

Aesthetic Research on the Proportion of the Structure of the Ujimqin Mongolian Robe

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How to cite this paper: Liu, X. X. (2026). Aesthetic Research on the Proportion of the Structure of the Ujimqin Mongolian Robe[J]. Sustainable Development, 1(2), 1-11. ISSN Print: 3104-4174; ISSN Online: 3104-4182.

<https://doi.org/10.63313/SD.9003>

Published: 2026-01-30

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Abstract

The Ujimqin Mongols, an ancient Mongolian tribe, are renowned for their ornate attire. Their tribal garments feature a distinctive "cross-shaped" structure with expansive designs, contrasting with other tribes' robes that emphasize wide collars, long sleeves, and broad chest sections. This loose, voluminous style has cultivated a unique fashion system. The golden ratio, a classic proportion, aligns with human aesthetic preferences, creating a sense of comfort and harmony. From its inception, the Mongolian robe's structure has prioritized comfort, inherently embodying proportional harmony. This study conducts an in-depth analysis of the Ujimqin Mongolian robe's compositional features, structural reconstruction mapping, drafting methods for structural diagrams, and the aesthetics of structural proportions. It explores the structural proportions of traditional Mongolian robes, reveals the proportional aesthetics underlying their design, and provides theoretical and practical references for modern clothing design.

Keywords

Ujimqin Mongolian robe; structural restoration surveying; method of structural diagram drawing; proportion aesthetics

1. Overview of Ujimqin Costume

The Ujimqin Mongols possess a long history and vibrant traditional culture, renowned worldwide for the splendor of their ethnic attire. Due to frequent interactions between the Altai Mountains and Central Asian Islamic ethnic groups in ancient times, the Ujimqin Mongols' clothing retains Islamic cultural elements in decorative forms, styles, fabric colors, and craftsmanship, showcasing intense vibrancy and intricate ornamentation. Consequently, their traditional garments feature vivid colors, elaborate decorations, and rugged fabrics, embodying a style that is both simple and dignified yet robust and unrestrained. Through prolonged migration and historical evolution, the Ujimqin Mongols gradually integrated cultural traits from various nomadic tribes, developing their unique clothing system.

Firstly, the Ujimqin Mongolian robes exhibit a distinctive "cross-shaped" structure, with wider collars, longer sleeves, broader chest panels, and wider hems compared to other tribal garments, presenting an overall loose and expansive style. Secondly, the most remarkable aspect of Ujimqin Mongolian robes lies in their exquisite and ingenious decorations. These adornments are omnipresent, appearing not only on the collar, large lapel, hanging lapel, hem, and slit, but also on the lapel surface, cuffs, and horseshoe sleeves. Moreover, the production techniques for these decorations are exceptionally complex, blending methods such as inlaying, embroidery, pasting, carving, piping, and coiling. The robes are adorned with exquisite colored threads along the edges, and their hues vary with age: elders predominantly wear grass green, light green, and dark green, while younger generations favor pink and purple. The fabrics include floral soft satin, brocade satin, tribute satin, silk, and ancient fragrant satin. These color choices and fabric combinations reflect the unique aesthetics of the Mongolian people and the spiritual essence of nomadic culture. Today, Ujimqin is located in central Inner Mongolia, nestled in the hilly terrain of the Xilingol Plateau, a typical Mongolian grassland region. With its high latitude, the area experiences scorching summers, arid autumns, and long, freezing winters. This climate has shaped the seasonal clothing of the Ujimqin people, who wear single-layer robes, layered robes, cotton robes, leather robes with hanging facings, and smoked leather robes. In summer, they predominantly wear white silk single-layer robes, which are breathable and cool. On the grasslands, herders always wear these white garments. The design of the white single-layer robe aligns with other robe styles, locally known as "Chamucha." This "Chamucha" has become a hallmark feature of Ujimqin tribal attire.

2. Structure Analysis of Ujimqin Mongolian Robe

2.1. Physical Measurement and Information Collection of Ujimqin Mongolian Robe

Figures 1 and 2 depict traditional Mongolian robes from the 1970s and 1990s collected during field research in the Ujimqin tribe. Despite decades of evolution, both garments retain their core characteristics and structural elements, with fluid overall silhouettes. The key distinction lies in the gradually widening rolled edges over time. The cuffs also differ—some feature standard cuffs, while others incorporate decorative and functional horseshoe cuffs.

This study focuses on the 1990s Ujimqin brocade satin cotton robe as a case study. Using the planar contact mapping method, we conducted repeated precise measurements of all dimensions of the robe's components, as illustrated in Figure 3. Each measurement point was independently measured three times with the average value calculated. To ensure data reliability, we established a strict error tolerance of 0.5 cm between any two measurements for the same area. Exceeding this limit triggered a re-measurement procedure until the data met precision requirements.

During the process, we observed that the collar area of the Mongolian robe was prone to deformation, which compromised measurement accuracy and affected the reliability of planar contact mapping results. To address this, we combined the mapping method with a drafting approach: first accurately sketching the collar's actual shape, then measuring its dimensions using the resulting blueprint. The data from both independent measurement methods were cross-validated to ensure accuracy in this critical area. Ultimately, the verified valid data was compiled in Table 1.

Figure1. Ujimqin Mongolian Robe in the 1970s



Figure 2. Ujimqin Red Brocade Mongolian Robe in the 1990s



Figure 3. Measurement Method

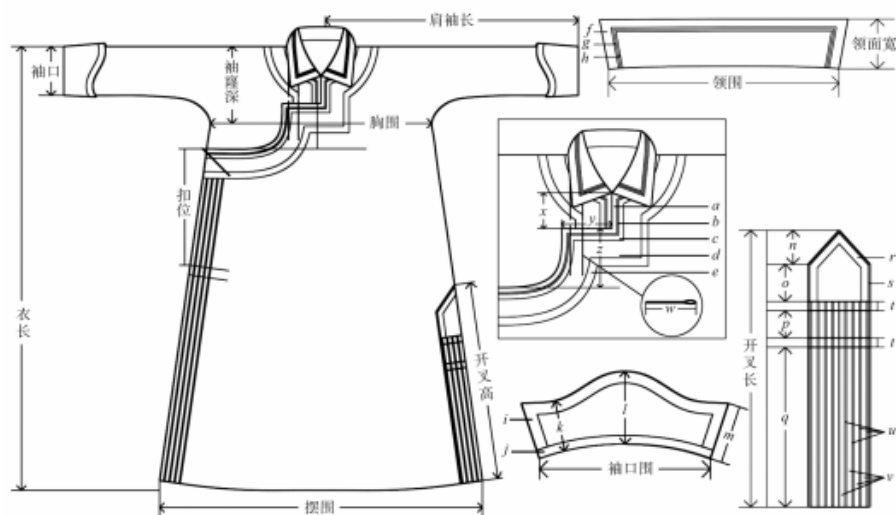


Table 1. 1990s Data Summary of Ujimqin Red Brocade Silk Mongolian Robes (Unit: cm)

order number	measuring point	size	order number	measuring point	size
1	front garment length	115.2	17	Long sleeves	120.6
2	preprolonged	107.3	18	Wide back hem	16.5
3	Shoulder width (with sleeves)	/	19	posterior thoracic circumference	59.6
4	Long sleeves/long sleeves	120.6	20	midhip circumference	67.8
5	Wide front cuffs	16.5	21	posterior hip circumference	75.2
6	antecervical circumference	59.6	22	High back circumference	29.0
7	Anterior midline circumference	67.8	23	posterior segmental length	38.0
8	Anterior hip circumference	75.2	24	High posterior hip circumference	60.0
9	High chest circumference/Deep sleeve	29.0	25	Wide hem	81.3
10	anterior segmental length	38.0	26	high back hem	3.0
11	High anterior hip circumference	60.0	27	High back slit	26.8
12	Wide front hem	80.4	28	neck line	33.8
13	Upturned hem	3.5	29	beam width	11.6
14	High front slit	26.2	30	depth of descent	10.2
15	The back of the dress is long.	115.2	31	Leading height	4.5
16	posterior mid-long	113.7			

2.2. Structural Restoration of Ujimqin Red Brocade Silk Mongolian Robe

To achieve precise restoration of the brocade satin Mongolian robe, this study utilized its cross-shaped symmetrical structure as a guiding principle, with the effective data obtained from preliminary measurements serving as the core reference. Through digital reconstruction using garment CAD software, a structural restoration mapping diagram of the robe was generated. Based on this diagram, complete structural diagrams and detailed local views were subsequently produced for display, as shown in Figure 4.

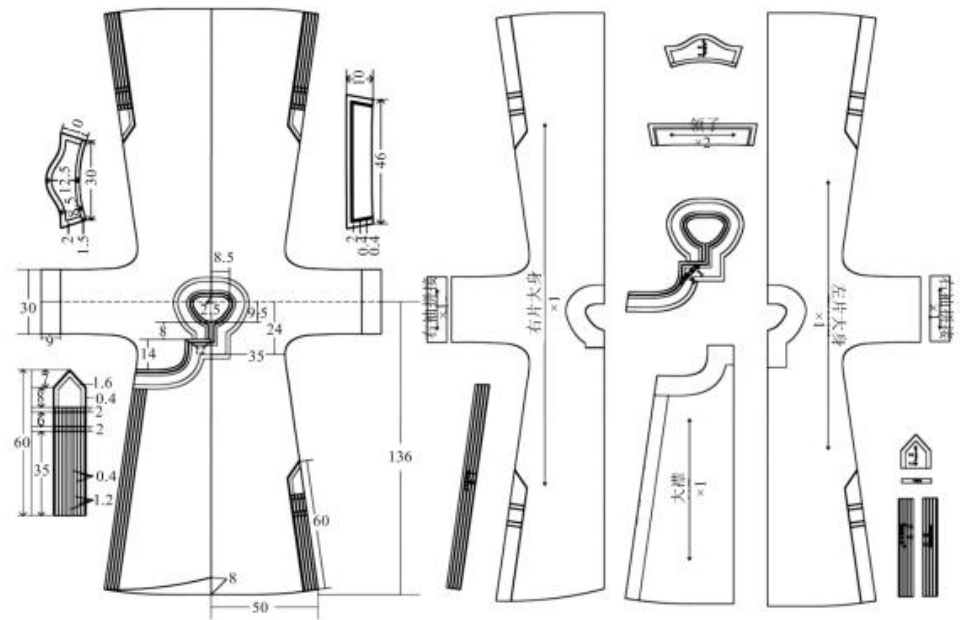


Figure 4. Structure restoration mapping

2.3. Structural Features of Ujimqin Mongolian Robe

The most distinctive structural feature of the Ujimqin Mongolian robe lies in its stable "cross-shaped" planar configuration. This classic design offers dual core advantages: Firstly, its functional superiority, where the generous silhouette provides ample flexibility to accommodate extensive movements; Secondly, its manufacturing efficiency, as the "cross" structure integrates all major fabric pieces, simplifying cutting while adapting to fabric width for economical "holistic tailoring". The "cross-shaped" universal structure diagram shown in Figure 5 is derived from summarizing sample characteristics of historical Ujimqin robes. This pattern-making method, based on detailed measurement data and sample analysis, demonstrates high universality and serves as a reference for restoring and producing various Ujimqin robes. Whether crafting single-layered robes, layered robes, cotton robes, or leather robes, this foundation can be used for drafting and evolution.

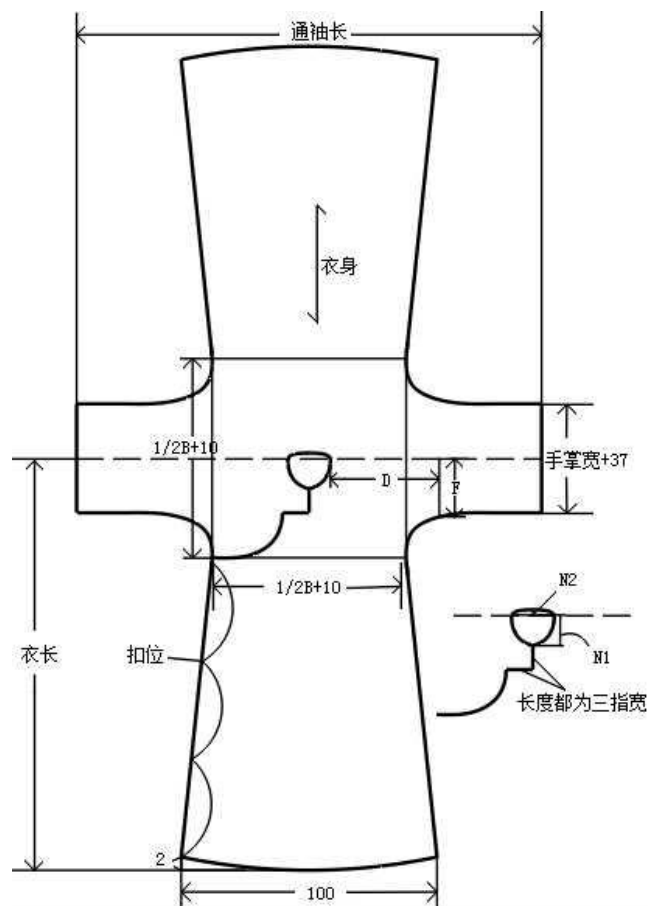


Figure 5. General structural diagram of the cross-shaped Mongolian robe

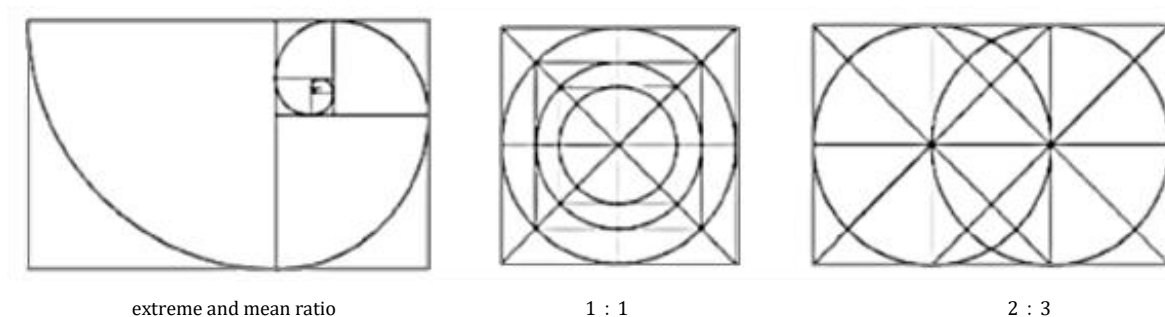
3. Comprehensive Analysis of the Proportion of the Structure of Ujimqin Mongolian Robe

After completing foundational tasks including measurement data compilation and structural mapping restoration for the 1990s Ujimqin brocade Mongolian robe, the project moved into the data analysis phase. This stage aims to uncover hidden dimensional proportion patterns within the traditional robe's structure. Specifically, we will conduct systematic measurements and analyses of both overall and local dimensions of the robe samples. During the analysis, we will focus on selected classic sections, examining them from two dimensions: "length proportions" and "area proportions," to reveal the intrinsic connections between structural proportions and aesthetic principles.

3.1. Classic Proportions in Design

Throughout the long history of design development, the pursuit of harmony, balance, and coherence in overall design has always been the core goal, and the exquisite mathematical proportions are the intrinsic foundation for achieving this goal. This exploration and application of proportion are profoundly reflected in design

traditions around the world. Ancient Chinese architecture possesses a self-contained system of classical proportions, such as the "Circular Square Diagram" and "Square Circular Diagram" in the "Treatise on Architectural Methods," whose compositional proportions are rooted in the cosmological concept of "heavenly roundness and earthly squareness," embodying the ancient cultural ideal of pursuing harmony among heaven, earth, and humanity, as shown in Figure 6.



3.2. Analysis and Testing of Length Ratio Relationships

This study utilizes survey data from 1990s Ujimqin brocade Mongolian robes to calculate key proportions, including sleeve-to-shoulder-to-chest-to-sleeve-to-body ratios. These measurements are then compared with established design standards to assess their accuracy. A clear quantitative evaluation system was established: a 95% or higher match is rated as "excellent," while a 90%-95% range is deemed "good."

(a) Sleeve proportions: sleeve fat 42.0 cm, half-shoulder sleeve length 64.3 cm, sleeve fat: half-shoulder sleeve length = $42.0:64.3 = 0.6532 \approx 2:3$ (matching degree 97.97%), with a 'good' matching degree, as shown in Figure 7(a).

(b) Shoulder-to-chest ratio: The anterior chest height was 29.0 cm, and the length of the half-shoulder cuff was 64.3 cm. The ratio of anterior chest height to half-shoulder cuff length was $29.0:64.3 \approx 0.4510 \approx 1:2$ (with a match rate of approximately 90.20%), which was classified as "basically matched" (see Figure 7(b)).

(c) Upper body proportion: Hip height 60.0 cm, sleeve length 128.6 cm, hip height:sleeve length = $60.0:128.6 \approx 0.4666 \approx 1:2$ (matching degree approximately 93.31%), judged as "basically matched", see Figure 7(c).

(d) Body-to-sleeve ratio: The garment length is 136.0 cm, with the sleeve length being 128.6 cm. The ratio of garment length to sleeve length is $136.0:128.6$, approximately 1.0575 or 1:1 (with a match degree of 94.56%). This is classified as 'basically matched,' as shown in Figure 7(d).

The proportion of the above main parts is more than 90%, which indicates that the structure proportion of the main parts of the Mongolian robe conforms to the classic proportion in the design and follows the classic design aesthetic law.

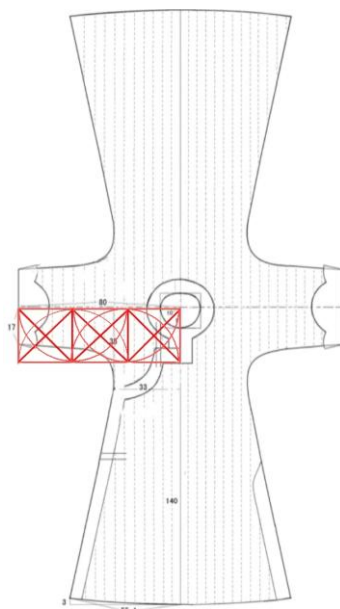


Figure 7. (a) Sleeve proportion diagram

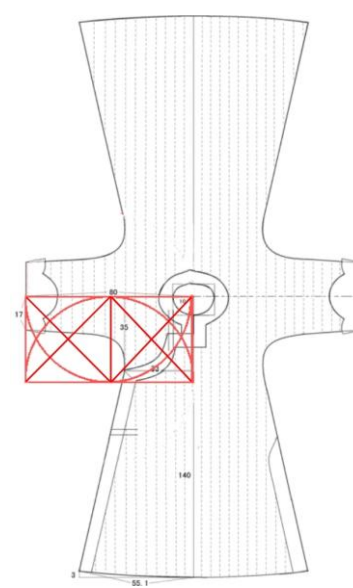


Figure 7. (b) Shoulder-to-chest ratio

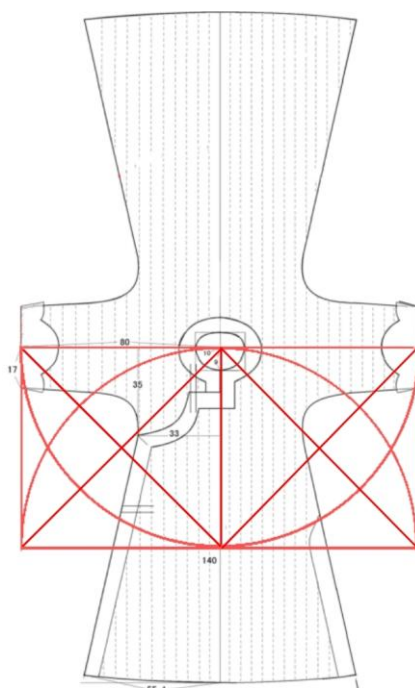


Figure 7. (c) Upper body proportion

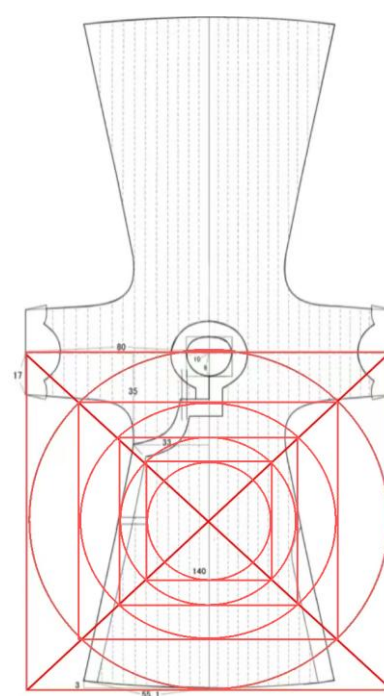


Figure 7. (d) Clothing body proportion

3.3. Area Ratio Analysis Test

Traditional Mongolian robes employ a distinctive "continuous-cutting" technique,

where the panels are symmetrically arranged along the central axis of the front and back, with the shoulder line serving as the central axis for front-back symmetry. The only asymmetrical elements are the neckline and the right-side large lapel. This right-side lapel, which extends diagonally from the neckline to the armpit, has become a signature feature of Mongolian robes. The large lapel is not only a crucial component of the robe but also plays a pivotal role in shaping its overall form, serving both structural and aesthetic purposes. Structurally, it is the key panel that transforms the robe from a flat-cut design into a three-dimensional, enveloping silhouette. Visually, the dividing line it creates forms a unique compositional layout. Based on this, the experimental section aims to investigate whether the visual segmentation surface created by the large front opening exhibits specific proportional relationships. Taking the 1970s Ujimqin Mongolian robe as an example, the large front opening clearly divides the robe body into two distinct areas—sleeves and the main body—through its projection effect, which serves as the intuitive basis for analyzing the area ratio relationship in this study. Using the front midline and waistline where the large front opening intersects as auxiliary lines, the upper right half of the Mongolian robe is segmented into two regions, S and A, within the selected area, as shown in Figure 8.

This study employed Adobe Photoshop to measure areas and analyze proportions in restored Mongolian robes through the following steps. In digital imaging, pixels serve as fundamental units, enabling the quantification of irregular regions by converting their areas into pixel counts. The histogram function in Photoshop accurately reflects the total pixel value of user-defined selections. Based on these principles and tools, pixel statistics were performed on specific regions of the restored robes, ultimately completing the proportion calculations for each body part, as shown in Figure 9.

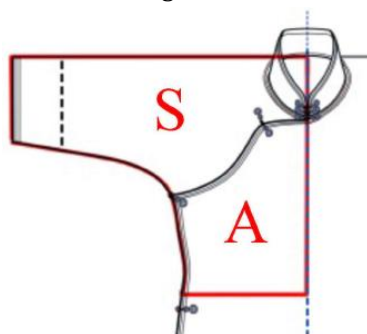


Figure 8. Partial structural diagram of the large flap

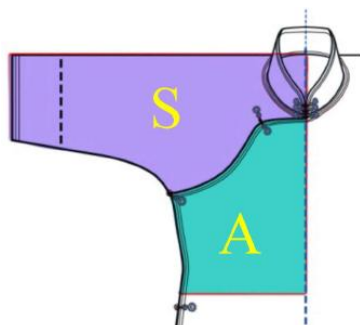


Figure 9. Schematic diagram of measurement area ratio

Using the PS Pen tool, draw the selected areas S and A, then record their pixel values (1358 and 855 respectively) from the histogram. Sum the pixel values to calculate the total pixel count for the upper right body: $M = S + A = 2213$. Subsequently, calculate the matching degree of the relevant proportions based on this data. The matching degree is evaluated according to the following quantitative criteria: $\geq 95\%$ is rated as 'excellent', while 90% to 95% is rated as 'basically matched'.

The results of the measurement are as follows: $M : S = 2213 : 1358 \approx 1.6296 : 1 \approx 1.618 : 1$ (conformity degree about 99.29%); $S : A = 1358 : 855 \approx 1.5883 : 1 \approx 1.618 : 1$ (conformity degree about 98.16%). That is, the golden proportion (1.618 : 1) is satisfied.

Through the analysis of the measurement data of the Ujimqin Mongolian robe, it is found that there is a golden ratio in the large front part above the waistline of the right front half of the body. In addition, the study also reveals a series of other harmonious proportion laws in the proportion of the sleeves, the proportion of the shoulders and chest, the proportion of the upper body, the proportion of the garment body, and the division of the overall silhouette. This pattern has been validated across diverse visual materials, providing empirical evidence for its universal applicability. The phenomenon demonstrates that the distinctive "cross-shaped" structure of the Ujimqin Mongolian robe—featuring a wide collar, long sleeves, broad chest, and expansive hem—represents a meticulously calibrated proportional system. The deliberate use of "loose and voluminous" design elements is not arbitrary but rather a harmonious framework constructed through precise proportional relationships.

4. Conclusion

The structural proportions of traditional Mongolian robes are one of the fundamental sources of their "comfort," representing a harmonious integration of functionality and form. This comfort stems from two aspects: Firstly, their physical design ensures ample space for movement while adapting to nomadic lifestyles. Secondly, the visually balanced proportions create both "aesthetic pleasure" and "psychological well-being," essential components of overall comfort. When

proportions adhere to the golden ratio or other classical principles, the robes visually convey a sense of internal order, stability, and rhythm. This formal harmony subtly influences both wearers and observers, fostering positive emotions of visual delight. Thus, the comfort of Ujimqin Mongolian robes emerges from the perfect fusion of physical functionality and visual aesthetics, with their structural proportions serving as the key aesthetic foundation. This reveals the core philosophy of traditional design wisdom: "human-centeredness" – where designs must satisfy not only physical needs but also psychological and aesthetic demands. Furthermore, interpreting and promoting the proportional aesthetics of Ujimqin Mongolian robes as a unique "cultural IP" through exhibitions, publications, and digital experiences helps showcase the scientific and cultural wisdom embedded in ethnic attire. This approach not only strengthens cultural confidence but also provides new opportunities for the development of creative industries.

In the context of sustainable fashion, adhering to the aesthetic principle of harmonious proportions is essential for creating timeless classic pieces. These designs resonate with humanity's fundamental aesthetic preferences and withstand the vicissitudes of trends, ensuring a longer product lifecycle.

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