



The aesthetic application of window design in traditional Chinese architecture

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ABSTRACT

Traditional Chinese architecture and gardens are known for their artistic charm, with windows playing a key role in both aesthetics and function. Windows serve not only for ventilation and lighting but also as design elements, reflecting cultural significance through various shapes and forms. In gardens, windows frame and borrow external views, blending nature with the interior space. This concept enhances the harmony of traditional Chinese garden design. This paper examines the integration of traditional window design with modern approaches, as seen in the renovation of the Beihai Garden Expo Park's "Ancient and Modern, Chinese and Foreign" campus.

KEYWORDS

traditional Chinese architecture, classical garden landscapes, aesthetics of window design

1. INTRODUCTION

Architecture, as a concentrated expression of culture, evolves under the influence of geographical conditions, historical changes, societal emotions, and religious beliefs. Architectural characteristics reflect the geographic environment, humanistic patterns, and social structures of their respective eras. As the renowned architect I. M. Pei [1] once remarked, "Architecture is a social art form." The development of this art is inextricably linked to its specific cultural context.

Traditional Chinese architecture and garden landscapes are cherished cultural legacies, renowned worldwide for their unique artistic appeal and profound cultural significance. Within this cultural framework, windows stand as indispensable elements that serve both practical functions, serving practical functions like ventilation and lighting, as well as aesthetic purposes, while also acting as a carrier of cultural symbols and spatial ambiance.

The window is an indispensable element; this paper takes the renovation project of the Han Culture Communication Industry Institute at Beihai University of Art and Design as a case study to explore the aesthetic application of traditional Chinese window design in modern architecture and garden landscapes. By analyzing its cultural connotations and artistic characteristics, the paper reveals the value of traditional window design in contemporary applications, offering insights into integrating traditional cultural elements with modern design principles, while achieving a harmonious balance between honoring the past and addressing the needs of the present and future [2].

2. THE HISTORY AND CULTURAL BACKGROUND OF WINDOW DESIGN IN CHINA

2.1. Window design in Chinese traditional architecture

The history of Chinese architectural window design is long and rich, embodying both cultural depth and artistic expression. From the Han dynasty to the Ming and Qing dynasties,

window design evolved continuously, showcasing distinctive characteristics in shape, materials, craftsmanship, and spatial arrangements across different historical periods.

Han Dynasty Window Design: in the Han dynasty (202 BCE - 220 CE), windows prioritize simplicity and functionality in terms of ventilation and lighting, focusing on meeting basic needs. Simple lattice structures were commonly employed to provide ventilation and natural lighting for interiors. The design of windows during this period was relatively plain, prioritizing functionality, which reflects the Han Dynasty's architectural philosophy of practicality.

Tang and Song Dynasty Window Design: During the Tang and Song dynasties (618 CE - 1279 CE), window design began to incorporate decorative and aesthetic elements alongside functional considerations. The shapes and decorations of windows became more diverse, with common forms including circular, fan-shaped, and plum blossom motifs. Tang dynasty windows, particularly, saw the refinement of openwork windows, featuring intricately carved motifs of flowers, birds, and auspicious symbols, showcasing the era's emphasis on artistry and refinement.

Ming and Qing Dynasty Window Design: The Ming and Qing dynasties (1368 CE - 1912 CE) marked the zenith of Chinese window design, characterized by an abundance of artistic styles and craftsmanship. Windows became more varied in form, including diamond shape, octagonal, and cloud patterns. The materials expanded beyond wood to incorporate stone and metal. The decorative motifs grew increasingly elaborate, featuring dragons, phoenixes, floral patterns, and auspicious characters, blending functionality with visual appeal. This period emphasized integrating lighting, ventilation, and landscape viewing into window design, achieving a harmonious balance of functionality and aesthetics.

The development of window design in traditional Chinese architecture vividly reflects the craftsmanship and cultural characteristics of different eras, while also mirroring the changes in social aesthetics and lifestyles. The rich connotations of this traditional design have become an important source of inspiration for modern architecture and landscape design, providing a solid historical foundation for the integration of traditional culture and contemporary practice.

2.2. Window design in Chinese garden landscapes

Window design plays a crucial role in Chinese garden landscapes. In these gardens, windows serve not only to provide ventilation and lighting but also as a focal point of the design, adding a dynamic beauty to the space. Looking at the history of ancient Chinese gardens, they can be broadly categorized into imperial gardens, private gardens, natural mountain-and-water gardens, and temple gardens. Regardless of the type, all these gardens focus on creating a landscape that emphasizes the harmonious relationship between buildings, and between buildings and the mountains, water, and plants.

The main function of traditional gardens is to provide spaces for rest and recreation. As a result, the architectural elements in gardens often include halls, pavilions, towers,

pavilions, corridors, and bridges, which are typically designed with a light and open form, exuding a rhythmic beauty. Due to the characteristics of garden architecture, window designs also exhibit many novel, lively, and playful forms.

In Chinese garden design, windows are used to ingeniously bring external natural landscapes into the garden space, blending the scenery with the architecture and creating a landscape with rich layers (Fig. 1). This creates an atmosphere of something that, although man-made, seems to have naturally emerged from the landscape. In gardens, windows become an important medium connecting the interior and exterior spaces, making the garden space more natural and harmonious while highlighting the unique aesthetic concepts and deep cultural heritage of traditional garden design.

In landscape architecture, windows not only enrich functionality and meaning but also cleverly make use of the limitations of sight, guiding the viewer's gaze and spatial transitions to create poetic scenic effects (as it is shown in Fig. 2). The windows of gardens are often combined with various architectural elements, including corridors, pavilions, towers, and pagodas to form a harmonious and unified landscape system. For example, lattice windows, empty windows, or decorative windows on Fen Qiang [3] employ a design of separation without complete obstruction, both dividing the space and framing the view. This design makes the foreground appear more distant, adding depth and a sense of layered complexity, while enhancing the visual interest of the scene.

In addition, windows use visual illusions to broaden the field of view and introduce external scenery, enriching the landscape. Beyond their basic functions of ventilation and lighting, garden windows also play a crucial role in decoration and scenic appeal. Their position and form complement the garden layout, and through careful control of height and sightlines, they allow visitors to experience dynamic changes in the scenery as they stroll, embodying the concept of "moving views with each step." Furthermore, the design and application of windows carry profound cultural significance, while also showcasing a unique aesthetic that evokes a sense of artistic mood.

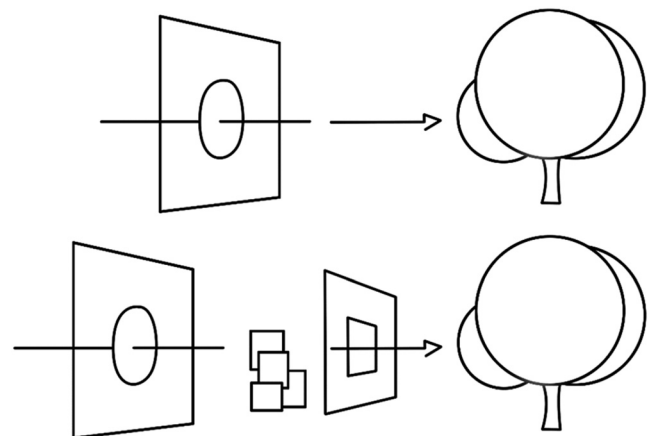


Fig. 1. Box scene: Single-storey window and double-storey viewing (Source: the Authors)



Fig. 2. Windows in Suzhou Gardens, China (Source: photo by the Authors)

Through an analysis of window designs in traditional Chinese architecture and garden landscapes, it becomes evident that Chinese traditional windows not only exhibit a high degree of diversity in form and craftsmanship but also reveal profound cultural and aesthetic connotations, it is also a kind of special symbol [4]. These design concepts and techniques not only enrich the visual layers of architecture and gardens but also serve as an important source of inspiration for modern design, creating more possibilities for the fusion of tradition and modernity.

3. AESTHETIC PRINCIPLES OF WINDOW DESIGN

3.1. Shape and craftsmanship

One of the key factors driving the evolution of traditional Chinese windows is advancements in technology. The extensive use of mortise-and-tenon joints and improvements

in construction techniques has enriched window designs with a diverse range of forms and variations.

The shape and craftsmanship of windows are central to their aesthetic value. The unique flexibility of the mortise-and-tenon structure in traditional Chinese architecture allowed windows to transcend purely functional constraints and adopt highly diverse design forms. This variety not only reflected the hierarchical structure of Chinese architecture, but also carries multiple layers of cultural connotations, including social, historical, folk, and aesthetic elements [5]. Traditional window designs, from square and round to fan shapes, showcase intricate patterns in flowers and window openings, emphasizing extraordinary craftsmanship. These windows, with their distinctive forms and artistic details, achieved a remarkable level of artistry. For instance, the hollow carving of flower windows required extraordinary skill from craftsmen and embodied the traditional Chinese cultural ideal of harmony with nature. A typical example is the “flower windows” in the Forbidden City in Beijing (Fig. 3). These windows use the traditional mortise and tenon structure, where wooden components are interconnected without the use of metal nails or screws, fully demonstrating the exquisite craftsmanship of the artisans. The mortise and tenon structure provides the window frames with stability, while also offering greater flexibility and artistic expression. The flower windows of the Forbidden City are not only uniquely shaped, but their meticulous craftsmanship and patterns make the windows an integral part of architectural aesthetics, embodying the perfect integration of function and beauty in traditional Chinese architecture.

3.2. Cultural symbolism

From a cultural perspective, the influence of ancient Chinese philosophy has profoundly shaped people’s unique interest in natural and cultural landscapes. This fascination with mountains, water, and the environment has added layers of complexity to the social significance of windows, greatly enhancing their aesthetic value. This is particularly evident



Fig. 3. The “Flower Windows” in the Forbidden City, Beijing, are a notable feature of traditional Chinese architectural design (Source: photo by the Authors)

in the design of windows in traditional Chinese gardens, where the interplay of nature and architecture is intricately reflected.

Different window shapes and craftsmanship not only showcase unique aesthetics but also carry rich cultural meanings. For example, round windows symbolize the “Heaven is round and the Earth is square” cosmology, reflecting the pursuit of harmony between heaven and earth; plum blossom windows, with their five-petal shape, symbolize nobility and resilience, conveying the spirit of ancient scholars’ pursuit of high moral character; windows bearing the characters “fortune” or “longevity” express people’s wishes for happiness and long life. Furthermore, dragons, phoenixes, flowers, birds, and auspicious patterns symbolizing good fortune on traditional windows not only enhance visual appeal but also convey cultural meanings of blessings, longevity, and happiness. Through these designs, windows not only provide practical functionality and aesthetic decoration for buildings and gardens but also deeply convey cultural and spiritual significance. They allow users to experience the immersion of traditional culture in daily life, giving traditional architecture and gardens a unique cultural depth and spiritual value.

3.3. Spatial layout

Windows in traditional architecture and garden landscapes are meticulously arranged in terms of spatial layout. Their design is typically tailored to the overall style, functional requirements, and environmental conditions. In traditional buildings, window design emphasizes harmony with the overall architectural style, reflecting the aesthetic beauty of structure and form. In garden design, windows become a key element in connecting indoor and outdoor spaces. Techniques including “view borrowing” and “framing views” are used to cleverly introduce natural landscapes into the interior, achieving an organic integration between spaces and creating a visually smooth transition.

“View borrowing” refers to the design strategy of using windows to bring external scenery - including mountains, water, and plants - into the interior, merging architectural space with the natural environment. This design not only expands the visual boundaries of the indoor space but also creates an atmosphere of symbiosis with nature. “Framing views,” on the other hand, involves using window frames to define the external landscape within a specific boundary, much like a picture frame outlining a serene and beautiful scene, thereby imbuing the space with a stronger sense of artistry and visual appeal. These design techniques, through the construction and arrangement of windows, not only enhance the spatial layers, but also reflect the unique aesthetic of traditional garden design, where “artifice and nature complement each other.” They skillfully integrate man-made and natural landscapes, presenting an effortlessly harmonious beauty. In addition, the arrangement of windows can guide the line of sight and create a richly layered spatial experience through variations in height. For example, by setting windows at staggered heights, individuals can view

the landscape from different angles and perspectives, experiencing a dynamic effect where the scene changes with each step, as if every movement reveals a new view and landscape.

Through an exploration of the shape and craftsmanship, cultural symbolism, and spatial layout of windows, it is evident that traditional Chinese window design possesses not only exceptional visual appeal but also profound cultural and spiritual depth. These aesthetic principles enrich the language of architectural and garden design, breathing life into traditional culture while providing valuable inspiration and references for modern design practices.

4. THE AESTHETIC APPLICATION OF TRADITIONAL WINDOWS IN THE CONSERVATION AND RENOVATION OF TRADITIONAL ARCHITECTURE AND GARDENS

4.1. The development of Chinese architectural heritage conservation theory

Traditional Chinese architecture, predominantly wooden structures, is prone to damage from moisture, weathering, and pest infestation, resulting in a shorter lifespan compared to stone or to brick buildings. Consequently, the maintenance and repair of wooden buildings have historically been routine practices in China. Throughout history, official policies often mandated annual maintenance and periodic large-scale restorations. This practice of “repairing as you use” allowed buildings to remain functional and aesthetically intact over time. Whether caused by component aging or localized damage, the goal of these repairs was always to restore the structure to its original state.

This repair philosophy reflects fundamental differences between Chinese and Western approaches to architectural heritage. In Western traditions, ruins are valued as carriers of historical information and as independent aesthetic entities embodying antiquity and historical beauty. The ancient Chinese, on the other hand, did not wish for buildings to reflect a state of decay, from a philosophical standpoint, they viewed decay as undesirable and imperfect. As a result, the principle of “repairing the old to make it look new” became a cornerstone of Chinese architectural conservation; it is also a pursuit of the aesthetic value of architecture.

By the late 19th century, under the influence of wars and intellectual awakening, China began adopting Western conservation ideas. Prominent scholars like Liang Sicheng [6], and Lin Huiyin [7], who studied abroad, introduced Western methods to China. The establishment of the China Society for the Study of Architecture in 1930 marked a significant milestone, laying the theoretical foundation for Chinese architectural conservation.

Liang Sicheng [8], in his report proposed the idea of “prolonging the lifespan” of ancient buildings. Liang Sicheng advocated for using modern technology to address structural deficiencies and restore buildings to their original form. Unlike traditional methods, which focused solely on

restoring grandeur, modern conservation emphasizes the responsibility to “preserve or restore authenticity.” Before undertaking restoration design, it is essential to thoroughly study the building’s era and characteristics, and, in conjunction with scientific and technological advancements, develop the optimal plan for extending the building’s lifespan. This concept marks a shift in China’s architectural conservation from traditional, functional repairs to a balanced approach that emphasizes both scientific preservation and cultural heritage [9].

In the process of protecting and renovating traditional buildings and garden windows, scientifically studying their form, craftsmanship, and positioning is crucial to appropriately restoring or recreating the original artistic features of the windows. This is an essential aspect of achieving the goal of prolonging the lifespan of architectural heritage. Moreover, during renovations, the cultural symbolism of traditional windows can be integrated with new materials and technologies, resulting in architectural designs that combine historical value with contemporary aesthetic appeal. The practice of protecting and innovating traditional windows not only continues architectural aesthetics but also reflects the fusion of traditional culture and modern design concepts, providing strong support for the ongoing transmission of cultural heritage [10].

4.2. The fusion of tradition and modernity

Under the guidance of the new era’s principles for the protection of Chinese cultural heritage, the aesthetic concepts and design techniques of traditional windows continue to hold significant reference value in restoration and renovation projects. By integrating traditional architectural heritage with modern design concepts, it is possible to create architectural works that not only have a sense of the times but also retain cultural depth. The following explores practical approaches for combining tradition and modernity from four aspects: materials, structure and craftsmanship, functional expansion, and the recreation of cultural elements.

Material Innovation and Application: Advances in modern material technology have opened new possibilities for modernizing traditional window design. Natural materials including wood, paper, and bamboo were commonly used for traditional windows. These materials are breathable, visually appealing, but not highly durable. Modern materials, including aluminum alloy, stainless steel, glass, and composites can mimic the texture and color of traditional materials while significantly improving durability and functionality. For instance, the Hangzhou National Archives of Publications and Culture (Fig. 4) has reinterpreted the translucent aesthetics of Song dynasty lattice windows through contemporary celadon-glazed folding screens, demonstrating innovative applications of traditional materials enabled by modern technology. These practices provide efficient architectural solutions that preserve cultural symbolism while meeting contemporary performance requirements.

Structural and Craftsmanship Optimization: Modern manufacturing techniques and design tools enable structural

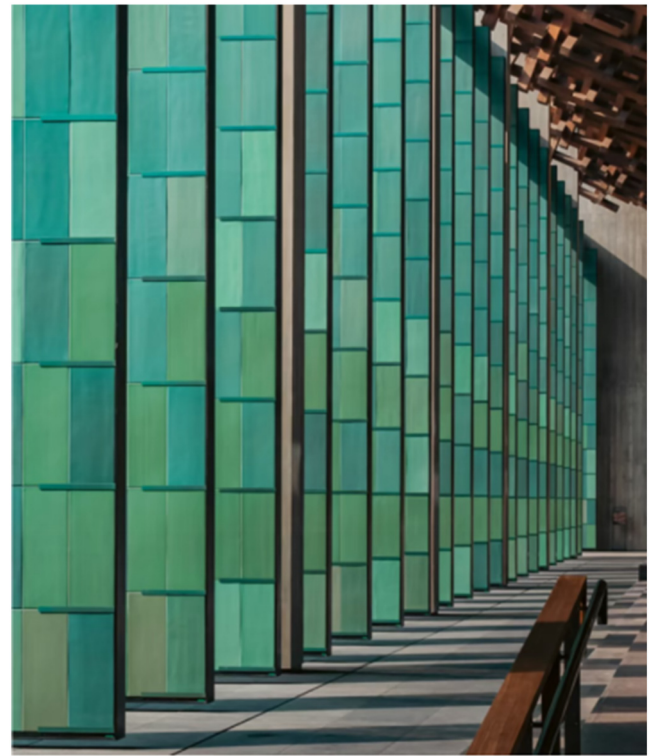


Fig. 4. The celadon-glazed folding screen windows at Hangzhou National Archives of Publications and Culture (Source: photo by the Authors)

optimization of traditional windows. Computer-Aided Design (CAD) can precisely model traditional lattice patterns, creating more intricate and refined geometric designs while ensuring structural stability and strength. Additionally, 3D printing technology can produce decorative details for traditional windows, enhancing production efficiency while preserving the artistic value of traditional craftsmanship. These advancements ensure the continuity of traditional craftsmanship in modern contexts. For instance, the restoration of Suzhou classical gardens employs 3D laser scanning and computer-aided design (CAD) technologies to accurately reconstruct traditional lattice window patterns such as the “swastika pattern” and “begonia pattern”. By integrating computer numerical control (CNC) carving techniques, this approach achieves high-precision restoration efficiency while demonstrating innovative integration between traditional craftsmanship and modern technology.

Functional Expansion and Enhancement: Modern architecture can imbue traditional windows with new functionalities, addressing basic needs of ventilation and lighting while incorporating intelligent and multifunctional designs. For instance, smart window technologies can use sensors and automation systems to adjust window operation dynamically, optimizing lighting, temperature, and airflow. The Shanghai Tower exemplifies (Fig. 5) the functional expansion and intelligent advancement of contemporary fenestration systems through its innovative double-skin glass curtain wall, which precisely regulates interior lighting and thermal conditions. Furthermore, modern windows can

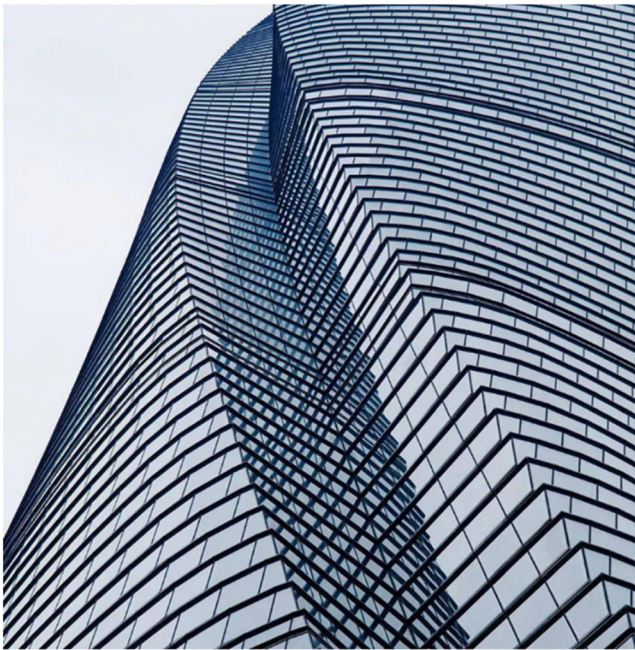


Fig. 5. Shanghai Tower (Source: photo by the Authors)

integrate features including soundproofing, insulation, and security enhancements, improving comfort and safety. These innovations elevate traditional windows from decorative elements to practical components with diverse applications.

Cultural Integration and Reinterpretation: Modern design can incorporate traditional cultural elements into window shapes, patterns, and spatial arrangements. Taking the hexagonal windows of Suzhou Museum (Fig. 6) as an example, this museum reinterpreted traditional garden latticework through a contemporary lens, simplifying it into geometrically striking steel-framed hexagonal windows. This design not only preserves the auspicious symbolism of traditional patterns, but also enhances visual impact through its minimalist modern form. This design approach demonstrates how contemporary design language can reinterpret traditional floral lattice and

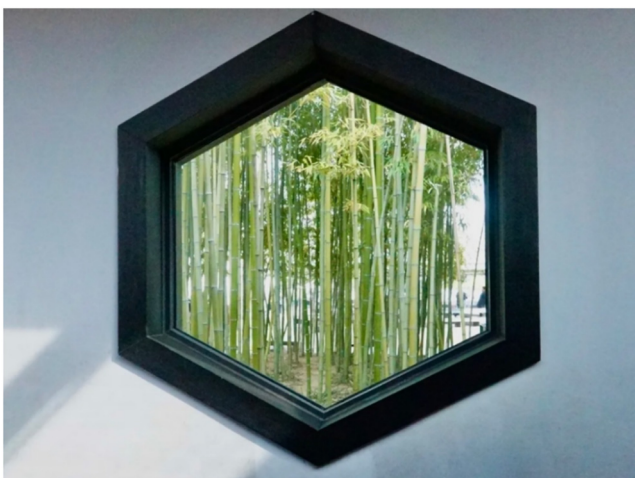


Fig. 6. The hexagonal fenestration system at Suzhou Museum (Source: photo by the Authors)

openwork window motifs, creating fresh visual effects in modern architecture. This cultural reimagining not only adds depth to architectural designs but also promotes the transmission and appreciation of traditional culture.

Through the integration of material innovation, structural optimization, functional expansion, and cultural reinterpretation, modern architectural design can preserve the aesthetic value of traditional windows while achieving a harmonious balance between functionality and artistry. This fusion creates modern architectural works rich in cultural depth and opens new avenues for the evolution of traditional culture in contemporary contexts.

4.3. Practical projects: landscape and architectural design of the Han Culture Communication Industry Institute at Beihai University of Art and Design

The “Ancient and Modern, Chinese and Foreign” project, located within the Beihai Garden Expo Park, serves as the campus for the Han Culture Communication Industry Institute at Beihai University of Art and Design. Beihai Garden Expo Park, situated in Guangxi Zhuang Autonomous Region’s Beihai City, was the site of the 2014 Fourth Guangxi Garden Expo. As a core component of the city’s greenbelt, the park spans approximately 298 ha and comprises one main and two subsidiary zones. Classified as urban planning green space, the park began to show signs of neglect and decline by 2022 due to poor management and aging infrastructure.

To revitalize the park, the government entrusted the renovation of the “Beihai Garden,” one of the park’s urban landscape demonstration zones, to Beihai University of Art and Design. Covering over 20,000 square meters, this area underwent a year-long renovation. On May 4, 2023, the Han Culture Communication Industry Institute was officially established in this location, becoming the academy’s first campus open to the public. The “Ancient and Modern, Chinese and Foreign” project exemplifies the successful preservation and revitalization of the Garden Expo Park’s existing landscape heritage and serves as a model for the aesthetic application of traditional window design. The application of window design in the project’s landscapes is particularly noteworthy and can be illustrated through the following aspects:

Skillful Use of Borrowed View and Framing View: The design team skillfully employed traditional window design techniques, seamlessly integrating the external natural landscape into the park’s buildings and courtyards. Taking the main courtyard entrance as an example, the team cleverly incorporated large flower windows into the corridors and buildings. These windows not only frame the external scenery of mountains, water, and plants but also guide the visitors’ gaze through precise layouts, blurring the boundary between indoor and outdoor spaces. This design not only creates a visually layered effect but also allows visitors inside to experience the continuity and transformation of the surrounding natural landscape, creating an atmosphere where nature and architecture harmoniously blend.

The main entrance of the courtyard is not only a transportation hub for the park but also the central venue for

major events, often hosting art or design exhibitions, outdoor fashion shows, and other activities (Fig. 7). To meet these functional requirements, the design team meticulously renovated the backdrop wall and architectural windows. Firstly, the entrance and courtyard were designed with a Chinese character as “hui” shape layout, which not only facilitates smooth pedestrian flow but also enhances the visual tension of the space. The area and proportions of the backdrop wall were adjusted, and its decorations were simplified to better accommodate exhibition functions. By reducing redundant details, the backdrop wall now more effectively highlights the exhibits or models, serving as an ideal backdrop that strengthens the visual appeal of the showcased content.

In the design of the building windows, the three buildings were treated differently according to their respective cultural themes. The size, style, and shape of the windows varied to suit the specific themes, not only providing light and transparency for the interior displays but also complementing the architectural cultural atmosphere. For example, some windows may adopt a simpler, modern design to emphasize the minimalism and contemporary feel of the cultural exhibition, while others may retain more traditional elements in their window shapes, aligning with the theme of traditional culture [11]. The renovation of these windows, in coordination with the backdrop wall, optimizes the spatial function while maintaining aesthetic unity and enriching cultural expression.

Coordination of Window Shapes and Proportions: The design team meticulously coordinated the shapes and proportions of the windows with the overall architectural style of the campus. For example, traditional circular and square windows were used in the main exhibition spaces, combining the classical aesthetic charm of traditional architecture with the minimalist elegance of modern design. By carefully controlling the size, shape, and placement of windows on building façades, the team successfully created a space that balances historical gravitas with contemporary simplicity, adding unique aesthetic value to the campus architecture (Fig. 8).

Inheritance and Innovation in Decorative Details: In terms of materials and craftsmanship, the design team innovatively adapted traditional decorative details using modern materials. For instance, aluminum alloy was used to recreate the intricate patterns of traditional flower windows, preserving the artistic expression of traditional carved



Fig. 7. The opening ceremony of the students' course achievement exhibition Beihai University of Art and Design and University of Pecs, 2024 (Source: the Authors)



Fig. 8. Architectural interior space (Source: the Authors)

window lattices while improving durability and maintenance efficiency. On key architectural façades, these patterned windows became exemplary combinations of traditional cultural elements and modern materials. This reinterpretation and innovation of decorative details allowed the campus buildings to retain their rich traditional cultural character while meeting modern functional requirements.

Optimization and Beautification of Spatial Layout: The overall layout of the campus emphasized the interaction between windows and the surrounding landscapes. Thoughtful window placement and design created a seamless connection between indoor and outdoor spaces. For example, large floor-to-ceiling windows were widely used in corridors and lounges, providing ample natural lighting and ventilation while framing views of the surrounding gardens. These windows enhanced the openness and comfort of the space, allowing visitors to enjoy the beauty of the garden's flowers, water features, and other natural elements, resulting in a more immersive visual and sensory experience.

Through these design strategies, the landscape and architecture of the Han Culture Communication Industry Institute at Beihai University of Art and Design have been revitalized, showcasing the perfect integration of modern architecture and traditional culture. This project demonstrates the immense potential of traditional window design in contemporary architectural practices, imbuing the campus with cultural significance and artistic beauty. It serves as a valuable reference for future projects aiming to blend traditional cultural heritage with modern innovation.

5. CONCLUSION

The window design in traditional Chinese architecture and garden landscapes reflects not only the basic functional requirements of ventilation and lighting but also embodies unique cultural significance and artistic charm. By exploring the historical evolution, cultural symbolism, and spatial arrangement of traditional window design, as well as its innovative

applications in modern architecture and garden design, this study highlights the distinctive value and broad applicability of traditional windows in contemporary design practices.

Using the “Ancient and Modern, Chinese and Foreign” project at Beihai Garden Expo Park as a case study, this paper systematically examines the practical and innovative applications of traditional window design aesthetics in modern contexts. The analysis demonstrates that integrating the aesthetic principles of traditional windows with modern materials, techniques, and functions enriches the cultural depth of modern architecture and gardens while achieving a harmonious balance between functionality and artistry. This fusion of tradition and innovation not only supports the continuation of traditional culture in modern settings but also provides valuable insights and references for future architectural and landscape design projects.

In conclusion, as an integral part of Chinese architectural heritage, traditional window design has played a vital role throughout history and will continue to inspire and thrive in the field of design in the future.

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