

# Examination of Digitalized Non-Heritage Apparel Design Using CLO3D: Case Study of Ningbo Gold and Silver Color Embroidery

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## Abstract:

Driven by the wave of digitalization and fashion, traditional handicrafts in intangible cultural heritage (ICH) have experienced a remarkable transformation in the existing social value coordinate system. On the one hand, as a key carrier of the historical and cultural memory of the nation and the state, intangible cultural heritage is faced with many challenges of preservation and inheritance; on the other hand, the rapid development of digital technology provides innovative solutions for the modernization of traditional arts. This paper uses Ningbo gold, silver and color embroidery as a case study to explore the application of CLO3D software technology in the design of nonheritage apparel products and shows nonheritage crafts through digital simulation technology, which is not only the future development direction of the apparel industry but also the reconstruction of the apparel form and the use of function, aiming to assess its impact on nonheritage protection and innovation and to find a new path for the digital inheritance of nonheritage.

**Keywords:** Intangible Cultural Heritage; Ningbo Gold, Silver and Color Embroidery; CLO3D; Apparel Design

## 1. Introduction

With the release of the Strategic Plan for Safeguarding Intangible Cultural Heritage during the 14th Five-Year Plan period, China has set a new goal of increasing the global impact of intangible cultural heritage (ICH), aiming to realize this ambitious vision between 2025 and 2035. While the current policy has led to significant achievements in ICH safeguarding, many challenges remain. The long R&D cycles, high costs, and low renewal rates of traditional handicrafts are becoming increasingly prominent, and these factors pose serious challenges to the market adaptability of enterprises. For this reason, this study aims to explore how to combine traditional NRLs with digital technology and adopt modern fashion design concepts to promote innovation, aiming to strengthen its inheritance and promotion through an in-depth analysis of the current situation and technical characteristics of Ningbo's gold, silver and color embroidery. This move not only helps to solve the contradiction between productivity and production relations faced by traditional nonheritage but also improves the market adaptability of nonheritage items. Through this innovative approach, we expect to inject new momentum into nonheritage, meet the aesthetic needs of modern society, and demonstrate China's contemporary aesthetic state, reflecting the confidence of Chinese culture. This exploration of integrating tradition and modernity is necessary for the inheritance and development of nonheritage, and it is of reference and significance for promoting the development of the influence of intangible cultural heritage.

## 2. Background of the study

Intangible cultural heritage is a manifestation of the cultural diversity of mankind. These intangible forms of cultural expression, such as traditional handicrafts, performing arts, and traditional festivals, not only record the history and cultural traditions of mankind but are also important markers of national identity and collective memory. The development of gold, silver and colored embroidery in the Ningbo area, an important starting point of the ancient Maritime Silk Road, also maps the exchange and integration of this area with the outside culture. It is not only a display of skills but also a witness of history and a transmission of culture. As part of China's intangible cultural heritage, Ningbo gold- and silver-colored embroidery first began in the Tang Dynasty, and it expresses the aesthetic pursuits and social customs of ancient China. Each stitch is not only the inheritance of skills but also the continuation of historical culture. In different historical periods, the patterns, colors and production techniques of gold- and silver-colored embroidery changed, reflecting the cultural characteristics and aesthetic concepts of each era. For example, Ningbo Gold and Silver-colored embroidery widely uses dragons, phoenixes, birds and other auspicious motifs, which not only shows the Chinese folklore of auspiciousness and harvest celebration but also reflects the worship of nobility, sanctity and authority.

In contrast, due to the rise of industrialized production and the impact of the market economy, the inheritance of traditional Ningbo gold, silver and colored embroidery crafts is facing great challenges. On the one hand, the low productivity of handmade crafts makes it difficult to meet the consumption demand of modern society; on the other hand, the reduction of craft inheritors also puts this skill at risk of being lost. Therefore, the protection of intangible cultural heritage is not only about preserving the past but also about cultural innovation and inheritance in the future.

## 3. Research status

### 3.1 Research status of Ningbo gold, silver and color embroidery

As an important part of traditional culture, Ningbo gold and silver-colored embroidery has a prominent position in the field of colored embroidery art. The book "Ningbo Gold and Silver Color Embroidery in the Perspective of Intangible Cultural Heritage Protection", written by Zhang Xia'er, states that in recent years, relevant government departments at all levels have actively responded to the situation of intangible cultural heritage on the verge of being lost and have actively cooperated with national policy to promote the revitalization and inheritance of Ningbo Gold and Silver Color Embroidery, which is a valuable folk arts and crafts cultural heritage that has been revitalized and revitalized with new vigor and vitality[1]. According to Yu Sheng'er and Zhang Bingyu, "Research on Visual Elements and Cultural Connotation of Ningbo Gold and Silver Color Embroidery", gold and silver color embroidery are among the local cultural symbols handed down from generation to generation by the people of Ningbo, and the exquisite patterns and designs embody the people of Ningbo's love and blessing for life, contain the cultural spirit and aesthetic consciousness accumulated by the people of Ningbo, and fully demonstrate the excellent creativity of the working people of the Ningbo area, which is a valuable cultural treasure. It is a very valuable cultural treasure[2]. In recent years, Ningbo Gold, Silver and Color Embroidery have begun to actively explore the transformation path of brand fashion, such as Sugar Heart Dan, Jinxiu Lifetime and other brands, which are committed to local traditional crafts in the international fashion stage and are integrated into the design of clothing, bags and other products. At the same time, nonlegacy embroidery has also attracted the attention of the mainstream market in Europe and the United States; its elegant and advanced oriental aesthetic style through history; and the pursuit of modern design simplicity, humanism, and increasingly more brands to learn from the design direction. This trend has injected new vitality and opportunities for the inheritance and development of Ningbo gold, silver and colored embroidery, making it blossom in the trend of contemporary cultural fusion.

### *3.2 Integration and development of nongenetic heritage and digital technology*

With the emergence of a new round of scientific and technological revolution and industrial change, the rapid development of digital technology is constantly expanding the boundaries of digitization so that the boundaries between the virtual world and the real world are becoming increasingly blurred. At present, many scholars, faced with the problems and challenges of the transformation of "ancient to modern" design, have launched the design practice of integrating nonheritage crafts with digital technology.

Li Jia and Zhang Jing pointed out in the article "Research on Shu Embroidery AIGC Innovative Design and Digitization Promotion under the Threshold of Aesthetic Education" that Shu Embroidery is currently facing the challenges of lagging aesthetic concepts, low utilization of resources, and the advanced age of the inheritors, so it needs to be combined with modern aesthetic concepts of nonheritage culture to carry out the innovation and transformation of nonheritage culture, take aesthetic education as the research perspective, and enhance the artistic value of Shu Embroidery through the digitization of innovative design[3]. Hong Fei pointed out in his article "Digital Design of Virtual Canton Embroidery Customized Clothing Based on CLO3D Platform" that the systematic exploration of customized clothing design strategies using CLO3D digital virtual technology can help to promote the integration and innovation of the art of Canton embroidery and digital virtual technology, show the preview effect in real time, and improve the efficiency and sustainability of creation[4]. Xiuwen Zhang and Kai Ma pointed out in the article "Research on Virtual Representation of Embroidery Texture Based on SD and CLO3D Software" that the real-time preview function of CLO3D software is very beneficial in the texture production process. Although much time needs to be invested in building a resource library in the initial stage, its reproducibility and editability are more efficient than those of traditional methods in the long run, and this sustainable way of creation is of great significance in terms of digital preservation and market potential[5]. To meet the aesthetic needs of the modern public and cultivate their aesthetic ability, NRL culture needs to be more closely integrated with the public, and with the help of digitalization technology, it can become more vital in the new era.

## **4. Ningbo gold and silver color embroidery research and overview**

### *4.1 Research Methodology and Selection*

The purpose of this study is to explore in depth the importance of nonheritage conservation and the digital realization of traditional handicrafts, with a special focus on the specific case of Ningbo Gold, Silver and Color Embroidery. To analyze and understand the complexity and multidimensional value of NRH preservation, this study employs a variety of research methods, including literature reviews, field research, and experimental research. By collecting first-hand information and evaluating the application of new technologies in NRH preservation through visits and interactions with local inheritors, this study aims to provide cross-disciplinary research perspectives and development strategies for NRH preservation and to propose feasible suggestions and strategies for future NRH preservation and development.

### *4.2 Research and Analysis of Ningbo Gold, Silver and Color Embroidery*

#### *4.2.1 An overview study of gold- and silver-colored embroidery*

It has been reported that the Tang Dynasty poet Du Fu praised gold and silver color embroidery—"embroidered clothes shine in the late spring, knit gold peacock and silver unicorn", and the "knit gold" mentioned here—"bird silver" is a special embroidery in gold and silver embroidery, revealing the exquisite craftsmanship of Tang Dynasty gold and silver embroidery. At that time, this decorative embroidery technique was called gold embroidery or panel embroidery, which reflected its honorable status and was often used as a gift for the royal family. In 743 A.D., Monk Jianzhen traveled east to Japan, carrying with him the gold and silver embroidered Thousand-Handed Goddess of Mercy from the Ashoka Temple in Ningbo, which is still cherished as a national treasure, demonstrating its cross-domain value. The rise of square embroidery in Ningbo during the Qing Dynasty and its spread by missionaries after the Opium War

added a new dimension to the development of gold- and silver-colored embroidery. Contemporary Ningbo craftsmen fused traditional and folk techniques to form a unique style. However, at the beginning of the 21st century, the challenges of handicrafts intensified due to the impact of Western commodities and the development of science and technology, and gold- and silver-colored embroidery fell into a slump, coupled with the problem of visual impairment caused by hand embroidery, which made traditional handicrafts face great difficulties and challenges. This state of affairs highlights the necessity and urgency of preserving traditional handicrafts.

Since ancient times, Ningbo has a tradition of "weaving mats in every house and embroidering in every household", and as a national intangible cultural heritage, embroidery art has a history of more than 1400 years. In 2008, Ms. Qiu Qunzhu established the Ningbo Gold & Silver Embroidery Company. Based on the improvement and innovation of the traditional craftsmanship of Ningbo Gold & Silver Embroidery, the company founded the brand "Jinxiu Lifelong", which is a creative and fashionable brand with the concept of designing boutique products, and most related studies have developed and created gold and silver embroidery embroideries suitable for daily life applications. Adhering to the concept of "East is the bone, West is the rhyme", Sugar Heart Dan brand, based on its inheritance and innovation of Ningbo's traditional gold, silver and color embroidery technology, for the first time put forward the concept of "art luxury", embroidery in Chinese wedding, dress and jewelry design, simple and fashionable Chinese style design, the nonheritage of Chinese style design, and the beauty of nonheritage framed infinite romantic service to fashionable and unique oriental people so that the traditional culture can be better inherited and glowing new luster.

#### *4.2.2 Ningbo gold and silver color embroidery process and material performance*

Tang to the Qing Dynasty before the use of traditional needlework, ornate and heavy, and embroidery in the use of gold and silver threads, these yarns originated from pure gold and silver, were cut into 0.2 to 0.5 mm of gold wire, and can be used directly, similar to embroidery yarn. After the opening of the port, overseas imports of foreign gold threads (imitation of gold threads) began to be used, according to the relevant historical records[6]. Along with the entry of foreign missionaries in the Opium War, a variety of foreign embroidery techniques were introduced, which were called "foreign embroidery". Local craftsmen incorporate characteristic stitches into gold- and silver-colored embroidery, forming their own characteristic stitches, such as pangold embroidery, pancolor embroidery, and stacked-color embroidery.










Ningbo gold and silver embroidery materials include gold and silver thread as the basic materials, silk thread, cotton, and gauze as auxiliary materials; embroidery works on silk fabrics; "pan gold" "pan silver" is a more typical form of gold and silver color embroidery; and basic yarn is closely wrapped on the surface of the color thread, not for direct embroidery, so it is not sewn on; it is stapled on by the silk thread. The basic yarn is used to wrap the gold and silver threads closely on the surface of the color threads, not for direct embroidery, so it is not sewn on; it is stapled to the silk threads. Then, in accordance with the direction of the white line, gold (silver) threads through the basic accessories into the blank until it fills it up to constitute a solid pattern. Compared with ordinary embroidery, the print is more three-dimensional and fuller to create bags, pendants and earrings, whether it is a large area of the flat or small details of the embellishments are very distinctive. The undulating effect of the picture not only allows people to feel the richness of the picture but also highlights the skillful embroidery techniques of the craftsmen.

#### *4.2.3 Analysis of relevant cases and topics*

Gold and silver color embroidery embroidery is now widely used in clothing, hats, jewelry, bags, interior furnishings, operas, religious ceremonies, and celebrations. The themes are mainly taken from popular dragons and phoenixes, birds, peonies and other auspicious motifs. The embroidery themes are mainly composed of Beijing style, gods and goddesses, Buddhist and Taoist, auspicious myths and legends, and sun,

moon and cloud patterns, which are modified with water ripples and auspicious cloud patterns. The background color is also mostly heavy dark red, dark blue, black and other dark colors to show off the luster of the gold- and silver-colored threads, thus making it more strongly decorative. Common types of subjects include animals and beasts, natural plants and text-based subjects. This paper collects and organizes the works of gold and silver color embroidery sample cases, as shown in Table 1.

Table 1 Examples of the use of gold- and silver-colored embroidery for clothing items

Case Studies	Concrete Figure	Thematic Linear Analysis	Color Extraction	Theme and Color Analysis
<p>Name: Purple red knit-gold embroidered large group of flowers worship cushion Time: Tang</p>				<p>With a red silk as the base, the four sides of the cushion are embroidered with Ruyi clouds, and in the middle, a large group of flowers with a fourfold treasure phase as the base, embroidered with gold threads, using bright colors and warm tones, implying good fortune and goodness, and possessing resilience and nobility of character.</p>
<p>Name: Zhangjiazhuang velvet ground plate gold color embroidery eight treasures dragon hanging screen Time: Ming</p>				<p>With navy blue satin as the embroidery base, embroidered with gold thread, with bright colors, warm tones, meaning good luck and good, the dragon pattern appeared in a large area, symbolizing the symbolism of solemnity and elegance but also a symbol of power.</p>
<p>Name: "Flat Gold and Silver Embroidered Dragon Robe with Cloud and Dragon Patterns Time: Qing Qianlong dragon robe</p>				<p>The blue satin is used as the embroidery base and embroidered with gold threads, like the sun's rays of gold, which is not only a symbol of power but also shows wealth and status. The lower panel is decorated with seawater river cliffs and eight treasures standing</p>

				in the water, symbolizing "mountains and rivers forever".
<p>Name: Yellow Satin Flat Gold Embroidered Five Poisoned Gourd Pattern Worker - Mirror Set Time: Qing Tongzhi</p>				Decorated with colorful silk threads, the five poisons motif implies a strong desire to pray for good health. The large yellow silk is used as the base to symbolize hope and reverence. At the same time, yellow color is also an expression of status and signifies prosperity.
<p>"The Scenery of Yongcheng Author: Qiu Qunzhu Time: 2011</p>				The embroidery mainly depicts the lively scenes of folklore activities, with a large red silk as the tone, meaning lively and auspicious to show the unique scenery of the Ningbo Harmony City.
<p>Hundred Birds and Songs (partial) Author: Xu Zhulun Time: 2011</p>				The theme of the work is peacock, phoenix and crane as the main theme. The color tone of the whole is mainly warm, red and orange main colors, meaning joy and good luck.

With different uses and themes, in traditional Chinese culture, many objects and symbols are endowed with auspicious and blessing meanings, and people often use these objects on important occasions or at specific moments to pray for good luck and peace. [7] The most important feature of Ningbo gold and silver color embroidery is the strong contrast effect formed by the weaving and embroidering of gold, silver and color threads. The different application scenarios for color collocation also differ: religion, birthday celebrations and other aspects of the use of an antique color system, cold colors to give a person a sense of

calmness and simplicity; wedding, the joy of peace; and the use of red, orange and yellow colors and a high purity of blue and green colors to produce a strong visual impact and vitality.

In addition, the use of different themes is also involved in different scenes. For example, in the clothing products for infants, gold- and silver-colored embroidery is usually used to make tiger shoes, tiger hats, long-life locks, etc., which signifies the hope that the child will be blessed by the tiger's might and grow up healthily. In addition, in the wedding, the bride was embroidered with dragons and phoenixes and other patterns of gold thread embroidery; it represented good luck and good blessings, heralding a happy marriage. In addition, gold- and silver-colored embroidery with patterns such as lotus flowers and lotus blossoms are also used in funerals, signifying the blessings of the deceased to be able to have a happy and good life in the afterlife. It is hoped that the deceased will bless his or her family, children and grandchildren in good health and peace. These traditional cultural symbols and customs reflect people's hope for a better future, good fortune and happiness, as well as their love and blessings for their families and grandchildren. These customs and symbols play an important role in Chinese culture and carry deep cultural connotations.

## **5. Ningbo gold and silver color embroidery in clothing product digital design practice**

### *5.1 Design methodology*

According to the analysis of the traditional design of Ningbo gold- and silver-colored embroidery, the key to traditional design lies in the pattern, color and layout of the gold- and silver-colored embroidery, which together constitute the core factors of the design process. Through preliminary analysis and research, the pattern of traditional gold- and silver-colored embroidery can be combined with digital technology, and through digital processing, it can not only preserve and inherit the essence of traditional culture but also provide a broader creative space for the development and expansion of traditional culture. This paper organically combines the two and proposes a design method for gold- and silver-colored embroidery crafts in the practice of digitized apparel (Figure 1). This design method aims to stimulate the creativity of designers and highlight the unique craftsmanship of gold- and silver-colored embroidery to realize the organic fusion of traditional craftsmanship and modern design.

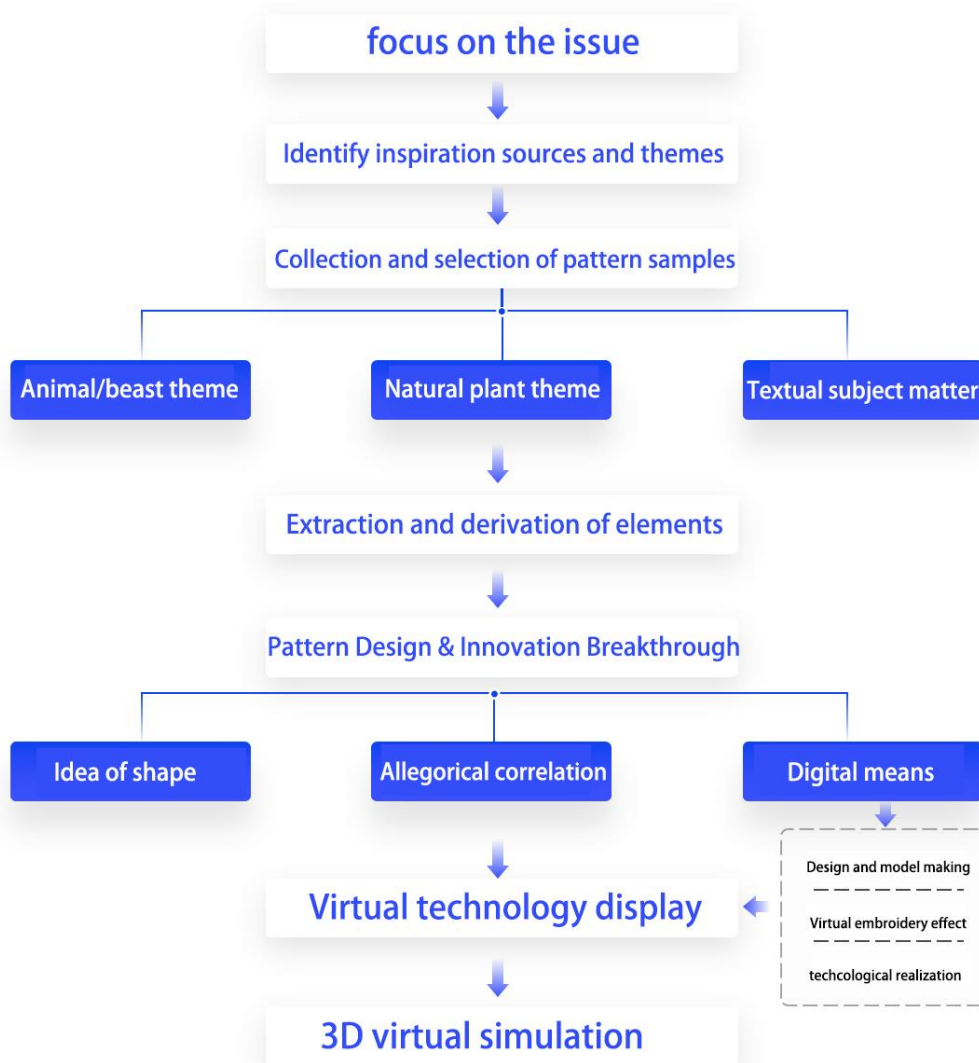


Figure 1 Methods for designing gold- and silver-colored embroidery techniques for digitized apparel items

### 5.2 Element extraction and pattern design

After analyzing and summarizing the traditional gold and silver color embroidery techniques and design forms, this paper tries to use the auspicious plant motifs in traditional Chinese clothing as the design theme; study its artistic characteristics; carry out the methods of element extraction, derivation, pattern design and process improvement; and then innovate and apply them to the pattern design of modern clothing and ultimately integrate and integrate all the links in CLO3D's digital practice to inject digital innovation ideas and practice methods into the "new Chinese style". The final integration of all aspects into the digital practice of CLO3D involved injecting digital innovative ideas and practical methods for the "New Chinese" style.

#### 5.2.1 Element extraction

The elements of traditional patterns are summarized and extracted, simplified and deformed, and the basic shape of a basic unit is refined, combined with modern design elements and techniques and applied in practical research, and then adjusted and modified in the process of actual practice, combined appropriately with the specific design scheme of clothing products; then, the design scheme is gradually implemented in the practice of the case.



The inspiration for this design mainly comes from the porcelain bowls of the Xianfeng Doucai, which are based on the strong outline embroidery characteristics of gold and silver color embroidery and the extraction of the elements of the Qing Dynasty's gold twinning branches pattern. Jiang Jin pointed out in his article "Research on the Use of Tangzhi Lotus in Modern Ceramic Decoration" that the traditional pattern "Tangzhi Lotus Pattern" has a long history, and the integration of the Tangzhi Lotus pattern into modern ceramic decoration not only enhances the added value of modern art but also fully demonstrates the cultural connotations of the Tangzhi Lotus[8], which serves as a reference basis for the use of design tools to transform the traditional pattern into a new and unique design. Using this as a reference basis, we use the design method to transform traditional patterns into new patterns and integrate them into bag design, which embodies not only the treasuring of traditional craftsmanship but also the pursuit of modern fashion. In the process of borrowing and adopting traditional Chinese patterns, such as Figure 1, the lotus pattern in oriental culture is regarded as a symbol of purity, hope and happiness, and in Buddhism, it is a symbol of Buddha's wisdom, representing "pure land". Thus, the lotus pattern in the visual sense of aesthetics implies a rich culture and good and auspicious symbolism. The lotus pattern is visually beautiful and contains rich cultural and auspicious symbols. Through the extraction of key elements and design transformation, traditional crafts are given a new language so that they can withstand scrutiny and discussion while expressing modern aesthetics and creative design.

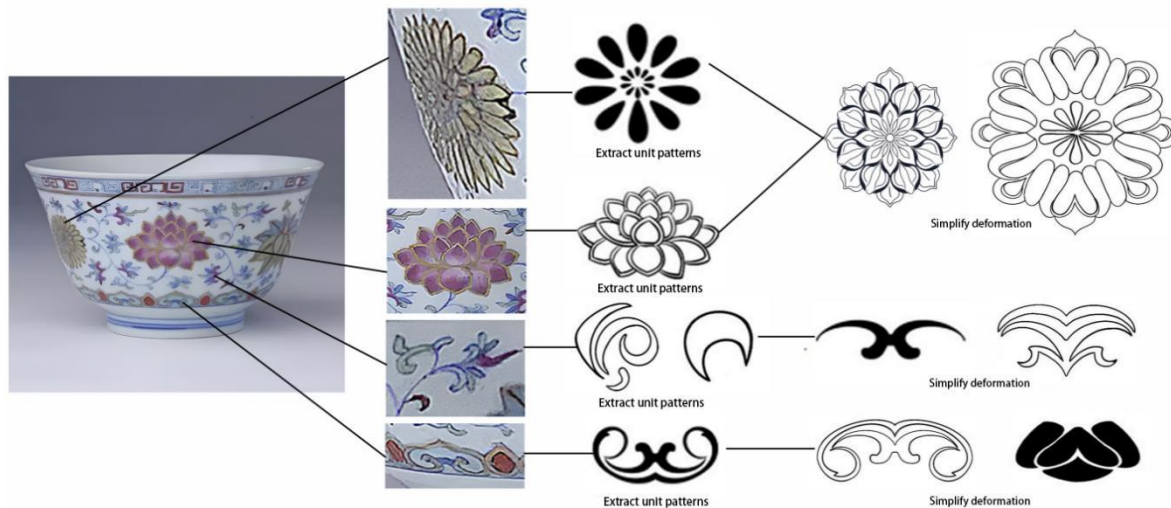


Figure 2 Base element extraction and derivatization

### 5.2.2 Pattern design

The representative and symbolic elements are selected from a number of traditional auspicious patterns, and multiple deconstructions and reorganizations are carried out, which are combined with the layout of the focal point pattern law through changes in the combination of color and element arrangement to form a series of complete original pattern designs. It breaks through the monotonous color and pattern expression and interprets the new cultural language of gold and silver embroidery. The color scheme mainly refers to the traditional color scheme, and on the basis of determining the color tone, it is integrated into modern aesthetics, which makes the visual impact of the picture not only impactful but also harmonious, as shown in Figure 3. We focused on streamlining the pattern, extracting the main body and deforming it. The main body is a flower with a clear texture, reconstructed into a new pattern that meets the modern minimalist aesthetic, incorporating more modern artistic elements while showing the vitality of the flower and simplifying the design of the zigzagging and extending branches and leaves. In the layout, drawing on the continuous arrangement of the Yuan Dynasty porcelain, using the focal point of the pattern layout, as shown in Figure 3, with the flower as the focal point itself, the rest of the pattern around the expansion is tightly encircled, and

the overall design of the pattern is more symmetrical, more sense of design and in line with modern aesthetics.

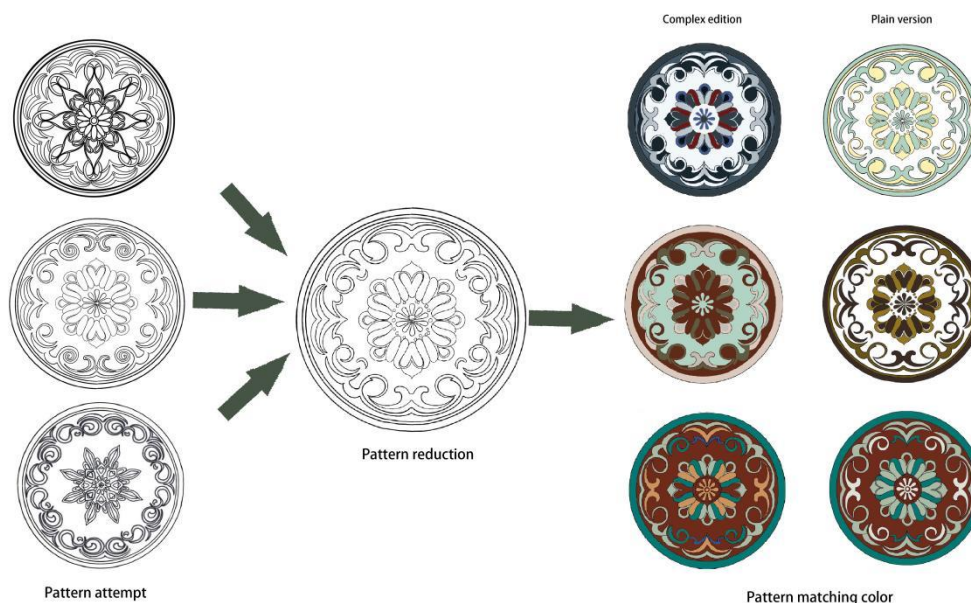


Figure 3 Pattern and color scheme design

### 5.2.3 Innovative application of apparel products and digital design practice

Ningbo gold and silver color embroidery is rich in embroidery methods, but due to its materials and embroidery techniques, the cost is usually high, and the time spent is long. On the basis of practical research on gold and silver color embroidery, it is possible to combine the modeling of apparel and embroidery techniques with innovative methods, which can not only retain the original craft characteristics of gold and silver color embroidery but also improve the style of craftsmanship and increase the frequency of application and popularization of the craft of gold and silver color embroidery in apparel design.

### 5.3 Design Concept Analysis

This design is inspired by the inheritance of traditional craftsmanship and the pursuit of modern digital fashion. Since ancient times, China has adopted the cultural concept of "heaven is round and earth is square", which reflects the ancient Chinese understanding of the universe and the social order of human beings. This concept expresses the harmony and unity between heaven and earth and the integration between the universe and human beings and embodies the concept of the unity of heaven and mankind in traditional Chinese philosophy. This implies that human society should conform to the laws of the universe, live in harmony with nature and pursue the idea of inner and outer harmony.

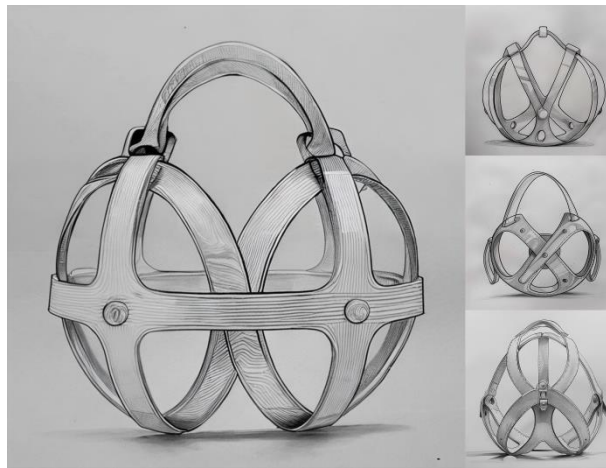


Figure 4 Sketch design

Based on the extraction of the elements of derivation and innovative pattern design, through the traditional cultural concept of "the circle of heaven and earth", the design of the use of a minimalist round geometric framework, combined with the consideration of the current trends and market factors, tries to inject modern fashion elements into traditional embroidery technology to create both a traditional flavor and fashionable bag design, as shown in Figure 4. The minimalist geometric frame gives the bag a unique visual impact, highlighting its atmosphere and full design appearance.

### 5.3.1 Design plate modeling

CLO3D software is a visual high-performance 3D apparel modeling software that collects the functions of sample drawing, style design, pattern making, virtual fitting, 3D rendering, animation simulation, and AI generation. Patternmaking modeling is a crucial part of digital apparel design.

According to the design concept and bag style design, the following bag size data were used: length, 55 cm; width, 7 cm; height, 45.5 cm; cut into the drawing tool in CLO3D software; inflatable fabric with the size of the bag as the base of the bag model; and placement on the level of the 3D virtual coordinates to ensure that the simulation of plate simulation in the plate-making process and the height of the X and Y axes coincide with each other. According to the preplanning and sketch design, the bag modeling effect diagram is first designed using simple color matching, as shown in Figure 5, and the production of the pattern starts according to the reference effect.

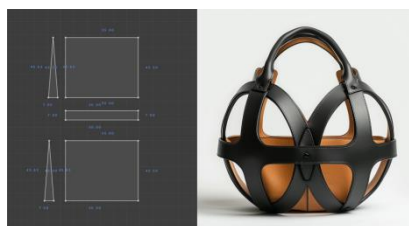


Figure 5 Base model construction and bag modeling effect

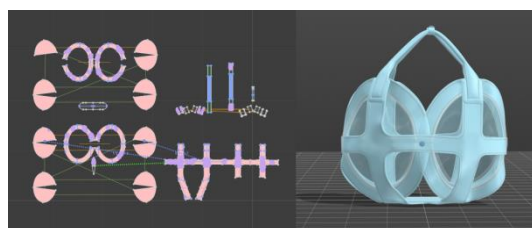


Figure 6 2D pattern making and 3D dynamic simulation

After confirming that the bag layout and the base model basically fit in the 2D window using the virtual thread sewing tool, the bag's front, back, bottom, handle pieces, etc., for virtual sewing, the sewing process, usually from the bottom-up order of the sewing implementation simulation, was confirmed. After basic sewing, in the CLO3D fabric material library, the basic leather material parameters are selected, and the stretching and bending rate parameters of the warp and weft slanting lines are adjusted to improve the virtual material simulation and visual display effect. After the simulation was completed, the fit and simulation effect of each plate were checked. On the one hand, the transparency tool can be used to hide the base model, and on the other hand, the gripper tool can be used to make local adjustments in real time to obtain better virtual simulation results, as shown in Figure 6. Combined with the advantages of CLO3D in the virtual simulation of specimens in the production process, inappropriate problems can be found in 3D simulation generation in a timely manner, and the real-time linkage in the 2D interface allows the modification of the 3D virtual design effect in an all-round way.

### 5.3.2 Embroidery Craft Show

In the process of modeling, according to the stylistic characteristics of gold- and silver-colored embroidery, catering to traditional Chinese culture and the current trend of aesthetic characteristics, combined with the laws of formal beauty, optimization and integration of pattern and layout design, the bag's cut and style design are adjusted to complement the pattern of gold- and silver-colored embroidery.

In virtual modeling, it is also necessary to consider the complexity and fineness of the gold- and silver-colored embroidery process, as well as the layout, size, color and other aspects of the bag, and rationally arrange the cutting and sewing process of the dress to ensure the integrity and beauty of the design. For example, the pattern elements of gold and silver color embroidery can be skillfully integrated into the edges of the frame and connections of the bag can be built, and the visual performance of virtual embroidery can be optimized, which not only increases the visual attractiveness and uniqueness of the bag but also increases the sturdiness and wear resistance of the frame of the bag. When simulating the virtual effect of the embroidery process, a layered representation is adopted, and the clever treatment of the pattern and embroidery is realized by adopting different process representations for the main pattern and the embroidery part. This method not only shows the material characteristics of gold- and silver-colored embroidery but also highlights the hierarchical relationship of the patterns and strengthens the visual contrast effect between the patterns. Through such processing techniques, the simulation expression of virtual visual effects is successfully highlighted, making the overall representation more three-dimensional and visually impactful.



Figure 7 Pattern layering treatment and process detail simulation

### 5.3.3 Digital Virtual Realization

In CLO3D modeling, the authors combined the methods of tiling, rotating, and false sewing to ensure that the plate piece was adsorbed with the template and used a fixed needle with free sewing, yardage, and other

related techniques to cut and sew the design. The experimental production constantly adjusts the size of the particle spacing, sharpens the edges of the model and increases the density of the mesh so that its simulated effect tends to be more realistic. After the completion of the model and embroidery simulation, we gradually improved the design details by adjusting the normal mapping parameters, fabric hardness, metal mapping, color texture and other setting details to complete the modeling of the whole model.

**Material selection:** The combination of embroidery and leather not only reflects traditional craftsmanship but also provides bag wear resistance and stiffness. The combination of embroidery and leather not only eliminates the limitations of traditional embroidery bags that emphasize craftsmanship but not of design but also provides a new form of simple, atmospheric and solid wear-resistant bag design, which is in line with the demands of modern people for practicality and aesthetics.

**Craftsmanship and details:** Ningbo gold- and silver-colored embroidery craft, velvet and beaded materials for the embroidery part of the bag are used to infuse the bag with the wonderful and exquisite craftsmanship style of traditional craftsmanship. The color performance and every exquisite detail show the exquisite skill and extraordinary beauty of an embroidery craft. The application of gold and silver color embroidery craft to bag design enables the visualization and three-dimensionalization of the design, providing more creative inspiration and possibilities for apparel designers.

**Function and structure:** This design contains two layers of outer and inner design. The inner liner has multiple replaceability and a variety of collocations, which are convenient for meeting a variety of travel needs. The designers have fully considered the actual needs of users, making the bag more practical and applicable for meeting the requirements of different occasions and needs.



Figure 8 3D finished product display and virtual fitting effect

In addition, by using the technological advantage of "Internet+Big Data+Artificial Intelligence" and effectively combining the online resource database in the design process, not only is the bag with the effect of embroidery craft produced by 3D virtual modeling, but the effect of the model is also shown by virtual fitting technology, as shown in Figure 8. The design of this embroidered bag combines traditional craftsmanship and modern fashion, and through the careful design and integration of materials, craftsmanship, function and design production, it presents a unique and artistic fashion item, which shows the beauty of the perfect combination of traditional craftsmanship and digital technology. Compared with the traditional method of laying embroidery on a large area, this approach not only reduces the difficulty of the traditional embroidery process but also saves the time and labor costs of a single finished product. With the assistance of digitizing tools, designers can make plate modeling more efficient, reduce the consumption of sample production, material and labor costs, shorten the design cycle, quickly verify the design scheme, and make necessary modifications and adjustments, making the design process more flexible and convenient.

## 6. Conclusion

Intangible cultural heritage, as a precious bearer of excellent traditional Chinese culture, has many types, different forms, exquisite craftsmanship and profound connotations. However, in recent years, due to the

development of science and technology, the complexity of the process and the difficulty of inheritance, gold- and silver-colored embroidery has faced the danger of being lost. Therefore, the inheritance and development of nonheritage sites need to be combined with higher standards. In addition to traditional development methods, the integration of modern technology and nonheritage sites has led to a new wave of hotspots and concerns for nonheritage sites. In the article, the author used CLO3D virtual technology to carry out innovative design and research and development of nonheritage crafts, injecting new vitality into nonheritage innovation and stimulating its diversified development. Moreover, the collision of virtual reality and reality brings a brand new experience for the display and dissemination of nonheritage. This research aims to provide a multidimensional and cross-field perspective of nonheritage protection research and contributes a modest effort to the innovative development of traditional nonheritage. By focusing on both the cultural value of nonheritage and exploring its fashion innovation and development, through this study, we expect to contribute new insights and solutions to the theory and practice of nonheritage protection.

**Data availability:** The authors have included all the relevant data and the sources of freely available data in the manuscript.

**Declarations:** Ethics approval No prior ethical approval was necessary for the study.

**Consent to participate:** No human subjects were included in the study. Consent not needed.

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