

Research on Urban "Patch" Interactive Space Design Based on the Concept of Sustainable Development

Yiting Huang¹ Jianing Hao² Liting Zhu³ Xinyi Lin⁴ Wanli Zhang⁵

^{1,2,3,4,5} Fuzhou University, Xiamen, Fujian 361000, China

⁵ Corresponding author.

ABSTRACT

In response to the 14th Five-Year Plan, this study proposes a "patch" interactive design based on the concept of sustainable development. The "patch" building system based on the concept of sustainable development can quickly present the spatial form and solve and improve the missing functions of public space. Therefore, it is suggested to implement point renewal in the city, meet the new functions of urban solidified space, promote the sustainable development of the city, and awaken people's awareness of sustainable development. What's more, as an adaptive spatial development method, it is in line with the current urban development trend of China.

Keywords: Sustainable design, Removable design, Patch repair in urban renewal.

1. INTRODUCTION

1.1 Research Background

In response to the 14th Five-Year Plan, the urban quality is comprehensively improved and the intensive and compact development model of function compound and three-dimensional development is implemented. And a series of problems such as structural inequality, uneven distribution of spatial resources and solidification of urban spatial resources that exist in urban space are considered. The land for public space under the original urban planning is saturated, but there is an inevitable change in demand brought about by social development, and urban development requires the use of small spaces to achieve the complement and perfection of demand. In this regard, "patch" interactive space is added to the original public space to alleviate the contradiction between people's growing demand for a better life and unequal and insufficient development.

1.2 Current Research Status of "Patch" Installations in China and Foreign Countries

1.2.1 Definition of "Patch" Installation

The plugin concept was developed in the 1960s. With the development of information technology and social production, the tendency of "techno-utopia" emerged in the field of cities and architecture. Pete Cook, the leading figure of the architecture and telecommunications in the UK, proposed the concept of plugin-based cities, that is, to adapt to the changing social conditions and technological development, and to transform multiple movable and replaceable spatial elements into an urban service framework in response to meet social development [1]. Based on the existing theory of "urban plugin", "patch" repair is proposed. And the difference between the two is that the "patch" repair tends to compensate for the gap between cities. "Patch" building is an important category of urban renewal. In order to adapt to the diversification of urban renewal objectives, it is an auxiliary function to use renewal methods combined with the diversification of the development of The Times to carry out

supplementary development of urban space and sew up urban gaps in the existing renewal system.

1.2.2 Research Progress of "Patch" Installation in Foreign Countries

The concept of urban plugin has been widely used in foreign countries. Opposite Office, a leading German office of architect, proposes to transform Berlin Airport into a "super hospital" that can be replicated at any airport in the world through structural design, with modular design for future emergency needs. Against the background of the epidemic, it is important for urban designers to consider how to find a balance between socialization and safety with the use of design, and to develop relevant codes and design specifications. Cities around the world need to be highly adaptable and resilient in order to provide people with a safe and trustworthy life. Therefore, reducing contact, buffer space and multiple applications are the key points of future public space design.

1.2.3 Research Progress of "Patch" Installations in China

The initial modular spaces in China are mainly in public spaces such as shopping spaces or parks, including the modular space for taking headshots and the modular space of KTV in shopping malls. In the face of the accelerated urbanization, China has recently applied this modular space to meet basic functional needs. For example, the mobile room of mother and infant in the stomatological hospital of the Jiaotong University in Xi'an, Shaanxi Province and the people's hospital in a county is built to solve the problem of lack of space for mothers and babies; the reading booths located in major cities in China allow people to experience their inner thoughts and feelings; and the reading bookstore set up in the citizens' square on the Hailun Road has awakened more and more people's interest in reading through the combination of architecture and installation.

1.3 Research Framework and Methods

The research methods of this study are as follows.

- Literature research

According to the direction and purpose of the research, the researchers firstly collected relevant literature on "plugin" urban renewal in China and foreign countries from CNKI, Baidu, Zhihu and

Chaoxing, etc. to understand the development trend of "plugin" urban renewal at this stage. Secondly, the researchers browsed a large number of actual cases on "plugin" urban renewal, compiled the case characteristics and classified them according to the advantages and disadvantages. Finally, according to the technical or material improvements in the "plugin" urban renewal cases, researchers updated the study on "patch" urban renewal at the conceptual level and technical level, so as to supplement and enhance the "patch" design.

- Technical research

Under the premise of human-oriented design concept, this study adopted the technical research method to research and designs the installation concentrating on three directions of scientific, humanized and dynamic design, and conducted the main research on the following three aspects. The first was the prefabricated assembly design, which could be adjusted in time according to the site conditions, with a certain degree of flexibility and convenience. Also, it would play a certain degree of savings in terms of labor and material costs. The second was demountable design. And it was a design method realized in the context of prefabricated assembly, and a sustainable development way of space use function from being single to being diverse. Under this method, multiple functions were put in the same space through different combinations, with the characteristics of sustainable development and extensive use. Third was the reduction design. And it was applied to space design, making the overall installation simple in shape, structure, assembly and disassembly, and meeting multi-functional needs.

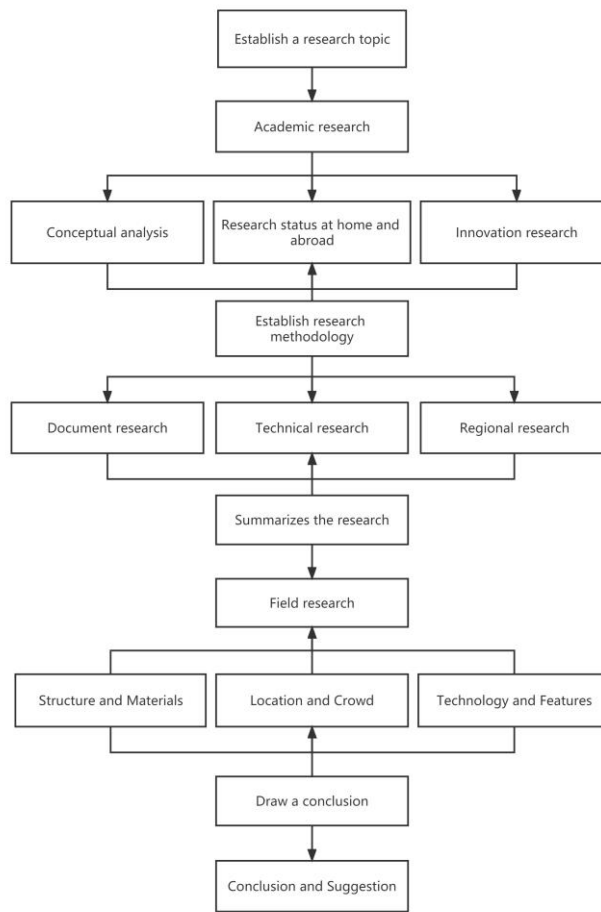


Figure 1 Research framework.

- Regional study

This study took Fuzhou city as the main research area. Through network data research and on-site exploration records, Fuzhou community, public park, commercial complex and Fuzhou urban village were considered for more detailed and in-depth project research. From the perspective of community residents, mother and child groups, shopping people and urban village residents, a feasible project research was proposed for the target group, and an urban installation renewal design with Fuzhou characteristics was created.

1.4 Innovation

At present, the research on plugin urban renewal has been practiced and explored in China to a certain extent. Most researchers believe that "plugin" urban renewal is more convenient based on the change of urban layers and urban texture transformation, and is conducive to rapid adaptation to changing social needs and technological updates. This study proposes a new concept of "patch" urban

renewal, which combines the original "plugin" research direction with modern urban needs deeply, and seeks to update and adapt to the new environment by focusing on the functions of public space, spirit, and social life. The internal functions of the patch will be achieved in the form of prefabricated assembly design, demountable design, reduction design, and high-tech design, providing more possibilities for urban micro-renewal and sustainable development strategies.

Based on the existing urban planning, this study will flexibly update the design for different areas to meet the needs of users from both the perspectives of "usability" and "user experience". "Patch" renewal fills in the gaps in the original urban planning. As a new concept of adaptive spatial development, it is an important inspiration for urban renewal in the context of dual urban development in China. Interactive design focuses on the information exchange between human and products, takes user needs as the research direction, and establishes the relationship among human and

products and services, which reflects the requirements and new directions of urban design in the new era.

2. RELATED CONCEPTS AND THEORETICAL FOUNDATIONS

2.1 Definition of Basic Concepts

- Sustainable development concept

The concept of sustainability is a design concept to improve the design efficiency and meet the multifunctional design at the same time. Through innovating and compounding a variety of space functions, it meets the design needs, adapts to the pace of The Times, and extends the service life of the space.

- "Patch" design innovation

Based on the existing urban planning, the "patch" design flexibly updates the design to meet the needs of different areas from both the perspectives of "usability" and "experience".

- Interactive art of installation

In a specific space-time environment, the artists effectively select the existing material cultural entities in life, and use, transform and combine them to create an art form that conveys a certain spiritual and cultural connotation, and this art is called installation art. [2]

2.2 Relevant Theoretical Foundations

2.2.1 Development History of "Plugin" Repair

In 1960, Peter Cook, a member of the architectural and telecommunications school, first proposed the concept of the plugin city in the context of rapid development of information technology and mass production. The aim was to adapt to the development of society and technology. A huge framework of urban services was set up and many plugin units were added to this framework. At the World Design Congress in May 1960, Maki Fumihiko of the Metabolism School also proposed the aggregated urban design model, which was based on a group paradigm, the megamorphic form, with the insertion of tree units as a way to prevent the expansion of low-density cities, but the megamorphic form as a technical utopian urban structure cannot meet the complex needs of the city functionally. In August 1972, Rainer Benham

defined the spatial structure of the city as a "huge framework" interspersed with "innumerable modular units" in a vast assemblage. [3] In the 21st century, Jon Lang proposed a new classification method in 2005, and took the urban planning and design process as a criterion to reclassify the "plugin city design". And the sustainability and interchangeability of the infrastructure units were the main focuses of this classification. [4]

2.2.2 The Concept of "Plugin" Repair

"Plug-in" repair belongs to the category of "discreet urban renewal", which aims to adapt to the changing needs of urban renewal. It uses a variety of design approaches to redevelop established spaces and to optimize and update urban policies. The focus of "plug-in" repair is to explore and analyze urban public space, which includes improving the quality of public space and achieving urban spatial justice. Therefore, "plug-in" repair should meet three criteria: precise spatial positioning, refinement of urban space repair, and simultaneous market and economic efficiency and social welfare benefits.

2.2.3 Development Trend of "Plugin" Repair

With the development of urbanization process in China, the public space in China's cities has been shrinking. Considering the global environment of ecological protection, China, as a large population country, proposed the red line of urban land in the 14th Five-Year Plan. As China's urban expansion is limited, it must seek a high-density spatial function structure. "Plug-in" repair can be very useful in today's urban renewal programs of stock planning. However, there is a high degree of solidification of urban space resources in the existing environment, but social change is very rapid, so the functional needs of urban space are also very variable. The researchers added a sustainable renewal model based on the concept of "plug-in" repair, using re-planning sustainable design of small space to adapt to the new demands of the urban development process.

3. PUNCTIFORM "PATCH" REPAIR SURVEY IN FUZHOU CITY

3.1 Research on the Current Situation of Fuzhou City

Fuzhou is an important metropolis in East China and one of the first coastal cities to be opened to the outside world. The excellent urban spatial layout of Fuzhou City is praised by the phrase "water surrounding the city and the mountains being around it". As of 2021, the total area of Fuzhou was about 11,968 square kilometers, the built-up area of the city was about 416 square kilometers, and the resident population reached 8.42 million people. In recent years, Fujian Province has adopted a policy of enhancing the provincial capital and accelerated the establishment of districts and the removal of counties, and the internal structure of the city, with the old city as the center of urban development, could no longer meet the development requirements of Fuzhou today. [5]

The constraint of construction land has led to increasing density as well as intensity of construction within the city, and traffic and other problems have become increasingly acute. The traditional excellent spatial form of Fuzhou no longer exists and has been replaced by a series of problems caused by poor urban planning, and many new needs in the old city cannot be met by overly dense construction.

3.2 Solution Strategies

The researchers adopted a "patch" installation renewal. Firstly, the activity density and demand of people in the urban area were sampled by questionnaire, and then the detachable lightweight devices were placed in the punctiform form in the densely-built old urban area to meet the needs of residents. Then, feedbacks from users were collected and the devices were upgraded again. Four specific locations were selected in Fuzhou city to target the specific design of the patch repair.

3.2.1 Minjiang Park

Minjiang Park is a park with a high pedestrian flow in Fuzhou, covering an area of 27.4 hectares. In the research on demand for mother and baby room, the park was the first choice for parent-child appearance. Therefore, next to the Colorful Garden of Minjiang Park and Children's Park, a miniature composite space integrating a breastfeeding room, a

dressing space, a make-up space, a baby lock and a resting space was designed and placed. There were diaper tables with safety locks, wash basins with hot water, automatic water dispensers, vending machines and disposable paper pads in the breastfeeding room to facilitate the travel of the maternal and infant groups.

3.2.2 Fuzhou Community

The selected site is located in Cangshan District, where many new subdivisions have been built to meet the needs of a larger population, resulting in a situation dominated by mixed old and new communities. Old communities are often unable to meet some living needs in the new age. Considering the current development of the "post-epidemic era", the community needs a comprehensive space that integrates a fresh access point and a nucleic acid monitoring space. The installation wall can be opened and closed panel to create a fresh food storage point to ensure cleanliness and hygiene of the food, and the residents can store the food based on face recognition. During epidemic health monitoring, the space is closed to ensure the safety of the population.

3.2.3 Zhongting Street (Commercial Complex)

Zhongting Street is an urban complex in Fuzhou with the largest area and the most complete product categories, meeting all needs for sightseeing, shopping and food. However, due to the aging infrastructure of Zhongting Street in recent years, the vitality of the mall has declined. In order to revive the vitality of the mall and facilitate the needs of the shoppers, several closed units are designed to meet the needs of different numbers of people in the open space. Behind the space, there are lockers designed to meet the needs of consumers for storage. The space is disinfected with ultraviolet light when the lounge is not in use to prevent the spread of epidemics.

3.2.4 Urban Village in Gaishan Township

Gaishan Town, which belongs to Cangshan District, Fuzhou City, Fujian Province, is built mainly with villagers' family residences, with a complex population composition and a large number of foreigners. There is a lack of urban infrastructure facilities, and there is a lack of necessary public green space, cultural, sports and leisure facilities in the city. Therefore, the

researchers chose to design a demountable integrated communication space integrating the functions of reading, weather forecasting, and sports in the urban village of Gaishan Town to promote communication and community identity among residents.

4. PRACTICE OF "PATCH" INTERACTIVE SPACE DESIGN

The theoretical research of this study proposes "patch" renewal as an urban renewal method, which is evolved from the "plug-in city" proposed by Peter Cook. Unlike the "plug-in" approach, the "patch" repair is an approach to repair problems in the process of social development, and the "patch" design approach is a relatively convenient way to repair urban space, which is derived from neoclassical or Baroque planning ideas. In Roman planning, city streets, squares and churches are inserted into the medieval urban fabric like punctuation marks, and new urban layers are superimposed on the existing urban substrate to upgrade the spatial and temporal dimensions of the existing urban system.

Based on the 14th Five-Year Plan, the city quality will be comprehensively improved, and an intensive and compact development model will be implemented with a combination of functions and three-dimensional development. Since the city is already saturated with planned public space, it is not possible to make major changes to the planned space, so it takes the form of "patches" to fill the problems that arise in the course of urban development, and the needs of people's lives can be met.

4.1 Innovative Points of the Scheme Design (Practice)

The design model is a sustainable renewal model that uses the re-planning of small spaces to allow for the refinement of the overall larger environment needs. It is the most direct and effective "patch" design approach to address new needs in the development of urban space. The study would establish a patch library to improve the functionality of the space, followed by a configuration station to improve the installation efficiency of the patch space, thus achieving better coverage. In the later stage, in order to seek to update and adapt to the new environment, the internal functions of the patch will be designed in the interactive space design, prefabricated assembly

design, demountable design, reduction design, and high-tech design to realize the sustainable development of the space.

4.1.1 Functional Patch in Public Space

By using research and comparative analysis in the public space, the problems of missing functions in public space are summarized and analyzed. It is suggested to establish design solutions to improve the functions of public space and realize the sustainability of public space. The main task of "patch" repair is to review the stock space, analyze the existing public resources, and improve the growth effect of urban public space. In the passive plug-in, the public products and public resources in the existing facility construction area will be integrated and reorganized in a combined way, so that the overall function can be improved. In addition, through infill development, material support of equal service will be provided for public products, and the repair at this level is mainly focused on the public social aspect. In terms of social interaction in the community, smart fresh food storage cabinets are used to ensure the freshness of food materials, provide the storage space needed by residents around them after shopping, and provide environmental bags to solve the inconvenience caused by diversified storage of goods. In addition, the space is also equipped with a number of sports spaces, where different sports equipment can be added by stretching the preset board, so that children and adults can have a place to play in their spare time. In this way, people's spirit, attention, memory and understanding will be improved, and the learning effect will be enhanced. People will create greater achievements and obtain more resources.

4.1.2 Living Social Patch

Using observation and research and other techniques, interactive space design solutions are proposed to improve interactive space functions, provide a good living social environment and improve social conditions. The characteristics of its spatial entity form lie in the location that can provide living services and social network. It has urban functions such as communication, leisure, neighborhood activities and recreational activities. The main function of living space is to provide residents with living services, and the main areas involved include public squares, parks, streets, green spaces, natural landscapes and other physical spaces. [6] It has the following important

characteristics, that is, it is an open space body attached to the urban building entity, with spatial interface, enclosure, proportion and other spatial morphological characteristics. In the case of the commercial area, it is divided into several spaces, such as children's lounge of block, office space, rest area, face recognition storage room, etc. As a mixture of private and open space, glass doors and acoustic prefabricated panel are set up to meet the maximum demand with the minimum space.

4.1.3 Spirit Patch

With the use of interactive space design, it is to create an immersive interactive environment and improve the interactivity of the space. The audience's passive participation in the past has been transformed into the active perception, which enables the audience to face the views expressed in the space in a more active way, so that some social problems can be actively paid attention to and even solved. In terms of the neighborhood, the art and culture appreciation space is divided in the patch space, which can meet people's aesthetic needs, improve the connoisseur's aesthetic ability, morality, thought, cultivate sentiment, develop intelligence, increase wisdom, etc. At the same time, it is an active form of entertainment, which can entertain the mind and promote people's physical and mental health.

4.2 Installation Design

4.2.1 Function and Structure

The installation as a whole is assembled on site using prefabricated panels. The size of prefabricated plate is 600mm*1200mm. Various sliding tracks are set inside, which can be disassembled and changed to meet various functional requirements.

The installation operation mode adopts the mode of site survey, installation release, installation feedback and patch update.

4.2.2 Artistry

Jasmine, the city flower of Fuzhou City, is famous for its long planting history. In order to reflect the regional cultural characteristics of Fuzhou in the design, jasmine is specially selected for the secondary design, and is painted outside the installation. In addition, the interior decoration also retains the color matching and aroma of jasmine to decorate the interior space.

5. CONCLUSION

Looking at the current urban development in China, there are still problems left over from the initial urban planning. In the face of structural inequality in urban space and uneven allocation of space resources, to equalize space resources and narrow the space gap to meet social development and strengthen people's spiritual civilization construction is still an important issue for urban development. It is expected to promote the sustainable development of urban space, attract the public to participate in it, and create a sense of social responsibility for the construction of urban public space and revitalization of the city through the micro city patch with punctiform update design in Fuzhou.

AUTHORS' CONTRIBUTIONS

Yiting Huang contributed to preliminary material collection, Jianing Hao and Liting Zhu are responsible for text editing, Xinyi Lin made the device experimental design, and Wanli Zhang did the environmental research.

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