Research on the Application of 3D Virtual Simulation Technology in Fashion Design from the Perspective of Meta Universe

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Abstract: Since the concepts of "virtual fashion" and "meta universe" were introduced in 2018 and 2019, respectively, many designers have taken advantage of these trends to emerge in the field of virtual fashion, injecting new vitality into fashion design in the fashion industry. Compared with traditional fashion design, the use of three-dimensional (3D) virtual simulation technology can effectively reduce the investment cost and improve the efficiency of fashion design. This paper studies the application of 3D virtual simulation technology in fashion design from the perspective of meta universe in order to provide reference for relevant personnel.

Keywords: Meta universe; 3D virtual simulation technology; Fashion design; CLO3D

1. Introduction

With the constant economic and social development, the pursuit of personalized fashion design is increasing, which puts forward new requirements for fashion designers. In order to improve user satisfaction and the efficiency of fashion design, three-dimensional (3D) virtual simulation technology has come into being. Under the background of meta universe, designers will not only save costs, but also make real-time changes and improve the effect of finished clothing by using 3D virtual simulation technology. Therefore, it is crucial to improve the application of 3D virtual simulation technology in fashion design.

2. Overview of three-dimensional virtual simulation technology
2.1. Concept of three-dimensional virtual simulation technology

With 3D virtual simulation, trainees are immersed in a very realistic environment that is specially set for training by using an immersive 3D display system and special gloves equipped with sensors, virtual sound, and touch, which can meet the training requirements of a variety of subjects. 3D virtual simulation uses virtual reality technology to create a "3D virtual reality," which can help save costs and achieve the effect of human operation. In fashion design, 3D virtual simulation technology is used to display virtual clothing products [1]. Designers can use 3D virtual simulation technology to experience the effect of fashion design and modify it, lift the limitations of paper, brushes, and pigments in traditional design, as well as frame the fashion design process in such a way that is more convenient for designers.

2.2. Features of three-dimensional virtual simulation technology

3D virtual simulation technology has strong interactivity, immersion, and simulation [2]. In the process of fashion design, designers can effectively control the virtual environment. Through the human-computer interaction feedback mechanism, users can use virtual fitting technology to experience "real fitting." At the same time, 3D virtual simulation technology enables users to design and observe clothes based on how they feel when trying on those clothes virtually, provides valuable reference for fashion designers, and improves users' sense of participation in design. In addition, through 3D virtual simulation technology, users can experience the real world, even more realistic than the real world itself.

3. Advantages of three-dimensional virtual simulation technology
3.1. Display the clothing effect in an all-round way

3D virtual simulation technology can display the clothing effect in an all-round and intuitive way, which is conducive to designers in identifying the problems and modifying them in time [3]. 3D virtual simulation technology has diversified the display methods. Users can utilize computer systems to view the finished products. With 3D virtual simulation technology, users can observe the color, style, pattern, and other aspects of the clothing. Through dynamic display, users can also observe the fabric texture, drape, and other features of the clothing, which helps users provide targeted and valuable feedback.

3.2. Accurately simulate the texture of different fabrics

A fabric database must be established in 3D virtual simulation technology. There must be a variety of fabrics in this database so as to provide inspiration to designers. With this database, 3D virtual simulation technology can accurately simulate the texture and drapability of different fabrics [4]. Designers can extract and use all kinds of fabrics by using the fabric database in 3D virtual simulation technology and carry out ironing, pattern design, *etc*. according to user needs. In addition, through dynamic display, users can intuitively observe the texture of certain clothing fabrics when the virtual characters are walking. This is conducive to users' selection.

3.3. Improve the convenience of fashion design

3D virtual simulation technology brings great convenience to fashion design and improves the practicability of fashion design [5]. 3D virtual simulation technology relies on the development of information technology. Its professional information system can be easily installed and carried. Designers can design, display, and generate clothing in computer software, which greatly reduces the time spent in designing and improves the production efficiency of fashion design. In addition, 3D virtual simulation design can realize the switch between two-dimensional (2D) and 3D, which can in turn help designers realize the structural design of fashion design and improve work efficiency.

3.4. Reduce the cost of fashion design

By using 3D virtual simulation technology, designers can save a lot of costs and improve the economic benefits for fashion design enterprises [6]. By means of information technology, designers can display and modify their designs in a 3D virtual software system, which greatly reduces the input of human, material, and other resources from fashion design enterprises and is conducive to reducing the cost of fashion design. In addition, through 3D virtual simulation technology, fashion designers can design clothing that is more in line with the public's aesthetic and needs and eliminate mediocre fashion in a timely manner. This is conducive to reducing the production cost of fashion design enterprises, improving production efficiency, and improving the economic benefits of enterprises.

4. Shortcomings of three-dimensional virtual simulation technology

4.1. Inaccurate three-dimensional measurement data

Since 3D virtual simulation technology designs and produces in a refined manner, it requires highly accurate data. However, there are still flaws in the accuracy of 3D measurement data at this stage. On the one hand, during data measurement, the subject is required to wear only their underwear or temple garment for measurement, which unacceptable to the measurer [7]. Influenced by values, people tend to emphasize on privacy and security at this stage, so the 3D measurement data method may not be acceptable to most people, thereby   affecting data collection to a certain extent and resulting in the inconsistency between fashion design and human model. On the other hand, the data processing ability of the system will also affect the accuracy of 3D measurement data to a certain extent.

4.2. Repetition of dress pattern

Although 3D virtual simulation technology is able to design clothes that meet the needs and aesthetics of the public, the problem of repeated clothing patterns persists due to the limitations of technical means. For example, in CLO3D software, when clothing patterns are added to clothing pieces, duplication occurs [8]. The reason for this is that designers have insufficient control over the color, graphic size, and other aspects of the 3D virtual software; in addition, some designers need to improve their professional quality. In the actual fashion design process, the designers lack familiarity with information technology, thus resulting in unskilled software application.

4.3. Failure to display exaggerated clothing

Although 3D virtual simulation technology can realize the conversion of two-dimensional patterns, in the actual application process, it can only design and modify simple styles. It is incapable of displaying exaggerated clothing. On the one hand, it is already difficult for three-dimensional digitization to achieve the design of exaggerated clothing, what more to achieve its full display. On the other hand, at this stage, the realization of 2D and 3D integration is poor, and there is no effective integration between hardware and software, thus making it difficult to complete the integration process and eventually making 3D virtual simulation technology lose its due significance.

5. Application of three-dimensional virtual simulation technology in fashion design from the perspective of meta universe: Pure Love Simulation System

Pure Love Simulation System is a 3D simulation software system for clothing. This system can combine the functions of clothing CAD patterns, digital mannequins, fabric material mechanics, three-dimensional visual rendering technology, and so on to achieve efficient fashion design and research and development (R&D) process.

5.1. Three-dimensional volume data acquisition

The 3D virtual simulation software contains the model's parameter information [9]. Taking Pure Love Simulation System as an example, life-like and complete human models can be built through the use of 3D body measurement technology and virtual reality technology offered by the system. In the software, the model's parameter information includes the model's skin color, height, size, *etc*. Designers can select the parameter according to user needs to build different models. This will effectively improve users' wear experience and improve the enterprises' R&D and production efficiency [10].

5.2. Establishment of a fabric database

With the constant development of technology, fashion design enterprises can rely on information

technology to establish a fabric database, providing rich fabric resources for designing. Realtime Technology fabric scanner has high processing efficiency and can meet the fabric collection needs of garment customization enterprises, textile enterprises, *etc*. [11]. This fabric scanner can automatically identify and sort out the texture, material, and pattern of fabrics as well as record them in the fabric database to provide designers with systematic fabric information. At the same time, the fabric materials collected through this fabric scanner are similar to real fabric in terms of material and texture. This is conducive to the designers' display of finished products [12].

5.3. Virtual fitting and pattern adjustment

In the 3D virtual simulation software, the virtual fitting system provides users a close-to-the-real experience of fitting, which is convenient for designers to adjust patterns. Designers can use virtual models to elicit the effect of sample clothing [13]. Taking Pure Love Simulation System as an example, designers can use the virtual reality technology and the virtual simulation model in this system to remotely measure and virtually sew clothes for users and to elicit the trial wear effect, respectively, so as to meet the customization needs of users [14]. Users can also provide their feedback according to the trial wear effect and further improve the design level, so that designers can design fashionable clothes that meet the needs of users [15].

5.4. Modification and multi-dimensional dynamic display

After completing the design, designers can use the virtual simulation system to modify the clothing and display it dynamically [16]. Taking Pure Love Simulation System as an example, this system uses 3D virtual reality technology to synthesize clothes and display three-dimensional clothes at any angle. It allows designers to modify them with relevant tools according to the clothing effect [17]. Through multi-dimensional dynamic display, designers can comprehensively and stereoscopically grasp relevant information of ready-to-wear fashion from different angles. With the help of virtual reality technology, designers can fully mobilize their vision, touch, hearing, *etc*. This allows designers to better modify ready-to-wear fashion and is conducive to stimulating their sense of participation as well as improving the efficiency of fashion design [18].

6. Conclusion

With the application of 3D virtual simulation technology, the fashion design industry has ushered in a new development momentum, which has played an effective supporting role in fashion design and structure design, and greatly promoted the development of the industry [19]. However, the development of 3D virtual simulation technology is relatively late at this stage, with certain deficiencies in fashion design. Therefore, the connotation and characteristics of 3D virtual simulation technology should be clarified and linked with fashion design, the quality of fashion design should be improved, and the development of 3D integration and fashion design enterprises should be promoted [20].

Disclosure statement

The author declares no conflict of interest.

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