

# Analysis of the artistic characteristics of lotus patterns and digital innovative design methods

Mo Jieshi\*, Jiang Xiaoming, Li Zheng

Soochow University, Suzhou, Jiangsu, China

\*Corresponding author: jiesmo@126.com

**Abstract:** In the long river of the evolution of Chinese civilization, the pattern is one of the most important art forms of human visual art language. It always loads the spirit and aesthetic consciousness of Chinese traditional culture with its 'symbolic' characteristics. As one of the traditional Chinese patterns, lotus pattern has become rich and complicated in content, form, aesthetic characteristics and cultural connotation with the development of the times. This paper analyzes the composition, color and implied beauty of lotus pattern through the study of literature cases and pictures. And use digital software and interactive technology to establish a lotus pattern digital resource library to realize its reengineering design and innovative application in digital clothing design. Using digital technology and interactive technology to carry out the design innovation practice of lotus pattern, explore the integration and innovation method of traditional culture and modern design, and provide a new thinking for the innovative design of traditional lotus pattern.

**Keywords:** Lotus-pattern; Costume design; Artistic features; Digitization; Novel design

## 1. Introduction

Lotus, also known as water lotus, lotus bud, Fuqu, Jingke, Yuhuan, etc. Today, the two appellations of lotus and lotus are interlinked. China has a long history of lotus culture. The Hemudu site in Zhejiang Province unearthed lotus pollen fossils dating back more than 7000 years ago. The lotus pattern first appeared on the bronze wares of the Western Zhou Dynasty. The bronze wares of the Spring and Autumn Period 'Lotus Crane Pot' have two layers of lotus petals on the lid of the pot, and the lotus flower is neutral to a crane. In the Northern Qi Dynasty, lotus patterns appeared in porcelain, such as the green glaze of the Northern Qi Dynasty covered with lotus. In the mural Hezao well of Dunhuang Mogao Grottoes, lotus patterns are seen everywhere. Lotus pattern is created by our ancestors through collective wisdom over thousands of years. After the change of dynasties, lotus pattern has more and more rich aesthetic characteristics in decorative techniques. It combines different techniques such as carving, characterization, printing and painting with other patterns to form different forms of composite patterns, thus deriving visual art language and formal beauty connotation with Chinese characteristics.

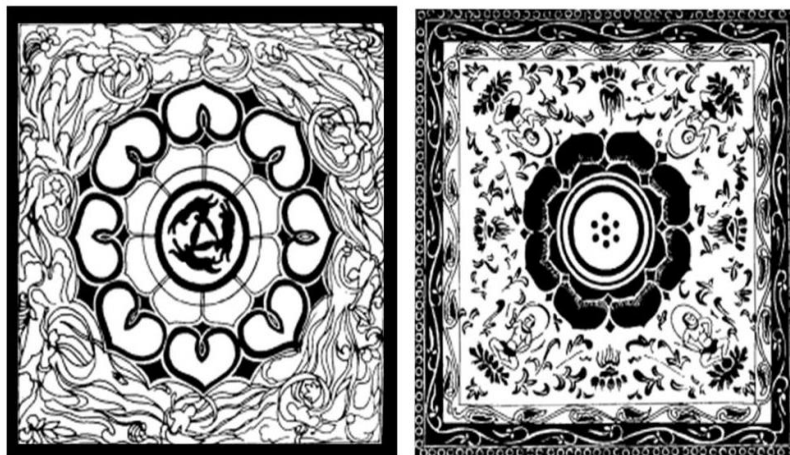


Figure 1: Sui Dynasty architectural decoration lotus pattern

China has a long history of loving lotus and liking lotus since ancient times. People like lotus, raise lotus and appreciate lotus. Literati chanting lotus, singing lotus and painting lotus.[1] There are countless poems describing lotus in Chinese cultural classics, and lotus culture dominated by lotus has gradually formed. The lotus flower is deeply loved by the world because of its high and clean character. Because of the holy quality of the lotus flower, the lotus flower has also become a symbol of Buddhism, representing 'pure land', symbolizing 'purity', meaning 'auspicious',[2] and appearing in the decoration of temples, caves, niches and other objects. After the Wei Jin Southern and Northern Dynasties, with the progress of society and the development of arts and crafts, lotus patterns gradually enriched and developed, forming a variety of forms, rich connotation, widely used national decorative patterns, widely used in architectural components, mural decoration, utensils and clothing. The lotus pattern appeared in the architectural decoration of the Sui Dynasty ( Figure 1 ).

## **2. The aesthetic characteristics of patterns**

Lotus decoration in traditional Chinese decorative art has become a model of traditional plant decoration with its aesthetic implication and rich cultural connotation. After the baptism of the civilization process in different periods, the lotus pattern was re-created through different forms of exaggeration, deformation, simplification, addition, combination, repetition, abstraction, synthesis, symbolization and implication, and gradually derived many forms,[3] such as twining lotus, lotus, etc. With its unique shape, rich form, colorful color and auspicious meaning, lotus pattern fully embodies the design idea, unique artistic charm and aesthetic value of Chinese traditional decorative pattern.

### **2.1. The beauty of pattern composition**

#### **2.1.1. Symmetrical equilibrium, coordination and unity**

Symmetry has natural beauty; equilibrium can produce coordination. They are two states of expression in design.[4] The lotus pattern is mostly symmetrical. No matter what period, the lotus pattern has a left and right, upper and lower center symmetrical composition pattern. In China 's traditional consciousness, people pursue four smooth and eight stable, symmetrical beauty can be seen everywhere in the lotus pattern, lotus pattern is mostly based on the vertical axis or horizontal axis, forming up and down, left and right, up and down. Its symmetry is either centered on a quarter or an eighth as the basic unit. The lotus petals in the lotus pattern are mostly eight-petal, ten-petal, twelve-petal, etc., with symmetrical shapes ( Table 1 ). The symmetrical pattern form structure is more rigorous, stable and regular. The unique symmetrical beauty of the lotus pattern gives a more mellow and stable feeling and a stable visual balance aesthetic feeling.

Equilibrium is the visual psychological balance of the quantity and force of the image in the location arrangement. It is a relatively stable balance effect between two unequal elements by selecting a corresponding support point.[5] Equalization is a visual judgment balance based on the shape, size, position, direction, brightness, space and other visual languages of the image. Equilibrium is a dynamic balance, which is a form of composition superior to the beauty of motion change. There are many examples of the balanced pattern of lotus patterns, such as the lotus pattern of the Tang Dynasty (Figure 2 ) ; the lotus pattern of the Northern Song Dynasty ( Figure 3 ) ; the lotus patterns in the Qing Dynasty, while giving the picture order, are solemn and full of changes, with the beauty of dynamic changes. Equilibrium breaks the strict and standard of symmetrical composition. The role of balance is to produce a balanced visual beauty. The pursuit of the unity of the overall form in the change increases the overall sense of inspiration, making the pattern more dynamic, aesthetic and more dynamic. Create a sense of rhythm on the composition.

Table 1: Analysis of lotus pattern composition form



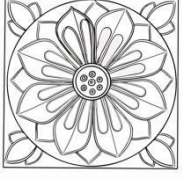
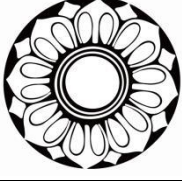

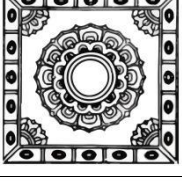

Composition Form	Number of lotus petals	Basic Cell	Example diagram	Source
Symmetric composition	8	Quarter		Lotus pattern ( Northern Wei Dynasty stone carving )
	8	Quarter		Lotus pattern ( Sui portrait brick )
	8	Okta		Lotus pattern ( Northern Wei Dynasty stone carving )
	8	Okta		Lotus pattern ( Northern Wei Dynasty stone carving )
	10	Quarter		Double petal lotus pattern ( Five Dynasties · pottery )
	12	Quarter		Lotus pattern ( Tang · brick carving )
	6	Quarter		Lotus pattern ( Qing · stone carving )



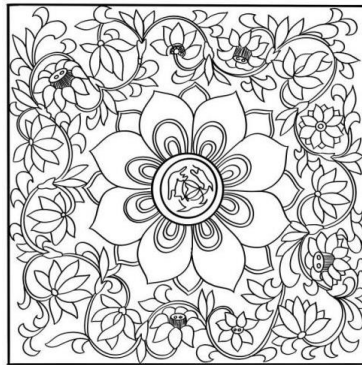
Figure 2: Tang Dynasty flower lotus pattern



*Figure 3: Northern Song Dynasty white porcelain carved flower-wrapped lotus pattern plate (self-painted)*

### **2.1.2. The rhythm is complicated and the level is clear.**

Rhythm refers to the regular and periodic changes of sound perceived through hearing in music, and is considered to be a repeated form and structure in plastic arts. Patterns in a certain element of many times, repeatedly alternating, regular dispersion changes, such as continuous lines, intermittent surface, will produce a sense of rhythm. The brick carving lotus pattern in the Sui Dynasty has a fine layout, and there is a continuous and repeated alternating lotus pattern belt on the outer edge, which makes the decoration delicate and orderly, rich and vivid, and has a strong rhythmic beauty (Figure 4). The specific performance of rhythm in lotus patterns includes: orderly change of pattern size, regular arrangement of pattern composition layout, change of color depth, alternation and repetition of two continuous patterns. Such as through the black and white color alternating interval form, so that the pattern between the close and orderly connection (Figure 5). Through the point, line, surface elements regularly echo changes, showing a strong sense of formal beauty. The shape, density, size and proportion of lotus patterns can produce rhythmic beauty.



*Figure 4: Sui Dynasty brick carving lotus pattern (self-painted)*



*Figure 5: Tang Dynasty sculpture decorative lotus pattern (self-painted)*

The beauty of the rhythm of the pattern is a kind of beauty of the loop. The regular changes in the size of the square circle of the image of the pattern, the thickness of the line, the length of the line, the primary and secondary density of the composition layout, the distance between the front and back levels, the depth of the color and other factors can produce the beauty of rhythm.[6] Rhythm beauty and rhythm beauty are also widely used in lotus patterns. No matter what period of lotus pattern, almost all of them reflect its rhythm beauty. For example, the winding branch lotus pattern in the Song, Yuan, Ming and Qing Dynasties embodies the beauty of rhythm and rhythm incisively and vividly. The winding branch lotus pattern in the Song Dynasty has uninterrupted lines of winding branches and vines. The patterns are euphemistic, dynamic, rich and coherent, cyclical and decorative. The Yuan Dynasty 's winding lotus pattern takes the ' S ' shape curve as the main skeleton, and takes the lotus petals and various lotus leaves as the main body to form a continuous two-party continuous style. The pattern is coherent as a whole, coupled with the changing branches and leaves, resulting in ups and downs of the rhythm, giving people a sense of cloud and water.

### ***2.1.3. Appropriate proportion, complete and complicated***

Whether it is architectural structure, clothing products or decorative patterns, the consideration and expression of design intention will be based on people 's visual habits and aesthetic needs to deliberate on the proportion of elements, and adjust the size of the shape, the distribution of the area, the choice of the position and direction. The Qing Dynasty lotus pattern is woven with gold satin ( Figure 6). The pattern is based on the lotus petals. The main lotus pattern is distinguished from the size ratio of the surrounding patterns. The appropriate proportion and scale are used to arrange the patterns, so that the patterns are concise and unified, rich in level, strong in decorative sense, and the overall pattern is rigorous, thick and gorgeous. In the decorative pattern, it is necessary to balance the proportional relationship and grasp the proportional relationship between the whole and the part, the part and the part, so that the composition relationship between the elements is reasonable and meets the aesthetic requirements.


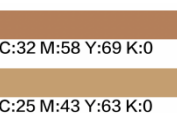



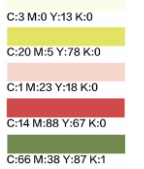

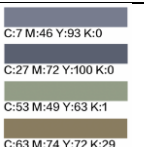


*Figure 6: Qing Dynasty twisted lotus weave gold satin*

### ***2.2. Beauty of pattern color***

By analyzing the color characteristics of lotus pattern fabrics from the Tang Dynasty to the Qing Dynasty ( Table 2 ), it is found that the color of the fabric pattern is very rich, including stone green, oil green, deep red, scarlet, turmeric, orange red, tea color, ochre, black and so on. Different colors echo and intersperse with each other, and the overall color is bright and distinct. Through the induction and summary of color, it can be found that the background color of lotus pattern is mainly red and yellow, and the lotus pattern brocade is mainly yellow, followed by dark brown and dark purple. The purity is mainly medium and high purity, supplemented by black and white tones; in terms of brightness, it is dominated by medium and high bright colors, showing the characteristics of lightness and harmony. The rich use of color is closely related to the development and maturity of textile technology since the Sui and Tang Dynasties. In the Tang Dynasty, there were twenty-five works under the weaving and dyeing department, of which ten were woven and six were dyed, namely, green, purple, yellow, white, soap and purple.[7] With the prosperity and development of printing and dyeing textile handicraft industry, weaving and embroidery patterns are more elegant and colorful. In the Ming and Qing Dynasties, the color of the brocade lotus pattern began to tend to be soft, adding more neutral gray, and the color began to show multi-level different colors, with a strong decorative meaning, and the lotus image was more clear and prominent.

Table 2: Extraction table of lotus color factor

name	Example diagram	Color the background color	Coloring pattern	Picture source
Tang Dynasty red treasure lotus pattern brocade fabric		 C:52 M:100 Y:100 K:36		Xinjiang Turpan Astana unearthed, Xinjiang Uygur Autonomous Region Museum Collection
Tang Dynasty flower lotus pattern brocade		 C:32 M:58 Y:69 K:0 C:25 M:43 Y:63 K:0		Nara Masahura Yamakura, Japan
Liao Dynasty Liantang embroidery fragments		 C:73 M:70 Y:72 K:35		Liao tombs unearthed in Shanxi Beijing Palace Museum Collection
Xixia baby play peony lotus pattern printing silk		 C:24 M:50 Y:83 K:0 C:29 M:60 Y:100 K:0		Ningxia Yinchuan Baisikou Twin Pagodas were found in Ningxia Museum.
The Southern Song Dynasty silk tapestry 'lotus pond duck map'		 C:19 M:62 Y:99 K:0		shanghai museum
Ming Dynasty lotus pattern brocade		 C:43 M:82 Y:75 K:6 C:56 M:53 Y:58 K:1		From the ' Chinese Elements Code ' Flowers, Fish and Insects Chapter 72
Ming Dynasty lotus flower pattern silk		 C:13 M:31 Y:69 K:0	 C:26 M:66 Y:73 K:0	From the ' Chinese Elements Code ' Flowers, Fish and Insects Chapter 77
Qing Dynasty blue satin patch embroidered butterfly love flower sleeves		 C:89 M:96 Y:55 K:34		From 'Page 98 of Women 's Clothing in Qing Dynasty '
Qing Dynasty sauce color dark satin flat embroidery group nan pattern		 C:77 M:80 Y:65 K:40		From 'Page 144 of Women 's Clothing in Qing Dynasty '
Qing Dynasty Lotus Pattern Brocade		 C:19 M:62 Y:99 K:0		From the ' Chinese Elements Code ' Flowers, Fish and Insects Chapter 79

### 2.2.1. Rich colors with harmony

Color is the most visual impact factor in natural images. Color is more likely to affect people's emotions than graphics or lines. The color of lotus pattern is rich and varied. Different colors create colorful visual effects by changing the area, distance, strength and other factors of color. Through the analysis of the purity, brightness and hue contrast characteristics of the color, the lotus pattern is mostly adjacent to the background color and the pattern color. For example, the background color of the Tang Dynasty's treasure lotus pattern brocade is red (Figure 7), and the pattern color is orange and orange. The main tone of the lotus pattern kesi in the Ming Dynasty is red (Figure 8), but gray is added to the red to reconcile, and red and gray become the tone of the work. The color purity of dark green, grass green, scarlet, orange, orange, pale yellow, baby blue, sky blue, egg green and other colors in the picture is not high. These colors are matched together, and different colors are interspersed with each other. By changing the area size of the color and the cross application of different colors, the vividness of the picture is strengthened, and a harmonious and coordinated color picture is produced.



Figure 7: Tang Dynasty treasure lotus brocade      Figure 8: Ming Dynasty lotus pattern brocade

### 2.2.2. Contrast subtle beautiful coordination

The color matching of lotus pattern is mainly complementary color and contrast color. The color purity is medium and high, and the lightness is medium and low, such as dark green and turmeric, dark purple and golden yellow, orange and gray green. The contrast of different purity and different hues, the pattern color shows the shade and level of color with subtle color gradation changes. The color matching of lotus patterns is mainly based on the comparison of inter-color and complementary color. Through the induction and exploration of the color of lotus patterns, we can roughly find that in lotus patterns, through the adjustment of the area of contrast color, complementary color or cold and warm color and the transposition and comparison of different colors, the color produces a harmonious and harmonious picture atmosphere. For example, in a large area of orange and yellow with warm blue, the brightness and purity of the color layer by layer change, rich and subtle contrast, but also appears harmonious and unified.

### 2.3. The beauty of pattern implication

In China's traditional culture, allegorical techniques are used in all aspects, from literature to art. Allegorical techniques are used in pictures and patterns. From content to form, it has become one of the important features. The beauty of lotus pattern is mainly reflected in homophonic expression and symbolic meaning.

#### 2.3.1. Homophonic performance

The meaning and pronunciation of Chinese characters seem to be relatively independent. There are many homonyms, which are borrowed by homonyms and become homophonic allegory. Through the homophonic reading of the text, you can get a very different meaning.[8] For example, the combination of lotus and mandarin duck is a blessing for a happy marriage ; the pattern of a lotus flower is ' Yipin Qinglian ', which is composed of homophony of ' Yipin ' and ' Qinglian ', implying that officials should be honest and clean when they are prime ministers. The ' lotus ' of lotus is homonymized with the word ' lian '. Extended out of ' years of harvest ', ' years of surplus ', ' even son ', ' even in the three yuan ', such as good things continue. The ' lotus ' of lotus is homonymized with the word ' and '. Derived 'Hehe Erxian ', ' Hehe Meimei ', ' Hehe Ruyi ', ' Heqi Zhixiang ', ' Taking harmony as the most precious ', metaphor ' a group of harmony '. To lotus root ' lotus root ' and ' even ' word homophonic. Double pairs, double pairs, double joy gates, bird wings, even trees, ' mandarin duck play lotus ', ' phoenix flying ', metaphor ' together to old age '.

### 2.3.2. Symbolic meaning

The expression of symbol and implication is to characterize the natural attributes of objects. Symbols can explain some abstract concepts by concrete tangible things in reality. The symbolism of patterns, take a lot of plants and animals. For example, peony flowers are full and graceful, symbolizing 'wealth'; pine and cypress are not withered by cold frost, which symbolizes 'chastity', emerald bamboo is straight and hollow, and symbolizes 'qinggao'. The symbolic and allegorical expression techniques are also reflected in the lotus pattern. The lotus flower's 'out of the mud but not dyed' is used to compare the gentleman. Lotus pattern in a simple shape, contains a wealth of content, in order to express feelings in the object, with the meaning of the object. In decorative patterns, there are many images and meanings that are far apart. Once they are linked, they are intriguing, which is also the charm of traditional patterns.

### 3. Design and innovation of lotus pattern in digital clothing

Today's era is the information age, and everything can be presented in a digital way. The combination of traditional Chinese patterns and modern digital technology applies patterns to clothing design through new scientific and technological means such as artificial intelligence and CLO3D virtual technology. It can not only more intuitively feel the state of patterns applied to specific design products, but also allow the public to notice the charm of traditional patterns in a creative manner. The lotus pattern contains the traditional aesthetic characteristics of the Chinese nation, with the formal beauty and connotation beauty of Chinese characteristics, including auspicious images such as nobleness and beauty. The arrival of digital information society also brings new opportunities for the design and development of traditional lotus patterns. The unique formal language and auspicious meaning of lotus patterns are introduced into digital clothing design. Through the establishment of digital resource library, digital interactive design and virtual product display, traditional patterns can be inherited and innovated in the era of big data, Internet and meta-universe intelligence (Figure 9).

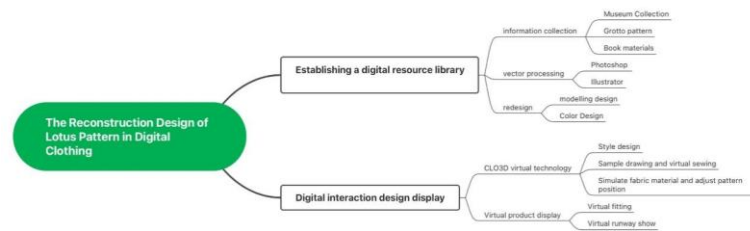


Figure 9: Reconstruction design of lotus pattern in digital clothing (self-painted)

#### 3.1. Establish a digital resource library

Nowadays, the digital resource library has become a necessity for researchers and designers to work and study. The use of science and technology to assist in the establishment of a digital resource library of traditional lotus patterns can save researchers and designers a lot of time and energy to find relevant resources. You can access the digital resource library of lotus patterns from anywhere in the world. Using digital links, you can observe different lotus patterns, establish a digital library of lotus patterns, and create a digital image interactive platform for lotus patterns, which can provide a powerful resource library support for digital innovation design of lotus patterns.

In order to establish the digital resource library of lotus pattern, it is necessary to collect the information of pattern data in the early stage, take high-definition pictures of relevant museum collections, Dunhuang grottoes, book materials, etc., and vectorize and digitally collect lotus pattern pictures to establish a digital resource library of patterns. The collected pattern images are translated and digitally extracted by professional software such as Photoshop and Illustrator. Extract the shape of the pattern, and then convert the shape into hundreds of anchor points to restore the pattern (Figure 10), and redesign the lotus pattern by changing the anchor points. The color of lotus pattern can also be extracted. Through the translation of digital software, different shapes and different regions can be re-matched with colors, and aesthetic knowledge can be used to improve the color matching of patterns and create innovative patterns in line with modern aesthetics.



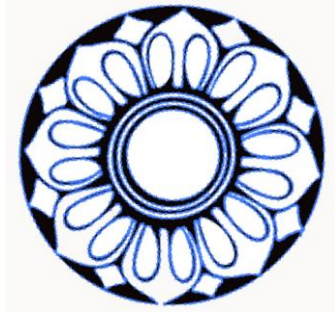


Figure 10: Illustrator software translates lotus pattern (self-painted)



Figure 11: Collar application pattern effect (author self-painted)

### 3.2. Design practice of lotus pattern in digital clothing

With the rapid development of Internet technology and the arrival of the meta-universe world, digital interaction design is also rapidly improving, such as holographic projection technology for clothing display, virtual fitting, through the three-dimensional space effect to bring people a new visual experience, and provide more effective information dissemination. We can use virtual technology to restore incomplete patterns, blurred patterns and colored patterns. We can also apply patterns to clothing design products in the virtual world to bring us visual feelings. The concept of interaction is reflected in the interoperability between designers and digital software systems. Digital simulation technology provides optimization solutions for various product designs. Designers use simulation technology to design in a virtual environment, which can obtain more accurate data and more three-dimensional and more simulated preview effects.[9]

#### 3.2.1. Application design of lotus pattern elements

The design effect pattern is a self-cultivation dress. The sleeve in the jacket structure is a lantern sleeve shape, and the collar is a small stand collar design. The secondary superposition pattern reduces the transparency of one of the patterns and applies it to the collar (Figure 11). The lotus pattern is applied on both sides of the hem of the skirt to change the color of the pattern, which visually presents a lively and flexible feeling. In the virtual model, the position of the pattern in the clothing is adjusted, the size of the pattern is enlarged or reduced in equal proportion, the pattern is deformed and twisted, the color matching of the pattern is adjusted, the number of patterns is increased or decreased, and the number of patterns is increased or decreased, and the virtual clothing design is simulated. With the dynamic change of the posture of the human body, the smart and graceful beauty of the clothing is brought. The organic integration of practicality and aesthetics, content and form not only retains the appeal of traditional culture and art, but also has the design trend of modern aesthetics.

#### 3.2.2. 3D virtual garment effect

In order to show the three-dimensional application effect of patterns in clothing and accessories design products more intuitively, CLO3D virtual clothing technology is used to express clothing in the form of 3D modeling. Firstly, virtual models are imported, and hairstyles, skin colors and accessories matching clothing styles are selected. Secondly, the garment plate is made according to the size, and the front and back pieces of the body, collar, sleeve and skirt are stitched one by one by using the sewing tool (Figure 11). Edit the fabric properties of 3D garments to simulate different fabric textures, select pattern positions, accessories, etc. Finally, adjust the model's posture, let the model move in the virtual three-dimensional space scene, improve the dress effect according to the try-on state, and render the front

back three views ( Figure 12). Through the clothing virtual reality software can reduce the difficulty of design and cost investment to a certain extent. Designers can choose different lotus patterns to apply in different clothing styles to generate preview maps. They can adjust the design according to the intuitive clothing effects to meet the personalized needs of different customers and create products that truly meet people 's needs.

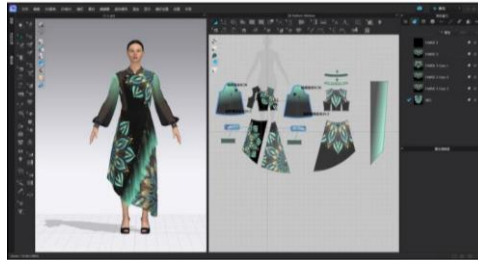


Figure 11: Virtual stitching ( self-painted )



Figure 12: Virtual clothing effects ( front, side, back ) ( author painted )

#### 4. Conclusion

The pattern of traditional arts and crafts is the essence of the treasure house of traditional culture. The lotus pattern shines in the long river of time. It has been used as a decorative pattern as early as the Spring and Autumn Period. It was active in the Wei, Jin, Southern and Northern Dynasties, and flourished in the Sui and Tang Dynasties and later dynasties. This paper analyzes and summarizes the composition, color law and symbolic meaning of lotus pattern. Through the collection and arrangement of original images, the digital resource library of lotus pattern is established by using digital technology to restore pattern modeling and color. With the help of 3D interactive technology and 3D virtual reality technology, the digital innovative design application of clothing products is completed, so that the aesthetic value of lotus pattern can be innovated and developed in modern design. The traditional pattern art is reinterpreted with digital design language, so that the traditional Chinese pattern can be protected and inherited through modern science and technology. The visual appearance and spiritual connotation of Chinese traditional pattern elements are integrated into the creation of digital clothing design, and new design expressions of traditional culture are sought.

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