



Adaptive Visual Interpretation and Digital Redesign of Han–Tang Chinese Textile Patterns

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Abstract. The work raises an important issue of protecting cultural identity through the digitization of artistic heritage achievements and their reinterpretation in the context of modern design using the example of traditional Chinese textile patterns. Based on the analysis of the rich aesthetic heritage of the Han–Tang dynasties, which embody the symbolic meanings and cultural connotations of Chinese art, an adaptive model of visual interpretation and digital redesign has been developed. A systematic rethinking of its key stages, in particular Traditional Inspirations, Adaptation and Simplifications; Implementation into Design Practices; Digital Transformations; and Cross-Cultural Fusion, is carried out in the context of national identification, universality and sustainability. The emphasis on the historical traditions and aesthetic concepts makes it possible to develop design products, which retain their original essence while adapting to modern appliance. Proposed model is universal and can be applied to design different works of art in order to preserve cultural identity during the globalization process. The results demonstrate the prospective of using it in fashion, interior design, graphics, and other creative industries, as well as a global desire to incorporate traditional heritage into modern culture. The use of the modified patterns shows that Chinese textile art influences and inspires design, opening new channels of cultural contact between East and West. These conclusions highlight the importance of digital protection of intangible cultural heritage in order to promote cultural continuity and cross-cultural communication, hence contributing to cultural sustainability.

Keywords: Han–Tang Aesthetics, Traditional Chinese Textile Patterns, Digital Redesign, Visual Interpretation, Cultural Heritage Preservation, Adaptive model.

1 Introduction

Nowadays in the globalized modern world preserved and rethought cultural heritage gains great importance. Rooted in national attitude and history, traditional art forms

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require transformation without losing their essence. In this vein, Chinese textiles became the perfect case study for understanding ancient artifacts as cultural history that forms aesthetics on the Han (206 BC–220 AD) and Tang (618–907 AD). The reason is that textile has always been an important highlight of cultural identity during centuries, which is undoubtedly an exemplar of Chinese culture that reached a high level of artistic mastery [1].

Chinese textiles of these dynasties, aside from exhibiting intricate designs also display sophistication of the meaning that each motive has. Every garment worn by the aristocracy, from the exquisite patterns on imperial robes to daily dress of ordinary citizens had its stories [2]. The Wu Leno weaving technique described in Yu's [3] work is an example of such intangible cultural traditions; those that are sustainable and resilient and today live on through digital measures. The digitalization transforms the interpretation and assimilation of ancient traditions into an accurate modern style without losing the historical context.

The digitalization of traditional Chinese textile patterns is a challenging task as many of the old samples are fading over time as well as losing parts of contents. It is indeed difficult to preserve these things, taking into account their fragile nature, due to which people can lose priceless cultural heritage. Consequently, digitalization of classical textile samples into new edited and simulated versions is essential to ensure its existence and becomes a creative way of preserving cultural heritage. The issue of delicate fabrics preservation has always been relevant, but modern researchers have more possibilities to solve it using new advanced technology such as digital virtual simulations and machine learning algorithms. When physical samples no longer exist, their virtual analogues remain and inspire people to create new things, preserving culture at the same time. These technologies make it possible to capture and reconstruct complex patterns in real or virtual environment [4][5].

On this background, current studies of murals of Tang Dynasty diplomatic envoys are a detailed example in a contextual environment, with the efforts aimed at the 360-degrees virtual simulation; digitalization initiatives are broadening and aimed at a deeper perception of material cultural heritage that can be saved [4]. According to the principles of the justified theory, this research systematically explores the usage of traditions and innovations in Chinese pattern design. This evolving model supports the idea that traditional motives are not the relics of the past, but the active participants in the cultural revival and are a part of the modern aesthetic as well as retain their historical significance [6][7].

The types of traditional Chinese textile patterns are rich in variations and differ depending on time and region. This study is based on data from records and fabric examples in Han and Tang dynasties, and outlines methods for systematic selection and conversion traditional fabric patterns of relevant periods into digital data according to theme classification and time. This approach not only allows to simplify and summarize complex and diverse traditional pattern designs but single out important symbolic elements and cultural characteristics, and retain elements with cultural significance. Moreover, it makes it possible to integrate modern design concepts and inspiration. Therefore, traditional styles and characteristics are transformed into digital form by current technological means and tools such as virtual simulation, 3D

modeling, and machine learning. This research deals with the general development of these trends and the ways of adapting them to the modern world. The purpose of this study is to combine the aspect of technology with the aspect of history, in order to form a theoretical basis for practical implementation that can also be used for scientific research.

Ancient practices and samples like traditional Chinese textiles will provide a basis for the study and digitization for a new visual language to emerge, one that unifies the traditional with the desired output required for a modern cosmopolitan working environment. This makes it possible to preserve cultural identity while in the meantime creates new designs.

Its essence is still reflected in the aesthetic of Tang Dynasty floral medallions, even in textile designs in the 8th to 9th centuries. An example of such lasting artistry is the flower medallion textile, Tang Dynasty (Figure 1), in The Metropolitan Museum of Art. This specific example is dated to the late 8th to early 9th century and exemplifies the exquisite craftsmanship and aesthetic sensibilities of the Tang dynasty while also focusing on motives still influencing modern design (The Metropolitan Museum of Art, Accession Number: 46.156.6).



Fig. 1. Textile with floral medallion, Tang dynasty (618–907), from The Metropolitan Museum of Art (Source: www.metmuseum.org/art/collection/search/39595)

The intensive development of digital tools and technologies is shaping the potential for cultures to mix. Shen [2] studied the modernization of traditional Chinese motives best embodied in imperial robes by transposing the shapes into a 3D design software to generate new and internationally referable design ideas. The combination of prints of different cultures demonstrates diversity and wide range of possibilities for rethinking of traditional Chinese textile, making it accessible for modern rendering. Despite the fact that these motives can be seen in various modern applications – from fashion and interior design to digital art – their essence remains unchanged. In this

way, they connect the past and the present and show that cultural identity does not have to become obsolete in the modern globalized world.

Inspired by the example of Han-Tang aesthetics, an adaptive model of digital redesign has been developed with constant transformations of cultural and artistic processes being considered. Taking this into account, such a systematic approach to interaction of modern technological developments with historical motives can possibly become a starting point for preservation and developing of creativity in traditional Chinese textile design.

2 Materials and Research Methodology

2.1 Cultural Relevance Analysis

By the means of historical analysis, this study highlights methodological strategy of artistic rethinking of various digital instruments and media approaches, digitally interpreting old textile motives in a new way. The study analyses aesthetic concepts and cultural meanings in order to guarantee that ancient patterns are not only excluded, but also implemented into modern design arrangement keeping their cultural relevance with the use of qualitative and quantitative approaches. For this reason, the research was conducted in seven aspects: Historical Perspective, Social Perspective, Cultural Transmission Perspective, Artistic Perspective, Semiotic Perspective, Psychological Perspective and Ecological Perspective (Figure 2).

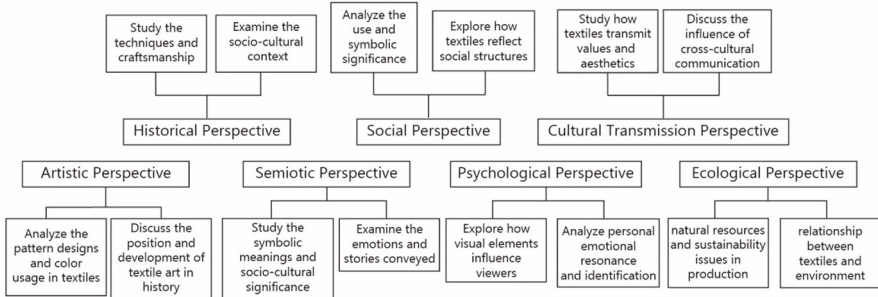


Fig. 2. Analyzing the aesthetic concepts and cultural meanings of textile samples

2.2 Material Collection

Emphasizing the antiques of the Han and Tang Dynasties, the materials for this study came from existing collections including about 100 samples of traditional textile styles. With the focus given on social and artistic aspects, samples are taken from collections of different historical periods, and examined fabrics belong to such kind of traditional Chinese textile as imperial robes. The design samples are taken from multiple places, digital archives, for instance, floral medallions and other culturally significant patterns, can be seen in museum collections and scientific publications, which are posted as high-quality photographs in the Internet. Museum collections, including

those at The Metropolitan Museum of Art, National Museum of China and China Silk Museum, are undoubtedly valuable archives of historically important textiles. Additional actual samples, such as replicas of classic textile designs, were also obtained from local textile preservation programs and cultural heritage groups. To ensure that the study included a diverse range of items, reflecting the historical, social and creative context of Han and Tang textiles, these sources were accessed (Figure 3).

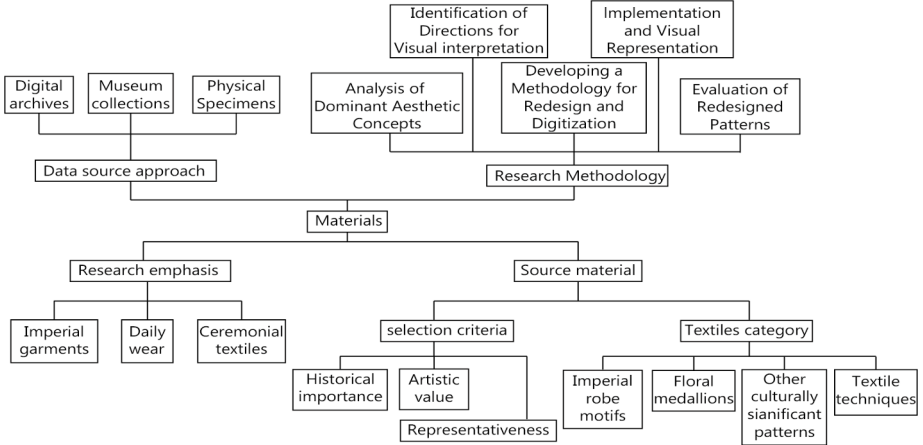


Fig. 3. Material Collection and Research Methodology Flowchart

2.3 Research Methodology

This study has a structured multi-stage methodology as outlined:

The first stage: Analysis of Dominant Aesthetic Concepts

This is an in-depth analysis focusing on the aesthetic concepts of reproduction textile patterns from Han and Tang Dynasty. To identify the basic visual principles, which are underlying them, these designs are analyzed (e.g. grandeur, natural harmony and symbolism). Correct understanding of these principles makes it possible to choose an appropriate strategy to operate future states while digitalizing and reconstructing of cultural and aesthetic integrity during redesign.

The second stage: Identification of Directions for Visual Interpretation

On this stage, the images of the patterns are visualized according to the identified aesthetic concepts. This, in turn, means translating the cultural meaning of motives, for example, dragons, phoenix, and floral elements, into a modern design vocabulary. Such an interpretative frame works for translating traditional motives into modern meanings, relevant for contemporary consumers.

The third stage: Developing a Methodology for Redesign and Digitalization

Mostly designers focus on searching the way of system digital development of certain textile patterns using the methodology of redesign and digitalization. On this stage, the model of digitalization of traditional elements, which goes beyond Chinese textile industry and is based on the synthesis of traditional aesthetic and new digital technology, gains particular importance. It is especially relevant in textile design to

preserve the integrity of original patterns and their ethnocultural sense, but at the same time gives wide range of possibilities for compositional experiments.

The fourth stage: Implementation and Visual Representation

In order to explain the research process, on this stage, the diagrams are presented in a step-by-step process starting from the selection of materials and the analysis of aesthetic concepts, through the interpretation of images and up to the final redesign. It also helps to clarify the flow of the research and at the same time shows the interconnection of the different parts of the process.

The fifth stage: Evaluation of Redesigned Patterns

This stage makes it possible to evaluate the redesigned pattern considering its adaptability and cultural relevance. The recreated motives are assessed to guarantee that the reproductions maintain their original cultural worth and are fit for current application by means of comments from professionals in traditional art, digital design and cultural heritage.

Following these methodical stages will help the research create a dynamic adaptable model based on which both traditional textile designs are preserved and inspired from. It shows how digitalization and modern reinterpretation of images can help to conserve cultural heritage and thus prove the relevance of the ancient patterns in the world of design (Figure 3).

3 Aesthetic Concepts in Han and Tang Dynasty Design with their visual interpretation

Aesthetic ideas are an integral part of Han and Tang cultural history and it helps to better understand and explore content and form of national traditional textile patterns. These concepts reflect the different aspects of the society and culture of the time including the systems of beliefs, values and social hierarchies that do not only determine what kind of artistic manifestation to make but also the spiritual and inspiring thoughts that are ingrained in the symbolic patterns. The concepts of Chinese textile aesthetics, which were used during its manufacturing, determine more general philosophical and cultural background of that time. Thus, a deep understanding of aesthetic principles is essential for both the preservation and the adaptation of such patterns for modern design as well as for appropriate understanding of old patterns.

Several notable aesthetic terms influenced textile production at the time of the Han (206 BC–220 AD) and Tang (618–907 AD) dynasties. The visual concepts were not only visual; they also held deep cultural value rooted in Chinese philosophy, social structure and spirituality. The major aesthetic ideas from those eras are indicated as follows: 1). Honoring the Dead as the Living. A longstanding Chinese philosophy of “Honoring the Dead as the Living” includes filial piety and is about the belief that life continues after death. This principle of polysemy can also be seen in the textile designs from the Han and Tang dynasties, where motives or patterns have symbolic meanings that could relate to respect for living people as well as the dead. Respect is embodied in tribute of iridescent flora of peony and magpie, which symbolized existence and reincarnation as well as old connection with ancestors [2]. 2). Grandeur

and Delicacy. The grandeur typically is achieved in the form of big, bold patterns – beautiful spectacle grander florals, mythic creatures or symbolic animals that catch your eye. Delicacy, on the other hand is seen in their intricate lines and subtle textures that come to life through meticulous production i.e., with layers of colours applied precisely; these designs are more nuanced and sophisticated [1]. 3). Natural Harmony. Textile design of Han and Tang Dynasties illustrate the aesthetics of interconnected but harmonic relations between people and nature. In this context, frequent natural motives can often be seen, for instance, clouds and flowers that symbolize human world balance with nature. Decorative textile images have deep philosophical and spiritual sense and demonstrate that a human should live in unity with nature and live according to nature cycles that give people force to live [1]. 4). Symbolism and Abstraction. In the field of textiles, these designs are based on symbolism and abstraction, especially if there are references to the Han and Tang dynasties. A sign and symbol language, representing a vast spectrum of ideas in abstract form, without the use of written language, these patterns work as a kind of graphic semiotics. Spiritual, intellectual and cultural values are potential signs in textile designs, and help us visualize abstract ideas. These designs are perceived as visual stories supporting culture, spirituality and social structure, and not as just decoration.

When traditional patterns are processed with modern digital design tools, it leads to the synthesis of visual symbolic and abstract aspects of patterns, and the result is modern digital redesign. Modern platforms based on the media art will help designers refer to these topics in a new way, more symbolically than before due to the interpretation of scale, form and colour [3]. Some forms or geometric abstractions of traditional patterns are culturally significant and compatible with current design aesthetics when processed by modern digital technologies. All of them are now tolerant of cross-cultural context, resistant and long-lived, and are therefore compatible with modernist visual approaches [11]. In addition, designers adopt such cultural symbols as fashion, traditional graphic design, and Chinese visual textile environment to digitalize various design fields. Applied themes and symbols become digital textures that guarantee the existence of creative industry functions in this modern era [12]. Today, designers transcend the past by blending symbolism and abstraction in a way that honours its rich cultural history while also creating new strategies.

4 Digital Redesign Techniques and Tools

Aesthetic concepts of Chinese textile art are visually interpreted using digitalization tools by rethinking the symbolism of these patterns and motives, along with dematerializing that content for some intriguing results. Cultural openness provides interaction and exchange between different cultures, countries, and nations.

The Han and Tang dynasties have a rich cultural heritage that contains many subtle aspects, which can be observed by carefully analyzing their visual features. Interpretation gives information about not only aesthetics and literacy of the past but also their

values and belief systems, at the same time revealing much about their society hierarchy [10][12].

The visual meaning and symbolic explanation of popular images like dragons, phoenixes, lotus flowers, and clouds are central to understanding traditional Chinese textile designs and is the base of the digital redesign of art works. These images usually symbolize wealth, longevity, harmony and the interconnection between humanity and nature. For traditional fabrics, the designers consider historical background and aesthetic concepts to decipher the underlying message in the language of visuals of fabrics. The most notable are dragons, because the dragon is one of China's symbols from ancient times and it stands for authority and power; it is often depicted on imperial robes or textiles [9]. This symbolical richness continues to make traditional Chinese textile so compelling, and makes it possible to rethink it in modern design.

The diversity and the delicate artistry of the ancient silk outfits is displayed at the Museum of Ethnic Costumes at the Beijing Institute of Fashion Technology. Flower medallions, paired birds, and associated animals demonstrate complex themes in many ranges of coloured paints, from grand magnificence to pastoral aspects [13].

The act of visual interpretation is more flexible than previous studies admit, as it is easily possible to digitize and reinterpret, in the digital age, the traditional cultures' motives. Today, new technology is required to record, reinterpret, and augment the complex details that appear due to the digitizing of ancient Chinese textile designs. In the work an adaptive model of visual interpretation and digital redesign of works of art has been developed (Figure 4). It is based on the previous search of Huo and Skliarenko [11] for a universal algorithm for the development of a product that includes traditional elements of national heritage. The model has five improved stages, in particular Stage 1: Traditional Inspirations; Stage 2: Adaptation and Simplifications; Stage 3: Integration into Design Practices; Stage 4: Digital Transformation; Stage 5: Cross-Cultural Fusion [11]. Each of them is distinguished by a specific approach to the interpretation of aesthetic and cultural concepts, the choice of composition of patterns, digital tools and methods of transformation.

Using traditional sources, it describes historical and cultural themes. For balancing abstraction and symbolism in Chinese traditional textile motives, the common designs of Han and Tang textile design have been analyzed. Prevailing images are birds, clouds and flowers, which combine aesthetic beauty and symbolism. It often becomes a great source of inspiration for modern designers. When interpreting these geometries, they have to pay attention to not only the visual impacts and power of forms but also their initial meaning as a symbol or a cultural phenomenon [1][14].

The patterns become more significant as they are simplified for use in the modern world. Designers copy these motives digitally, and use the accuracy in scale and colour and composition precisely, all the time retaining the original symbolic concept. The digital recontextualization process is the way that makes it possible to transfer and implement information from the traditional textiles to the contemporary media, fashion, graphic design or even virtual environments [3].

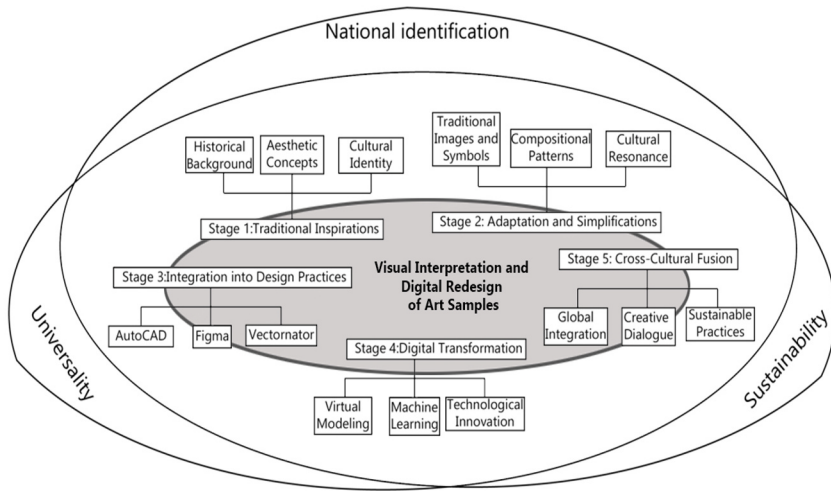



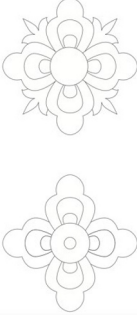



Fig. 4. Adaptive model of visual interpretation and digital redesign of art samples

Integrating AutoCAD, Figma, and Vectornator into design practices results into the creation of reusable 2D templates. New design possibilities appear due to the implementation of the latest technology such as virtual modelling and machine learning during this digital transformation. To reflect progression historic patterns are updated and reinterpreted, and they preserve cultural authenticity, because it connects ancient artistry and modern design innovations [8].

Cross-cultural fusion encourages the formation of international partnerships and the development of cross-cultural creativity and innovation, and at the same time, it combines the contemporary design with the historical details, which makes the design not only culturally meaningful and relevant, but also environmentally friendly. Digital transformation makes it possible to reinterpret these historic fabrics so that their past is honored, but also they can be easily adapted to the needs of today's global design world.

The process of digitizing and thereby rethinking the traditional textile patterns is not only a technical process but also a process of changing the cultural identity and integration of the past and the present. As demonstrated in Table 1, this process starts with the thorough survey and recording of the historical textile samples to guarantee that the traditional motives are preserved correctly. Then these traditional elements of the pattern are taken out and processed to create adaptive and simplified two-dimensional and three-dimensional samples, which can be easily used in modern creative industries. For example, the floral pattern shown in the table was used in design of pins production.

Table 1. Margins and print area specifications.

Stage 1: Traditional Inspirations	Stage 2: Adaptation and Simplifications	Stage 3: Integration into Design Practices	Stage 4: Digital Transformation	Stage 5: Cross-Cultural Fusion
The sample of ancient textile with a flower medallion	Stylization of elements of traditional Chinese patterns	Digitalization of samples and variety of templates	Creation of digital patterns	Integration of patterns to the modern design
				

The advanced tools and techniques are used to ensure preservation and innovation in the redesign process. 1. The first step in this digital transformation process is the use of AutoCAD software to accurately sketch the complex patterns found in traditional textiles. This process is somewhat similar to a digital loom that replicates the details of a peony’s petals or feathers of a phoenix, for instance. Due to the development of digital printing technologies, these patterns can now not only be used on fabric but also applied to any other particular surface at any different scale without losing the original beauty of products [8]. 2. After the digitizing, 3D Virtualization tools such as Rhino 3D or CLO 3D are used where virtual clear models of textile patterns are produced. These virtualizations let designers experiment with the patterns in the three-dimensional space, observe and analyse interaction of traditional ornamental structures with modern forms and structures to exclude conflict situations. 3D modelling has also made it possible to create large-scale, dynamic examples showing how these designs adapt to modern aspects of life such as fashion, interior design, or industrial product design. Two-dimensional and three-dimensional visualization makes it possible to convey specific features of traditional Chinese textile more vividly due to the using of textures and light to adapt patterns to usage in various fields of design [8]. 3. Interactive digital experience that provides communication in different environments is innovational. A significant example is immersive visual versions of textile prints, which are created as augmented reality that makes it possible for the viewers to add historical patterns to real objects and interact with them [3]. Virtual reality lets users teleport to digital worlds and interact with environment full of imagined conventional designs, therefore enhancing the whole experience. Not only is this awareness tool but also an educational one since it allows traditional designs to expose more viewers to their ways in this interactive

manner. Viewers can be immersed in the history and culture that is the base for these patterns and it helps them rethink these models in the context of modernity [3].

These digital redesign approaches and tools make it possible to preserve and create modern design product on the base of traditional Chinese textile designs. By using history and innovation, the integration of frontier technologies relies on the culture in order to make these patterns more resilient. Since they can develop over time in modern design contexts, this approach guarantees that their historical and symbolic importance are preserved – thus they can be implemented in a variety of creative fields where culture has a new place to develop in, inspire and create in the global world. This approach shows how innovation can be driven by heritage and, therefore, engage culture and traditional content for future generations.

5 Conclusion

This work shows how the traditional and the modern are well combined on the example of the patterns from Han and Tang dynasties' textiles. It explains ways to revive and translate traditional patterns in the context of interpretation of the concept and cultural digital identity redesign and aesthetic art philosophy. The analyzed samples are able to describe the essence of historical concepts implementing them into an adaptive model of the latest digital visual tools and of generating a disciplinary paradigm of preservation and innovation of traditional Chinese textile patterns.

This research is a contribution to the discussion of the appropriateness of using criteria such as honoring the dead as living, grandeur and delicacy, natural harmony, symbolism and abstraction as parameters that should be used in the redesign process. Authors prove theoretical achievements with practical samples, which they have found, and explain how researched motives can remain authentic in modern environment.

Using historical data, along with digital technologies such as virtual simulations and 3D modeling it is possible to verify the study records and identify original patterns even in the present time. The adaptive approach is sustainable, universal and culturally identifies the preservation of cultural heritage, which is important in modern daily life.

Digital products are used in fashion, interior design, and graphic design. The possibility of digitalized textile patterns to be implemented in other areas of design is indicated by their applicability in the modern world. The processes of transformation of traditional art forms through digital redesign methods show how the connections between the historical practices and present needs are kept on. Therefore, the digital interpretation has a positive effect on the modern creative segment.

This research shows how digital innovation can maintain and enhance traditional design patterns. It offers a reference model of how cultural heritage can remain relevant in the current interconnected world of design, where innovation and tradition can coexist in a cyclic manner to support cultural durability and intercultural understanding. It demonstrates how cultural heritage can live on in the current

creative practices and how traditions can be kept and revitalized for the next generations.

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