

Study on the Spatial Design of the Main Street of the Special Town from the Perspective of Production-life-ecology Integration

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Abstract:

This paper aims to improve the design of street space in the characteristic town, from the perspective of "production, life and ecology" integration, through the analysis of the "trinity" integration space concept, the integration influence factors are extracted. And by analyzing the problems in creating the main street space of the characteristic town for the three influencing factors of functional integration, social integration and ecological integration, the optimization strategy of the main street space design of the characteristic town is proposed from five aspects: functional inclusion, proximity scale, spatial interface, public life and green ecology.

Keywords:

Production, Life, Ecology, Integration, Special Town

1. Research Background

In recent years, as China's "urban-rural integration" process accelerates, national ministries and commissions have paid special attention to the industrial development characteristics and environmental spatial planning of small towns around cities, and the concept of "special town" has emerged. A special town is a new type of urbanization model with clear industrial positioning, cultural connotation and ecological environment, which relies on a special industry and special environmental factors. It is a fusion of "beautiful countryside" + "micro-industrial zone" in the context of rural revitalization, and is an important combination of new urbanization and rural revitalization. The construction of a special town is based on people-oriented, adhering to the concept of integrated development of production, life and ecology, creating a livable and business-friendly town environment that leads the gathering of local special industries, optimizes basic living facilities and improves ecological environment. Therefore, the environmental space shaping of the characteristic town becomes an important carrier of whether the three can be integrated development.

In the environmental space of the characteristic town, the street is the main connection and important part of the public space, which is related to people's production and life, and has a direct impact on the environmental space form of the town. Especially, the main street in the center of the town, also called "main street", is an important carrier for creating the basic framework of town characteristics, and its spatial design directly affects the livability of the town. But at present, many characteristic town main streets in Jiangsu and Zhejiang areas are not given enough attention, and there are generally problems such as single function, lack of facilities, insufficient features and lack of public life, which are still far from the construction goal of "livable and viable". The relationship between production, life and ecology in the street space of the town is being cultivated in the late stage of the construction of the characteristic town, which can bring into play the function of the core area of the town, and is important to improve the spatial appearance of the town and the quality of life of the residents. Therefore, from the perspective of "trinity" integration, this paper discusses the environmental enhancement strategy of the main street space of the characteristic town based on microscopic, in order to guide the relevant environmental construction practice.

2. Research Perspective

2.1. The concept of "Trinity" integration space

The "trinity" means the integration of production, life and ecology. Production refers to the activities and processes of creating various material wealth, including industrial products, agricultural products and service products, and production determines the power source of urban and rural areas and reflects the core competitiveness of towns and cities; life includes human living, consumption, leisure and entertainment activities, which determines the quality of life in urban and rural areas; ecology refers to the state of survival and development of organisms in a certain natural environment, which is the transformation and Ecology refers to the survival and development of organisms in a certain natural environment, and is the transformation and upgrading of the natural environment of production and living space. The space of "production, life and ecology" is a spatial development concept that covers the necessary needs of production and life directly and the spiritual satisfaction of culture, leisure, environment and aesthetics indirectly, which is an important guarantee for the sustainable development of cities and towns.

2.2. Influencing factors of "Trinity" integration space

The main street space of the special town under the integration orientation of "Trinity" is a street space where industrial and living functions are coupled and promoted, and ecological elements are integrated. It should bring together industrial elements and emphasize the supporting of living functions and the beautification of natural environment. The influence factors of its integration are mainly functional integration, social integration and ecological integration. In order to realize the functional integration, the spatial layout must be considered; social integration is the soul, in order to realize social integration, the integration of people should be the starting point, providing comfortable and pleasant activities and service facilities for interaction, and promoting the harmony of social life in the town; ecological integration is the enhancement of spatial value, not only to undertake ecological environmental protection and provide Ecological integration is the enhancement of

spatial value, not only for ecological environmental protection and provision of ecological services, but also to provide social services for the neighborhood and create a well-landscaped neighborhood space to meet the residents' pursuit of a livable environment.

3. The Development of the Main Street of the Special Town

3.1. Review of the development of the town's main street

The main street was the center of the town and related to the social, economic and political form of the township. Before the Middle Ages, people often relied on the main street for production, socializing, recreational travel, shopping, games, meeting and communication, thus, the main street of the town at that time already showed the integration of production and life. However, modern urban planning advocates functionalist design, which divides urban space into different areas for living, working, shopping and entertainment, and the street behaves as a single transportation space. This design ignored the social and humanistic factors in the design of public space, which led to the fragmentation of the street from the architectural space and living space. 2017, the government introduced the planning of the characteristic town, which emphasized the function of "gathering and integration" and required the integration of the four functions of industry, culture, tourism and community, which is the rationalization of the environmental space construction of the characteristic town. This is a rational return to the environmental space construction of characteristic towns. The main street, as an important symbol of the town, should also be created as a comprehensive space with integrated functions.

3.2. Types of main street in the characteristic town

The main street of the special town can be divided into living main street and production main street according to the functional layout of the production and living space, the form of the street space and the role it plays in the town.

Life type main street, mostly located in the important streets and side streets in the town, while solving the traffic function of the town, pay more attention to the town life and commercial service function [1]. For example, there is Puyuan Avenue in Puyuan Woolen Town and Haipi Shopping Street in Hangzhou Cross Trade Town.

The production-oriented main street gathers production factors and organizes the industrial chain in the form of a main street. The building space along the street mainly accommodates enterprise production, administrative offices, scientific research and education and other industrial functions, and the street provides communication, exchange and material circulation among industries. For example, Yunzhan Road in Yunqi Town, Yongfeng Road in Tongxiang Sweater Town, etc.

3.3. Problems of spatial integration in the characteristic town

3.3.1. Single functional integration

The function of the street is determined by the function of the buildings along the street and the spaces attached to the buildings, and has an impact on the economic and social vitality of the street. If the buildings along the street have a single function, it is impossible to ensure that the street space gets a continuous flow of people, which affects the living and commercial service support of the street, resulting in people's

demand for goods, culture and social life not being supported through the street. Only when the buildings along the street have a diverse mix of functions, and the production and living functions are integrated and distributed, can the crowds be attracted to the street at different times, thus guaranteeing the perfection of commercial and service facilities. Therefore, from the social and economic point of view, the functional integration of the street is the basis for the safety, public interaction and cross-use of the street, which can better balance various different demands for street functions and street facilities, and at the same time, the resulting effect can stimulate a large number of commercial facilities to come into being, which is conducive to the formation of a prosperous business circle.

At present, the inadequate mixing of production and living functions is the main problem in the central neighborhood of the characteristic town. Many production-oriented main streets are mainly distributed along the street with various types of homogeneous production buildings including office buildings, research buildings, factory buildings, etc. For example, the Yunzhan Street in Yunqi Town of West Lake, Hangzhou, has a convention center, research institute, town management committee, office buildings, etc., which are mainly office research functions and lack of living and commercial functions, so there is a stable flow of people during the day, but on weekends and at night, the streets are empty and fall into The streets are dead. The main street, which is mainly used for living and residential purposes, is mainly used on weekends and at night, and there is not enough variety of commercial functions to meet the cultural and social needs of the community, which makes it a vibrant street. The impact on the density and vibrancy of street traffic is evident due to the lack of a primary mix of productive and living uses, especially mixed uses and active cultural uses in the evenings [2] .

3.3.2. Social integration fragmentation

Social integration is a process in which individuals or groups influence each other, adapt to each other, and integrate with each other. In this process, through interpersonal interaction and active participation, social experiences and social civilization are widely shared, the identity and sense of belonging of social groups are enhanced, and a harmonious and harmonious social relationship network is eventually achieved. Social integration is based on the basic life of urban residents, and its essence is the emotional concern for social life, which is one of the links most closely connected with residents' lives in the spatial integration of the Trinity, and has an important positive role in the physical and mental health of residents, organizational performance, and the healthy development of the town economy. Social integration at the street micro level is influenced by design strategies. Appropriate building forms and street layout and scale along the street can increase visual contact between people, stimulate more meaningful interpersonal interactions, contribute to the formation of neighborhood social networks, and facilitate the development of social integration.

The social integration in the featured town is mainly to coordinate the mutual relationship between the aborigines and foreign workers, which are distinguished by their occupation, education level, and living habits. From the current use of the streets in the featured town, the foreign high-level entrepreneurs usually communicate with similar groups of people indoors, with little participation in the outdoor streets and a lack of interactivity with the aborigines. The reasons for this phenomenon are: (1) Buildings along the street do not have active street frontage, or even form a conspicuous separation from the street through fences, causing a shrinking of street

life. (2) Many building facades are cold and monotonous, without considering the aesthetic and psychological interactive feelings of the near human scale. Some characteristic towns use the main road of the city as the central street, the road is more than 20 meters wide and dominated by lanes, which is not conducive to the communication between the two sides of the street. (3) Most of the characteristic town main streets mainly provide traffic functions and lack public facilities, which makes the street space unable to provide space for pedestrians to stop and further contact and interaction. Foreigners cannot adapt to the town lifestyle, integrate into the local culture, participate in social management, and get the connotation of belonging to the citizenship through the medium of the main street, thus causing the fragmentation with the local society.

3.3.3. Lack of ecological integration

The ecological space of a street consists of ecological infrastructure with certain green ecological technologies and landscapes, including rain gardens, ecological detention ponds, permeable pavement systems and other landscape design elements such as street trees, small green spaces, greenery vignettes, green gray spaces and water bodies. The integration of ecological space is the key to coordinating the integration of production and living elements in the street, and to constructing the integration of "ecology + living" and "ecology + production". It can provide a variety of ecological functions, economic values and social service values for the street. Such as maintaining biodiversity, beautifying streets, improving traffic, controlling stormwater runoff, developing tourism, and providing space for community recreation. It can comprehensively improve the living environment and entrepreneurial conditions of town residents and promote industrial upgrading and sustainable socio-economic development.

However, at present, the characteristic town generally lacks diverse street landscape, mainly with street trees and isolation zone greenery, green vignettes, vertical greenery, green corridors, green gray space and small green space are less distributed, and the ecological infrastructure design mainly focuses on landscape greenery function, lacking consideration of social service function. For example, the green space is mainly ornamental green space, ignoring the shaping of plant space and space under trees, which hinders the deep integration of social life and ecology in the street.

4. The Design Strategy of the Main Street of the Special Town Under the Integration Orientation of "Trinity"

The street is the main carrier of the characteristic town space, combined with the above summary of integration problems, the integration of the street to the specific micro material level, from the space of the functional layout, spatial interface, facilities elements, spatial scale and other aspects, combined with the existing main street space skeleton. Guided by the concept of industrial integration, social integration and ecological integration, the street optimization strategy of the special town with "clustered and combined" function and "small but beautiful" form includes the following aspects.

4.1. Inclusion of diversity - functional composite strategy

The street is a vibrant central main street where the integration of productive and living functions contributes to the formation. But it is not a mechanical patchwork of

functions, but an organic and borderless fusion. It should start with eliminating the sense of separation of the physical space of the neighborhood, and on top of that make the integration of various functions more diverse in order to maintain the balance of productive and living functions and promote the creation of neighborhood interaction and a sense of community. For example.

(1) Removal of fences along the street

Streets have been the physical space for developing and carrying living and working relationships since ancient times, while the fences along the streets in many characteristic towns artificially divest living and productive functions from the streets. The fences hinder the cross-use of various people in the street space and prevent the development of an interrelated social relationship network with the help of the streets like the traditional streets. Therefore, to promote the effective integration of production and life, the fences along the streets should be removed in order to improve the permeability of the buildings along the streets to the street space and enrich the functions of the street space.

(2) Mixed functional layout

Proper leisure and communication in the process of production work is a necessary part of the office, while various scientific research activities, business negotiations, training and education and new product exhibitions in the production process also have good compatibility with leisure and living functions, so the mixture of production and living functions can be considered in the building function. The layout method can follow the way of traditional Chinese street of upper residence and lower store, front store and back room, adopting the horizontal layout of single-use building as the main, vertical layout of mixed-use building as the main, and the functional layout of mixing the two. At the same time, attention is paid to enriching the diversity of building functions along the first floor of the street. The organic layout of traditional Chinese villages can be followed to build a multifunctional mixed block space integrating office, residence, leisure and commerce. When the coffee shop on the street is also the office and negotiation and communication place for enterprises, and the new product exhibition can provide the surrounding residents with the function of visiting and learning, the street will naturally become a part of production and life, and the boundary between different functions and people will disappear. Such an arrangement can promote the interweaving and overlapping of activities, which is conducive to the functional integration of production and life.

4.2. Accessibility and Humanization - Small Scale Space Strategy

Scale is an aesthetic pattern, the length of the street and the width to height ratio of the street space both have a direct impact on the accessibility, spatial quality, comfort, social relationship, and commercial richness of the street. So it is possible to create a small-scale space strategy starting from the proximity of street space to humanity, for example.

(1) Setting up short streets

Short streets are an important influence in forming a pleasant street scale, and Saxena believes that a traffic grid between 80-110 meters is the optimal choice. Short street segments can promote human interaction and cross-use of resources, enhance the sharing of street space, and trigger a substantial increase in the distribution of

various commercial services. For example, the Internet Village pedestrian area in Hangzhou Dream Town, with Cangqian Ancient Town as the carrier, is connected by several alleys between Cangxing Street and Venture Street with lengths between 50-100 m. The short and short interchange of streets promotes residents and entrepreneurs to visit small neighborhood stores such as bookstores and sporadic grocery stores at any time, which improves the convenience of life, secures the economic benefits of the neighborhood, and generates more public life interactions (Figure 1).



Figure 1. Spatial layout of short streets in Dream Town.

(2) Adjustment of street space width to height ratio

The appropriate street scale has a close relationship with the horizontal distance between the street and the vertical height of the buildings on both sides, assuming that people stand on one side of the street to see the buildings on the other side of the street, the width of the street is D , the height of most buildings on both sides of the street is H , the ratio of $D:H$ is the width to height ratio of the street space[3]. With the change of $D:H$ ratio, people will have different psychological reflections. When the $D:H$ ratio is between 0.8 and 1.5, the spatial effect of the street is the most comfortable for people. However, many characteristic towns are using the main road of the city as the central street, the road width is more than 20 meters, the D/H ratio is too large, which gives people a cold feeling and is very unfavorable to the communication between both sides of the street. Therefore, the livability of the street space can be increased by adjusting the street space width to height ratio on the basis of the existing neighborhood space. For example, setting up ground floor shops below two floors of high-rise buildings, using the podium space on the ground floor to buffer or visually defining its space to reduce the oppressive feeling of high-rise buildings on the street space, or using tall trees and shrubs to secondly divide the street space, shorten the street width within the line of sight, optimize the scale of the building interface along the street, and form the street subspace to stimulate social vitality.

4.3. Flexible Boundary - Spatial Interface Optimization Strategy

The buildings along the street are part of the street, equivalent to the side interface of the street space, and the building frontage and transition space define the side interface form of the street space. When designing the street space, we should consider the relationship between the street frontage of the building and the psychological use of the crowd, shape the flexible boundary, improve the inclusion and penetration of the street and street buildings, and make the street a place suitable for residing activities.

(1) Create positive building frontage

Giving active functions to buildings along the street and shaping the positive street frontage of buildings can make the street space more social. This is done by combining the principles of narrow facades and wide depths with careful use of façade space where buildings face sidewalks and pedestrian streets[4]. Small-scale building facades with narrow facades and wide depths can make the layout of the street more concentrated and compact, which is conducive to the integration of various functional uses; optimizing the spatial facade through vertical greening, curtain wall transformation and wall decoration, and the arrangement and design of building windows can shape a changing architectural interface space, which helps the formation of street characteristics and personality and makes people more willing to stay in the street space.

(2) Create architectural transition space

Transitional spaces are places where the interior and exterior of a building meet, such as colonnades, canopies and awnings along the street, semi-public foyers, and elaborate courtyards. These spaces allow people to stay and observe without being in full view, and are often the most active places, and are the "intermediaries" between buildings and streets. The relationship between the public buildings and the street in a special town is mostly a hard boundary without transition areas. By opening up the architectural gray space, plant gray space and landscape frame gray space in the façade, front yard and inner glass corridor, the communication between the building and the street can be promoted. For example, Dream Town Pedestrian Street sets up a continuous arcade of 2m depth on the first floor of the building near the side of the pedestrian path, forming a gray space connecting the building and the street[5], which integrates the building with various activities in the street and greatly expands the richness of the social life of the street (Figure 2).



Figure 2. Design of the arcade gray space of Dream Town.

4.4. Social Streets - Public Life Promotion Strategy

Public space is the place for outdoor living and gathering, and is the node distribution of linear space in the street. And public facilities are the urban furniture that meet the functional support of production and life and promote public life. Both are strong carriers that support, promote and enhance the sociality of the street. So it is possible to promote the public life of the street from these two aspects.

(1) Tandem public space

London launched the "Better Streets Program" in 2009. Through the transformation of more than 50 streets, the quality of public space in the city has been improved and

the city has become more vibrant. The main measures include transforming roads as spaces for people to gather, linking a large number of open public spaces along the streets, and combining streets with squares, courtyards, “pocket parks”, playgrounds and resting places to form a continuous network of recreational streets. The integration of the main street of the special town is also inseparable from the public space nodes that are connected by the main street line. These node spaces can avoid the monotony and visual fatigue brought by long linear spaces, and form a variable spatial form. At the same time, they play an important role in enriching the street atmosphere and promoting street activities. Specifically, they can be set on street corners, in the middle of the block, or on the widened sidewalks by using the corners of streets and concave spaces of buildings. For example, the Dream Town entrepreneurship block takes the ancient town cluster as the base, demolishes part of the destroyed old buildings to form public space, and distributes a series of open activity spaces such as waterfront square, cultural square, sunshine lawn, boat dock along the road and water system, and organically connects to form a living gathering street (Figure 3).



Figure 3. Mixed functional layout of Dream Town after demolition of some old buildings.



Figure 4. Design of public space in Dream Town tandem.

(2) Configuration of various facilities

Facilities are devices for people to participate in the life of the street and are the medium to stimulate activities. Whether it is for communication, negotiation, leisure in the production process or for all kinds of people to live and play as well as to support tourism activities to rest and stop, the diversity of living convenience facilities, transportation function facilities and public art facilities on the main street to meet all kinds of people are indispensable, such as game facilities, water dispensers, multi-functional tables and chairs, kiosks, flower ponds, etc. The configuration of facilities on the main street should consider a reasonable layout, set between the street and the space attached to the building, and laid out along both sides of the core road to form a continuous street wall. The design should be integrated with the regional culture and industrial characteristics, and blend with the surrounding environment. The design of functionally compound facilities should also be considered, such as setting up bicycle

parking devices in combination with sanitary facilities and city maps or signs in combination with bus stops.

4.5. Green interface - nature and environment co-construction strategy

The green interface of the street is a flexible interface formed by the combination of various ecological and technical facilities, landscape facilities and buildings and street interface, which reflects the harmonious coexistence of man and nature and brings new imagery and vitality to the characteristic town. The construction of green interface can take the following measures.

(1) Concentrated greening to increase plant diversity

There are many kinds of planting forms. The ecological benefits and landscape value of piecemeal clumping and group planting are more superior than solitary planting, therefore, it is necessary to centralize greening in the slow-moving areas on both sides of the street combined with sidewalks and concave spaces in the areas attached to buildings, forming green sidewalks with rich layers of trees, shrubs and grass plants and various plant species, small open space green areas, etc., which can regulate microclimate and rainwater management and achieve ecological low maintenance effect, thus improving the ecological comfort of the street.

(2) Enhance the value of social services

Green interface not only provides landscape value, ecological value, but also has street service attributes as part of the street interface. For example, green vignettes also attract people's attention and create an important communication medium for topics; street trees can divide the space and make the street space scale more pleasant; small green spaces can promote crowd communication and interaction; the use of trees, green corridors and other construction of transition space. These spaces dissolve the boundary between building and street space to a certain extent, making the two become an organic whole, which is conducive to the overflow of internal building activities to the street space. Therefore, the greening of the main street of the characteristic town should try to avoid pure landscape greening, and needs to combine the greening space with the living and production space, so that the greening space becomes usable. For example, Dream Town uses the concept of embedded development, and integrates roads, greenery and water bodies on the basis of retaining the original natural appearance. The bottom of the building is elevated and the greenery is embedded in the building to provide a healthier resting space (Figure 5).



Figure 5. Ecological space where greenery and water bodies intermingle.

5. Conclusions

In a word, a characteristic town is not only a gathering place for characteristic industries, but also a new space for green, healthy and beautiful people to live in, regardless of the characteristic industries of the characteristic town, it is necessary to build a spatial environment rich in living interest and ecological livability. Therefore, the integration concept of "trinity" of production, life and ecology can provide an effective paradigm for building a good town street space, which is of great practical significance for showing the industrial characteristics and vitality of the town, creating a diversified street living space and creating an ecological and livable environment [7].

Conflicts of Interest

The author declares that there is no conflict of interest regarding the publication of this article.

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