A study of replication of Qing Dynasty dragon robes based on CLO3D technology

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Abstract: So far, the research on Chinese historical costumes has stayed on the discussion of culture, shape, pattern and social background. There is a big gap in the research on the reproduction of historical costumes. In this paper, the clothing characteristics of Qing Dynasty dragon robe pattern, craftsmanship, shape and structure are analyzed by referring the literature, with the purpose of realizing the digital virtual display of ancient traditional clothing, and it carries out a comparative analysis of clothing CAD pattern, 3D virtual fitting and replication of samples, which put forward the detailed problems and solutions in the traditional dragon robe virtual simulation process. The research shows that the three-dimensional virtual simulation model can accurately restore the fabric, pattern, color and structure of the dragon robe of the Qing Dynasty. Therefore, this paper provides a reliable patterns and simulation modeling method for the research about the dragon robe, which offer an innovative research method for inheritance of traditional Chinese clothing.

1. Introduction

Three-dimensional clothing virtual technology is a hot spot in the field of clothing engineering technology. The research of this article is based on the CLO3D fitting software of South Korea's CLO company, which can intuitively demonstrate the wearing effect of clothing through simulation. So far, there are still gaps in the three-dimensional virtual modeling and reproduction of traditional Chinese costumes. Therefore, in this article, the nine-roll dragon yellow silk robe embroidered by panelled gold is chosen as an example. The 2D patterns are made, and the virtual fitting modeling is set up by CLO3D software. Finally the satin fabrics with similar patterns are used for sampleexperiments to verify the digital inheritance of traditional dragon robes in the Qing Dynasty.

2. Dragon robe pattern and techniques of the Qing dynasty

2.1 Seated dragon pattern

There are many different types of dragon patterns in Qing dynasty costumes, and the different parts of the robe body will generally use different forms of dragon patterns. The sitting dragon pattern is generally located in the middle part of the chest of the robe, with a curved torso and seven bends, and
a dynamic but steady tail, further highlighting the unshakeable supremacy of the ruler. In the early Qing dynasty, the overall appearance of the seated dragon is majestic and fierce; in the mid-Qing dynasty, the head of the dragon is slightly smaller than in the early period, and the head is progressively narrower, the pupil is larger than in the early period, and the body of the dragon is free and longer and finer, obviously with more delicate detailing of the scales and hairs than in the early period. The slight change in the form of the dragon is mainly due to the fact that at the beginning of the Manchu’s domination of the Middle Kingdom in the early Qing dynasty, the political direction to the people was not yet stable, and the emperor ruled the world by force, needing to strengthen the deterrent and shocking effect.

2.2 Seawater river cliff pattern
The "sea water pattern" and "river cliff pattern" are two parts, more located in the hem or cuff part of the dragon robe, with the Qing dynasty clothing system to improve the pattern in the body gradually to form a regular pattern. Such as in the morphological characteristics, the sea water pattern is the horizontal spiral curve of the flat water pattern and big spiral curl in the early Qing dynasty, at this time the sea water river cliff pattern often accounted for about 20% of the overall clothing; to the middle of the Qing dynasty, with the centralization of the continuous improvement, sea water river cliff pattern gradually tend to program, in the proportion of the robe body to enhance to about 25%, the overall effect of the pattern compared to the early more exquisite and gorgeous, each standing water pattern between The overall effect of the pattern is more exquisite and ornate compared to the early period, with the gap between each standing water pattern becoming smaller and smaller, while the height has increased to a certain extent[4].

2.3 Dragon robe pattern silk craft
From the Palace Museum's existing silk costumes of the Qing dynasty palace, mass production of silk fabrics for daily wear by the emperor and empress began after the Qianlong period. The image of the dragon is interpreted by the technique of silk scales and silk gold, which is fine and delicate, and the use of gold threads will bring out the majesty and wealth of the royal family in the overall pattern; the standing water pattern in the seawater river cliff pattern is chosen as the bump silk method, which is natural and rich in texture with the shape of the cliff. three colour silk technique in Qing dynasty can be a regular expression of the progressive arrangement of colour shades, including "three blue silk", "three colour silk gold" and so on.

3. Analysis of the shape and structure of the Qing dynasty dragon robe

3.1 Analysis of the form of the nine-roll dragon yellow silk robe embroidered by panelled gold
The nine-roll dragon yellow silk robe embroidered by panelled gold in the Daoguang period is used as an example, as shown in Figure 1. After analysis, it can be concluded that the main structural form of the Qing dynasty dragon robe is that it has a front and back centre seam, and no shoulder seam. The front and back pieces are evenly cut, and there is no dart and shoulder slant treatment on the robe body, forming an overall continuous body with sleeves. Although the type of dragon robe varies, its shape is not very different. The dragon robe shape is mainly round collar, also has a few round standing collar, and cuffs are as hoof shape. Most of the dragon robes in the Qing dynasty were round-necked, right-over-right robes, and it is intuitive to see that the outer contours of the dragon robes in the Qing dynasty were A-shaped and the sleeves were gradually tightened from root to cuff.
3.2 Structural restoration of a yellow silk panelled gold embroidered dragon robe

Taking the nine-roll dragon yellow silk robe embroidered by panelled gold as an example, the pattern was drawn and the details are corrected according to the literature and the actual size[5], the cutting pattern was extracted and the thread of the fabric was determined, and a structure pattern suitable for simulation was made, as shown in Figure 2. The Qing dynasty dragon robe is a typical "cross-shaped flat structure" in the front of a garment which buttons on the right, the front centre and back centre are cut, the large lapel is cut in a single piece and sewn together with the left front piece. As the width of the fabric was narrower in ancient times, so the sleeve body and the jointed sleeves were divided; the round collar, the collar is small, the collar surface is usually 8-10cm. The robe body loose and fat, the robe is long to the ankle, with slits on both sides and front and back to about 10cm above the knee, making it easy to move and ride.

3.3 Structural analysis of the hoof sleeves of the nine-roll dragon yellow silk robe embroidered by panelled gold

The hoof sleeve has a wide and varied sleeve edge, which allows the sleeve to be lowered against the cold. The wide edge of the sleeve also protects the back of the hand from sharp objects, while the width of the sleeve near the palm is narrower so that the end of the sleeve does not prevent the hand from holding the reins or bow and arrow, and the sleeve is then pulled up when not in use. According to experimental data in the literature, the degree of rise of the hoof sleeve is proportional to the curvature of the wrist cuff line and the inner cuff line of the sleeve edge of the hoof sleeve, both lines are equivalent to the current three-dimensional cutting of the dart design, increasing the curvature of either line will increase the degree of rise, resulting in a different sleeve end structure[6]. In order to ensure that the hoof sleeve is restored with a slight upward rise, the straight line at the middle of the sleeve is turned inwards by 0.8cm to form a slightly inward curved line with an arc length of 31cm; according to the method of cutting the end of the hoof sleeve in the antique book, a triangle with a base of 22cm and a height of 21cm is first made, and the bowl line is moved inwards by 1.7cm to make the shape of the hoof sleeve, as shown in Figure 3.

| Name                      | Size | Name                      | Size |
|---------------------------|------|---------------------------|------|
| Length of clothing        | 140.2| Collar circumference      | 37   |
| Bust                      | 137  | Deep sleeve hole          | 34.2 |
| Swing around              | 121  | Cuff circumference        | 31   |
| Shoulder sleeve length    | 80   | Wide cuffs                | 15.5 |
| Collar width              | 10   | Side Split                | 49.5 |
| Rear collar concave       | 1.2  | Front and back slit       | 53   |
| Deep front collar         | 10, 5| Long left and right slit  | 49   |
4. Sample reproduction and discussion

This paper selects the nine-roll dragon yellow silk robe embroidered by panelled gold as the experimental object, where the effect and structure drawings are drawn by the author, the data are from the literature collected from the real size.

4.1 Qing dynasty dragon robe CLO3D virtual sewing

The arrangement of the samples plays a decisive role in the success of the garment simulation. For some modern more fitted garments, such as suits, dresses and T-shirts, the sample can be automatically discharged on the virtual model according to the arrangement points in 3D, and each part of the plate will be automatically wrapped around the human torso by moving the mouse, which will naturally simulate the form of the garment after stitching. The dragon robe is a cross-linked sleeve structure, the arrangement point cannot play a role, there will be a situation: like the Qing Dynasty dragon robe such as the front and back of the piece for a whole piece of clothing, the plate piece near the arrangement point can not automatically fold; In addition, because the plate piece is too large, it will be the formation of clothing across the human body, more difficult to simulation. Therefore, the method of making the structure of this gown is as follows: firstly, in order to achieve the effect of simulating a complete garment, the front and back pieces of the garment need to be divided along the shoulder line to form two front and back pieces; secondly, the virtual model is adjusted to the X-Ray state, and the movement of the whole arm is adjusted at the shoulder joint by means of a hovering wheel, so that the model presents the horizontal unfolding of the upper arm and then the plates are discharged on the corresponding arrangement points in an orderly manner, from the inside out; thirdly, during the initial simulation, the collar cannot be sewn flat to the garment piece, so the collar is divided according to the collar arc. The panels are then virtually stitched to each other. (As in Figure 4)

4.2 The fabric and detailing of Qing dynasty dragon robes

In order to ensure the integrity and beauty of the virtual fitting of the nine-roll dragon yellow silk robe embroidered by panelled gold, the body part of the robe is embroidered with the dragon pattern in bright yellow, and the leader parts are all in stone blue gold edge. The fabric pattern of the dragon robe was redraw by Photoshop, the pattern was adjusted to a suitable size to obtain a fabric pattern similar to the real one, the fabric pattern was added to the corresponding plate in CLO3D software, the

![Structural drawings](image1)
![Cropping diagram](image2)
![Hoof sleeve cuff construction](image3)

![2D sample processing](image4)
![Sample Arrangement](image5)
![Sample stitching](image6)
highlight colour was adjusted in the property editor to enhance the texture effect of the dragon robe fabric to achieve the visual effect of the woof silk process, the gloss, the hardness, strength of the fabric and a series of other values, basically completing the virtual fitting effect of the Qing Dynasty dragon robe. However, the horseshoe sleeve end in the virtual simulation experiment did not show the shape of warping, which is different from the effect of the sample replica experiment; the virtual simulation of the fabric and the actual fabric compared to the texture of a slight difference, but it can see that the overall contour of this dragon robe, colour, fabric drape, pattern and wearing effect is basically the same, presenting the solemn, gorgeous dress style of the Qing dynasty royalty, as shown in Figure 5.

4.3 Experimental production and validation of sample garments

In this paper, an experimental prototype of a dragon robe in yellow silk with gold embroidery was made using the traditional production method to verify the correctness of the 3D model and method established by the research, as shown in Figure 6. Firstly, the experimental sample was perfectly reproduced with the "cross-shaped" structure of the Qing dynasty dragon robe, as well as the hoof sleeve shape of the sleeves, indicating that the sample of the 3D virtual model is consistent with the historical relics. Secondly, the texture of the sample is as good as the traditional dress. The texture of the sample effectively simulates the material characteristics of the fabric itself, with bright and lustrous colours, but it takes longer time and the cost of the fabric is higher, and the silk technique used on the fabric cannot meet the realistic restoration of the pattern and techniques of the Qing dynasty costume.

5. Conclusion

This paper uses 3D virtual fitting technology to combine technology, techniques and traditional culture to replicate the pattern, craftsmanship, fabric, colour and form structure of the Qing dynasty dragon robe, achieving a high degree of consistency with the original in the museum collection. During the experimental production of the sample garment and the 3D virtual fitting process, it is concluded that the 3D simulation technology can be directly imported into the sample for virtual fitting and final effect display, which can visually show the characteristics of the narrow-sleeved and A-shaped shape of the Qing dynasty dragon robe. The 3D simulation model can show the silk craft and satin fabric of the dragon robe perfectly, showing the ancient craft techniques more intuitively and vividly.

The 3D virtual modelling of the dragon robe in yellow silk with gold embroidery of the Qing Dynasty is a useful attempt to integrate culture and technology, leaving a reliable data base for the preservation of the traditional court dress culture of the Qing Dynasty, which in turn broadens the
means of propagating traditional Chinese dress and is a new way of thinking in the study of Chinese historical costumes with digital technology.

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