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SEMIOTIC APPROACH TO DIGITAL FASHION: VIRTUAL CLOTHING DESIGN BASED ON CHINESE MYTHOLOGY

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Abstract. ***Purpose.*** *Analyze the artistic and aesthetic characteristics of the characters from Chinese mythology's "Twelve Flower Gods" and offer modern design solutions for digital clothing in a Chinese style.*

Methodology. *Theoretical and practical research methods have been used, including analyzing scientific and popular literature on the topic, as well as applying a semiotic approach to create a modern product design that reflects elements of Chinese mythology. By studying cultural heritage and the elements of Chinese mythology, we will propose stylized design solutions based on evolving pattern forms. The work uses software: for creating visualization of digital clothing CLO 3D, for creating accessories Nomad, Blender. To interact with augmented reality, the professional AR technology platform ZERO 10 and Kivicube are used.*

Results. *Inspired by the "Twelve Flower Gods" and using flowers as a source of inspiration, innovative digital clothing designs have been created, as well as corresponding scenes have been modeled. Each piece of clothing, through its shape, color, texture, and composition, reveals a corresponding story associated with each Flower God. Virtual clothing collections have been developed that reflect the traditional Chinese style in innovative digital design products.*

Scientific novelty*. This is the first time a semiotic approach has been applied to create modern digital clothing design that reflects the text of Chinese mythology. The practical results of virtual fashion design have been summarized.*

Practical relevance*. The results demonstrate the potential of virtual fashion design in incorporating traditional ancient mythological elements into contemporary fashion and enable us to implement a virtual fashion design concept based on the imagery of the "Twelve Flower Gods". Models of digital garments with the ability to virtually dress on a consumer's body have been created. These models can be utilized to further explore digital fashion design and develop future style trends.*

Keywords: *Chinese culture, cultural heritage, fashion design, digital fashion, Chinese mythology, virtual wearable clothing, augmented reality, computer graphic, semiotics.*

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INTRODUCTION

In the field of fashion design, all design works often carry a certain "brand" of historical culture, production and life knowledge, and specific concepts. These "brands" are condensed in specific fashion phenomena through unique aesthetic expressions, modeling elements, and design concepts. Due to their relative reproducibility and stability, they gradually form values or humanistic spirits that can be inherited and developed in the continuation of time and space. These inherent cultural marks have a profound impact on the style and trend of fashion design, and have become an indispensable core element in design works over time. Therefore, these cultural marks in fashion design are called "cultural genes". They not only carry the spiritual world of mankind, but also influence and promote the development and evolution of fashion design in the context of globalization.

"Gene" was originally an important concept in biological genetics, referring to a DNA fragment with genetic effects. "Gene" in the biological sense plays a core role in supporting the basic structure and performance of organisms.

ANALYSIS OF RECENT RESEARCH

The Selfish Gene [5] introduced the concept of "gene" and first proposed the concept of "meme", the basic unit of cultural genes. Although it mainly involves biology, its cultural communication theory is inspiring for understanding how cultural genes are expressed in design. The Origin and Evolution of Cultures [2] explored the mechanism of cultural evolution, including the way cultural genes are spread in different societies and cultures, which has important reference value for understanding the inheritance and innovation of cultural genes in design. The Book Meme Machine [1] further expanded the theory of cultural genes (memes) and analyzed how they play a role in cultural communication and innovation.

Fashion design is a form of cultural expression that can be influenced by various factors, including genes. Gene extraction from specific cultural backgrounds, such as the Nanjing Yunjin culture, can be applied in fashion design to create unique and innovative pieces [12]. The characteristics of Chinese social and cultural values can impact fashion design transformation, emphasizing the importance of understanding cultural genes in the design process. Overall, the relationship between fashion design and culture genes is complex and multifaceted, with various influences shaping the creative process and resulting in unique and culturally significant designs. By exploring these connections, designers can create innovative and meaningful fashion pieces that reflect the rich tapestry of cultural heritage

The main focus of this study is to explore how oriental cultural themes from myths and legends can be translated into virtual fashion design using digital technology. The goal is to integrate and innovate culture and design with oriental aesthetics as the central theme. By visually interpreting Chinese myths and legends and dynamically expressing virtual fashion, the study aims to promote the digital preservation of cultural themes and expand oriental cultural aesthetics into the global virtual fashion realm. The significance of the study lies in two main areas: 1. Cultural preservation and innovation: This study aims to digitally transform traditional cultural themes and incorporate ancient myths and legends into digital design language through virtual fashion, preserving the essence of traditional culture while also reconstructing cultural themes in contemporary ways. 2. Application of digital technology in design: By combining digital technology (such as 3D modeling, virtual reality, augmented reality, etc.) with cultural themes and oriental aesthetics, the study aims to promote the use of virtual fashion design in digital art and technology, expanding the expressive form and cultural significance of virtual fashion.

The cultural gene theory is widely utilized in the field of design. It allows for the preservation and adaptation of cultural heritage into modern contexts, incorporating traditional design shapes, ideas, and concepts. Research on cultural gene theory in design demonstrates its ability to safeguard cultural heritage while fostering innovation in various fields [10] introduced a framework that integrates traditional cultural elements such as patterns, materials, and symbols into creative product design, enabling designers to uphold cultural identity while cultivating new ideas. Han et al. [8] further implemented this concept by creating a database of cultural gene characteristics for cultural relics, ensuring that traditional designs can be innovatively reimagined.

Chiou and Wang [3] used genetic algorithms in cultural brand design, combining cultural gene theory with optimization techniques to enhance customer engagement and commercial success. Yan et al. [16] used cultural algorithms in electronics design to improve efficiency and innovation by incorporating cultural knowledge into evolutionary models. These studies show that cultural gene theory can be applied to many fields, offering new ways to preserve cultural heritage and promote personalized, intelligent

design. The article by Gao and Yezhova [6] analyzes examples of the use of traditional Chinese imagery in modern fashion design.

Research in the field of digital fashion is a focus of modern scientists. The article by Yezhova et al. [18] provides a definition of digital fashion and identifies the main areas of research in this field. The review identifies various technologies used in digital fashion design, such as artificial intelligence, 3D printing, wearable electronics, and virtual and augmented reality. Some research are devoted to the use of digital technologies in modern fashion: the design of digital mannequins [17], the use of digital technologies in the training of fashion design and technology specialists [9].

The significance of digital fashion has been widely discussed in recent research. Ha Luong et al. [7] found that the metaverse has emerged as a new platform for digital fashion, enabling consumer engagement through virtual clothing and digital collectibles. The study identified six main themes in consumer discourse, including spending resistance, excitement, and low-value perception, indicating that virtual clothing operates within a complex sign system, where material absence is compensated by symbolic presence.

In the context of affective and aesthetic dimensions, Crepax and Liu [4] explored the role of emotions and bodily experiences in digital fashion consumption. Their study emphasized that augmented reality (AR) and digital fashion experiences enhance user engagement by extending garments beyond their visual form, aligning with semiotic theories of fashion, which define clothing as a medium of communication and identity construction.

From a consumer behavior perspective, Lin et al. [11] found that interactivity, aesthetics, and creativity significantly influence the adoption of virtual clothing.

Technological advancements, particularly in artificial intelligence (AI)-driven design, have further transformed digital fashion. Zhang and Liu [19] investigated the use of AI-based image generation systems, such as Midjourney, in fashion design and e-commerce.

Another critical area of research is virtual fitting technology, which enables consumers to experience digital fashion in immersive environments. Zhang et al. [20] analyzed virtual fitting applications using the Kano model and Quality Function Deployment (QFD) method to assess user demands. They also identified personalized avatars and realistic digital fabric rendering as top priorities for enhancing virtual fitting technologies.

An additional technological advancement influencing digital fashion is 3D printing, which has emerged as a tool for creative expression in fashion and textile design. Tolmaç and Ismal [13] explored the potential of 3D printing as an aesthetic language, demonstrating how flexible printed structures can be integrated into garment design.

PURPOSE

This article analyzes the artistic aesthetic characteristics influenced by cultural genes in digital fashion design, taking the "Twelve Flower Gods" of Chinese mythology as the source of inspiration and flowers as the main element, innovative digital fashion designs are carried out for clothing, modeling, scenes, etc., showing the traditional Chinese connotation and digital innovation with virtual wearable clothing.

RESULTS AND DISCUSSION

The Twelve Flower Gods are not only symbols of flowers, but also incorporate the aesthetic tastes and life philosophy of ancient Chinese literati [14]. "The Twelve Flower Gods" is a traditional Chinese cultural story that represents the seasonal flowers in the twelfth month of the lunar calendar. It includes personification and mythological elements.

According to legend, the twelfth day of the second lunar month is the birthday of all flowers, known as the Flower Festival. On this day, people hold a grand Flower Festival, also called the "Flower God Festival". Flowers are seen as the embodiment of the beauty of heaven and earth. The term "flower gods" is used in Eastern culture, while the West uses the term "flower fairies". Flowers give people different temperaments and beauty depending on the season and terrain.

The twelve flower gods are the plum blossom god, apricot blossom god, pear blossom god, peony flower god, pomegranate flower god, lotus flower god, crabapple flower god, osmanthus flower god, chrysanthemum flower god, hibiscus flower god, camellia flower god, and narcissus flower god. These gods are not ordinary fairies; they are transformed from various beautiful flowers. Their mission is to spread pollen in the human world during specific seasons so people can feel the breath of the season.

As a new high-end national-style brand, Jinshang Yuyi uses clothing to communicate truths and tell stories through national-style attire (Fig.1). Its goal is to preserve and innovate various intangible cultural heritage skills by creatively combining traditional Chinese elements with current global trends. In terms of design,

Fig. 1. Guangdong Fashion Week Chinese style high-end custom brand "Jin Shang Yu Yi " press conference (China, 2023, Cong Yu)

the designer uses fabrics of different levels and textures to embody the oriental color aesthetics of reality and illusion, light and darkness. In four chapters of spring, summer, autumn and winter, the Twelve Flower Gods series are presented one by one, telling a magnificent and wonderful Chinese mythological story.

In digital fashion design, the concept of the Twelve Flower Gods can be used as a source of inspiration, and designers can incorporate flower god elements of different months into clothing design. For example, designers can design a digital fashion for each month, using augmented reality technology to combine the image of the flower god with virtual clothing to create a unique visual experience. Each piece of clothing not only shows the beauty of flowers, but also conveys the cultural story behind it and the meaning of the season.

The clothing for the twelve flower gods is inspired by the flower elements associated with each god, such as lotus, plum blossom, and chrysanthemum. These elements can be directly used as clothing patterns and design inspiration. The flowers representing each god typically correspond to specific colors and patterns. Designers can incorporate these colors and patterns to create clothing with an oriental charm that reflects the changing seasons and the beauty of nature.

The designer developed a virtual costume series based on the "Twelve Flower Gods," incorporating their cultural elements. The series used illustration techniques to depict the unique features, temperaments, and myths associated with each flower. The modeling and clothing styles reflected the distinct characteristics of each flower, with a color palette based on the primary hue of each flower. The designs ranged from vibrant and eye-catching to gentle and refined, with linework emphasizing coherence and rhythm. Traditional Chinese character features were incorporated into the character images to preserve cultural continuity. This project was created by Yaning Li, a student of the bachelor's Digital Media Art at Beijing Technology and Business University, under the scientific supervision of Simiao Wu (Fig. 2, Fig. 3).

The various applications of the mythological elements of the "Twelve Flower Gods" in modern clothing are not only very attractive in visual design, but also successfully enhance the cultural value and market influence of brands and products through the integration of cultural connotations and the application of technical means. This design uses the extracted cultural elements for clothing design, combines the characteristics of traditional clothing with modern fashion elements, highlights the elements of "flowers", and forms a unique virtual clothing series. Fig. 4 shows the pomegranate flower god design project of a digital fashion design made by the student of the bachelor's Digital Media Art at Beijing Technology and Business University Xini Li, scientific supervisor of the project is Simiao Wu.

Virtual clothing use Augmented reality technology allows consumers to try on these floral-themed clothing in a virtual environment through smart devices, see the effects of different floral patterns and design elements, and deepen the shopping experience. Digital technology could create various effects in contemporary Chinese style digital fashion design. This allows designers to create new and innovative plans that incorporate traditional Chinese elements in a modern way [15]. Digital artists and fashion designers can create unique digital clothing based on the "Twelve Floral Gods" elements and trade them as NFTs (non-fungible tokens), providing dual value of collection and

Fig. 2. Visual design of "Twelve Flower Gods", (China, 2024, Yaning Li)

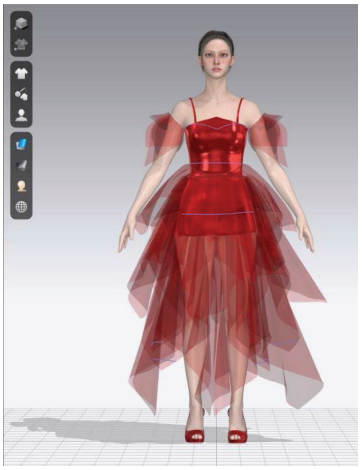
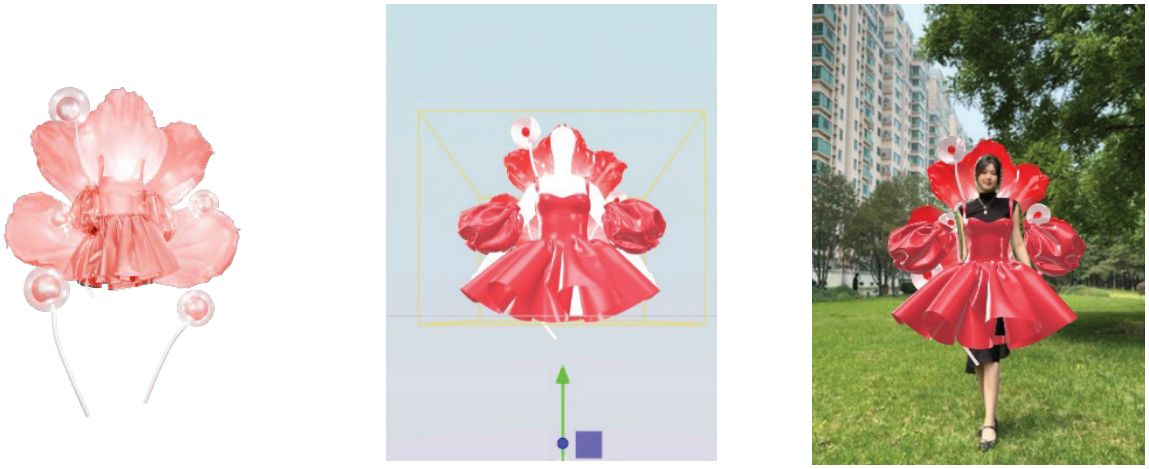


Fig. 3. Virtual clothing production scene, (China, 2024, Yaning Li)



a *b* *c*

Fig. 4. Examples of Virtual fashion design of the pomegranate flower god (China, 2024, Xini Li): a – Virtual Clothing Modeling; b – AR platform effect; c – Actual try-on effect

use. Fig. 5 shows the Clothing details of the design project made by the student of the bachelor's Digital Media Art at Beijing Technology and Business University Xini Li, scientific supervisor of the project is Simiao Wu.

Digital fashion design has the characteristics of reproduction, interpretation, and experience. Based on the design characteristics driven by these unique technologies, we can further elaborate on the formation of contemporary Chinese-style fashion design characteristics [15]. Taking the "Twelve Flower Gods" as inspiration and flowers as the main elements, innovative digital fashion designs are carried out for clothing, modeling, scenes, etc., and virtual wearable clothing is used to show the traditional Chinese connotation and digital innovation.

Designers can also further explore the legends and myths based on the "Twelve Flower Gods," construct in-depth cultural narratives, and deliver them through digital media and social platforms, create brands, and leverage cultural connotations and consumers' emotional resonance to carry out digital clothing and brand virtual design projects.

CONCLUSIONS

This paper focuses on the development trend of virtual fashion design and the significance of cultural influences in design. It explores the use of Chinese Twelve Flower Gods Mythology as a source of inspiration for virtual fashion design. By integrating Chinese cultural elements and mythological motifs, the aim is to preserve and promote traditional culture while showcasing it to a global audience.

The paper provides detailed examples of how 3D modeling and digital technology can

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Fig. 5. Examples of Clothing details of the "Twelve Flower Gods" series (China, 2024, Xini Li)

be used to express characters, scenes, and artistic concepts from oriental myths and legends in virtual fashion design. It also suggests that designers can combine these elements with concepts from other cultures to create fashion works that blend traditional, modern, Eastern, and Western characteristics. The digital application of these design elements is seen as a way to attract global interest and increase awareness of Chinese culture, leading to a mutually beneficial impact in terms of commercial value and cultural exchange.

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АНОТАЦІЯ

У Симяо, Єжова О. Семіотичний підхід у дизайні цифрового одягу: дизайн віртуального одягу, створений за китайською міфологією

Мета. *Проаналізувати художньо-естетичні характеристики персонажів китайської міфології «Дванадцять богів-квітів» та запропонувати сучасні дизайнерські рішення в дизайні цифрового одягу в китайському стилі.*

Методологія*. Були використані теоретичні та практичні методи дослідження: аналіз наукової та популярної літератури за темою дослідження, а також семіотичний підхід до створення сучасного дизайн продукту, який відображає відповідний текст китайської міфології. На основі вивчення культурної спадщини та елементів китайської міфології запропоновано стилізовані дизайнерські рішення, засновані на еволюції форм візерунків. У роботі використано програмне забезпечення: для створення візуалізації цифрового одягу CLO 3D, для створення аксесуарів Nomad, Blender. Для взаємодії з доповненою реальністю використано професійні платформи AR-технологій ZERO 10, Kivicube.*

Результати*. Надихаючись «Дванадцятьма богами-квітами» і використовуючи квіти в якості джерела натхнення, розроблено інноваційні цифрові дизайни одягу, а також змодельовано відповідні сцени. Кожна модель одягу через свою форму, колір, текстуру та засоби композиції розкриває відповідну історію, пов'язану з кожним богом-квіткою. Розроблені колекції віртуального одягу, які відображають традиційний китайський стиль в цифрових інноваційних продуктах дизайну.*

Наукова новизна*. Вперше застосовано семіотичний підхід для створення дизайну сучасного цифрового одягу, який відображає відповідний текст китайської міфології. Узагальнено практичні результати віртуального дизайну одягу.*

Практична значущість. *Результати відображають потенціал віртуального дизайну одягу в інтеграції традиційних стародавніх міфологічних елементів у сучасну моду і дозволяють реалізувати схему віртуального дизайну одягу, засновану на образі «Дванадцяти богів-квітів». Розроблені моделі цифрового одягу з можливістю віртуального одягання на фігуру споживача. Вони можуть бути використані для подальшого вивчення цифрового дизайну одягу та розробки стильових характеристик майбутнього.*

Ключові слова: китайська культура, культурна спадщина, дизайн одягу, китайська міфологія, віртуальний одяг, цифрова мода, доповнена реальність, комп'ютерна графіка, семіотичний підхід.

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