Study on the Sustainable Development of JingZuo Furniture Structure and Pattern

Xiang Wang*, Xun Liu, and Jia Guo
North China University of Technology, 100144 Beijing, China

Abstract. This paper aims to study the protection for sustainable development of Jingzuo furniture. Intangible cultural heritage has undergone static protection and active inheritance, and is currently in a stage of sustainable development and protection. By taking the structure and pattern of Jingzuo furniture as an example, the approach and methods were studied, such as database building and simulation methods. Through the practice of the design of Jingzuo furniture, it is proved that digital technology is feasible and effective way to protect Jingzuo furniture.

1. Introduction

While enjoying the high-quality material life was brought by the development of science and technology, humans also face various problems such as resource shortage, air pollution, global warming, and loss of species diversity. The relationship between humans and nature has experienced imbalanced development. In order to restore the ecological environment and promote harmonious coexistence between humans and ecology, the concept of sustainable development was proposed in Our Common Future. China attaches great importance to the issue of sustainable development. The report to the 20th National Congress of the Communist Party of China pointed out that "China is committed to sustainable development and to the principles of prioritizing resource conservation and environmental protection and letting nature restore itself".

Chinese traditional furniture reflects the aesthetic awareness and spiritual characteristics of Chinese culture. Jingzuo furniture stands out among traditional furniture. Influenced by palace furniture, Jingzuo furniture can be said to integrate the best technology in Ming and Qing Dynasties.[1] Its decoration is exquisite, the materials are precious, the structure is reasonable, the shape is solemn, and the craftsmanship is exquisite. Due to its high artistic and academic value, in 2007, it was listed in the Beijing municipal intangible cultural heritage and in national intangible cultural heritage in 2008.

The protection of Jingzuo furniture has gone through three periods: static protection, active inheritance, and sustainable development. Among them, sustainable development protection utilizes modern multimedia digital technology, establishes digital scenes or constructs digital models through modeling and programming software, and achieves simulation design and processing solutions for Jingzuo furniture.[2] It is currently a very effective means of protection. This article discusses the sustainable development of Jingzuo furniture from two aspects: Jingzuo furniture structure and pattern.

2. Sustainable development of Jingzuo furniture structure

The Jingzuo structure is a concentrated reflection of the beauty of traditional furniture craftsmanship. The tightly knit mortise and tenon structure requires rich experience and exquisite technology from craftsmen to be processed. The core principle of mortise and tenon structure is to use the mutual bite of the structures to make the splicing tight, evenly stress, and achieve the effect of stabilizing the structure. Only the furniture made by skilled craftsmen appears natural and integrated from the outside, without any issues such as looseness or rusting that may occur with metal parts. However, this technology is difficult and requires accurate accuracy, which places high demands on the craftsman's craftsmanship. Utilizing digital protection and production will largely solve this problem.

2.1. Sustainable development approaches for Jingzuo furniture structure

Digitization is the important protection way for the sustainable development of Jingzuo furniture structure. It refers to the use of technologies such as digital collection, storage, processing, display, and dissemination to transform, reproduce, and restore Jingzuo furniture structure into a shareable and renewable digital form. It can be interpreted from a new perspective, preserved in a new way, and utilize it with new needs to achieve protection and dissemination.
2.2. Digital protection plan for Jingzuo furniture structure

The digital protection of Jingzuo furniture can be considered from two aspects: factory processing and production, and promotion of Jingzuo furniture. Different technologies can be used for digital protection.[3]

Firstly, advanced technologies such as 3D scanning and 3D image acquisition are used to measure and store complex shaped Jingzuo furniture in a complete and accurate manner. For simple shaped Jingzuo furniture, 3D modeling software can also be used for self modeling. Secondly, the established digital model can accurately express various parts of the work, playing a guiding role in design, production and processing, or directly connecting processing centers for production. For the establishment of a digital exhibition hall, various parts can be disassembled and combined, allowing users to experience the subtleties of Jingzuo furniture. The interactive digital display method is used to encourage consumers to actively participate in the learning of the scene. It is not only to passively receive information through traditional images, but also to guide learners to transform into active experience, participation and interaction, and then to trigger thinking.

The Round-backed armchair (Figure 1) is a very important type of Jingzuo furniture, with distinct features of shape and structure. The chair round-backed extends from the top of the head to the front of both sides, following the trend and merging with the armrest to form a unique and beautiful curve with multiple centers. This large curvature of the chair ring contour highlights the main tone of the furniture design, forming the characteristics of this furniture. All other components correspond to it.

Figure 2 is the diagram of the components of the round-backed armchair. The drawing disassembles the parts of the round-backed armchair to obtain a plan view. Based on this plan, the shape, specifications, dimensions, and quantity of the parts can be clearly seen. Combined with other corresponding views, a three view and three-dimensional model of each part can be generated. Ideal technical documents can be provided for cutting, processing, and installation.

Figure 3 is an exploded diagram of the round-backed armchair, which clearly expresses the relative position relationship, structure, and detail of each component of the parts, which is of great help in spreading and popularizing the intangible cultural heritage of Jingzuo furniture. This structure can be designed as a game for users to disassemble and understand the parts, structure, and assembly process of the round-backed armchair. Through the immersive virtual experience of the virtual Jingzuo furniture culture and the interactive experience based on the touch screen, it can be realized the experiential cognition of Jingzuo furniture culture and stimulate cross-cultural users’ deep concern for Jingzuo culture (Figure 4).[4]

![Fig. 2. Diagram of the components of Round-backed armchair](image)

![Fig. 3. Explosion diagram of Round-backed armchair](image)

![Fig. 4. Disassembly and assembly steps of Round-backed armchair](image)
3. Sustainable development of Jingzuo Furniture Pattern

"China-Chic" is a popular online term, which means products made in China based on Chinese elements and Chinese brands. The trend of promoting and liking among young people is a manifestation of the confidence of the younger generation in Chinese culture. It is regrettable that the rich, and vivid patterns on traditional furniture, which are hidden in museums, or in the works of professional researchers, or in the design of modern furniture, are rarely understood by the public. If the pattern can be combined with modern design and become a part of China-Chic, which young people like, it will certainly be widely promoted and well protected.

3.1. Sustainable development approaches for Jingzuo furniture Pattern

Jingzuo furniture patterns refer to the patterns used in traditional furniture to decorate surfaces and corners, carry cultural connotations, which expressed through carving, painting, embedding, and other techniques. Researchers organize these beautiful patterns, accurately grasp their profound connotations, extract their types, shapes, and colors, and establish a database to provide designers with rich design elements. These works perfectly are combined with modern social needs, and give new sense of the vitality. Which make traditional furniture decoration art shining. [5] So it will definitely provide good protection. Digital protection and its corresponding cultural and creative product design can be seen as an important approach to sustainable development.

3.2. Sustainable design plan for Jingzuo furniture

It is first step to establish a database in the specific plan for sustainable design of Jingzuo furniture patterns. Designer can select suitable elements from the database for pattern design, and further complete the design of cultural and creative products, when the pattern design is completed. Jingzuo furniture patterns database includes three components, the pattern type factor, pattern feature factor, and color feature factor, which provide rich forms for product design. In the research process of sustainable development of Jingzuo furniture, the most important thing is attached to public participation. Therefore, a design template factor database has been added, providing a convenient form for non professional design enthusiasts to complete corresponding designs. After the pattern is completed, the corresponding cultural and creative product design can be carried out. And the database also provides the public with corresponding design templates for cultural and creative products, thereby completing design works(Figure 5).

The work in Figure 6 extracts elements from the Jingzuo furniture database (listed in Table 1), with the color of blue and yellow as the main tones. The plant, animal, auspicious patterns, cloud patterns, and water patterns on Jingzuo furniture are extracted, simplified, and redesigned. The patterns are simple, elegant, and elegant, with integrating retro and modern aesthetics. The fourth column database in the table1 also provides design templates. For design enthusiast, who can select favorite template and fill in various elements and colors by design software to obtain favorite design patterns. By designing the patterns of Jingzuo furniture, a series of cultural and creative products have been derived, such as the pillows, decorative paintings, tableware, and tablecloths shown in Figure 7. These designs give new meaning to the patterns of Jingzuo furniture. Through this approach, more people can learn about Jingzuo furniture and promote the development of Jingzuo furniture culture.

Through this case study, it can be seen that the application of Jingzuo furniture patterns in modern design can unleash the greater effectivness of traditional patterns. The design of Jingzuo furniture embodies too much of the wisdom, craftsmanship, and cultural essence of predecessors, combined with modern design to release its greater artistic, cultural, and commercial value.

<table>
<thead>
<tr>
<th>Pattern type</th>
<th>Pattern shape</th>
<th>Pattern color</th>
<th>Design Template</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant pattern</td>
<td>[Image]</td>
<td>221,186,1 18</td>
<td></td>
</tr>
<tr>
<td>Ruyi pattern</td>
<td>[Image]</td>
<td>218,129,9 0</td>
<td></td>
</tr>
<tr>
<td>Retroflex pattern</td>
<td>[Image]</td>
<td>163,85,73</td>
<td></td>
</tr>
<tr>
<td>Cloud pattern</td>
<td>[Image]</td>
<td>135,233,2 17</td>
<td></td>
</tr>
<tr>
<td>Animal pattern</td>
<td>[Image]</td>
<td>109,181,1 68</td>
<td></td>
</tr>
<tr>
<td>Water pattern</td>
<td>[Image]</td>
<td>102,166,1 88</td>
<td></td>
</tr>
</tbody>
</table>

Table 1. Factor description of form feature content

![Fig. 5. Pattern Design Database](https://example.com/f5.png)
4. Conclusion

Excellent traditional culture and intangible cultural heritage are precious treasures that have been preserved in the long river of history. The exquisite structure, magnificent decoration, and profound cultural connotations of Jingzuo furniture are all worth learning and developing for future generations. Emphasizing the inheritance of Jingzuo furniture and sustainable development is a necessary path in the field of cultural protection in China. Inheriting and carrying forward the spirit of craftsmanship, continuously innovating and developing the advanced parts of traditional culture, not only valuing the protection of Beijing’s hardwood furniture and intangible cultural heritage, but also using advanced methods to make more people spontaneously familiar with and love, optimize and upgrade on the future development path, and take further steps. The protection of Jingzuo furniture can be divided into three parts: static inheritance, active inheritance, and sustainable development. The use of modern multimedia digital technology in sustainable development protection, through modeling and programming software, to establish digital scenes and achieve the construction plan of a virtual exhibition hall for hardwood furniture in Beijing, is currently a very effective means of protection.

Acknowledgments.

This paper is funded by R&D Program of Beijing Municipal Education Commission (SZ202110009003), and is one of the phased achievements of Research on the sustainable protection of JingZuo furniture.

References