
# Application of CAD Technology in Textile Art Design

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**Abstract.** The development of China's textile design with China textile education are closely connected, using computer aided design software to carry out the textile art design compared with traditional manual, with the advantages of convenient, flexible, cost savings, new design concept, design tools and techniques to textile art design injected fresh blood. This paper discusses how to make full use of the functional advantages of design software, creatively use the advantages of Photoshop, Primavision and other design software, improve the quality and efficiency of design from the aspect of expression, and narrow the gap between design draft and product by using the effect of simulation. So that the design effect can be directly displayed, so that the artistic design of textile products to a new height, shorten the production cycle, to provide consumers with better and more home textile products. In some sense, the application of CAD technology in textile art design, is our country present a huge change in the process of the textile art design, inspired by a growing number of designers under the information age change the way of design thinking, so as to establish and perfect a new set of design system, makes the textile pattern design in digital technology, can more quickly and accurately complete the design task, so as to realize the textile design personalized, small batch, high quality, fast demand. Greatly shorten the design and production process, the real realization of green environmental protection of modern textile design.

**Keywords:** textiles; art design; computer aided design (CAD); digital technology
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## 1 INTRODUCTION

Nowadays, computer digitalization technology has penetrated into every field of human life, and the traditional textile design industry is also deeply affected by it. The development and innovation of computer digitalization technology also provides new opportunities for the development of

creative expression of textile pattern design. Textile pattern design digital technology used widely at present stage, not only is the use of computer software to provide some of the drawing tool and draw directly on the computer graphics, image processing function design, but also to give the traditional pure stays in the hand draw level of textile design injected new creative ideas and creative design language [1]. The function of computer digital expression can not only quickly assemble the design ideas and elements, but also intuitively present the design ideas and production expression in a more intuitive and accurate way. The traditional textile pattern design is rely on tool material such as paper, pen, color by hand to complete the performance of the whole idea and implementation, and creative design digital implementation is not the traditional creative design hand-painted performance need paper, pen, paint and so on many kinds of constraints, also not restricted by time, place and space, the site, Moreover, the whole design drawing will not be invalid due to the change of customers' requirements for color and style.

Facing the development of modern information technology and the diversification of market demand, is characterized by industrialized mass production of the division of design and production process of phase separation way already cannot satisfy the need of modern design, the research of CAD technology and the comprehensive application of the textile art design, to break the border of design and production, to implement the comprehensive level of design has become a textile art design, the only way to realize the diversification and individuation of textile design and production [2]. The further improvement of people's living standards, to a great extent, has affected consumers' aesthetic standards. The product life cycle of domestic home textile market is further shortened, and the demand for home textile design is also higher and higher. First of all, delicate and elegant product appearance is required to meet the aesthetic needs of consumers. Secondly, the design effect should be quickly displayed to meet the requirements of customers and shorten the production cycle. At present, Grimmelsmann et al. [3] mentioned that home textile CAD design software is of great significance to further improve design level, shorten product cycle and improve product competitiveness. However, this can hardly meet the needs of the rapidly developing market. In recent years, by trying to the integrated use of several kinds of CAD software, from each director, results greatly improve the design efficiency, the display effect is real, natural, vivid, solve the gap between the design draft and product big problems, in order to further dig the existing resources, improve the design efficiency, expand the design space, find a new way.

Textile art design refers to a kind of artistic design that expresses and completes the beauty of textile with certain creation way and expression means. It requires both unique artistic effect and practical application function. Therefore, the designer should not only consider the perfection of the composition, but also consider the completion of the craft. To master the application of new computer software and understand the textile design process of digital technology has become a necessary knowledge and skills for designers. At the same time, the changes brought by the application of computer technology are not limited to the simple design links, but also the production, sales, use of textiles and other aspects brought innovation. In today's textile market, due to the development of science and technology and the explosion of information, textile design is no longer confined to the design of a single product, but for the cost, market, use environment, aesthetic value, production technology and many other aspects of the overall consideration. The realization of CAD technology provides designers with great creative space for textile pattern design, and truly realized the unlimited ideal of color simply adopt the traditional way for textile design, obviously cannot adapt to the current development trend. How to make good use of computer technology to design has become a problem that designers generally consider.

## 2 COMPUTER-AIDED PRODUCT INNOVATION DESIGN

Modern home textile design is a systematic project, which integrates modern technology and art and pays attention to the perfect combination of decorative function and practical function. It not only emphasizes the humanistic spirit, but also pays more attention to the concept of ecological development and environmental protection. It requires an enterprise's information technology and production facilities to be constantly updated to adapt to changing international fashion trends and

design consciousness. Recupero et al. [4] mentioned that there is still a certain gap between the design and production of Chinese home textiles and the world level. Mainly in two aspects. First, external style: lack of rich style, serious assimilation, lack of innovation. There is a big gap in harmony of color, novelty of pattern, fabric structure design and product serialization. Second, internal quality: the product quality is not stable, the environmental protection awareness in the process of processing is insufficient, and the post-finishing supporting level lags behind the spinning and weaving, and the lack of domestic special post-finishing equipment and additives that can effectively improve the product style and quality.

So, make home textiles production enterprises in China from the global OEM situation, make the independent development and production of home textiles in the world advanced level, designers must have good comprehensive quality and capability to develop, set up the concept of market globalization, product design, integration, at the same time, constantly updated production equipment, perfect finishing equipment and technology. Kovacevic et al. [5] mentioned that only in this way, the domestic textile enterprises can make use of the opportunity of joining WTO, give full play to their advantages and become the world's domestic textile production power.

Computer Aided Design (CAD) for textile is the theory and technology of textile Design and digital proofing with powerful computing function and high efficiency of graphics and image processing. Ricotta et al. [6] mentioned that it is mainly reflected in the application of textile CAD Design system. Fabric CAD system can use computer screen instead of traditional paper to design the organization and computer drawing, which makes the organization design and transformation and modification very convenient. The system can automatically generate the fabric simulation image according to the given structure, yarn arrangement and yarn type, and output the fabric simulation image which is completely consistent with the actual requirements in vision, and the fabric can be applied to the real object in the computer to display. Product innovation design is an inevitable law of economic and technological development. In order to enhance product competitiveness, it is necessary to have a certain supporting environment for product innovation design, in which information technology, especially the application of CAD technology and system, is the key part of this supporting environment. At present, CAD system has been widely used. In the field of product design, computer aided industrial design (CAID) has been developed with CAD concept as the core. Computer aided conceptual design (CACD), computer aided process design (CAPP) and a series of related CAD technology and system. But how to make the traditional CAD system support product innovation design is the focus of concern in the business world, but also the hot issue in the academic research. The textile CAD system workflow is shown in Figure 1.

Although CAD of domestic expenses textile is design personnel part threw off drawing board, shortened product cycle, improved design quality, but still have bigger distance with market requirement. The reason is that quite a number of designers cling to a certain software, which is difficult to achieve the delicate and elegant appearance of the product and quickly show the design effect. As we all know, every kind of design software has its own advantages, and it is difficult to achieve the desired effect by using a software. As more popular 3D design software, it put the product design lead to the 3Dworld are its strong, but with 3D design product, must first modeling, its structure is complex, requires careful, need tedious calculation, time-consuming, more important is to use it to design the product the effect is false, not real, natural, fabric texture is not easy to performance, this naturally affects the intuitive feeling of the product. Using Primavision to do texturing can be completed quickly, but the posted items may not be in harmony with the environment. In this case, import the image into Photoshop, it is much easier to adjust the environment relationship in Photoshop, and the final display effect will also appear real, natural and vivid, which will undoubtedly shorten the production cycle of the product. Master the popular home textile CAD software, integrate their advantages, to the designer's creativity and imagination, design form and connotation to provide a new space. Rational use will greatly improve the ability of home textile design. Shorten the distance between the design draft and the product, let the customer perceive the product as soon as possible, further shorten the product cycle and the blindness of production, so that the design form a whole supporting design from the yarn to the finished product. The operation mechanism and work flow of CAD software is shown in Figure 2.

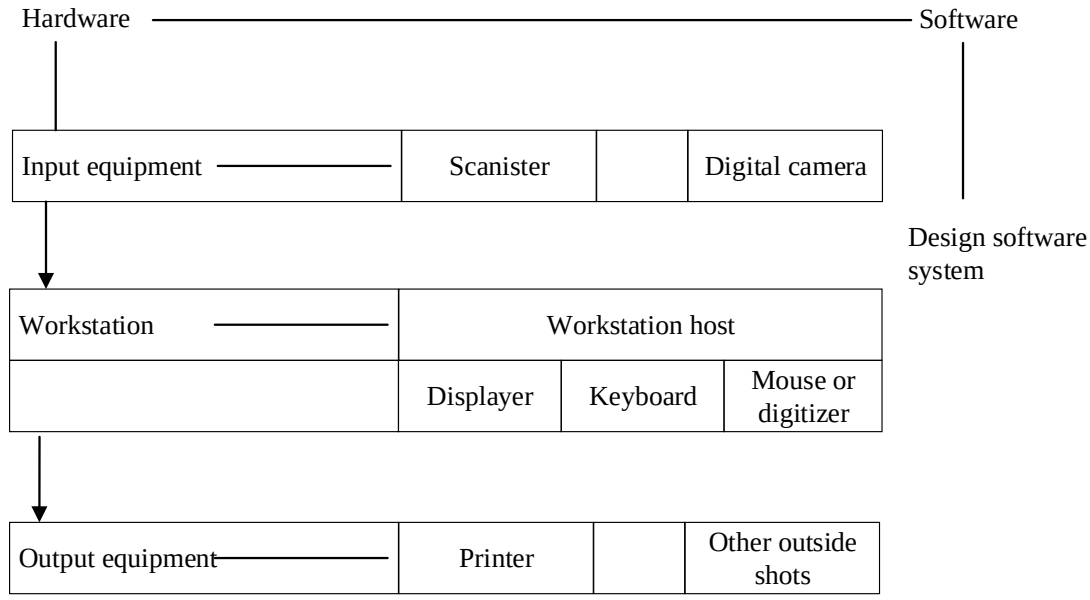


**Figure 1:** Textile CAD system workflow.

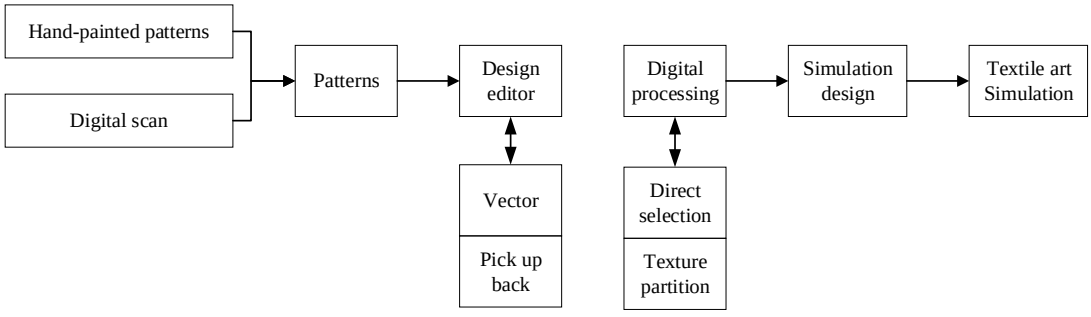


**Figure 2:** Operation mechanism and work flow of CAD software.

## 3 INFLUENCE AND DEFICIENCY OF CAD TECHNOLOGY ON TEXTILE ART DESIGN

### 3.1 Influence of CAD Technology on Textile Art Design

The influence that CAD technology brings to textile art design, main expression is: one, advance the effective innovation of traditional design drawing means. If the use of traditional pattern design means, in the process of drawing a variety of regular straight lines and patterns, it is necessary to use ruler, compass, pencil and other conventional tools, this process is not only relatively complex, but also there is a certain degree of difficulty. Using digital technology, textile pattern drawing process can be greatly simplified. For example, when drawing free curve, can use CAD technology to adjust curve radian to reasonable range, ensure curve satisfies natural, fluent requirement, make audience generation then look brand-new visual experience. At present, many computer-aided design software can achieve this function, such as Photoshop, Freehand, corelDRAW, etc., the software can achieve accurate drawing of lines and graphics in patterns. In specific drawing process, the designer can according to their own expectations expressed by the

design for convenient drawing, if appear rendering errors or need to change the part, using the Undo function can return in the software, and the pattern are redrawn or optimizing adjustment, thus breaking the traditional mapping there is an error in the design after hard to change. In the process of using CAD technology to carry out design drawing, if the designer needs to define the unit design, he can use CAD technology to fill the design to the predetermined size screen, which is difficult to achieve in traditional textile art design. In addition, the use of traditional manual design of textile patterns, patterns are often linked to the problem of stitching dislocation. And the use of CAD technology can be convenient to complete seamless stitching, so that the pattern layout is more reasonable. Second, color transformation facilitation. The use of traditional manual design of textile pattern, if the pattern needs to be color transformation, it is necessary to re-draw the design draft, color area as a basis to carry out color filling, for example, there are three color drafts will be required to draw three times. Not only does it take a lot of effort, but it's also a huge waste of drawing materials. Using CAD technology to carry out textile pattern art design, with the help of computer aided software can easily realize the color transformation. Borrow vector software, use straw and paint bucket tools. For example, using the function of adjusting the tone and color balance in the image software to effectively adjust the color saturation, contrast and brightness of the pattern, you can design a rich and diverse pattern works. Third, promote the effective dissemination of patterns. In the use of traditional manual design of textile patterns, patterns mainly include pattern drawing manuscripts, photographs, books and so on. This mode of communication not only cannot meet the basic needs of modern design industry, but also cannot effectively ensure the speed of communication. The application of CAD technology in textile art design practice is helpful to promote the effective dissemination of patterns and design effects. With the development of information technology, patterns spread in diversified ways, Internet communication platform is the main carrier to achieve effective dissemination of patterns. When users need relevant patterns, they can search and download them through the network, which greatly speeds up the spread of patterns, creates a lot of convenience for designers to carry out design communication with each other, and provides an effective way for textile production enterprises to obtain more samples. The diagram of CAD textile system is shown in Figure 3.

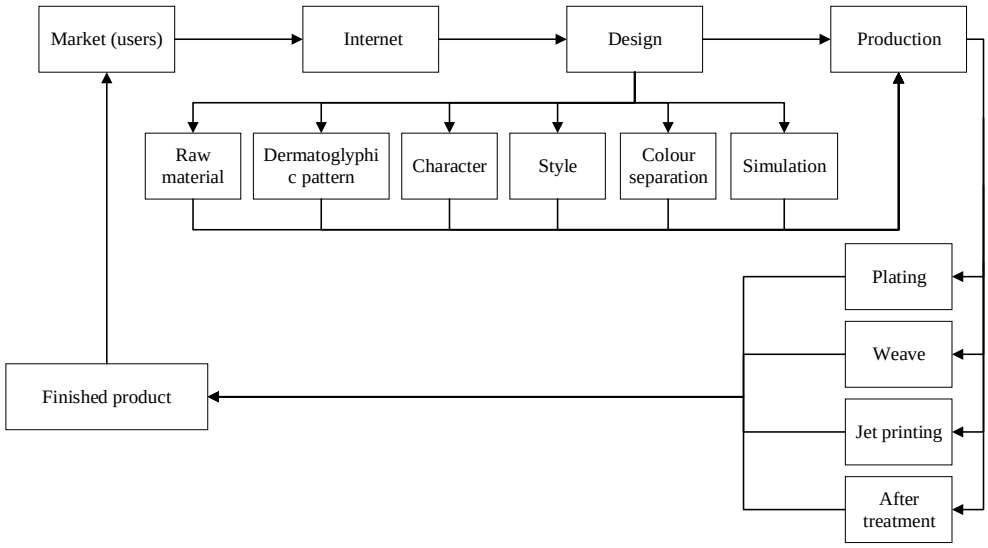


**Figure 3:** Diagram of CAD textile system.

Through the use of computers, designers can overcome many aspects of hand-drawn design weaknesses, which has brought unprecedented development for textile design.

a. Computers are designed to be efficient. Designers use computer to carry out textile design mainly through computer software. Heo et al. [7] mentioned that people can easily and quickly complete the heavy design work for hand-drawn design. For example, Photoshop software can be used to copy, cut, synthesize and modify the picture easily, so Photoshop is widely used in the creative and post-processing stage of textile design.

b. The accuracy of computer design is high. In the process of using the computer to design, as long as the data is set, the size, proportion and color of the picture can be accurate to the extent we need, unlike hand-painted design due to the proportion, color control of more or less deviation, and caused by the expected design effect is not consistent. Mainly reflected in the two formats of the picture -- vector map and bitmap, these two formats of the picture can achieve the degree of precision, hand-drawn design is beyond reach.

c. Computer designs are easy to keep. Computer designs can be stored very quickly and the designer only needs to choose different formats. Moreover, the design draft is stored in the computer as an electronic file, which only occupies the space of the hard disk, and will not change as the hand-drawn design draft changes over time.

d. Computer design is easy to grasp. Hand-drawn design is difficult, while computer software is easy for designers to use, even though self-study designers can master.

Computer has more and more application space in textile design:

a. The high intelligence of computer design makes its function of imitative hand-drawing enhanced. Computer software provides the production techniques, transformation effect, brush, color and material types, for textiles in the creative design, the processing of drawings have brought great convenience. For example, Painter software, which has a large number of brushes, including oil brushes, pencils, chalk, pens, watercolor pens, crayons, etc., as well as a large number of brush effects, for the design of hand-drawn effect to provide help.

b. Computer design can fully demonstrate the function of physical simulation. On the PC computer platform, the more excellent 3D software is 3Dsmax, which has powerful 3d modeling, mapping, lighting, animation and other functions. In textile design, 3Dsmax software can be used to display and simulate the effect of textiles in the actual use environment such as clothing, and adjust the textiles according to the actual effect. Computer design is more convincing than hand-drawn design in physical simulation, so that textile users can truly feel the effect of textile design.

c. Computer design can be directly linked to the production of finished products. Modern textile production is digitally controlled. Textile design companies have a variety of different categories of textile design software, the software to produce the design draft can be well combined with the software used in production, some software even have the function of creative design and production control.

### 3.2 CAD Technology in Textile Art Design Deficiencies

In order to promote the scientific application of CAD technology in textile art design, designers should understand the shortcomings of CAD technology while making clear the influence of CAD technology on textile art design. First of all, CAD technology is the product of the development of science and technology, which has high requirements for designers. If designers do not have good artistic quality, lack of computer aided software proficiency, it is difficult to create a unique pattern works. Generally speaking, the artistic quality of designers involves the designer's creativity, aesthetic feeling and taste, among which creativity refers to the designer's innovative ability, aesthetic feeling refers to the designer's unique perception and expression ability of beauty, and taste often refers to the designer's ability to appreciate originality. Therefore, to have these artistic qualities, designers need to constantly develop good thinking and innovative design thinking in daily life and professional learning process. Only in this way can the quality of artistic creation of designers be enhanced. Secondly, CAD technology is used in textile art design to show the problem of inadequacy of personality and sameness easily. This is mainly because designers rely too much on the network or existing materials, and neglect the mining of their own creativity, in

the use of similar materials will inevitably appear patchwork phenomenon. Again, because the CAD technology has such characters as rules, procedural, if used in the design process is not reasonable, on the one hand can't express the designer's creation thought, on the other hand may also make the traditional manual creation characteristics of natural affinity, disappear completely, which may be present CAD technology in textile art USES the key deficiencies. It is also the reason why most designers reject it. Some researchers liken the use of CAD technology to the difference between traditional manual writing and printing. In their opinion, it is also the use of symbols to express artistic feelings, the former is orderly, while the latter is varied and different. France, for instance, famous brand, herms, and the production of each type of silk scarves, either at the beginning of design drawing, or in the middle of the color, printing, or the last side, the entire link completely with the traditional manual to complete, is not only a luxury experience for consumers, but also a let consumers enjoy the feast of traditional art essence. Therefore, the future in our country's textile art design practice, the designer shall promote the organic integration of CAD technique and traditional handicrafts, computer aided software requires both designers to mastery of their skills and shall also have a solid strength, create textiles with eastern culture characteristics for people is the prosperity of the textile industry in China.

Computer design also has some shortcomings:

a. Ou et al. [8] mentioned that due to the non-manual design, the visual effect of textile designed by computer has a strong mechanical taste and lacks human perceptual factors, which makes it cold and boring and difficult to fully meet people's psychological needs.

b. Because of the powerful computer function, many students are eager to achieve and ignore the hand-painted modeling of solid basic training, the design of the product is often inferior art, coarse, vulgar. Some designers rely more and more on the computer and ignore the creativity. They only use the computer to design their works. They excessively use the ready-made materials, pictures and effects, making the design language poor and similar, resulting in the loss of the free will and free emotion of the design works, and having no soul.

c. Because the teaching and research of computer software are not fully developed, designers often use software in isolation, without comprehensive use of various tools in one software or without comprehensive use of the functions of multiple software. And in the combination of computer and hand-painted design, hand-painted good designers are often only in hand-painted efforts, and the computer is only symbolic processing; Computer software used more familiar designers are often hand painted on the perfunctory, and in computer applications to do more processing. Such design habits and methods are difficult to give full play to the respective advantages of the two design methods, and they are not organically combined into a "resultant force" for textile design, which affects the quality of textile design.

## 4 IMPROVE DESIGN ABILITY BY COMPREHENSIVE USE OF DESIGN SOFTWARE

The comprehensive application of computer and software technology provides designers with a new way to express design ideas, help designers accurately, vividly and efficiently express design intentions, and provide some supplements for designers' imagination. But the function of software must be developed in a large number of design practices, effective methods can make the computer as much as possible to play its role as an auxiliary design tool [9].

In the process of traditional pattern creation, the following situations are often encountered: Figure and shape is no problem, but after a lot of adornment gimmick after processing is not satisfactory, the effect of the modification process of chalk line and color is hard to wipe, if again to create a picture of the same pattern "in the form of composition and how much will change shape, after all of the differences between manual is hard to avoid, probably in the new creation in the lack of vitality of the original composition, shape, It cannot achieve the purpose of second creation to perfect the original picture, and the re-creation time is also very large. At this time, the use of computer tools can save time and effort, its approach is to scan not very satisfied with the work into the computer, with the graphics processing software Photoshop related software

functions to remove the failure in the pattern, retain those satisfied with the place, and then will be repaired after the work can be printed [10]. Sometimes the size of the original work exceeds the printing range allowed by the computer, two to three parts can be printed and then pieced together into the size of the original picture, copied in the new picture, so that you can continue to complete a larger unit pattern on the original composition and shape, and the manual production of larger patterns needs to spend double time. The simulation renderings are shown in Figure 4.

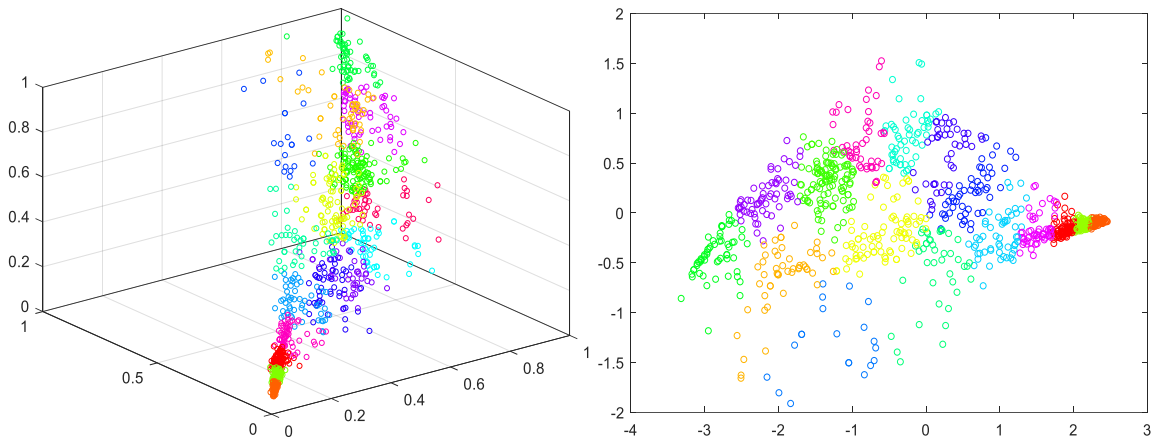


**Figure 4:** Simulation renderings.

A designed fabric pattern is mostly composed of some simple unit patterns. In this case, the cycle function of Primavision can be used to accurately and quickly cycle the pattern of a basic unit into a complete pattern. Edit loops using Primavision's loop pen. Loop drawing can be used as a freehand brush in the loop design process. Similar to the existing loop window instruction, the loop pen instruction temporarily creates an automatic full-area loop for users to modify timely. However, since the circular pattern and the original pattern coexist in the same drawing area, editing with this command is more natural. The loop pen is especially good for creating basic patterns that serve as a base for loops, as well as quick and easy geometric patterns for other purposes. Using the software function of Primavision cycle, you can reduce the repetitive work in pattern design, and accurately and quickly integrate the pattern of a basic unit into a complete square continuous pattern. The visual textile art design system structure is shown in Figure 5.

In today's society, the means of information communication are diversified, and many means coexist: "image-text-three-dimensional environment-virtual design" and so on. Because words and images are difficult to explain the effect of things in a certain state, people today prefer to use three-dimensional environment to create a virtual reality, so that the effect of the design can be directly and truly displayed. Using Primavision's stereo mapping tool, you can directly paste the design pattern on the product position in the THREE-DIMENSIONAL environment, and intuitively see the effect of the pattern on the real object. For example, do bedspread mapping, first select the area to map, and then do the mesh of warp and weft yarn, and then adjust the mesh according to the different folds and undulations, make the corrugations, select the fabric to map, drag the selected fabric to the area to paste, and then paste the required fabric. Such as feel the texture space environment is not appropriate, can open the whole figure in Photoshop, then levels, contrast, color saturation, etc to adjust environment integrity, to make the map and environment to achieve harmonious and unified, may encounter perspective on the problems in the process of operation, will they do when selecting regional segmentation to solve, use this way to put up a map, Strong sense of space, real, natural, fabric texture can be fully displayed, can let customers

more intuitive to see the product effect will be produced. The efficiency comparison between hand drawing and CAD is shown in Figure 6.

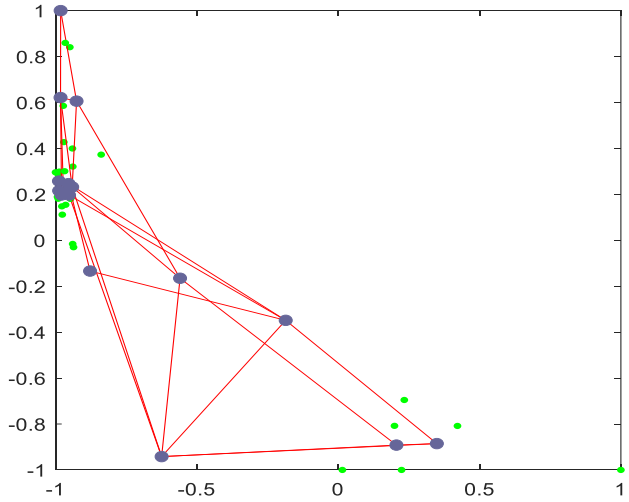

**Figure 5:** visual textile art design system structure.

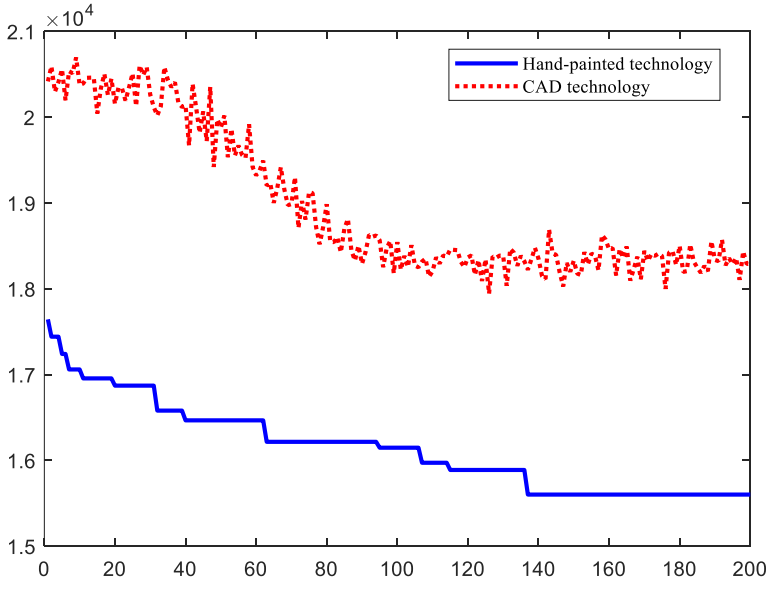


**Figure 6:** Efficiency comparison between hand drawing and CAD.

In the past, people need to see the actual effect of the pattern, through the production of fabric, regeneration products to see the effect, now through the software function before the production of finished products can see the virtual design effect in advance, and according to the effect to decide whether to produce and use what kind of production technology. U4ia software design samples can be simulated on the screen, can be directly on the screen for the design of woven and knitted fabrics, and in a virtual state display all of the samples, can also be used in model pictures of different fabric, for its put on the design sketch, and can solve include issues such as shadow

and twisted fabric, In U4ia, fabrics that have been scanned were harmoniously organized in striped, exotic patterns, crocodile skin and velvet styles, creating flexible fabric pairings and presenting materials in a realistic manner, particularly in the form of animal skin. U4ia Software transforms the ideal of simulation design into reality, enriching and developing the creativity of designers. This virtual design enables designers to use advanced means to arrange the relationship between human and nature and between human and human more reasonably, and to plan a more reasonable way of information transmission. Under the condition of the coexistence of tradition and modernity, it is the only way for textile art design to perfect the tradition and expand the new field. It is not difficult to see from the above methods that computers and their software, as auxiliary design tools, are playing an increasingly important role in textile art design. In many cases, they can achieve effects that are difficult to achieve in traditional design. If combined with other production techniques, the forms of textile products will be greatly enriched. The time comparison between hand drawing and CAD is shown in Figure 7.

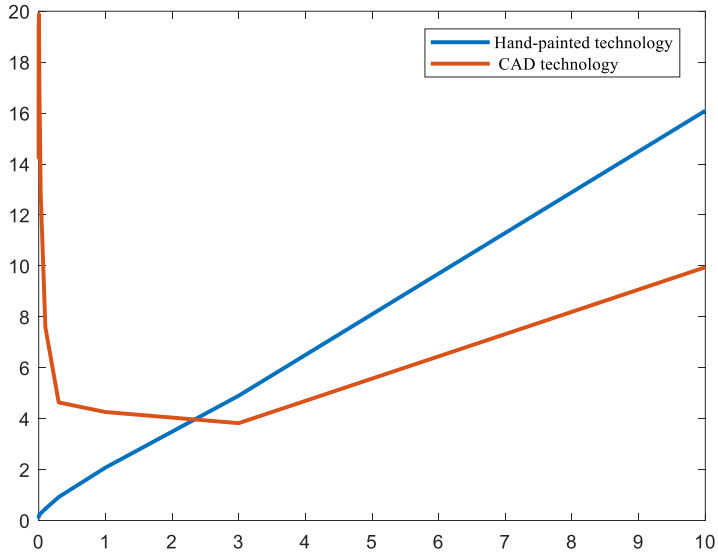


**Figure 7:** Time comparison between hand drawing and CAD.

## 5 CONCLUSION

With the rapid development of society, textile designers should keep pace with the development of The Times, constantly reform the concept of design innovation, and strengthen the guidance of design strategy learning in the information age. In the digital age of modern rapid development, the digital representation of textile pattern design in traditional textile industry has become an inevitable trend of industry development. In order to further promote the integration of digital technology and traditional handwork in the scientific application of textile art design, the following content as a design entry point :(a) Applied to decorative wall hanging design. Relying on digital technology and traditional manual construction of Chinese landscape painting melodious and quiet unique artistic conception, the use of progressive color wool felt to show the level of distant mountains and pure land, thick design techniques. The clear and ethereal digital technology forms a sharp contrast with the traditional manual dyeing, which effectively improves the ornamental value of wall hanging works. (b) Used in bedding design. Bedding is the indispensable part in home spinning, such as pillow, cover, bedding kind, no matter its design, color or craft is affecting the style of interior design, also be the important carrier that stylist expresses design characteristic

at the same time. Because bedding has health care, comfortable wait for demand however, must want comprehensive consideration on making craft so. Designers use digital technology to spread out the design on the quilt cover, introducing the beautiful scene of Provence into the bedroom. Meanwhile, to reveal the stereo feeling of design, enhance the administrative levels feeling of picture, stylist still used traditional hand painting to add the design gimmick of hand embroider, communicated the visual effect of lavender layer upon layer cluster and distinctive glamour effectively. The adoption of diversified design techniques is often the key measure to increase the added value of design products in commercial competition. In brief, the designer must correctly understand the impact of digital technology to the traditional textile art design, understanding the function of the computer aided design software, scientific and rational by means of computer design, designers can grasp skilled design software applications, integrate their advantages, give full play to the specialty of each software can significantly improve the design efficiency and effectiveness, Further shorten the product production cycle, to provide better and more home textiles to the market.

The deficiency of this research work is that it cannot be combined with computer software technology to further solve the problems found in the process of digitalization of textile pattern design. Textile art design of digital expression as a design professional artistic expression, the digital technology and traditional art organic union, in addition to the designer to enhance its own artistic accomplishment constantly, but also with the new technology of computer design accurate convey ideas and thinking, this is also the designer must constantly explore a new topic. The application of CAD technology is an inevitable trend, its construction and development is also a long-term study and research work, new problems will constantly appear. However, the digital performance of textile pattern design will continue to improve and innovate, are worth our thinking and exploration of the subject.

## 6 ACKNOWLEDGEMENT

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