

Research on the Innovative Application and Development of Digital Han Opera Costumes

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Abstract:

This study analyzes the innovative application and sustainable development of digitalized Han opera costumes, identifying specific challenges in the digital transformation process. It explores the unique value of digital technology in restoring Han opera costume styles, presenting patterns, and preserving cultural heritage. By comparing the characteristics of modern garment cutting design with traditional flat-cutting techniques for opera costumes, the study proposes improved methods for digitalized Han opera costume processing, providing both theoretical support and practical guidance for the dynamic preservation of Han opera costumes.

Keywords:

Digital Han Opera Costumes, Cultural Dissemination, Living Heritage Transmission

1. Overview of the Current Situation of Han Opera Costumes

As a representative local opera in Hubei Province, after hundreds of years of development, the costume of Han Opera is an important carrier bearing the historical and cultural heritage and artistic value of Han Opera, and it is also the most important material manifestation of Han Opera culture. With the acceleration of social transformation and the rapid development of information technology, the inheritance and development of Han opera costumes have encountered many problems. On the one hand, the traditional hand-made technology takes a long time and the input cost is high, so it can't meet the changing requirements in the market today. On the other hand, due to the lack of cultural identity of the younger generation, the skills are facing the dilemma of being lost. The introduction of digital technology into the field of costumes of Han opera provides a new way to solve these problems. Because the costumes of Han opera are completely different from modern clothes in terms of cutting, it has also become a bottleneck.

2. Application and Innovation of Digital Han Opera Costumes Technology

2.1. Digitalization of Form and Innovative Design

There are various forms of costumes in Han opera, and traditional costumes such as python robes, official robes, and pleated robes contain many cultural connotations. Among them, the python robe belongs to the exclusive clothing of emperors, kings, generals, and ministers. Its prominent feature is that the robe is relatively wide, the cuffs are relatively wide, and it has been carefully embroidered to showcase the identity and meaning of this character. By relying on 3D clothing design software such as Style3D and CLO3D, designers can achieve highly accurate digital reproductions of traditional Han opera costumes. In specific operations, it should be noted that there are significant differences in the cutting methods between Han opera costumes and modern clothing. Modern clothing mostly uses segmented cutting methods, such as collars, front, back, sleeves, etc., which are generally composed of four pieces; However, traditional Chinese opera costumes are often made using the “ten” structure plane cutting method, which is usually done by cutting a single piece. The single cropping mode cannot be directly applied to the model pattern allocation rules of Style3D.

To address the above issues, segmented cutting technology can be used to perform fine cutting processing on the fabrics of opera costumes. Taking Han opera pleats as an example, the structure is first analyzed, and then combined with its unique traditional craftsmanship characteristics such as “slanted collar, wide sleeves, and slits”, precise segmentation is carried out at key points such as neckline, shoulders, and side seams to convert them into basic patterns that meet the needs of modern clothing production, such as front, back, collar, and sleeve patterns. During this period, the traditional shape characteristics of pleats should be fully considered, and the specific dimensions and arc values of each part should be accurately measured to ensure that the segmented basic pattern can fully reproduce the unique temperament of this clothing, which is broad, elegant, and elegant. Import the deconstructed costume component patterns into the Style3D platform and use its provided free sewing tool to perform the white embryo splicing process. This can simulate the real cutting and sewing process, and carefully adjust sewing parameters such as needle spacing density, stitch type, etc. to ensure that the generated virtual white embryo is as close to the actual effect as possible. In order to maintain the visual consistency of the entire garment, the software’s built-in hidden stitch function is used to remove the stitch marks. This way, the digital costume can be completely identical to the traditional physical object in appearance, achieving the goal of accurately reproducing and improving the traditional garment shape in the digital space.

2.2. Digital presentation and interactive experience of patterns

The patterns of Han opera costumes carry rich cultural connotations, serving as both auspicious symbols and important cultural symbols, as well as a manifestation of Han opera art. When designing digitally, first use Procreate drawing software to complete the pattern drawing of each part. Utilize its professional drawing function to accurately depict traditional pattern details such as dragon patterns, phoenix patterns, and seawater river cliff patterns. Taking dragon patterns as an example, using brush tools and layer stacking, the texture of dragon scales, the elegance of dragon whiskers, and the dynamic posture of the dragon body are vividly presented. After the design is

completed, import the DXF format 2D version of the costume produced by the clothing CAD software into the Style3D fitting platform to achieve data sharing and collaborative work.

The Style3D fitting platform relies on digital printing technology to achieve precise pattern printing, and integrates dynamic digital pattern design methods to add light and shadow changes and interactive response functions to the patterns. Taking the Haishui River Cliff Pattern as an example, it is pushed through a program in a virtual scene, changing according to the viewer's perspective, displaying different wave shapes and light effects, greatly enhancing the visual impact. Combined with augmented reality (AR) technology, users only need to scan the pattern images in the virtual representation area to obtain corresponding Han opera video materials using mobile devices, and deeply explore their cultural meanings. Taking bat patterns as an example, the digital display platform will automatically display an interactive interface containing detailed information when scanning devices. This interface will systematically discuss the cultural symbolic significance of bat patterns in Han opera costumes and their specific application scenarios for a certain character, leading the audience to appreciate the cultural connotations of Han opera while enjoying the costumes. This new means of expression not only improves the quality of visual presentation, but also forms an immersive cultural experience place, greatly expanding the scope and social influence of Han opera culture.

2.3. Visualization process and technical realization of costume wearing

The visual design process of costume of Han opera includes many core links, including pattern design, white embryo fitting, fabric improvement, pattern simulation, makeup matching and final virtual presentation. In the preliminary preparation, designers use clothing CAD software to plan the two-dimensional pattern of costume, and then export the results to dxf format files. Designers use Procreate tools to draw patterns of various parts, which will provide technical support for digital processing. At this stage, designers should follow the historical documents and physical samples of Chinese opera costumes in an all-round way to ensure the accuracy of the design of patterns and patterns.

In the core production process, the patterns and designs are imported into the Style3D fitting system for white embryo simulation fitting, so that the overall appearance of the costume can be directly seen. In the virtual environment, preliminary adjustments are made to the pattern structure, and design problems can be immediately detected and corrected. Observing the virtual model wearing the white embryo costume can accurately calibrate key parameters such as sleeve height and length, ensuring that the costume meets both ergonomic and aesthetic standards. Utilize the parameter adjustment function of Style3D fitting tool to improve the design of details such as makeup, headwear, fabric, embroidery, etc. The fabric attribute adjustment module has multiple parameter adjustment functions. For silk materials, key indicators such as glossiness, transparency, and drape coefficient can be finely adjusted to reproduce the true texture characteristics of silk in virtual scenes. In terms of embroidery process parameters, different needle types can be selected, such as flat needle, nested needle, seed needle, etc. Density range and color matching scheme can also be set to improve the accuracy of simulation. After multiple iterations and improvements, the virtual try on effect has finally been achieved, and the entire process of digital design and manufacturing of opera costumes throughout their life cycle has been completed.

This full-process visual production mode relies on a variety of digital tools and technical means, which greatly optimizes the efficiency of the production of traditional Chinese opera costumes. It takes weeks or even months to make traditional Chinese opera costumes by hand. However, after adopting the digital technological process, it takes only one week to finish the virtual fitting from the layout design, which greatly reduces the production time. In the virtual environment, all details and the overall image of the costumes can be displayed in all directions. It has greatly helped the artistic innovation and cultural inheritance of Chinese opera costumes. Designers can quickly spread their works on the network platform by recording virtual try-on videos and dynamically displaying videos.

3. The Value Enhancement of Digital Han Opera Costumes

3.1. Empowering new forms of cultural dissemination

The digital research on Han opera costumes, which relies on digital twin technology, has achieved a comprehensive record and visual display of traditional costume production techniques and cultural connotations. Taking “Kao” as a typical costume as an example, this technology can accurately reproduce its complex structural characteristics and subtle decorative details, and can also deeply explore its symbolic meaning and the function of color patterns reflecting character personalities in Han opera performance art. The public can easily obtain these materials through mobile terminals or online platforms, thus achieving an immersive cultural experience. This new form of dissemination breaks through the constraints of time and space, expands the scope of Han opera costume culture, meets the various needs of audiences in different regions of the world, and further improves the international circulation effect and global identity of Chinese excellent traditional culture.

3.2. Enhance the ability of artistic innovation

Artificial intelligence technology can quickly generate creative schemes with elements of Han opera costumes. Algorithms extract key features and analyze thematic connections, allowing designers to obtain various conceptual sketches in a short period of time, providing more inspiration support for designers and greatly improving the efficiency and originality of artistic creation. With the continuous development of intelligent wearable technology, the cultural significance of Han opera costumes can be integrated into functional design in the future. By developing decorative devices with interactive perception capabilities, traditional costumes can not only have contemporary aesthetic connotations, but also broaden their technological application scope, extending the vitality of traditional culture in contemporary times.

4. Conclusions

Digital Han opera costumes are a model of the integration of traditional culture and modern technology. They not only break through the technical barriers to the inheritance of Han opera costumes, but also broaden their artistic expression and cultural connotations. They meet the current social demand for high-quality cultural products and have broad development prospects.

The fundamental purpose of studying Han opera costumes is to use visualization technology to promote cultural inheritance and dissemination. Its core value lies in the protection and development of cultural heritage. Opera costumes belong to the main

form of traditional theatrical art, and due to their material characteristics, they are easily affected by physical damage, mechanical wear, and material aging. Visualization methods can overcome these limitations, accurately reproduce the original appearance of costumes, and provide strong technological support for the comprehensive preservation and sustainable development of opera costume culture. A systematic digital reconstruction of the form, material, color, pattern, and accessories of Han opera costumes is carried out to create a complete archive management framework, which provides basic data support for the formation of the opera culture database. Digital archiving has the functions of resource integration and collaborative sharing, which can promote design updates, skill improvement, and promote the deep integration and development of traditional culture and modern industries.

The construction of a visual representation, systematic restoration, and long-term preservation mechanism for the wearing system of Han opera costumes has significant cultural heritage value. This not only helps to effectively protect the traditional artistic heritage of Han opera, but also provides new ideas for its modern transformation. By expanding the audience, it can stimulate its internal vitality and promote the sustainable development of Han opera art in today's society.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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