

Design of Street Furniture for Famous Historical and Cultural Cities in the View of Cultural and Technological Integration - A Case Study on the Design of Bus Shelter in Bozhou

Yaqin Xia^{1,a}, Changchun Yang¹ and Xiang Wu¹

¹*Fashion and Art Design Institute, Donghua University, 1882 West Yan'an Road, China*

Abstract. It is necessary and urgent to integrate culture and technology into the street furniture of famous cultural and historical cities. A design model of innovative cultural and technological integration is constructed by combining its internal mechanism and analysing the status of street furniture of famous historical and cultural cities in China. Meanwhile, principles and methods of design street furniture for famous historical and cultural cities in the view of cultural and technological integration are proposed, and strategies of applying the design of street furniture for famous historical and cultural cities under the cultural and technological integration are elaborated in detail based on the design case of urban street furniture in Bozhou.

1 Introduction

The famous historical and cultural city is a cultural relic preservation system confirmed and announced by the State Council of the People's Republic of China. As of July 2017, 133 cities had been listed as famous historical and cultural cities in China, as the carriers of protecting historical feature and inheriting characteristic regional culture [1]. With the development of the Internet technology and gradual progress of smart city, it is necessary for many cities including famous historical and cultural cities to conduct urban renewal in order to meet the increasingly diversified demands of people. Street furniture, as the most representative entity sign of urban intelligence, is now drawing increasing attention of urban planners and urban managers.

With respect to the design of urban street furniture, domestic studies mainly focus on the following perspectives. 1). Aiming at the relationship between urban regional culture and street furniture and its application, for instance, Chen Chao interpreted the close relationship between regional culture and public art and mutual influence, and analyzed the application form of regional cultural element in public art with specific examples [2]. 2). Aiming at the application of technology in street furniture, for instance, Zhou Xinhai proposed the design and planning of intelligent street furniture in the background of smart city by aiming at the existing problems in the design of urban street furniture[3]. 3). Aiming at the planning of street furniture, for instance, Li Wenjia et al. sorted out and inspected the relationship between single street furniture and the entire city from the overall spatial structure of city [4]. Liu Quan et al. studied the size of urban communities, spatial planning and layout of street furniture, and re-interpreted the principles of urban street furniture [5]. In conclusion, studies on urban street furniture mainly focus on the culture, technology and planning. Though there are various studies

^a Corresponding author : summer@dhu.edu.cn

on the cultural and technological aspects of urban street furniture, most separate the two aspects, and there is few theoretical research or case analysis of the integrated innovation of culture and technology in street furniture.

In the trend of Internet and smart city, street furniture of famous historical and culture cities should be equipped with perfect functions and characteristic cultural connotations, in order to create good user experience and meet the diversified demands of people. Therefore, how to integrate modern science and regional culture in the design of urban street furniture to promote urban quality and realize the “harmonious coexistence” with the overall urban environment has already become a pressing problem of the construction of famous historical and cultural cities in the current trend of smart city.

2 Overview of street furniture in famous historical and cultural cities in China

2.1 Development of urban street furniture and its connotation

“Street furniture”, originated from Britain, is literally translated as “furniture of street”, and it is usually called as urban element in Europe. In China, it is generally referred to as “urban public facilities”, “urban environmental facilities”, “urban furniture”, etc. Street furniture is public goods provided by the government to meet people’s demands for outdoor interactions, activities and travelling, etc. In the meantime, it creates the atmosphere of public space, as an indispensable element of urban space. Therefore, its design is especially important, which is a significant approach of improving the urban quality.

2.2 Design status of street furniture of famous historical and cultural cities in China

Famous historical and cultural city refers to the city with profound historical and cultural deposits, which would shoulder important responsibilities in the context of cultural revitalization. With the development of the times, famous historical and cultural cities should also advance with the times and keep updating constantly. Street furniture, as the “first name card” of famous historical and cultural cities, may impact the first impression of residents and tourists. Good street furniture can not only serve urban residents and foreign tourists, but also enhance the spatial connotation and quality of famous historical and cultural cities, and shape the cultural features of the city. Through the field research and collection, classification, settlement and analysis of second-hand information, it is found that most less developed famous historical and cultural cities are evidently disadvantageous in the street furniture, mainly for the following two reasons [6]: firstly, improper planning and lack of cultural connotation. Domestic famous historical and cultural cities were built a long time ago, and the original urban planning failed to reserve space for street furniture. Besides, it was not adjusted timely later, and accordingly, most street furniture was located in corners, of poor regional position. Currently, most cities mainly launch the urban construction by relying on the mass-produced street furniture. As a result, completely the same street furniture may occur in different cities, resulting in the loss of cultural genes, and “the same appearance of a thousand cities”. Secondly, lack of the application of new technological achievements, incomplete functions, poor experience and tolerance. At present, street furniture of famous historical and cultural cities in China ignores the application of new technological achievements, such as interaction technique, energy-saving materials, big data, etc. In the meantime, currently, street furniture of cities is greatly defected in the man-machine size, information cue, etc. and of poor tolerance, and it might be dangerous for some weak or disabled users to use the street furniture.

3 Research analysis of street furniture design for famous historical and cultural cities in the background of cultural and technological integration

3.1 Necessity of cultural and technological integration in the design of street furniture for famous historical and cultural cities

Culture is a broad concept, and till now, there have already been hundreds definitions of culture, but all fail to summarize it comprehensively and accurately. Culture is mainly composed of material culture and intangible culture, which can be simply summarized as the general term of living factors in a region, including clothing, food, accommodation, travelling, culture and materials, etc. Owing to the lifestyle and folk culture of different regions, the folk culture and scene of buildings are quite different. Therefore, street furniture should respect the regional differences in the design and reflect characteristics. Technology is a general term of science and technology, which directly promotes the changes of the production mode and lifestyle. The technological development completely changes people's living conditions. The internet, artificial intelligence, auto drive, etc. have already become the hottest technical terms, and people are enjoying the convenient services brought by technological products like the mobile phone, computer, subway, vehicles, etc.

Culture and technology are two core elements promoting the social development. Huge progress has been made in science and technology in recent years. "Intelligence" is one of the important attributes of all cities including famous historical and cultural cities in the future. Smart city, smart community and smart traffic will become an irresistible development trend. Currently, there have already been almost 200 cities launching the smart city strategy. Specifically, in 2017, top 20 cities of smart city construction included 14 famous historical and cultural cities, such as Beijing, Shanghai, Hangzhou, Suzhou, Nanjing, etc. The integration of technology and culture will help to explore the characteristic history and cultural resources of famous historical and cultural cities, and boost the sustainable cultural development ability.

Nowadays, function is no longer the only determinant of product evaluation. What's more, it emphasizes more on the interaction between human and products and people's emotional dependence on products. The integration of culture and technology can create a good spiritual experience and functional experience for users, and satisfy the increasingly diversified demands of people. In such a context, street furniture, as an indispensable element in the construction of famous historical and cultural cities and lives of residents, should be equipped with characteristic cultural connotation, sound functions and good experience in the near future. Therefore, it is necessary, urgent and inevitable to integrate the integration of technology and culture in the design of street furniture.

3.2 Innovative design model of cultural and technological integration

Integration refers to a process of combining two or more different things. Technology and culture are in a co-existence and co-fusion relationship, and design plays a vital role in the integration process. Technology mainly selects and determines the goal, while design substantiates the realization of goal and realizes one of the standards, namely emotional. During the design process, only by making the technology useful and attaining the unity with the social environment system, can it be called as innovation. Culture is the endogenous power promoting the technological development, while technology is an important approach of inheriting the cultural innovation. Design coordinates in the relation between technology and culture (as shown in Fig. 1), promotes the integration and co-existence between the two, and changes people's lifestyle, as the main power of boosting the transformation of technology to be the actual productivity.

Emotional experience is determined by the cultural connotation, Emotion and culture supplement each other, since emotion is the outward manifestation of culture in products, while culture is the internal source of product emotion. Good products must be pleasant, communicable and sustainable.

Functional value is mainly promoted by technological innovation, as the expression carrier and communication tool of culture. Technology is the most direct way of realizing product functions; availability, usability and efficiency are three-step evaluation indexes of the action of technology on products to realize the functions. The application of new technology, new materials and new technology expands the boundary and space of design (as shown in Fig. 1). During the design, designers should apply the latest technological achievements, and combine cultural and aesthetic elements, to realize the development of new products, so that new products can be equipped with complete functions and abundant emotions to meet the diversified needs of users [7].

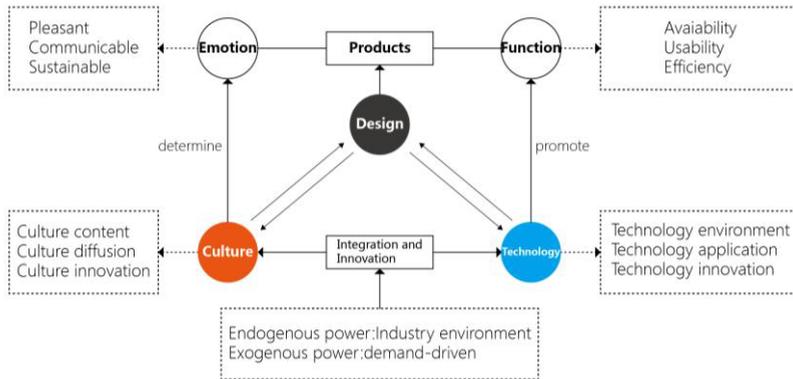


Figure 1. Innovative design model of cultural and technological integration

3.3 Design principles of street furniture for famous historical and cultural cities in the context of cultural and technological integration

Street furniture is mainly designed to meet the practical needs of the public, and such practicability not only requires good technology and processing property of street furniture, but also reflects designers' consideration of the using process and environment, and future development of the society. Therefore, the street furniture design for famous historical and cultural cities in the context of cultural and technological integration must abide by the following principles. Above all, to be "human-oriented" and "demand-oriented"; secondly, to reflect the regional characteristic culture, follow the cultural difference; to improve the functions of facilities with technological means, and optimize the experience, and to abide by the sustainable development design principle.

1) To be "human-oriented" and "demand-oriented"

Design mainly resolves the problems of human and things, and human needs essentially, the needs for all kinds of materials and equipment [8]. To be "human-oriented" is to take human's physiological needs, emotional needs and psychological needs into full account, so as to make full use of things. While designing street furniture, its structure and size should be considered, and its functions and safety should be guaranteed, to meet the physiological needs of people. In the meantime, the street furniture should be endowed with characteristic cultural properties, like the shape, color, texture, etc. to meet the different emotional and psychological needs of people, and enhance people's sense of belonging and involvement. The "human-oriented" design principle attempts to turn the relation between human and facility to be a similar communicable harmonious relation between people, which is the fundamental principle of street furniture design.

2) To reflect the regional characteristic culture, follow the cultural difference

Culture is developed through long-term accumulation and evolution in a region, and it is integrated with the surrounding environment. So culture has regional characteristics. The culture of different famous historical and cultural cities is distinctive, and difference is the unique factor of a city, as a sign of a city differing from other cities. Street furniture is an important media inheriting the regional history and culture. When the cultural value gathers in the street furniture, urban residents or tourists may feel the underlying connotation consciously, reflect the cultural characteristics, be culturally influenced silently, and reach a higher balance between human and the environment [9].

3) To improve the functions of facilities with technological means, and optimize the experience

A huge progress has been made in the technology, and a great batch of new materials and new technologies emerge endlessly, such as carbon fiber, solar energy, internet, big data, interactive technology, etc. In such a context, urban residents have new demands on the life quality and environment quality. Technicalization and intelligence would certainly become the future development trend of urban street furniture. Therefore, the latest technological achievements should be introduced to the design of urban street furniture. The deep integration of street furniture and urban scenes through technological means can enhance the user experience and meet the public demands. [10]

4) To abide by the sustainable development design principle

The sustainable design principle emphasizes on the important role of environment quality and environment input in improving people's life quality, and it puts forward long-term planning for the development of cities and urban street furniture. The design of urban street furniture should fully consider the economic and environmental sustainability, which requires the designers to use energy-saving, environmentally-friendly and recyclable materials in the design process and reduce the environmental burden consciously.

4 Study on the application of innovative cultural and technological integration in the street furniture design of Bozhou

4.1 Introduction of the project

Bozhou, located in the northwest of Anhui Province, is a state-level famous historical and cultural city, one of the first tourist cities in China, and head of the four cities of medicine, known as the “pearl of the north of Anhui Province”. With more than 35000 years of history, Bozhou displays profound historical and cultural deposits, and it is also the representative of culture in the north of Anhui Province. Moreover, it has numerous historical sites and cultural heritage, including prehistoric culture, imperial and capital culture, Laozi & Zhuangzi culture, Cao Wei culture, traditional Chinese medicine culture, Gujing wine culture, etc. (as shown in Fig. 2).



Figure 2. Overview of Bozhou culture

4.2 Design of research goal and field research analysis

This research aims to design the bus shelter for Bozhou, and it mainly focuses on the reflection of regional cultural characteristics, application of technology, experience of facility functions and pain point analysis, etc. As a practical design project, the design team would conduct the field research on Bozhou first, record existing problems of bus shelters, crowd behaviors, traffic status, and spatial element through observation, photograph diary, etc. and conduct further analysis. According to the results, bus shelters in Bozhou are old, of incomplete functions, improper size, poor experience, inappropriate planning and lack of regional cultural characteristics (As shown in Fig.3).

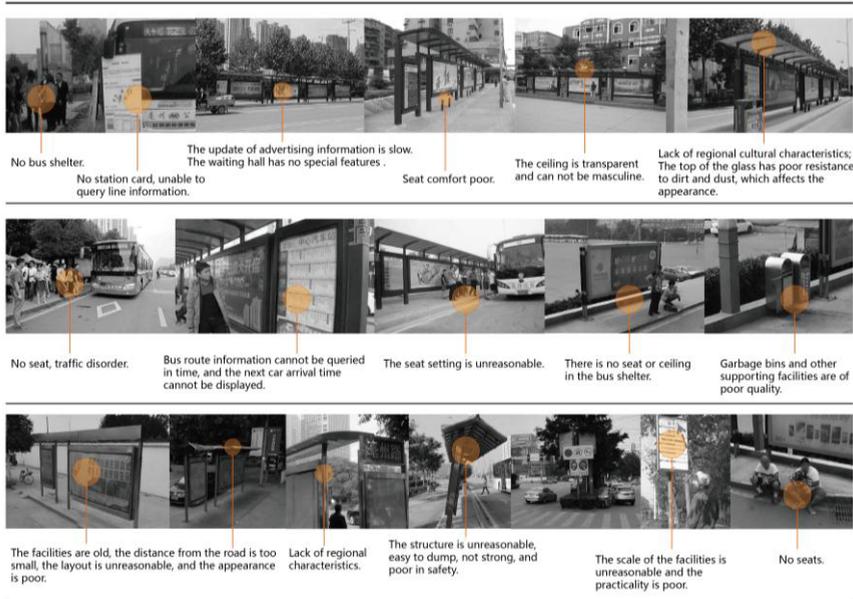


Figure 3.Research analysis of the status of bus shelter in Bozhou

4.3 Analysis of the functional requirements of urban bus shelter

Urban bus shelter is a small building that mainly serves the urban traffic, as the connection point of human and traffic means and playing a vital role in the urban traffic system. The design team conducts the functional requirements analysis for urban facilities like the bus shelter, and clarifies the specific functional requirements of bus shelter from three levels, namely usability, accessibility, and experience of products (as shown in Fig. 4). Meanwhile, functions of culture and technology on the basic functions, convenient functions and emotional experience of bus shelters are analyzed respectively, for guiding the subsequent project design.

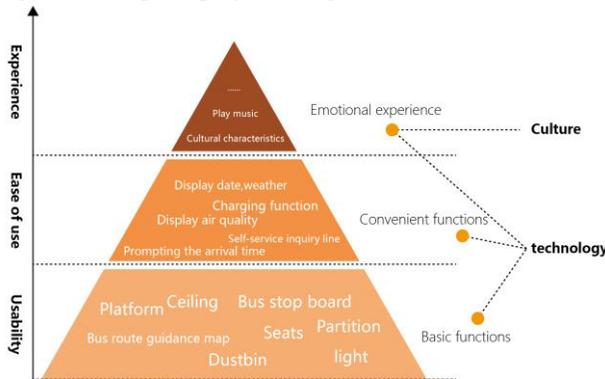


Figure 4.Analysis of the demand level of urban bus shelter facilities

4.4 Design of solutions and innovative points

In accordance with the above stated research conclusions, the design team clarifies the design goals and principles of Bozhou bus shelters in the context of cultural and technological integration. In the meantime, based on the analysis results of problems in existing bus shelters, a set of bus shelter design plans is constructed by integrating the regional culture, technical functions and public demands (as shown in Fig. 5).



Figure 5. Design plan of bus shelter in Bozhou

The design focuses on users and makes innovations from the application of cultural and technological integration on the basis of user demands. Above all, philosophical and physiological demands of different users are taken into full account in the size of bus shelter. The height of station board and display of route information meet people's visual height, featuring high readability. From the cultural level, the design team analyzes the historic culture of Bozhou and architectural characteristics, extracts cultural elements and signs from Cao Cao Park, Wei Wu Temple, Traditional Chinese Medicine City, etc., applies them in the design of bus shelter, expresses the forms and colors through modern design methods, to convey the profoundness of history, and form an organic whole with the urban environment. From the technological level, the design team analyzes the development trend of urban bus shelter design through the smart city strategy, and applies LED to display propaganda posters of the city. Moreover, interactive information display screen is added on the basis of the Internet and big data, to realize the point-to-point service: for instance, display and inquiry of bus routes and real-time route information, tracking and positioning of bus, forecasting the bus arrival time, real-time display of time and weather, etc. which can avoid such problems as the information design, difficulty of identification, etc. In the meantime, based on the consideration of sustainable design, the top of bus shelter adopts new energy materials, which can provide electricity for the shelter. Generally speaking, the application of regional cultural elements in the design of bus shelter in Bozhou enhances the visual recognition of the city. Moreover, functions of the bus shelter are improved through technological methods, and it optimizes the service experience.

5 Conclusion

With the gradual development of the society, the gradual integration of culture and technology is indispensable. Based on this research background, this project applies the innovative cultural and technological integration theory to explore the design strategies of street furniture from the view of cultural and technological integration, and construct an innovative design model of cultural and technological integration. Meanwhile, corresponding street furniture design principles are proposed and applied to the design of street furniture for Bozhou, which provides the theoretical model and practice of street furniture for famous historical and cultural cities in China from the perspective of methodology.

Urban street furniture specifically reflects the spiritual culture of the city, as well as the degree of civilization and spiritual quality of the city. Each city is in need of certain amount of street furniture to reach the mutual integration with the space environment. The penetration and integration of culture and technology in urban street furniture will help boost the sense of belonging and sense of place of urban space, and increase the charm of the city.

Acknowledgement

This paper is a staged achievement of the major project of 2017 national social science fund *Research on Design Morphology* (Project No.: 17ZDA020) and innovative fund project of 2017-2018 graduates in Donghua University *Systematic Planning and Design of Urban Image and Environmental Street Furniture in Shiqiu Town of Nanjing* (Project No.: EG2018012). It is funded by the special fund for the basic scientific research in central colleges and universities.

REFERENCES

1. General Office of the State Council. Order of the State Council of the People's Republic of China, No. 524th. (2008).
2. C. Chao, *Art and Design*. **05**, 98 (2015).
3. Z. Xinhai, C. Xing, *Packaging Engineering*. **38**, 207 (2017).
4. L. Wenjia, K. Xiaoyan, G. Jin, *Packaging Engineering*. **20**, 42(2014).
5. L. Quan, Z. Zhenyu, *CITY PLANNING REVIEW*. **39**, 46(2015).
6. Xu X, Cao X, Jie L, etal, *CAIDCD*. **11**, 1002(2011).
7. L. Lin, C. Junyan, W. Hui, *Science Technology and Industry*. **13**, 13(2013).
8. H. Fei, *Focus on users: UCD concept and Practice* (China Architecture & Building Press) (2009).
9. A. Boting, *Research on urban culture and urban characteristic* (China Architecture & Building Press) (2010).
10. Hopper Leonard J, *Landscape Architectural Graphic Standards* (John Wiley & Sons. Inc) p257 (2007).