INNOVATIVE DESIGNS OF DAI PAPER-CUTTING PATTERNS FROM THE PERSPECTIVE OF INTANGIBLE CULTURAL HERITAGE

By
Miss Yixia LEI

A Thesis Submitted in Partial Fulfillment of the Requirements
for Master of Fine Arts Program in Design
Silpakorn University
Academic Year 2025

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MissYixia LEI

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Title	Innovative Designs of Dai Paper-cutting Patterns from the Perspective of Intangible Cultural Heritage
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Advisor	Assistant Professor Dr. Thatree Muangkaew

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This paper takes the Dai ethnic paper-cutting art of Dehong, Yunnan as the research object, studies the intangible cultural heritage of Dai paper-cutting, and explores the extraction and innovation of its traditional patterns.In response to the current innovation dilemma faced by traditional handicrafts in the process of modernization, the core of this research aims to solve two key problems: "how to systematically analyze the cultural connotation of Dai paper-cutting" and "how to achieve innovative transformation of its expression in contemporary design".

To address this issue, this study constructs an interdisciplinary methodology for cultural decoding and design coding. First, we comprehensively utilize literature review and field investigation methods to solidify the theoretical foundation and field evidence of our research. Furthermore, by introducing semiotics and schematism, the patterns of Dai paper-cutting are systematically deconstructed, and the visual external composition at the "signifier" level and the cultural connotation at the "signified" level are analyzed from the perspective of semiotics. Based on this, shape grammar is innovatively used as the core generation tool. Through the theoretical definition of a series of rules such as deformation, copying, and rotation, traditional patterns are logically deduced and derived.

The core objectives are threefold: 1. To systematically organize the traditional elements, patterns, compositions, and cultural value of Dai paper-cutting art. Through textual research, field investigation, and semiotic analysis, this study systematically sorts out the traditional element system and cultural value of Dehong Dai paper-cutting. First, from the perspective of visual form, it extracts the unique symbols of Dehong Dai paper-cutting, including regionalized patterns, iconic compositional forms, and technical characteristics. Secondly, we analyze the deeper meaning behind the patterns from the perspective of cultural value. 2. Based on the analysis, complete the extraction and fusion of paper-cutting elements. Based on semiotics and other theories, this study uses shape grammar to deduce and recreate traditional pattern units by defining a series of basic rules based on translation, rotation, mirroring, scaling, etc. 3. Promote the integrated and innovative development of paper-cutting and expand its practical application areas. The innovative patterns described above are applied to specific design practices, such as displaying the patterns on everyday consumer goods and cultural and creative products, to empirically demonstrate the effectiveness and feasibility of the innovative

design methods proposed in this study.

The study validated the theoretical path through objectives and design practices, and successfully applied the innovative patterns to the design of cultural and creative products such as coasters and scarves. The results of the questionnaire survey and data analysis show that the public has a high degree of understanding and acceptance of innovative designs that combine clear cultural expression with beautiful and unique patterns, which verifies the feasibility of the innovative approach of this study. Ultimately, this study not only provides an operational theoretical model and practical case for the contemporary transformation of Dai paper-cutting, but also offers a valuable interdisciplinary methodological reference for innovative design research on similar intangible cultural heritages.

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Introduction

1.1 Research Background

Paper cutting is an important part of traditional Chinese folk handicrafts, and paper cutting culture has a history of hundreds of years. Throughout China, paper-cutting style culture will continue to evolve according to local customs and aesthetic style characteristics, and paper-cutting has gradually formed a unique cultural and artistic tradition (Jin & Li, 2012). As a visual medium about collective identification, Dai paper-cutting transforms specific cultural symbols into highly expressive patterns, so that paper-cutting can convey ideas and emotions. Dai paper cutting mainly stands out among many local traditions with its unique shape and vivid style. As an important part of China's intangible cultural heritage, the history of Dai paper cutting can be traced back to about 1,500 years ago. The earliest form of paper cutting was on the paper flag used in sacrificial ceremonies (Wang & Gao, 2018). Dai paper-cutting art integrates Buddhist culture and Central Plains culture, and has gradually developed into a more complete form of artistic expression, which is widely used in various ceremonies, especially in Buddha statue offerings. Dai paper-cutting not only preserves the historical memory and collective spirit of the Dai people, but also shows their rich imagination and creativity, which is an important part of their artistic life. The paper-cut pattern of Dehong Dai Autonomous Prefecture has unique artistic characteristics and distinct regional characteristics, and has become an important part of Dai cultural expression (Yang & Yang, 2018). Many of the patterns displayed by Dai paper cutting are based on nature and daily life scenes, including common animals and plants. Through the ingenious composition design and exquisite paper-cutting skills of paper-cutting inheritors or artists, these elements have been transformed into vivid and interesting paper-cutting works. Dai paper cutting not only shows the aesthetic ideals of Dai people, but also conveys their longing for life. As an intangible cultural heritage, Dai paper-cutting embodies the historical accumulation and cultural wisdom of the ethnic group. In 2006, Dehong Dai paper-cutting was included in the first batch of national intangible cultural heritage lists; in 2009, it was also included in the UNESCO Representative List of the Intangible Cultural Heritage of Humanity as a sub-project of "Chinese Paper-cutting," establishing its cultural status at the national and even global levels (Ma, 2010).

As an important representative of China's intangible cultural heritage, the Dai paper-cutting of Dehong Prefecture has become a shining cultural symbol of Dehong Prefecture, Yunnan Province, with its unique ethnic style and aesthetic value. Dai paper-cutting, as a handicraft that integrates historical memory, religious beliefs and

aesthetic tastes, embodies the artistic wisdom of the fusion of diverse cultures in its pattern system. Since 2006, China has been intensifying its efforts to protect intangible cultural heritage. In 2005, the General Office of the State Council of China issued the Opinions on Strengthening the Protection of China's Intangible Cultural Heritage, which put forward the guiding principles of "protection first, rescue first, rational utilisation, wide dissemination and education". This framework provides specific institutional support for Dai paper-cutting culture and other intangible cultural heritage protection projects (Li, 2015). During the 14th Five-Year Plan, China also paid more attention to the dissemination and promotion of the innovative practice and development of intangible cultural heritage in daily life. This shift marks a change in the way intangible cultural heritage is protected, from rescue-oriented to renewal-oriented and innovation-oriented (Sofield & Li, 1998).

However, with the pressures brought about by modernization and globalization, Dai paper-cutting now faces two major dilemmas: it has become more difficult to pass on the skills to the next generation, and the driving force for creative development remains weak. Based on the principles of re-creation advocated by UNESCO and the goal of "integrating into modern life" in China's "14th Five-Year Plan" for intangible cultural heritage, it is necessary to promote its contemporary development through systematic innovative design methods. Current research on Dehong Dai paper-cutting is still significantly insufficient. The systematic analysis of its patterns and symbols is weak, there is a lack of methods for extracting elements, and there is little exploration of its application in contemporary design.

Against this backdrop, traditional pattern resources are transformed into modern design language, realizing the value enhancement from "heritage" to "resource". This research direction not only echoes the academic trend of intangible cultural heritage innovation, but also provides a theoretical basis for this paper's focus on the research path of "pattern extraction - integration and innovation - application expansion". This paper uses semiotics as a framework and combines shape grammar to geometrically deconstruct and derive traditional patterns. This research method mainly expresses that researchers are exploring the feasible way to combine traditional cultural elements with modern aesthetics, and at the same time retains its cultural connotation value. Through innovative and creative changes, it focusses on the technical and cultural value of intangible cultural heritage, so that it can develop sustainably in the future, that is, not only retain its cultural and artistic core, but also strengthen its ability to adapt to contemporary needs.

In a word, Dai paper cutting is an important part of traditional Chinese culture, with profound historical and cultural heritage and unique artistic style characteristics. The study of its innovative practises is not only conducive to the dissemination and development of traditional Chinese culture, but also provides a new perspective for the innovative design of modern art.

1.2 Research Questions

1. How can we analyze and promote Dai paper-cutting, an intangible cultural heritage?

2. How can the expressive forms of traditional Dai paper-cutting art be innovatively transformed in contemporary design?

1.3 Research Hypothesis

1. Through a framework of semiotics and typology, we can systematically analyze the traditional element system of Dehong Dai paper-cutting, explore the cultural connotations of its patterns and compositions, and then organize traditional pattern elements that combine cultural integrity and design usability, providing a research foundation for subsequent innovative designs. The purpose of this article is to systematically sort out the traditional elements of Dai paper-cutting. It is predicated to using semiotic theory to deconstruct the "signifier" and "signified" theory of patterns, such as the correspondence between the external visual form of peacock patterns and the cultural connotations of "auspiciousness and nobility", and to combine it with typological methods such as pattern classification and composition categorization to sort out the pattern elements.

2. The design methodology centered on shape grammar can preserve the cultural core of traditional elements of Dehong Dai paper-cutting while innovating its visual form, forming a new paper-cutting pattern system that meets the needs of modern aesthetics and design, verifying the feasibility of contemporary innovative transformation of traditional patterns, and adapting to modern aesthetics while preserving cultural identity.

1.4 Research Objectives

1. Systematically organize the traditional elements, patterns, compositions, and cultural value of Dai paper-cutting art. Through textual research, field investigation, and semiotic analysis, this study systematically sorts out the traditional element system and cultural value of Dehong Dai paper-cutting. First, from the perspective of visual form, it extracts the unique symbols of Dehong Dai paper-cutting, including regionalized patterns, iconic compositional forms, and technical characteristics. Secondly, we analyze the deeper meaning behind the patterns from the perspective of cultural value.

2. Based on the analysis, complete the extraction and fusion of paper-cutting elements. Based on semiotics and other theories, this study uses shape grammar to deduce and recreate traditional pattern units by defining a series of basic rules based on translation, rotation, mirroring, scaling, etc.

3. Promote the integrated and innovative development of paper-cutting and expand its practical application areas. The innovative patterns described above are

applied to specific design practices, such as displaying the patterns on everyday consumer goods and cultural and creative products, to empirically demonstrate the effectiveness and feasibility of the innovative design methods proposed in this study.

1.5 Expected Benefits

1.5.1 Cultural Preservation

1. Enhance cultural identity: Through in-depth research and innovative design, showcase the unique charm and cultural connotations of Dai paper-cutting patterns to more people, enhance public identification with Dai culture, and promote the development of ethnic culture.

2. Enhance cultural influence: Innovative design will promote the integration of Dai paper-cutting patterns with modern aesthetic needs, thereby enhancing their artistic and aesthetic value.

1.5.2 Artistic Innovation

1. Promoting artistic innovation: The research will explore innovative design paths for Dai paper-cutting patterns, creating new works with contemporary characteristics.

2. Expanding the design field: Innovative design will no longer be limited to the traditional paper-cutting field, but will also extend to daily necessities, cultural and creative products and other fields, providing a broad space for the innovative application of Dai paper-cutting patterns.

1.6 Scope of Study

1.6.1 Geographical Scope

Dai paper cutting mainly originated in Dehong Dai and Jingpo Autonomous Prefecture, Yunnan Province, China. As one of the main settlements of the Dai nationality, Dehong has rich national cultural traditions, including the Dai paper-cutting art with unique characteristics. The paper cutting of this research mainly focusses on the Dai paper cutting patterns in the Dehong area, which not only helps us to better understand the regional characteristics and national styles of these paper cutting patterns, but also provides rich materials and inspiration for future innovative design practises.

1.6.2 Time Range

This research mainly explores the two key stages of the development of Dai paper-cutting culture: one is the development of history and culture, and the other is the application of modern innovative design. First of all, by tracing the origin and intrinsic meaning of these patterns, we can better understand the unique cultural

significance of Dai paper cutting. Secondly, focussing on contemporary innovative design, we should explore how to integrate the modern heart-piercing design concept while retaining the traditional Dai paper-cutting characteristics, so as to contribute to the dissemination and development of this art form.

1.6.3 Scope of Content

1. Historical and cultural scope: summarise and build a cognitive system that integrates visual, cultural and technical elements.

It mainly focusses on three core dimensions: visual elements, cultural connotations and technical characteristics. After examining the pattern and composition of Dehong Dai paper cutting, this article then analyses the visual elements of Dai paper cutting and records the traditional colour matching. By linking these visual elements with the folk culture and historical background of the Dai nationality, the cultural concepts they express are explained. In addition, this study also outlines the paper-cutting techniques and steps of the paper-cutting art form, such as the selection of paper, the selection and use of tools, and the creative process of paper-cutting, so that future innovative designs can retain the authenticity and original texture of the paper-cutting art.

2. The scope of the theory and method of this research: This research mainly uses semiotic theory and schematic theory. First, it conducts a semiotic theoretical analysis of paper-cut patterns, and then designs and adjusts the innovative design scheme by using basic shape grammar such as translation, rotation, mirroring and scaling to deduce rules. The goal is to test a clear, easy-to-understand, easy-to-explanatory and practical interdisciplinary research method.

3. The innovative design practice steps of this study mainly include three parts: cultural concepts, design processes and innovative applications. The design principle is mainly to create works that reflect the traditional culture of Dai paper cutting and conform to modern aesthetics. Here, innovation refers to updating the visual form under the premise of being faithful to the essence of traditional culture, so as to realise the reinterpretation of innovation and creativity.

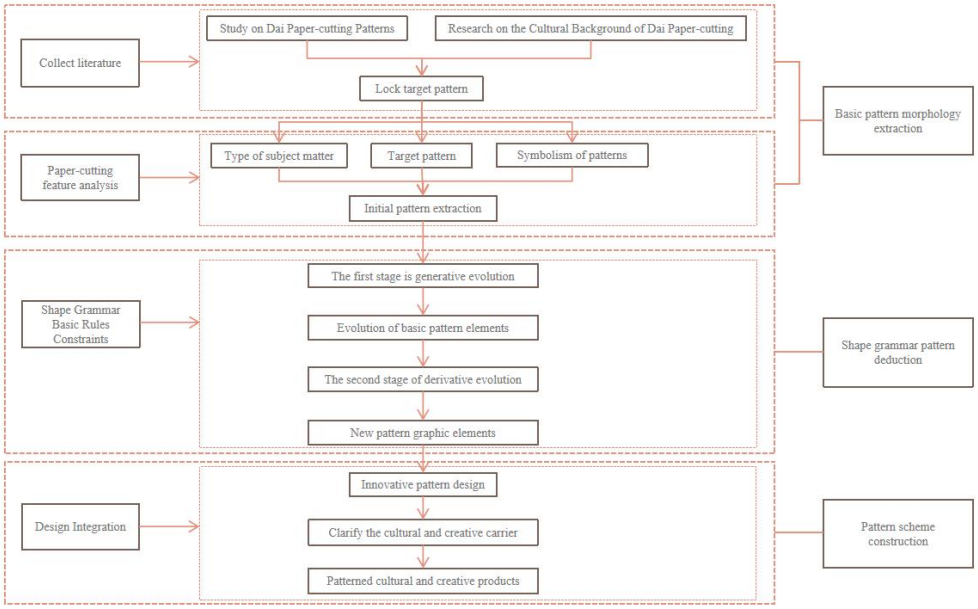
We will adopt a clear design process: first, extract the most representative pattern elements from traditional design; second, use shape grammar to convert these elements; third, start the design scheme based on cultural connotation and aesthetic attractiveness; finally, improve the selected design and develop it into a series of Works. This step-by-step approach ensures the logic of the process and the consistency of the results.

In terms of application, we will focus on visual communication design, covering daily necessities and cultural creative products.

1.7 Conceptual Framework

Figure 1

Conceptual framework diagram



Note: Drawn by the author.

1.8 Research Methods

This research mainly focusses on the paper-cutting pattern of the Dai nationality. First, it explores and records its artistic characteristics through historical literature review and field visits and research. Study the semiotic theoretical relationship of using shape grammar, and use semiotics to explain the cultural value and historical origin of these patterns. By integrating traditional cultural style with modern design, this study introduces Dai paper-cutting culture into the field of contemporary product design, and also provides a new perspective for similar research.

This research mainly adopts mixed research methods, combining qualitative research and quantitative research methods, and using interviews, questionnaires and experimental design analysis to ensure that it can meet the needs of the modern aesthetic market while inheriting and spreading the Dai paper-cutting culture.

1.8.1 Literature Review Method

1.We need to systematically collect and organize academic materials on Dai paper-cutting patterns, which mainly cover multiple aspects such as historical origin, cultural background, paper-cutting techniques and stylistic characteristics. Specifically, this includes books, journal articles, dissertations, newspaper articles, and other

relevant research and compilation materials, aiming to comprehensively grasp the connotation and value of Dai paper-cutting patterns.

2. Conduct an in-depth analysis of the policies and specific measures for the protection and development of Dai paper-cutting as an intangible cultural heritage, focusing on the strategies, measures and their effectiveness adopted by governments at all levels, cultural institutions and all sectors of society, to provide institutional and practical background for the research.

1.8.2 Field Research Method

1. Travel to Dehong Dai and Jingpo Autonomous Prefecture in Yunnan Province, go deep into the Dai ethnic minority areas and paper-cutting production sites, systematically observe and record their production environment, tools, materials and processes, and fully grasp the actual operation process of paper-cutting art.

2. Through face-to-face interviews and in-depth exchanges with local paper-cutting artists, listen to their creative experiences, technical insights and artistic perceptions, and gain a deeper understanding of the cultural connotations and artistic value behind paper-cutting.

3. Systematically collect and organize Dai paper-cutting works and related documents, including physical samples, image data and historical documents, to ensure that the sources of data are diverse and reliable, and to provide empirical support for subsequent research.

1.8.3 Case Study Method

This study selects typical and representative intangible cultural heritage patterns as cases, analyzes their pattern composition, design concept, symbolic meaning, and other dimensions, systematically reveals their artistic features and stylistic characteristics, and provides a reference for subsequent innovative designs.

1.8.4 Design Practice Method

1. Systematically carry out the entire process from design conception to specific implementation, including ideas sorting, pattern extraction, and innovative design, to ensure the rationality and feasibility of the design process.

2. Data was collected through expert interviews and user questionnaires. Based on fundamental research theories, and drawing on traditional craftsmanship and modern aesthetics, we have carried out innovative design practices on Dai paper-cutting patterns, so that the designs have both cultural continuity and contemporary applicability.

3. By combining data obtained during the practical process, a hybrid research approach is adopted, integrating qualitative data such as interviews and questionnaires

with quantitative experimental analysis to ensure that the final results are both culturally and modernly relevant.

1.9 Terminology Definition

Intangible cultural heritage: In this paper, the status and value of Dai paper-cutting art as an intangible cultural heritage are specifically referred to.

Dai paper-cutting is a traditional paper-cutting art of Dehong Dai and Jingpo Autonomous Prefecture in Yunnan Province. This craft uses paper as the base material and relies on tools such as scissors or small carving knives to create patterns with distinctive Dai ethnic cultural characteristics.

Semiotic Analysis: A Study of Dai Paper-cutting Patterns Based on Semiotic Theory. This study analyses the specific forms and characteristics of Dai paper-cutting patterns from the perspective of Nengzhi, and explores the cultural connotation, cultural characteristics and aesthetic value of Dai paper-cutting patterns from the perspective of Nengzhi, and analyses its influencing factors and research value.

Innovative design: This includes combining Dai paper-cutting patterns with modern design concepts, so as to improve and innovate Dai paper-cutting patterns, while retaining the core essence of traditional art.

Chapter 2

Literature Review

This chapter mainly reviews the relevant literature in a comprehensive way, laying a solid theoretical foundation for the study of the innovative design of Dai paper-cutting patterns from the perspective of intangible cultural heritage. First of all, this chapter outlines the cultural and historical background, geographical distribution and overall status of paper cutting of the Dai nationality, and focusses on the Mangshi area of Dehongzhou, and explains its historical origin, technical characteristics and pattern elements.This paper analyzes relevant policies and research trends in the protection of intangible cultural heritage, and elaborates on the urgency and contemporary significance of such protection. Based on this, it introduces theories from semiotics, pattern studies, and shape grammar to construct a theoretical framework for the analysis and innovation of Dai paper-cutting patterns. Finally, through the analysis of relevant pattern design cases both domestically and internationally, it summarizes the experiences and shortcomings in existing practices, providing practical references for the innovative path of this research.

2.1 Overview of the Dai ethnic group

Yunnan has been a multi-ethnic region since ancient times. Records from the Qin and Han dynasties show that it has always been a crossroads of diverse cultures. Due to historical and political reasons and the division of national territory, Yunnan has become a symbiotic zone where many ethnic minorities in China coexist with those in Southeast Asia and South Asia. Yunnan's unique geographical environment and historical background make it a meeting point of various ethnic cultures, thus forming a vibrant and diverse national cultural landscape (Yang et al., 2022).

As one of the ethnic minorities in Yunnan Province, the Dai nationality is not only large in population, but also famous for its unique culture and influence. The Dai culture has a long history and profound cultural heritage. From language, clothing, or architecture to religious beliefs and customs, the Dai nationality has shown distinctive national cultural characteristics in all aspects. Among them, the Water Sprinkling Festival, which is the New Year of the Dai people, has been included in the national intangible cultural heritage list, which also reflects the integrity of their national cultural system (Li et al., 2020). These Dai cultural characteristics have become an important part of Yunnan's multiculturalism. In addition, Dai culture also plays the

role of a bridge connecting other cultures, and Dai culture has consolidated its status as an indispensable and precious intangible cultural heritage in Yunnan.

2.1.1 Distribution of the Dai ethnic group

According to authoritative statistics from the "China Statistical Yearbook-2021," the Dai population in China has reached 1.3299 million, a figure that fully demonstrates the important position of the Dai people as a member of the Chinese nation. Among them, Dehong Prefecture and Xishuangbanna Prefecture have Dai populations of 359,800 and 333,900 respectively (Tao & Zhou, 2024). The Dai population in other autonomous counties is mostly around 50,000. Overall, the Dai population is characterized by a relatively large concentration in the two autonomous prefectures, while in other areas it exhibits a pattern of widespread distribution with small clusters. The Dai people have thrived and multiplied across this vast land of China, developing their own unique and rich ethnic culture, and becoming a significant and long-standing ethnic group in southwestern my country. The Dai people in China are mainly concentrated in the southwestern part of Yunnan Province, where they live in an arc-shaped area adjacent to the border. The Dai people mainly live in Xishuangbanna Dai Autonomous Prefecture and Dehong Dai and Jingpo Autonomous Prefecture, as well as several autonomous counties such as Gengma, Shuangjiang, Yuanjiang, Menglian, Jinggu, and Xinping, which are areas with relatively dense Dai populations. Through the implementation of the system of regional ethnic autonomy, these autonomous regions have not only preserved and developed Dai culture, but also actively promoted exchanges and integration among various ethnic groups (Li & Zhang, 2008). In addition, a small number of Dai people are also distributed in Simao, Tengchong, Cangyuan, Jiangcheng, Lancang, Hekou, Ximeng and other counties.

2.1.2 The Development History of the Dai People

In China, the Dai people are an ethnic group with a long history spanning thousands of years. Throughout different historical periods, the Dai people have been given various names. These names not only reflect the social and cultural background of the Dai people in different periods, but also demonstrate the cultural heritage and national identity of the Dai people at different stages. For example, in the "Records of the Grand Historian: Biographies of Dawan", the Dai people are referred to as "Dianyue", a name that reflects the Dai people's residence and activities in the ancient Dianchi Lake area. In the "Biography of the Southwestern Barbarians" in the Book of the Later Han Dynasty, the Dai people are referred to as "Shan," a name that may be related to their geographical location and political status during the Han Dynasty (Wang & Zhu, 2010). During the Tang Dynasty, Fan Chuo's book "Man Shu" (also known as "Yunnan Zhi") provided a more detailed record of the Dai people, who were referred to as "Mang Man", "Hei Chi Man", "Jin Chi Man", "Yin Chi Man", "Xiu Jiao

Man", "Xiu Mian Man", etc. These names are mainly based on the Dai people's living areas and clothing characteristics. “Mangman” means “people who live on the dam”, which reflects the characteristic of the Dai people as a dam-dwelling ethnic group, who usually live in plains formed by river alluvium. The terms "golden teeth barbarians" and "silver teeth barbarians" are related to the Dai people's custom of decorating their teeth with gold and silver. This unique style of decoration was considered a symbol of beauty at the time, as well as an important marker of adulthood and social status (He, 2006). During the Song Dynasty, the Dai people acquired new names, such as "white-clad," "golden-toothed," and "black-toothed". The emergence of these names may be related to the clothing habits and cultural characteristics of the Dai people. In the "Yunnan Zhilue" written by Li Jing in the Yuan Dynasty, the Dai people were generally referred to as "Baiyi" or "Baiyi". In the Ming Dynasty book "Baiyi Zhuan" written by Qian Guxun and Li Sicong, the Dai people were still referred to as "Baiyi". These changes in terminology reflect the deepening understanding of the ethnic groups in the southwestern frontier by the central government during the Yuan and Ming dynasties. The term "Baiyi" (百夷) even became a general term for the ancestors of the Dai people, reflecting the degree of political integration in Dai society at that time (Zheng, 2005). In the Qing Dynasty book "Dianhai Yuzheng Zhi" by Tan Cui, the Dai people were referred to as "Baiyi". These ancient books record simplified names for the Dai people, but they are all based on the Dai ancestors' customs of decorating, dyeing, and tattooing their teeth. These customs hold an important place and significance in Dai culture.

The name of the Dai nationality not only reflects its unique traditional cultural characteristics, but also reveals its historical migration route and distribution scope. For example, "Mang man" usually refers to the Dai people in southern Yunnan, and "Jin Chiman" may also be related to the custom of inlaying golden teeth. These changes in names not only reflect the interaction and integration of the Dai nationality, but also reflect the changes in the political, economic and cultural status of the Dai nationality at different historical stages. Throughout the ancient and modern history, while inheriting their own cultural traditions, the Dai nationality has also absorbed the essence of other ethnic cultures and formed a rich and diverse national culture. The evolution of these names can also better show the diversity and historical depth of the traditional Dai culture. By studying historical literature, we can have a more comprehensive understanding of the historical process and social and cultural background of the Dai nationality.

2.1.3 Classification of the Dai ethnic group

The Dai people, an ethnic group with a long history and unique culture, are considered descendants of the ancient Yue people and are collectively known as "Dai".

In the long course of history, the ancient Yue people later split into multiple tribes due to different regions and the dispersion of political rule. Although these tribes identify with a common ancestor, they each have different tribal names. This phenomenon continues to this day, resulting in different names for the Dai people in different regions. The Dai people in different regions have different self-designations. In Dehong Dai and Jingpo Autonomous Prefecture, Baoshan, Tengchong and other places, the Dai people refer to themselves as "Dai Na". In Xishuangbanna Dai Autonomous Prefecture, Menglian, Jinggu, Jiangcheng and other places, the Dai people call themselves "Dai Le". In Xinping, Yuanjiang and other areas of Yuxi City, the Dai people call themselves "Dai Beng".

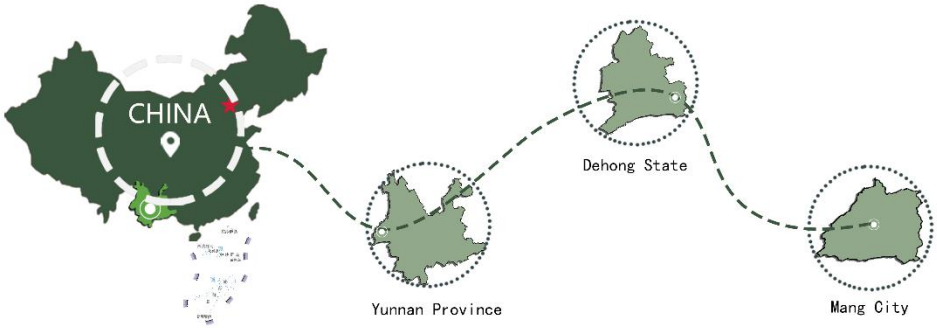
These names are all transliterations based on the pronunciation in the local language. Each branch has its own unique style and characteristics, and we can easily identify and distinguish the Dai names from different regions through their traditional clothing.

2.2 Basic Situation of the Dai Ethnic Group in Mangshi, Dehong Prefecture

Dehong Dai and Jingpo Autonomous Prefecture is located in western Yunnan Province, China, bordering Myanmar. It is a region where many ethnic groups live together. The prefecture consists of five county-level administrative regions: Mangshi (formerly known as Luxi City, renamed in 2012), Ruili City, Lianghe County, Yingjiang County, and Longchuan County. Dehong Prefecture is located in the southern section of the Hengduan Mountains, with a terrain that is high in the north and low in the south. Major rivers such as the Ruili River and the Daying River flow through the prefecture, forming a unique river valley basin landform, which provides excellent natural conditions for the traditional rice farming of the Dai people. According to the 2020 Seventh National Population Census, the permanent resident population of Dehong Prefecture has increased to 1.315 million. The main ethnic groups in Dehongzhou are Dai, Jingpo, Han and Deang. Among them, the Dai nationality has the largest population, reaching 359,800, making Dehong one of the most populous areas of the Dai nationality in the country.

There are many Dai villages scattered in Mang City, Dehong Prefecture, and most Dai people believe in Theravada Buddhism. Therefore, each village has Buddhist temples of different sizes. These Buddhist temples are not only places for religious activities, but also important centres for inheriting Dai culture. In the village, Buddha statues are placed in the living rooms of almost every household, which reflects the important position of Buddhism in the life of the Dai people. For the Dai people, Buddhism is not only a religious belief, but also deeply affects their daily life and behaviour, and its doctrines permeate their culture, education and customs. In the Dai community, Buddhist temples are like schools, teaching believers to stay away from sin, encouraging them to do good deeds and accumulate virtues, and inherit positive cultural values and concepts.

Figure 2



Dehong Mangshi geographical location

Note: Drawn by the author

2.2.1 Overview and Historical Origins of Dai Paper-cutting Art in Mangshi

There are several different theories about the origin of Dai paper-cutting art in Dehongmang City. One is said that this unique art form comes from the notes used in ancient primitive religious ceremonies. Another theory is that it first appeared in Dai funerals and sacrificial ceremonies, and was used to make paper carvings of figures and horses. It is worth emphasising that both theories of origin point to the original religious beliefs held by the Dai people before Buddhism was introduced, including two aspects of nature worship and ancestor worship (Suo, 2014). According to historical records, the ancient Dai people usually used colorful animal figures to carry the coffin during funerals, and they would also decorate the coffin with paper-cuts, making the whole ceremony very solemn and dignified.

After Theravada Buddhism was introduced to the Dai region, paper-cutting in Mangshi gradually developed and matured, and was widely used in various fields such as religion, funerals, and decoration. This process was gradually enriched and developed under the long-term influence of Buddhist culture and Central Plains culture, a view shared by many Dai cultural experts. The Dai people's palm-leaf scriptures and some ancient narrative poems that have been passed down for thousands of years also mention the practice of using cut-out patterns from leaves to offer to the Buddha. Today, the Dai people of Mangshi still retain the custom of making Buddhist umbrellas by cutting patterns from cloth to offer to Buddha, which further proves that Mangshi Dai paper-cutting is an ancient and unique handicraft art.

From a craftsmanship perspective, Mangshi Dai paper-cutting has developed a unique artistic language. Scissors and carving knives are the main tools of paper cutting. The techniques combine cutting, cutting, carving, chiselling and other methods. The pattern lines are smooth and natural, and the composition pattern is symmetrical, showing the unique aesthetic concept of the Dai nationality (Wang, 2008). Historical records also document the use of Dai paper-cutting in Buddhist temples and pagodas. In 1767, during the 32nd year of the Qianlong Emperor's reign, Zhou Yu accompanied the army on a campaign in Burma. When he passed through Mangshi, he observed that "Buddhism was highly valued, and wherever there was a large village or the residence of a chieftain, there was a Buddhist temple with white paper banners hanging above it." This indicates that the application of Mangshi Dai paper-cutting to Buddhist sites has a very long history.

Since ancient times, Mangshi Dai paper-cutting has existed for its practical function, and its forms of expression are inseparable from religious activities. It is not only an art form with aesthetic function, but also a series of objects with clear uses. The development of Mangshi Dai paper-cutting is parallel to the development of Dai history and culture. The content of Dai paper-cutting in Mangshi is rich and varied, and is mostly related to Theravada Buddhism, the Dai people's faith, as well as their production and daily life. The theme of paper cutting mainly covers Buddhist classics, folk customs, folklore and border scenery, showing distinctive characteristics, rich life atmosphere and unique national customs. This local paper-cutting art is deeply loved by local people, passed down from generation to generation, deeply rooted in people's hearts, and widely popular. It is also a local original art form, deeply rooted in the local collective consciousness.

2.2.2 A Review of the Dai Paper-cutting Techniques in Mangshi

The materials and tools used in Dai paper cutting are unique, fully demonstrating the diversity and adaptability of their processes. In terms of materials, in addition to the common red, yellow, green and other coloured papers, cloth and metal sheets, such as aluminum sheets, copper sheets, etc., are also often used. The choice of these materials reflects the simple materialistic belief of the Dai people in "everything has a spirit", and conveys rich cultural symbolism through different materials (Nie, 2002). Metal materials are mainly used in Buddhist temple architectural decoration, Buddha umbrellas, Buddha flags and other religious supplies. For example, the metal carving pattern in the room of Mangshi is a classic case of transforming paper-cut patterns into metal reliefs.

These tools mainly include scissors and carving knives. The distinctive characteristics of the blades are "sharp, sharp, narrow and thin", which is convenient for precise cutting and carving. Research shows that the research and development of this special tool is the product of the interaction between the long-term practical experience of Dai craftsmen and the characteristics of materials (Wang, 2011).

Ordinary paper cutting requires the assistance of a paper cutting knife and handy gadgets; while metal paper cutting requires special tools, such as chisels of different shapes (flat and round), mallets, nails and cutting mats to create complex patterns on the metal surface through cutting, carving, chisel and cutting techniques.

Figure 3

Tools of a Paper-cutting Inheritor 1

Note: Photo taken by the author.

Figure 4

Tools of paper-cutting inheritors 2

Note: Photo taken by the author.

The production techniques of Dai paper cutting are mainly divided into two categories: "cutting" and "engraving". There is no need for a draft. It completely relies on the improvisation of paper-cutting artists. The paper is directly cut out of a symmetrical pattern after a single folding or multiple folding. This method reflects the oral tradition of Dai paper-cutting art. "Engraving" needs to draw or copy patterns in advance, and then use carving tools to carve or chisell on paper according to the

designed patterns. The method of "chiselling" is especially suitable for the mass production of metal materials or complex designs, reflecting the trend of process standardisation (Zhou & Xiao, 2013).

Take the symmetrical pattern as an example, the production process can be divided into the following steps:

1. First, prepare the materials for paper cutting: use a paper cutter to cut the coloured paper or card paper into the required size, and then fold it in half along the back to make the two layers of paper overlap back to back.

2. Draw a pattern: use a pencil to outline one side of the pattern on the folding surface (skilled people can cut it directly along the pattern).

3. Finally, it is cropping: cut off the excess parts along the edge of the pattern, and then unfold the paper cutting to get a symmetrical pattern. If it is a metal material, transfer the pattern to the production board, then fix it on the wooden board, and chisell it with a chisel and a mallet.

The technical skills of paper cutting have expanded from paper to metal, which not only retains the traditional pattern aesthetics of Dai paper cutting patterns, but also gives paper cutting more practical and ceremonial functions, better demonstrating the profound integration of skills and beliefs.

Figure 5

Paper-cutting made by inheritors

Note: Photo taken by the author.

2.2.3 Stylistic Characteristics of Dai Paper-cutting

As an ancient and unique traditional folk art form, paper cutting takes paper as the main material and skilfully uses lines and planes as basic design elements. The uniqueness of this art form lies in its two-dimensional uniqueness; artists must construct visual images in a limited two-dimensional space by manipulating the relationship between entities and void (Lv, 2009). In the process of paper cutting, artists employ basic symbolic linguistic elements such as dots, lines, and planes to express their creativity and emotions.Due to the special nature of paper-cutting materials, its expressive techniques are somewhat limited, for example, it cannot fully

demonstrate the volume of objects and the complex layers of the image. Therefore, in terms of composition, paper-cutting artists usually adopt a level perspective composition, using precise depiction of outlines and organic combination of blocks to highlight the unique charm of paper-cutting art by maximizing its strengths and minimizing its weaknesses.

In the life of the Dai nationality, the art of paper cutting has been uniquely inherited and developed. Studies have shown that the composition principle of Dai paper cutting is deeply influenced by the southern Buddhist view of the universe. Therefore, paper cutting often uses techniques such as central symmetry and centribal radial arrangement to express this worldview (Wu et al., 2013). Dai paper-cutting artists can freely express themselves and create works of art with strong national customs with rich paper-cutting experience and creative inspiration, not bound by traditional forms of expression, space and perspective techniques. It is because of the bold innovative spirit and pure pursuit of art of Dai paper-cutting artists that the pure essence of Dai paper-cutting art can be fully demonstrated.

Dai paper cutting usually uses monochrome paper, so it belongs to monochrome paper cutting. This paper-cutting style is clear and elegant, highlighting the essence of aesthetics and techniques such as images, composition and knife methods. Because the composition ideas of Dai folk paper cutting are not limited to real life scenes and existing themes, multiple images can be skilfully combined together to make them harmonious and symmetrical, forming a unique visual effect of Dai paper cutting.

In terms of paper-cutting techniques, Dai paper-cutting mainly adopts a combination of yin and yang cutting. The shearing method of positive shearing retains the shape and removes the outer part of the shape at the same time. The lines of the sun clipper are thick and simple, which makes a deep impression on people. The cutting rule of the shadow shear is to cut out the shape first, and then use the cut blank lines to show the cut patterns and designs (Wang & Li, 2013). Paper cutting uses the abstract to highlight the concrete, creating a strong contrast. This type of paper cutting is dynamic and rich in effect, while retaining a rustic charm and maintaining a good sense of layering.

The alternation of negative and positive cutting enriches the language of paper cutting, enabling it to better express the relationship between the real and the virtual and the content of the pattern. Through paper-cutting techniques such as positive cutting, negative cutting, or a combination of both, Dai paper-cutting artists are always able to skillfully organize the different parts of the object they want to represent, creating a harmonious and complete beautiful picture through appropriate coordination.

Figure 6

The expressive methods of paper cutting (positive cutting, negative cutting, and yin-yang cutting

Note: Photo taken by the author.

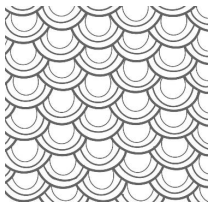
2.2.3.1 Basic Patterns of Dai Paper-cutting

Table 1

Basic Pattern Table for Dai Paper Cutting

Pattern Name	Pattern Form	Pattern Interpretation	Presentation method	Representative pattern
Serrated pattern		A zigzag pattern is a stripe pattern that mimics the shape of a sawtooth. It is characterized by a series of sharp triangles or small rectangles arranged to create an uneven edge effect.	In paper-cutting art, serrated patterns can be used to fill in patterns, such as within the outline of a peacock feather that has already been cut out, to simulate and present the natural texture of the feather.	

Branch and leaf pattern		Branch and leaf patterns mainly refer to paper-cut patterns that imitate the shapes of branches, leaves, flowers, etc. of various plants in nature.	Leaf and branch patterns can showcase the characteristics of various plants and flowers.	
crescent moon pattern		The crescent moon pattern is a design that imitates the shape of the moon. It usually appears as curved lines, and its shape is similar to a part of a new moon or a full moon.	The crescent moon pattern in Dai paper-cutting is usually created using the openwork technique of paper-cutting. This technique includes both positive and negative carving.	
cloud pattern		Cloud patterns are decorative designs that mimic the shape of clouds. They are usually composed of continuous curves and wavy lines, and come in various forms,	In paper-cutting works, cloud patterns can be used as background designs to complement the foreground elements and add depth to the artwork.	

		some simple and some complex.		
Fish scale pattern		Fish scale pattern is a decorative pattern that imitates the shape of fish scales. This pattern is usually composed of a series of closely arranged small triangles, rhombuses or other geometric shapes, mimicking the layered effect of fish scales.	Fish scale patterns typically appear in paper-cutting works in a continuous and regular arrangement, imitating the natural arrangement of fish scales to create an orderly aesthetic.	
Geometric patterns		Geometric patterns are decorative designs based on geometric shapes, including but not limited to triangles, squares, circles, rhombuses, and hexagons. These patterns are simple and regular.	Geometric patterns are widely used in Dai paper-cutting art. These patterns, with their unique geometric shapes and designs, showcase aesthetic characteristics .	

Note: Drawn by the author

2.2.3.2 Classification Characteristics of Patterns and Themes in Dai Paper-cutting

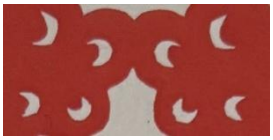
The Dai people are a people who revere nature and hold it in deep respect. Given that their living environment is filled with trees and flowers, the depiction of plants naturally occupies an important place in Dai paper-cutting art. Furthermore, the themes of paper-cutting patterns are extremely rich, mainly derived from nature and human social life. In Mangshi area, Dai paper-cutting art enjoys a broad popular base and a long historical tradition. Deeply influenced by Theravada Buddhism, the themes of Dai paper-cutting often carry a strong religious character. These paper-cutting works can generally be divided into the following categories: animal patterns, plant patterns, natural patterns, geometric patterns, human figures patterns, and architectural patterns.

Table 2

Classification Table of Dai Ethnic Paper-cutting Patterns

PATTERN CLASSIFICATION	COMMON PATTERN TYPES	MAIN PATTERN	SAMPLE PATTERN	PRESENTATION METHOD	SYMBOLIC MEANING
ANIMALS	Real-world animals include elephants, peacocks, water buffalo, tigers, butterflies, horses, and fish. Mythical beasts include the qilin, dragon, and	Elephant Peacock	 	Peacocks are typically depicted with flowing lines to represent their elegant posture, and their tails are often presented symmetrically when they spread their tail feathers, showcasing the symmetrical beauty of paper-cutting art. Elephants in paper-cutting often appear with simplified outlines,	In Dai culture, the peacock is considered a symbol of beauty and good fortune. The elephant, on the other hand, symbolizes strength and wisdom and is a sacred animal in the hearts of the Dai people.

	phoenix.			emphasizing their stability and strength.	
PLANTS	Bodhi tree and floral patterns are common and highly representative. In addition, there are patterns of banyan trees, dendrobium flowers, camellias, bamboo, peonies, banana trees, as well as fruit patterns such as pomegranates and grapes.	Bodhi Tree Flowers	  	In paper-cutting, the Bodhi tree is typically depicted as a lush, leafy figure, using intricate lines and shapes to express its vibrant life. Flowers in paper-cutting are often presented in simplified or abstract shapes, emphasizing the outline and characteristics of the blossom, such as the number and shape of the petals. The lines are usually fluid and elegant, used to express the softness and naturalness of the flowers.	The lush growth of the Bodhi tree also symbolizes the strength of life and the continuous process of regeneration. In Dai paper-cutting, flowers typically represent beauty and happiness, expressing wishes for a good life. Different flowers may also have specific meanings; for example, the peony represents prosperity, and the lotus represents purity and beauty.

NATURAL CATEGORY	Cloud patterns, swirling patterns, crescent patterns, flame patterns, etc.	Cloud pattern Crescent pattern	 	Cloud patterns are characterized by curling, flowing lines, with a free and graceful form. Crescent moon patterns come in various forms, such as full moon and crescent moon, and their lines are relatively soft.	Cloud patterns symbolize auspiciousness and natural harmony; crescent patterns exude gentleness and tranquility, containing feminine energy.
GEOMETRY	Patterns include floral patterns, vine patterns, rhombus patterns, wave patterns, and meander patterns.	Floral pattern Vine pattern	 	Floral patterns are often based on simplified versions of natural flower shapes, extracting their essential characteristics. These simplified flower shapes are arranged in a repetitive yet orderly manner, creating a continuous pattern effect. Vine-like patterns often employ meandering lines to mimic the natural form of vines.	Floral patterns, as symbols of flowers, typically represent prosperity, beauty, and vitality. Vine-like patterns also represent perseverance and enduring qualities, symbolizing people's persistence and relentless pursuit of life.

CHARACTERS	The figures and patterns are mainly divided into two categories: one is the image of Buddha, and the other is the depiction of hardworking Dai people.	Buddhist statues; folk figures		Buddhist images are typically depicted as solemn and sacred figures in paper-cutting.	It represents the Buddhist faith and devotion of the Dai people to Buddha.
				Custom-themed paper-cuttings usually depict scenes of daily life for the Dai people, such as work and festival celebrations.	The folk portraits are extremely flexible in their expression and have a wider range of themes, mainly showcasing the Dai people's love for life.
ARCHITECTURE	Most of them are Buddhist buildings, such as pagodas and temples.	stupa		The paper-cut patterns of pagodas usually use simple outlines to represent their basic shape, which delineate the multi-layered structure and conical appearance of the pagoda.	In Dai paper-cutting, pagodas are a symbol of Buddhist faith, representing respect for Buddhist doctrines and unwavering faith.

Note: Drawn by the author

2.2.3.3 The Symbolic Structure of Dai Paper-cutting

The Dai paper-cutting in Mang City is mainly famous for its rich and diverse patterns and compositions. Scissors are indispensable tools in the creative process of paper cutting; Dai inheritors skilfully use scissors to cut, cut, chisell, twist and rotate

the folded paper, thus creating unpredictable patterns. After unfolding, the pattern on the paper presents an unexpected and exquisite effect. The composition of Dai paper cutting is diverse, mainly divided into symmetrical, centripetal, continuous and "S" forms. Each form has a unique structure, reflecting the profound cultural heritage and exquisite craftsmanship of the Dai people.1: Symmetrical structure

1,Among the representative patterns of Dai paper cutting, symmetrical patterns are a composition method based on horizontal or vertical axes. Its prominent feature is that the patterns on both sides of the axis show a complete or almost corresponding relationship, thus forming a stable and harmonious sense of order. The overall composition is based on the central axis, and the patterns in the left and right directions or the upper and lower directions echo each other like a mirror image, which not only emphasises the regularity of the structure, but also gives the picture a sense of solemn harmony.

Figure 7

Symmetrical structural composition

Note: Photo taken by the author.

2: Centripetal structure

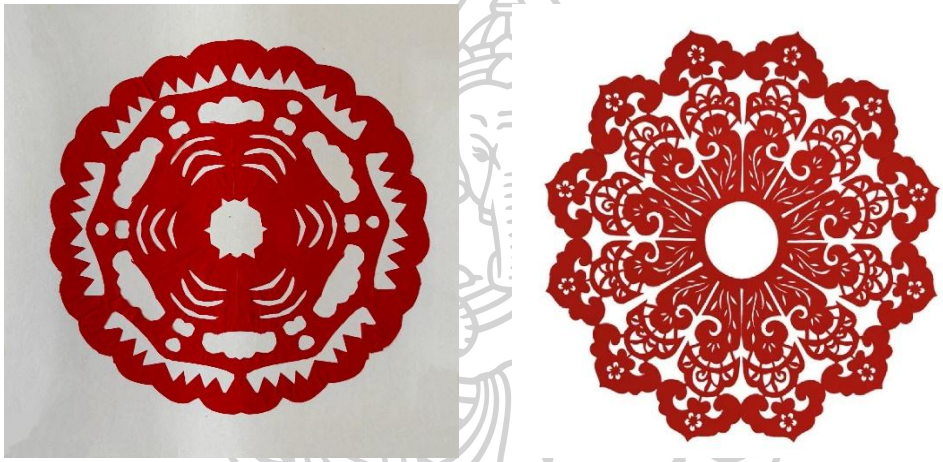
The so-called centripetal pattern structural form refers to a structural layout of Dai paper cutting. Its core pattern is located in the visual centre, and the auxiliary elements surround the core pattern, forming an adsorption state, just like the stars surrounding the moon. The overall structure shows the visual effect of the core pattern radiating energy outward, while the surrounding pattern converges to the centre in a dynamic form. This layout structure not only strengthens the correlation between the surrounding auxiliary elements and the core pattern, but also effectively defines the sense of picture space through the surrounding elements, thus building a visual feeling with clear main and secondary elements and clear inner and outer boundaries.

Dai paper-cutting patterns generally adopt the centripetal structure pattern technique, and the outer contour of the pattern is subject to pre-set shape constraints. When innovating patterns, its outline is limited by the specific shape. However, when

the constraint shape is erased or removed, the pattern still retains its original outer contour features. This technique can skilfully integrate geometric shapes, natural elements and animal and plant symbols into the creative design to create patterns that are both decorative and symbolic. Its main elements are circular patterns composed of various plants, animals and other elements. Based on circles or near-circles, it skillfully combines natural elements such as lines, flowers, and vines through exquisite paper-cutting techniques to form richly layered and compact patterns.

Figure 8

Centripetal structural composition, also known as floral pattern composition.



Note: Photo taken by the author.

3: Continuous structure

Continuous patterns are a widely used form of decorative art that uses one or more specific decorative elements to create a basic pattern. These basic patterns, through careful repetition and combination, create an infinitely looping, continuous pattern effect. Based on their different compositional forms, continuous patterns can be further subdivided into two main types: two-dimensional continuous and four-dimensional continuous.

(1) Two-dimensional continuous pattern: mainly based on some independent graphic elements, which are repeated along the vertical or horizontal direction to form a strip-shaped, continuous pattern. The organizational forms of this type of pattern are extremely diverse. In Dai paper-cutting art, two-dimensional continuous patterns mainly use flowers and geometric shapes as design elements. Their organizational structure usually adopts horizontal or vertical border patterns, which makes the paper-cutting works present a unique sense of rhythm and cadence.

(2) Four-square continuous pattern: Compared with paper cutting, this pattern is more often used in the design of Dai brocade patterns. The four-square continuous pattern has been fully displayed and applied in brocade weaving. The continuous

four-square pattern on the brocade not only greatly enriches the visual effect, but also endows the fabric with a unique artistic charm and cultural connotation.

Figure 9

Continuous structural compositions include two-dimensional continuous patterns and four-dimensional continuous patterns.

Note: Photo taken by the author.

4: "S" rhythmic structure

The "S" rhythmic structure pattern is a compositional form in Dai paper-cutting with smooth curves as its framework. The "S" shaped wave pattern is a typical structure, which constructs a visual sequence with rhythm and cadence through continuous swirling lines. In Dai paper-cutting patterns, rhythmic structures often use natural elements with graceful curves, such as vines and water ripples, as carriers. Through the extension, overlapping and connection of the "S"-shaped skeleton, a continuous and undulating dynamic momentum is formed.

Figure 10

"S" rhythmic structural composition

Note: Photo taken by the author.

2.3 Overview of Policies Related to Intangible Cultural Heritage

The concept of intangible cultural heritage can be traced back to Japan. In 1950, Japan officially promulgated the Law for the Protection of Cultural Properties, a landmark act as the world's first legal document to explicitly include the protection of intangible cultural heritage at the national policy level. The rules and methods not only cover the protection of tangible cultural heritage, but also emphasise the importance of intangible cultural heritage protection. For this reason, the "Human National Treasure Identification System" has also been established to protect "important intangible cultural property holders". The system stipulates in detail the authority, procedures and processes of the identification of intangible cultural property, and the definition of intangible cultural property is basically consistent with the current understanding of "intangible cultural heritage" (Liebs, 1998). Japan's concept of intangible cultural heritage has had a profound impact on the international community. In the 1970s, UNESCO began to pay attention to the protection of intangible cultural heritage, and in 2003, it adopted the Convention on the Protection of Intangible Cultural Heritage, which formally established the internationally recognised concept of "intangible cultural heritage" (Heritage & Rii, 2020).

China's intangible cultural heritage is an important part of China's excellent traditional culture. It reflects the traditional cultural expressions passed down from generation to generation by all ethnic groups in China, as well as the items and places related to these manifestations. These intangible cultural heritages not only have rich historical and cultural values, but also play an important role in maintaining national feelings and national unity. Since China joined the Convention for the Protection of Intangible Cultural Heritage in 2004, it has gradually established and improved the intangible cultural heritage protection system, mainly forming a national, provincial, municipal and county-level protection mechanism (Wang, 2007). As of 2023, 43 intangible cultural heritages in China have been included in the UNESCO Representative List of Intangible Cultural Heritage of Humanity, ranking at the forefront of the world.

According to the definition of intangible heritage, intangible cultural heritage covers various social practises, ideas, expressions, knowledge, skills and related tools, items, artefacts and cultural spaces. These heritages are passed down from generation to generation, constantly created and inherited, providing a sense of identity and continuity for communities and groups, thus enhancing respect for cultural diversity and human creativity. The scope of China's intangible cultural heritage generally includes oral traditions and expressions, performing arts, social customs, rituals, festivals, knowledge and practises related to nature and the universe, and traditional handicraft customs.

2.3.1 The Necessity of Intangible Cultural Heritage Protection

Under the background of today's accelerated globalisation, the protection of intangible cultural heritage is of special significance to cultural inheritance and innovation. According to the spirit of the UNESCO Convention for the Protection of Intangible Cultural Heritage, the protection of intangible cultural heritage should not only protect the expression of traditional culture, but also promote its inheritance and development in contemporary society (Aikawa, 2004). Folk stories, handicrafts, ethnic music, ethnic dances and artistic performances are all intangible cultural heritages and precious spiritual and cultural treasures of the Chinese nation. These heritages not only reflect national cohesion and cultural identity, but also reflect the wisdom of the working people. They are also an important part of China's cultural heritage and provide a source of inspiration for inheritance craftsmen. China's long history has given birth to abundant and abundant intangible cultural heritage, which lays the foundation for a culturally powerful country and symbolises national confidence. Therefore, it is very important to protect, inherit and spread these heritages. According to statistics, China currently has 1,557 national representative intangible cultural heritages, including ten categories such as folk literature, traditional music, dance, drama, fine arts and medicine. These intangible cultural heritages together constitute the gene bank of Chinese culture.In particular, intangible cultural heritage items of ethnic minorities, such as Dai paper-cutting and Miao silver jewelry forging techniques, not only reflect the cultural characteristics of specific ethnic groups, but also serve as important evidence of the diverse yet unified pattern of the Chinese nation (Wang, 2007). These intangible cultural heritages exist in various forms in daily life. They are not only the continuation of history, but also the bridge to the future, reflecting the fine traditions and historical achievements of the Chinese nation. Protecting and inheriting intangible cultural heritage is conducive to maintaining cultural diversity, then enhancing national identity and promoting harmonious social development. Finally, it is also of far-reaching significance to maintaining national unity and the creation and utilisation of cultural resources.

2.4 Research Basis

This research mainly uses semiotics, pattern theory, schema theory and shape grammar theory to construct its methodological framework. Semiotics is to analyse the pattern symbol system and meaning expression of Dai paper cutting, and provide a philosophical basis; the pattern theory focusses on interpreting the rules of pattern composition; the shape grammar theory reveals and deduces the generation logic and style characteristics of paper-cut shapes through rule generation rules and derived rules.The above-mentioned aspects complement each other in terms of meaning, form, and structure, providing multi-dimensional support for in-depth research on the artistic characteristics and cultural connotations of Dai paper-cutting.

2.4.1 Overview of Semiotic Theory

Semiotics has expanded its scope to various fields, from culture and art to society. It emphasizes the study of the theory of signs, the analysis of the relationship between signs and their signifiers, the evolution of signs, and the interaction between signs and humans and the world. Semiotics originated in ancient Greece and has a long history. It explores the meaning of symbols and the entire symbol system. Through the theoretical system of semiotics, people can think and create better, study form, internal structure and method, and endow symbols with meaning through semantic value. Western works generally define semiotics as: the study of signs. Zhao Yiheng, in ‘Semiotics: Principles and Deductions’, defines it as: a sign is a perception that is believed to carry meaning. Furthermore, it is argued that meaning must be expressed through symbols, and symbols, as carriers of meaning, are regarded as a form of perception capable of conveying information. The expression of meaning is inseparable from the use of symbols; symbols are precisely the tools used to express meaning. In other words, without symbols, meaning cannot be expressed; similarly, there are no symbols that do not carry meaning. Symbols and meanings are inextricably linked; they are interdependent and together form the cornerstone of human communication and understanding (Wang, 2010).

Symbols, as tools for information transmission and meaning expression, have a wide-ranging influence on human culture and communication. Key theories in semiotics include Saussure's theory of linguistic signs, Peirce's theory of logical semiotics, Morris's semiotic theory, and Susan Langer's theory of art semiotics. In his ‘Course in General Linguistics’, Saussure pointed out that the rules followed by linguistics also apply to all kinds of symbolic activities, ranging from daily life such as eating, dressing, and etiquette to more complex cultural activities (Key & Noble, 2017). Saussure also proposed the concepts of a sign's "signifier" and "signified."The external form of a sign is its "signifier," and its internal meaning is its "signified." A complete sign needs to possess both a "signifier" and a "signified" simultaneously, which lays the foundation for analyzing the compositional mechanism of cultural signs (Krampen, 1987).皮 Ernst, on the other hand, believed that a sign consists of three elements: medium, referent, and interpretation(Zeman, 1977). 莫 Ries categorized signs into five types: locative signs, denotative signs, evaluative signs, prescriptive signs, and constitutive signs. He also divided semiotics into three branches: semantics, pragmatics, and syntactics(Posner, 1987).苏 Shan Langer studies the connotations of artistic symbols, arguing that they possess certain symbolic characteristics. Based on this, she conducts in-depth research on artistic symbols and

constructs a semiotic system based on art(Langer & Langer, 1953). In the creative process, artists transform their subjective feelings into artistic symbols in reality, and the symbols in the works created by the artists and the works themselves are a kind of artistic symbol.

2.4.1.1 A Study of Dai Paper-cutting Patterns from the Perspective of Semiotic Signifiers

Saussure defined language as a structured system, and he elucidated the arbitrary nature of signs, namely that the relationship between a sign and the object it represents is based on convention rather than natural laws. This perspective is crucial for understanding the core concepts of semiotics. It can be said that there is no inherent necessary connection between the form of a sign and the meaning it represents, but rather it is determined by social and cultural conventions. This concept holds particular importance in the design of Dai ethnic paper-cutting patterns. In semiotics, Saussure's semiotics theory emphasises the duality of symbols, and the relationship between the expression can and the meaning is relatively unified, which means that the two are interdependent and indispensable theories. When innovatively designing Dai paper-cutting patterns, this theoretical guidance closely combines visual elements with cultural connotations to create profound and powerful symbols. This procedure requires both the artist's creativity and the artist's keen perception of culture to ensure that the appearance of the symbol is consistent with the connotation it represents. In Saussure's semiotic theory, the concepts of "signifier" and "signified" were introduced to explain the composition and function of signs. These two concepts are contradictory yet unified and interdependent. The signifier is the physical representation of a symbol, the external form of a symbol that we can perceive and recognize. It can be an image, sound, text, etc. In the design of Dai paper-cutting patterns, the signifier can be a specific pattern or color.

2.4.1.2 A Study of Dai Paper-cutting Patterns from the Perspective of Semiotics

The signified is the concept, connotation, or meaning represented by a symbol; it is the true meaning behind the symbol. In design, the signified refers to the specific thing or concept represented by the symbol. For example, a symbol "x" can represent an error or failure, or it can represent the result of an action or decision. Dai paper-cutting patterns represent the aesthetic values, historical and cultural background of the Dai people. Research on the semiotic significance of Dai paper-cutting patterns can be conducted from the following two aspects:

(1)The cultural connotation of Dai paper-cutting patterns

Dai paper-cutting patterns reflect the history, culture, and values of the Dai people. Studying Dai paper-cutting patterns can help us better understand the history, culture, customs, aesthetic values, and beliefs of the Dai people.

(2) The aesthetic value of Dai paper-cutting patterns

Dai paper-cutting patterns have unique aesthetic value. Studying the aesthetic value of these types of patterns can help us better appreciate and understand their structure, symbolism, conciseness and mystery.

2.4.1.3 Thematic Classification and Symbolism of Dai Paper-cutting Patterns from a Semiotic Perspective

Dai paper-cut patterns are rooted in their unique geographical areas, natural ecology, religious beliefs and folk culture, and contain a wide range of themes and rich cultural connotations. In order to deeply explore the characteristics of these patterns, this article will apply Saussure's basic theory of semiotics. The external form of Dai paper-cutting patterns is its "can refer to", and its internal cultural meaning is its "referred to". This article will explain the four representative pattern types that have been previously identified.

1. Natural phenomenon category patterns: These pattern patterns are usually based on the dynamic elements of nature, which abstractly express the awe of the Dai people for the innate power of nature. These patterns usually depict streams, clouds and other natural landscape phenomena. They are not just a simple imitation of nature, but a deep understanding and internal embodiment of the symbolic meaning of nature.

Table 3

Table of patterns related to natural phenomena

 **cloud pattern**	 **swirling pattern**	 **crescent moon pattern**	 **Flame pattern**
Pattern symbolism	Cloud pattern: Auspicious celestial sign, symbolizing blessings from the heavens and harmony with nature; Whirlpool pattern: Cosmic cycle; Crescent moon pattern: Gentleness and feminine energy, metaphorically representing female wisdom; Flame pattern: Light, vitality, and warding off evil.		

Note: Drawn by the author.

2. Animal patterns: These patterns mainly reflect the Dai people's respect for sacred animals. Common animal patterns in paper cutting include elephants, peacocks and butterflies. The patterns of these animals greatly enrich the external artistic expression of the Dai paper-cut patterns, and also reflect the yearning and love of the Dai people for nature.

Table 4

Animal Pattern Theme Table

			
Elephant pattern	**Peacock pattern**	**Butterfly pattern**	**Horse stripes**
Pattern symbolism	Elephant pattern: strength and wisdom; peacock pattern: beauty and good fortune; butterfly pattern: free transformation and rebirth; horse pattern: success.		

Note: Drawn by the author.

3. Plant patterns: These patterns mainly come from the tropical plant vegetation in the Dai living areas. They take local common plants as the main symbolic pattern elements, emphasising the beauty of their natural growth rhythm. These plant patterns not only reflect the Dai people's love for plants, but also further enrich the artistic expression of Dai paper cutting.

Table 5

Table of Plant Pattern Themes

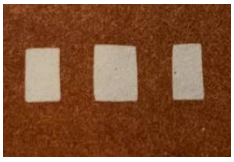
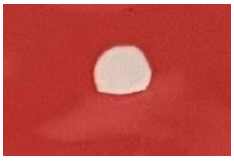
			
Bodhi leaf pattern	**Lotus pattern**	**Gardenia pattern**	**Rose pattern**
Pattern symbolism	Bodhi leaf pattern: wisdom and enlightenment; lotus pattern: purity and transcendence of reincarnation; gardenia pattern: holiness and dedication; rose pattern: evergreen and happiness.		

Note: Drawn by the author.

4. Geometric patterns basically use repetitive patterns and symmetrical patterns to enhance the sense of visual order. These patterns are composed of simple geometric figures, such as squares, circles, triangles and hearts.

Table 6

Geometric Pattern Theme Table

			
Square pattern	**triangle pattern**	**Circular pattern**	**Heart-shaped pattern**
Symbolic meaning of the patterns:	Square pattern: stable earth, peaceful home; Triangle pattern: stability and holiness; Circular pattern: Buddhist perfection; Heart pattern: love and unity.		

Note: Drawn by the author.

The Dai paper-cut pattern can not only reflect the Dai people's awe and aesthetic expression of nature, but also combine religious beliefs with daily life to build a unique Dai cultural connotation symbol system. When we study Dai paper-cutting patterns from the perspective of semiotics, it helps us to have a deeper understanding and appreciation of the unique religious beliefs, folk culture and aesthetic system of the Dai people, and also allows us to experience the rich national charm and intangible cultural heritage of the Dai people. Furthermore, Dai paper-cutting provides diverse sources of inspiration for modern design, thus fully promoting the integration and development of tradition and modernity.

2.4.1.4 Reasons for Selecting Patterns

The core logic for choosing these patterns is: adaptation to local culture + characteristics of paper-cutting art + balance of visual expression.Four of each were selected to ensure the representativeness and diversity of the pattern system, which can be explained from three dimensions: regional connection, artistic characteristics, and compositional function.

Table 7

Select Pattern Table

classification	Pattern	Regional connections	Artistic characteristics	Composition function
Natural category	cloud pattern	This corresponds to the local climate characteristics of being rainy and shrouded in mist.	With its smooth and rounded lines, it is an excellent medium for paper-cutting and hollowing-out techniques.	Infuse it with a gentle rhythm as the core expression of the "sky element".
	swirling pattern	The design is inspired by the flow patterns of local rivers.	Spiral curves possess inherent dynamic tension, with rich variations in the density of their lines.	It breaks the monotony of the image, creates a visual focal point, and adds a sense of depth.
	crescent moon pattern	It originates from the local natural landscape that can be seen every day.	Its form is simple and regular, and can be presented without complexity or simplification.	It serves both as an embellishment and a filler.
	Flame pattern	It aligns with our perception of warmth and vitality in life.	The lines are full of tension.	Enhance visual impact and balance rhythm.
Animals	Elephant pattern	It is a representative animal of the Dai ethnic region.	It has a regular outline, a thick and full shape, and is highly recognizable.	As the main pattern, it conveys a sense of stability and enhances regional recognition.
	Peacock pattern	These rare birds, unique to the Dai ethnic region, are iconic species of the local ecology.	The layered feather design complements the multi-layered openwork, creating a look that is both elegant and uncluttered.	The core decorative patterns enhance the artwork's artistic and regional distinctiveness.

	Butterfly pattern	Small creatures commonly found in tropical regions, they are found throughout villages and courtyards.	The wings are symmetrical, the lines are light and graceful, and the design is simple.	The auxiliary filling pattern fills in the gaps in the image and conveys a sense of dynamism.
	Horse stripes	It symbolizes the hardworking qualities of local life.	The body lines are smooth and flowing.	Enrich visual layers.
Plants	Bodhi leaf pattern	The native tree species widely planted in Dai villages are closely related to daily life.	The leaf shape is regular and easy to cut.	Scattered decorative elements adapt to the compositional needs of multi-point layouts.
	Lotus pattern	Widely distributed plants fostered by the aquatic environment of the Dai people	The petal-layered structure is suitable for layered hollowing techniques.	The core decorative pattern achieves a rich effect within its simplicity.
	Gardenia pattern	Native flowers commonly found in Dai courtyards and villages.	The petals are simple in shape, fitting the art of negative space.	The key decorative elements balance the visual center of the image.
	Rose pattern	Ornamental flowers widely cultivated locally are integrated into everyday scenes.	The petals are intricate yet the lines are smooth, allowing ample room for detailed depiction.	Enhance the decorative effect.
Geometry	Square pattern	It originates from the regular shapes and elements found in Dai architecture and artifacts.	The lines are sharp and regular, the shape is stable, and it is suitable for tailoring techniques.	As borders or partition frames, they establish a sense of order in the image.
	triangle pattern	The geometric shapes are taken from common local household items and architecture.	The sharp-angled, zigzag design creates visual tension.	Fill or connect patterns to balance soft shapes and enhance the sense of depth.

Circular pattern	It echoes the imagery of the sun and moon in the local nature and the circular shapes in objects.	The lines are smooth and without sharp edges, making it suitable for openwork designs.	The core decorative or transitional elements coordinate the rhythm of different patterns.
Heart-shaped pattern	It aligns with the local people's need for friendly and gentle expression.	Its shape is rounded and approachable, simple and unobtrusive.	It embellishes the image, enhances visual appeal, and does not disrupt the overall order.

Note: Drawn by the author.

The rationale for selecting four from each option, balancing representativeness and suitability:

1. Covering core dimensions: Select four types for each category to fully cover the core forms of that category. For example, in the natural category, the sky, water, stars and moon, and energy are included. The line features are curves, broken lines, and arcs to avoid visual monotony caused by a single pattern.

2. Adaptable to creative needs: The four patterns can serve as the main subject, auxiliary, filling, and embellishment respectively, meeting the needs of the entire process of paper cutting from overall composition to detailed depiction, without the need to increase the number of patterns.

3. Maintain system balance: The number of the four types of patterns is consistent, forming a balanced system of nature, animals, plants and geometry, which conforms to the principle of clear classification and harmonious proportion in artistic creation, and facilitates the presentation of a complete visual expression.

2.4.2 Explanation of Schematic Structure Theory

As a core theoretical category originating from Western epistemology, "schema" essentially refers to a knowledge representation model with organizational functions in the human cognitive system (Schmidt, 2014).This psychological structure forms the cognitive basis for an individual's ability to identify, analyze, and integrate new information, enabling people to form a systematic understanding of unfamiliar things based on their existing experience system (Bartlett, 1995). In his Critique of Pure Reason, German philosopher Immanuel Kant first defined schema as "the medium that connects sensible intuition with the categories of understanding." Modern cognitive psychology has further developed it into a basic cognitive unit of information processing (Kant, 1999). In the dimension of design studies, schemata are the structured representation of the visual transformation of design thinking. Through

the systematic organization of their basic components, they form visual modules with internal logic, and ultimately integrate into a visual system that conveys a complete aesthetic experience. Swiss psychologist Piaget emphasised in his epistemology that the formation of schratic structure is a process in which individuals continuously build cognitive systems through assimilation and conformation mechanisms (Funt, 1971).

The so-called schematic structure mainly refers to the structural composition rules, skeleton relationships and internal connection mechanisms between visual patterns. By systematically combining the elements of structural composition methods and unit forms, we can construct recognisable visual elements and guide observers to form specific cognitive experiences and aesthetic feelings. In the book Art and Illusion, Gombrich argued the structural role of diagrams in visual cognition through the analysis of visual perception (Gombrich, 2023). The essence of flat structure lies in the fact that the designer consciously refines objective things, integrates contemporary context and emotional experience, and once again transforms it into a design form with contemporary characteristics through artistic language. This method transforms subjective cognition into an objective form of visual expression, and finally triggers the communication effect of the audience's emotional resonance through visual expression. Contemporary design practice mainly shows that the mature graphic structure should not only reflect formal aesthetics, but also be an important medium for conveying cultural connotation and emotional value (Yin et al., 2016).

2.4.3 Shape Grammar Theory

Shape Grammar (SG), this rule was first proposed by Stiny and Gips in 1972. It was originally applied to painting, sculpture and other fields of artistic creation, and then gradually expanded to brand vision, innovative product design and other fields. The theoretical framework of the research replaces the language elements in traditional grammar with relatively simple geometric shapes and their own conversion rules, and builds a generation system about visual morphology. The core concept of shape grammar is to extract and decompose complex forms into basic unit forms, and then construct new graphic forms through orderly combination and transformation. Shape grammar theory plays a crucial role in innovative pattern design. Using different shape grammar rules can stimulate infinite creativity, thus producing new patterns. At the same time, it can also retain the characteristics of the original pattern while effectively creating new patterns.

2.4.3.1 Shape Grammar Deduction Rules

According to the definitions of Stiny and Gips, a shape grammar can be defined as a quadruple, specifically SG = (S, L, R, I), where S (shape) is a finite set of shapes, L (label) is a finite set of labels, R (rule) is a finite set of inference rules, and I (initial shape) is the initial shape (Stiny & Gips, 1971). A shape grammar defines a set of

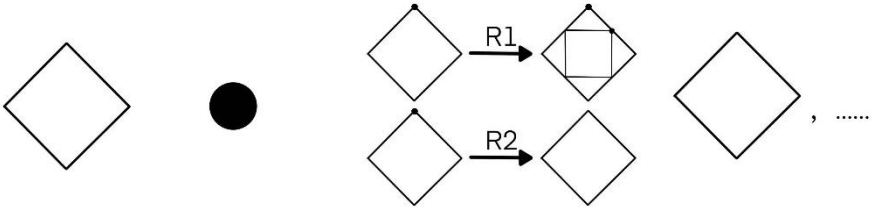
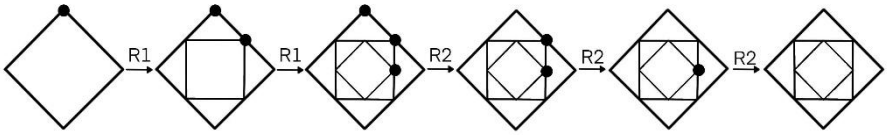
shapes, which is called a "grammar," meaning a language. This language includes all forms derived from the shape grammar, and is gradually derived according to rules based on the initial form, thus forming various patterns of different shapes and styles (Verniz & Duarte).

The shape set S serves as the visual carrier for the system output, containing all geometric shapes formed in the grammatical derivation process (excluding the marker L);the positioning marker L serves as a functional symbol for assisting spatial positioning, with a visual form significantly different from the main shape, primarily serving as a coordinate reference and compositional benchmark; the generation rules R include both specific rules customized by the designer according to creative needs and basic geometric transformation syntax; the initial unit I, as the basic constituent element of the system, is both the starting point for pattern construction and the smallest operational object for all rules.

Shape grammar rules are mainly divided into two categories: one are descriptive grammar rules defined by designers, which usually involve the use of marking symbols (see Table 8); the other are basic inference rules (see Table 16 and Figure 20).

Table 8

Descriptive grammar rule table

Collection Name	**I（initial shape）**	**L（label）**	**R（rule）**	**S（shape）**
Collection content				
Deduction process				

Note: Drawn by the author.

2.5 Case Analysis

To systematically explore the innovative transformation paths of traditional patterns in contemporary design, this paper selects the following representative domestic and international practical design cases in the fields of intangible cultural heritage protection and pattern innovation. These cases not only demonstrate the contemporary interpretation of traditional visual symbols, but also provide methodological references and aesthetic paradigms for this study via semiotic analysis, shape grammar deduction, and pattern structure reorganization. The following is a summary and analysis of these typical cases:

Case 1: The Palace Museum Stationery "Auspicious Splendor" Gel Pen Set – A Everyday Interpretation of Auspicious Beast Patterns

The "auspicious and brilliant" ballpoint pen set launched by the stationery series of the Palace Museum is mainly designed with the auspicious animal pattern elements in the museum's collection. The design team extracted core elements from artifacts such as the five-clawed golden dragon pattern on Emperor Qianlong's dragon robe, the phoenix pattern on a Qing Dynasty empress's robe, and the qilin hanging screen from the Kangxi era, preserving the traditional meaning of "every pattern has a meaning"—the dragon symbolizes majesty, the phoenix signifies good fortune, and the qilin represents talent and ability. Its innovation mainly lies in simplifying the pattern and improving the process: the complicated auspicious meaning pattern is simplified to be suitable for the design of the pen body, and the pattern details are also restored through hot stamping and other processes. Coupled with the use of traditional colours such as bright yellow and vermilion, the recognition is enhanced. The method of extracting element patterns from cultural relics, simplifying pattern forms and adapting to daily media can integrate high-end traditional patterns into stationery, which also provides valuable references for the transformation of Dai paper-cutting patterns into portable cultural creative products.

Figure 11

The Palace Museum's "Auspicious Splendor" Pattern Gel Pen Set

*Note:*Image source:https://www.thepalacemuseumstationery.com/zh-CN/.Search time:2025.

Case Study 2: Pop Mart x Chen Fenwan Paper-cut Toys – IP-based Innovation of Paper-cut Patterns

Pop Mart's cooperation with paper-cutting artist Fan Wan is a cross-border combination attempt to skilfully integrate traditional paper-cutting pattern elements with fashion toys. Chen Fanwan was inspired by traditional Chinese paper-cutting techniques such as cascade hollowing, and designed an exclusive paper-cutting pattern for Pop Mart's SPACE MOLLY character: while retaining the traditional paper-cutting pattern and composition structure, the designer also integrated science fiction elements to reconstruct details. In the classic paper-cutting The combination of hollow and the future symbols of science fiction creates a strong visual tension. The innovation core of this cooperation mainly lies in the combination of patterns and scenes: the combination of flat two-dimensional paper-cutting patterns is transformed into three-dimensional decorative components of fashion toys. People can identify the sense of hierarchy of paper cutting through light and shadow effects, and realise cultural dissemination with the influence of IP. This method of "refining traditional techniques—grafting onto IP carriers—transforming into three-dimensional forms" provides a direct reference for the youthful expression of Dai paper-cutting patterns.

Figure 12

The Paper Universe Now Has a SPACE MOLLY. POP MART x Chen Fenwan

Note: Image source: https://chenfenwan.com/withlpopmart. Search time:2024.

Case Study 3: Givenchy 2024 Chinese Almanac - Dragon Scale Scroll: A Luxurious Reinterpretation of Ancient Book Patterns

Givenchy's collaboration with the Scroll Store to launch the "Dragon Scale Scroll" almanac uses the traditional Chinese dragon scale pattern as its innovative core. The design team extracted the "layered and interconnected" structural pattern of the dragon scale pattern and invited intangible cultural heritage inheritors to create dragon totems on the inner pages using wood carving techniques. The color chosen is traditional bright yellow, which echoes the imagery of imperial power. The innovation lies in the reconstruction of the carrier: transforming the patterns of ancient book bindings into the form and language of high-end almanacs, and matching them with leather covers and metal accessories, so that traditional patterns can be adapted to the positioning of light luxury cultural and creative products. This path of "extracting traditional bookbinding patterns - reproducing intangible cultural heritage techniques - adapting to high-end carriers" provides a reference for the transformation of Dai paper-cutting patterns into collectible cultural and creative products.

Figure 13

Givenchy presents the Chinese Lunar Calendar for the Year of Jia Chen - Dragon Scale Scroll

Note: Image source: https://www.sohu.com/a/748836093_116152. Search time:2024.

Case Study 4: Dunhuang Art Research Institute × Starbucks Collaboration Series – Cross-Domain Integration of Cultural Symbols

The collaboration between the Dunhuang Art Research Institute and Starbucks, themed "Flying Apsaras Meets Sirens," achieves cross-border innovation of traditional patterns. The design team extracted the core form of flowing ribbons and graceful posture from the Northern Wei flying apsara mural in Cave 251 of Mogao Grottoes, while incorporating the spinning top pattern from the early Tang Dynasty in Cave 387, visually merging the Eastern flying apsara with Starbucks' iconic siren goddess. On mugs, canvas bags, and other media, the transformation is achieved through "pattern recombination + process matching": the mug body is printed with a pattern of flying apsaras and siren coexisting in retro colors, while the canvas bag uses embroidery to outline coffee flowers and flying apsara ribbons. This method of deconstructing traditional element patterns, integrating symbolic meaning elements, and innovative design can adapt to different carriers also provides a new direction for the cooperation between Dai paper-cutting patterns and modern consumer products.

Figure 14

The Starbucks x Dunhuang Art Research Institute collaboration series is inspired by

"Eastern aesthetics + modern life," bringing the millennia-old Dunhuang art into everyday life in a "Starbucks-esque" way.

Note: Image source: https://www.sohu.com/a/942122237_727781. Search time:2025.

Case 5: Wanshili x Zhu Bingren Copper Co-branded Gift Box – Craftsmanship Symbiosis of Intangible Cultural Heritage Patterns

The "Splendid Copper Heart" gift box, jointly launched by Wanshili and Zhu Bingren Copper Industry, realizes the fusion of intangible cultural heritage through combining silk scarf patterns with copper sculpture patterns. The design team extracted scroll and entwined branch patterns from traditional patterns such as Dai paper-cutting and applied them to two different craft carriers: digital printing technology is used on the silk scarf to reproduce the delicate brushwork of the pattern, while engraving technology is used on the copper incense box to present the three-dimensional texture of the pattern. The key to innovation lies in the "translation of pattern language": the thickness and density of the lines of the same core pattern are adjusted based on the silk scarf's softness and the copper material's hardness to create a visual echo of "softness and toughness". This strategy of "sharing core patterns - adapting to process characteristics - translating material language" provides a model for the multi-media presentation of Dai paper-cutting patterns.

Figure 15

Intangible cultural heritage pattern craft co-branded gift box

Note: Image source:https://www.163.com/dy/article/JOBT3GHN0517IJJM.html.Search time:2024.

Chapter 3

Research Methods

This research mainly adopts a mixed research method that combines qualitative and quantitative, focussing on comprehensively and deeply exploring the artistic external characteristics and internal cultural values of Dai paper-cutting patterns through multi-angle and multi-dimensional data collection and analysis. Specifically, this article adopts qualitative research methods, combined with expert interviews and documents, to systematically explore the historical origin, cultural connotation and artistic characteristics of Dai paper-cut patterns. At the same time, quantitative research should be carried out again through questionnaires, and the statistics and analysis of survey data results should be used to supplement and verify the qualitative research results, so as to ensure the comprehensiveness and rigour of the research results.

3.1 Research Preparation Stage

In the preparation stage of my research, I first systematically built a two types of research foundation combined with data collection system of literature research and field research. Through multi-dimensional cross-verification and multi-angle analysis, the main theoretical foundation has been laid for the study of Dai paper-cutting patterns. At this stage, on the basis of sorting out the intangible cultural heritage protection policy and academic theory, and then carry out field research in the Dehong Dai ethnic area. Once again, through interviews with paper-cutting inheritors and folklorists to collect physical materials, the comprehensive preparation from the construction of the theoretical framework to the acquisition of first-hand information has been completed, laying a solid theoretical and practical foundation for the subsequent paper-cutting innovative design research.

Literature review method: First, through a systematic review of the relevant literature of Dai paper cutting, I mainly build the basic theoretical foundation from three levels. First of all, at the policy level, it mainly analyses the guiding principles on the innovation, transformation and development of intangible cultural heritage of traditional art, such as the 14th Five-Year Plan for the Protection of National Intangible Cultural Heritage, and also refers to the Regulations on the Protection of Intangible Cultural Heritage in Dehong Dai and Jingbo Autonomous Prefecture, Yunnan Province and other local regulations. Second, at the theoretical level, the cultural value of Dai paper-cutting is discussed in works including Wang Wenzhang's "An Introduction to Intangible Cultural Heritage" and Lü Pintian's "The Concept of Chinese Folk Art," with particular emphasis on the academic interpretation of Dai paper-cutting’s symbol system and aesthetic characteristics. Third, at the academic

level, it comprehensively studies the field records of Dai paper-cutting in works such as Yin Shaoting's "Research on Yunnan Ethnic Folk Crafts and Techniques," as well as the latest research results on the inheritance and innovative development of Dai paper-cutting techniques published in journals such as "Ethnic Art Research" and "Yunnan Social Sciences" in recent years, establishing a complete knowledge framework. Fourthly, in the field of cultural and creative industries, within the research area of cultural and creative design, a review of the paper "The Application of Traditional Patterns in Modern Design" introduces the relevant content of combining traditional patterns with modern design through deformation and decomposition (Hui, 2001). For example, Yu Jie et al. extracted shape features from traditional Guizhou batik patterns and used shape grammar deduction rules to deduce a shape derivative tree model for single-petal patterns (Yu et al., 2020). The above content provides the theoretical basis and policy guidance for this study.

Fieldwork: This study focuses on Mangshi City, Dehong Dai and Jingpo Autonomous Prefecture, Yunnan Province, employing a combination of multi-point field investigations and interviews. Firstly, through on-site investigations of intangible cultural heritage inheritor Shao Meihan and her training centers, as well as typical local villages and cultural centers, firsthand data on paper-cutting artifacts and tools were systematically collected. Secondly, through in-depth exchanges with intangible cultural heritage inheritors and folklorists, the creative experiences and artistic insights of paper-cutting artists were obtained, allowing for an internal understanding of the cultural value of paper-cutting. Thirdly, based on the fieldwork, key culturally representative core patterns such as peacocks, elephants, and bodhi leaf patterns were selected as innovative prototypes. Through expert interviews and discussions, the innovative design principle of Dai paper cutting and integrating modern design language while retaining the core cultural symbols has been determined, laying the foundation for the subsequent innovative design of shape grammar.

Figure 16

Interview with a Dai ethnic paper-cutting inheritor

Note: Photo taken by the author.

3.2 Implementation Phase

This research mainly adopts a dual-perspective research method, integrating the perspectives of users and experts, focussing on hybrid research methods. Systematically integrate quantitative data and qualitative methods to provide theoretical guidance for the innovative design of Dai paper-cutting patterns, and ensure that they have both rich inherent cultural connotations and market feasibility. In addition, this study also records expert interviews with Dai paper cutting, explores the insights into the evolution of pattern rules, and builds a research data system for two-way verification. This research conforms to the trend of design research, and also emphasises demand-driven and professional collaboration to ensure that innovative design can enhance market adaptability while maintaining the accuracy of cultural value, laying the foundation for subsequent design practice.

3.2.1 Expert Interviews and Opinion Analysis

This study also conducted in-depth interviews and collected the professional opinions of Dai paper cutting and experts in related fields. The respondents include: 1. Shao Meihan (the representative heir of the Dai paper-cutting national intangible cultural heritage project), she has been committed to the inheritance of Dai paper-cutting pattern skills and the innovative practice of paper-cutting for a long time; 2. Nan Wenxiang (Dai folklorist, heir of Jinshui leakage printing and painting skills) has in-depth research experience in the cultural connotation and external performance of traditional Dai patterns; 3. Mixed Hanzhen (the first-class intangible cultural heritage inheritor of Dai paper-cutting localities) has rich practical experience in the innovation and application of paper-cutting patterns. This study summarises these expert opinions and analyses the innovative design and application scope of Dai paper-cutting patterns.

Expert opinions mainly focused on the following aspects:

Advantages and potential:

(1) It has important intangible cultural heritage value: Experts agree that this research has systematically collected and sorted out Dai paper-cutting patterns, which has important cultural connotation value and can also effectively promote the inheritance and dissemination of paper-cutting, an intangible cultural heritage;

(2) It is believed that such an innovative design method is feasible: experts unanimously recognise the combination of semiotics theory and shape grammar theory, and agree that this theoretical framework can provide systematic methodological support for the innovation of paper-cutting models;

(3) Broad visual expression: Experts pointed out that Dai pattern patterns have unique shape language and structural rules, and still have a broad application prospect

in modern design, especially in line with the wisdom and aesthetic characteristics of life and contemporary innovative design trends.

Shortcomings and suggestions for improvement:

The process of expert interviews also reflects the aspects that need to be improved in the research. Some experts suggest that the modern innovation of traditional patterns needs to pay more attention to cultural values; other experts emphasise that in the process of innovative design, it is necessary to maintain the core characteristics of traditional patterns and ensure the authenticity of cultural patterns; some experts point out that it is necessary to increase the semantics of patterns in the process of innovation. Accurate transmission of. The opinions of these majors provide important reference information for the subsequent innovative design practice of this study, and also reflect the combination of balancing tradition and innovative design in the innovation of intangible cultural heritage.

3.2.2 Questionnaire Design and Respondent Analysis

This study mainly investigated the following target groups: 18-50-year-old cultural design enthusiasts and design professionals. The selected respondents are based on the dual consideration of the research objectives:

On the one hand, we evaluate the market acceptance of innovative Dai paper-cut patterns from the perspective of potential survey users. It is also based on the questionnaire designed by cultural enthusiasts around the following dimensions: visual appeal, exploring the audience's subjective evaluation of the integration of innovative patterns with aesthetic form, modernity, and cultural characteristics; cultural identity, assessing the degree to which users understand and resonate with the Dai ethnic cultural connotations carried by the patterns; application adaptability, examining the performance potential of innovative patterns in cultural and creative products; innovation acceptance, understanding the degree to which users approve of the transformation of traditional patterns; and willingness to use, measuring users' decision-making tendencies when choosing to purchase or use products containing innovative patterns.

On the other hand, the interviews with experts such as Shao Meihan, folk experts such as Nan Wenxiang and Henghan Zhen, are based on the important basis for the experts to develop cultural creative products and choose daily life products as paper-cutting carriers. This core foundation echos the results of the preliminary questionnaire survey and interview analysis, laying the foundation for the rationality and logic of the subsequent innovative design of paper-cutting patterns. Shao Meihan pointed out that paper-cut patterns need to find a fit with modern life, which directly indicates the development of daily necessities. Folklorist Nan Wenxiang further explained that coasters can reflect the way of hospitality, and silk scarves can show patterns and can be worn close to the body, reflecting the unique advantages of daily necessities in cultural communication. In terms of product selection, experts put

forward a more specific plan based on cultural cognition: the round coaster echoes the structure of the Dai group flower, with composition aesthetics, and the tea culture and the hospitality etiquette of the Dai nationality resonate; and the texture of the silk scarf fluidity complements the paper-cut hollow curve language. Experts agree that the design principle of retaining the original colour of the core symbol and combining modern composition will be verified through online and offline questionnaires. This method also turns the opinions of experts into visible evaluation indicators. It verifies the applicability of shape grammar in innovative pattern design through the structured questions of the questionnaire, and the rationality of using coasters and scarves as design carriers, which is more advantageous in terms of accuracy and convenience. This kind of product development of professional judgement not only ensures the accuracy of the expression of cultural connotations, but also ensures the effective dissemination of design carriers in daily life, laying a professional foundation for subsequent design practice.

In the traditional pattern setting, these dimensions establish a cognitive connection and emotional system between target users and innovative design, and also provide data support for subsequent innovative design optimisation and marketing. At the same time, interviews with paper-cutting professionals focus more on the accuracy of the connotation of cultural values and the innovation and feasibility of the conversion of new model rules, and then form a double practical verification based on user needs and professional judgements.

3.3 Data Analysis in the Design Phase

At this stage of research, the researchers organised and systematically analysed the previously collected questionnaire data and expert interviews, and extracted innovative design references on the guiding significance. The questionnaire data adopts the methods of descriptive statistical analysis and differential analysis to quantify the design preferences, cultural identity and application scenarios of target users for innovative design patterns. This clearly presented the differences in pattern acceptance, aesthetic preferences, and product preferences among user groups of different age groups and cultural backgrounds.

In terms of expert interviews, content analysis was used to deeply explore the interview texts, extract keywords and core themes, and focus on the experts' professional insights on the feasibility of pattern innovation, the accuracy of cultural inheritance, and the applicability of design methodologies. By summarizing and organizing the two dimensions of "preservation of cultural connotation" and "innovation of expression", the advantages and development space of Dai paper-cutting patterns in terms of symbol translation, visual reconstruction and modern application are clarified.

Based on the comprehensive analysis of quantitative and qualitative data, the study established the design principle of "traditional patterns - modern expression",

providing a clear direction for subsequent shape grammar derivation and innovative design. Data analysis shows that users have a high acceptance of patterns that have distinct Dai cultural characteristics and conform to modern aesthetics, while experts emphasize the need to maintain the recognizability of core cultural symbols during the innovation process. These research findings provide important empirical facts for subsequent design practises, and also ensure innovative design solutions to respect the core of traditional culture while meeting the needs of contemporary users.

3.3.1 Design Output

At this stage of design output, the theoretical rule of shape grammar is deduced as the core innovation tool for systematic innovative design practice. First, typical selected Dai paper-cutting patterns are deconstructed and recombined, adopting a schematic method to break them down into the most basic shape units, such as characteristic patterns and specific geometric shapes. Based on this, a series of shape evolution rules are formulated or based on: simplifying rules to summarize complex details into simple geometric forms to adapt to modern aesthetics; using superposition and combination rules to achieve cross-category fusion of different pattern units and create new patterns; and using gradient iteration rules to give patterns a sense of rhythm and cadence, making them suitable for serialized design. Subsequently, by implementing the above rules through assisted design or hand-drawing, traditional patterns are innovatively derived to generate a series of innovative pattern families that retain the original charm while possessing a brand-new visual expression. For example, the lotus pattern commonly found in Dai paper-cutting can be simplified and iterated through shape grammar to create innovative patterns that can be applied to multiple practical fields, such as serialized packaging, stationery, and scarves in cultural and creative product series, forming a concrete and complete design proposal and completing the transformation from theory to practice.

3.4 Conclusion Phase

3.4.1 Market Research Conclusions

This study mainly combines the data of the consumer group questionnaire and the report on the current cultural and creative market trend, and makes a preliminary market evaluation of the innovative design practises of Dai paper-cutting patterns. The research results show the market positioning of this series of innovative designs, and set a moderate price range in the market for young consumers who pursue cultural identity and personality expression. The data analysis of the results shows that the products that combine innovative traditional paper-cutting patterns with modern design language have received relatively positive feedback in terms of final aesthetic acceptance and willingness to buy.

3.4.2 Design Summary

For the systematic review and summary of the whole research process, the four-stage research workflow is: theoretical research, field research, data collection and shape grammar innovation design. The success of this research theory mainly comes from three aspects: solid literature theoretical research and early field research lay the cultural foundation for innovative design; the collection and collation of quantitative and qualitative data of questionnaires and expert interviews on target groups in the medium term to determine the consistency between the design direction, market demand and cultural values; after The introduction of shape grammar theory provides structured and systematic theoretical tools for the modern innovative design of traditional pattern patterns, which effectively avoids arbitrary design and cultural misreading. This complete closed-loop model not only produces innovative design results with cultural and market value, but also provides a relatively clear and referenced research paradigm for the innovative practice of other relevant intangible cultural heritage projects.

3.4.3 Desirability, Difficulties and Recommendations

This study validates the comprehensive advantages of the method used. Its merits are mainly reflected in the depth of cultural interpretation brought about by the intersection of multiple theories, the systematic innovation efficiency brought about by shape grammar, and the guarantee of design feasibility by the dual feedback mechanism of users and experts. However, the practical process also faces many challenges: First, in field research, the original cultural meanings of some ancient patterns are at risk of being lost due to the interruption of oral transmission, which makes it difficult to accurately interpret and transform cultural elements; Second, in the design integration stage, how to achieve a balance between the trend of modern aesthetic simplification and the complex heritage of traditional culture is a topic that needs to be continuously explored; Third, when innovative designs move towards large-scale production, they may encounter the contradiction between traditional handmade texture and modern production technology, as well as the resulting cost control issues. In response to the aforementioned difficulties, two aspects of further research are recommended: first, to promote the establishment of a more comprehensive digital museum for Dai paper-cutting, by means of digital tools to systematically preserve, interpret, and revitalize cultural heritage; second, to actively explore in-depth integration with digital technologies such as AR/VR, expanding the immersive experience and dissemination scope of intangible cultural heritage.

3.5 Data Collection and Analysis Methods

In order to ensure the rigour of this research process and the verifiability of the conclusion, this study adopts a mixed research method that combines quantitative and

qualitative. Through questionnaire survey, field research, expert interview consultation and other research methods of the target population, and systematically collect and analyse all kinds of real-time data, laying a solid foundation for the innovative design practice of Dai paper-cutting patterns. This hybrid research method follows the research design principle proposed by Creswell, mainly through cross-verification of data from different sources to form a "triangular verification", which can effectively improve the confidence and validity of the research (Creswell, 2009). In innovative practice, quantitative data mainly focusses on analysing the cognitive understanding and innovative acceptance of paper-cutting patterns by target users, while qualitative data focusses on analysing the cultural connotation and symbolic meaning of paper-cutting. The two complement each other and work together to build a complete research route.

3.5.1 Quantitative Data Collection and Analysis Methods

At the quantitative research level, this study mainly collected data through a structured questionnaire designed in the early stage, and distributed the questionnaire through an online platform (Wenjuanxing). Through questionnaires, literature collection, and expert interviews, data was systematically organized and analyzed. The questionnaire focused on core dimensions such as experts' and the public's awareness of Dai paper-cutting, their aesthetic preferences for different styles of innovative patterns, and their willingness to purchase cultural products. The aim was to obtain intuitive feedback and data support from the target user group on the direction of pattern innovation design.

3.5.2 Qualitative Data Collection and Analysis Methods

At the qualitative research level, the data foundation of this study mainly comes from three directions: First, a systematic review of historical documents, local chronicles, craft illustrations, and academic monographs related to Dai paper-cutting to gain a deep understanding of its technical traditions, cultural symbol system, and stylistic evolution; Second, a systematic collection and analysis of outstanding domestic and international intangible cultural heritage innovative design cases and visual communication practices to provide theoretical reference and creative development for the design transformation of this study; Third, first-hand materials such as interview records with inheritors, on-site video materials, and expert consultation texts obtained from field investigations provide a true record of the current state of paper-cutting techniques.

The qualitative materials mentioned above will be systematically processed using content analysis and thematic analysis methods. Content analysis provides an objective and systematic quantitative description of textual materials; thematic analysis extracts core themes such as the modern expression of cultural identity and the tension between traditional techniques and modern design from repeated readings,

interviews, and observation notes, thereby deeply elucidating the underlying motivations of phenomena and providing strong guidance for design innovation.

Figure 17

On-site guidance from inheritors of Dai paper-cutting techniques and learning of Dai paper-cutting skills by the artists.

Note: Photo taken by the author.

Chapter 4

Analysis and Design

This chapter aims to systematically present the research process and practical results of innovative design of Dai paper-cutting patterns, and to explore the transformation potential of traditional intangible cultural heritage in the context of modern design through multiple dimensions. Based on shape grammar theory and semiotic analysis methods, and combined with user needs and expert wisdom, this study has constructed a complete innovative system from cultural decoding to design encoding, providing a methodological support that can be learned from for the living inheritance of intangible cultural heritage.

This chapter is divided into three parts. The first part quantitatively analyses the results of the questionnaire of the two target groups of cultural lovers and intangible cultural heritage experts. This study mainly uses descriptive statistical analysis, variance analysis and correlation testing, and then collects the main evaluation of the Dai paper-cutting patterns of the target group, including their understanding of Dai paper-cutting, the acceptance of innovation, and cultural identity and application preferences, so as to provide data support for subsequent design optimisation.

The second part mainly comprehensively sorts out the opinions of experts, and then shows the deduced process of pattern patterns according to the rules of shape grammar, which can systematically show the further innovative design and transformation of traditional paper-cut pattern patterns through geometric abstraction, composition reorganisation and rhythmic form extension. Experts' opinions also affirm the effectiveness of shape grammar in traditional cultural innovation, and also emphasise the importance of protecting the core characteristics of traditional cultural technology, which provides a clear direction for innovative design practice. Secondly, by comparing and analysing different rules to deduce the effect of pattern changes under combination, thus establishing a design transformation path from traditional culture to modern innovation, providing a rich pattern resource library for cultural and creative application paths.

Finally, the third part focusses on the application of innovative design patterns in cultural and creative products such as coasters and scarves. Through physical display, the visual perception ability of paper-cut patterns and the functional adaptability to different materials are verified.

In summary, this chapter mainly combines data analysis, summary and innovative design practice, and shows the practical process of Dai paper-cutting patterns from traditional cultural form to modern innovative design in an all-round way. It not only proves the methodological connotation value of shape grammar in the innovative design of intangible cultural heritage, but also reflects the

multi-dimensional possibility of integrating traditional culture and modern life, laying a solid foundation for subsequent research.

4.1 Data Analysis

4.1.1 Descriptive Statistical Analysis (George & Mallery, 2018)

Based on the descriptive statistical analysis of questionnaire data 1, the demographic characteristics and cognitive preferences of the respondents showed the following features: the gender distribution of the respondents was relatively balanced (47% male and 53% female). The age structure shows a trend of becoming younger, mainly concentrated in the 18-35 age range (accounting for 75.75% cumulatively), with the 26-35 age group accounting for the highest proportion (44.75%), followed by the 18-25 age group (31%), indicating that the survey results mainly reflect the views of young and middle-aged groups.

Table 9

Descriptive statistical analysis table

project	category	number of people	percentage
gender	male	188	47%
	female	212	53%
age	Under 18 years old	0	0%
	18-25 years old	124	31%
	26-35 years old	179	44.75%
	36-45 years old	62	15.5%
	46 years old and above	35	8.75%

Note: Drawn by the author.

Regarding basic knowledge of Dai paper-cutting, data shows that respondents had a relatively good understanding: 70.5% of respondents indicated they were familiar with Dai paper-cutting. Of those who had some knowledge of Dai paper-cutting art, 66.5% were at the basic level of "having heard of it," 24.75% were at the level of "being very familiar with it," and only 8.75% were completely unaware of it. This provides an effective audience base for subsequent research on innovation in paper-cutting patterns.

Table 10

Descriptive statistical analysis table

project	Options	number	percentage

		of people	
Are you familiar with Dai paper-cutting	Yes	282	70.5%
	No	118	29.5%
How well do you know about Dai paper-cutting art?	1: Very familiar with	99	24.75%
	2: Heard of	266	66.5%
	3: Completely unfamiliar with	35	8.75%

Note: Drawn by the author.

According to the expert survey results in Questionnaire Data 2, all the experts interviewed have been engaged in the field of Dai paper-cutting for more than 5 years. All the experts interviewed (100%) had participated in previous in-depth interviews on Dai paper-cutting, forming a basis for professional consensus. At the level of innovative understanding, experts showed a high degree of consensus on the necessity of innovative design of traditional paper-cutting patterns, with 66.67% "strongly agreeing" and 33.33% "agreeing".

Table 11

Descriptive statistical analysis table

Question Number	Abstract	High approval rate
Question 3	Have you participated in the expert interviews conducted in the early stages of this study regarding "Dai paper-cutting"	100%
Question 4	Do you agree that it is necessary to innovate the design of traditional paper-cutting patterns	100%

Note: Drawn by the author.

The method of using the "split-deformation-recombination" rule of shape grammar to innovate patterns also shows the same distribution of recognition, reflecting that the feasibility of this method at the professional level has been verified. Regarding the path to value realization, experts unanimously recommend that artistic value be transformed through "cultural and creative practical products" (100% choice), and fully recognize the advantages of cultural and creative products in achieving high-frequency dissemination (100%), expanding the scope of awareness (100%), and adaptability to carriers (100%). In terms of specific carriers, experts prefer everyday practical items, with coasters being chosen by 66.67% and scarves by 33.33%,

indicating that simple and practical daily necessities are considered the best carriers for pattern innovation.

Table 12

Descriptive statistical analysis table

Question Number	Abstract	Selection status
Question 5	To more effectively showcase the artistic value of paper-cutting patterns, which of the following presentation methods would you recommend	High
Question 6	You would suggest applying Dai paper-cutting patterns to cultural and creative products because	Relatively high
Question 8	Do you agree with the method of "innovating the core patterns of Dai paper-cutting through the 'decomposition-deformation-recombination' rule of shape grammar"	High
Question 9	Which of the following cultural and creative products would you choose if Dai paper-cutting patterns were applied to it	Relatively high

Note: Drawn by the author.

4.1.2 Analysis of Variance (Larson, 2008)

Based on the analysis of questionnaire data 1, in order to understand the differences in the level of understanding of Dai paper-cutting art among different age groups and the focus of innovation in paper-cutting pattern products, this paper uses "your age" as the independent variable and "your level of understanding of Dai paper-cutting art" and "your opinion on the focus of innovation in paper-cutting pattern products" as dependent variables to conduct one-way ANOVA.

The results showed that there were no significant differences among different age groups in terms of "understanding of Dai paper-cutting art" ($P>0.05$) and "emphasis on innovation in paper-cutting patterns" ($P>0.05$), indicating that among the surveyed population aged 18–46 and above, there was a high degree of consistency in their understanding of Dai paper-cutting art and their perception of the emphasis on innovation in paper-cutting patterns. Although there are slight differences in the mean across different age groups, it means that there is consistency in the understanding of these two aspects across all age groups, which also supports the homogeneity of the

survey sample in the age dimension, and further comprehensive analysis can be carried out.

Table 13

Analysis of variance table

Analysis Dimensions	**Independent variable**	**Dependent variable:**	**p-value**
Cognitive Differences Among Different Age Groups	Your age is	Degree of understanding of Dai paper-cutting art	0.417
		Do you think innovation in paper-cutting patterns should focus on	0.977

Note: Drawn by the author.

Based on the expert survey results of Questionnaire Data 2, Question 1 "Your gender" was the independent variable and Question 4 "Do you agree that it is necessary to innovate the design of traditional paper-cutting patterns?" was the dependent variable, and a one-way ANOVA was conducted. The results showed that there was no significant difference between male and female experts in their recognition of the necessity of innovative design of traditional paper-cutting patterns ($P>0.05$), indicating that this innovative concept has formed a general consensus among expert groups of different genders.

4.1.3 Pearson Correlation Analysis (Cleophas & Zwinderman, 2018)

To understand the relationship between audience cognition and innovation preferences, a relevant analysis was conducted on questionnaire data 1. The results showed a significant positive correlation between the two variables: "your level of understanding of Dai paper-cutting art" and "your opinion on the focus of innovation in paper-cutting pattern products" ($r \approx 0.37$, $P < 0.01$). This finding indicates that the deeper the respondents' understanding of Dai paper-cutting art, the higher their acceptance of innovative design of patterned products. This result statistically verifies the intrinsic link between cultural cognition and innovation acceptance, providing important data support for the innovation path of this study.

Table 14

Pearson correlation analysis table

Variable A(X)	Variable B(Y)	Pearson r	Significance level (p)
How well do you know about Dai paper-cutting art	Do you think innovation in paper-cutting pattern products should focus on	0.37	P < 0.01

Note: Drawn by the author.

In Questionnaire 2, Pearson correlation analysis was conducted on two variables: "Do you agree that it is necessary to innovate the design of traditional paper-cutting patterns?" and "Do you agree with the method of 'innovating the core patterns of Dai paper-cutting through the 'split-deformation-recombination' rule of shape grammar?" The data results based on expert samples show that there is a positive correlation between the two variables ($r \approx 0.21$, $P < 0.01$). This analysis shows that experts' recognition of the necessity of innovative design for traditional paper-cutting patterns is significantly positively correlated with their acceptance of shape grammar innovation methods. That is, the more experts recognize the necessity of innovative design, the more they are inclined to support the use of shape grammar as a specific innovation method.

Table 15

Pearson correlation analysis table

Variable A(X)	Variable B(Y)	Pearson r	Significance level (p)
Do you agree that it is necessary to innovate the design of traditional paper-cutting patterns	Do you agree with the method of "innovating the core patterns of Dai paper-cutting through the 'decomposition-deformation-recombination' rules of shape grammar"	0.21	P < 0.01

Note: Drawn by the author.

Judging from the results, the questionnaire has made important findings from the target group, the interviewees and the interviews of the expert group. From the perspective of the respondents, a large majority of respondents (according to the data, mainly young and middle-aged people) have shown good consensus on the innovative

understanding of Dai paper cutting. The cognitive tendencies of Dai paper cutting at different ages are basically similar, which lays the foundation for the subsequent comprehensive analysis. For researchers to note, the respondents' understanding of Dai paper cutting is positively related to their acceptance of innovative design practises, which directly reflects the positive views of cultural values on the acceptance of innovative design. From the perspective of the expert group, Dai paper-cutting research experts highly agree with the innovative design and methodology of paper-cutting patterns. Experts generally agree that cultural values can be disseminated through daily necessities and cultural creative products, while paying attention to the deep value of paper-cutting culture. It is particularly noteworthy that there is a significant positive correlation between experts' recognition of the necessity of innovation and their support for the innovative design rules of shape grammar, which shows that the basic theoretical cognition of research can be effectively transformed into support for specific methodologies. These studies summarise and find that from the perspective of the respondents' cognition and expert consensus, it provides reliable research and theoretical evidence for the innovation of contemporary Dai paper-cutting patterns, and also points out the direction for subsequent design practice.

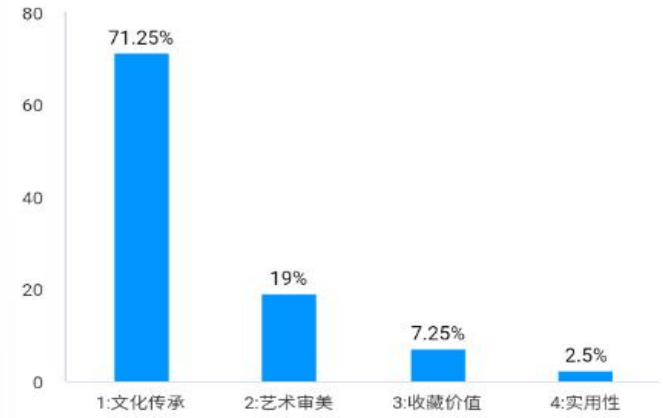
4.2 User Needs Analysis

Based on the preliminary expert questionnaire research and suggestions, this content develops cultural creative products featuring Dai paper-cut patterns. To this end, the researchers designed and distributed a questionnaire "Questionnaire on the User Demand of National Cultural Creative Products such as coasters and scarves". Among them, a total of 400 valid questionnaires were recovered, including 188 for men (accounting for 47%) and 212 for women (accounting for 53%), which shows that the gender ratio is relatively balanced. The questionnaire included 15 questions, covering basic user information, cultural awareness, demand for cultural and creative products, and evaluation of design elements, thus providing multi-dimensional data support for the development of cultural and creative products featuring Dai paper-cutting patterns.

From the perspective of cultural connotation, in the ninth question of the questionnaire, "What do you think is the core value of intangible cultural heritage elements in the product?" According to the survey results, 71.25% of the respondents thought it was "cultural connotation", 19% thought it was "artistic aesthetics", 7.25% thought it was "collection value", and only 2.5% thought it was "practicality". This clearly shows that users' perception of the core value of the elements of intangible cultural heritage in the product is mainly guided by cultural inheritance, highlighting the importance of the connotation of Dai paper-cutting culture.

Figure 18

Survey results data bar chart

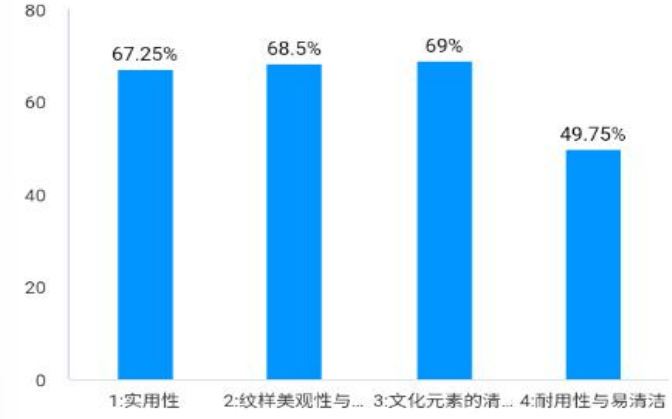


Note: Drawn by the author.

Regarding the innovative design needs of coasters (Question 12), users think that the design of coasters should focus on is that "clear expression of cultural elements" accounts for 69%, "aesthetics and uniqueness of patterns" accounts for 68.5%, "practicality" accounts for 67.25%, "durability and ease of cleaning" accounts for 49.7 5%. Based on the needs of survey users, innovative design should take into account aesthetics, fashion and elegant style, and highlight the cultural connotation of Dai paper-cutting patterns. In addition, a good balance can be achieved between practicality, pattern design and cultural connotation expression to meet the dual needs of users for culture and function.

Figure 19

Survey results data bar chart

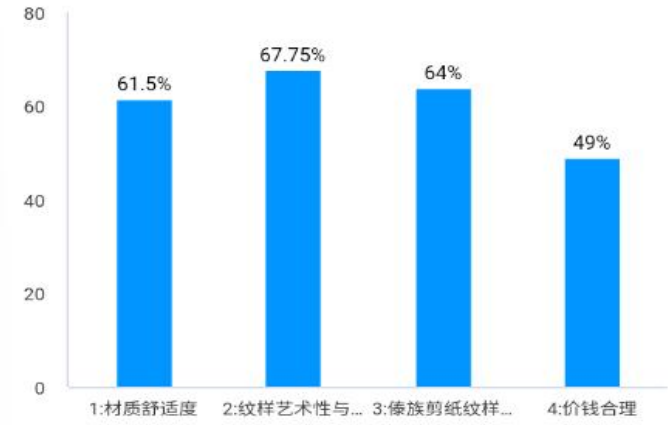


Note: Drawn by the author.

Regarding the design requirements for silk scarves (Question 13), "artistic features and cultural recognizability of patterns" accounted for 67.75%, "modern expression of Dai paper-cutting patterns and symbols" accounted for 64%, "material comfort" accounted for 61.5%, and "reasonable price" accounted for 49%. This indicates that silk scarf design should be centered on highly recognizable Dai ethnic paper-cutting art patterns, combined with modern design language for innovative expression, while ensuring material comfort and pricing that aligns with the public's expectations for a reasonable price, in order to create silk scarf products that combine cultural artistry with a pleasant user experience.

Figure 20

Survey results data bar chart



Note: Drawn by the author.

In summary, this questionnaire survey clarified the direction for the development of Dai ethnic paper-cutting patterns in cultural and creative products such as coasters and scarves from the dimensions of cultural awareness and product design elements. With cultural connotation as the core value, the coaster design balances cultural expression, pattern aesthetics and practicality, while the scarf design highlights the pattern artistry and modern expression, and also takes material factors into account, providing a clear user demand basis for the design positioning of subsequent cultural and creative products.

4.3 Innovative Design of Dai Paper-cutting Patterns in Products

4.3.1 Basic Rules of Shape Grammar

The core principle of shape grammar is, first and foremost, to determine the initial form of the pattern based on design requirements. Then, it is refined and evolved according to modern aesthetics, and reconstructed and rearranged according

to rules and certain logic to form basic units with a sense of order, modern aesthetics, and the ability to extend new connotations. Next, using derivation rules such as translation, rotation, and mirroring, the initial form undergoes the first stage of generative evolution, thereby obtaining new graphic elements, which can be defined as basic graphic units. Subsequently, the basic graphic units obtained from the first stage of evolution are further processed by applying the derivation rules of the second stage of derivative evolution; finally, through the complete derivation process of the above shape grammar, a scheme for innovative patterns is generated. From the perspective of rule classification, the rules of shape grammar can be mainly divided into two categories: one is the descriptive grammar rules defined by the designer, which usually involve the use of marking symbols (see Table 8); the other is the basic reasoning rules used for morphological evolution (see Table 16 and Figure 21).

The basic rules of shape grammars can be divided into generative deduction and derivational deduction. Using shape grammar as the design method, the geometric triangle from Dai paper-cutting patterns is selected as the initial shape for demonstration, and corresponding derivative graphics are constructed using basic deduction rules. As shown in the table below, this process is called generative deduction rule (see Table 16); by continuing to deduce the generated basic graphics according to the rules, more and more new graphics can be created, and this process is called derivational deduction rule. For example, the derivation rule arranges one or more basic shapes in a specific spatial relationship according to the grammatical relationship and rules of shapes, thereby creating new shapes and deriving a series of new design schemes, while maintaining a certain continuity. The advantage of shape grammar lies in its ability to orderly transform symbolic elements, generating graphics that retain the original cultural genes while presenting new visual forms. Using shape grammar for graphic innovation design can take into account the unique artistic characteristics of Dai paper-cutting patterns. When determining inference rules, the degree of deformation can be decided based on the importance of an element to the overall style. Elements that have a significant impact on the style of paper-cutting patterns should minimise deformation and maintain the continuity of cultural values. On the contrary, elements that have less impact on the style of paper-cutting patterns can be deformed to a greater extent, and subsequently, richer and more diverse visual effects can be achieved for innovative design patterns.

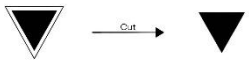
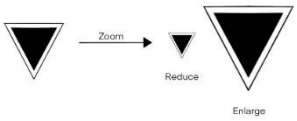
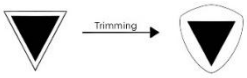
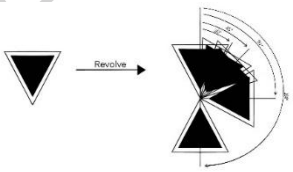
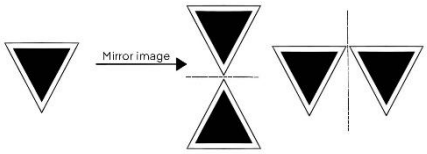
The theoretical basis and deducing evolution rules of shape grammar are mainly composed of the following methods, including addition, deletion, scaling, copying, fine-tuning, rotation and mirroring. Addition refers to adding some new lines or elements to the pattern shape to build new graphics; deletion refers to removing the lines or some elements of the shape to form a new graphic; scaling refers to enlarging or reducing the shape according to the proportion of the figure or line; copying refers to copying the original pattern shape and moving in a specific direction, while maintaining the original shape. Initial graphic shape; fine-tuning refers to the fine-tuning of the lines or shapes of the initial figure; rotation refers to the shape that

changes its direction according to the angle of the shape around a certain point or axis; mirror image refers to the symmetrically copying the shape along the central axis, so that the shape is symmetrical on both sides of the axis, including horizontal symmetry and vertical Symmetry.

This paper primarily uses rules such as addition (R1), deletion (R2), scaling (R3), copying (R4), fine-tuning (R5), rotation (R6), and mirroring (R7). Taking the triangular geometric pattern from Dai paper-cutting as an example, it demonstrates the generative rule derivation of shape grammar. The generative derivation rule table is as follows:

Table 16

Generative Inference Rule Table

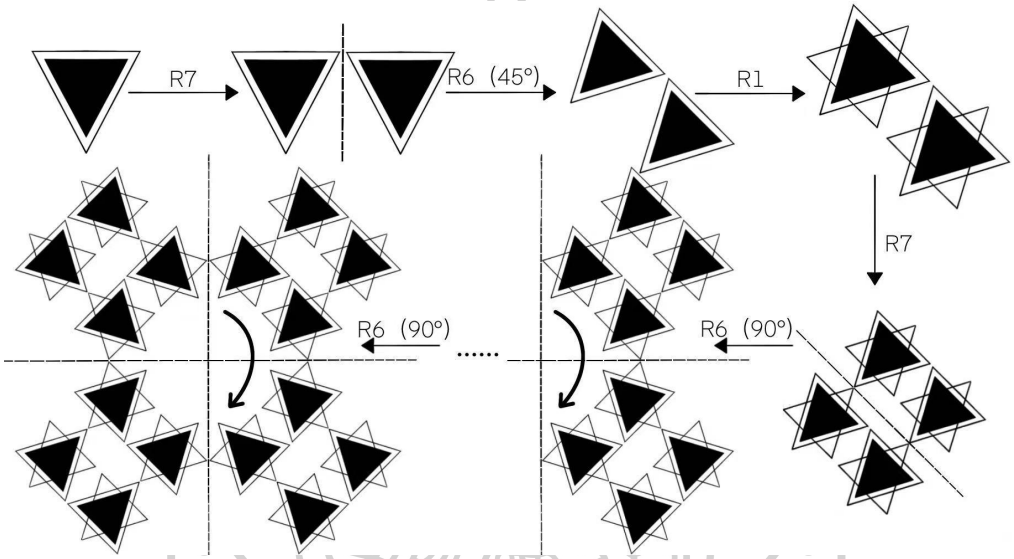
Rule Number	**Schematic diagram**	**Rule Number**	**Schematic diagram**
Increase （R1）		Cut（R2）	
Zoom （R3）		Duplicate （R4）	
Trimming （R5）		Revolve （R6）	
Mirror image （R7）			

Note: Drawn by the author.

Derivative deduction is a process of deep re-creation of the basic patterns that have been obtained, based on generative rules. Specifically, it uses the initially derived pattern as a new initial form, applies generative rules again, and thus derives more complex pattern structures. Below, we will use the geometric triangular pattern in Dai paper-cutting as an example to systematically demonstrate the complete derivation path of this rule.

Figure 21

Schematic diagram of derivation rules



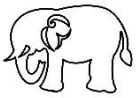
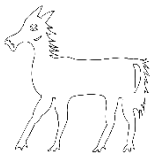
Note: Drawn by the author.

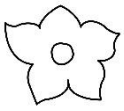
4.3.2 Extraction and Deduction of Dai Paper-cutting Patterns Based on Shape Grammar

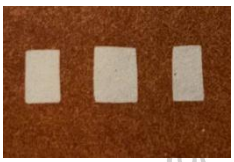
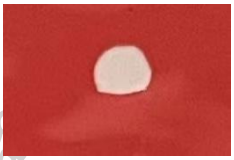
As the target patterns for this study, based on the above analysis of Dai paper-cutting patterns, the following patterns were mainly extracted as research objects. These patterns are categorized according to their themes, and individual patterns are represented by numbers, serving as core samples for the initial shape extraction of Dai paper-cutting patterns.

Table 17

Initial pattern morphology extraction table

name				
	Cloud Pattern	Swirl Pattern	Crescent Pattern	Flame Pattern
Pattern Extraction				
number	A1	A2	A3	A4
name				
	Elephant pattern	Peacock pattern	Butterfly pattern	Horse pattern
Pattern Extraction				
number	B1	B2	B3	B4
name				
	Bodhi leaf pattern	Lotus pattern	Fragrant gardenia pattern	Rose pattern

Pattern Extraction				
number	C1	C2	C3	C4

name				
	Square pattern	Triangle pattern	Circular pattern	Heart pattern
Pattern Extraction				
number	D1	D2	D3	D4

Note: Drawn by the author.

Basic pattern evolution process: Through the application of shape grammar, the evolution of pattern innovation design can be divided into the following stages. First, the original shapes of Dai paper-cutting are transformed into basic pattern elements using shape grammar. Then, in the second stage, derivational rules are used to evolve the newly generated pattern elements, thereby creating innovative paper-cutting patterns with distinctive Dai characteristics. The table below illustrates how shape grammar is comprehensively applied in these two stages to form the evolutionary process of new patterns. By applying generative and derivational rules to innovate graphic evolution, diverse designs of two-dimensional graphics are achieved, showcasing the new graphics from the derivation process to the evolutionary innovation.

4.3.3 Product Design Scheme Generation Based on Shape Grammar

4.3.3.1 Determination of Design Carrier

Based on expert interviews and questionnaire analysis, using coasters as a design medium for Dai paper-cutting patterns in cultural and creative products highlights the perfect unity of cultural inheritance and innovative use. The design carrier is not only the material foundation of the connotation of cultural elements and innovative concepts, but also has a decisive impact on cultural and creative products. This research mainly takes the coaster as the design carrier, which can show the uniqueness of the Dai paper-cutting pattern. The application of Dai paper-cutting patterns to coasters not only effectively spreads its unique national cultural connotation, but also enhances the decorative effect of coasters and integrates Dai cultural elements into modern life. The portability of coasters can also make it an ideal choice for promoting cultural and creative products, thus further promoting the spread of Dai culture. In addition, the flat material of the coaster (such as ceramic or acrylic) can well show the hollow lines of paper cutting and echo it. Therefore, coasters are undoubtedly the carrier of Dai paper-cut pattern cultural creative products. After screening and selecting the design carrier, we finally innovated and designed a cultural creative product featuring Dai paper-cutting patterns.

Secondly, Dai paper-cut patterns can also be derived from clothing products and home decorations, such as scarves, canvas bags and pillows. These derivative products have diverse material elements, flexible shapes and strong decorative properties, and can also effectively spread the cultural value and aesthetic connotation of paper-cut patterns. These products can be widely used in daily life, including a variety of life scenarios such as office, travel, leisure, etc. They can not only naturally reflect the aesthetic taste of users in life, but also broaden the scope of dissemination of Dai paper-cutting patterns, and can better realise the dissemination channels and organic integration of traditional culture and modern life. . Through these cultural and creative products, paper-cutting art is not only a work of art on the wall, but also a part that can be seen, used, practical and worn in daily life.

4.3.3.2 Design Concept

This design focusses on investigating user needs through expert interviews and analysis, and applying the innovative patterns of Dai paper-cutting art (an intangible cultural heritage) to the two carriers of coasters and silk scarves, so as to realise the transformation from the form of watching art to the aesthetics of life practice.

1.Choosing the design concept for coasters:

The combination of cultural images: the shape of the round group flower on the coaster forms a natural echo with the classic "group flower" pattern in Dai paper cutting. The deconstruction of the group flower pattern symbolises consummation, harmony and unity in the cultural connotation. Among them, the continuous lines of

the centripetal graph structure are perfectly combined with the round edges of the coaster, which can show a stable and complete visual image. However, as daily necessities, coasters as tea sets can evoke people's sense of leisure, elegance and tranquillity. This is unified with the core values of the Dai nationality in attaching importance to nature and pursuing a harmonious life. When the teacup is placed on a coaster decorated with Dai paper-cutting patterns, it seems to have completed a link dialogue between the past and the present. Of course, it also adds a rustic cultural ritual to daily tea drinking and other behaviours.

Intangible cultural heritage is being integrated into daily life: we apply innovative Dai paper-cutting patterns to coasters, which is a more direct way to bring intangible cultural heritage from art galleries and museums to modern life. This allows users to experience the warmth of traditional culture in daily life, which can truly reflect the intangible cultural heritage protection concept of "seeing people, seeing things, and looking at life".

2. Choosing a design concept for the scarf:

About the art of silk scarves: Silk scarves are like flowing canvases. The soft material sense and elegant structural shape of silk scarves give the dynamic vitality of static Dai paper-cutting patterns. The rhythmic "S"-shaped curve is presented in the Dai paper-cutting pattern, which enhances the sense of rhythm of the overall pattern shape.

The structural carrier of the pattern: the scarf is a regular square space in terms of visual effects, which provides an ideal pattern display method for symmetrical structure and "S"-shaped pattern structure, and can also well correspond to the edge shape and the main pattern of the centre.

Cultural aesthetics: transform the symbols of ancient cultural elements into a contemporary fashion design language, and realise the dissemination of intangible cultural heritage aesthetics in the public domain.

3. Design concepts for other products:

The design of this series of innovative derivative products not only continues the innovative application of Dai paper-cutting patterns, but also integrates intangible cultural heritage into multi-dimensional life scenes. Canvas bags can regard paper-cut patterns as walking scenery, which is equivalent to moving cultural business cards in daily life; key chains perfectly display Dai innovative patterns in exquisite and compact forms; refrigerator stickers inject artistic atmosphere into the home living space, capturing the unique beauty of Dai paper cutting; pillows are in terms of material , analyse the paper-cut hollow pattern with soft fabric to add a warm atmosphere to modern home life; these derivative products have realised the innovative and practical transformation of Dai paper-cut patterns in contemporary life.

4.3.3.3 Color Element Extraction

In terms of color extraction, through field investigation and extensive collection of relevant data, it was found that Dai paper-cutting art usually uses a single color as its main color element. Based on these colors, it originates from the Dai regional natural and life aesthetics, and echoes the cultural core of the Dai people who live in nature and integrate life into art through the language of color. Based on the relationship between "signifier" and "signified" in Saussure's semiotic theory, we analyze the color system of Dai paper-cutting as follows. Color serves as a visual symbol here; its physical representation using CMYK values is the "signifier," while the cultural concepts and emotions it carries are the "signified," together forming a complete symbolic system. These colors are used as the main color scheme for the coaster design to reflect the unique charm and cultural connotations of Dai paper-cutting.

Table 18

Color Extraction Table for Dai Ethnic Paper-cutting Patterns

Color coding (CMYK)	**Color diagrams**	**Visual attributes (signifier)**	**Cultural meaning (signified)**
C:53%M:69%Y:83%K:16%		Low saturation, simple and natural.	The landscape, palm bark, and wooden architecture embody the cultural concept of using nature as the primary material.
C:45%M:83%Y:72%K:7%		It has a reddish tint and a sense of depth.	It echoes the colors of traditional artifacts and architecture, reflecting the cultural connotations of life's accumulation and nature.
C:10%M:23%Y:44%K:0%		Light and translucent, with a warm tone, soft and not glaring.	Corresponding to rice paddies and bamboo woven objects, it conveys the simple pursuit of agricultural life and everyday aesthetics.
C:57%M:95%Y:33%K:0%		High saturation, leaning towards magenta, bright and vibrant, with strong	Regional ecological vitality and life force.

		recognizability.	
C:0%M:0%Y:0%K:100%		Extremely dark tone, sharp and clean lines, strong sense of line, and striking contrast.	Echoing the traditional technique of charcoal drawing, it symbolizes the sense of order and precision in the craft.
C:0%M:0%Y:0%K:0%		Extremely bright tone, clean and transparent, strong white space, and a balance between solid and void.	Based on the natural color of paper, it embodies an artistic thinking that blends the real and the virtual.

Note: Drawn by the author.

4.3.3.4 Coaster Design Scheme

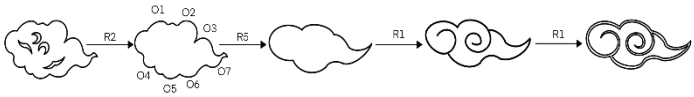
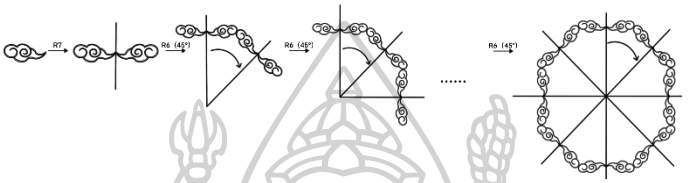
Referring to the example derivation rule diagram above, select an initial pattern from each of the four themes according to the numbering order (e.g., A1, B1, C1, D1). Subsequently, the numbered patterns are first subjected to generative rules for preliminary deduction, and new graphics are derived and then further refined using derivational rules; finally, all the deduction results are innovatively integrated and color elements are added to form the final graphic. In terms of composition, the orderly "○" shape is used as the outer contour to create innovative combinations of single-pattern graphics, as shown in the image below. By applying the basic rules of shape grammar and the aesthetic principles of composition, elements are cleverly rearranged and combined to ultimately create a graphic art with a clear theme and balanced layout in paper-cutting patterns. While translating designs using shape grammar, we follow the principles of formal beauty, such as harmony, balance, contrast, unity, proportion, and rhythm, to innovatively reorganize the basic units of the newly generated patterns.

Option 1: Taking cloud pattern A1, elephant pattern B1, bodhi leaf pattern C1, and square pattern D1 as examples, we will conduct a deduction.

1. First, delete the cloud pattern A1 using the deletion command R2; then use the fine-tuning command R5 to process the curves of O1-O7; finally, use the addition command R1 twice to form the pattern N1. The derivation rules of N1 are deduced. First, N1 is mirrored by command R7; then rotated 45° clockwise by command R6; finally, the pattern P1 is obtained by performing 7 copy rotation commands.

Table 19

Cloud Pattern Deduction Process Table

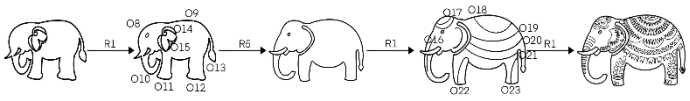
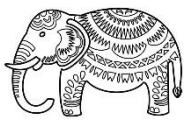
Cloud Pattern A1	Deduction process	Deduction results and numbering
A1 Generative Deduction		 N1
A1 Generative Deduction		 P1

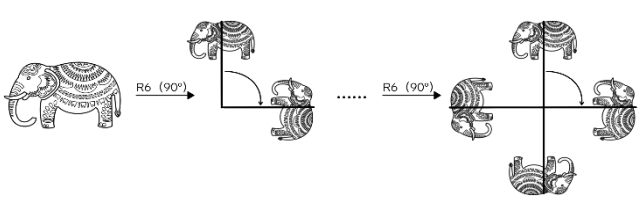
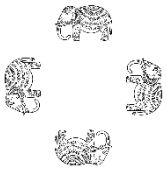
Note: Drawn by the author.

2. Add the pattern B1 using the R1 instruction; use the R5 instruction to perform curve processing on O8-O15; then use the R1 instruction to add the basic pattern to the O16-O23 line segment to form the pattern N2. The derivation rules of N2 are deduced, and N2 is rotated 90° clockwise; finally, the pattern P2 is obtained by copying the rotation command 3 times.

Table 20

Table of Elephant Pattern Deduction Process

Elephant Pattern B1	Deduction process	Deduction results and numbering
B1 Generative Deduction		 N2

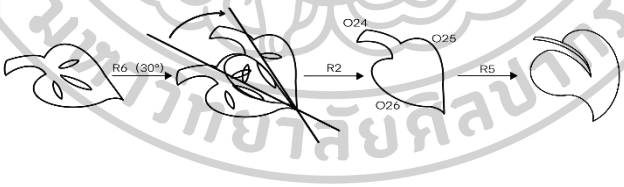
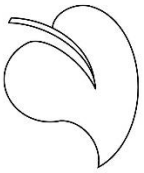
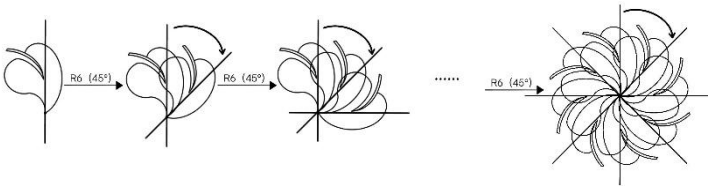
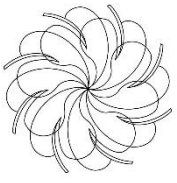
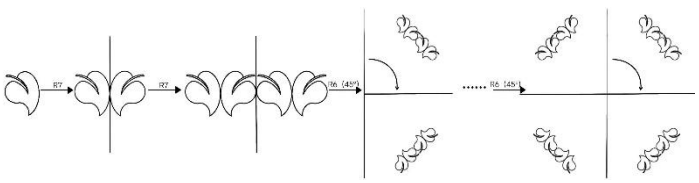
N2 Derivative Deduction		 P2

Note: Drawn by the author.

3. First, rotate the Bodhi leaf pattern C1 by 30° clockwise using the rotation command R6; then use the delete command R2; finally, use the fine-tuning command R5 to process the curves of O24-O26 to form the pattern N3. The process involves two iterations of N3. First, N3 is rotated using the command R6. Then, N3 is rotated 45° clockwise. Finally, the rotation command is copied 7 times to obtain the pattern P3. The second time, N3 is mirrored twice using the R7 command; then the rotation command R6 is used to rotate it 45° clockwise; finally, the pattern P4 is obtained by performing three copy rotation commands.

Table 21

Bodhi Leaf Pattern Derivation Process Table

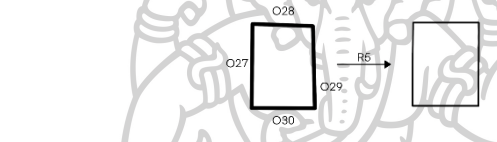
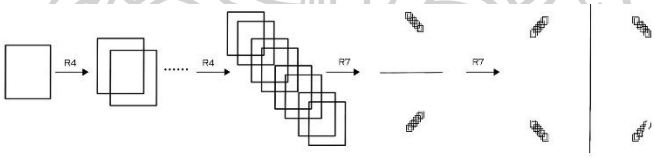
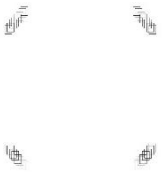
Bodhi leaf patternC1	**Deduction process**	**Deduction results and numbering**
C1 Generative Deduction		 N3
N3 Derivative Deduction		 P3
N3 Derivative Deduction		 P4

Note: Drawn by the author.

4. Fine-tune the square pattern D1 with command R5, and perform curve processing on O27-O30 to form pattern N4. The derivation rules of N4 are deduced. First, N4 is copied by instruction R4, and the pattern is obtained by copying and translating 7 times. Then, the pattern P5 is obtained by using the mirror instruction R7.

Table 22

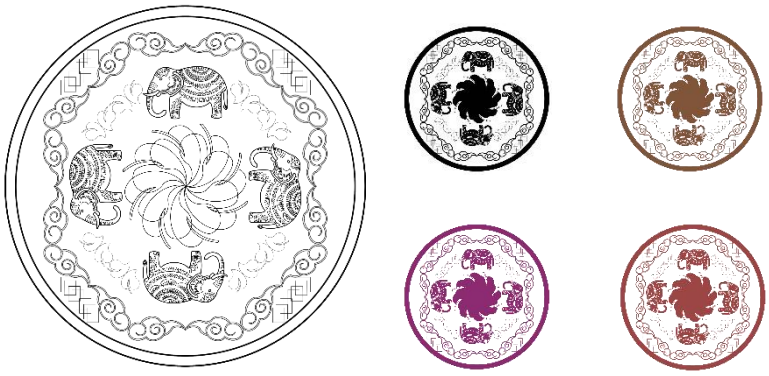
Table of square pattern derivation process

Square Pattern D1	Deduction process	Deduction results and numbering
D1 Generative Deduction		
N4 Derivative Deduction		N4  P5

Note: Drawn by the author.

The generated patterns P1, P2, P3, P4, and P5 are used as core units, and are systematically integrated using a circular framework and monochrome color scheme. By utilizing the natural sense of order and centripetal unity of the circle, the various pattern units are creatively arranged and combined within this outline.

Figure 22



Scheme 1 Graphical Composition

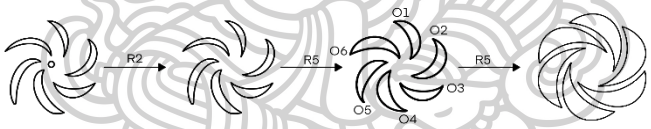
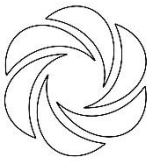
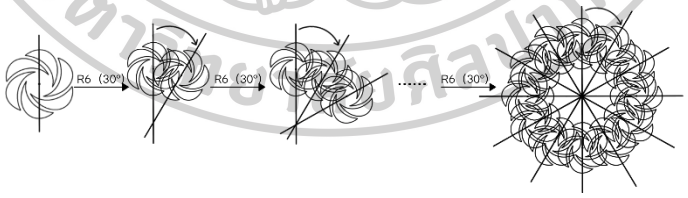
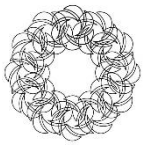
Note: Drawn by the author.

Option 2: Taking the swirling pattern A2, peacock pattern B2, lotus pattern C2, and triangle pattern D2 as examples, we will conduct a deduction.

1. First, delete the swirl pattern A2 using the deletion command R2; then, use the fine-tuning command R5 to process the curves of O1-O6 to form pattern N5. Next, perform derivative rule deduction on N5, and then use the rotation command R6 to rotate N5 30° clockwise. Finally, perform 11 copy rotation commands to obtain pattern P6.

Table 23

Table of vortex pattern derivation process

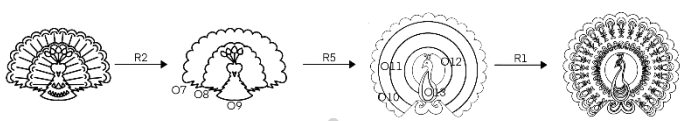
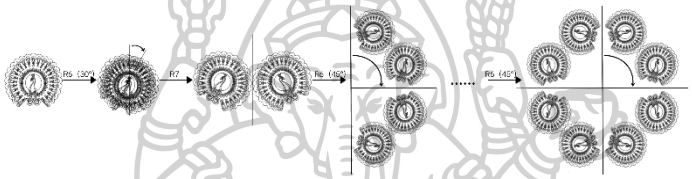
Swirl Pattern A2	**Deduction process**	**Deduction results and numbering**
A2 Generative Deduction		 N5
N5 Derivative Deduction		 P6

Note: Drawn by the author.

2. First, delete the peacock pattern B2 using the deletion command R2; then use the fine-tuning command R5 to process the curves of O7-O9; finally, use the addition command R1 to add basic patterns to the line segments O10-O13, forming pattern N6. The derivation rules are derived from N6. The rotation command R6 is applied to N6, rotating it 30° clockwise. Then the mirror command R7 is applied. Then the rotation command R6 is applied again, rotating it 45° clockwise. Finally, the rotation command is applied 3 times to obtain the pattern P7.

Table 24

Peacock Pattern Derivation Process Table

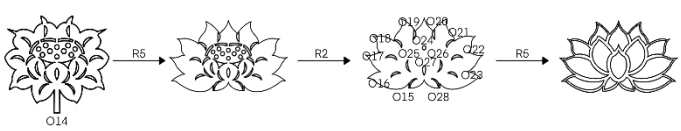
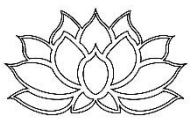
Peacock Pattern B2	Deduction process	Deduction results and numbering
B2 Generative Deduction		 N6
N6 Derivative Deduction		 P7

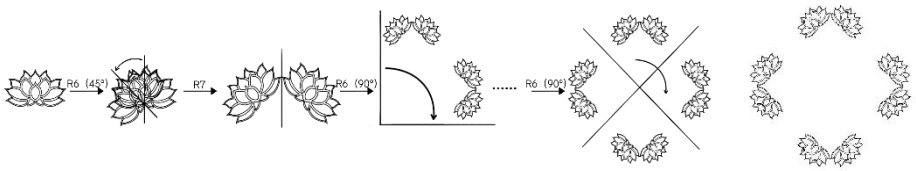
Note: Drawn by the author.

3. First, use the fine-tuning command R5 to process the curve of point O14 on the lotus pattern C2; then use the delete command R2; and then use the fine-tuning command R5 again to process the curve of points O15-O28 to form pattern N7. The derivation rules of N7 are deduced. First, rotate N7 by R6, rotating it 45° counterclockwise; then mirror it by R7; rotate it 90° clockwise by R6 again; finally, perform three copy rotation commands to obtain pattern P8.

Table 25

Lotus Pattern Derivation Process Table

Lotus pattern C2	Deduction process	Deduction results and numbering
C2 Generative Deduction		 N7

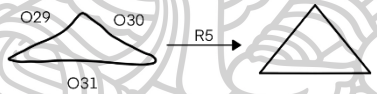
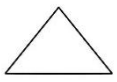
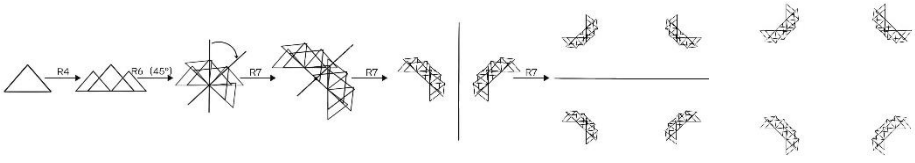
N7 Derivative Deduction		P8

Note: Drawn by the author.

4. Use the fine-tuning command R5 to adjust the triangular pattern D2, and perform curve processing on O29-O31 to form the pattern N8. The derivation rules of N8 are deduced. First, N8 is copied and scaled using the copy instruction R4 to obtain the pattern. Then, the rotation instruction R6 is used to rotate it 45° clockwise. Next, the mirror instruction R7 is used to mirror and flip it around the point. Finally, the mirror instruction R7 is used twice to obtain the pattern P9.

Table 26

Triangle Pattern Derivation Process Table

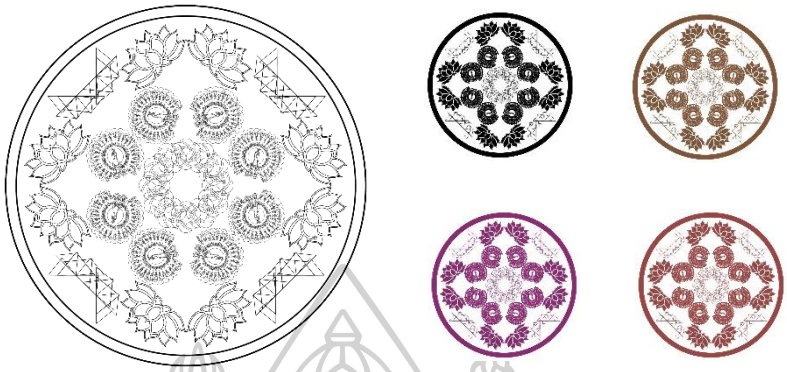
Triangle pattern D2	**Deduction process**	**Deduction results and numbering**
D2 Generative Deduction		 N8
N8 Derivative Deduction		P9

Note: Drawn by the author.

The derived patterns P6, P7, P8, and P9 will be systematically integrated and their colors applied within a circular framework.

Figure 23

Scheme 2 Graphic Composition



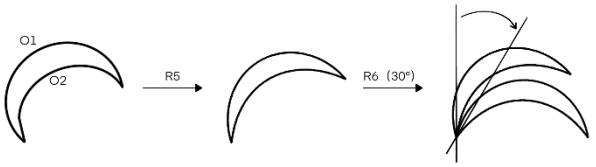
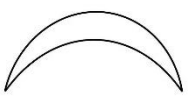
Note: Drawn by the author.

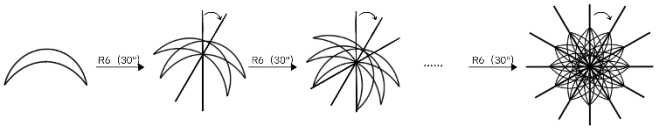
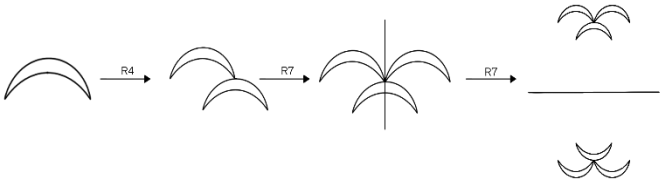
Option 3: Taking crescent moon pattern A3, butterfly pattern B3, gardenia pattern C3, and circular pattern D3 as examples, we will conduct a deduction.

1. First, use the fine-tuning command R5 to adjust the crescent pattern A3, then process the curves of O1 and O2, and finally use the rotation command R6 to rotate 30° clockwise to form the pattern N9. Two derivative rule derivations are performed on N9. In the first step, N9 is rotated 30° clockwise using rotation command R6. Finally, 11 copy rotation commands are performed to obtain pattern P10. In the second step, N9 is copied using command R4 and then mirrored using command R7 to obtain pattern P11.

Table 27

Crescent Moon Pattern Deduction Process

Crescent Moon Pattern A3	**Deduction process**	**Deduction results and numbering**
A3 Generative Deduction		 N9

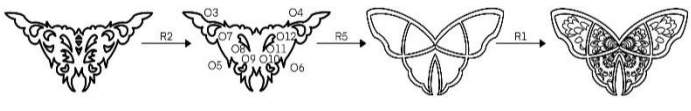
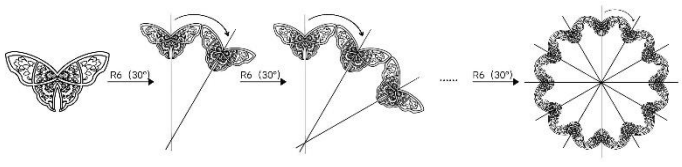
N9 Derivative Deduction		P10
N9 Derivative Deduction		P11

Note: Drawn by the author.

2. First, use the delete command R2 to delete the butterfly pattern B3; then use the fine-tuning command R5 to process the curves of O3-O12; finally, use the add command R1 to add the basic pattern within the frame, forming pattern N10. The derivation rules of N10 are deduced, N10 is rotated 30° clockwise, and finally the pattern P12 is obtained by copying the rotation command 11 times.

Table 28

Butterfly pattern derivation process

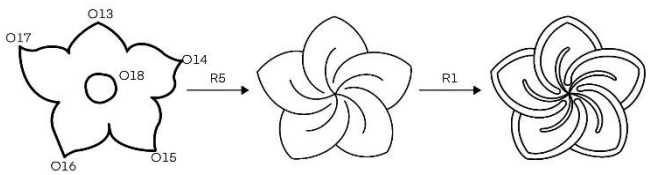
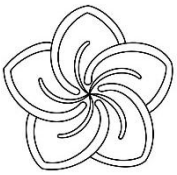
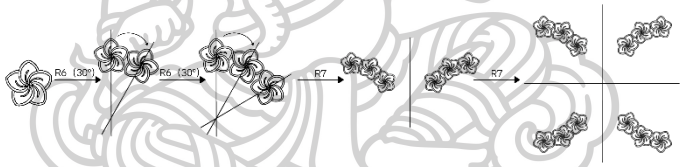
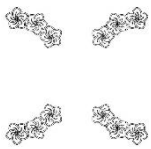
Butterfly Pattern B3	**Deduction process**	**Deduction results and numbering**
B3 Generative Deduction		N10
N10 Derivative Deduction		P12

Note: Drawn by the author.

3. First, use the fine-tuning command R5 to process the curves of points O13-O18 on the gardenia pattern C3; then use the increase command R1 to form the pattern N11. The derivation rules of N11 are deduced. First, rotate N11 by R6, rotating it 30° clockwise twice; then perform two mirror commands R7 to obtain pattern P13.

Table 29

Derivation process of gardenia pattern

Gardenia pattern C3	**Deduction process**	**Deduction results and numbering**
C3 Generative Deduction		 N11
N11 Derivative Deduction		 P13

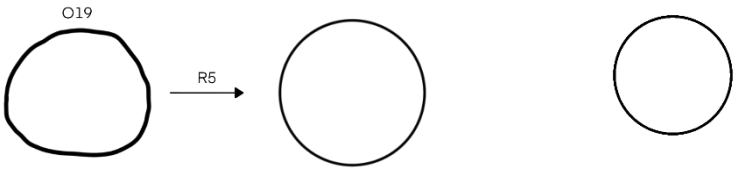
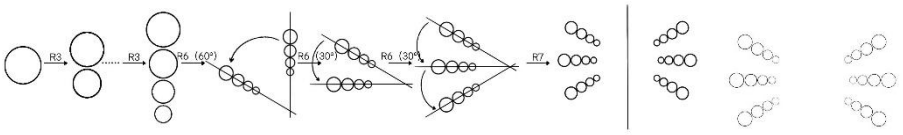
Note: Drawn by the author.

4. Use the fine-tuning command R5 to adjust the triangular pattern D3, and perform curve processing on O19 to form the pattern N12. The derivation rules of N12 are deduced. First, N12 is copied and scaled using the copy instruction R4 to obtain the pattern. Then, the rotation instruction R6 is used to rotate it 60° counterclockwise to obtain the pattern. Next, the rotation instruction R6 is used to copy and rotate it counterclockwise twice. Finally, the mirror instruction R7 is used to mirror and flip the pattern to obtain P14.

Table 30

Circular Pattern Derivation Process

Circular Pattern D3	**Deduction process**	**Deduction results and numbering**

D3 Generative Deduction	
N12 Derivative Deduction	

Note: Drawn by the author

The derived patterns P10, P11, P12, P13, and P14 are systematically integrated and color-coordinated using a circular framework.

Figure 24

Scheme 3 Graphic Composition

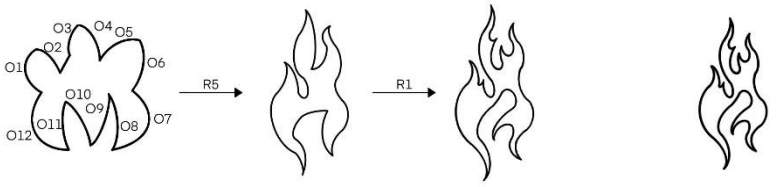
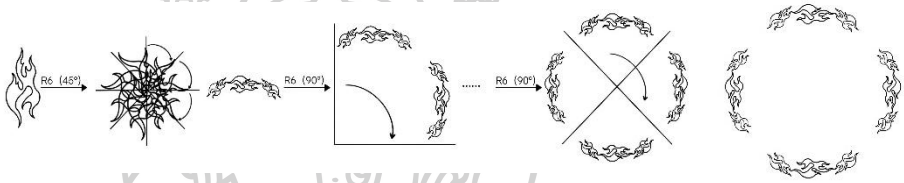
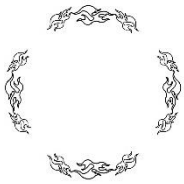
Note: Drawn by the author.

Option 4: Taking flame pattern A4, horse pattern B4, rose pattern C4, and heart pattern D4 as examples, we will conduct a deduction.

1. Use the fine-tuning command R5 to adjust the flame pattern A4, and perform curve processing on O1-O12; then use the add command R1 to add lines to the edge of the graphic to form the pattern N13. Perform derivation of rules for N13, use rotation command R6 to rotate N13 45° clockwise 3 times to obtain the pattern; then use rotation command R6 to rotate 90° clockwise, and finally perform 3 copy rotation commands to obtain the pattern P15.

Table 31

Flame Pattern Deduction Process

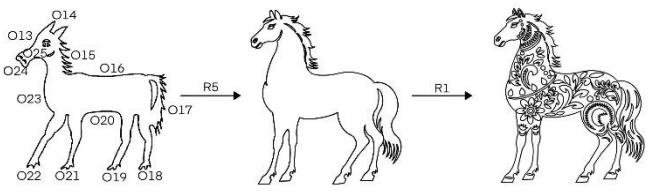
Flame Pattern A4	Deduction process	Deduction results and numbering
A4 Generative Deduction		N13
N13 Derivative Deduction		 P15

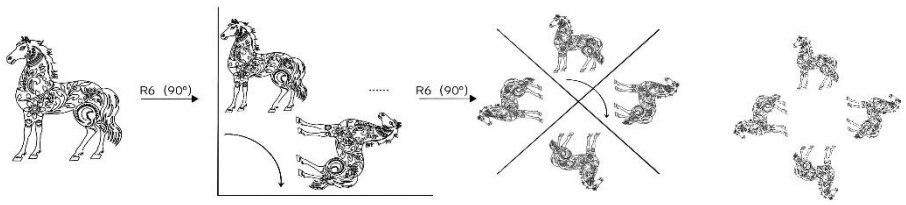
Note: Drawn by the author.

2. First, use the fine-tuning command R5 to adjust the horse pattern B4, and then perform curve processing on O13-O25; continue to use the add command R1 to add the basic pattern within the frame, forming pattern N14. The derivation rules of N14 are deduced, and the rotation command R6 is applied to N14 to rotate it 90° clockwise. Finally, the pattern P16 is obtained by copying the rotation command 3 times.

Table 32

The process of deducing the horse pattern

Horse stripe B4	Deduction process	Deduction results and numbering
B4 Generative Deduction		 N14

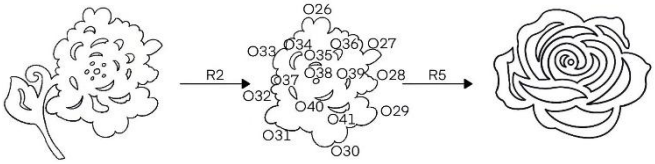
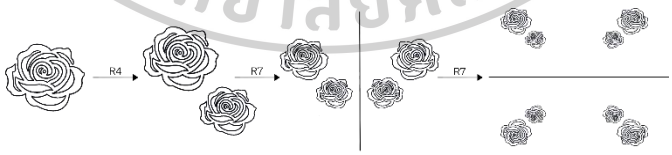
N14 Derivative Deduction		P16

Note: Drawn by the author.

3. First, delete the rose pattern C4 using command R2; second, use fine-tuning command R5 to process the curves of O26-O41 to form pattern N15. To deduce the derivative rules for N15, first perform a copy instruction R4 on N15; then use a mirror instruction R7 to mirror and flip around the axis, performing two mirror instructions R7 to obtain pattern P17.

Table 33

The derivation process of the rose pattern

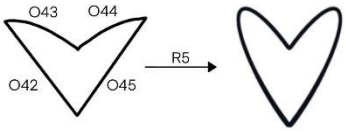
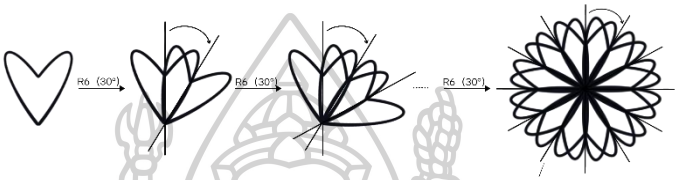
Rose pattern C4	**Deduction process**	**Deduction results and numbering**
C4 Generative Deduction		 N15
N15 Derivative Deduction		 P17

Note: Drawn by the author.

4. Fine-tune the heart-shaped pattern D4 with command R5, and perform curve processing on O42-O45 to form pattern N16. The derivation rules of N16 are derived, N16 is rotated 30° clockwise, and finally the pattern P18 is obtained by copying the rotation command 11 times.

Table 34

Heart-shaped pattern derivation process

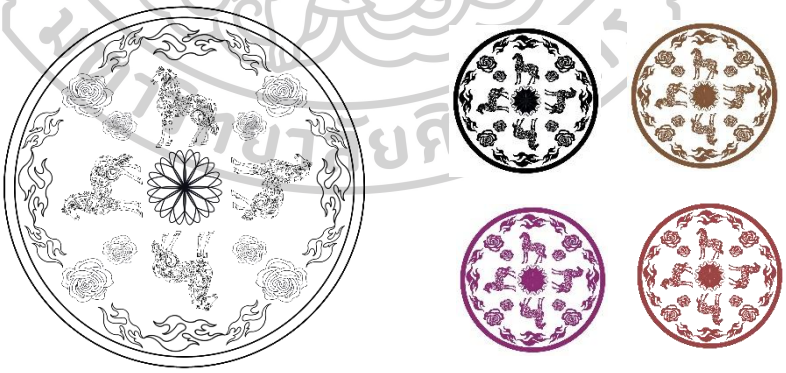
Heart-shaped pattern D4	**Deduction process**	**Deduction results and numbering**
D4 Generative Deduction		 N16
N16 Derivative Deduction		 P18

Note: Drawn by the author.

The derived patterns P15, P16, P17, and P18 are systematically integrated and color-coordinated using a circular framework.

Figure 25

Scheme 4 Graphic Composition



Note: Drawn by the author.

Table 35

Summary table of graphic associations of the scheme

Scheme Number	Texture Association	Meaning Association	Design Significance
Option 1	The soft and flowing lines of the cloud pattern, the steady and full outline of the elephant pattern, the simple and clear veins of the Bodhi leaf pattern, and the orderly straight lines of the square pattern, each with its own softness, stability, simplicity, and order, form complementary layers that are suitable for the design of the coaster.	The cloud pattern corresponds to the regional climate, the elephant pattern symbolizes steady labor, the Bodhi leaf pattern corresponds to the vegetation of the local villages, and the square pattern reflects the sense of order in architecture and artifacts. The combination of the four also illustrates the core of the Dai people's life: living in harmony with nature and making a living through labor.	By making practical objects cultural carriers that embody everyday atmosphere, traditional patterns can be transformed from artistic symbols into everyday necessities.
Option 2	The swirling pattern is presented as a dynamic curve in the form of a spiral; the peacock pattern has a more gorgeous and intricate feather texture; the lotus pattern has a simple and elegant petal outline; and the triangular pattern has stable tension. The visual effect is formed by dynamism, splendor, elegance and stability, making the coaster decorative.	The swirling pattern corresponds to the water source near the living area, the peacock pattern corresponds to the local iconic rare bird, the lotus pattern corresponds to the aquatic living environment, and the triangular pattern is taken from the form of objects and buildings. All four also interpret the ecological aesthetics of the Dai people's coexistence with nature.	Focusing on the unique regional ecology, the coasters showcase the beauty of Dai life, and through a balance of complexity and simplicity in the patterns, they adapt to modern aesthetics that value both decoration and cultural appeal.
Option 3	The crescent moon pattern is soft and simple, the butterfly pattern has light and symmetrical wings,	The crescent moon pattern corresponds to everyday landscapes, the butterfly pattern to the natural vitality of villages, the	By applying everyday aesthetics to coasters, users can experience

	showing a sense of agility, the gardenia pattern has unfolded petals, which are fresh and elegant, and the circular pattern has smooth lines. With softness, agility, elegance and roundness, they create a gentle atmosphere and have a friendly feel.	gardenia pattern to courtyard scenes, and the circular pattern to a harmonious and fulfilling life. These four patterns showcase the Dai people's aesthetic attitude towards daily life.	the gentleness of Dai life and see the everyday application of traditional patterns.
Option 4	The combination of flame-shaped arcs presents tension and passion, the horse pattern has a smooth and flowing outline, the rose pattern is delicate and gorgeous, and the heart pattern corresponds to friendliness and warmth. The combination of tension, movement, splendor and warmth creates an atmosphere and enhances the visual appeal of the coaster.	Flame patterns correspond to the warmth and vitality of life, horse patterns symbolize success, rose patterns represent the embellishment of life, and heart patterns convey the affinity and warmth of interpersonal relationships. All four illustrate the Dai people's warm and hardworking spirit.	By combining vibrant patterns, the distance between traditional patterns and modern culture is narrowed, and the adaptability of cultural dissemination is enhanced.

Note: Drawn by the author.

4.3.3.5 Scarf Design Scheme

This series of innovative design scarves is based on the aesthetics of traditional graphic structure, and uses modern design language for deduction and reconstruction. In terms of composition, the structure adopted is a centripetal layout pattern structure, and the core pattern is first placed in the visual focus of the scarf. The cascading effect pattern surrounding the core pattern creates a convergence or divergence effect, naturally guiding people's eyes to move to the centre of the pattern. At the same time, the symmetrical diagram structure constructs an overall framework, and the decorative pattern elements on both sides of the central axis correspond to each other. Use small details to hide in this stability and balance, and then give the pattern the rhythm of the combination of movement and tranquillity. The edge is cleverly

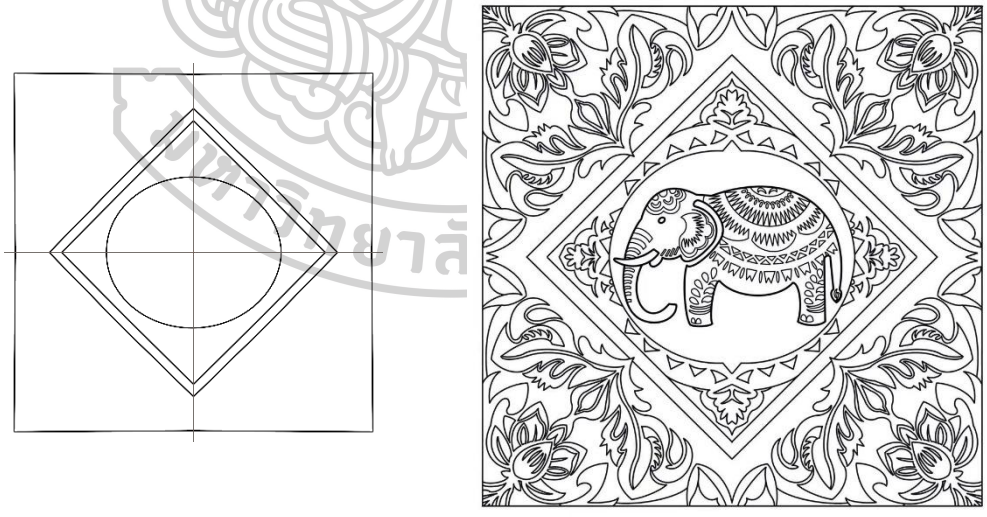
integrated with the natural plant category pattern, which is perfectly combined with the square outer contour of the scarf, thus further strengthening the integration of the overall pattern structure and paper-cutting style.

In terms of the pattern innovation design of the scarf, we extract the representative pattern elements from the classification subject of Dai paper-cutting patterns, and construct a graphic visual framework with a sense of order and inclusiveness according to the outline shape of the scarf. Using the translation, rotation and mirroring rules in the shape grammar theory, the extracted pattern units are reconstructed with rules and aesthetics. While following the principle of formal beauty, we also emphasise the rhythm, contrast and balance of pattern patterns, and finally form a scarf pattern pattern with unified scheme and harmonious pattern layout.

In terms of colour, the design is inspired by the colour elements of Dai paper cutting. By adjusting the colour saturation appropriately, it creates a rich sense of visual hierarchy. This design technique not only inherits the cultural heritage of paper-cutting art, but also gives the silk scarf a modern aesthetic value, making it a mobile carrier of intangible cultural heritage aesthetics.

Figure 26

Graphic Composition 1



Note: Drawn by the author.

Schematic structure: symmetrical structure, centripetal structure.

Figure 27

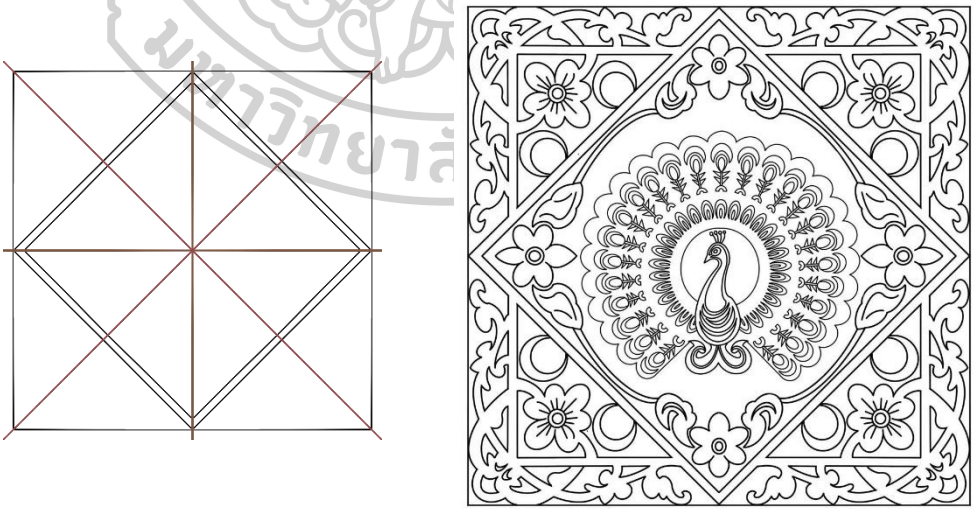
Graphic Composition 2

Note: Drawn by the author.

Schematic structure: symmetrical structure, centripetal structure.

Figure 28

Graphic Composition 3

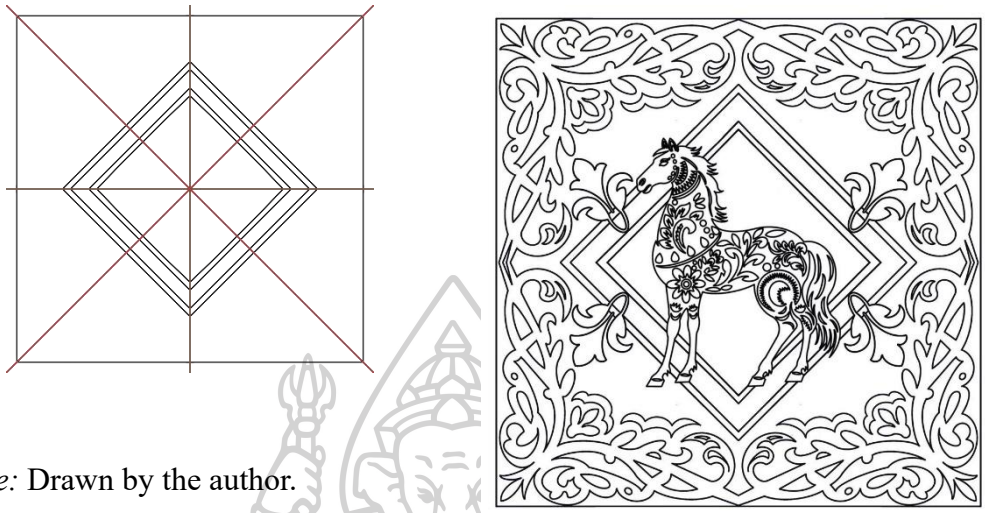


Note: Drawn by the author.

Schematic structure: symmetrical structure, centripetal structure.

Figure 29

Graphic Composition 4



Note: Drawn by the author.

Schematic structure: symmetrical structure, centripetal structure.

Figure 30

Color application

Note: Drawn by the author.

4.4 Innovative Pattern Derivative Applications Showcase

Cultural and creative products have a variety of forms and styles, occupying a major position in the modern consumption market, truly linking traditional culture with the needs of young consumers. According to the preliminary research and analysis in the early stage, this research mainly focusses on the innovative design practice of Dai paper-cut pattern patterns, mainly with coasters and silk scarves as application carriers, and supplemented by a series of other types of derivative products such as other creative bags, refrigerator stickers and key chains. Coasters and scarves, as the main product categories, have become ideal mediums for Dai paper-cutting patterns and their cultural connotations due to their moderate display area and adaptability. Meanwhile, auxiliary products such as creative bags, refrigerator magnets, and keychains, with their flexible and lightweight characteristics, can effectively expand the coverage of cultural dissemination and consumer groups. These products have strong practicality and high contact rate, which can effectively meet the actual needs of target users, allowing intangible cultural heritage patterns to be naturally integrated into modern life scenarios, thereby verifying the feasible path of transforming them from "cultural heritage" to "design resources".

Figure 31

Coaster design

Note: Drawn by the author.

Figure 32

Silk scarf effect pictures

Note: Drawn by the author.

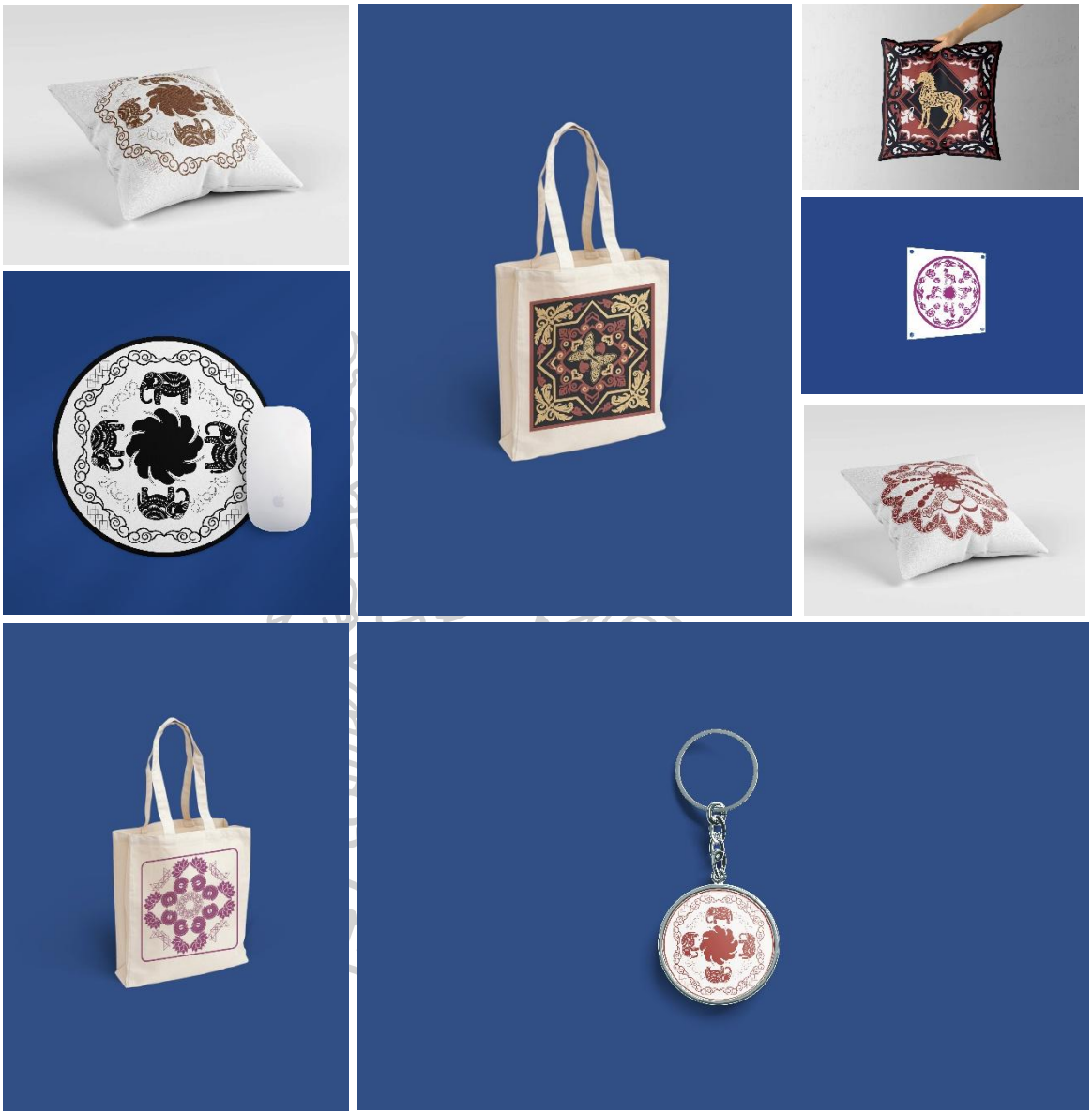
Figure 33

Canvas bag renderings

Note: Drawn by the author.

Figure 34

Other derivative designs include: mouse pads, refrigerator magnets, and cushions.



Note: Drawn by the author.

4.5 User Feedback on Innovative Patterns in Dai Ethnic Paper-cutting Cultural and Creative Products

To assess the cultural and market acceptance of the final products of this innovative design of Dai paper-cutting patterns, five respondents with different backgrounds were invited to experience the core products, scarves and coasters, as

well as derivative products such as canvas bags and refrigerator magnets. Their feedback was summarized and compiled into a table.

Table 36

User Feedback Form for Innovative Cultural and Creative Products Featuring Dai Ethnic Paper-cutting Patterns

Respondent's identity	Feedback on core products	Overall impressions and suggestions for the series
Paper-cutting intangible cultural heritage inheritor (62 years old)	The silk scarves resemble cultural display panels. This series cleverly incorporates Dai paper-cutting patterns into the composition, demonstrating excellent symbolic translation and highlighting its research value.	Small decorative paintings retain the purity of art. It is recommended to include a small cultural story card with each product to enhance its educational function.
Design student (23 years old)	The patterns are well-coordinated; for example, the combination of elephant and cloud patterns creates a clear sense of depth and texture, resulting in a delicate and highly recognizable design when transferred onto the silk scarf. The design clearly incorporates Dai ethnic elements; the pairing of bodhi leaf and square patterns enhances the cultural feel and embodies traditional beauty.	You could include some instructional cards to help more people understand. You could also unify the color scheme, using color schemes based on themes, etc., to make it more widely compatible.
Ethnic culture enthusiasts（30 years old）	You can see the specific patterns such as butterfly and lotus, and the dynamic feeling of the butterfly pattern is more obvious when it is displayed on the silk scarf. You can feel the inner culture of the Dai people who live in harmony with nature. The patterns are not just simple accumulations, but also	This is a modern application of intangible cultural heritage. The entire series starts from the cultural core and translates it into contemporary design, with a clever product layout. I look forward to seeing more series developed on themes such as Dai festivals, songs, and myths.

	a cultural transmission of life scenes.	
Young consumer (26 years old)	The patterns on the silk scarf are easily recognizable whether tied around the neck or hung on a bag. Coasters are more than just cup mats; they are exquisite pieces of tabletop art, and I'm inclined to buy them.	The canvas bag is quite versatile, and I'd appreciate it if it came in other colors and styles. The fridge magnets are small and cute. A trial set containing all the small items would probably be even more appealing.
Household everyday consumer (41 years old)	Coasters are the most practical; you can use them right away after buying them, and their patterns make for great conversation starters. Silk scarves, on the other hand, are more of a meaningful gift for yourself or family. They have a natural, soft feel and pleasing patterns.	We can launch larger sizes of silk scarves, which are more convenient to use as shawls. We can also launch matching small accessories such as hair ties with the same pattern, and make them into sets.

Note: Drawn by the author.

In conclusion, based on the feedback from various aspects, it can be seen that the innovative design of the Dai paper-cutting pattern has successfully achieved its intended goals:

Cultural recognition: Experts acknowledge the accuracy of the cultural translation.

2. Popular on an artistic level: The aesthetic appeal and fashion sense of the design have been recognized by young consumers and the market.

3. Commercial value level: The product demonstrates a clear market positioning.

4. In terms of educational and dissemination functions: It effectively stimulated the general public's interest in gaining a deeper understanding of Dai culture.

Chapter 5

Conclusion, Discussion and Recommendations

5.1 Conclusion

This study focuses on the Dai paper-cutting art in Dehong Prefecture against the backdrop of the innovative development of intangible cultural heritage. By systematically applying semiotics, schematism, and shape grammar theory, a complete research path from "cultural decoding" to "design encoding" was constructed, effectively addressing the two core research questions of how to analyze and promote Dai paper-cutting and how to achieve its contemporary transformation.

5.1.1 Conclusions based on the systematic review of traditional elements: A cultural connotation system of Dai paper-cutting based on semiotics and schematism was constructed.

This study first systematically sorted out the traditional elements of Dehong Dai paper-cutting through literature review and field investigation. This process was not a simple compilation of data, but rather the construction of a two-layer deconstruction model of symbols and diagrams, achieving an in-depth analysis from visual appearance to cultural core.

At the theoretical level of semiotics, this study mainly establishes the Dai paper-cut pattern pattern into a complete symbol system of cultural elements. First of all, starting from the direction of "can point", this study deeply and systematically analyses the theme, traditional colours, pattern structure and paper cutting techniques of Dai paper-cutting patterns, and explains the basic visual structure units of paper cutting. Starting from the direction of "referring to", this study analyses the cultural connotation and characteristics of Dai paper-cut pattern patterns, and explores the factors affecting these patterns and the value of their research. For example, in addition to its external beauty, the interpretation of "peacock pattern" symbolises auspiciousness and nobility, reflecting the cultural identity of the Dai nationality.

At the level of schematic composition, the stable and unique structural organisation logic of Dai paper-cutting patterns can be summarised. Its composition form often follows the principles of central symmetry and centripetal composition, so that the picture is full and leaves very little white, and it also reflects the aesthetic way of paper-cutting artists who pursue integrity, harmony, unity and vitality.

This study has successfully transformed the scattered Dai paper-cut pattern elements into a structural logical visual database with verifiable and cultural value. This traditional cultural decoding work not only answers the question of how to

analyse these elemental patterns, but more importantly, it also provides a solid cultural foundation for subsequent innovative design practises.

5.1.2 Conclusions regarding "Integration, Innovation, and Modern Transformation": A design path for innovative use of traditional patterns, centered on shape grammar, has been formed.

Based on the systematic review of traditional cultural elements, the main core innovation of this study is to introduce shape grammar as a methodological tool according to the theory, and to successfully transform traditional patterns into modern innovative designs. Transformation logic: Shape grammar generates evolutionary rules such as addition, copying, rotation and mirroring according to the preset deration rules, and adds theoretical and logical methods to the creation of paper-cutting patterns. For example, in this study, the crescent pattern is extracted as the initial pattern element, and then through a series of derivative rules, namely scaling, rotation and replication rules, a new pattern pattern that can not only retain the characteristics of the crescent pattern, but also has a modern composition structure and a sense of rhythm is generated.

Re-case study and data analysis support: The effectiveness of this research method has been verified in innovative design practice. In the design of coasters, the survey data of relevant target users shows that 69% of the respondents believe that "clear expression of cultural elements" is important. Through the study of theoretical shape grammar, the traditional cloud pattern pattern is deduced and reorganised, and the final pattern innovation design has been confirmed in the subsequent evaluation that it can meet the dual requirements of Dai cultural recognition and modern simple aesthetics at the same time.

This study confirms that shape grammar can be used as a bridge to achieve the creative transformation and innovative development of traditional Dai paper-cutting patterns. This method ensures that innovative results are not simply a patchwork of symbols, but rather logical methodological rules derived from the core of traditional culture, perfectly matching the core requirements of the research objective of both carrying traditional culture and conforming to modern aesthetics.

5.1.3 Regarding the conclusion on "Promoting Innovative Development and Application Expansion": It verifies the feasibility of applying innovative patterns in multiple fields and points out future directions.

The ultimate value of theoretical research lies in guiding practice. This study, through a series of design practices, successfully expanded the innovative Dai paper-cutting patterns to multiple application areas.

Application areas expanded: The research results have been successfully extended from traditional scenarios to the field of modern life aesthetics. Specific practices include: cultural and creative products: the development of a series of coasters, scarves, and creative canvas bags, etc. The scarf design features a centripetal composition, and user surveys show that 67.75% of respondents value the artistic quality and cultural recognizability of its patterns, demonstrating the role of innovative patterns in enhancing the cultural added value of products.

Interior space decoration: The successful application of paper-cutting innovative patterns on refrigerator stickers, decorative paintings and other products clearly shows its great potential as a decorative pattern element for modern home and indoor space.

The innovative design application exploration of this research is in line with the current trend of national trend design emphasising the depth of cultural meaning rather than cultural surface symbols, which should be in line with the current research situation. In addition, the generated digital pattern library has laid the foundation for the development of virtual scene visits, digital collections or virtual clothing in the future, and also conforms to the direction of digital inheritance of intangible cultural heritage.

This research not only puts forward a series of specific design schemes, but more importantly, it explores and verifies the complete innovation chain from cultural research to product realisation and future digital applications. This proves that the innovation of Dai paper cutting is not limited to the craft itself. As a unique national cultural connotation, its core pattern can truly penetrate into all aspects of contemporary life through modern design methods, so as to realise the real upgrading and revival of culture.

5.2 Discussion

5.2.1 Similarities and Differences between Innovative Patterns and Design Cases in Dai Paper-cutting

By comparing the innovative design of Dai paper-cut pattern patterns and other pattern case studies, it can be found that their innovative paths are common with the times, and also show their own unique value and research depth.

1. Commonality: The logic of modern transformation of traditional patterns is consistent.

These designs have common core cultural roots, all of which are based on traditional patterns, intangible cultural heritage, ancient books, auspicious animals and regional symbols. They reject empty creation without cultural roots, which is essentially a contemporary revival of traditional culture. These innovative designs

adapt to modern life scenes, break the traditional pattern single scene display, and integrate them into stationery, fashion toys, gift boxes and other modern daily necessities. Innovative approaches are employed, adhering to the principles of retaining core recognizability while simplifying and recombining forms. This preserves the classic characteristics of traditional patterns while adapting them to modern aesthetics. Extending the value dimension, both cultural and practical value are realized. It not only inherits cultural connotations but also enables traditional patterns to generate contemporary communication power through productization and IP development.

2. Differences: The difference between the direction of transformation and the focus of attention.

Table 37

Differences between innovative patterns and design examples in Dai ethnic paper-cutting

Comparison Dimensions	**Innovation in Dai Paper-cutting Patterns**	**Commonalities in Design Cases**
Core Direction of Transformation	Focusing on the local nature, lifestyle, and craftsmanship of the Dai people, this approach emphasizes regional distinctiveness and artistic characteristics.	Covering diverse cultures including the imperial court, Dunhuang, and ancient books, emphasizing scenario-based, IP-driven, and accessible luxury commercial adaptability.
Scope of cultural carriers	It concentrates solely on natural, animal, plant, and geometric patterns in Dai paper-cutting, resulting in a highly focused cultural direction.	The diverse cultural sources include auspicious beasts from the Forbidden City, Dunhuang symbols, ancient book patterns, and intangible cultural heritage crafts, encompassing a wide cultural span and rich variety of types.
Emphasis on transformation methods	The design primarily optimizes pattern forms and uses symbolic colors, ultimately serving the innovative expression of the paper-cutting art itself.	Focusing on IP creation, cross-brand collaborations, and craft integration, the core service is commercial products, prioritizing commercial adaptability.
Depth of cultural expression	Based on the Dai people's philosophy of living in harmony with nature and the characteristics of their	The design emphasizes the lightweight integration of cultural symbols, pursuing rapid adaptation between

	paper-cutting craftsmanship, the cultural expression possesses greater depth and uniqueness.	culture and products, with a relatively broad cultural expression.

Note: Drawn by the author.

5.2.2 Theoretical and practical value of the research

Theoretical value: This study is the first to apply the semiotic perspective of "signifier" and "signified" and the theory of shape grammar to the study of Dehong Dai paper-cutting patterns, making up for the shortcomings of insufficient regional specificity and weak theoretical support in existing studies. Existing research on intangible cultural heritage patterns mostly focuses on intangible cultural heritage projects with a wide audience, such as those of the Miao and Yi ethnic groups. There is a lack of systematic research on Dehong Dai paper-cutting. The "theory-analysis-transformation" research framework constructed in this study can provide a methodological reference for the research on similar niche intangible cultural heritage patterns.

Practical Value: The innovative transformation path proposed in this study is highly feasible and its feasibility has been verified through the design practice of cultural and creative products. Compared with the existing Dai paper-cutting cultural and creative products in Dehong, which are mostly simple replicas of traditional patterns, the transformed works in this study are more in line with the aesthetic needs of young consumers. According to the "2023 Intangible Cultural Heritage Cultural and Creative Consumption Report," 72% of young consumers prefer intangible cultural heritage products that combine traditional elements with modern designs.

5.2.3 Alignment with Current Research Trends

1. Digital Transmission of Intangible Cultural Heritage: Under the trend of digital transmission, this study uses a database of traditional elements constructed through semiotics and schemata to lay the foundation for subsequent digital modeling and AI-generated design.

2. Application of interdisciplinary methodologies: Under the trend of interdisciplinary integration, intangible cultural heritage innovation has broken through the single design field and moved towards a diversified integration of "design + intangible cultural heritage + commerce". This study combines theories such as semiotics and schema with visual communication design, which is a manifestation of interdisciplinary thinking.

5.2.4 Research Limitations and Future Expansion Potential

This study still has some limitations: First, the sample scope focuses on paper-cutting works from core intangible cultural heritage workshops in Dehong region, and does not cover niche patterns from remote villages, so the comprehensiveness of the element analysis needs to be improved. Secondly, the innovative transformation practices mainly focus on visual communication design, with insufficient depth in the application of digital technologies (such as 3D printing and AR interaction), failing to fully align with the cutting-edge trend of "technology empowering intangible cultural heritage".

In the future, we can expand in the following ways: First, we can broaden the sample scope to include more Dai paper-cutting patterns from villages in Dehong Prefecture, enriching the database of traditional elements; Second, we can deepen digital applications by combining the transformed patterns with design tools such as AR to develop interactive cultural and creative products.

5.3 Recommendations

5.3.1 Recommendations for subsequent academic research

1. Deepen theoretical integration: It is recommended that subsequent research introduce cognitive psychology experiments to quantitatively assess the differences in user emotional resonance and cultural cognition of different innovative patterns, so as to make design decisions more scientific.

2. Conduct cross-regional comparative studies: carry out comparative studies on Dehong Dai paper-cutting, Xishuangbanna Dai paper-cutting, and even similar paper-cutting arts in Southeast Asian countries, to explore the uniqueness and commonality of Dai patterns from a broader perspective.

5.3.2 Recommendations for the inheritance and design practice of intangible cultural heritage

1. Jointly build a "pattern gene bank": It is recommended that cultural departments cooperate with universities and technology companies to jointly build an open "Dai paper-cutting digital pattern bank" with semiotic interpretations to provide designers with authoritative and rich creative materials.

2. Promote collaborative innovation among industry, academia, and research: Encourage design schools to establish long-term cooperation mechanisms with intangible cultural heritage workshops and cultural and creative enterprises. This will allow inheritors to deeply participate in the design process, ensuring the accuracy of the cultural core; and enable designers to introduce modern methods to enhance the

market competitiveness of products. For example, design workshops or competitions themed around Dai paper-cutting can be held regularly.

3. Expand application scenarios: In addition to the traditional field of graphic design, we should actively explore applications in broader fields such as digital media, interactive devices, clothing and textiles, and even architectural decoration.

APPENDIX

Supplementary page 1: IOC EXPERT EVALUATION AND ANALYSIS

RESULTS

Index of item objective congruence

Through the Index of item objective congruence and the applicability of research tools, the data collection is organized in the following table, and the experts' ratings in the per person section are as follows:

All variables and questionnaire questions in this study: An innovative design questionnaire based on Dai paper-cutting patterns from the perspective of intangible cultural heritage. To ensure consistency of each variable and question in the questionnaire, the thesis supervisor and three experts in related fields evaluated the questionnaire, including:

Expert1: Shao Meihan

Expert2: Nan Wenxiang

Expert3: Hun Hanzhen

The author uses index of Item Objective Congruence (IOC) to examine consistency between questions and objective or objective and content,it's can be calculate from formula:

$$IOC = \frac{\sum R}{N}$$

Where:

IOC=Consistency between questions and objective or objective and content.

$\sum R$ = Total assessment points that given from all qualified experts.

N= Number of qualified experts.

There are 3 levels of assessment point as follow:

Suitable (+1) means The questionnaire's questions are certainly consistent with the objective.

Not Appropriatences(0) means The questionnaire's questions are unsure to be consistent with the objective.

Not Suitabel(-1) means The questionnaire's questions are inconsistent with the objective.

The consistency index value must have the value of 0.5 or above to be accepted.

Index of ltem Objective Congruence (IOC) from three experts result are as followed:

QUESTIONNAIRE PART 1:

NO.	Expert1			Expert2			Expert3			Total Scores $\sum$	IOC $\frac{\sum R}{N}$	Data Analysis
	-1	0	1	-1	0	1	-1	0	1			
Q1			√			√			√	3	1	Acceptable
Q2			√			√			√	3	1	Acceptable
Q3			√			√			√	3	1	Acceptable
Q4			√			√			√	3	1	Acceptable
Q5		√				√			√	3	0.6	Acceptable
Q6			√			√			√	3	1	Acceptable
Q7			√			√			√	3	1	Acceptable
Q8			√			√			√	3	1	Acceptable
Q9			√			√			√	3	1	Acceptable
Q10			√			√			√	3	1	Acceptable
Q11			√			√	√			3	0.3	Reject
Q12			√			√			√	3	1	Acceptable
Q13			√			√			√	3	1	Acceptable
Q14			√			√			√	3	1	Acceptable
Q15			√			√	√			3	0.3	Reject

QUESTIONNAIRE PART 2:

NO.	Expert1			Expert2			Expert3			Total Scores ∑	IOC $\frac{\sum R}{N}$	Data Analysis
	-1	0	1	-1	0	1	-1	0	1			
Q1			√			√			√	3	1	Acceptable
Q2			√			√			√	3	1	Acceptable
Q3			√			√			√	3	1	Acceptable
Q4			√			√			√	3	1	Acceptable
Q5			√			√			√	3	1	Acceptable
Q6			√			√			√	3	1	Acceptable
Q7			√			√	√			3	0.3	Reject
Q8			√			√			√	3	1	Acceptable
Q9			√			√			√	3	1	Acceptable
Q10			√			√			√	3	1	Acceptable
Q11			√			√			√	3	1	Acceptable

IOC= $\frac{\sum R}{N}$

Where:

IOC= Consistency between questions and objective or objective and content.

∑R= Total assessment points that given from all qualified experts.

N= Number of qualified experts.

Therefore

IOC = $\frac{23.5}{26}$

=0.9

The value index of item objective congruence (IOC) assessment result of this questionnaire is equal to 0.9. There are Three questions which have IOC index less than 0.5.

The value of IOC is 0.9.

It is proved the questions in this questionnaire are consistent.

List of experts

Expert 1:Shao Meihan

Dai paper-cutting inheritor, a national intangible cultural heritage item

Expert 2: Nan Wenxiang

Dai folklore scholar and inheritor of the Jinshui stencil printing technique

Expert 3: Hun Hanzhen
Local-level intangible cultural heritage inheritor of Dai paper-cutting

Supplementary page 2: Index of Item Objective Congruence (IOC)

Questionnaire

Consideration, Evaluation, Suggestions

Research topic:

Innovative Designs of Dai Paper-cutting Patterns from the Perspective of Intangible Cultural Heritage

Researchers:

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Research objectives:

1. Systematically organize the traditional elements, patterns, compositions, and cultural value of Dai paper-cutting art.
2. Based on the analysis, complete the extraction and fusion of paper-cutting elements.
3. Promote the integrated and innovative development of paper-cutting and expand its practical application areas.

This study tool is used to answer the following research questions:

1. How can we analyze and promote Dai paper-cutting, an intangible cultural heritage?
2. How can the expressive forms of traditional Dai paper-cutting art be innovatively transformed in contemporary design?

Clarification:

+1=the question is appropriate

0=Not sure whether the question is appropriate. -1=the question is inappropriate

Tick(✓)in your comment box and write down suggestions for further improvement.

Part 1: Expert survey questionnaire

Questions in the questionnaire	Expert Options			Suggestions
	Appropriate (1)	Uncertain (0)	Inappropriate (-1)	
1. Your Gender: □ Male □ Female				
2. Your years of work experience: □ Less than 5 years □ 5-10 years □ 11-20 years □ More than 20 years				
3. Have you participated in the expert interview on "Dai paper-cutting" in the early stage of this study: □ Yes □ No				
4. Do you agree that it is necessary to innovate the traditional paper-cut pattern: □ Very much agreed □ Recognition □ General □ Disagree				
5. In order to more effectively demonstrate the artistic value of the paper-cut pattern, which of the following presentation methods would you suggest: □ Cultural and creative practical products, integrating paper-cut patterns into daily use scenarios				

□ Home decoration carrier, suitable for home or commercial space decoration □ Digital communication media, combined with modern technology to expand the display dimension				
6. You suggest applying the Dai paper-cutting pattern to cultural and creative products because: [Multiple choice question] □ Cultural and creative products are close to daily life and can make paper-cut patterns achieve "high-frequency dissemination" □ Cultural and creative products have a wide audience, which can expand the cognitive scope of Dai paper-cutting □ Cultural and creative products have commercial value □ The carriers of cultural and creative products are diverse, suitable for the visual presentation of paper-cutting patterns				
7. What do you think is the main advantage of using paper-cut patterns for cultural and creative products: [Multiple choice questions] □ Enhance cultural dissemination □ Enhance the artistic value of products □ Attract consumer attention				

□ Promote the modernization of traditional crafts				
8. Do you agree with the method of "innovating the core pattern of Dai paper-cutting through the "split-deformation-reorganization" rule of shape grammar": □ Very much agreed □ Recognition □ General □ Disagree □ Strongly disagree				
9. Apply the Dai paper-cutting pattern to the following cultural and creative products, which one will you choose: □ Coaster □ Silk scarf □ Canvas bag □ Tableware □ Others:				
10. If you need to expand other types of cultural and creative products in the future, which carrier do you think is suitable for Dai paper-cutting patterns: □ Keychain □ Decorative painting □ Carpet □ Others:				
11. Do you have any other suggestions for the innovative design of Dai paper-cutting: □ Yes □ No				

Supplementary page 2: Index of Item Objective Congruence (IOC)

Questionnaire

Consideration, Evaluation, Suggestions

Research topic:

Innovative Designs of Dai Paper-cutting Patterns from the Perspective of Intangible Cultural Heritage

Researchers:

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2. How can the expressive forms of traditional Dai paper-cutting art be innovatively transformed in contemporary design?

Clarification:

+1=the question is appropriate

0=Not sure whether the question is appropriate. -1=the question is inappropriate

Tick(✓)in your comment box and write down suggestions for further improvement.

Part 2: Questionnaire on User Needs for Coasters and Scarves (Ethnic Cultural and Creative Products)

Questions in the questionnaire	**Expert Options**			**Suggestions**
	Appropriate (1)	**Uncertain (0)**	**Inappropriate (-1)**	
1. Your gender: □ Male □ Female				
2. Your age is: □ Under 18 years old □ 26~35 □ 18~25 □ 36~45 □ 46 and above				
3. Your Career: □ Student □ a freelancer □ office workers □ Personnel of enterprises and institutions □ Other				
4. Your cultural qualifications are: □ High school and below □ College □ Undergraduate □ Master's degree or above				
5. Which channels do you prefer to buy cultural and creative products through: [Multiple choice questions] □ Offline physical stores □ E-commerce platform □ Tourist attractions □ Handicraft market □ Live streaming				

6. Your main motivation for purchasing ethnic cultural products: [Multiple choice questions] □ Self-use □ Gifts □ Collect commemoration □ Support intangible cultural heritage □ Decoration needs				
7. Do you know about Dai paper-cutting: □ Yes □ No				
8. How well do you know the art of Dai paper-cutting: □ very familiar □ I have heard something □ Not at all				
9. What do you think is the core value of intangible cultural heritage elements in products: □ Cultural inheritance □ Artistic aesthetics □ Collection value □ Practicality				
10. Which attributes of the product do you pay more attention to: [Multiple choice question] □ Pattern design □ Material process □ Practical functions □ Value range □ Cultural connotation				
11. What kind of material do you expect the coaster to be made of: □ Natural bamboo and wood □ Ceramic glaze				

□ Acrylic material □ Metal alloys				
12. What aspects do you think should be focused on when designing coasters: [Multiple choice questions] □ Practicality □ Pattern beauty and uniqueness □ Clear expression of cultural elements □ Durability and easy cleaning				
13. What do you think should be paid attention to in the design of silk scarves: [Multiple choice questions] □ Material comfort □ Pattern artistry and cultural recognition □ Modern expression of Dai paper-cut pattern symbols □ The price is reasonable				
14. Do you think that the innovation of paper-cutting pattern products should focus on: □ Pattern redesign □ Functional expansion □ Cross-border integration □ Use scenario extension				
15. You can accept the cost range of cultural and creative products as follows: □ Within 1:100 yuan □ 100 yuan ~ 300 yuan □ 300 yuan ~ 500 yuan □ 500 yuan or more				

Supplementary page3: Photos of participants in the library

Figure 35

DE-TALES exhibition photos

Note: Photo taken by the author.

Supplementary page4: About periodicals

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Subject Notification of Acceptance of the Journal of Interdisciplinary Social Development

Dear Lei Yixia and Thatree Muangkaew

We have much pleasure in letting you know your paper herein referred to as: **" Research on Innovative Design of Dai Paper-Cutting Pattern Extraction Based on Shape Grammar"** registered under Journal of Interdisciplinary Social Development ISSN : 2822-1060 (Online). Editorial department i would like to inform you that your article has been examined by three experts (Peer Review) and has been considered for publication in the Journal of Interdisciplinary Social Development. Therefore, your article will be published on the Vol. 3, No. 6, (November - December 2025). You can download the complete article on December 30, 2025 at https://so12.tci-thaijo.org/index.php/JISDIADP/about Thank you for this opportunity.

If you have any questions, please do not hesitate to contact with us.

Yours sincerely

(Phrakrusutasarabundit, Dr.)
Editor-in-Chief
Journal of Interdisciplinary Social Development

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