Fully Exploring Traditional Chinese Culture and Promoting Organic Development of Green City

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Abstract

Starting from cultural roots, the paper fully explores traditional Chinese culture and clearly defines the definition, connotation as well as features of Chinese cultural tradition. As the carrier of Chinese culture, Chinese traditional architecture emphasizes natural landscape and expresses the concepts of “oneness of nature and man”, which are consistent with the modern desire of “living in nature”. Through studying distribution features, ecological characteristics and building experience of Chinese traditional architecture, combining related practices of building a green city in recent years, and based on the research of traditional culture on design of cities, we plan to promote the organic development of green city. The paper takes Hankou town for example. The examples receive inspiration from the ecological concept of traditional architecture, and put into practice the ecological concept under guidance of culture. Modern architectural language and green technology are used to interpret traditional architectural features. We will better promote the organic development of green city through fully exploring and inheriting culture.

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1. Introduction

The concept of "green architecture" has been widely proposed since 1960s and green architecture has become the mainstream trend for the development of architecture industry in future. The so-called "green" herein means to build...
architecture which is harmless to the environment and is constructed by taking full advantage of natural environment resources on the basis of not destroying environment and ecological equilibrium. Green architecture can be interpreted as reducing environmental load, fully using sunshine, saving energy, and bringing residents with the feelings close to nature and making harmonious and sustainable development between the architecture and the environment. The co-existence and syncretism between nature and human beings are highly stressed according to traditional Chinese culture. The spiritual connotation of traditional Chinese culture is reflected through traditional architecture and city construction, namely, respecting the environment, making adjustment based on the local conditions, using local materials and adapting to the climate [1]. When reviewed from the contemporary green architecture concept, the traditional Chinese architectures are dominated by green architecture, whose green factors need to be explored, studied and re-used deeply.

Reviewing history would be the best strategy for studying contemporary issues. The idea of sustainable development can be met by introducing the green features of traditional culture and traditional architecture into contemporary architectural design through deeply exploring and studying traditional culture.

As a typical case for in-depth study in this paper, Wuhan, located in the eastern part of Hubei Province, is China’s first batch of historical and cultural famous cities with a history of more than 5,000 years. Along the long history, the typical courtyards in Ming and Qing Dynasties and “Lifen” (special civil residential building in Wuhan) in republican period are Wuhan’s representative traditional architectures. Their ecological green features will be analyzed in the study.

The traditional architecture in Wuhan is analyzed in this paper using the multiple layers of study frameworks of typology and morphology, and the memory “collective unconsciousness” of Wuhan people on life is reproduced using typology design method of prototype extraction-type transformation-form reconstruction. The design of green urban streets that are ecological, sustainable and contain rich connotation of traditional culture such as Hankou Town and Chu River and Han Street, brings reference significance to the design of future green district.

2. Idea of Sustainability in Traditional Chinese Culture

According to traditional Chinese culture, the relationship between human beings and nature is highly stressed, which coincides with the modern idea of current sustainable development. It is highly stressed in Confucianism that the change of any matter is within the integral system, both human beings and nature should make development harmoniously, and the human beings should transform and use nature as well as protect it (Fig. 1). Natural inaction and accommodation to nature are highly stressed in Taoism. The essence of traditional Chinese architecture idea lies in harmony between human beings and nature, which is also advocated by geomancy. Human beings is part of nature according to geomancy, which considers that human beings and nature are within one organic integrity and human being’s living space should be integrated with the surrounding environment [2].

![Fig. 1. Architecture is in harmony with the nature.](image)

The traditional Chinese architecture is the carrier that inherits traditional Chinese culture. Natural mountain forest geomancy is highly stressed in the traditional Chinese architecture, which represents the idea of “syncretism between nature and man” and “natural inaction”. This idea coincides with the willingness of “returning to nature” in modern society.
3. Ecological design Idea of Traditional Wuhan Architecture

3.1. Distribution features

The distribution features of the traditional architectures in Wuhan are based on the view of ecological environment-making adjustment based on the local conditions. With diversified geomorphic types in Wuhan, the traditional architectures are distributed in the form of “large-scaled decentralization and small community”. The traditional courtyards are established by adapting to the trend of mountains and near water so as to be in harmony with nature and topographical changes. Ecology, water and soil are maintained by natural environment and terrain (Fig. 2).

- Internal ecological features: Traditional architectures are generally in the form of courtyard buildings, the combined mode of which is different due to different terrain conditions. Some are symmetric courtyards with several accesses and form a circle with roof connected mutually. Differently, some traditional residential buildings are in the form of dooryard or space bucket or a combination of both. The internal property of courtyard reflects the meanings of multiple layers of connotations of Confucianism in traditional Chinese culture, such as cohesion, centrality and gradability.

- Architecture sustainability - combination composition: Another significant feature of traditional Chinese architecture is a cluster of buildings. By learning from the architectural history, there are two different modes ever used for expanding architecture modes. The first one is about the expansion in terms of quantity, by which, more and more complicated contents are organized and integrated in the same house which is changed from small to large one and from one layer to multiple layers. On the basis of single house, the extension is made to the height in maximum or on the plane. The other one is about dividing "one single building" with different applications into several ones on the basis of increasing "quantity", thus small groups can be changed into big ones(Fig .3). On the basis of architecture cluster, they are distributed in space with one layer connected with another, forming a broad and well-organized artificial environment. The mode is generally adopted in the Chinese classic architecture and as a result, a series of architecture clusters with a number of buildings are formed, bringing the closed open space and natural scene into the composition of architecture [3]. This mode of composition is indeed green and sustainable.
3.2. Ecological features

Several ecological features are represented in the traditional architectures in Wuhan and some of them are hereby analyzed:

Street size: with general large depth-width ratio, traditional streets avoid direct sunshine, which is beneficial to energy saving and cooling in summer.

Natural air channel: the natural ventilation promoted by thermal pressure and wind pressure reduces refrigerating load and removes indoor harmful gas; the following principles were focused on by ancient architects: the wind speed becomes higher in windward side and nook, and the distribution of wind pressure on the external building envelope of architecture is affected by ambient conditions such as form of architectures nearby and density.

- Dooryard and space bucket: Improvement of indoor thermal environment by combining climate: chimney is most commonly used by the traditional residential architectures for ventilation and cooling. Chimney makes smoke indoors exhaust to the outside in a well-organized manner through drafting instead of mechanical mode. People realize the purpose of ventilation and cooling by the effect of chimney subtly so as to improve the indoor air quality significantly. The thin and high dooryard of traditional architecture is used for ventilation, cooling and smoke exhausting, by the effect of chimney. In terms of use of natural wind, doors and windows or both windows are opened at the opposite mutually so as to form cross ventilation. Monsoon, dominant wind and orographic winds should be used as much as possible. Sunlight hour can be reduced in virtue of the narrow dooryard organization space together with trees planted in open space. Some cool place is formed purposefully and the principle of sluggish cold air is used to form cool and comfortable cool belt in the hot summer.

- Using local and natural materials fully-using local materials: The materials of traditional architecture are dominated by local architecture materials—brick, stone, tile and wood. Not only the low-influence materials are used but also the local natural environment is protected.

- Integrating overall ecological system: The integration of traditional architecture and nature enables architectures to co-exist with ecological system in a friendly manner. The combination with environment, as highly stressed in traditional Chinese architecture, aims at minimizing the influence on the environment and thus coordinating ecological system.
3.3. Cultivation experience

A great deal of ecological cultivation experience has been accumulated during the process of constructing traditional architectures in Wuhan. All these methods can be used for design reference and the low cost features fully manifest ecological feature. Construction method of diversified building envelope: cob wall, wall filled with wall stone and earth, wall covered by bricks and filled with soil and rubble wall. Double-layer window: the external layer is wooden louver while the internal layer is glass window. In case of direct sunshine, external window will be closed for covering sunshine and ventilation. The indoor should be separated by wooden grating with good ventilation conditions.

4. Reproduction of Traditional Streets

Typology refers to one kind of design strategy by which architects have dialectical dialogue with history by effectively carrying local space traditions [4]. The significance of streets in urban unit and city texture is highlighted when studying city with typology method. The reconstruction of the original historical space and new urban space manifests the diversified space consisting of architectures, streets and interface from spatial perspective.

4.1. Selection of type

- Lifen in Wuhan: As a city with a long history, Wuhan now has a great number of traditional streets with unique features, dominated by “Lifen” (Fig. 4) [5]. Appeared in the early stage of the last century, Lifen refers to several row low-layer residential buildings that were quite common in inland port cities. As the earliest housing cluster in Wuhan, Lifen was mainly in Hankou and Wuchang Districts along Yangtze River and it was most widely distributed in the areas along Yangtze River in Hankou, with large quantity and extremely high quality and historical value. As a typical region that is hot in summer and cold in winter, Wuhan has severe climate conditions in both seasons (Fig. 5) [6]. More than one hundred years of architecture culture brings simple ecological idea and simple but efficient energy-saving measures to the design and construction of traditional streets. The residential buildings in Lifen are generally two layers and partially three layers with the building height about 8-10 m. The lanes and roads in Lifen are generally narrow, 4.5-10 m, forming large width of lanes and roads so as to avoid direct sunshine (Fig. 6) [7]. It is beneficial to energy saving and cooling in summer. A majority of Lifen architectures were dense in land use and spatial arrangement but one inside yard was reserved in design. Different from quadrangle courtyard that is quite common in North China; this kind of yard is set at the entrance of building and is separated from the outside by just a wall [8]. It plays a role in indoor and outdoor buffering, protecting the privacy of households and making space more interesting. What is more, the face width of Lifen building was narrow but the depth was long due to the restriction of site. In order to facilitate lighting, one concave yard was designed to enhance the face width of building so as to acquire more lighting.

Fig. 4. Views of Lifen Architecture.
Dooryard courtyard: The key feature of residential buildings in Wuhan is the courtyard plane layout featured by dooryard (Fig. 7). The orientation of residential buildings is dominated by east or southeast direction so as to fully use sunshine, comply with the dominant wind direction at local area and benefit indoor natural ventilation. House doors are dominated by dooryard through which natural lighting is formed. Through refraction, ray of light is less dazzling and becomes soft. Dooryard is used reasonably for indoor natural ventilation, collection of rainwater and sunshade in summer. Pool and potted landscape inside the room is used for greening and adjusting indoor humidity, making it cool in summer and warm in winter. It can be called natural air conditioner in ancient times. In general, the main building contains three rooms with the door of central room opening to the dooryard. It is also the living and activity center of the household (Fig. 8) [9]. The wing-rooms and the side rooms on both sides of central room are bedrooms, which were not provided with windows towards the external wall but with windows towards dooryard. In this way, the security is satisfied and less heat is reduced by window, which also connotes a cluster of wealth. The indoor lighting, ventilation and drainage depend on dooryard, the design of which is in the layout of "collecting all things from different directions", which implies a "collection of wealth". The plane shape of residential buildings are mainly rectangular and the sizes between columns are close to the modern size with small spacing but large depth, making heat transfer and consumption value inside the room less than energy consumption. "Courtyard" architecture reflects the organic combination of buildings and natural environment, and natural and ecological energy-saving idea through its special architectural form.
4.2. Space texture

The local traditional space type in Wuhan is dominated by street space, courtyard space, row multi-layer space and disorder courtyard [10].

4.3. Reconstruction of urban streets

New architectures are created by transforming and reconstructing the elements extracted from traditional historical blocks based on site characteristics. Following the above studies, this paper selects two architectural practices - Hankou Town and Chu River and Han Street to describe the application of traditional ecological concept in the creation of contemporary architectures.

5. Sustainable Design Concept

5.1. General layout

Given that it is very hot in Wuhan and the prevailing wind direction is southeast wind in summer, the main lanes of Hankou Town are designed in north-south orientation, after taking site characteristics and the wind direction in summer into consideration. Besides, 3 nodes, the Main Entrance Square, "Dragon God Temple" Wharf and the Secondary Entrance Square, are designed based on the needs of functional and spatial layout within the site (Fig. 9). During the opening period of the 10th China (Wuhan) International Garden Expo, crowds flowed into the 3 nodes; in particular, the Main Entrance Square in the southeast direction, and the "Dragon God Temple" Wharf and the Secondary Entrance Square in the east direction induced natural wind into the site. In addition, the underground parking space of Hankou Town is designed to form a "valley" with the surrounding soil, and the valley facilitates the introduction of wind direction, by which the microclimate of Hankou Town is improved together with the 3 nodes.
At the meantime, the buildings in the north side of the Town are relatively dense comparing with other streets in terms of layout, and their height is slightly higher than the buildings in the south side, so that they form a barrier to stop the permeation of Winter wind to some extent, and thus improving the microclimate of the streets of Hankou Town and saving energy. Moreover, the buildings in the north side are adjacent to the inside of the garden, so that the internal scene of the garden can be viewed as much as possible through the balcony and terrace designed.

![Fig. 9. (a) Hankou Town layout; (b) Hankou Town CFD analysis.](image)

As the basic layout of Hankou Town space, the streets significantly affect the spatial texture of the whole project through its organizational structure and space configuration. The streets are designed in a crisscross pattern and paved with blue flagstone. The main streets, including Changdi Street, Dajia Street, Hanzheng Street and Hualou Street, are 170-190 m long and 5-8 m wide, forming the main sightseeing route. In the main streets, 3-4 m wide bystreets are built with a spacing of 50-70 m to connect 3 main streets, so as to facilitate the evacuation and diversion of tourists. Bridge galleries are designed between certain lanes. The three-tier spatial layout of "main street-secondary street-lane" is formed and reflected as "overall space-streets-architectural courtyard" in the space of Hankou Town. The scattered buildings along streets divide the streets into many small spaces organically, making the overall space secured and filed with humanity.

Kevin Lynch said in his book The Image of the City that: "nodes, which can be referred to as the sudden change of line of communications, are really important to city observers, because people have to make a choice on them"[11]. He emphasized the significance of nodes to city recognition. In the overall layout of Hankou Town, the main streets and secondary streets, and the secondary streets and lanes form many nodes, among which the Shanxi & Shaanxi Guildhall in the main square is the core, and the "Fisherman's Wharf", "Lantern Riddles", "Chu Opera & Puppets" and "Picking Lotus on Fishing Boat" form the secondary nodes. In addition, the "Chu Opera & Puppets" node combines the square of large spatial scale with carved poems and springs, and the vertical wall surface is constructed as the puppet wall to miniature Chu opera featured with "One Accented Beat and One Unaccented Beat", "Dancing with Long Sleeves" and "Mount the Stage in Full Regalia". These clearly defined nodes tell stories with regional features in the form of spatial section, and then all the spatial sections from south to north are connected with smooth paving lines to present the warm living scene of Chu people in the vast earth of Hubei.

5.2. Enlightenment from traditional space

Buildings in Hankou Town generally include two layers and partially three layers. Restricted by the street, the facade is used for transmission and transformation of space and based on the strategy of subtle coexistence of multiple styles. The street transmits from Chinese style to Western style from the south to the north and they are divided by the Secondary Entrance Square. The Guildhall Building No. 3 Street Lane is mainly featured by Chinese style, while the areas at the west of Hualou District are featured by Western style. The Chinese and Western culture
meets at the Secondary Entrance Square, so do theater stage and bell tower. The architectural forms include official and folk style, in which, the official style is represented by buildings with outstanding nodes, such as "Shanxi & Shaanxi Guildhall", "Longevity Palace" and "Guangdong Guildhall"; while the folk buildings are focused on recovering street scene and local architectural style of Hubei, with emphasis on the overall harmony of streets and lanes[12]. A colorful image is created by integrating multiple forms including theater stage, bell tower, brick arch arcade, wharf and yard.

Space is the core of architecture. In this project, an architecture space with ordered opening and closing is formed by using gentle and natural architecture layout and layered building and the design represents both traditional architectural space - street/lane, corridor/bridge and courtyard/yard and space characteristics of modern architecture such as lightness and transparency. The well-arranged space under eaves, courtyard space and buildings have formed street space and square nodes with the feeling of plentiful layers.

While recovering the characteristic street space of Wuhan, Hankou Town also uses the energy saving design idea and design methods that are extracted from traditional street of Wuhan and suitable to Wuhan’s hot summer and cold winter. To ensure high special feeling in architectures, the depth-width ratio of street and lane is strictly controlled; the building height is around 10-15 m and street is controlled with a width of 5-8 m in order to shade sunlight in Summer, keep buildings and streets within shade for a long term and reduce influences of high temperature in Summer on people’s activities (Fig. 10). In the meantime, internal yard is established in single architectural design based on actual demand by referring to the internal yard of Lifen. The form of internal yard is thus enriched by creating fully enclosed courtyard, semi-enclosed courtyard, courtyard with several accesses and independent building in courtyard [13].

5.3. Application of traditional materials

The traditional materials such as brick, wood, tile, stone and adobe are used and traditional waste materials were recycled. Large amount of waste bricks, concrete blocks, woods and metals may be generated by demolishing old building or the buildings damaged by natural disaster; if such wastes are widely used as recycled construction materials, it not only protects environment, reduces the influence of construction waste on environment, but also greatly saves construction cost and resources. The old buildings at Hanzheng Street were transformed and dismantled after completing the design of Hankou Town. As recommended by the designer, the owner recycled the old bricks, door heads, doorstep stone and wooden door & window, and had them grinded and painted for direct utilization during the construction of Hankou Town according to their characteristics. It not only brings charm and sense of history to the building, but also shows the concept of environmental protection and energy saving to tourists (Fig. 11).

The modern architectural structure plus traditional facade was integrated in Chu River and Han Street. The frame structure was uniformly used in architecture, but the facade was decorated by traditional grey brick matched with red brick. By comparing the masonry at site, the facing brick was replaced by real bricks collected from old houses.
demolished to construct the wall. To combine the real brick wall and concrete framework, angle steel was installed below the beam to support the brick wall and the effect proves to be overwhelmingly amazing.

6. Conclusion

Green city's sustainable development is a wide range of topics, the traditional architecture of the green concept can be used in urban design, is a very meaningful thing. Chinese traditional architecture emphasizes the harmony between man and nature environment, the building should respect the environment, adapt to the climate, the use of easy to get materials. Modern green cities promote the use of local renewable energy and resources; its design concept is consistent with the traditional architecture.

The design of the Hankou town uses a large number of ecological strategies from the traditional historical building and has achieved great social repercussions and good experience in the use of inputs. Not only to give people emotional satisfaction, but also make people had very good physical body feelings.

The green measures in the traditional architecture can be improved and utilized, combined with the new technology, applied to the design practice of the contemporary architecture.

In conclusion, the exploration of the relationship between the green design method of traditional architecture and the contemporary architectural design method is a very meaningful topic. The exploration of this connection is of great significance to the future design of the green city.

References