

The Construction Principles and Processes of Design Evaluation Index System for Cantonese-Style Chairs

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Abstract

"Cantonese-style furniture," as one of the three major schools of traditional Chinese furniture, represents the most distinctive and emblematic regional cultural furniture from Guangdong Province, China. Currently, the Cantonese-style furniture on the market either imitates traditional designs, failing to meet modern lifestyles and aesthetic needs, or features mass-produced modern hardwood furniture lacking regional characteristics. This highlights the importance of establishing a design evaluation system for Cantonese-style furniture. Therefore, this study aims to explore the principles and processes for constructing a design evaluation index system for Cantonese-style chairs. Through a review of existing literature and comparative analysis, eight key principles have been identified for the development of this index system: Scientific validity, Objective, comprehensiveness, hierarchical structure, operability, independence, significance, and dynamism. Additionally, the construction process is outlined in five stages: preliminary development, qualitative screening, quantitative screening, rationality verification, and feedback verification. This research provides a methodological reference for constructing evaluation index systems for other furniture or product designs.

Keywords: Cantonese-Style Chairs, Design Evaluation, Index System, Construction Principles, Construction Process

Introduction

Cantonese-style furniture, as one of the three major schools of traditional Chinese furniture, represents the most distinctive and representative regional cultural furniture of Guangdong Province. This style not only embodies the essence of traditional Chinese culture but also incorporates elements of Western classical art. Its unique aesthetic features and cultural

connotations are highly regarded both domestically and internationally, possessing significant cultural and artistic value.

With the enhancement of living standards and the improvement of living environments, consumer demands for furniture have shifted from a singular focus on functionality to a multifaceted pursuit of practicality, emotional engagement, experiential quality, and cultural significance (Zhou et al., 2023). Currently, the Cantonese-style furniture available in the market either imitates traditional designs, failing to meet the lifestyle and aesthetic needs of modern consumers, or is mass-produced modern mahogany furniture lacking the regional characteristics of Cantonese style (Qiuli et al., 2021). The integration of traditional Cantonese elements with modern aesthetics, which respects the original culture while catering to contemporary consumer demands, has become a focal point for designers and researchers in Cantonese furniture (Qiaowen et al., 2024). Presently, due to a lack of research on the design evaluation theory of Cantonese furniture (Qiong et al., 2022), companies often rely on subjective evaluations from decision-makers when conducting design assessments, leading to a lack of objectivity and a tendency toward one-sided judgments in the evaluation process.

Design evaluation refers to the comparative assessment of design solutions to determine their merits, thereby identifying the best design option (Zujian, 2008). In the furniture design and development process, design evaluation is crucial for optimizing design schemes and supporting design decisions, significantly impacting the accurate identification of user needs and enhancing market competitiveness (Binbin & Heping, 2021). A scientifically sound design evaluation index system can assist designers in grasping market trends and consumer demands, enabling more targeted design practices (Derong & Kairi, 2022). Furthermore, a comprehensive design evaluation index system serves as a scientific evaluation tool that can objectively and thoroughly assess the design quality of furniture products (Suandi et al., 2022). In summary, the design evaluation index system is one of the most critical elements in conducting design evaluations and serves as the foundation and core of comprehensive evaluation issues. Therefore, constructing a scientifically sound and rational comprehensive evaluation index system for Cantonese furniture design is an urgent issue that needs to be addressed.

Chairs represent the most evolved category of traditional Chinese furniture, being the most frequently used type of support furniture and having the most flexible usage contexts. They have a close relationship with users and thus possess significant research value (Chengmin et al., 2021). Among Cantonese-style furniture, chairs are the most prevalent, reflecting the social value of Cantonese furniture styles across different historical periods in terms of both the variety of furniture forms and the quantity of surviving pieces (Huihua & Han, 2022). The diversification of traditional Cantonese chair forms, the innovation in decorative techniques, and the flexibility in dimensions have profoundly influenced modern Cantonese furniture design.

Consequently, this study focuses on Cantonese chairs as the research object, exploring the design principles and construction processes of a comprehensive evaluation index system for Cantonese chair design. This will lay the foundation for theoretical research on the design evaluation of Cantonese-style furniture and provide reference methods for constructing comprehensive evaluation index systems for other types of seating furniture.

Literature Review

Current Research Status of Cantonese-Style Furniture

Cantonese furniture, as one of the important schools of traditional Chinese furniture, is characterized by unique artistic features and profound cultural connotations, attracting increasing scholarly attention in recent years. Research on Cantonese furniture primarily focuses on aspects such as developmental evolution, decorative characteristics, and stylistic changes, with relatively few new perspectives or breakthroughs emerging. Existing methods for heritage and innovation predominantly center around aesthetic and stylistic imitation (Qiong et al., 2022). Cai Yian conducted field visits and follow-up investigations to analyze the materials and craftsmanship of Cantonese furniture, exploring its historical origins and developmental context, and initially establishing a framework for the study of Cantonese furniture (Yian, 1993). Chen Lingling explored the decorative and craftsmanship characteristics of Cantonese furniture through literature review and case studies, noting significant influences from Western art, particularly Rococo, which resulted in a "Sinocentric and Western Fusion" characteristic (Lingling, 2000). Zhou Jingnan detailed the historical background that gave rise to Cantonese furniture, as well as the Western furniture craftsmanship and styles that influenced its development (Jingnan, 2010). Li Yingxin analyzed the artistic characteristics of Cantonese furniture from the perspectives of materials, forms, craftsmanship, and decoration (Yingxin, 2018). The innovative application of AR technology has been explored for the cultural dissemination and digital representation of Cantonese furniture (Xie & Tang, 2018). Zhu Yun examined the design features and philosophies of Cantonese furniture while discussing the themes of heritage and innovation (Zhu Yun, 2018). Wang Haoming traced the developmental trajectory of Cantonese furniture during the Qing dynasty, elucidating its exquisite craftsmanship, artistic features, and inherent value (Haoming, 2020). Guo Qiong et al. (2021), analyzed the pattern characteristics of late Qing Cantonese furniture from the perspective of foreign trade. Chen Huihua and Han (2022), examined the typical categories and form characteristics of Cantonese-style seating, proposing ideas for the inheritance and development of Cantonese chair design. Mazurkewich (2024), identified the style of Cantonese furniture through the lens of collections, highlighting its luxurious materials and intricate carvings.

Currently, there is a scarcity of research focusing specifically on the design and production aspects of Cantonese furniture (Liuzhuang et al., 2023). Some researchers are exploring innovative integrations of traditional plant motifs in Cantonese furniture with modern furniture designs, enhancing the fashion and individuality of contemporary furniture (Jing, 2023). Debin (2020), engaged in the refinement and innovative design practice of Cantonese plum blossom patterns in modern furniture, investigating their practical applications in chair design. Chun (2018), undertook innovative design of cultural symbols of Cantonese furniture, suggesting that contemporary aesthetic needs can be met by reinterpreting these symbols into new forms, thereby facilitating the heritage and development of Cantonese furniture culture. Qiuli (2018), surveyed contemporary perceptions of Cantonese furniture, concluding that innovative designs should build upon traditional Cantonese characteristics, favoring youthful and fashionable shapes in cohesive collections. Xiaoqing (2017), reviewed the development history and elemental characteristics of Cantonese furniture, summarizing modern innovative design principles, which were then applied in the innovative design of Cantonese furniture.

In terms of Cantonese furniture design works, Wanjing and Xianglong (2024), extracted common furniture leg designs characterized by the "three-curved leg" and the "scroll grass pattern", integrating these with the decorative features of Cantonese architecture to create a conceptual design for modern Cantonese furniture. Xianglong and Yuhua (2021), based on the traditional Nanguanmaodao chair, simplified the Passiflora patterns of Cantonese furniture, presenting them in the form of a window with decorative panels. Xue Yongjun and Fan (2021), fused the design of the Cantonese-style Grand Master chair with plum blossom motifs, creating a conceptual design for Cantonese living room furniture that resonates with modern aesthetic values.

In summary, research on Cantonese furniture remains relatively scarce and fragmented, lacking a systematic approach. However, some scholars have begun to focus on modern design for Cantonese furniture, engaging in exploratory innovative design practices. Nonetheless, the existing literature reveals a significant gap in understanding consumer needs regarding Cantonese furniture and in the research on evaluation criteria for its design.

Thus, conducting research on the design evaluation of Cantonese furniture and constructing an evaluation index system that aligns with the demands of modern consumers is imperative in the current context of Cantonese furniture research. This endeavor will not only fill the theoretical gap in the evaluation of Cantonese furniture design but also contribute significantly to the inheritance and promotion of Cantonese furniture culture, fulfill modern consumer needs, enhance the quality of Cantonese furniture, and promote sustainable development in the furniture industry.

Current Status of Research on Design Evaluation Index Systems in Furniture

Current research on design evaluation predominantly focuses on methodologies, with relatively little attention given to the construction of design evaluation index systems (Yaxue, 2021). Within the realm of furniture design evaluation, scholars have primarily concentrated on aesthetic assessments and green evaluation index systems, while comprehensive design evaluations for specific furniture categories remain limited (Yilian, 2022).

In the context of chair furniture design evaluation, Zhizheng (2024), developed an evaluation index system for New Chinese-style chairs based on the Kano model and the Analytic Hierarchy Process (AHP), aimed at conducting design evaluations for this category of seating (Zhizheng et al., 2024). Yuting (2023), constructed an evaluation index system for wooden chairs used in kindergartens, utilizing fuzzy evaluation methods to provide quantifiable references for furniture design in early childhood settings (Yuting & Huiyuan, 2023). Jia (2023), applied fuzzy AHP to quantitatively assess qualitative multi-factor issues in smart office chair design, offering valuable insights for the procurement and improvement of designs in higher education settings (Liang Jia et al., 2023). Xuyinglong (2022), established an evaluation system for office chairs using fuzzy AHP and fuzzy comprehensive evaluation methods, allowing for comprehensive assessments of this furniture category (Xuyinglong et al., 2021). Chen Zhe (2020) combined TOPSIS and PSI methods to create a more scientific and comprehensive evaluation index system for office chair design (Zhe et al., 2020). Wanning (2020), integrated AHP and fuzzy comprehensive evaluation methods to analyze design elements such as safety, comfort, and aesthetics in automotive seats, establishing a comprehensive evaluation model (Wanning, 2020). Utilizing literature reviews and surveys

with consumers and experts, Xin and Yuyun (2019), identified key consumer considerations and issues when selecting products, using AHP and TOPSIS to develop an evaluation index system for children's safety seats.

However, research specifically focused on chair design evaluation index systems is scarce. Most studies have concentrated on constructing evaluation systems for office chairs and automotive safety seats. Jiaze (2022), conducted research on the design and evaluation of comfort in automotive seats (Jiaze et al., 2022). Kai (2021), developed a scientific and comprehensive evaluation index system for comfort in chair design, applying user experience theory and affordance theory. Some researchers have also addressed evaluation systems for kindergarten seating and seating designed for the elderly (Kai et al., 2021). Yuting (2023), created an evaluation index system for wooden chairs in kindergartens based on user and manufacturer needs (Yuting & Huiyuan, 2023). Binbin (2021) developed a hierarchical evaluation index system for age-friendly furniture from a design evaluation perspective, validating it with elderly seating examples. Furthermore, some scholars have approached the construction of evaluation index systems primarily from an ergonomic perspective (Binbin & Hemin, 2021). Liming et al. (2023), established an ergonomic evaluation index system for office chair armrests to facilitate a comprehensive analysis of their effectiveness. Hexin (2012), constructed a design evaluation index model for seating based on human factors engineering, evaluating several chair designs in relation to a harmonious interaction among users, machines, and the environment. Utilizing human factors engineering principles, Weilei (2005), designed the safest and most comfortable seating, analyzing and evaluating it to enhance work efficiency and comfort.

In summary, a review of the literature on furniture design evaluation reveals that current research on the construction of evaluation index systems primarily emphasizes aesthetics, green design, comfort, and ergonomics, with insufficient focus on comprehensive design evaluation systems. Research on chair furniture design evaluation has predominantly centered on office chairs and automotive safety seats, with limited attention given to the evaluation of stylistically distinctive home seating designs. Studies on evaluation methods for furniture have mainly adopted qualitative and quantitative approaches, typically utilizing Delphi methods, expert surveys, and AHP to construct evaluation index systems in a top-down manner, lacking a bottom-up approach that collects information from consumer needs to inform and refine the index systems. However, a critical aspect of evaluating the quality of Cantonese furniture design schemes is their relevance to users; regardless of the quality of Cantonese furniture products, if they do not resonate with user needs or expectations, the perceived quality will be deemed poor. Thus, establishing a comprehensive evaluation index system for Cantonese furniture design schemes that prioritizes consumer needs is urgently required.

Based on this context, this study will explore the use of grounded theory research methods to select Cantonese furniture consumers, designers, and experts as research subjects to construct a consumer-oriented evaluation index system for Cantonese furniture design schemes. This approach will not only fill the theoretical gap in Cantonese furniture design evaluation but also provide a reference for scientific research in the comprehensive evaluation of other chair products.

Design Characteristics of Cantonese-Style Chairs

Cantonese-style furniture holds significant importance in Chinese traditional furniture culture due to its unique design characteristics. Cantonese-style seating exhibits distinct features in terms of form, decoration, materials, structure, and craftsmanship (Huihua & Han, 2022).

Form Characteristics

(1) Integration of Eastern and Western Styles

Cantonese furniture retains elements from traditional Chinese design while incorporating numerous Western artistic influences, which distinguishes it from other traditional furniture styles (Zhu Yun, 2018). Under the influence of Rococo and Baroque styles, Cantonese chairs boldly merge Western forms and decorations, shifting from the solemn "vertical" forms to those that prioritize curves and elegance (Lin Qiuli & Guo Qiong, 2018). The various components of Cantonese chairs often feature C-shaped and S-shaped curves, such as the armrest (Figure 1), backrest (Figure 2), seat, legs (Figure 3), and armrests, particularly during the late Qing period, showcasing a blend of different styles and the incorporation of Western furniture forms for a unique Cantonese aesthetic.



Figure 1: Armrest



Figure 2: Backrest



Figure 3: Legs

Source: Analysis of the Forms and Artistic Characteristics of Cantonese Chairs (Chen Huihua & Liu Han, 2022)

Additionally, Cantonese furniture is primarily modeled on Western styles, utilizing local materials, craftsmanship, structure, and decorative elements, as seen in Cantonese armchairs and high-backed chairs that often emulate Baroque or Rococo designs.

(2) Ergonomically Designed Forms

Influenced by Western furniture design, the forms of Cantonese chairs increasingly emphasize human functionality. This has led to modifications of the traditional vertical backrests and leg structures, resulting in innovative and comfortable designs such as lotus chairs, triangular chairs, and reclining chairs (Li Yingxin, 2018). The unique design of Cantonese seating emphasizes smooth lines that harmoniously combine curves and straight edges, creating an overall elegant aesthetic. When constructing an evaluation index system, the innovativeness, coherence, and aesthetic appeal of the form design should be key evaluation indicators. Assessing the design of critical areas such as the backrest, armrests, and legs can comprehensively reflect the distinctive charm of Cantonese chairs in terms of form.

Decoration Characteristics

(1) Complex and Diverse Decorations

Cantonese furniture decoration is primarily expressed through carving, mother-of-pearl inlay, marble inlay, glass painting, enamel, and ceramic inlay. This furniture style is often humorously referred to as “selling flowers and stones,” highlighting both its craftsmanship and decorative richness (Zhu Yun, 2018). Predominantly featuring intricate carvings and mother-of-pearl inlays, Cantonese furniture embraces the beauty of multiplicity in its decoration (see Figure 4). Consequently, Cantonese chairs also exhibit opulent decorative characteristics.

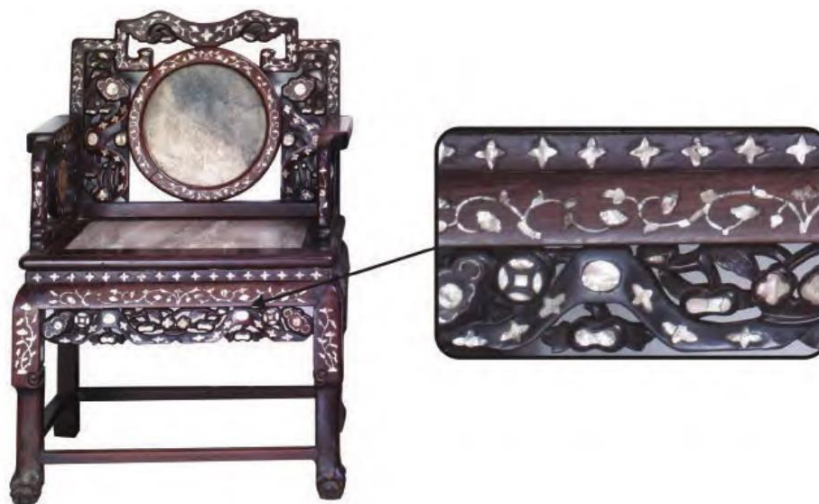


Figure 4: Mother-of-Pearl Inlay Decoration

Source: Analysis of the Forms and Artistic Characteristics of Cantonese Chairs (Chen Huihua & Liu Han, 2022)

(2) Integration of Eastern and Western Decorative Patterns

The decorative elements of Cantonese furniture embody an innovative and inclusive ethos, directly utilizing Western decorative motifs while also emphasizing the integration of Eastern and Western elements. The rich decoration of Cantonese chairs showcases a fusion of Eastern and Western patterns, often featuring multiple stylistic influences on a single chair. This is achieved through techniques such as carving and inlaying, resulting in a high degree of visual unity in patterns and forms, thus enhancing the artistic and cultural fusion of Eastern and Western influences. For example, the zitan armchair (see Figure 5) integrates Western shell patterns with traditional Chinese vase motifs, where the vase outline resembles that of classic Chinese ceramics, infused with Western designs.

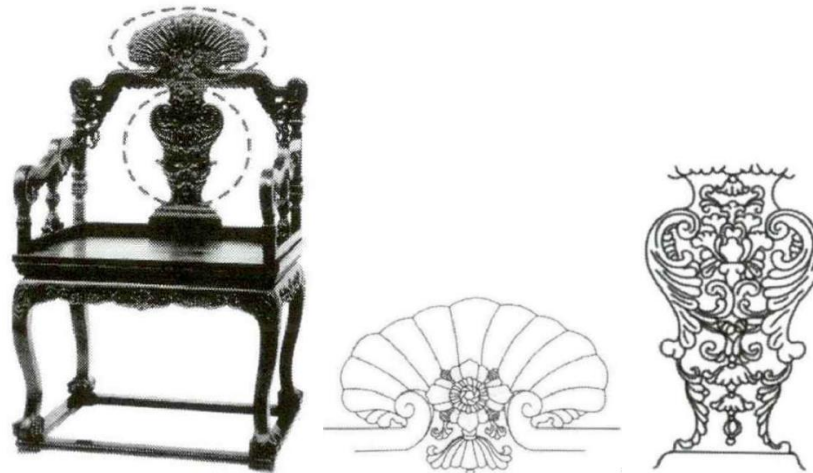


Figure 5: Zitan Armchair with Shell and Vase Patterns

Source: Fusion and Transformation—Qing Dynasty Cantonese Furniture (Wang Haoming, 2020)

The decoration of Cantonese seating is characterized by intricate and meticulous craftsmanship, with diverse carving techniques and thematic patterns. Evaluating the decorative characteristics is vital for reflecting the artistic value and cultural significance of Cantonese furniture. When constructing the evaluation index system, attention should be paid to the delicacy of the decorations, the craftsmanship level, and the cultural context. Evaluating the carving techniques, thematic designs, and color combinations can effectively showcase the unique decorative style of Cantonese chairs.

Material Characteristics

(1) Types of Materials

Cantonese-style chairs are primarily crafted from high-quality hardwoods, often embellished with materials such as stone, shell, and ivory (Lin Qiuli & Guo Qiong, 2018). The main woods used include three precious hardwoods: rosewood, zitan, and huanghuali, along with other premium hardwoods such as chicken wing wood, iron wood, kundian wood, and pineapple wood (see Figure 6). Due to the hardness of these premium hardwoods, they are particularly suitable for the mortise and tenon joinery, carving, and inlay techniques characteristic of Cantonese furniture. Visually, these woods display beautiful grain patterns and subdued hues. Additionally, colors like "red" from rosewood, "purple" from zitan, and "yellow" from huanghuali carry positive connotations in Chinese culture, further enhancing their appeal to consumers. Tactilely, these hardwoods have a high oil content, resulting in a finely polished surface that feels smooth and cool, ideal for the region's hot climate.



Rosewood/ Sandalwood/ Huanghuali /Wenge

Ironwood / Nanmu /Kempas/Burmese Padauk

Figure 6: Commonly Used Woods in Cantonese Furniture

Source: Design Research on Contemporary Cantonese Furniture (Lin Qiuli, 2018)

To enhance the opulence of Cantonese furniture, materials such as stone, shell, and ivory are often inlaid. The stone is primarily used in large pieces embedded in seating or backrest areas, presenting natural texture effects visually and offering a smooth, cool tactile sensation suited to Guangdong's hot weather.

(2) Characteristics of Material Use

Cantonese furniture is characterized by its luxurious and generous use of materials. Typically, a single type of wood is used for an entire piece of furniture or crafted from a single large timber. Instead of combining different materials for components usually made from two parts, Cantonese furniture often employs a single piece of wood, emphasizing authenticity (Yun, 2018).

In material selection, Cantonese chairs prioritize durable and aesthetically appealing woods such as zitan and rosewood. The quality of materials significantly impacts the tactile quality and longevity of the furniture. Therefore, when constructing the evaluation index system, the texture, grain, and durability of the materials should be critical evaluation indicators. Assessing these material characteristics ensures the high quality of materials used in Cantonese chairs.

Craftsmanship Characteristics

The craftsmanship of Cantonese furniture is predominantly characterized by intricate carving and inlay techniques. Cantonese furniture is often colloquially referred to as "selling flowers and stones," where "selling flowers" indicates the prevalence of ornate carvings, while "selling stones" effectively highlights the commonality of inlay craftsmanship.

(1) Carving Techniques

Cantonese furniture primarily employs wood carving techniques. Within this realm, various methods such as round carving, relief carving, openwork, and semi-openwork are utilized (Li & Xu, 2022). Round carvings are typically applied to the ends of arms and legs, while relief carvings are predominantly used on surfaces of major supporting and load-bearing components, such as the legs of chairs. Openwork and semi-openwork techniques are commonly found on non-load-bearing components, particularly the backrests of chairs. Compared to wood carving techniques from other regions, the patterns in Cantonese furniture tend to be more pronounced. There is also a pursuit of abundance in both the proportion and quantity of carvings, with some pieces featuring full carvings throughout specific components or the entire piece, thereby affirming the "selling flowers" notion (see Figure 7).



Figure 7: Carved Dragon Motif Armchair in Rosewood
Source: "Cantonese Furniture of the Qing Dynasty" (Cai Yian, 1993)

(2) Inlay Techniques

The inlay craftsmanship of Cantonese furniture encompasses techniques that incorporate materials such as marble, mother-of-pearl, jade, enamel, and glass paintings, with marble and mother-of-pearl being the most prevalent (Zhu, 2018). Marble inlays are primarily applied to larger surface areas, such as the seat tops and backs of chairs (see Figure 8).



Figure 8: Armchair with Marble and Mother-of-Pearl Inlay in Rosewood
Source: "Cantonese Furniture of the Qing Dynasty" (Cai Yian, 1993)

Mother-of-pearl is widely utilized in Cantonese furniture, enhancing the visual richness and adding a unique charm. The craftsmanship emphasizes uniformity and coherence in the use of mother-of-pearl, with a focus on “clean colors” and full inlay coverage; thick mother-of-pearl typically appears in white or ivory hues, while thinner inlays exhibit vibrant shades of red, pink, and blue. The inlay work demonstrates an overall coherence, applicable to both large structural components and smaller carved elements (Chen Xiaoqing, 2017). The meticulous craftsmanship of Cantonese chairs, with an emphasis on detailed execution, directly influences the quality and status of the furniture.

Structural Characteristics

Cantonese furniture primarily employs traditional Chinese mortise and tenon joinery. In contrast to other traditional Chinese furniture, the structures of Cantonese furniture exhibit certain differences influenced by Western furniture-making techniques, leading to the introduction of new structural forms, such as disassemblable and foldable designs for ease of transport (Chen Xiaoqing, 2017).

Furthermore, significant structural changes can be observed in Cantonese chairs, particularly regarding the leg support and backrest configurations. Cantonese chairs often feature H-shaped and X-shaped leg supports, or replace the traditional interlocking systems with horizontal crossbars to optimize the under-chassis space (see Figure 9).



Figure 9: H-shaped Leg Support

Source: An Exploration of the Form and Artistic Features of Cantonese Seating (Chen Huihua & Liu Han, 2022)

In certain Western-style Cantonese chairs, even the crossbars may be omitted. When employing these Western-style leg structures or omitting crossbars, the upper sections of the legs typically feature a large curved structure, commonly referred to as "eight-character legs" in Guangdong, which embodies a distinct Western aesthetic. In terms of the backrest structure, the rear legs are often separate from the backrest posts to accommodate the curvature of the backrest.

Cantonese chairs utilize traditional mortise and tenon joinery, ensuring stability and durability (see Figure 10). The rationality of structural design is critical to the practicality and safety of the furniture. In constructing the evaluation index system, attention should be given to the stability, rationality, and functionality of the structure. By evaluating key elements such as mortise and tenon structures, connection methods, and load-bearing capacities, the scientific and rational design of Cantonese chairs can be ensured.



Figure 10: Mortise and Tenon Structure of Cantonese-Style Chair

Source: The Artistic Features of Cantonese Furniture (Li Yingxin, 2018)

In summary, Cantonese chairs are cherished for their unique design style and exquisite craftsmanship. Their design characteristics exhibit uniqueness in terms of form, decoration, materials, craftsmanship, and structure. When constructing a comprehensive evaluation index system for Cantonese chairs, it is essential to fully consider these design characteristics

and cultural connotations to ensure the comprehensiveness and scientific validity of the evaluation criteria. Through the evaluation of these design characteristics, a more accurate reflection of the cultural design level and market value of Cantonese chairs can be achieved, thereby providing robust support for the assessment of Cantonese furniture.

Research Methodology

This study employs a combination of qualitative and quantitative methods to scientifically construct an evaluation index system for the design of Cantonese chairs. The research is divided into several key phases:

Preliminary Construction Phase: Qualitative research methods, including literature review, observational studies, and interviews, are utilized to extensively collect and analyze the design characteristics of Cantonese chairs, resulting in a preliminary set of indicators. This phase involves repeated communication with consumers, designers, and experts to clarify the specific goals and ultimate purposes of the design evaluation.

Qualitative Screening Phase: The Delphi expert method is employed to assess the preliminary indicators, eliminating those that are unmeasurable or difficult to obtain data for, thereby ensuring the operability of the indicators.

Quantitative Screening Phase: Quantitative methods such as correlation analysis and principal component analysis are utilized to examine the independence and significance of the indicators, reducing information redundancy and enhancing the effectiveness of the evaluation indicators.

Rationality Verification Phase: Factor analysis is performed to calculate the information contribution rate of the retained indicators, assessing whether the selected indicators effectively reflect the main characteristics of Cantonese chair design.

Feedback Verification Phase: Dynamic adjustments are made based on the practical effectiveness of the evaluation results, ensuring the ongoing applicability and validity of the evaluation index system.

The research methodology provides systematic and scientific support for the construction of the evaluation index system for Cantonese chairs, and it is applicable to the development of evaluation systems in other furniture design fields.

Findings

Principles for Constructing the Evaluation Index System for Cantonese-Style Chair Design

The complexity of Cantonese chair design and the diversity of evaluation purposes necessitate a correspondingly complex and variable evaluation index system. The establishment of the evaluation index system must comprehensively consider factors such as the objectives of the evaluation, the issues and subjects of the evaluation, the sources of evaluation data, and the specific temporal context in which the evaluation events or behaviors occur (Zhanglin et al., 2017). The primary aim of product design evaluation is to assess the quality of a product's design; thus, when selecting indicators for product design evaluation, it is essential to first consider the attributes of the evaluation subject and the principles that should be followed in the design process (Yaxue, 2021). As a unique product, Cantonese chairs possess characteristics related to their era, regional culture, and environmental context. Cantonese chairs must embody the attributes of industrial products, fulfilling consumers' physiological and aesthetic needs while also aligning with modern production technologies that facilitate mass production. Additionally, they must possess the attributes of cultural products, catering to the emotional needs of contemporary consumers.

Furthermore, Cantonese chairs should be considered environmental products, as they are intended for use within indoor spaces, requiring harmony with the surrounding environment. Therefore, the acquisition of evaluation indicators for Cantonese furniture design should involve comprehensive consideration from multiple perspectives, including consumers, designers, and experts.

Scientific validity is the most critical goal of the evaluation index system design, if not the sole objective. The scientific validity of the evaluation index system directly determines the scientificity, credibility, and reliability of the overall evaluation results. To construct a scientifically sound comprehensive evaluation index system, several principles should be adhered to during the design and construction of the index system. Zuo Yaxue (2021) asserts that the formulation of a comprehensive evaluation index system for product design should adhere to principles of comprehensiveness, scientificity, a combination of dynamic and static indicators, quantitiveness, operability, independence, hierarchical organization, and differentiation (Zuo Yaxue, 2021). Chen Zhuojian (2008) argues that the establishment of a comprehensive evaluation index system for furniture design should follow principles of scientific and practical relevance, completeness and operability, compatibility and systematicity, and a combination of qualitative and quantitative indicators, as well as the unity of static and dynamic indicators (Chen Zhuojian, 2008). Chen Yilian (2022) suggests that the construction of an evaluation index system for elderly-friendly furniture should comply with principles of systematicness, authenticity, typicality, stage appropriateness, and quantitiveness (Chen Yilian, 2022). Liang Jia (2023) posits that constructing an evaluation index system for intelligent office chairs should adhere to principles of systematicness, scientific validity, representativeness, and operability (Liang Jia et al., 2023). Peter F. Drucker (2009) proposed that during the establishment of organizational goals or indicators, adherence to the SMART principles—Specific, Measurable, Attainable, Realistic, and Time-bound—can be beneficial.

Based on the aforementioned research, this study contends that in the design and construction of the evaluation index system for Cantonese chairs, emphasis should be placed on eight principles: Scientific validity, Objective, comprehensiveness, hierarchical structure, operability, independence, significance, and dynamism, as illustrated in Figure 11.

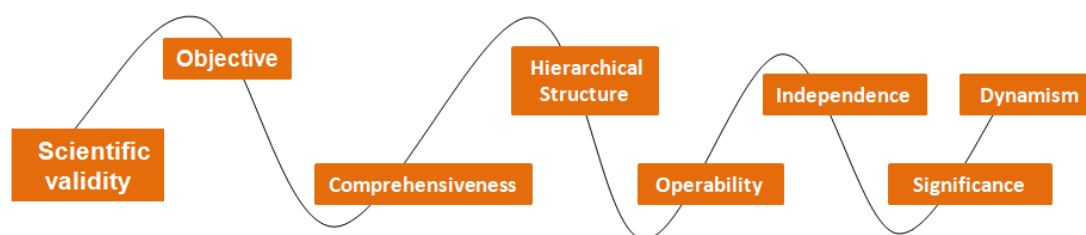


Figure 11. Principles for Constructing the Design Evaluation Index System of Cantonese-Style Chairs

Principle of Scientific validity: Scientific validity is the most critical objective in constructing the evaluation index system and serves as its primary principle. The scientific validity of the evaluation index system directly influences the scientificity, credibility, and reliability of the evaluation results. All steps, including the selection of indicators, must maintain scientific rigor to ensure that the constructed evaluation index system accurately reflects the true conditions of the Cantonese chair design.

Principle of Objective: Indicators are specific representations of objectives. Therefore, the evaluation indicators must authentically reflect the goals of the design evaluation and accurately characterize and describe the features of the Cantonese chair design. They should encompass the essential content necessary to achieve the evaluation objectives. Furthermore, evaluation indicators should exhibit a certain level of guidance based on the evaluation purpose. For instance, when evaluating a Cantonese chair design, the "cultural" indicator can be incorporated into the overall assessment framework. This would encourage designers to explore the cultural connotations of Cantonese furniture and apply them in their chair designs.

Principle of Comprehensiveness: A single evaluation indicator reflects a specific feature of the Cantonese chair design. In contrast, the evaluation index system should comprehensively represent the overall characteristics of the design, enabling multidimensional assessment of the attributes of the Cantonese chair design. For example, the evaluation index system should assess the design from various dimensions, including functional, aesthetic, cultural, economic, and social attributes. Additionally, both qualitative and quantitative indicators should be considered, utilizing interdisciplinary knowledge to ensure the comprehensiveness of the evaluation indicators and the rationality of the results.

Principle of Hierarchical Structure: The evaluation of the Cantonese chair design involves multiple dimensions, levels, and attributes. Different levels of evaluation indicators target distinct evaluation objectives, providing varied information to designers and experts. Therefore, when establishing the evaluation index system for Cantonese-style chairs, the indicators should be organized hierarchically, ensuring that indicators within the same level address similar objectives. Indicators across different levels should exhibit clear subordinate relationships, thereby providing coherent and clear evaluation data for Cantonese chair designs.

Principle of Operability: Operability refers to the observability of evaluation indicators and the associated observation costs. Firstly, the evaluation data for the indicators must be observable, meaning that the indicators should be collectible or assignable; otherwise, the establishment of the indicator is meaningless. For example, the evaluation indicators for Cantonese chair design should have clear definitions based on real statistical data to facilitate quantitative analysis. Secondly, the data for the evaluation indicators should be easy to collect, with observation costs kept minimal. For instance, the indicators for evaluating furniture design should be concise and manageable, ensuring simplicity and operability while maintaining effectiveness.

Principle of Independence: Independence requires each indicator to have a clear definition and to be as mutually independent as possible. Indicators at the same level should not overlap or have causal relationships, maintaining a good degree of independence. For a multi-level comprehensive evaluation index system, a top-down hierarchical structure should be established based on the categories and levels of the indicators. There should be a clear subordinate relationship between upper and lower-level indicators, ensuring that both the sets of indicators and the individual indicators within each set remain independent.

Principle of Significance: The evaluation index system for Cantonese-style chairs should retain the main key indicators while excluding non-essential ones. The greater the number of indicators, the higher the costs of obtaining evaluation data and information, which may lead to data redundancy. The primary criterion for determining whether an indicator is key is its contribution to the overall evaluation; the greater the contribution, the stronger the significance, qualifying it as a key indicator. Conversely, lower significance may categorize an

indicator as non-essential. While the evaluation index system should comprehensively assess all characteristics of Cantonese chair design, it is not advantageous for the number of indicators to be excessively high during the construction process.

Principle of Dynamism: While the evaluation index system should maintain a certain degree of stability during a specific evaluation timeframe, it is essential to dynamically adjust the system in response to changing conditions and evaluation objectives. Such dynamic adjustments can be classified into proactive and reactive adjustments. Proactive adjustments involve modifying or redesigning the evaluation index system based on new evaluation objectives and requirements. Reactive adjustments entail dynamically revising certain indicators within the evaluation index system based on the feedback from evaluation results, allowing for the inclusion or exclusion of specific indicators.

In summary, the principles for constructing the comprehensive evaluation index system for Cantonese chair designs provide guidance for the design and construction of the evaluation index system from a top-level perspective. Scientific validity, purposefulness, comprehensiveness, hierarchical structure, operability, independence, significance, and dynamism collectively reflect the fundamental requirements for developing the evaluation index system for Cantonese chair design. Only by considering these principles comprehensively can a scientific, comprehensive, rational, and applicable evaluation index system be established.

Construction Process of the Evaluation Index System for Cantonese Chair Design

The process of constructing a design evaluation index system primarily consists of three stages: qualitative design, quantitative screening, and relevance testing (Peng Zhanglin et al., 2017). During the construction of the comprehensive evaluation index system, the qualitative design phase involves analyzing and summarizing the characteristics of Cantonese-style chairs based on the evaluation objectives through qualitative research methods such as literature review, observation, and interviews. This phase also includes designing and constructing the evaluation index system while repeatedly refining it using observation and expert consultation methods. However, there has been insufficient focus on the more scientific and objective phase of quantitative screening of evaluation indicators (Peng Zhanglin et al., 2017). Consequently, the current construction of furniture design evaluation index systems often exhibits excessive subjectivity and insufficient objectivity. Furthermore, research in the relevance testing phase is relatively lacking. While these three stages encompass the fundamental process of indicator construction, the necessity for dynamic adjustments within the index system has been overlooked.

Therefore, this paper analyzes existing literature to further refine the construction process of the comprehensive evaluation index system for Cantonese chair design. It adheres to the principles of scientific validity, purposefulness, comprehensiveness, hierarchical structure, operability, independence, significance, and dynamism, proposing a construction process based on five procedural models for the evaluation index system of Cantonese-style chairs, as illustrated in Figure 12.

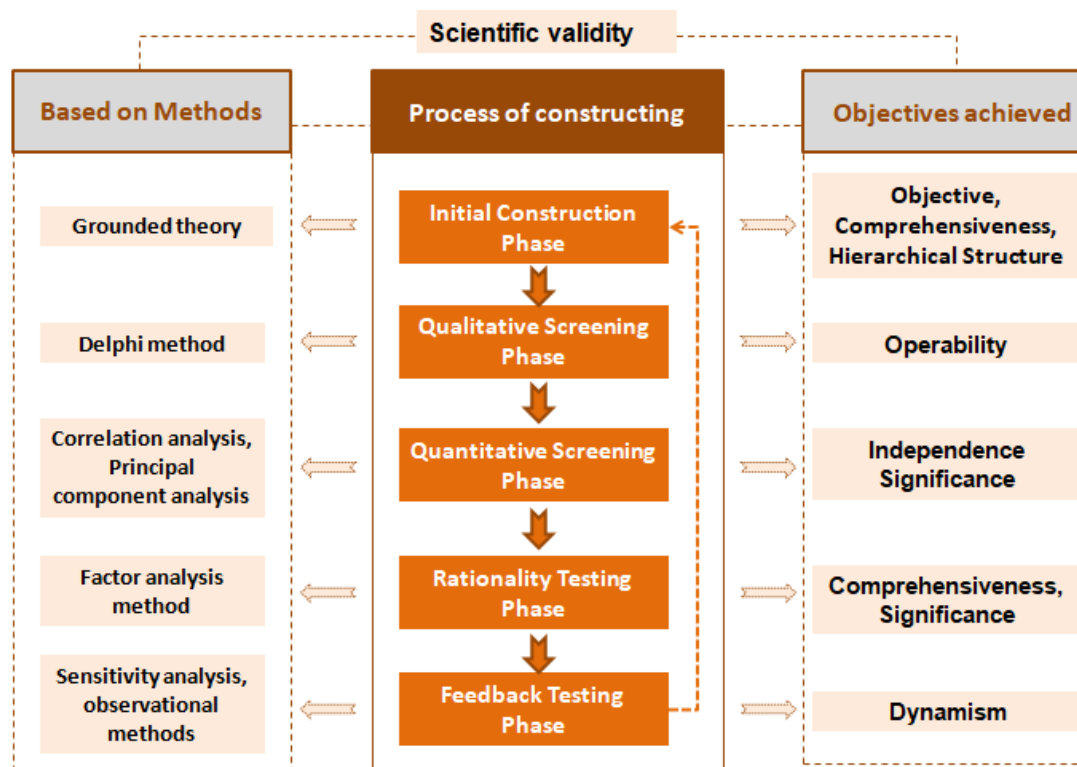


Figure12. Five-Stage Process for Constructing the Design Evaluation Index System of Cantonese-Style Chairs

Initial Construction Phase

In the initial construction phase of the index system, the main task is to form a comprehensive set of indicators that reflect the characteristics of Cantonese-style chairs as completely as possible, based on the evaluation objectives. This phase requires the design of the index system to closely align with the evaluation goals, meaning it must not only reflect consumer needs but also consider the requirements of modern production. Additionally, it should embody the cultural and ecological attributes of Cantonese-style chairs. To achieve this, multiple rounds of communication and interaction with consumers, designers, and experts in Cantonese furniture are essential to clarify specific evaluation objectives and ultimate goals. Consequently, the design of the index system should comprehensively describe all relevant characteristics of the Cantonese chair. Therefore, the evaluation index system constructed in this phase must satisfy the principles of purposefulness, completeness, and hierarchical structure.

Methods for this phase: Based on the aforementioned goals and principles, grounded theory can be employed to comprehensively collect interview information from consumers, designers, and experts in Cantonese furniture, as well as to integrate information from existing relevant literature. By continually refining concepts and categories, a comprehensive, hierarchical index system for evaluating Cantonese chair designs can be constructed.

Qualitative Screening Phase

In the preliminary screening phase of the index system, the primary task is to ensure that the evaluation indicators are observable or measurable while considering observation costs. The objective of this phase is to eliminate those indicators from the set that are not obtainable or require prohibitively high costs, ensuring that all indicators can yield data within an

acceptable cost range. This will result in an operable evaluation index system for Cantonese chair design. Thus, the index system constructed in this phase must meet the principle of operability.

Methods for this phase: After the preliminary formation of the evaluation index system, the Delphi method can be applied to rigorously evaluate each indicator within the system, removing those that are unmeasurable or difficult to obtain data for. This completes the subjective qualitative screening of the initially constructed evaluation indicators.

Quantitative Screening Phase

In the quantitative screening phase, the primary task is to ensure the independence and significance of each indicator in the evaluation index system for Cantonese-style chair design. The previous two phases primarily focused on the comprehensiveness and completeness of the evaluation indicators, which may lead to an excessive number of indicators and information redundancy, along with potential correlations among indicators. Thus, this phase requires the use of quantitative research methods to scientifically and objectively refine the constructed index system. The aim is to reduce and eliminate correlations among evaluation indicators while enhancing their independence and significance. Therefore, the evaluation index system constructed in this phase must adhere to the principles of independence and significance.

Methods for this phase: To assess the independence of the evaluation indicators, correlation analysis or principal component analysis can be employed to examine correlations between pairs of indicators and among multiple indicators. Indicators with correlation coefficients exceeding a critical value (commonly, a threshold of M set at 0.9) should be refined (Murtagh & Heck, 2012). For assessing the significance of evaluation indicators, information entropy can be utilized to calculate the importance level of each indicator. Indicators with low significance in the evaluation results may be selected for removal (Shannon, 1948). Specific reference values for information entropy may vary based on the characteristics of the research field; however, indicators with low importance are typically considered those with an information entropy less than 0.5 or 0.6 (Shannon, 1948; Zadeh, 1965).

Rationality Testing Phase

In the rationality testing phase of the index system, the main task is to verify whether all retained indicators can still adequately express the primary features and information content of the Cantonese chair design. Generally, to determine the rationality of the retained indicator system, it is necessary to calculate the percentage of information retained by the selected indicators after quantitative screening in relation to the total information content of all indicators post-initial screening. Gu Xuesong (2010) posits that if indicators representing less than 30% of the initial selection can convey over 95% of the original information, the index system can be deemed rationally constructed. Otherwise, if the rationality test is not passed, the index system must be readjusted (Gu Xuesong et al., 2010). Thus, the goal in this phase is to ensure that the retained indicator system meets the principles of comprehensiveness and significance.

Methods for this phase: Factor analysis and data variance can be utilized to represent information content, calculating the information contribution rate of indicators post-quantitative screening to establish criteria for rationality assessment.

Feedback Testing Phase

In the feedback testing phase of the index system, the main task is to conduct a feedback examination regarding the sustainability of the evaluation index system based on the effectiveness of the executed evaluation results or changes in evaluation objectives. The need for feedback testing arises from two main reasons: first, if the implementation of the evaluation of Cantonese chair designs yields unsatisfactory results that do not meet expected objectives; second, as time and environmental conditions change, the goals of the decision-making entities regarding evaluation activities may evolve, necessitating corresponding adjustments to the evaluation indicators (Peng Zhanglin et al., 2017). Consequently, the evaluation index system for Cantonese-style chairs must adhere to the principle of dynamism.

Methods for this phase: If the execution of evaluation results is unsatisfactory and does not achieve the expected objectives, sensitivity analysis, observational methods and other methods can be used to identify key factors for dynamic adjustments to the evaluation indicators. If the objectives of the evaluation activities change, the evaluation index system will need to be modified accordingly.

In conclusion, through the five stages of initial construction, qualitative screening, quantitative screening, rationality testing, and feedback testing, a scientific process for constructing the comprehensive evaluation index system for Cantonese chair design can be established. These five stages not only exhibit a certain level of hierarchy but also form a closed loop, with each stage being supported by corresponding theories and methods. Simultaneously, they fulfill and achieve the principles of scientific validity, purposefulness, comprehensiveness, hierarchical structure, operability, independence, significance, and dynamism in the design of the comprehensive evaluation index system. Thus, this method can also serve as a reference for constructing evaluation index systems for other types of furniture design.

Conclusion

Conducting research on the evaluation of Cantonese furniture design and establishing an evaluation index system that aligns with modern consumer needs is a pressing necessity in the field of Cantonese furniture studies. Cantonese chairs possess unique design characteristics and cultural connotations in aspects such as form, decoration, materials, craftsmanship, and structure. When constructing a comprehensive evaluation index system for Cantonese chairs, it is essential to fully consider these distinctive cultural attributes.

Through literature review and comparative analysis, this paper proposes eight design principles for the evaluation index system of Cantonese chair design, namely Scientific validity, Objective, comprehensiveness, hierarchical structure, operability, independence, significance, and dynamism. By comprehensively considering these principles, a scientific, comprehensive, reasonable, and applicable evaluation index system for Cantonese chair design can be established. Furthermore, five procedural steps—preliminary construction, qualitative screening, quantitative screening, rationality verification, and feedback verification—are proposed to systematically construct the comprehensive evaluation index system for Cantonese chair design.

The construction principles and methods of the design evaluation index system for Cantonese-style chairs proposed in this study make significant theoretical and practical

contributions to current research. Theoretically, this study fills a gap in the evaluation of Cantonese-style furniture design, providing a systematic framework for academic inquiry in related fields and promoting interdisciplinary research. Furthermore, the eight construction principles introduced, such as scientific validity and purposefulness, expand the theoretical perspective of design evaluation, enhancing both the depth and breadth of the research. Practically, the evaluation system offers concrete guidance for designers and manufacturers, assisting them in effectively integrating the cultural characteristics of Cantonese style into their designs and improving the quality of their products. This not only meets the aesthetic and functional needs of modern consumers but also promotes the inheritance and innovation of traditional culture. Therefore, this research holds an important position within the knowledge system, contributing to the overall advancement of the furniture design field by elevating design standards and guiding industry development..

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