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The Ecological Code of Landscape Cities: Traditional Feng Shui Patterns for Modern Sustainable Spatial Designs

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Abstract: The traditional Feng Shui pattern embodies rich ecological wisdom and philosophical thoughts, which are of great significance to the modern sustainable space design. The core concepts of Feng Shui patterns from traditional civilization can provide a theoretical foundation and research framework for this study. By integrating these principles, such as "hiding the wind and gathering the Qi" and "backing the mountain and facing the water", a functional relationship between urban structures can be established. This approach can help optimize the spatial layout of urban elements, minimize energy consumption, and enhance environmental comfort. It also examines the influence of the ShanShui City pattern in traditional Feng Shui on guiding the development of modern urban ecological networks, as well as its role in protecting and restoring biodiversity through ecological corridors and ecological nodes. The modern urban design of traditional Feng Shui culture focuses on the inheritance and innovation of riotous things and the combination of traditional Feng Shui concepts and modern design concepts to form ecological spaces with cultural connotation. This paper hopes to give some inspiration or methods for contemporary urban design and to reconcile the relationship between human and nature through these thoughts.

Keywords: ShanShui City; Ecological code; Traditional Feng Shui pattern; Modern sustainable space design; Ecological balance

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1. Introduction

As urbanization continues to accelerate, cities are gradually maturing while also facing many ecological and habitat problems and how to achieve ecological harmony in urban design has become an important issue. Traditional Feng Shui pattern, as a form of ancient ecological wisdom, emphasizes the harmonious coexistence of human and nature, and contains rich ecological significance and philosophical thoughts. The analysis of the influence of traditional Feng Shui patterns on the modern urban design can optimize the spatial layout of cities and buildings, improving the ecological resilience of cities and the quality of life of residents. This paper will discuss the inspiration of traditional Feng Shui pattern for modern sustainable space design, analyze how it is applied in space layout optimization, ecological network construction, cultural inheritance and innovation, and give new

ideas and methods for modern city design.

2. Traditional Feng Shui patterns —core concepts

2.1. The essence of Feng Shui

(1) The aiming concept: The four "Qi", "wind" and "water" of Feng Shui and their ecological implications

Qi is the fundamental principle behind Feng Shui and the life force of the universe understood to be omnipresent and constantly moving. This flow and gathering of Qi also has a direct impact on a person's fortune and health. In the context of ecology, Qi can be interpreted as the flow of energy within the natural environment, including air, sunlight, and geothermal heat. By harnessing these energy sources as potential generators and maximizing their synergy across a broad area, a stable and sustainable regional ecological environment can be formed. According to Fengshui, "hiding the wind and gathering the Qi", that is to say, a reasonable environmental layout can help gather and maintain auspicious Qi and avoid the influence of bad factors.

The wind is considered one of the factors that is always dispersed Qi in the Feng Shui, so it is necessary to avoid an excessive wind frontal impacted to the living environment. In ecology, the effect of wind in nature is ultimately reflected in air circulation and climate regulation. Moderative wind can supply fresh air, but too strong wind can stimulate energy loss and environment instability.

Water in Feng Shui represents the flow of wealth and fortune, and clear, meandering rivers are believed to impart prosperity and vitality to the surrounding area. Water in ecology is the origin of life. Water bodies can moderate the climate, enrich the land, and sustain different life forms. As an example, Hong Kong Victoria Harbor, the asymmetric bay shape not only brings landscape beauty to the city, but also relieves the heat island effect of the city through the regulating effect of water body, which improves the quality of the city's ecological environment.

(2) Analyzing how Feng Shui patterns influence the energy flow and material circulation in the environment

Feng Shui patterns focus on optimizing spatial layouts to ensure the free flow and accumulation of Qi, aligning with the principles of energy (material) circulation in the environment. For example, mountain ranges are believed to channel and guide the Earth's Qi, influencing its movement and enhancing the surrounding environment. Among natural elements, large bodies of water, where Qi tends to accumulate, are considered the most beneficial, followed by wind, which plays a secondary role. Rational architectural planning and directional collection can lure and settle good Qi, avoid bad factors, and serve the goal of improving the living and working environment.

Ecology, in this configuration supports air flow, climate, soil and water retention, and encourages living organisms. Essentially, for a design closer to the water source, but not facing directly to the water flow, it is helpful to regulate the microclimate, reduce the occurrence of diseases, reasonable distribution of vegetation, taking terrain design into consideration to maintain soil and water, and effective propulsion of material circulation. For instance, with the Hakka roundhouses in southern China, the layouts of the buildings are typically designed to face the paddy field and have their back toward the hilly area, forming a good ecological circulation system. The grasses on the hills help stabilize the soil, preventing erosion, while paddy fields and mulched farmland contribute to a life-supporting environment by enhancing moisture levels through evaporation. These agricultural landscapes also regulate local climates and support diverse ecosystems, promoting ecological balance.

2.2. Elements of traditional Feng Shui layout

(1) Landscape, topography, and vegetation as well as their importance in Feng Shui layout

From a Feng Shui perspective, the mountains, topography, and vegetation are natural elements that help

the layout arrangement. Mountains are considered as the head of Feng Shui, symbolizing stability, solidity, and longevity. The height, shape, and orientation of mountains affect the landscape and well-being of the inhabitants. For example, having a dominant high peak and symmetrical peak on the left and right in a mountain range is the most ideal Feng Shui pattern for positive energy gathering.

According to Bagua theory and the Five Elements, the orientation of the mountains determines the fortune of the occupants. The height can be the height of the land, the height of the slope near the building, and the shape of the valley surrounding the environment. An environment of high ground is often a territory of talent, whereas low-lying areas might just be graced by riches and fortune.

Feng Shui also sees the importance of vegetation. The greenery on the hills must be dense and flourishing, which will increase the gathering of energy. On the other side, mountains with barren and dry plants may produce bad energy, which leads to a bad impact on the inhabitants. Based on Shen *et al*, Huangshan Mountain located in Anhui Province of China, the unique of the mountain shape and superb vegetation not only provides rich tourism resources for the area but also maintains soil and water and regulates the climate through the ecological function of vegetation, which provides an important base support for the ecological environment of the adjacent areas.

(2) Balanced relationship among the buildings and the nature

The most crucial one of traditional Feng Shui patterns considers the nature of the relationship between buildings and nature as harmonious and symbiotic and believes that the perfect combination of the two is a core principle that needs to be pursued. These principles, particularly the layout concepts of "backing the mountain and facing the water" and "hiding wind and gathering Qi", exemplify the ancient people's deep understanding of natural laws and their enduring pursuit of an ideal living environment.

The pattern of "back to mountains and front to water" carries profound cultural significance and practical value. In Feng Shui concepts, the mountain serves as a steadfast protector, shielding the back of the house. This not only provides structural support but also blocks cold northern winds and potential natural disasters, such as landslides and mudslides, ensuring a stable and undisturbed living environment. At the front, flowing water symbolizes vitality and prosperity. The movement of water represents the continuous cycle of life, while its shimmering presence enhances the visual beauty of the surroundings. Beyond aesthetics, water is believed to bring fortune and abundance. Many ancient village houses reflect this ideal layout, nestled against picturesque mountains with clear streams flowing in front. In such environments, villagers have long experienced harmony and prosperity, deeply connected to nature.

The principle of gathering wind and Qi should not be overlooked when creating an ideal living environment. A well-balanced space should be designed to shield against harsh winds while allowing Qi to circulate smoothly and accumulate rather than disperse. This fosters an atmosphere of stability, prosperity, and auspicious energy. From a practical perspective, if a home's front door directly aligns with a window or a back door, Qi flows straight through without settling, making it difficult to form a harmonious energy field. To counteract this, traditional courtyard designs often incorporate strategically placed walls, screens, or partitions. These elements not only maintain spatial ventilation but also guide airflow in a way that allows Qi to twist and circulate within, effectively achieving the feng shui principle of "hiding wind and gathering Qi".

The orientation of a building is important for creating a comfortable living space. Sunlight, wind direction, and temperature affect different directions in different ways. A well-placed building can stay warm in winter by absorbing sunlight and cool in summer by using natural breezes. Choosing the right orientation helps make a home more comfortable and energy-efficient. A good example is Wuzhen in Zhejiang Province, China, where traditional houses are built to fit the natural landscape. With mountains and water nearby, and tall trees and hills behind, the layout creates a peaceful and eco-friendly environment.

3. Key elements of modern sustainable space design

3.1. Ecological balance and biodiversity

It is vital to protect and restore the integrity of natural ecosystems in urban design. The natural heritage of the city must be protected, not only for the current benefit of mankind but also to maintain the potential needed for future generations. Specifically, the protection, maintenance, sustainable use, restoration, and enhancement of the environment are key to achieving this goal. For example, protecting natural areas such as natural river basins, coastlines, and forests ensures that these ecosystems can continue to fulfill their ecological functions. In addition, by rationally planning urban space and avoiding overdevelopment and destruction of natural habitats, pressure on ecosystems can be effectively reduced, thereby maintaining ecological balance. Taking Singapore as an example, the country attaches great importance to the protection of natural ecosystems in its urban planning. By establishing several nature reserves and national parks, such as the Gardens by the Bay and the U Min Island Nature Reserve, the country protects the rich biodiversity and at the same time provides opportunities for urban residents to get close to nature.

Green infrastructures, such as urban parks and green space networks, are effective means to promote biodiversity. These green spaces not only provide urban residents with places for leisure and recreation but also provide habitats for a variety of organisms. For example, urban parks and green space networks can serve as corridors for biological migration, connecting different natural areas and promoting species exchange and genetic diversity. In addition, green infrastructure can support the survival and reproduction of different species by providing diverse ecological environments. For example, Barcelona provides important support for biodiversity through a complex resource of green spaces, each type with its own characteristics and functions, such as protecting nature, reducing air pollution, and regulating temperature. According to statistics, Barcelona's network of urban parks and green spaces provides habitats for more than 200 species of birds, 50 species of mammals, and thousands of plant species, greatly enriching the city's biodiversity.

3.2. Efficient utilization of resources

In cities, recycling of water resources and energy is a key strategy for achieving sustainable development. In terms of water resource management, rainwater harvesting systems can effectively reduce the burden of urban drainage and, at the same time, be used for non-potable water purposes, such as garden watering and toilet flushing. For example, rooftop rainwater harvesting tanks with filtration devices ensure that the water quality is basically clean and then stored in underground cisterns for secondary use.

In addition, the choice of water-saving appliances, such as low-flow toilets and shower heads, can drastically cut down on daily water consumption and, in the long run, will greatly reduce the cost of water supply. Taking the city of Freiburg in Germany as an example, the city has reduced the city's per capita water consumption to less than 100 liters per day, well below the national average in Germany, through an extensive rainwater collection system and the use of water-saving appliances.

The application of green building technologies is an important means of improving resource utilization efficiency. For example, passive solar design reduces energy consumption through rational layout and technological innovation to achieve the purpose of energy saving and emission reduction. Large south-facing windows with sun-shading facilities allow full sunlight to reach the interior in winter while blocking too much direct light in summer to maintain a comfortable room temperature.

High-performance insulated windows and an Intelligent Building Management System (IBMS) automatically adjust lights, curtains, and HVAC (heating, ventilation, and air conditioning) to optimize energy allocation based on actual occupancy rates and weather forecasts, enabling refined management and avoiding waste. In addition, LED lighting systems are favored for their high efficiency and long lifespan, saving more than 75% of electricity

compared to traditional light sources with no mercury pollution. Take Seattle in the United States as an example; many of the city's new buildings have adopted passive solar design and intelligent building management systems, reducing the building's energy consumption by more than 30%, thus greatly improving the city's energy efficiency.

3.3. Green infrastructure construction

Planning and designing green infrastructures, such as urban green spaces and water systems, are essential for the modern sustainable design of spaces. Urban green spaces consist of parks, green spaces along city roads, rooftops of buildings, and many other forms, which not only offer a space to rest and play for the urban inhabitants but also grant habitats for numerous types of organisms. As canonical examples, the intersections between urban parks and green infrastructure or hydrological systems can function as biological corridors, enabling the migration of organisms across fragmented landscapes into "natural" systems and allowing species to move and mix for genetic diversity and adaptable evolution. On the other hand, planning water systems incorporates the conservation and rehabilitation of water bodies (like rivers, lakes, and wetlands), which are vital to climate regulation, water storage, and air purification.

Restoring the natural shape and ecological function of rivers can significantly reduce urban flooding and improve the microclimate of cities, for instance. Moreover, when planning green infrastructure, it should also be the coordination of other functional areas in the city, such as transportation, residential, and commercial areas, to achieve a comprehensive optimization of urban space. For example, the design of extensive green spaces and water systems in Amsterdam, Netherlands not only lays a good ecological foundation for the ecological environment of the city but also integrates green infrastructure with the transportation, residential, and other functional areas of the city, improving the overall quality of the city.

Green infrastructure serves in multiple ways, making the city more ecologically resilient and residents' life quality more pleasant than the engineered infrastructure. Firstly, green infrastructure can help to improve the recovery of the city in natural disasters. Green spaces and water systems, for example, can serve as urban "sponges" by absorbing and storing rainwater during heavy rains to mitigate flooding risk and releasing water during droughts to support ecosystem stability. Second, green infrastructure has the potential to enhance urban microclimate. Evaporation and transpiration from green spaces and water bodies help lower urban temperatures and reduce the heat island effect; they also absorb airborne pollutants and improve air quality.

Green infrastructure also gives residents a chance to engage with nature, which can improve their physical and mental well-being and their quality of life. For example urban parks and green space can provide a space for residents to relax, exercise, and socialize, improving community cohesion and sense of well-being for residents. For example, in Tokyo, Japan, by creating plenty of urban parks and green spaces, including Ueno Park and Yoyogi Park, the city not only effectively improved the ecological environment in the city, but also provided people with a wealth of recreation and leisure places, which indirectly improved people's quality of life.

4. Implications of traditional Feng Shui patterns for modern sustainable space design

4.1. Optimization of spatial layout

The feng shui concept of "hiding wind and gathering Qi" has important inspiration significance to modern city and building spatial layout. Therefore, the idea of Feng Shui has always been on collecting and leading the flow of Qi through reasonable spatial layout, which creates a harmonious and stable environment. The orientation and layout of buildings can be optimized, reducing energy consumption and improving environmental comfort through the use of natural wind and sunlight in modern urban planning. To reduce the use of air conditioning and artificial

lighting, for example, buildings can be built in a north-south orientation to utilize natural light and ventilation.

A rational building layout can also create natural ventilation corridors, guiding the flow of tide air to facilitate smooth airflow and optimizing the microclimate in the city. Taking Beijing as an example, many traditional courtyard architectural settings fully reflect the principle of "hiding the wind and gathering the Qi" through reasonable orientation and layout to create good ventilation and lighting conditions inside the courtyard, to enhance the comfort of living.

Proper building orientation and design is an effective means to reduce energy consumption and improve envelope comfort. Zero energy building(ZEB) design comes from passive strategies based on site analysis, such as integration and building orientation and layout to make the most of natural light and ventilation to avoid using light and mechanical cooling systems. Additionally, the rational building layouts can serve as natural ventilation corridors to smoothen the airflow and enhance the microclimate of cities. For instance, by using certain spatial arrangements of buildings, we could increase air circulation and reduce heat accumulation, resulting in the reduction of heat island effect in the city.

These designs not only just preserve energy and limit emissions, but they help state residents live better, too. Taking Hamburg in Germany as an example, there are several natural ventilation corridors formed by rational building layout and orientation design in city planning advantages, which can effectively alleviate the urban heat island effect and improve the environmental comfort degree of the city.

4.2 Construction of Ecological Network

The ShanShui pattern of traditional Feng Shui provides a guiding significance for the construction of the ecological network in modern cities. In Feng Shui, emphasizing the environment of mountains and water, refracting wind and gathering Qi, which symbolizes Fengqi and can be formed through the rational layout of ecological network and the landscape resources in modern urban planning. Water bodies like rivers, lakes, and wetlands can act as ecological corridors of the city and can integrate ecological patches that enable population migration and gene exchange. Furthermore, mountains and green lands can be ecological knots, providing habitation and ecological works for the ecological resilience of cities. For example, in Hangzhou, China, the beautiful water bodies, surrounding mountain ranges, and greenery are reasonably distributed to form a complete ecological network to ensure the protection of rich biodiversity and improve the quality of the city's ecological environment.

Biodiversity can be protective and restored through ecological corridors and ecological nodes. Ecological axes can connect different ecological patches to form a continuous ecological network and promote the migration of species and gene exchange. Rivers, green spaces , and parks, for example, can provide ecological corridors in cities, serving as migratory corridors for birds, insects, and other organisms.

Ecological nodes, in contrast, can serve as habitats for many life forms and help the reproduction and growth of multiple species. For example, parks and recreational sites can be captured as habitats to host a variety of plants and animals to enhance the biodiversity. Ecological networks provide not only support to protect biodiversity but also contribute to enhancing the ecological resilience of cities and the quality of life of urban residents. Taking Portland in the United States as an example, through the construction of several ecological corridors and ecological nodes, such as the Willamette River Ecological Corridor and Forest Park Ecological Node, the city has effectively protected and restored the city's biodiversity and improved its ecological quality.

4.3. Cultural inheritance and innovation

The inheritance and innovation of traditional Feng Shui culture in modern urban design is of great significance.

Feng Shui culture contains rich ecological wisdom and philosophical ideas, which can provide new ideas for modern urban design. For example, the principles of Feng Shui, such as "hiding the wind and gathering the Qi" and "facing the mountain and the water", can be applied to modern architectural design to create a harmonious and comfortable living environment.

At the same time, the symbols and elements of traditional Feng Shui culture can also be integrated into modern design to increase cultural connotation and artistic value. Taking Shanghai in China as an example, many modern buildings have incorporated elements of traditional Feng Shui in their design, such as the building layout of the Lujiazui area, which fully considers the ShanShui City pattern in Feng Shui and forms a unique cityscape. Combining traditional Feng Shui concepts with modern design concepts can create ecological spaces with cultural connotations. For example, modern architectural design can incorporate the landscape pattern in Feng Shui to form an ecological network through the rational layout of landscape resources.

At the same time, symbols and elements in Feng Shui, such as dragons, phoenixes, Bagua, etc., can be used in modern design to increase the cultural connotation and artistic value. This combination not only helps to pass on and promote traditional culture but also enhances the ecology and artistry of modern urban design. In Guangzhou, China, for example, many modern buildings combine traditional Feng Shui concepts with modern design concepts in their design, such as the Canton Tower, which was designed with full consideration of the ShanShui City pattern and cultural symbols in Feng Shui, and has become a cultural landmark of the city.

5. Conclusion

As an ancient ecological wisdom, traditional Feng Shui patterns provide valuable insights for modern sustainable spatial design. By drawing on the concept of "hiding wind and gathering Qi" in traditional feng shui, the spatial layout of cities and buildings can be optimized, energy consumption can be reduced, and environmental comfort can be improved. At the same time, the ShanShui City pattern in traditional Feng Shui provides guidance for the construction of modern city ecological network, through the construction of ecological corridors and ecological nodes, can effectively protect and restore biodiversity. In addition, the inheritance and innovation of traditional Feng Shui culture in modern urban design, combining traditional Feng Shui concepts with modern design concepts, can create ecological space with cultural connotations. In conclusion, the traditional Feng Shui pattern provides new ideas and methods for modern urban design, promotes the harmonious coexistence of man and nature, and provides important theoretical and practical guidance for sustainable development.

Disclosure statement

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