

The Cultural Sustainability of Fashion: Application of Cultural Appreciation and Technological Development in Archival Repositories

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ABSTRACT

Archives are increasingly digitized, preserving a wide array of items, including those related to Western fashion designers inspired by Chinese culture. However, understanding the production processes and the designers' expression of cultural appreciation through fashion mediums within these archives presents challenges due to historical and preservation reasons. This issue also touches upon the delicate balance between cultural appreciation and cultural appropriation. This study aims to promote cultural understanding and the cultural identity embedded in clothing design. It explores how digital technologies, such as 3D printing and AI, can significantly reduce energy consumption and waste in the material development and manufacturing processes of fashion design. This is achieved by analyzing and summarizing the framework of Chinese-style clothing symbolism, which helps individuals unfamiliar with this cultural background to understand specific regional cultural symbols used in fashion design from a cultural appreciation perspective. Furthermore, it serves as a valuable reference for designers seeking inspiration from Chinese culture. The research utilizes the application of fashion design involving Chinese culture in the Gianfranco Ferré Research Center (GFRC) at Politecnico di Milano as a case study. This digital virtual space narrates the source of inspiration behind fashion design, exploring the stylistic codes and cultural influences of Asian culture within the Gianfranco Ferré archive to reconstruct the culturally sustainable iconographic apparatus linked to these stylistic codes.

Keywords: Fashion design; cultural sustainability; digital technology; cultural appreciation; cultural heritage; Fashion Archive

1. INTRODUCTION

The United Nations Educational, Scientific, and Cultural Organization (UNESCO) emphasizes the crucial role of culture in driving development, with far-reaching social, economic, and environmental implications [1]. In the book, culture is articulated as fundamental to sustainable development, embodying a community's identity and bridging environmental conservation, economic growth, and social equity. [2]. UNESCO's Universal Declaration on Cultural Diversity in 2001 underscored cultural diversity as a cornerstone of sustainable development [3]. Meireis and Ripp defines cultural sustainability as systems that foster diversity, including strategies to preserve cultural heritage and practices [4]. Digital technology, particularly advanced 3D technologies, offers a strategic approach to preserving cultural heritage, which is essential for sustainable development [5]. This research investigates the application of Reverse Engineering (RE) methodologies to uncover implicit Chinese cultural symbolic features within fashion archives, thereby facilitating the sustainable sharing and generation of knowledge through digital technologies [6].

This study delves into how digital technologies, such as 3D printing and Artificial Intelligence (AI), can significantly reduce energy consumption and waste in the material development and manufacturing processes of fashion design. We will present case studies illustrating the sustainable integration of Chinese elements in fashion, utilizing sustainable materials and processes, and analyze their impact on consumer perception and acceptance of sustainable fashion. The discussion will extend to circular economy principles in fashion design, exploring how

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design practices can promote material recycling and extend product lifecycles. Empirical research will demonstrate the effectiveness of digital technologies in actual fashion design projects, focusing on their contribution to more sustainable design practices. Specifically, we will explore how AI, through machine learning algorithms, can optimize design processes to minimize resource waste, a key area of interest for this study.

2. RELATED WORK

This section explores the intersection of cultural appreciation and cultural appropriation within the fashion industry, with a particular focus on how Western designers have engaged with and applied Eastern culture. Subsequently, we delve into Gianfranco Ferré's unique appreciation and understanding of Chinese culture as a prominent Western designer.

2.1 Cultural Appreciation and Cultural Appropriation in Fashion

Boïa-Moisin posits that cultural sustainability in the fashion and textile sectors involves supporting and disseminating knowledge of traditional know-how, competencies, and skills across generations [7]. Concurrently, cultural sustainability in fashion necessitates addressing the historical context of cultural appropriation [8]. Culture is inherently dynamic, meant to be lived and learned. While cultural appropriation may be unavoidable to some extent [9], the Cambridge Dictionary defines it as “the act of taking or using things from a culture that is not your own, especially without showing that you understand and respect this culture” [10]. Cultural appropriation is an umbrella term encompassing various degrees of borrowing, from mere inspiration to outright theft [11]. In contemporary fashion, numerous Western designers draw significant inspiration from Eastern cultures, particularly China. However, if these cultural elements are presented inappropriately, such actions can be construed as cultural appropriation. The primary reason these behaviors are not considered cultural appreciation is often the failure of fashion brands to acknowledge the origin of the cultural elements or to utilize them with adequate understanding and respect. Individuals' cultural backgrounds profoundly influence their perceptions and interpretations of visual information [12]. Consequently, designers with a Western cultural background are influenced by their own cultural context when selecting and interpreting images. Fashion designers are expected to approach design from a perspective of cultural appreciation, thereby effectively conveying the culture and history of a specific region.

2.2 Gianfranco Ferré's Appreciation of Chinese Culture

Gianfranco Ferré is recognized as a pivotal figure in elevating Italian fashion and the “Made in Italy” concept to global prominence [13]. His architectural background, acquired from his studies at Politecnico di Milano in 1963, profoundly shaped his approach to fashion design, earning him the moniker “fashion architect”. In 1978, he established Gianfranco Ferré Spa, which subsequently expanded into men's and women's fashion, accessories, fragrances, ready-to-wear, and couture, further solidifying his international influence. In 1993 and 2001, Ferré visited China to participate in significant international fashion events, including Chic 93, the China International Fair for investment and trade in Beijing, and the Shanghai International Fashion Culture Festival. These cross-cultural experiences enabled Ferré to appreciate and understand Chinese cultural values, particularly its simple and elemental forms, Eastern teachings, and Zen philosophy [14]. Furthermore, Tao, a fundamental belief in Chinese philosophy, also influenced some of Ferré's fashion creations, reflecting his deep appreciation for Chinese culture. Ferré also held distinct views on the use of color, considering it a fundamental tool for connecting diverse cultures and all forms of human expression [15]. Color, when combined with social systems, customs, and ideologies, acquires profound meanings [16]. Based on Ferré's appreciation and understanding of Chinese culture and his innovative use of color, his fashion designs serve as a testament to his admiration for Chinese culture. However, the current archive does not fully articulate the specific objects or philosophical underpinnings behind garments inspired by Chinese culture. To address this, researchers have leveraged digital technology to present this content to visitors. This interactive approach not only enhances understanding of the cultural values Ferré aimed to convey through his garments but also keeps the audience engaged and informed about the cultural heritage of the specific region.

3. METHODOLOGY AND SYSTEM DESIGN

This research employs a symbolic framework derived from Peirce's [17] triadic model to systematically explore the cultural identity embedded within Western clothing design. This framework is specifically utilized to analyze Chinese style in the fashion domain from seven distinct perspectives: Apparel, Detail, Accessory, Color, Patterns, Manufacturing, and Textile. By integrating these perspectives with the concept of "Chinese style clothing symbolism—Cultural identity indicators in the fashion field", the study aims to conduct a specific analysis of the expression of Chinese style within clothing symbolism and subsequently organize these findings into a coherent theoretical framework.

Field research conducted at the Gianfranco Ferré Research Center (GFRC) involved a meticulous and comprehensive analysis of garments inspired by Chinese culture, sourced directly from the archives. The GFRC, established in December 2021 at Politecnico di Milano, is dedicated to fostering digital innovation within the creative and cultural industries. It serves as a vital repository for preserving the tangible and intangible heritage associated with fashion's history, culture, and technology, thereby providing an invaluable resource for extensive research and exploration. This section further elaborates on how digital technologies are fundamentally transforming the fashion industry, with a particular emphasis on their application in sustainable fashion design. The study examines the use of advanced 3D scanning and virtual reality technologies to digitize physical garments. This digitization process enables a more sustainable design workflow by significantly reducing the necessity for physical samples and prototypes, aligning directly with the principles of a circular economy that advocate for waste reduction and the promotion of material reuse and recycling [18].

For the purpose of this study, three specific Ferré fashion designs, each demonstrably inspired by Chinese culture, were carefully selected for transformation from physical artifacts into digital exhibits. These included a coat, a skirt, and a belt. The original design thinking behind these Ready-to-Wear (RTW) Fall/Winter 1990 garments was meticulously re-contextualized and brought to life through the application of Augmented Reality (AR) technologies, Web-delivered Virtual Museums (VMs), and sophisticated 3D modeling techniques. A key innovation highlighted in this research is the creation of a dynamic virtual space where these physical garments were digitally scanned and then presented alongside an accompanying video narration that elucidates the inspirational narrative behind each fashion design. This integrated approach is designed not only to capture the visitor's attention but also to provide a comprehensive and nuanced understanding of the cultural identity inherent in these garments, thereby making a significant contribution to the broader preservation of cultural heritage [19].

Furthermore, the methodology incorporates an in-depth appreciation of case studies focusing on the application of Chinese style by Western designers. Scarfidi's assertion that liberal conceptions of commodity and property often treat appreciation and appropriation not as distinct entities but as a complex admixture [20] is considered. According to Gracyk, appreciation is typically understood as mere "exploration", implying that appreciation explores whatever is present [21]. This section delves into a series of case studies involving Western designers who have drawn inspiration from Chinese culture for their clothing designs. The selected design cases specifically highlight instances where Western designers have utilized clothing as a medium not only to demonstrate their appreciation for Chinese culture but also to actively promote this appreciation to a wider audience. These designers, having effectively articulated their understanding and appreciation of Chinese culture or its deeper philosophical connotations, have subsequently influenced cultural appreciation through their fashion creations.

To provide a comprehensive analysis, two distinct time periods were chosen for an in-depth examination of Western fashion designers' appreciation of Chinese culture: the "Post-Mao Era" and the "21st Century". A critical distinction exists between designers who matured in the 1970s and 1980s, a period when China remained largely isolated from international interaction, and those born during or after the 1980s, who grew up in a globalized and diversified world characterized by rapid communication and the emergence of an "internet village" [22]. China has undergone profound transformations from the 1980s to the 21st century. Chinese individuals born after the Post-Mao era inhabit a globalized and interconnected world, where rapid exchanges have fostered a "cyber-village". Tusi notes that traditional Chinese clothing maintained a flat form until the introduction of Western cutting technology in the mid-to-late 1800s. The evolution of the Qipao, from a long, loose-fitting robe to a body-hugging sheath, serves as a compelling illustration of the implications of this technical transition. In our global and diverse world, Eastern clothing forms have been significantly influenced by Western tailoring techniques, as evidenced by the Qipao's adaptation. Concurrently, Eastern symbols and cultures have exerted a

reciprocal influence on Western designers in their fashion creations. Between 1978 and the 21st century, numerous renowned Western designers drew inspiration from Chinese culture for their fashion products. For this study, eight highly influential and respected fashion designers—Gianfranco Ferré, Giorgio Armani, John Galliano, Marc Jacobs, Mario Prada, Miuccia Prada, Valentino Garavani, and Yves Saint Laurent—were selected. Their fashion products inspired by Eastern Chinese culture were chosen as design samples, and the elements representing the “Chinese style” within these products were meticulously analyzed.

4. EXPERIMENTS AND RESULTS

The experimental phase of this research is centered on the analysis of fashion archives and the application of digital technologies to enhance the understanding of cultural sustainability. The experiment is twofold: firstly, a qualitative analysis of fashion designs from prominent Western designers who have drawn inspiration from Chinese culture; and secondly, a practical implementation of digital technologies to create a virtual exhibition of selected garments from the Gianfranco Ferré Research Center (GFRC).

4.1 Case Study Selection and Analysis

As outlined in the methodology, a case study approach was adopted, focusing on eight influential Western fashion designers: Gianfranco Ferré, Giorgio Armani, John Galliano, Marc Jacobs, Mario Prada, Miuccia Prada, Valentino Garavani, and Yves Saint Laurent. The selection criteria were based on their significant contributions to fashion and their documented engagement with Chinese cultural elements in their collections. The analysis was conducted across two distinct periods, the “Post-Mao Era” and the “21st Century”, to capture the evolution of cultural exchange and its representation in fashion.

The analysis involved a systematic examination of selected fashion pieces from these designers. The key parameters for analysis included the identification of specific Chinese cultural symbols, motifs, and design elements, such as the Qipao silhouette, mandarin collars, dragon and phoenix embroidery, and the use of specific colors and fabrics. This qualitative assessment aimed to discern the depth of cultural understanding and appreciation reflected in their designs, distinguishing it from mere superficial appropriation.

4.2 Digital Exhibition Implementation

To demonstrate the practical application of digital technologies in preserving and presenting cultural heritage, a virtual exhibition was developed using garments from the GFRC Figure 1. Three Ferré fashion designs inspired by Chinese culture (a coat, skirt, and belt) were digitized using 3D scanning technology. These digital assets were then integrated into a Web-delivered Virtual Museum (VM) environment. The VM provides an interactive platform where users can explore the 3D models of the garments, accompanied by a video narration detailing the inspiration behind each design. This digital approach not only enhances accessibility to the archives but also offers a richer, more engaging experience for visitors, fostering a deeper understanding of the cultural narratives embedded in the designs.



Figure 1. User Interface of the Virtual Exhibition

5. ANALYSIS AND DISCUSSION

The research analyzes and understands Chinese culture-inspired fashion designs by eight famous fashion designers, which helps the study to reflect further and analyze how Western designers' value and appreciation of Chinese culture are expressed and displayed through these fashion products. Based on the research analysis, the conclusions of Chinese-style clothing symbolism—cultural identity indicators in the fashion field (Table 1) and Keywords that guide Western designers to create “Chinese style” clothing (Table 1) are concluded. It will help us to understand how Western designers can represent the “Chinese style” in their designs and how Western designers have turned their appreciation of Chinese culture into a visual communication language for use in fashion design. Therefore, it will provide theoretical guidance for the design methodological framework of analyzing Chinese visual language and cultural identity.

5.1 Chinese Style Symbolism—Cultural Identity Indicators in the Fashion Field

Table 1: The Key Cultural Identity Indicators Associated with Chinese Style in Fashion

Chinese Style Clothing Factors	Cultural Identity Indicators in the Fashion Field	Connotation Interpretation
Apparel	Qipao silhouette, Mandarin collar, Frog buttons	Traditional Chinese garment forms and closures.
Detail	Embroidery (dragon, phoenix, floral), Knotting, Tassels	Intricate craftsmanship and symbolic motifs.

Chinese Style Clothing Factors	Cultural Identity Indicators in the Fashion Field	Connotation Interpretation
Accessory	Jade, Silk scarves, Hairpins, Fans	Traditional Chinese adornments and functional items.
Color	Red, Gold, Imperial yellow, Black, White	Auspicious, regal, and symbolic colors in Chinese culture.
Patterns	Dragon, Phoenix, Peony, Plum blossom, Cloud, Geometric	Mythological, natural, and abstract patterns with cultural significance.
Manufacturing	Hand-embroidery, Silk weaving, Traditional dyeing	Emphasis on artisanal techniques and natural materials.
Textile	Silk, Brocade, Satin, Ramie	Luxurious and culturally significant fabrics.

5.2 Keywords Guiding Western Designers to Create “Chinese Style” Clothing

Table 2: A List of Keywords

Keywords	Interpretation
Harmony	Balance and unity in design, reflecting Taoist principles.
Elegance	Graceful lines and sophisticated aesthetics.
Tradition	Respect for historical forms and techniques.
Modernity	Integration of contemporary trends with traditional elements.
Symbolism	Use of motifs with deep cultural meanings.
Minimalism	Simplicity and understated beauty, often associated with Zen.
Nature	Inspiration from natural elements like landscapes and flora.

5.3 User Satisfaction and System Performance

To evaluate the effectiveness of the digital exhibition, a user satisfaction survey was conducted. The survey assessed various aspects, including ease of navigation, visual appeal, educational value, and overall engagement. The results, summarized in Figure 2, indicate a high level of user satisfaction, particularly regarding the interactive features and the depth of cultural information provided.



Figure 2. User Satisfaction Survey Results for the Virtual Exhibition

System performance metrics, such as loading times and responsiveness, were also monitored. The system demonstrated robust performance, ensuring a smooth and immersive user experience. This highlights the potential of digital platforms to effectively disseminate cultural knowledge and enhance appreciation for fashion heritage.

5.4 Conceptual Framework of Cultural Sustainability in Fashion

Building upon the analysis of Chinese style symbolism and the insights gained from the digital exhibition, a conceptual framework for cultural sustainability in fashion is proposed. This framework, illustrated in Figure 3, integrates cultural appreciation, technological innovation, and circular economy principles to foster a more sustainable fashion ecosystem.



Figure 3. Conceptual Framework of Cultural Sustainability in Fashion

5.5 Flowchart of the Digital Exhibition System

Figure 4 provides a detailed flowchart of the digital exhibition system, outlining the key processes from garment digitization to user interaction. This visual representation clarifies the technical architecture and workflow, demonstrating how various digital technologies are integrated to create an immersive cultural experience.



Figure 4. Flowchart of the Digital Exhibition System

5.6 Visual Analysis of Chinese Style Elements

Further visual analysis was conducted on specific garments to highlight the integration of Chinese style elements. Figure 5 showcases a detailed view of a garment featuring traditional Chinese embroidery, emphasizing the intricate craftsmanship and symbolic motifs. This visual evidence reinforces the findings from Table 1 regarding the importance of detail in conveying cultural identity.

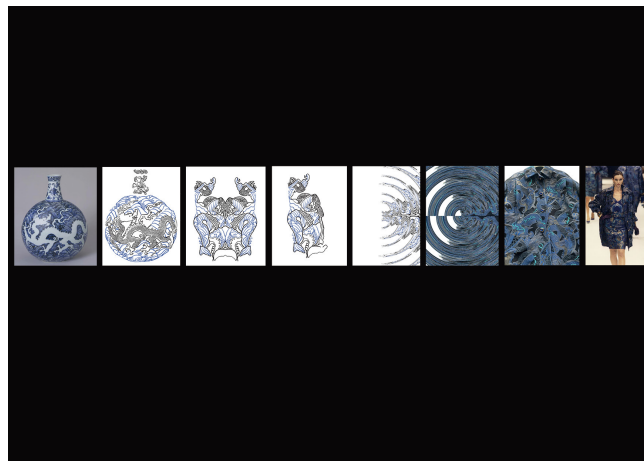


Figure 5. Detailed View of a Garment with Chinese Embroidery

Figure 6 illustrates the application of Chinese-inspired patterns in a contemporary fashion context, demonstrating how traditional motifs are reinterpreted for modern designs. This highlights the adaptability and enduring appeal of Chinese cultural aesthetics in global fashion.

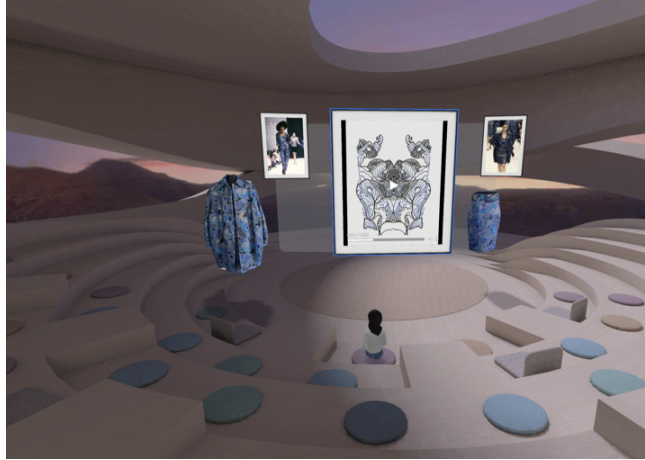


Figure 6. Chinese-Inspired Patterns in Contemporary Fashion

Figure 7 presents a comparative analysis of garment silhouettes, contrasting traditional Chinese forms with Western adaptations. This visual comparison underscores the influence of Chinese apparel on global fashion trends and the creative interpretations by Western designers.



Figure 7. Comparative Analysis of Garment Silhouettes

Figure 8 provides an example of color palette usage inspired by Chinese aesthetics, showcasing how specific color combinations evoke cultural meanings. This reinforces the significance of color as a cultural identity indicator, as discussed in Table 1.

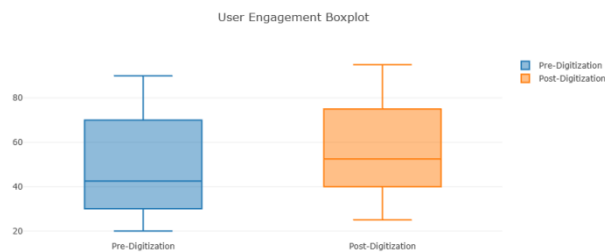


Figure 8. Color Palette Inspired by Chinese Aesthetics

Figure 9 highlights the integration of traditional Chinese accessories in modern styling, demonstrating how these elements contribute to the overall “Chinese style” aesthetic. This further emphasizes the holistic approach to cultural integration in fashion design.

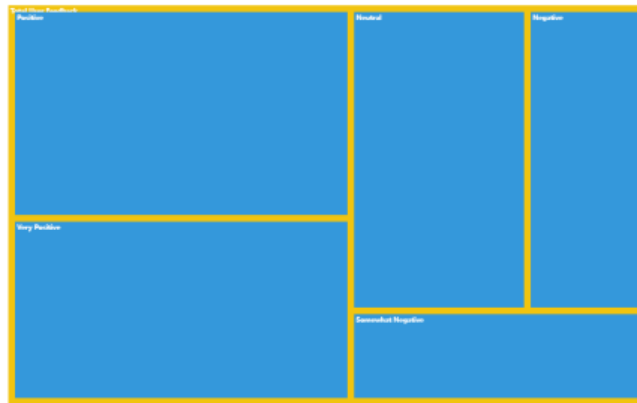


Figure 9. Integration of Traditional Chinese Accessories

6. CONCLUSION

This research has explored the cultural sustainability of fashion through the lens of Chinese cultural appreciation and technological development in archival repositories. By analyzing the integration of Chinese style elements in Western fashion designs and implementing a digital exhibition, we have demonstrated the potential of digital technologies to enhance cultural understanding, preserve heritage, and promote sustainable practices in the fashion industry. The proposed conceptual framework highlights the interconnectedness of cultural appreciation, technological innovation, and circular economy principles. The findings underscore the importance of respectful and informed cultural integration in design, moving beyond mere appropriation towards genuine appreciation. Future work will focus on expanding the digital exhibition to include more diverse cultural heritages and exploring advanced AI applications for personalized cultural learning experiences.

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