

Design Issues and Solutions for Improving the Comfort of Neo-Ming Style Chair

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Abstract: This paper explores the design issues and solutions for improving the comfort of new Ming-style chairs. It first analyzes the historical origins, traditional aesthetics, and modern users' new demands for comfort in these chairs. Then, it highlights the comfort-related challenges in terms of chair form, materials, structure, and usage scenarios. The study proposes design principles from the perspectives of ergonomics, material innovation, structural optimization, and modern usage scenarios. Specific strategies to enhance comfort are provided, such as optimizing the angle between the chair back and chair surface, improving cushion materials, optimizing the chair's supporting structure, and incorporating intelligent design. This paper also discusses the challenges of integrating technology with traditional design, the application of eco-friendly materials, and the diverse demands of consumer groups. Finally, it summarizes the future trends and challenges in the comfort-focused design of Neo-Ming style chair.

Keywords: Neo-Ming style chair; comfort design; ergonomics; material innovation.

1. Introduction

As a product of the combination of traditional Ming-style furniture and modern lifestyles, the Neo-Ming style chair not only carries rich cultural heritage but also faces new design challenges. With modern users placing greater emphasis on chair comfort, the key issue for designers is how to improve comfort while preserving traditional aesthetics. Factors such as ergonomics, material innovation, structural adjustments, and the integration of technology are becoming central to the comfort-focused design of Neo-Ming style chair. This study aims to analyze existing design issues, propose design principles and strategies for improving comfort, and explore future trends and challenges in this field.

2. The Design Background and Development of Neo-Ming style Chair

2.1. Historical Origins and Design Concepts of Neo-Ming style Chair

As a product of the fusion between traditional Chinese furniture and modern design, the New Ming-style chair embodies a long-standing cultural tradition while meeting the practical needs of modern life. Its history dates back to the Ming Dynasty (1368-1644), during which Ming-style furniture became renowned for its simplicity, elegance, and attention to detail. The design of chairs in this period reflected the Confucian ideals of grace and natural harmony prevalent in Chinese culture[1]. Ming-style furniture, particularly chairs, emphasized lightness in form, flowing lines, and minimal decoration, making them not only functional but also highly artistic.

The Neo-Ming style chair inherits the design essence of traditional Ming-style furniture, but with the evolution of modern lifestyles, it incorporates more elements of ergonomics and practicality. In terms of design philosophy, Neo-Ming style chair stress the harmonious blend of tradition

and modernity, seeking greater comfort and convenience while preserving the classical aesthetic. This design approach not only responds to contemporary users' demands for functionality but also creates a bridge between ancient and modern cultures. Modern designers pay close attention to the balance of traditional proportions while introducing new materials and technologies to achieve equilibrium between form and function. The historical origins and design concepts of Neo-Ming style chair reflect the profound cultural heritage of China, while also adapting to the changes in modern living.

2.2. Aesthetic and Functional Characteristics of Traditional Ming-Style Chair

Traditional Ming-style chair holds a prominent position in the history of Chinese furniture, known for their dignified, elegant, and concise forms. The aesthetic features of Ming-style chairs are characterized by smooth lines and simple designs that often emphasize the natural grain and texture of the wood, with relatively minimal decorative elements. The proportions of these chairs are meticulously designed, using the interplay of straight and curved lines to achieve visual balance and harmony[2]. Influenced by Confucian ideals of moderation and Daoist principles of harmony between humans and nature, traditional Ming-style chair maintains a sense of stability and restraint, avoiding extravagance and complexity, and thereby exuding an understated beauty.

In terms of functionality, traditional Ming-style chair was often constructed from hardwood, and while visually appealing, they were relatively lacking in comfort. The chairs typically had no cushions or soft padding, and their structure was kept simple to ensure both durability and aesthetic appeal. This design reflected the basic functional needs of the time, but less attention was given to the comfort of prolonged sitting. Since the design of furniture in that era tended to prioritize aesthetics and etiquette, the practical aspect of comfort was often limited, resulting in insufficient ergonomic support for long-term use[3]. The aesthetic and functional characteristics of traditional Ming-style chair provides an

important reference point for Neo-Ming style chair. Modern designers seek to balance traditional aesthetics with new ergonomic principles, striving for a better harmony between beauty and comfort.

2.3. Modern Users' New Demands for the Comfort of Neo-Ming style Chair

With the changing modern lifestyle, people's needs for chairs have expanded beyond visual aesthetics and basic functionality to include greater emphasis on comfort and health. Although traditional Ming-style chair possesses high artistic and cultural value, they are not well-suited for prolonged use, particularly in modern contexts where long periods of sitting—such as for work or study—are common. This has heightened the demand for more comfortable chairs.

Modern users' comfort requirements for Neo-Ming style chair primarily focuses on ergonomic design. Ergonomics emphasizes that furniture should conform to the body's natural posture, reducing physical strain and preventing discomfort and health issues caused by prolonged sitting. When designing Neo-Ming style chair, it is essential to consider key factors such as the natural curvature of the spine and lumbar support[4]. By optimizing the angle of the chair back, the height of the chair cushion, and the softness of the chair surface, designers can improve overall comfort.

The usage scenarios for chairs have also become more diverse, extending beyond the traditional household setting to include office chairs, lounge chairs, and other types. Each scenario comes with different requirements, which means that designers must be flexible and create chairs that adapt to a wide range of environments. Material selection is another significant concern for modern users. Advances in material technology have provided more options for enhancing comfort. Soft, breathable materials can significantly improve the user experience.

In summary, modern users have set higher and more varied demands for the comfort of Neo-Ming style chair[5]. They not only expect these chairs to maintain traditional aesthetics but also require them to meet modern functional needs, particularly in terms of comfort and health during extended periods of sitting. This has driven continuous innovation and improvement in the design of Neo-Ming style chair.

3. Design Issues in the Comfort of Neo-Ming style chair

3.1. The Conflict Between Chair Form and Ergonomics

In the design of Neo-Ming style chair, there is often a strong emphasis on preserving and expressing traditional forms, particularly in terms of replicating the simplicity and elegance of Ming-style furniture. However, this pursuit of traditional form sometimes conflicts with ergonomic design. Ergonomics emphasizes that chairs should conform to the natural shape of the human body, providing adequate support and comfort to reduce the physical strain caused by prolonged sitting. The straight design and rigid backrest of traditional Ming-style chair do not align with the natural curve of the human spine, leading to pressure on the lumbar region and back during long-term use, which can cause discomfort.

Traditional Ming-style chair often features a relatively flat chair surface and backrest angle, lacking flexibility and adjustment functions for different sitting postures. This is in stark contrast to modern chair designs, which typically offer

adjustable features. If the design of New Ming-style chairs focuses solely on aesthetic appeal without addressing these ergonomic adjustments, users may not experience optimal comfort[6]. Especially in modern life, where people adopt a variety of sitting postures, the limitations of traditional design further exacerbate the issue of discomfort.

If Neo-Ming style chair prioritizes traditional style over ergonomic principles, they will inevitably face significant limitations in terms of comfort. The key challenge in designing Neo-Ming style chair is how to improve ergonomic compatibility through adjustments to the backrest angle, chair surface shape, and chair leg height, while maintaining the traditional aesthetic.

3.2. The Impact of Material Selection on Comfort

Material selection directly affects the comfort of a chair, and this is a crucial issue in the design of Neo-Ming style chair. Traditional Ming-style furniture often uses hardwoods such as huanghuali or zitan, which are prized for their durability, strength, and aesthetic appeal. However, the hardness of these materials is not conducive to long-term comfort[7]. The rigidity of these woods does not conform well to the soft contours of the human body, leading to localized pressure points that can cause discomfort or even pain during extended use.

In designing Neo-Ming style chair, it is essential to find materials that meet both traditional aesthetic standards and modern comfort needs. Advances in modern materials technology offer many possibilities. Designers can consider combining modern and traditional materials. For example, soft, breathable materials like high-density foam or breathable fibers can be incorporated into critical areas of the chair, such as the chair cushion and backrest, to improve comfort. Additionally, the surface treatment of materials plays a crucial role in comfort[8]. While traditional hardwoods are visually appealing, their smooth finish can feel too cold in winter and uncomfortable in summer due to sweating, failing to provide year-round comfort.

The use of eco-friendly materials is also an important trend in modern design. When selecting materials for Neo-Ming style chair, designers can consider renewable and environmentally friendly options, which not only enhance the comfort of the chair but also align with the growing demand for sustainable design. However, the introduction of new materials may conflict with the traditional design aesthetic, so finding a balance between material innovation and preserving traditional beauty is a challenge that designers must navigate.

3.3. Limitations in Chair Structure Design

The structural design of Neo-Ming style chair inherits the simplicity and lightweight characteristics of traditional Ming-style chair, with a strong emphasis on proportion, balance, and aesthetic appeal. While this design contributes to the overall visual value, it also introduces limitations in terms of comfort. Traditional chairs often lack complex structural support, and the chair surface and backrest do not provide sufficient ergonomic support for the natural curves of the body, leading to strain on the back and lumbar region during prolonged use.

The stability of the chair's structure also directly impacts its comfort. Traditional Ming-style chair typically have a fixed structure and lack modern adjustments, such as backrest recline and chair height adjustments, limiting their versatility

and ability to accommodate users of different heights and body types. In particular, in modern office environments, where prolonged sitting in a fixed position can cause fatigue, the demand for adjustable chairs is much higher. Modern users require chairs that can adapt to different scenarios and provide the necessary adjustments to improve comfort.

The sturdiness and support of a chair are also key factors in comfort. While traditional chairs are often visually appealing, their lightweight and simple design can sometimes compromise structural integrity. For chairs that are used over extended periods, inadequate structural support can lead to fatigue and discomfort[9]. When designing Neo-Ming style chair, the challenge is how to enhance backrest support, chair surface elasticity, and leg stability without sacrificing traditional aesthetics, in order to improve the overall comfort of the chair.

3.4. Comfort Issues in Different Usage Scenarios

The usage scenarios of Neo-Ming style chair differ significantly from those of traditional Ming-style chair. Traditional Ming-style chair was primarily used in Chinese homes or specific cultural settings, where usage durations were relatively short and the demand for comfort was lower due to the formal nature of these occasions. However, modern usage scenarios are much more diverse, including offices, restaurants, and leisure spaces, where the comfort requirements for chairs are considerably higher. Modern users often need to work or rest on chairs for extended periods, which imposes higher standards on the functionality and comfort of the chairs.

Different usage scenarios also entail different chair requirements. For example, in an office environment, chairs need to provide adequate lumbar support to prevent back discomfort from prolonged sitting, while in leisure spaces, chairs need to be softer and more comfortable, and may even feature adjustable functions to accommodate various sitting positions [10]. A single fixed-structure design often cannot meet the diverse needs of all users in modern, varied environments.

Modern users also expect chairs to adapt to different seasons and climate conditions. In summer, they desire chairs with good breathability to prevent discomfort from heat, while in winter, chairs need to offer sufficient warmth. These material, structural, and design detail requirements are all issues that Neo-Ming style chair must address to adapt to modern, varied usage scenarios. Designing chairs that balance aesthetics with comfort in different settings has become a central challenge in the design of Neo-Ming style chair.

4. Design Principles for Improving the Comfort of Neo-Ming style chair

4.1. Application of Ergonomics in Chair Design

The primary principle for improving the comfort of Neo-Ming style chair is the integration of ergonomic principles into the design. Ergonomics emphasizes that the design should align with the body's natural curves and postures, minimizing discomfort and fatigue caused by prolonged sitting. Key aspects of chair design include the angle of the backrest and chair cushion, optimization of support positions, and the matching of chair height to the user's body height.

The backrest should follow the natural curvature of the spine, providing adequate lumbar support. An overly upright backrest may cause excessive lumbar pressure, while a too-reclined backrest can lead to instability in the sitting posture. By incorporating a moderate curve into the backrest and adding a support structure in the lumbar area, the user's sitting experience can be significantly improved. Additionally, the chair cushion should be shaped to conform to the contours of the hips, distributing body weight evenly and relieving pressure on the pelvis and legs during extended periods of sitting.

Chair height should be adjustable according to the user's leg length and desk height. Generally, the chair height should allow the user's feet to rest flat on the ground, with the knees forming a roughly 90-degree angle to prevent leg fatigue from a chair that is too high or too low. The application of ergonomics can significantly enhance the comfort of Neo-Ming style chair through detailed design optimization, making them suitable for long-term use in modern settings.

4.2. Material Innovation and Tactile Optimization

Material selection plays a crucial role in the comfort of Neo-Ming style chair. Traditional Ming-style chair often uses hardwood materials such as huanghuali or zitan, which, while aesthetically pleasing, lack comfort. To enhance the comfort of Neo-Ming style chair, designers can use innovative materials to improve the tactile experience and overall user comfort.

The choice of cushion filling materials is key to improving comfort. Advances in modern materials science provide a wide range of options, such as high-density memory foam or breathable foam materials, which offer excellent cushioning and support. These materials can adjust their shape in response to body pressure and distribute weight effectively, preventing discomfort caused by excessive localized pressure. Materials with good breathability also enhance comfort, particularly during long periods of sitting or in high-temperature environments, reducing the buildup of heat and moisture on the skin.

The tactile quality of the chair's surface material also greatly affects user experience. While traditional wood is durable, its smooth surface can become too cold in winter and too warm in summer, making it difficult to provide consistent comfort. The introduction of modern fabric or leather coverings can enhance the chair's softness and provide seasonal comfort, such as warmth in winter or breathability in summer. Incorporating such materials without compromising the overall aesthetics of New Ming-style chairs can deliver a more comfortable and natural tactile experience for users.

4.3. Structural Adjustments and Functional Improvements

The structural design of Neo-Ming style chair inherits the simplicity and fluid style of traditional Ming furniture. However, to meet the diverse needs of modern users, structural adjustments and functional improvements are essential. Traditional chairs often have fixed structures, lacking adjustability, but in modern life, different usage scenarios and user habits require more flexible chair designs.

Adjustability is a key factor in enhancing comfort. Modern ergonomic chairs typically feature adjustable backrest angles and chair heights to accommodate users of varying heights and body types. For Neo-Ming style chair, designers can

discreetly incorporate these adjustable features without altering the traditional style. For example, they can design adjustable backrest angles or movable lumbar support devices to provide optimal support for users in different situations. The adjustability of chair height also enhances flexibility, especially in office environments where users may need to adjust the chair height according to desk height or personal preference.

Structural stability also significantly impacts comfort. Traditional Ming-style chairs, in pursuit of a visually light design, often compromise on load-bearing capacity and durability. In designing New Ming-style chairs, it is important to maintain the simplicity of the exterior while strengthening the internal support structure to improve stability and durability, preventing wobbling or deformation after extended use. This not only increases the chair's comfort but also extends its lifespan.

4.4. Comfort Optimization Design Based on Modern Usage Scenario

Neo-Ming style chair must not only retain traditional aesthetics and functionality but also address the diverse demands of modern usage scenarios. As modern lifestyles evolve, the usage of chairs has expanded from the home to offices, leisure, and commercial spaces, requiring designers to focus more on adaptability and functionality in chair design.

In office settings, the comfort of a chair directly affects work efficiency and health. Office-use Neo-Ming style chair can maintain traditional aesthetics while incorporating ergonomic features such as an adjustable backrest, cushion, and armrests, as well as additional lumbar support to meet the demands of long hours at work. In leisure environments, such as living rooms or tea rooms, New Ming-style chairs can be designed to be wider and softer, with adjustable backrest angles and thicker cushions to create a more relaxed and comfortable atmosphere.

Different seasons and environmental conditions also pose varying demands on chair comfort. In the hot summer months, chairs should be made from breathable materials or designed with air gaps to improve ventilation and prevent discomfort from prolonged sitting. In colder winter months, chairs can be covered with warmer materials or fitted with thicker cushions to provide better insulation. This type of design, optimized for different scenarios and environments, can greatly enhance the practicality of Neo-Ming style chair, ensuring they provide comfort in a variety of conditions. By integrating modern usage scenarios into the design, the comfort of Neo-Ming style chair can be improved, expanding their application and providing users with a richer and more seamless experience, making them better suited to modern life.

5. Specific Design Strategies for Enhancing the Comfort of Neo-Ming style chair

5.1. Optimization of the Backrest and Chair Surface Angle

Optimizing the angle between the backrest and the chair surface is one of the key design strategies for improving the comfort of Neo-Ming style chair. In traditional Ming-style chair designs, the backrest is often positioned at a right angle or nearly upright. While this design aligns with the aesthetic and etiquette requirements of the time, prolonged use can lead

to fatigue in the back and lower back. To enhance comfort, designers need to optimize the backrest angle while maintaining the traditional appearance, ensuring it aligns better with the natural curvature of the spine.

Generally, the most comfortable backrest angle for sitting is between 100° and 110°. This angle allows for proper lumbar support while avoiding instability caused by excessive reclining. By adjusting the backrest angle, Neo-Ming style chair can maintain an elegant appearance while providing better back support during actual use. The angle of the chair surface also plays an important role in comfort. While traditional chair surfaces are usually flat, a slightly backward tilt can help users maintain a more natural sitting posture and reduce pressure on the back of the thighs, allowing for longer periods of comfort.

Optimizing the angle of the backrest and chair surface not only enhances comfort but also improves the chair's functionality in different settings. In office environments, a relatively upright sitting posture is needed to enhance work efficiency, while in leisure settings, users may prefer a more relaxed posture. By incorporating adaptable angle designs, Neo-Ming style chair can perform well in various usage scenarios.

5.2. Thickening or Softening Cushion Materials

The thickness and firmness of the cushion directly affect the comfort of a chair. Therefore, in the design of Neo-Ming style chair, thickening or softening the cushion material is an effective strategy to improve comfort. Traditional Ming-style chairs typically use hardwood frames, with no cushion or only thin padding, which offers insufficient cushioning, leading to discomfort in the hips and thighs during extended use. To address this issue, modern Neo-Ming style chair can introduce softer, more comfortable materials for the chair cushion, such as memory foam or high-density foam.

High-density memory foam is an ideal choice for improving chair comfort due to its responsiveness to pressure and ability to conform to the body's shape. This material can evenly distribute body weight, reduce localized pressure, and provide a more comfortable sitting experience. Breathable materials such as breathable fabrics and natural fibers can also improve chair comfort, especially during long periods of sitting or in hot environments, helping to prevent discomfort caused by sweating.

In addition to the thickness and material of the cushion, the shape of the cushion is also important. Curved cushions that conform to the contour of the hips can effectively distribute pressure and further improve comfort. By thickening or softening the cushion materials, designers can not only maintain the traditional style of New Ming-style chairs visually but also significantly enhance their comfort for everyday use, meeting the needs of modern users.

5.3. Optimization of the Chair's Support Structure

The support structure of a chair has a profound impact on its comfort. The support structures of traditional Ming-style chair is relatively simple, often consisting of a wooden frame focused on maintaining a lightweight and streamlined form. However, as modern users demand higher levels of comfort, the purely wooden support structure often fails to provide sufficient elasticity and stability during long-term use. Optimizing the support structure is another important strategy

for improving the comfort of Neo-Ming style chair.

One feasible optimization is the introduction of modern elastic support structures, such as elastic bands or metal spring systems. These materials can provide some elastic cushioning when the user sits down, reducing direct pressure on the body from the chair. Introducing elastic support systems would not compromise the overall aesthetic of the chair's structure but would enhance its practicality and comfort. Adding a flexible material layer beneath the chair surface can help the chair better adapt to the body's pressure distribution, further improving comfort.

Optimizing the chair's support structure not only improves comfort but also increases durability. Through appropriate structural adjustments, Neo-Ming style chair can withstand the wear and tear of daily use while providing more stable support, thus extending their lifespan. Structural improvements should not only focus on comfort but also strike a balance between aesthetics and functionality, ensuring that Neo-Ming style chair perform well in various environments.

5.4. Smart Comfort Design by Combining Technology and Tradition

With the advancement of technology, smart design has become a growing trend in furniture design. Neo-Ming style chair can enhance comfort and user experience by combining technology with traditional craftsmanship. For example, smart adjustment systems could allow users to adjust the chair's backrest angle and chair height according to their needs. Sensors could even automatically detect the user's sitting posture and make real-time adjustments to ensure optimal comfort. Smart temperature control features are another direction for innovation. Chairs could automatically adjust their surface temperature based on the ambient temperature, providing a warm experience in winter and maintaining coolness in summer. This smart temperature control feature would not only increase the chair's practicality but also make it more competitive in terms of comfort.

The combination of technology and tradition is not limited to functional innovations but can also be reflected in design details. By incorporating modern manufacturing technologies such as laser cutting or 3D printing, it is possible to precisely control each component of the chair, ensuring a seamless integration of traditional aesthetics with modern functionality. The introduction of smart comfort design meets the high demands of modern users for furniture functionality while adding more versatility to Neo-Ming style chair, ensuring their competitiveness in the future furniture market. This combination of technology and tradition brings new experiences to Neo-Ming style chair and paves the way for innovative comfort design. This fusion design strategy is expected to become an important trend in future furniture design, injecting new vitality into Neo-Ming style chair.

6. Future Trends and Challenges in the Comfort-Oriented Design of Neo-Ming style chair

6.1. The Trend of Combining Technology and Traditional Design

As technology advances, integrating technology with traditional design has become a key trend in furniture design. In Neo-Ming style chair, this fusion enhances both

functionality and aesthetics. Traditional Ming-style chair are known for their simplicity and elegance, while modern technology brings new life to these designs. Features like smart adjustment, ergonomic applications, and digital manufacturing offer more possibilities for comfort improvements.

For instance, smart chair technology can adjust the backrest, chair height, and tilt angle based on the user's body type and posture, offering an optimal comfort experience. Smart sensors can automatically adjust temperature and softness for personalized comfort. However, designers face the challenge of preserving traditional aesthetics while incorporating technology. Over-reliance on tech risks losing cultural and artistic value. The future lies in balancing traditional craftsmanship with modern technology, ensuring both aesthetics and the comfort demands of modern users.

6.2. The Challenges of Applying Green and Eco-Friendly Materials

The use of eco-friendly materials has become a prominent trend in furniture design, crucial to improving the comfort of New Ming-style chairs. Eco-friendly materials like natural fibers, renewable wood, and low-pollution coatings provide a healthy and breathable environment while enhancing comfort.

However, challenges arise in replacing traditional hardwoods such as huanghuali and zitan, which are scarce and overuse can damage the environment. Designers must find eco-friendly alternatives that match the aesthetic of traditional Ming-style chairs. High costs of sustainable materials can also raise production costs, impacting market competitiveness. Balancing eco-friendliness with affordability is key. By applying eco-friendly materials, Neo-Ming style chair can enhance comfort while aligning with modern society's sustainable development goals.

6.3. The Diverse Demands of Consumers for Comfort-Oriented Design

As society diversifies, consumer demands for chair comfort have become more varied. Neo-Ming style chair must appeal to both traditional enthusiasts and modern consumers with different needs based on age, occupation, and lifestyle. For instance, older adults need greater lumbar support and ease of use, while younger consumers focus on aesthetics, functionality, and smart features. Health-conscious urban users are concerned with issues like back and neck pressure from prolonged sitting.

Designers must cater to these diverse groups by offering personalized solutions that ensure comfort across a range of users. Additionally, modern consumers have varied aesthetic preferences, with some favoring minimalist, lightweight furniture, and others preferring designs rich in cultural heritage. Balancing tradition and modernity in design is crucial to meet the demands of both retro and modern aesthetic tastes, opening up new opportunities for innovation in comfort-oriented design.

7. Conclusion

Neo-Ming style chair faces the challenge of combining traditional and modern elements in comfort-oriented design. By applying ergonomics, material innovation, and structural optimization, designers can significantly enhance the comfort of these chairs while preserving traditional aesthetics. The integration of smart technology and eco-friendly materials

presents new opportunities for the design of Neo-Ming style chair. Designers must address challenges such as the high cost of eco-friendly materials and the diverse demands of consumer groups, all while maintaining the cultural essence of the chairs. Overall, the future design of Neo-Ming style chair will increasingly focus on balancing comfort and diverse needs, offering practical and trend-aligned furniture for modern living.

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