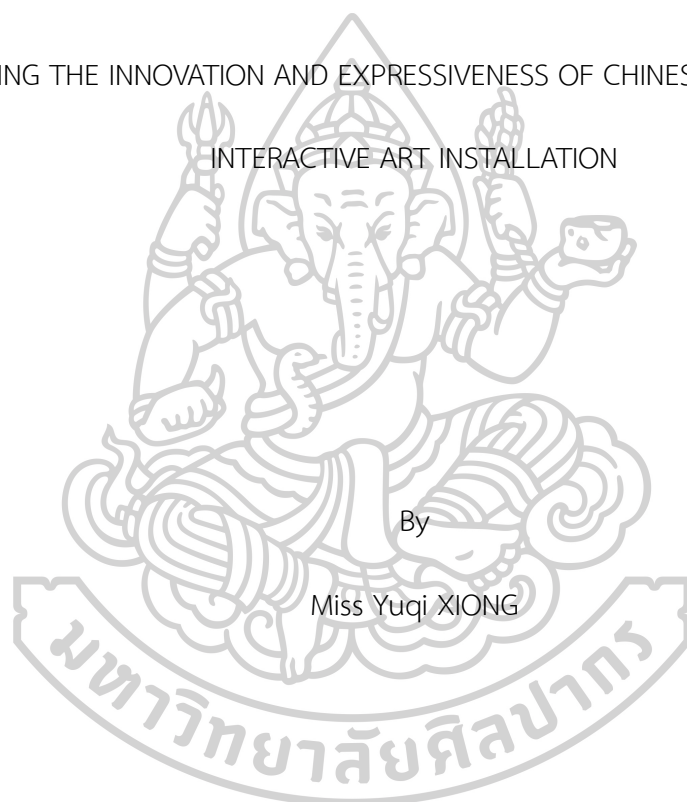




EXPLORING THE INNOVATION AND EXPRESSIVENESS OF CHINESE GRASS CLOTH IN
INTERACTIVE ART INSTALLATION



A Thesis Submitted in Partial Fulfillment of the Requirements
for Doctor of Philosophy Design Arts (International Program)

Silpakorn University

Academic Year 2025

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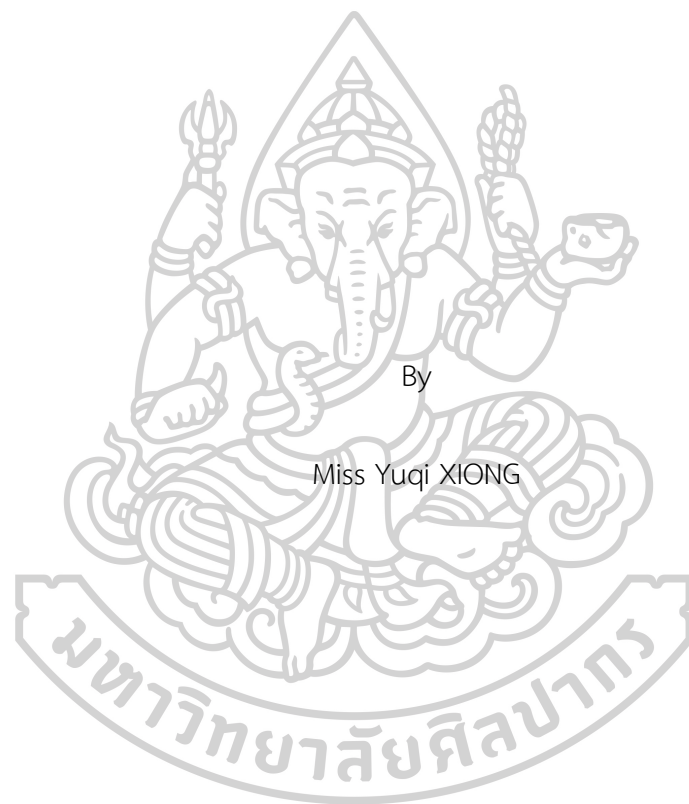
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Keyword : Chinese Grass Cloth; Interactive art installation; Natural forms; Textile innovation.

Miss Yuqi XIONG : Exploring the Innovation and Expressiveness of Chinese Grass Cloth in Interactive Art Installation Thesis advisor : Assistant Professor Jirawat Vongphantuset, Ph.D.

This study explores the innovative potential and expressive capacity of Chinese grass cloth (Xiabu) within interactive art installations. As a traditional textile with unique materiality and cultural symbolism, the experimental application of grass cloth in contemporary textile art remains largely unexplored. This research investigates how innovative methods can be developed for grass cloth, how it can be creatively integrated into interactive installations, and how a replicable design paradigm combining natural forms, fabric manipulation, and interactive technology can be established.

The objectives are to analyze the expressive qualities of grass cloth when reinterpreted through natural forms, textures, and biomimetic principles; to experiment with fabric manipulation and interactive technology to enhance its artistic dimensions; and to investigate how traditional textiles can evolve into dynamic, interactive art installations that embody both cultural heritage and ecological consciousness.

Using a mixed-methods approach—including literature review, unstructured observation, semi-structured interviews, questionnaire surveys, and material experiments—the study reveals that grass cloth's physical properties, when enhanced through dyeing, restructuring, and interaction, exhibit strong adaptability to interactive and experiential art.

The study concludes that Chinese grass cloth can transcend its traditional functions to become a medium of experimental textile art, offering new aesthetic and cultural expressions. The implications lie in establishing pathways for the sustainable revitalization of traditional crafts and contributing to the discourse on material innovation and interactive art practices.



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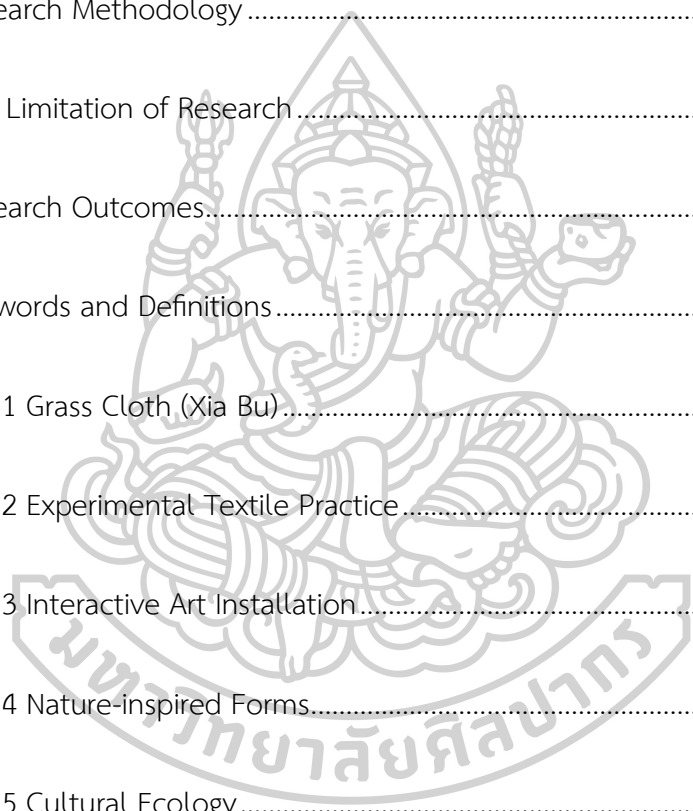


Yuqi XIONG

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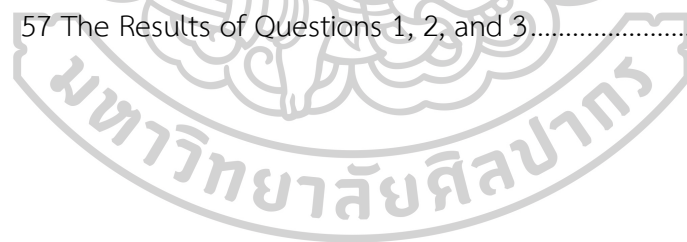
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Chapter 1

Introduction

1.1 Background and statement of problem

1.1.1 Background

Chinese grass cloth is a traditional handwoven textile made from ramie fibers (Liao & Yang, 2016). The origins of grass cloth date back approximately 6,000 years, making it one of the earliest textiles in China's cultural history. Traditionally, garments made from grass cloth are stiff yet breathable, durable, hydrophilic, and antibacterial. Beyond its physical characteristics, grass cloth reflects the material wisdom and aesthetic sensibilities of the Chinese people, holding an important place in the history of Chinese textile craftsmanship (Lin et al., 2022)

Despite its deep historical roots, grass cloth has faced significant challenges from industrial mechanization and the decline of traditional handweaving practices. Although recent efforts in intangible cultural heritage preservation and the rise of sustainable cultural trends have renewed interest in grass cloth, its applications in contemporary design remain limited. Products often rely on outdated stylistic conventions, and fail to connect with modern audiences. Breakthroughs in material experimentation, expressive language, and design integration are urgently needed.

Existing research has shown that integrating traditional textiles with modern visual culture and natural imagery through craft techniques not only enriches the artistic expression of traditional textiles but also supports the inheritance of

traditional culture (Chen, 2023). The richness of natural texture, structure, and tactile effects provides endless possibilities for experimental transformations in textile materials (Srisongmuang et al., 2022). Nature has long been recognized as a reliable and inexhaustible source of inspiration for artistic and design practices, profoundly influencing human visual expression and creative thinking (Aziz, 2016). From traditional painting to contemporary design and craftsmanship, textures, structures, and imagery derived from natural elements have been continuously borrowed, transformed, and reinterpreted by artists. With the increasing prominence of biomimicry and sustainable development, nature-inspired design has attracted growing scholarly and practical attention (Ganesan et al., 2025). In textile art, biomimicry serves as a source of inspiration for developing innovative textiles (Das et al., 2015). Nature is therefore not only an aesthetic source but also a driving force for material innovation and process restructuring (Jazmik, 2021). Through experimental treatments such as layering, collage, twisting, burning, or crystallization, grass cloth can be reinterpreted as a medium of contemporary textile art rather than being confined to its conventional functions.

The integration of interactive technology offers additional opportunities to expand the expressive capacity of grass cloth. By embedding sound, light, and air pump interactions into textile artworks, grass cloth can serve as an interactive medium in immersive installations. For example, this study develops a series of installations inspired by lichen forms, reconstructed through experimental

manipulation of grass cloth and interactive techniques, to test both artistic feasibility and audience reception.

In summary, grass cloth stands at the intersection of tradition and innovation. Although it faces outdated applications and limited visibility, it also holds significant potential when reimagined through nature-inspired aesthetics, experimental craft, and interactive technologies. This study positions grass cloth not only as a medium of cultural heritage but also as a living material for experimental textile art, with implications for ecological ethics, cultural preservation, and design education.

1.1.2 Statement of Problem

Despite its long history and cultural significance, Chinese grass cloth remains marginalized in modern design. Most current uses of grass cloth are limited to traditional areas such as garments, household textiles, and heritage exhibitions, with little innovation in form or function. Although some studies have examined dyeing techniques for grass cloth (Lin et al., 2022) or conducted innovative design research on grass cloth from the perspective of intangible cultural heritage and creative products (Li, 2017), few academic works have systematically explored the physical transformation of grass cloth through fabric manipulation or interactive technologies to achieve artistic expression. The expressive potential of grass cloth, especially its ability to reinterpret natural forms through experimental textile techniques and

interactive technologies, remains underexplored. This creates a gap between its historical importance and its limited modern applications.

Accordingly, this study seeks to address three main questions:

What innovative methods can be developed for grass cloth?

How can grass cloth be creatively integrated into interactive art installations?

How can a replicable design paradigm be constructed to unite natural forms, textile processing, and interactive technology?

1.2 Significant of Research

1.2.1 Academic Significance

The academic value of this study lies in bridging the gap between traditional textile studies and contemporary interactive art practices. Although Chinese grass cloth has been historically documented for its distinctive durability, breathability, and aesthetic qualities, scholarly research has primarily focused on its ethnographic, historical, and cultural preservation aspects. Few academic works have systematically examined its material transformation or its potential as a medium for experimental and interactive art. By situating grass cloth within the framework of interactive installation art, this study advances textile scholarship beyond conventional domains and introduces a new perspective to the discourse on material innovation.

Moreover, the research contributes to the growing field of biomimetic and nature-inspired design. Previous studies emphasize the role of natural structures,

textures, and processes in stimulating material innovation; however, few have addressed how natural morphology can be directly integrated with traditional fabrics like grass cloth to create experimental artistic expressions. By analyzing and experimenting with biomimetic transformations of natural forms, this study advances design theory by proposing a methodology that links natural inspiration with textile manipulation and interactive technologies.

The mixed-methods approach—combining literature review, semi-structured interviews, unstructured observation, questionnaire surveys, and material experiments—further enhances the academic significance. It provides a replicable research paradigm for future textile art studies, especially those focused on integrating traditional crafts and new technologies. Thus, this research not only enriches theoretical discussions on textile innovation but also contributes to methodological diversity within design and art research.

1.2.2 Cultural Significance

At the cultural level, the research highlights the revitalization of Chinese grass cloth as an intangible cultural heritage. Grass cloth weaving, once central to daily life, has gradually declined due to industrial mechanization and changing consumer preferences. Despite heritage protection policies and renewed cultural interest, grass cloth remains at risk of being confined to museum displays or commodified as souvenirs, disconnected from contemporary cultural life.

By reinterpreting grass cloth through interactive installations, the study offers a way to re-contextualize tradition in contemporary art and design practices. Instead of treating grass cloth as a static cultural artifact, this research shows how it can evolve into a medium that aligns with modern aesthetics, sustainable values, and immersive cultural experiences. This approach provides an alternative model for safeguarding intangible heritage—not only through preservation but also through creative transformation and reintegration into living cultural systems.

Furthermore, the study emphasizes the dialogue between tradition and innovation. It shows that traditional materials are not obsolete but can be reimagined to express contemporary narratives and sensibilities. This broadens the scope of cultural continuity and reinforces the importance of traditional crafts in shaping identity within a globalized cultural context.

1.2.3 Artistic and Technological Significance

This research is significant in advancing the convergence of artistic expression and interactive technology. Grass cloth, with its unique texture, absorbency, and tactile qualities, provides a distinctive surface for embedding sound, light, and air pump interactions. By experimenting with these integrations, this study demonstrates how traditional fabrics can move beyond passive visual display to engage audiences in multisensory, participatory experiences.

In the broader discourse of interactive art, textiles are underrepresented compared to digital media, projections, or kinetic sculptures. This study contributes to diversifying the material vocabulary of interactive art installations. The artistic outcomes, such as biomimetic installations inspired by lichen forms, demonstrate the capacity of textiles to evoke natural imagery and mediate sensory interactions between audiences and artworks.

From a technological perspective, the study's experimental methods—dyeing, restructuring, and embedding interactive sensors—expand the repertoire of fabric manipulation for digital and sensory technologies. This interdisciplinary approach offers valuable insights into how traditional materials can adapt to contemporary demands for interactivity, multisensory engagement, and experiential design.

1.2.4 Social and Practical Significance

At the societal level, this research addresses broader concerns related to sustainability, cultural participation, and design education. Grass cloth, made from ramie fibers, is eco-friendly because of its natural durability, biodegradability, and antibacterial qualities. By promoting its use in contemporary art and design, the research aligns with global discussions on sustainable materials and eco-conscious design.

The interactive installations created in this study foster public engagement with heritage materials. Audiences are no longer passive observers but active

participants, experiencing grass cloth through sound, light, and air pump. This participatory model enhances cultural awareness and appreciation, especially among younger generations who may have little exposure to traditional crafts. It also offers a novel way to connect the public with ecological ethics by linking natural inspiration, material innovation, and interactive design.

In terms of education, the study has pedagogical implications for art and design curricula. It provides a model for integrating material-based experimentation, cultural heritage studies, and interactive technology into studio practice and research. By emphasizing interdisciplinary collaboration, the study prepares future designers and artists to merge tradition with innovation.

1.2.5 International and Future Development Significance

Finally, this research has implications for cross-cultural exchange and global design innovation. Grass cloth, while deeply rooted in Chinese tradition, has the potential to enter international design dialogues as a sustainable and expressive material.

The proposed design paradigm—linking natural forms, textile processing, and interactive technology—can be applied to other traditional textiles worldwide. This positions the research as a model for revitalizing heritage crafts within a contemporary, globalized framework. Additionally, the findings encourage

international collaboration among artists, designers, and technologists, thereby expanding the cultural and creative economy.

Looking ahead, the study opens avenues for further exploration in interactive textile art. As digital technologies evolve, the adaptability of grass cloth and similar materials may redefine the future of textile art and design. Thus, the research addresses current challenges and anticipates long-term trajectories for material innovation, heritage revitalization, and interactive art practices.

1.3 Research Framework

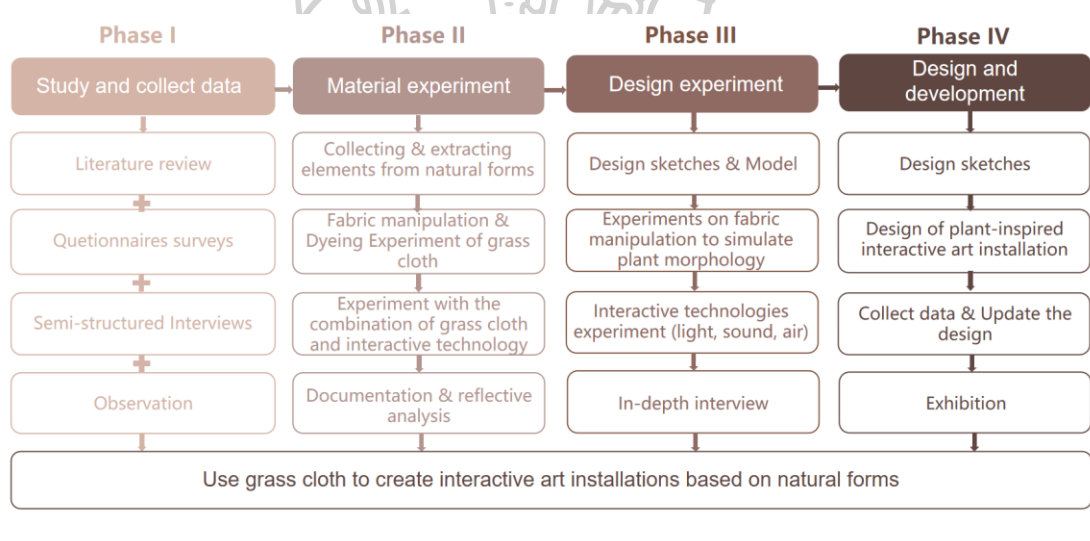


Figure 1 Research framework

1.4 Scope of the Research

This research focuses on the intersection of traditional textile heritage, material experimentation, and interactive art practice, with Chinese grass cloth (Xia bu) as the central subject. Although grass cloth has been extensively studied for its

historical origins, cultural values, and preservation strategies, this study intentionally shifts from ethnographic documentation to artistic innovation and experimental application. The research is limited to exploring how grass cloth can be transformed, manipulated, and reinterpreted within interactive art installations.

Geographically, the study focuses on grass cloth traditions from Jiangxi Province, a core region where the material and craft techniques have historically thrived. However, the findings are not limited to this local context; instead, they are placed within a broader discourse of global textile innovation and contemporary art practices. By situating a local heritage material within the context of international design and interactive art, the study aims to construct a framework with both regional specificity and global applicability.

The research content is organized around four main dimensions. First, it includes a theoretical exploration through a literature review, identifying how natural forms, biomimicry, and material innovation can inform the reimagining of traditional textiles. Second, it involves material experimentation, focusing on fabric manipulation techniques such as dyeing, restructuring, layering, and physically modifying grass cloth to uncover its expressive potential beyond conventional functions. Third, the scope covers interactive integration, embedding multisensory elements—including sound, light, air pump, and tactile responsiveness—into installations to expand the experiential dimensions of the textile. Finally, the research incorporates audience-centered evaluation through surveys, interviews, and participatory

observation to assess how contemporary viewers perceive and interact with grass cloth in immersive art contexts.

The research does not aim to provide a comprehensive historical analysis of grass cloth weaving or to optimize its production for large-scale commercial applications. Instead, the study focuses on the expressive and experimental value of grass cloth as an artistic medium. Similarly, while sustainability and heritage revitalization are underlying themes, they are treated as implications of the artistic practice rather than as primary objectives of industrial or policy-driven research.

Overall, the scope of this research is carefully defined to balance depth and manageability: it focuses on the artistic, experimental, and interactive dimensions of grass cloth, while acknowledging broader cultural, ecological, and educational implications. This defined scope ensures that the research remains rigorous, feasible, and directly relevant to the central aim of demonstrating how Chinese grass cloth can transcend its traditional identity and evolve into a medium or contemporary interactive textile art.

1.5 Research Objectives

1. To analyze the expressive qualities of Chinese grass cloth when reinterpreted through natural forms, textures, and biomimetic design principles.
2. To experiment with fabric manipulation techniques and interactive technology to enhance the dimension of its artistic expression.

3. To investigate how traditional textiles can evolve into dynamic, interactive art installations that embody both cultural heritage and ecological consciousness.

1.6 Research Methodology

This study uses a mixed-methods research approach to systematically examine the innovation and expressiveness of Chinese grass cloth in interactive art installations. The methodology combines qualitative and quantitative methods to balance theoretical analysis, material experimentation, and empirical evaluation, ensuring both academic rigor and creative applicability.

In the first stage, a literature review provides the theoretical foundation for the research. Sources include academic studies on textile innovation, cultural heritage preservation, biomimicry, and interactive art practices. This review identifies existing knowledge gaps, clarifies the historical and cultural significance of grass cloth, and establishes a framework for integrating nature-inspired design with textile experimentation and interactive technology.

The second stage involves field-based qualitative research, including unstructured observation and semi-structured interviews. Fieldwork is conducted in Jiangxi Province, where traditional grass cloth weaving is still practiced. Unstructured observation records weaving processes, material characteristics, and contextual environments, while semi-structured interviews with artisans, designers, and cultural practitioners provide insights into the craft's cultural meanings, current challenges,

and potential for innovation. These qualitative methods highlight practitioners' lived experiences and inform the experimental direction of the study.

The third stage focuses on material experimentation and practice-based research. This stage involves systematically manipulating grass cloth through dyeing, fabric techniques, and embedding interactive technologies such as sound, light, air pump and tactile sensors. Drawing inspiration from natural forms and biomimetic principles, the experiments test the physical adaptability, expressive qualities, and sensory potential of grass cloth. Documentation of each experiment—including visual records, technical notes, and reflective analysis—serve as the basis for evaluating how traditional fabric can be reinterpreted as a medium for contemporary interactive art.

The fourth stage emphasizes audience-centered empirical evaluation. Prototypes of interactive installations developed during the experimental phase are presented to participants in controlled exhibition or workshop settings. Data is collected through questionnaire surveys to measure perception, usability, and aesthetic appreciation, as well as through participatory observation to capture spontaneous reactions and engagement behaviors. This combination of qualitative and quantitative data provides a multidimensional understanding of how audiences experience grass cloth as an innovative artistic medium.

Finally, a synthesis stage integrates findings from all methods. The literature review, field data, experimental results, and audience feedback are triangulated to

construct a replicable design paradigm that unites natural inspiration, textile transformation, and interactive technology. This methodological integration ensures that the study contributes to theoretical discussions and delivers practical strategies for revitalizing traditional textiles through contemporary art practices.

1.7 The Limitation of Research

Although this study provides valuable insights into the innovation and expressiveness of Chinese grass cloth within interactive art installations, several limitations must be acknowledged. First, the research is geographically concentrated in Jiangxi Province, the core production region of grass cloth. While this focus offers depth and cultural specificity, it inevitably limits the generalizability of the findings to other regional contexts or international textile traditions.

Second, the study uses a practice-based research approach that inherently emphasizes artistic experimentation. The experimental scope of material manipulation and interactive integration is limited by available resources and technical conditions. Only a selected set of fabric treatments and interactive technologies (sound, light, air pump) were tested. This limitation means that other potential techniques, such as advanced digital fabrication or smart textile applications, remain unexplored.

Third, the evaluation of audience perception relies primarily on small-scale surveys, interviews, and participant observation conducted in specific installation

settings. While these methods provide qualitative richness, they cannot fully represent the diversity of audience experiences across different cultural or social groups.

Finally, this orientation may limit its applicability to industrial-scale innovation or policy-oriented heritage protection. Future research could address these gaps by expanding cross-regional comparisons, incorporating advanced interactive technologies, and engaging larger and more diverse audiences.

1.8 Research Outcomes

This research produces both theoretical and practical outcomes that contribute to the fields of textile art, cultural heritage, and interactive design. Theoretically, the study deepens the understanding of how natural forms—as plant morphology, textures, and patterns—can be translated into visual and tactile expressions through grass cloth. It demonstrates the symbolic resonance of natural imagery in textile-based art and positions grass cloth as a meaningful medium that bridges tradition and contemporary creativity.

At the material and technical level, the research provides experimental evidence of the physical properties and expressive possibilities of grass cloth. Through dyeing, fabric manipulation, and integration with interactive technologies, the study demonstrates the adaptability of this traditional material in new contexts.

The results suggest that grass cloth can be transformed from a conventional fabric into a medium suitable for interactive art installations.

From a cultural and ecological perspective, the research highlights the significance of grass cloth in preserving intangible cultural heritage and proposes innovative approaches for its sustainable preservation and revitalization. By engaging local artisans, conducting fieldwork, and incorporating participatory evaluation, the study outlines practical strategies that balance cultural continuity and artistic innovation. Ultimately, the outcomes contribute to the broader discourse on how traditional materials can gain new relevance in the age of interdisciplinary design and digital interactivity.

1.9 Keywords and Definitions

1.9.1 Grass Cloth (Xia Bu)

Grass cloth, also known as Xia Bu, is a traditional Chinese handwoven textile made from ramie fiber. Known for its durability, breathability, and unique texture, grass cloth carries both material and cultural significance. It represents not only the craftsmanship of handloom weaving but also embodies the sustainable philosophy of traditional Chinese textile culture. In contemporary art practice, grass cloth becomes a medium for innovation, where its rough texture and natural appearance enhance the connection with organic aesthetics.

1.9.2 Experimental Textile Practice

Experimental textile practice encompasses innovative approaches applied in the process of textile art creation, such as natural dyeing, fabric restructuring, and the integration of interactive technologies. These practices enable artists to test the physical adaptability of materials while exploring how traditional fabrics such as grass cloth can be reinterpreted in modern contexts. The experimental process serves to demonstrate the viability of grass cloth as a versatile artistic medium.

1.9.3 Interactive Art Installation

An interactive art installation is an artistic form that integrates space, technology, audience participation, and multisensory experience to create dynamic, immersive works. Unlike traditional static artworks, interactive installations emphasize active audience involvement, where gestures, movements, or touch can trigger responses in sound, light, or visual changes within the artwork. In the context of grass cloth, interactive installations offer new possibilities for reinterpreting traditional materials. By combining grass cloth with interactive technologies, the textile transcends its traditional function as fabric and becomes an active interface for communication. This integration enriches the expressive power of grass cloth and demonstrates how heritage crafts can engage with contemporary digital culture, fostering dialogue between tradition and modernity, materiality and interactivity.

1.9.4 Nature-inspired Forms

Nature-inspired forms refer to aesthetic and structural patterns derived from the natural world, including plant morphology, natural textures, and landscapes. These forms often serve as a source of creative inspiration for designers and artists. By analyzing their visual and symbolic features, creators can translate organic complexity into artistic works, making textile art not only a reproduction of natural beauty but also a symbolic medium for human-nature interaction.

1.9.5 Cultural Ecology

Cultural ecology is a theoretical framework that examines the interaction among culture, environment, and human creativity. In the context of Xia Bu, cultural ecology highlights how textile practices are intertwined with regional resources, local traditions, and cultural identity. It emphasizes sustainable development by balancing heritage preservation and innovation, ensuring that Xia Bu continues to evolve within contemporary society.

1.9.6 Heritage Preservation and Innovation

Heritage preservation refers to safeguarding the traditional knowledge, skills, and cultural significance associated with grass cloth weaving. Innovation involves reinterpreting this heritage through modern techniques, new applications, and

creative practices. Together, they form a dynamic system where tradition and modernity coexist, ensuring both cultural continuity and artistic advancement.

1.10 The relationship between Research Objective (RO), Research Question (RQ), Research Methodology (RM), Research Outcomes (ROC)

Table 1 The relationship between research objective, research question, research methodology, and research outcomes

Research Objectives (RO)	Research Questions (RQ)	Research Methodology (RM)	Research Outcomes (ROC)
To analyze the expressive potential of Chinese grass cloth when reinterpreted through natural forms, textures, and biomimetic design principles.	How can the expressive qualities of grass cloth be enhanced through experimental fabric manipulation and the integration of interactive technologies?	Literature review, unstructured observation, semi-structured interviews, questionnaire surveys.	Identification of grass cloth's tactile, visual, and structural properties, and its adaptability in experimental textile practices.
To experiment with fabric manipulation	In what ways can grass cloth be	Observation, Material	Demonstration of grass cloth as a

<p>techniques and interactive technology to expand the dimension of its artistic expression.</p>	<p>applied within an interactive art installation to create an immersive, multi-sensory environment?</p>	<p>experiments.</p>	<p>viable medium for interactive textile installations, bridging tradition and contemporary design.</p>
<p>To investigate how traditional textiles can evolve into dynamic, interactive art installations that embody both cultural heritage and ecological consciousness.</p>	<p>How can a design framework be developed that systematically integrates biomimetic forms, textile experimentation, and interactive technology?</p>	<p>Practice-based research.</p>	<p>A framework for innovation that connects heritage materials, biomimetic design, and interactive technology.</p>

Chapter 2

Literature Review

2.1 Historical Development and Cultural Significance of Grass Cloth

Grass cloth (Xia bu), a traditional Chinese textile primarily made from ramie fibers, has a long and rich cultural history. The term Xia bu appeared as early as the Yuan and Ming dynasties and became widely popular during the Qing period (Liao & Liao, 2020). Over time, major production centers gradually formed in regions such as Jiangxi, Sichuan, Chongqing, and Hunan, where climatic and ecological conditions supported high-quality ramie cultivation and contributed to the establishment of stable local weaving traditions.

Over the past six hundred years, the development of grass cloth in Jiangxi Province has undergone significant transformation. The three stages of grass cloth cultural ecology evolution in Wanzai and Fenyi, Jiangxi Province (social, economic, and environmental dimensions) are shown in Table 2. In the first stage, during the Ming and Qing Dynasties (1368–1912), grass cloth production was mainly carried out within families, with the sound of looms heard in every house. According to modern Jiangxi literature, there were hundreds of workshops producing grass cloth, and about 70% of farmers in Wanzai were engaged in grass cloth production during the Ming Dynasty. In the Qing Dynasty, there were more than 1,000 workshops and over 3,000 people involved in grass cloth production and trade.

The second stage, during the Republic of China (1912–1949), saw the traditional family-based production mode of grass cloth replaced by individual handicrafts organized into factories. During this period, the annual production of grass cloth in Wanzai often exceeded 10,000 rolls, making it a model for the industry throughout China. However, after Japan launched its war of aggression against China in 1931, sales of grass cloth fell sharply, and grass cloth enterprises closed down and went bankrupt one after another. In the 1920s, grass cloth exports had already declined sharply due to the impact of the foreign cloth market, which led to a significant decrease in exports. The third stage spans from the founding of the People's Republic of China to the 21st century (1949–present).

After the founding of the People's Republic of China, grass cloth production in Jiangxi Province was rapidly restored and developed, and grass cloth factories were reopened. However, in the 1980s, with the influx of modern textiles, grass cloth production declined sharply. In the 1990s, when the international market reopened, grass cloth shifted from meeting domestic demand to becoming export-oriented. This era marked the most prosperous period for grass cloth, with more than 85% of the population in Shuanglin Town engaged in the industry. Shuanglin grass cloth received widespread praise and held a large market share in South Korea, Japan, and other countries. The financial crisis of 2008 caused a sharp decline in exports, nearly pushing Jiangxi grass cloth to extinction. Wanzai and Fenyi, as representative production areas of Jiangxi grass cloth, have both actively promoted the deep

integration of grass cloth culture and the tourism industry over the past decade. Visitors to the Wanzai Grass Cloth Culture Museum in the Wanzai Ancient City Scenic Spot can not only purchase various grass cloth products, but also learn about grass cloth production techniques and related knowledge. As shown in Figure 2, the Shuanglin Grass Cloth Cultural Tourist Attraction in Fenyi has established a cultural tourism and idyllic complex project site that integrates grass cloth handcrafting, education, experience, and leisure, making it an important support project for the local economy.

Table 2 Comparison of the three stages of grass cloth cultural ecology evolution in Wanzai and Fenyi, Jiangxi Province (social-economic-environmental dimensions)

Stage	Society	Economy	Environment
Stage 1 (1368–1912) Ming and Qing Dynasties	Household-based production of grass cloth is integrated into farmers' daily lives.	With more than 1,000 handicraft workshops, grass cloth became a pillar of the local economy.	Production relies on manual labor and local raw materials, creating an ecological pattern of coexistence between humans and nature.
Stage 2 (1912–	Grass cloth	The industry, once	Production was

<p>1949) The Republic of China</p>	<p>production became industrialized, with peasants becoming factory workers, while war caused social instability.</p>	<p>a national model, declined after the war and due to foreign competition, leading to factory closures and trade stagnation.</p>	<p>factory-based but still relied on local resources; ecological management declined during wartime.</p>
<p>Stage 3 (1949–Now) After the founding of the People's Republic of China</p>	<p>Urbanization endangers traditional crafts, while ICH policies and rural revitalization promote the revival of grass cloth. Cultural and tourism integration fosters diverse social culture and cognitive</p>	<p>The grass cloth industry has experienced cycles of revival and decline. Following export prosperity in the 1990s and setbacks from the financial crisis, its 21st-century transformation relies on the “cultural</p>	<p>Modern textiles disrupt the traditional ecological chain, while tourism development connects ecological experience with ICH protection. Cultural villages pursue an ecology-based</p>

	transformation.	innovation + tourism” model.	sustainable path.
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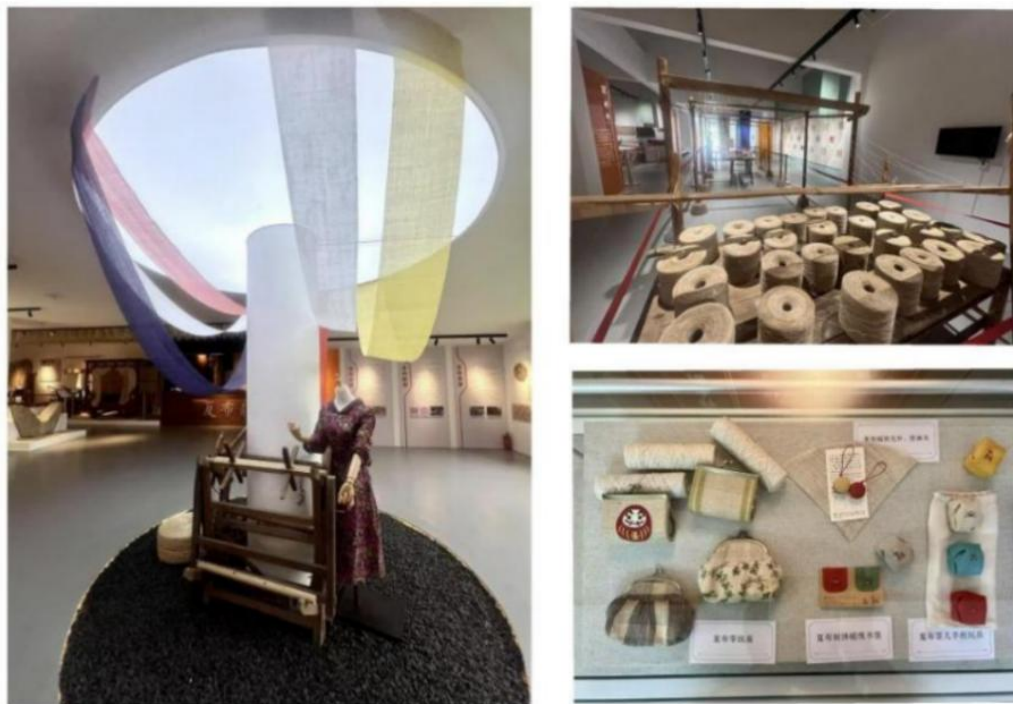







Figure 2 Shuanglin Grass Cloth Cultural Tourist Attraction





Source: Photographed by reasearcher


The production of grass cloth is embedded in a complete ecological and technical system that includes ramie cultivation and the production process of stripping, soaking, scraping, sun-drying, spun yarn, winding, warp, starch, and weaving, as shown in Table 3. The natural and rugged characteristics of ramie fabric are mainly due to the ramie fiber and semi-degumming and spinning processes (Chen & Huang, 2008). This craft cycle reflects an intimate relationship between humans and their

natural environment, demonstrating knowledge accumulated through long-term coexistence with local ecosystems.

Table 3 The production process of grass cloth

1	Ramie cultivation	Ramie can be harvested three times a year (spring, summer, and autumn).	
2	Stripping	The optimal time is between 5 and 8 a.m., when dew forms on the ramie bark, making it easy to strip.	
3	Soaking	Soak ramie skin that has been stripped in water, make it ferment naturally, achieve the purpose of partial degumming.	
4	Scraping	Scrape off the surface of the green skin with a knife, remove the ramie bone, shell and impurities on the fiber.	
5	Sun-drying	Place the ramie skin in the sun to dry to prevent rotting.	

6	Spun yarn	It is divided into four working procedures: tearing, rolling, twisting, and winding.	
7	Winding	Winding is a type of high-quality yarn wound around a bamboo tube about half a foot long. After the yarn is fully wound, the tube is removed.	
8	Warp	When working with the warp, it is essential to check the tightness and strength of each thread and to ensure that every ramie yarn is consistent in thickness.	
9	Starch	The rice paste is made from early-harvested rice and cooled to 20 degrees Celsius. Craftsmen use small brushes to apply the paste evenly onto the thread, making it straight and smooth.	

10	Weaving	The weaver shuttles the weft thread back and forth to create ramie cloth.	
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On an aesthetic level, the clearly visible texture, crispness, and unpolished feel of grass cloth resonate with the Taoist concept of "harmony between man and nature," embodying the traditional values of nature and simplicity. These aesthetic qualities, shaped by the inherent fiber structure and handcrafting techniques of grass cloth, endow it with enduring cultural symbolism.

Historically, grass cloth was primarily used for making garments, mosquito nets, and food sacks, highly valued for its breathability, durability, and antibacterial properties (Liao & Yang, 2016). Grass cloth is not only a practical textile but also a carrier of social memory and cultural identity. The craft embodies ecological wisdom through effective fiber utilization, low-carbon production, and environmentally friendly processes.

This research revisits this traditional material, transforming grass cloth from a utilitarian household fabric into an expressive medium in art. It highlights its capacity to both carry cultural narratives and adapt to new creative contexts.

2.2 Cultural Ecology and Protection of Traditional Handicrafts

The concept of cultural ecology was first proposed by American anthropologist Julian Steward to study cultural change and evolution in human

adaptation to the environment and to explain the origin of certain cultural characteristics and patterns with regional differences (Wang, 2022). As an important part of intangible cultural heritage, traditional handicrafts carry rich historical memory and regional culture. However, under the impact of modernization, many traditional skills are at risk of being lost. Some researchers have used cultural ecology to provide a systematic theoretical framework and practical approach for protecting traditional handicrafts. Yang et al. (2022) suggest constructing a multidimensional inheritance model for traditional handicrafts adapted to the new cultural ecology to achieve their sustainable development. Jin (2016) proposes the concept of non-heritage community building to protect the health of cultural ecology. Li et al. (2024) advocate optimizing exhibition methods through the concept of cultural ecology to integrate skill knowledge, regional environment, and public experience, providing a path to enhance the social communication of traditional handicrafts. Fu (2023) proposes continuous cultural innovation and technological upgrading, exploring the development of traditional handicrafts in marketing, industrialization, and modernization through innovative creation and entrepreneurial innovation. These studies cover multiple perspectives, including policy, design, and community participation. In addition, some studies propose strategies for developing traditional crafts from a cultural ecology perspective based on empirical research. For example, Yang et al. (2018), through an empirical study of traditional crafts in Pakistan, proposed policies to promote and protect traditional craft heritage, emphasizing the

roles of technology and innovation, education and training, infrastructure improvement, and promotion of tourist attractions in supporting craft traditions.

Existing literature mostly focuses on exploring holistic conservation principles or policy recommendations for cultural ecosystems, and empirical research on specific craft categories is still insufficient, especially the systematic examination of traditional crafts in specific geographical areas.

2.3 Current Situation and Dilemma of the Inheritance of Grass Cloth

Grass cloth is an important testament to China's ancient textile civilization, carrying the memory of local history and embodying the cultural and ecological philosophy of harmonious coexistence between humans and nature. However, due to industrialization, modernization, and changing consumption patterns, the inheritance and development of grass cloth face serious challenges. Zhang (2021) provides a comprehensive overview of Chinese grass cloth, covering its history, craftsmanship, current status, characteristics, and applications. He notes that the lack of inheritors of grass cloth techniques is a major current dilemma. Liao and Yang (2016) point out that the high cost of hand-weaving, combined with a limited product range and outdated deep-processing technology, has resulted in a lack of market competitiveness, which is one of the main challenges in the current inheritance of grass cloth. Pan et al. (2009), focusing on the backwardness of deep-processing technology of grass cloth, further emphasizes the need to develop

new varieties of grass cloth through technological innovation, expand its applications, and build traditional cultural brands to promote the development of the grass cloth industry.

Existing research has more comprehensively analyzed the current situation and challenges facing the grass cloth industry. It is generally noted that the main issues in the cultural inheritance of grass cloth are outdated deep processing technology, market marginalization, and a shortage of skilled talent. However, most current literature focuses on the industry and craft levels, lacking research on innovative applications of grass cloth.

2.4 Protection and Innovation Model of Grass Cloth

With the gradual decline of traditional crafts, how to effectively protect and revitalize grass cloth culture in contemporary society has become a research focus. Especially from the perspective of cultural ecology, the protection of grass cloth should not be limited to technical skills but should also address multi-dimensional factors such as the ecological environment, community participation, and industrial transformation. Liu et al. (2022) proposed a strategy for the productive conservation of grass cloth based on service design, while Luo et al. (2021) proposed a strategy for developing tourism cultural and creative products based on productive conservation. This includes a diversification strategy based on tourist needs, a cultural creativity strategy to enhance brand image, and a strategy for applying key elements to

continue the inheritance of intangible cultural heritage. Deng (2019) explored an innovative model combining Jiangxi Ramie resources with the local tourism industry, emphasizing the branding and industrial development of Ramie cultural tourism resources. (Liao, 2022) explored derivative design of grass cloth and the multi-faceted ecology of cultural inheritance, emphasizing cultural tourism projects themed on the history and culture of grass cloth to achieve the modern transformation of its multiple values.

These studies have developed a relatively rich understanding of grass cloth cultural protection models from multiple perspectives, including service design, cultural and tourism integration, brand development and derivative design. However, current research lacks exploration into achieving its modern transformation from the perspective of creative design practices in grass cloth.

2.5 Nature as a Source of Inspiration in Textile Art and Design

Nature has long been regarded as a primary source of inspiration for design, art, and material innovation. Ram (2025) explored how Indian textiles and fashion design draw from nature, examining floral, botanical, and animal motifs, as well as the concept of organic patterns in textile design. Biomimicry has been applied to textiles and fashion. Das et al. (2015) emphasized that biomimicry can inspire the development of innovative textiles. Similarly, Beans (2023) showed that nature-inspired biomimetic fashion not only expands the aesthetic possibilities of

fashion design but also offers pathways to sustainable practices. These perspectives underscore nature's significance as both a conceptual and material foundation for textile and fashion design. Other studies enhance textiles based on current scientific advancements. For example, Singh et al. (2012) analyzed ten biomimetic smart fabric design methodologies, demonstrating the integration of nature-inspired design into textiles alongside advances in biomimetic materials and polymer science. Collectively, these studies affirm that natural forms are not merely aesthetic references but serve as functional blueprints for material and artistic innovation.

2.6 Textile Material Experiment and Fabric Manipulation

Several studies have examined the expressiveness of fabrics and the aesthetic interpretation of natural forms in textile practices. Srisongmuang et al. (2022) conducted experiments on uneven angles between yarn twist and weft direction, showing how simplified natural leaf morphologies affect a fabric's visual and tactile properties. Chen (2023) used “homespun-collage” as a primary medium to demonstrate practical methods for reinterpreting traditional materials such as homespun cloth. Their findings indicate that material experimentation is essential for textile development and expression.

Grass cloth, a traditional Chinese textile, is used for clothing, accessories, mosquito nets, bedding, handicrafts, and grass cloth paintings (Liao & Yang, 2016). Although its experimental use in contemporary textile art remains underexplored, its

natural fiber texture, durability, stiffness, and organic grain offer significant potential for artistic expression. Fabric manipulation can transform fabric into a three-dimensional material to create contrast, add fullness, and produce surface effects (Fawzy Abdel Wahab, 2022). Techniques such as gathering, shirring, pleating, tucking, smocking, quilting, stitching, beading, patchworking, and applique are used to reshape base fabrics and foster creative innovation (Burns, 2022). Therefore, when combined with fabric manipulation techniques, grass cloth has the potential to reinterpret natural imagery in textile art.

2.7 Interactive Textile Art

Interactive technology plays a significant role in expanding the expressive dimensions of textile art. Nualdaisri (2022) examined the integration of various weaving techniques, yarn types, and textile innovations into Thai silk to create interactive art installations, unlocking new possibilities for this ancient material. Lim (2017) explored the potential of incorporating interactivity into knitted fabrics, where flexible electronic components embedded within textiles create sensory experiences that engage touch, hearing, and aesthetics. Guridi et al. (2021) investigated how electronic textiles can be applied to traditional textile arts. Integrating technology with crafts that have strong cultural identities helps attract new audiences, revitalize traditional techniques, and create new tools for expression and creativity. Several practical cases demonstrate how textile materials can gain new value through

interactive design. Colchester (2007) presented case studies of textile projects incorporating interactive design. For example, Maggie Orth designed products printed with thermochromic ink that changes color when electrically heated conductive yarns are activated, exploring the relationship between textiles, lighting, and color. For grass cloth, such approaches suggest the possibility of expanding beyond conventional uses into immersive textile installations, where natural imagery can be conveyed through interactive experiences.

In summary, although previous research has highlighted the value of biomimicry, material innovation, and technological integration, a clear research gap remains in exploring the experimental application of Chinese grass cloth as a medium that embodies both natural aesthetics and cultural heritage. This study addresses this gap by examining how grass cloth can be manipulated and combined with interactive technology to create contemporary textile art inspired by natural forms.

2.8 Examples of Innovative Uses of Grass Cloth (Case Study)

2.8.1 Case Study 1: The Grass Cloth Workshop at Sichuan Fine Arts Institute

Sichuan Fine Arts Institute selects locally sourced traditional grass cloth as raw material and continuously holds grass cloth-themed workshops to experimentally explore innovative applications of traditional materials and techniques in contemporary design. The one-and-a-half-month ramie research and design

workshop unfolds in three phases: five days of field research, two weeks of material study, and three weeks of design application.

Research on grass cloth begins with fabric manipulation, exploring its physical properties, visual texture, and forming techniques, as shown in Figure 3. By fully leveraging grass cloth's natural characteristics—its inherent foldability, resilience, and high plasticity—experiments used various methods such as folding, tying, embroidery, wrapping, botanical dyeing, and burning to create diverse visual textures.

The fabric manipulation experiments incorporate various hand-weaving techniques. Using knitting needles and crochet hooks, fiber art methods such as wrapping and warp/weft knitting are applied. Grass cloth is woven with other materials to create diverse fabric textures and novel appearances. Through weaving techniques, grass cloth is cut into multiple strips. Techniques such as folding, sewing, and burning are comprehensively applied to these threads and strips, resulting in a series of combinations. This transforms the inherently flat fabric surface into a three-dimensional form, delivering a completely new visual effect. When woven with chiffon, blue linen, and metal chains, ramie fabric gains new vitality by blending the silkiness and transparency of chiffon, the rustic quality of linen, and the rigid metallic feel of chains.

Another experimental approach involves cutting grass cloth into rectangles and triangles, folding them, sewing them tightly together, then drawing out the threads and burning the edges to create a three-dimensional, undulating effect.

Traditional Bai ethnic tie-dye techniques from Southwest China were used to tie-bind the grass cloth, followed by high-temperature steaming to set the shape and dye it, creating sharp, protruding three-dimensional forms.

The experiments also explored combining grass cloth with contemporary materials such as silicone and resin. This series first created textures through sewing and folding, then encased them in resin to achieve a fossil-like effect, ultimately producing a collection of jewelry pendants using this technique. The pieces feature grass cloth of varying densities and colors to create texture. Combined with ramie silk, mesh fabric, hemp rope, and lightweight clay, they form a series of accessories.

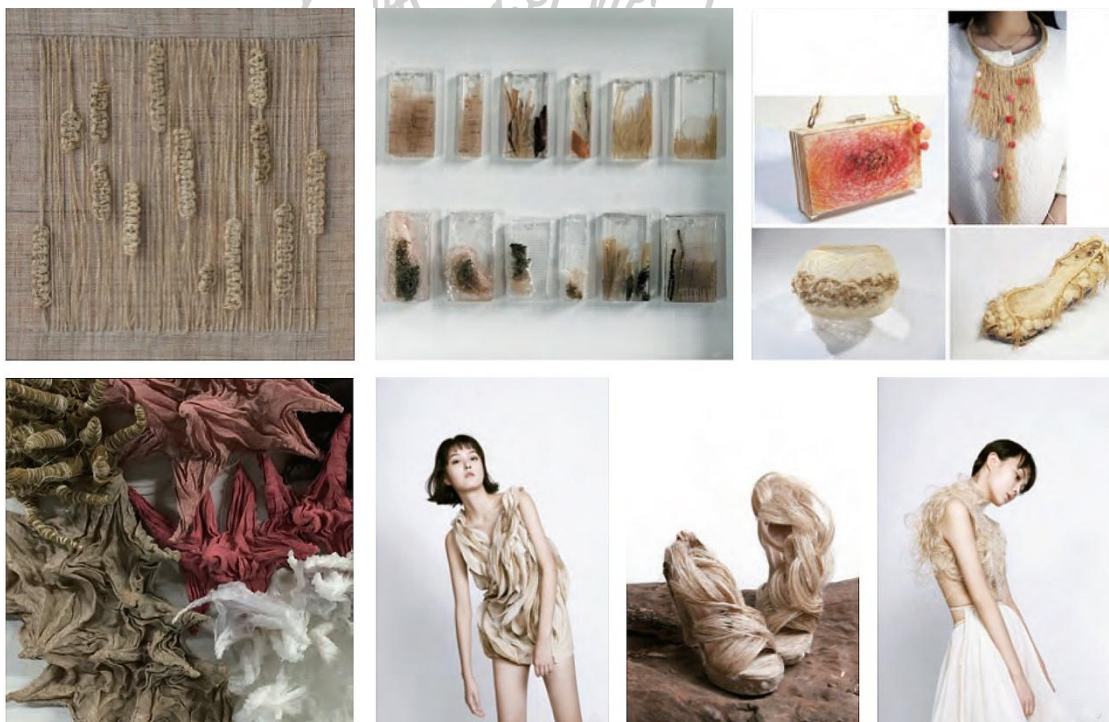


Figure 3 Innovative Achievements of the Grass Cloth Workshop

Source: *The Grass Cloth Workshop at Sichuan Fine Arts Institute*

2.8.2 Case Study 2: Summerwood Brand

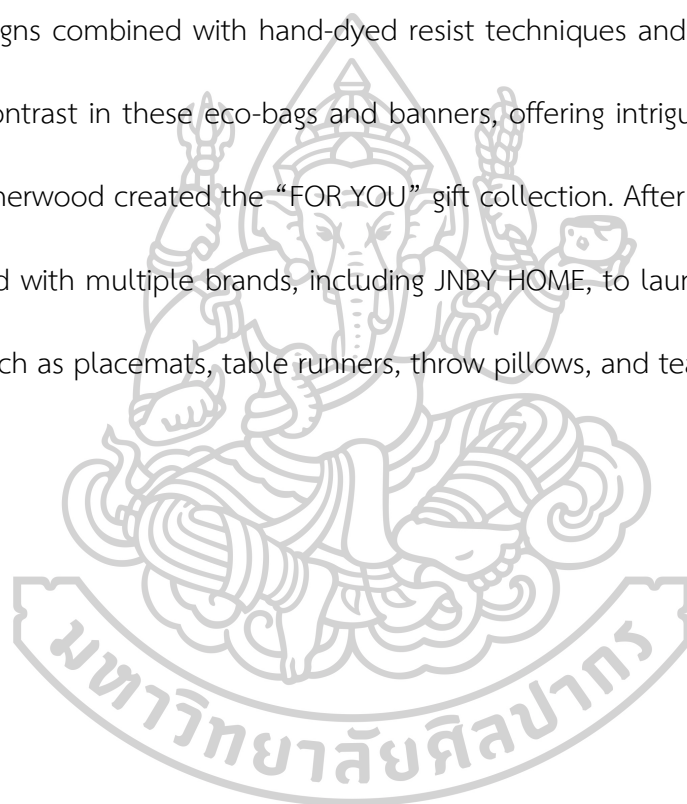
Summerwood was founded in 2013 as a design brand dedicated to handwoven textiles. Founder Hongbo Yi aims to infuse the traditional handwoven fabric known as grass cloth with modern sensibilities. Through collaborations with apparel design brands and independent design initiatives, he enables the revival of grass cloth fabrics in garments and products, integrating them into contemporary design. Summerwood's work highlights the unique charm of traditional handwoven textiles, attracting attention for their rich historical and cultural significance. At the same time, the developmental challenges faced by Summerwood in the modern era prompt reflection on the preservation and innovation of traditional craftsmanship.

In 2013, Summerwood collaborated with two independent apparel brands, “Digestion” and “No Borders.” Motivated by a shared fascination with materials, they began this joint venture. Hongbo Yi first provided basic fabric samples, then discussed the desired color effects and texture firmness to select suitable materials. Although Hongbo Yi specifically used biological enzyme degumming treatment, the fabric remained relatively stiff. Additionally, the pronounced transparency and narrow width of ramie fabric posed adaptation challenges for designers. Ultimately, the “Digestion” collection used Eastern flat-pattern cutting to highlight the handwoven qualities of grass cloth, while the “No Borders” series employed techniques such as patchwork and folding to harmonize with grass cloth's simple, rustic aesthetic.

Beyond apparel, Hongbo Yi continually explored grass cloth's potential in accessories and footwear. In 2015, Summerwood collaborated with MouHoo to create windmill grass necklaces and brooches. Here, grass cloth moved beyond its role as a raw material to become an integral design element. Paired with metal, it achieved a balance of strength and softness, while the fiber's texture and translucency stood out through contrast. In 2017, Summerwood collaborated with Kreuzzz to design several headwear pieces. Using techniques such as pressing, folding, and coiling, they explored the fabric's sculptural potential. Meanwhile, the partnership with HENG SHU marked an experiment using ramie as a shoe material. For ramie products, Hongbo Yi collaborated with MORE studio in 2013 to create the Year of the Horse collection. Playful graphic designs on ramie fabric, combined with hand-dyed resist techniques and embroidery, created a natural contrast in these eco-friendly bags and banners—a delightful interplay worth savoring. In 2017, Summerwood created the “FOR YOU” gift collection. This Year of the Rooster series, following the “Year of the Horse” line, included ramie fabric pouches, coasters, throw pillows, back cushions, eco-bags, and tea coasters.

Beyond apparel, Yi Hongbo has consistently explored the diverse possibilities of grass cloth in accessories and footwear, as shown in Figure 4. In 2015, Summerwood collaborated with MouHoo to create innovative necklaces, brooches, and other products. The combination of grass cloth and metal imparted softness within the products' rigidity, while the fiber's texture and translucency were

highlighted through contrast. In 2017, Summerwood partnered with Kreuzzz to design several headwear pieces. Using techniques such as pressing, folding, and coiling, they explored the fabric's sculptural potential. The partnership with HENG SHU marked an experiment using ramie as a shoe material. For ramie products, Hongbo Yi teamed up with MORE studio in 2013 to co-create the Year of the Horse collection. Playful graphic designs combined with hand-dyed resist techniques and embroidery created a natural contrast in these eco-bags and banners, offering intriguing visual appeal. In 2017, Summerwood created the "FOR YOU" gift collection. After 2018, Summerwood collaborated with multiple brands, including JNBY HOME, to launch distinctive home products such as placemats, table runners, throw pillows, and tea coasters.



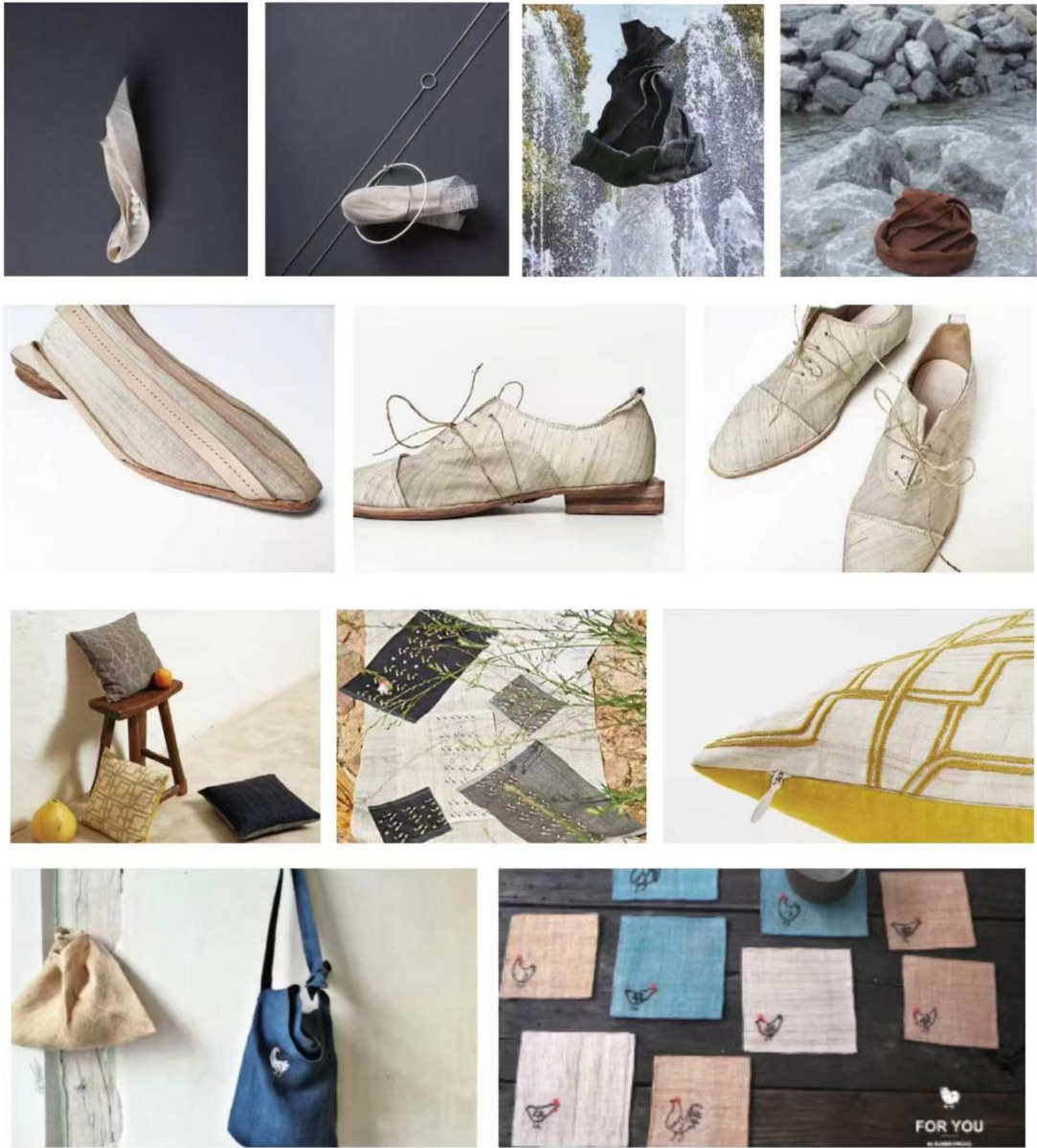


Figure 4 Summerwood brand products

Source: <https://summerwood.cn/textiles/zhubu/>, online store

2.8.3 Case Study 3: 'Yan · Summer Language' clothing collection

Qi Cheng, Jie Luo, and Ruixue Qin's research fully leverages fabric properties, using diverse techniques to create textured surfaces with raised and recessed

patterns, shaping new appearances and visual effects for fabrics. This process focuses on multilayered exploration of material textures and the creation of multidimensional visual imagery—an investigation into material tactility and texture. Its conceptual scope continually expands and evolves alongside innovations in design philosophy and style, giving materials new possibilities within contemporary fashion contexts.

Through artistic reinterpretation of materials, they investigated techniques and regeneration methods, leveraging inherent properties and aesthetic qualities to explore possibilities for material transformation. They uncovered expressive potential during grass cloth manipulation experiments, explored diverse manipulation techniques and approaches, and sparked design inspiration through material innovation for apparel creation.

As shown in Figure 5, the Silk Series garments from “Yan-Summer Language” are crocheted from ramie yarn, combining the resilience of hemp with the elasticity of knitwear. Their lightweight, translucent appearance reflects the natural, pure, and primal qualities of ramie fabric. The Water Series of “Yan-Summer Language” uses a technique in which grass cloth and silk threads are curled and wrapped to form flowing, vortex-like patterns, shaped directly on the mannequin through layered construction. The bottom features knitting techniques, incorporating the structural elements of the circular skirt found in ethnic attire. The Gold Series of “Yan-Summer Language” uses traditional flat-pattern cutting for zero-waste efficiency. Black and

gold silk embroidery, combined with fabric collage, recreates the structural composition of traditional motifs. The Earth Series uses traditional tie-dye techniques, shaping pointed forms through steaming and drying. The Fire Series of “Yan-Summer Language” uses a cut-and-burn technique: raw silk is cut into arcs of varying sizes, then singed to create edges of different depths and natural lines, before being grouped and fixed into shape.

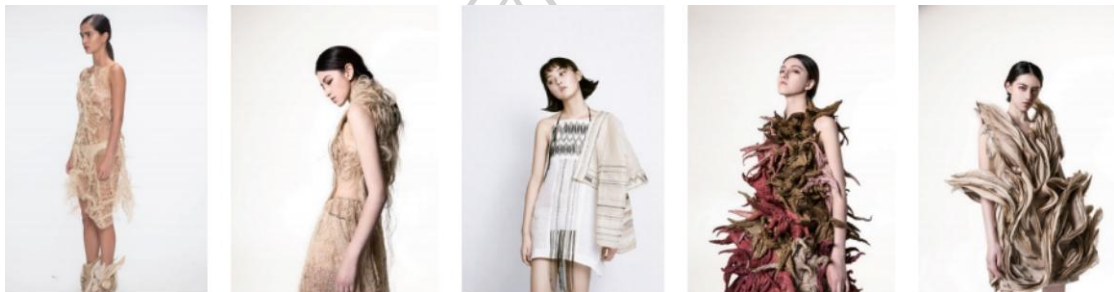


Figure 5 ‘Yan · Summer Language’ clothing collection

Source: Qi Cheng, Sichuan Fine Arts Institute

2.9 Example of interactive installation (Case Study)

Philip Beesley, a Canadian artist, is widely acclaimed for his installations that integrates intelligent interactive systems with biological materials to investigate the dynamic interplay between human participants and their surrounding environments. His installations consist of complex networks of digitally fabricated acrylic and ABS structures, custom glass vessels, programmable LED arrays, infrared sensors, and sound modules. These responsive systems envelop viewers within multisensory

environments that dissolve the conventional boundaries between static architecture and living organisms.

As shown in Figure 6, Grove serves as a quintessential example of Beesley's vision of architecture as an animate, responsive entity. Designed as a luminous, collective gathering space, the installation features a flowing canopy of translucent, lace-like forms embedded with liquid-filled glass vessels, suspended above a central pool-like projection surface. A film titled *Grove Cradle*, created by artists Warren du Preez and Nick Thornton Jones, is projected onto this surface. The fusion of moving imagery, sound, and kinetic structure produces an immersive sensory experience in which myriad worlds appear to disintegrate into chaos and then regenerate into new forms of life.

This case illustrates how living morphologies can inspire interactive and sensory environments through the integration of material experimentation and technological mediation. It offers a conceptual framework for reimagining traditional textiles within contemporary art practices that unite organic inspiration with responsive and adaptive systems.

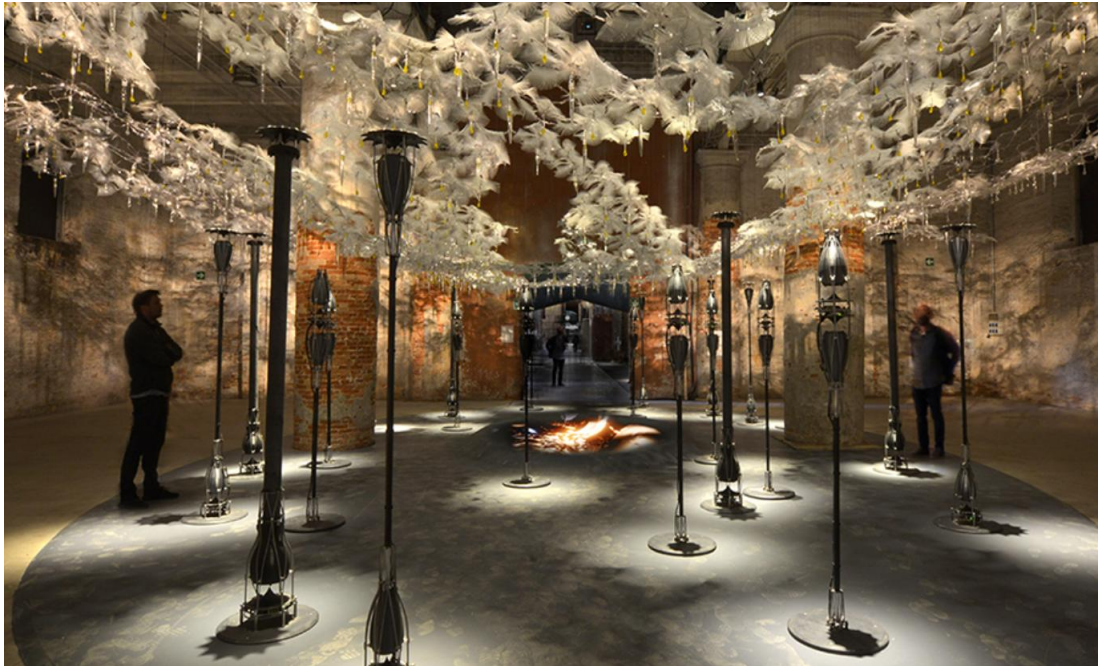


Figure 6 Grove, Venice Biennale 2021

Source: <https://www.philipbeesleystudioinc.com/sculpture/grove/>



Chapter 3

Research Methodology

3.1 Research Methodology

This study uses a mixed-methods approach, combining quantitative and qualitative data analysis to provide a comprehensive understanding of the innovative application of Chinese grass cloth in textile art. Mixed-methods research is especially suitable for addressing questions that cannot be fully answered by quantitative or qualitative data alone. By integrating numerical data with contextual insights, this approach enables the researcher to capture both measurable public perceptions and the deeper cultural, historical, and material dimensions of grass cloth as a textile art medium.

The methodological framework of this research includes four main components: questionnaire survey, unstructured observation, semi-structured interviews, and material experiments, as shown in Figure 7. Each method complements the others, ensuring data triangulation and enhancing the reliability and validity of the study's findings.

Qualitative	Quantitative
<p>Unstructured observation</p> <ul style="list-style-type: none"> • The inheritance mechanism of grass cloth craftsmanship inheritance • Cultural ecological environment • Diversified development and brand product characteristics of grass cloth 	<p>Questionnaire</p> <ul style="list-style-type: none"> • The public's perception and acceptance of Chinese grass cloth as a medium for textile art • Innovative applications of grass cloth
<p>Semi-structured Interviews</p> <ul style="list-style-type: none"> • Individual Growth and Technique Inheritance • Community Inheritance Mechanisms • Industrial Impact • Contemporary Challenges and Future Outlook <p>Opinions from inheritors, cultural center staff, company founders, and factory employees.</p>	<p>Material experiment</p> <ul style="list-style-type: none"> • Experiments on Grass Cloth: Fabric Manipulation and Dyeing to Simulate Plant Morphology • Experiments on Grass Cloth: Interaction with Light, Sound, and Air Pumps

Figure 7 The methodological framework

In this study, the questionnaire was designed to evaluate the public's perception and acceptance of grass cloth as a medium for textile art. The survey specifically investigated awareness of grass cloth, attitudes toward its traditional and innovative uses, and preferences regarding its integration into contemporary textile art practices. The questionnaire was distributed online through Wenjuanxing, a widely used Chinese platform for digital survey distribution, ensuring efficient collection of responses from a broad demographic range.

While surveys capture general attitudes, they often overlook the complexity of cultural practices and interactions. Therefore, this research used unstructured observation as a qualitative method to examine the cultural ecology of grass cloth in its natural context. Unstructured observation is particularly useful for exploring complex social behaviors and interactions without the constraints of rigid protocols. Fieldwork was conducted in Wanzai and Fenxi counties in Jiangxi Province, the historical centers of grass cloth production. Key observation sites included the

Wanzai Shuangzhi Grass Cloth Factory, Fenyi Ramie Planting Base, and cultural institutions such as the Wanzai Grass Cloth Cultural Museum, the Fenyi Hemp Museum, and the Shuanglin Grass Cloth Cultural Tourist Attraction. In addition, representative enterprises such as Jiangxi Gu Xia Jin Zhao Grass Cloth Cultural Co., Ltd. and Xian Yun Grass Cloth Cultural Communication Co., Ltd. were documented for their branding strategies under the “intangible cultural heritage + cultural creativity” model. During the observation process, three major themes were prioritized: examining how traditional knowledge is passed down through daily practices, workshops, and community activities; analyzing how museums, study-tour bases, and tourist attractions function as spaces for both heritage protection and cultural display; and exploring the dynamics between local governments, enterprises, and intangible cultural heritage participants in promoting innovation and diversification of grass cloth. Field notes, photographs, and contextual recordings were collected to provide nuanced insights into the living conditions of grass cloth culture. These observations not only documented the socio-cultural environment in which grass cloth is embedded but also established the contextual foundation for the second phase of semi-structured interviews.

To complement the observational data, semi-structured interviews were conducted with key stakeholders. Semi-structured interviews are characterized by the use of open-ended questions, allowing participants to express their views freely and giving the researcher the flexibility to probe deeper into emerging themes. This

method is particularly effective for exploring complex issues such as heritage transmission, market dynamics, and personal experiences. Multiple rounds of interviews were conducted with representative inheritors Zhixue Song and Yusheng Wang, who are recognized for their expertise in traditional grass cloth craftsmanship. In addition, interviews were conducted with Zhixue's family members, factory employees, and Yi Liao, founder of Xian Yun Grass Cloth Cultural Communication Co., Ltd. These interviewees provided diverse perspectives on inheritance, production, entrepreneurship, and policy implementation. The interview questions focused on five key themes: the historical development of grass cloth and its changing functions in daily life; inheritance models and the challenges of transmitting traditional skills to younger generations; market dynamics, including opportunities and constraints in promoting grass cloth as a cultural and creative product; policy and institutional support, with attention to government initiatives, subsidies, and cultural heritage programs; and protective measures and innovation, addressing how traditional techniques are preserved and adapted to meet contemporary needs. The qualitative data gathered through interviews were transcribed and coded thematically, enabling the identification of recurring patterns and unique insights. The interview results provided a deeper understanding of the human experiences, motivations, and strategies that shape the contemporary evolution of grass cloth.

The final component of this study involved material experiments, bridging the gap between theory and practice by testing the physical and artistic properties of

grass cloth. Drawing on insights from the survey, observation, and interviews, a series of controlled experiments were designed to explore how grass cloth could be manipulated and transformed into innovative textile art forms. The experiments focused on three main areas: dyeing techniques, testing traditional methods such as tie-dye to observe how different levels of tightness influence color patterns and texture; fabric manipulation, altering the structure of grass cloth through cutting, layering, folding, and stitching to simulate natural morphologies such as bark, leaves, and geological textures; and interactive technology integration, incorporating capacitive touch sensors, pneumatic devices, and light-responsive systems to enhance the expressive potential of grass cloth in interactive art installations.

The experimental outcomes were evaluated using three criteria: texture, assessing the tactile qualities and durability of modified grass cloth; morphological adaptability, analyzing how effectively grass cloth can simulate natural patterns and forms; and artistic expressiveness, evaluating the aesthetic impact and emotional resonance of the material in artistic contexts. The results provide practical evidence of grass cloth's versatility and theoretical support for its role as an innovative medium in textile art. These experiments form the basis for subsequent creative practice, linking material research with artistic production.

3.2 Data Collection

3.2.1 Questionnaire Survey

Researchers can use questionnaires to obtain information about participants' thoughts, feelings, attitudes, beliefs, values, cognition, personality, and behavioral intentions (Johnson & Christensen, 2000). To understand the public's perception and acceptance of Chinese grass cloth as a medium for textile art, a convenience sampling method was employed to distribute the questionnaire online via the Wenjuanxing platform. The typical users of Wenjuanxing are general Chinese internet users, encompassing a wide demographic range in terms of age, occupation, and geographical location. The demographic characteristics of the respondents, including gender and age distribution, were collected to understand the sample's composition. Additionally, the questionnaire inquired about respondents' existing knowledge and practical experience with grass cloth and textile arts to segment the audience based on their familiarity with the subject. The questionnaire contains 10 questions, as shown in Table 6. Professional terms used in the questionnaire, such as “grass cloth” and “textile art,” were accompanied by concise annotations to ensure participants could accurately understand them. Before distributing the questionnaire, all participants received an informed consent form, as shown in Table 5. Before participating in the study, participants were informed of the study's purpose, benefits, risks, time required, and level of confidentiality. A statement indicated that

participation was voluntary and that participants could withdraw or refuse to participate at any time without penalty.

Table 4 Informed Consent Form

Informed Consent
<p>Thank you for your interest in this study. Please read the information below before you begin.</p> <p>Consent and Confidentiality: Your participation is entirely voluntary; you may withdraw at any time without penalty. All information you provide will be strictly confidential and used solely for academic research purposes.</p> <p>Purpose of the research: This study, titled “Textile Art Inspired by Natural Forms: Experimental Applications of Chinese Grass Cloth.” aims to explore innovative artistic practices using grass cloth to interpret natural forms. The research seeks to demonstrate the artistic potential of grass cloth as a primary medium in creating contemporary nature-inspired textile art.</p> <p>Time Commitment: The questionnaire will take approximately 5 minutes to complete. Your feedback is invaluable to the success of this research. If you understand and agree to these terms, please proceed with the questionnaire.</p> <p>Thank you for your support.</p>

Table 5 Online Questionnaire Form

Perception Survey on Chinese Grass Cloth and Textile Art
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	Questions	Options
1	What is your gender?	<input type="checkbox"/> Male <input type="checkbox"/> Female
2	What is your age range?	<input type="checkbox"/> Under18 <input type="checkbox"/> 18-25 <input type="checkbox"/> 26-30 <input type="checkbox"/> 31-40 <input type="checkbox"/> 41-50 <input type="checkbox"/> 51-60 <input type="checkbox"/> Over60
3	Do you know about grass cloth?	<input type="checkbox"/> Yes <input type="checkbox"/> No
4	Do you have experience making handicrafts using grass cloth or other textile fabrics?	<input type="checkbox"/> Yes <input type="checkbox"/> No
5	What type of product do you think could increase the added value of grass cloth? (Multiple choices)	<input type="checkbox"/> Artworks <input type="checkbox"/> Cultural and creative products <input type="checkbox"/> <input type="checkbox"/> Home goods <input type="checkbox"/> Clothing and accessories <input type="checkbox"/> <input type="checkbox"/> Souvenirs <input type="checkbox"/> Other Please list _____
6	Would you be interested in purchasing creative products made from grass cloth or participating in experiential activities related to grass cloth art design?	<input type="checkbox"/> Yes <input type="checkbox"/> No
7	Are you familiar with textile art?	<input type="checkbox"/> Yes <input type="checkbox"/> No

8	Which natural elements in textile art do you find appealing? (Multiple choices)	<input type="checkbox"/> Natural texture <input type="checkbox"/> <input type="checkbox"/> Natural shape <input type="checkbox"/> Natural tactus <input type="checkbox"/> Natural color <input type="checkbox"/> Natural odour <input type="checkbox"/> Other Please list _____
9	Do you think that using grass cloth as a medium in textile art creation is conducive to the development of grass cloth?	<input type="checkbox"/> Yes <input type="checkbox"/> No
10	Do you think that researching methods of fabric manipulation will help preserve and innovate the intangible cultural heritage of grass cloth weaving techniques?	<input type="checkbox"/> Yes <input type="checkbox"/> No

3.2.2 Unstructured Observation

Unstructured observation was selected because direct observation or participation provide a mean to understand the essential characteristics of the research subjects, their social worlds, and their lives (Lofland et al., 2022). This research approach is particularly suitable for documenting the authentic dynamics of

the grass cloth cultural ecology in Wanzai and Fenyi, Jiangxi Province, and observing inheritance practices, community participation, and related cultural activities.

Selection Criteria of Research Sites and Samples: Wanzai and Fenyi counties were selected as the primary research sites due to their status as the most representative regions of grass cloth production in Jiangxi. These location exhibit both significant cultural heritage and active contemporary innovation (See Figure 8).

Within these sites, samples were selected based on three key criteria:

(1) Inheritance Lineage: The selection included nationally recognized inheritors, such as Zhixue Song, to represent the craft's recognized

(2) Institutional and Industrial Significance: Key enterprises, museums, and cultural tourism sites were chosen to reflect their role in the grass cloth ecosystem.

(3) Participant Diversity: A wide range of stakeholders, including inheritors, factory employees, cultural promoters, and policy practitioners, were involved to ensure a comprehensive perspective.

Long-term fieldwork was conducted between November 2023 and September 2024, making six intensive visits to Wanzai and Fenyi, with each visit lasting one to two weeks. Field notes were recorded systematically to ensure consistency across sites and time periods.

Observation focused on three key areas: first, the interactions between inheritors and community members; second, cultural ecology protection sites, such as cultural museums and study-tour bases, to understand inheritance mechanisms

and display logic; and third, the collaboration between local governments, enterprises, and intangible cultural heritage participants in promoting the diversified development of grass cloth.

These observations provided a crucial perspective on the interaction between local specificity and cultural ecology, laying the contextual foundation for the subsequent in-depth interviews.

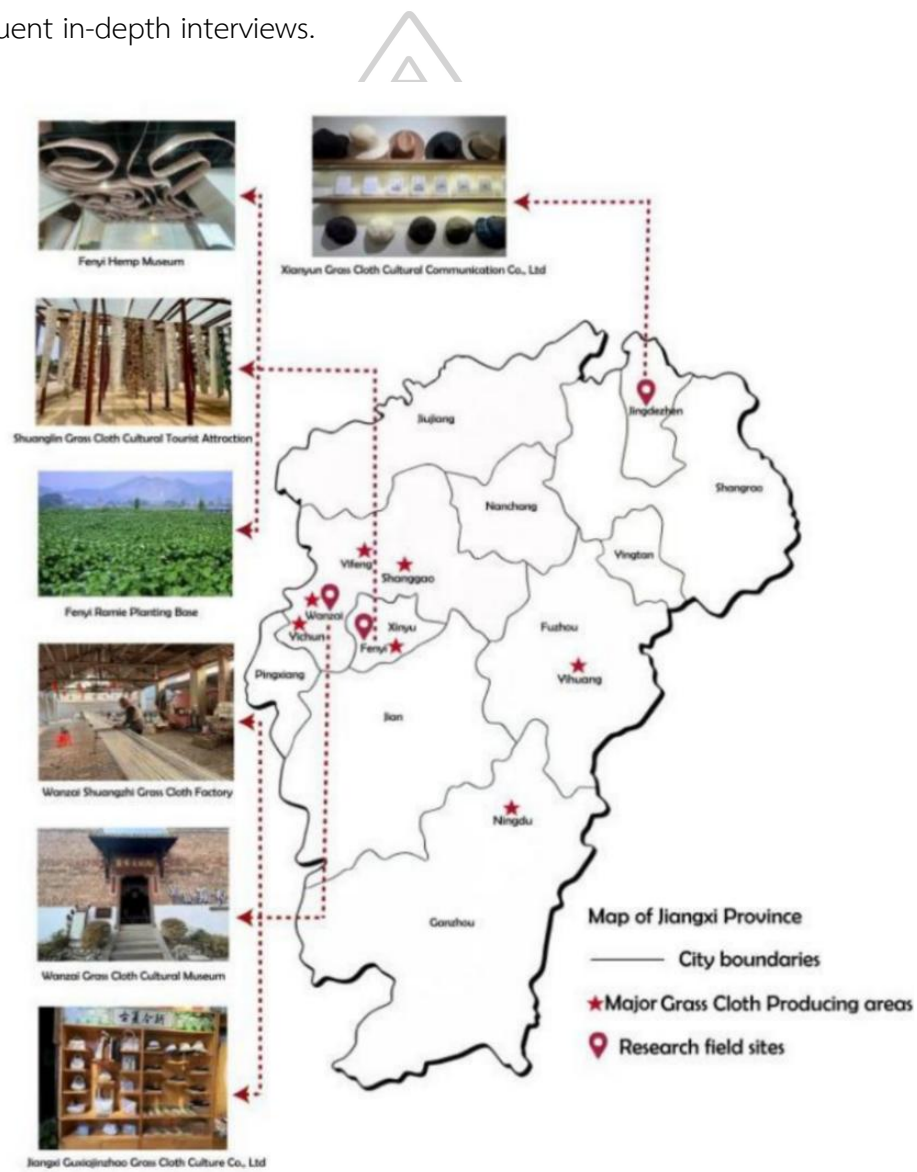


Figure 8 Map of research field sites

3.2.3 Semi-structured Interviews

Over 12 semi-structured interviews were conducted to allow for adaptability while maintaining focus on predetermined topics. The interviews took place in two stages: the first from December 2023 to February 2024 and the second from July to September 2024, with each session lasting approximately 40–60 minutes. The interviews took place in two stages: the first from December 2023 to February 2024, and the second from July to September 2024,

Multiple rounds of interviews were conducted with key representative inheritors, such as Zhixue Song and Yusheng Wang. Additional interviews were held with other stakeholders, including Zhixue Song's family members, employees of the Grass Cloth factory, and Yi Liao, founder of Xian yun Grass Cloth Cultural Communication Co., Ltd. These formal sessions were also supplemented by informal interviews during daily interactions to capture unstructured but valuable perspectives.

With participant consent, the in-depth interviews were recorded and structured to explore four key dimensions. These These formal sessions were supplemented by informal interviews during daily interactions to gather additional context.

The four dimensions were: (1) **Individual Growth and Technique Inheritance:** Participants' personal experiences with learning and carrying on of grass cloth production techniques. (2) **Community Inheritance Mechanisms:** The processes of

knowledge transfer within families and communities. (3) **Industrial Impact:** The effects of industrial and economic changes on the preservation of grass cloth. (4) **Contemporary Challenges and Future Outlook:** The current difficulties faced in inheritance, the strategies used to cope with them, and participants' suggestions for future development.

3.3 Data Analysis

3.3.1 Questionnaire Survey

A survey was distributed via the Chinese online platform Wenjuanxing, starting on August 13, 2024 to August 27, 2024, yielding 308 valid responses. The survey was design to gain a deeper understanding of public's perceptions regarding Chinese grass cloth and textile art.

The questionnaire covered area, including: respondents' demographic information, familiarity with and usage experience of grass cloth, willingness to purchase grass cloth products and participate in related art activities.

The analysis of this data aims to reveal the value of grass cloth in contemporary society and its development potential in the field of textile art, providing a basis for future product development and cultural heritage preservation. The questionnaire feedback was statistically analyzed, with the results presented in chart form.

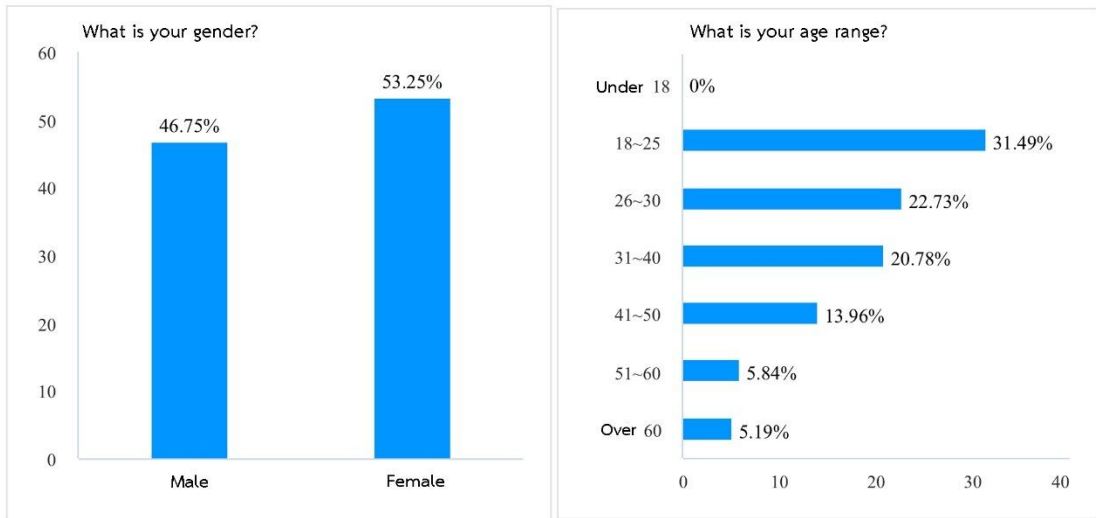


Figure 9 The Results of Questions 1 and 2

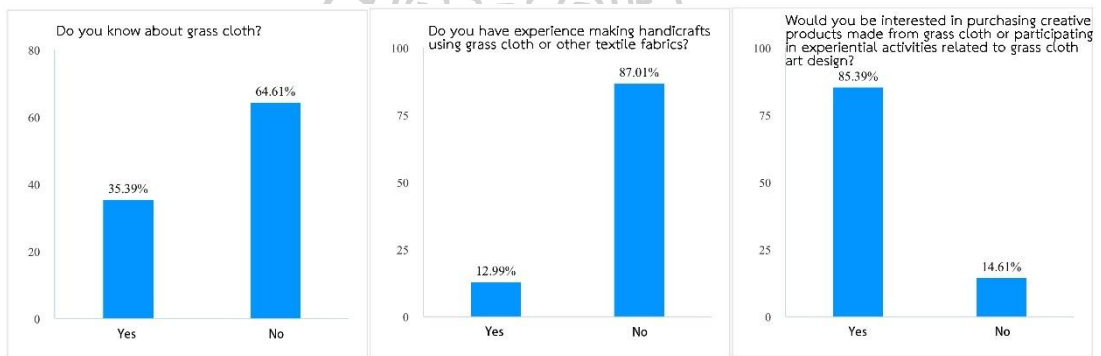


Figure 10 The Results of Questions 3, 4, and 6

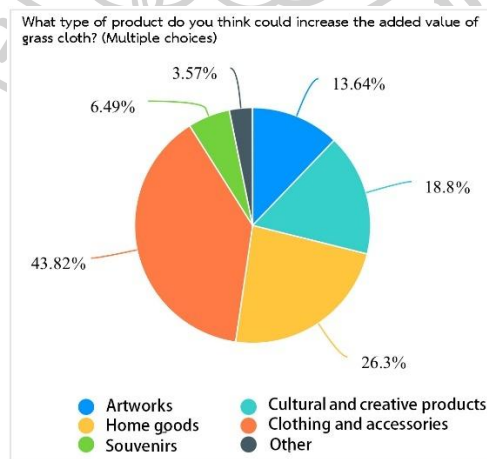


Figure 11 The Result of Questions 5

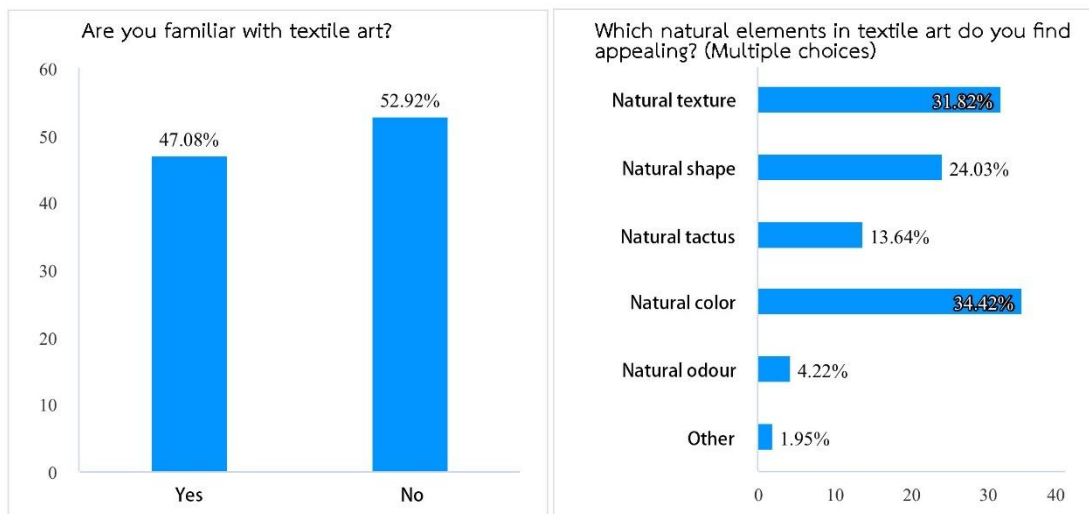


Figure 12 The Results of Questions 7 and 8

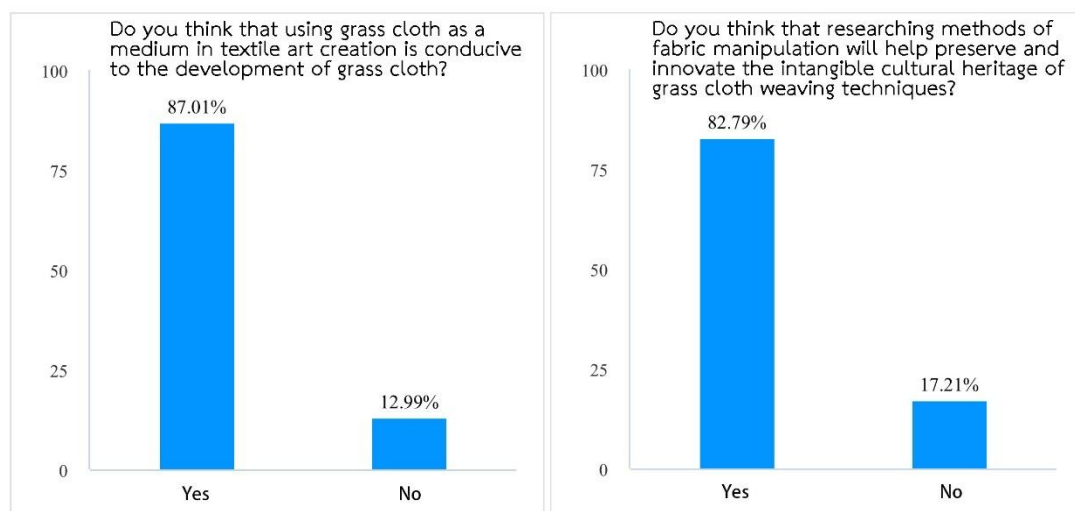


Figure 13 The Results of Questions 9 and 10

The result of the questionnaire is organized as follows: The questionnaire results indicate a relatively low public awareness of grass cloth. As shown in Figure 10, 64.61% of respondents were unfamiliar with the material, a finding that aligns with its status as a local handicraft lacking systematic promotion. Furthermore, 87.01% of respondents had no experience using grass cloth or other textile materials for handmade creations.

Despite this lack of familiarity, a significant 85.39% of respondents expressed a willingness to purchase creative grass cloth products or participate in related experiential activities. This suggests a high level of public interest and strong potential consumer demand for grass cloth.

The questionnaire results show that respondent preferences for grass cloth products are concentrated in three main categories: clothing and accessories, home goods, and cultural artworks.

As shown in Figure 11, clothing and accessories hold the most market appeal, with 43.51% of respondents believing this category can best enhance the added value of grass cloth. This finding is corroborated by field research on the product lines of *Gu Xia Jin Zhao*, *Xian Yun*, and *Bo dao Fang*, where clothing and accessories are the top-selling items.

A combined 58.77% of respondents also believe that home goods, and cultural artworks have significant potential. This aligns with market performance, as home goods are the second-best-selling category, and artworks have gained customer recognition for their innovation and cultural storytelling.

These results indicate that the future development of grass cloth should extend beyond daily necessities to emphasize the integration of cultural connotations and design innovation, thereby meeting consumer demands for personalization and cultural expression.

As shown in Figure 12, over half of respondents (52.92%) were unfamiliar with textile art, suggesting a significant gap in public education on the subject. Despite this, the survey revealed that natural colors and textures are the most appealing elements in textile art for the public. Therefore, the promotion of grass cloth should not only focus on foundational education but also emphasize its aesthetic value within contemporary art and lifestyle context.

A vast majority of participants (82.79%) believe that applying artistic fabric manipulation techniques to grass cloth is beneficial for its inheritance and innovation (see Figure 13). This strong consensus suggests a positive public attitude toward the integration of traditional craftsmanship with modern art, reflecting both a recognition of and an anticipation for such creative adaptations.

In summary, the future promotion and development of grass cloth should focus on integrating modern art with traditional craftsmanship, exploring diverse forms to engage a wider consumer base. Concurrently, strengthening public education and outreach regarding textile art is essential for raising awareness and promoting the inheritance and innovation of grass cloth culture.

3.3.2 Unstructured Observation

The mild climate and abundant water supply in Jiangxi Province provide ideal conditions for producing grass cloth. For over 1,600 years, Jiangxi Province has been one of the primary production areas of grass cloth in China. All 83 counties and cities

in Jiangxi Province produce grass cloth, with well-known production areas including Wanzai, Fengyi, Shanggao, Yifeng, Yihuang, and Ningdu. Among these, Wanzai and Shuanglin are the most famous. However, due to rapid industrialization and the exodus of its youth, the number of artisans possessing traditional weaving skills dwindling, placing this ancient craft is at risk.

In response, the Jiangxi Provincial Government has re-evaluated the connection between traditional culture and rural revitalization, implementing a series of conservation initiatives, aimed at building a sustainable cultural ecology.

First, the integrating and synergistic development of the synergistically developing protection initiatives through the grass cloth cultural and tourism industry and creative industries will help Jiangxi's grass cloth industry move beyond its original single-industry structure. This will provide the industry with a more solid, risk-resistant foundation and help support the sustainability of the inheritance of grass cloth cultural inheritance. Qiu et al. (2022) suggest that intangible cultural heritage can be a valuable tourism resource for governments and local communities. The most representative example in Jiangxi Province is the Shuanglin Grass Cloth Cultural Tourist Attraction in Fenyi County, which includes the Grass Cloth Culture Center, Weaving Art Center, Grass Cloth Cultural Experience and Education Center, Ramie Park, and Forest Park. Among them, the Grass Cloth Culture Center primarily showcases the historical origins of grass cloth culture and its production process, and consists of three halls. As shown in Figure 14, the History Hall reviews the brief

history of Chinese grass cloth and the history of Shuanglin grass cloth. As shown in Figure 15, the Production Process Hall displays scenes of the grass cloth production process. The Exhibition Hall presents the inheritance genealogy of the technique and products of grass cloth. As shown in Figure 16, to highlight the innovative use of grass cloth, the scenic area also invites artists to create and organize grass cloth art exhibitions. At the same time, Fengyi County relies on the Shuanglin Grass Cloth Cultural Tourist Attraction to conduct educational study activities, breaking the traditional mode of indoor teaching by combining indoor learning with outdoor experience as an educational method. As shown in Figure 17, the Shuanglin Grass Cloth Cultural Tourist Attraction invited inheritors to explain the knowledge of ramie growth, teach the techniques of stripping, drying, and weaving, and allow participants to experience the production of grass cloth.



Figure 14 The History Hall of Shuanglin Grass Cloth Cultural Tourist Attraction History Museum

Source: Photographed by researcher

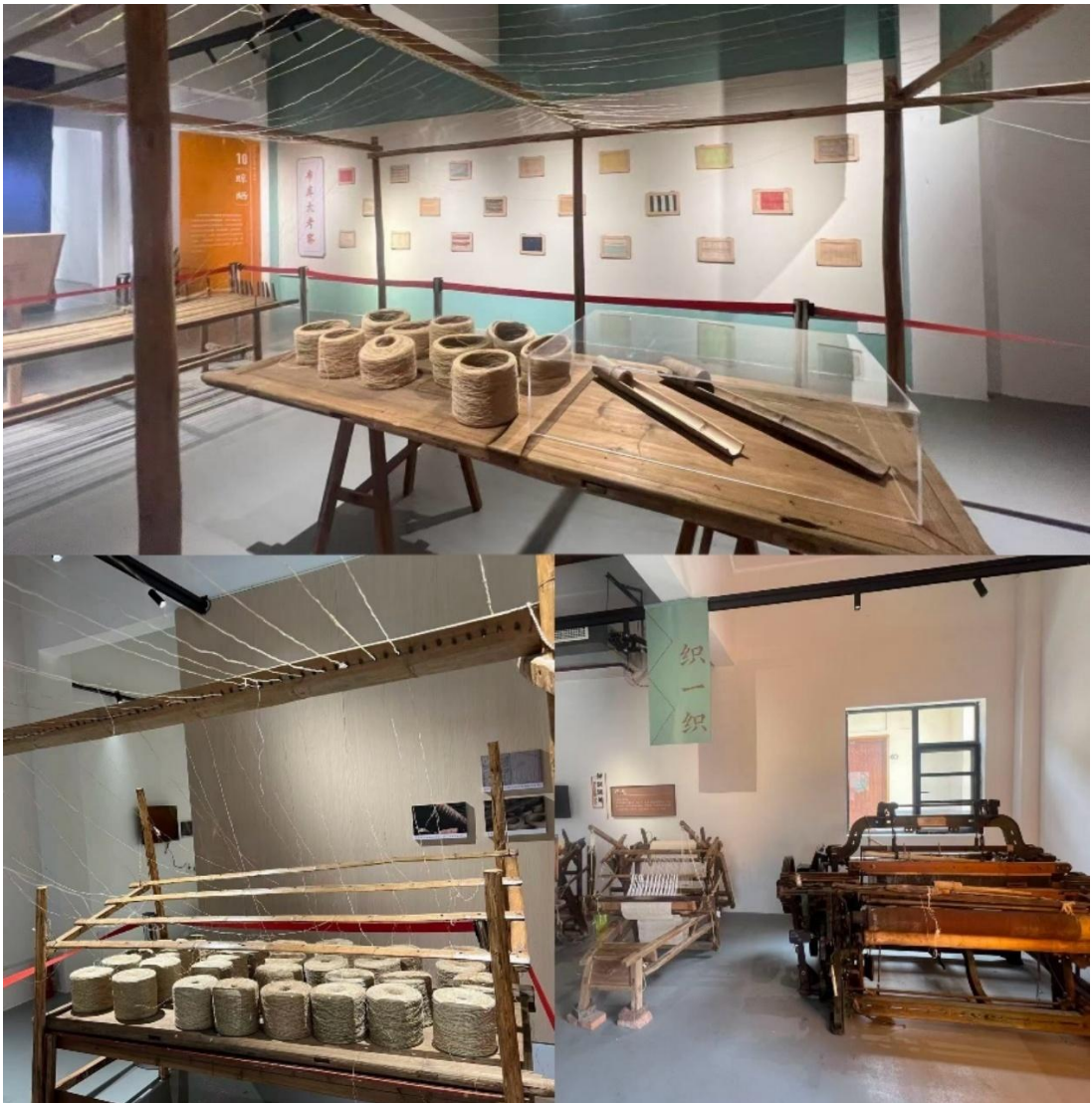


Figure 15 The Production Process Hall of Shuanglin Grass Cloth Cultural Tourist Attraction History Museum

Source: Photographed by researcher



Figure 16 Grass cloth art exhibition

Source: Photographed by researcher



Figure 17 Teaching scene of inheritor

Source: Photographed by researcher

Secondly, the sustainable inheritance of grass cloth depends on the creative transformation of grass cloth resources and industrialized development. Branding is a key approach for the creative transformation and innovative development of grass cloth culture. Jiangxi Gu Xia Jin Zhao Grass Cloth Culture Co., Ltd. is the most representative grass cloth brand established in Wanzai. Figure 18 shows the company's production scene. From the perspective of branding development with regional characteristics. The company has developed various types of home and creative grass cloth products, as shown in Figure 19. According to market response, the development of grass cloth branding with regional characteristics can not only increase the market share of grass cloth but also promote the diversity of grass cloth culture, which is important for the sustainable development of grass cloth. Song Zhixue, the municipal representative inheritor of the grass cloth weaving technique in Wanzai, stated the following:

In 2015, I founded Jiangxi Gu Xia Jin Zhao Grass Cloth Culture Co., Ltd. Although we have not yet established a mature branding model, there is significant potential and promising market prospects for the branding development of grass cloth. Currently, we are actively expanding the application of grass cloth in contemporary daily necessities to meet market demand and promote its industrialization. To improve the softness and comfort of grass cloth, we have also collaborated with universities in recent years to conduct research on biofungal

enzyme degumming and anti-wrinkle treatment technologies, achieving good results.

(Personal Interview, WZ202407)

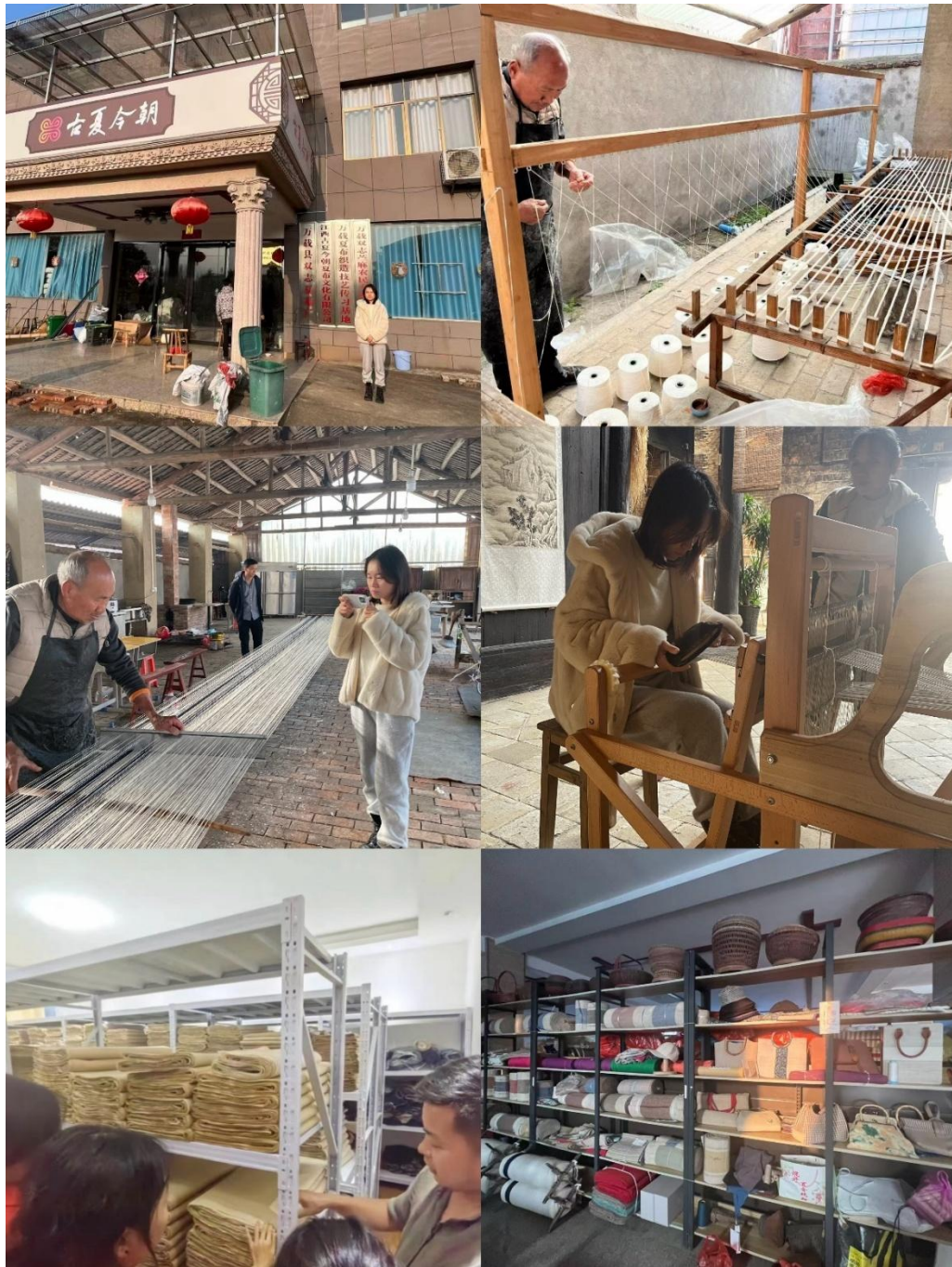


Figure 18 Production scene of Gu Xia Jin Zhao Grass Cloth Culture Co., Ltd.

Source: Photographed by researcher

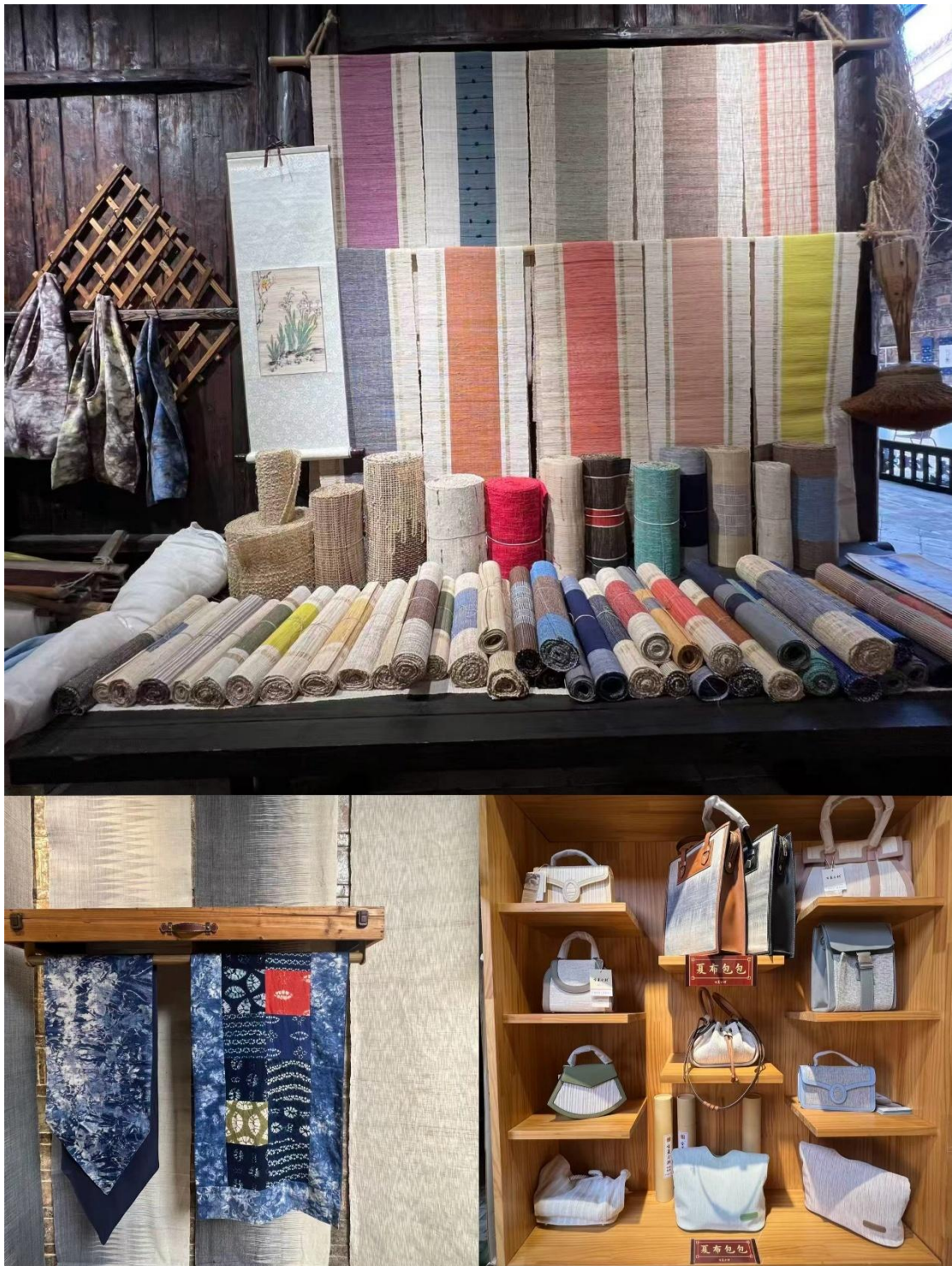


Figure 19 Grass cloth products in Gu Xia Jin Zhao brand store

Source: Photographed by researcher

Xian Yun Grass Cloth Co. Ltd. was established by Liao Yi in 2018 to protect and preserve grass cloth weaving techniques. The company uses Wanzai grass cloth as the raw material for its cultural and creative products. As shown in Figure 20, these products are widely sold and form the core of the company's profitability. The brand creates unique cultural and lifestyle products by adhering to traditional handcraft skills. Each handmade grass cloth product bears distinctive marks of its production, meeting the intrinsic needs of contemporary consumers who seek personalization and emotional connections with traditional culture.

The development of a distinctive brand can enhance the commercial value of grass cloth while preserving traditional skills. This commercial value, in turn, supports the development and inheritance of grass cloth, form a significant role in promoting the protection and inheritance of Jiangxi grass cloth.



















Figure 20 Grass cloth products in Xian Yun shop

Source: Photographed by reasearcher

Data collected from three grass cloth enterprises and studios—Gu Xia Jin Zhao, Xian Yun, and Bo Dao Fang—shows that grass cloth companies have been continuously improving their deep processing capabilities and developing a series of grass cloth derivatives to boost market competitiveness in recent years, as shown in Table 7. With the state's promotion of traditional culture and the diversification of Xia cloth products, an increasing number of people are willing to purchase these cultural and creative goods. Currently, the appearance design of most grass cloth products follows either a minimalist or traditional classic style. Field research indicates that clothing and accessories are the most popular in the market, with hats, bags, and earrings achieving the best sales, consistent with the results of the first-phase questionnaire survey. Home goods and artworks, such as door curtains, tea mats, bed linens, and decorative art objects, are also appealing to customers. Currently, Gu Xia Jin Zhao has developed grass cloth paintings, but due to their overly traditional content, they are not very popular. In contrast, Bo Dao Fang has designed decorative artworks based on regional cultural themes and art installations inspired by plants, which have been well received by customers. This demonstrates that the content, form, and cultural messaging of products are all factors that must be considered in the development of grass cloth products.

Table 6 Types of Grass Cloth Products and Brand Features

Brand	Company Location	Brand Features	Grass Cloth Product Type	Clothing and Accessories	Home Goods	Artworks, Cultural and creative products
Gu Xia Jin Zhao	Wanzhai County, Yichun City, Jiangxi Province.	Leveraging the ancient town of Wanzhai to create a distinctive cultural tourism brand.	Clothing and accessories, home goods, decorative paintings.	 	 	 
Xian Yun	Zhushan District, Jingdezhen City, Jiangxi Province.	Leveraging internet marketing and online store promotions to build a youthful Xia Bu lifestyle brand.	Clothing and accessories, home goods.	 	 	/

Bo Dao Fang	Xinjian District, Nanchang City, Jiangxi Province.	Leveraging university resources to develop derivative products of grass cloth, creating personalized cultural and creative brands.	Accessorie s, home goods, cultural and creative products, artworks.	 	 	 
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The loss and decline of inheritors is a real challenge for the living inheritance of grass cloth. Therefore, protecting inheritors is essential to preserving grass cloth. In recent years, Wanzai County has actively promoted the living inheritance of grass cloth by helping inheritors establish studios, organizing training courses, and encouraging the integration of master-apprenticeship with modern teaching to innovate the inheritance mechanism. Fenyi County has established cultural venues such as the Shuanglin Grass Cloth Cultural Tourist Attraction, providing teaching platforms for inheritors and revitalizing traditional crafts.

Figure 21 presents a SWOT analysis based on unstructured observations of the Jiangxi grass cloth industry. The analysis summarizes the internal strengths and weaknesses of the current cultural ecology, as well as the external opportunities and threats shaped by contemporary socio-economic and environmental conditions. By mapping these four dimensions, the figure highlights how cultural heritage, tourism integration, and emerging branding efforts interact with challenges such as artisan decline, industrial competition, and market instability. This framework provides a clear foundation for understanding the developmental trajectory of grass cloth and identifying strategic pathways for its sustainable development.

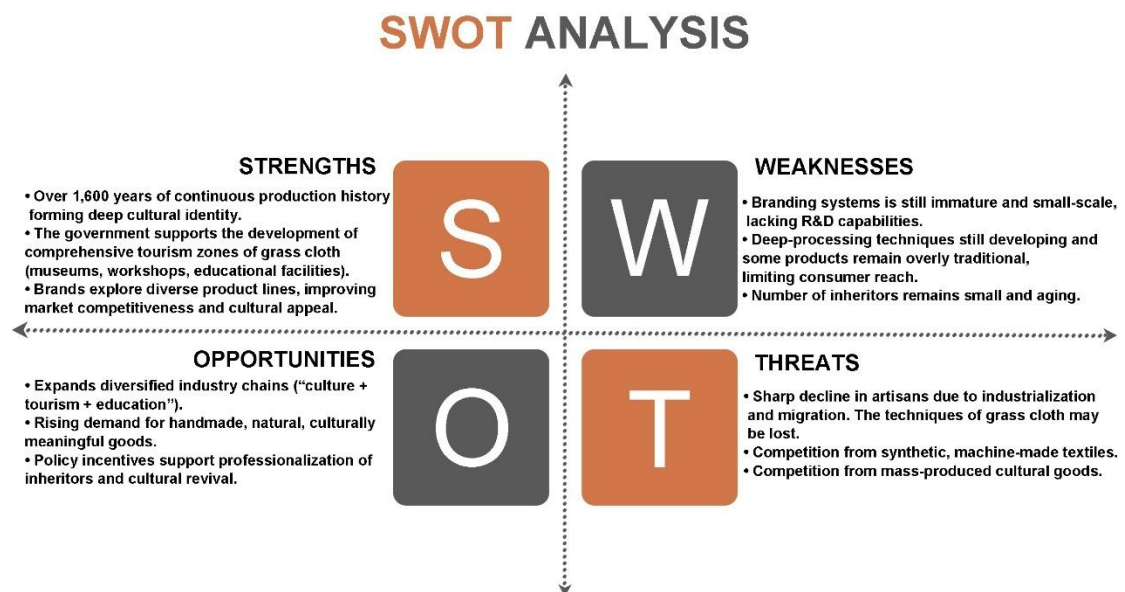


Figure 21 SWOT Analysis of Jiangxi Grass Cloth Based on Unstructured Observation

3.3.3 Semi-structured Interviews

The in-depth interviews were structured around four dimensions, and the researchers recorded the interviews with the participants' consent. In addition to the in-depth interviews, the researchers conducted informal interviews in the participants' daily lives to gather additional information. The first dimension focuses on participants' experiences of individual growth and the inheritance of grass cloth production techniques. The second dimension examines inheritance mechanisms within families and communities. The third dimension examines the impact of industrial development changes on the preservation of grass cloth. The fourth dimension summarizes the challenges and coping strategies in contemporary inheritance and invites participants to share their views and suggestions for future development.

Zhixue Song is currently the most well-known inheritor of the grass cloth weaving technique in Wanzai County, and his family has been engaged in grass cloth weaving for generations. In 1998, his father, Shuya Song, founded the Wanzai Shuangzhi Grass Cloth Factory. Through strict quality control, the grass cloth produced by Shuangzhi Grass Cloth Factory quickly gained popularity both domestically and internationally. To promote grass cloth, Zhixue Song introduced Yunnan's tie-dye technique into grass cloth production and invited designers to create more than 200 types of cultural and creative products made from grass cloth, such as shoes, bags, hats, fans, and curtains. Zhixue Song said the following:

“The essence of grass cloth lies in its handmade nature, but this also presents its main challenge. To encourage everyone’s participation, whenever someone grows ramie and produces yarn, I visit their home to purchase it. Handmade production results in high costs for grass cloth products, making them less competitive in the market compared to other fabrics. However, if we switched to machine spinning, all the valuable natural gum would be lost. To overcome this dilemma, we have partnered with several universities to research and optimize the grass cloth weaving process. We hope to achieve large-scale, efficient production while preserving the natural texture and antibacterial properties. In fact, I have continued to pursue grass cloth as my career not only out of sentiment, but also because I truly believe in its value. This ancient craft deserves more support.” (Personal Interview, WZ202407)

Yusheng Wang is a renowned inheritor of Fenyi’s grass cloth production techniques. He adheres to traditional handmade craftsmanship and believes that machine stripping of ramie easily damages the fiber and cannot meet quality requirements. Yusheng Wang has not only inherited grass cloth production skills but has also helped promote the integration of grass cloth and cultural tourism in Fenyi. Yusheng Wang stated the following:

“My family has been making grass cloth for three generations, and I have been doing it for more than 30 years. In the early 1990s, grass cloth was at its peak in Fenyi, and at that time, we could collect 100,000 pairs of grass cloth in one night in a single village. Nearly every family here made grass cloth. Nowadays, the inheritors are

aging rapidly and there are few newcomers, so I am worried that this craft will be lost in the future. What I want to do is use the platform created by the government to pass on this skill that I have mastered.” (Personal interview, FY202409)

The protection and support of inheritors require establishing a diversified financial support system, developing innovative inheritance models, and providing platforms for inheritors to teach their skills and display their achievements, all of which are diversified and effective protection mechanisms.

Interviews with inheritors, entrepreneurs, and employees reveal five interrelated themes that shape the cultural and ecological development of grass cloth. As shown in Table 8, these themes include the safeguarding of heritage and skills through intergenerational transmission and workshops; the transformation of industrial development from factories to creative industries; the role of market and branding in enhancing competitiveness; the importance of policy and support, such as subsidies and training platforms; and the promotion of cultural tourism through museums, education bases, and interactive experiences. These insights highlight the resilience of grass cloth culture and demonstrate the dynamic interplay between tradition and innovation.

Building on these findings, Wanzai and Fenyi have promoted the development of grass cloth into a diversified model that integrates tourism, cultural creation, and education. Public participation and cultural experiences have increased through the establishment of grass cloth cultural attractions and study bases. The creative

transformation and market-oriented extension of grass cloth resources have been achieved through the development of regional characteristic brands. In addition, supporting inheritors, innovating the transmission mechanism, and building display and exchange platforms can effectively alleviate the problem of inheritance interruption. Ultimately, an integrated model of ecological maintenance, industrial development, and skills inheritance has been established as a comprehensive strategy for sustainable protection.

Table 7 Summary of interview themes (summarized from inheritors, entrepreneurs, and employees)

Dimension	Themes from Interviews	Representative Quotes
Heritage & Skills	Intergenerational transmission, risk of extinction, apprenticeship & workshops.	“The essence of grass cloth is handmade, and the plight of it is also handmade.” – Zhixue Song
Industrial Development	Shift from family workshops → factories → creative industries.	“In the early 90’s, basically every family here made grass cloth. After 2014, the grass cloth market began to slowly shrink. We are actively expanding the use of grass cloth into contemporary daily

		necessities.” – Qing Song
Market & Branding	Branding enhances competitiveness, expansion into lifestyle products.	“Even after gaining protection as an intangible cultural heritage, its ecosystem continues to shrink. Only through commercialization and widespread application can this craft survive.” – Yi Liao
Policy & Support	State subsidies, intangible cultural heritage protection, training platforms.	“The state provides financial subsidies to inheritors every year, but we rely more on our own strength. We hope that the local government can give us more support.” - Zhixue Song
Eco-cultural tourism	Museums, education bases, interactive experiences attract younger generations.	“Whenever needed, I go to the Shuanglin Grass Cloth Cultural Tourist Attraction to demonstrate the millennia-old grass cloth weaving techniques to students and visitors. The skills we learned from our ancestors must not be lost in our generation.” – Yusheng Wang

3.4 Material Experiments

Experimentation is a method for obtaining knowledge with practical application value (Sørensen et al., 2010). This study aims to conduct material experiments based on the information and data collected in the first phase. The material experiments primarily focus on fabric manipulation and morphological simulation of grass cloth, aiming to validate its feasibility and expressive potential in natural morphological manifestations. The experimental results will be evaluated based on the texture, morphological changes, and artistic expressiveness of the grass cloth, and will provide technical support for subsequent creative practices.

This study uses grass cloth as an experimental medium and explores its potential in natural form simulation and textile interaction design from multiple perspectives, including dyeing techniques, fabric manipulation, and interaction technology. The results are shown in Table 9.

Table 8 Experimental Results

Experimental Results
<p>Experiment 1: Dyeing Techniques</p> <p>Natural patterns are created on ramie fabric using tie-dyeing and dip-dyeing techniques.</p>



Figure: A comparison of dyeing effects based on varying thread tension.

Observations: 1. Excessive thread tension result in insufficient dye penetrate. 2. A looser tie, when combined with twisting, produced the richest and most complex texture. 3. Pre-washing and soaking the grass cloth was determined to be a critical step for achieving a successful resist-dyeing effect.

Experiment 2: Fabric Manipulation

Fabric manipulation techniques, including curling, layering, collage, and drawn thread work, were employed to stimulate the forms and textures of fungi, lichens, and mosses.



Figure: Reshaping grass cloth to recreate natural texture.

Observations: 1. The exceptional stiffness of grass cloth provides excellent shape retention, achieving structural stability without requiring setting spray or heat. 2. This process effectively simulate natural forms, allowing for the creation of rich, complex textures in the fabric.

Experiment 3: Deconstructive Techniques

Burning and drawn thread techniques were utilized to stimulate the delicate forms of lichens and flowers.



Figure: Applying deconstructive method to shape natural forms in grass cloth.

Observations: 1. The burning rate of grass cloth was found to be readily controllable. 2. The yarn does not unravel post-burning, which facilitated precise shaping. 3. In the drawn thread process, securing iron wire to the warp threads prior to cutting and dyeing was effective in creating a light and natural form.

Experiment 4: Crystallization

Alum was used to induce a crystallized effect on yarn, stimulating the texture of long lichen.



Figure: The resulting crystalline texture on yarn after treatment.

Observations: 1. A solution was created by mixing alum and boiling water in a 1:2 ratio 2. The yarn was dipped into the mixture, then removed and air-dried. 3. It was observed that a higher alum concentration produced a more pronounced crystallization effect.

Experiment 5: Interactive Technology

An interactive system was developed by embedding sensor wires, light strips, and sensor modules onto the reverse side of the grass cloth.

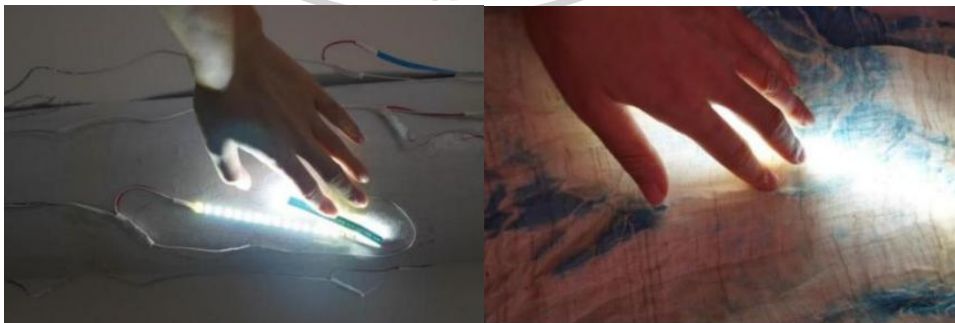


Figure: Testing the interactive lighting effects integrated with the fabric.

Observations: 1. The components were installed according to the design's specified

layout. 2. This setup enable the fabric to respond to touch and proximity with programmed light patterns, transforming the textile into a dynamic medium for visual and tactile interaction.

Experiment 6: Sonic Interaction

An interactive audio system was integrated with the grass cloth using a custom electronic circuit.

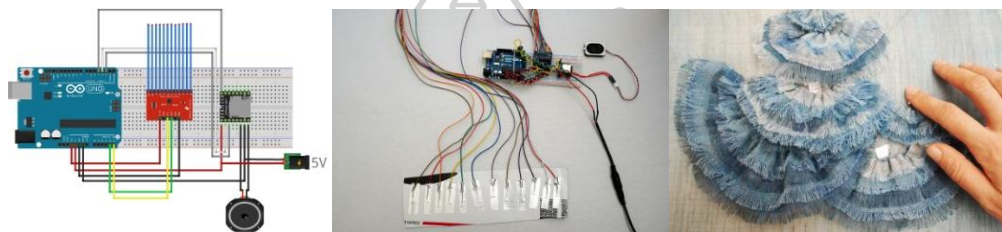


Figure: A Circuit diagram and a demonstration of the interactive audio effect.

Observations: 1. The system was constructed using an Arduino UNO development board, an MPR121 module, a speaker, and an SD card. 2. The MPR121 touch detects touch input across 12 channels on the fabric's surface. 3. When a touch is detected on a specific Channel, a corresponding audio file is triggered played via the DF Player Mini module. 4. The 12 audio files consist of different plant-themed music tracks generated by a MIDI plant generator, linking the sonic output to the project's natural theme.

This integration transforms the grass cloth into a responsive medium for sonic interaction and tactile communication.

Material experimentation provides a multidimensional framework for exploring the use of grass cloth in textile art. The study validated the physical properties and

aesthetic potential of grass cloth through dyeing techniques, fabric manipulation, and interactive technologies.

First, the experimental results of dyeing techniques show that tie-dyeing and dip-dyeing can create rich textural effects by controlling tension. This process preserves the rustic essence of ramie fabric while showcasing the randomness and diversity of its natural texture, highlighting its unique advantages in simulating natural colors and textures. Second, fabric manipulation techniques such as curling, layering, collage, and drawn thread break through the original physical properties of grass cloth, giving it new expressive forms. This demonstrates that grass cloth can not only present natural textures on a two-dimensional plane but also display complex formal beauty in three-dimensional shapes.

In destructive experiments, burning and drawn thread techniques further expand the expressive boundaries of grass cloth, enabling it to display rich morphological effects. This method embodies the dynamic balance between “destruction” and “regeneration” in traditional materials and provides a new interpretive perspective for the application of grass cloth in contemporary textile art. Experiments with alum crystallization have produced crystal structures on the surface of grass cloth yarns, creating a natural mineral texture and infusing the fabric with a unique natural ambiance.

By integrating light interaction and sonic interaction technology, grass cloth has achieved a cross-disciplinary fusion of traditional textile materials and modern

technology. This experiment validates the potential application of grass cloth in interactive textile art. When grass cloth is given interactive attributes, its expressiveness and cultural value are enhanced, breaking through the limitations of traditional craftsmanship and entering broader contemporary art and design fields.

Overall, these experiments highlight the multifaceted expressiveness of grass cloth in reproducing natural forms and provide practical evidence for its cross-disciplinary application in contemporary textile art and interactive design.

3.5 Summary

This study adopts a mixed-methods approach that integrates quantitative and qualitative research to explore artistic potential of chinese grass cloth. The methodological framework comprises four interrelated components—questionnaire survey, unstructured observation, semi-structured interviews, and material experiments—each contributing to a comprehensive and triangulated analysis.

The questionnaire survey provided quantitative insights into public perceptions, awareness, and acceptance of grass cloth as an artistic medium. It established a baseline understanding of general attitudes and informed the subsequent qualitative inquiries. Unstructured observation offered contextual depth by documenting the living ecology of grass cloth production and inheritance within Jiangxi's local communities. Fieldwork across factories, museums, and cultural enterprises revealed how heritage, craftsmanship, and innovation intersect in everyday practices.

Semi-structured interviews with inheritors, entrepreneurs, and cultural practitioners further uncovered diverse perspectives on heritage transmission, policy influence, and creative development within the framework of cultural sustainability. The material experiments bridged theoretical research and practical creation, testing grass cloth's physical and expressive properties through dyeing, structural manipulation, and the integration of interactive technologies. The experimental results demonstrated grass cloth possesses excellent formability and aesthetic potential.

Together, these four methodological components form a coherent research system that combines empirical investigation with artistic experimentation. This integrated approach not only ensures the reliability and validity of findings but also provides a solid foundation for understanding how Xia bu can be reimagined as a dynamic and expressive medium in contemporary textile art.



Chapter 4

Development of interactive textile art installations based on natural forms

4.1 Textile art installations based on plant forms

This artwork is inspired by the ramie leaf, the raw material of Chinese grass cloth, and uses Wanzai grass cloth from Jiangxi—a recognized item of national intangible cultural heritage—as the primary medium. As shown in Figure 22, techniques such as botanical dye, drawn-thread work, and shaping transform the material into dozens of ramie leaves. As shown in Figure 23, the unique fiber texture and natural grain of the grass cloth give the ramie leaves a sense of lightness and vitality, creating an atmosphere of elegance and ethereality. The work reflects a sensitive appreciation of natural forms and the pursuit of unity between nature and spirit, evoking deeper contemplation of life and existence.



Figure 22 The production process



Figure 23 Textile art installations based on ramie leaf forms

By employing grass cloth, a material rich in cultural memory and historical significance, the artwork establishes a dialogue between tradition and innovation. It demonstrates how intangible heritage can transcend functional use and be

reinterpreted within contemporary artistic contexts. Ultimately, the piece explores the profound connection between form and meaning, nature and humanity, offering an experimental yet poetic expression of cultural continuity and artistic exploration. This installation was exhibited at Xinyu Art Museum, Yichun Cultural Center, and Qianhu Art Museum from August to November 2024, as shown in Figure 24.



Figure 24 Exhibition Photos

4.2 Dynamic opening and closing interaction art based on flower forms

This artwork is a dynamic textile installation inspired by the structural form of flowers, exploring new possibilities in textile art through the integration of natural imagery, material experimentation, and interactive technology. The flower, one of the most significant symbols in nature, embodies vitality, purity, and beauty. Its opening and closing movements reveal a rhythmic cycle of life that has long inspired

artistic expression. This work draws directly from this natural inspiration, translating the dynamic gestures of blooming flowers into an interactive art form that can be perceived, experienced, and engaged with.

This work uses garment accessory bead tubes as its primary structural elements. The transparent, shimmering quality of the bead tubes creates a sense of delicacy and lightness. As shown in Figure 25, the tubes are meticulously woven into layered, petal-like structures using beading techniques. When light passes through the beads, it is refracted and diffused, producing a crystalline visual effect. As shown in Figure 26, even in a static state, the piece conveys fragility, elegance, and vibrancy. At the same time, beading preserves the fundamental logic of textile construction—transforming points into lines and lines into surfaces—while ensuring flexibility and malleability, which allows the dynamic mechanism to be seamlessly integrated within the structure.

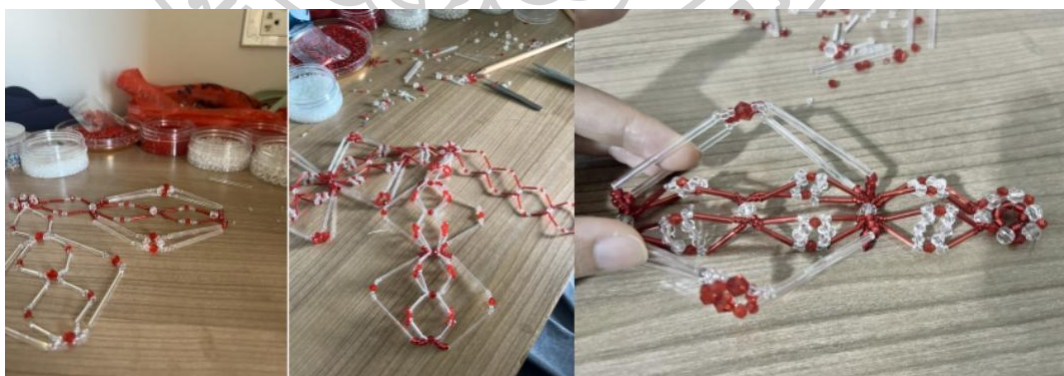


Figure 25 The production process



Figure 26 Opening and closing interaction art based on flower forms

The technological dimension of the work lies in the incorporation of interactive opening and closing mechanisms, as shown in Figure 27. Equipped with proximity sensors, the flower-like structure responds when a viewer approaches within 30 centimeters. The petals open and close automatically, mimicking the natural rhythms of blooming and folding in response to environmental changes. This dynamic interaction transforms the viewer from a passive observer into an active participant, whose presence becomes the trigger for the artwork's movement. The piece thus emphasizes the reciprocal relationship between art and audience, extending the vitality of the installation beyond its material form.

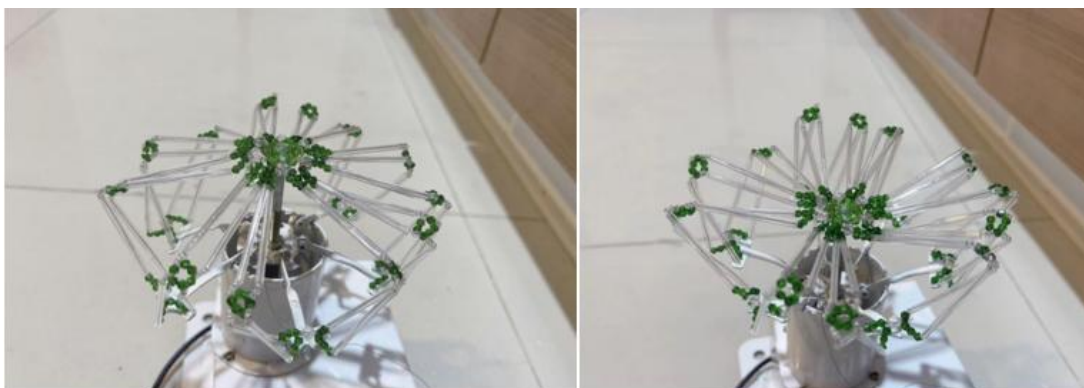


Figure 27 Appearance Changes under Interaction

Symbolically, the work fuses natural metaphors with technological language. The blooming and closing of the flower embody the rhythm of life, the breathing of nature, and the unfolding of the spirit. By embedding interactive systems, the artwork elevates these metaphors from contemplative symbols to experiential events. The responsive interaction signifies the perceptual bond between humans and nature, prompting reflection on existence, perception, and interconnectedness. Through this layered dialogue, the piece presents a poetic interplay among nature, technology, and humanity.

4.3 Dynamic opening and closing interaction art installation based on flower and Chinese Gardens

This installation builds on the previous dynamic textile flower made with beaded tubes, further expanding the possibilities for material and structural expression. As shown in Figure 28, and inspired by the basic form of a flower, it emphasizes the integration of natural morphology into both textile art and interactive art. In this work, acrylic is introduced alongside beadwork techniques, creating a striking contrast and complementarity between materials: acrylic, with its transparency and solidity, provides strong support and a clear form, while the beaded elements add delicacy, fluidity, and shimmering visual effects. Together, they embody a tension between the “rigid” and the “soft,” allowing the petals to display

a dynamic beauty that is both stable and graceful during the process of opening and closing.

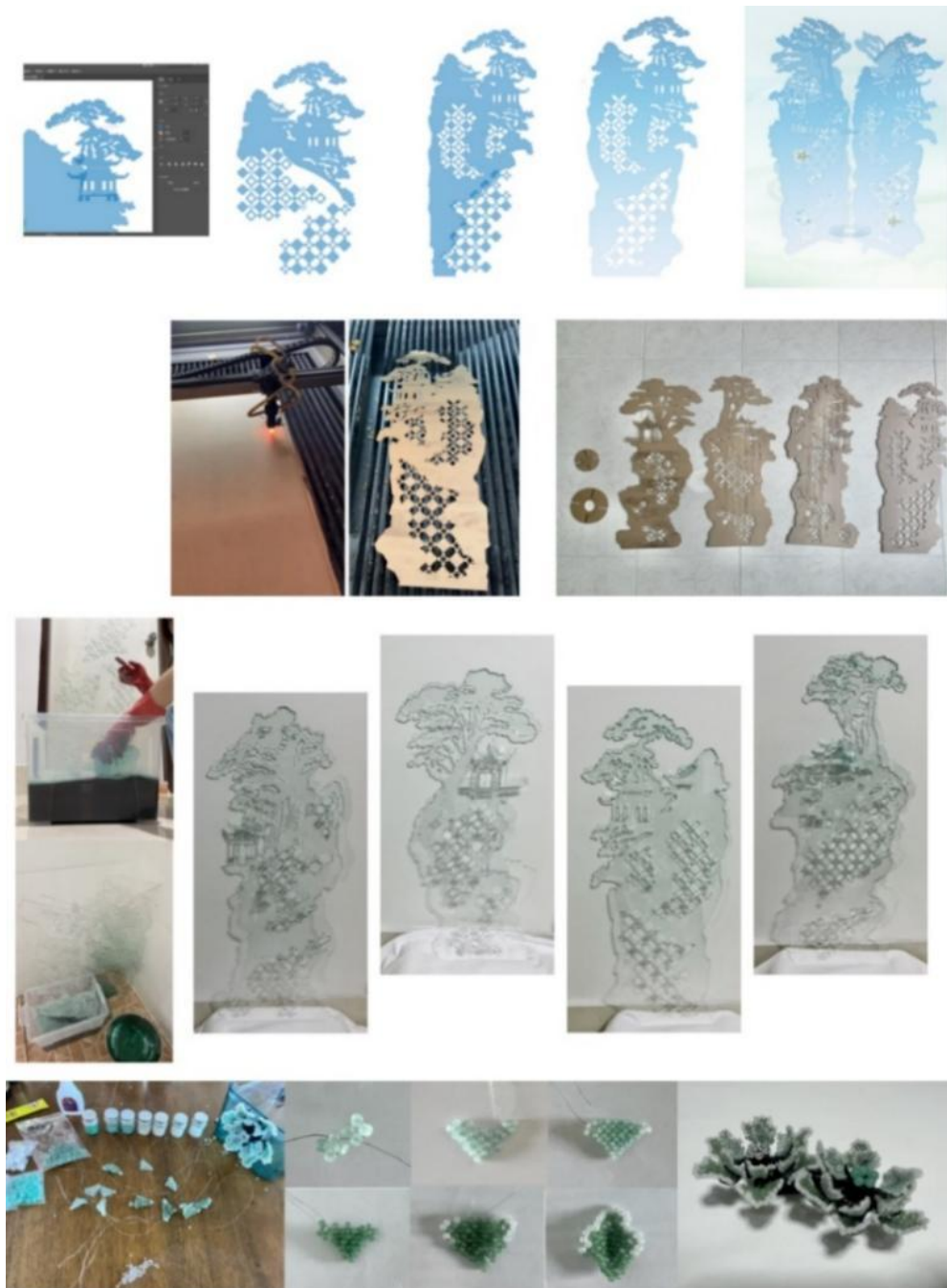


Figure 28 The production process

Technologically, the piece uses the same automatic opening-and-closing interactive system as the previous work, as shown in Figure 29. When a viewer approaches within a certain distance, the structure senses their presence and responds with the organic motion of the petals, echoing the rhythm of human breath and movement. Compared with the purely beaded version, this work is structurally more resilient, with smoother and more precise movements. The transparency of acrylic enhances light projection and refraction, generating layered spatiality and shifting light effects that enrich the audience's immersive experience.



Figure 29 Opening and closing interaction art based on flower forms

Symbolically, the installation extends the metaphor of the flower as a symbol of life, while the modern, industrial quality of acrylic introduces a sense of contemporaneity and futurism. It conveys the imagery of natural growth and respiration and reflects humanity's desire to maintain a connection with nature within a technological society. Through the combination of beads and acrylic, along

with interactive technology, this work expands the boundaries of textile and installation art, presenting multiple interpretations and limitless possibilities of natural forms in a contemporary context.

4.4 Light interactive textile art installation based on plants

The installation titled “Tree Imprint I” draws inspiration from the texture of tree trunks and the growth of lichen, abstracting natural forms and reinterpreting them through fabric manipulation. The natural texture and stiffness of the grass cloth are fully utilized in this process, giving the surface of the installation a natural rhythm of life.

In interactive design, the work integrates sensor modules, light strips, and metal wires to create an effect where light and shadow flow in response to the audience's touch, as shown in Figure 30. Figure 31 illustrates the production process of this textile art installation. The two-second delay before the lights turn off enhances the interactive enjoyment of the piece and provides viewers with an extended sensory experience, as shown in Figure 32. This dynamic transformation emphasizes the dialogue between nature and technology, materials and viewers, preserving the handmade texture of grass cloth while introducing a new contemporary context.

Audience members actively engaged with the installation during the interactive process, indicating that when grass cloth shifts from a static object to a dynamic

medium, its cultural and artistic appeal increases significantly. This transformation breaks through the traditional functional attributes of textile materials, turning them into a comprehensive medium for cultural narratives, interactive experiences, and artistic innovation.

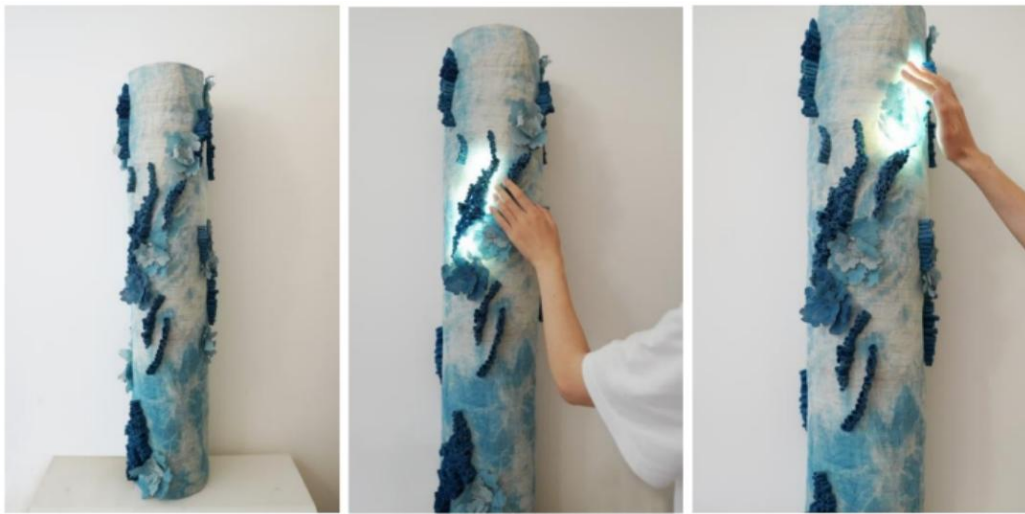


Figure 30 Appearance changes under interaction



Figure 31 The Production Process of Textile Art Installations

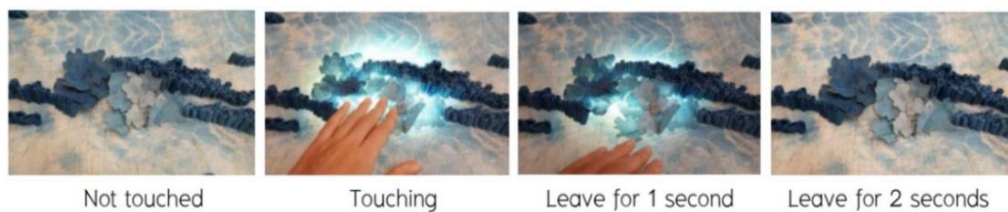


Figure 32 Visual changes during interaction

After completing the work, the researchers solicited feedback from the audience to expand the creative boundaries of the textile art installation. The audience expressed interest and appreciation for this art form and concept, demonstrating that traditional grass cloth becomes more appealing when integrated with modern textile innovation and interactive technologies.

4.5 Sound and light interactive art installation based on plants

The second piece in this series, shown in Figure 33, is inspired by the organic forms of *trametes versicolor* and moss found on tree bark, reinterpreting these natural forms through textile art and interactive design. The texture and crispness of grass cloth are preserved and reshaped using fabric manipulation and tie-dye techniques, creating a layered surface that reflects the vitality and rhythm of nature. As shown in Figure 34, the folds and tactile qualities of the fabric mirror the organic patterns of tree bark and epiphytes, giving the work material depth and symbolic meaning. The detailed production process is shown in Figure 35.



Figure 33 Source of inspiration



Figure 34 Texture details



Figure 35 The production process

This work is a light and sound interactive art installation that integrates embedded hardware and multimodal interaction modules. The hardware system centers on the Arduino UNO development board, combined with an MPR121 capacitive touch sensor for multi-channel touch input. The output consists of two units: a visual feedback module, which includes a WS2812 light strip and supporting circuitry, and an auditory feedback module, which comprises a DFPlayer Mini MP3 module, a speaker, and an SD card capable of playing audio files in response to touch input.

The primary material used in the work is grass cloth and conductive sewing thread. The hardware for sound interaction includes an 830-hole breadboard, an Arduino UNO development board, an MPR121 multi-channel touch sensor, an MP3 module, a speaker, an SD card, and a 5V power adapter, as shown in Figure 36. The hardware for light interaction includes an ESP32 development board, an MPR121

touch sensor, an air touch sensor, a WS2812 light board, an 830-hole breadboard, a 5V power adapter, and DuPont cables, as shown in Figure 37. This hardware configuration not only supports the dual output of light and sound, but also provides a technical foundation for the immersive interactive experience of textile art artworks.

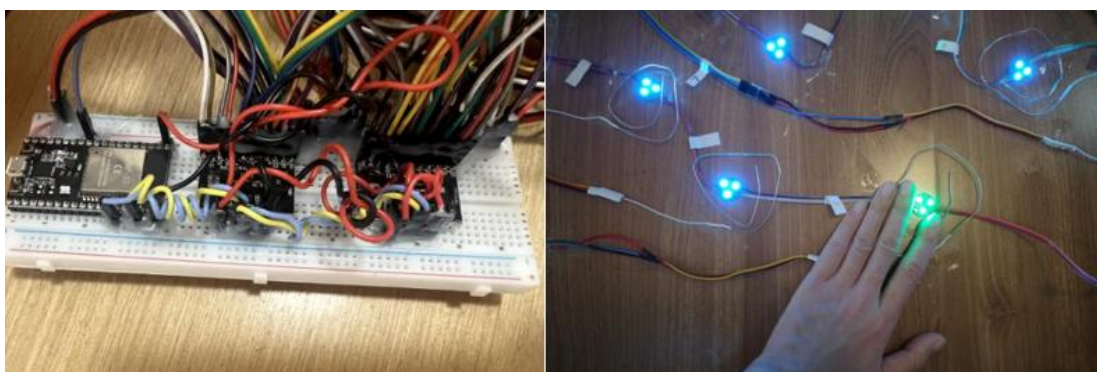


Figure 36 Lighting interaction hardware configuration

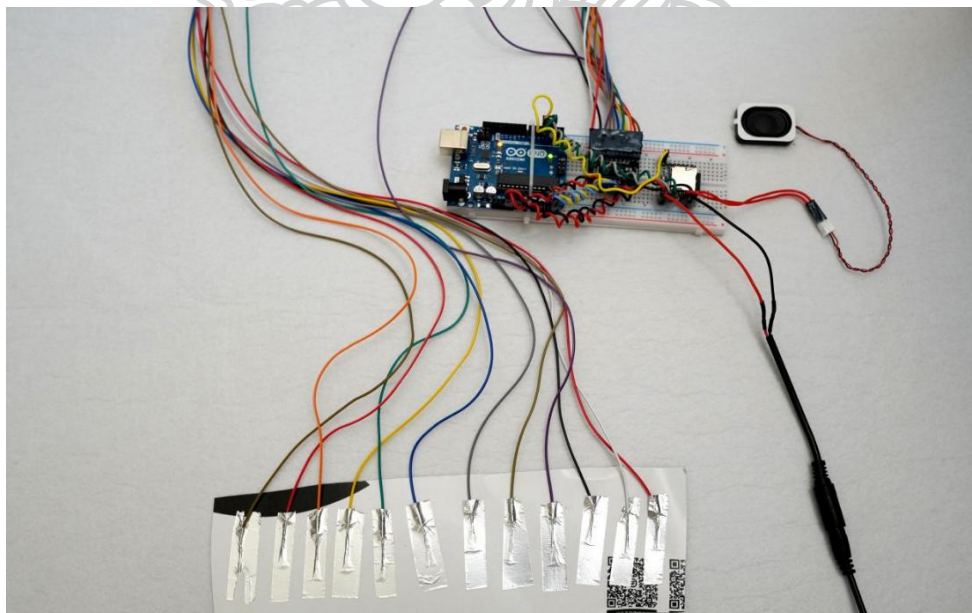


Figure 37 Sound interaction hardware configuration

The system logic employs a "touch-multimodal response-auto-recovery" cycle. The lighting system uses group control to map 24 touch inputs to LED groups. Light

blue indicates the default state, green indicates the touch-activated state, and the system returns to its original color after four seconds of inactivity, as shown in Figure 38. For audio, the MPR121 sensor captures touch signals and transmits them to the DFPlayer Mini module. Each touch channel corresponds to a specific audio file. When a valid touch is detected and no music is currently playing, the system automatically plays the audio file associated with that channel number. The circuit diagram is shown in Figure 39. This dual triggering of light and sound provides instant feedback and creates a multi-sensory interactive atmosphere, allowing viewers to experience the vitality and rhythm of natural forms through both sight and sound.

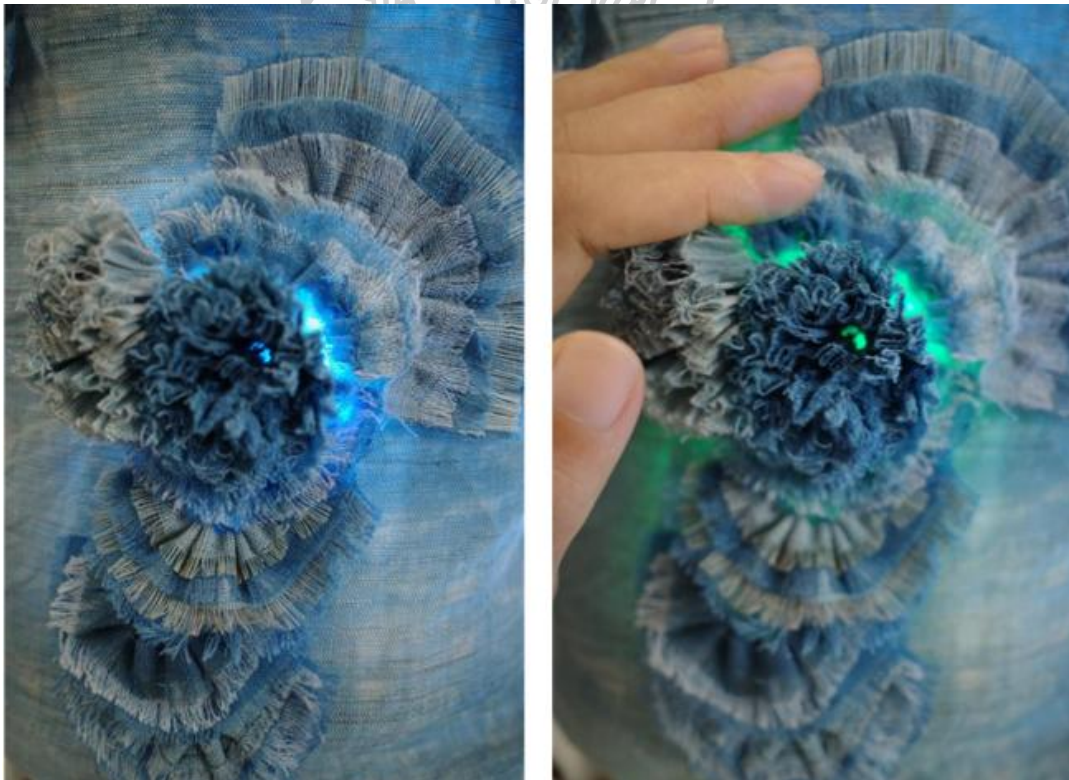


Figure 38 Light changes during interaction

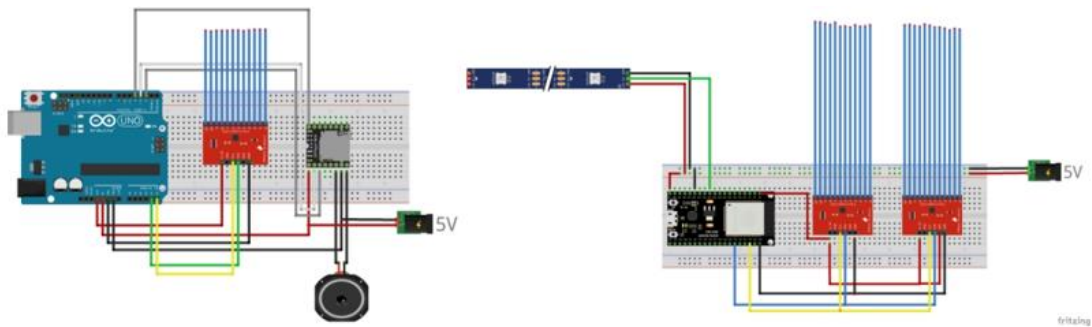


Figure 39 Circuit diagram

At the operational level, the system consists of three parts: initialization, calibration, and the main loop. The initialization phase includes I2C communication and configuration of the MPR121 sensor, setting the brightness and color of the WS2812 light strip, initializing the DFPlayer Mini module and setting the volume, and configuring the playback status detection pin as input. The calibration phase collects touch baseline values for each channel over a 3-second period and records the lowest filtered value as the judgment threshold. The main loop runs in a non-blocking manner: light touch data is read every 300 milliseconds, sound touch data is collected every 100 milliseconds, and the corresponding audio is played when the threshold is triggered. The system also checks the playback status every 80 milliseconds and updates the musicState variable to prevent interference from simultaneous triggering of multiple channels. This operating mechanism ensures coordinated responses between light and sound.

The implementation principle of this work is based on the dual application of capacitive touch detection for both light and sound feedback. The MPR121 sensor transmits capacitance values via the I2C bus, and a touch event is detected when

the value falls below a set threshold. Lighting feedback is provided by RGB switching of the WS2812 light strip, offering instant visual response. Audio feedback is managed by a DFPlayer Mini module, which accesses pre-stored audio files on an SD card and triggers corresponding sound clips at different touch points. The system uses millis() for non-blocking timing, ensuring synchronization and continuity of light and sound signals. Through this technical approach, the work successfully links vision and hearing, allowing textile art to present dynamic light and shadow in natural forms, and to convey the acoustic metaphor of natural ecology through sound, as shown in Figure 40, thereby deepening the audience's immersive experience and ecological perception.



Figure 40 Appearance changes under interaction

The work was exhibited at the Science and Technology Innovation Center of Jiangxi Science and Technology Normal University in August 2025, as shown in Figure 41. Audience members showed strong interest and engagement, highlighting the transformative potential of grass cloth when it evolves from a static form into a dynamic medium. This shift moves textiles beyond their traditional utilitarian role, positioning them as carriers of cultural narratives, interactive experiences, and artistic innovation. By preserving the handmade quality of grass cloth while integrating it into a contemporary technological framework, the work explores new possibilities for tradition in modern practice. Ultimately, the installation emphasizes the dialogue between nature and technology, tradition and innovation, reaffirming the capacity of natural materials to inspire new forms of artistic expression.



Figure 41 Exhibited at the Science and Technology Innovation Center of Jiangxi Science and Technology Normal University

The next work in this series draws inspiration from crustose lichen—a symbiotic organism that firmly adheres to the surface of tree, as shown in Figure 42. This piece continues the thematic exploration of the Tree Imprint series, which focuses on the traces of growth and transformation found in natural organisms. The creative intent lies in expressing the silent vitality and persistence of lichen as a metaphor for coexistence between humans and nature. Through the reinterpretation of the minute yet complex structures of lichen, the work transforms the concept of attachment into a poetic dialogue between life and environment. By embodying the subtle interaction between the organic and the artificial, the installation extends the reflection on ecological interdependence and material continuity.



Figure 42 Source of inspiration

From a technical perspective, the production process employs traditional techniques such as tie-dye and hand sewing, as shown in Figure 44. Indigo tie-dyeing

uses indigo paste, mordant, and reducing agent in a 10:1:2 ratio. The color intensity can be controlled by adjusting the amount of water. The specific steps are shown in Figure 43:

1. Wash the fabric in the water, then tie it into the desired pattern.
2. Add the mordant to the water.
3. Add the indigo paste and stir thoroughly.
4. Add the reducing agent and mix until completely dissolved.
5. After 30 minutes, when the dye solution turns from blue to green, submerge the fabric in the dye.
6. Remove the fabric and wait for it to change from green back to blue.

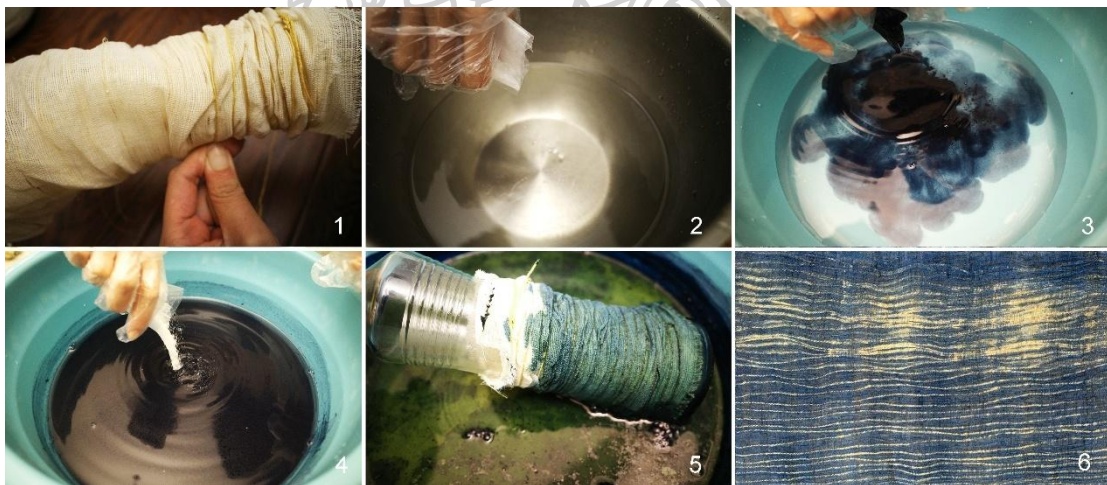


Figure 43 Tie-dyeing steps

The tie-dye process introduces irregular gradients and mottled transitions, simulating the naturally textures of lichen. Hand stitching functions as both a structural reinforcement and a symbolic act of connection—each stitch embodies the fusion between handmade craftsmanship and interactive technology

experimentation. This process maintains the tactile quality of grass cloth while enabling its transformation into a responsive surface. Through this synthesis of tradition and technology, the work embodies a dynamic balance between preservation and innovation.



Figure 44 The production process

The primary material used in the work is handmade grass cloth from the Wanzai Shuangzhi Grass Cloth Factory., combined with conductive sewing thread, Arduino-based microcontrollers, and WS2812 light strip. The translucent fiber structure of grass cloth allows light to diffuse softly through the fabric layers, producing a gentle luminescent effect. Conductive threads serve a dual function—as electrical connectors and aesthetic lines—integrating the hardware invisibly into the textile composition. The hardware configuration includes two 830-hole breadboards, a Arduino UNO development board, an ESP32 development board, two MPR121 multi-channel touch sensor, an MP3 module, a speaker, a WS2812 light board, two 5V power adapter, and DuPont cables. This configuration ensures stable light and sound interaction while preserving the integrity of the handmade textile surface.

The interactive logic of the system is based on light and sound feedback. As shown in Figure 45, when the installation is in its default state, it emits a soft blue light, glowing gently through the grass cloth. When a viewer touches the blue conductive sewing threads, the sensor detects the capacitance change and triggers both visual and auditory responses: the touched area shifts from blue to green for approximately two seconds before gradually returning to blue, while a corresponding piece of plant music plays through an speaker. Each touch point activates a distinct sound element, creating a layered natural soundscape that harmonizes with the visual rhythm of light. This multi-sensory interaction is designed to evoke a sense of

calm and healing, allowing the audience to feel relaxed and emotionally attuned to the work's organic resonance.



Figure 45 Appearance changes under interaction

The overall display effect of this series is shown in Figure 46. The subtle transitions of light and sound transform the textile into a living interface that glows and sings in response to human touch.

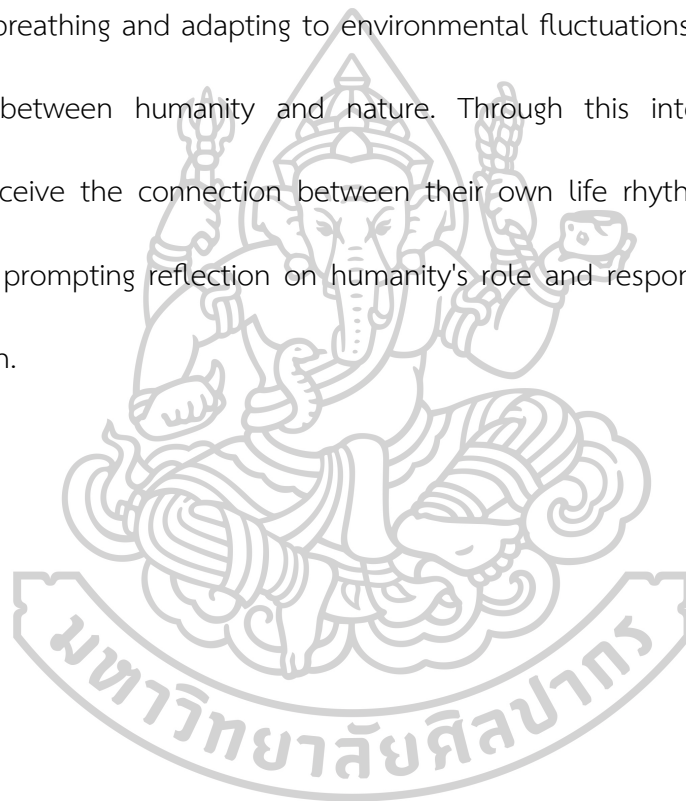


Figure 46 Overall display effect

4.6 Air pump and light interactive art installation based on plants

The final piece in the Tree Imprint series further explores and interprets the morphology of lichen through the integration of bead embroidery and tie-dye techniques with air pump and lighting interaction. This textile art installation generates undulating and luminous interactive effects based on heart rate changes and draws inspiration from fruticose lichens. Lichens have unique ecological value because of their symbiotic relationship between fungi and algae, as well as their remarkable survival capabilities, making them important indicators of ecological balance. Choosing lichens as inspiration not only artistically reimagines nature's microscopic forms but also conveys the significance of environmental symbiosis and life's resilience through their ecological value.

As shown in Figure 47, the use of bead embroidery and tie-dye techniques enhances the layered surface of grass cloth, creating a fine and intricate visual effect that reflects the complexity of lichen growth. Figure 48 illustrates the manufacturing process. As shown in Figure 49, when viewers place their fingers on the heart rate sensor, the piece's colors and light patterns shift in rhythm with their pulse, much like lichen breathing and adapting to environmental fluctuations, evoking a sense of resonance between humanity and nature. Through this interactive experience, viewers perceive the connection between their own life rhythms and the natural ecosystem, prompting reflection on humanity's role and responsibility in ecological conservation.



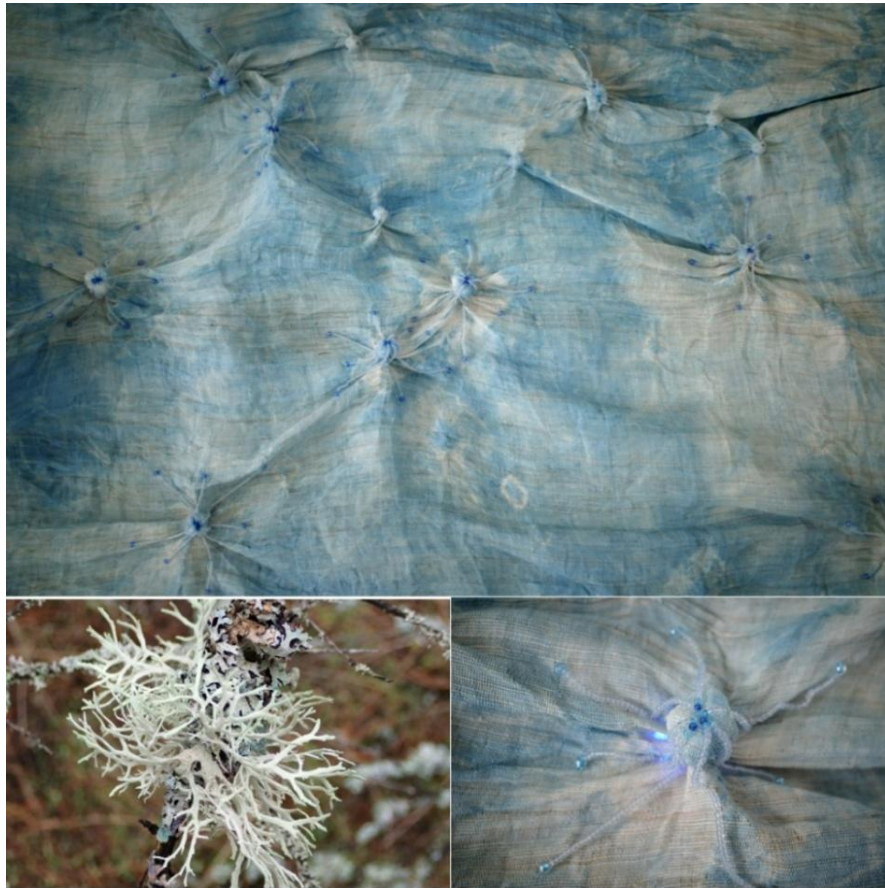


Figure 47 Source of inspiration and appearance texture

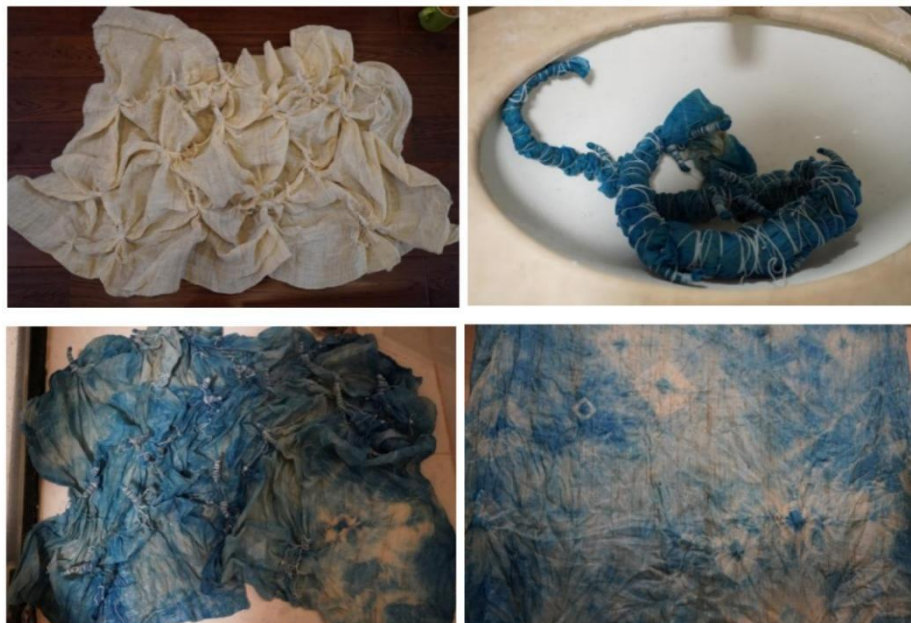


Figure 48 The production process

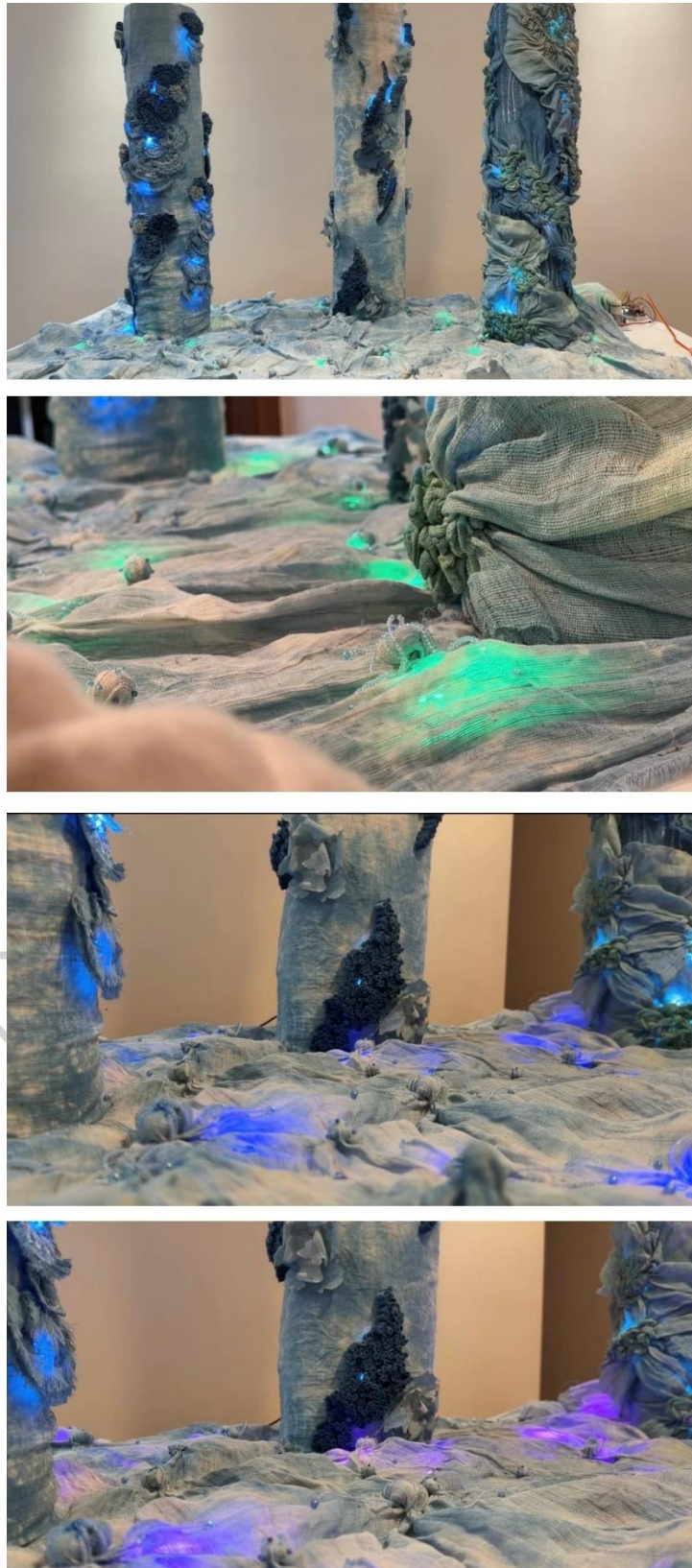


Figure 49 Appearance changes under interaction

The artwork uses bead embroidery techniques to mimic the form of fruticose lichens, reimagining fabric by integrating LED strips, air pumps, and heart rate sensors. This combination creates a dynamic visual experience with undulating textures and luminous effects. The primary materials are grass cloth and beads. Hardware components include one ESP32 development board, one Max30105 heart rate sensor, 30 WS2812 LED strips (3 LEDs per strip), six integrated air pumps (air pump and valve), one 830-hole breadboard, one 400-hole breadboard, three power adapters, and several lengths of DuPont wires, as shown in Figure 50. The circuit diagram is shown in Figure 51.

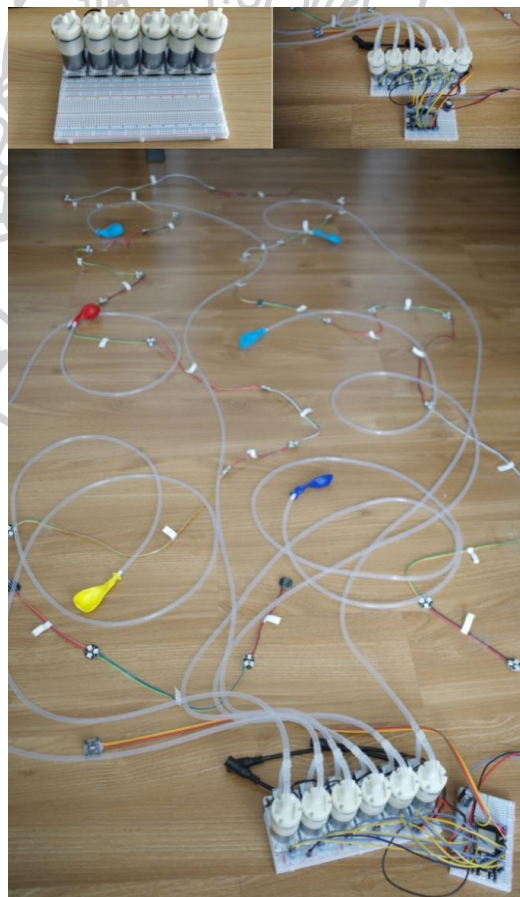


Figure 50 Air pump and lighting hardware configuration

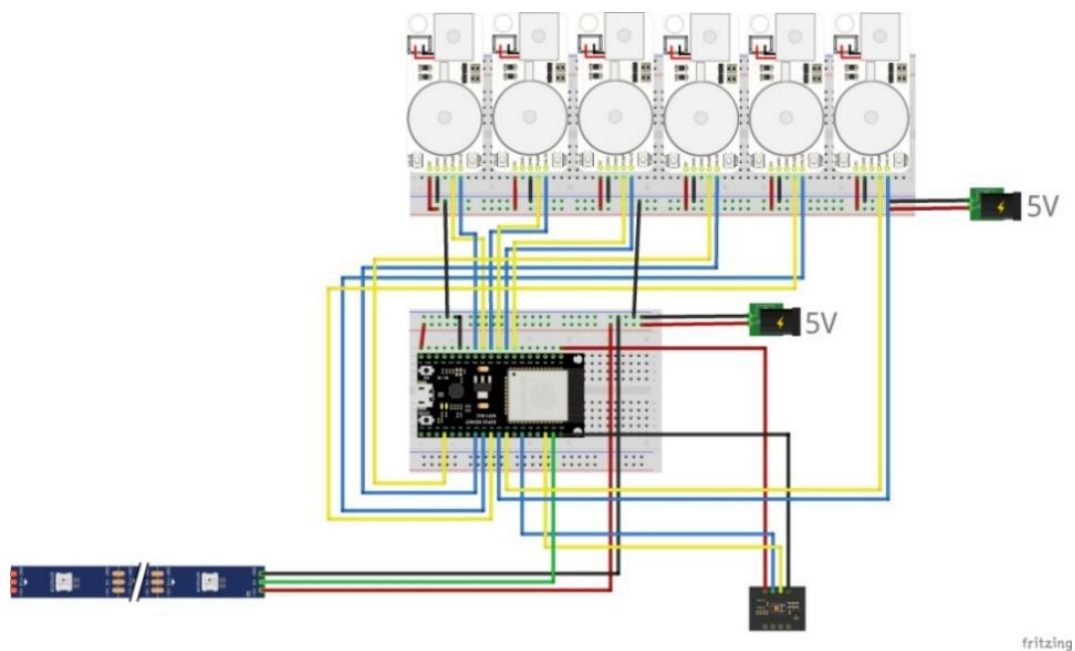


Figure 51 Circuit diagram

The core logic primarily includes heart rate detection and state classification, as well as control strategies for lighting and air pumps. By continuously reading heart rate data and calculating BPM, the system categorizes heart rate into four states: no signal, low heart rate, normal heart rate, and high heart rate. The lighting system adjusts color and transition speed according to these heart rate states, enhancing the visual dynamism of the work, as shown in Figure 52. Meanwhile, the air pump inflates and deflates based on heart rate states, simulating fluctuating air pressure changes that correspond to the fabric's dynamic undulations, as shown in Figure 53. Together, these elements create a biomimetic visual and tactile experience.



Figure 52 Lighting change test

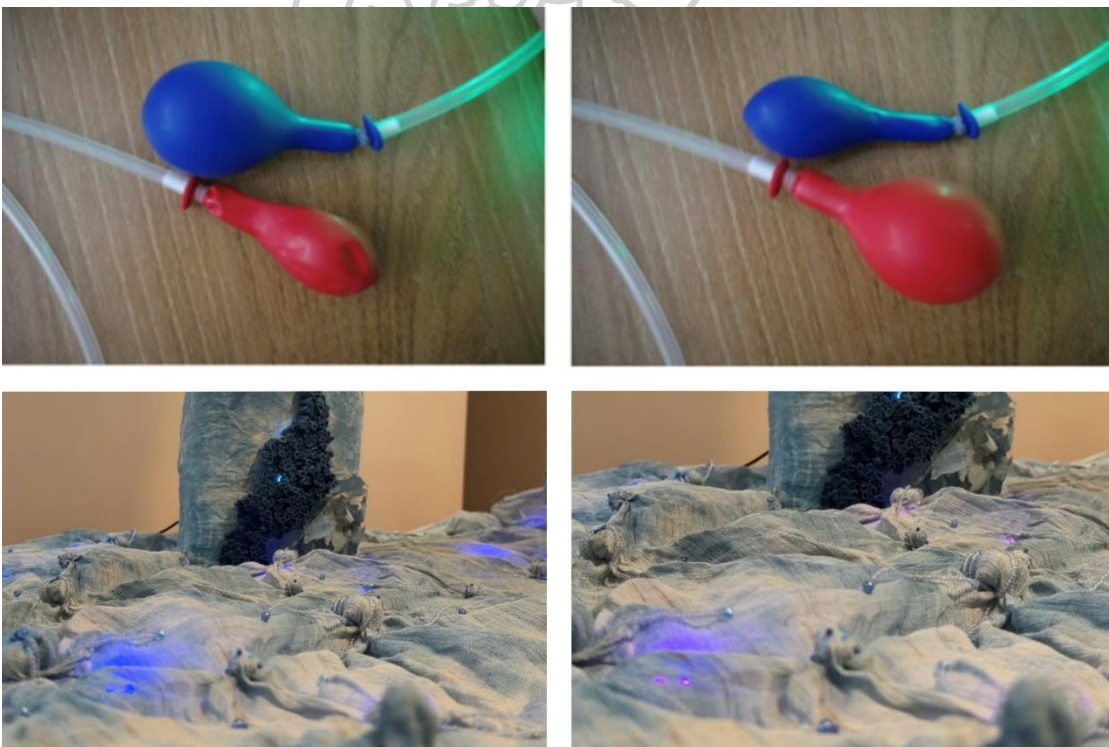


Figure 53 Fluctuation test

The system process begins with initialization, completing hardware configuration and sensor activation. This includes initializing the serial port, air pump and valve pins, WS2812 LED strip, and MAX30105 sensor. In the main loop, the system continuously monitors heart rate, switching colors and transition speeds based on heart rate status to create a breathing light effect. The air pump performs inflation, deflation, and delay operations according to the state machine sequence. At high heart rates, the air pump operates faster with shorter delay times.

Different heart rate states correspond to distinct control parameters, enabling synchronized dynamic changes in lighting and air pressure to create an artistic effect of natural undulations. The entire design uses a non-blocking architecture, utilizing `millis()` for multitasking timing control to ensure immediate and continuous interaction, fully embodying the fusion of textile art and intelligent interactive control. This work uses heart rate variations to drive dynamic responses in lighting and air pumps. By merging textile craftsmanship with electronic technology, it creates a visual and tactile experience reminiscent of plant respiration, presenting an innovative interactive approach that unites art, technology, and nature. This piece stands as a textile art installation with both aesthetic appeal and technological sophistication, offering new possibilities for natural perception and emotional expression.

4.7 Summary

All works collectively showcase the experimental transformation of Chinese grass cloth from a traditional cultural material into a medium for contemporary textile art. These six works, though diverse in form and technology, share a unified conceptual foundation: they draw inspiration from natural forms—leaves, flowers, trees, and lichens—and reinterpret them through the integration of traditional craftsmanship, material experimentation, and interactive technology. Together, they form a coherent body of research exploring the expressive potential of grass cloth as both a cultural and ecological medium.

In Section 4.1, Textile Art Installations Based on Plant Forms, the study begins with a poetic exploration of the ramie leaf, directly linking the raw material of grass cloth to its botanical origin. The use of dyeing, drawn-thread work, and shaping techniques transforms the coarse textile into delicate, leaf-like structures that embody lightness and spirituality. Through this reinterpretation, the work bridges tradition and modernity, expressing reverence for nature and a contemporary artistic sensibility. It establishes the thematic foundation for later works: the unity between natural inspiration and cultural continuity.

Section 4.2 advances this dialogue by incorporating interactive dynamics. The Dynamic Opening and Closing Interaction Art Based on Flower Forms transforms the static beauty of floral morphology into a responsive installation. Beaded tubes mimic petals that open and close automatically in response to human proximity,

symbolizing the rhythmic vitality of nature. This integration of sensor-based motion makes the viewer an active participant, creating an interactive cycle between art and audience. The work's technical and poetic dimensions demonstrate the potential of textile materials to convey emotional and perceptual experiences beyond their physical form.

Building on this, Section 4.3, Dynamic Opening and Closing Interaction Art Installation Based on Flower and Landscape, expands the floral concept by combining acrylic and beadwork. The dialogue between soft and rigid materials enhances the installation's visual and structural tension. The transparent acrylic amplifies light effects and spatial layering, while the beaded petals preserve tactile delicacy. The result is an installation that embodies both organic growth and technological elegance, symbolizing the coexistence of nature and industry. This section marks a clear shift from material exploration to cross-material hybridity, bridging the aesthetic and mechanical dimensions of textile art.

Section 4.4, Light Interactive Textile Art Installation Based on Plants, introduces light as an expressive medium, transforming grass cloth into an illuminated, responsive surface. Inspired by the textures of tree bark and lichen, this work integrates sensor modules and light strips to create visual effects that react to touch. The delayed lighting mechanism extends audience engagement and sensory immersion. Importantly, this work reinforces the notion that cultural heritage can evolve through technological reinterpretation. Audience feedback confirmed that

such integration revitalizes traditional materials, making them more accessible and engaging to contemporary viewers.

Section 4.5, Sound and Light Interactive Art Installation Based on Plants, marks a technical advancement and conceptual deepening of earlier works. By introducing multimodal interactivity—the simultaneous use of light and sound feedback—the piece offers an immersive sensory experience. Using Arduino UNO, MPR121 sensors, and DFPlayer Mini modules, the installation maps touch inputs to synchronized visual and auditory responses. This integration of textile, sound, and light transforms grass cloth into a multisensory interface that encourages tactile exploration. The installation also embodies the ecological metaphor of symbiosis, linking the natural rhythm of life to the digital logic of interaction. The successful public exhibition of this work highlights its effectiveness in engaging audiences through a balanced synthesis of art, craft, and technology.

The final piece, Section 4.6, Air Pump and Light Interactive Art Installation Based on Plants, concludes the exploration by integrating biometric interaction—heart rate sensing—into textile expression. Inspired by fruticose lichens, the work uses bead embroidery, LED systems, and air pumps to translate physiological data into fluctuating light and movement. The system responds to the viewer's heart rate in real time, creating a breathing, undulating surface that evokes the interconnectedness of human life and natural rhythm. Technologically, it is the most complex system in this series, utilizing non-blocking multitasking architecture to

achieve seamless responsiveness. Conceptually, it conveys an ecological message—an artistic meditation on the balance between human emotion, technology, and nature’s resilience.

The series begins with tangible craft processes—dyeing, pearl embroidery, and fabric manipulation—and gradually evolves toward intangible experiences mediated by light, sound, air, and physiological data. As shown in Figure 54, throughout these works, grass cloth transcends its utilitarian origins, emerging as a living medium capable of communication and response. The creative trajectory demonstrates how traditional materials can become vehicles for technological imagination while preserving their cultural identity.

Audience feedback further validates this approach. Based on 25 valid responses, as shown in Figure 57, most participants described their first impression of the installation as curious and interactive or visually striking, highlighting its sensory and experiential appeal. The most impressive aspects were interactivity and material texture (grass cloth), revealing the significance of tactile engagement and participation. Nearly all respondents found the interactive form highly engaging, and open-ended comments emphasized the desire for more dynamic sound integration. Viewers expressed feelings of naturalness, creativity, immersion, and connection to nature, affirming the success of the multisensory design in evoking emotional and ecological resonance.



Figure 54 Photographs from the exhibition at the Bangkok Center for Culture and Arts

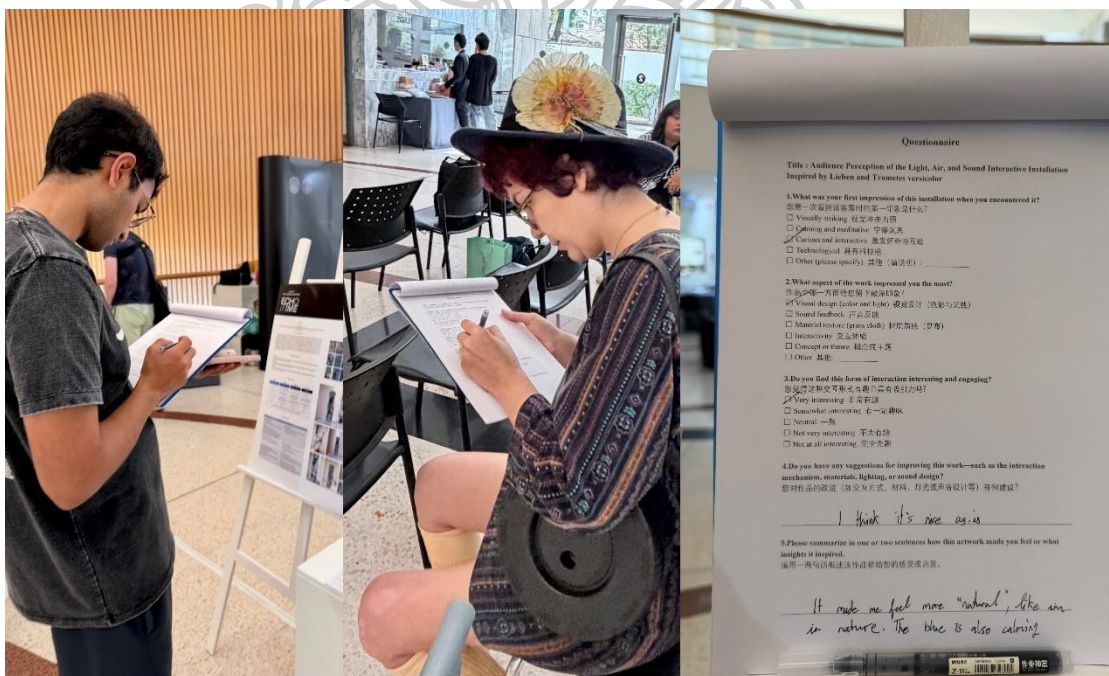


Figure 55 Questionnaire collection feedback

Questionnaire

**Title : Audience Perception of the Light, Air, and Sound Interactive Installation
Inspired by Lichen and Trametes versicolor**

1.What was your first impression of this installation when you encountered it?

您第一次看到该装置时的第一印象是什么？

- Visually striking 视觉冲击力强
- Calming and meditative 宁静沉思
- Curious and interactive 激发好奇与互动
- Technological 具有科技感
- Other (please specify) 其他 (请说明) : _____

2.What aspect of the work impressed you the most?

作品中哪一方面给您留下最深印象？

- Visual design (color and light) 视觉设计 (色彩与光线)
- Sound feedback 声音反馈
- Material texture (grass cloth) 材质质感 (夏布)
- Interactivity 交互体验
- Concept or theme 概念或主题
- Other 其他: _____

3.Do you find this form of interaction interesting and engaging?

您觉得这种交互形式有趣且具有吸引力吗？

- Very interesting 非常有趣
- Somewhat interesting 有一定趣味
- Neutral 一般
- Not very interesting 不太有趣
- Not at all interesting 完全无趣

4.Do you have any suggestions for improving this work—such as the interaction mechanism, materials, lighting, or sound design?

您对作品的改进 (如交互方式、材料、灯光或声音设计等) 有何建议？

5.Please summarize in one or two sentences how this artwork made you feel or what insights it inspired.

请用一两句话概述该作品带给您的感受或启发。

Figure 56 Audience Perception Survey Questionnaire

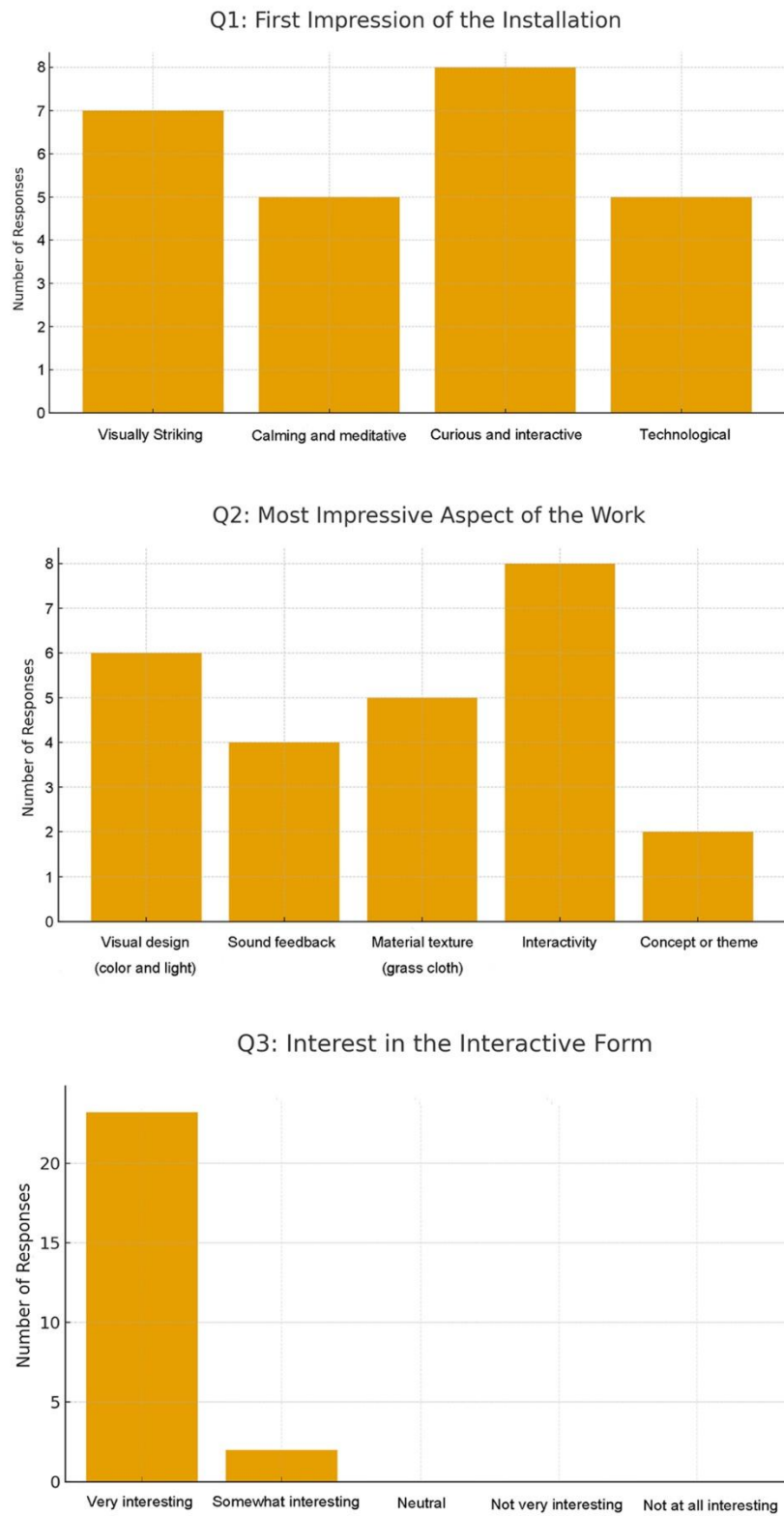
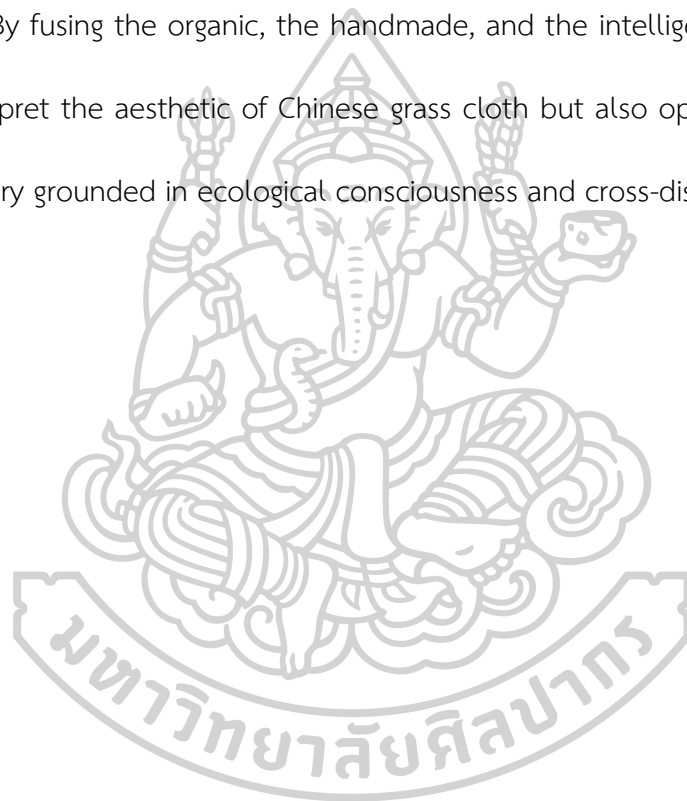


Figure 57 The Results of Questions 1, 2, and 3

In summary, this chapter highlights three main achievements: (1) it establishes a comprehensive methodology for transforming traditional textiles into interactive, multisensory artworks; (2) it articulates a theoretical model in which nature, material, and technology coalesce into a coherent system of expression; and (3) it contributes to the broader discourse on sustainable and cultural innovation in contemporary textile art. By fusing the organic, the handmade, and the intelligent, these works not only reinterpret the aesthetic of Chinese grass cloth but also open new frontiers for artistic inquiry grounded in ecological consciousness and cross-disciplinary creativity.



Chapter 5

Conclusion

5.1 Conclusion

This study examines the expressive potential and innovative applications of grass cloth in contemporary textile art. Through three phases—questionnaire surveys and field research, material experiments, and the creation of interactive textile art installations—it reveals the current level of recognition of grass cloth in contemporary society, its expressive potential in textile art, and its innovative value in cross-disciplinary interactions. Material experiments confirmed grass cloth's multidimensional expressive capabilities in dyeing, fabric manipulation, and interactive technologies, highlighting its strengths in simulating natural forms and facilitating cross-disciplinary art. Art installation practices further demonstrate that grass cloth not only conveys cultural narratives but also achieves interactivity and immersion through various processes and technologies.

Research findings indicate that the future development of grass cloth can incorporate diverse design approaches and technological methods to achieve both cultural preservation and innovation. This provides practical guidance for the protection and development of grass cloth and offers a new research paradigm for the regeneration of traditional textiles in a modern context. The value of this research lies in providing methodological frameworks and practical examples for the inheritance and innovation of grass cloth; however, its limitations include a limited

sample scope and insufficient experimental depth. Future research could expand cross-regional surveys, integrate more advanced interactive technologies, and explore the possibilities of grass cloth within an international art and design context, thereby promoting the regeneration and dissemination of this traditional textile material in contemporary culture.

5.2 Discussion

The stiffness, distinct texture, and natural properties of grass cloth facilitate the representation of natural forms. Although public awareness of grass cloth is limited, there is a clear latent demand for it. Fabric manipulation techniques and interactive technologies have enhanced the innovation, dissemination, and appeal of grass cloth. The research analyzes the expressive characteristics of natural forms, textures, and colors, validates the practical applications of grass cloth in dyeing, fabric manipulation, and interaction, and demonstrates its feasibility and artistic expressiveness as a core medium in installation art.

However, the sample in this study focused on Chinese audiences and Jiangxi grass cloth brands, with limited coverage of craftsmanship and no systematic evaluation of interaction durability. Future research could include cross-regional and cross-cultural comparative studies, as well as longitudinal research. Expanding craftsmanship methods and interactive technologies, conducting experiential

evaluations, and establishing a replicable design paradigm for natural forms, grass cloth craftsmanship, and interactive applications are also recommended.

5.3 Contributions

This study makes three key contributions to the field of textile art and cultural heritage innovation. First, it enriches the experimental repertoire of techniques that extend both the physical properties and aesthetic vocabulary of Chinese grass cloth. Through material experimentation in dyeing, fabric manipulation, and structural shaping, the study expands the expressive range of this traditional textile from functional craft to a contemporary art medium.

Second, it demonstrates the feasibility of grass cloth as a multisensory artistic medium by developing interactive installation prototypes that integrate light, sound, motion, and biometric responses. These works transform grass cloth from a static cultural artifact into a dynamic interface for audience engagement, offering new possibilities for participatory and immersive art experiences.

Third, the research proposes an innovative framework that bridges cultural heritage materials, biomimetic design, and interactive technologies. By combining ecological inspiration with digital fabrication and sensor-based interactivity, the study establishes a new paradigm for regenerating traditional materials within contemporary creative practices.

Collectively, these contributions advance the theoretical understanding and practical application of sustainable textile innovation grounded in cultural continuity and interdisciplinary exploration.

5.4 Recommendations

5.3.1 Research Applicability and Expansion

The findings of this study suggest that Chinese grass cloth can be positioned as both a medium for artistic creation and a bridge connecting cultural heritage with contemporary art. The material experiments and interactive installations demonstrated that grass cloth has strong adaptability in simulating natural forms, enabling its application in fashion, product design, and cultural industries. Moreover, the research provides practical guidance for integrating traditional craft with interactive technologies, expanding possibilities for art education, cultural tourism, and sustainable product development.

5.3.2 Future Research

Future studies could expand the scope beyond Jiangxi to conduct cross-regional and cross-cultural comparative analyses, revealing the global relevance of grass cloth. Longitudinal studies may further investigate audience perception and cultural narrativity within interactive textile installations. In addition, exploring advanced technologies such as smart textiles and augmented reality may enrich the expressive dimensions of grass cloth. This expansion would provide a replicable model for

combining natural inspiration, cultural heritage, and artistic innovation in contemporary textile practices.



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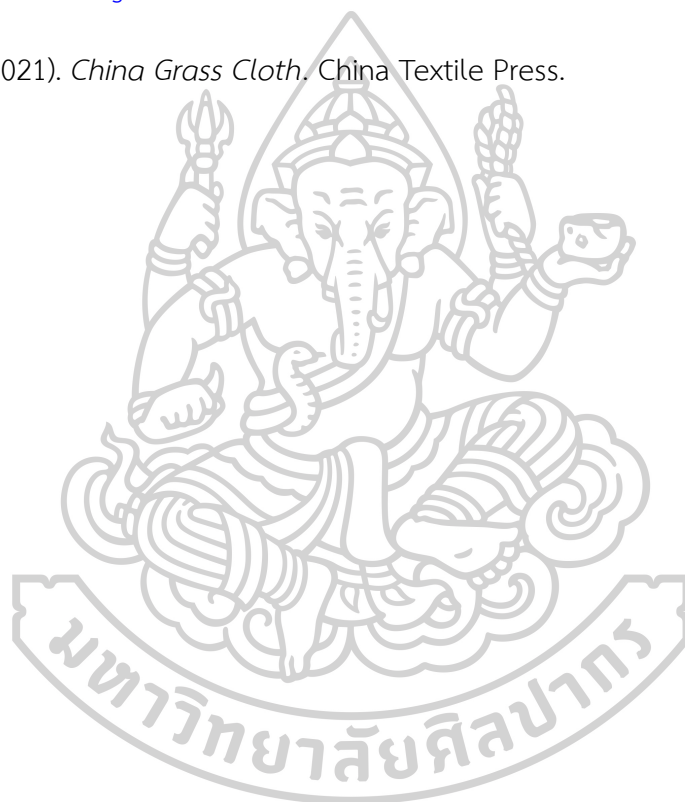
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