

Research on the Spatiotemporal Evolution of Urban Historical Landscapes from the Perspective of Cultural Genes: A Case Study of Changting, Fujian

Zhefeng Lin^{1,a}, Jiangang Xu^{1,b,*}

¹*School of Architecture and Urban Planning, Nanjing University, Nanjing, 210093, China*

^a*zhefeng-lin@smail.nju.edu.cn*, ^b*xjg129@sina.com*

**Corresponding author*

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Abstract: In the context of cultural confidence, the new development stage of the era puts forward new requirements for the protection, renewal, and development of historical cities. This paper attempts to adopt the perspective of cultural genes, introducing the concept of cultural genes. Through the evolutionary characteristics of urban historical landscape space, it explores the inherent principles of cultural gene generation. A cultural gene map is constructed from both material and non-material culture. Based on the analysis of the cultural gene map, it is divided into three categories: primitive genes, replicative genes, and variant genes. According to these three gene types, three paths of cultural gene inheritance are proposed: gene protection, gene implantation, and gene recombination. Using the inheritance mechanism of cultural genes, this study takes Changting, a national historical and cultural city, as an empirical object, guiding the organic renewal of historical and cultural cities and providing scientific decision-making basis and reference for the planning and development of historical and cultural cities.

The spatial layout of historical and cultural cities, as an important cultural form in the past, has become a concentrated reflection of the long history, splendid culture, and national spirit of the Chinese nation, with its unique cultural atmosphere, spatial characteristics, and distinctive regional cultural landscapes. However, with the progress of urbanization in China, the pace of urban construction has accelerated. Many cities, in the process of reshaping their landscapes, gradually lose their unique regional cultural landscape features and connotations. The Central Urbanization Work Conference once proposed the idea of allowing residents to 'see mountains, see water, and remember hometown memories,' indicating the urgent need to address the protection and inheritance of regional cultural genes in ancient towns.

Against this background, this study is based on the spatiotemporal evolution of urban historical landscapes and introduces the concept of 'cultural genes.' Here, 'cultural genes' are defined as the developmental laws of the spatial form of urban historical landscapes and the key influencing factors in their evolution. The study explores the historical context of diverse cultural evolution. It comprehends the overall cultural ecology of the ancient city. Finally, it provides a reference for

planning strategies for the development and transformation of cultural heritage cities.

1. Overview of Cultural Gene Theory

1.1. Conceptual Content of Cultural Genes

The concept of 'cultural genes' was first proposed by American anthropologists Kroeber and Kluckhohn^[1]. In 1976, Richard Dawkins formally introduced the concept of cultural genes (Meme) in his book 'The Selfish Gene,' which marked the first combination of culture and genes. He identified it as the 'basic unit of cultural transmission and imitation'^[2]. Dawkins argued that the transmission of culture is similar to genetic transmission because genetics involves internal transmission of biological reproduction, relying on the mutation, replication, and recombination of genes. In contrast, culture is not directly controlled by cellular genes; it has its own culture and its own replicating gene patterns^[3].

The study of 'cultural genes' in China began with the translation of 'The Selfish Gene' in 1981. Various domestic scholars have conducted extensive research on the nature of cultural genes. In 1990, Liu Changlin proposed that the cultural system itself carries unique genes, known as cultural genes, which influence the development and thinking of urban development^[4]. Some scholars have connected the study of cultural genes with traditional Chinese culture, suggesting that the path and characteristics of China's entry into civilization are different, leading to the formation of distinct cultural genes^[5]. Liang Henian believes that cultural genes possess uniqueness, authenticity, and inheritability^[6]. Scholars have also discovered cultural genes from the perspective of landscape research, introducing them into the concepts of urban landscapes, city blocks, and architecture^[7]. Although the connotations of 'cultural genes' may differ in Eastern and Western contexts, both consider cultural genes as the fundamental unit of cultural inheritance. Similar to biological genes, processes such as the replication, recombination, and expression of genes require material media to be realized. Cultural genes also need certain genetic media to form observable and tangible cultural phenomena. Using historical cities as carriers and elements such as the landscape pattern, residential architectural features, and folk skills, cultural genes' information transmission is achieved.

1.2. Development of Urban Historical Landscapes

The Historical Urban Landscape (HUL) is a new theory that has gradually emerged in the fields of cultural heritage conservation and urban planning in recent years. It was first proposed and promoted by UNESCO^[8] and serves as a comprehensive approach to guide historical cities in addressing the contradictions between conservation and development^[9]. The universality of sustainable development research for cultural heritage cities and its theoretical framework is first discussed. Subsequently, through an analysis of the historical development and urban protection planning of the Hakka county town in western Fujian and the Changting cultural area, there is an expansion and improvement of the protection connotation and system of urban material and non-material heritage. This allows for the realization of the value cognition of historical cities, as well as innovation and development in protection planning theory and methods. The HUL theory, as a research and planning practice method, is widely applied to protection method explorations at different hierarchical scales, such as historical cities, historical cultural districts, historical buildings, heritage routes, and more. The research content mainly focuses on heritage value interpretation, highly controlled urban character, urban design, protection planning compilation, and exploration of methods. It also includes experience research on tourism route and facility planning and urban protection management.

2. Decomposition and Refinement of Cultural Genes in Changting Ancient City

2.1. Construction and Analysis of the Ancient City Cultural Gene Map

Combining on-site investigations of the ancient city with extensive reviews of ancient literature, as well as modern and contemporary documents such as the Changting Chronicles and planning texts at various levels, it is possible to extract and construct the cultural gene map of Changting from both material and non-material culture. This map primarily embodies aspects of Hakka culture, landscape culture, cultural ecology, and red culture.

2.1.1. Hakka Culture: Migration and Evolution of the Hakka Ancestors

Due to its geographical location, far from the political center, not a military stronghold, and not a major transportation hub, Fujian has historically lagged behind economically. Since the Qin Dynasty, it has been consistently overlooked by the central government. It was only during the Tang Dynasty, with its strong centralization and active expansion of power, that the remote Fujian region became integrated into the extension of national authority^[10]. During the Tang Dynasty, many people fled to Fujian, leading to the establishment of prefectures and counties, and during this period, Tingzhou was set up in western Fujian. To explore the historical development of Changting, it is essential to trace its regional culture and the socioeconomic changes. The study of Hakka people is closely related to the development of Changting. The Hakka ethnic group is an important branch of the Han ethnic group, and Hakka people, who belong to the Han ethnic group, differ from other Han ethnic groups primarily in terms of culture rather than lineage.

With the continuous changes in historical dynasties, the Hakka ancestors experienced five major migrations. As the migrations progressed, Tingzhou was influenced by cultural diffusion at different times, affecting the cultural life and external communication in the Tingzhou region. For example, during the Tang and Song dynasties, the development of roads in Tingzhou was mainly due to political factors and primarily involved water routes. With the population growth in Tingzhou, there was an increase in the demand for essential goods, especially salt. The transportation of salt in Tingzhou, which addressed the problem of salt consumption for the people, also promoted the opening of the waterway of the Ting River. With the opening of postal routes in the Yuan Dynasty, the waterway of the Ting River officially became an important part of the national postal route. The opening of this postal route fundamentally changed the situation of backward transportation in Tingzhou, making it a key town and transportation hub at the junction of the three provinces of Jiangxi, Fujian, and Guangdong. This facilitated the formation of the economic zone centered around Tingzhou, which encompasses the border regions of Fujian, Guangdong, and Jiangxi.

2.1.2. Landscape Culture: Evolution of Urban Spatial Patterns

In fact, the first three migrations of the Hakka ancestors led to the formation of Hakka settlements. In the Tang Dynasty, the embryonic form of the city of Changting was initially established, and it had a small scale. Through the third migration, a large number of Central Plains Han people migrated south to the southern part of Jiangxi and the western part of Fujian. The population expanded significantly, and in response, the construction of the city was expanded. It was during this time that the Shuidong urban area, east of the Ting River, was formed. Subsequently, it gradually expanded to become Shuidong Street, extending to Banpian Street. At this point, the renowned city of Changting, as the central settlement of Hakka immigrants in western Fujian, was essentially established.

During the Ming and Qing periods, the shipping and transportation in Changting further developed, and economic trade flourished. The increasing number of outsiders, merchants, and

craftsmen led to the annual growth of various workshops, stores, and inns. Due to the rapid population increase, the ancient city of Changting expanded further to the south. The city wall was expanded and repaired, and the wall of the prefectural city was dismantled, completing the plan of integrating the prefecture and county cities. The city wall extended south to the Ting River, then turned from east to south, encircling around the foothills of the Sleeping Dragon Mountain, incorporating half of the mountain into the urban layout. Thus, the ancient city of Changting took on the pattern of having a mountain inside the city and a city within the mountain. The city wall resembled a string of prayer beads hanging around the neck of Guanyin. In many historical documents, this period of the ancient city's form is often expressed as 'Guanyin Hanging Beads' or 'Buddha Hanging Beads.' During this period, the form of the ancient city basically took shape, making it the largest city in western Fujian at that time.

2.1.3. Cultural Ecology: Rich Non-Material Cultural Landscape

Cultural ecology is a system of interaction formed by the cultural aspects of a place, including natural environment, economic forms, modes of production and life, linguistic environment, social organization, values, etc. It possesses characteristics of wholeness and dynamism. Intangible cultural heritage is an important component of cultural ecology. After over a thousand years of development and accumulation, Changting has formed a rich and diverse intangible cultural landscape, categorized into clan culture, folk customs and culinary culture, traditional craftsmanship, and more. This includes three national-level intangible cultural heritages, and provincial intangible cultural heritages such as paper-carving dragon lanterns and Hakka spring farming customs in western Fujian. Additionally, there are numerous city and county-level intangible cultural heritages.

Among these, clan and ancestral culture best exemplify the cultural ecology of Changting. As Hakka people migrated southward over a long and extensive route, with a large geographical scope, they placed great importance on maintaining clan connections. To facilitate the quest for roots, genealogy documentation, the establishment of ancestral halls, and ritual activities became indispensable aspects of their historical continuity. Clan culture has thus become a spiritual pillar for the Hakka people in Changting, serving both the need for tracing roots and the requirements of survival and development in specific historical contexts.

2.1.4. Red Culture: Memories and Marks of the Anti-Japanese War Revolution

From the historical record, Changting, as the source and economic center of the past, plays a very important role in the history of the Chinese revolution and has made great contributions to the establishment of the country. Changting was the turning point of the Chinese revolution, the economic support behind the war, and the cradle of training and development of the army^[11]. The development of Hakka people is not only reflected in the growth of population and the expansion of geographical distribution, but also in the national struggle against foreign invasion and the revolutionary struggle to overthrow foreign rule, in which the red spirit gets red sublimation in the baptism of blood and fire. Therefore, Changting has a rich red culture, is the "hometown of the Red Army", as one of China's 21 revolutionary holy places, but also one of the four Red Army Long March departure point. During the Second Revolutionary Civil War, Changting was known as "Little Red Shanghai" because of its good economic and geographical location. Under the cultural background and environment of this period, the cultural emergence of Changting Red Ancient City was created.

3. Types and Inheritance Evolution of Cultural Genes in Ancient City

3.1. Types of Cultural Genes in the Ancient City

In molecular biology, a gene, as a DNA segment on a chromosome that controls biological traits, undergoes metabolic processes including replication, repair, and recombination. DNA replication is the biological process of producing two identical copies of the original DNA molecule. Through processes like replication, variation, and recombination, DNA molecules ensure the continuity of genetic information by passing it from parent to offspring. Drawing an analogy between the inheritance mechanisms and types of cultural genes and biological genes (Figure 1), and considering the influence of various cultural factors on the formation and development of Changting Ancient City in the past, these factors play different roles in the evolution of the ancient city. They have distinct functional positions and significance levels. By studying the functional differences resulting from the gene concept and the impacts of these factors, they can be classified into primitive genes, replicative genes, and variant genes.

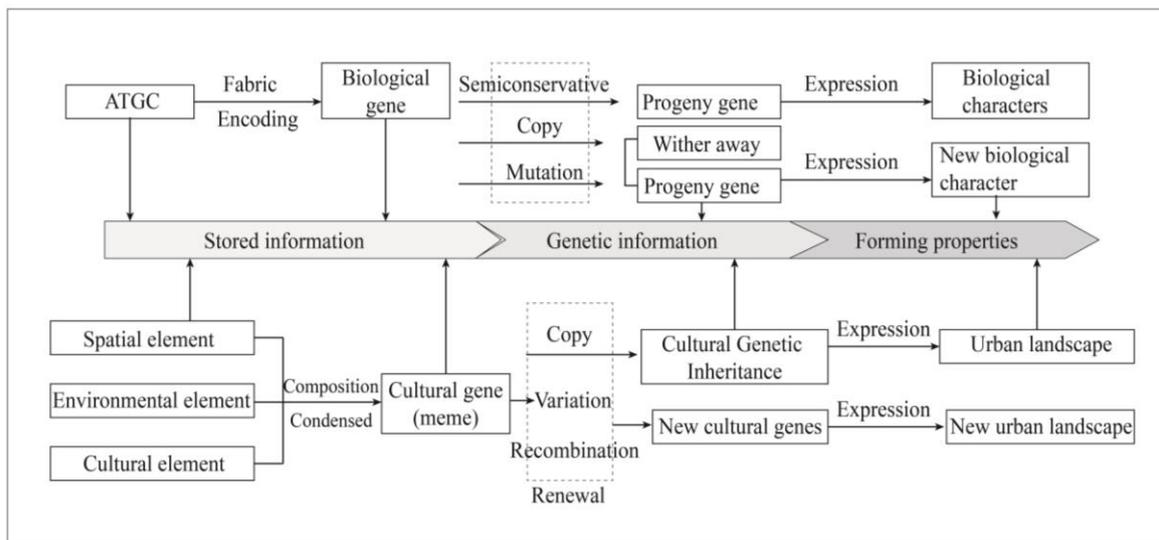


Figure 1: Flowchart of the Cultural Gene Inheritance Mechanism

3.1.1. Original Genes

The primitive gene has the most profound impact on regional culture, representing the information generated by the initial regional culture. It serves as the matrix from which other cultural genes in the gene culture spectrum form and derive. Once the primitive gene is missing, it becomes challenging for regional culture to develop, propagate, and subsequently express itself in urban landscapes.

The development of Changting is inseparable from the development of Hakka culture. In order to escape wars and disasters, the Hakka ancestors, undeterred by difficulties, migrated southward in search of a place to settle. The Tinging River basin, chosen as the first stop for the weary migrants due to its favorable natural environment, played a crucial role. With the advantage of higher economic and cultural levels, the Hakka people assumed a dominant position in the struggles and integration with the indigenous people. Through the fusion of Central Plains culture and indigenous culture, Hakka culture emerged. As the primitive gene for the development of Changting Ancient City, the genesis and development of Hakka culture progressed simultaneously with historical and cultural evolution, profoundly influencing the production and life of the people of Changting.

3.1.2. Replication Genes

The process of urban development from inception to maturity involves the continuous replication, variation, and recombination of different cultural genes. The replicative genes mainly include synchronous replication and diachronic replication, which inherit cultural genes or generate new cultural genes.

Consensual replication of cultural genes occurs through construction activities carried out under the leadership of the same regime during a specific period, referencing similar styles. This is reflected in the regional diffusion of cultural genes. For example, during the Tingzhou administration period, nearby cities developed under similar natural environments and economic-cultural backgrounds, constructing urban landscapes with similar mountain-water patterns, often featuring the construction technique of surrounding the city with mountains. Diachronic replication of cultural genes, on the other hand, involves the inheritance and development of the same cultural genes through construction activities in different periods. This diachronic replication can be understood as the continuous development of cultural genes. For instance, many ancient cities in China have inherited landscape genes such as "central-axis symmetry" and "rectangular form." The urban landscape is characterized by a square city plan, with a spatial order exhibiting central-axis symmetry and clear hierarchy, a feature also reflected in the urban spatial pattern of Changting.

3.1.3. Mutation Genes

In the process of replication, genes may undergo mutations, known as 'mutant genes.' As a result, descendants may exhibit new traits that were previously absent in their ancestors. Therefore, gene mutation is also one of the important factors driving biological evolution.

Mutant genes are new types of genes generated through the exchange, conflict, and fusion of different cultural genes in various regions and types. They may not be region-specific but preserve historical information and spirit from different periods and backgrounds. Mutant genes are an indispensable part of cultural genes in the urban inheritance and development. For example, Changting's clan and family culture are reflected in the 'earth building culture' found in residential areas. The unit-style clan earth building residences embody the characteristics of Hakka clan system, where large families live together, while also serving as effective military defense structures. It represents the perfect unity of Hakka family ideals and real-life practices. Furthermore, it is manifested in the red culture generated during the resistance against Japanese invasion, leaving behind memories of 'Little Red Shanghai' and 'Red Post Office.' Even in the last thirty years, the impact of conservation plans for the ancient city is evident, with newly constructed modern high-rise buildings impacting the historical cityscape, demonstrating the effects of mutant genes in urban development.

3.2. Inheritance Evolution and Countermeasures of Cultural Genes in Ancient Cities

In the developmental process of the ancient city, the underlying cultural genes have also evolved through the inheritance of different cultures. While the overall form of Changting's ancient city is well-preserved, protection and renovation still face significant challenges and pressures. Based on the characteristics of the three types of genes mentioned earlier, corresponding paths of inheritance and evolution are proposed, attempting to offer a new research perspective on the conservation and renewal of urban historical landscapes.

3.2.1. Protection of Ancient City Original Genes

Changting Ancient City is nestled among the mountains. Historically, the selection and urban

layout of Changting align well with the principles of traditional Feng Shui, showcasing the science of human habitat, emphasizing the harmonious coexistence of humans and the natural environment. It can be considered an exemplary ancient city site, providing a solid foundation for the development of the city's primitive genes. While the mountainous terrain around the Changting Basin has not been significantly disturbed, the foothills are gradually encroached upon by construction. With the acceleration of urbanization, the field area in the suburbs has greatly reduced, and the construction of new large-scale modern buildings has also had a certain impact on the ancient cityscape. Therefore, the protection of primitive genes should be the main focus in the inheritance path.

Firstly, following the urban historical landscape of mountains and rivers, the first ridge line of the historical urban area is delineated as the boundary of the harmonious natural landscape area. Ecological restoration methods such as afforestation conservation and ecological conservation are employed, and activities that damage the development of mountains and water bodies are strictly prohibited. Special emphasis is placed on protecting the first mountain, which constitutes the Feng Shui pattern of "a thousand mountains enclosing deeply." Secondly, the line of sight corridors between the mountains and the main scenic nodes of the city are protected, and measures such as lowering the height or relocating affected buildings are taken. Thirdly, construction activities on the mountains and their surroundings are strictly controlled, with activities such as mining, land reclamation, tomb construction, or any alteration of the topography being strictly prohibited. Logging and damage to ancient trees are also strictly forbidden. Finally, whether adopting a ring-layered or a central cluster approach for urban expansion in Changting's new city, a continued adherence to the spatial control of historical landscape axes is essential in preserving the original genes of the ancient city during urban development and economic growth.

3.2.2. Implantation of Ancient City Replication Genes

Gene implantation in biology is a way of genetic inheritance. The process of gene implantation must be based on a thorough analysis of the cultural genes within the ancient city, and by artificial means, replicate genes are implanted into the ancient city to give the original genes new vitality and functionality. For Changting Ancient City, in the process of the evolution of the urban historical landscape, the symbols of replicated genes are refined, and different aspects are implanted into the ancient city through protective planning and design to give the cultural genes a more local flavor.

The changes in the community system and the influence of Feng Shui culture in the past society have created different types of spatial textures (Figure 2) and functional zones in Changting Ancient City. Currently, due to high building density and the explosive growth of the urban population in modern times, the block space appears fragmented, and the appearance of modern buildings disrupts the texture of historical blocks, making it difficult to achieve spatial replacement and functional revival. Therefore, the process of repairing the ancient city's texture is also the process of implanting replicated genes. Firstly, by continuing the original layout of the ancient city and ensuring the integrity of the street and lane space, the organization of street-block courtyards is reconstructed, and the spatial texture of the block is rewoven. Quantitative identification methods, such as street profile quantification, spatial nodes, porosity, fragmentation, and other spatial features, are used to achieve the modernization of space function adaptation adjustments. Secondly, combining with the actual protection of historical and cultural districts in Changting, optimize the interface of streets and lanes, and reshape the characteristic street block features (Figure 3). Specific measures include controlling the volume of buildings, coordinating building colors, preserving building materials, and inheriting construction techniques.



Figure 2: Sequence Diagram of Historical District Spatial Structure

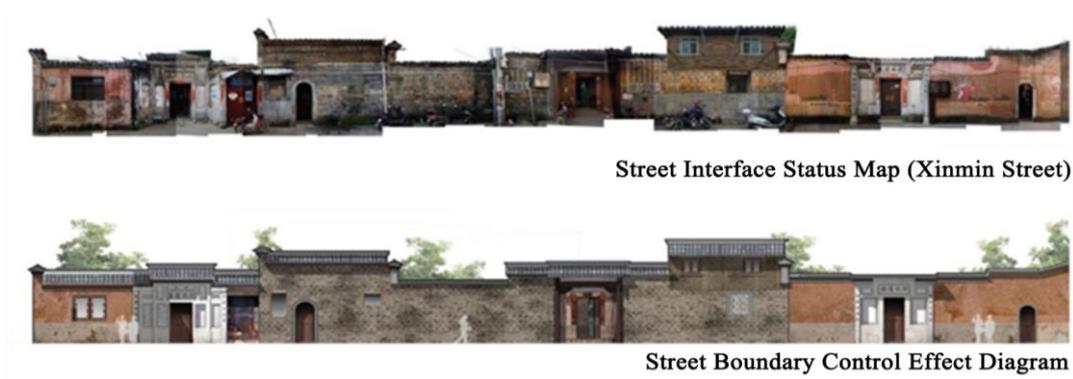


Figure 3: Schematic Diagram of the Renovation and Optimization of Street and Lane Architectural Features

3.2.3. Recombination of Ancient City Mutant Genes

During the inheritance and development of the city, new cultural genes inevitably emerge. In an environment where old and new genes coexist, the city has generated a more diverse historical landscape. For example, many of Changting's historical buildings are the mansions typical of Hakka cities in western Fujian. They are architectural styles developed by Hakka ancestors based on local natural conditions, while retaining the characteristics of Central Plains architecture. The materials and craftsmanship used in these buildings are unique. As time passes, these buildings undergo material aging due to erosion, leading to varying degrees of damage and changes. Continuous protection and restoration are necessary. Relying solely on modern restoration techniques without integrating traditional craftsmanship can to some extent destroy the original features, historical information, and craftsmanship characteristics of the buildings, reducing their cultural value. It also contributes to the emergence of variant genes in the ancient city. To address this, protective measures need to be taken for existing courtyards, streets, and buildings in the ancient city. New buildings should be integrated with the old spatial sequence. For areas where new buildings are needed, basic architectural design references should be provided for residents and developers. Residents and developers are encouraged to fully incorporate natural environmental factors into the construction process, achieving harmony between humans and nature and forming a unified architectural style for the ancient city.

Through formal innovation and diverse integration, historic preservation buildings can be opened to the public. The focus should be on the historical significance of the buildings. In the organic renewal process of historic buildings, efforts should be made to preserve the original functions of old buildings as much as possible. By reviewing the original functional configurations, spatial order can be reorganized, and new functions can be developed on the basis of preserving the old functions. Open-air exhibitions can be combined with tourism planning, and necessary public service facilities

can be added. However, it must be ensured that various tourism exhibition facilities do not compromise the authenticity of historical buildings. Periodic maintenance of historic buildings is essential to effectively utilize the efficiency of variant cultural genes in the genetic recombination of the ancient city and to reflect the ancient city's cultural landscape in the new era.

4. Conclusions

The continuation of urban context involves maintaining the development context of the city based on respecting the historical environmental pattern. In the process of recreating cultural landscapes, it is essential to clarify and activate the urban areas developed in different periods, endeavoring to extend their historical appearances and street patterns. The evolution of cultural genes from their original forms to replication, variation, and reconstruction is reflected in the temporal and spatial evolution of urban historical landscapes. Future planners are required to respect cultural legacies that have persisted to this day, such as Hakka traditional culture, while also acknowledging new cultural elements that have entered later, the red culture in wartime and the preservation culture of historic cities in the new era. Protecting cultural genes does not mean static, closed conservation. More important than mere architectural preservation is the use of the material carriers of historic buildings to convey cultural and historical value to the world. In urban planning, the understanding of the city's current development stage and the identification of influencing factors based on the laws of cultural genes can facilitate future urban development. This understanding may help prevent certain negative development effects, contributing to scientifically supported government planning and decision-making.

In conclusion, whether in urban planning and design or the preservation of historical cities, it is crucial to respect the natural environment, the achievements of predecessors, and the characteristics of existing elements. By summarizing suitable development paths for ancient cities from a cultural gene perspective, continuously expanding the recognition of the cultural heritage value of cities, identifying elements that constitute urban charm, and innovating on the basis of protection and inheritance, we can contribute to creating a favorable development model for ancient cities.

References

- [1] Pan Yihe. (2005) *Culture and International Relations*. Zhejiang University Press.
- [2] Dawkins, R. L. (1976). *The selfish gene*. *Evolution*, 32(1).
- [3] Zhang, Z., Xu, H., & Xu, M. (2021, February). *Research on the Protection and Inheritance of Traditional Villages from the Perspective of Cultural Genes—Take Wuhan Dayu Bay Historical and Cultural Village as an Example*. In *IOP Conference Series: Earth and Environmental Science* (Vol. 668, No. 1, p. 012066). IOP Publishing.
- [4] Liu Changlin. (1990) *Chinese System Thinking: A Cultural Gene Perspective*. China Social Sciences Press.
- [5] Jiang Guanghui, *On the Formation of Chinese cultural Genes: Historical Shadows and Traditions in the Pre-Axis Era*. Chinese Confucianism Network, 2008.
- [6] Hok-Lin Leung. (2011) *Cultural Dna In City Planning*. *City Planning Review*, (10): 78-85.
- [7] Yu Kongjian. (2004) *The ideal landscapes: the meanings of feng-shui*. Beijing: The Commercial Press.
- [8] UNESCO, W. (2005). *Vienna memorandum on world heritage and contemporary architecture—managing the historic urban landscape*. WHC. 05/15. GA/INF. 7.
- [9] Liu Yifei. (2016). *A Review of the Ten-year Research on Historic Urban Landscape in China—In Memoriam of Dr. Ronald van Oers*. *Chinese Landscape Architecture* (02), 74-77.
- [10] Jin Yangchun. (2011). *The Economic and Social development and change of Tingzhouln Song and Yuan Dynasties* Doctoral dissertation, Fujian Normal University.
- [11] Zhuo Guozhi. (2017). *On the historical position of Changting in the history of Chinese Revolution*. *Straits Communications* (08), 10-11.