

# The Exploration and Inheritance of the Texture and Material Value of Ming Dynasty Huzhou Silk Damask and the Influence of Technological Digitization

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## Abstract

In order to explore the archaeological value of ming dynasty huzhou silk damask and improve the inheritance effect of silk culture, this paper analyzes from the perspective of huzhou textile culture. The material, dye and weaving technology of ming dynasty huzhou silk damask were observed with a high-definition microscope, the weaving strength was detected by a film strength measuring instrument, and its warmth was observed by infrared equipment, and its cultural connotation was collected through CNKI and Wanfang websites, and it was summarized and compared. The results showed that the material of ming dynasty huzhou silk damask was mainly mulberry silk, the weaving form was three (vertical and horizontal, cross and winding), the dyes were safflower, sumac, bluegrass, black bean, gardenia, turmeric, locust flower, gallnut, etc., and the main component was alkaloids. The insulation effect of silk is balanced, the permeability is strong, and the weaving strength is uniform. ming dynasty huzhou silk damask adopts natural dyeing methods such as grass dyeing, and the use of Chinese traditional weaving technology is a representative, with a large space for sustainable development, is a representative case of huzhou textile culture development, and can promote the inheritance of ming dynasty huzhou silk damask.

**Keywords:** virtual and realitytechnology, ming dynasty huzhou silk damask, culture, digitalization.

Ming dynasty huzhou silk damask is a treasure in traditional Chinese handicrafts, which can be traced back to the Three Kingdoms period (220-280 AD) and has a history of thousands of years. As one of the treasures of traditional Chinese material culture, the ming dynasty huzhou silk damask culture of the Song Dynasty in the Southern Dynasties became an important trade product and was exported to countries such as Vietnam, India and Cambodia. Among the traditional Chinese silk fabrics, the silk from Shuanglin Town, Huzhou, Zhejiang Province is

the most famous(Bonialian, 2022). The silk fabric of the silk is soft and light, and it is made of spring mulberry silk, the texture is quite light and delicate, and has a clear texture(Brem & Nylund, 2021), and the luster is bright. Among the traditional Chinese silk fabrics, ming dynasty huzhou silk damask has always been a superior product and is known as the "flower of silk weaving technology". Due to the unique craftsmanship of ming dynasty huzhou silk damask, the quality is excellent, and the colors are diverse and vivid. Shuanglin Town, located

in Huzhou, Zhejiang Province, is famous for its silk production and quality(Danylenko, 2022), because Shuanglin Town is strategically located in the Hangjia Lake water network area, which has always been rich in sericulture, and the silk reeling industry is extremely developed. In ancient times, local residents used cottage industries to complete the production of silk, which has always been known for its soft and light texture. In traditional Chinese handicrafts, this exquisite weaving process and high-quality and high-quality raw materials make ming dynasty huzhou silk damask a precious product(Delaunay, 2020). Because of its long history and rich cultural characteristics, ming dynasty huzhou silk damask has always been known as a valuable cultural heritage. During the Southern Dynasties, silk was widely used to mount paintings and calligraphy and manufacture palace lanterns. It can show the industrious wisdom of ancient laborers and the pursuit of beauty, respect and admiration for textile technology in the excellent traditional Chinese culture. In the past, ming dynasty huzhou silk damask was respected by dignitaries and middle-level people in society(Kang et al., 2022). during the Ming Dynasty, the official also used ming dynasty huzhou silk damask as a tribute, which was widely favored by the imperial court, such as framed paintings and calligraphy. It can be seen that in ancient China, the society attached great importance to the craftsmanship and quality of ming dynasty huzhou silk damask. However, although ming dynasty huzhou silk damask has a glorious history and high cultural value, the protection and inheritance of ming dynasty huzhou silk damask is facing difficulties in modern society. For example, because of changes in market demand and serious backwardness in production technology, excessive loss of talents, etc., ming dynasty huzhou silk damask is now in decline. In this way, it means that shortly, ming dynasty huzhou silk damask may disappear. It can be seen that relevant practitioners need to focus on further protecting and inheriting ming dynasty

huzhou silk damask culture(Ling & Ling, 2020 ). From the current point of view, digital technology can be used to protect, inherit and promote ming dynasty huzhou silk damask culture, and provide new development opportunities for ming dynasty huzhou silk damask industry. The use of virtual and augmented reality technology can better reproduce the process of ancient Chinese weaving technology, showing its pattern characteristics so that users can experience the complex production process and feel the exquisite skills of ancient times. In addition, the application of digital platforms can promote ming dynasty huzhou silk damask culture and provide more space for related innovative designs. Silk design can be carried out in line with contemporary aesthetic needs, and new patterns and color matching can be displayed using the concept of ecological development and ecological technology. In the digital presentation, contemporary people can better understand the culture of ming dynasty huzhou silk damask, and further participate in the handmade production of ming dynasty huzhou silk damask, so as to inject new vitality into the further protection, inheritance and development of ming dynasty huzhou silk damask. In China's long history, many precious handicrafts and products have been born, and ming dynasty huzhou silk damask is one of the treasures of ancient Chinese handicrafts. Due to the development and inheritance of thousands of years, the current ming dynasty huzhou silk damask has become a treasure in the traditional Chinese silk fabrics, and has a profound historical and cultural connotation, with high cultural value. It can be seen that the protection of ming dynasty huzhou silk damask culture is of great practical significance, which is also the basis of this paper. Under the huzhou textile culture of virtual and reality, the inheritance of ming dynasty huzhou silk damask culture needs to be digitally presented to attract the attention of the younger generation and expand the market. Based on this, this paper will discuss the

inheritance of ming dynasty huzhou silk damask culture under the huzhou textile culture of virtual and reality, and focus on the digital presentation of innovative design of ming dynasty huzhou silk damask. This paper uses comparative analysis and case analysis to study the digital application strategies and technologies in ming dynasty huzhou silk damask's protection and innovation process(Naughton, 2020;Peng et al., 2021). After research, this paper concludes that it is necessary to record, preserve and inherit the ming dynasty huzhou silk damask weaving process through 3D scanning technology and virtual reality technology, augmented reality technology and other means, and combine it with modern aesthetic elements through the study of the traditional elements of ming dynasty huzhou silk damask to obtain innovative design. In addition, in order to further protect and inherit the ming dynasty huzhou silk damask culture, cross-border cooperation, digital platform construction, and related exhibitions can be adopted to better promote the further dissemination of ming dynasty huzhou silk damask culture on a global scale, so as to achieve the purpose of protecting traditional Chinese handicraft and cultural heritage.

Research Methods and Results

2.1 Research Methodology

The material, dye and weaving technology of ming dynasty huzhou silk damask were observed by using a 4K high-definition microscope (Dongguan, Guangdong, multiples of 0.7~4.5 times), a film strength measuring instrument (Zibo, Shandong, 3kg) was used to detect its weaving strength, and infrared equipment (Qingdao, Shandong, infrared scanning) was used to observe its warmth, and its cultural connotation was collected through CNKI and Wanfang website (<https://www.cnki.net/>), and its cultural connotation was summarized and compared. Observations include: material, dyes, weaving technique, weaving strength, permeability, heat retention, and pattern modeling. The observation sample is a ming dynasty huzhou silk damask product; the information is public, and there are no copyright disputes.

2.2 Dyeing materials of silk

Comparing the dyeing materials of silk, it was found that the dyeing process was mainly grass and wood dyeing, and the dyeing process was carried out by adding acetic acid, alum, iron dioxide and other medium dyeing, as well as decoction dyeing, knocking and over-dyeing, and the specific results are shown in Table 1.

Table 1 Dyeing methods of silk

sampl e	method	Medium dyeing	dye	Polluting	Degradati on time	Advantages and disadvantages
ming dynast y huzho u silk damas k	Fermentati on dyeing and knocking topping	Yellow (aluminu m oxide), red (alum), blue (lime)	Safflower, sumac, bluegrass, black bean, gardenia, turmeric, locust flower, gallnut	Early water pollution, disappear after biodegradati on, no soil and air pollution	2~3 days	Environmenta lly friendly, complex to operate, and moderately costly
	Set dyeing and decoction dyeing	Black (iron dioxide), white				

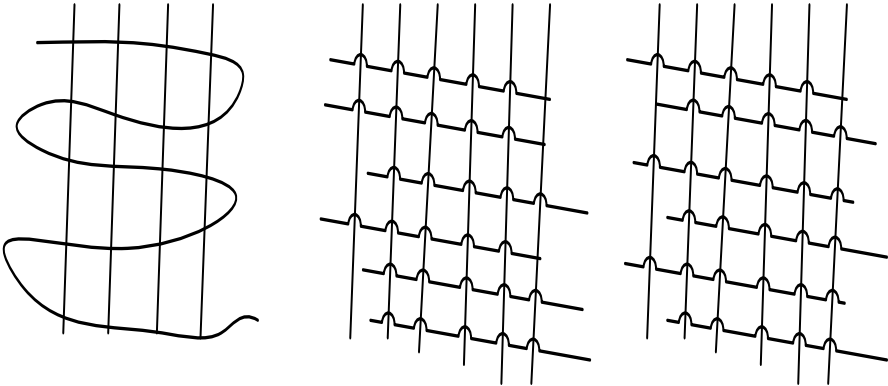
		(acetic acid)				
Modern silk	Chemical staining	Firming agents, sunscreens, anti-wear agents, etc	Diaminostilbene disulfonic acid, 4,4'-diaminodiphenylurea, 4,4'-diaminobenzoyl teaniline, diaminoheterocyclic, and other reactive dyes, disperse dyes and sulfur dyes	Persistent water, soil, and air pollution	1~2 years	Low cost, simple operation, strong pollution

From the content in Table 1, it can be seen that ming dynasty huzhou silk damask can not achieve large-scale production, and the production cost is relatively high, and the operation is complex, so that it can not obtain more profits, but its production advantages are obvious, and it has a high value of huzhou textile culture promotion. Modern silk has a variety of colors, but the pollution to the environment is high, and the cultural heritage is poor. At present, China adopts the economic path of sustainable development, and the development of ming dynasty huzhou silk damask should be promoted. During the ming dynasty huzhou silk damask has always existed as a fine silk fabric, and in addition, ming dynasty huzhou silk damask has a unique cultural value. During the Southern Dynasties, because the Huzhou area was rich in sericulture, and the silk reeling industry and handmade silk fabrics were famous in various places, the economy of the Shuanglin area was increasingly developed, so that the grass and wood dyeing methods of ming dynasty huzhou silk damask were improved. During the Song Dynasty (961~1279 AC), the production of silk was in a virtuous circle, and the unique

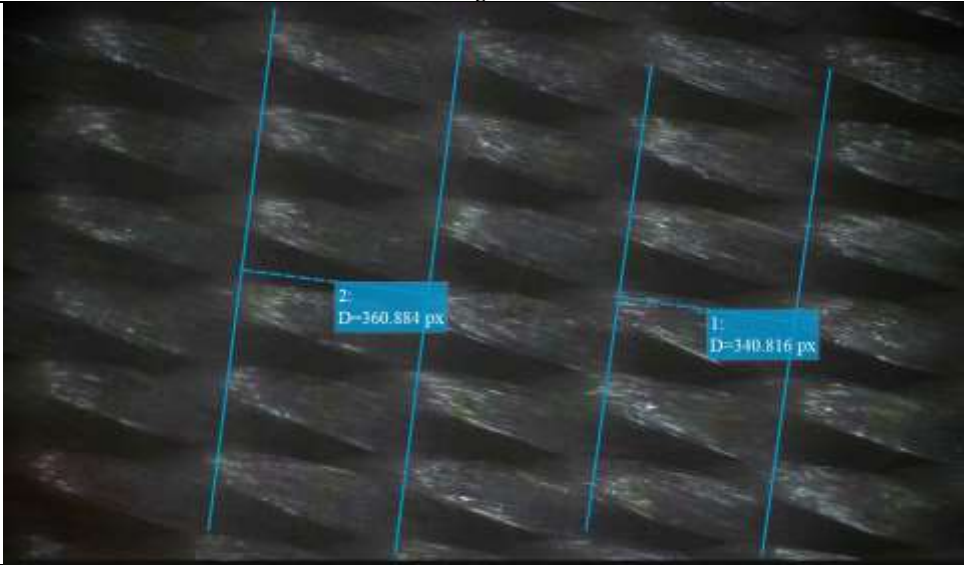
conditions for dyeing plants and trees were mastered. During the Song Dynasty (961~1279 AC), the handmade silk fabrics in the Huzhou area have formed an economic model of cottage industry, where families can dye plants and trees, and produce silk products with regional and national characteristics. Moreover, as the local silk fabric center of Huzhou, Shuanglin Town became increasingly famous, becoming one of the famous silk production areas in the Song Dynasty (961~1279 AC) and Tang Dynasty (618~907 AC). As one of the traditional Chinese silk fabric treasures, ming dynasty huzhou silk damask not only reflects the textile technology of the Tang and Song dynasties but also reflects the pursuit of outstanding skills of Chinese weavers.

2.3 The material and weaving form of huzhou silk damask

Comparing silk damask's weaving forms, it is found that there are three weaving processes, namely vertical and horizontal, cross and winding, and the material is made of mulberry silk, as shown in Figure 1.



Weaving method



Material and texture gaps

Fig.1 The material and measurement of ming dynasty huzhou silk damask

From the content in Figure 1, it can be seen that ming dynasty huzhou silk damask uses mulberry silk as the main material, and the distance between the woven lines is almost the

same, between 0.34~0.36cm, indicating that the weaving accuracy of the texture is high. In the case of non-mechanical weaving, the difference in the distance of manual weaving is so small, which shows that the craftsmanship of ming dynasty huzhou silk damask is exquisite. As a soft and easy silk fabric, ming dynasty huzhou silk damask uses mulberry silk as the material, which has a good gloss, bright and light, and can show the unique craftsmanship of traditional Chinese textile skills and high quality. After the mulberry silk has been carefully knitted, its texture is light, soft, and very gentle to the touch, so it is very popular. The strength distribution test of silk shows that the variation of its weaving strength is relatively uniform, which further indicates the exquisite weaving technique, as shown in Figure 2.

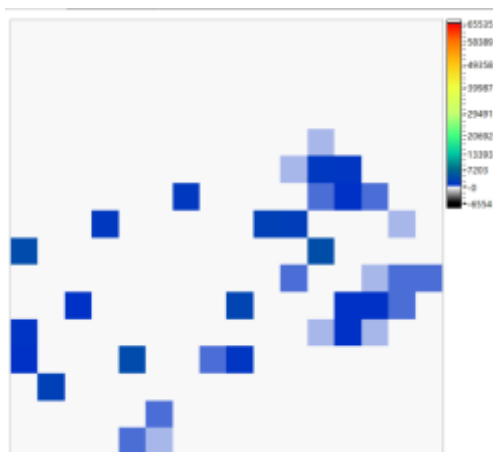


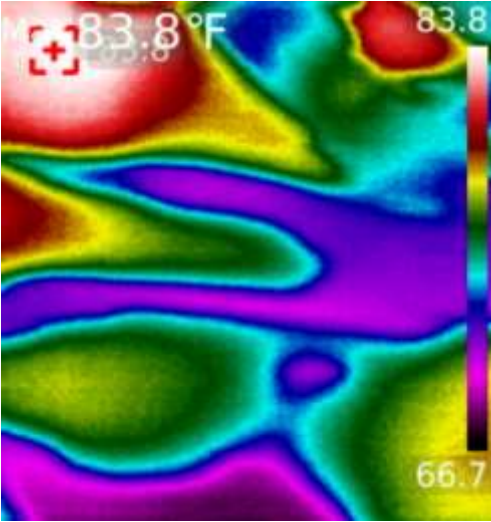
Fig.2 Strength distribution test of Ayasu

From the results of the force distribution test, it can be seen that the weaving focus of the silk is distributed largely, and the force is uniform, indicating that there is a good force balance between the silk as a whole. The design of the silk in terms of materials, dyes and weaving makes the balance of power of the silk reasonable, and fully reflects the exquisite craftsmanship of the traditional craftsmanship. Due to its exquisite weaving technology and

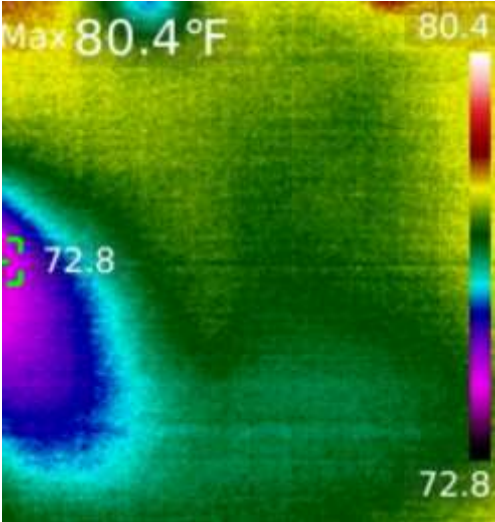
clearer texture, during the Tang Dynasty (618~907 AC), ming dynasty huzhou silk damask was mainly used as a mounting material for arts and crafts, and was often used to frame calligraphy and paintings, court lanterns, kites, etc., so its artistic value is unique. Moreover, the framing effect of ming dynasty huzhou silk damask on some precious calligraphy and painting works was also talked about at that time, mainly because the calligraphy and painting works after being framed by ming dynasty huzhou silk damask were ornamental and had high-grade artistic effects, and their appreciation was greatly improved. ming dynasty huzhou silk damask carried by it are very rich, and after thousands of years of historical development and inheritance, it has been included in the traditional Chinese silk fabrics and has become one of the cultural treasures. the ming dynasty huzhou silk damask dyed grass and trees, occupying a unique historical and cultural position in Chinese silk fabrics. ming dynasty huzhou silk damask can not only show the exquisite textile craftsmanship of plant dyeing, but also show the richness and layering of ancient Chinese history and culture

#### 2.4 Comparison of the thermal insulation effect

The thermal insulation effect of silk is measured, and the specific results are shown in Figure 3.

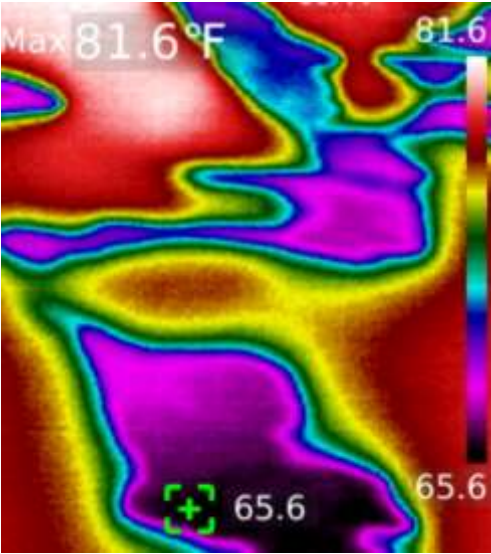


Observe for 10 min



Observe for 30 min

Fig. 3 Observations over time



Observe for 20 min

The observation of silk for 30 minutes shows that silk's thermal insulation effect is good, and there is no large temperature change, indicating that the insulation ability of silk is strong. The main reason is that silk weaving technology is exquisite and the weaving material has good thermal insulation performance. The exquisite weaving technology of ming dynasty huzhou silk damask has gradually been lost, and the traditional handicrafts have been subject to various problems such as inheritance faults, rapid changes in market demand, and the impact of modern production methods. For example, the fault line of skill inheritance is one of the main problems of ming dynasty huzhou silk damask. Because the traditional handicraft of ming dynasty huzhou silk damask has high professional requirements and is very complex, the ming dynasty huzhou silk damask need to go through a long period of master-apprentice inheritance before they can be mastered, and it takes a certain amount of time to accumulate experience in order to have a good level of skills. At present, with the continuous advancement of

modernization, young people are almost not interested in handicrafts, in this case, the inheritance chain of ming dynasty huzhou silk damask's traditional handicraft skills has been interrupted, and many old craftsmen are gradually retiring, and it is difficult to find successors. In addition, ming dynasty huzhou silk damask's traditional handicraft skills have declined due to changes in market demand. With the continuous change of market demand, the aesthetics, production and other aspects of ming dynasty huzhou silk damask are being challenged. With the improvement of the economic level and the great change of consumption concepts, many people's demand for clothing and decorations has also significantly changed. Modern people are looking for fashionable and convenient products that can be mass-produced (Peterson, 2020; Ren & Cao, 2021), while fabrics made by traditional Chinese handicrafts are complex, expensive and not easy to accept. At the end of the Qing Dynasty, the market demand for ming dynasty huzhou silk damask fell sharply, putting market pressure on the inheritance of traditional handicrafts. In addition, the application of modern production technology and the improvement of productivity have also caused traditional handicrafts to face great difficulties. For example, the application of modern production technology and mechanization has greatly increased the production scale of various clothing and decorative products, and its production efficiency has also been greatly improved. In this way, it seems that traditional handicrafts' time-consuming and labor-intensive problems are prominent, which makes the production method of ming dynasty huzhou silk damask suspicious. Over time, it will also affect the further protection and inheritance of ming dynasty huzhou silk damask, and make it difficult for many craftsmen to make a living. It can be seen that we need to strengthen the publicity and education, protection and inheritance of ming dynasty huzhou silk damask traditional handicrafts, and improve the public's

understanding and awareness of ming dynasty huzhou silk damask production methods and cultural values through various ways, so as to improve the visibility and audience scope of traditional handicraft products (Santiago & Amsterdam, 2021; Tang et al., 2020).

#### 2.5 Digital presentation of ming dynasty huzhou silk damask

According to the dyeing, texture, color, and other data of ming dynasty huzhou silk damask, the virtual simulation software was carried out to realize the digitization of Ayajuan, as shown in Figure 4.

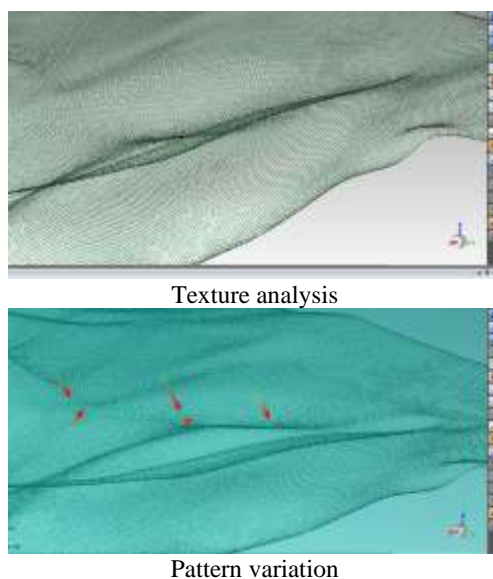


Fig.4 Virtualized reproduction of Ayaju

As can be seen from Figure 4, the data of the dye, texture, and shape of the silk are measured and the virtual technology is used to reproduce the silk, providing a basis for post-production and technology inheritance. Digital technology can play a key role in the protection and innovation of ming dynasty huzhou silk damask, including 3D scanning technology. Using the 3D scanner, it is possible to complete high-precision and comprehensive 3D scanning and modeling of ming dynasty huzhou silk damask. This



technology is able to accurately record the texture and structure of ming dynasty huzhou silk damask, other details, etc., and the weaving process. Using 3D scanning, a corresponding digital model of ming dynasty huzhou silk damask can be created to preserve its form and structure and achieve a better technical reproduction of ming dynasty huzhou silk damask. Second, virtual reality technology. Virtual reality technology in the current application has become mature, can use virtual reality technology, through the computer to form a virtual environment, so that users can have an immersive experience of the weaving process of ming dynasty huzhou silk damask (Van Uhm, 2020; Woon, 2020), so that they can better understand the preciousness of ming dynasty huzhou silk damask craft. With the help of virtual devices, users can enter a virtual studio or handicraft workshop to learn and simulate the hand-weaving process of ming dynasty huzhou silk damask in the Song Dynasty (961~1279 AC) in a virtual environment. The technology can provide an immersive experience and enhance the sense of interactivity, so that users can truly feel and understand the exquisite craftsmanship of ming dynasty huzhou silk damask weaving and experience the complexity of its weaving process. With the use of augmented reality, virtual objects can be better superimposed on reality to create an experience that combines the fusion of real and virtual, and the dyeing method of silk in the Northern and Southern Dynasties is studied. Through the application of augmented reality technology, users can complete the virtual experience by scanning and simulating ming dynasty huzhou silk damask through a tablet or smartphone to see relevant virtual information on the screen and then study the pattern of Silk during the Tang Dynasty. For example, with virtual augmented reality technology, you can see the superimposed information of ming dynasty huzhou silk damask in the digital device, such as the animation of the weaving process and the change of patterns. This technology allows

students to learn and complete interactive experiences better, so as to make ming dynasty huzhou silk damask hand-weaving technology charming, such as the patterns and patterns of silk in the Northern and Southern Dynasties. Through several digital technologies, the ming dynasty huzhou silk damask culture can be displayed and promoted as necessary, and combined with the Northern and Southern Dynasties (420~581 AC), the silk graphic logo, and the Tang Dynasty's silk texture can be designed. Use the digital platform to hold an online handicraft exhibition to understand the historical development process and cultural connotation of ming dynasty huzhou silk damask and the details of the production process after the Northern and Southern Dynasties. For example, through the video, pictures and text of the works of Aya Juan during the Northern and Southern Dynasties (420~581 AC), the advantages and various characteristics of ming dynasty huzhou silk damask are highlighted, and the cultural connotation of Aya Juan is excavated. In addition, you can also promote ming dynasty huzhou silk damask on social media, museums, auction houses and other institutions to understand the culture and dyeing skills of ming dynasty huzhou silk damask during the Northern and Southern Dynasties (420~581 AC), so as to achieve protection and inheritance and improve popularity. Digital display and promotion will allow the ming dynasty huzhou silk damask culture to be better protected, inherited and disseminated in the period after the Northern and Southern Dynasties (420~581 AC), to guarantee the preservation of ancient weaving techniques.

### **Analysis of the cultural inheritance of ming dynasty huzhou silk damask**

#### **3.1 Deepen the integration of virtual technology**

In the protection and inheritance of ming dynasty huzhou silk damask culture, the necessary innovation will become the key part,

so we should pay attention to the application of digital technology, so as to better protect and innovate ming dynasty huzhou silk damask products, and continue to inspire inspiration, and explore the connotation of silk. In order to improve the diversity of products and enhance the market competitiveness of ming dynasty huzhou silk damask, this paper analyzes from the following points: First, innovative design tools. As we all know, the application of digital technology requires the design of many advanced design tools and software, which allows designers to create more flexibly. For example, designers can use CAD software and other digital tools to complete their designs, and in the virtual environment, designers can continuously experiment and modify to present different design solutions faster. This allows the combination of traditional elements and modern aesthetics to achieve better innovative design. For example, the simulation of digital fabrics. Designers can simulate, modify and display various traditional patterns of ming dynasty huzhou silk damask through digital design software, and apply them to the innovation. For example, designers can use Adobe Photoshop software to re-invent traditional patterns so that the colors and forms of traditional patterns can have new pattern designs. Then, through some 3D rendering software, designers can use this to innovate many traditional patterns and apply them to virtual fabric models to simulate various fabrics' texture and drape effect. In this way, the design effect on the garment can be previewed and adjusted and optimized before production to ensure the final product's quality and aesthetic requirements. Another example is digital printing technology. With the help of digital printing technology, designers can directly print the ming dynasty huzhou silk damask patterns that have been digitally processed and innovatively designed onto some fabrics. As a result, customized products can be produced in small batches very quickly, with a precise representation of a wide range of complex traditional and innovative patterns and vibrant

colors. For example, in many high-end fashion shows, designers can combine classical elements and modern graphics, and apply the relevant elements of ming dynasty huzhou silk damask to digital printing to print silk fabric patterns with special visual effects(Wang et al., 2021;Woon, 2021), so as to better integrate traditional and modern elements, so as to cause changes in the fashion industry and promote the application of ming dynasty huzhou silk damask culture in the field of high-end fashion. It can be seen that digital technology can combine ming dynasty huzhou silk damask culture with contemporary aesthetics and provide a wider space for product innovation. The traditional ming dynasty huzhou silk damask pattern is unique, which is one of the reasons why it is famous. With the application of digital technology, designers can better integrate modern technology to process, modify, and create new patterns that combine tradition and modernity. For example, through some image processing technology software and pattern generation algorithms, designers can readjust and deform, combine traditional patterns, and then innovate the ming dynasty huzhou silk damask process to create more innovative products. For example, there were patterns of adjustment and deformation during the Tang Dynasty, such as calligraphy and painting. For this purpose, the design can be scaled and rotated by modern design software, which in turn changes its size, orientation, and symmetry. Based on this, designers can adapt these traditional patterns to modern products' form and size requirements. Moreover, designers can modify parameters such as color and lines to align traditional patterns with modern aesthetics. In this way, it is possible to combine the characteristics of ming dynasty huzhou silk damask and modern aesthetics in the Northern and Southern Dynasties to improve the diversity and innovation of products. For example, pattern combination and creation. Specifically, designers can use digital technology to combine and create the ming dynasty huzhou silk damask craftsmanship and related traditional patterns

during the Northern and Southern Dynasties to create novel patterns. Using specialized image processing software or pattern generation algorithms, designers can assemble, reassemble, borrow, and fuse patterns to create new modern fabric patterns. to combine them and then achieve personalized combinations. It can be seen that through the application of digital technology and the combination of ming dynasty huzhou silk damask patterns, designers can have a better creative play, so as to combine the ming dynasty huzhou silk damask culture and modern aesthetic concepts, so as to improve the diversity of products, improve the fashion sense and individuality of products, and improve their market competitiveness(Xu, 2022).

### 3.2 Enhance the added value of ming dynasty huzhou silk damask

ming dynasty huzhou silk damask can realize personalized customization services, integrate new materials to enhance its own added value, and realize cultural inheritance through added value. Because of the rapid development of the current era, many people pursue personalized customization, customizing products with cultural heritage such as Tang Dynasty patterns and Song Dynasty patterns. Based on this, digital technology can increase the convenience of personalization. For example, enterprises can provide consumers with personalized customization services through online platforms and applications, so that users can choose the pattern, color, size and so on of the product according to their preferences and obtain ming dynasty huzhou silk damask products that meet their needs. In this way, it can meet the individual needs of users and improve ming dynasty huzhou silk damask's market competitiveness. For example, pattern customization. Through the digital platform and application, users can watch and browse ming dynasty huzhou silk damask patterns in various styles, themes and patterns on the online platform, and then adjust the density, size, and color of the patterns according to their own needs,

to meet the requirements of personalized customization. In this way, the market competitiveness of ming dynasty huzhou silk damask products can be improved, and the combination of digital technology and material innovation can promote the development of ming dynasty huzhou silk damask culture and improve its product diversity and market competitiveness. For example, designers can use advanced materials and fiber technologies, textile processes, and digital technologies to design and produce them to improve product innovation and the softness, durability, and functionality of Shuangbayashi silk products. Based on this, it is possible to expand the market space of ming dynasty huzhou silk damask(Zhang et al., 2020). For example, combining new fiber materials and digital technology makes creating ming dynasty huzhou silk damask products with special functions possible. Alternatively, nanofiber technology and digital design can be used to ensure the waterproof performance, antibacterial function, and anti-ultraviolet function of ming dynasty huzhou silk damask products. For example, digital design tools can be used to optimize the specially treated fiber materials so that ming dynasty huzhou silk damask has a better texture and excellent waterproof function. Based on this, the added value of ming dynasty huzhou silk damask products can be increased, and its overall competitiveness can be improved. However, when the cultural heritage of silk is restored, the effect of these innovative designs must also be rigorously tested and verified to ensure their performance and quality. Moreover, when applying these digital technologies and innovative materials, we should also pay attention to environmental protection, ensure their sustainable development, and ensure the safety of products, so as to promote the further expansion of the market space of ming dynasty huzhou silk damask's innovative design. The protection, dissemination and inheritance of ming dynasty huzhou silk damask culture under

the huzhou textile culture of the proposed and realistic reality require the joint efforts of many parties. First, cross-border cooperation. In order to ensure that ming dynasty huzhou silk damask culture is promoted as much as possible on a global scale and maintains a certain degree of prosperity, cross-border cooperation can be actively sought. For example, in various fields such as home decoration and fashion, modern art, etc., it integrates the cultural elements of the Tang Dynasty of ming dynasty huzhou silk damask, cooperates with well-known brands and designers, and then launches co-branded product series. Through cross-border cooperation, enterprises can expand their market coverage, improve the innovation of their products, and improve the influence of ming dynasty huzhou silk damask culture and the market competitiveness of their products. Secondly, the strategy of sustainable management. The use of sustainable business strategy can ensure the effective use of resources and achieve effective environmental protection at the same time. For example, in the production process, sustainably used materials can be used to meet environmental requirements. At the same time, the concept of circular economy can also be actively promoted, for example, designers should take into account the impact of the life cycle in the design process(Zhao et al., 2021). Sustainable management is not only in line with the global trend of sustainable development, but also conducive to shaping brand image and attracting some environmentally conscious consumers. With this strategy and suggestions, we can better promote traditional handicrafts in the current society, realize the protection and inheritance of ming dynasty huzhou silk damask culture, and expand the future development space of ming dynasty huzhou silk damask culture and traditional handicrafts. All in all, the ming dynasty huzhou silk damask under the huzhou textile culture of virtual and reality will be protected and inherited to a certain extent, showing the culture of the Tang Dynasty

(618~907 AC), the Song Dynasty (961~1279 AC) and the Ming Dynasty (1368~1644 AC).

### 3.3 Dig deep into the cultural heritage of ming dynasty huzhou silk damask

Cultural heritage is the advantage of ming dynasty huzhou silk damask, and it is also the entry point of its inheritance, combined with digital technology to show the charm of ming dynasty huzhou silk damask's culture during the Northern and Southern Dynasties (420~581 AC). Shuanglin City can build a digital museum and regularly carry out silk exhibitions, displaying silk from the Tang Dynasty (618~907 AC), Song Dynasty (961~1279 AC) and Ming Dynasty (1368~1644 AC). A digital museum or online exhibition platform can be established so that people from all over the world can access the ming dynasty huzhou silk damask culture online at any time and any place, so that they can truly appreciate the ming dynasty huzhou silk damask culture, in short, the use of such platforms can allow the audience to obtain a lot of high-definition pictures and videos, tutorials, etc. related to ming dynasty huzhou silk damask, to understand the Tang Dynasty (618~907 AC), the Song Dynasty (961~1279 AC) and the Ming Dynasty (1368~1644). AC) ming dynasty huzhou silk damask production technology, historical background, cultural significance, and conducive to the subsequent development of ming dynasty huzhou silk damask, improve the protection and inheritance of ming dynasty huzhou silk damask culture. Secondly, augmented reality and virtual reality experience enhance Lingjuan's cultural heritage, especially during the Northern and Southern Dynasties (420~581 AC).culture. Through augmented reality and virtual reality technologies, the user can present an immersive experience and feel as if they are in a real historical scene, so that the audience can not only watch the ancient traditional craftsmanship work, but also try to make ming dynasty huzhou silk damask from their own perspective. These experiences are interactive and appealing to the younger generation, so they can be combined with

education and fun to allow many people to experience the joy of traditional handicrafts, increasing their interest in ming dynasty huzhou silk damask culture. In addition, it will increase the younger generation's interest in the combination of ming dynasty huzhou silk damask and digitalization. Educational games and apps. In order for the younger generation to be interested in ming dynasty huzhou silk damask culture, it is necessary to combine it with digitalization. For example, relevant personnel can develop educational games and applications related to ming dynasty huzhou silk damask culture, and integrate the knowledge content of this traditional handicraft into games or applications so as to broaden the horizons of young people and make them gradually interested in the weaving skills of ming dynasty huzhou silk damask in the game. Gamified learning can stimulate young people's curiosity and desire to explore ming dynasty huzhou silk damask culture and improve their awareness of cultural protection, so that young people can be motivated to develop ming dynasty huzhou silk damask culture and encouraged to take action. Second, social media engagement activities. Through social media platforms, online activities related to protecting and developing the cultural heritage of ming dynasty huzhou silk damask Juan culture can be organized. For example, online seminars or work design competitions are held on social media, live teaching, etc., to encourage the younger generation to participate in and share their thoughts on ming dynasty huzhou silk damask culture, and use the huge influence of social media to promote and spread ming dynasty huzhou silk damask culture among the younger generation. In addition, relevant departments and personnel should also attach importance to cross-border cooperation, and actively promote the protection and revival of ming dynasty huzhou silk damask. However, the most important thing is that in the inheritance of ming dynasty huzhou silk damask culture under the huzhou textile culture of virtual and reality,

designers should be able to make good use of digital technology to seriously integrate tradition and modernity so as to realize their own innovative design better, and show these innovative ming dynasty huzhou silk damask products or related elements to the audience in a novel way, so as to improve the public's awareness of ming dynasty huzhou silk damask culture, so as to protect and inherit ming dynasty huzhou silk damask culture. Increase the excavation of cultural heritage, such as the patterns of the Song Dynasty and the Tang Dynasty, the application of effective channels, and other reasons, such as the promotion of ming dynasty huzhou silk damask culture through the story of the Ming Dynasty and the history of the Tang Dynasty. In the face of related challenges, comprehensive measures must be taken to protect and revive the ming dynasty huzhou silk damask culture. For example, strengthen the inheritance of skills, and encourage the younger generation to actively understand the development history of silk in the Northern and Southern Dynasties period (420~581 AC), inherit the culture of ming dynasty huzhou silk damask and some of its skills, actively explore market channels, integrate modern aesthetic needs to design ming dynasty huzhou silk damask products, and innovate the design of them, and provide personalized customized services. In addition, relevant personnel should also strengthen the publicity of ming dynasty huzhou silk damask culture and increase attention to it through online exhibitions and displays.

## Conclusion

As a valuable ancient handicraft product and cultural heritage of the Chinese nation, ming dynasty huzhou silk damask has immeasurable value and significance. The results of this paper show that ming dynasty huzhou silk damask adopts the grass dyeing method, the dye steps are cumbersome, and the production process is complex, which has the potential for the

development of huzhou textile culture. Moreover, the dyeing method adopted by ming dynasty huzhou silk damask is scientific and continuous, the textile technology is exquisite, and the silk produced has the advantages of mechanical balance and heat preservation advantages. By measuring the data of Ayajuan, digital simulation can be carried out to enhance the development potential of Lingjuan, increase the publicity of traditional production processes, and promote the inheritance of Ayajuan culture. At the same time, combined with the modern

market demand, give full play to the advantages of ming dynasty huzhou silk damask, and carry out the inheritance of skills, dyeing, weaving and culture through digital and virtual technology, so as to promote the development of ming dynasty huzhou silk damask intangible cultural heritage. There are also some deficiencies in the research of this paper, mainly because there are few related materials on silk, which will be further improved in the future.

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