Xingcheng Ancient City: The Digital Protection and Inheritance of the Early Qing Dynasty Cultural Heritage in Liaoning

Yijia Sun

A Thesis Submitted in Partial Fulfillment of Requirements for
degree of Doctor of Philosophy in Cultural Science
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เมืองโบราณซิงเฉิง: การรักษาและการถ่ายทอดมรดกวัฒนธรรมเหลียวหนิงราชวงศ์ชิงในรูปแบบดิจิตอล

วิทยานิพนธ์

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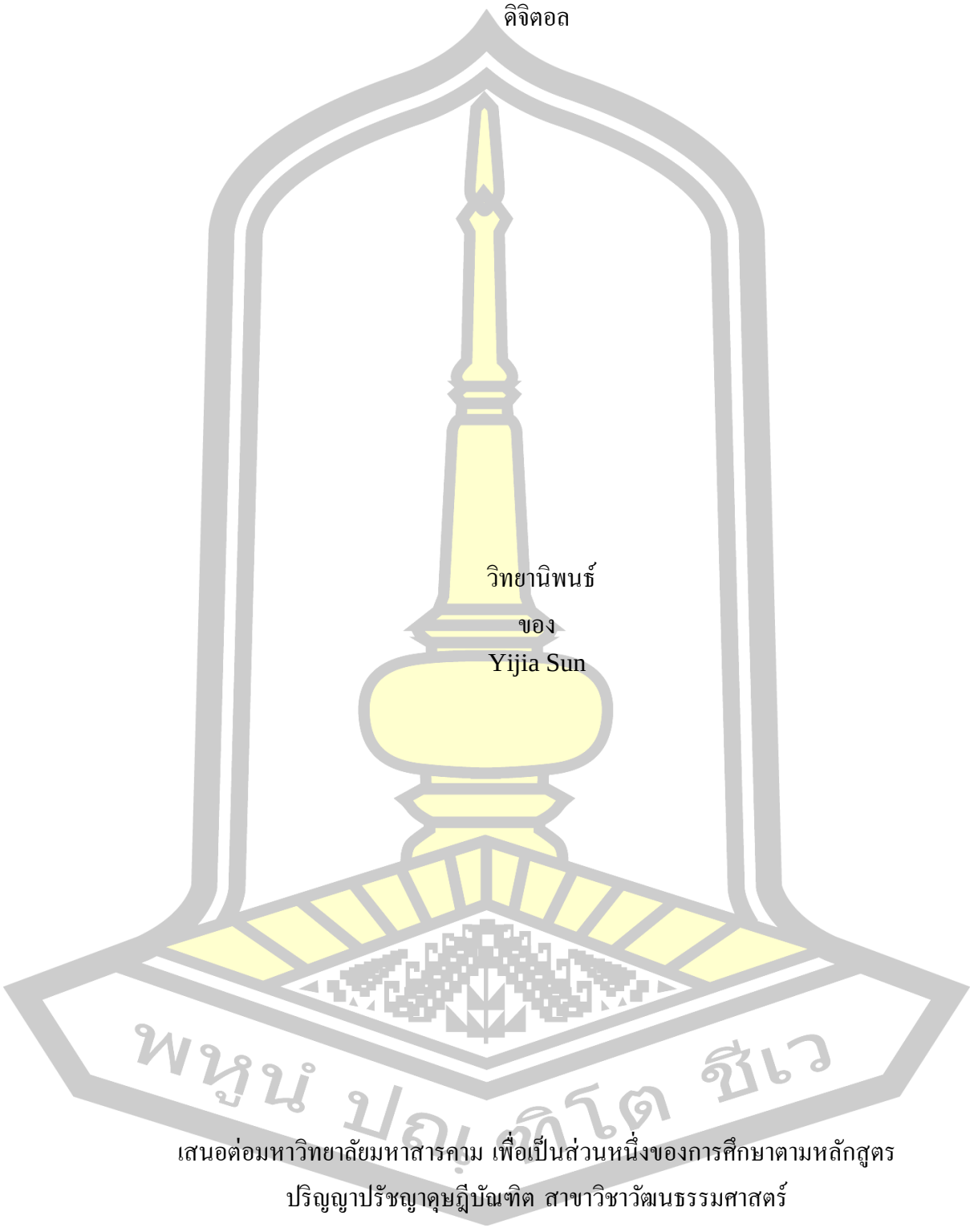

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ABSTRACT

The architectural cultural heritage of the ancient city of Xingcheng has distinct historical and cultural value, providing an important research sample for this article. This study took the national key cultural relics protection unit of Xingcheng Ancient City as the research object, and conducted a mixed study that combined qualitative and practical research. This research has 3 core objectives: 1) To study the history and development of inheritance in Xingcheng Ancient City; 2) The current problem and the form of cultural heritage for digital media design; 3) Develop digital systems for protection and transfer of knowledge about cultural heritage. This study will conduct on-the-spot research in Xingcheng Ancient City, Xingcheng Folk Museum, Huludao Cultural Center and other places multiple times from July 2022 to October 2023. This study collected data through document analysis, interviews, observations, in-depth interviews and group discussions. The sample consists of 33 people. Through talking about the needs of the target group and descriptive analysis, the following conclusions are drawn:

The research results are as follows: (1) The research results can sort out the history and development of Xingcheng Ancient City into four stages: namely, the stage from which Xingcheng Ancient City was a military town to a state of defunct defense, full of wars and changes, the modernization development stage, and the protection and inheritance stage.

(2) Through the analysis of the current protection and inheritance status of Xingcheng Ancient City, it is found that the protection of the ancient city is still only static protection, lacking dynamic protection methods, and the unique cultural connotation of the ancient city architecture is vague. Therefore, this study deeply explores the architectural style and cultural connotation of the ancient city of Xingcheng, uses the concept of cultural genes to sort out and extract the unique culture of the ancient city, and extracts and effectively organizes the core cultural genes of the ancient city based on the different expression forms and identification dimensions of cultural genes. The internal cultural logical structure constructs a genealogy diagram of Xingcheng Ancient City's cultural genes, thereby increasing the systematic academic data on the cultural heritage of Xingcheng Ancient City and enriching the statistical information of Xingcheng Ancient City's cultural data.

(3) Combined with digital means, use information visualization means to translate the extracted important and unique historical and cultural information of the ancient city into a visual language familiar to the audience, and disseminate information through the construction of digital websites to enhance the attractiveness of the ancient city culture and enhance the local culture Recognize, strengthen educational inheritance and community participation, thereby better protecting the ancient city culture and providing new ideas for the inheritance of ancient city culture.

Keyword : Xingcheng Ancient City, Cultural Heritage, Digitalization, Protection and Inheritance

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These three years of study have been more like a wonderful journey, different from the past, which was always full of unknowns, but this time should be a phased end on my path to study.

There are many important stages in life, and at each stage you will meet different mentors and close friends. Every decision in adulthood is determined and full of expectations. I still remember that when I first met Maha, I felt a little unfamiliar and a little worried, but now I can't bear to leave here, the people here and the stories here.

First of all, I would like to thank my dearest mentor, Assoc Prof. Dr. Sitthisak Champadaeng, who is very serious and loves to laugh. He gave me a clear direction while I was writing the thesis, and helped me time and again until I successfully completed the thesis. I would also like to thank every teacher who gave me wonderful classes: Dr. Thitisak Wechakama, Dr. Boonsom Yodmalee, Assoc Prof. Dr. Sastra Laoakka. I would like to thank Associate Professor Nisanart Sopapol, Associate Professor Theerapong Meethaisong for providing a lot of suggestions for my thesis, which made my thesis richer, and I would like to thank Asst Professor Kittiphong Praphan for helping me, I am very grateful.

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Finally, I would like to thank my family, my husband and myself. There will be many unknowns on the road ahead, so stay curious and stand on solid ground.

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CHAPTER I
INTRODUCTION

1.1 Background of the Research

Xingcheng Ancient City is located in Liaoning Province, China. Liaoning Province is located in the northeast of China, while Xingcheng Ancient City is located in the southwest of Liaoning Province, on the west coast of Liaodong Bay. The ancient city was built along the river and against the mountains, guarding the Shanhaiguan defense line. Xingcheng Ancient City is one of the four most complete Ming Dynasty ancient cities in my country and the only existing square ancient city. It was listed as a national key cultural relic protection unit in 2006 and has now entered the World Cultural Heritage Preparatory List. Since the construction of the ancient city of Xingcheng in the third year of Xuande in the Ming Dynasty (1428), for about 600 years, the ancient city of Xingcheng has cultivated a profound cultural heritage and connotation. (Fan, X.Y.,2006).

China's thousands of years of history and culture have given birth to many ancient cities. The ancient cities have rich historical relics and vast areas of historical buildings. Ancient cities are important representatives of Chinese history and important evidence for historical research in different stages of my country. They are the result of cultural preferences and cultural development in different periods of our country, and are the integration of human culture and the natural environment (Wang, R.X.,2019).

Since the 1980s, culture and development have increasingly attracted widespread attention from countries around the world. The integration and globalization of the world economy and the development of high-tech science and technology, especially information and media technology, have caused people to pay close attention to the development of culture. More and more countries and cities recognize the huge influence and constraints that culture has on contemporary social and economic life. The impact of globalization on world development is not limited to economic and international exchanges. The globalization of culture is becoming increasingly prominent. Compared with the "hard power" of political economy,

culture is a kind of "soft power", but its influence and penetration on the economy and society are continuous. Contemporary global city competition is a game based on culture. On the basis of certain hardware, "soft power" has become the main "chip" in the competition. Competitive cities will be cultural cities and cities with cultural originality. Because of this, in recent years, many countries and regions have begun to regard cultural and creative industries as strategic industries and pillar industries, and cultural and creative industries have become new engines to promote urban development. Culture has become the driving force for urban development in the new century (Gao, H.Y.,2007).

In 2014, Xi Jinping elaborated on the importance of historical and cultural protection during his inspection in Beijing. He pointed out that history and culture are the soul of the city, and the city's historical and cultural heritage must be protected as much as one's own life (Yu, C.M.,2018).

The "Guidelines for the Protection of Cultural Relics and Monuments in China" promulgated by the state in 2015 encourages the use of digital methods to bring missing cultural relics and monuments back to the world based on historical relics. The national "Twelfth Five-Year Plan" proposes to use contemporary information technology to build a national cultural relics resources basic database, a cultural relics preventive protection platform and a digital museum project (Ze, J.,2017).

The national "Thirteenth Five-Year Plan" once again emphasizes "strengthening the protection of cultural and natural heritage, inheriting historical context, and building a humanistic city" (Liu, T.& Qian, Y.,2017).

The National New Urbanization Plan (2014-2020) proposes that urban cultural resources should be explored in the construction of new cities, cultural inheritance and innovation should be strengthened, and the city should be built into a charming humanistic space with rich historical heritage and distinctive characteristics of the times. Pay attention to the protection of historical and cultural heritage, national cultural styles and traditional features in the reconstruction of old cities, and promote the combination of functional improvement and cultural relic protection. Pay attention to integrating traditional cultural elements into the construction of new cities and new areas to coordinate with the original natural and humanistic characteristics of the city.

Strengthen the exploration of cultural resources and the overall protection of cultural ecology in famous historical and cultural cities and towns, historical and cultural blocks, and ethnic towns, inherit and carry forward excellent traditional culture, promote the development of local characteristic culture, and preserve urban cultural memories. Encourage the diversified development of urban culture, promote the integration of traditional culture and modern culture, local culture and foreign culture, and form a diverse and open modern urban culture (Ministry of Land and Resources of the People's Republic of China,2014).

Articles 4, 17, 18 and 31 of the "Urban and Rural Planning Law of the People's Republic of China" (2008) clearly state that "protect historical and cultural heritage and maintain local characteristics, national characteristics and traditional styles", “Protection of historical and cultural heritage” and other related requirements (Standing Committee of the National People’s Congress of the People’s Republic of China, 2010).

In this context, what methods should be used to protect and inherit the unique cultural resources of the ancient city of Xingcheng, and improve the recognition of the ancient city culture by the people of the ancient city, especially young people, so that in the context of urban modernization, they can better integrate its protection and Inheritance will be a matter of need. Therefore, this study focuses on the unique historical and cultural value of Xingcheng Ancient City, and deeply explores the history and development of Xingcheng Ancient City. Using the concept of cultural genes, the ancient city culture was extracted and sorted out. Based on the different expression forms and identification dimensions of cultural genes, the core cultural genes of the building complex of the national key cultural relics protection units in Xingcheng Ancient City were extracted, and information visualization samples of the four building systems were constructed. , and at the same time disseminate information visualization samples through digital websites, allowing more groups, especially young people, to understand the architecture of Xingcheng Ancient City and the cultural connotations behind the architecture, and broaden the channels and methods of disseminating the ancient city's heritage culture.

1.2 Objectives of the Research

1.2.1 To study the history and development of inheritance in Xingcheng Ancient City

1.2.2 The current problem and the form of cultural heritage for digital media design

1.2.3 Develop digital systems for protection and transfer of knowledge about cultural heritage

1.3 Research Questions

1.3.1 What kind of history has Xingcheng Ancient City experienced and how did it develop? What was the opportunity for them to build this ancient city, and how did it become a famous historical and cultural city?

1.3.2 What is the current status of the inheritance of Xingcheng Ancient City? What is the relationship between its architectural form and the unique cultural connotation behind the building?

1.3.3 How to combine digitalization with the protection and inheritance of the ancient city? What kind of digital methods are there to protect and inherit the cultural resources of the ancient city of Xingcheng?

1.4 Importance of Research

1.4.1 Add systematic academic data and statistical information on the cultural heritage of Xingcheng Ancient City

This study systematically sorts out the cultural genes of the ancient city of Xingcheng through the perspective of cultural genes. The research results can enrich the cultural database of the ancient city of Xingcheng and provide detailed information for relevant researchers.

1.4.2 Enhance local cultural identity, strengthen educational inheritance and community participation

The ancient buildings of the Ming Dynasty are the core cultural gene carriers of the ancient city of Xingcheng. They record the rise and fall of the ancient city of Xingcheng and reflect the historical stories of different periods. After field investigation, it was found that due to the variability and instability of culture, it is

easy to Affected by environmental changes, it will also affect the values of the village. Nowadays, many local young people and children do not understand the culture behind these buildings. Some young people go to the city and bring back a lot of new culture. Local villagers Started to pursue new things blindly and ignored traditional culture. Therefore, this study integrates cultural genes and uses interactive means such as visualization and augmented reality to enhance local cultural identity while strengthening educational inheritance and community participation.

1.4.3 Provide support for policies formulated by local governments and relevant national departments

This research hopes to provide support for relevant policies formulated by local government departments or relevant national departments. The Chinese Cultural Gene Database has been accumulating and organizing in recent years. At the same time, from the perspective of world heritage, the ancient city wall of Xingcheng is being It has been declared a World Heritage Site and has been included in the candidate list. Xingcheng Ancient City covers many cultural heritages , but its current development is not very good and needs continuous excavation and presentation. It will also have a certain impact on the work of applying for world heritage. The writing of this article will also be based on the laws and regulations of international organizations such as the World Heritage Protection Organization, using new digital media to point out the direction for the inheritance of ancient city culture and contribute to the inheritance of ancient city culture .

1.5 Definition of Terms

1.5.1 History and development refers to the period from the founding of the ancient city in 1428 to 1912 to the feudal period, 1912 to 1949 to the period of the Republic of China, 1949 to the founding of New China in 1978 to the period of socialist construction in New China, 1978 to —Since the reform and opening up. The social history and meaning changes of the ancient city of Zhongxing City in these four periods.

1.5.2 The cultural heritage of Xingcheng Ancient City refers to the national key cultural relics protection units in Xingcheng Ancient City: Xingcheng Ancient City Wall, Xingcheng Confucian Temple, Xingcheng Bell and Drum Tower, and

Xingcheng Stone Square. They were merged into Xingcheng Ancient City in 2006 and were awarded Evaluation of national key cultural relics protection units. National key cultural relics protection units are cultural relics units designated by the State Council of China to provide special protection for cultural relics with important historical, artistic, and scientific values. These units represent the rich heritage of Chinese history and culture, including architecture, sculpture, calligraphy and painting, ancient artifacts, etc.

The following are some common types of national key cultural relics protection units: Architecture: ancient palaces, temples, city walls, city gates, ancient residences, etc. The protection of these cultural relics units is jointly undertaken by the State Administration of Cultural Heritage and local cultural relics departments. The determination of national key cultural relics protection units is a systematic task that requires consideration of multiple factors such as the historical, artistic, and scientific value of cultural relics. Since this list is constantly updated, specific national key cultural relics protection units can check the latest information through relevant official channels or cultural heritage departments.

1.5.3 Cultural genes are to introduce the concept of genes into the cultural field and explore the basic genetic units of culture. Urban culture is just like people. Although it has many origins, it also has its genetic code: the precipitated material culture is its surface, the diverse production and life of citizens are its cells, and the temperament and spirit of the city are its soul. Urban cultural genes control the elements and patterns of urban culture, guiding the city to operate according to a certain trajectory. Under special conditions, new elements and patterns can also be created. Urban culture also has dominant genes and recessive genes, carrying out dominant and recessive inheritance. Cultural genes are the interpreters of the city's historical appearance, the qualitative stipulation that gives the city a distinction from other cities, and the basic driving force that controls the future direction of the city. Many well-known cities in the world have their own cultural genes, and they carry out cultural positioning based on the genes, such as Tokyo as the "City at the Crossroads of Eastern and Western Cultures", Rome as the "City of Classical Culture", and London as the "City of Choices Full of Opportunities" , Vienna, the "hometown of world music", Paris, the "clothing capital of the world" and the "romantic capital of

the world". From the perspective of cultural genes, this study sorted out, analyzed, and extracted the culture of Xingcheng Ancient City into a unique cultural gene genealogy library of Xingcheng Ancient City.

1.5.4 Information visualization includes a complete set of models and implementation paths. It can not only help people understand large-scale data collections, but also display and observe the attributes and meaning of information in the visualization space that processes data and information, allowing information to be displayed The hidden relationship with information reception becomes intuitive and obvious, achieving effective transmission and interaction between people and information. This research on information visualization in digital websites is not only to present the textual information of rural cultural heritage, but also to explore the characteristics and connotations behind cultural heritage and transform it into visual design methods and design symbols.

1.5.5 Information architecture theory refers to the technology of abstracting the data information of software products and combining and classifying the information before designing the actual user interface of the software product. By classifying, organizing and designing the information, in order to achieve Make it easy for users to find and use. Information architecture generally includes a combination of organizational systems, navigation systems, classification systems, and labeling systems. Information architecture not only makes the information presented to users more scientific, but more importantly, enhances the understandability and accessibility of information. It helps users quickly find the information they need by reasonably organizing information classification and designing a navigation structure. Greatly reduces the user's learning cost.

1.5.6 Digitization is divided into two aspects: information visualization and the construction of digital websites. Information visualization is to translate the screened and extracted important and unique historical culture, architectural culture, and military culture information of the ancient city into a visual language familiar to the audience. The construction of a digital website is to disseminate information visualization content through the digital website, thereby providing new ideas and methods for the cultural protection and inheritance of the ancient city.

1.5.7 Lasswell's Communication Model is a communication theoretical model proposed by sociologist Harold D. Lasswell in 1948. The model attempts to answer basic questions in the information dissemination process and provides a framework for systematic analysis of communication activities by emphasizing five key questions. Here are the five key questions of Lasswell's communication model: Who, Says What, Through Which Channel, To Whom, With What Effect. The theoretical basis of Lasswell's communication model lies in an in-depth analysis of all aspects of information communication through the answers to these five key questions. The simplicity and intuitiveness of this model make it an important tool in communication research and practice. It provides a framework for systematically thinking about information dissemination activities for the practical part of this study, helping to disseminate information more effectively.

1.5.8 Learning Xingcheng ancient city culture means that young people understand and understand the unique style of Xingcheng ancient city architecture and the cultural connotation behind the architecture through the digital system.

1.6 Conceptual Framework

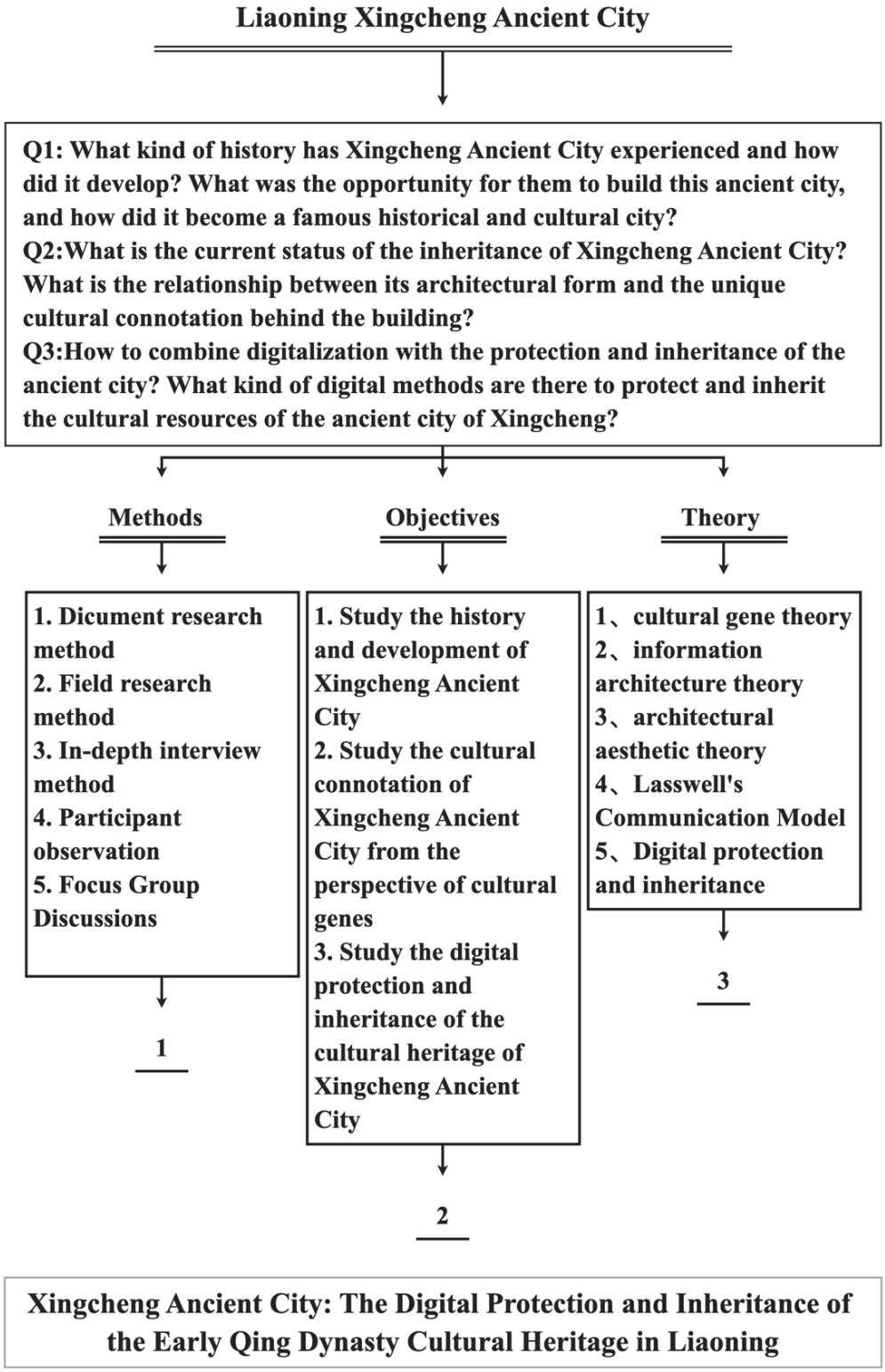

Table 1- 1 Conceptual framework

Source: Sun Yijia (2023)

CHAPTER II
LITERATURE REVIEWS

This chapter mainly introduces relevant literature on Xingcheng ancient city culture and cultural digital protection and inheritance, introduces research concepts and research progress of related concepts, and provides a basic part for further research in this article.

2.1 “Developing the City” and “Urban Culture”

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2.1.2 Urban culture

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2.1 “Developing the City” and “Urban Culture”

2.1.1 Xingcheng City

Xingcheng as a county seat, has a history of 1,033 years so far (2023). In 1986, the State Council approved the Ministry of Civil Affairs' "Report on Adjusting the Standards for Establishing a City and the Conditions for Municipal Leadership of Counties" (Guofa, [1986], NO.46) It is stipulated that in a county with a total population of more than 500,000, the non-agricultural population of the town where the county people's government is located is generally more than 120,000, and the annual gross national product is more than 400 million yuan, the county can be removed and a city can be established, including ethnic minority areas and Although the population and gross national product of remote areas and other areas do not meet the standards, municipal institutions can also be set up if necessary.

In 1986, the Xingcheng County People's Government decided to apply to remove the county and establish a city, and submitted the application in accordance with the procedures. The State Council's 1987 short-term and long-term planning for county-to-city conversion stipulates that the six counties in Liaoning Province that can be converted into cities in the near future include Jinxi, Beipiao, Xinmin, Fengcheng, Haicheng, and Xingcheng. "Removal of counties and establishment of cities" has five aspects of impact on local governments. First, the organizational structure and other aspects are more adapted to the needs of urbanization development. Many institutional functions corresponding to "cities" have been added, strengthened, expanded or upgraded. Second, relevant standards for urban construction will be improved, and urban construction land will generally increase to a certain extent. Third, it plays a role in shaping the image of development and promoting investment promotion. Fourth, we can obtain more working capital and considerable urban construction expenses financially. Fifth, we can strive for more projects and funds. In December 1986, the State Council approved the establishment

of a city in Xingcheng County and the removal of a county. On January 21, 1987, the "Fourth Meeting of the 10th Xingcheng County People's Congress" was held at Xingcheng Xinghua Theater (originally located in today's Xinglong Family Shopping Center), with 338 representatives present. Passed the "Resolution on Cancellation of Major Issues Related to the Establishment of Xingcheng City in Xingcheng County". In January 1988, the State Council listed Xingcheng City Wall as a national key cultural relic protection unit.

In March 1988, the State Council included Xingcheng in the expanded coastal economic development zone. In August 1988, the State Council approved Xingcheng Seaside Scenic Area as a national key scenic spot. In 1990, the provincial government approved Xingcheng as a famous historical and cultural city in Liaoning Province. In 1991, the Ministry of Forestry approved Shoushan as a national forest park. In 1995, Xingcheng City was rated as an outstanding city in the country for comprehensive urban environment management. In 2002, Xingcheng was rated as a national health advanced city. In 2004, Xingcheng was rated as a national outstanding tourist city. In January 2005, the Xingcheng city wall and the city walls of Xi'an, Ganzhou and Nanjing were officially declared as world cultural heritage in a bundled form. In the same year, Xingcheng was rated as an advanced city for national progress and selected as one of the top 200 charming cities with Chinese characteristics. In 2006, the Bell and Drum Tower, Zushi Stone Square, Xingcheng Confucian Temple and the third batch of national key cultural relics protection units Xingcheng City Wall were merged into Xingcheng Ancient City, which was announced as the sixth batch of national key cultural relics protection units. In 2007, it was selected as one of the "Top Ten in China " Ancient City" (Wang, J. H.,2005).

2.1.2 Urban culture

2.1.2.1 “Culture” and “Urban Culture”

The scope of “culture” is quite broad and complex. In a broad sense, culture can be said to be the material and spiritual production capabilities acquired by human beings in the process of social practice and the sum of the material and spiritual wealth created; in a narrow sense, it refers to spiritual production capabilities and spiritual products, including Forms of social consciousness, natural sciences, technical sciences, social ideologies. Gao Hongyu mentioned that culture is a social

and historical phenomenon that is closely connected with all aspects of human existence and development. It embodies and is responsible for the purpose and requirements, achievements and destiny, values and choices of human historical development and historical creation(Gao, H. Y.,2008). The famous American anthropologists (Kroeber, A. L. & Kluckhohn, C.,1952). Extensively sorted out relevant literature and found that there are more than 160 definitions of "culture", classifying different cultures and their definitions.

China is currently emphasizing "confidence in the road, confidence in the system, and confidence in the culture" on the road to great rejuvenation as a cultural power. CCTV3 variety show channel - Cultural Noon program is also constantly promoting: "Culture is a kind of power, culture is an influence". What exactly is culture? What is urban culture? How does culture play a role in urban construction? What content does urban culture include? Which urban culture can serve as a core factor in urban development and promote the protection and inheritance of ancient cities. The above issues are discussed in this chapter on urban culture. the key and core.

Because urbanization and modernization started earlier in Western countries, the depth and breadth of urban culture research are at the forefront of the world. The research on the content of urban culture is relatively comprehensive and profound. Many Western countries believe that cities need "historical space". The city's cultural protection and promotion of its own nation or city is regarded as a noble responsibility of the nation and the country. It plays an important role in the development of urban infrastructure and the cultivation of the ethics of urban residents. Not only is cultural content integrated into urban planning, but it is also raised to a strategic level.

The earliest study of urban culture in Western countries was in 1903, when the German sociologist Simmel published the article "Urban and Spiritual Life": "The high-density stimulation and high-frequency interactions in cities have created the unique psychological experience structure and structure of urban people. Mental attitude. Urban people are good at calculations, communicate with each other using their brains rather than their hearts, and have an indifferent attitude. This is in sharp contrast to the close interpersonal relationships in village communities in the past.

Simmel's academic intention is to reveal the impact of urban space on urban personality and its impact on the city. The influence of human behavior" (Simmel, G.,1995).

From 1915 to 1940, the Chicago School of Sociology led by Parker put forward the emphasis on urban culture. R.E. Parker, a representative of the school, pointed out in "Cities: Some Opinions on the Study of Human Behavior in the Urban Environment" that cities are not It is not a collection of many individuals, nor is it a collection of various social facilities or a simple collection of various civil affairs institutions. "A city is a psychological state and a whole composed of various customs and traditions. In other words, a city is anything but A simple material phenomenon is by no means a simple artificial structure. The city has been closely connected with various important activities of its residents. It is a product of nature, especially a product of human attributes". Voss, another representative of this school, studied urbanism from the perspective of lifestyle. The opening chapter of his "Urbanism as a Lifestyle" published in 1938 said: "Just like the beginning of Western civilization was settled by nomadic peoples As the Mediterranean basin marks, the most significant sign of the beginning of modern human civilization was the growth of the metropolis"(Wirth, L.,1995).

In 1938, Mumford published the book "The Culture of Cities", and in 1961 he published the world-renowned and most prestigious book "History of Urban Development". He believed: "The most important function of a city is its impact on human beings." Those functions that are significant in higher levels of life" (Lewis, M.,2000). He said: "The city should be an organ of love, and the best economic model of the city should be to care for and cultivate people." The city in history was originally the home of God, a place that represents eternal value and displays divine power. Mumford connected the origin, development, and evolution of cities with religion. The main academic purpose is probably to demonstrate the "eternal value" and its importance in the development of human civilization; without it, there would be no human urban civilization, and human culture would become purposeless. blind process. Therefore, he synthesized Western religious thought and teleological thought and put forward an extremely metaphysical assertion: "The ultimate task of the city is to promote people to consciously participate in the process of the universe and history

(Lewis, M.,2000) ". Although Mumford's assertion has certain religious ideas, it also raises a question for urban researchers that must be seriously considered, that is, urban research must have a clear ideological theme. Only in this way can urban cultural research be guaranteed to have the character it deserves as a humanities academic.

In 1961, French geographer Jean Gottmann published the book "Urban Belt: The Urbanized Northeastern Coast of the United States". Since then, a new compound word Boswash has appeared in American English, referring to this city. The Belt, also known as the "Boston-Washington Corridor." According to Gottman's research, the Boswash provides numerous basic services to the entire United States. It is a huge functional urban area, just like a community accustomed to drawing from its city. As the center receives services, it could be nicknamed America's "Main Street." Many urban geographers have studied and borrowed the concept of urban belt, applying it not only in the United States but also around the world. Therefore, it can be said that the current research on urban culture in Western developed countries is not only limited to the development of the city itself, but has also developed into the urban spatial structure.

The French anthropologist Armand Master explained the culture created by various human nations from the perspective of cultural anthropology. Culture is the self-protection of the continuation of the human race to reveal the essence of human culture; the American scholar Lester explained from the perspective of cultural constructivism that civilization is the human race. Practice produces the essence of accumulation; British scholar Snowe tells people from the perspective of cultural sociology that society is the foundation of culture(Clarke, D. B.,2003); British scholar Hall believes from the perspective of cultural ecology that culture means vitality and its contribution to the city continues to increase; American scholar Frisker clarified the economic logic and economic structure of the cultural industry from the perspective of cultural economics. Culture is derived from economic and social benefits; and Americans Druke and Brooke discussed from cultural management that culture not only needs to be transmitted, but also needs to be restrained and manage. Mokara, a cultural project officer of UNESCO, discussed from the perspective of cultural geography that culture originates from the geographical environment, as well

as the distribution, spatial combination and development and evolution laws of various cultural phenomena.

"Urban Sociology" written by RE Parker, the founder of the Chicago Urban School, believes that if you look at a city from a cultural perspective, it is a psychological state that reflects the psychological needs of human behavior and is composed of various customs, civilizations and traditions. overall (Parker, R. et al.,1999). Lewis Mumford's 1961 book "A History of Urban Development: Origins, Evolution and Prospects" conducted a systematic and in-depth study of New York and its surrounding areas from a sociological and ecological perspective, and made outstanding contributions. It lies in revealing the relationship between urban development, civilization progress and cultural renewal (Lewis, M.,2000). Urban planning master Le Corbusier (France) looked at urban culture from an architectural perspective. Corbusier believed that urban planning and layout and architectural forms should be based on a humanistic perspective, and architectural forms should reflect humanistic care and display humanistic temperament.

What is the relationship between cities and culture? Xunzi, the ancient Chinese philosopher, once said: "When you enter the country, you will see its customs. The people are simple, the music is not filthy, and the people who obey are not obscene. You can't help but sigh at the governance." The Western planning master Salining also concluded: "According to your The house you live in will tell you who you are, and the appearance of the city will tell you the cultural pursuits of the residents here." Lewis Mumford further proposed that the earliest ceremonial gathering place of human beings was the initial embryo of urban development, which showed that human beings are spiritually different from animals. The domestication of wild animals and plants and the domestication of humans themselves are objective processes that go hand in hand with the domestication and transformation of natural terrain; and the nature transformed by humans is an important part of the city that later formed. He vividly compared the city to a "container, disseminator and disseminator", and called "cultural storage, cultural dissemination and exchange, and cultural creation and development" the "three most basic functions of the city". This all shows that cultural essence is the core of the city (Xu, Y. F.,2007).

With the continuous development of my country's urbanization process and urban construction, Chinese scholars' research on culture is mostly concentrated in the fields of literature and art, and there are relatively few research results in the fields of planning and architecture. Before the 1980s, it was mainly the introduction and introduction of Western urban culture research theories and methods. Generally speaking, the current research on urban culture in China is still in its initial stage of development, and the research on urban culture construction is mostly concentrated in the theoretical field. Since the 1990s, the reconstruction of old cities in various places has gradually lost the local characteristics and traditional characteristics of the original cities. Many architectural planners and scholars have strongly called for "the city must develop without losing its characteristics." Cities and culture go hand in hand, directly affecting the way citizens think and behave.

Writer Feng Jicai believes: "As an accumulation of historical culture, local culture is the unique spiritual creation and historical record of the local people." Urban culture should be established by people through continuous historical development and long-term social practice. It has accumulated national characteristics and is a cultural form formed under the practice of the natural environment and social environment. The local culture in the new era not only has strong local color but also has a certain historical inheritance. It is a regional culture that can integrate history and modern civilization and reflect local humanities, customs and natural characteristics. Local culture is the soul of urban architecture (Dong, Y.P.,2014).

Zhang Hongyan (2002) regards urban culture as a form of capital existence and believes that cities are the gathering place of human material wealth and the innovation place of human spiritual culture. If you understand the city from the perspective of cultural capital, you will find that the city has a whole new world and level. Urban culture is the appearance of the city and the humanistic spirit of the citizens (Zhang, H.Y.,2002). Chen Lixu (2002) emphasized the systematic nature of urban culture, and urban culture is composed of many subsystems. The structure of urban culture is the different levels displayed by the urban cultural system. Urban culture is the sum of the achievements of human material civilization and spiritual civilization, which is inherited by the times. Urban culture is an organic whole formed by the mutual influence and interaction between various levels (Chen, L.X.,2002).

The spatial, social and historical nature of cities are interrelated, and urban culture reflects human action practices and meanings in urban space. According to Wang Enyong's research, urban culture is usually divided into three categories: material culture, institutional culture and spiritual culture (Wang, E.Y. et al.,2008). Material culture reflects the relationship between man and nature. Institutional culture is used for normative constraints, such as institutional norms and legal systems. Spiritual culture is diversified, dominant, and the core of culture.

Ding Jijun, Ye Ling, etc. believe that through rational layout of urban space, adhering to the human scale, paying attention to the development of urban regional context, emphasizing historical and cultural characteristics, and developing urban cultural space through characteristic design strategies such as its role and inheritance in urban functional zoning (Ding, J. J. et al.,2011). Many experts and scholars in the academic world have conducted specialized research on urban culture in the fields of economics, geography, sociology, history, demography, culture, environmental ecology, urbanism, and urban planning.

In the article "Research on Old City Renewal Based on Cultural Inheritance", urban culture is divided into material culture, institutional culture and spiritual culture, clarifying the connotation of culture (Wang, W.Z.,2010). In summary, although the research focuses are not necessarily related, they all agree that urban culture should include material culture, spiritual culture and institutional culture. According to urban culture, it is the sum of the inherent morphological characteristics of the city and the material and spiritual production capabilities and material wealth and spiritual wealth created by human beings in the process of social practice, and it becomes richer with the continuous evolution of human history. Generally speaking, urban culture and ancient city culture should cover the inherent natural environment culture of the city, all the material heritage accumulated by the city's history, and the intangible folk culture formed by the life of urban citizens. This study of the author mainly focuses on the architectural culture in the material culture.

Therefore, it can be said that the city is the main component and carrier of culture, and culture is the symbol and internal cause of urban progress.

2.1.2.2 Urban culture classification

In the article "Research on Old City Renewal Based on Cultural Inheritance", urban culture is divided into material culture, institutional culture and spiritual culture, clarifying the connotation of culture (Wang, W.Z.,2010). In summary, although the research focuses are not necessarily related, they all agree that urban culture should include material culture, spiritual culture and institutional culture. According to urban culture, it is the sum of the inherent morphological characteristics of the city and the material and spiritual production capabilities and material wealth and spiritual wealth created by human beings in the process of social practice, and it becomes richer with the continuous evolution of human history. Generally speaking, urban culture and ancient city culture should cover the inherent natural environment culture of the city, all the material heritage accumulated by the city's history, and the intangible folk culture formed by the life of urban citizens. This study of the author mainly focuses on the architectural culture in the material culture.

2.2 “Xingcheng Ancient City” and “Ancient City Culture”

2.2.1 “Ancient City” and “Ancient City Culture”

The ancient city was created by the intersection of material space and spiritual space, leaving traces of changes in a city's social, cultural, economic and historical activities. Due to different geographical locations and historical backgrounds, each ancient city has its own distinct ancient city culture, which is the sum of all material and spiritual products created by people. It is the tangible and intangible formed over a long period of time by factors such as geography, history, economy, and society. culture (Yue, Z. Y & Li, L.,2019).

Ancient city culture often needs to be inherited by relying on the spirit of literati, documentary carriers, and architectural remains (Chen, Z.,2019).The cultural and historical celebrities of the ancient city are the cultural business card of the ancient city. Their spiritual qualities are often what modern people lack and need to learn. The essence of literati culture is the symbol of the spirit and consciousness of the ancient city, the condensation of literati sentiment and character (Wang,W.Z.,2011). Therefore, exploring the cultural image and contemporary value of historical celebrities in the ancient city is of great significance to public education

and order maintenance (Han, C. M.,2019) ". Ancient city documents mainly include county annals, local annals, genealogy, biographies, place names and monographs, etc., which record the development of the ancient city in detail. They are valuable materials for studying the history and culture of the ancient city and are the information carrier of the ancient city culture. Organizing and excavation of ancient city documents can promote The construction of spiritual civilization in ancient cities, thereby establishing the correct value orientation (Xu, Y.,2019). Ancient cities often retain many historical and vernacular buildings such as ancient houses, city walls, ancient temples, bell towers, county offices, academies, stages, gardens, etc. As an important carrier of ancient city culture, they demonstrate the spiritual temperament of the ancient city (Deng, Z.W.,2021), and reflect the degree of social, economic and cultural development and the characteristics of the times in the historical period (Yan, T. L.,2010) .

The direct starting point for the protection and inheritance of ancient cities is to explore the relationship between urban culture and the planning and construction of ancient cities. Feng Jicai once wrote: "The historical and cultural form of a city is an important wealth of human culture. Especially those historical and cultural cities are the largest cultural relics alive on the earth, a variety of humanistic miracles, and a spiritual space full of charm. (Feng, J. C.,2000). " Some scholars also concluded : " A historical city is a container of culture, and this carrier of multicultural collection needs us to pass it on through intelligent means. The so-called " protection is development " shows that urban development is A metabolic process that is constantly updated and transformed (Tong, L., & Wang, M.,2014) . " Along with the rapid economic rise of this series of ancient cities, towns, and villages , it has also brought about a series of problems in cultural protection and inheritance. Based on the wide scope of national-level historical and cultural cities, the complete content of cultural relics, and the complete urban structure, the ancient city in this article mainly refers to the national key cultural relics protection unit and the provincial-level historical and cultural city Xingcheng Ancient City .

2.2.2 Excavation methods of ancient city culture

Each ancient city has its own unique cultural system and spiritual outlook. Excavate the cultural connotation of the ancient city, explore new paths for the

cultural inheritance of the ancient city, and provide cultural support for the sustainable development of the ancient city (Li, M. F & Deng, Y.,2021).The traditional cultural excavation method is to comprehensively collect and organize the cultural resources of the ancient city through multiple channels of literature review and field investigation, survey and map to record important cultural relics, systematically sort out the cultural carrier of the ancient city, and then condense the ancient city culture. It is true that subjective qualitative analysis and investigation based on historical materials, biographies and interviews (Chen, M.& Li, H. C.,2018) may lead to inaccurate excavation and extraction of ancient city culture. Space is the carrier of culture, and culture is the soul of space. Regional space forms regional culture, and regional culture constitutes landscape space. Culture turns space from abstraction to concreteness (Hu, X. Y & Zhang, X.,2021). Therefore, mining culture from ancient city space is a A good entry point.

An ancient city is a living environment built by people under a specific background, influenced by factors such as social situation, culture and history, and integrates historical and cultural characteristics. Studying the spatial pattern of the ancient city is of great significance to the excavation of historical culture and the continuation of the memory of the ancient city. Space syntax is a method to explore the relationship between spatial structure and human society by quantitatively describing the spatial structure of settlements, ancient cities, etc. (Hillier, B.,2009) . Through this method, we can analyze the spatial characteristics of ancient cities and obtain more historical information. , revealing the connection between the ancient city space and historical society, which can further refine the ancient city culture.

The form of the ancient city can show the local culture of the region, and the layout of the ancient city is inextricably linked with the feudal etiquette system. Ancient maps reflect the natural landscape and cultural and political conditions of the city during its historical period, record the historical planning of the ancient city, and have extremely high cultural research value. Even though historical maps are all imagery, according to current standards, scale, orientation, and shape are all ambiguous (Luo, H. et al.,2019) and cannot be directly used as reference materials for restoration. The historical map translation method is a digital technology that can provide in-depth understanding of historical information and accurate spatial

positioning. First, we need to collect and organize relevant information in ancient maps from historical documents, classify and extract map elements, sort out and process the data in layers, and obtain more information elements to build a database. Then visualize the digital information, draw historical maps at different spatial and temporal scales, and overlay them with the current digital map to find relevant elements and continuously correct them to improve the accuracy of map translation (Tan, Y. et al.,2016). This technology collects extensive historical information, accurately translates historical maps, and traces historical development. It is an important means to excavate the culture of ancient cities and shape the characteristics of ancient cities.

In summary, although the research focuses are not necessarily related, they all agree that urban culture should include material culture, spiritual culture and institutional culture. According to urban culture, it is the sum of the inherent morphological characteristics of the city and the material and spiritual production capabilities and material wealth and spiritual wealth created by human beings in the process of social practice, and it becomes richer with the continuous evolution of human history. Generally speaking, urban culture and ancient city culture should cover the inherent natural environment culture of the city, all the material heritage accumulated by the city's history, and the intangible folk culture formed by the life of urban citizens .

2.2.3 Xingcheng Ancient City

Xingcheng Ancient City is the most complete Ming Dynasty ancient city existing in my country, and is the epitome and model of the entire Ming Dynasty city architecture. This was once the only passage from the Ming Dynasty to Liaodong, and it was the first military town and command center guarding Guandong in the late Ming Dynasty. Throughout the ages, it has been a battleground for military strategists. Especially in the military defense system of the Ming Dynasty, Xingcheng integrates the garrison system, the beacon system, the post road system, and the coastal defense system. It is a non-renewable and the only living resource for studying the military system of the Ming Dynasty and the Ming Great Wall defense system. The specimen is also the best specimen for studying the Ming Dynasty's guard system. In the military defense system of the Ming Dynasty, there was no place like Xingcheng,

which integrated guards, posts, forts, posts, beacons, coastal defenses, islands, farming and grain farming. As the military defense system of the Ming Dynasty, its humanistic connotation is unmatched by any other ancient city in the Ming Dynasty. In the late Ming Dynasty, this place became the main battlefield related to the fate of the Ming Dynasty, and became the first military town and command center guarding the outside of the pass in the late Ming Dynasty. The armies of the Ming and Qing Dynasties fought repeatedly here. Hundreds of generals gathered in Ningyuan to guard the Guanning defense line and defend the Ming Dynasty. The famous "Ningyuan Battle" and "Ningjin Battle" both took place here, and the "Ningyuan Battle" was written into the world's military history books as a glorious battle example of a small victory over a large number. The two generations of emperors Nurhachi and Huang Taiji were both defeated at the foot of Ningyuan City. Huang Taiji could not even step into Ningyuan City until his death. The small Ningyuan City has left an eternal mystery. Yuan Chonghuan and his soldiers served the country loyally and defended Ningyuan, creating an invincible Ningyuan cavalry. The ancestors of the ancestors of Dashou guarded Ningyuan for the Ming Dynasty for 212 years, which was unprecedented in ancient times. Hong Chengchou led the 8th Route Army with a total of 130,000 troops to swear an oath here and set off to fight against Songshan.

Wu Sangui, the hero of the two dynasties who once proclaimed himself emperor, was the last general outside the Pass in the turbulent late Ming Dynasty. He loyally and tenaciously defended the last isolated city outside the Pass. Emperor Shunzhi ruled the Central Plains here, and the four emperors of the Qing Dynasty stayed here to worship their ancestors ten times. Emperor Kangxi passed through Ningyuan and shot a tiger, and Emperor Qianlong ordered Chaoyang Temple. Since the late Qing Dynasty, every spring and summer, a large number of Mongolian compatriots from Inner Mongolia and Fuxin, Chaoyang and other places in Liaoning Province have come to Xingcheng to worship the "holy water" and bathe in it to strengthen their health. In June 1924, Prince Horqin Zasak and Shuo Darhan of Mongolia came to Xingcheng to take a bath due to illness. The Central Ministry of Communications of the Beiyang Government under Zhang Zuolin approved the construction of the "Railway Bathhouse Hotel" in Xingcheng Hot Spring in 1927, which was later known as the "Zhang Zuolin Villa". Xingcheng has beautiful

mountains and rivers and outstanding people. Through the ages, there have been hundreds of civil and military generals such as first-rank officials of the imperial court, magistrates of prefectures, county magistrates, provincial governors, and mayors.

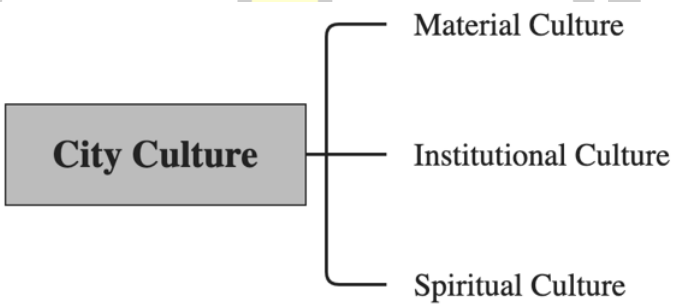
Wu Jinglian served as the speaker of the country four times and was one of the nine founders of the Kuomintang. He once organized the election of Sun Yat-sen as Generalissimo and personally delivered a eulogy to the Generalissimo. Kuangwu General Wang Chengbin intercepted the special train of President Li Yuanhong and forced Li Yuanhong to hand over his national seal. Wang Chengbin thus became the first person in Chinese history to dare to seize the presidential seal. The Eighth Route Army entered the Northeast and landed on Diaoyutai for the first time. The People's Liberation Army attacked Xingcheng and kicked off the Liaoshen Campaign. Hundreds of People's Liberation Army soldiers were stained with blood. "After death, I will not worry about the lack of brave generals, my loyal soul will still protect Liaodong!" How many emperors, generals and ministers, how many literati. The most unforgettable thing should be Yuan Chonghuan and those loyal and brave soldiers, those heroes who fought for the interests of the country and the people. The people of Xingcheng will never forget that their heroic names will shine through the ages. Although things are changing nowadays, things have changed and people have changed. But their traces can still be traced in ancient Xingcheng (Zhang, K. X. 2006) . To sum up, Xingcheng Ancient City is well-deserved as a famous historical and cultural city.

2.2.4 Classification of ancient city culture

At present, there are relatively few research results on the specific classification of urban culture. In 1997, Lu Jiarui and others published the article "A Brief Discussion on Urban Cultural Construction": "It is believed that urban culture includes design culture, architectural culture, natural environment culture, transportation culture, residential population culture, commercial culture, humanistic landscape culture, etc. Urban cultural construction We must follow the principles of economic practicality, sustainable development, comprehensive development and national participation" (Zhao, H.,2007). In 2004, Li Pengcheng's "On the Cultural Philosophical Basis of Contemporary Metropolis Cultural Construction" believed that

the cultural construction of metropolitan areas is divided into four major "cultural domains", namely material culture, institutional culture, spiritual culture and information culture. Only by understanding the In each of these four cultural domains, cities will inevitably or have undergone tremendous changes in the era of globalization. Only then can we concretely study the cultural issues of metropolitan cities in this era, foresee the cultural trends of metropolitan areas, and truly grasp the cultural trends of metropolitan areas. The 'soul' (Li, P. C. 2004). In 2010, Wang Wenzhuo divided urban culture into material culture, institutional culture and spiritual culture in his article "Research on Old City Renewal Based on Cultural Inheritance", clarifying the connotation of culture (Table 2-1, Table 2-2).

Table 2- 1 Classification of urban cultural elements



Source: Sun Yijia (2023)

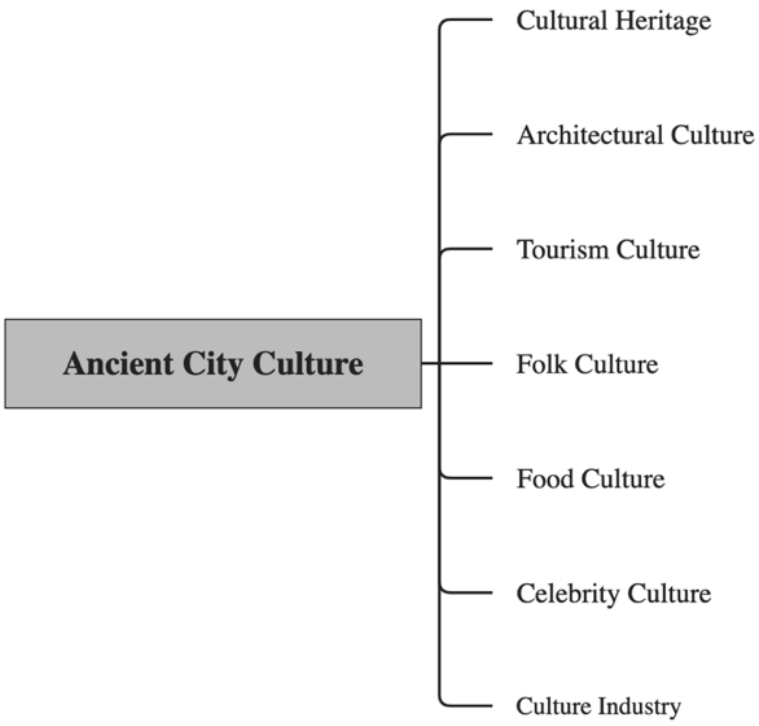


Table 2- 2 Classification of ancient city cultural elements

Source: Sun Yijia (2023)

2.3 Overview of China's cultural heritage protection and related policies

2.3.1 Policies related to the protection of cultural heritage in China

The protection of Chinese cultural heritage can be considered to have begun with modern archaeological scientific research in the early 20th century. Peking University established the Institute of Archeology in 1922 and later the Archaeological Society.

In 1929, the Chinese Architecture Society, a private academic research institution, was established and began to systematically study ancient Chinese architecture using modern scientific methods.

In 1930, the Nationalist Government promulgated the Antiquities Preservation Law, which stipulated the meaning of antiquities, preservation requirements, and excavation of cultural relics;

In 1931, the "Implementing Rules for the Preservation of Antiquities Law" was promulgated.

In 1948, Liang Sicheng of Tsinghua University presided over the compilation of the "Brief List of National Important Cultural Relics Buildings", which laid the foundation for the first batch of national key cultural relics protection units to be announced later.

After the founding of the People's Republic of China, in response to the destruction and loss of a large number of cultural relics caused by the war, the Central People's Government (Government Council) issued a decree on the protection of cultural relics in 1950, and designated the Ministry of Culture as the central administrative agency responsible for the protection of cultural relics nationwide. , starting from the local establishment of corresponding cultural relics protection and management agencies.

In 1961, the State Council promulgated the "Interim Regulations on the Protection and Management of Cultural Relics", announcing the first batch of 180 national key cultural relics protection units, legally clarifying the hierarchical protection policy for immovable cultural relics, and implementing the naming of "cultural relics protection units" to protect cultural relics. The institution of monuments.

In 1982, the State Council announced the first batch of 24 historical and cultural cities, marking the establishment of the historical city protection system. In the same year, the "Cultural Relics Protection Law of the People's Republic of China" was promulgated, marking the beginning of legalization of the protection of cultural heritage in our country.

In January 1984, the State Council promulgated the "Urban Planning Regulations", stipulating that urban planning should effectively protect cultural relics and historic sites, protect and promote national style and local characteristics. In January 1985, the Chinese government joined the Convention for the Protection of World Cultural and Natural Heritage.

In 1986, the State Council determined that blocks, building groups, towns, and villages with relatively concentrated cultural relics and historic sites, or that relatively completely preserve the traditional features and ethnic and local characteristics of a certain historical period, should be designated as historical and cultural protection zones for protection.

In 1987, China had the first batch of "World Cultural Heritage" such as the Great Wall and the Forbidden City.

In 1987 and 1990, Mount Tai and Mount Huang were the first to be included in the "World Cultural and Natural Heritage".

In 1992, Jiuzhaigou, Huanglong and Wulingyuan were among the first to be listed as "World Natural Heritage". In 1997, for the first time in my country, ancient cities were included in the "World Cultural Heritage" list. They were Pingyao and Lijiang.

In 2000, for the first time, a village (ancient village in southern Anhui) was listed as a "World Cultural Heritage".

The Urban Planning Law was promulgated in December 1989. On the basis of urban planning regulations, it is stipulated that the preparation of urban planning should protect historical and cultural heritage, traditional urban features, local characteristics and natural landscapes. The development of new urban areas should avoid underground cultural relics and historic sites.

In March 1997, the State Council issued the "Notice on Strengthening and Improving Cultural Relics Work", emphasizing the need to strive to establish a cultural relics protection system that adapts to the requirements of the socialist economic system, follows the own laws of cultural relics work, gives priority to state protection and mobilizes the participation of the whole society, and All departments and localities are required to achieve "five inclusions", that is, to incorporate the protection of cultural relics into economic and social development plans, into urban and rural construction plans, into fiscal budgets, into institutional reforms, into leadership responsibility systems at all levels, and to incorporate the responsibilities of governments at all levels to protect cultural relics. Further concretely, this has important guiding significance for strengthening the protection of cultural relics under the conditions of the socialist market economy.

The revised "Cultural Relics Protection Law" was promulgated in October 2002, establishing a three-level protection system for cultural relics protection units, historical and cultural blocks (villages, towns), and historical and cultural cities, and established the "protection first, rescue first, The work policy of "rational utilization

and strengthening management" provides a solid legal guarantee for the development of cultural relics in the new era.

From November 2003 to present, the Ministry of Construction and the State Administration of Cultural Heritage have announced a total of 157 famous historical and cultural towns and villages in China in three batches.

In December 2005, the State Council issued the "Notice on Strengthening the Protection of Cultural Heritage", which used the concept of "cultural heritage" as a framework, emphasized the importance and urgency of protecting cultural heritage, and established the guiding ideology and basic principles for strengthening cultural heritage protection. Guidelines and overall goals, clarifying specific measures to solve the outstanding problems currently faced by cultural heritage protection; at the same time, it was decided to establish China's "Cultural Heritage Day". Since 2006, the second Saturday in June every year will be "National Cultural Heritage Day"(Yu, H. G., & Wang, J. S. 2008).

2.3.2 Overview of cultural heritage

2.3.2.1 “Heritage” and “Cultural Heritage”

(1) Heritage

Heritage includes cultural heritage and natural heritage. Cultural heritage is the relic of various creative activities in the process of human civilization and the witness of history. These residues include material and immaterial, movable and immovable. Natural heritage refers to the geological landforms, biological communities, species, and ecological landscapes formed during the evolution and succession processes of nature.

"Heritage" is a word that is constantly evolving and expanding in today's world, and its connotation and denotation have long exceeded its original meaning. We should understand it as evidence of history, the inheritance of history in today's society, and the link connecting the past, present and future. Not only that, the concept of "heritage" also involves a series of ideas and consciousness closely related to "heritage". For example, the awareness of sharing, because the purpose of all activities such as the protection, management and utilization of heritage is to meet the needs of people and their descendants as much as possible, this is the embodiment of the modern concept of human rights.

In our country, in addition to its original meaning, the concept of "heritage" refers to the material wealth and spiritual wealth left by history, but it is more often used at the spiritual and ideological level . Since the 1990s, with the increase in exchanges with the international heritage community and the development of all aspects of world heritage work, the relationship between the concept of "heritage" and cultural relics and its material significance have gradually been recognized and valued. The concept of "heritage" gradually began to be widely used in various academic papers and books, and the media used it accordingly. However, the long-term habitual use of the concept of "cultural relics" has resulted in the failure of the concept of "heritage" to enter our country's legal documents. The same is true in actual management. Names such as cultural relics protection units, cultural relics departments, and cultural relics undertakings have long been used by default. Therefore, in our field of heritage protection, the concept of "heritage" is implicitly under the concept of "cultural relics". But in terms of the inclusiveness and breadth of its connotation and denotation, the concept of “heritage” is greater than “cultural relics”.

According to the definition of "heritage", "cultural relics" undoubtedly correspond to the concept of "cultural heritage". The "Cultural Relics Protection Law of the People's Republic of China" (hereinafter referred to as the "Cultural Relics Protection Law") revised in 2002 quoted the internationally accepted concept of "cultural heritage" and divided cultural relics into "movable cultural relics" and "immovable cultural relics". "Two categories. , replacing the two concepts of "cultural relics" and "cultural relics protection units" in the "Cultural Relics Protection Law" promulgated in 1982.

(2) Cultural heritage

Cultural heritage can be divided into two parts: tangible heritage, also known as material cultural heritage, and intangible heritage, also known as intangible cultural heritage. The definition of material cultural heritage is cultural relics with historical, artistic and scientific value; intangible cultural heritage is expressed in the form of traditional culture that exists in intangible form and is closely related to people's lives and passed down from generation to generation (Zhao, Z. C. & Wang,X.,2021) . According to the different attributes of cultural heritage space, it can

be divided into“movable cultural heritage”and “immovable cultural heritage”two basic types.

The difference between the material attributes of "material cultural heritage" and "intangible cultural heritage" is relative, because intangible cultural heritage also requires material carriers, such as tools, materials, necessary places, etc., and the results of its creation are often expressed in material form come out. form, or requires a physical medium to record or preserve. On the other hand, material cultural heritage must also contain and carry the content of intangible culture. It can be the material carrier of one or more intangible cultures, and is intangible culture expressed and embodied in a material and tangible way. Therefore, the fundamental difference between "tangible cultural heritage" and "intangible cultural heritage" lies not in material attributes, but in whether they can be copied. Once material cultural heritage is destroyed, it cannot be regenerated. Generally speaking, intangible cultural heritage can be continuously created, produced and developed as long as it has the necessary conditions (referring to people, tools, materials, etc. related to its inheritance). It breaks through the material boundaries of cultural heritage. For example, for a certain folk craft, as long as there are inheritors who master this craft and the raw materials and tools for production, works can be continuously produced. Once architectural heritage is damaged and collapsed, it can never be restored.

The concepts of "moving" and "immovable" are also relative. In an absolute sense, as long as there are sufficient technologies and related supporting conditions, all cultural heritage can be relocated; at the same time, all cultural heritage should not be relocated, because relocation will change its spatial attributes, thus affecting the value of the heritage. Commonly used movable cultural heritage mainly includes utensils, artworks, documents, etc., which basically correspond to my country's traditional concept of "cultural relics". Immovable cultural heritage mainly refers to architectural heritage.

2.3.2.2 Material cultural heritage

According to UNESCO's 1972 World Heritage Convention, tangible cultural heritage is divided into: Cultural Objects: Buildings, sculptures, paintings, compositions or structures of outstanding, universal value or archaeological significance at a historical, artistic or scientific level and a complex of various types

of cultural relics; architectural complex: an interconnected architectural complex with outstanding and universal value at the historical, artistic or scientific level because of its architectural form and unity; site: historical, aesthetic, ethnographic Or at the anthropological level, areas with outstanding universal value of man-made projects or projects that combine nature and man-made and archaeological sites (Cultural Heritage Classification. State Administration of Cultural Heritage, 2010) .

2.3.2.3 Intangible cultural heritage

My country divides intangible cultural heritage into 10 categories of traditional cultural expressions: folk literature, traditional sports, entertainment and acrobatics, traditional music, traditional art, traditional dance, traditional skills, traditional drama, traditional medicine, folk arts, folk customs, and related objects and places. Its greatest feature is a way of life and production that is not divorced from national characteristics. It is a "living" embodiment of national personality, aesthetic habits, and ways of thinking, and contains the deepest roots of traditional culture (Zhou, Y. L. et al. 2012) .

The term "intangible cultural heritage" comes from the English translation of the Japanese "intangible cultural property", and Japan is the first country to use this term. However, it is widely used as a legal term because it was first used in the international legal document "Convention for the Protection of Intangible Cultural Heritage" adopted by UNESCO in 2003. As a result, "intangible cultural heritage" was quickly recognized and accepted as a legal term, and then the term "intangible cultural heritage" was also used many times in many relevant legal documents in our country. The "Opinions on Strengthening the Protection of my country's Intangible Cultural Heritage" issued by the General Office of the State Council on March 26, 2005, and the "Interim Measures for the Application and Assessment of National Intangible Cultural Heritage Representative Works" issued by the General Office of the State Council in the form of an attachment are also adopted. this term. In the "Intangible Cultural Heritage Protection Law of the People's Republic of China" promulgated on February 25, 2011, the legal term "intangible cultural heritage" was not only adopted, but also defined.

The Convention for the Protection of Intangible Cultural Heritage adopted by the United Nations Educational, Scientific and Cultural Organization (hereinafter

referred to as UNESCO) on October 17, 2003 defines intangible cultural heritage as follows: it refers to the cultural heritage that is protected by various communities and groups. The various social practices, representations, expressions, knowledge, skills and related tools, objects, artefacts and cultural places that are sometimes considered by individuals as part of their cultural heritage. This definition of "intangible cultural heritage" is because it is constantly created and the concept continues to develop in the game with the surrounding natural environment and historical conditions, and it has achieved social and group recognition. This convention also takes into account international human rights and the sustainable development of intangible cultural heritage, so it is generally adopted by the international community and is considered the authoritative definition of "intangible cultural heritage ". In March 2005, the State Council, deeply aware of the importance and urgency of protecting intangible cultural heritage, issued the "Evaluation of Applications for National Intangible Cultural Heritage Representative Works".

Interim Measures are formulated. Article 2 of the "Interim Measures for Application and Assessment" defines "intangible cultural heritage" as follows: Intangible cultural heritage refers to various traditional cultural expressions and cultural spaces that are inherited from generation to generation by people of all ethnic groups and are closely related to people's lives. Later, the "Notice of the State Council on Strengthening the Protection of Cultural Heritage" also provided a definition of "intangible cultural heritage": Intangible cultural heritage refers to various cultural heritages that exist in intangible forms and are closely related to people's lives and inherited from generation to generation. Traditional cultural expressions, including oral traditions, traditional performing arts, folk activities and rituals and festivals, folk traditional knowledge and practices about nature and the universe, traditional handicraft skills, etc., as well as cultural spaces related to the above traditional cultural expressions. With the definitions of the first two legal normative documents as a basis, my country's "Intangible Cultural Heritage Protection Law" was officially implemented on June 1, 2011. Article 2 of the "Intangible Cultural Heritage Protection Law" defines intangible cultural heritage as follows: The term "intangible cultural heritage" as used in this law refers to the various traditional cultures passed down from generation to generation by people of all ethnic groups and considered as

part of their cultural heritage. expressions, as well as the objects and places associated with traditional cultural expressions.

An international convention and three domestic legal norms have given precise definitions of intangible cultural heritage. However, many famous scholars and experts in my country still believe that the concept of intangible cultural heritage is still incomplete and needs further development. Supplements and modifications, so they also want to define an accurate academic concept for "intangible cultural heritage". Professor Qi Aimin defined "intangible cultural heritage" in his work: Intangible cultural heritage refers to the results of intellectual activities that are passed down from generation to generation in a specific community and are an integral part of the cultural and social characteristics of the community (Qi, A. M., 2007) . Yuan Li and Gu Jun gave this definition of intangible cultural heritage in their works: The so-called intangible cultural heritage refers to things created by humans in history and passed down in living forms to this day, which have important historical and cultural value. , scientific value and social value, which are traditional cultural matters of knowledge, technology and skills that are of universal value and are recognized by the local society and are sufficient to represent a party's culture (Yuan, L., 2009). Mr.Wu Bing'an believes that intangible cultural heritage is: cultural expressions (or cultural expressions, cultural expression activities) that have great influence and are passed down from generation to generation among specific ethnic or regional groups (Wu, B. A.,2010).

With a clear definition of intangible cultural heritage, research and definition of intangible cultural heritage of ethnic minorities will naturally occur in the process. The "Intangible Cultural Heritage of Ethnic Minorities" appeared for the first time in the "Notice of the State Council on Strengthening the Protection of Cultural Heritage" in December 2005. The notice emphasized the need to focus on supporting and protecting the intangible cultural heritage in minority areas, and to rescue and protect endangered minority cultural heritage and cultural ecological zones.

There are now many academic explanations of "minority intangible cultural heritage" in many documents. Therefore, four different theories on "minority intangible cultural heritage" have been formed, namely, the "comprehensive cultural

system" theory, the "expression technique characteristics" "said"the definition of the convention is applied abstractly", and "the definition of the convention is applied concretely". Since the connotation and denotation of intangible cultural heritage in the Convention for the Protection of Intangible Cultural Heritage has been highly recognized by many countries in the world, its authority is certainly unquestionable, so it is inevitable to apply the convention's expressions retains the limitations of the definition. In the book "Research on Basic Issues in the Legal Protection of the Intangible Cultural Heritage of Ethnic Minorities in China", the author defines "Intangible Cultural Heritage of Ethnic Minorities" as: refers to the cultural heritage components that are regarded by various ethnic minority societies, groups or individuals in China as their cultural heritage. Various social practices, conceptual expressions, expressions, knowledge, skills and related tools, objects, handicrafts and cultural places. The core of cultural heritage value is the historical and cultural information interests of the ethnic minority expressed through material carriers (Han, X. B.,2011). What we call the intangible cultural heritage of ethnic minorities today is the performing arts, traditional knowledge, and skills that are closely related to the life of the ethnic group and passed down from generation to generation, starting from the primitive hunting society, gradually developing to the farming society, and then to the modern agricultural society. Craftsmanship, folk activities, etc., as well as national cultural spaces. Therefore, the definition of intangible cultural heritage of ethnic minorities is based on the "convention definition theory".

2.3.3 Cultural heritage and protection

Drawing on the definition of "protection" in the 2003 Convention for the Protection of the Intangible Cultural Heritage, cultural heritage protection refers to various measures to ensure the vitality of cultural heritage, including the identification, documentation, research, preservation and protection of all aspects of this heritage. , publicity, promotion, inheritance (especially through formal and informal education) and revitalization.

2.3.3.1 Cultural heritage protection

Cultural heritage protection refers to the protection of various historical and cultural heritages in the region, including tangible cultural heritage and intangible cultural heritage. This kind of protection is not just a simple preservation, but a

prerequisite for ensuring the authenticity of cultural heritage. Under this circumstance, historical and cultural heritage should be preserved, preserved and maintained, and properly utilized to ensure that it can exert its historical and cultural value and even economic value. The protection of cultural heritage should be given top priority and the principle of protection first should be adhered to (Jian, B.,2009).

According to my country's current legal policies, the protection of historical and cultural heritage can be divided into three levels, namely, individual cultural relic protection units, historical and cultural blocks, and historical and cultural cities. This hierarchical protection method is a summary of many years of experience in the protection of historical and cultural heritage and is an effective way to resolve the contradiction between protection and urban development. The protection of historical and cultural heritage requires different methods according to different characteristics. For "cultural relics protection units", we must follow the principle of not changing the original state of cultural relics and preserve the original appearance and authenticity of history; for typical areas that represent the traditional style of the city, we must preserve the authenticity and integrity of history; for famous historical and cultural cities, we must not only protect the city cultural relics and historical locations, and also to protect and continue the pattern and historical features of the ancient city (Shan, J. X.,2010) .

2.3.3.2 Related theories on cultural heritage protection

(1) Ripkemar’s value theory and four-part syllogism once proposed (Rypkema, 1992): "There are seven 'values' of historical resources that should be protected in urban development: social value, cultural value, aesthetic value, urban context value, architectural value, historical value and sense of place value." In general, the value of cultural relics and historical buildings to historical and cultural blocks is multi-layered. However, "economic value" is the foundation that supports other values. In other words, if there is a lack of commercial interests, most cultural heritage Protection can only rely on public intervention with a "official document ". But without public intervention, it will be difficult for the market to effectively protect those buildings that the public thinks are worthy of preservation. Regrettably, they are more or less at the mercy of commercial interests. Outside the circle." Therefore, Ripkema proposed four syllogisms: "Historic preservation must first involve

buildings; historic buildings are real estate, and real estate is commodities; for a commodity to attract investment, it must have economic value. Therefore, in order to attract private investment in historical preservation, we must first create and enhance the commercial value of historical buildings. For any commodity, including real estate, to be valuable, it must possess four characteristics: scarcity, purchasing power, demand and practicality (Steven, T. et al.,2006)."

(2) Nathaniel Litchfield's Social Impact Planning Evaluation Theory mentioned the importance of resource allocation in this theory. He believes that the benefits or losses that spatial resource allocation brings to people will have an impact on the government's policy evaluation of urban development. He believes that there are two test standards for resource allocation: one is to test the consumption rate of natural or human resources; the other is to test the degree of abandonment (or reduced utility) of man-made resources such as buildings.Because the beauty, practicality and historical significance of the building can determine whether the building is demolished or retained. Of course, reuse is better than being demolished, and its value will be reflected through investment and consumption (Steven, T. et al.,2006). Therefore, building renovation is less expensive and cheaper than complete reconstruction, while reuse promotes the protection of cultural heritage, reduces the consumption of energy and materials in the construction process, and gradually improves the level of resource management.

(3) Fitch classification method for remediation James Marston Fitch (1990) proposed a view on valuable historical buildings: "According to incremental radicalization, there are seven scales of remediation (intervention level) of historic buildings" An effective classification method (Steven, T. et al.,2006): Protection: the original natural state remains unchanged, without adding or subtracting anything; restoration: restoring the object to some early stage of its morphological development process The material state of the stage; renovation: protecting and adjusting the actual state of the building to ensure that its structure and space can be used normally after being perfected; reorganization: reinstalling a building at the original site or a new site through careful assembly of original components; transformation (Applicable reuse): giving a building a new function; reconstruction: rebuilding a lost building on its original site; duplication: accurately copying and constructing an existing building.

(4) Architectural Integrity and Facadeism John Ruskin's architectural integrity believes: "A building worthy of praise is a building whose structure is true to its appearance Steven, T. et al.,2006)." He It is believed that people do not have any right to change historical buildings. They belong partly to the builders and partly to the people who follow them for generations. Facadeism's approach of weakening the significance of architectural design and pursuing only two-dimensional facades has also been criticized for hindering the development of architectural styles, and has even been called "designing the town landscape with stage scenery." Brent C. Brolin, a spokesperson for façadeism, counters: "Having an interior function 'truly' represented on the exterior does not contribute to reputation or higher ethics. This It is a modernist stereotype that it is not as important as the visual relationship between the building's exterior and the architectural context (Steven, T et al.,2006) ." In fact, whether indoors or outdoors, for historical buildings The best way is to use it effectively, and its original characteristics should be respected. The important thing is to avoid "renaming" it, thus severing its connection with its own history.

(5) Tanel Erqi Contextual Continuation Contextual continuation lies in inheriting tradition and transforming it into a part of modernity rather than rigidly copying and utilizing it. Tim Heath actually combined the views of Alan Middleton after integrating and juxtaposing contexts: "History is a record of the past, and tradition means passing on a past." A more positive change (Middleton, R.,1983) "formed. Thus, cultural continuity as a method provides a middle ground between the dangers of destroying contextual continuity through transitional juxtaposition and consolidating context through blind conformity. The three are not independent of each other, but are on the same line, integrated and juxtaposed at both ends and continuing in the middle.

2.4 Digitization

The Massachusetts Institute of Technology (MIT), known as the "Preacher of the Digital Revolution", launched the book <Being Digital>, which has since been translated into more than 30 languages. caused a worldwide sensation and is regarded as a "digital classic ". Mainland China translates it as " Digital Survival " . Since then, "digitalization " has gradually become an important word in modern Chinese.

2.4.1 Digital development process

The term "digitalization" has not been in our country for a long time, but digitalization has gone through a long period of time internationally.

(1) 1950s: English and number symbol stage

von Neumann in 1950, the birth of the first TRADIC computer using transistors in 1954, and the emergence of the IBM 1401 computer in 1958, Shannon formally proposed the " The role of "bit" is becoming increasingly obvious, and human beings are gradually beginning to " digitally survive ."

At this stage, the digital language adopts English conformity and numerical expression , and adopts ASCII (American Standard Code for Information Interchange) technical code, which is the "American Standard Code for Information Interchange". It stipulates that 8 " bits " are used to represent all numbers, upper and lower case English characters , punctuation marks and other commonly used symbols to express 256 different kinds of information . This technology has brought mankind into the era of digital computing . Scientists and engineers can use computers to perform large-scale numerical calculations, and they can also use similar technology to record sounds and colors, allowing them to launch missiles and predict weather, among other things . During this period, digital computers had just appeared in some university research institutions in the United States and the United Kingdom. The creation and production of digital technology mainly came from the United States . Digitalization was only used in the field of science and technology, and only a very small number of scientific and technological personnel in cutting-edge fields had access to it. to the computer.

(2) 1960s - 1970s: graphics stage

In 1963, "Ivan Edward Sutherland, the father of computer graphics, submitted his doctoral thesis "Sketchpad: Human-Computer Graphics Communication System" at MIT, which paved the way for digital technology in the field of graphics. In 1965, Ivan Edward Sutherland published a paper " The Ultimate Display " provides a predictive description of the future digital virtual world, proposes a new theory of human-computer cooperation that feels real and interactive, and proposes a basic plan for the realization of digital virtual reality technology, becoming an important milestone in digital technology. In 1966, the Massachusetts Institute of Technology

developed the first "Helmet Mounted Display " and later added simulated force and tactile feedback devices to the system, allowing users to simulate contact with the virtual world. In 1968, Ivan Edward Sutherland launched the "3D Display" Helmet-mounted Display " took an important step in digital technology. In the 1970s, the American Lockheed Aircraft Company completed an interactive graphics digital processing system for aircraft design, namely CADAM. This system can complete engineering drawings Drawing, analyzing and producing CNC processing paper tapes has been used in many countries. Since then, many new and more complete graphics systems have been continuously developed, and digital graphics technology has entered the practical application stage, ushering in digital display technology and a new era in which interactive technology is widely used.

(3) 1980s - mid-1990s: text and multimedia stage

This is a stage of rapid digital development. Since the 1980s, digitization has developed to the word processing stage. At this time, the functions of computers have expanded from processing numbers and characters to text, making people truly realize that computers are a "new tool", providing scientific researchers with a new way of thinking, and greatly changing people's understanding and transformation of nature. and social ways. Soon, computers were fully capable of processing sound, color, graphics and images, and digitization entered the multimedia era. Starting around the 1990s, computers truly "entered the homes of ordinary people" and began to affect people's work, life, leisure and entertainment (Dong, H. J.,2004).

In the 1980s, digitalization was considered a viable technology and began to be applied in business. During this period, Dr. Michael McGreeway of the University of California, USA, with the support of the military, created a virtual environment for the airport, which was successful and attracted widespread attention from the scientific community, industry and military circles . Commercial digital systems for interactive games began selling in the 1990s. In this way, digitalization started from the needs of the US military industry, gradually applied to education, medical and other fields, and penetrated into the industrial and service industries with its huge commercial functions (Zhang, G. F.,2007).

From the mid-1990s to the present, the networking and virtualization stage

Since 1995, the Internet has connected different countries, races, and regions in different worlds, and has also connected more isolated people. Society has entered the Internet age. The network is a product of the combination of network technology, database technology and artificial intelligence technology , but its technical foundation is still digital technology . The rapid development of network and multimedia technology makes virtualization possible, and digitalization has entered a higher development trend - virtualization. From the proposal of Sutherland's "virtual theory" to the real stage of virtualization, the core feature of virtualization is digital technology. Virtual symbols can virtualize almost all social realities, which is the highest stage of digital development. Digital virtualization moves from physical virtuality to object virtuality, and then to human virtuality. With the development of the times, the degree of virtualization is getting stronger and stronger, and its scope is getting wider and wider. Currently, the social breadth of digital virtualization has greatly expanded. Digital design, digital business, digital manufacturing, digital clothing, digital books, digital museums, digital government, digital cities, digital army, digital campus, digital education, etc. Digital virtualization has become an increasingly common social reality (Bao, Z. H.,2003).

2.4.2 Information and digitalization

2.4.2.1 Information society

From 20 century 50 Since the 1990s, the revolution in information technology has brought human society into the information age. For the first time, humans have placed the role of information in a key position in society, and information has become the driving force for the development of human society. No matter in economy, Various fields such as politics, culture, and education have been impacted by the information age and have been changed by information. James Gleic 's book "Information: History, Theory, In "The Flood", the author has this description of the scale of information growth: " " It's as if you kneel to plant the seed of a tree and it grows so fast that it swallows your whole town before you can even rise to your feet." (Gleick, J.,2011) With the information society comes the explosion of information. All kinds of information flood the entire society. Human beings' ability to produce information has far exceeded the cognitive ability of the brain. Massive information and people's ability to receive

information have become to understand the important contradictions in the information society, How to quickly, conveniently, Efficiently conveying and obtaining information has become a problem that everyone from scientists to designers is discussing and solving. The emergence of new research fields and disciplines such as human-computer interaction, information visualization, information design, interface design, interaction design, etc. are all intended to make up for the above-mentioned contradictions in the information society. Information emerges as a universal principle in every work of the world, giving form to the invisible, illustrating the characteristics of forms of life, and even helping determine thought patterns through specific codes. In this way, information spans the originally disparate fields of space-time computers, classical physics, molecular biology, human communication, language evolution, and human evolution."In the information industry, designers of all types ultimately find new ways to spread and present information. Information also connects all aspects of life. Connect with a variety of information devices.

2.4.2.2 Information and groups

Sociologists and psychologists have long studied human groups and discovered many things about Interesting phenomena in groups. For example, the American scholar Harding. In 1968, a famous publication "Science" published a An article titled "The Tragedy of the Prairie" describes how in a group, people only expect to gain from public goods. But no one cares about the public goods themselves. Because of this, it will eventually lead to "Tragedy of the Commons". This seems to be an inevitable contradiction in human groups, but in the information age, larger human groups are connected together through the Internet, and through group collaboration, similar things are created. A series of treasure troves of human civilization and wisdom such as Wikipedia, flickr, sourceforge, etc. And these The scale of the collaborative group in the example is unprecedented. No organization or institution has ever been able to manage and coordinate the collaboration of so many people. In the book "Cognitive Surplus " by the famous Internet thinker Clay Shirkey, The author gave a set of terrifying data : “Americans spend about 100% of their time watching TV a yea"r. 200 billion hours , that's almost 2000 How many hours per year does a Wikipedia project take (Clay, S. ,2012) . And in the book, the author also It is proposed that it is precisely because of the emergence of Internet tools that the cost of communication, sharing and

collaboration between groups has become cheaper and cheaper, allowing people to express themselves in a more generous, open and social way, and at the same time The regional nature of the Internet also makes everyone around the world a potential participant. "The desire to be a member of a group, Sharing, cooperating, and acting in concert with others in a group are basic human instincts that have previously been inhibited by transaction costs. "It is precisely because of this human instinct that This has created such large-scale group collaboration on the Internet.

From another perspective , the openness and sharing of data in the era of big data also allows individuals to have more information rights and freedoms. from Web2.0 At the beginning of the era, with the development of self-media tools such as blogs, WeChat, and Weibo, With the emergence of tools, everyone has almost zero-threshold content production and dissemination tools. Everyone is both a receiver and a producer of information. The entire society is reorganized and distributed by the surging information. On the one hand, the behavioral patterns of social groups have become increasingly diversified and complex; on the other hand, group behavior has continuously improved the organizational level under the guidance of this information torrent, becoming a social phenomenon that surpasses the capabilities of previous groups. In recent years, The popular "flash mob"is a typical example. Several strange individuals rely on the Internet to communicate and collaborate together to complete a specific action. This is the impact of the Internet on group mobility.

2.4.3 Information and information visualization

Although information has only been studied as a science for a hundred or two hundred years, information itself has been closely connected with human activities since ancient times. In the long years of human civilization, we have been looking for more convenient and Effective forms to transmit and share information. The abstract concept of information appears in various forms in human society. From the drumbeats of African tribes delivering messages to ancient Chinese beacon towers that communicated messages through thick smoke, from the earliest human cave paintings discovered in Spain to the hieroglyphs found in the tombs of pharaohs in ancient Egypt, messages come in many forms. However, conveying and expressing information through visual graphics and text has gradually become the main way for humans to obtain and share information. The reasons are not only the characteristics

of graphics and text themselves as information media, but also due to the physiological and psychological structure of people themselves. With the development of computer science, especially computer graphics, modern information design has 20 century 80 Since the 1990s, the concept and application of visualization have been pushed to the forefront of research. Information visualization, as the main topic of information design at this stage, is also one of the core concepts in this study. The next section will elaborate and analyze it from the perspective of concept and research status.

2.4.4 Digital technology - augmented reality

Augmented Reality , the development of AR can be mainly divided into three periods. The reason why this research was proposed in the earliest period was to improve Virtual Reality , the use of VR (Luo, Y.,2012) , the most famous research during this period was conducted by Harvard University Ivan Sutherlan Professor and his student Bob Sproull co-founded the world’s first head-mounted system that combines virtual reality technology and augmented reality technology ” The Sword of Damocles" , however, due to technical limitations, the head-mounted display system of this period required users to wear large and heavy head-mounted equipment. This system makes users feel more immersive by directly stimulating vision. Unfortunately, such a large device makes this technology unable to be easily copied and popularized.

The second period is during 1970 New Year's Eve 1980 During the 1990s, major development and distribution was at the U.S. Air Force Arms Zhuang Laboratory, University of North Carolina at Chapel Hill, NASA and other institutions. The most famous research during this period was 1980 by Steve Mann builds first wearable head-mounted display that combines images Text is presented to the user in the captured picture, although the augmented reality technology at that time could not be called actual "enhancement" in the sense of "But the subtitles appear on the screen "The effect can indeed be said to be augmented reality. Performance.

The third period is in 1990 Earlier this year, Boeing researchers Tom Caudell First, it was proposed to increase The term augmented reality is used to describe the flight training system developed by Boeing, which uses virtual aircraft objects to simulate flight controllers in a real environment. Although there was no clear

conceptual category to define augmented reality at the time, the flight simulation controller actually added various real-world environment parameters, such as weather, wind direction, time, etc., to achieve interaction between the real world and virtual objects.

Arrive in 2008 Research and various application cases in 2021 also show that users are interested in application AR technology guide The browsing format presents an interesting, fun, interactive and immersive experience, thereby improving user enthusiasm for participation. In recent years, technological innovation has gradually lowered the application threshold of this technology. With the development of hardware such as smartphones and tablets, their processing capabilities have been greatly improved, making AR technology Applications on these devices become a reality. As a result, the development of augmented reality technology has also become greater room for progress.

Augmented reality technology has developed from the conception of the concept in the 20th century to the present, and the technological development of its display methods has also It has gone through multiple versions, starting from the "monitor-based presentation method that is most accessible to ordinary users. "To the latest laboratory level" reality based on digital light field ” concept, depending on how it is used, each Presentation technologies are developing in their own application paths. Let’s discuss the current most popular augmented reality technology. There are four main categories of display methods: monitor-based display, head-mounted optical see-through display, head-mounted image display , and digital light field display technology.

In summary, this study uses the display method of the monitor to conduct augmented reality on the ancient city buildings in Xingcheng, so as to effectively protect and inherit the ancient city culture.

2.5 Concept Theory Review

2.5.1 Cultural genes

American scholars Clyde Kluckhohn and Alfred LKroeber first proposed the hypothesis and possibility of cultural genes. They believed that the hypothesis of cultural genes is composed of implicit and explicit behavioral patterns. The cultural

system is based on behavior, but its core is Convey concepts and at the same time make judgments for subsequent actions.

Cultural genes introduce the concept of genes into the cultural field and explore the basic genetic units of culture. In the 1950s, American scholars Alfred Kroeber and Clyde Kluckhohn proposed that in different cultures, there may be a basic unit similar to the basic characteristics of biology—cultural identity. In the 1960s, scholars used "characteristic clusters" and "lines" to represent "cultural fragments" with replication and inheritance functions, similar to genes in organisms. In the 1970s, British biologist and behavioral ecologist Dawkins coined a new word - M EME in his book "The Selfish Gene". She believes that M EME is a cultural gene with replicative characteristics. Lakemore published her monograph "The Meme Machine - The "Genetics" of the Cultural Social Communication Process", trying to use "memes" to interpret the evolution of human culture.

Scholars generally agree that urban culture is like people. Although it has multiple sources, it also has its genetic code: the precipitated material culture is its skin, the citizens' various forms of production and life are its cells, and the city's temperament and spirit are its cells. its soul. Urban cultural genes control the elements and patterns of urban culture, guide the city to run on a certain track, and create new elements and patterns under specific conditions. Urban culture also has dominant genes and recessive genes, carrying out dominant and recessive inheritance.

Cultural genes are the interpreters of the city's historical appearance, the qualitative regulator that distinguishes the city from other cities, and the basic driving force that controls the future direction of the city. Many well-known cities in the world have their own cultural genes, and they carry out cultural positioning based on their genes, such as Tokyo, "the city where Eastern and Western cultures meet," Rome, "the city of classical culture," London, "the city of choice, full of opportunities," Vienna, "the city of the world." "Hometown of Music", Paris "Fashion Capital of the World", "Romantic Capital of the World".

Scholars are still in the process of exploring cultural genes, and some tentative classifications have emerged:

Cultural landscape scholar Liu Peilin divided cultural genes into three gene types based on their own attributes and importance: main genes, accessory genes and

mixed genes (Liu, P. L.,2011). Major genes refer to genes that occupy a core position in regional culture, dominate cultural attributes, and have a greater impact on regional surface culture. It is the matrix from which cultural gene lineages are formed and derived. Without or giving up the main gene, culture cannot be passed on. . Attached genes refer to genetic symbols that exist attached to a certain carrier and can accurately reflect regional cultural characteristics. Hybrid memes exist in multiple regions and are not unique to a certain region, but they are memes that actually record key historical information about the region during a specific historical period. It is an integral part of the cultural gene pool of the region. Abandonment may destroy the ecological balance of the cultural system (Bi, M. Y.,2011).

When Wang Xitao and others designed the cultural gene genealogy of Xinmin Street in Shenyang, they divided local cultural genes into three levels: expanded regional cultural genes mainly refer to production and lifestyle genes, including food cultural genes, custom genes and cultural genes. There are three aspects of cultural genes: external image gene fragments, including architectural cultural genes and environmental style genes. The core cultural gene layer includes ideological genes in three aspects: historical cultural genes, national cultural genes and medical cultural genes (Wang, X. T. et al., 2015)

When Zhao Heling and others designed the cultural genes of the ancient Dian Kingdom, they divided them into material cultural genes and spiritual cultural genes. Among them, material cultural genes include architectural culture and bronze culture; spiritual cultural genes include totem culture, bronze drum culture and customs(Zhao H. L., et al.,2014).

Some scholars divide cultural genes into tangible cultural genes and intangible cultural genes, historical cultural genes and natural cultural genes.

Among them, most scholars adopt the division method of material cultural genes and intangible cultural genes. Material cultural genes exist in the form of material materials, and are presented, spread, and inherited through material materials. What is commonly referred to as food culture, life culture, and production culture are all material cultural genes. Intangible cultural genes exist in the form of spiritual states, expressed and passed on through oral narratives and personal behaviors. Also

known as “living culture”, it includes belief culture, language culture, institutional culture (Zhao H. L., et al.,2014).

The above classification shows that the cultural genes in many places are not single. Active original cultural genes have absorbed new cultural genes in the process of historical changes, forming a gene pool. Wuhan culture has a long history, and multiple cultural sources coexist. Therefore, its cultural genes do not exist in a single way, but in a gene pool.

2.5.2 Local cultural identity

2.5.2.1 Cultural identity

Gao Yuan (2017) studied the cultural identity of college students’ socialist core values in the Internet era. He believed that cultural identity refers to achieving subject understanding, cognition, and then acceptance and approval in the process of cultural dissemination and homogenization. Achieve objective effects from subjective recognition of emotion and psychology to belief and following.Zhao Ning believes that cultural identity is a rich, multi-dimensional and complex concept. Culture is the root of the country and the soul of the nation. It is an important factor that promotes social members to form national cohesion.“The identity contained in identity Or role legitimacy, they are all inseparable from culture. Identity, role, and legitimacy can only have meaning in a certain culture." Zhou Yajun believes that cultural identity refers to the social psychological process in which people tend to recognize and agree on a certain common culture they live in, and ultimately form a relatively stable value concept in people's consciousness, and consciously Use it as your own code of thinking and behavioral norms. Cultural identity means that the cultural groups that people identify with have shared symbol systems, meaning frameworks, and common behavioral norms. Specifically, the following four connotations can be inferred: First, correct cultural identity should adopt the golden mean of "harmony without difference" to establish common values amidst differences and achieve transcendence on the basis of negotiation and integration. The goal. Second, the path to constructing cross-cultural identity does not lie in embracing cosmopolitanism or multiculturalism, nor does it lie in abandoning collective attributes and completely returning to the individual. Third, in terms of attitudes towards identification with one's own culture and identification with foreign cultures, cultural hegemony, cultural isolation, or the

complete acceptance of foreign cultures are not advisable. Fourth, we should maintain and develop our own cultural identity as the cornerstone, and expand on this basis, actively participate in the social activities and group life of other cultural groups, and achieve coordinated development and common progress of multiple social cultures.

2.5.2.2 Local cultural identity

Cultural identity includes identity with social values and norms, identity with religious beliefs, identity with customs and habits, identity with language, identity with art, etc. Cultural identity is the process of forming "self", and self is the deep structure of an individual's psychological structure, and it is also the core part that can be accessed when exploring a culture. The psychological mechanism of cultural identity includes four basic processes: cultural comparison, cultural categorization, cultural identification and cultural positioning. Cultural identity affects the social identity and self-identity of Chinese people, and guides people to love and be loyal to national culture, thereby preserving and carrying forward national culture.

There is an important objective premise for raising the issue of cultural identity, and this objective premise is the difference between multiple cultures. Simply put, cultural differences refer to the differences between various cultures. This difference often emphasizes the different views and attitudes that people hold towards the same things or issues, that is, the difference in values. The formation of cultural differences comes from the different backgrounds in which different cultures arise. The local culture of each nation is formed and developed under a specific historical background. It has distinctive characteristics of the times and is a concentrated reflection of the historical background in which it grew up. The local culture of each nation exists because of its uniqueness. Each nation has its own local culture after a long period of historical practice. The concept of treating the same thing is different from the understanding of the national culture of other regions, and the way of thinking is also different, forming The perceptions cannot be exactly the same. Therefore, in the process of cultural exchanges between various ethnic groups, it is inevitable that different opinions and views will arise on the same thing. For example, what is considered reasonable in one national culture, or has been a long-standing local culture, does not apply in other national cultures. This is a very common cultural

phenomenon, and it occurs precisely because of the cultural differences between various ethnic groups.

Mutual exchange, reference and integration among multiple cultures are the only way to achieve cultural development and innovation. To achieve cultural development, the prerequisite is to inherit cultural traditions, which shows the necessity of establishing national cultural identity. Only by establishing an identity with our own national culture, firming up our own value standards, and at the same time absorbing the outstanding achievements of the world's multiculturalism, adhering to tradition while embodying the spirit of the times, can we maintain the unique connotation of our national culture and stand firm in the confrontation of world multiculturalism. Does not fall. In the face of globalization, the issue of local cultural identity is essentially a process of cultural integration.

That is, on the basis of the original local culture, we analyze and study foreign culture, absorb factors that are beneficial to the development of local culture, promote the cultural development of the nation, the innovative development of the culture of the region, and form new vitality of the national culture. The foundation of this new vitality is the affirmation and inheritance of the national culture. Only the "roots" of cultural traditions can grow the "new leaves" of cultural innovation. Without the inheritance of cultural traditions, cultural innovation and cultural development will be impossible. Talk about. Local cultural identity is, firstly, the recognition of the characteristic culture of one's own nation, and secondly, it is the process of accepting other ethnic cultures to promote the development of local culture. However, this acceptance is not a total acceptance, but a selective acceptance. This choice must be based on the characteristics of our national culture, combined with the reality and laws of our social development, and combine the advanced technologies, advanced concepts, advanced development models and other outstanding achievements in foreign cultures with our development practices to enrich and develop The connotation of local culture promotes the establishment of local cultural identity and cultural development.

2.5.3 Architectural aesthetic theory

Architectural aesthetics refers to an emerging profession that integrates architecture and aesthetics and uses the commonalities of the two to study beauty and

aesthetic issues in architecture. The concept was proposed in the last century by Rogers Scratton, who is considered the founder of architectural aesthetics. Rogers Scratton used the theory and knowledge of aesthetics to study the basic attributes of architecture from an aesthetic perspective, namely practicality, technology, publicity, regionality and overall effectiveness. Attributes. Scholars generally divide architectural aesthetics into narrow architectural aesthetics and broad architectural aesthetics. Architectural aesthetics in a narrow sense aims to study or express the beauty or artistic features of a single building. Architectural aesthetics in a broad sense goes beyond general boundaries to study issues of beauty. In layman's terms, Chinese architectural aesthetics researchers divide architectural aesthetics into three types: new functional theory, "two-level theory", and "systematic" architectural aesthetics theory.

Rogers Scratton believes that an era, a country, a region, a family, a social form, etc. can all be reflected by the buildings in the specific environment at that time. At the same time, architectural aesthetics gives people the ability to appreciate architecture and gives buildings appreciation value. Studying architectural aesthetics can make the relationship between people and architecture, people and nature, and people and society more harmonious. Give the building more aesthetic skills and beautiful decoration to make the building more beautiful. Only by unifying the two can the unique meaning of the building be truly reflected.

Architecture is essentially a material product created by human beings through production labor using material materials from nature. This product provides a series of products that meet the basic functional requirements of human life and production and have a certain length, width and The so-called three-dimensional space of height is architectural space. In addition to meeting the basic functions of people's life and production, human architectural space also understands architectural space through their own vision, hearing, touch and thinking abilities, and puts forward unique human psychological functional requirements for architecture. Therefore, humans have both material and physical requirements for architectural space. Functional requirements also have spiritual function requirements. The so-called "spiritual function" can also be called architectural art requirements (Feng, X.Y.1990)

2.5.4 Information Architecture Theory

The concept of Information Architecture (IA) was first proposed by graphic designer and architect Richard Saul Wurman in 1975. In an article about Wurman in Wired Magazine, author Gary Wolf explains that Wurman's work contributes to the idea that "the presentation of information is more important than the information itself" (Gary, W. 2000). In the mid-1980s, the main role of information architecture was as a design tool for the computer foundation and data layer, and it mainly played a role in sorting out information data in the organization and business aspects of information networks (Morrogh, E.,2002). Today's information architecture remains focused on solving the fundamental problems of accessing and using today's vast amounts of information. Information architecture is a new paradigm gradually introduced in most web development projects today and is defined as the science of structuring, organizing and managing information, where usability plays an important role in the solutions created.

There are currently many studies on information architecture, and many scholars have given the definition and scope of information architecture. The information architecture mentioned by Louis et al. in their book "Information Architecture: For the Web and Beyond" is not only a way of creating site maps, wireframes and website navigation menus, but also a more comprehensive introduction to information architecture. Definition: (1) Information architecture is the structured design of a shared information environment; (2) It integrates the organization, labeling, search and navigation system of information; (3) Improves the usability and understandability of products scientifically by sorting out information; (4)Apply architectural principles of design and architecture to the digital realm. In addition, the book also studies the construction process and methods of information architecture, explaining the basic principles of the organization system, tag system, navigation system and search system respectively. It also analyzes and summarizes the construction methods of information architecture and summarizes what needs to be paid attention to. The place. The information architecture in software products may not be felt by users when using it. Few users will comment on the software, "The information architecture of this software is very good." However, information

architecture makes information easier to understand, organizes information in the most appropriate way, and makes software easy to use(Morville, P., et al.,2015).

In terms of building information architecture, it was mainly used in websites in the early days. Jesse mentioned in "User Experience Elements" that when building an information architecture, you need to organize the information to be displayed to users and create a classification system based on the website goals and user needs. There are generally two methods of constructing a classification system: top-down and bottom-up. The advantages and limitations of the two methods are explained respectively. Also for the information architecture of web pages, Robert et al. studied the information architecture of web pages. In their book "Web anatomy: interaction design frameworks that work", they proposed three frameworks of web page frameworks: directory framework, search framework and Register the framework and make suggestions on how to use the framework system(Hoekman, J. R. & Spool, J.,2009).

Regarding the general process and method research on how information architecture is built in computer software, Lamar research believes that information architects define the relationships between web pages, and these relationships in turn define the paths that users can take between these pages: Users' An important aspect of the overall experience of the site. Outlines the main steps in the information architecture process: understanding strategic goals, defining user needs, defining interactivity of required information, creating site maps, designing wireframes (Lamar, L. 2001). Henderson et al. provide an innovative way of expressing information architecture, explaining how each step of information architecture (needs analysis, competitive analysis, audience definition, user scenarios, processes, and site maps) is relevant to everyone's daily life. (Henderson, R. et al.,2003).

In addition to theoretical research on information architecture, some scholars have also explored the design principles of information architecture. In order to explore the impact of the type and depth of information architecture on user satisfaction, Cao Minjie and others conducted research from two aspects: the type and depth of information architecture. , designed experiments on the menu information architecture and icon information architecture respectively, using user satisfaction and operation efficiency as the experimental indicators. The experimental results show

that the icon information architecture with shallow depth has the highest user satisfaction and the best operating efficiency. Finally, two design principles for constructing information architecture are obtained: the flat principle and the iconization principle, which provide a reliable basis for designing information architecture (Cao, M. J. et al.,2016).

In terms of the application of information architecture, a formal approach to represent knowledge from IA concept definitions and a mechanism to transform this knowledge into analysis and design information for software engineers to process in order to develop interactions is proposed in Rojas et al. network application. Automatically convert the information architecture output by the information architect into the UML elements required by the software engineer for analysis and design, solving the problem of difficult information transmission between information architects and software engineers. It also examines how web visitors from different cultures allocate their attention to the four main parts of information architecture (tags, organization, navigation and search), and explores how the cultural background of web visitors is related to the network components in different information architectures. Follow the association. The topic of culture-specific information architecture in the global web community is finally revealed to aid better web design and development (Tang, G. M. et al.,2020).

2.5.5 Lasswell's Communication Model

The communication model, the 5W model, is one of Lasswell’s outstanding communication theories. Li Bin believes that the 5W model proposes five major elements that have an impact on the development of communication. These five major elements cover almost all content in the field of communication and are the theoretical framework of the entire communication science (Li, B.,1993). Zhang Guoliang believes that the 5W model has two values. First, it is the first time that the communication process has been divided in detail in the field of communication; second, it has proposed the five major research areas of communication for the first time, providing a basis for people to conduct in-depth and systematic research on communication theory. new ideas and channels. The proposal of 5W theory created a comprehensive theoretical framework and laid a foundation for people to study communication theory.

Scholars have also profoundly criticized the limitations of the 5W model. Lasswell's outstanding contribution to communication studies is that his 5W model provides a direction for communication research and enables people to find the focus of communication studies. In the past half century, the communication academic community has focused on studying the basic elements of the communication process. The emergence of the 5W model has laid a solid foundation for the long-term development of communication studies. The communication theory proposed by Lasswell has become a beacon of communication for more than half a century (Lin, Z.D.,1996). "

American scholar Simpson once satirized the 5W model, "The 5W model seems to have become a universal declaration at the entrance of the American Communications Research Institute". He believes that this model can decompose complex phenomena into independent elements, fully demonstrates the connotation of positivist theory, and replaces overall research with partial research. thus spreading rapidly. As research continues to deepen, the communication academic community has also begun to pay attention to the formation process of the 5W model. Morrison once proposed that the Lasswell model was formally formed at the Rockefeller Communication Seminar. Buckton also mentioned in his research that John Marshall had explained the 5W model in detail and comprehensively in his personal notes, so he mistakenly believed that Marshall was the founder of the 5W model (Harold D. Lasswell. 2008). American scholar Gary once conducted an in-depth and systematic study of the Rockefeller Communication Seminar, and his research results explained the formation process of the 5W model.

At present, scholars are still systematically analyzing the ideological dynamics behind the 5W model. Simpson once mentioned that the American elite system's theory of mass manipulation was the key to Lasswell's ability to propose this model, and it was this theory that caused great controversy throughout the Rockefeller Communication Research Conference. Simpson also noted that at the Rockefeller Communication Seminar, Lasswell proposed the concept of “communication intelligence” in order to increase government departments’ interest in communication research(Li, J., & Xiang, J. Q.,2008). This concept is closely related to the government’s military The concept of intelligence is relative. Gary analyzed the

connotation and value of Lasswell's theory mainly from a policy perspective. He believed that the fundamental purpose of Lasswell's 5W model was to launch a "war of words" in the hope of building a propaganda defense line. Judging from the above analysis, the historical background on the eve of World War II had a profound impact on the communication theory proposed by Lasswell, which fully demonstrated Lasswell's efforts to promote the US government's intervention in the war.

Although the above-mentioned scholars cannot fully show the full picture of the research on the 5W model by domestic and foreign scholars, they show to a certain extent the scholars' affirmation of the 5W model. With the deepening of research, the attention of industry scholars has shifted to the proposal and formation process of the 5W model. Among them, American scholar Gary conducted an in-depth and comprehensive analysis of the formation process of the 5W model.

2.5.6 Digital protection and inheritance

After the reform and opening up, our country quickly integrated with the world, and digital technology began to be widely used in all walks of life. From the industrial field to daily production and life, people's behavior and lifestyle have undergone earth-shaking changes. With computer network technology, information Technology-led digital technology has brought opportunities and challenges to traditional culture.

At the level of theoretical research on digital protection, my country has drawn on the digital research results of foreign developed countries and proposed many localized digital concepts based on its own national conditions. In his study of applying digital technology to the protection of national cultural heritage, Wang Yaoxi proposed the use of digital collection technology, digital storage technology, digital processing technology, digital display technology, digital communication technology, etc. to transform, reproduce, and restore national cultural heritage into a shareable and reproducible form. Regenerate digital forms, interpret them from a new perspective, preserve them in new digital forms, and then use them according to new needs (Wang, Y. X.,2009) . Song Junhua and Wang Mingyue analyzed the "emphasis on technology and light on culture" in the application of digital technology in the protection of intangible cultural heritage, the lack of cultural care, "emphasis on "tools" and neglect of "Tao", that is, only focusing on the cultural form of intangible

cultural heritage. While ignoring the inherent cultural structure and connotation of intangible cultural heritage, by drawing on the "participatory development theory" in the fields of anthropology and sociology, the concept of "participatory digital protection" is proposed, which is to introduce the inheritors and owners of intangible cultural heritage into digital protection process, and fully give them the right to speak, so that they can fully participate in the development and design of digital products. Through the cultural logic of inheritors and on the basis of communication, negotiation and discussion with computer programmers, we establish A digital classification and evaluation system that is in line with this culture; and based on the knowledge system and life experience of the intangible cultural heritage inheritors, combined with their own understanding of the characteristics of intangible cultural heritage, carry out reasonable digital design, so as to give full play to the educational and cultural functions of digital technology ;At the same time, establish a convenient and free interactive platform to facilitate healthy interactions between inheritors and inheritance owners and other different cultural groups, and finally achieve mutual understanding between cultures. Its core includes "participation", that is, intangible inheritance Human identity is involved in the process of digital protection and development to form the subject consciousness of cultural inheritance; secondly, "empowerment" changes the previous top-down government and expert model, giving inheritors sufficient voice and mobilizing their enthusiasm (Song, J. H. & Wang, M. Y.,2015).

Huang Yonglin and Tan Guoxin believe that in the process of using digital technology, it is necessary to handle the balance between digital technology and cultural ecology, the cross-integration between digital technology and multi-disciplines, and the role of digital technology in compound talents. The cultivation of aspects, the relationship between digital technology and the development of cultural industries; the application of digital technology in the protection and inheritance of intangible cultural heritage should be focused on four aspects: that is, digital collection and digital storage provide a complete protection of intangible cultural heritage To ensure the foundation, digital restoration and digital reproduction technology provide support for the effective inheritance of intangible cultural heritage, digital display and digital communication technology provide a platform for

widespread sharing of intangible cultural heritage, and virtual reality technology provides a platform for the development and utilization of intangible cultural heritage. space; and it is recommended to study the in-depth development and application of digital technology for intangible cultural heritage from six aspects: creating technical standards for intangible cultural heritage collection of digital resource data, exploring the application of visual expression of knowledge in intangible cultural heritage, and constructing A comprehensive application system of new technologies in intangible cultural heritage, building an interactive system platform for multimedia intangible cultural heritage, and building a technical system for the protection and inheritance of national intangible cultural heritage(Huang, Y. L. & Tan, G. X.,2012).

2.6 Reviews of Research Articles

2.6.1 Overview of digital protection and inheritance of cultural heritage

2.6.1.1 Overview of domestic research

This article takes the digital protection of cultural heritage as an entry point and focuses on exploring the research direction of photo blogging institutions. An advanced search was performed on the CNKI database of China National Knowledge Infrastructure. Since there are few documents directly related to "digitization of cultural heritage" and "digital archives", the scope was first expanded to "digitization of cultural heritage" and the search conditions were set to "topic=culture" "Heritage and theme = digitalization", as of December 30, 2022, a total of more than 5,000 documents were retrieved . Based on the retrieved documents, irrelevant content was eliminated, and a total of more than 50 valid data were obtained. Through in-depth analysis of the literature, from three perspectives : research on the concept of cultural heritage digitalization, cultural heritage digital protection policies and status quo, research objects and applications of cultural heritage digital protection, and Chinese scholars' related research on cultural heritage digital protection and inheritance . Provide a detailed explanation of the domestic current situation.

(1) Research on the concept of digitalization of cultural heritage

Huang Yanan(2007)There is no unified concept of "digital protection of cultural heritage" in our country. The concept of digital protection of cultural

heritage that is commonly used by Chinese academic circles is Wang Yaoxi's "using digital collection, storage, processing, display, dissemination and other technologies to transform, reproduce, and Restore it to a shareable and reproducible digital form, interpret it from a new perspective, preserve it in a new way, and use it with new needs." In recent years, many scholars have tried to redefine the concept of digital protection of cultural heritage. From the perspective of sports culture, Huang Yanan, Sun Shouqian and others proposed that this concept covers all aspects of digital protection, including: digital preservation, archiving, simulation, restoration, repair, evolution simulation, display, establishment of information systems, etc. Xu Fang, Jin Xiaopu (2020) these concepts can better help us understand the protection of cultural heritage. Some scholars have also sorted out the concept of digital protection of cultural heritage in the process of studying the development, technology application and digital cases of cultural heritage. Xu Fang and Jin Xiaopu (2020) pointed out that the focus of digital protection is the cultural connotation and spiritual inheritance of cultural heritage, and its realization Methods include using cloud computing, linked data, ontology, semantics, virtual reality, virtual augmentation and other technologies, as well as using the practices of cultural institutions such as libraries, museums, cultural centers, and archives.

Huang Yonglin (2012) Some scholars have also defined the concept of digitization of intangible cultural heritage. Huang Yonglin and Tan Guoxin proposed the concept of digitization of intangible cultural heritage and emphasized the importance of modern digital technology in protecting intangible cultural heritage . From a goal perspective, Zhao Yue, Zhou Yaolin (2017) believe that through the application of digital technology, the protection level of intangible cultural heritage can be effectively improved, thereby ensuring its long-term existence and development.

To sum up, scholars usually determine the concept of digital protection of cultural heritage based on the purpose, function, process, technology and actual needs of cultural heritage protection. With the continuous advancement of digital technology, the process and role of its use are also changing dynamically. Therefore, the concept definition is still in a dynamic development process.

(2) Policies and current status of digital protection of cultural heritage. my country has also actively explored the digital protection of cultural heritage. Laws and regulations such as the "Cultural Relics Protection Law of the People's Republic of China" and the "Intangible Cultural Heritage Law of the People's Republic of China" have been promulgated successively to provide strong guarantees for the protection of cultural heritage; in December 2005, the "Notice on Strengthening the Protection of Cultural Heritage" was proposed , so that the broad masses of the people are fully aware of the importance and urgency of protecting cultural heritage; in May 2022, the General Office of the Central Committee of the Communist Party of China and the General Office of the State Council jointly issued the "Opinions on Promoting the Implementation of the National Cultural Digital Strategy".

Wang Xiaoyu, Yang Li (2018) This is the first time From a new perspective, traditional cultural resources, cultural products, public cultural services, cultural consumption, and cultural management are integrated into the digital China environment to achieve common prosperity of cultural resources shared by all people. Some cultural institutions have also carried out related protection work to varying degrees. For example, the Dunhuang Academy used a variety of digital technologies to digitally reconstruct the cultural heritage of Dunhuang Mogao Grottoes, in order to achieve the permanent preservation of cultural relic information ; The National Library has launched the "Memory of China" project based on traditional cultural heritage and major modern and contemporary events. By digitally integrating such materials, it provides the public with online browsing, multimedia display and other services (China National Library, 2022) ;

Tao Lin (2013) In order to protect the "Legend of West Lake", Hangzhou Library interviewed oral inheritors and made audio and video recordings. Through digital technology, the interview content was made into a CD and materialized so that it can be better preserved in the library ; Zhengzhou Municipal Archives has also actively explored in-depth collection of intangible cultural heritage and historical relics archival materials, and expanded the collection of scattered historical materials in society, and organized activities such as immersive concerts for the inheritance of intangible cultural heritage (Zhengzhou Municipal Archives Museum , 2022) , highlighting the important role played by archives in inheriting excellent cultural

heritage. In addition, Chinese scholar Yan Hui (2022) also used the public policy content analysis method to conduct a comparative analysis of the cultural digital development strategies and policies of five countries and regions: China, the United Kingdom, Australia, the European Union, and the United States, to deeply understand and learn from their successful experiences. paving the way for countries to learn from each other's experiences in cultural digitization

(3) Related research by Chinese scholars on the digital protection of cultural heritage

Some scholars are based on a theoretical perspective: Wang Jianhua(2021) used the China National Knowledge Infrastructure (CNKI) 2001-2021 intangible cultural heritage digitization research field documents as the basic data source, combined with visual measurement software to perform keyword clustering, and generated a visual map to explore the domestic intangible cultural heritage in China in the past 20 years. Current status and research hotspots of digital research; Based on 160 intangible cultural heritage research projects funded by the National Social Science Fund from 2004 to 2019 and 1181 result papers, Xu Fei (2022) has in-depth explored the intangible cultural heritage Cultural heritage research projects, paper distribution, research hotspots and development trends, in order to provide useful reference for social developmen; scholars such as Tan Biyong (2021) discuss the operation model and implementation strategies of archives participating in the digital protection of intangible cultural heritage in the digital era . Yao Guozhang (2021) and other scholars pointed out that strengthening the digital protection of intangible cultural heritage is of great significance to promoting the inheritance, safety, dissemination and development of intangible cultural heritage. Therefore, they proposed the challenges and challenges faced by our country in the protection of intangible cultural heritage. The focus of digital protection. Some scholars based on a practical perspective: Ding Xiaoran (2022) deeply discussed the digital protection of intangible cultural heritage archives, elaborated on its connotative characteristics, analyzed current problems from multiple angles, and finally proposed a series of effective digital protection strategies. In order to achieve better protection results; Shu Xihong (2021) carried out special research on digital protection of rock art cultural

heritage, exploring how to digitally protect and innovatively utilize rock culture to make it "alive".

2.6.1.2 Overview of foreign research

The UNESCO World Heritage Convention [UNESCO, 1972] defines cultural heritage of world value as “architectural works, monumental sculptures and paintings, Elements or structures, inscriptions, cave dwellings and combinations of features of an archaeological nature; ICOMOS (2002) defines “cultural heritage” as “the expression of a way of life, including customs, practices, developed by a community and passed down from generation to generation , places, objects, artistic expressions and values, often expressed as intangible or tangible cultural heritage". It means the aesthetic, historical, social, spiritual or other special characteristics and value that a place, an object or a custom may have for present and future generations. The content of the term "cultural heritage" has changed significantly in recent decades and is not limited to monuments and collections of objects. UNESCO states that it also incorporates traditions or living expressions inherited from ancestors and passed on to future generations, mainly including oral traditions, performing arts, social customs, rituals, festivals, knowledge and practices about nature and the universe, or knowledge and skills for the production of traditional handicrafts. From a historical perspective, "cultural heritage" constitutes the memory of living culture, but this concept expands dramatically and incorporates both tangible and intangible cultural characteristics. Coordinated efforts and experiences in the form of initiatives and projects are moving towards the digitization of cultural heritage. Digitization helps in the best cases Preserve original heritage items and make digital equivalents available to the public at large. Advances in digital technology have facilitated the observation and study of heritage artefacts across the board at different levels.

2.6.2 Review of relevant literature on the digital protection and inheritance of Xingcheng Ancient City

Books or papers have been found that use digital means to protect and inherit the cultural heritage of the ancient city of Xingcheng.There are three theoretical papers in the study. The following introduces the expansion of the research scope from residential forms to the entire ancient city, and provides a detailed explanation of the protection theory. There are many basic research materials, but there is no

research on the digital protection of cultural heritage in Ningyuan Acropolis. There is only static protection and the continuation of some folk culture, which lacks practicality. Of course, this is also caused by the theoretical research ideas in previous years.

Hu Fei (2007) of Shenyang Jianzhu University wrote "Protection of Traditional Residential Houses in the Ancient City of Xingcheng, Liaoning Province". According to the characteristics of traditional residences in the ancient city of Xingcheng, and on the premise of protecting the historical and cultural value of traditional residences, the maintenance methods of traditional residences were analyzed and studied. This article puts forward some suggestions from three aspects: overall protection, partial maintenance and construction of traditional residences. In addition, a manual for the convenience of residents of the ancient city - "Xingcheng Ancient City Traditional Residential Residence Maintenance Manual" was also summarized and formed. This article involves the protection of traditional dwellings in the ancient city and is the third part of the "World Heritage Application Manual". Through on-site surveying and mapping, the author analyzed and summarized the local current situation through research analysis, interviews, questionnaires, survey analysis, etc., and summarized the types of ancient buildings and characteristics of traditional residences in the city, the spatial characteristics of traditional residence courtyards, and the traditions of residences. . The construction of handicrafts, traditional residential buildings and the protection methods of traditional residential buildings were studied and summarized.

Fei Xinyan(2009) from Harbin Institute of Technology said that the main content of the research on ancient city protection is around the urban spatial environment, architectural form and cultural characteristics of the ancient city. The research focuses on the following aspects: First, the research background and content are problematic as a whole. Environment, historical evolution, historical inheritance, value and current situation. As a comprehensive research section, this section aims to summarize the values and issues. The second is the direction of ancient research and the third is specific implementation methods, including protected areas, space and building protection measures. This part mainly studies methods of urban protection. Protect ancient cities through concrete actions.

The first chapter of "Research on the Renewal and Heritage Protection of the Ancient City of Xingcheng, Liaoning" written by Wang Ahui of Shenyang Jianzhu University explains the significance of this research. Chapter 2 conducts a detailed analysis through the investigation and research of basic information such as the historical evolution of Xingcheng Ancient City, the spatial characteristics of the ancient city, residential characteristics, and heritage overview. Combined with the characteristics of Xingcheng ancient city, the overall research framework of the paper is constructed. The third chapter, based on summarizing the research and analysis results, discusses the issues that should be paid attention to in the renewal process of Xingcheng ancient city and puts forward suggestions for rectification. We designed the specific project and conducted a comparative analysis of the construction effects before and after the design. Chapter 4 is the thoughts and experiences on the heritage protection and urban renewal of Xingcheng Ancient City.

However, a review of the research revealed that China has not formed a complete protection system for important cultural heritage protection institutions such as pictures and archives. The institutions participating in the digital protection of cultural heritage are relatively scattered, there is a lack of contact between various institutions, and there are few projects. The advantages and resources of these cultural institutions have not been fully utilized to maximize their effectiveness. As a developed country with rich cultural heritage, Germany has carried out a number of cultural heritage protection efforts, especially in terms of the participation of cultural institutions such as photo archives. It has formed a relatively complete policy system and protection system from top to bottom, and has achieved A series of results have been achieved, and in the current related research, there is still a lack of in-depth exploration of the digital protection of cultural heritage in Xingcheng Ancient City . This study hopes to study Xingcheng Ancient City from the perspective of cultural research and deeply explore Xingcheng Ancient City . The history and development of the ancient city uses the concept of cultural genes to sort out the culture of the ancient city. Based on the different expression forms and identification dimensions of cultural genes, the cultural resources of Xingcheng ancient city are divided into dominant cultural genes and recessive cultural genes. Extract core cultural genes and effectively organize the internal cultural logical structure to build a digital database of

cultural genes of Xingcheng Ancient City , thereby increasing the systematic academic data on the cultural heritage of Xingcheng Ancient City and enriching the archives and statistical information of Xingcheng Ancient City Cultural Gene Map. At the same time, visualization methods are used to translate historical and cultural information into a visual language that is familiar to the audience, and digital methods such as augmented reality are used to conduct interactive experiments with the audience to enhance the attraction of ancient city culture, enhance local cultural identity, and strengthen community participation and educational inheritance, thereby Better protection of ancient city culture also provides new ideas for the inheritance of ancient city culture.

CHAPTER III
RESEARCH METHODOLOGY

This study adopts a mixed research method that combines qualitative research with practice. It mainly studies how to sort out and extract the ancient city culture, conduct information visualization design at the same time, and finally disseminate the visualization through digital websites to provide new solutions for the protection and inheritance of the ancient city. ideas. The research location is Xingcheng Ancient City, Xingcheng City, Liaoning Province, and the research objects are the national key cultural relics protection units in the ancient city: ancient city walls, Confucian temples, bell and drum towers, and stone squares. This chapter introduces the research methods used in this study, mainly including research content, research methods, research period, research area, population and sample, research tools, data collection, data processing and analysis, research results, etc. It specifically includes the following parts:

3.1 The Scope of Research

3.1.1 Research Content

3.1.2 Research Methods

3.1.3 Research Period

3.1.4 Research Area

3.1.5 Population and Sample

3.2 Research Administration

3.2.1 Research Tools

3.2.2 Data Collecting

3.2.3 Data Processing and Analysis

3.2.4 Research Result and Presentation

3.1 Scope of Research

3.1.1 Research Content

This time, we mainly study the ancient city of Xingcheng, Liaoning: the digital protection and inheritance of cultural heritage. The detailed content mainly includes three parts:

(1) The history and development of the ancient city of Xingcheng is divided into two parts: history and development. Study historical documents and combine on-the-spot surveys and interviews to deeply explore the social history and changes in the meaning of the construction of the ancient city of Xingcheng.

(2) Analyze the current status of protection and inheritance of Xingcheng ancient city's cultural heritage and the unique style of ancient city architecture, and at the same time deeply explore the cultural connotation behind the architecture, use the concept of cultural genes to sort out and extract cultural content and construct a cultural gene genealogy map.

(3) Design the information visualization of the cultural gene genealogy map, and at the same time disseminate it through digital websites, use information visualization to protect the ancient city, and use digital websites to inherit the culture of the ancient city.

3.1.2 Research Methods

(1) Literature research method

By comparatively analyzing, summarizing and refining domestic theoretical monographs, academic papers, research reports, newspapers, laws and regulations and practical cases on the digital inheritance and protection of ancient city culture through literature reading, we can obtain the current domestic and foreign research on the digital protection and inheritance of ancient city culture and its Research trends on related applications, clarify the research content and dimensions, hot spots and deficiencies; collect, consult and organize historical documents related to Xingcheng Ancient City, including archive compilation, local chronicles, cultural and historical materials, Chinese and foreign travel notes, folk records, historical maps, etc. Through basic data screening, study and comparison, the development trajectory of Xingcheng Ancient City is clarified, the cultural resources of Xingcheng

Ancient City are refined, and basic data are provided for sorting out and researching its cultural genes.

(2) Field investigation method

Field investigation is a very common research method in qualitative research. Through on-the-spot visits, on the one hand, different types of cultural relics sites, historical buildings, cultural relic protection units, residential facilities, commercial facilities and tourism projects are selected as inspection points to conduct an investigation of the ancient city. Conduct in-depth investigation of cultural heritage. Collect first-hand information; on the other hand, select representative residents, business owners, tourists, and relevant management departments of Xingcheng Ancient City as interviewees to prepare for in-depth interviews and record relevant information.

(3) In-depth interview method

The interview method can understand a specific group's understanding of a matter, and the interviewer should also be involved, such as archives staff and chat interviews with ordinary residents, to fully understand the actual situation and relevant data of archives managers, and to understand the public's perceptions of the situation. cognition of ancient city cultural heritage archives, and summarize and analyze the beneficial impact that strengthening the management of ancient city cultural heritage archives may have on society. At the same time, representative residents, business owners, tourists, and relevant management departments of Xingcheng Ancient City were selected as interviewees, and in-depth interviews were conducted to record relevant information.

(4) Participant observation

Participant observation is to observe, listen and ask in a specific environment and then obtain relevant materials needed for research. This process can provide a deeper understanding of the local residents of Xingcheng Ancient City’s intuitive feelings about the current status of Xingcheng Ancient City’s cultural heritage. With prepared questions, enter the living spaces of different groups of people, conduct relevant interviews and records, and obtain first-hand information.

(5) Digital records

Digital recording of construction refers to the practice of using digital technology to record and manage relevant information during the design, construction and maintenance of buildings.

(6) Group discussion

This study uses group discussions and other methods to segment and organize and analyze user needs to help designers better understand and grasp the characteristics of users' needs. The differences in needs brought about by different types of users will affect designers' decisions in information filtering and display methods. A total of 15 participants were found here, divided into three types: understanding users, usage users, and research users.

First, understanding users. Such users browse information quickly for the purpose of entertainment and leisure, and only have superficial recognition and understanding of the ancient city information. They generally focus on displaying the basic information and historical background of the ancient city's cultural heritage.

Second, usage users. Such users are very interested in ancient cities and need to have an in-depth understanding of the cultural connotations of ancient cities. Content about the folk activities and stories of the ancient city can be added and interactive experiences can be provided.

Third, research users. Such users are mainly cultural protection staff and scientific researchers. It is not only necessary to display ontology information, but also has a certain demand for the deep culture expanded by ontology information.

Through the digital website design of Xingcheng Ancient City, different types of users can find the content they care about on the same digital platform, achieving the goal of a website design that meets the needs of multiple users. Of course, during the actual design process, the content and functions of each part can be optimized and adjusted according to the specific conditions and resource constraints of the project.

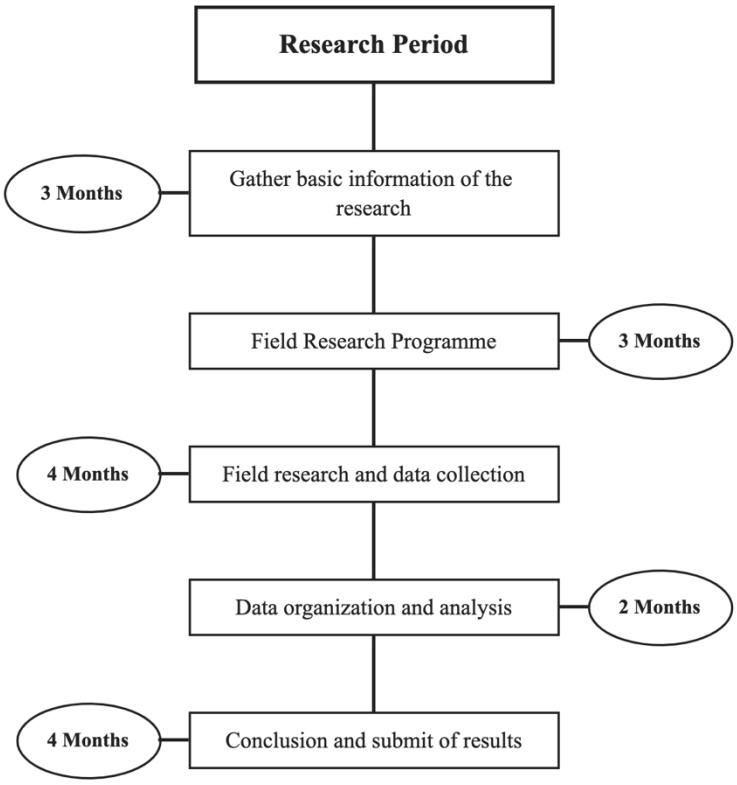
At the same time, when the digital website was completed, all 15 members of the user needs group discussion participated in the evaluation.

3.1.3 Research Period

The research period lasts for about one year, June 2022 - December 2023

This is the timetable for the research:

Table 3- 1 Research Period



Source: Sun Yijia (2023)

3.1.4 Research Area

Xingcheng City is located in the southwest of Liaoning Province, on the west coast of Liaodong Bay. Xingcheng Ancient City is located in the middle of Xingcheng City. The ancient city is square in shape, with a city gate in the middle and a semicircular urn outside the gate. There is a Kuixing Tower in the southeast corner. There is a majestic bell tower in the city. The east, west, south and north streets of the bell tower run through the center of the city. Xingcheng Ancient City is one of the four most complete ancient Ming Dynasty cities in existence (Figure3-1).

Figure 3- 1 Definition of Xingcheng Ancient City Protected Area

Source: Google Map

The main scope of this study is the national key cultural relics protection units in Xingcheng Ancient City, including: Protection unit, as shown in Figure (3-2). Among them, the Xingcheng City Wall was announced by the State Council as the third batch of national key cultural relics protection units in 1983. In 2006 and 2012, the Xingcheng City Wall was twice included in the "China World Cultural Heritage Tentative List" by the State Administration of Cultural Heritage. In December 1990, Xingcheng Ancient City was approved as a provincial-level historical and cultural city. In 2006, the Bell and Drum Tower, Zushi Stone Square, Xingcheng Confucian Temple and the third batch of national key cultural relics protection units, Xingcheng City Wall, were merged into Xingcheng Ancient City, which was announced as the sixth batch of national key cultural relics protection units. In 2007, it was selected as one of the "Top Ten in China" Ancient City" (Cultural Relics Management Office, 2020).

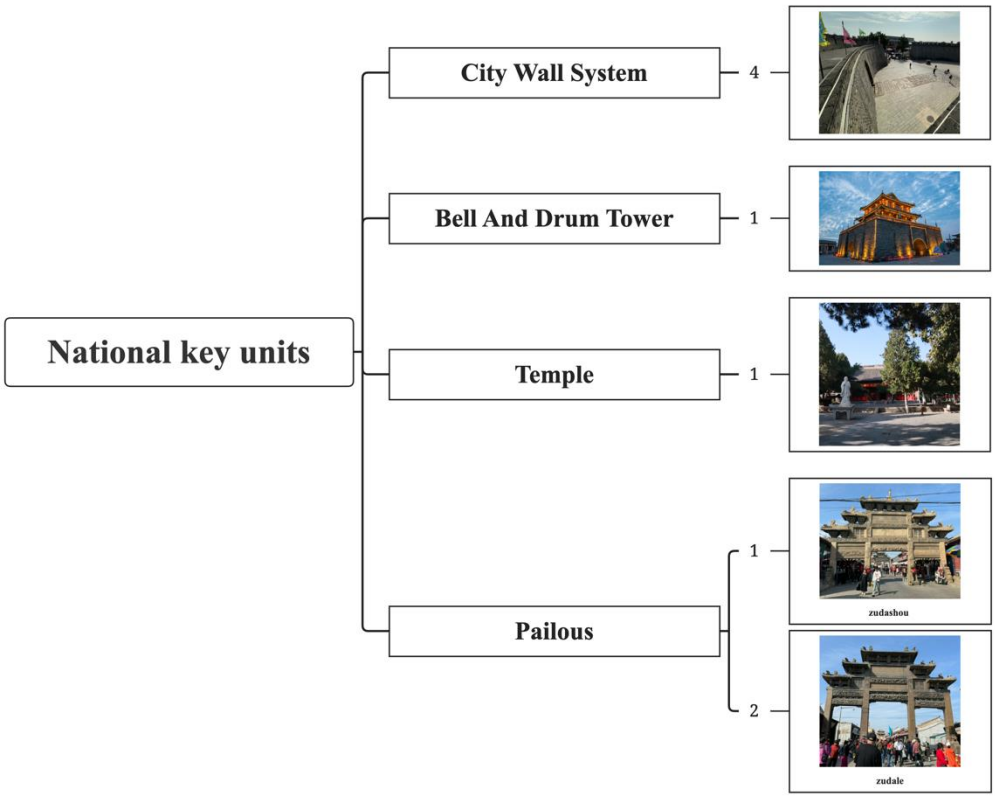


Figure 3- 2 Xingcheng ancient city geographical location

Source: Google Map

3.1.5 Population and Sample

(1) The first group (Key Informants): A total of 5people, they are the government and related researchers, the person in charge of the ancient city project, the internal workers of the ancient city, museum director、and scholars

(2) The second group (Casual Informants):A total of 11 people, they are tour guides in the ancient city, operators of shops in the ancient city, University Digital Media Arts Teacher,cultural relics conservation worker, digital media designer and student.

(3) The third group (General Informant、practice information provider): A total of 15 people, they are local residents, digital media designer, tourists in the ancient city etc and College Students

3.2 Research Administration

3.2.1 Research Tools

The tools used in this study are mainly used for data collection and sorting in the process of basic research. At the same time, relevant collection and retrieval were carried out through field visits and interviews. The main research tools used are as follows:

3.2.1.1 Literature search

Document retrieval is one of the very important tools for cultural research. The documents mainly used in this study include archives, ancient books, local chronicles, professional books, academic papers, academic journals and other documents. This part is mainly used to understand the ancient city of Xingcheng. History and development, while sorting out the cultural connotation of the ancient city, providing sufficient theoretical information and support for this study.The main sources for literature search are:

(1) CNKI

CNKI is a national key knowledge infrastructure project approved by the State Press and Publication Administration and managed by the Chinese Academy of Sciences. It aims to build a digital, networked and intelligent service platform for China's knowledge resources. The main function of CNKI is to provide retrieval and reading services for various Chinese literature resources such as academic journals, theses, conference papers, newspapers, yearbooks, and encyclopedias. Users can perform literature search, view full text, download cited documents and other operations through CNKI. In addition, CNKI also provides some auxiliary functions, such as document management tools, reference generation tools, knowledge discovery tools, etc. (Baidu Encyclopedia, 2023) .

(2) Google Scholar

Google Scholar search is a document retrieval service that mainly provides retrieval services for several academic literature resource databases such as VIP Information and Wanfang Data. Google Scholar lets you find reports, abstracts, and citations for these scholarly materials. Google Scholar provides an easy way to search a wide range of scholarly literature. Search many disciplines and sources from one place: from scholarly publishers, professional Sexual societies, preprints, peer-

reviewed articles, theses, books, abstracts, and articles from universities and other academic organizations. Google Scholar helps identify the most relevant research across academic fields. (Baidu Encyclopedia , 2023) .

(3) Xingcheng Investment Group official website、Xingcheng Culture and Tourism Bureau official website、National Cultural Relics Protection Network and other websites

Use online databases and websites to search for keywords such as the history of the ancient city. These websites provide a large amount of literature. During the research process, by consulting multiple historical documents, we found that the historical documents are numerous and complex, and many contents are not summarized and recorded in detail. , during the review process, it took a lot of materials to find one content, so at this time, the author also had the practical context to finally sort out each building for final digital inheritance.

3.2.1.2 Interview method

This interview mainly used two methods: face-to-face interviews and online interviews. Due to the impact of the epidemic, some interviews were conducted online. Questions were sent to the interviewers in a unified manner. After receiving responses, they will be conducted according to the questions. The interviewers and interview questions were expanded, and each interview process was recorded in its entirety. Face-to-face interviews are conducted in the ancient city of Xingcheng to ensure that the information provided by the interviewees is true and effective.

3.2.1.3 Observation method

The observation methods of this study mainly include direct observation and participatory observation. As a bystander tourist, I went deep into the ancient city and observed the current status of cultural inheritance in Xingcheng ancient city tourism. At the same time, we went deep into some local schools, training institutions, and residential areas to establish close contact with them and understand the issues of dilution of educational inheritance faced in cultural protection.

3.2.1.4 Group discussion

The group discussion was divided into 3 times. Tourists, ancient city workers , ancient city residents, and digital technicians were divided into 3 groups to discuss the same issues. The questions prepared in advance were distributed to the

elder group. In this way, the current situation and problems in the cultural inheritance of Xingcheng ancient city are collected, and the entire process is recorded in detail to lay a solid foundation for further research and screening.

3.2.2 Data Collecting

Data collection is mainly carried out through written documents and field work. The basic survey was divided into three stages for collection, namely, June July 2022, December 2022 January 2023, and May June 2023

(1) collection of written documents: written documents mainly include literature materials, books, images, audio, video, etc., mainly through copying, recording, video recording to collect and analyze these information.

(2) On-site work: Go to the data collection site in person, integrate into the local Zhuang people, intuitively understand the daily life behaviors and subjective concepts of the participants from the perspective of the participants, and understand the uses and functions among the participants. During interviews and observations, relevant notes should be recorded during fieldwork. At the same time, the name, contact information, address and other personal information of the relevant information provider should be recorded for next time contact.This part of the data collection mainly focuses on understanding the current status of cultural inheritance in Xingcheng Ancient City and understanding local cultural and educational inheritance issues.

(3) Understand the applicable methods for digital inheritance of ancient cities through technical support personnel, and estimate and judge the value.

3.2.3 Data Processing and Analysis

Guided by the conceptual framework, this study collects information through field and literature, and classiifies the information preliminarily according to the research objectives. Finally, Through the combing of the historical context of the ancient city, the classification of cultural genes and the means of digital innovation are used as tools for descriptive analysis，The specific research is as follows:

Step 1: Literature Research

Through archives, ancient books, local chronicles, professional books, academic papers, academic journals and other documents, it is used to understand the history and development of Xingcheng ancient city, as well as the cultural

connotation and architectural features behind the buildings, and based on the unique history of each building It divides time periods and important historical nodes with development, and is used to visualize the historical context of each building.

Step 2: Expert Interview

Interview experts in relevant fields, history, culture, and digital media arts to gain unique insights and understanding not found in books. Also get digital advice.

Step 3: Sorting and Extraction

After conducting literature research and expert interviews, the key information of the research object was sorted out and extracted for use in digital practice.

Step 4: User needs survey

Through focus group discussions, the user needs of digital websites were investigated and discussed based on different user needs.

Step 5: Selection of technical tools

The main technologies used in this digital website are: information visualization, 3D scanning and modeling, virtual reality, and augmented reality interactive technology.

Step 6: Content Practice

Based on the research content, we customized content planning and determined the specific content of digital website practice as using information visualization to organize the historical and cultural connotations of each building and disseminating them through digital websites.

Step 7: Testing, Evaluation and Educational Inheritance

Choose an art university and a group of digital media arts majors to get their feedback and support through an online platform.

3.2.4 Research Result and Presentation

All collected data are analyzed and illustrated in a descriptive manner to answer the research objectives of each item. I will apply various concepts and theories to assist in data analysis. The discussion of the results is to determine whether they are relevant to the previous research.

This study adopts a mixed research method that combines qualitative and practical methods to conduct on-the-spot research, observation and interviews in the ancient city of Xingcheng, collect data and analyze the information during the

participation process. Understand the current problems encountered in the inheritance of ancient city culture. On this basis, use the concept of cultural genes to sort out the ancient city culture, propose strategies and plans for digital protection and inheritance of the ancient city, and implement some of them.

This research will be published in two forms: full-text graduation thesis and journal paper.

CHAPTER IV
RESEARCH RESULTS

This chapter is the target chapter of the paper and consists of three parts.

The first part studies the history and development of Xingcheng Ancient City, and conducts in-depth excavations from the two parts of history and development. First, the archives category: Archives collected by the First Archives of Chinese History, Liaoning Provincial Archives, Ming and Qing Archives, China's First Historical Archives, Selected Archives of the Northeast Frontier; Ancient Books Category: History of the Ming Dynasty, Liaodong Chronicles, Complete Liao Chronicles, Liaohai Series, Qing Dynasty Tongdian, Ningyuan Prefecture Chronicles, Xingcheng County Chronicles, Suizhong County Chronicles, Shengjing General Chronicles; modern works: Northeastern Local History Manuscripts, Ancient Town in Western Liaoning - Xingcheng, Research on the Liaodong Border in the Ming Dynasty, Northeastern Immigration and Social Changes in the Qing Dynasty , Qing Dynasty, local government; and the collection of relevant periodicals and literature, sorting out the social history and development of Xingcheng ancient city before and after the city was founded. At the same time, it combined field surveys, participant observations, in-depth interviews and other methods to collect data from different groups of people. A lot of text. Understand the development context of Xingcheng Ancient City and the architectural heritage in Xingcheng Ancient City in the modernization process, combined with the changes in the social fields that have a great impact on the development of Xingcheng Ancient City, and improvise the evolution of the ancient city from a traditional society to a modern society, and a military city to a cultural heritage The process of transformation laid a solid theoretical foundation for the subsequent research on specific content.

The second part focuses on the historical and cultural relics in the ancient city of Xingcheng and conducts specific research on the four building groups of the national key cultural relics protection units, namely: city wall system, temples, bell and drum towers, and stone squares. This summary will have three subsections. The first subsection specifically analyzes the architectural characteristics and architectural

styles of the four building groups, as well as the changes in meaning of each building in its history and development stages; the second subsection studies the cultural connotation behind the architecture; and finally One section uses the concept of cultural genes to organize and screen the scattered cultural heritage resources in the first two sections to condense the unique cultural resources that are most effective for the protection and inheritance of the ancient city . It conducts gene sorting, extraction and map construction.This part of the review is used to solve the visualization part of the third research goal.

The third part, which is the practical part of this chapter, visually translates the historical and cultural relics and their contextual genetic maps sorted out in the previous chapters, and achieves digital protection and inheritance through the construction of a digital system. At the same time, through the development of digital systems, we will use them in museums, educational classrooms, communities and other places to conduct experimental research to ensure the continuation of culture and the inheritance of traditions, and to better understand the learning styles and cultural interests of the new generation. Convey cultural content in an attractive way and promote communication and dialogue between different cultures. At the same time, the feasibility of this system will be finally tested and analyzed to achieve better inheritance and protection.

The specific research objectives are as follows:

4.1 To study the history and development of inheritance in Xingcheng Ancient City

4.1.1 1428 – 1912 Ancient city was founded to the feudal period (Ancient city of Xingcheng went from a military stronghold to a defunct defense)

4.1.2 1912-1949 Republic of China period (Full of war and change)

4.1.3 1949-1978 From the founding of New China to the construction of socialism in New China (Reform and Development)

4.1.4 1978-2022 Since reform and opening up (Modern development and cultural protection and inheritance stage)

4.2 The current problem and the form of cultural heritage for digital media design

4.2.1 The architectural style and cultural connotation of Xingcheng Ancient City

4.2.2 Analysis of the current situation of cultural heritage protection and inheritance in Xingcheng Ancient City

4.2.3 Extraction of ancient city cultural heritage forms and construction of pedigree diagram from the perspective of cultural genes

4.3 Develop digital systems for protection and transfer of knowledge about cultural heritage

4.3.1 Demand analysis for Xingcheng Ancient City digital website design and development

4.3.2 Digital website design practice

4.3.3 Xingcheng Ancient City Digital Website Results Test

4.3.4 Xingcheng Ancient City Digital Website Communication Experiment

4.1 To study the history and development of inheritance in Xingcheng Ancient City

The ancient city of Xingcheng was built in the Ming Dynasty. The nearly 600-year-old ancient city records the changes of the sun and the moon. Xingcheng Ancient City is not just a simple ancient city, but more importantly, its magical history and profound cultural connotation. This research collected a large number of social and historical documents, historical records and books about Xingcheng Ancient City through archives, ancient books, modern works, CNKI, Baidu Academic and Xingcheng Ancient City Book Collection. At the same time, during the physical inspection process, through communication with the interviewees, we obtained first-hand information on the current development status of Xingcheng Ancient City (Dong, Y. P.,2014).

Xingcheng City, Liaoning Province, is located in the southwestern part of Liaoning Province, on the west coast of Liaodong Bay. "It is bounded by Xiongbian in the north, the Bohai Sea in the Antarctic, and is surrounded by narrow mountains and natural dangers." (Xingcheng Urban Construction Bureau,1979) During the Qing Dynasty, due to the establishment of Ningyuan Prefecture, its administrative division

was expanded to the outside of Shanhaiguan. It was an important gateway and frontier position in the Northeast region connecting the pass. Ningyuan area is surrounded by mountains and rivers and has a pleasant climate. There are many mountains, rivers and rich natural resources in the area. The name Xingcheng originated from the Liao Dynasty and was called Xingcheng County. It was changed to Ningyuanwei in the Ming Dynasty and Ningyuan Prefecture in the Qing Dynasty. In 1913, it was changed to Ningyuan County in the second year of the Republic of China. In 1914, it was changed to Xingcheng County in the third year of the Republic of China. By December 1986, with the approval of the State Council, Xingcheng County was abolished and established as Xingcheng City (county-level city).

Xingcheng Ancient City is an ancient city from the Ming Dynasty with a long history. It has a development history of nearly 600 years and is one of the most intact ancient cities in China. It has preserved the complete urban layout and many important historical buildings, and witnessed a series of major historical events in the late Ming Dynasty. It is an important carrier of the culture of the Western Liaoning Corridor, fully embodies the cultural connotation of life in Western Liaoning, and has extremely high historical and cultural value.

The ancient city has been repaired through the ages and has effectively preserved a large number of traditional elements. Since the reform and opening up, the rapid development of modern urban construction has brought great interference and damage to the protection of the ancient city, affecting the cultural heritage of the ancient city, leading to the gradual dilution and loss of the ancient city's culture. At present, the protection and inheritance of the ancient city have entered a new era, and there have also been tremendous changes and developments. This chapter will deeply explore the history and development of the ancient city. The research is divided into four parts. The history of Xingcheng ancient city is divided into two stages. The locations are: 1428 - 1912, when the ancient city was founded to the feudal period, describing the transformation process of the ancient city of Xingcheng from a military stronghold to a defunct defense; 1912 - 1949, the period of the Republic of China, a period full of wars and changes. The development stage is divided into two parts, namely: 1949 - the founding of New China in 1978 to the period of socialist construction in New China, the period of reform and development; 1978 - the present

reform and opening up to the present, which is the period of cultural protection, inheritance and modern development stage (Yan, H.,2022).

4.1.1 1428 – 1912 Ancient city was founded to the feudal period (Ancient city of Xingcheng went from a military stronghold to a defunct defense)

The ancient city of Xingcheng was built in the Ming Dynasty, and the entire history of the Ming Dynasty revolves around the word "city". At the beginning, Zhu Yuanzhang of the Ming Dynasty relied on "building high walls and hoarding grain" to conquer the world. In the 276 years of its existence, the Ming Dynasty built countless cities and built a whole dynasty of cities. This city includes the capital city, the town city, the acropolis, the suo city, the fort city, and the post city. It also built a Great Wall to prevent the northern nomads from invading southward.

The ancient Chinese legend "Han Dynasty Tombs and Tang Towers with Zhu Circles" means that the Ming Dynasty attached great importance to building cities. The ancient city of Xingcheng was built in this era and was built on flat ground in full accordance with the regulations of the Ming Dynasty(Xu, F. et al.,2022).

Since the construction of the ancient city of Xingcheng in the third year of Xuande in the Ming Dynasty (1428), over the past 600 years , the ancient city of Xingcheng has cultivated profound cultural heritage and connotations. The thousand-year-old ancient county tells ancient legends. The city walls of the past 600 years record the changes of the sun and the moon. Xingcheng Ancient City is not just a simple ancient city, but more importantly its magical history and profound cultural connotation (Wu, B. A.,2010).

(1) Overall environment

Xingcheng Ancient City is located in the west of Liaoning Province (Figure 4-1) , in Xingcheng County, Huludao City, on the west coast of Liaodong Bay. It is located in the middle of the Liaoxi Corridor, the chokepoint of transportation between Beijing and Shenyang (Ding, X. R.,2022).

Figure 4 - 1 Forms the geographical location of the ancient city
Source: Google Map

There are thick mountains in the north of this place, forming a long and narrow channel along the coast, called the Western Liaoning Corridor (Figure 4-2) . Since ancient times, this place has been an important transportation artery connecting the inside and outside of Shanhaiguan. It has outstanding military capabilities and is an important condition for the establishment of the ancient city of Xingcheng. In the long-term historical development process, it has become the only way for exchanges between the northern region and the Central Plains.

Figure 4 - 2 Formation of topography around the ancient city
Source: Google Map

The terrain in Xingcheng County is high in the northwest and low in the southeast. It is a hilly area continued by the Songling Mountains. From an altitude of 300 meters in the northwest to less than 20 meters in the southeast coast, it forms the southeast coastal plain, the central slope hills and the northwest low mountainous area, forming a geographical environment of "six mountains, one water, and three parts of fields". There are more than 130 peaks above 300 meters above sea level in the city, among which 12 peaks such as Laohuangding, Wudingshan, Daqingshan, Dadingshan and Huamei Mountain are all above 500 meters above sea level. The highest peak, Huangding Mountain, is 701.8 meters above sea level, and the coast of the Bohai Sea is a long and narrow coastal plain. There are 151 large and small rivers in Xingcheng, among which Xingcheng River, Yantai River and Liugu River are distributed vertically and horizontally at equal intervals. Xingcheng Ancient City is located between mountains and rivers, with a natural and harmonious environment. Its surrounding ecological environment was very good during the Ming and Qing Dynasties. According to the "Xingcheng County Chronicle", "In February 1682, Saint Ancestor Xuanye went to Shengjing Mausoleum again. On the 10th, he surrounded Ningyuan and shot two tigers to death, and stationed in Ningyuan Prefecture."

Emperor Kangxi wrote a poem here again One song: The ancient city is close to the vast wilderness, and the old warriors recall the Western Expedition. The fortress is full of brambles and hazelnuts, and the village chickens are crowing at dawn. It can be seen that the overall environment around the ancient city was still in a very primitive mountain and forest state at that time.

Xingcheng Ancient City is located in the north temperate zone, and its climate characteristics are subhumid monsoon climate. There are four distinct seasons, with rain and heat at the same time, and plenty of sunshine (Wang, Y. X.,2009).

The ancient city is located in the center of the ancient city, covering a total area of 67.76 hectares. The city walls are square and it is a typical military defensive city. The internal environment is mainly composed of traditional neighborhoods, with residential functions forming the main body. They are distributed vertically and horizontally from north to south, east and west along the street, with rich shapes and evenly distributed in four areas divided by cross streets. Form a traditional urban form dominated by residential functions. The main commercial shops in the city are located along both sides of the cross street. Other functions are scattered in residential neighborhoods, such as schools, theaters, factories and administrative buildings. Most of these buildings are renovated and updated from original temples and government offices. The existing city wall is the original inner city boundary of the ancient city. There used to be a moat and an outer city wall on the outside. These parts have disappeared and have been replaced by free-form neighborhoods, which constitute the external environment. The outer environment of the ancient city covers an area of about 30 hectares, and the nature of its residential function can also be clearly seen. The blocks show a natural growth state, and the architectural texture is the same as that inside the city, distributed on a small scale. Commercial and office functions are distributed on the main traffic facing the four city gates. There are fixed open-air farmers' markets, shopping malls and other buildings not far from the four city gates (Wang, X. Y. & Yang, L.,2018).

Generally speaking, the current layout of the ancient city inherits the rigorous planning structure of ancient times. The blocks on the periphery of the ancient city extend outwards with a radius of about one kilometer from the ancient

city as the center. They grew disorderly and freely over a long period of time, forming a unique traditional urban form (Figure 4-3). The planning and development of the ancient city of Xingcheng were influenced by the traditional concepts and ruling ideas of ancient China. At the same time, its establishment had a strong purpose of military defense, and its overall characteristics are very prominent.

Figure 4 - 3 Xingcheng Ancient City Urban Environment
Source: Fan Xinyu and Sun Yijia

(2) Historical evolution

Historically, since the founding of the city, the occurrence of these major historical events have marked the reasons why the ancient city of Xingcheng will become a cultural heritage in the future. In the early Ming Dynasty, due to intrusions from northern ethnic minorities, the imperial court began to set up defenses. In the third year of Xuande in the Ming Dynasty (1428), Wu Kai, the quasi-general soldier of the Ming Dynasty, and Bao Huaide, the imperial censor, set up an acropolis in the land of Jinzhou and Duanzhou, north of Caozhuang and west of Tangchi. Named Ningyuanwei, it was completed in the fifth year of Xuande (1430) in the Ming Dynasty. In the same year, the Ningyuan Confucian Temple was completed and

Ningyuan Academy was built in the Confucian Temple. The city at that time was square in shape, with a gate in the middle of each side of the city wall (Figure 4-4).

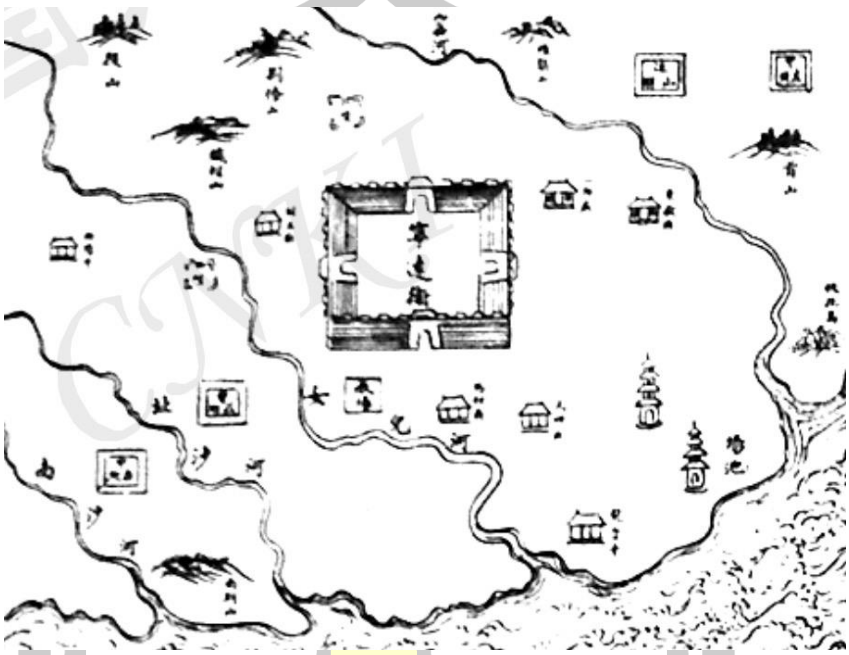


Figure 4 - 4 Ancient map of Ningyuan Acropolis in the Ming Dynasty
Source: Xingcheng County Chronicle of the Republic of China

In the second year of Longqing in the Ming Dynasty (1568), an earthquake occurred in Xingcheng and Ningyuan City was destroyed. After the second year of Tianqi (1622), the Jin soldiers captured Guangning. The court was shocked and undecided. Yuan Chonghuan, the staff officer of the Ministry of War, rode out of the customs alone to Ningyuan to inspect the situation outside the customs. In the third year of the Apocalypse (1623), Yuan Chonghuan, the deputy military commander of Ningqian Road, carried out reconstruction. In the fourth year of the Apocalypse (1624), Ningyuan City was completed and became an important town outside the pass. After the sixth year of the Apocalypse (1626) , Jinhan Nurhachi led an army of 60,000 to attack Ningyuan City. They suffered disastrous defeats in successive sieges. Nurha was naked and heavily wounded by the red Yi cannon. This battle was known as the "Ningyuan Victory" in history. In the seventh year of the Apocalypse (1627) Hou Jin Khan Huang Taiji avenged his father's hatred and led his army to attack the

two cities of Ningyuan and Jinzhou, both of which suffered heavy defeats. It was called the "Ningjin Victory" in history (Tong, L. & Wang, M.,2014).

In the third year of Chongzhen (1630) , Yuan Chonghuan was sentenced to death . From then on, Ningyuan's defense was weakened. Most of the city walls preserved today were rebuilt during that period. During the Ming Dynasty, Ningyuanwei was both the name of an administrative region and the name of a military organizational unit. It was derived from the military system of the Ming Dynasty - the Weisuo system. Ningyuan Guard is one of the twenty -five guards of Liaodong Dusi. It has seven thousand-household offices and two hundred-household offices under its jurisdiction. In the late Ming Dynasty, it played a very important role in resisting the invasion of the Qing Dynasty (Deng, J. Y. et al. 2013).

Regarding the wars between the Ming and Qing Dynasties, the people in Ningyuan area were forced to leave their homes and the land was barren. The war caused great damage to local farming and economy. The war also caused a serious imbalance in the population ratio. During my fieldwork, I was fortunate enough to interview Mr. Yi Lao from Changde, who has been engaged in cultural relics and cultural relics protection for nearly his entire life. He said: The war between the Ming and Qing Dynasties in Ningyuan had a huge positive impact on the Ming Dynasty regime: First, the great victories of Ningyuan and Ningjin severely damaged the Jin army and extended the life of the Ming Dynasty warrants. The second is to enhance the self-confidence of Ningyuan defenders and improve the cohesion of Ningyuan people. Without these two battles, Xingcheng Ancient City's social status and influence today would not necessarily be as important as it is today. (Chang, D. Y. 2022 : Interview).

After the fall of the Ming Dynasty, the Ningyuan area entered the period of Qing rule (1644) . During this period, the ancient city reached its peak. In the early days when they took over the Central Plains, the rulers of the Qing Dynasty attached great importance to the governance and development of the Northeast region. Since the Qing Dynasty encountered extremely rapid and violent counterattacks in the early days when it took control of the national power, and the regime was in an unstable state, it regarded the Northeast as its fundamental place. In addition, the Qing emperor's annual ancestor worship activities had to go to Shengjing through the

Western Liao Corridor. The royal family stationed and hunted here frequently, which made the strength of Ningyuan City in the middle of the corridor very important.

So the rulers of the Qing Dynasty took a series of consolidation measures for this place. First, soldiers and civilians were sent for farming and development. Secondly, establish a "wicker edge" restricted area to strengthen public security control. Third, rectify the inns and develop transportation and communications. The above three measures have resulted in rapid economic recovery, social stability, and population increase in western Liaoning. On this basis, in the third year of Kangxi (1664), the Qing government adjusted the administrative regions, abolished the Ming Dynasty's guard system, replaced it with the state and county system, and merged the jurisdictions of Qiantun and Ningyuan Erwei in the Ming Dynasty, set to Ningyuan Prefecture. In the Qing Dynasty, the prefectures were divided into two types: Zhili prefectures and subordinate prefectures. Ningyuan Prefecture was a subordinate prefecture. The organizational structure below the state level is Shejia. According to "Ningyuan Prefecture Chronicles" , during the Kangxi period, the prefecture governed 24 communities and 159 natural villages. It turned out that the planning of Ningyuan Guards in the Ming Dynasty was inherited in the Qing Dynasty (Xingcheng Urban Construction Bureau,1979), including administrative offices were also set up in the city (Luo, Y. 2013).

Because the Qing Dynasty's regime has always been in an unstable state, and the Northeast, especially the Changbai Mountain area, is their root and birthplace, and the Liaoxi Ping where Ningyuan Acropolis is located is the most convenient way for the Manchus to return to the pass. Moreover, regular ancestor worship activities must also be carried out through this passage (Figure 4-5).

Figure 4 - 5 Inside the ancient city formed in the late Qing Dynasty
Image source: Old Photo Network

Therefore, the military role of Ningyuan City gradually declined in the early Qing Dynasty (1680) . After the development of the prosperous ages of Kangxi and Qianlong, economic and cultural aspects reached their peak (Figure 4-6).

Figure 4 - 6 The bustling scene outside the ancient city of Xingcheng in the late Qing Dynasty

Source: Internet e-book - China in the early 20th century through Japanese spy lenses

4.1.2 1912-1949 Republic of China period (Full of war and change)

(1) Historical evolution

After the decline of the Qing Dynasty, in the first year of the Republic of China (1912) , Sun Yat-sen became the interim president. The Qing emperor stepped down and established a democratic republic, which initially belonged to Ningyuan Prefecture, Jinzhou Prefecture, Fengtian Province. In the second year of the Republic of China (1913) , the state system of the Qing Dynasty was abolished. At the same time, the original Ningyuan Prefecture was renamed Ningyuan County. The following year, the name of Xingcheng County in Liao Dynasty was reused. In the 17th year of the Republic of China (1928), the three eastern provinces changed their banners and were unified under the Nanjing National Government. From then on, the period of rule by the government of the Republic of China was formed. In the 20th year of the

Republic of China (1931), the Japanese invaders launched the "September 18th" Incident, and Northeast China fell. After the invasion by the Japanese invaders, Xingcheng entered the period of Japanese and puppet Manchukuo rule. In the 27th year of the Ming Dynasty (1938), in order to further implement enslaved education, the Japanese and puppet authorities issued an education order to change the original junior primary school to a national school; the senior primary school to a national superior primary school; the junior high school to Jinzhou Province An agricultural school was established. In the 34th year of the Republic of China (1945), Japan surrendered, and the democratic government of Xingcheng County was established in mid-September. In the 38th year of the Republic of China (1949), Liaoxi Province was established, and Xingcheng County belonged to it. On October 1 of the same year, China The People's Republic was established, and people of all nationalities in all counties solemnly celebrated the founding ceremony (Deng, J. Y. et al.,2013).

(2) Puppet Manchu enslavement education

Life scenes around the ancient city of Xingcheng during the Puppet Manchukuo period, taken around 1935. The Weiyuan Gate Tower and Wengcheng of the ancient city in the old photos were buildings restored in the Qing Dynasty, and the surrounding scene was far more desolate than it is now. There are several houses with roofs outside Wengcheng, and "horse-drawn carts" parked next to them can be seen waiting for work; a shop assistant wearing overalls is walking, and a primary school student wearing black school uniforms saw the camera lens show A confused look. Today, the city wall in the old photos remains the same, but the tall courtyard walls, quaint folk houses and lush locust trees no longer exist (Figure 4-7) .

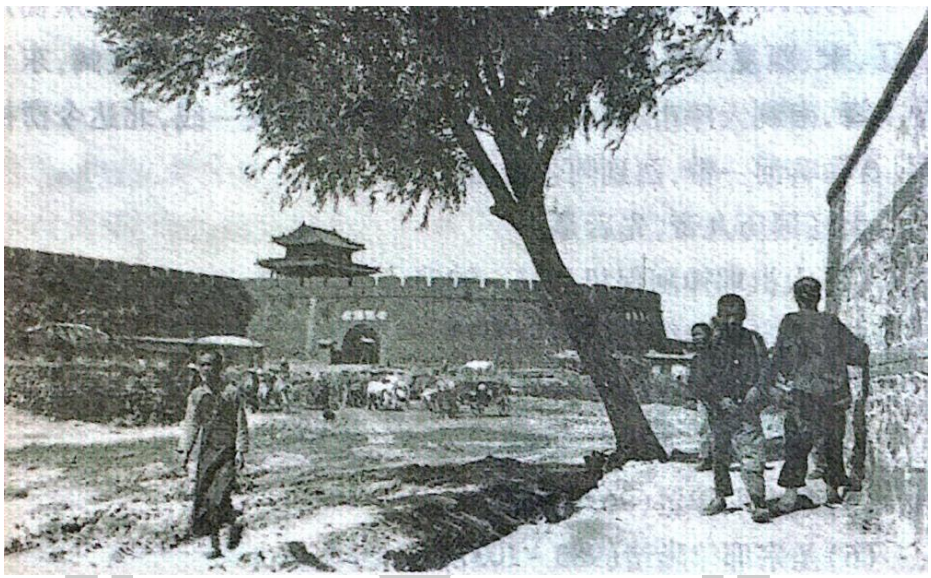


Figure 4 - 7 Life scenes around the ancient city formed during the Puppet Manchukuo period

Source: Zhang Kaixin

During Japan's invasion of China, in order to reduce the anti-Japanese fighting spirit of the Chinese people in the occupied areas, it deceived the Chinese people into serving its war of aggression and implemented barbaric enslavement education on the Chinese people in the occupied areas to achieve its long-term military occupation and colonial rule. The enslavement education of the Japanese puppets can be roughly divided into two stages. The first stage is from the September 18th Incident to 1937. The second stage of enslavement education began with the implementation of the "New Academic System" in 1937 and ended in 1945, when Japanese rule finally collapsed. The essence of the enslavement education promoted by Japan is colonial servitude (Lin, Y.,2012).

I had the honor to interview a colleague of Zhang Kaixin, the author of the book "Xingcheng Ancient City". He said: "The task of the new academic system is to cultivate loyal and good citizens. It is based on the spirit of founding the country, cultivating personality and cultivating morality." In fact, it is. It is necessary to enslave the Chinese people to obey them and serve as "good people" driven by the Japanese invaders at will, and to become willing "slaves to the country's subjugation". (Cui, M. 2022: Interview)

At that time, not long after the puppet Manchukuo was "founded", students suffered from enslavement education. The 23 students who entered the camera were aged between 12 and 14 years old. They were in the growth stage and were innocent, lively and optimistic by nature. However, facing the lens of the Japanese photographer, they all had dull eyes and seemed to be under a lot of mental stress. big. Only one girl can be seen in the photo, which shows that the patriarchal mentality was still very serious at that time. Boys shave their heads and girls cut their hair short. This is a product of the "militarized" education of the Japanese puppets. In addition, you can see photos of Puyi hanging on the walls of the classroom, and paper "Sun Flag" and "Manchurian Flag" hanging under the ceiling. (Figure 4-8)

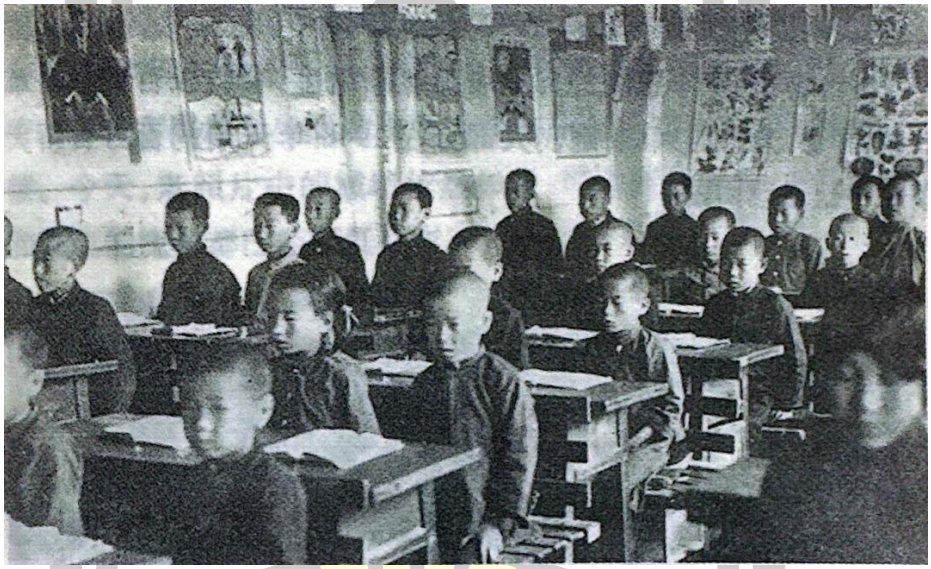


Figure 4 - 8 Classroom photos of a primary school in Xingcheng County

Source: Zhang Kaixin - - "Xingcheng Ancient City" P223

4.1.3 1949-1978 From the founding of New China to the construction of socialism in New China (Reform and Development)

After the founding of New China, Xingcheng urban construction entered a new historical period, and planning work took a new turn. The city master plan has been prepared three times. In 1954, on the basis of the comprehensive economic recovery and the city entering a sound development track, the Xingcheng urban master plan was compiled for the first time . Hot spring resources, beach bathing, and

hot spring recuperation areas have been delineated. The ancient city area is planned as a living area, and Tiexi is an industrial area and warehouse area. It focuses on protecting the ancient city wall, cultural relics, and developing the food industry and the vegetable base on the other side of the south river. In June 1954, this plan was submitted to Liaoxi Province for approval, but no approval was received. Second planning. In 1956, the Liaoning Provincial Department of Construction organized a planning group for those who participated in the provincial planning study class, and Liu Shixun led the team to Xingcheng to conduct planning pilot projects. This plan was prepared according to planning procedures, and a large amount of economic and natural data were collected as the basis for planning. This plan was compiled in accordance with the actual development requirements of various undertakings in Xingcheng County, emphasizing the transformation of the old city, fully integrating old resources, and renovating and utilizing old buildings in the ancient city. In 1977, after two years, the Xingcheng County Construction Bureau supplemented and modified many contents on the basis of the original urban plan and formulated the third plan. This plan determined that Xingcheng is located on the coast of the Bohai Sea, with hot springs and ancient city monuments, and has favorable conditions for the development of tourism. Taking into account the characteristics of the city itself, Xingcheng should be developed into a city focusing on recuperation and tourism. The ancient city area served as the main resource for urban development during this period. The city's residences, administrative offices, and major businesses all developed around this area (Li, Y. Q. et al.,2012).

(1) Urban and rural construction-the period of reform and development

In 1954, the city began to focus on the construction of urban transportation arteries. First, the Gulou roundabout road was widened, 30 private houses were relocated, and the original 6-meter-wide roundabout road was widened to 12 meters. At the same time , more than 30 private houses were demolished, and the gaps in the barbicans at the south and west gates were opened and leveled. Block the outer gate of the Nanmen Wengcheng, make the two gaps straight with the South Street and West Street in the city, open the road, and build an urban highway with low-grade pavement (granular reinforced soil) on Nanguan Street, with a total length of 250 meters and a width of 250 meters. 20 meters (including sidewalks on both sides).

From now on, vehicles and pedestrians no longer need to go around the Wengcheng gate, but can go directly through the road.

In 1961 , the County People's Committee mobilized employees from various units under the county government to transform the four main streets in the city and the low-grade pavements in Nanguan and Xiguan into intermediate pavements (gravel pavements).

In 1973, the pavement reconstruction project of four streets in the city and Nanguan and Xiguan was completed in two phases, transforming the intermediate pavement into a sub-high-grade pavement (residual oil pavement).

From 1958 to 1978, after 20 years, all four streets were made straight and widened to 12 to 13 meters along with the reconstruction of market housing on the streets.

(2) Cultural heritage protection

After liberation, people's governments at all levels attached great importance to the restoration and protection of ancient buildings in Xingcheng. Especially after the Third Plenary Session of the Eleventh Central Committee of the Communist Party of China, the Xingcheng County Party Committee and the County People's Government clarified the direction of Xingcheng construction and stepped up the maintenance of the ancient city.

On September 30, 1963, the People's Committee of Liaoning Province announced that Xingcheng Ancient City was a provincial-level cultural relic protection unit. From 1972 to 1982, a total of 562 meters of collapsed city walls, 400 crenels, and 1,400 meters of wall foundation slope protection were repaired; in 1977, the Zudale Stone Square was repaired; in 1980, efforts were made to solve the congestion problem of the ancient city, combined with the construction of new areas, The county party committee and government took the lead in moving out of the city and stipulated that large motor vehicles were not allowed to enter the city. Later, more than 30 institutions, groups and factories originally located in the city also moved out of the city one after another, alleviating the congestion in the ancient city and restoring a simple and quiet environment. In the same year, the East City Gate Tower, which was destroyed in the war, was repaired; in 1982, the North City Gate Tower

was repaired; in 1983, the Dacheng Hall and the East Verandah Hall of the Confucian Temple were repaired, covering an area of 250 square meters.

After the liberation of Xingcheng, the Xingcheng County Committee and County Government of the Communist Party of China attached great importance to the protection of the ancient city and repaired the destroyed towers and crenellations. A Ming Dynasty street is built on Yanhui Street. From June to August 1985, Yanhui Street was paved as a stone road and all alleys were paved with cement brick pavements (Song, J. H. & Wang, M. Y.,2015).

(1) Tourism development

Xingcheng has a long history of tourism. During the Liao and Jin dynasties, many officials, celebrities, and literati came here to bathe, watch the sea, visit islands, and enjoy Xingcheng's scenic spots. Cui Moumou said: Xu Kangzong of the Song Dynasty was sent by the imperial court as an envoy to the Kingdom of Jin and wrote a "Record of the Journey of Xuanhe's Envoy to the Kingdom of Jin". The scenery of Xingcheng was mentioned in many places in the book. There are also many literati who wrote immortal poems after visiting Xingcheng ." (Cui Moumou, 2022 : Interview)

In the Qing Dynasty, emperors of all dynasties would stay here during their eastward tours. At the end of the Qing Dynasty, Xingcheng began to be connected to trains. Every summer, some Mongolian compatriots from Fuxin, Chaoyang, Chifeng and other areas come to Xingcheng to bathe in the "holy water" of hot springs and view the scenery of Xingcheng. This custom continues to this day.

During the Japanese and puppet rule, Puyi selected Haikou to plan and build the palace. The Japanese invaders forcibly relocated the fishing villages in Haikou and turned Haikou into a paradise for the invaders.

After the liberation of Xingcheng, with the improvement of people's living standards, the number of people visiting Xingcheng for tourism and vacation has increased year by year. Especially after 1966, in order to commemorate Chairman Mao Zedong's swim in the Yangtze River, cities and counties held commemorative meetings on the seaside every July 16 and held various water competitions. At that time, workers, farmers, cadres, students and PLA commanders and fighters from Jinzhou and neighboring counties gathered in Xinghai Bay. At this time, Xinghai Bay

was crowded with people and it was very lively. It was really a sea of thousands of people , an unprecedented grand occasion. After 1978, although the government no longer held commemorative activities, the "July 16" and "Hai Hai" events still continued.

In order to meet the needs of tourism development, the Xingcheng County Committee and the county government of the Communist Party of China began to strengthen the restoration of the ancient city in a planned and step-by-step manner in 1980. In the ancient city, offices and factories were gradually relocated outside the city, city walls and towers were repaired, and a plan to restore a street in the Ming Dynasty was proposed. As these plans continue to be realized, Xingcheng's appearance has been completely renewed, and the number of tourists coming to Xingcheng has increased day by day.

Cui Moumou said: In 1984, when Premier Zhao Ziyang inspected the work in the ancient city, he said : "We need to hire some people to do planning, and we must consider both the present and the future." "Xingcheng is a very good place. It needs to be built." The second Beidaihe." After the inspection in the same year, Vice Premier Wan Li also said : " After he returned, he asked the Ministry of Urban and Rural Development and Environmental Protection to send people to help with planning (Liu, Y. 2019). "

In order to implement the instructions of Premier Zhao and Vice Premier Wan, the county government established the Tourism Development Board in 1984 to be specifically responsible for the development of tourism and recuperation. At the same time, a county tourism bureau and a tourism service company were established to be specifically responsible for tourism work. He also mentioned that in 1985 , Hu Yaobang, General Secretary of the Central Committee of the Communist Party of China, came to Xingcheng for inspection and wrote an inscription for Xingcheng, "With courage and knowledge, enrich the country and the people . " I still look proud when I talk about this. (Cui, M. 2022 : interview)

In 1985, it received 3 million tourists and directly obtained economic income of 29 million yuan from tourism services, accounting for nearly one-tenth of the county's total industrial and agricultural output value.

4.1.4 1978-2022 Since reform and opening up (Modern development and cultural protection and inheritance stage)

(1) Urban protection and development

After the reform and opening up, the ancient city of Xingcheng entered a new stage of development. This stage is not only a period when the ancient city is prone to great changes with the trend of the times, but also a period when the value of the ancient city can be highlighted.

Since the 1980s, Xingcheng County has prepared 10 plans of various types. Among them, there have been as many as 7 plans dedicated to the protection and development of ancient cities, which shows that the significance of ancient city protection has increased rapidly, and that protection and inheritance of culture have been fully recognized as playing a very important role in urban development. at the same time. There have also been big changes in the specific measures to treat the ancient city. After Xingcheng accelerated the construction of tourism as the leading industry, the development positioning of the ancient city has undergone tremendous changes. The previous idea of renovating and utilizing as much as possible has changed to restoration and protection, while paying attention to Creation of landscape and character. The center of urban economic development has shifted outside the ancient city, and a modern new city has gradually formed. Frequent renovations were carried out on the ancient city. The functions originally occupied by the ancient buildings have also been gradually relocated. In 2006, Xingcheng Ancient City Wall, Bell and Drum Tower, Confucian Temple, and Zushi Stone Square were merged into Xingcheng Ancient City, and was awarded the title of National Key Cultural Relics Protection Unit.

The past thirty years have been a period of rapid development in urban construction in our country. In the process of vigorously developing and constructing, accelerating urbanization, and pursuing economic growth, in the process of urban construction, especially the protection and development of historical cities, it is inevitable that Many problems arose.

China is currently at an important stage of urban construction. The "14th Five-Year Plan" adopted by the Fifth Plenary Session of the 19th Central Committee of the Communist Party of China proposed that with the rapid development of

urbanization, China's urban construction has changed from "incremental development" in the past to "incremental development". In the new development stage of "stock renewal", the core of construction has changed from "emphasis on economy" to "emphasis on people-oriented" planning concepts. Due to the special historical pattern and protection value of historical ancient cities, in the development process of protection and renewal, traditional protection concepts and modern functional renewal needs are often seen as contradictory points. Many historical ancient cities are under single material protection. Facing population loss, ancient cities are gradually losing their vitality. In the process of renewal and construction to promote vitality, they often lose their original charm, resulting in the phenomenon of "a thousand cities look alike".

After the liberation of Xingcheng, people's governments at all levels attached great importance to the maintenance and protection of Xingcheng's ancient buildings. After many repairs over the years, the ancient city buildings have restored their ancient style and become one of the three county-level ancient cities (Pingyao, Shanxi and Jingzhou, Hubei) that are relatively well-preserved in China and have high historical value.

(2) Problems caused by the rapid development of tourism

With the continuous development of the economy, China's residential historical cities have vigorously developed tourism construction with the purpose of promoting tourism to promote the economy and promote protection. The rise of tourism has indeed transformed many historical cities from dilapidated old cities into bustling " "Busty city", with an endless stream of tourists, shows the prosperous scene, but behind this "prosperity", there is hidden the loss of the authenticity of life and the crisis of disappearing daily life. This crisis has exposed the shortcomings of the development model of historical ancient cities with tourism as the leading service function during the tourism gap period after the outbreak of the new coronavirus epidemic: behind the "busyness" of commercialization, it is the single function of space that leads to The ancient city has gradually evolved from a "living space" full of life to a "consumption space" focusing on leisure and tourism, and from a place where locals feel contentedly to a scenic spot serving foreign tourists. This update and development trend, which brings about short-term "prosperity" phenomena, further

damages the original non-renewable value of the historical city and accelerates the decline of the historical city.

During the interviews with local residents, we learned that Xingcheng leaders often conduct interviews with existing residents in the city. They adhere to the guidance of the Thought on Socialism with Chinese Characteristics for a New Era and implement actions to improve civilized literacy as the starting point. We practice the core values of socialism and are committed to inheriting and innovating historical resources. (Fang, S. Y. 2023 : Interview)

But during my interview, tourists had other comments. Wang Hongfei is the father of a primary school student. Because his child likes history very much, he took his children to visit Xingcheng Ancient City during the summer. He commented: The architecture of Xingcheng Ancient City is still very spectacular, as if he had seen the flames of war and gunpowder here 500 years ago. He brought his children here hoping that they could experience the historical and cultural heritage here. However, after the overall visit, the historical features of Xingcheng Ancient City were not outstanding, whether it was ancient buildings or the ancient city. Tourists cannot feel the historical heritage behind the streets. Only the south gate of Xingcheng Ancient City has been developed. The shops on both sides of the streets are highly homogeneous. They cannot find what they want, and the layout of the houses is also confusing. He believes that it may be necessary to protect and promote historic sites, and explore projects with local characteristics to provide tourists with viewing and experience, such as Northeastern Yangko, Manchu embroidery, gourd pyrography, straw weaving, etc. Some ancient simulated shops can also be established, such as Pawn shops, banks, restaurants, etc., allow visitors to truly see what a complete ancient city looked like. In addition, urban residents are used to operate restaurants, accommodations, etc. to improve basic tourism service facilities. (Wang, H. F. 2022 : Interview)

I also interviewed nearly 10 tourists who came to visit, and asked them why they chose to visit Xingcheng Ancient City. More than half of them reported that they did not know the specific story of Xingcheng Ancient City, but they just wanted to come to Xingcheng Beach. I heard that If you come to visit the ancient city, most people only browse around the periphery of the ancient city and do not enter the

Confucian Temple, the ancient city wall or the Bell and Drum Tower. This shows that the popularity and inheritance of culture are very low.

During the interviews with businessmen around the ancient city, although they were very proud of the historical and current status of the ancient city, they could not fully tell the historical and cultural connotations behind each building, and only knew a little bit.

Through communication with local government staff, we learned that the ancient city has been actively protected, but most of them still focus on the static protection of the ancient city buildings. At the same time, many interesting attempts have been added in the tourism industry to ensure that tourists come during their visit. , had a good experience. During the communication, Xingcheng Ancient City tour guide Zheng Hui said: The current passenger flow in Xingcheng Ancient City is divided into peak season and off-season. The peak season is only from May to October every year. After October, the passenger flow gradually decreases. There are basically not many activities in winter. Three years into the epidemic, the shortcomings of the ancient city have been revealed. There is a lack of publicity and publicity models on the Internet, and there are no corresponding promotional videos in nearby large city museums. Therefore, she feels that in addition to the static protection of the ancient city and the development of tourism projects, publicity is also crucial. (Zheng, H. 2022 : interview)

Through the previous analysis of the history of the ancient city of Xingcheng and the current situation of urban development , we can know that in the long history of the ancient city, what has been preserved is the ancient city with rich historical and cultural accumulation. Hundreds of years of urban construction history have left him with the legacy of various eras. Throughout the history of the development of the ancient city, it was once the center of the Ming Dynasty war front line, the only place where emperors paid homage to their ancestors, and the only passage for immigrants. In every different period, there are some humanistic stories to reflect it. Judging from the development history of Xingcheng Ancient City, it is a historical and cultural achievement that has been continued, and every era has left its mark on it. In the course it has taken, we can clearly see how its value is condensed. It

is precisely this process that must be seen in conservation, so that conservation can have an accurate positioning.

4.2 The current problem and the form of cultural heritage for digital media design

As a famous historical and cultural city in Liaoning Province, China, Xingcheng Ancient City has rich cultural heritage and historical relics. The scope of this study mainly focuses on the heritage sites in Xingcheng Ancient City that have been rated as national key cultural relics protection units, namely: Xingcheng Ancient City Wall, Xingcheng Confucian Temple, Zushi Stone Square, and Bell and Drum Towers. This summary sorts out the specific historical context of the four building groups and the cultural connotations behind the architectural heritage; analyzes the inheritance status of the heritage of Xingcheng Ancient City; at the same time, uses the concept of cultural genes to combine the historical context and cultural connotations of these scattered cultures The heritage resources were sorted and screened to condense the unique cultural resources that are most effective in protecting and inheriting the ancient city. They were genetically sorted to extract and construct a unique genetic genealogy of Xingcheng ancient city heritage. This part of the research is used to address the digital visualization translation part of the third research goal.

4.2.1 The architectural style and cultural connotation of the ancient city

The research in this section is mainly divided into three parts, namely the determination of the research scope, the style of ancient city architecture and the cultural connotation behind the ancient city architecture.

4.2.1.1 Definition of the scope of ancient city cultural heritage research

(1) Definition of Xingcheng Ancient City Cultural Heritage Protection Area

The protection scope of the ancient city of Xingcheng should be centered on the city pool of the ancient city. In the 1979 Xingcheng Tourism Scenic Plan, it was delineated that the bell and drum towers of the ancient city should be the center of the circle, and the ancient city area would be within a radius of one kilometer. There is an overall understanding of the protection of the ancient city.

(Xingcheng Urban Construction Bureau. Xingcheng County Urban Master Plan, 1979:10~ 11) .

The ancient city is located in the center of the ancient city, covering a total area of 67.76 hectares. The city walls are square and it is a typical military defensive city. The internal environment is mainly composed of traditional neighborhoods, with residential functions forming the main body. They are distributed vertically and horizontally from north to south, east and west along the street, with rich shapes and evenly distributed in four areas divided by cross streets. Form a traditional urban form dominated by residential functions. The main commercial shops in the city are located along both sides of the cross street. Other functions are scattered in residential neighborhoods, such as schools, theaters, factories and administrative buildings. Most of these buildings are renovated and updated from original temples and government offices. The existing city wall is the original inner city boundary of the ancient city. There used to be a moat and an outer city wall on the outside. These parts have disappeared and have been replaced by free-form neighborhoods, which constitute the external environment. The outer environment of the ancient city covers an area of about 30 hectares, and the nature of its residential function can also be clearly seen. The blocks show a natural growth state, and the architectural texture is the same as that inside the city, distributed on a small scale. Commercial and office functions are distributed on the main traffic facing the four city gates. There are fixed open-air farmers' markets, shopping malls and other buildings not far from the four city gates.

Generally speaking, the current layout of the ancient city inherits the rigorous planning structure of ancient times. The blocks on the periphery of the ancient city extend outwards with a radius of about one kilometer from the ancient city as the center. They grew disorderly and freely over a long period of time, forming a unique traditional urban form. The planning and development of the ancient city of Xingcheng were influenced by the traditional concepts and ruling ideas of ancient China. At the same time, its establishment had a strong purpose of military defense, and its overall characteristics are very prominent.

(2) Definition of the scope of ancient city cultural heritage research

This study was selected based on the large number of historical relics currently preserved in Xingcheng Ancient City. Including historical ancient relics, traditional buildings reflecting regional characteristics, etc., the classification is based on the national key cultural relics protection units promulgated by the State Council of the People's Republic of China. At present, there are four national key cultural relics protection units in Xingcheng Ancient City, namely: Xingcheng Ancient City Wall, Bell and Drum Tower, Xingcheng Confucian Temple and Zushi Stone Square. In 2006, the four buildings were merged into Xingcheng Ancient City and were awarded the title of National Key Cultural Relics Protection Unit.

This study on the content and digital protection and inheritance of Xingcheng ancient city heritage focuses on the above four building groups. They are the core content in the protection of ancient cities. These historical relics are very rich in content. They belong to different functional parts of the city and are distributed in various locations in the ancient city (Figure4-9). They are products formed in different periods and play a prominent role in witnessing history and reflecting the characteristics of the ancient city. They have also become conservation projects that require strict control and are non-renewable cultural heritage. This study mainly focuses on the national key cultural relics protection units. Since they are of outstanding importance in protection, they need to be analyzed and discussed individually one by one to form an in-depth understanding.

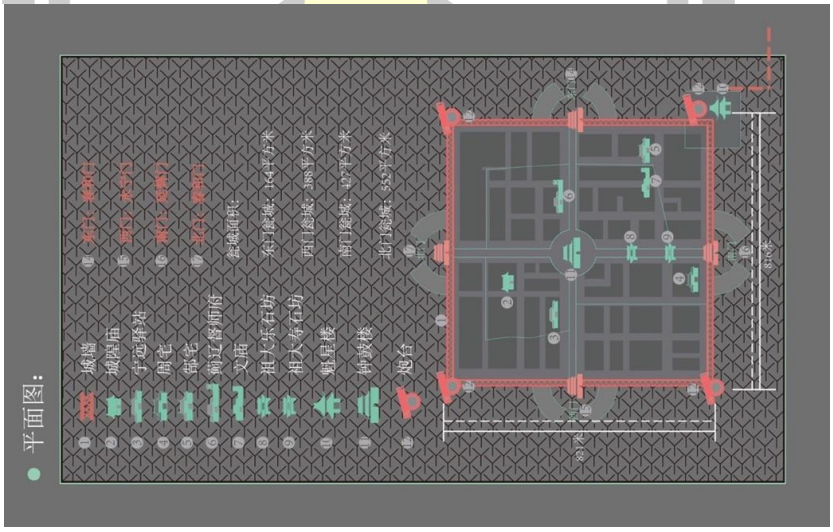


Figure 4 - 9 Distribution map of historical remains of Xingcheng Ancient City

Source: Self-drawn by Sun Yijia

4.2.1.2 The style of architecture in Xingcheng Ancient City

The city architecture of the Ming Dynasty has developed to its highest peak in the thousands of years of city architecture history in my country. The ancient city of Xingcheng is the epitome and model of acropolis architecture in the entire Republic of China.

1. city wall system

The architectural structure of the ancient city wall of Xingcheng was built entirely in the style of the Ming Dynasty. Since it was built from the ground, it is not subject to the restrictions of other previous buildings, whether it is its shape, orientation, layout, regulations, site selection, building materials, etc. Very obvious characteristics of the Ming Dynasty. The city wall building system as a whole presents a very regular shape (Figure 4-10) , which is the most important among the buildings of the ancient city. It not only constitutes the overall framework of the entire ancient city, but it is also a complete building system, with each part embodying military significance. defensive function. The main components of the ancient city wall building system consist of city walls, city gates, forts and Kuixing Tower. These parts have been preserved through repairs in the past dynasties. The architectural structure of Xingcheng ancient city wall includes: the theme structure of the city wall and the architectural settings on the city wall.

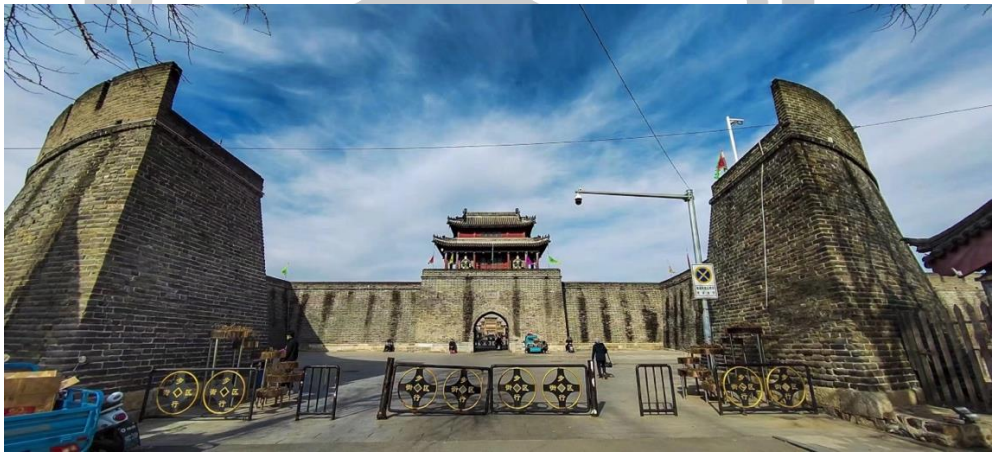


Figure 4 - 10 South Gate of Xingcheng Ancient City Wall

Source: Photographed by Sun Yijia

(1) Main structure of the city wall

The original ancient city wall was built in the third year of Xuande (142) of the Ming Dynasty when Ningyuan was guarded. At that time, only compacted soil was used. It was destroyed by an earthquake in 1568. At the end of the Ming Dynasty, Yuan Chonghuan redesigned the ancient city wall according to the needs of the war: "The height is three feet and two feet, the height of the pheasant is six feet, the site is three feet wide, the upper part is two feet and four feet, the bottom stone is seven layers, the bottom is two feet, and the soil is two feet. On top of the five, there is one horizontal inch every five feet; those who have built it will add four bricks, and those who have not built it will add six bricks. They all need to be filled with mortar." This design is taller and thicker than the original city wall, and the purpose is to The powerful defensive Houjin Cavalry. Most of the city walls you see today retain their current status at that time. The city wall forms a square shape with a circumference of 3274 meters, a length of 826 meters from north to south , a length of 804 meters from east to west, a height of 8.88 meters, a bottom width of 6.5 meters, and a top width of 5 meters. There are crenels on the outside of the top of the city wall and a parapet on the inside. The brick surface on the top of the city wall is called Haiman, which is used for waterproofing. The internal structure of the city wall is made of rammed earth, the foundation is made of large strips of stone, the outer wall is made of green bricks, and the inner wall is made of free-form stones. At that time, due to the rapid attack of the Qing troops, the war was extremely urgent, so the city wall was quickly repaired under a shortage of materials and extreme tension. Traces of the emergency repairs at that time can still be seen (Figure 4-11). In some places, large stones are on top and small stones are on the bottom. In some places, the use of stones is also confusing. This feature reflects the role of the city wall as a historical carrier(Liu, Y.,2019).

Figure 4 - 11 Traces of the ancient city's past maintenance
Source: Photographed by Sun Yijia

From the military and aesthetic point of view, the ancient city of Xingcheng is a linear structure that emphasizes horizontal height and has a solid three-dimensional structure. It has the momentum of thousands of troops lined up in a row, creating a tight barrier for the enemy soldiers rushing under the city, the feeling of majesty standing tall. The city wall was towering, like an insurmountable barrier, blocking Nurhaci and Huang Taiji's 100,000 cavalry. The flags of the Ming Dynasty are flying on the four gates and bell and drum towers of the ancient city of Xingcheng. Soldiers wearing Mingjun armor at the south gate are still guarding the ancient city (Figure 4-12) . On many ancient city buildings in the Northeast, the Sun and Moon Flag of the Later Jin Dynasty or the Eight Banners of the Qing Dynasty are often placed, with Jurchen cavalry or statues standing next to them. Only Xingcheng embodies the unique vitality of the Ming Dynasty. As early as 1988, the ancient city wall of Xingcheng was approved by the State Council as a national key cultural relics protection unit.

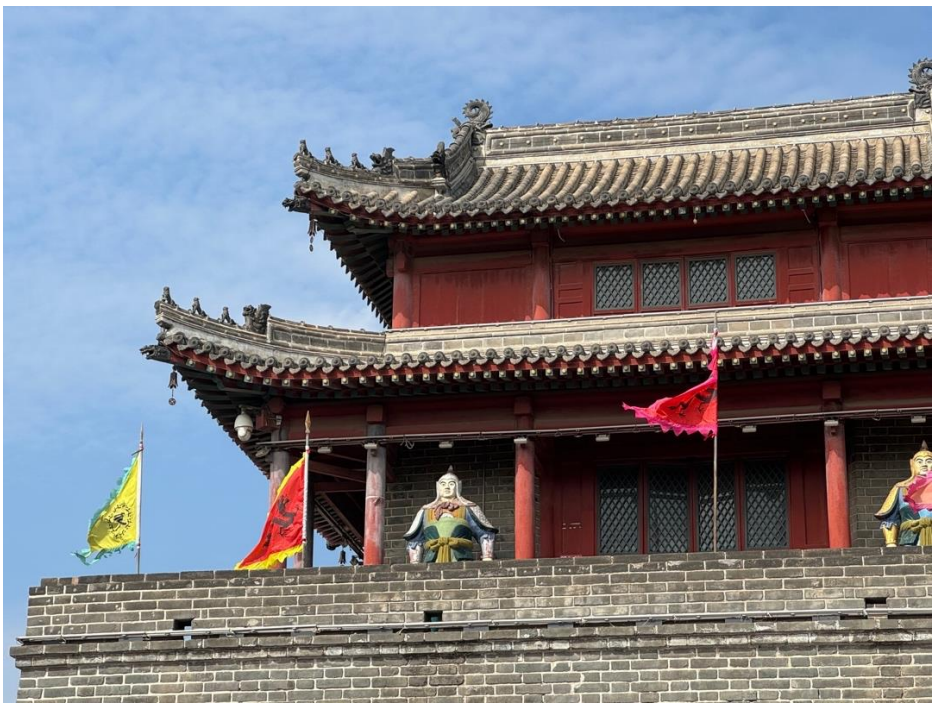


Figure 4 - 12 Flags on the ancient city

Source: Photographed by Sun Yijia

Interior wall

The inner wall refers to the side of the wall facing the city. When built, there is generally no obvious cutoff and the wall is constructed into a relatively vertical wall. The inner walls are built with tiger skin rough stones with a side length of 0.20-1 meters and irregular sizes, and the joints are filled with glutinous rice mortar. The thickness of the interior walls is approximately 1 meter.

Exterior wall

The outer wall refers to the side of the wall facing outside the city. When building, there is an obvious point gain. The closing of the wall can increase the strength and stability of the wall, enhance the defensive performance of the city wall, and make the outer wall majestic. The base of the exterior wall is built with three layers of strips of stone, with green bricks on top, and glutinous rice mortar is also used to fill the joints. The specifications of the green bricks are 402,010 meters and32,167centimeters.

Regarding the thickness of the exterior wall, the upper part is generally one and a half bricks thick. According to the ratio of the points, the

thickness becomes thicker as it goes down. The thickness at the bottom is about 1.5 meters. The brick laying method is mainly flat laying.

Middle rammed earth wall

While the rammed earth wall in the middle is constructed of exterior and interior walls, loess is rammed in the middle mixed with broken masonry. Each rammed earth layer is 30 centimeters. The thickness of the rammed earth wall is about 3-3.6 meters.

Wall base

The wall base is one meter deep into the ground. Use glutinous rice slurry mixed with 30% white ash and 70% loess, and compact it in layers, each layer is 30 cm. A solid wall foundation, firstly, enhances resistance, and secondly, it exceeds the freezing layer to prevent the wall from being deformed by freezing.

Top of wall

Two layers of glutinous rice slurry Panax notoginseng dust are rammed on the top of the wall, with a thickness of about 0.4--0.6 meters, and then a green brick path is laid. There are crenellated walls built on the outside of the top of the wall, also called battlements; there are walls built on the inside of the top of the wall, also called parapets. Drainage holes are left in the lower part of the crenellated walls and parapet walls.

(2) Building facilities on the city wall

In addition to its thematic structure, the city wall also includes many architectural facilities on the city wall. The architectural facilities on these city walls include: city gates, city gate towers, horse paths, crenellated walls, parapets, sea blocks, drainage holes, water gate holes, corner platforms, and Kuixing Tower.

City gates and gate towers

There is a city gate built in the middle of each side of the city wall, with Chunhe Gate in the east, Yongning Gate in the west, Yanhui Gate in the south, and Weiyuan Gate in the north. The four gate towers have the same architectural form and scale. The height of the city gate tower is about 15 meters. The bottom section is a balcony, built of blue bricks, connected to the city wall on both sides, with a width that slightly protrudes from the city wall, and is closed from bottom to top, with an arched door opening in the middle. The outside of the door opening is small and the

inside is large. There is a door axis stone at the intersection of the large and small scales. Above the balcony is a two-story wooden pavilion. The building is shaped like a hilltop with double eaves. The roof is covered with gray tiles and surrounded by corridors. There are six columns and five bays on both sides inside and outside. The proportions of the city gates are harmonious, and their height constitutes the symbol of the four directions in the ancient city. The four city gates are not only the only ways to enter the ancient city, but also the ways to climb the city wall. There are urns built on both sides of the outside of the city gate, with arched door openings on them (Figure 4-13).

Figure 4 - 13 City Gate Tower

Source: Photographed by Sun Yijia

Bridleway

On the inner right side of the four gates of the Xingcheng city wall, there is a horse path sloping from the ground to the top of the city wall against the inner wall. One side of the horse path is against the city wall, and the other side is built with a protective wall more than 2 meters high, which serves as a railing and closure. Since the horse track has an inclination of about 20°, in order to prevent

slipping, the green bricks are turned sideways upward and built into cross-shaped caulking joints. At the entrance of the horse track, there is a small gatehouse with a single-layer hard mountain roll-top roof（Han, C. M. 2019).. The two doors open opposite each other and can be opened at any time. Once a war breaks out, soldiers and horses can rush to the city to fight. The width of the horse paths at the four city gates is different, about 3.3 meters to 4.4 meters wide; the length of the horse paths at the four city gates is also different, about 20 meters long (Figure 4-14).

Figure 4 - 14 Bridle Path

Source: Photographed by Sun Yijia

Wall

The crenellated wall, also called the battlement, is a low wall with crenellations built on the outside at the top of the city wall. It is used to cover the defenders when attacking the enemy. There are crenellations in the upper part of the wall for watching and shooting at invading enemies, and there are drainage holes in the lower part to protect the wall. The construction method of the stacked walls is to use plain ash to build the inner and outer brick walls. The two skin walls are built

along the cross seams, and there are no small brick connections. A layer of pre-fired capping bricks is added to the top of the wall and the crenellation. The width of the capping brick is equal to the width of the top of the crenellation wall, and a sloped roof is made above. The height of the stacked walls is about 1.9 meters to facilitate cover. The wall of the stack is about 33 cm thick, the opening of the stack is 36 cm wide, and the height is 90 cm. It usually reaches the chest of the human body to facilitate observation and shooting. The front width of the crenellated wall is about 2 meters, and it can cover the bodies of 3-5 people side by side(Figure 4-15).

Figure 4 - 15 Stacking Wall

Source: Photographed by Sun Yijia

Parapet

Parapet parapet, also called female wall, Yuqiang, and parapet. It is a low wall with the top of the city wall built on the inside. It is lower than the crenel and about 0.7-0.8 meters high. It functions as a guardrail to protect the safety of soldiers, horses and vehicles on the city wall. A layer of ridge bricks is built on the topX (Figure 4 -16).

Figure 4 - 16 Parapet

Source: Photographed by Sun Yijia

Haiyuan

Haicheng is the road at the top of the city wall, 4.0 to 4.5 meters wide. The surface is paved with blue bricks, jointed with lime, and the bottom is made of two layers of glutinous rice slurry Panax notoginseng lime soil. Sanqi gray soil is 30% ash and 70% soil, mixed with glutinous rice slurry

Starting from 30cm per layer. Haicheng has three functions: First, it increases the strength of the road surface. The second is drainage. The third is conducive to walking (Figure 4-17).

Figure 4 - 17 Haiyuan

Source: Photographed by Sun Yijia

Drainage hole

There are drainage holes in the crenellations at the top of the city wall and the lower part of the parapet. Drainage holes are designed to drain accumulated water on the top of the city wall in a timely manner. Drainage holes are built at regular intervals, and rainwater is discharged outside the city wall through the drainage holes. The length and width of the drainage hole are approximately 2030 cm (Figure 4-18).

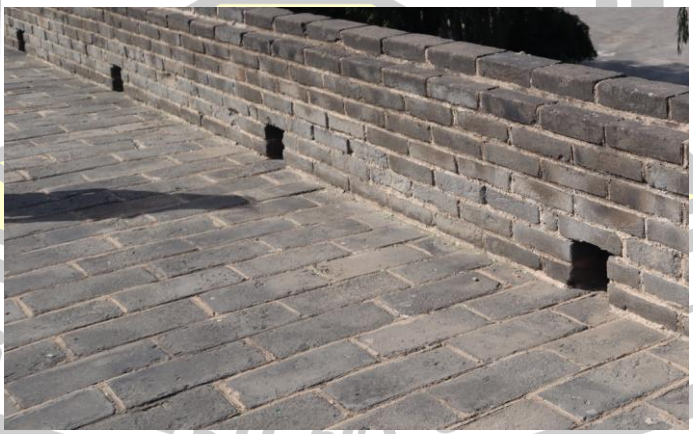


Figure 4 - 18 Drainage hole

Source: Photographed by Sun Yijia

Puimun cave

Shuimen Cave Shuimen Cave, also called a drainage cave, is used to drain accumulated water in the city. Xingcheng Ancient City has a water gate hole in the south of the east city wall and a water gate in the west of the south city wall. The hole is 1.2 meters high and 1.0 meters wide. The two sides are built with large strips of stone, and the roof and floor are paved with strips of stone. Shuimen Cave is sometimes passable. During the War of Liberation, the People's Liberation Army once entered the city from Dongshuimen Cave.

Corner platform

A corner platform is a type of city platform or wall platform. It is called a corner platform because it is built on a corner of the city wall. The corner platform protrudes from the outside of the wall. When the enemy approaches the city wall and prepares to board the city, the guards on the corner platform can use the corner platform to shoot the invading enemy from the side.

There are platforms at the four corners of the Xingcheng city wall. Except for the Kuixing Tower on the southeast corner platform, watch towers are built on the other three corner platforms to provide shelter from wind and rain and rest for the defenders. Later, the three watch towers fell into disrepair and were used as forts. The "Hongyi Cannon" was installed in the Ming Dynasty, and a bunker was built during the Kuomintang period(Liu, Y.,2019).

The southeast corner platform is about 14.4 meters long, 14.3 meters wide, and covers an area of about 206 square meters. During the Ningyuan War, there were forts, also known as corner platforms, on the four corners of the ancient city wall. Later, Kuixing was added to the southeast corner platform. building. At that time, these open forts were designed to install the "Hongyi Cannon", an advanced weapon imported from the Netherlands(Figure 4-19).

Figure 4 - 19 The corner platform is not

Source: Photographed by Fan Xinyu

Kuixing Tower

Kuixing Tower on the city wall was built to worship Kuixing God, the god who was in charge of the rise and fall of articles (Figure 4-20). Kuixing, also known as "Xuanji", commonly known as Kuixing, is the general name of the four bucket-shaped stars in front of the Big Dipper, namely Tianshu, Tianxuan, Tianji and Tianquan. According to the "Xingcheng County Chronicle", Kuixing Tower was built in 1629 and was added when the four corners of the city were repaired at that time. The current Kuixing Tower has two floors. It is 8.5 meters high excluding the city wall. The building has octagonal faces and a pointed top. The overall shape is similar to a pavilion. There is a clay statue of Kuixing inside. Kuixing Tower is a landmark building in the southeast of the ancient city. You can see it when entering this area.

Figure 4 - 20 Kuixing Tower

Source: Photographed by Sun Yijia

Later, it was repaired twice in the 47th year of Qianlong (1782) and the 25th year of Jiaqing (1820) in the Qing Dynasty. Unfortunately, it suffered a fire in the thirteenth year of Daoguang (1833). "Not an inch of rafters or tiles remain, and the inscriptions on the monument were also destroyed." In the 27th year of Daoguang reign (1847), Ningyuan Zhizhou Qiang Shanglin was rebuilt. In the 13th year of the Republic of China (1924), Wang Chengbin, the provincial governor and military governor of Yiren, made a sole donation to repair it. It was destroyed by war again in 1948.

In 1986, the local government organized donations from cadres and employees, and the cultural relics department rebuilt the "Kui Xing Tower" based on actual photos(Liu, P. L.,2011).

Today, Kuixing Tower stands on the corner platform in the southeast corner of the ancient city with its beautiful, simple and touching new

appearance. There is a sound and light statue of Kuixing inside, which is a fine landscape made with modern technology. As long as visitors press the button, "Kuixing" will dance the magic pen in his hand up and down, allowing visitors to experience the true meaning of the legend of "Kuixing Point Number One Scholar". When visiting the city, tourists must appreciate the splendor and grandeur of Kuixing Tower. Because of its geographical location, it is known as the "No. 1 Kuixing Tower outside Guanxi".

Wengcheng

The urn city formed an encircling trend in front of the city gate, which could protect the very important gate tower from frontal attacks and also kill a large number of enemies under the city gate. During the wars of the Ming Dynasty, the city gate tower served as a sub-command post for the four directions of the ancient city, and generals were assigned to guard them respectively, responsible for adjusting tactics and mobilizing troops. The gate tower plays a very strong role in commanding on the spot. It has a prominent marking function on the facade and has outstanding features (Figure 4-21).

Outside the four gates of the city wall, there is a tall and solid half-moon-shaped urn city. The urn city is also called the moon city. It is a small city built outside the city gate facing the enemy. It is called the urn city because its shape is like an urn. Its function is to protect the city gate and increase the defensive capability of the city gate. When sending troops to fight, they can also gather troops here. The Wengcheng system began in the Han Dynasty and was perfected in the Ming Dynasty. In addition to the role of the barbican in protecting the main city gate, Feng Shui practitioners also use the barbican to "avoid evil spirits". In fact, the barbican can indeed shield the wind, dust and cold air from the suburbs. The gate of Wengcheng opens to the east, which can absorb the spirit of Shou Mountain and welcome the dawn of the east. The gate of Wengcheng opens to the south, which can be connected with the official road in the south of the city and can also receive warm sunshine.

The ancient city walls and gate towers have been baptized by many wars, and many places were damaged after the founding of the People's Republic of China. During the Cultural Revolution, the ancient city gatehouse was once used as a stronghold for factions, and the battles between them also caused a lot of damage to

the city wall. In 1979, 11 collapsed walls were repaired. In the same year, the East City Gate Chunhe Gate was restored. In 1982, the Weiyuan Gate of the North City Gate was restored. In 1988, the State Council approved the ancient city wall as a nationally protected cultural relic and decided to conduct a five-year comprehensive maintenance of the ancient city wall.

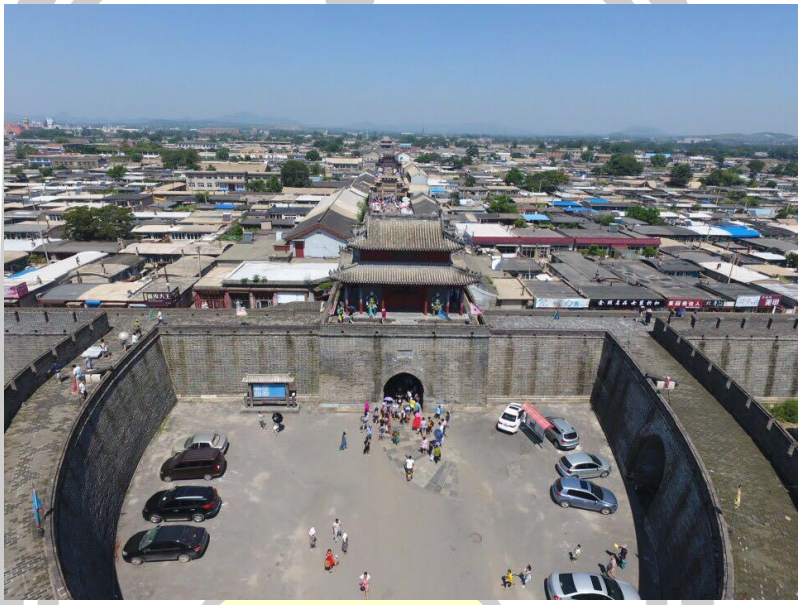


Figure 4 - 21 Gate tower and barbican

Source: Photographed by Sun Yijia

2. Bell and Drum Tower

The Bell and Drum Tower is located in the center of the ancient city. It is the most well-preserved central building of the ancient city in my country that integrates a bell tower and a drum tower. It is a place where drums were beaten to help in wartime in ancient times and the dawn was announced in peacetime.

The Bell and Drum Tower was built in the fifth year of Jingtai (1454) in the Ming Dynasty and was built by Governor Jiao Li. At that time, there were two floors of bells and drums. In the 43rd year of Jiajing's reign (1564), deputy envoy Chen Jiang rebuilt it.

The entire building is 17.6 meters high and is divided into two parts: the lower part is a base covered with blue bricks, and the upper part is a two-story mountain-style pavilion.

The base is square, with each side 20 meters long and 8.3 meters high. There is a cross coupon hole in the middle facing the Fourth Street. The solitary arrow in the cave is 2.17 meters high, the foot of the cave is 1.4 meters high, and the cave is 4.8 meters wide(Figure 4-22).

Figure 4 - 22 North facade of Bell and Drum Tower

Source: Photographed by Sun Yijia

The Bell and Drum Tower is built on a base. It is a two-story building with a brick and wood structure. Each floor has a single eaves and a mountain style. The first floor is 9.6 meters wide and 6.8 meters deep; the second floor is 7 meters wide and 4.2 meters deep, and the top is covered with green tiles. On the indoor wall on the first floor hangs a plaque written by Emperor Qianlong, "Mianshan and the Sea". In the center of the room, there is also a cowhide military drum, the largest in Asia, with a diameter of 2.25 meters and made of a whole cowhide. The indoor display on the second floor includes cultural relics unearthed in Xingcheng and porcelain of the Ming and Qing Dynasties. Pictures of party and state leaders visiting Xingcheng are hung in the outer verandah. The Bell and Drum Tower stands majestically, is simple and dignified, with rolling gates on the mountain,

carved beams and painted buildings, green tiles and flying eaves, and ridged beasts flying in the sky.

It corresponds to the four towers at a distance, making it very spectacular. Climb the building and look around: the square ancient city, the four spacious streets, the towering Zushi Stone Square, and the solemn Confucian Temple are all in sight. You can feel the ancient city's literary style and ancient rhyme, which makes you feel relaxed and happy. It was as if we could see the tragic scene of two armies meeting each other, with swords and swords flashing. It is now a national key cultural relic protection unit(Figure 4-23).

The Bell and Drum Tower is located in the very center of the ancient city, at the intersection of Cross Street. The facade is more gorgeous and has outstanding iconic characteristics . The Drum Tower is both the center and the highest point of the ancient city. It is the landscape center of Cross Street. From the top of the Drum Tower, you can see the whole city. In ancient wars, the Drum Tower was an important military command location and played the role of ringing bells in peacetime.

Figure 4 - 23 Bell and Drum Tower

Source: Drawn by Fan Xinyu

3. Xingcheng Confucian Temple

The Confucian Temple, also known as the Confucius Temple, was the place where Confucius was worshiped in the old days. Xingcheng Confucian Temple is located in the southeast corner of the ancient city. It is the oldest and largest ancient building complex in the ancient city. It has a rigorous overall layout and outstanding features. The Confucian Temple is a rectangular building, 200 meters long from north to south and 84 meters wide from east to west, covering an area of 16,800 square meters (Figure 4-24)

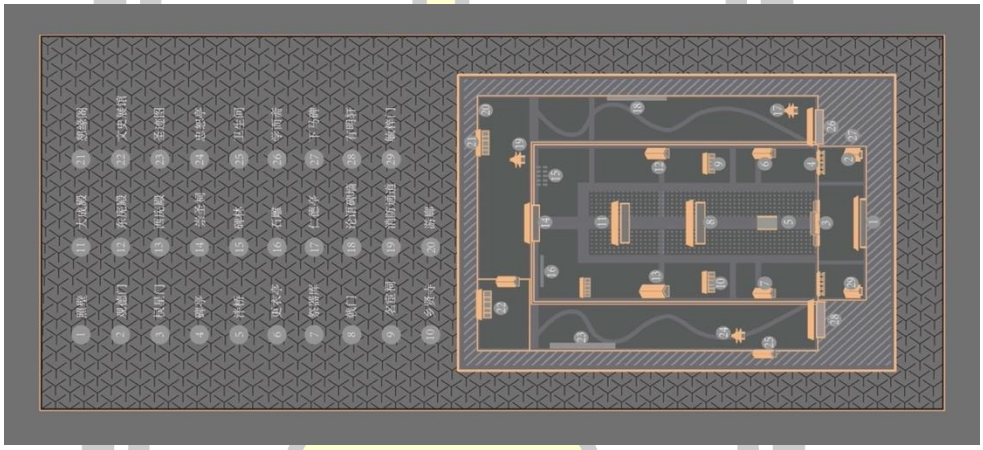


Figure 4 - 24 Location of Xingcheng Confucian Temple Complex

Source: Self-drawn by Sun Yijia

The Confucian Temple was built in the Xuande 5th year of the Ming Dynasty (1430) by Liu Bin, the commander of Ningyuan. It was relatively simple when it was first built. The first repair was carried out in the fourth year of Jingtai in the Ming Dynasty (1453). Jiao Li, the commander-in-chief of Liaodong Province, was guarding Ningyuan. Seeing that the Confucian Temple was dilapidated, he and his subordinates donated funds for repairs. This maintenance enabled the Confucian Temple's ceremony hall and Confucius statue to be built in accordance with regulations. In the 36th year of Emperor Kangxi of the Qing Dynasty (1697), Li Wenxi, the prefect of the state, carried out large-scale repairs to the Confucian Temple and rebuilt the Hall of the Master, the Chongsheng Temple, the two side halls, and the Pantheon and the Minghuan Temple on the east and west sides. At that

time, the scale of the Confucian Temple was relatively large, with a wall of one hundred and eighty feet.

This renovation laid the foundation for the heyday of the Confucian Temple in the Qing Dynasty. In the 36th year of Qianlong's reign in the Qing Dynasty (1771), Kesheng'e, the magistrate of Ningyuan, renovated and expanded the temple. He moved the Chongsheng Temple to the back of Dacheng Hall and placed it in the middle. It was increased to three couplets, forming the current three-entry courtyard pattern. In the 27th year of Daoguang reign of the Qing Dynasty (1847), Ningyuan magistrate Qiang Shanglin mobilized civil and military officials in the city and banner people, gentry and merchants to donate money, and expanded it again. The dressing pavilion and sacrificial vessel storehouse were moved to both sides of Jimen and outside Lingxingmen. A stele pavilion was built on each side of the east and west sides, and six old and new stone stele were placed, forming the current layout. In the twelfth year of the Republic of China (1923), Wang Chengbin, who was then a native of Changxing City, Zhili Province, donated his own money to repair the Confucian Temple again. This time, the main building and basic layout of the Confucian Temple were preserved. After the founding of New China, the Xingcheng Confucian Temple was once used as a county party committee office, but was moved after the Cultural Revolution.

The current Confucian Temple's construction environment has been improved through successive dynasties, and the structure of the entire building complex is rigorous and orderly. The main buildings of Zhaobi, Lingxingmen, Panqiao, Jimen, Dacheng Hall and Chongsheng Temple are arranged on the central axis of the entire building. There are east verandahs, west verandas, stele pavilions, famous official temples, rural ancestral halls, and sacrificial vessels warehouses on both sides. Most of the buildings are on hard tops, and their shapes are in line with the mature form of traditional Chinese architecture (Figure 4-25).

Figure 4 - 25 Entrance to Xingcheng Confucian Temple

Source: Photographed by Sun Yijia

The entire building is divided into three courtyards. There are two corner gates on the east and west ends of the courtyard wall. The east is called Yucui Gate (which means nurturing the essence), and the west is called Guande Gate (which means observing the virtues of Confucius). The Renjiao Gate is the first entrance to the Confucian Temple. There is a screen wall and the south courtyard wall in the south of this courtyard.

There is Lingxing Gate in the north, which is a wooden archway with four columns, three rooms, three floors, and multiple rooms and brackets. The three characters "Lingxingmen" are written on the forehead in the middle. There are garden moon gates on both sides of the Lingxing Gate. There is a stele pavilion built next to the door. Each pavilion originally had three stele monuments (buildings). After passing the Yuan Yue Gate, you will enter the second courtyard. There is a Panshui Bridge (Zhuangyuan Bridge) in the center of the courtyard, which is built over the pond. There are exquisite white marble carved railings on both sides of the bridge.

There is a halberd gate standing on a high platform in the middle of the courtyard behind the bridge.

There are east and west wing rooms at the south end of the courtyard, which are the dressing pavilion and the sacrificial vessel storage respectively; at the north end of the courtyard, there are three ancestral halls facing south, with the Xiangxian Temple in the east and the Minghuan Temple in the west. In front of the Mingguan Temple, there are ancient cypresses of the same age as the ancient city. Two sycamore trees sprout alternately at the base. They are now as thick as a thumb. The growing points of the sycamore and cypress trees are 25 centimeters from the ground. The bark of the cypress trees is not damaged or cracked. Both coniferous and broad-leaved trees cannot be grafted or planted. Botanists think this is a mystery and are known as "ancient cypresses and tung trees". Entering the third courtyard, the magnificent Dacheng Hall comes into view. In front of the Dacheng Hall, there is a statue of Confucius teaching. The temple enshrines the statue of Confucius, with twelve philosophers (Yan Yuan, Zengzi, Mencius, Zisi) on both sides. High on the door is a huge plaque with the words "Teacher of All Times" written during the reign of Emperor Kangxi.

There are also replica plaques hung in the hall specially written and issued by eight emperors of the Qing Dynasty for Confucian temples in various places: Yongzheng's "The People Have Not Been Born", Qianlong's "Joining the Heavens", Jiaqing's "Holy Collection Dacheng", Daoguang's "Holy Association". "Zhong", Tongzhi's "Holy God Tianzong", Guangxu's "gentle and gentle", Xuantong's "Zhonghe Weiyu". There is also a plaque of "Dao Qia Da Tong" written by Li Yuanhong, President of the Republic of China in the 6th year of the Republic of China.

The east and west verandahs (wing rooms) on both sides of Dacheng Hall are dedicated to 79 sages and 63 Confucians. The fifth generation ancestor of Confucius is worshiped in the Chongsheng Temple behind Dacheng Hall. In the past, every Spring and Autumn Festival day, local officials, gentry, and school teachers and students headed by the magistrate or county magistrate would always gather in front of the Dacheng Hall, standing one by one facing the north. The chief priest would

sacrifice cattle, pigs, and sheep in front of the incense table. A ceremony to worship Confucius was held.

In recent years, the Confucian Temple has also built a wall with a monument to the Analects of Confucius and a "holy traces map" of Confucius' life. The wall of the Analects of Confucius stele is made of black granite, with a total length of 188 meters and 100 engraved stelae. There are 41 pictures of holy sites in total, which are from the Ming Dynasty version, with a total length of 86.7 meters and a screen area of 74.7 square meters. The Xingcheng Confucian Temple, with its blue bricks and gray tiles, vermilion doors and windows, towering ancient cypresses, and winding paths, is a typical ancient architectural complex in my country. It is the oldest and best-preserved Confucian temple in Northeast China (Hu, X. Y. & Zhang, X.,2021).

Xingcheng Ancient City Confucian Temple was listed as a provincial cultural relic protection unit in August 1984. Due to the needs of protection and tourism, it was expanded and tidied up in 2002. After restoration, it covers an area of 15,300 square meters, and newly opened east and west courtyards. There is a wall with a monument to "The Analects of Confucius" in the east courtyard. In the west courtyard, there are stone carvings and stele pavilions from the comic strip "Holy Relics Pictures" reflecting Confucius's life deeds. At the north end of the west courtyard, there is a courtyard with five couplets in the main hall, three couplets in the east and west wings, a porch in front, and a calligraphy and painting exhibition in the main hall. The layout of Siheyuan is rigorous, quiet and peaceful. Going east out of the courtyard, a U-shaped corridor is built, about 73 meters long, for visitors to relax.

4. Zushi Pailous

There are two stone squares in the ancient city of Xingcheng, both located on Yanhui Street south of the Drum Tower. The one in the south is called Zu Dashou Shifang, and the one in the north is Zu Dashou Shifang. The distance between the two is 85 meters, the North Square is 194 meters away from the Drum Tower, and the South Square is 108 meters away from Yanhui Gate. The two stone squares are both carved in imitation of traditional wooden structures, with four pillars, three bays and five floors, with a single eaves verandah roof. These two stone squares were built by the Zu brothers, the famous generals who guarded Ningyuan City, to show off their

achievements. Since the Zu brothers were famous generals who fought against the Qing Dynasty, but had betrayed them, local people had mixed feelings about these two stone buildings. The most valuable aspect of Zushi Stone Square is reflected in its carving art. It also has rich historical legends and has become a scenic spot in the ancient city.

(1) The first stone square in the south is Zu Dashou's "Loyalty, Courage and Wisdom" square (Figure 4-26)

Zu Dashou Shifang was built in the fourth year of Chongzhen in the Ming Dynasty (1631). The whole body is carved from gray-white granite and is about 8 meters high. There are stone brackets on the top supporting the eaves above. The three tiers of forehead beams on top are arranged compactly, with few gaps, giving it a dignified sense of fullness. The uppermost forehead square is engraved with "Loyalty, Courage and Wisdom" on the south side, and "Kuoqing Zhizhi" on the north side. On the north and south sides of the middle-level square are engraved with the six characters "Fourth Yuanrong Shaofu", which refers to the fourth generation of the ancestor's general. The inscriptions on both sides of the lower forehead square are the same, written in vertical lines and incised, describing the inheritance of the fourth generation of officials and titles in the Zu family. The borders of the forehead railings are engraved with reliefs with themes of two dragons playing with pearls and riding horses to go to war. These carvings are very exquisite, dignified and dynamic. There is a stone elephant carrying a stone tower carved in the middle of the top of the forehead, and a rectangular stone forehead below is engraved with the word "Yuyin" vertically. The dot of the word "yu" is on the top, indicating the emperor's nod and acquiescence. The entire archway is supported by four stone pillars. There are large stone lions in front and behind the two middle stone pillars, a total of four. Under the stone pillars on both sides are drum-holding stones, with carvings of wave patterns and little lions on them.

Figure 4 - 26 Zu Dashou Stone Square

Source: Photographed by Sun Yijia

(2) The second stone square from the south is the "Dengtan Junlie" square of Zu Dashou's cousin Zu Dalue (Figure 4-27)

Zudaleshi Square, located in the north, is also known as "Dengtan Junlie" Square and commonly known as "Erdao Archway". Built in the 11th year of Chongzhen (1638), it is made of ocher-colored rocks. Its structure is roughly the same as that of the south square. The square is about 16.5 meters high, 13 meters wide, 4.15 meters wide in the open space, and 2.2 meters wide in the east and west ends. . On the south side of the upper floor is engraved "Dengtan Junlie", which means to climb the altar of generals and establish meritorious deeds; on the north side is engraved "Yuanxunchuxi", to the effect that erecting a stone square is the first reward for those who have made first-class meritorious service, which means This is just the beginning of the rewards. The side inscription reads "Chongzhen Wuyin was born in the middle of autumn," and the lower inscription is "Inscribed by Fang Yizao, the minister of the Liaodong Ministry of War, on patrol."

On the third floor are engraved the imperial edicts presented to Dr. Ronglu, the chief military officer of the Suppression Relief and the Zuo Dudufu of Zuozhen, the Dudufu of the Zuo Army; Dr. Lu, the chief military officer of the aid and suppression campaign, and the Zuodududuzu of the Zuojun governorate inherited the teachings; Dr. Ronglu, the chief military officer of the aid and suppression campaign, and the Zududuzuzu of the Zuojundudufu were promoted to Dalue. There are two couplets engraved on the two stone pillars in the middle. To the south is "Huan Jiu rejuvenated the country by relying on the weight of Qiancheng, and the silk fiber (lun) tin favored the imperial court and the Ming Dynasty Tripod". To the north is "Song Yi Ru Xin Qing is good at cultivating it." "Four generations, Linlang has a great reputation and will be praised forever." The two couplets roughly mean that Zu Dalue praised his bravery and might. He was cultivated by his ancestors' good deeds and virtues. As a famous and brave general, he was praised by generations. , was relied upon and praised by the country, favored by the imperial court, and given a grand engraved gold and stone medal with the emperor's permission. This honor will last forever (Li, Y. Q. et al.,2012).

There are large stone lions holding the pillars at the lower end of the central pillars on the north and south sides of the two stone squares. There are pillar-holding stones at the lower end of the side pillars on the north and south sides. A small stone lion is carved on the upper end. The shape is vivid and lifelike, with the back arched and the head raised, both of them looking at each other. These stone lions are regarded by local people as a symbol of warding off disasters and turning bad luck into good luck. For hundreds of years, every fifteenth day of the first lunar month, all men, women and children in the city go to the stone lion, hoping that if they touch any part of the stone lion, the disease in that part of their body will be cured.

Although the Zushi Stone Square has been eroded by wind and rain for 400 years, it is still well preserved, which provides precious physical information for studying the stone carving art of the working people in the Ming Dynasty and studying the history of the Ming and Qing Dynasties.

Zu Dashou is Zu Dalue's cousin, and they are the descendants of Zu Ti, a famous general in the Eastern Jin Dynasty. During the Chongzhen period of the Ming Dynasty, he guarded western Liaoning and made great contributions. He

was repeatedly praised and favored by the court. On the historical stage of the late Ming and early Qing dynasties, the two Zu brothers were both subordinates of the Ming Dynasty general Yuan Chonghuan. They fought many times with the Jin army and won countless battles. By the fifteenth year of Chongzhen (1642 AD), except for Ning Yuan, all the important places outside Shanhaiguan were lost in the Ming Dynasty. The Ming Dynasty government was attacked by the peasant uprising army and the Manchu Qing forces, and it was on the verge of collapse.

Zu Dashou had no choice but to submit to the Qing Dynasty and conform to the historical trend. When Emperor Qianlong was stationed in Ningyuan during his eastward tour, he visited his ancestor's stone workshop and wrote a poem: "The fire is cold and the beacon is waiting for the court, and the dove craftsman has no time to be free. If it were not for the Huabiao to leave his name, who would know the Yuan and Rong Dynasties in the two dynasties. " The stone squares have similar shapes but show different characteristics. The exquisite carving art makes them have high aesthetic value.

Figure 4 - 27 Zudaleshifang

Source: Photographed by Sun Yijia

After Zu Ti, a famous general in the Eastern Jin Dynasty, the idiom "hearing the chickens dance" has remained famous in the world. The ancestors moved

to Ningyuan, and Bao Daming guarded Ningyuan for eight generations for 212 years, which was unprecedented in ancient times. No matter what history says, Zushi Stone Square, as the exquisite stone carving architectural art of the working people, will always shine with brilliance. It also provides precious physical information for studying the history of the Ming and Qing Dynasties (Li, Y. Q. et al.,2012).

In 1969, Zu Dashou Stone Tower was demolished with the approval of the relevant provincial departments due to the risk of collapse. It was rebuilt as it was on June 26, 1988. Zu's Stone Square has exquisite carvings, tall columns and small buildings, and is so majestic and majestic that it is rare in the country. Especially the large and small stone lions under the pillars of the stone square are beautiful and lifelike in shape, with their heads held high and their backs bowed, lifelike and full of aura. Local people respect these lions and regard them as a symbol of turning misfortune into good luck and bringing good luck. For many years, on the fifteenth day of the first lunar month, all men, women, and children in the city have gathered in the stone square and stroked the stone lions in order to ward off disasters, diseases, and good health. In September 1963, Zushi Shifang was announced as a provincial key cultural relic protection unit by the Liaoning Provincial People's Committee. In 2006, it was listed as a national key cultural relic protection unit (Liu, C. L.,1989).

4.2.1.3 Cultural connotation of Xingcheng ancient city architecture

1. Architectural culture

Buildings are the carrier of architectural culture. They carry information about the mutual movement between human society, nature and architecture. The synthesis of this information is architectural culture. This section mainly studies the form and Feng Shui in the architectural culture of ancient Xingcheng (Liu, P. L.,2011).

(1) Feng Shui culture

The site selection of ancient buildings in Xingcheng area pays attention to Feng Shui, which is a kind of culture. What is Feng Shui? Wind is vitality and field energy, and water is flow and change. Feng shui is originally the art of looking at the ground, which is a method of checking geography on the spot. It was

called the art of geomantic omen in ancient times. Feng Shui is not only a traditional national culture, but also a rigorous science.

The ancient city of Xingcheng is backed by mountains. The famous Lishan Mountain and Jiulong Mountain stretch for hundreds of miles, winding westward like a giant dragon, connected with the remaining veins of Yanshan Mountain and Songling Mountain. This is the "dragon vein".

To the left of the ancient city are Shoushan and Xiashan, and to the right are Heifeng Mountain and Tiema Mountain. They are ideal "sand mountains" that surround the ancient city on the left and right.

The Xingcheng River flows continuously, coming from the northwest. The one that flows through the west of the city is called Xihe, also called Xingcheng River, Ningyuan River, and in history it was also called Guo'er River. It is one mile west of the ancient city and flows around the city and flows into the sea in the southeast. The other river flows through the east of the city and is called the East River. It is one mile away from the east of the ancient city and flows southward to join the Xingcheng River and flow into the sea. To the southeast of the city is a flat area 15 miles wide, and then there is the roaring Bohai Bay.

Xingcheng ancient city is backed by dragon veins and surrounded by sand mountains. It is the best point for the separation of two waters. It is the best point for the intersection of dragon, sand and water. The plain land with mountains on its back and water on its side, the yin and the yang, and the intersection of mountains and rivers is the best place to build a city and govern it; this shows the good intentions when building the ancient city of Xingcheng.

As a military defense facility, Xingcheng Ancient City fully meets the requirements of military science and Feng Shui science in China's cold weapon war era. "Guanzi·Chengma" says: "Every country is not established under the mountains but above Guangchuan. " This means that in ancient times, the establishment of a country and the construction of a city were either against mountains or next to rivers. In today's terms, it's either close to mountains or close to water. The ancient city of Xingcheng follows this principle and is both close to mountains and water (Figure 4-28).

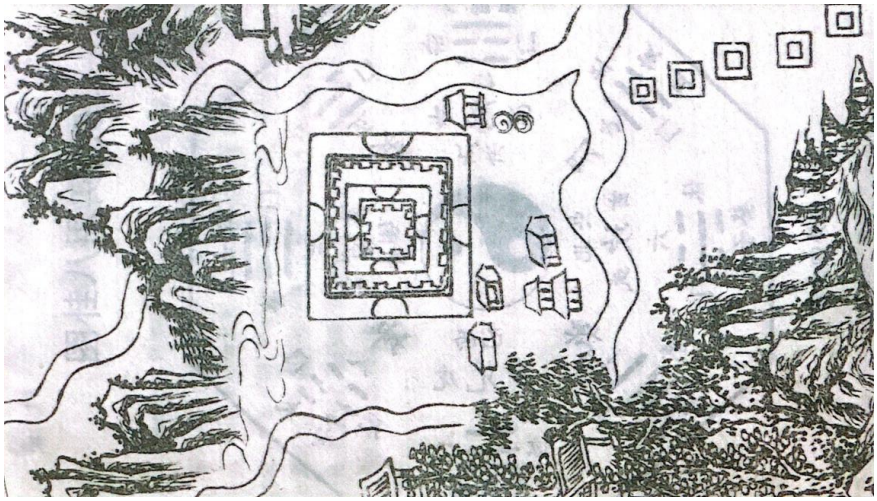


Figure 4 - 28 Map of Xingcheng Ancient City Military Fortress
Source: Zhang Kaixin

The construction of the ancient city of Xingcheng involved mechanics, mathematics, architecture, aesthetics, philosophy, economics, military science, politics, Feng Shui and many other disciplines.

The architectural layout and orientation of the ancient city of Xingcheng fully embodies the layout program of "five directions and four images, highlighting the center, strengthening the central axis, facing south as the respect", and "distinguish the direction and position". From small residential courtyards to large urban areas, they all pursue the harmony between "man, heaven, earth, and architecture", that is, "the unity of heaven and man." It fully demonstrates the traditional Chinese city architectural culture.

The architectural layout of the ancient city Feng Shui: The architectural orientation of the ancient city of Xingcheng is facing south and 10 degrees east. It is a typical traditional Chinese ancient city building.

Facing south and sitting north is an important symbol of the traditional Chinese concept of hierarchy. It mainly comes from traditional Chinese architectural theories. The reason is that China is located north of the equator, and facing south is suitable for sunlight, especially at noon of the day, the sun has reached its highest point, and the Yang energy has reached its peak. The orientation of the building is 10 degrees to the east, which is a large sunrise in traditional Chinese

architecture and is suitable for human habitation. The orientation of the temple is due south and north.

In addition, facing south and sitting north are inseparable from "resembling the sky and the earth". "Xiangtianfadi" refers to observing celestial phenomena and observing Feng Shui, and also refers to the buildings built by feudal rulers. The political purpose of the ancient feudal ruling class was to rationally control the people's human rights and thoughts in the name of Heaven by acting on behalf of Heaven. However, observing celestial phenomena and observing Feng Shui also contains many scientific principles such as astronomy and Feng Shui. This cannot be denied (Pei, P. R.,2019).

Feng Shui of the architectural orientation of the ancient city: The buildings in the ancient city of Xingcheng are based on the thinking of numbers, and most of them use even numbers. Ancient Chinese philosophy believes that even numbers are successful numbers, which are symbols of stability, harmony, joy, and perfection.

The circumference of the ancient city is six miles and eight steps long, the circumference of the pond is seven miles and eight steps long, and the circumference of the original outer city is nine miles and one hundred and twenty-four steps long. There are four gates on all sides of the city, four central streets, and eight large alleys. The total number of large and small alleys is 36 articles. They all mean "everything is stable and everything is stable, six and six are smooth". The eight large alleys form the Bagua directions in Yin-Yang theory and the Bagua formation map in ancient military science. The 28 small alleys fully reflect the twenty-eight constellations in astronomy (Huang, Y. L. & Tan, G. X.,2012).

(2) Shape

Shape refers to the architectural form, that is, the fixed architectural style and style. For example, the architectural style of a county town, the shape and size of the houses, the appearance specifications, the cultural style, the brackets and the Western style of the roof, etc. Ningyuan Acropolis 1 - The Ming Dynasty attached great importance to the location of the Acropolis, and most of them chose places with flat terrain and easy settlement.

The Five Directions and Four Symbols of Xingcheng Ancient City: The architecture of Xingcheng Ancient City is completely consistent with the Five Directions and Four Symbols in traditional Chinese architecture. Among the five directions, there are five directions: east, west, south, north, and middle. Among them, "middle" is the center position among the five directions, center is the symbol of rule.

The command structure of a city must be established in the "center", and all buildings must be built around the central axis. The central axis is the skeleton of a city's buildings. There is a bell and drum tower in the center of the four intersecting streets in the city. The command center of Xingcheng Ancient City has 36 large and small alleys arranged in the order of the four central streets. There are four east, west, south and north gates on the four sides of the city. Together with the 17.6-meter-high bell and drum tower in the middle of the city, it just forms the five directions and four images of east, west, south, north and center.

The green dragon elephant is in the east, the basalt elephant is in the north, the white tiger elephant is in the west, and the red bird elephant is in the south. Each of the four city gates has its own meaning: East means Chunhe, which means that the sun rises from the east and the sun is shining brightly in Spring. The south is called Ying En, and the south side is Zheng, welcoming the mighty favor of the emperor. Later it was changed to Yanhui, hoping that the sun's glory would last forever. In the west, Yongning means eternal peace. North is called Guangyuan, which means the vast and far-reaching area in the north. Later it was changed to Weiyuan, indicating that the power of the imperial court spread far and wide.

Arch-type buildings: The gate openings of the four gate towers of Ningyuan (Xingcheng) Acropolis are all arch-type buildings. During the interview, Chang Deyi described it this way: The arch structure combines the artistic image of ancient Roman architecture, giving people a brand-new feeling. It has a new styling factor - coupon hole. This arc-shaped shape is not only beautiful in composition, but also highly practical. The buildings in Xingcheng used a large amount of bricks and stones, and the arch-type buildings were further developed. This also promoted the development of masonry structures. For example, the Bell and Drum Towers rebuilt during the Qianlong period have four arched aisles underneath that cleverly form a

continuous coupon pattern, which is something that many Bell and Drum Towers in state cities do not have (Chang, D. Y. 2023 : Interview) .

2. Special war culture

War, if it exists for a long time in a specific area, will form a culture. As far as Xingcheng (Ningyuan) is concerned, from the Xuande period to the Wanli period of the Ming Dynasty, Ningyuan had frequent wars with the nomadic people in the north; from the Wanli period to the Tianqi period, Ningyuan had fierce wars with the Hou Jin Dynasty. Therefore, a social culture that is different from other cultures is formed, that is, a war culture. War culture in a broad sense refers to the embodiment of combat thoughts in political, military, economic and other aspects, which is war culture. War culture is a very special social culture and is the product of the interaction between human culture and war practice. During the interview, Wang Guimin mentioned: Archaeologist Su Bingqi once commented on the ancient corridor in western Liaoning and pointed out: "A series of problems in the formation of China's unified multi-ethnic country seem to be most concentratedly reflected here, not only before the Qin Dynasty, but also in the future. From the "Five Hus" to the Liao, Jin, Yuan, Ming, and Qing dynasties, many "highlights" were performed on this stage, and the actors on this stage were Han, Donghu, Khitan, Jurchen, Mongolian, Manchu, etc. Nation." (Wang, G. M. 2023 : Interview)

The two sides in the war were the Ming Kingdom and the Later Jin Kingdom (Qing Dynasty). The Ming and Qing Wars refer to the many wars that occurred between the Ming and Qing Dynasties during the rise of the Qing Dynasty and the demise of the Ming Dynasty. Wang Guimin said: The outbreak of the Ming and Qing wars was inevitable in its historical development. Here we only talk about the wars related to Ningyuan (today's Xingcheng) (Wang, G. M. 2023 : Interview).

(1) Ming army equipment

Flag: The military flag is a manifestation of war culture. The wind blows the commander's military flag, blowing the flags of each army, each battalion, each thousand households, each hundred households, each general flag, and each small flag, making a hunting sound. It means that the army is of high quality and has strong fighting spirit. The central military flag is the main flag of an army. It is generally awarded by the emperor to the leading general and can only be used in

wartime. Generally, those given by the emperor have red characters on a blue background and red edges, while those authorized have black characters on a white background and blue edges. They are written as imperial gifts or royal orders to a certain general and such-and-such officer (such as a certain governor, a certain admiral or a certain general soldier), and are three feet long. Five to three feet wide, it is generally used by generals who command several armies (governors, admirals) or several battalions (general soldiers) during war, and are guarded by the central military flag officer. The Chinese military flag has symbolic significance and will inspire soldiers to fight bravely. For example, (like the word "ancestor" on the flag of Ning Yuanwei's ancestral army general, if the flag does not fall down, it means that general ancestral is still there, and the soldiers will have the courage to continue fighting.

War soldiers: Yuan Chonghuan said: "The war soldiers are horse soldiers, infantry, chariot soldiers, and sailors, with a total of twenty-four battalions. Today they are soldiers to occupy the territory. In the future, as the land becomes wider, they will sit and fight everywhere. Soldiers are defenders." The infantry battalion system is divided into five levels: department, division, bureau, flag, and team. There are 3 teams per flag, and each team consists of 12 infantrymen. Each flag has 1 flag officer and 36 soldiers: each bureau has 1 hundred officers and 111 officers and soldiers: each division has 1 commander and 448 officers and soldiers: each department has 1 cadre and 898 officers and soldiers: each The battalion has 1 general officer, 1 central military officer, and 1 firearms commander. The total number of officers and soldiers is 2,697, and the total number of officers and soldiers in the battalion is 2,700. The Ming Dynasty army had a lot of muskets and artillery equipment. In addition to self-produced ones, there were also imported ones from Portuguese merchants. A battalion of 5,000 soldiers is equipped with 1,000 thunderbolts, 200 shotguns, 20 cannons, 1,080 blunderbuss and accessories, and 6,480 rockets. In addition, there are also ghost-head swords, bows, crossbows, grenades, and rockets. equipment. From the perspective of equipment, firearms equipment accounts for 50% of the total equipment of the infantry battalion (Dong, Y. P.,2014).

Sergeant clothing : The Ming Dynasty sergeant clothing had a kind of fat coat, which was made: "knee-length, narrow sleeves, and made of cotton

inside." The color was red, so it was also called the "red fat coat." Knights often wear double lapels to facilitate riding horses. Doudou used for combat are mostly made of copper and iron, rarely leather. Soldiers wear chainmail below the waist, an iron mesh skirt and mesh trousers, and iron mesh boots. The armor worn by generals is also made of copper and iron. The shape of the armor pieces is mostly a "mountain" pattern. It is made with precision and is easy to wear.

(2) Educate

Education - The education received by the Ming army was based on Confucianism. Faced with most of Liaodong being occupied by Hou Jin and the territory being encroached on, the Ming court carried out unification education on a regular basis. One of the essential pre-war preparations for the Ming Dynasty army was the military oath. The military oath is a pre-war mobilization meeting. This is not only a morale-boosting and rallying meeting, but also a passionate patriotic education. Regarding Yuan Chonghuan's education for the troops, Jin Yong said this: "Yuan Chonghuan, with his unfailing enthusiasm and indomitable pride, inspired all the soldiers, heated the blood of his subordinates, and defeated a group of sluggish remnants. , Forged into an elite division that fights to the death and is unyielding." Before the Battle of Ningyuan, Yuan Chonghuan "pierced blood as a book to inspire loyalty and worship him", asking the soldiers and people in the city to share the hatred of the enemy and to live and die with Ningyuan City. Yuan Chonghuan announced to the entire army: "Every general, whether guarding or assisting, should be united with his own way for survival and death. They should be united and united. They will survive in death, and they will live without death." The soldiers were deeply moved and "please die for your service."

(3) War

After the fall of Liaodong, the number of people using firearms in the infantry of the Ming Dynasty gradually increased, and firepower battles often became the primary stage of battles. The battle begins by striking the enemy with a cannon. After the firearm is released, the battle formation must be changed, with cold weapons in the front and firearms in the back, and then a close-quarters fight. Although firearms can inflict a certain amount of damage on the enemy at this time, the outcome is still determined by fighting with cold weapons such as swords and

spears. With the increase in the number of combatants using firearms, firearms have increasingly become the main weapon used to kill the enemy. When you are within a hundred steps of the enemy, fire the birdshot first, then the rapid fire gun and rockets in sequence.

This kind of leveled lifting can effectively attack the enemy. When the cavalry of the two armies were fighting, the cavalry of the Guan Ning Cavalry of the Ming Dynasty held three-eyed iron blunderbuss and fired iron beads and lead bullets dozens of meters away from the Eight Banners Army (Dong, Y. P.,2014). In this situation, the enemy cavalry may be frightened and confused. When the Ming army rushed forward, they waved their three-eyed iron guns and fought hard, causing them to retreat in rout. Yuan Chonghuan followed the advice of his subordinates and changed the layout of the cannon. Before Yuan Chonghuan, Ming Dynasty generals generally used artillery to bombard the field. After the first shot was fired, the golden cavalry rushed up without waiting for the charge. The soldiers of the Ming Dynasty died and the cannons were gone. In the sixth year of Ming Dynasty (1626), Yuan Chonghuan placed cannons on the city wall, which were extremely powerful. Yuan Chonghuan changed his tactics of only defending without attacking. In the seventh year of Ming Dynasty (1627), Huang Taiji personally led hundreds of thousands of Eight Banners soldiers to attack Ningyuan and Jinzhou. Yuan Chonghuan used tactics flexibly and ordered Mangui and Zu Dashou to lead the Ningyuan cavalry to attack and fight with the Houjin cavalry. He also won a great victory over Ningjin with the strength of the city and artillery (Dong, Y. P.,2014).

(4) Celebrities born of war

During the Tianqi period, Sun Chengzong and Yuan Chonghuan, who were stationed in Ningyuan City, were heroes of the Han nationality. What they faced was the rising Jurchen regime. Under the leadership of the Jurchen hero Nurhaci, they unified various tribes in the northeastern region. They had transformed from a slave society to a feudal society, known in history as the Hou Jin Dynasty.

Sun Chengzong : During the interview, Wang Guimin said: The application of ideas such as "knowing others and knowing the enemy" in "The Art of War" in war is the culture of war, which inherits and carries forward the military theories of ancient military strategists (Wang, G. M. 2023 : Interview) . Sun

Chengzong carefully studied "Sun Tzu's Art of War" and insisted on combining theory with practice. When he was in Ningyuan, he wrote in "Sun Tzu's Art of War: Planning and Attack" on strategy: "If you know your enemy and yourself, you will not be in danger in a hundred battles; if you don't know your enemy but know yourself, you will win one and lose one; if you don't know your enemy and yourself, you will be in danger in every battle."

In the battle of wits and courage with Nurhaci, Sun Chengzong "knew himself and the enemy", measured the strength of both sides realistically, and adhered to the principle of focusing on defense. He built castles, beacon towers, and built the Ningjin defense line. To persist and not to attack easily is to use one's own strengths to deal with the weaknesses of others. The soldiers of the Later Jin Dynasty were good at riding, shooting, and fighting in the wild; the Ming army had strong cities and was suitable for defense.

Wang Guimin said: Sun Chengzong has taken a big step forward than Qi Jiguang's combined army tactics based on the use of Folang machine guns. This book was of great help in holding on to Ningyuan and regaining lost territory. (Wang , G. M. 2023 : Interview)

Yuan Chonghuan:Yuan Chonghuan was born as a Jinshi and was well versed in Confucianism. He spent nearly three years under Sun Chengzong (Minister of War and Superintendent Ji Liao) and learned a lot of military strategy knowledge. He knew very well that in the ancient times when the Yan and Huang clans merged, the reason why the Yellow Emperor was finally revered as the Son of Heaven by the princes was that the Yellow Emperor, who advocated martial arts, combined the cultivation of virtue with the promotion of soldiers. Not only are they good at martial arts, but they are also good at uniting and being compatible with other clans and tribes. Experts believe that the unity of martial arts and virtue, strong military force and peace is the great wisdom of the Chinese nation's martial ethics. When Yuan Chonghuan dealt with Hou Jin, he not only emphasized the martial ethics of the Chinese nation, but also used force to stop and eliminate violence at critical times.

Wang Guimin said: Yuan Chonghuan creatively used military tactics and combined with reality, which enriched Ningyuan's war culture and wrote a new chapter in the history of Liaodong war. (Wang, G. M. 2023 : Interview)

In the Battle of Ningyuan, Yuan Chonghuan treated his soldiers sincerely, gave full play to their advantages, protected his family and country, and guarded the Liao territory. Yuan Chonghuan loved generals, and he valued Zu Dashou, Zhao Lijiao, Zhu Mei, Zuo Fu, He Kegang, Jin Qizong, Mao Yuanyi, etc. and showed great concern. Among them, Zu Dashou was a rare general. He was valued by Yuan Chonghuan. Yuan Chonghuan believed that "a thousand armies are easy to obtain, but a general is difficult to find."

Yuan Chonghuan and the Guan Ning Cavalry At the end of the Ming Dynasty, Sun Chengzong supervised the Liao Dynasty as the imperial division. He spent more than four years in Liaodong and adopted Yuan Chonghuan's correct suggestions to improve the Guan Ning Jin defense line. Yuan Chonghuan is a famous general with great talents and strategies. Although he is a scholar, his military foresight is no less than that of a military general. Yuan Chonghuan inherited Sun Chengzong's approach and continued to attach importance to the ancestral military group headed by Zu Dashou, and strengthened the construction of the cavalry team on the basis of the ancestral army.

Yuan Chonghuan is the master of Guan Ning's cavalry. He and his men trained Guan Ning's cavalry into a force with strong combat effectiveness and strict military discipline. With the Guan Ning cavalry, the Guan Ning Jin defense line became an indestructible and solid fortress of Hou Jin.

Yuan Chonghuan applied the theory of fighting and defending to build the Guanningjin defense line, focusing on defense. Yuan Chonghuan used the border defense strategy of "fighting and defending, defending and fighting, building and fortifying" and "the law is gradual but not sudden, and the reality is not false". After the Battle of Ningyuan, Yuan Chonghuan worked hard to build the Guanningjin Defense Line to resist the Hou Jin Dynasty, making it a line of defense in the Western Liaoning Corridor that was difficult for the Hou Jin Army to cross.

Yuan Chonghuan flexibly used the theory of "defending for good and fighting for surprise" to use the weak against the strong. In the battle of

Ningyuan, we should "defend" and not attack easily. Yuan Chonghuan gave the command of defending the east, west, south and north sides of the city to the brave and capable Man Gui, Zuo Fu, Zu Dashou and Zhu Mei respectively. In the Battle of Ningjin, Yuan Chonghuan changed his tactics. Based on the principle of focusing on defense, he used "war as a surprise" and sent powerful cavalry troops to take the initiative to support Jinzhou.

Yuan Chonghuan, the commander of Ji Liao, was stationed in Ningyuan. He had a thorough understanding of "Sun Tzu's Art of War: Planning and Attack" and used it freely. It is worth mentioning that Yuan Chonghuan used "harmony as a side effect" to achieve "subjugation without fighting". Soldiers are good." It is good to hope that Huang Taiji can stop the war and reduce casualties without resorting to war. Even if the peace talks fail, the peace talks can still be used to achieve the purpose of repairing the city. It should be said that this is a very clever strategy (Wang, G. M. 2023 : Interview).

(5) The nature of wars in the Ming and Qing Dynasties

The wars between the Ming and Qing Dynasties caused the people in Ningyuan area to leave their homes and the land was barren. The war caused great damage to the local farming economy. Thousands of merchants on Juehua Island died. The war seriously imbalanced the population ratio and restricted economic development. The war also caused serious psychological trauma to the people. During the war, the people were on tenterhooks and were in fear all day long.

However, according to experts, the war between the Ming and Qing Dynasties in the Ningyuan area had a huge positive impact on the Ming Dynasty regime: First, the Ningyuan and Ningjin victories severely damaged the Jin army and extended the life of the Ming Dynasty regime. The second is to enhance the self-confidence of Ningyuan defenders and improve the cohesion of Ningyuan people.

In short, the negative impact of war is absolute, long-term, and profound; while its positive impact is generally short-lived, superficial, and relative. War culture covers a wide range of topics and needs further discussion. Wang Guimin said: Historian Sun Wenliang and others emphasized that "no matter how they fought among themselves in the Ming and Qing Dynasties, it was by no means a national war." What does this national war refer to? It is necessary to explain. This national

war refers to the national war between different countries. For example, wars of national independence and liberation fought against invasion, oppression and enslavement by foreign nations. Experts such as Sun Wenliang also pointed out that between the Ming and Qing Dynasties, "in the final analysis, it was just a question of who would unify the country." This shows that the war between the Ming and Qing Dynasties was a war between the relevant ethnic groups within a country. The Han regime and the Jurchen regime fought wars for their own interests, both trying to unify the country (Wang, G. M.2023 : Interview).

(6) War etiquette

In the wars of the Ming and Qing Dynasties, when conflicts and disputes occurred between the two sides, although they had to fight each other in battle, benevolence, justice and etiquette were not discarded. Even in the war, we still insist that "when two armies are fighting, the envoy will not be killed." When attacking, the trumpets and drums are blown, and when the troops are withdrawn, the troops are struck with the sound of gold (the sound of gold is to strike the zheng. The zheng is a long, narrow, bell-shaped instrument with a handle and made of copper.) This is an unwritten rule between the two sides. In ancient times, before the emergence of the art of war, the confrontation between two armies was particularly moral as long as it was not a sneak attack. For example, during the Warring States period, if a war started, one side would beat drums to advance and the other side would also beat drums to fight. If the other side does not fight, the attacking side cannot fight first. During a battle, those who lay down their weapons and do not resist will not be killed. Because most soldiers go to the battlefield not voluntarily, massacring the unarmed soldiers is an unjust act that is outraged by both humans and gods. During the reconciliation stage between the two parties, the Ming Dynasty opened the horse market and wood market, and the two parties conducted transactions and exchanged what they had. Local officials met from time to time and exchanged gifts.

(7) The influence of war culture

The culture of war is reflected in children's games. In the interview, Wang Guimin mentioned: For example, cow-butting: The person who bucks the cow turns one of his legs, holds his feet with both hands, and uses his knees as horns to

butt each other. Most of them are for two people, but there can also be more than one person. The one who is pushed down or falls to the ground loses, and the last undefeated person is the general. It is required that you can only use your knees to top your head and not push the opponent with your hands. Bull-topping can exercise bravery and test endurance. Another example is the children's game of bamboo horse riding. The bamboo horse is a bamboo pole. Children ride on the bamboo pole, holding the bamboo pole with one hand and using the other as a whip, as if they are riding a horse. Boys like to ride bamboo horses, which was influenced by the war environment at that time. They wanted to become generals galloping on the battlefield in the future, and also hoped that they could ride horses to fight and kill enemies to serve the country (Wang Guimin, 2023 : Interview) .

4.2.2 Analysis on the current situation of digital protection and inheritance of cultural heritage in Xingcheng Ancient City

4.2.2.1 Current status of Xingcheng ancient city cultural heritage protection

An ancient city has recognizable and unique characteristics mainly depends on the culture of the ancient city, whether it has a strong historical and cultural atmosphere, and the integrity of its overall style. Cultural genes are the "soul" of the ancient town, and the overall style is the "form" of the ancient town. Only by combining and protecting cultural genes with the overall style of the ancient town can we achieve both form and spirit.

The ancient city of Xingcheng was once a glorious military stronghold, as well as an important commercial trading center and material distribution center for surrounding towns. Time has passed and the glory of the past has long faded. Nowadays, under the impact of the rapid urbanization process, Fengheng’s past advantageous conditions (location, transportation, hinterland) are gradually weakened. With the passage of time, lack of timely protection, lack of protection awareness, and lack of protection system, most of the buildings in Fengfen have gradually declined in style and weakened the function of cultural gene carriers. Some temples, ancient villages, and other buildings built in the Ming and Qing Dynasties, Buildings etc gradually disappear. This situation ushered in a turning point after the founding of the People's Republic of China. The ancient city of Xingcheng received attention, local

characteristic architecture and culture were initially valued and excavated, and important historical buildings and cultural relics of the ancient city were protected and repaired. The government has also taken corresponding measures, inviting experts and scholars to carry out on-the-spot investigations and make suggestions to further promote the protection and development of ancient towns.

The ancient city of Xingcheng was built in the Ming Dynasty and has experienced development and evolution from the Jin Dynasty and the Qing Dynasty to modern times. During the long years of baptism and the precipitation of historical culture, it has preserved numerous historical and cultural resources, highlighting the wisdom genes of the ancients. These historical and cultural resources are the product of the wisdom genes of ancient people and the result of the integration, dissemination and replication of cultural genes . The profound historical and cultural heritage has given the ancient city of Xingcheng a unique spatial pattern and formed its unique architectural style, spatial form and texture characteristics. Since the development of the ancient city of Xingcheng, the buildings have been relatively well preserved and there are many groups of ancient buildings. Most of these well-preserved residences are buildings from the Ming and Qing Dynasties and are distributed in the ancient city. The streets in the ancient town have a complete layout, and the cross-shaped streets and alleys continue to this day.

(1) Protection achievements - material carriers

Protection of material carriers. The Xingcheng City Government has done a lot of protection work and taken some protective measures. During interviews with government staff, we learned that in the protection work of Xingcheng Ancient City, a special protection department and ancient city protection regulations have been established to list and repair cultural relics protection units and important historical buildings. The protection of Xingcheng Ancient City is divided into four levels: important protection points, core protection areas, construction control areas and style coordination areas, and the ancient city protection goals are established. In order to protect the buildings and street spaces in Guchang Town, some places were moved away from Guchang Town. The buildings in Xingcheng Ancient City were partially repaired, and the buildings along the streets were relatively well protected. List some important buildings as cultural relics protection units and key protection sites (Zheng

Hui, 2023 : Interview) . After on-site investigation and interviews, we learned that the government has made some achievements in protecting the ancient city of Xingcheng. The government maintains the cultural gene carrier of the ancient city and repairs and maintains key buildings. Therefore, the overall external expression of the ancient town and the protection of architectural cultural genes have been done relatively well, and the overall architectural style of the ancient town is relatively complete.

(2) Conservation Achievements—Aspects of Ancient City Culture

Xingcheng culture . In terms of food culture, the brochure of Fengsheng Ancient Town introduces and displays the ancient town's special local snacks (Figure 4-29).

Figure 4 - 29 Traditional food in Xingcheng Ancient City
Source: Zheng Hui, person in charge of the ancient city

Regarding the protection of traditional skills, we learned from interviews with inheritors of traditional skills in ancient towns that if you successfully apply for intangible cultural heritage, you can receive a small amount of support every month (Wang, J. M. 2022 : interview) ; In terms of folk activities, I heard from local residents , important festivals, such as the Spring Festival , Mid-Autumn Festival, etc., will hold some activities such as guessing lantern riddles, playing dragon and lion dances, etc. In order to protect the characteristics of the ancient town , large-scale

activities will be held on the occasion of the birth of Confucius, and there will also be some parades for the top candidates in the ancient imperial examinations(Feng, S. Y. 2022 , interview) (Figure 4-30,4-31).

Figure 4 - 30 Commemorating the birthday of Confucius

source: Sun Yijia

Figure 4 - 31 Folk activities in Xingcheng Ancient City

Source: Sun Yijia

4.2.2.2 Problems existing in the protection of cultural heritage in Xingcheng Ancient City

(1) Inadequate mining of cultural genes

After many on-site surveys and interviews, I felt that the cultural genes of Xingcheng Ancient City were insufficiently explored and displayed, resulting in the cultural atmosphere of the ancient town being diluted and the cultural connotation missing. Regarding the protection of the ancient town's culture, only an exhibition room has been set up in the Governor's Mansion to provide a simple text introduction and picture display of the ancient town's culture. Most tourists may not know that there is a cultural display in this building, although there are some There are experience areas and interactive areas, but due to ticket restrictions, many tourists may not spend money to enter. When I interviewed 12 general informants from residents and tourists in the streets and surrounding areas of the ancient city, I asked a question: Do you think the cultural atmosphere of Xingcheng Ancient City is strong? 1. 9 out of 2 people thought it was not strong, and 2 people thought it was not. Generally speaking, 1 people think it is strong.

The cultural atmosphere of the ancient city of Xingcheng is not strong enough and needs to be improved. Although Xingcheng Ancient Town will hold some activities during the Spring Festival and festivals, the cultural exploration of this ancient town is insufficient. There are few festival activities that are in line with the culture of this ancient town and lack uniqueness. As a result, some characteristic cultures of the ancient town are missing and cultural protection is incomplete. Local residents believe that the historical and cultural atmosphere of Xingcheng Ancient City has been diluted and not strong enough. There is not enough understanding of the culture of the ancient town. Based on the above cultural awareness analysis, it can be seen that most of them only know the architectural culture of the ancient town of Xingcheng and the two well-known battles in which a small number defeated a large number. They do not know the unique war culture and defense culture of the ancient town. Not much is known. The culture of the ancient city of Xingcheng is insufficiently explored and displayed, and its carriers are in decline, resulting in the dilution of the unique cultural atmosphere. Most residents do not understand the

origin of culture. Today 's ancient town has lost its former prosperity, and its unique war culture and architectural culture have gradually faded away.

(2) Important historical nodes disappear

of the Ming Dynasty are the core cultural gene carriers of the ancient city of Xingcheng. They record the rise and fall of the ancient city and reflect the aesthetic value of different eras. Field investigation found that some buildings have been damaged. The remaining ancient buildings in Xingcheng Ancient City are centered on the Bell and Drum Towers, and the Xingcheng Ancient City Wall is the boundary. At present, the ancient city walls, Confucian Temple, Bell and Drum Towers, and Stone Squares have been basically restored to their original appearance after years of restoration. However, due to the vicissitudes of life, the structure has been partially damaged, cracks have appeared on the walls, the columns and carving patterns have also suffered varying degrees of damage, and the brick carvings on the stone square have also been damaged to a certain extent. In the process of cultural inheritance, cultural genes are affected by external conditions, which leads to genetic variation to a certain extent. With the changes of the times, cultural genes have also changed to varying degrees. Therefore, in order to better inherit the ancient city of Xingcheng, we should comply with the development of the times when carrying out the protection and development of the ancient city to ensure that the cultural gene carrier is not destroyed.

(3) Dilution of traditional culture and values

The ancient city of Xingcheng has a long history and culture. After hundreds of years of accumulation, it has gradually penetrated into every corner of the ancient city. Because culture is characterized by variability and instability, it is highly susceptible to environmental changes and will also affect the values of the ancient city. Nowadays, with the rapid development of the city, most young people in the ancient city have chosen to move to the big cities and brought back a lot of new culture. After accepting the culture of the new era, the residents of the ancient city began to pursue new things blindly and ignored the traditional culture. irreplaceable and unique value. In this duel between the old and the new, it is clear that the new culture has won. The residents of the ancient city have simply forgotten the traditional culture passed down by their ancestors and have not implemented active protection

measures for them. Cultural genes are time-sensitive. Without external help, it is impossible to obtain a healthy inheritance.

(4) Protection and inheritance methods are single and digital utilization is insufficient.

For a long time, the protection and inheritance method of the historical culture of Xingcheng Ancient City has been very simple. Apart from the routine protection and display of the ruins, there are no special inheritance methods. However, with the acceleration of the digitalization process and the increase in people's demand for culture, this protection method can no longer meet people's consumption needs for culture. Strengthen the development of the special culture of the ancient city in a way that is in line with the development trend of the times. , that is, in digital form, use digital visualization technology, digital platform, virtual reality technology, etc. to establish a standardized digital resource library, online platform, etc. for the historical and cultural resources of Xingcheng Ancient City, and carry out the cultural genes of Xingcheng Ancient City culture. Storage, display, development and utilization will become the best means to protect and inherit cultural heritage.

At present, the digital development of cultural heritage in our country is uneven. The public "has a disdain and resistance to the new information technology, and they stay away from it; some people also have fear and confusion because they are not aware of it, so they avoid and reject it, which restricts the cultural relics undertaking. Promotion and application of informatization; due to limited funds for cultural relics and insufficient understanding, insufficient funds have been invested in informatization, so that the basic level of hardware and software for informatization applications has not been significantly improved, and the infrastructure is still weak; development is uneven , the infrastructure is uneven, the provincial cultural and museum units are developing rapidly, while the city and county levels are relatively backward. From facilities to personnel, there is a big gap." This also hinders the process of digital protection of cultural heritage.

4.2.3 Extraction and construction of ancient city cultural heritage forms from the perspective of cultural genes

In the first section, the forms of the ancient city's cultural heritage have been analyzed in detail. This part will not go into details. It mainly focuses on the cultural

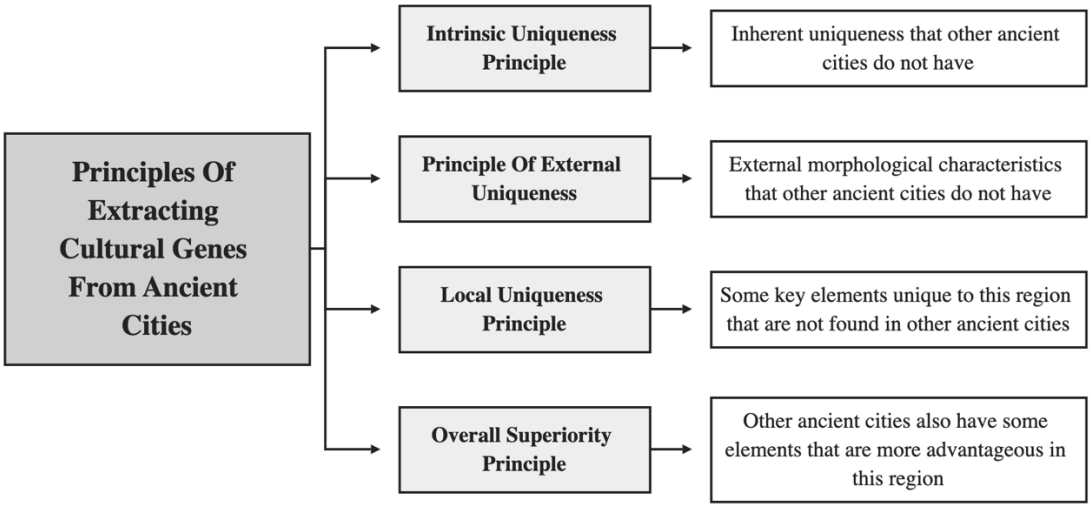
gene theory to classify and extract the forms of the ancient city's cultural heritage in Xingcheng. And construct a genetic genealogy map for subsequent digital translation, protection and inheritance of ancient city culture.

4.2.3.1 Gene extraction of ancient city cultural heritage forms

(1) Principles of extracting cultural genes from ancient cities

Cultural genes are the basic unit of cultural transmission and can distinguish the essence of different cultures. Therefore, cultural genes play a unique and important role in the protection and inheritance of ancient cities and the exploration of cultural connotations. When excavating and analyzing the cultural genes of ancient cities, we should not just stop at its external material appearance, but also delve into its deeper connotations, such as history, culture, customs and customs, etc. Combining the connotation of biological genes and the principle of difference in geography, through analysis and research, it is believed that when selecting cultural genes for ancient cities, the following principles should be followed: the principle of internal uniqueness, the principle of external uniqueness, the principle of local uniqueness and The principle of overall superiority (Chen, M. & Li, H. C.,2018). Among them, the principle of internal uniqueness refers to the internal characteristics unique to the studied area; external uniqueness refers to the external characteristics unique to the studied area; local uniqueness refers to the important characteristics unique to the studied area that do not exist in other areas. Elements; the principle of overall dominance refers to elements that are not unique to this study area, but are more advantageous than other areas (Table 4-1).

Table 4 - 1 Principles of ancient city cultural gene extraction



Source: Self-drawn by Sun Yijia

(2) Reverse transcription of cultural genes

This article follows the basic principles of cultural gene theory, that is, the concepts of cultural genes and genes in the field of biogenetics are basically the same. It is believed that cultural genes are the information carrier with the least expressive power in the process of cultural information dissemination, similar to the concept of DNA in the field of genetics. Its function is mainly the carrying, copying, dissemination and variation of information, so it plays a decisive role in the external characteristics and development direction of culture. The extraction of cultural genes from Xingcheng Ancient City was carried out with reference to the method of biological gene extraction.The core rule of the biological genetic inheritance process is that genetic information is transmitted from DNA to RNA to protein through self-replication. On the contrary, DNA replication and RNA reverse transcription determine DNA . Variations in genes during the genetic process create diversity in organisms.

In 2002, Professor Feng Peien first proposed the idea of extracting product genes by reverse transcription and applied it to the product field. The concept of "reverse search" refers to obtaining the composition of biological genes through "reverse transcription" when the protein is known (Feng,P. E. et al.,2002). The cultural gene extraction method of Xingcheng Ancient City can learn from the

product gene extraction method, and the cultural gene extraction method of Xingcheng Ancient City can still be tried with the idea of "reverse seeking".

(3) Ancient city cultural gene extraction method

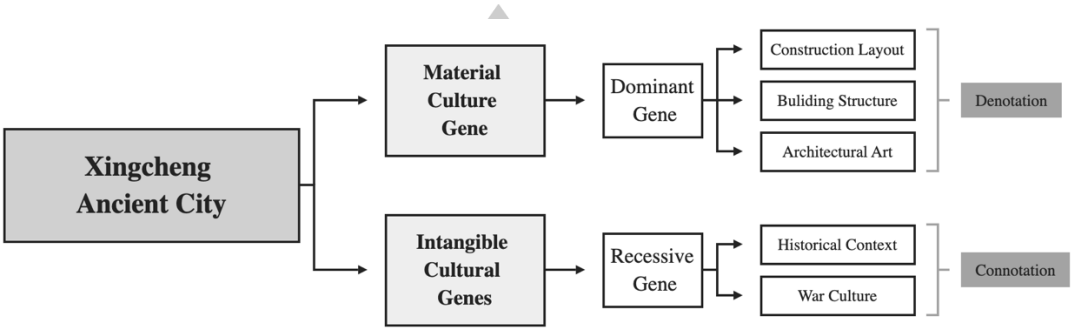
At present, gene extraction has achieved remarkable results in many fields such as medical treatment, molecular evolution, environmental protection, and crop cultivation. This provides good reference ideas and methods for the selection and research of ancient city cultural genes. The extraction method of biological genes mainly relies on RNA templates and reverse transcription to synthesize DNA genes through base pairing. The transmission process of cultural genes is similar to that of biological genes. It needs to be carried out based on the carrier. Through the analysis and transformation of the carrier, cultural genes are obtained. The specific steps are to analyze, extract and transform the two types of cultural genes according to the hierarchical logic based on the above-mentioned cultural gene analysis principles, based on the cultural gene basic pedigree diagram.

Step 1: This study selected the more commonly used material cultural genes and intangible cultural genes that are divided into material forms as the entry point to conduct a first-level decomposition of cultural genes.

Step 2: Combined with the existing status of material culture and intangible cultural resources, the dominant genes and recessive genes were decomposed into two levels respectively. Specifically, dominant genes can be further decomposed into architectural layout, architectural structure, and architectural art; while recessive genes can be decomposed into architectural history and culture and war culture.

Step 3: More detailed third-level decomposition of various secondary cultures is carried out based on their specific manifestations (Table 4-2) .

Table 4 - 2 Step 1:Decomposition of cultural genes of Xingcheng ancient city



Source: Self-drawn by Sun Yijia

4.2.3.2 Construction of ancient city cultural heritage forms

(1) Dominant genetic construction of ancient city cultural heritage forms

This ancient city cultural heritage gene extraction mainly focused on Xingcheng ancient city walls, bell and drum towers, Confucian temples, and stone squares. According to the principles and methods of the previous extraction, combined with the previous extraction of history, culture and their architectural forms, specific gene extraction was carried out:

Step 1: Four national key cultural relics protection units in the ancient city of Xingcheng: the ancient city wall, the Bell and Drum Tower, the Confucian Temple, and the Stone Square were selected as research samples;

Step 2: Collect data through the first research goal and the second research goal, including field visits and photography, and collect a large number of physical pictures and historical data;

Step 3: Based on the collected pictures and data, the architectural layout, architectural structure, and architectural art-related data of the ancient city walls, bell and drum towers, Confucian temples, and stone squares were extracted and summarized to form a current factor map;

Step 4: According to the dominant factor map, the most representative morphological characteristics of different buildings are sorted out.

Based on the above four steps, the representative genes of the national key cultural relics protection units are distributed as follows:

(1) The dominant genes of Xingcheng ancient city wall include: architectural layout, architectural space and architectural art. The architectural layout is divided into strategic positioning and architectural orientation; the architectural space is divided into architectural plane shape, architectural facade, architectural gate and tower. , horse road, Duoqiang, Wengcheng, Shuimen Cave, corner platform, Kuixing Tower, Hongyi Cannon; architectural art is divided into: roof, eaves corners, corner beams, doors and windows and other parts.

(2) The dominant genes of Zu's Stone Square include: Zudale Stone Square: Architectural art: details of stone square patterns, plaque details; architectural space: floor plan, shape structure, stone square engraving, stone lion structure, stone pillar details, stone square door and window details ;Military culture: children's games- cow-topping, children's games - riding bamboo, sergeant's turban-hood, flag-Chinese military flag (Table 4-3).

Zu Dashou Stone Square: Architectural art: relief details, plaque details, pattern details on both sides of stone pillars, stone square pattern details "Double Dragons Playing with Pearls", stone square pattern details "Qilin Xian Rui", stone square pattern details "Haiyan Heqing" "; Architectural space: floor plan, stone column structure, shape structure, stone door and window structure, eaves structure, stone lion structure, stone square carving, stone imitation mortise and tenon structure (Table 4-4).

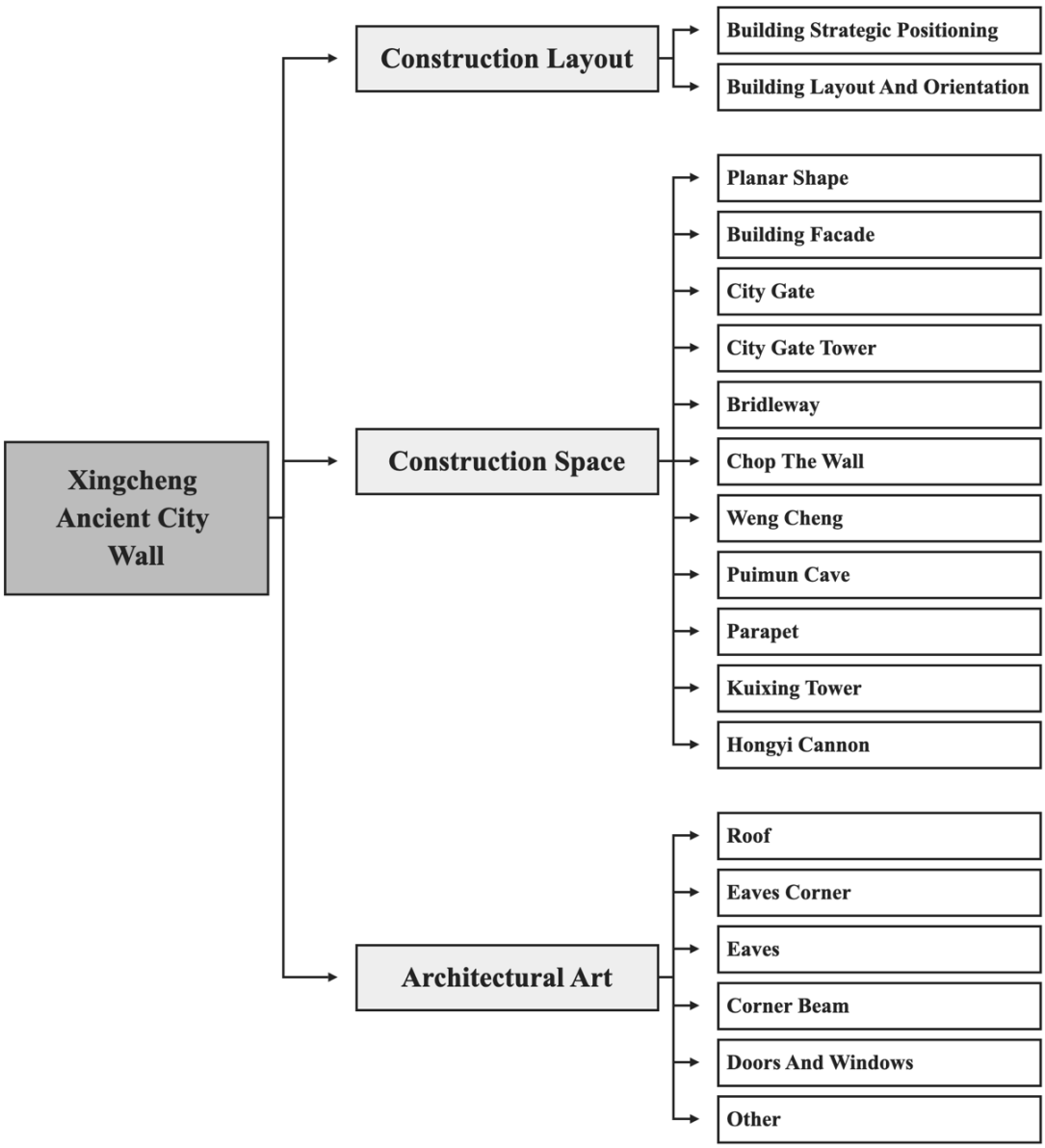
(3) The dominant genes of the Confucian Temple include: architectural art: details of the door pillars of the Jimen Gate, details of the plaque of the Dacheng Hall, details of the brick carving patterns on the round door of the Confucian Temple, and details of the Kangxi calligraphy plaque of the Dacheng Hall; architectural space: floor plan, corner door structure , Moon Gate structure, Lingxing Gate structure, Dismounting Monument structure, White Marble carved railing structure, Halberd Gate door and window structure, Dacheng Hall meat plaque list, WoTong forest, Roof ridge beast structure, Eaves structure.

(4) The dominant genes of the Bell and Drum Tower include: architectural art: drum surface details, door and window details, eaves decoration

details, military flag details; architectural space: plan, three views, eaves structure, roof ridge structure, drum body structure, and shape structure.

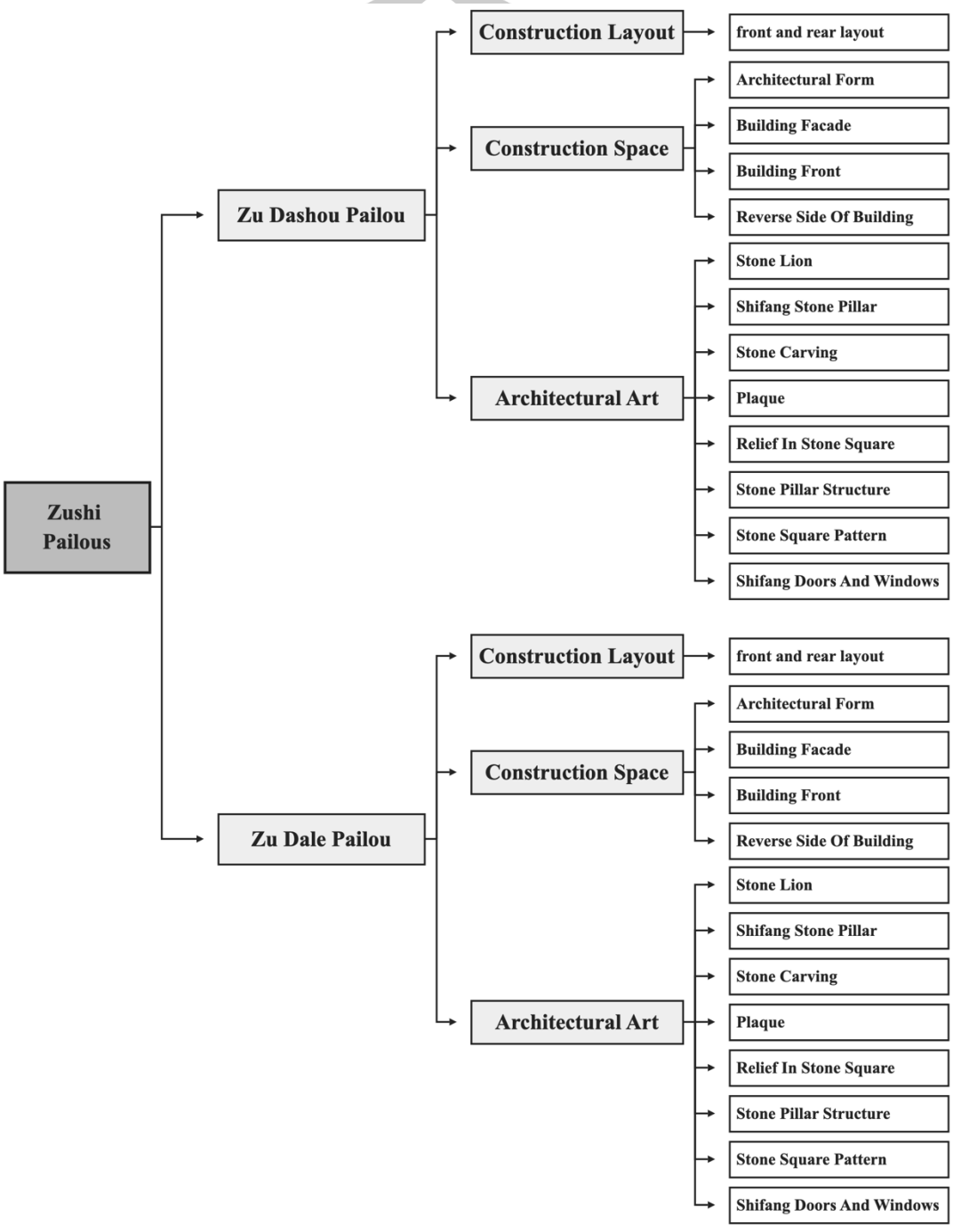
Xingcheng Ancient City is one of the four existing ancient cities of the Ming Dynasty in China. Its architectural layout, architectural space and architectural art reveal to us the unique ancient architectural forms of this region, which has important historical, cultural and artistic value. By in-depth study of these factors, we can not only better understand the inheritance, development and changes of ancient city culture, but also provide important theoretical basis and practical guidance for the protection, restoration and utilization of ancient cities. This will not only help inherit and carry forward China's excellent traditional culture and enhance national cultural self-confidence, but also promote the prosperity and development of Xingcheng ancient city architectural culture and enhance the cultural soft power of the entire country. Therefore, conducting in-depth research on the architectural factors of Xingcheng Ancient City is not only an inevitable requirement for protecting and inheriting historical and cultural heritage, but also an important measure to promote the development of cultural industries and build cultural confidence.

Table 4- 3 Construction of dominant gene map of Xingcheng ancient city wall



Source: Self-drawn by Sun Yijia

Table 4 - 4 ZuShi Construction of Pailous dominant gene map



Source: Self-drawn by Sun Yijia

(2) Construction of invisible genes of cultural heritage of Xingcheng Ancient City

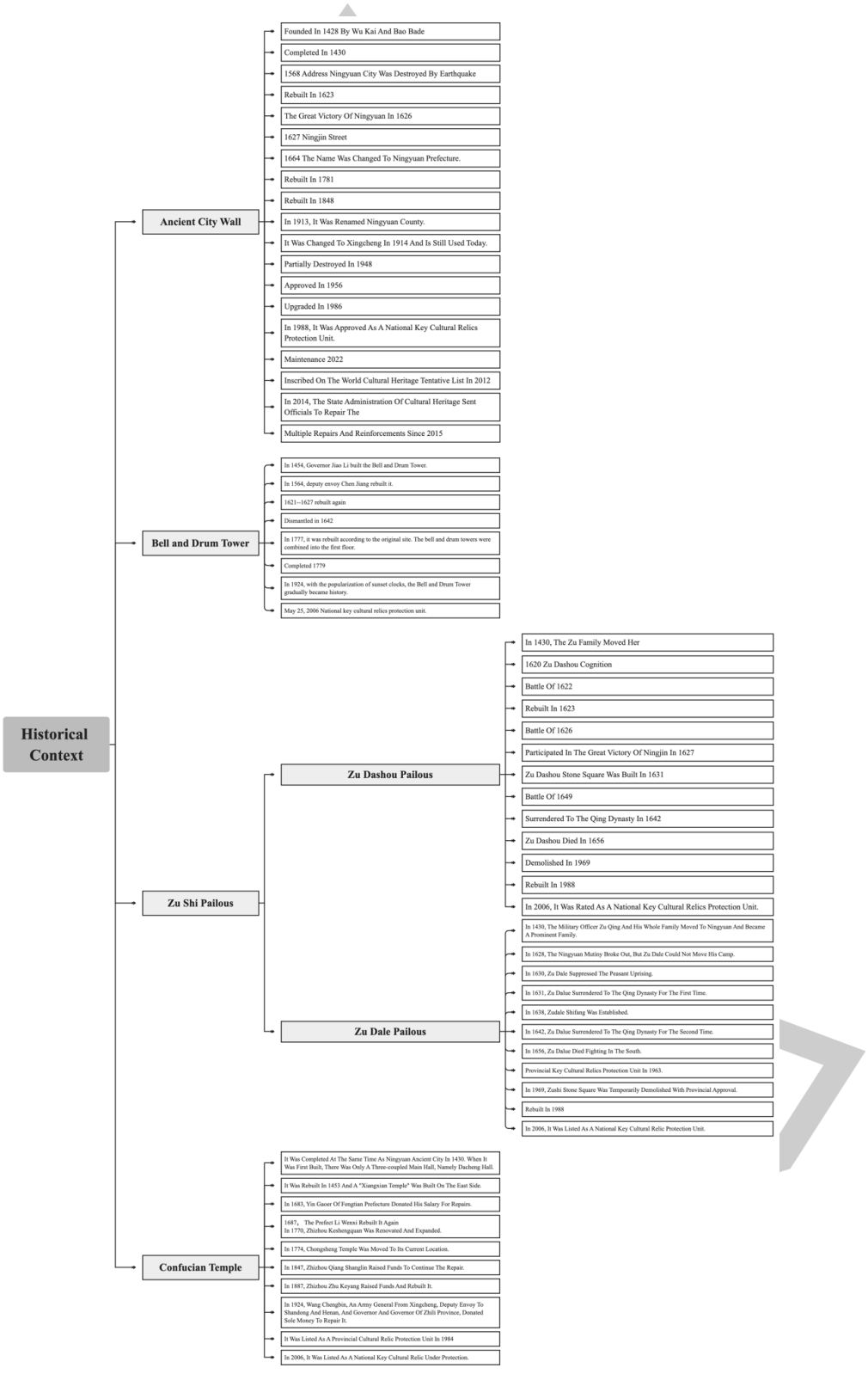
The recessive gene extraction of Xingcheng Ancient City still takes the national key cultural relics protection units in Xingcheng Ancient City as the research object. The recessive genes are extracted by sorting out its historical context and the cultural connotation behind each building. The specific operation steps are as follows:

Step 1: Analyze and sort out the historical context compiled through various documents, interviews, and field visits in the first goal;

Step 2: Analyze and sort out the cultural connotations behind each building in the second goal, explore the historical and cultural connotations of the ancient city, and explore its relationship with the development of modern society.

Step 3: Combine the hidden factors of Xingcheng ancient city and innovatively integrate it into modern technology, art, education and other fields to promote the inheritance and development of Chinese culture (Table 4-5).

Table 4- 5 Xingcheng Ancient City Recessive Gene Genealogy Map



Source: Self-drawn by Sun Yijia

4.3 Develop digital systems for protection and transfer of knowledge about cultural heritage

The Xingcheng Ancient City Digital Website is a project to develop the ancient city's architectural cultural heritage based on digital technology. It visually translates the Xingcheng historical and cultural relics and its contextual genealogy map that were sorted out earlier, and achieves digitization through the construction of a digital website system. protection and inheritance. At the same time, through the development of digital systems, we will use them in museums, educational classrooms, communities and other places to conduct experimental research to ensure the continuation of culture and the inheritance of traditions, and to better understand the learning styles and cultural interests of the new generation. Convey cultural content in an attractive way and promote communication and dialogue between different cultures. At the same time, the feasibility of this system will be finally tested and analyzed to achieve better inheritance and protection.

Since the 1980s, with the widespread popularization of computer technology, computer-aided design, which combines editing and design functions, has become a daily tool used by designers. The rapid popularization of network technology has pushed the design relationship into the large system of "man-machine-environment-society". The design of the entire network system, including websites, web UI interfaces, interactive systems, etc., runs through the collection of information, Arrangement, transformation, transmission, storage, processing, and feedback are a series of basic activity elements (Geng, M. M.,2010). Therefore, through the integration of digital media to enhance the sense of participation, the user-centered satisfaction of "sharing" and "creativity" combined with novelty is finally achieved. design style. As a multi-dimensional art design category, web design is not only a page design that satisfies the traditional visual impact, but also requires humanization and user-centered remote communication art, which is the new network art of web design. central element of the design.

The design and development of this digital website uses Information Architecture theory to rationally organize and present the information on the website to ensure that users can easily find the content they need. The digital visualization translation part uses information visualization design and uses the basic principles of

graphic design to create clear and easy-to-read visual charts. At the same time, it emphasizes reducing irrelevant and cumbersome visual graphic elements in the charts, so that the excellent data of the digital network can be presented more clearly. In terms of the use of digital websites, Emotional Design Theory is used to consider the user's emotional experience when interacting with the website to create a more attractive and emotionally resonant design. Lasswell's communication theory is used in inheritance, focusing on the technical and cultural sustainability of digital website inheritance projects.

To sum up, the design and development of Xingcheng Ancient City's digital website combines digital technology and related theoretical knowledge. It creates a systematic, rich, in-depth, and participatory visual cultural experience for visitors. It also solves the gap in the digital inheritance of cultural heritage in Xingcheng Ancient City and promotes the digital protection and inheritance mechanism of cultural heritage.

4.3.1 Demand analysis for Xingcheng Ancient City digital website design and development

4.3.1.1 Design concept of digital website

As the only Ming Dynasty ancient city in the three eastern provinces, in order to fully display the cultural connotation behind the existing remains of Xingcheng Ancient City, this study displays the material and intangible cultural genes of Xingcheng Ancient City through the design and development of a digital website. Through digital technologies such as visual translation and AR augmented reality interaction, the audience can gain a more intuitive and vivid insight into its characteristics and connotation, thereby enhancing the awareness of the cultural heritage of Xingcheng Ancient City. In addition, this study also aims to improve the attractiveness and interactivity of Xingcheng Ancient City, attract more visitors to understand the diversity and uniqueness of Xingcheng Ancient City culture, and thereby promote the protection and inheritance of Xingcheng Ancient City cultural heritage. In view of the problems encountered in the inheritance of cultural heritage of Xingcheng Ancient City, this study takes the national key cultural relics protection unit of Xingcheng Ancient City as the research object, sorting out the architectural form and its cultural connotation through information visualization design, and

combining it with AR interaction to allow digital websites to Comprehensive service to different audience preferences.

For better implementation, a cultural gene-based analysis and extraction scheme was adopted during the planning stage. The user experience model is used to carry out hierarchical specific design to improve the audience's awareness and participation in the cultural heritage of Xingcheng Ancient City, thereby promoting the inheritance and dissemination of the Great Wall culture.

4.3.1.2 Target task analysis

The main goals of this design practice project include the following:

(1) Verify the effectiveness of the strategy

Through the practical application of the cultural gene-based visual translation of architectural form genealogy proposed in the second section, its effectiveness in actual projects is tested, and it provides a reference strategy for information visualization design of similar cultural heritage.

(2) Improve user participation

Try to provide users with opportunities to explore, interact and participate in exchanges with the Zhaobei Great Wall of the Warring States Period. By attracting users to actively participate, we can increase users' attention and awareness of the cultural heritage of the ancient city of Xingcheng.

(3) Meet user needs

On the premise of meeting the user's cognitive needs, functional needs and experience needs, a more natural interaction method, story-like narrative structure and synesthetic design allow users to have a more comprehensive understanding of the cultural heritage of Xingcheng Ancient City.

(4) Developing a digital system

Use digital technology to create an online platform digital website to achieve the goals of protecting and delivering cultural heritage knowledge through digital means.

(5) Protection and transfer of knowledge

Protection: means measures to protect, preserve and secure knowledge. This includes ensuring that information is not lost, damaged or accessed by unauthorized persons. In the context of cultural heritage or other fields, protecting

knowledge may involve taking measures to prevent the dilution and loss of knowledge. Transfer: The process involving the transfer of knowledge from one place, person, or context to another. Knowledge transfer can take different forms, such as sharing information between individuals, organizations or different platforms. It is the process of making knowledge accessible and applicable in different contexts. Taken together, “protection and transfer of knowledge” implies a comprehensive approach to managing and utilizing information. This may involve developing strategies and systems that both ensure the security of knowledge and ensure that it is effectively disseminated and used in different settings.

(6) Cultural learning for the new generation

Strengthen cultural inheritance and dissemination: Through the practice of this project, it will help spread the historical and cultural value of the cultural heritage of Xingcheng Ancient City, further strengthen the inheritance and dissemination of cultural heritage in contemporary society, and provide richer materials for future cultural heritage protection and research. , while emphasizing the focus on providing learning opportunities for new generations about cultural aspects and cultivating an understanding of specific cultural heritage. Overall, this emphasizes the importance of providing a rich cultural education to the younger generation.

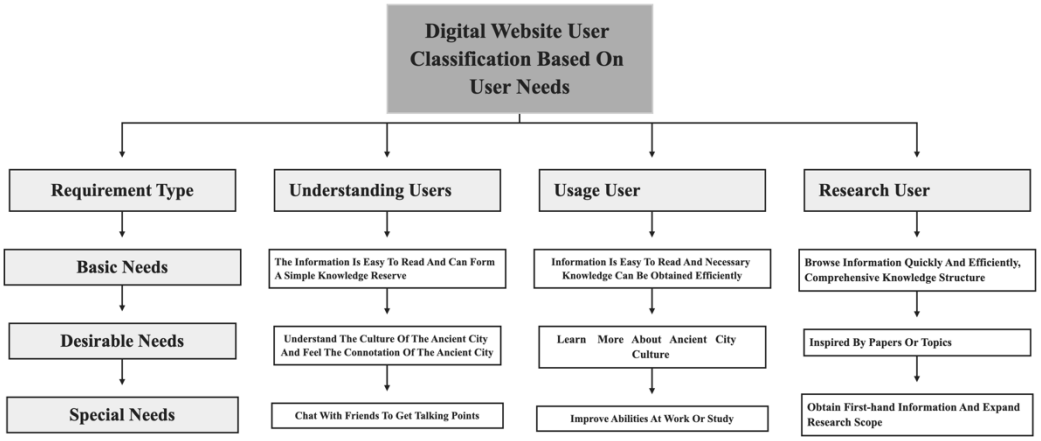
4.3.1.3 Analysis of user needs of digital websites

In digital website design, user needs are a very important aspect, because the goal of digital websites is to ultimately provide users with optimal information display and research strategies. To ensure the rationality of digital website information design, an accurate assessment of end-user capabilities and needs is required. In this process, group discussion is a necessary part. Segmentation and analysis of user needs through user interviews, group discussions, etc. can help designers better understand and grasp the characteristics of user needs. The differences in needs brought about by different types of users will affect designers' decisions in information filtering and display methods.

This study takes the key cultural relics protection units of Xingcheng Ancient City as the object. Through user interviews and group discussions, the objects of the group discussion are classified into three categories: understanding user groups, usage user groups, and research user groups. , and classified and explained the needs

of different user types. As shown in Table 4-6 (see the appendix for group discussions and interviews).

Table 4- 6 Classification of digital website users based on user needs



Source: Self-made by Sun Yijia

First, understanding users. Such users browse information quickly for the purpose of entertainment and leisure, and only have superficial recognition and understanding of the ancient city information. They generally focus on displaying the basic information and historical background of the ancient city's cultural heritage.

Second, usage users. Such users are very interested in ancient cities and need to have an in-depth understanding of the cultural connotations of ancient cities. Content about the folk activities and stories of the ancient city can be added and interactive experiences can be provided.

Third, research users. Such users are mainly cultural protection staff and scientific researchers. It is not only necessary to display ontology information, but also has a certain demand for the deep culture expanded by ontology information.

Through the digital website design of Xingcheng Ancient City, different types of users can find the content they care about on the same digital platform, achieving the goal of a website design that meets the needs of multiple users. Of course, during the actual design process, the content and functions of each part can be optimized and adjusted according to the specific conditions and resource constraints of the project. When conducting feasibility analysis, we mainly consider the feasibility of technology, economy, society, operation, platform implementation

effects, etc. Technical feasibility is mainly about the technical support of the system platform. The technical support of this study mainly includes picture editing, processing technology, audio editing technology, video editing technology, 3D modeling technology, and interactive technology. At present, these technologies are relatively mature, so it is achievable at the technical level.

With the popularization and development of computer technology, students have been exposed to electronic products since childhood. Home computers have become very popular. The overall computer level and computer literacy of citizens have been greatly improved. For the operation of the platform, as long as you can use the keyboard and mouse, you can use the digital website platform, so the platform is not difficult for users to operate and is operationally feasible.

From the perspective of social feasibility, digital museums are in line with mainstream development. The country strongly encourages citizens to establish national self-confidence and pride, and cultivate patriotism. Users can learn the long history and culture of the ancient city through such an operational platform. It conforms to the trend of development of the times.

4.3.2 Digital website design practice

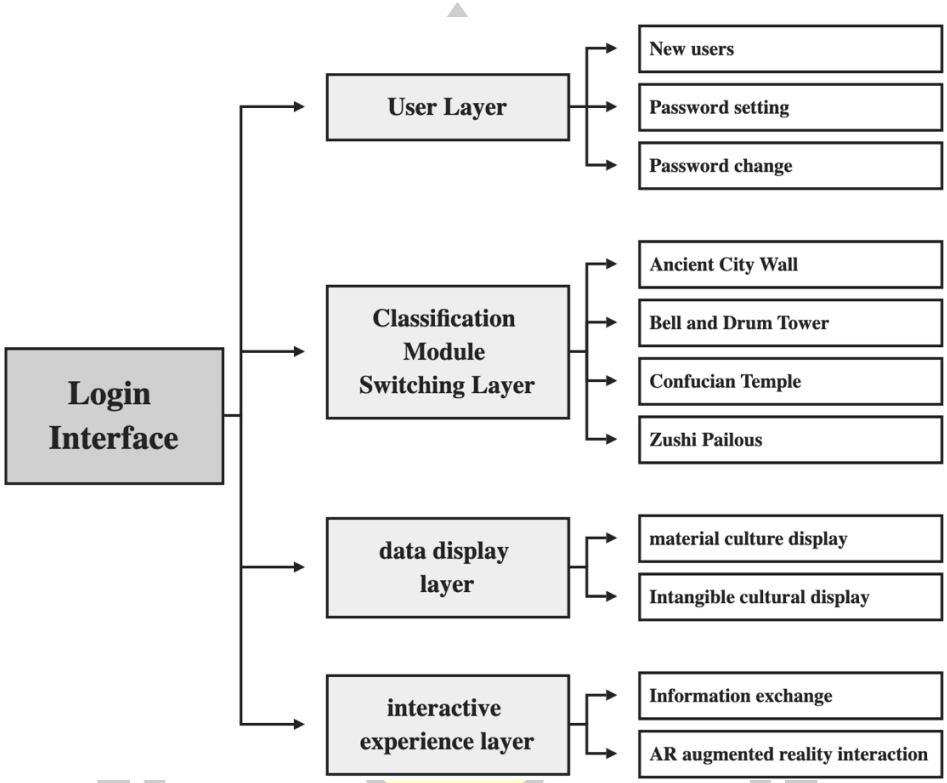
4.3.2.1 Digital website interface hierarchical structure division

Web interface design should be an interdisciplinary subject of computer science, design, psychology, or aesthetics and philosophy (Xue, Y. Y.,2019). Today's design methods no longer simply satisfy visual effects and create a stylized art design school. Instead, it is gradually transformed into improving people's living environment, spiritual demands and human beings' own pursuit of tool use and beauty. This sense of social identity and demand requires an immediate change in the research methods of the design discipline, and the design process of the web display platform is endowed with a wide range of perspectives from philosophy, sociology, psychology and other disciplines. The overall browsing experience of the website is used to display "Mapping" of space, environment and structure (Woolman M.,2002). Sort out the logic and integrate it from historical evolution to create a comprehensive humanized user-centered digital display platform. The artistry of the website's visual design should be met during the design process, and usability is also a measurable indicator (Xuan, J.,2021). The comprehensive configuration of website resource

allocation ultimately presents the results of the digital dissemination of Xingcheng ancient city's architectural culture in terminal use.

The data hierarchy structure of "Xingcheng Ancient City Digital Website" has a total of four layers, namely: login layer, classification module switching layer, data display layer, and interactive experience layer. The login layer mainly implements the function of user login. Users with different permissions will display different content when logging in. The classification module switching layer is mainly to realize the switching of different modules of Xingcheng Ancient City Wall, Bell and Drum Tower, Stone Square, and Temple, while the data display layer In order to display the main content of the data, the data display layer will also be subdivided into material data display and non-material data display. At the same time, the Data -Ink Ratio (Data-Ink Ratio principle) theory will be used in conjunction with information design to emphasize the importance of the data in the charts. Reduce irrelevant and cumbersome visual graphic elements to make the digital network's excellent data presentation clearer. The last level is the interactive experience layer to better enhance the user experience. The main purpose of designing the four layers is to reduce the difficulty of database operations and reduce the learning cost of operators. The basic operations of the database are extracted and made into a web interactive interface, and professional data segmentation, migration and other functions are still reserved for the database operation platform,the other four levels of design can also meet the loading speed requirements for network use. When the database is migrated to the cloud in the future, part of the database content will inevitably be opened. If the frequency of access to the server is too high, it is easy to cause server data congestion. Causes a crash, see the specific level design (Table 4-7)

Table 4- 7 Data level architecture diagram



Source: Self-made by Sun Yijia

4.3.2.2 Interface hierarchical architecture: design of login layer and information module switching layer

Step 1: Login Design of Login Layer Visual Elements

Before the unification of words, patterns were the carrier of visual communication, with multiple visual elements or a series of combined visual elements used for visual identification and information dissemination (Hang, J.,2011) . A logo design with symbolic language must be impactful and unified. In the time and space of limited network exploration, the visual subject is clearly located, thus highlighting and reflecting the directions of different fields presented by the website, and the visual symbolic image can also be elaborated, disassembled and recreated in different ways. It should be based on the audience group and brand IP image. Although the focus of the displayed content is different, it must be reflected in a unique and easily identifiable way so that every user can clearly understand it and play a good guiding

role. A concise brand IP symbol must have a visual "bullseye" and should also have its own unique symbol.

In terms of presentation, the logo design of Xingcheng Ancient City followed the preservation of traditional culture while exploring digital symbols that are compatible with the digital feel. For the choice of text, serif fonts were chosen because the ancient buildings in the ancient city have a certain sense of age and inheritance, so the font design Serif fonts should be chosen. At the same time, when matching English and text, a contrast between dark and light that is full of digital changes is used, like the disappearance and reappearance of digital symbols. Very consistent with the overall feeling of the ancient city, these buildings are like entire symbols, which have been damaged, repaired, reproduced and digitally inherited in the long history of history (Figure 4-32).

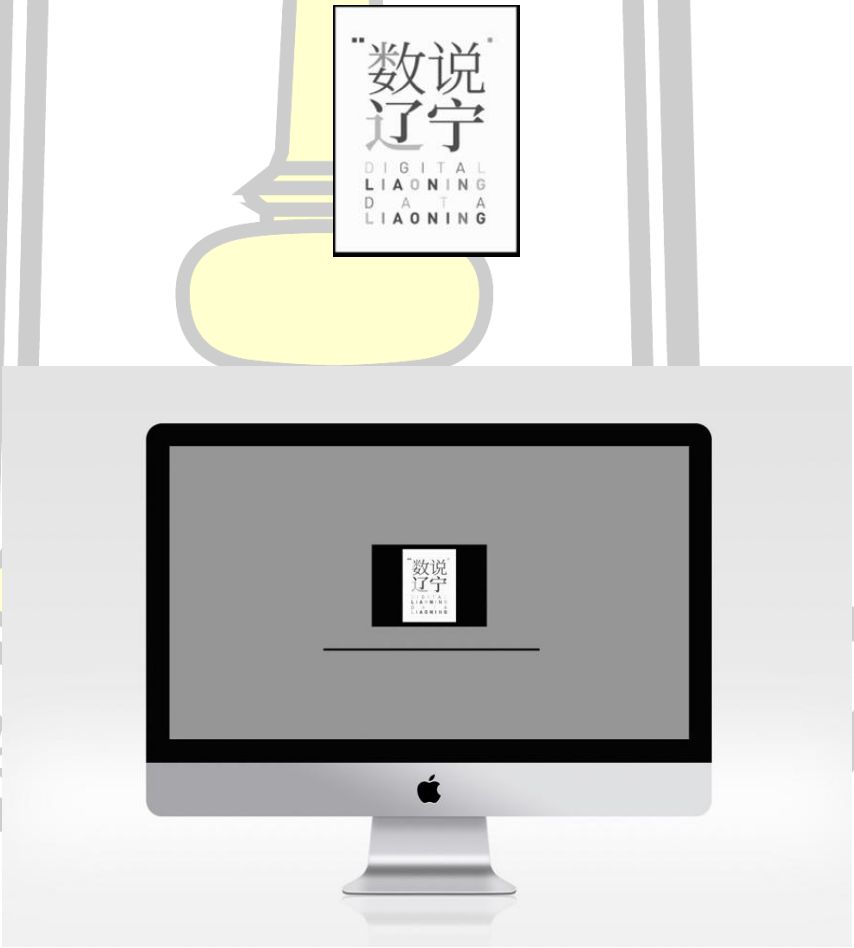


Figure 4 - 32 Gucheng digital website logo design

Source: Self-drawn by Sun Yijia

Step Two: Graphic Button Design

The overall plan of the Xingcheng Ancient City digital website gets rid of the cumbersomeness and complexity of design and modeling applications, and is simple but not simple for recognition and ease of use. It tries to avoid the visual fatigue and heaviness of the traditional cultural theme of the communication theme in the subconscious of the audience. Enjoy a pleasant browsing atmosphere to receive messages. A diversified, diverse and flexible expression design form is an important part of website design. Therefore, in addition to an iconic logo, the buttons in the website control must also be designed to highlight clicks. By changing the color, shape, and brightness of the button, the two states are distinguished, and the visual experience assists the control process.

Page designers often use various visual communication elements to attract users' attention (Akbulut Ö. E. & Akbulut K, 2010). For the page turning button in the web page, the highlight color filling is improved, and the color display of the sliding area is changed for guidance. Pattern buttons are mainly used in the Datang Cloud website for supplementary information on secondary pages or online viewing of cultural relics. They will be displayed in the form of dynamic clicks on patterns, carrying more concise display page information in paginated chapters. During layout, users can directly click the button to browse directly. Design is not only the presentation of beauty, but also the path of visual elaboration (Baker, M. J., & Balmer, J. M.,1997). This digital website graphic button design uses a simple high-brightness circle design, which can clearly identify the buttons and at the same time does not occupy the brilliance of the main page.

4.3.2.3 Interface hierarchical architecture: visual translation of information in the data display layer

Step 1: clarify information attributes

Information attributes are the properties of information. Experts and scholars in different fields have different definitions of information attributes. In his work, Colin Ware, a scholar in the field of information visualization, defined the category attributes, interval attributes and numerical attributes of information as the three main attributes of information. S. Stevens, a scholar in the field of statistics, divides information attributes into four categories: nominal, sequence, interval and

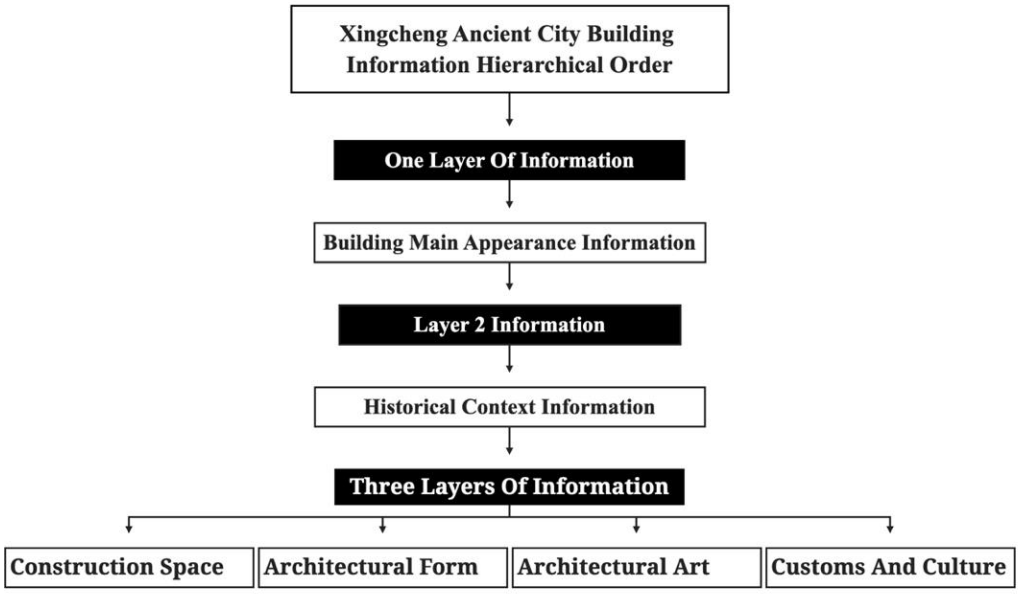
ratio. In complex network theory, information entity, information association and information whole are used as three forms to understand the logical relationship of information. This theory regards interface information as a complex network system composed of various nodes. According to the perspective of information logical relationship construction, information can be divided into ontology attributes related to the information itself, which can define the effective elements of the information, including names, values, etc.; relationship attributes that express the logical relationship between information, including between information entities. The correlation, contrast, hierarchy, etc.; the state attribute that describes the change of information within a period of time is the time attribute of the information. Association attributes and time attributes are implicit presentations of information attributes, and logical relationships are mapped through visual structures such as space and hierarchy. Through the analysis and research of information attributes, the mapping relationship between information and visual structure is found.

Step 2: Visually layer information elements

The information visualization design of this topic takes the four national key cultural relics protection unit buildings in Xingcheng Ancient City as the main body. Through the history and development of the research objective 2, the construction of the cultural gene genealogy diagram of the research objective 2, the key content of the information is sorted out, and the information is carried out at the same time. The division of levels, in the expression of hierarchical organization, shows the progressive relationship between various types of information. Good basic logical relationships can assist the development of subsequent design practices and the interception of information nodes by information audiences. At the early stage of the entire design process, it is necessary to ensure the primary and secondary logical relationships of the information content of the research object and the correlation between the information points, so that the entire information section is logical and facilitates the observation and application of the information content during the design process. During the design process, if you just pile up information content blindly, it will cause obstacles for the information audience to receive information. Distribute information content according to levels, and design the combination of content under the guidance of the cognitive psychological laws of the information audience. In the

hierarchical order of building information in Xingcheng Ancient City, building appearance information that can be visually perceived is placed on the first level. Although the construction time and location information are not intuitively perceived by vision, they belong to the content scope of the basic information of ancient city buildings, and the two are juxtaposed on the second level. The third level is to further explore and analyze the information content based on the basic information of the second level, including the architectural space, architectural form, and architectural art of the building. The specific hierarchical order is shown in (Table 4-8):

Table 4- 8 Xingcheng Ancient City Cultural Heritage Information Visualization Layer



Source: Self-made by Sun Yijia

After completing the design conception and design positioning, by sorting out the information levels of the research object, combined with the analysis of historical and cultural elements in the first research goal and the second research goal, a framework was constructed for the overall architectural information. For the architectural information visualization design framework, the entire information section is processed as a total score, the overall timeline and overall location relationship are summarized and presented, the four building information is analyzed

and presented on a case-by-case basis, and finally all the information is summarized for the Xingcheng Ancient City architectural information visualization design.

Part 3: Visual translation of visual elements

As for the design of architectural elements, the external forms of the four buildings have strong historical and cultural characteristics. The extraction and translation of architectural elements must fully demonstrate the external morphological characteristics of the buildings. When the external forms of the individual buildings tend to be similar, It is necessary to highlight the differences in the external forms of different building units. The translation methods of architectural elements can be roughly divided into two types: realistic and abstract. Realistic translation restores the external form of the building as much as possible. The shape and detailed features of the building are restored according to a certain proportion, while abstract image translation is to restore the architectural form. Make a certain degree of generalization, focus on the design of the parts that best reflect the architectural characteristics, and express the rest in general terms.

Graphicalization of architectural elements refers to the extraction and translation of architectural features of relatively typical individual buildings among the four buildings in the ancient city through artistic techniques. The abstract translation method of architectural elements is to transform the overall morphological characteristics of the building into visual graphics through concise and summarized basic plane graphics, highlighting the most typical detailed features of the individual building, and expressing the rest in a generalized manner.

The translation object will eventually present architectural information in the form of combined geometric figures. This architectural translation method aims to express the external morphological characteristics of the building in a highly general way. The concrete translation method of architectural elements is to use the sketch to express the external form of the building. An independent art form transforms visual graphics, and the translation object will eventually be presented in a visual image that combines lines and shadows. This element translation method aims to restore the morphological characteristics of the building's exterior relatively realistically to a certain proportion (Figure 4-33).

Figure 4 - 33 Translation of some elements

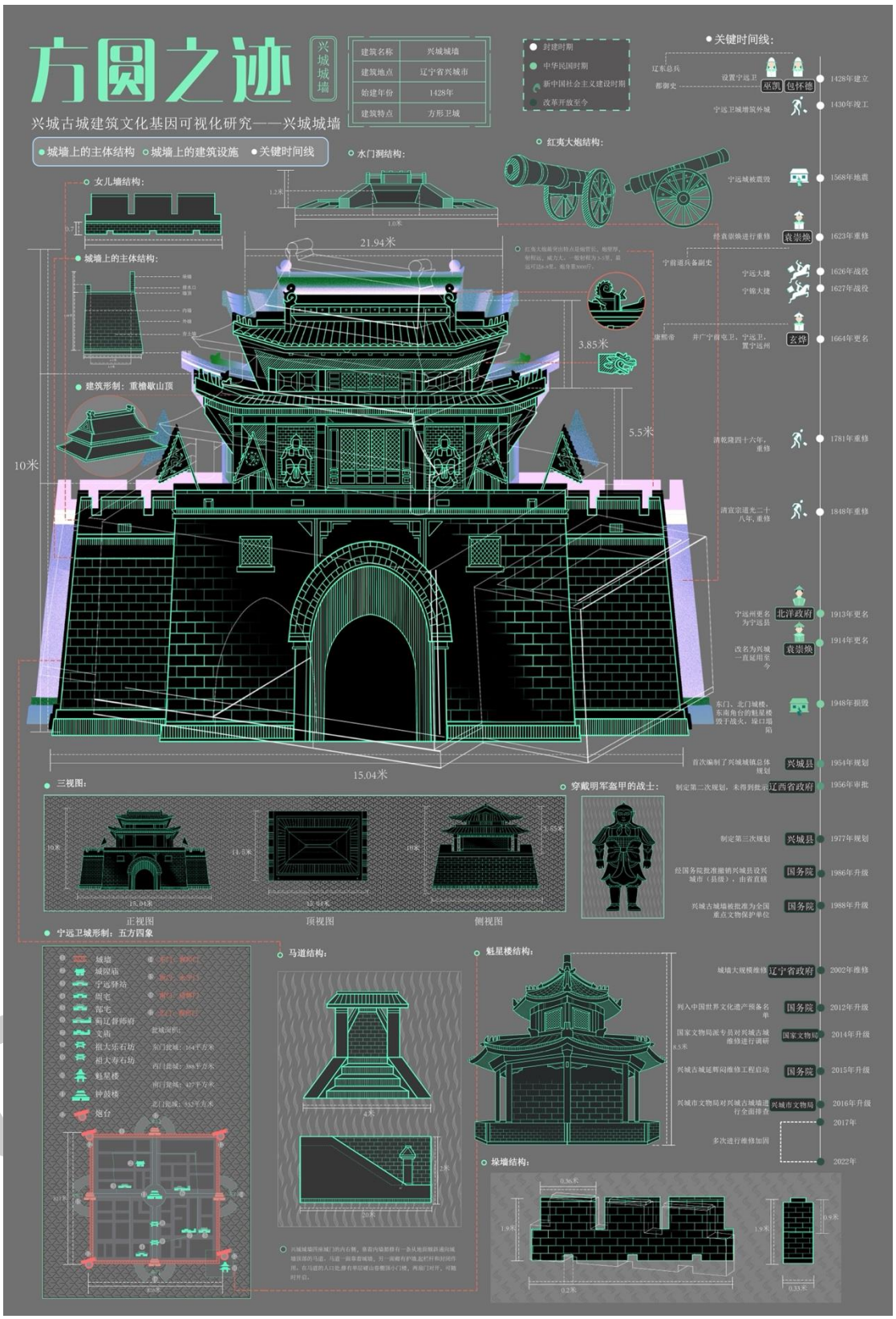
Source: Self-drawn by Sun Yijia

Step 4: Integrate information design

Architectural historical context is a time axis-type information visualization design. It takes the historical construction period of a single building as the axis and carries out staged chart design focusing on important historical nodes. Taking the external form of the building unit as the basic coordinate point, corresponding to the time node of its construction year, we can intuitively understand the age when each building unit was built, as well as the corresponding changes in architectural art characteristics along the entire time axis. Compared with It is more intuitive and interesting than data charts. Abstract hierarchical expression description of building location analysis diagram. The visual content of Xingcheng Ancient City architectural information includes analysis of architectural history and culture,

architectural orientation , architectural space and architectural art.The individual building is abstractly translated and combined with geometric elements for combined design, ultimately forming the main visual element in the visible view. At the same time, it is supplemented by the concrete graphic expression of detailed feature symbols, which balances the communication of artistic features and information content. Finally, all the information maps were integrated into an information visual map of the four buildings in the ancient city, which is composed of the historical axis map of the building, the location analysis map, and the visual map of the ancient city's architectural form (Figure 4-34).

The design of this part is based on the contextual analysis of history and development in the first research goal, and the cultural gene genealogy diagram of the ancient city of Zhongxing City, the second research goal.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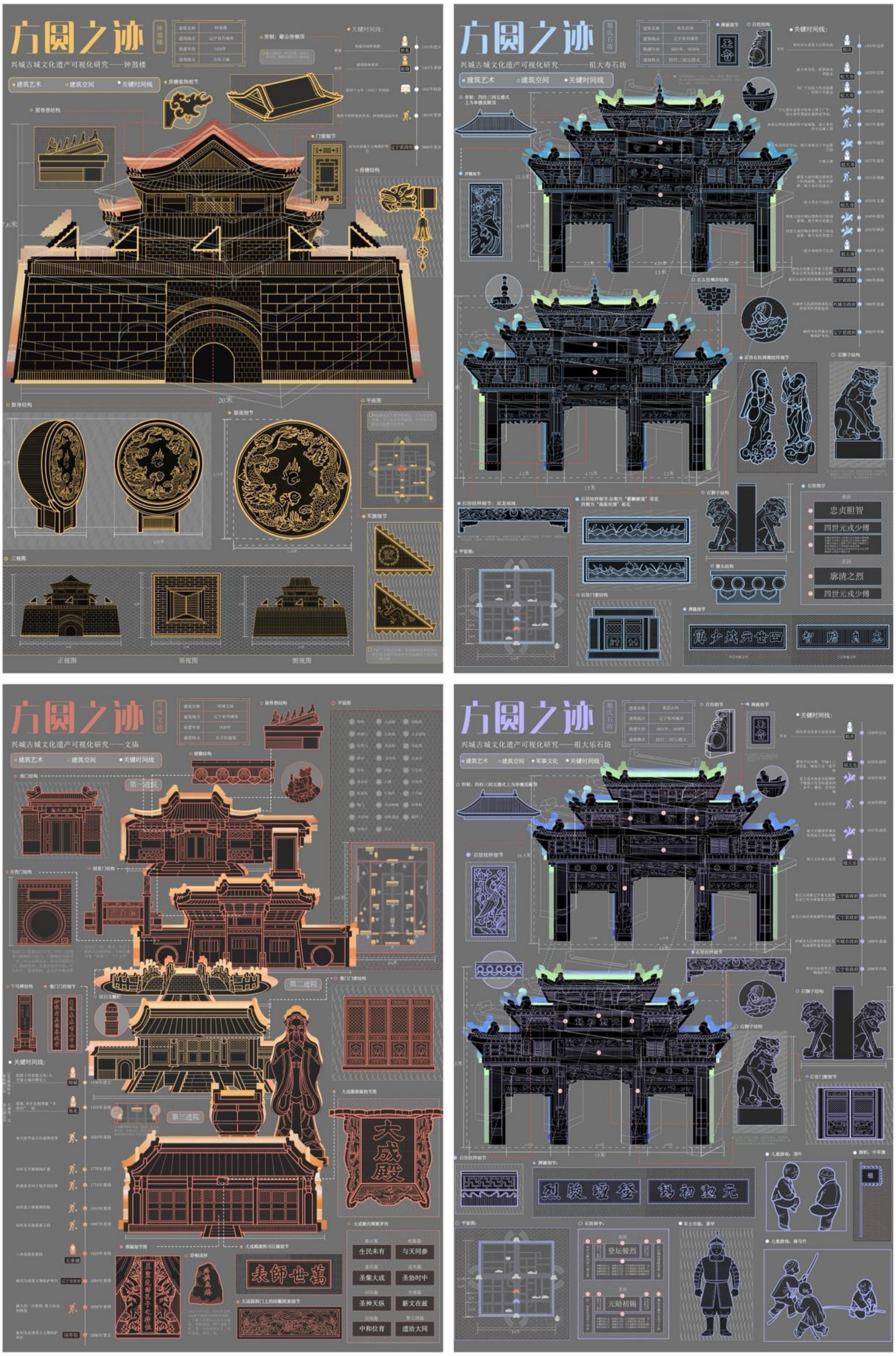
兴城城墙
兴城古城建筑文化基因可视化研究——兴城城墙
城墙上的主体结构 城墙上的建筑设施 关键时间线
建筑名称 兴城城墙
建筑地点 辽宁省兴城市
始建年份 1428年
建筑特点 方形卫城
封建时期
中华民国时期
新中国社会主义建设时期
改革开放至今
关键时间线：
1428年建立
1430年竣工
1568年地震
1623年重修
1626年战役
1627年战役
1664年更名
1781年重修
1848年重修
1913年更名
1914年更名
1948年损毁
1954年规划
1956年审批
1977年规划
1986年升级
1988年升级
2002年维修
2012年升级
2014年升级
2015年升级
2016年升级
2017年
2022年
女儿墙结构：
水门洞结构：
红夷大炮结构：
城墙上的主体结构：
建筑形制：重檐歇山顶
21.94米
3.85米
5.5米
10米
15.04米
三视图：
正视图
顶视图
侧视图
穿戴明军盔甲的战士：
宁远卫城形制：五方四象
马道结构：
魁星楼结构：
垛墙结构：



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四世元戎少傅
廓清之烈
四世元戎少傅
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第二进院
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生民未有
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圣集大成
圣协时中
斯文在兹
中和位育
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建筑艺术
建筑空间
军事文化
关键时间线

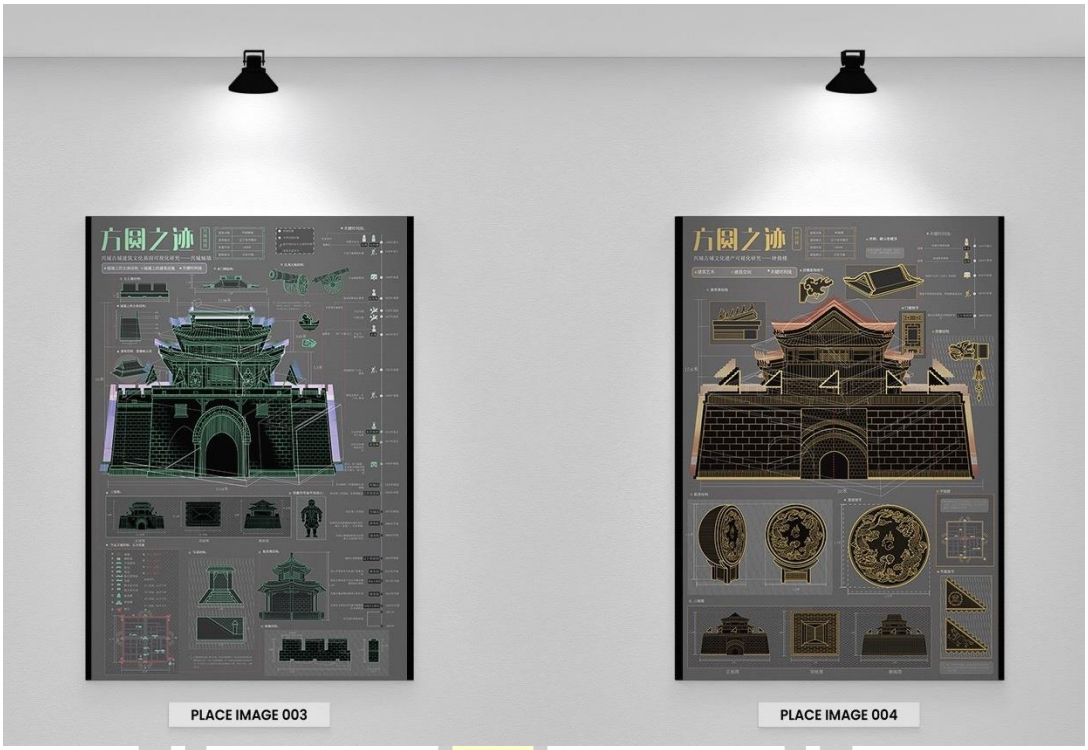


Figure 4 - 34 Xingcheng Ancient City Architectural Information Visualization Design

Source: Self-drawn by Sun Yijia

4.3.2.4 Interface hierarchical architecture: interactive experience layer design

Step 1: 3D modeling based on laser scanning - data collection

Digital reproduction of ancient buildings is a new field resulting from the intersection and integration of architecture, art, culture, history, technology and other disciplines(Rudolf A.,1998).Compared with traditional restoration and protection, digital protection and inheritance can save a lot of manpower, material resources and financial resources. The specific work of digital protection and inheritance of Xingcheng Ancient City includes the following links: object identification, data collection, model production, shot preview, material mapping, lighting settings, rendering output and post-production. I conducted on-site inspections of Xingcheng ancient city buildings, collected relevant data, and then analyzed and processed the data materials, which is the basic link of this design. For this project, it is necessary to conduct on-site photography of the ancient city buildings, collect relevant architectural drawings and other auxiliary information, and classify the collected

information according to the type of use, mainly into material type, architectural terrain type and building facade type. At the same time It is necessary to analyze and sort out the purpose of the data, eliminate some repetitive and useless information, and organize and summarize important data.

Step 2: Application of 3DS MAX

3DSMA software is a commonly used three-dimensional modeling software . It is widely used in various animation and rendering solutions. The generation of digital buildings since the development of 3DMAX will use more intelligent interfaces, plug-ins, and stackable models to build new buildings. The digital construction of ancient city buildings will also use the early construction of architectural models, the early collection and import of materials, and the annotation of collected building entity data, such as the length, width, and height collected by entities and the data of virtual simulation models. Ensure synchronization, especially the confirmation of data in each part.

In the model building stage, we use polygon modeling in this software. The modeling is fast, convenient and easy to master. When modeling, input is based on specific proportions. But on the other hand, compared with NURBS non-uniform rational B-splines, compared with fixed UVs, it needs to be edited by itself to prevent overlap. The UV should be saved in JPG image format, and when imported into PS software, the proportion, position, and shape of the collected data should be checked and the corresponding details should be processed. Each face of the building should be cropped to make it as highly sealed and appropriate as possible. In terms of size UV, try to achieve high-simulation visual effects. In the processing of lighting, the brightness of light in different weather should be involved, and the visual effects of design and identification should be designed with reference to different weather. This requires long-term observation in the early stage, as well as specific reference to the color tone of the light in the software, to grasp the relationship between the basic characteristics of light, intensity, direction, color, etc., and the weather. The effect of the simulation of natural light lighting will also be An important factor affecting the authenticity of simulation. During the final rendering of the image, the software UNITY3D is used for specific practice. It is only necessary to establish key dimensions, models and materials in 3DMAX, and then import them into UNITY3D

for final editing. When saving, you should pay attention to set it to FBX format so that it can be recognized by the system. Because these two can not only be imported into the UNITY3D software, but also the materials can be directly imported into the conversion software of the mobile terminal for the next step.

Step 3: Model design

The model design here takes the ancient city wall of Xingcheng as the main design example, and the other buildings are carried out in sequence. In terms of the production process, the design of the Xingcheng Ancient City architectural model requires alignment of the selected data based on data collection and material analysis, and scene model production, lens rehearsal, material mapping, and lighting settings based on effective data, render output, and finally conduct final testing, adjustments and improvements to the work. Therefore, to present the grandeur of the Nanjing Ming City Wall in a digital form requires model design and image synthesis. First, set the size of the 3Dsmax drawing, the international standard is millimeters. Secondly, set the 3Dsmax automatic saving time. The default is to save every 5 minutes. The city wall is a large scene. Saving every 5 minutes will increase the pressure on the computer memory, cause the computer to become stuck, and greatly reduce the efficiency of the work. It is recommended to save every 15 minutes; again, set 3Dsmax. Capture, based on 2.5, requires three captures: vertical, vertex, and center point to prevent alignment errors; finally, set the rotation angle of 3Dsmax, generally set to 45 degrees (as shown in (Figure 4-35).

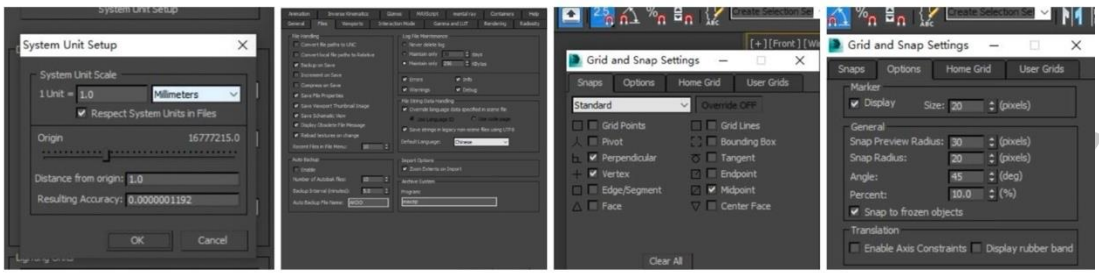


Figure 4 - 35 Basic setup operations for 3D modeling

Source: Sun Yijia

The three-dimensional modeling software 3Dsmax was used to digitally model the city wall and surrounding environment to achieve a multi-faceted display of

the scene. Common modeling methods include: polygon modeling, which connects complex models through simple cubes or spheres through enlargement, reduction, and deformation; spline modeling: using several splines to jointly define a smooth surface, characterized by smooth transitions without abrupt changes and wrinkles, modeling requires not only accuracy, but also artistry. In view of the fact that the architecture of the ancient city wall of Xingcheng is relatively regular and has rules to follow, the polygonal modeling method was chosen in practical operations. The surrounding scene terrain is relatively complex and changeable, and the spline modeling method can solve this problem well (Figure 4-36). After the model is sorted out, you need to set up a moving lens for the scene to make the picture move, which is a scene preview. When setting up the lens, you need to consider the most touching space of the Xingcheng Ancient City Wall itself, coordinate the relationship between light and shadow and the environmental background, focus on the architectural features of the Nanjing Ming City Wall, and enhance the visual impact of the picture. During the actual operation, the author mainly referred to some documentaries showing the performance of ancient buildings, summarized their main lens presentation methods, and then applied them to the digital scene presentation of the Ming Dynasty City Wall.

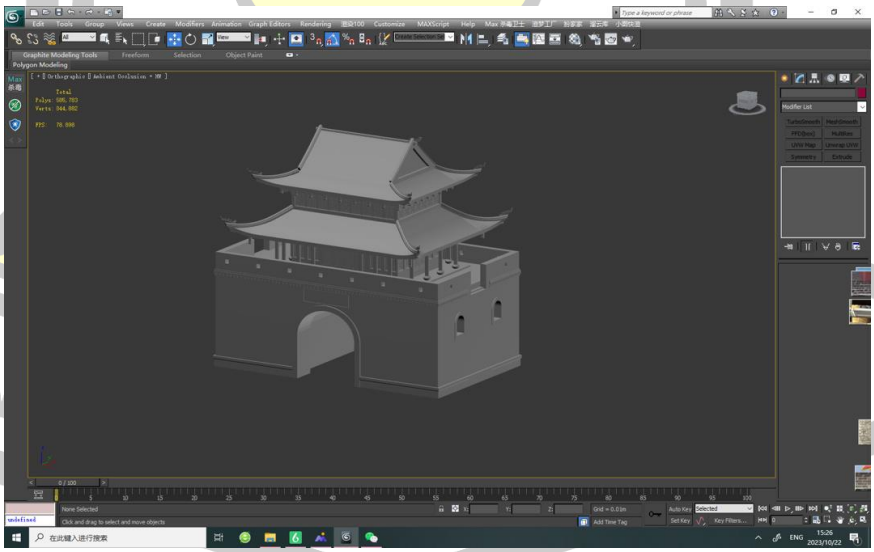


Figure 4 - 36 Basic setup operations for 3D modeling

Source: Sun Yijia

In 3ds max, key frames are set through the free camera, and all key frames are connected to form the camera's movement trajectory, that is, the lens movement trajectory. In the performance of the entire picture, according to the pre-shot script design, the virtual camera in 3ds Max is used to simulate the push, pull, shake, move, follow, rise and fall of the real camera to adjust the dynamic picture. In order to make the lens effect better and more outstanding, the author tried a variety of lenses and finally selected them (Figure 4-37).

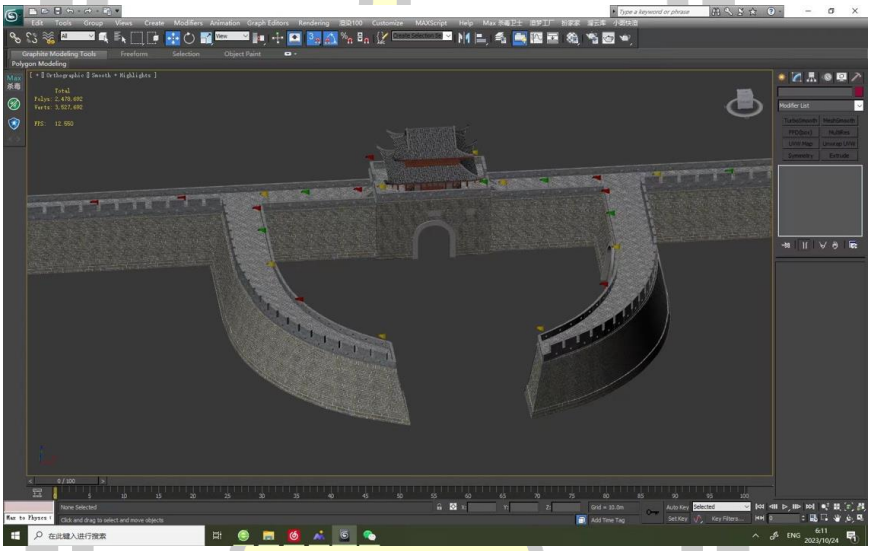


Figure 4 - 37 Basic setup operations for 3D modeling

Source: Sun Yijia

The texture mapping was processed after the digital lens preview was determined. Due to the particularity of the city wall building itself, the texture mapping was more complex, giving the main wall the texture. In order to show the rough concave and convex texture of the city wall, activating a blank material ball requires using a variety of mixed material mapping modes. In addition to applying the texture of the city wall itself, you also need to download the black and white mode map of the city wall material in the Bump panel. Its main function is Give the wall surface a concave and convex texture. At the same time, load the processed reflection map in the Reflection panel to express the reflective texture of the wall. In order to further enrich the material texture, dirty old materials need to be pasted on the Varydirt panel to express the historical vicissitudes of the city wall.

From 3D software to picture formation, a rendering output process is required. The rendering software is Vary renderer. In order to ensure smooth picture, the number of lens rendering frames per second is adjusted to 25 frames, that is, 25 static pictures need to be rendered and output per second. Each picture needs to output multiple channels at the same time, such as material channel, reflection channel and refraction channel, etc. to facilitate post-processing (Figure 4-38).

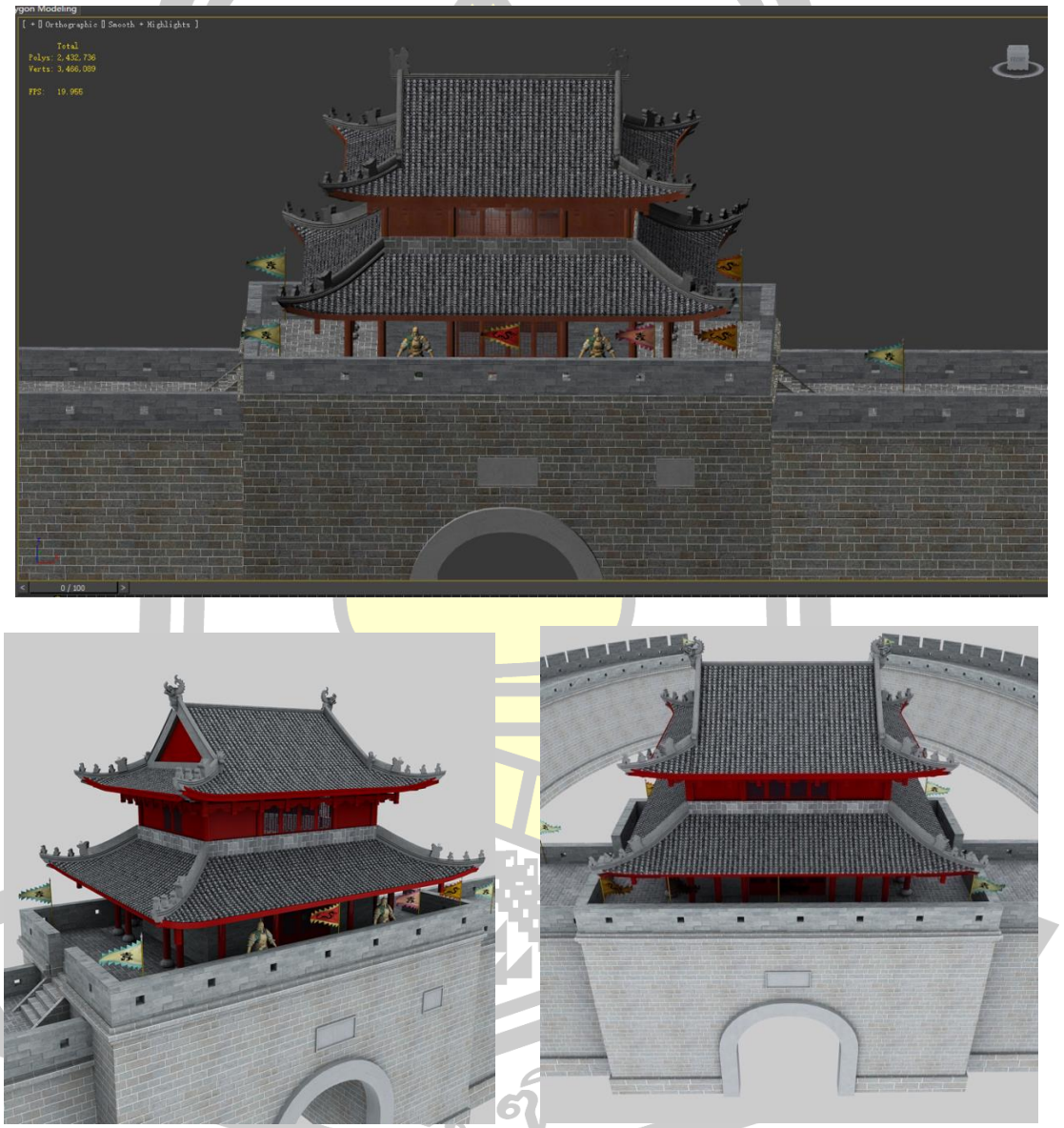


Figure 4 - 38 Comparison before and after rendering

Source: Sun Yijia

Step 4: AR augmented reality interactive experience

The model design here takes the ancient city wall of Xingcheng as the main design example, and the other buildings are carried out in sequence.

(1) Application of UNITY3D

Unity3d software is software developed by unity technologies company. This is a professional game development tool mainly aimed at 3D video games, architectural visualization, real-time 3D animation and other related interactive platforms. It provides strong technical support for the application of AR technology in mobile handheld device terminals. Make settings such as interactive selections. Its main components are divided into editing interfaces such as attribute viewer, terrain system, material editor, skeletal animation system, particle and environment effects editor, script editor, etc., which can intuitively and conveniently develop mobile terminals. When used on different terminals, there are different version configurations, which are mainly divided into: Android version, iPhone version, Mac version, and Windows version. The software application of 3DS MAX also saves the output format in FBX format for actual application and then imports it into UNITY3D.

First, create a cube in unity3D, adjust the size, assign materials, and use it as the ground; then add two Directional Lights to the scene, and then import the previously processed material resource package and the 3D data model of the ancient city into the unity3D software, and Convert the relevant material map to Sprit (2D/uGUI), add the corresponding material ball and assign the texture, and then assign the material ball to the corresponding object respectively, and control the relevant material parameters to the best state as shown in the figure. Finally, add another skybox to the scene. After all materials are added, add a camera and adjust the width and distance of the field of view. At the same time, in order to avoid the phenomenon of the camera passing through the wall, add a box collider component to the object and bake it to initially obtain a virtual three-dimensional scene.

(2) Increased cultural elements

In order to provide users with a better operating experience, we chose to use AR to show the appearance of the "Xingcheng Wall". Scan the picture with your mobile phone or tablet, and the model of the ancient city wall will appear on the

picture. Add a control script on the city wall model. Use two fingers to zoom in and out to control the zoom in and out functions of the model. Swipe the screen with one finger to control the rotation of the model. , allowing users to view the details of the city wall in an all-round way (see Appendix 4 for the specific script) .

(3) Implementation of AR effects

We use Unity 3D to complete the AR effect implementation. First, complete the modeling in 3DMAX and Maya, and export it to. Fbx format (Unity 3D has better support for .fbx format models) . When Unity 3D imports a model, it will sometimes be displayed as a white model. In this case, the material can be displayed in the following steps (Figure 4-39).

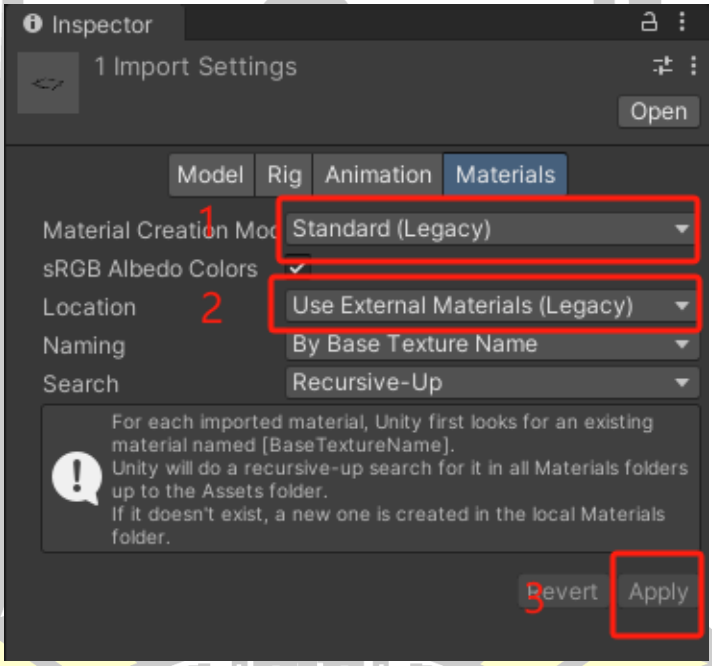


Figure 4 - 39 UNITY3D operation step 1

Source: Sun Yijia

Import the Vuforia plug-in , use the Image Target function , and specify the recognition map . At this time, the ImageTarget will be displayed in the scene in the form of a recognition map.

Drag the model to the Hierarchy and place it under the ImageTaregt as a sub-object. Adjust the position so that the positional relationship in the scene corresponds to the scanning effect (Figure 4-40),(Figure 4-41),(Figure 4-42).

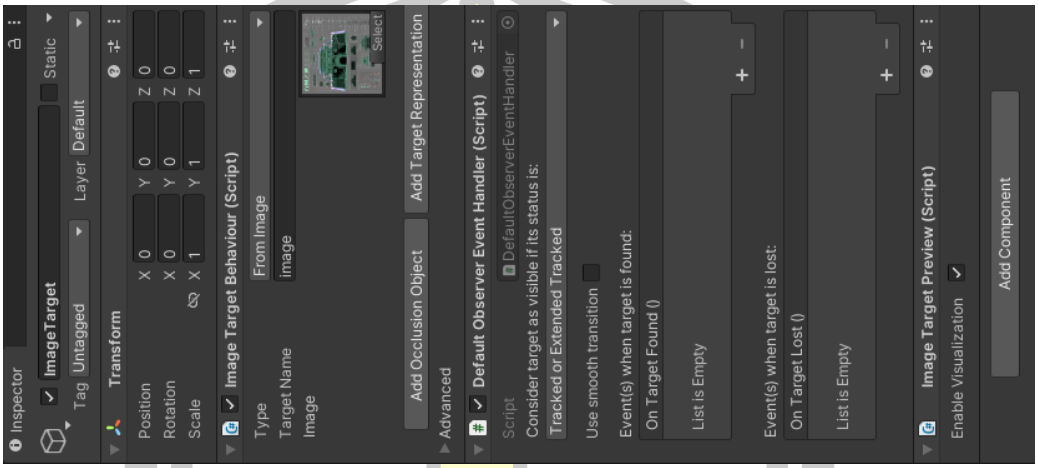


Figure 4 - 40 UNITY3D operation step 2

Source: Sun Yijia

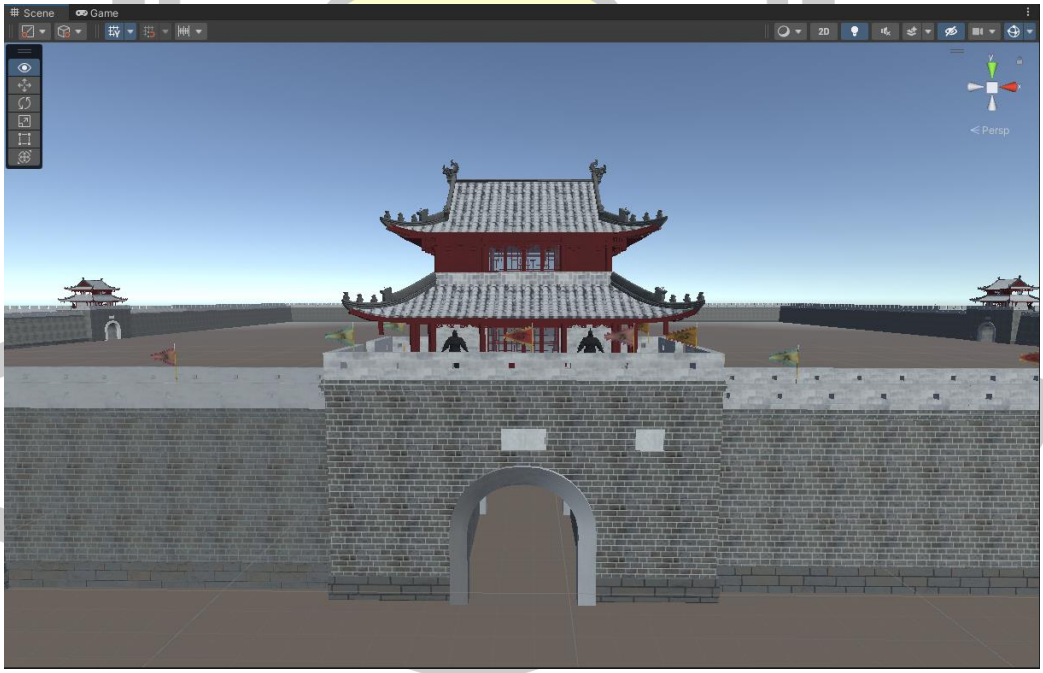


Figure 4 - 41 UNITY3D operation step 3

Source: Sun Yijia

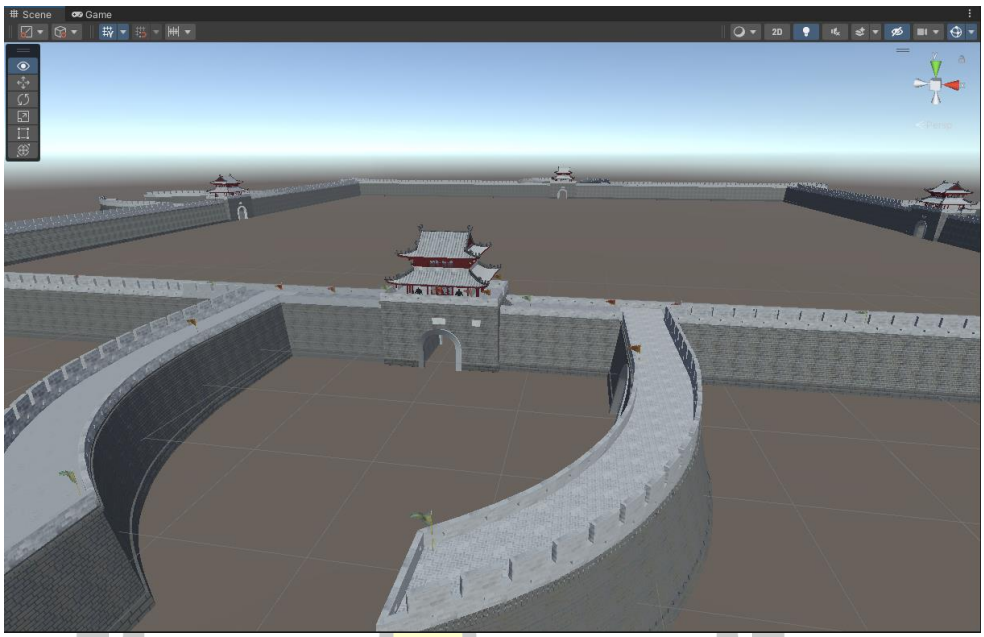


Figure 4 - 42 UNITY3D operation step 4

Source: Sun Yijia

(4) nteractive interface editor

Create buttons on Canvas: including "Introduction to the City Wall", "History of the City Wall", and "Function of the City Wall", and add click events to them to control the display of the introductory text(Figure 4-43).

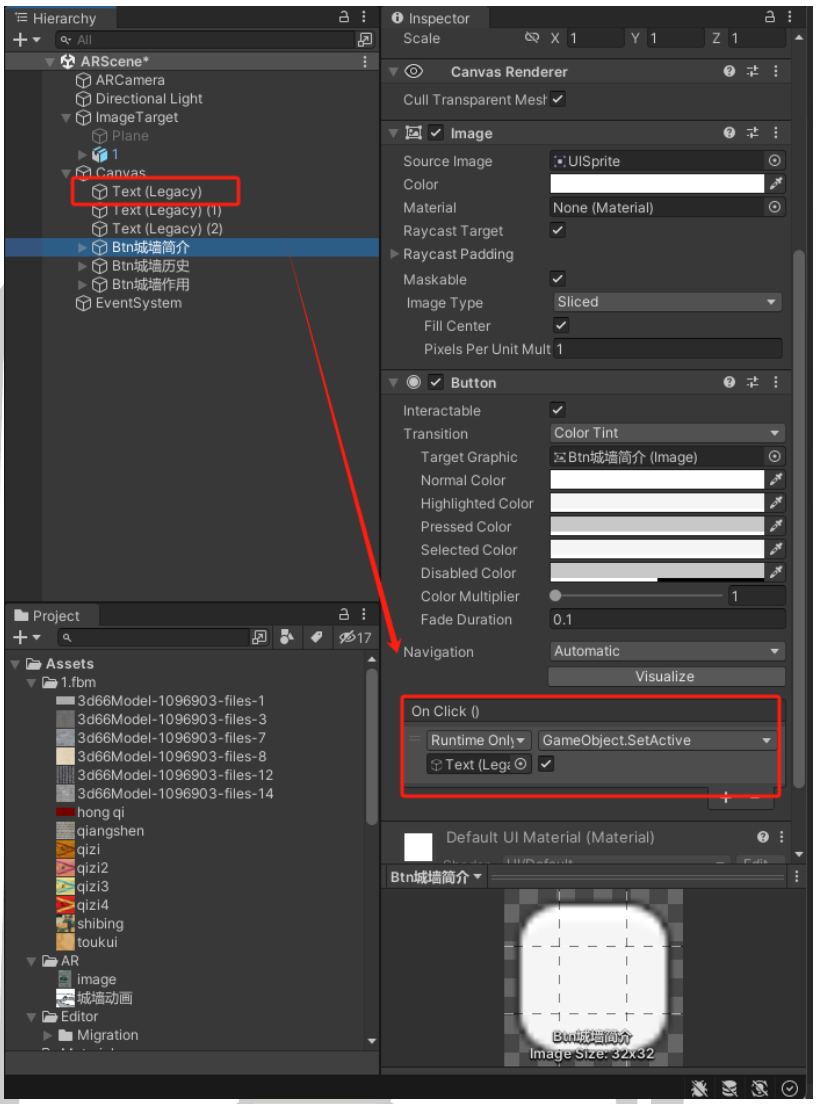


Figure 4 - 43 UNITY3D operation step 5

Source: Sun Yijia

(5) AR running test

After the project is completed, click Build Setting , switch the platform to the Android platform, and set the package name. Set up Graphics API , minimum API Level , Scripting Backend , Target Architecture , and package(Figure 4-44).

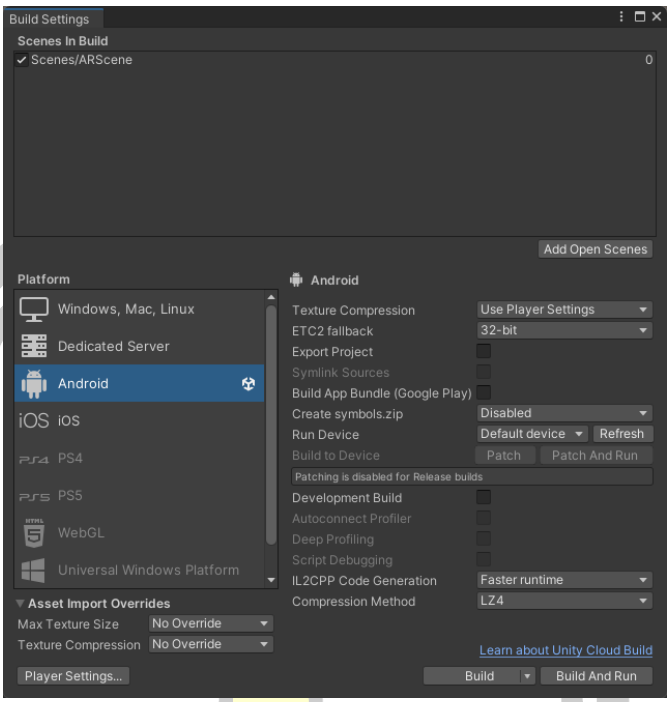


Figure 4 - 44 UNITY3D operation step6

Source: Sun Yijia

Set up Graphics API, minimum API Level , Scripting Backend , Target Architecture , and package(Figure 4-45).

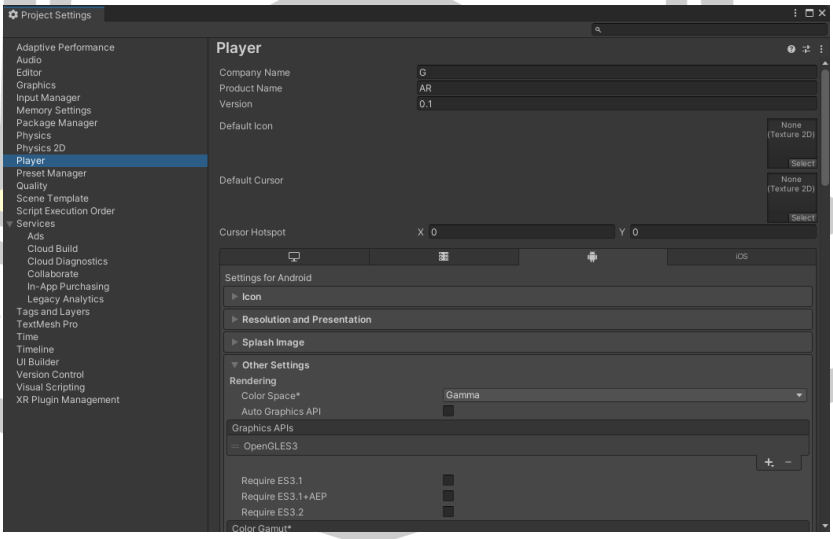


Figure 4 - 45 UNITY3D operation step 7

Source: Sun Yijia

After the packaging is completed, you will get the .apk file. After installing it on a supported mobile phone, you can run it. After scanning the identification map, a city wall model will appear, which can be used for functional testing through gesture interaction(Figure 4-46).

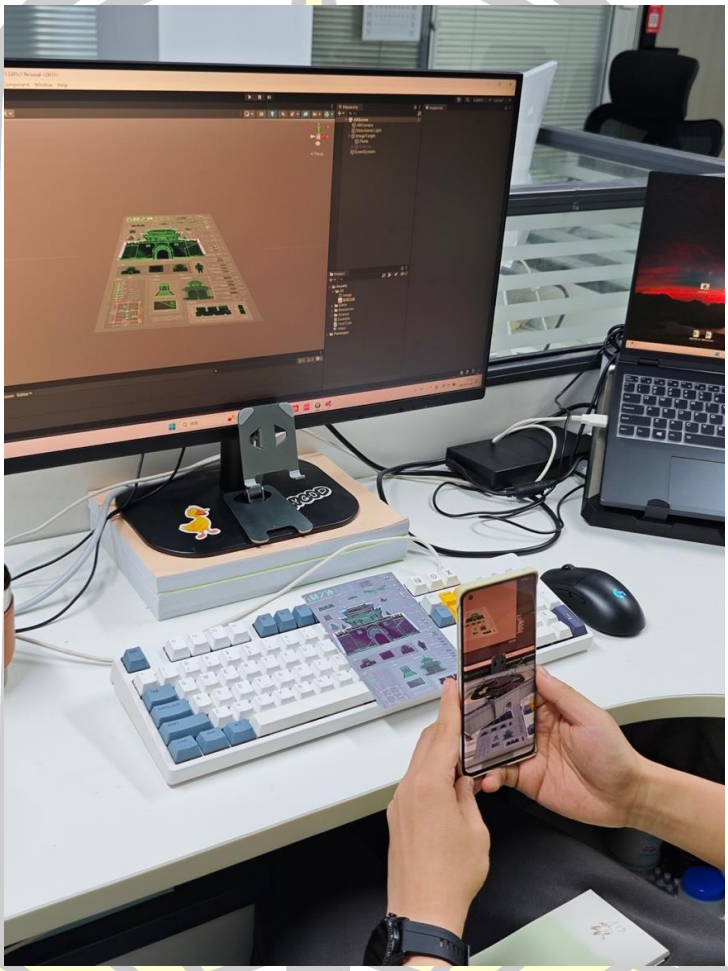


Figure 4 - 46 AR interactive test

Source: Sun Yijia

4.3.2.5 Digital website usage process and steps

Step 1: Login and System Navigation

After the user opens the platform website, he first enters the login interface, enter the functional navigation interface of the Xingcheng Ancient City Cultural Inheritance Digital Website by correctly entering the account number and password. As shown in (Figure 4-47).

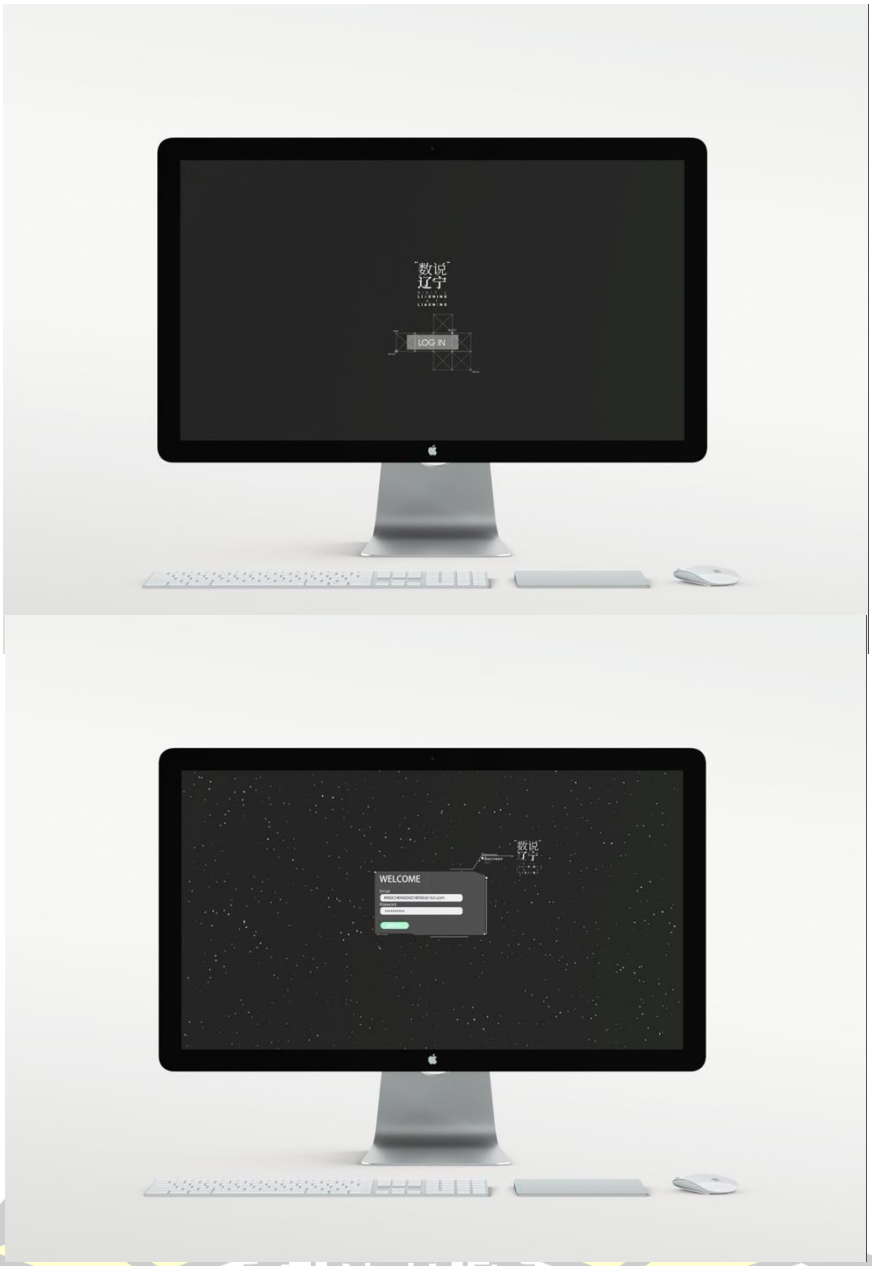


Figure 4 - 47 Login and system navigation

Source: Sun Yijia

Step 2: Narrative timeline expansion (navigation bar)

Click on the " circle area" in the navigation bar to enter the narrative timeline, as shown in(Figure 4-48). The core concept is to take the time of city construction as the starting point. There are four building groups, each of which has a different time of city construction and its historical context. This part is combined

with the combing of history and development context in the first research goal. Green represents the ancient city wall of Xingcheng, orange is the bell and drum tower, red is the Confucian Temple, and blue is the stone square. The balls of different sizes represent their historical changes from the founding of the city to the present. Select one of the colored circles to connect to the timeline of the building. At the same time, click on the timeline of the building to preview the next level (Figure 4-49).

Figure 4 - 48 Narrative timeline expansion

Source: Sun Yijia

Figure 4 - 49 Narrative timeline expansion (navigation bar)

Source: Sun Yijia

Step 3: Visual display of ancient city cultural heritage information

Through the navigation bar of the time narrative axis, you can enter the interior of a specific building. Entering this area can display the information design part of the building based on manual operations based on the different shapes and locations of the building. Each level has a detailed and comprehensive explanation as shown in the (Figure 4-50).

Figure 4 - 50 Visual display of ancient city cultural heritage information

Source: Sun Yijia

Step 4: AR augmented reality interactive experience

Based on information design, the digital website also adds AR augmented reality interactive experience to make up for the shortcomings of clear information design and lack of intuitive experience. Touch screen interaction is the most direct way to present mobile terminal interactions. It uses touch screen panel technology to establish an interactive platform for the AR system on the mobile terminal. It uses the interface of the interactive platform to set up the touch screen interaction module and directly uses the touch screen. Select and move the interactive interface icons on the screen to view the device effects of the preset system. If the design of the interactive interface and the touch-screen system are optimally coordinated, the user experience will be greatly improved. Not only that, it can be easily understood intuitively by users, and the visual language part of the interactive part(Figure 4-51).

Figure 4 - 51 AR augmented reality interactive experience

Source: Sun Yijia

4.3.3 Xingcheng Ancient City Digital Website Results Test

User experience design is the design of the emotional connection between the digital world and people. According to the definition of the International Standards Organization, user experience is "people's cognitive impression and response to the products, systems or services they use or expect to use", and lists three factors that affect user experience: human, machine and environment. The three elements of human, machine, and environment listed above have a one-to-one correspondence in this design practice: product users are mainly those described above, and are divided into three categories, namely: understanding user group, usage user group User group, research user group, the above three groups have a total of 15 people, 5 people in each group. In the previous part of the initial user demand section of the digital website, the above 15 people were also interviewed.

In the digital protection and inheritance of ancient city architectural heritage, in the process from design expression to effective user perception, user experience is the most critical measurement indicator, which can effectively evaluate the rationality and efficacy of design practices. An important presentation dimension of user experience is product usability (Usability). In order to test the feasibility of the digital website interactive system, this article conducts a feasibility test on the product from the perspectives of experts and users. The value transfer of urban architectural cultural genes is also one of the design purposes of this design practice. The transfer of culture in design, the visual experience and cultural experience brought to people through the information design medium, together with the functional attributes of the product itself, constitute the user's part of the experience. Therefore, product evaluation and testing also need to consider the value transmission and presentation of cultural genes.

The evaluation criteria are based on six dimensions: "overall evaluation", "visual element design", "data content", "data presentation", "user interface and interactive experience", "science popularization and education", and a total of 9 details to conduct a satisfaction scale. Scoring provides direction reference and develops design ideas for the later design and application of similar urban architectural cultural genes.

4.3.3.1 Assessment purposes and methods

As mentioned earlier, modern digital website design pays more attention to the interactive data exploration process, and as a data product, it also pays more attention to the user experience. To a certain extent, the design of digital websites has a very similar relationship with interaction design. Here, this article will introduce several evaluation methods that are relatively mature in interaction design, combined with the characteristics of visualization itself, and try to propose several evaluation methods in practice. A visual design evaluation method that can be applied quickly.

According to relevant research reports by Nielsen, collecting feedback data from one user can discover about 35% of design problems. Usability test data from five users is close to the maximum benefit-cost ratio of user testing, which is enough to reflect 85 % of the usability of a product design or service system. Question. When the number of test users reaches 12, there is an obvious diminishing marginal effect, which can basically reflect all usability problems in design and development. Even if the number of users is increased at this time, more effective usability problems will not be discovered. Therefore, a total of 12 test users were selected for this study. A group of 4 people was divided into: understanding user group, usage user group, and research user group. The composition of the test users is as follows:

(1) The members of the understanding user group are mainly: tourists, employees of Xingcheng Ancient City, and surrounding residents

(2) The members of the user group are mainly: students engaged in digital media art and cultural relics protection workers

(3) The members of the research user group are mainly: senior practitioners of digital media and persons in charge of cultural relics protection.

4.3.3.2 Test process

(1) Recruit test subjects as required

(2) Organize the testers to view and use the beta product, and be accompanied by a staff member to explain. Finally, the testers are asked to fill in the usability test questionnaire based on the usage results.

(3) Record the experimental results, organize and analyze the data, and obtain evaluation results and feedback.

4.3.3.3 Feedback on evaluation results

12 questionnaires were distributed to different groups in this evaluation, and the questionnaires were passed through six categories: "overall evaluation", "visual element design", "data content", "data presentation", "user interface and interactive experience", and "science popularization and education" Conduct questionnaires across dimensions. A total of 12 questionnaire participants completed and returned 15 questionnaires, with a completion rate of 100 %. The following evaluations can be obtained based on the questionnaire results.

Table 4- 9 Analysis of Xingcheng Ancient City Digital Website Questionnaire Results

Six dimensions of assessment	overall evaluation	Average S core （Range 1 to 5 ）	S tandard Decision
overall evaluation	visual evaluation	4.5	0.57
	Experience evaluation		
Visual element design	Logo design	4.7	0.46
	narrative navigation		
	information level		
Data content	History and development	4.5	0.49
	culture		
	Building style		
	construction space		
	architectural art		
Data presentation	information design presentation	4.3	0.66
	3D modeling effect		
	AR interactive presentation		
User interface and interactive experience	User interface and interactive experience	4.5	0.55
Educational science	Popular science and education	4.3	0.64

Source: Sun Yijia

From a comprehensive perspective, the following key conclusions are drawn:

(1) Overall evaluation: The overall evaluation is 4.5 points, indicating user-friendliness. The digital website is better in terms of user experience. It is easy to navigate and use the website. This is a relatively high score. At the same time, despite the high score, A participant in the research group wanted to optimize the website's responsive design to ensure a consistent user experience across a variety of devices.

(2) Visual element design: The visual element design has an evaluation of 4.7 points, which shows that the website’s layout, graphics, icons, and text colors are very successful and attract the user’s attention. At the same time, the hierarchy and layout of the website are very clear, and users can easily understand the content and structure of the website.

(3) Data content: The data content scored 4.5 points, indicating that the digital website performs well in terms of information clarity, clarity and accuracy in data content. At the same time, the organization and presentation of data content can also make it easy for users to navigate. One of the research-type Participants in the group mentioned that in the future, the real-time data quality of the website can be increased to ensure that the data content of the website is kept updated, especially for research scholars like them, which will help maintain user interest and reliability.

(4) Data presentation: The data presentation scored 4.3 points, indicating that the website uses effective visualization tools. Information visualization is mainly used here, and the user's emotional experience when interacting with the website is considered to create a more attractive and emotionally resonant design. However, due to the large amount of visual data information, it may not be attractive to younger experiencers.

(5) User interface and interactive experience: The user interface and interactive experience scored 4.5 points, indicating user friendliness. While based on ordinary interface interaction, there is also an AR augmented reality interactive experience, allowing users to face a large number of problems during the browsing process. Information data creates boring, tedious questions.

(6) Science popularization and education: Science popularization and education scored 4.3 points. Although it is slightly lower than other dimensions, it

also has certain achievements in digital websites. The website provides rich and in-depth educational and popular science information to meet the learning needs of users. However, in the user-oriented group, a student majoring in digital media art said: The current popular science information and content are very rich, and in the process I learned a lot of historical and cultural information in middle school, but interactive learning can be added and small tests can be introduced to ensure the mastery of knowledge.

In summary, the design and development of the Xingcheng Ancient City digital website can meet the needs of the continuation of culture and the inheritance of traditions, target the learning methods and cultural interests of the new generation, convey cultural content in a more attractive way, and promote different Exchange and dialogue between cultures to achieve better inheritance and protection. At the same time, this design and development has also been highly praised by different groups.

4.3.4 Xingcheng Ancient City Digital Website Communication Experiment

4.3.4.1 Students to learn about the history and development of Xingcheng Ancient City

Students learned about the ancient city of Xingcheng, located in Xingcheng City Liaoning Province. It has a development history of nearly 600 years and is one of the most complete ancient cities in China. The ancient city of Xingcheng was the acropolis of the Ming Dynasty war system Dusiweishuo system. It was an important node of the Guanning Defense Line and the Ningjin Defense Line in the late Ming Dynasty. It occupied an extremely important geographical location at the end of the Ming Dynasty. City has preserved a relatively complete urban layout and many important historical buildings. It has witnessed a series of major historical events in the late Ming Dynasty. It is an important carrier of the culture of the Western Liaoning Corridor, fully embodies the cultural connotation of life in and has extremely high historical and cultural value.

The ancient city has been repaired over the years and has effectively preserved a large number of traditional elements. Since the reform and opening up, the rapid development of modern urban construction has brought great interference and damage to the protection of ancient cities, leading to the gradual dilution and loss of ancient city culture. At present, the protection of Xingcheng Ancient City has

entered a new period of development, and protection research has also entered a new stage of exploration. The protection of Ancient City started early, as early as the early 1980s. In the overall planning and construction of the city, a number of ancient buildings with historical and cultural value were identified as cultural relics. Through extensive sorting and restoration, the historical relics of outstanding value in the ancient city have been well protected. However, due to limitations in protection awareness, the protection at that time was only centered around these important cultural relics and buildings, and the implementation was static protection. At the same time, rapid development was accompanied by the dilution of local cultural identity and the lack of educational inheritance. Cultural heritage of the ancient city of Xingcheng which is the national protection unit for important cultural relics, including the ancient city wall, Confucius Temple, Bell and Drum Tower, and the four buildings have been combined together. and has been ranked as a nationally important cultural relic conservation unit.

This study takes Xingcheng Ancient City as the main research object, and deeply explores the history and development of Ancient City. Using the concept of cultural genes, the ancient city culture was sorted out, and based on the different expression forms and identification dimensions of cultural genes, the cultural resources of Ancient city were divided into dominant cultural genes and recessive cultural genes. Extract core cultural genes and effectively organize the internal cultural logical structure to construct a cultural gene genealogy diagram of Ancient City, thereby increasing the systematic academic data of cultural heritage and enriching the statistical information of cultural gene data. At the same time, digital means are used to design and develop digital websites, information visualization means are used to translate historical and cultural information into a visual language familiar to the audience, and augmented reality is used to conduct interactive experiments with the audience to enhance the attraction of ancient city culture, enhance local cultural identity, and strengthen Education and inheritance can better protect the ancient city culture and provide new ideas for the inheritance of ancient city culture.

4.3.4.2 Experimental object selection

In the experiment of educational application in this section, the digital website platform used is Shushuo Liaoning - Xingcheng Ancient City Bottle. Through specific experimental research, we will further verify whether the digital website has an impact on learners' learning effects and whether it can assist schools. Culture and education.

Regarding the selection of subjects for the experiment, the author selected the appropriate experimental population based on the objects targeted by the Xingcheng Ancient City Digital Museum platform. Because users of the digital museum platform need to have certain computer literacy, it will be difficult to grasp the cognitive abilities and cognitive levels of the experimenters if they are recruited from society, which will affect the accuracy of the experimental data. In order to better control the experimental variables, the cognitive level of students is relatively uniform. At the same time, because this data website involves a large number of information charts, younger students may not be able to understand its content. Therefore, the author determined the subjects of the experiment to be selected from college students. . The author combined the content of the Xingcheng Ancient City digital website with the visual communication of cultural information, and selected a total of 32 students from freshman to senior year as the experimental subjects.

In recent years, in order to establish a student-centered educational concept, encourage student participation and continuous innovation, and carry out activity learning, interactive learning and project-based practical learning, the workshop model has been widely used in practical teaching. The workshop model not only respects the subjective learning wishes of informal learners, but also provides them with the necessary activity resources and the on-site space needed to carry out learning activities through appropriate regulation. The cultural exchange project in this round of research is to bring together informal learners through workshops, provide them with activity venues and activity resources, and promote communication and collaboration among learners. With the help of the digital website designed in this study, a mobile learning environment is provided for informal learners in the workshop. Expert teachers only play a guiding role in the workshop, fully

highlighting the subject status of informal learners and providing rich activities for learners. resources and a broader learning space.

4.3.4.3 Knowledge management for learning the architectural art of Xingcheng Ancient City

The development of digital systems for protection and transfer of knowledge about cultural heritage

The research goal is based on basic knowledge from the analysis of artistic elements of the architecture of the ancient city of Xingcheng. The design of various building proportions using a ready-made program is partly based on the idea of protecting the cultural heritage. The researcher therefore created a digital website. By designing a digital museum that shows the shape and space of architectural structures connected to a website, students can access it anytime, anywhere via the Internet. The production of teaching media integrates the created digital media, can increase participation opinions and achieve guidelines for media improvement. User-centric design that caters to "sharing" and "creativity" combined with an innovative design style. Because it is a multi-dimensional art design category. Website design is not only about designing web pages that satisfy traditional visual impact. But it also requires the humane and user-centered art of remote communication. which is the new network art of web design Students who use learning media can use their phones to learn all the time.

The Xingcheng Ancient City Digital Website is a project to develop the ancient city's architectural cultural heritage based on digital technology. It visually translates the Xingcheng historical and cultural relics and its contextual genealogy map that were sorted out earlier, and achieves digitization through the construction of a digital website system. protection and inheritance. At the same time, through the development of digital systems, we will use them in museums, educational classrooms, communities and other places to conduct experimental research to ensure the continuation of culture and the inheritance of traditions, and to better understand the learning styles and cultural interests of the new generation. Convey cultural content in an attractive way and promote communication and dialogue between different cultures. At the same time, the feasibility of this system will be finally tested and analyzed to achieve better inheritance and protection.

Creative teaching media designed to understand ancient architectural art were used to transfer knowledge to students in the Lu Xun Academy of Fine Arts. The researcher developed the media using a workshop method. BringInformation Visualization Design to Student Major: Digital Media Arts Number of people: 32 people First-year students 10 people Sophomores 9 Junior students 9 Senior students 4 people, the recipients of this lesson can study through the mobile phone system, which is a new, modern method.

4.3.4.4 Experimental content

According to the needs of learning activities, learners must be provided with necessary activity resources and subject-related learning materials before starting. This part of learning resources needs to be specifically designed and implemented based on the previous analysis. In terms of learning content, this group selected the ancient city wall in the national key cultural relics protection unit of Xingcheng Ancient City for study. The learning goal is to understand the origin of the ancient city wall and its architectural functions, architectural forms, architectural art and other features through the study of relevant materials. Meaning changes. Through interviews with learners and real-time recorded data, the focus is on the application effects of college students' traditional cultural learning activities. The purpose of this workshop is to quickly and comprehensively understand the ancient city culture based on digital websites. When disseminating ancient city culture through digital media in the future, students can quickly obtain resources on digital websites and create specific works from different perspectives. The design and creation of each work can reflect the essence of the ancient city culture from different perspectives.

4.3.4.5 Educational effect analysis

In informal learning, learners' motivation comes from their own internal needs, which usually has a certain purpose, but is not strictly organized. The control of informal learning often lies with the learner. In this round of experiments, teachers and students participating in the project have a strong interest in the history and culture of Xingcheng Ancient City, and participate with a clear learning purpose, focusing on collaboration, communication and sharing between individuals. During the project, teachers and students will learn about the ancient city culture of

Xingcheng through various methods such as inquiry learning based on problem solving, situation-aware learning, and situation simulation experiential learning.

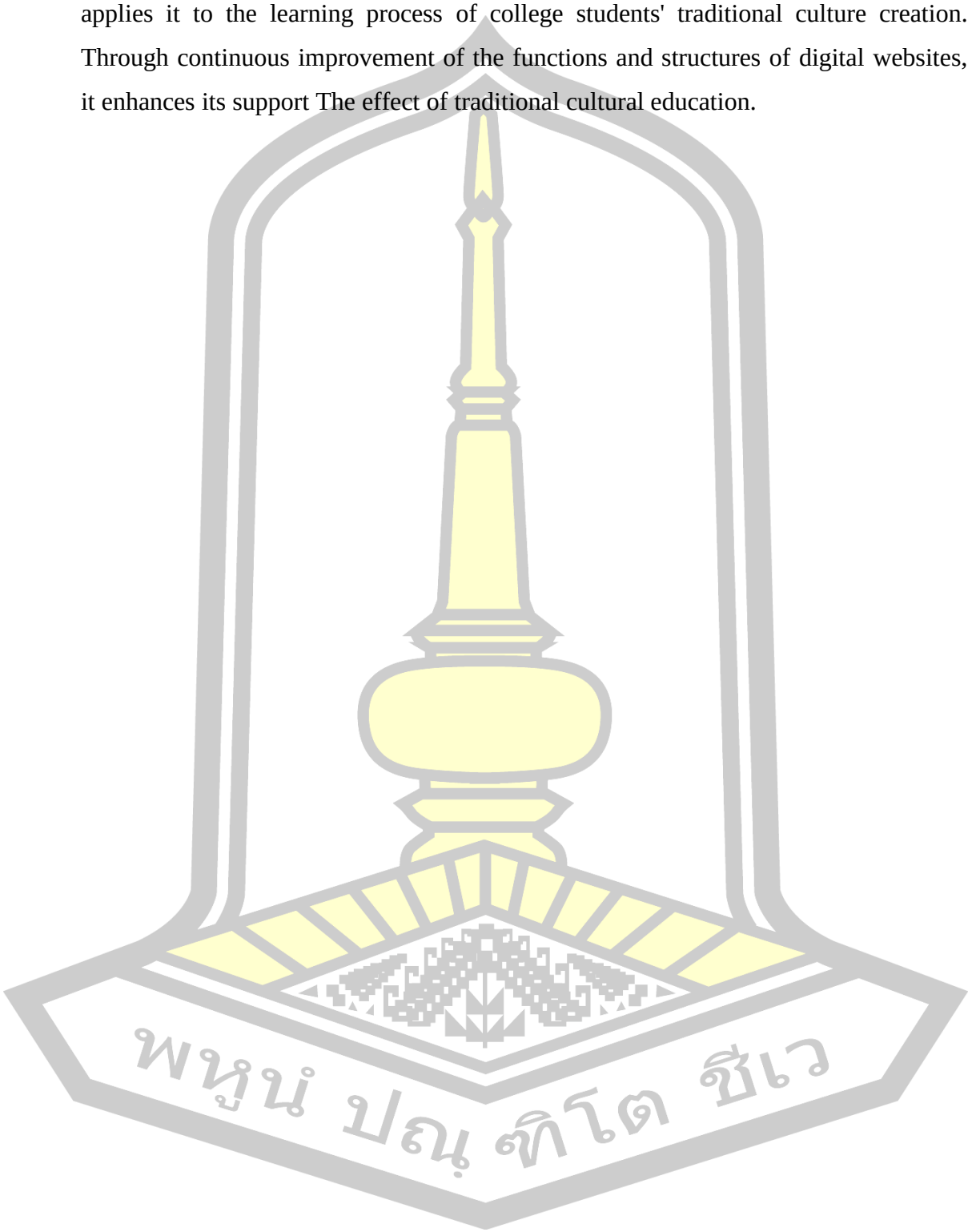
The main purpose of building a learning environment through a digital website is to provide convenience for informal learners participating in the workshop, expand their learning time and learning space, enhance the occurrence of learning interactions, and provide a display of final generative learning resources, learning The resultant online platform brings a more ideal learning experience to informal learners and improves the learning effect of traditional culture.

Through interviews with experts and instructors, we learned that after the activities were carried out, the design works of relevant teachers and students have improved in innovation, close integration with culture, and closeness to life. The mobile learning environment built with the help of this platform has a good supporting effect on traditional cultural education in colleges and universities, and can solve existing problems such as insufficient learning interaction and lack of resources. The functions of the platform are targeted for college students to carry out traditional cultural learning and cultivate independent learning and inquiry abilities. sexual support,

To sum up, traditional culture, as the essence of material civilization and spiritual civilization in the course of human history, embodies the historical origins, cohesion, vitality and creativity of a country, nation and society. China's excellent traditional culture plays an important role in building a spiritually civilized society. Crucial role. As an important base for cultivating social elites, colleges and universities also shoulder the important task of inheriting traditional culture. College students, as high-quality talents, shoulder the important task of national and national development. They are the main body of inheriting excellent traditional culture and need to continue to learn and Deeply understand traditional culture, enhance national self-confidence and pride, and improve personal overall quality.

However, in real situations, college students face several problems when understanding and learning traditional culture. The effect of traditional culture education in colleges and universities is not ideal. Under the guidance of relevant policies, it is necessary to propose targeted solutions and provide technology and resources. effective support. This study uses digital websites to build a suitable

learning environment, conducts detailed design and experiments on the platform, and applies it to the learning process of college students' traditional culture creation. Through continuous improvement of the functions and structures of digital websites, it enhances its support The effect of traditional cultural education.



CHAPTER V
CONCLUSION, DISCUSSION AND SUGGESTIONS

This chapter is the conclusion of the paper. Through the discussion in the previous chapters, it summarizes the history and development of the ancient city of Xingcheng and the form of the ancient city's cultural heritage. It also uses the concept of cultural genes to sort out and extract the form of its cultural heritage and its cultural connotations,constructed a cultural gene genealogy chart belonging to the ancient city of Xingcheng. The construction of the genealogy chart provided important theoretical support for digital protection and inheritance. On the basis of theoretical research, a digital website was designed and developed. This chapter elaborates on the conclusions and discussions obtained from the three objectives. At the same time, more interesting and possible phenomena were discovered during the research process to sort out and make suggestions.

There are three objectives of this study:

1. To study the history and development of inheritance in Xingcheng Ancient City

2. The current problem and the form of cultural heritage for digital media design

3. Develop digital systems for protection and transfer of knowledge about cultural heritage

5.1 Conclusion

5.1.1 Summarizes the history and development of Xingcheng Ancient City and divides it into four stages.

5.1.2 Summarizes the architectural style of the national key cultural relics protection unit building complex in Xingcheng Ancient City and the cultural connotation behind it, and also explores the current inheritance status and problems of Xingcheng Ancient City.

5.1.3 Visually translate information on the history and development, style and cultural connotation of architecture, and disseminate it through multiple channels through digital websites.

5.1 Conclusion

5.1.1 Summarizes the history and development of Xingcheng Ancient City and divides it into four stages.

The history and development of Xingcheng Ancient City are summarized and divided into four stages.

In-depth exploration of the history and development of the ancient city of Xingcheng, summarized and discovered several key time nodes, and the changes in the meaning of the ancient city under different social backgrounds:

First of all, according to historical records, there was no urban planning in the Xingcheng area before the Ming Dynasty. Therefore, this study started from the early Ming Dynasty and divided the history and development of the ancient city of Xingcheng into historical stages and stages of development.

Secondly, the historical stages are divided into : from 1428 to 1912, from the founding of the ancient city to the feudal period. After the development of the prosperous age of Kangxi, the military role of Ningyuan City gradually declined, while the economy and culture reached its peak. The ancient city of Xingcheng at this stage is from a military stronghold to a depleted defense system, during the period of the Republic of China from 1912 to 1949, after the decline of the Qing Dynasty, Xingcheng officially entered the period of the Republic of China. During this period, the ancient city was a period full of wars and changes.

Finally, the development stages were divided into two parts, namely: from 1949 to 1978, from the founding of New China to the period of socialist construction in New China. Xingcheng urban construction entered a new historical period, and planning work took a new turn.The city master plan has been prepared three times. This plan determined that Xingcheng is located on the coast of the Bohai Sea, with

hot springs and ancient city monuments, and has favorable conditions for the development of tourism. Taking into account the characteristics of the city itself, Xingcheng should be developed into a city focusing on recuperation and tourism. The ancient city area served as the main resource for urban development during this period. The city's residences, administrative offices and major businesses all developed around this area. This stage belongs to the period of reform and development, from 1978 to the present, since the reform and opening up, and into the last period. After the 1980s, Xingcheng County has prepared 10 plans of various types. Judging from the development history of Xingcheng Ancient City, it is a historical and cultural achievement that has been continued. Each era has left its mark. This stage is the stage of cultural protection, inheritance and modern development.

Through searching different documents, we can divide the history and development of the ancient city according to time periods, and we can see more clearly the changes in history, culture and meaning of the ancient city under different social and historical backgrounds, and we can have a clearer understanding of the ancient city of Xingcheng. The foundation of local cultural identity. Through sorting out the historical context, the value of the ancient city can be clarified, and at the same time it provides theoretical support for the visual translation of information.

5.1.2 Summarizes the architectural style of the national key cultural relics protection unit building complex in Xingcheng Ancient City and the cultural connotation behind it, and also explores the current inheritance status and problems of Xingcheng Ancient City.

This article summarizes the architectural styles of the national key cultural relics protection units in Xingcheng Ancient City and the cultural connotations behind them, and also explores the current inheritance status and problems of Xingcheng Ancient City. The second research goal focuses on the historical and cultural relics in the ancient city of Xingcheng, and conducts specific research on the four building groups of the national key cultural relics protection units, namely: city wall system, temples, bell and drum towers, and stone squares. This summary will have three subsections. The first subsection specifically analyzes the architectural characteristics and architectural styles of the four building groups and the cultural connotations behind the buildings. The second subsection analyzes what has been and has not been

fully improved in inheritance and protection of the ancient city. Safeguard. The last section uses the concept of cultural genes to organize and screen the scattered cultural heritage resources in the first two sections, and condense the unique cultural resources that are most effective for the protection and inheritance of the ancient city. It conducts genetic combing, extracts and constructs a pedigree diagram. This part of the review is used to solve the information visualization part of the third research goal of digital website design and development.

This study collected data on four key building groups, combined with field surveys to visit local residents, people in charge of ancient city protection, tourists and other related groups, and sorted out the style of each building group and the cultural connotation behind it.conduct an integrated analysis of the collected architectural data based on the characteristics of cultural genes. Dominant genes include architectural layout, architectural space and architectural art, while recessive genes include historical context and special cultural connotations. Four different building components are used to construct the primary building body, the construction of secondary architectural style characteristics, and the construction of third-level historical context to complete the genetic genealogy. The construction of the genetic genealogy can be reasonably applied to Chapter 3 Digital Website Design and Development information visualization part.

At the same time, the investigation found that the inheritance of Xingcheng Ancient City still faces a series of problems. The recognition of ancient city culture in contemporary society is relatively low, which also highlights that Xingcheng Ancient City currently needs new technologies and scientific means to protect the ancient city. cultural mechanisms, including formulating relevant policies for unified and effective management of cultural resources. At the same time, the rapid social transformation and modernization process have brought about a lot of cultural impact. Therefore, we should dig deeper into the cultural connotation of the ancient city, maintain the authenticity and core value of the culture, and use modern means to reasonably and effectively protect the ancient city culture.

5.1.3 Visually translate information on the history and development, style and cultural connotation of architecture, and disseminate it through multiple channels through digital websites.

The third research goal is based on the previous analysis of the protection status and existing problems of the ancient city's cultural heritage. In order to better protect and inherit the culture, the researcher established a digital website. This digital museum has greatly expanded the digital presence of Xingcheng Ancient City. Port information. Our digital website is accessible anytime and anywhere via the Internet. Therefore, through the integration of digital media, we can enhance the sense of participation and ultimately achieve a user-centered approach that satisfies "sharing" and "creativity" combined with a novel design style. As a multi-dimensional art design category, web design is not only a page design that satisfies the traditional visual impact, but also requires humanization and user-centered remote communication art, which is the new network art of web design. central element of the design.

The Xingcheng Ancient City Digital Website is a project to develop the ancient city's architectural cultural heritage based on digital technology. It visually translates the Xingcheng historical and cultural relics and its contextual genetic genealogy map that were sorted out earlier, and through the construction of a digital website system, to achieve Digital dissemination to better protect and inherit the ancient city culture. Through the development of digital systems, we will use them in museums, educational classrooms, communities and other places to conduct experimental research to ensure the continuation of culture and the inheritance of traditions, and to target the learning styles and cultural interests of the new generation to be more attractive. Convey cultural content in a human way and promote exchanges and dialogues between different cultures. At the same time, the feasibility of this system will be finally tested and analyzed to achieve better inheritance and protection.

5.2 Discussion

5.2.1 Discussion on research objectives

5.2.1.1 Discussion on the history and development of Xingcheng Ancient City

Fan,X. Y. (2012) Taking the entire city of Xingcheng as a carrier, it summarizes the origin of Xingcheng city and the current anti-war situation, mainly

focusing on the city's Feng Shui, city celebrities and other aspects. (Wang, S. L.,2022) Conduct research on the evolution of the military settlement system of the Liaodong Town Guard Station on the Great Wall of the Ming Dynasty, and focus on a certain culture at a certain stage for in-depth discussion. (Liu, P. L.,2014) From the perspective of the changes in the historical features of the ancient city, it focuses on analyzing the impact of modernization on the historical features of the ancient city. The above research provides us with theoretical basis for historical development from different perspectives.

The difference of this study is that it conducted a comprehensive study on the overall history of the ancient city of Xingcheng. From the founding of the ancient city of Xingcheng to the feudal period, and after the development of the prosperous age of Kangxi, the ancient city went through stages of change from a military stronghold to a defunct defense; The period of the Republic of China was a period full of wars and changes ; from the founding of New China to the socialist construction of New China, it entered a period of reform and development. From reform and opening up to the present, it is a period of cultural protection, inheritance and modernization. In summary, through the division of historical context, we can more clearly see the social history and meaning changes of the ancient city at each stage. These contents shape the value of the ancient city.

5.2.1.2 About the digital protection and inheritance of ancient city cultural heritage

With the acceleration of China's modernization process, both ancient city protection and cultural heritage inheritance are facing more severe challenges. Traditional building construction techniques play an important role in the protection of ancient cities. Due to insufficient knowledge of relevant theories, the focus of ancient city protection is limited to static protection and restoration of cultural relics, while neglecting the protection of architectural cultural heritage in the ancient city. The protection and inheritance of traditional buildings are an important prerequisite for the continuation and development of the ancient city. Therefore. The relationship between the two should be re-understood to more effectively promote the protection of ancient cities and the inheritance of cultural heritage. In the past thirty years, our country has attached great importance to research related to the theory and technology

of cultural heritage digitization. Experts and scholars have collaborated to implement many research projects, hoping to further promote the digitalization of cultural heritage. Some of the substantive research projects carried out have achieved remarkable results. The well-known digitization projects in China are mainly Beijing's Digital Forbidden City (2004) and Digital Old Summer Palace (2006), Gansu's Digital Dunhuang (2006), etc. Dunhuang and the Forbidden City are pioneers in the digital protection of China's historical and cultural landscapes, and their digital protection work has achieved remarkable results. Among them, the Digital Dunhuang project realizes the virtual restoration of precious cultural heritage such as murals, which is amazing and meets the needs of diversified creation of culture and art. Since the beginning of this century, the Forbidden City has cooperated with Japan Toppan Printing Company, using digital technology to collect three-dimensional data of ancient buildings and cultural relics, restoring the original style of ancient building scenes and realizing virtual reproduction of cultural relics, allowing us to have technical support for in-depth exploration of the Forbidden City architecture.Subsequently, they collaborated again and successfully produced the first large-scale documentary in China relying on high-end digital technology in less than a month, namely "Beijing's Forbidden City: The Emperor's Palace" based on virtual reality technology. As the new media team grows stronger, Beijing continues to explore innovations based on the Digital Forbidden City project and develops various interesting terminal games. At the same time, it also develops various types of business software APPs, creative products and popular public accounts. It not only enhances the visibility of the cultural heritage of the Forbidden City, but also broadens the commercial channels for the Forbidden City culture.

In 2009, Tsinghua Tongheng Planning Institute, where Professor Guo Dada from the School of Architecture of Tsinghua University worked, decided to bring together two professional teams of historical research and digital technology to carry out the Old Summer Palace scientific research project "Representing the Heritage", integrating and transforming the academic research of the Old Summer Palace through digital technology. In 2013, the team specially produced the English version of the app "Recreating the Old Summer Palace" at the "Asian Research Annual Conference" held in the United States. International scholars highly

recognized the value of research in displaying oriental architecture and culture. The following year, domestic scientific research institutions achieved a 90% virtual restoration of the Old Summer Palace. Mainly through high-end information technology such as digital true three-dimensional modeling, we store and organize documents in the form of databases, scan and restore design drawings, and restore relevant research on many important scenic spots and spatial units of the Old Summer Palace.

In addition, Wang, X. F. et al.(2009).Explored the application of digital technology in the protection of Hebei folk paper-cut art. Zhang Y. et al.(2010) used digital technology to study the ruins of Ganquan Palace, a garden in the Han Dynasty, to open up new ways for garden landscape protection. Li, Y. Q. et al.(2012) conducted a three-dimensional digital modeling of the Qiyun Pagoda of White Horse Temple, and studied how digital technology can be applied in the protection of large-scale ancient architectural cultural relics. Wang,H.Y,Liu, Z.F.(2015) A studied the specific application of digital technology in the architectural landscape protection of Nanjing in the Republic of China. Feng, Y. L,Wu, S. M. (2018) Studied how digital technology is applied in the protection of ancient buildings in Huizhou, and presented the research results. Bai, L,Zhang, X. H. (2018) When studying the protection issues of Tibetan Buddhist buildings in Inner Mongolia, they collected and organized data to establish a database to lay the foundation for further digital protection. Zhao, B. B,Zhao, P. (2018) Demonstrated the application of digital technology in the protection of architectural cultural heritage through digital research on Fengguo Temple.

Through sorting out and analyzing the current research status, it can be found that the main problems existing in the current related research include the following two aspects:

(1) The applicable model for digital protection and inheritance of traditional architectural techniques is still unclear. At present, although digital technology has achieved a lot of results in the field of research and practice of cultural heritage protection and formed a certain protection model and methodology system, the research on ancient architectural cultural heritage is still in its infancy and development, and has not yet explored the methods and methods related to cultural heritage. appropriate and systematic conservation and development model.

(2) Domestic and foreign scholars have conducted a large number of applied research on digital technology in the field of cultural heritage protection, and have also achieved fruitful research results. However, cultural heritage covers a wide range. Most scholars' research focuses on the field of intangible cultural heritage protection, and many scholars' research focuses on the field of material cultural heritage. However, few scholars have conducted research on the cultural genes contained in ancient buildings. Digital conservation research.

To sum up, this article, based on previous mature research results on the use of digital technology in cultural heritage protection, extends the research object to the cultural genes behind ancient buildings. By sorting out the historical context, architectural style, architectural space and architecture Art, sort out and extract it through cultural gene theory, create the unique cultural gene of the ancient city to protect and inherit the culture of the ancient city, and through the design and development of digital websites, we hope to enrich the application cases of digital technology in the field of cultural heritage protection.

5.2.2 New knowledge

5.2.2.1 Construction of Xingcheng Ancient City Architectural Gene Genealogy Based on Cultural Gene Theory

Scholars have studied cultural genes at different levels. In the direction of Chinese cultural genes, (Liu, C. L.,1989) believed that the traditional Chinese way of thinking is the essence of the Chinese nation's cultural genes. The study summarized and sorted out the content of traditional Chinese thinking methods, using philosophy, Multidisciplinary case facts such as psychology and thinking science analyze Eastern and Western cultures and male and female thinking. In terms of urban cultural genes (Zhang, H. Y. 2003), it is proposed that understanding urban cultural genes and social genes is a new perspective for understanding urban development. Since the cultures produced by cities in different eras and regions are different, the ways and degrees of future evolution of different cities are also different. In the analysis, protection and inheritance of cultural genes of traditional villages, (Zhao, Y. Q. et al.,2015) used cultural genes as a research perspective and big data as a research method to study and discuss the protection of traditional villages, and constructed a big data platform to protect the cultural genes of traditional villages. Four key links, (Huang, H. L. et al.

2018). Believes that it is very difficult to protect and inherit culture in villages. The author conducted a research and investigation on Yuankeng Ancient Town through the cultural gene theory. In addition, the analysis and structure of the cultural genes of Yuankeng Village are conducive to more Carry out targeted protection, restoration, inheritance and other work on local issues. In Architecture and Cultural Genes (Yang, D.Y.,2011), an overview of the relationship between residential architecture and traditional culture was conducted, and the relationship between regionality, nationality and cultural genes was studied, and the importance of culture in the inheritance of residential architectural characteristics and Creativity narrates. Chose cultural genes as the starting point of the paper to conduct research and analysis on the characteristics and cultural connotations of yurt architecture. In addition, by exploring cultural inheritance models under different categories, corresponding strategies are provided for the protection and modern inheritance of yurt architecture. In the research on the construction and application of cultural gene maps (Liu, P.L.,2011), from the perspective of "cultural genes", a comprehensive and comprehensive study of traditional settlement landscapes from the inside to the outside was conducted to form a genetic map, which provides important ideas for landscape gene research. (Ji, C. X.,2019) Based on the theory of cultural genes, this article classifies and analyzes the cultural genes and connotations of Dai lacquerware, and translates it into a genetic map to explore the rules for map compilation. In new technologies and cultural genes, (Zhao, Y. Q. et al. 2015) closely combines cultural genes with big data, uses a wide range of data to conduct relevant research on traditional villages in my country, provides basic preparations for big data application research, and builds an open big data Data platform ideas.

To sum up, this study focuses on the four building groups of the ancient city's national key cultural relics protection units, carries out a basic system structure of the cultural genes of the building groups, analyzes the history and development of the ancient city, and conducts specific cultural element analysis of each building group, based on the logic of gene and carrier transmission, the basic pedigree diagram framework of each building is constructed. Through the investigation of existing physical space entities, combined with ancient books, documentary materials, and field interviews, the cultural genes of ancient city buildings are analyzed and

extracted, and the cultural genes are summarized and organized to obtain the cultural genes. The genetic genealogy diagram is used for the information visualization creation part of the digital website.

5.2.2.2 Information visualization translation of ancient city cultural gene genealogy map

In 2005, Tsinghua University established the Department of Information Art Design. Under the chairmanship of Professor Lu Xiaobo, it conducted extensive theoretical research and practical exploration in the fields of mobile service design and information interaction design, inspiring people to use a humanistic scale to understand the existence of human society. Think critically about the status and development trends, and encourage people to examine the rational digital world with artistic and perceptual thinking. The book "Information Design" (2010) written by Xiao Yong of the Central Academy of Fine Arts and others explains the concept and content of information design, and explains the application elements and graphic symbols of information design.

The paper of Tsinghua University (Qin, J. Y. 2006) takes digital cultural heritage projects as the management object, information philosophy as the thinking, information visualization as the design method, and information technology as the means to explore the design feasibility of cross-disciplinary cooperation in the digital protection and inheritance of cultural heritage. (Liu, W. et al.,2003) co-authored "Research on Text-Based Information Visualization Methods" and (Lu, X. B.,2001) wrote "New Directions in the Development of Information Society Design Discipline—Information Design" and "Flying Lines—Information" "The Positioning and Social Function of Art Design" (2005) and "Research and Application Examples of Interaction Design in Information Visualization" (2011) respectively started from the new direction of the information design discipline and the positioning of information visualization, and interpreted information in the field of design expertise. The origin and development of visualization. Anhui Jianzhu University (Yuan, J. J.,2022), from the perspective of cultural and tourism integration, explores the development direction of the memorial hall's information visualization design combined with aesthetics, technology, etc., and builds a theoretical framework for the memorial hall's information visualization design. Lanzhou University (Liu, S. 2020)

extracted and redesigned the information of solar terms culture, a world-class intangible cultural heritage, and combined design techniques such as balance and variation, opposition and unity to explore design works that are easy to read and have artistic beauty. Hainan University (Lin, M. Y. 2021) used Hainanese, a local language, to conduct information visualization design to visually reshape the language, improve the readability and interest of Hainanese, and expand its communication scope and cultural influence.

In summary, information visualization design has specific applications in many cultural heritages, but there is a temporary vacancy in information visualization design about the cultural heritage of Xingcheng Ancient City. This study is based on the cultural gene analysis and information visualization design of Xingcheng Ancient City to explore how to use Information visualization enriches the design and development of the ancient city's digital website, presenting the unique cultural genes of the ancient city to the public to increase awareness of its historical value and cultural inheritance. This study uses the concept of cultural genes to sort out and find innovative design strategies suitable for analyzing cultural genes that form ancient city buildings, thereby promoting the protection and dissemination of cultural heritage.

5.2.2.3 Efficiently disseminate cultural knowledge through digital means and technology

In today's era, culture has increasingly become an important source of national cohesion and creativity, and an important support for economic and social development. Enriching spiritual and cultural life has increasingly become the people's ardent desire. At the same time, numbers are no longer just about calculations, and computing is no longer just about computers. The prediction made by the great futurist Professor Negroponte years ago has become a reality, and "digits" have now penetrated into Within our pores, human beings have begun to live digitally. Digital survival has brought unprecedented opportunities to all walks of life, including the protection and inheritance of historical and cultural resources.

The Lasswell model mainly focuses on the description and control of the communication process. Lasswell believes that communication is a purposeful behavior. Therefore, the Lasswell model attaches great importance to its propagation

effect. For the digital communication of cultural heritage, “Successful awareness communication means effective control of communication, comprehensive communication of culture, utilizing the advantages of various media, targeting recipients with different interests, using a unified and distinctive image, and actively Active cultural dissemination can achieve long-term effects and promote the healthy development of tourism."

The effects of this cultural dissemination mainly depend on the following aspects:

1. The organizers and organizational methods of cultural communication are clear, and the communication practice is mainly target ed at educated groups, local residents, museums, etc.

2. Make full use of the advantages of the media for relevant communication

3. The communication objects have clear goals and pertinence

5.3 Suggestions

5.3.1 Suggestions on research results

This study conducted an in-depth discussion on the architectural form, architectural space, architectural art and the cultural connotation behind the four building groups of the national key cultural relics protection units in the ancient city of Xingcheng. Through a large number of ancient books, history books, and modern works combined with field surveys and visits, detailed research was conducted, providing valuable materials for the protection and inheritance of the cultural heritage of Xingcheng Ancient City. However, due to time and cost constraints, researchers are unable to build a larger digital system and study the entire ancient city's buildings. They can only focus on the most representative buildings in the ancient city and explore their cultural connotations to build a digital website.

Digital websites are an effective way to protect and pass on culture. This study sorted out the gene pool for the four building systems of the national key cultural relics protection units in Xingcheng Ancient City. The results of this study can be promoted online so that more people can participate, and at the same time, private

institutions and individuals can be encouraged to provide funds. support so as to jointly deal with cultural protection.

Secondly, this research will also help local cultural relics protection-related management departments, governments, scenic spots, etc. to carry out and promote digital communication, so that the interaction of digital websites can be widely promoted in surrounding museums and schools, thereby ensuring the inheritance of cultural education. Help schools and some educational institutions better protect and inherit the unique culture of the ancient city.

Finally, this digital website is also based on a popular science website, which contains information data and resources about Dalian. Through the exchange of information resources, international cultural exchanges can also be expanded, and digital technology can be used to more effectively spread and inherit the ancient city culture.

In summary, in terms of the breadth of the research, the number of samples can be increased to conduct a more comprehensive study of the ancient city; in terms of the difficulty of the research, the precise carrier location of each cultural gene in the ancient city can be investigated in depth and a distribution map of cultural genes can be drawn; In terms of the depth of research, digital websites can have more substantial content, be updated at any time, and build a cultural gene database of the entire ancient city.

5.3.2 Suggestions for future research

In order to further study and excavate the culture of the ancient city and promote the digital protection and inheritance of the ancient city, future researchers can adopt the following suggestions.

1. Construct a theoretical system for ancient city culture excavation. Theory supports practice and is the basis for carrying out specific work. Different geographical conditions and historical backgrounds have created unique historical and cultural cities. Most of the current studies are cultural excavations and generalizations of specific areas. Various disciplines should be combined to further analyze and explore the cultural elements of ancient cities, analyze and classify them in detail, and construct a universal Theoretical framework of sexuality;

2. Optimize the comprehensive part of the ancient city's history and humanity in the digital website. Enrich the content library of the platform;

3. The platform integrates historical and cultural information and digital ancient city models. However, with the rapid development of visualization and interaction, it is necessary to optimize and update the website in real time to find the best way to achieve visualization and interaction.

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APPENDIX

APPENDIX A

Key Informants

Title: Xingcheng Ancient City: The Digital Protection and Inheritance of the Early Qing Dynasty Cultural Heritage in Liaoning

Name:_____ Age:_____ Gender:_____。

Occupation:____ Time:_____ Place:_____。

1. How did you become a member of the ancient city management or operator?
2. What are your most critical job responsibilities in the ancient city?
3. What specific measures have been taken to protect cultural heritage?
4. How do you see the sustainability of the ancient city?
5. Have you considered digital inheritance projects to protect and pass on the cultural heritage of the ancient city?
6. What are the main challenges you face in the management of the ancient city?
7. Does the ancient city currently work with local communities to ensure that management meets community needs and expectations?
8. Has community participation had a positive impact on the sustainable management of the ancient city?
9. How do you think digital technology will help the future cultural heritage inheritance of the ancient city?
10. How do you balance the relationship between tourism development and cultural protection?
11. Do you promote cultural education projects and cultural heritage plans?
12. What is the most important inheritance direction in the digital inheritance of ancient city cultural heritage?

APPENDIX B

Casual Informants

People engaged in digital media arts

Title: Xingcheng Ancient City: The Digital Protection and Inheritance of the Early Qing Dynasty Cultural Heritage in Liaoning

Name:_____ Age:_____Time:_____。

Occupation:____ Place:_____。

1. What is your academic background and professional training?

2. How did you enter the field of digital inheritance of cultural heritage?

3. Please share the cultural heritage digital inheritance projects you have been or are currently involved in, including your role and contribution.

4. What digital technologies or tools did you use in your projects? ?

5. Which technologies do you think have the most potential for the digital inheritance of cultural heritage?

6. What is the importance of digital inheritance for the protection and inheritance of cultural heritage?

7. In digital inheritance projects, how do you ensure the accurate presentation and transmission of cultural heritage?

8. Do you work with local communities to ensure digital heritage projects meet community needs and expectations?

9. Has digital inheritance driven local residents' participation in and attention to cultural heritage?

10. What do you think of the current development trend in the field of digital inheritance of cultural heritage?

11. Can digital inheritance help improve the sustainability of cultural heritage?

12. Do you have any other experiences or opinions about the digital inheritance of cultural heritage that you would like to share?

APPENDIX C

General Informants

Title: Xingcheng Ancient City: The Digital Protection and Inheritance of the Early Qing Dynasty Cultural Heritage in Liaoning

1.Your name:

2.Your age:

3.Your gender:

4.Your occupation:

5. Which province and city are you from:

6. Do you think there is something unique about the protection of the cultural heritage of Xingcheng Ancient City?

□ Yes □ A little bit □ No

7. Which architectural system in Xingcheng Ancient City do you like best?

□ city wall system □ temples □ Bell and Drum Tower □ Ishibos

□. others

8. Do you know about the cultural heritage of Xingcheng Ancient City?

9. In your daily life, do you pay attention to the inheritance of cultural heritage?

10. Will you post photos of ancient city buildings on the Internet when you return?

11. What forms of interaction are you interested in in the inheritance of digital cultural heritage?

12. What do you think is the best thing about the current digital inheritance of ancient city cultural heritage?

APPENDIX D

Xingcheng Ancient City digital website design needs

Understanding User Group

Usage User Group

Research User Group

1.Have you learned about the architectural culture of Xingcheng Ancient City before?

□ Very knowledgeable

□ Understand something

□ Don’t know much about

□ Don’t understand at all

2. What are your hobbies and needs?

□ Entertainment and leisure, quick browsing of information

□ In-depth understanding of cultural connotations

□ Understand the relevant fields of the ancient city and obtain detailed information

3. What content do you most want to see on Xingcheng Ancient City’s digital website?

□ Basic information on architectural remains, landscapes, ecology, etc.

□ Folklore, historical stories and other cultural connotations

□ In-depth content such as protective measures and research results

4. In what ways do you hope to experience the architecture of Xingcheng Ancient City?

□ Traditional display methods such as pictures and videos

□ Data visualization, infographics, etc.

□ Interactive information visualization

5. What suggestions do you have for interaction in digital website presentations?

□ More information translated through visualization

□ Real scenes and human-computer interaction

□ Fresh and interesting interface

6. What kind of design style are you looking forward to for Xingcheng Ancient City's digital website?

□ Work clearly and concisely

□ Reasonable and unified collocation

□ Accurate interpretation of graphics

□ Interesting visual language

7. In specific architectural visualization translation, which style do you prefer?

□ Simple and modern

□ Traditional Classical

□ Art illustration

□ Others————

8. What aspects are you most concerned about regarding the protection and inheritance of the ancient city?

□ Current situation of the ancient city

□ Protection measures and policies

□ Protection technology and methods

□ Awareness of social participation

List of interviewees

key informant					
Serial Number	**Name**	**Gender**	**Role**	**Age**	**Remark**
1	Li Mou	Male	Government staff 1	59	Unable to remark full name due to work reasons
2	Li Moumou	Male	Government staff 2	48	
3	Jin Moumou	Male	Government staff 3	37	
4	Zhang Huanxi	Male	Director of Xingcheng Folklore Museum	57	
5	Zheng Hui	Female	Person in charge of the ancient city	45	
Casual Informant					
Serial Number	**Name**	**Gender**	**Role**	**Age**	**Remark**
1	Lin Xiaoxi	Female	College teacher/digital media major	35	
2	Feng Meizi	Female	Student/Digital Media Major	20	
3	Wang Jianmin	Male	Intangible genetic inheritors	67	
4	Wang Guimin	Male	Intangible genetic inheritors	82	
5	Ou Jiantao	Male	Student/Digital Media Major	20	
6	Fang Yanqing	Female	College teacher/digital media major	45	
7	The sky will come	Male	Designer/Digital Media Major	31	
8	Zhang Tong	Male	photographer	36	
9	Gao Kun	Male	Designer/Digital Media Major	38	

10	Yang Xiaofeng	Male	Government officials	51	
11	Du Xuebin	Male	Government officials	39	

General Informant					
Serial Number	**Name**	**Gender**	**Role**	**Age**	**Remark**
1	Wang Kehao	Male	Elementary school students/tourists	12	
2	Yang Yu	Male	designer/tourist	29	
3	Fang Shengyu	Male	community residents	71	
4	Wang Hongfei	Female	Parents/tourists of primary school students	11	
5	Sun Zhiqiang	Male	community operator	51	
6	Wang Peng	Male	Senior high school students/tourists	17	Want to apply for archeology major in university
7	Wang Zidan	Female	Middle school students/tourists	14	
8	Gao Kexin	Female	Middle school students/tourists	14	
9	Shi Ximei	Female	community sanitation worker	64	
10	Cai Dongchen	Female	We-media workers/tourists	35	
11	Chen Jian	Male	Security personnel at the south gate of the ancient city	49	
12	Ye Lei	Female	ancient city conductor	42	

Li Mou, Government staff 1, online interview on May 3, 2022, offline interview on March 6, 2023

Li Moumou, Government staff 2, online interview on May 3, 2022, offline interview on March 6, 2023

Jin Moumou, Government staff 3, online interview on May 3, 2022, offline interview on March 6, 2023

Zhang Huanxi, Director of Xingcheng Folklore Museum, online interview on July 6, 2022, offline interview on March 6, 2023

Zheng Hui, Person in charge of the ancient city, online interview on July 6, 2022, offline interview on March 6, 2023

Lin Xiaoxi, university teacher/digital media major, online interview on April 11, 2022, offline interview on August 23, 2022

Feng Meizi, student/digital media major, March 6, 2023

Wang Jianmin, inheritor of intangible cultural heritage, online interview on February 6, 2023

Wang Guimin, intangible genetic person, February 6, 2023

Jiantao Ou, student/digital media major, March 6, 2023

Fang Yanqing, university teacher/digital media major, online interview on April 11, 2022, offline interview on August 23, 2022

Day Will Come, Designer/Digital Media Major, March 6, 2023

Zhang Tong, photographer, February 6, 2023

Gao Kun, designer/digital media major, February 6, 2023

Yang Xiaofeng, government official, online interview on November 3, 2022

Du Xuebin, government official, online interview on November 3, 2022

Wang Kehao,Elementary school students/tourists February 8, 2023

Yang Yu, designer/tourist, February 8, 2023

Fang Shengyu, community resident, February 8, 2023

Wang Hongfei, Parents/tourists of primary school students, February 8, 2023

Sun Zhiqiang, community operator, February 8, 2023

Wang Peng, Senior high school students/tourists, August 6, 2022

Wang Zidan, Middle school students/tourists, February 8, 2023

Gao Kexin, Middle school students/tourists, February 8, 2023

Shi Ximei, community sanitation worker, August 6, 2022

Cai Dongchen, We-media workers/tourists, October 8, 2023

Chen Jian, Security personnel at the south gate of the ancient city, August 6, 2022

Ye Lei, ancient city conductor, August 6, 2022

SCRIPT

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.EventSystems;
public class ModelCtrl : Nonbehavioral
{
//用来获取模型画面的摄像机
public Camera modelCamera;
//起始位置、鼠标按下的位置、鼠标按下的滑动距离、鼠标抬起后和初始位置的距离
private Vector3 startPosition, previousPosition, offset, finalOffset;
//计时器，在一定的时间内双击有效
//private float time = 0f;
//计数器
//private int count = 0;
//放缩模型
bool isInit;
Vector3 touch1, touch2, oriPos, pos, resetPos, resetCameraPos;
//float scale, disX, disY, oriScale;
public float scaleSpeed = 1;
public bool isLimitScale;
public float min, max;

//拖拽模型
private Vector3 AOTIScreen; //用来获取物体在屏幕的坐标
private Vector3 MouseStartScreen; //用来获取鼠标按下时在屏幕的位置
```

```
private Vector3 MouseNewScreen;  //用来获取鼠标按下时每帧的位置
private Vector3 valueScreen;  //用来获取偏移量

private void Awake()
{
    resetPos = transform.position;
    resetCameraPos = modelCamera.transform.position;
}

private void Update()
{
    if (Input.GetMouseButton(0))//点击鼠标左键，可以旋转查看模型
    {
        Rotate();
    }

    //Scaling();

    if (Input.GetMouseButton(1))//点击鼠标右键，可以拖拽移动模型
    {
        Move();
    }
}

//旋转模型
public void Rotate()
{
    //左右旋转&上下旋转
```

```
        if (Input.GetMouseButtonDown(0))     // Input.GetMouseButtonDown(0) 当0键
被按下一次
        {
            startPosition = Input.mousePosition;
            previousPosition = Input.mousePosition;
        }
        if (Input.GetMouseButton(0))      // Input.GetMouseButton(0) 当0键被按住持续
侦测(包含down和up各一次)
        {
            offset = Input.mousePosition - previousPosition;
            previousPosition = Input.mousePosition;
            if (Mathf.Abs(offset.x) >= Mathf.Abs(offset.y))
            {
                transform.Rotate(Vector3.Cross(new Vector3(offset.x, 0, 0),
                    Vector3.forward).normalized, offset.magnitude*0.1f, Space.World);
            }
            else
            {
                transform.Rotate(Vector3.Cross(new Vector3(0, offset.y, 0),
                    Vector3.forward).normalized, offset.magnitude*0.1f, Space.World);
            }
        }
        if (Input.GetMouseButtonUp(0))    //Input.GetMouseButtonUp(0) 当0键放开一
次
        {
            finalOffset = Input.mousePosition - startPosition;
        }
    }
```

```
//放缩模型
public void Scaling()
{
  //if (Input.GetMouseButtonDown(0))
  //{
  //    count++;
  //    //当第一次点击鼠标，启动计时器
  //    if (count == 1)
  //    {
  //        time = Time.time;
  //    }
  //    //当第二次点击鼠标，且时间间隔满足要求时双击鼠标
  //    if (2 == count && Time.time - time <= 0.5f)
  //    {
  //        transform.localScale = new Vector3(1.5f, 1.5f, 1.5f);
  //        count = 0;
  //    }
  //    //当第三次点击鼠标，且时间间隔满足要求时三击鼠标
  //    else if (3 == count && Time.time - time <= 1.0f) ;
  //    {
  //        transform.localScale = new Vector3(1.0f, 1.0f, 1.0f);
  //    }
  //    if (Time.time - time > 1.0f)
  //    {
  //        count = 0;
  //    }
  //}

  if (Input.touchCount != 2)
  {
```

```
            isInit = false;
        }
        //初始化
        if (Input.touchCount == 2 && !isInit)
        {
            //两指点位
            touch1 = Camera.main.ScreenToWorldPoint(Input.GetTouch(0).position);
            touch2 = Camera.main.ScreenToWorldPoint(Input.GetTouch(1).position);

            //目标初始点位
            oriPos = new Vector3(transform.position.x, transform.position.y, 0);

            //两指中点
            pos = new
Vector3((Camera.main.ScreenToWorldPoint(Input.GetTouch(0).position).x +
Camera.main.ScreenToWorldPoint(Input.GetTouch(1).position).x) / 2,
(Camera.main.ScreenToWorldPoint(Input.GetTouch(0).position).y +
Camera.main.ScreenToWorldPoint(Input.GetTouch(1).position).y) / 2, 0);

            //两指中点和目标距离
            disX = pos.x - oriPos.x;
            disY = pos.y - oriPos.y;
            oriScale = transform.localScale.x;

            isInit = true;
        }
        if (Input.touchCount == 2)
        {
            //两指缩放比例
```

```
            scale =
Vector3.Distance(Camera.main.ScreenToWorldPoint(Input.GetTouch(0).position),
Camera.main.ScreenToWorldPoint(Input.GetTouch(1).position)) /
Vector3.Distance(touch1, touch2);

            //利用scaleSpeed控制缩放速度
            scale = (scale - 1) * scaleSpeed;

            //给缩放比例加限制
            if (isLimitScale && this.transform.localScale.x <= min && scale < 0)
                return;
            if (isLimitScale && this.transform.localScale.x >= max && scale > 0)
                return;

            //缩放目标大小
            this.transform.localScale = new Vector3(oriScale + scale, oriScale + scale,
oriScale + scale);
            //改变目标位置，让位置保持不变
            transform.position = new Vector3(oriPos.x - ((this.transform.localScale.x -
oriScale) * disX), oriPos.y - ((this.transform.localScale.y - oriScale) * disY), 0);
        }
    }

    //拖拽模型
    public void Move()
    {
        //1.首先将物体从世界坐标转为屏幕坐标
        AOTIScreen = Camera.main.WorldToScreenPoint(transform.position);
        //2.获取鼠标在屏幕坐标的偏移量
```

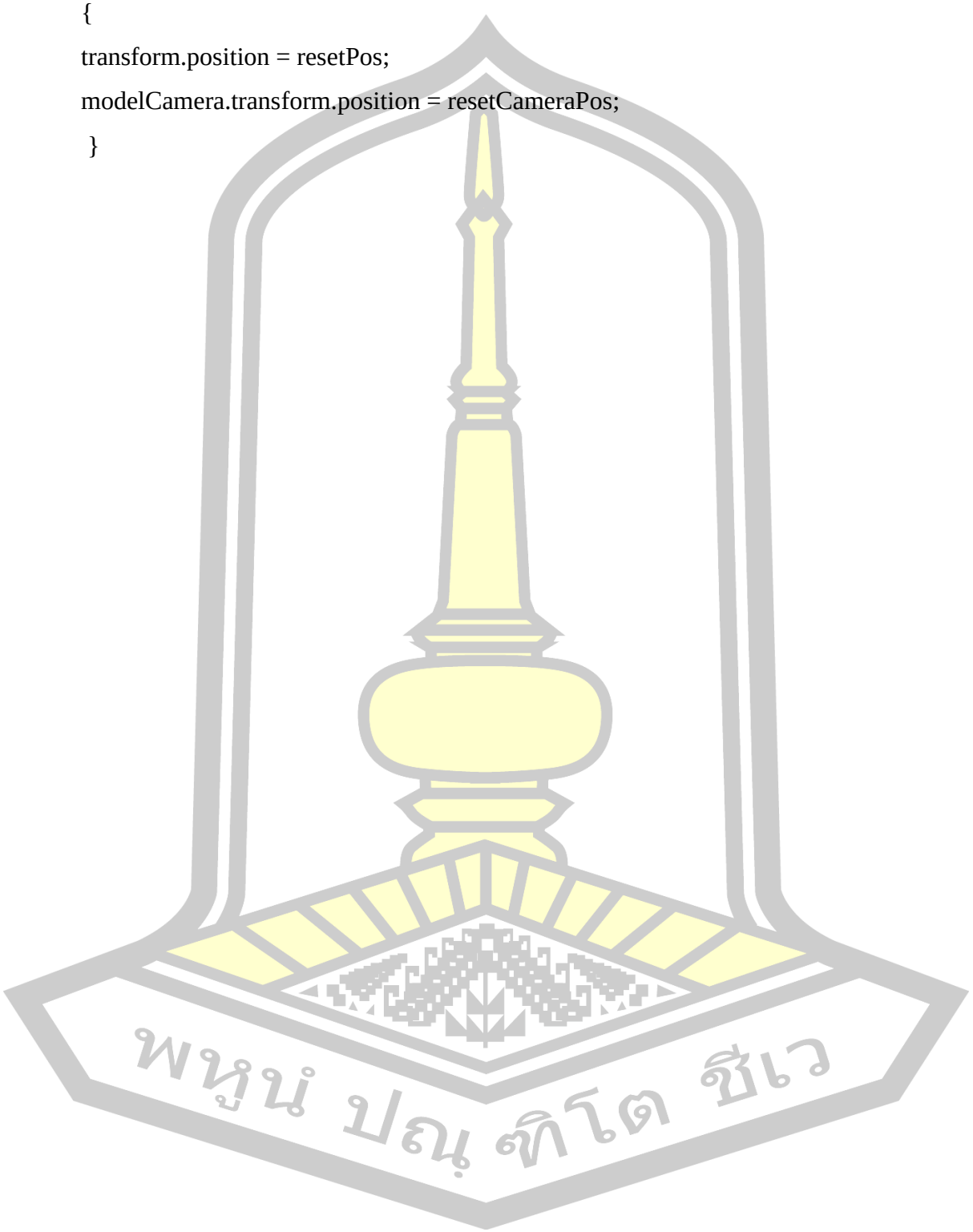
```
        if (Input.GetMouseButtonDown(1))
        {
            MouseStartScreen = new Vector3(Input.mousePosition.x,
Input.mousePosition.y, AOTIScreen.z);
        }
        MouseNewScreen = new Vector3(Input.mousePosition.x,
Input.mousePosition.y, AOTIScreen.z);
        if (MouseNewScreen != MouseStartScreen)
        {
            valueScreen = MouseNewScreen - MouseStartScreen;
            //3.将偏移量给物体
            transform.position = Camera.main.ScreenToWorldPoint(AOTIScreen +
valueScreen);
        }
        MouseStartScreen = MouseNewScreen;
    }

    //激活本模型（每个模型都要挂载该脚本）
    public void ActiveSelf()
    {
        this.gameObject.SetActive(true);
    }

    //失活本模型（每个模型都要挂载该脚本）
    public void DeactiveSelf()
    {
        this.gameObject.SetActive(false);
    }

    //重置模型位置
```

```
    public void ResetPos()
{
transform.position = resetPos;
modelCamera.transform.position = resetCameraPos;
 }
```



BIOGRAPHY

NAME	Yijia Sun
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