



# Study on the Vitality Enhancement and Environmental Intelligence Technology of Historical and Cultural Neighborhoods Based on Organic Renewal Theory: Jinan Mingfu City as an Example

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**Abstract.** With the change of urbanization mode, some historical and cultural districts gradually appear to have declining functions and less prominent historical and cultural attributes which are unable to keep up with urban development requirements. Based on the theory of organic regeneration, this paper selects representative streets in the Ming City historical and cultural district of Jinan as research samples to explore the conservation and regeneration methods of historical and cultural districts. This paper uses environmental intelligent sensing technology to broaden cultural communication channels and implement refined management of internal roads in the neighborhood through intelligent means. Additionally, this paper uses big data to collect residents' preferences and help them establish and maintain new social relationships, promoting the development of smart neighborhoods while bringing new vitality to be historical and cultural neighborhoods.

**Keywords:** organic renewal · historical and cultural block · vitality promotion · intelligent infrastructure

## 1 Introduction

Historic and cultural neighborhoods are important carriers of cities' historical changes and cultural memories, carrying part of cities' residential and commercial functions. With the development of cities, China has been steadily promoting the protection and renewal of historical and cultural neighborhoods in recent years. Historic and cultural blocks should focus on protecting the material level and the inheritance of the immaterial cultural connotation of the block. Adopting organic renewal theory to transform the neighborhood gradually can effectively protect the spatial texture and architectural style of the neighborhood, perpetuate the regional cultural characteristics of the city, stimulate the vitality of public space, and achieve the goal of sustainable development of the neighborhood.

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Scientific renewal of historical and cultural neighborhoods cannot be achieved without rigorous data investigation. The reasonable use of environmental intelligence technology can enrich the cultural communication path of the neighborhood and make the distribution of pedestrian and traffic flow in the neighborhood clearer. The “intelligent” approach to renewal brought by modern technology offers new possibilities for integrating neighborhoods and cities. It can help neighborhoods improve the comfort level of both outsiders and local residents and lay the foundation for neighborhood vitality.

## 2 The Difficulties Faced by China’s Historical and Cultural Blocks

### 2.1 Function Formats are Enhanced, but Cultural Attributes are Weakened

Historical and cultural blocks are one of the living heritage of traditional urban culture. Large-scale renovation approaches such as “pushover and reconstruction” and “modernization” have severed the local cultural vein in the past decades. In recent years, however, neighborhood renovators have abandoned the “pushover and reconstruction” approach and have focused more on preserving the neighborhood’s original appearance in the renewal process. However, to make the neighborhood commercially profitable, some renovated historic and cultural neighborhoods have become “emphasis on commerce and disregard for culture.” Neighborhoods “wear” the historical style “coat” but have “inner” foreign stores, which makes the cultural attributes of the historical and cultural blocks weakened and the cohesiveness of the neighborhoods weakened (Fig. 1).

### 2.2 Spatial Order is Chaotic and Public Space Encroaches

Currently, some urban historical and cultural districts transform their main streets into commercial pedestrian streets in order to realize the dual attributes of residential and commercial functions, attract crowds to gather, and bring commercial income to the



**Fig. 1.** Jinan Mingfu City historical and cultural block-Furong Street



**Fig. 2.** Jinan Mingfu City historical and cultural block-Shuangzhongci Street

district. This will lead to residential and commercial spaces intermingle in the neighborhood. The intermingling of the two types of spaces is conducive to promoting spatial diversity, but improper handling can also result in spatial disorder. Most of the renovations of historic districts will maintain the original texture and width of the alleys in the district and do not support the passage of vehicles. However, residents living in the neighborhoods choose to put their vehicles in the common areas of the neighborhoods for easy access, which encroaches on the public space resources and forces poor road access (Fig. 2).

### **2.3 Traditional Relationship Networks of Residents Are Affected**

In the commercialization of historical and cultural districts, excessive commercial activities directly affect the daily life of residents, and their habits are forced to change [1]. In the highly commercialized mode of historical and cultural neighborhoods, the neighborhood residents will choose to move out, and foreign tenants will move into the neighborhood. The restructuring of the neighborhood's staff changes the residents' original habits, and the instability of foreign tenants affects the inherent neighborhood network, which may decrease the neighborhood's vitality.

## **3 The Significance of Organic Renewal Theory to Enhance the Vitality of Historical and Cultural Blocks**

### **3.1 Organic Renewal of Historical and Cultural Neighborhoods**

Through the literature study, the analysis of the history of urban development in China and the West, and the theory of urban development after the transformation of the old

city of Beijing, Professor Wu Liangyong proposed the theory of “organic renewal” in the 1980s. He believed that urban renewal should be “an exploration of urban renewal and development based on sustainable development according to the inherent laws of urban development and urban structure [2]. The concept advocated by organic renewal theory coincides with the development trend of historical and cultural neighborhoods. “Organic” means that the renewal of historical and cultural neighborhoods should conform to the development law of the city as a “living organism” and protect the original structure and growth trend of the neighborhood. “Renewal” means that the future of the neighborhood should continue the historical lineage and integrate into the current society while eliminating the irrational aspects of the development.

### **3.2 Application of Environmental Intelligence Technology in Historic Districts**

The “ambient intelligence” concept was first introduced in Europe in the 1990s. The main emphasis is on the data resources prevalent in the surrounding environment, from which people can obtain information and services anytime and anywhere. The use of ambient intelligence technology in historical and cultural neighborhoods is to embed a large number of sensors into the neighborhood, and obtain data on the neighborhood’s landscape, traffic conditions, and pedestrian distribution through scanning, which facilitates visitors to understand the interior of the historical and cultural neighborhood space more intuitively, and is conducive to enhancing the “wisdom” of the neighborhood from three levels: cultural, spatial, and humanistic. This is conducive to enhancing the “wisdom” of the neighborhood from three levels: cultural, spatial and humanistic, so that the historical neighborhood can be better integrated into the modern city.

### **3.3 Organic Renewal is Conducive to the Vitality Promotion of Historical and Cultural Blocks**

In 1961, Jane Jacobs proposed in *The Death and Life of Great American Cities* that internal dynamism is an important component of cities and that good social organization and social institutions are the foundation of urban vitality. For historic and cultural blocks, good “community organization” is also an important factor in maintaining the vitality of the block [3].

The historical and cultural block can be regarded as an “organic life”, and the block will have vitality only if it has “life”. The synergistic development of several elements, such as culture, economy, and space, will bring more vitality and vigor to the neighborhood. Therefore, to revitalize historical and cultural blocks, it is necessary to strengthen the diversity of their spatial functions and maintain the social relationships among residents.

## **4 The Current Situation of Jinan Mingfu City Historical and Cultural Block**

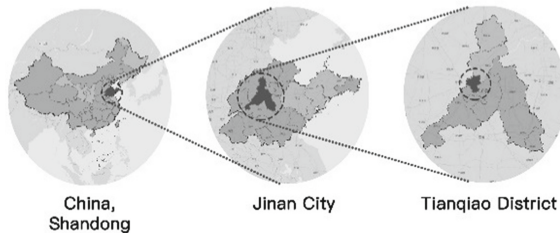
Mingfu City is located in the center of Jinan, Shandong Province, and was built in the fourth year of Hongwu of the Ming Dynasty. It is currently planned as a comprehensive

historical and cultural block integrating residence, commerce, and tourism. There are many historical buildings preserved in Mingfu City, such as Zhuangyuan Building and Chenghuang Temple; there are also some characteristic historical and cultural neighborhoods, such as Furong Street and Xigengdao Street (Table 1). As can be seen from Table 1, the neighborhoods of Mingfu City are mainly residential areas, supplemented by commercial areas. However, the most widely known commercial streets, such as Furong Street and Qushuiting Street, attract tourists. Street spaces are sometimes wide and sometimes narrow; for example, the narrowest part of Xiangfeng Lane is only 0.8 m, which can only be passed by one person, while the widest street can be passed by two cars in parallel. The loose streets have their own unique rhythm, and the staggering houses, roads, and springs constitute the beautiful spatial texture of the Ming City historical and cultural district (Fig. 3).

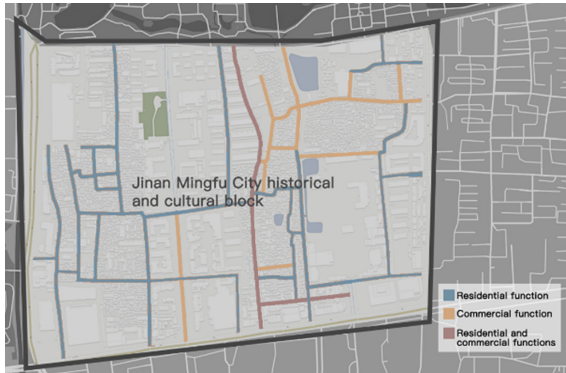
In 2006, the Jinan municipal government restored and renovated the characteristic historical and cultural neighborhood of Furong Street, an old commercial street within Mingfu City, focusing on the preservation of the neighborhood's characteristic architecture and the development of characteristic folk culture. 2020, Jinan issued the Regulations on the Protection of Jinan's Famous Historical and Cultural City. According to which the residential neighborhood of Mingchengfu was Micro-renewal, such as paving stone

**Table 1.** Functions of the internal streets and lanes of Mingfu City

Neighborhood function type	Names of streets and lanes
Residential function	Xigengdao Street. Mashi Street. Wangfuchizi Street. Pingquan Lane. Qifengqiao Street. Xiangfeng Lane. Xiaoxinglong Street. Gongyuanqianggen Street. East Huaqiangzi Street. West Huaqiangzi Street. Kumenli Street. Banbi Street. Zhenchi Street. Yuanhou Street. Yongquan Hutong. Xixuanmen Street. Daizong Street. Qiming Street. Shuangzhongci Street.
Commercial function	Furong Street. Furong Lane
Residential and commercial functions	Qushuiting Street. Gulubazi Street. Houzaimen Street. Jinju Lane



**Fig. 3.** The Regional analysis chart of Jinan Mingfu City historical and cultural block



**Fig. 4.** The road distribution of Jinan Mingfu City historical and cultural block

pavement in Xiyuanmen Street, renovating municipal pipelines, and building facades in Qifengqiao Street and Qiming Street (Fig. 4).

## 5 Organic Renewal Strategy of Mingfu City Historical and Cultural Block

The organic renewal theory includes three characteristics: the organic nature of the city as a whole, the organic nature of the renewal of cells (courtyards) and organizations (neighborhoods), and the organic nature of the renewal process. The purpose of adopting organic renewal theory in street protection and renewal is to protect the integrity of the historical and cultural block and gradually complete the renewal without destroying the street texture so that the block can be revitalized.

### 5.1 Focus on Connotation and Show Multi-cultural Life with “WISdom” Means

The Mingcheng city Historical and Cultural District can display historical and cultural stories and traditional handicraft skills through VR and AI to give visitors an intuitive impression of the area’s human landscape environment. For example, VR technology can make cold historical relics “come alive,” allowing visitors to see and experience the area’s original daily life and historical landscape and recreate historical moments. In addition, visitors can scan QR codes to view videos, pictures, and written materials of relevant historical buildings to learn about relevant historical facts and experience multi-cultural life in various ways.

The core of revitalizing historical and cultural blocks revolves around regional culture. The living heritage of historical and cultural blocks cannot be separated from the historical and spiritual-cultural core, which needs to be protected and continued with the help of figurative methods. In the process of renewal, preserve the authenticity of the block’s material and intangible cultural heritage and protect the unique residents’ customs, with the focus on protecting the cultural core of the historical block.

In terms of commercial culture, Furong Street and Qushuiting Street in Ming City have been the core commercial areas of the old Jinan City since the Ming and Qing

dynasties and still retain their commercial functions today. These two commercial districts are currently filled with national chain stores, but there is little space for local food stores and local cultural consumption. In this regard, Mingcheng city should balance preservation and development and promote the spread of local characteristics and culture by arousing visitors' interest through interaction and cultural displays. In addition, the renewal of Mingcheng city needs to be led by the government to explore the distinctive commercial culture and enhance the vitality of traditional commercial culture in the historic district.

In terms of residential culture, more than half of the Mingfu City has residential spaces. The protection of residential houses should be targeted according to their different ages and characteristics to maintain their unique cultural characteristics. In protecting residential houses, old Jinan houses (North Courtyard) with historical value and cultural connotations should be protected; dilapidated houses with historical value should be repaired and renovated; and "dangerous houses" with safety hazards should be demolished. At the same time, the community should guide residents to develop in the direction of planning. On the premise of maintaining the traditional appearance, gradually formalize the form of independent renovation [4].

## **5.2 Reasonable Planning to Build a Wise Historical and Cultural District**

The internal spatial functions of the historical and cultural neighborhood need to be planned rationally. First of all, it is necessary to unblock the connection between functional blocks, sort out the relationship between residential and commercial areas based on coordinating the overall appearance of the neighborhood, create spatial highlights, and establish a network of spatial relationship connections [5]. Secondly, set up walking attraction points in the non-main road areas of the neighborhood to drive people to understand the regional culture hidden deep in the neighborhood. Finally, the driving routes of residents' daily trips should be considered, and driving lanes and parking areas should be reasonably planned [6].

The reasonable use of ambient intelligence technology helps build a historical and cultural neighborhood with intelligent functions, providing convenience for residents and tourists and fine control of roads in the neighborhood. Tourist crowds can be diverted and directed based on real-time information to avoid congestion on major streets and uncrowded gatherings on secondary streets. Vehicles can also find suitable parking locations based on real-time road measurements to avoid congestion in the main streets and alleys.

The organic regeneration of the historical and cultural district should be based on the needs of different users, the right-of-way should be reasonably allocated, and a safe and effective access system should be established. The plant coverage of the Ming City historical and cultural district is relatively low, and the landscape distribution in the internal areas of the buildings is very sparse. In order to address this problem, the neighborhood should be based on the theory of organic regeneration, appropriately increase the landscape coverage area and vertical greening without destroying the street texture, emphasize the refinement of the existence of the neighborhood landscape, and establish an ecological corridor unique to the historical and cultural neighborhood.

### 5.3 Collecting Scene Data to Establish a New Social Network

#### 5.3.1 Excavating Memories and Adjusting Neighborhood Public Space Using Environmental Intelligence Technology

Maintaining the daily life of the residents is also to protect the humanistic characteristics of the historical and cultural neighborhoods. Residents are one of the important components of the neighborhood, and the development of the historical and cultural district should fully consider the inherent lifestyle of the residents and integrate the preservation of the neighborhood culture into the daily life of the residents, which is more conducive to the inheritance and development of the characteristic historical culture of the district.

In the era of the Internet of Everything, using ambient intelligence technology to collect data on residents' habitual activity places allows designers better to understand residents' daily habits in the Mingcheng Building. First, collecting data information on the residence time of residents in different areas of the historical and cultural district, the activity habits and preferences of the residents can be calculated. Secondly, by collecting information on the gathering of people in different activity places in the district through ambient intelligence technology, it is possible to understand the activity factors that attract residents to go out. Consequently, big data can help planners and designers understand residents' needs and preferences and help designers create more activity areas that fit local habits without destroying the original street network. The planning and construction of public areas can help old and new residents better integrate with each other, forming new social networks and making neighborhoods more vibrant.

#### 5.3.2 Promoting Communication and Building a New Neighborhood Network

- Neighborhood events are held regularly in the neighborhoods of Mingfu City to encourage residents to participate, which promotes communication and mobilizes residents to take an active role in neighborhood renewal while also finding a backbone of neighborhood grassroots organizations at events that help residents reflect on the community promptly. In this way, an effective communication channel is formed.
- The renewal of the historic and cultural block of Mingfu City should respect the residents' daily habits, preserve the elements of daily contact, and minimize the sense of unfamiliarity resulting from the renewal of the block.
- Mingfu City should enrich the lives of residents by adding more spaces for communication in its construction. Newly moved-in residents can trigger more communication possibilities in the public space, which also helps to build a new neighborhood network.

## 6 Conclusion

Under the guidance of organic theory, this paper proposes to continue the regional culture of the city, sort out the spatial order of the streets, and establish a new social network of the neighborhood under the premise of protecting the existing architecture and style through the analysis of the existing problems of the Ming City historical and cultural neighborhood. At the same time, modern means such as intelligent environmental technology are used to expand the dissemination of local traditional culture, improve the



daily living environment of residents, rationalize the shared space of residents, promote communication among residents, and rejuvenate the neighborhood space.

The historical and cultural district is an important part of China's heritage protection, playing an important role in inheriting history and culture and shaping the city's image. Its existence is a valuable treasure left to humankind by history. However, at the same time, the development of the neighborhood also has some problems of lagging function. Consequently, synchronizing the neighborhood with the modernization process is an important topic that needs to be discussed at present.

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