

УДК 7.012: 687:016

DOI:10.30857/2617-0272.2024.4.4

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## ECOLOGICAL DESIGN CONCEPT OF TEXTILE PRODUCTS: A STUDY ON BROCADE WEAVING MATERIALS OF THE CHINESE ETHNIC MINORITY YAO

**Purpose** of this study is to identify the principles of environmental feasibility that were applied in the design and reflected in the artistic style of textiles of the Chinese Yao ethnic minority; as well as in the formation of the means of their implementation in modern clothing design.

**Methodology.** Through field research, the paper substantiates that the brocade textiles of the Chinese Yao ethnic minority embody ecological principles, such as the use of natural, degradable materials, resource conservation, and elimination of excess textiles. Also the work uses the methods of systematic generalization and classification, as well as the analysis of literary and scientific data to generalize the composition and diversity of artistic styles of traditional and modernized brocade textile patterns.

**Results.** The ecological concept is an important principle followed by the Chinese Yao ethnic minority in the design and decoration of textiles. They apply its principles throughout the process of pattern making and brocade weaving, including cotton thread production, dyeing, embroidery, and garment design. Natural patterns such as octagonal floral and zoomorphic fish patterns were found to be preferred. A set of design cases from modern Chinese design brands and the textile company Hainan Lizhiyun Cultural Communication, which use the ecological concept in the development of fashionable clothing models for various purposes, was analyzed. It is characterized that traditional ethnic brocade textile elements and ecological principles are combined with modern creative design to bring new visual and design properties and achieve harmonious coexistence with the environment.

**Scientific novelty.** The principles of environmental awareness in traditional and modern textile design of the Chinese Yao ethnic minority are identified. It is justified that it is based on the experience of adaptation to the natural environment and skillful application of ecological principles in the development and production of brocade textile products. It has been found that the ecological principles embedded in the traditional means of development of textile brocade products of the Yao ethnic minority have an inspiring influence on modern clothing design. It is emphasized that this is in line with the UN's advocacy of low-carbon and environmentally friendly production development, and therefore encourages the application of environmentally-oriented practices during the development of textiles and the design of textile products.

**Practical significance.** As a result of the research, the main typical examples of textile patterns and colors of traditional Chinese ethnic Yao brocade, used in modern clothing design, were characterized. In addition, by combining the traditional ethnic patterns of Yao brocade with creativity, more creative design solutions can be created and cultural elements and connotations can be introduced into modern clothing design.

**Keywords:** textile design, fashion design, Yao ethnic brocade; degradable materials; eliminating textile excess; creative design.

**Introduction.** Guangxi Province is the main settlement area for Chinese Yao ethnic minority, with a population of about 1.683 million. This area has a lot of mountains and less land, and the Yao people have a natural respect for the environment and maintain an ecological balance through their actions. From

the perspective of ecological resources, Guangxi Province is in a subtropical climate and has abundant heat and rich hydrological resources, providing good conditions for the growth of local animals and plants. The rich natural patterns in Yao ethnic brocade patterns are inspired by the abundant flora and fauna

here, such as the octagonal flower pattern and fish pattern.

Through their history of harmonious coexistence with the natural environment, Chinese Yao ethnic minority have gradually become familiar with the physical and chemical characteristics of natural materials. Therefore, they have formed the ecological principles of using degradable materials, conserving resources, and eliminating textile excess in the production of textile products. This provides a favorable guarantee of ecological resources for the settlement and reproduction of Yao ancestors. With the development of modern design, the ethnic cultural elements and ecological principles of Yao ethnic brocade weaving in Guangxi have been inherited and promoted, providing a huge source of creative inspiration for modern fashion designers. At the same time, this also allows the world to recognize the wisdom and inspiration brought by ethnic cultures.

**Analysis of previous research.** As a kind of textile product with distinct historical and cultural characteristics, brocade is very important to people's lives and is also an important cultural heritage. As early as 4,000 years ago, the use of crushed plant roots for dyeing was already being used in Asia, such as the widespread use of natural dye madder in the Caucasus region for dyeing carpets and fiber fabrics. It was not until 1870 that the widespread use of synthetic dyes gradually took over the market for natural dyes [16]. Iranian researchers Koochakzaei A. and Oudbashi O., through molecular analysis of the court belts of the Qajar period (1789-1925) in Iran, discovered traces of the use of a large number of natural dyes [6]. Chinese scholars Jiu Z. and Frankie N. G. [5] believe that the history of Chinese brocade is even longer, and it was initially used by nobles of feudal dynasties. With the development of brocade technology, they gradually evolved from simple decoration to cultural symbols, and then spread to the Silk Road, influencing and giving birth to the four famous brocades of China: Shu

brocade, Yun brocade, Song brocade, and Zhuang brocade, as well as the brocade styles of Chinese ethnic minorities. Zhang F. and Krotova T., through analyzing the artistic characteristics of Tang Dynasty brocade patterns, believe that the Silk Road strengthened the cultural exchange between East and West, and summarized the reasons for the symmetrical beauty, curve beauty, and symbolism of Tang Dynasty brocade patterns [23].

Wang W. F. [16] scientifically proved through eye-tracking experiments on data of different brocade patterns that men and women have preferences for brocade patterns, providing better design solutions for fashion design. Chen X L et al [2] studied the innovative influence of 3D printing and laser engraving technology on Dong brocade. Ni, M., Huang, Q., Ni, N., et al also constructed a Zhuang brocade pattern feature data set using computer technology and proposed a method of automatic generation using relative coordinates and regional content substitution, using intelligent extraction algorithms and processes to effectively extract the color matching, pattern, and organizational form of the pattern into the feature data set. This provides a new method for quickly generating brocade patterns [12]. Liang, Yun, et al conveyed creative ideas with ethnic cultural elements by applying brocade patterns to children's toy product design, providing new ideas and opportunities for the design, preservation, and dissemination of ethnic cultures [9].

In addition, some researchers have studied brocade from the cultural characteristics and comparative perspectives: Reitz S C B [1] compared the differences between Chinese and Japanese brocade, and believed that Japanese brocade technology was learned from China, and later integrated with the style of ukiyo-e, forming the Japanese art style. American scholar Mueggler E [11] believes that China's open and inclusive culture can be reflected in the cultural heritage of the

Yao ethnic minority, and he also mentioned that the ethnic history of the Yao people written by Western scholars is too Orientalist, as they imagined a closed cultural world, which is actually the opposite in reality.

In general, research on brocade has mainly focused on historical research, material analysis, and textual comparison. For the artistic patterns of brocade, they are mostly studied from the perspective of computer science. However, there has not been enough discussion about the ecological awareness and cultural elements contained in Yao ethnic brocade. At the same time, the demand for ecological environment and cultural elements in modern design shows that we need to further research on ecological design in this aspect.

**Statement of the problem.** Chinese Yao ethnic brocade textile products contain rich ecological concepts, and these concepts, combined with the preferences of the Yao people, have formed unique brocade patterns, such as octagonal patterns, fish patterns, and so on. This article combines field investigation of the Yao ethnic brocade culture to understand their individual aesthetics, material usage, and color matching in brocade textile products, focusing on exploring the ecological principles contained in Yao ethnic brocade and summarizing the ecological principles and pattern art styles followed by Yao ethnic brocade. It also analyzes how these cultural elements and ecological principles can provide designers with more diverse creative inspiration and promote modern design.

**The results of the research and their discussion.** Chinese Yao ethnic brocade is a type of textile product that integrates protection, healthcare, identity recognition, and decorative functions. It is also a reflection, record, accumulation, and summary of the aesthetic taste, lifestyle, and production technology of the Chinese Yao ethnic group. It is not only a unique cultural heritage of the Chinese Yao ethnic group, but also an outstanding representative of traditional Chinese ethnic culture.

### **Survey of Chinese Yao ethnic brocade.**

The Yao ethnic group is an ancient ethnic group originating from China and has spread worldwide, with populations in Southeast Asia, Europe, the United States, and other places. In Guangxi, China, the Yao ethnic group has the largest population. The authors have visited six major Yao ethnic counties in Guangxi, including Jinxiu County, Fuchuan County, Gongcheng County, Du'an County, Dahua County, and Bama County, investigating the production and manufacturing of Yao ethnic brocade, and obtained the following basic information about Yao ethnic brocade textile products.

**Production process.** Chinese Yao ethnic brocade is a textile product made from locally produced cotton as raw material. It undergoes 13 spinning processes, including selecting cotton, rolling cotton (removing seeds), hand-rolling cotton strips, boiling cotton yarn, dyeing colored cotton thread, spinning (Fig. 1), installing a loom, and weaving brocade (Fig. 2). Through these processes, the Yao people can weave brocade with various beautiful patterns (Fig. 3), which are widely used in their daily lives, mainly for items with decorative and aesthetic requirements such as clothing, shoulder straps, and headwear. When brocade is used for daily necessities such as bedspreads, the colors are pure, the lines are simple and quaint, but the patterns have a strong rhythm [14]. Traditional Yao ethnic brocade is mainly woven using the "three shuttle method", where the first shuttle is for the pattern warp, the second shuttle is for the ground pattern warp, and the third shuttle is for the plain weave, repeating this process. In addition, some women will also embroider on the brocade to make the patterns richer and more versatile.

**Pattern style.** The pattern composition of Chinese Yao ethnic brocade is complete, with various forms, strong decorative features, natural rhythm, simple and concise patterns, and prominent objects; the colors are rich and solemn, with vivid shapes, exquisite craftsmanship, and beautiful, sturdy, generous, and durable features. In Yao ethnic brocade,

apart from text patterns, the main focus is on animal patterns and plant patterns. These patterns are all derived from objects in the Yao ethnic group's living environment, and are beautified, such as octagonal patterns, fish patterns, and so on.

*Octagonal pattern.* The octagonal pattern is a plant pattern commonly used in Yao ethnic brocade and is also known as the "King's Seal" or "Sunflower" pattern. Its shape is made up of a geometric figure with eight corners (Fig. 4), representing the sun's cycle in a tropical year, which is the seasonal changes throughout the year. At the same time, the pattern also symbolizes the Yao people's worship and memory of their ancestor, the King of Pan, and also represents their hope for the happiness of future generations [3]. During the field investigation, some people also mentioned that the octagonal pattern is derived from the evolution of the plant spice, *Illicium verum*.

*Fish pattern.* The fish pattern is an animal pattern commonly used in Yao ethnic brocade (Fig. 5). Fish is an important animal in the Yao ethnic group's totem worship, and its history is long. It symbolizes reproduction, life, abundance, longevity, and unity. In the Yao people's concept, fish live in water and have strong vitality and strong reproductive capacity. In ancient times, due to the low productivity and harsh production and living conditions, not only was the lifespan of people generally short, but the reproductive capacity and survival rate of infants were also low. In order to survive and develop the clan, people longed for and prayed for strong vitality and population growth. However, due to the low level of cognition, the ancestors did not understand the reasons for long or short human lifespan and low reproductive capacity, so they attempted to worship and bless the animals and plants in nature with strong vitality and strong reproductive capacity, in order to obtain their spiritual power or blessing, and achieve the utilitarian purpose of increasing lifespan and enhancing reproductive capacity. Fish in the water, due to their strong vitality and strong

reproductive capacity, became one of the objects of worship by the Yao people.

In addition, there are also patterns such as frog patterns and geometric shapes, which together make up the patterns of Yao ethnic brocade. These patterns are mainly created by Yao women through two-way or four-way continuous organization methods, with symmetrical, central, and enclosed composition styles to create a harmonious and full composition. In the space of ten centimeters to several meters on the fabric surface, the vertical and horizontal warp and weft, needle and thread, are a test of the embroiderer's years of skilled techniques and an expression of their confidence and proficiency [20]. After careful consideration, each brocade pattern has a distribution of primary and secondary, dense and sparse, achieving an orderly, standardized, and visually balanced effect.

***The ecological concept embodied in Yao ethnic brocade.*** Guangxi Yao ethnic brocade has followed the ecological wisdom that has been passed down by the Yao people since its inception. This ecological wisdom includes understanding of different ecosystems, grasping of biological species and their interactions, and rational use of biological resources [14]. In the production process of brocade, the Yao people have put into practice ecological consciousness of using naturally degradable materials, conserving resources, and eliminating textile surpluses, and have formed an environmental protection goal of "turning waste into treasure," "finding new uses for old materials," and "making the most of everything"

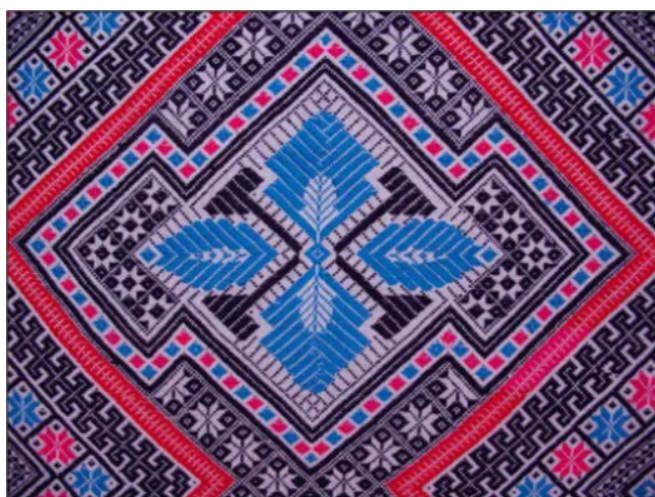
*Using naturally degradable materials.* The Yao people live in the hot climate of the southwestern mountains of China, and their brocade materials are mainly cotton, linen, and silk. In winter, they prefer to use cotton to make winter clothes because cotton is soft, fluffy, and has a high air content (air has the lowest thermal conductivity and the best insulation performance).



**Fig. 1.** Yao women spinning yarn.  
China, 2016 [15]



**Fig. 2.** Yao ethnic textile scene.China, 2017.  
Photo: Xinhua [18]



**Fig. 3.** Yao ethnic colored brocade. China [19]



**Fig. 4.** Yao ethnic brocade: : Octagonal pattern (King's Seal). China 2024,  
Photo:Yuan Xing



**Fig. 5.** Fish pattern [21]



**Fig. 6.** Guangxi Jinxiu Yao ethnic patchwork brocade  
shoulder strap. China 2024, Photo:Yuan Xing

Linen is a commonly seen plant in the mountains, and its products have a sparse texture and excellent heat dissipation performance, making it the most wise choice for summer clothing. Some male Yao people also use animal leather to make shoes, as leather is firm and dense, and is the best material for protecting the feet from wear and tear. These materials are all from natural sources in the Yao people's living area, or have been processed, and are extremely friendly to the ecological environment, without causing any damage. In addition, the Yao people have regulations that the 3rd and 8th of each month are special days when it is not allowed to cut down trees or dump sewage. These are all principles of ecological protection that the Yao people adhere to in their daily lives.

*Eliminating textile surpluses.* In Yao ethnic brocade, "finding new uses for old materials" means that after making a piece of brocade, the Yao people will keep the remaining parts and, when they have accumulated enough, sew them together in a certain pattern or pattern to create new textiles. These textiles can be patchwork children's shoulder straps (Fig. 6), which are specifically used by mothers to carry their children while working. This ecological idea of using old materials has saved resources and eliminated textile surpluses, greatly increasing the utilization rate of materials.

In addition, the Yao people also have the cultural custom of dressing children in "hundred family clothes". This type of clothing is used to pray for the child's health and longevity, and is also blessed and protected by the hundred families. Hundred family clothes are made up of various colored cloth pieces, carefully combined, with beautiful patterns, designs, and colors, and are loved by people. Among them, the purple fabric is hard to come by because "purple" in Chinese sounds like "son", symbolizing many children and blessings. Therefore, ordinary families are

unwilling to give away purple cloth and can only ask for it from lonely and elderly people.

***The ecological concept in Yao ethnic brocade and its inspiration for ecological design.*** The ecological concept reflected in Yao ethnic brocade in China reflects the gratitude and awe of the Yao people towards nature. They deeply understand the immense value of nature for their survival and development, which can meet current survival needs and sustain future development, while also playing a constraining role in human survival and development. Combined with modern design, these principles can generate design applications that consider both natural environment and cultural elements.

*Using plant dyes in modern textile design.* The natural indigo dye used by the Yao people in the process of dyeing cloth is made from fermented blue grass (with the root being the woad root) grown near the Yao mountains. The dyed clothing has a natural light blue color and herbal fragrance, and is said to repel mosquitoes and prevent colds, without causing any pollution to the environment [7]. Young designer Ran Guangjin draws inspiration from traditional Yao textile dyeing and uses this method to design her works (Fig. 8). The fabric dyed with plants has a comfortable texture, soft color, and is also very imaginative and artistic. It conforms to Eastern aesthetics and has an ink and wash atmosphere. In current trends and fashion, you can see many top fashion brands using designs that combine Chinese ethnic cultural elements and plant dyes.

Overall, the use of plant dyes is an artistic achievement created by the Yao people through the comprehensive integration of materials, needlework, color matching, shaping, dyeing, weaving, and embroidery techniques. It represents the folk wisdom inherited by the Yao people for generations and showcases their superb craftsmanship and practical concepts [22], which has great enlightening value for modern design.



**Fig. 7.** Yao patchwork fabric in Guangxi. China [17]



**Fig. 8.** Clothing design using traditional plant dyes. China [8]



**Fig. 9.** Clothing design that combines traditional brocade with creativity. 2024, China, Hainan Fashion Week [10]

*Traditional brocade combined with creativity for modern design.* At the 4th China International Consumer Goods Expo Fashion Week, Hainan Lizhiyun Cultural Communication Co unveiled a series of outfits that blend traditional Chinese brocade with modern garment structures (Fig. 9). These outfits incorporate the weaving techniques and patterns of traditional Chinese brocade into popular elements, and use natural plant dyes for color, preserving the beauty of Eastern traditional aesthetics while also possessing a

modern sense of fashion. They combine creativity with cultural elements and target young people to resonate with them. The overall style is also very elegant.

On an artistic level, modern design combines the simplicity of line and form with traditional brocade cultural elements, integrating the true beauty of science, the beauty of ethnic culture, and the beauty of art into the work. This makes modern design more fashionable and culturally creative, and also places more emphasis on the artistic and

cultural connotations of brocade. Therefore, traditional brocade can provide modern design with more creative inspiration.

**Conclusions.** The production of traditional brocade textile products in China is an important part of Yao culture and a true reflection of the harmonious coexistence between the Yao people and the natural environment. In this process, there is the simple ecological wisdom and principles of the Yao people, mainly including natural and degradable materials, and the reuse of old materials to eliminate textile waste. These

ecological principles also influence the formation of patterns in Yao brocades, such as the octagonal floral pattern and fish pattern. The wisdom of the Yao people living in harmony with nature is the source of creativity for modern design, and more and more designers are seeking inspiration from Chinese Yao brocade culture to meet the demand for cultural elements and promote environmental friendliness. Through these works, the beauty of Eastern culture is expressed, calling for harmonious coexistence between humans and the environment.

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## ЕКОЛОГІЧНА КОНЦЕПЦІЯ ДИЗАЙНУ ТЕКСТИЛЬНИХ ВИРОБІВ: ДОСЛІДЖЕННЯ ТКАЦЬКИХ МАТЕРІАЛІВ ПАРЧІ КИТАЙСЬКОЇ ЕТНІЧНОЇ МЕНШИНИ ЯО

**Мета** цього дослідження полягає у визначенні принципів екологічної доцільності, що застосовувались в дизайні та відображувались в художній стилістиці текстильних виробів китайської етнічної меншини Яо; а також у формуванні засобів їх впровадження в сучасному дизайні одягу

**Методологія.** Завдяки польовим дослідженням в роботі обґрунтовано, що парчові текстильні вироби китайської етнічної меншини Яо втілюють екологічні принципи, такі як використання природних матеріалів, що розкладаються, збереження ресурсів і усунення надлишку текстилю. Крім того, в роботі використано методи систематичного узагальнення та класифікації, а також аналіз літературних та наукових даних для узагальнення композиційного та розмаїття художньої стилістики традиційних та осучаснених парчових текстильних візерунків.

**Результати.** Екологічна концепція є важливим принципом, якого дотримується китайська етнічна меншина Яо у дизайні та оздобленні текстильних виробів. Вони застосовують її принципи у всьому процесі створення візерунків та ткацтва парчі, включаючи виробництво бавовняних ниток, фарбування, вишивання та дизайн одягу. Виявлено, що перевага надається природним візерункам, таким як восьмикутні квіткові та зооморфні рибні візерунки. Проаналізовано набір дизайнерських кейсів від сучасних китайських дизайнерських брендів та текстильної компанії Naipan Lizhiyun Cultural Communication, що застосовують екологічну концепцію при розробці моделей модного одягу різного призначення. Охарактеризовано, що традиційні етнічні парчові елементи текстилю та екологічні принципи поєднуються з сучасним креативним дизайном, щоб привнести

нові образно-проектні властивості та досягти гармонійного співіснування з навколишнім середовищем.

**Наукова новизна.** Визначено принципи екологічної обізнаності у традиційному та сучасному текстильному дизайні китайської етнічної меншини Яо. Обґрунтовано, що вона спирається на досвід адаптації до природного середовища та вмілого застосування екологічних принципів у розробці та виробництві парчових текстильних виробів. Виявлено, що екологічні принципи, закладені в традиційних засобах розробки текстильних парчових виробів етнічної меншини Яо, мають інспіруючий вплив на сучасний дизайн одягу. Наголошується, що це узгоджується з пропагандою ООН щодо низьковуглецевого та екологічно чистого розвитку виробництва, а отже спонукає застосовувати екологічно орієнтовані практики під час розробки текстилю та дизайну текстильних виробів.

**Практичне значення.** У результаті дослідження охарактеризовано основні типові зразки текстильних візерунків та кольорів традиційної китайської етнічної парчі Яо, що застосовуються в сучасному дизайні одягу. Крім того, поєднуючи традиційні етнічні візерунки парчі Яо з креативністю, можна створити більш оригінальні дизайнерські рішення та внести культурні елементи та конотації в сучасний дизайн одягу.

**Ключові слова:** текстильний дизайн, дизайн одягу, етнічна парча Яо; матеріали, що розкладаються; усунення надлишків текстилю; креативний дизайн.

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**Цитування за ДСТУ:** Yuan Xing, Chuprina N. Ecological Design Concept of Textile Products: A Study on Brocade Weaving Materials of the Chinese Ethnic Minority Yao. *Art and design*. 2024. № 4(28). С. 51–61.

[https://doi.org/  
10.30857/2617-  
0272.2024.4.4](https://doi.org/10.30857/2617-0272.2024.4.4)

**Citation APA:** Yuan, Xing, Chuprina, N. (2024) Ecological Design Concept of Textile Products: A Study on Brocade Weaving Materials of the Chinese Ethnic Minority Yao. *Art and design*. 4(28). 51–61.