence indicates that in urban areas possessing sufficient digital infrastructure, there is a notable rise in both participation and contentment with public art venues.

Technology company promotion: Technology companies are crucial in driving the digitization of public art spaces. According to the interview data, artists and arts organizations expressed that collaborating with digital businesses afforded them the technological advancements and resources necessary to actualize ground-breaking art projects. Observational data indicates that the involvement of technology businesses has

resulted in the emergence of novel artistic expressions, including artworks generated by artificial intelligence. These creations frequently evoke interest and a sense of exploration among the audience.

Virtual art community establishment: The creation of a virtual art community allows art institutions to facilitate connections between artists and spectators, serving as a crucial component of the urban digital art scene. Interview data indicates that both artists and audiences value this straightforward mode of communication, which enhances the personal and profound nature of the art experience. Observational evidence indicates that virtual communities have the capacity to attract a worldwide audience, surpassing the geographical constraints of conventional art shows.

Feedback on audience data: The field of enhancing public art spaces through audience data feedback is expanding. Within the interview data, art institutions and curators highlighted the need for comprehending audience preferences and behaviors to effectively cater to their requirements. The analysis of audience interaction data reveals that the art space can alter the exhibition's content and arrangement, thereby enhancing audience satisfaction and engagement.

We anticipate further development of urban public art spaces in the future, transforming them into more interactive and technologically advanced environments offering dynamic cultural experiences. This endeavor would not only enhance the quality of life for city residents but also establish a more expansive arena for artists to create their work, thereby fostering the harmonious cohabitation of art and urban society.

5.3.2 Research Objective 2: To evaluate the practical context of the digital art scenes

This section explores the practical context of digital art scenes, focusing on the challenges and opportunities they present. It examines the practices of artists, art institutions, and public art spaces, providing insights into how these actors navigate the intersection of digital art, technology, and audience engagement. The analysis is divided into four key analyses subsections: Current practices of artists and art institutions (5.3.2.1); Current Scenarios of Public Art Spaces (5.3.2.2); Urban Government Practice (5.3.2.3) and Ways for Arts Organizations to Guide Audiences to Understand Digital Art (5.3.2.4) to systematically address the unique dynamics of these stakeholders.

5.3.2.1 Current practices of artists and art institutions

When examining the digital art scene as a connection between public art spaces and the Metaverse, artists and art institutions encounter numerous obstacles and opportunities. According to recent studies, the digital art industry incurs significant costs related to technology research and development. Usually, the artists or art organizations responsible for organizing exhibitions bear the majority of these expenses. Spending in this area typically has restrictions. Since digital art demands a high level of technical expertise and a significant initial investment, budgetary constraints can have a negative impact on the scene. Therefore, careful planning and resource allocation are required of artists and art organizations. Art institutions and artists have recognized through practical experience that digital art scenes provide new avenues for audience engagement. However, they must also consider the continuous expenses associated with maintaining these scenes. Consequently, it is necessary for them to seek out sustainable operating methods, such as collaborations, financial support, and the exchange of technological resources, in order to distribute the burden of risk and expenses.

In addition, since the digital art scene depends so heavily on technology, there is concern that a reliance on technology too much could obscure the emergence of authentic artistic breakthroughs. Therefore, it is imperative that institutions and artists collaborate to achieve a balance between fostering artistic creation and utilizing the technology. Instead of replacing genuine artistic impact and superficial novelty, artists should view digital technology as a tool to express themselves more effectively.

The current audience for the digital art scene remains limited. Younger individuals and art professionals primarily make up this audience. The inclusion of technical devices like mobile phone mini programs, wearable devices, and interactive sensing devices sets apart digital art exhibitions from traditional ones. Based on the findings, certain elderly viewers who do not use smartphones exhibit lower levels of engagement. It is worthwhile to enhance the interest and engagement of the older audience in digital art by implementing more advanced technological methods. Furthermore, we cannot ignore the crucial concern of safeguarding audience data in terms of security and privacy. Several interactive gadgets require the use of personal mobile phones or accounts to log into mobile applications. Consequently, art institutions must implement robust procedures to guarantee the security of this sensitive information.

5.3.2.2 Current Scenarios of Public Art Space

The research concludes that the operational model of public art spaces will undergo changes as the digital art scene continues to grow. Currently, the transmission of the digital art scene is still influenced by spatial limitations; varied spatial parameters serve as the necessary requirements for various digital art scenes. The digital art scene predominantly showcases its works through various forms of exhibitions, including art festivals, community

events, art exhibitions, and museum displays. The technical aspects of digital art determine the specific digital parameters that are suitable for each exhibition space. Based on the research findings, art shows occur with varying frequency, ranging from a few days to several weeks. Additionally, market activities associated with these exhibitions typically span 3–7 days. This dynamic drives public art spaces to innovate and adopt new operational approaches. Simultaneously, the wide range of artistic expressions necessitates that public art spaces possess more adaptability and flexibility in their design and functionality.

The findings inform the researcher's depiction of the public art venue paradigm. The quality and novelty of the exhibition content are essential in these cycles. To successfully implement the digital art scene, operators must concentrate not only on using technologies but also on effectively converting them into artistic expressions that possess both visual impact and emotional resonance. The essence of the show is in its content, regardless of whether it is a conventional art exhibition or a digital art exhibition. Viewers must translate the content into a visual language. The digital art scene demands more advanced methods for creating customized exhibition content. The use of different technologies in art experiences generates unique and specific behavioural data from the audience. Designers can use this data to provide feedback, guiding them in modifying and adjusting the art display. Through the analysis of audience behavioural data, art space managers can effectively tailor the exhibition material to align with the audience's expectations and boost their level of engagement. Utilizing data-driven display adjustment enhances both the audience's experience and the operational value of the art space.

Once the aforementioned output model reaches a state of maturity, it is highly likely to discover novel sources of economic revenue. Consequently, this will generate profitable

business opportunities for companies prepared to commit capital and technological resources toward the creation of novel products that streamline the integration of cutting-edge technologies. For instance, many large cities nowadays have endless, gigantic screens that create the illusion of three dimensions in the naked eye. The seamless transitions between LED display corners are no longer a problem thanks to this advanced display format, which has greatly advanced the LED display industry. In addition to encouraging the development of new forms of art, technological advancements also have the potential to create and support new forms of cultural reception. This, in turn, stimulates further innovation and development within the industry. The establishment of technology-driven art display and consumption patterns creates a positive feedback loop. Public art space operators must stay up-to-date and provide a versatile operational structure to accommodate evolving art exhibition requirements and meet audience expectations. In addition, it is imperative for them to collaborate closely with artists, technology developers, and other players in the cultural business to foster innovation in artistic expression and cultural consumption.

5.3.2.3 Urban Government Practice

An examination and analysis of the impact of the digital art scene on urban development might provide valuable insights for urban governments. The advancement of the digital art scene serves as both a cultural emblem of prosperity and a significant catalyst for the holistic progress of urban areas. For cities like Hangzhou, which have access to the Internet, abundant scientific and technological resources, and a wealth of tourism attractions, the digital art scene can serve as a powerful tool to enhance the city's brand image and function as a digital representation of the city. Due to the substantial initial investment required, the advancement of digital technology necessitates a significant financial commitment. The government should proactively endorse and engage in funding the study

and development of digital art technologies. Several entrepreneurial firms in the field of digital art technology exist within the technology industry. The government should promote a model of collaboration between the public and commercial sectors, engage in logical and efficient planning, allocate resources wisely, and refrain from imposing needless financial strain. The development of essential infrastructure for public art spaces aims to foster industrial innovation and enhance the overall quality of the public art experience. Simultaneously, it seeks to attract a greater influx of cultural tourists, thereby contributing to the growth of the entertainment business.

The local administration should incorporate the digital art scene into the public art space, taking into account its current capacity and future potential. The government should promote the growth of eco-friendly and sustainable exhibition formats within the digital art scene by including them. The government can enhance tourism revenue by organizing digital art exhibitions and interactive experiential activities to attract both local and international tourists. In addition to enhancing the city's reputation globally, it can simultaneously promote a variety of social interactions, increase the effectiveness of local cultural communication, and strengthen the unity of the community.

Developing the conceptual model of the digital art scene as a link between public art space and the metaverse necessitates collaboration from multiple perspectives. Figure 6.2 illustrates the functions of the digital art scene, which are derived from the findings of this research. This collaboration necessitates efficient coordination by the government, the development of favorable policies, the encouragement and promotion of cooperation across different departments, and ensuring the accessibility of the digital art scene. This involves taking into account the spatial distribution of the digital arts scene in urban planning, with

the aim of encompassing various public spaces and communities and facilitating more accessible and inclusive opportunities for individuals with diverse skills and educational backgrounds. Ensure that the integration of digital arts yields enduring economic, social, and human advantages for the city.

In addition, the local administration should prioritize the integration of art and technology while fostering the digital art scene. Using Oeeli Art Park in Hangzhao, China as an example, the digital art scene in Hangzhou benefits not only from local Internet and technology companies, but also from the presence of universities that provide talent and artistic innovation. Therefore, it is imperative to promote collaboration between local universities, research centers, and art organizations. It is important to support the establishment and protection of intellectual property rights in this area while encouraging the growth of creative skills in the field of digital art. The international partnership will also create new economic prospects in the field of cultural tourism and support the integration and development of art and technology in the city.

These government practices can offer future suggestions for the municipal government to foster the thriving growth of the digital art scene and make valuable contributions to the city's social, cultural, and economic development.

5.3.2.4 Ways for arts organizations to guide audiences to understand digital art

The interview data revealed that arts organizations are able to guide audiences toward understanding digital art pathways. These data helped to provide specific attributes that are related to the organizations including:

Providing detailed explanations and background information: Art organizations provide detailed explanations and background information about digital art at exhibition venues or on online platforms to help audiences understand the origin, development, and importance of digital art.

Organize lectures and seminars: Art organizations invite artists, scholars, or experts to hold lectures and seminars to explain the theory and practice of digital art in depth.

Provide interactive experiences: Through interactive experiences, viewers can directly participate in the creation process of digital art so as to better understand the creation methods of digital art.

Creation Tutorials and Workshops: Art organizations provide tutorials on the creation of digital art or hold workshops to teach viewers how to use digital tools and technologies to create art.

Exhibition of Creative Process: Art organizations show the creative process of artists, allowing viewers to see the entire process from the initial idea to the completion of the work, which can help visitors understand the creation method of digital art.

Utilizing Virtual Reality and Augmented Reality Technology: The art organization utilizes virtual reality and augmented reality technology to create immersive art experiences that allow viewers to understand the concepts and creation methods of digital art.

Creative Guides and Resources: Art organizations provide guides and resources for digital art creation, including software tutorials, technical guides, art theories, etc., to help audiences understand and master digital art more deeply.

Artist Interviews and Displays: Through artists' interviews and artwork displays, viewers can learn about the artists' creative thinking and process and how they use digital technology to realize their artistic concepts.

Community Involvement: The arts organization encourages the audience to participate in the digital art project in order to understand and learn digital art through practice.

5.3.3 Research Objective 3: To propose a framework for developing public art spaces that enhance the multi-dimensional digital art landscape of Hangzhou city in the future.

The data collected for this research objective specifically addresses the need to develop a framework for enhancing the digital art landscape of public art spaces in Hangzhou, as gathered through the practices of technology enterprises, artists, and policymakers. The findings demonstrate how collaborative efforts and design strategies can be utilized to create innovative and interactive digital art experiences, ultimately aligning with the goal of proposing a comprehensive framework.

The interview data also revealed that the technology enterprises provided artists and policymakers with a framework for digital art in public art spaces. The technology enterprise conducts in-depth communication with artists and policymakers to understand their needs and expectations, including the artistic concepts expressed, the target audience, and the expected results. Based on the needs analysis, the design team comes up with design concepts. For instance, the design team creates a virtual city model that visitors can interact with via a touch screen or a mobile device, enabling them to gain insight into the city's history and culture. The design concept guides the technical implementation. For example, use 3D modeling technology to create a virtual city model, and use touch-screen technology

and mobile device technology to realize user interaction. Based on the technical realization, conduct user experience tests to collect users' feedback and evaluate the effectiveness of digital art and user experience. For instance, I invite a subset of visitors to participate in experience tests, gather their feedback, and assess the effectiveness of the installation and user experience. Based on the results of the user experience test, optimize and improve the digital art to achieve the best effect and user experience. For example, optimize and improve the installation based on the results of the experience test. Consider enhancing user interaction or incorporating additional historical and cultural details.

Based on optimization and improvement, assist artists and policymakers in implementing digital art, which includes equipment installation and software configuration. Additionally, provide post-production technical support and maintenance. For example, assist governments and artists to implement digital art installations, including equipment installation, software configuration, etc. During the operation of the installation, provide technical support and maintenance services to ensure normal operation of the installation. After the installation has been in operation for a period of time, conduct post-evaluation, including, for example, the usage of the installation, user feedback, and the impact of the installation on the park's visitor numbers and cultural atmosphere. The results of these evaluations provide some lessons for the design and implementation of similar digitization projects in the future.

The interview data also revealed that technology companies can assist artists and policymakers in enhancing the multidimensional digital art scene in Hangzhou city in the future as recommended below:

Provide technical support: Technology enterprises can provide technical support to artists and policymakers; for example, technology enterprises provide the latest digital art technology, such as virtual reality, augmented reality, 3D modeling, etc., to help artists create a unique multi-dimensional digital art scene.

Provide design consultancy: Technology enterprises cooperate with artists and policymakers to provide design consulting for art scenes, helping artists and policymakers to transform art concepts into actual art scenes.

Provide implementation services: The technology enterprise provides implementation services for the art scene, including installation of equipment, configuration of software, testing of the scene, etc., to ensure the smooth operation of the art scene.

Provide training services: The technology enterprise provides digital art training services to help artists and policymakers enhance their digital art skills so that they can better create and manage multi-dimensional digital art scenes.

Provide post-maintenance: The technology enterprise provides post-maintenance services for the art scene, including technical support, scene updating, collection and processing of user feedback, etc., to ensure the continuity and effectiveness of the art scene.

Provide strategy consulting: Based on the characteristics and needs of Hangzhou city, the technology enterprise provides art scene strategy consulting to help artists and policymakers formulate effective art scene strategies to enhance the multi-dimensional digital art scene in Hangzhou city.

Promoting Community Participation: Technology enterprises help artists and policymakers establish links with the community and encourage community residents to

participate in the creation and experience of the digital art scene, thereby enhancing the vitality and influence of the art scene.

Promote Policymaking: Technology enterprises work with policymakers to promote the formulation of relevant policies, such as copyright protection for digital art and management regulations for public art spaces, in order to protect the rights and interests of artists and promote the healthy development of digital art.

Establishing Partnerships: Technology enterprises establish partnerships with artists, designers, technology companies, educational institutions, etc. to jointly promote the development of a multi-dimensional digital art scene in Hangzhou.

5.3.3.1 Digital art scene framework

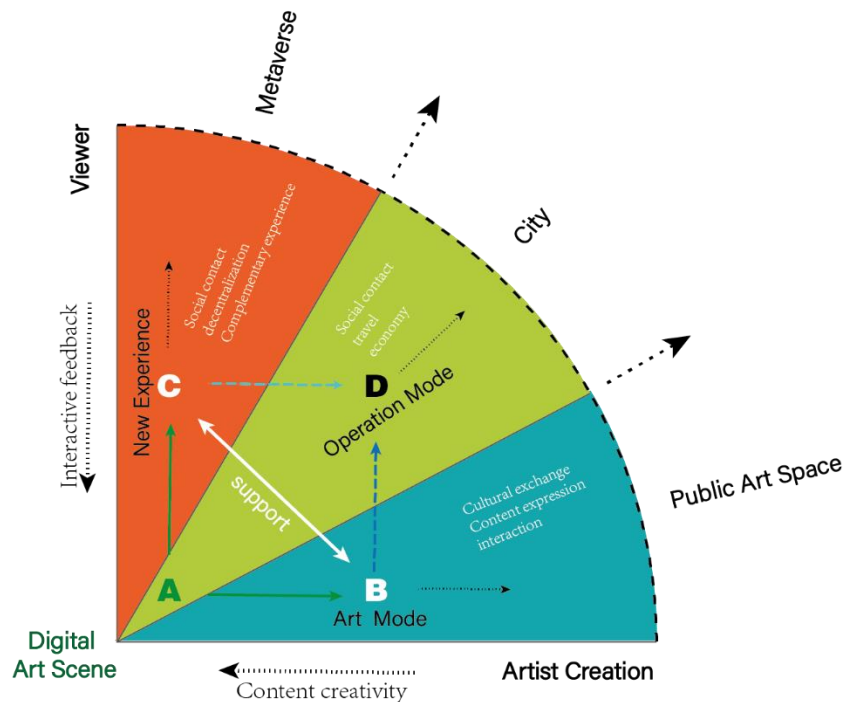


Figure 5.1: Proposed framework for digital art scene (Author’s illustration)

This research proposes a framework to explain the interplay between various elements of the digital art scene, as illustrated in Figure 5.1. The framework positions the digital art scene as a central starting point, linking and interacting with audiences and artists' creations. It is divided into three main components: the virtual world, the urban environment, and the public art area. These components interact dynamically, allowing audiences and artists to provide feedback and engage with the digital art scene continuously.

The feedback mechanism embedded within the framework serves as a critical element for fostering deep communication between audiences and artworks. This mechanism enables viewers to connect more meaningfully with the art, while simultaneously offering artists immediate creative insights and suggestions for refinement. Such interactivity and feedback act as key drivers for innovation in digital art, facilitating its evolution and continuous improvement. By incorporating these elements, the framework provides a comprehensive understanding of the potential for digital art to thrive in diverse contexts, enhancing its cultural impact and appeal in public spaces.

Furthermore, the framework aims to guide the future application and development of digital art. It acknowledges the transformative role of digital art in connecting the physical and virtual realms, serving as a conduit for artistic expression, social interaction, and cultural innovation. Through this framework, the research underscores the capacity of digital art to adapt and evolve within broader social and cultural contexts, ultimately contributing to its sustained growth and prosperity.

Figure 5.2 presents a proposed framework tailored for practitioners and policymakers, offering a strategic model for planning and implementing multi-dimensional digital art displays in public spaces. This framework adopts a forward-looking perspective, recognizing

the digital art scene as a nexus that bridges various spatial dimensions. By facilitating connections between the physical and virtual worlds, the framework underscores the pivotal role of digital art in shaping artistic practices, fostering social engagement, and driving cultural progress.

This proposed framework not only serves as a tool for understanding the complexities of the digital art scene but also provides practical guidance for leveraging its potential in future urban and cultural developments. By integrating these insights into planning processes, stakeholders can ensure the continued relevance and appeal of digital art in public spaces.

The strong relationship among the digital art scene, public art space, and the metaverse holds significant potential for growth. Public art spaces, meta-universe platforms, and specific actors must collaborate to establish a comprehensive digital art scene structure and effectively execute this relationship. To enhance a public art space, it is necessary to modify its exhibition focus, incorporate new art styles, develop innovative financial strategies, and tailor exhibition material to gather data insights. Public art spaces must develop their display methods and actively seek ways to link with digital art and the metaverse.

The Metaverse building should prioritize four main modules: the social mode, the digital economic mode, the digital art and culture communication mode, and the art market mechanism. The social model focuses on establishing a technology-friendly society that provides a unique environment for individuals to interact and create new forms of social media. The digital economy model aims to encourage interactive purchasing patterns by creating new interactions between 3D businesses and users. The digital art and culture

communication model encompasses AI communication culture, profound entertainment, and the development of virtual culture. The art market mechanism emphasizes achieving public openness in art market sharing and managing virtual copyright complexities.

The data analysis results from the previous chapter demonstrate that artists, technological firms, and art institutions are essential in shaping the framework of the digital art scene. Artists are a wellspring of creativity and substance, consistently expanding the limits of digital art via the exploration of novel forms of expression and techniques. Technology firms offer technical assistance and platforms for creating, showcasing, and trading digital artworks. Art institutions serve as intermediaries and agents that enable interaction between artists and the public through curatorial, educational, and promotional efforts while also offering a space for artists to collaborate with technology firms. Furthermore, the government can boost the cultural atmosphere and quality of the city by promoting the merger of art and society through public art projects. To foster the growth of digital art, the government can establish conducive conditions through policy-making, financial backing, and infrastructure development.

Developing a thorough framework for the digital art scene necessitates collaboration among artists, technological corporations, art institutions, and city governments. We can alter the central focus of the public art space exhibition, integrate new art forms, create innovative revenue models, and customize exhibition content using data analysis. Simultaneously, the meta-universe construction should emphasize four key modules: social mode, digital economy mode, digital art and culture communication mode, and art market mechanism.

The extended framework outlined in Figure 5.2 holds significant potential to enrich the multidimensional art landscape in Hangzhou, China. By incorporating a structured process—beginning with needs analysis and progressing through design concept, technical implementation, user experience testing, optimization, implementation, maintenance, and post-assessment—this framework enables a comprehensive approach to integrating art and technology.

In the context of Hangzhou, a city renowned for its rich cultural heritage and growing digital economy, this framework fosters a dynamic artistic ecology that aligns with the city's vision for innovation and sustainability. The incorporation of technological advancements and artistic creativity not only enhances the digital art scene but also creates avenues for more immersive and interactive public art spaces. Furthermore, by promoting collaborations between artists, technologists, and other stakeholders, this framework supports the development of new partnership models and operational strategies. These efforts can lead to the creation of cutting-edge art experiences that attract diverse audiences, stimulate the local economy, and solidify Hangzhou's position as a global hub for digital art and cultural innovation.

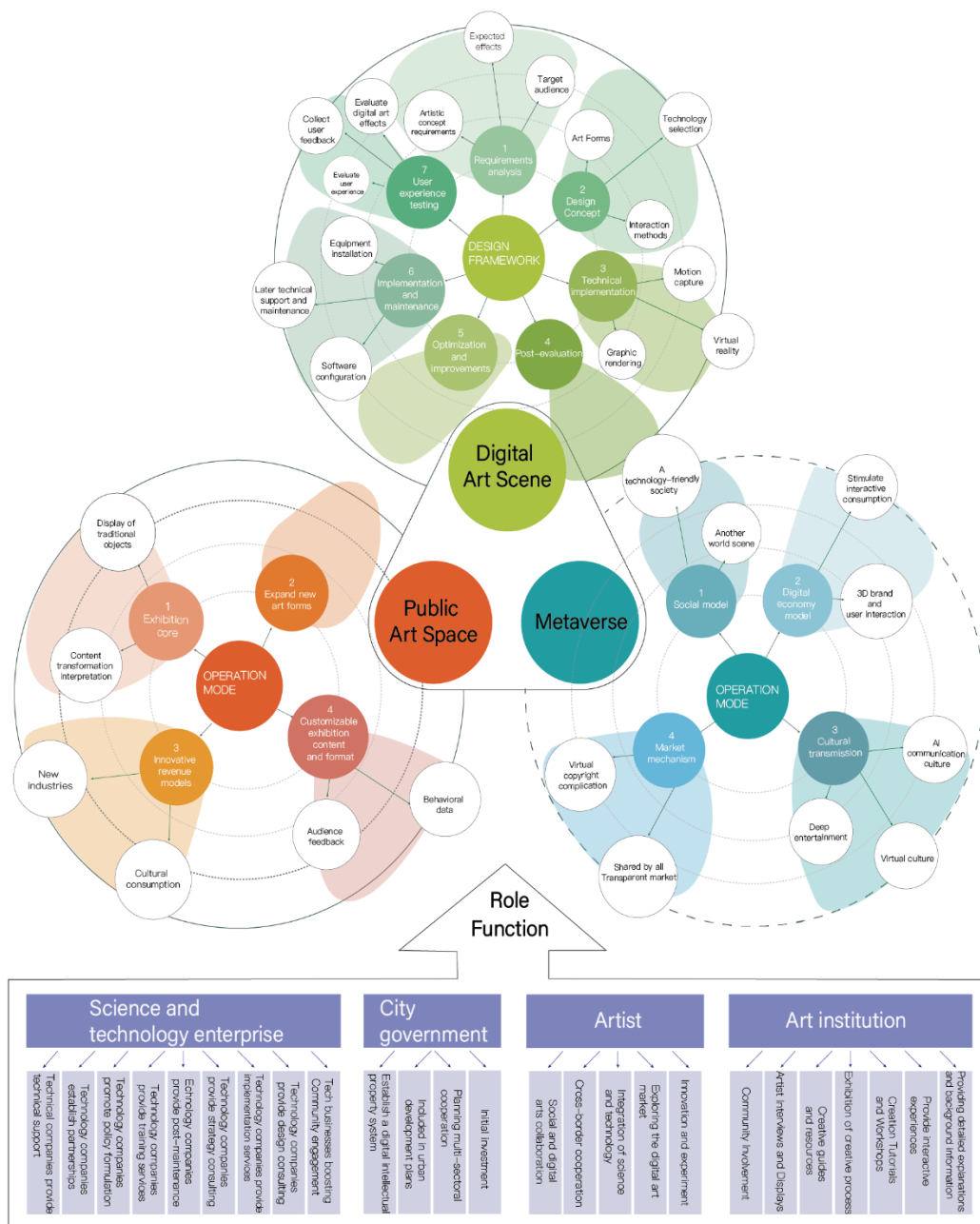


Figure 5.2: Extended version of framework for digital art scene and functions (Author's illustration)

5.3.4 Addressing the Research Gap

The cultural mechanisms of contemporary public spaces increasingly recognize the digital art scene as a vital medium for fostering interactions between artists and audiences, while simultaneously contributing to urban development and cultural dissemination. Future public spaces, such as museums, must expand their mission to incorporate the evolving context of digital art, education, human identity, and life (Giannini, 2022). This study examines the practical implications of the digital art scene by analyzing its functions and impacts in various domains, including urban design, cultural policy, and social transformation.

The development of a conceptual framework places the digital art scene at the intersection of the metaverse and public art spaces. The metaverse is a cutting-edge digital ecosystem that goes beyond geographical boundaries and provides an immersive, interactive medium for audience participation, cultural exchange, and artistic expression. Analysis of empirical data demonstrates how the metaverse broadens the scope of public art venues and empowers artists to produce works that blend the real and virtual worlds. By enabling worldwide accessibility and engagement, this integration not only raises the profile of digital art but also increases its social and cultural influence.

Interview and observational data emphasize the transformative potential of the metaverse in redefining audience experiences. The metaverse allows for interactive and participatory engagement, where audiences can explore art beyond traditional boundaries. For instance, virtual exhibitions hosted within the metaverse have demonstrated higher levels of audience immersion, particularly among younger demographics who actively engage with augmented reality (AR) and virtual reality (VR) technologies. This enhanced

interaction fosters a deeper connection between audiences and artworks, further enriching the cultural value of the digital art scene.

The empirical findings also reveal that the metaverse serves as a critical platform for fostering innovation in public art spaces. Artists and technology enterprises collaborating within the metaverse ecosystem are able to experiment with new forms of digital art, such as AI-generated content and immersive installations. These innovative practices drive artistic creativity while simultaneously offering new business opportunities in the digital art market. Furthermore, the metaverse enables real-time feedback and interaction between audiences and creators, creating a dynamic feedback loop that informs artistic practices and improves audience experiences.

This study positions the metaverse as a crucial part of the modern urban cultural mechanism by highlighting its function in bridging the gap between digital and public art settings. The metaverse improves cities' social interaction and cultural vibrancy by enabling a smooth transition between real and virtual worlds. Additionally, it promotes cultural diversity and community cohesiveness by facilitating more inclusive involvement by overcoming physical and geographic constraints.

The findings also highlight the potential of the metaverse to influence urban development and economic growth. Virtual art spaces within the metaverse create opportunities for cultural tourism, attracting global audiences and generating new revenue streams. The empirical evidence indicates that the integration of metaverse platforms into public art spaces not only drives innovation in artistic expression but also supports sustainable urban and cultural development.

Through this study, the metaverse is positioned as an essential element in understanding the evolution of the digital art scene. By bridging public art spaces and the metaverse, this research provides new perspectives for leveraging the potential of digital art to drive social progress and cultural prosperity. The comprehensive empirical analysis offers valuable insights for policymakers, urban planners, and technology enterprises, ensuring the continued relevance and influence of digital art in shaping modern urban societies.

5.5 Recommendation for Future Research

Currently, the notions of digital art and metaverse are in the early stages of development, and there is a scarcity of important theoretical and practical evidence. The potential to conduct comprehensive research in the literature on these new topics is somewhat limited. As these domains continue to advance and mature, future studies will be able to gather more precise data, offering more thorough and extensive theoretical literature. This study examines the impact of the digital art scene on urban development, using Ooeli Art Park in Hangzhou, China, as a case study. Hangzhou has achieved significant progress in digital modernization and the construction of smart cities. Nevertheless, it is important to recognize that while Hangzhou's experience, art models, and future trends have some universal aspects, the unique requirements and particular circumstances of each city can impact the growth and reception of the digital art scene. Consequently, limiting research to specific regions or cultural contexts may lead to an incomplete coverage of digital art practices across various global locations. When implementing Hangzhou's practices in other cities, it is necessary to make suitable adaptations and localize them accordingly.

Furthermore, the global spread of the coronavirus during the research period imposed restrictions on the inclusion of foreign individuals in the observation sample, potentially

leading to a dearth of research findings from a multicultural standpoint. As international exchanges resume, future studies can expand more extensively to encompass a wider range of viewpoints, taking into account art experience and interaction patterns in many cultural contexts. This study employs a qualitative research method, which aims to get a comprehensive comprehension and elucidation of phenomena. It is imperative to recognise that this methodology has the potential to add subjectivity and bias. Future research initiatives could use quantitative approaches that include greater sample sizes, in addition to thorough data analysis and statistical verification, to overcome these limitations and improve the conclusions' objectivity and universality.

Despite its limitations, this study provides a valuable theoretical framework and practical insights into the role of the digital art scene in the evolution of contemporary urban culture. The findings underscore the significance of the digital art scene in shaping modern urban culture, contributing to sustainable urban development and the cultural enrichment of cities.

The digital art scene is increasingly recognized as a critical factor in promoting cultural vitality and enhancing the social and aesthetic experiences within public art spaces. By bridging the virtual and physical dimensions, it fosters new forms of interaction and participation, ultimately redefining the identity and cultural narrative of urban environments.

Future research should focus on exploring the dynamic evolution of the digital art scene and its implications for urban public art spaces. Particular attention should be given to its influence on interactions within these spaces and the ways it transforms the cultural and social identity of cities across both virtual and physical dimensions. Longitudinal studies and comparative analyses across different cultural and urban contexts would provide deeper

insights into these evolving dynamics. By expanding on these research directions, scholars and practitioners can further understand the potential of the digital art scene to drive innovation, foster inclusivity, and contribute to the sustainable and cultural success of cities in the digital age.

This study also highlights emerging challenges in copyright, ownership, and identification arising from the increasing prominence of digital art in virtual environments such as the Metaverse. These issues underscore the need for deeper investigation into the legal, ethical, and societal implications of digital art in these evolving spaces. Addressing these challenges will provide a foundation for protecting artistic integrity while fostering innovation.

Additionally, the findings align with the broader objective of supporting the multifaceted development of intelligent cities, where digital art can play a transformative role. Future research should aim to enhance and expand the understanding of digital art in the following areas:

Cross-cultural research: Conduct an extensive cross-cultural comparative study to investigate the developmental approach and level of public involvement in digital art across diverse cultural contexts.

Striking a balance between art and technology: While technology offers new avenues for artistic creativity, the essence of art should remain centered on innovation and creative expression. Subsequent investigations should delve into the methods of harnessing cutting-edge technology without compromising the autonomy and originality of artistic expression.

Utilization of audience data: To offer a more customized and engaging art experience, arts organizations should create sophisticated analytics tools to gain a deeper understanding of audience preferences and behaviors.

Creating a virtual art community: Art institutions should consider developing a virtual platform that allows artists and viewers to communicate and collaborate online, thereby establishing a dynamic platform for art exchange.

By undertaking these endeavors, we aim to get a deeper comprehension of the digital arts' influence on urban cultural policies throughout the age of globalization and digitalization.

5.6 Conclusion

The primary finding of this study is that the digital art scene serves as an intersection between the virtual and public realms, breaking down barriers between traditional art spaces with the help of digital technology. It also makes art more accessible to a wider audience and encourages innovation and the cross-border integration of artistic expression.

Public art spaces have attributes such as social interaction, entertainment, cultural exchange, and city image. Typically, these spaces serve as venues for public use and participation, showcasing artworks, organizing cultural activities, and fostering social interaction. Based on artists' creations and policy support, public art spaces can create digital art scenes. Digital art scenes utilize tools such as digital technology and the Internet to present artworks in digital form, providing the public with new art experiences and operational models.

The digital art scene not only brings a new operation mode for public art space but also promotes the development of the surrounding industry. The digital arts scene attracts more audiences and participants, bringing opportunities and vitality to the surrounding industries, such as commerce, catering, and tourism. The digital art scene has become an important port for the audience to enter the world of the metaverse. The metaverse is a virtual multi-dimensional space in which people can engage in activities such as virtual socialization, entertainment, and tourism. The digital art scene introduces new traffic and content to the Metaverse space, providing new possibilities for the development of the Metaverse.

The results of this study highlight the metaverse's innovative potential as a vital enabler of the digital art scene. Through the use of technologies like virtual reality (VR), augmented reality (AR), and immersive digital environments, the metaverse offers audiences a more engaging experience with the digital artworks. These technological advancements enable audiences to interact with art outside of traditional settings, resulting in stronger emotional bonds and a greater sense of immersion.

Furthermore, the metaverse extends its impact beyond the mere consumption of art, creating dynamic opportunities for socialization, entertainment, tourism, and cultural exchange. Within this virtual ecosystem, audiences can actively participate in shared cultural experiences, fostering global connectivity and cross-cultural understanding. For instance, virtual art exhibitions and interactive installations in the metaverse not only bridge geographical divides but also democratize access to art, making it more inclusive and accessible to diverse audiences worldwide.

From a technological perspective, the metaverse offers a robust infrastructure that supports the continuous evolution of digital art, enabling innovative artistic expressions and novel forms of audience interaction. This dynamic interplay between technology, art, and audiences positions the metaverse as a pivotal space for redefining the relationship between public art and urban culture in both virtual and physical dimensions.

The implications of these findings highlight the metaverse as not only a technical platform but also a cultural and social mechanism that reshapes the ways in which art is created, experienced, and shared. Its integration into the digital art landscape paves the way for future research and practice, focusing on how virtual environments can contribute to sustainable cultural development, community cohesion, and the expansion of creative possibilities in the evolving urban cultural ecosystem.

As a conclusion, this research highlights that the convergence of public art spaces and digital art scenes creates an enriched and multifaceted platform for audience engagement. By offering more diverse and immersive art experiences, this integration not only deepens the cultural and aesthetic appreciation of art but also stimulates the growth of peripheral industries such as tourism, technology, and creative economies. The development of these industries illustrates the broader socio-economic impact of the digital art scene, positioning it as a key driver of urban and cultural innovation.

Moreover, the interaction between digital art scenes and metaverse spaces introduces unprecedented opportunities for audience participation and experience. Through virtual and augmented realities, the metaverse transcends the limitations of physical spaces, enabling global accessibility and fostering cross-cultural exchange. This dynamic interplay between the physical and virtual realms facilitates new forms of socialization, entertainment, and

cultural interaction, redefining the boundaries of public art in contemporary urban contexts.

The metaverse, digital art scenes, and public art spaces have all demonstrated immense potential, but they also bring up significant issues regarding sustainability, inclusion, and accessibility. It is still very difficult to ensure that all socioeconomic groups have equal access to digital technologies, especially when it comes to closing the digital divide. Furthermore, the use of cutting-edge technologies necessitates a careful assessment of their effects on the environment in addition to moral considerations pertaining to intellectual property rights and data privacy. The integration of digital art scenes and public art spaces not only fosters the growth of related industries but also offers audiences diverse and richer art experiences. The interplay between metaverse spaces and digital art scenes broadens the range of experiences and participation options available to audiences, opening up new avenues for entertainment, socialisation, tourism, and cross-cultural exchange.

These findings suggest that while the combination of public art spaces and digital art scenes, amplified by the metaverse, provides a transformative cultural mechanism, its broader implementation must be approached with a balanced perspective. Future initiatives should prioritize inclusivity, sustainability, and ethical considerations to fully realize the potential of these integrations. By addressing these challenges, this research lays the groundwork for a more comprehensive understanding of how digital art can drive cultural innovation, urban development, and global connectivity in a rapidly evolving digital age.

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APPENDICES

Appendix A - Published ARTICLES

- D. Liu** and S. A. Hamid,. (2023). Digital art scene development strategy and conceptual framework—Coding analysis through artist interviews. *International Conference on Intelligent Computing and Next Generation Networks (ICNGN), Hangzhou, China, 2023*, pp. 1-5, <https://10.1109/ICNGN59831.2023.10396731>.
- D. Liu**, (2023). Design of Digital Museum System Based on Optimized Virtual Reality Technology. *International Journal of Communication Networks and Information Security (IJCNIS)*, 15(1), 194–203. <https://doi.org/10.17762/ijcnis.v15i1.5885>

Appendix B - Observation record

During the field investigation, the reliability of the observation data was enhanced through recording activities such as visiting and drawing. These records provide insight into the specifics of the study site, providing rich and detailed first-hand information. In this way, not only can the actual situation in the field be more accurately captured, but also the object of study can be understood and analyzed from different angles and levels, thus ensuring that the research results are more reliable and comprehensive.



Figure B-1 Researcher field drawing records

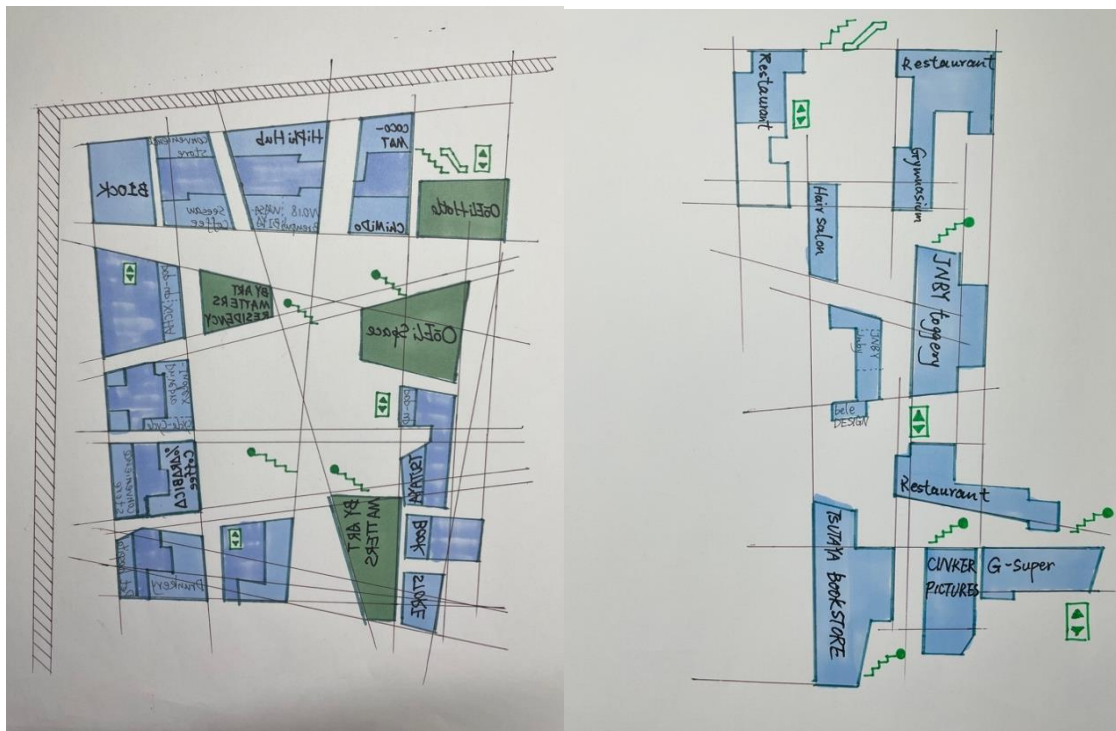


Figure B-2 Ooeli topographic map



Figure B-3 Ooeli Local sketch



Figure B-4 Ooeli Observation sketch

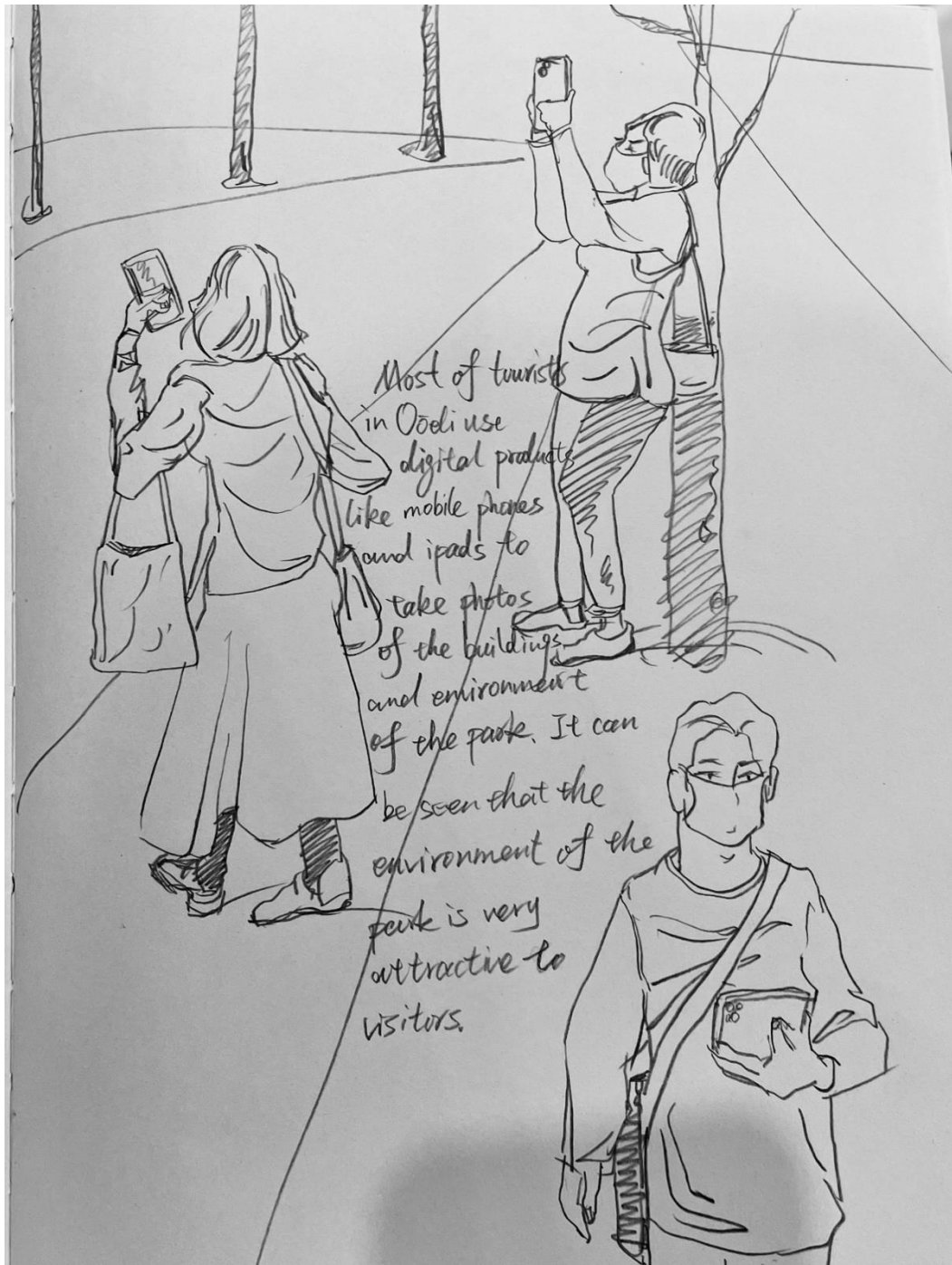


Figure B-5 Ooeli Observation sketch

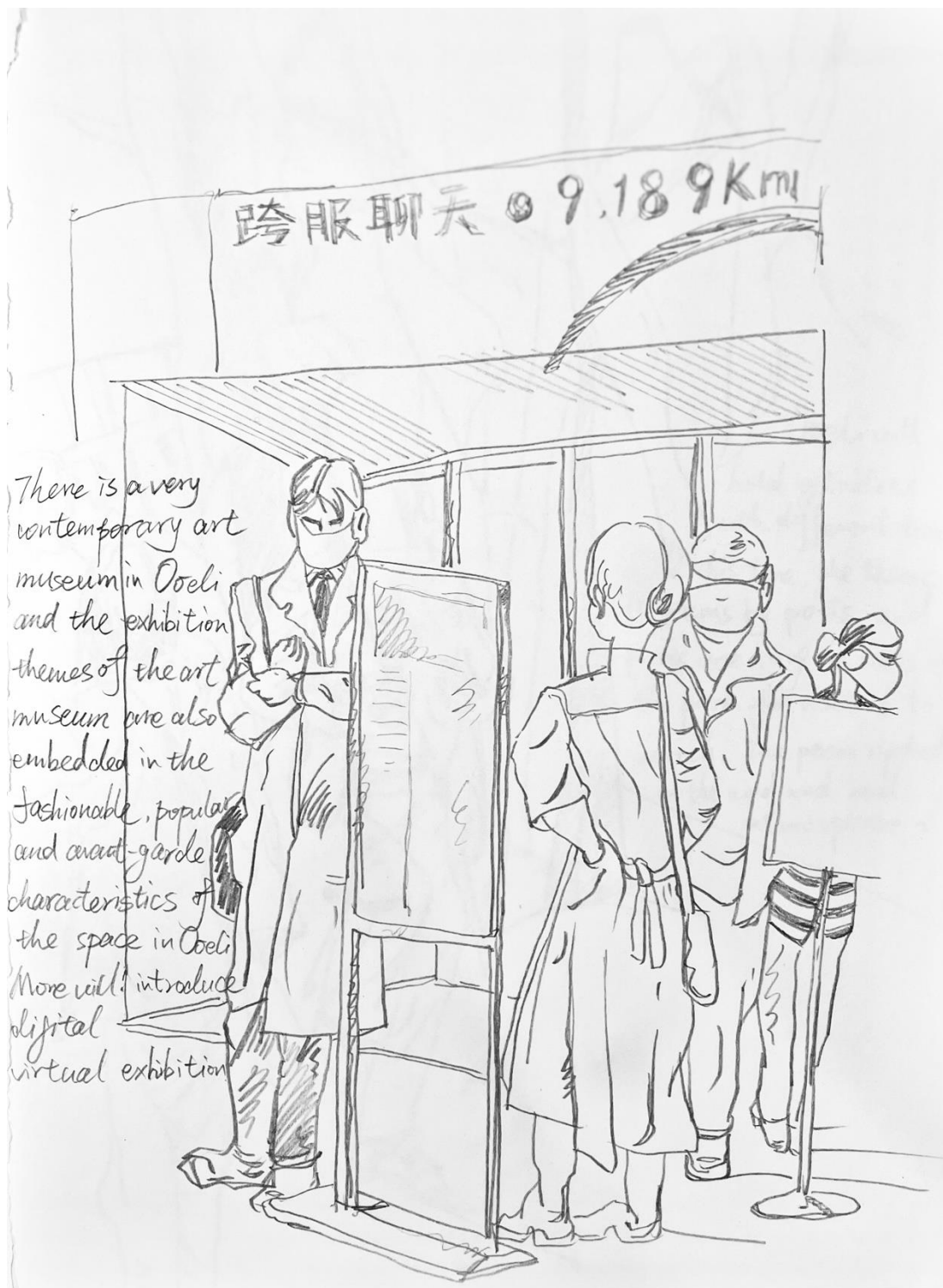


Figure B-6 Ooeli Observation sketch

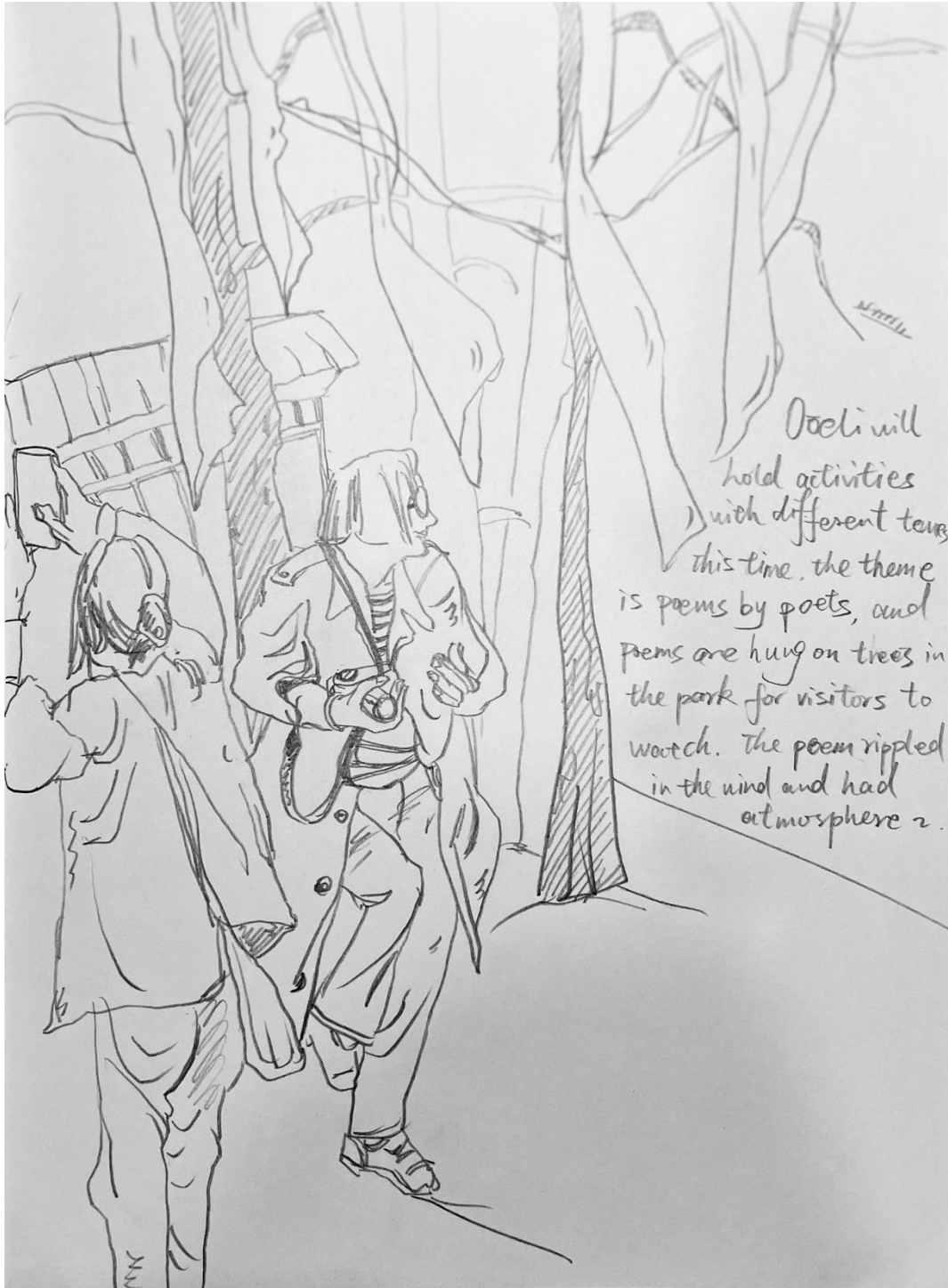


Figure B-7 Ooeli Observation sketch



Figure B-8 Ooeli Observation sketch



Figure B-9 Ooeli Observation sketch

Appendix C - Interview outline

C-1: Art organization interview

The questions change with each interviewee

1.Q: Do you have any idea about public art space? When we mention the concept of digital art scene, what do you think of?

2.Q: The medium and content of the multimedia technology exhibition you mentioned, do you mean the multimedia display method we see in some museums and art galleries? For example, for a period of time, some places used multimedia technology to create interactive exhibition effects of Van Gogh's works in the special exhibition of Van Gogh. The Van Gogh Starry Sky Art Exhibition, which is particularly attractive to the audience, and the "New Classics of Mountains and Seas" exhibition organized by the Zhejiang Provincial Museum, are these exhibitions?



Figure C-1-1 Digital art exhibition Shanhai Jing poster

3.Q: What do you think is the essential difference between such digital art exhibitions and traditional exhibitions? Will it help enhance the audience's experience of the exhibition? In our city Hangzhou and other city exhibitions, is it necessary to enhance the audience experience of public art spaces through digital art scenes?

4.Q: I also went to see the exhibition of "New Classics of Mountains and Seas" and liked it very much. The theme, interpretation, and display are all great. This is also a very good exhibition among the exhibitions of the Museum of Traditional Significance. Have you ever been to a park like Ooeli in Hangzhou? Ooeli also holds some contemporary art exhibitions, as well as VR and AR exhibitions, such as the "Holodeck" exhibition, and some virtual reality exhibitions that can be viewed on devices through mobile apps. Do you know something about this?



Figure C-1-2 Digital art exhibition in Ooeli

5. Q: Has your institution cooperated with Ooeli? Want to collaborate? Do you think it has any characteristics?

6. Q: What do you think is the role of art institutions in the digital art scene of public art spaces?

7.Q: How can art institutions assist artists to use the digital art scene to promote their works and brand building?

8. Q: In the digital art scene, how can art institutions cooperate with technology companies to promote innovation in digital technology and art?

9.Q: In the digital art scene, how do art institutions respond to the challenges brought about by the rapid changes in digital technology? How do they keep up with the latest technological developments to ensure the innovation and quality of digital artworks?

10.Q: What do you think of the role of art institutions in promoting Hangzhou local culture and promoting community integration in the construction of digital art scenes? In what ways do they combine digital art with local community culture?

11.Q: What do you think of the impact of digital art scene construction on the interaction and cooperation between artists and audiences? What kind of intermediary role do art institutions play in this?

12.Q: For the public, what are the benefits of participating in the digital art scene? How do you think art institutions can better attract public participation and attention to digital art?

13. Q: How do you observe the public's acceptance of the digital art scene? What do you think of the digital art scene's role in promoting the public's artistic literacy and aesthetics?

14. Q: How do you think art institutions use the digital art scene to break the boundaries between traditional art and technology and create unique forms of artistic expression?

15. Q: In the digital art scene, how does an art institution evaluate audience feedback and participation in digital art? How can art institutions use this data to improve display and interactive experience?

16. Q: In the digital art scene, how can art institutions guide audiences to better understand the concept, background and creation methods of digital art?

17. Q: In the digital art scene, how do art institutions cooperate with local governments and urban planning departments to ensure that digital art projects in public spaces are supported and implemented.

C-2: Digital Artist Interview Question Outline

The questions change with each interviewee

1.Q: What is your creative inspiration to create a virtual space world or a virtual reality work?

2.Q: What kind of concept do you understand about public art space and digital art scene?

3.Q: At present, besides the traditional art museums, exhibitions, public account recommendations, and self-media publicity, are there other channels that have good promotion effects but relatively small audiences?

4.Q: In the eyes of digital artists, the means of digital technology may be as important as the brush and canvas in the hands of traditional artists. Creating digital art with

digital technology and presenting it in a digital art scene is a form of art presentation that expands the real art space. Do you agree with this understanding?

5.Q: Could you briefly describe your understanding of how art uses digital technology to redefine and expand public art spaces.

6.Q: Your works are created in virtual spaces as well as realistic installation art. Your concept is also to break the boundary between virtual and reality through continuous exploration and experimentation. What do you think is the boundary between virtual and reality based on your actual creation and works? Because I think this boundary is also the connection point between virtual space and real space.

7.Q: As an artist, when you can express a new space world through augmented reality (AR) technology, do you usually consider the relationship between the new virtual space you create and the overlapping of the real space? For example, to create a marine life in the sea in a real ocean environment, or do you want to break away from the real space, expand an irrelevant space in a real world, and create a virtual ocean in a community park?

8.Q: How do you create a digital work that can inspire audience participation and interaction in your work? How do you decide or judge whether your work is expressed through installation, virtual reality (VR) or augmented reality (AR) technology?

9.Q: Are these technologies mastered by yourself or do you need to develop and seek new technology support?

10.Q: How does digital technology change the relationship between people and art. What impact will the digital art scene have on the public art space? Is there a suitable case to share?

11.Q: I see that your works have participated in many exhibitions. Which one or several exhibitions are relatively successful in your impression? What characteristics do they have in common? For example, it is highly interactive, and the audience is relatively young.

12.Q: There is a problem of preservation of digital art works. These works need media to archive. Similar to the CYBER JELLYFISH -AGN brand concept collection display space you designed, it cannot be visited like a physical store. We need to visit the digital space through the digital avatar in the metaverse space. The physical brand display space is to increase the purchase rate through customer experience. What do you think is the ultimate purpose of creating a virtual space?

13.Q: What do you think is the role and responsibility of art in enhancing the digital art scene?

14.Q: Your works are in museums, online, and virtual reality spaces. With these rich display experiences, what are your real needs and requirements as an artist for public art spaces and digital art scenes?

15.Q: You held the exhibition "0x0" in "Who Says Reality Isn't Unreal" in Hangzhou. Can you tell us about your cooperation model and why you chose each other? In contrast, will the art operation model in Tianmu be different? What is their art promotion mechanism like?

C-3:Technology enterprise interview

The questions change with each interviewee

1.Q: Hello, thank you for taking the time to meet with me. First of all, I have a question about public art space. Do you have any idea about it? What comes to mind when you think of the digital art scene?

2.Q: It's true that when people think of public art space, they usually think of museums and galleries. Then do you know about the comprehensive public space, such as the novel park in Hangzhou Tianmuli? Do you think it has any special features?

3.Q: What role do you think technology companies can play in improving the quality of public art Spaces?

4.Q: You mentioned that many artists have their own unique wild imagination. However, they do not master technology, and they are eager to realize their creative imagination under the support of technology. In your opinion, how do technology companies collaborate with artists in the process of creating digital art? What do you think is the fundamental impact of this cross-border collaboration on digital art creation?

5.Q: How concerned and involved is your company in the realization of the digital art scene in the current public art space?

6.Q: You said that during the development of the game project, the company found that the meta-space of virtual exhibition hall is a new world for the construction of digital art scene in public art space. In your experience, what are the influences and trends of digital technology on the construction of public art space?

7.Q: What are your company's concerns and practices regarding the sustainability and environmental protection of digital art works? What is the significance of the digital art scene in the sustainable development and environmental protection of public art Spaces?

8.Q: Do you think the digital art scene can promote audience engagement and community interaction? How can technology companies use social media and interactive technologies to enhance audience engagement with the digital art scene?

9.Q: How do you think the digital art scene will affect the brand image and market competitiveness of technology companies? What is the significance of digital art scene for social and cultural development and the construction of public art space?

10.Q: What is your outlook on the possible contribution and future development of technology companies in enhancing the digital art scene in public art Spaces?

Appendix D - Data analysis

Modify the user profile via the file-option in NVIVO and re-encode the node with the new user, as shown in Figure D-1.

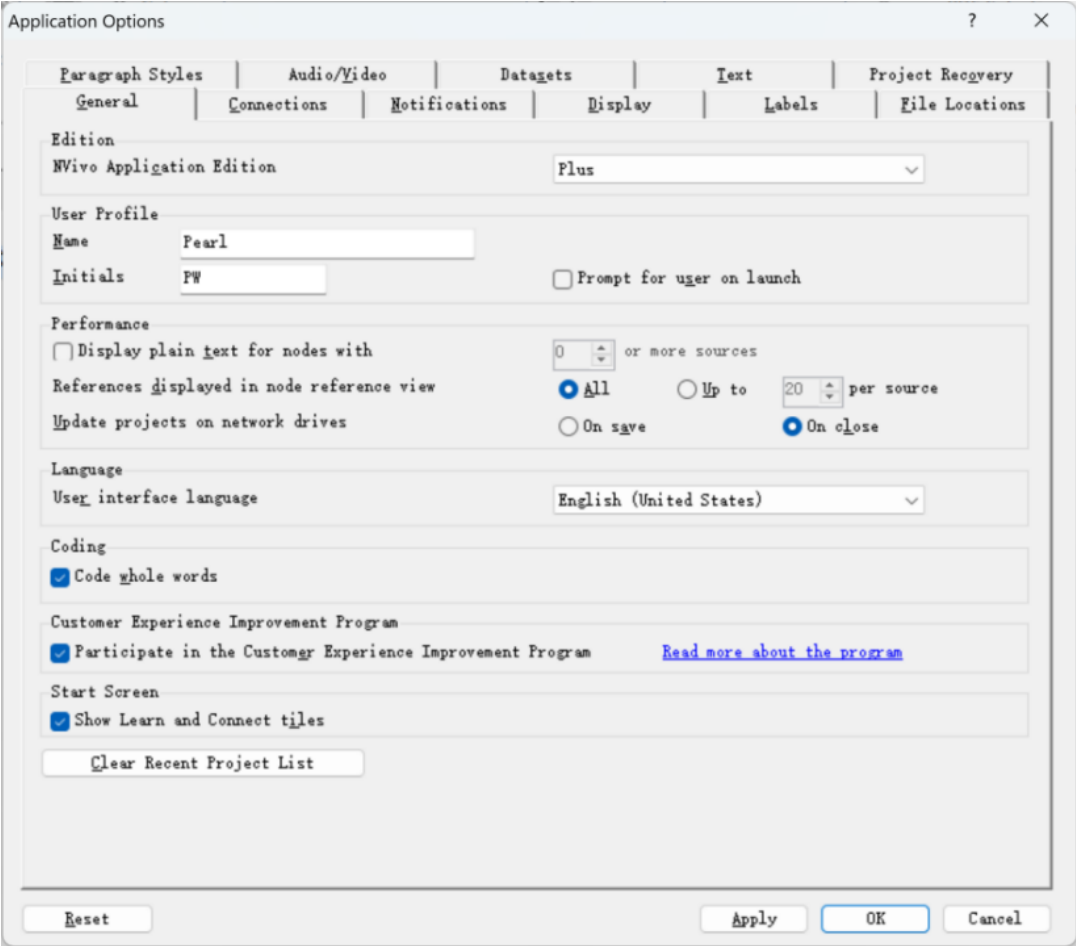


Figure D-1: Modify user

After the encoding is complete, select Query-New Query-Encoding Comparison to perform reliability analysis. This is shown in Figure D-2.

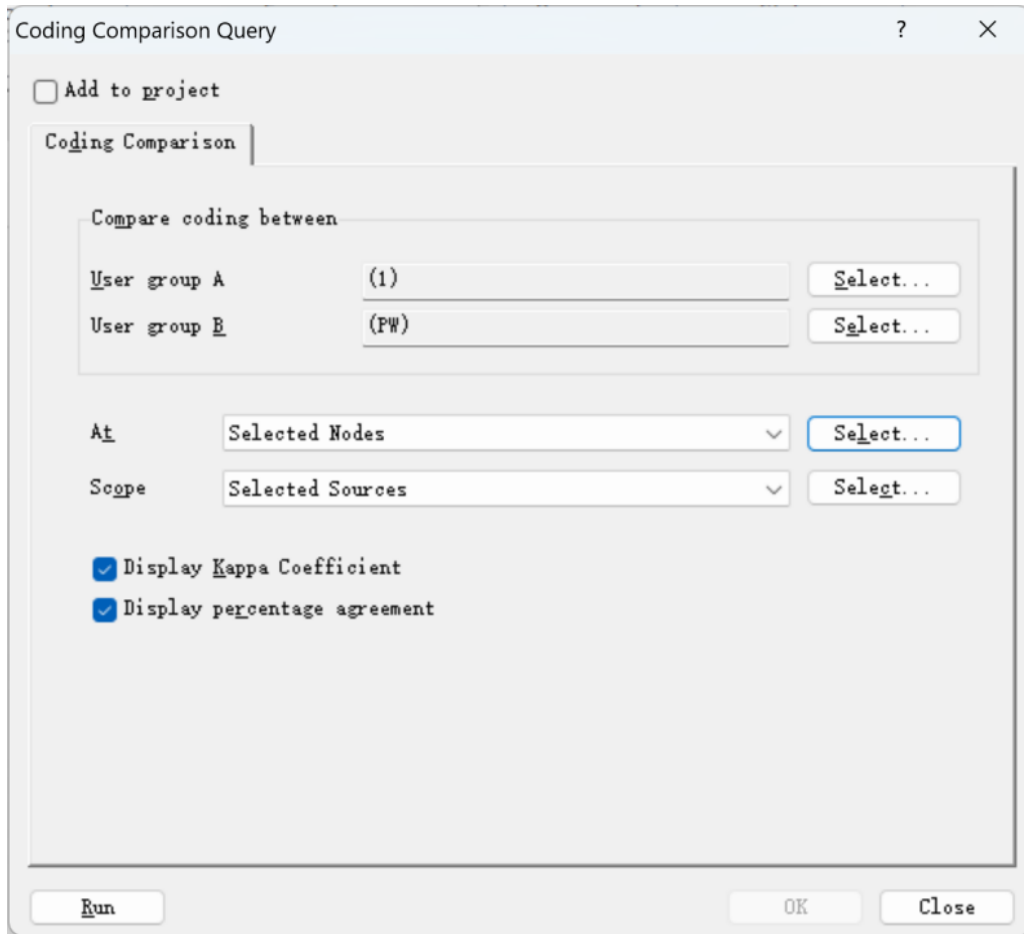


Figure D-2: Comparison of encoding

The analysis results are shown in Figures 4 and 5, and the coding kappa coefficients of all nodes are greater than 80%, and the coding consistency of each node is greater than 70%, which also meets the acceptance standard of 80% specified by Huberman and Miles (1994). It indicates that the consistency (reliability) of the two codes of the material is relatively high.

	Node	Source	Source Folder	Source Size	Kappa	Agreement (%)	A and B (%)	Not A and Not B (%)	Disagreement (%)	A and Not B (%)	B and Not A (%)
	Digital art scene b1 THE INTERVIEW	internal material	4208 chars	1	100	0	100	0	0	0	0
	Digital art scene b10interview	internal material	716 chars	1	100	0	100	0	0	0	0
	Digital art scene b2 THE INTERVIEW	internal material	2844 chars	1	100	0	100	0	0	0	0
	Digital art scene b3 THE INTERVIEW	internal material	3220 chars	1	100	0	100	0	0	0	0
	Digital art scene b4 interview	internal material	2461 chars	1	100	0	100	0	0	0	0
	Digital art scene b5 the interviewer	internal material	3623 chars	1	100	0	100	0	0	0	0
	Digital art scene b6Adam Interview	internal material	7045 chars	1	100	0	100	0	0	0	0
	Digital art scene b7 Interview	internal material	5194 chars	1	100	1	99	0	0	0	0
0	Digital art scene b8interview	internal material	2975 chars	1	100	0	100	0	0	0	0
1	Digital art scene b9interview	internal material	650 chars	1	100	0	100	0	0	0	0
2	Digital art scene b1 THE INTERVIEW	internal material	4208 chars	1	100	0	100	0	0	0	0
3	Digital art scene b10interview	internal material	716 chars	1	100	0	100	0	0	0	0
4	Digital art scene b2 THE INTERVIEW	internal material	2844 chars	1	100	0	100	0	0	0	0
5	Digital art scene b3 THE INTERVIEW	internal material	3220 chars	1	100	0	100	0	0	0	0
5	Digital art scene b4 interview	internal material	2461 chars	1	100	0	100	0	0	0	0
7	Digital art scene b5 the interviewer	internal material	3623 chars	1	100	0	100	0	0	0	0
8	Digital art scene b6Adam Interview	internal material	7045 chars	1	100	0	100	0	0	0	0
9	Digital art scene b7 Interview	internal material	5194 chars	1	100	1.19	98.81	0	0	0	0
9	Digital art scene b8interview	internal material	2975 chars	1	100	0	100	0	0	0	0
1	Digital art scene b9interview	internal material	650 chars	1	100	0	100	0	0	0	0
2	Digital art scene b1 THE INTERVIEW	internal material	4208 chars	1	100	0	100	0	0	0	0
3	Digital art scene b10interview	internal material	716 chars	1	100	0	100	0	0	0	0
4	Digital art scene b2 THE INTERVIEW	internal material	2844 chars	1	100	0	100	0	0	0	0
5	Digital art scene b3 THE INTERVIEW	internal material	3220 chars	1	100	0	100	0	0	0	0
	Digital art scene b5 the interviewer	internal material	3623 chars	1	100	0	100	0	0	0	0
	Digital art scene b6Adam Interview	internal material	7045 chars	1	100	0.81	99.19	0	0	0	0
	Digital art scene b7 Interview	internal material	5194 chars	1	100	0	100	0	0	0	0
	Digital art scene b8interview	internal material	2975 chars	1	100	0	100	0	0	0	0
	Digital art scene b9interview	internal material	650 chars	1	100	0	100	0	0	0	0
	Digital art scene b1 THE INTERVIEW	internal material	4208 chars	1	100	0	100	0	0	0	0
	Digital art scene b10interview	internal material	716 chars	1	100	0	100	0	0	0	0
	Digital art scene b2 THE INTERVIEW	internal material	2844 chars	1	100	0	100	0	0	0	0
	Digital art scene b3 THE INTERVIEW	internal material	3220 chars	1	100	0	100	0	0	0	0
	Digital art scene b4 interview	internal material	2461 chars	1	100	0	100	0	0	0	0
	Digital art scene b5 the interviewer	internal material	3623 chars	1	100	0	100	0	0	0	0
	Digital art scene b6Adam Interview	internal material	7045 chars	1	100	0.7	99.3	0	0	0	0
	Digital art scene b7 Interview	internal material	5194 chars	1	100	0	100	0	0	0	0
	Digital art scene b8interview	internal material	2975 chars	1	100	0	100	0	0	0	0
	Digital art scene b9interview	internal material	650 chars	1	100	0	100	0	0	0	0
	Digital art scene b1 THE INTERVIEW	internal material	4208 chars	1	100	0	100	0	0	0	0
	Digital art scene b10interview	internal material	716 chars	1	100	0	100	0	0	0	0
	Digital art scene b2 THE INTERVIEW	internal material	2844 chars	1	100	0	100	0	0	0	0
	Digital art scene b3 THE INTERVIEW	internal material	3220 chars	1	100	0	100	0	0	0	0
	Digital art scene b4 interview	internal material	2461 chars	1	100	0	100	0	0	0	0
	Digital art scene b5 the interviewer	internal material	3623 chars	1	100	0	100	0	0	0	0
	Digital art scene b6Adam Interview	internal material	7045 chars	1	100	0.79	99.21	0	0	0	0
	Digital art scene b7 Interview	internal material	5194 chars	1	100	0	100	0	0	0	0
	Digital art scene b8interview	internal material	2975 chars	1	100	0	100	0	0	0	0
	Digital art scene b9interview	internal material	650 chars	1	100	0	100	0	0	0	0
	Digital art scene b1 THE INTERVIEW	internal material	4208 chars	1	100	0	100	0	0	0	0
	Digital art scene b10interview	internal material	716 chars	1	100	0	100	0	0	0	0

Figure.D-3 Consistency analysis

AppendiX E - AR small program design experiment

In the process of research, I am also trying to develop some AR small programs to experiment the integration of digital art scenes and real scenes of virtual reality technology at OOELI

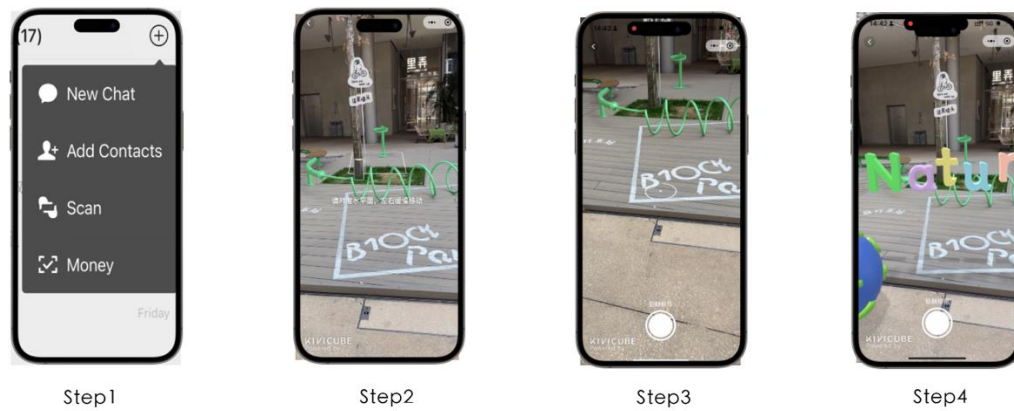


Figure.E-1 The steps of using small programs in wechat



Figure.E-2 Ooeli Live scene 1



Figure.E-3 Digital art scene combined with virtual



Figure.E-4 Ooeli Live scene 2



Figure.E-5 Digital art scene combined with virtual



Figure.E-6 Ooeli Live scene 3



Figure.E-7 Digital art scene combined with virtual