Design Studies and Intelligence Engineering
L.C. Jain et al. (Eds.)

doi:10.3233/FAIA231511

Research on Creative Design Reasoning Model Based on Cultural Elements

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Abstract. Creative reasoning is an important part of product creative design. To help designers clarify their reasoning thinking in the design process, this paper proposes a manual craft product creative design reasoning model based on traditional animal pattern cultural elements. This model combines the form, color, and semantics of traditional animal patterns with traditional intangible cultural heritage and uses semantic reasoning to assist creative design. The cultural elements in animal patterns are combined with modern products and objects, personalized requirements, and scenarios to generate random sentences, which helps designers in creative design reasoning. This model can effectively guide designers to integrate cultural elements into creative design, provide ideas and practical methods for the inheritance and innovation of traditional patterns and handicrafts, and improve the cultural connotation and market competitiveness of handmade products.

Keywords. Animal pattern, Cultural element, Creative design

1. Introduction

Creative design is the process or outcome of extending, presenting, and interpreting innovative ideas and concepts through the medium of design [1]. It is a design approach that emphasizes innovation, transformation, and enhancing user value, highlighting the integration of design with technology, culture, and market in multiple domains. Based on specific design requirements, designers constantly seek creative solutions through analogies drawn from reality and past experiences. The creative design comprises two processes: creative reasoning and creative expression [2]. During the process of creative reasoning, designers establish associations between patterns and products based on design objectives. In the process of creative expression, designers utilize the various associative relationships obtained from reasoning to sketch product designs, thereby completing the creative design process. The process in which people draw inspiration from one domain and apply it to another is known as analogy[3]. By employing analogies and associations between patterns and products, designers can enhance the fluency of their conceptualization during the process of creative expression. This enables the designed products to convey the cultural imagery and aesthetic beauty inherent in the patterns[4].

Common strategies for creative reasoning include inductive reasoning, deductive reasoning, concept combination techniques, and case-based reasoning. Inductive

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reasoning helps designers draw inspiration from existing handicrafts, while deductive reasoning transforms abstract ideas into concrete design solutions. Concept combination techniques support creative thinking[5]. Common strategies for creative reasoning include inductive reasoning, deductive reasoning, concept combination techniques, and case-based reasoning. Inductive reasoning helps designers draw inspiration from existing handicrafts, while deductive reasoning transforms abstract ideas into concrete design solutions. Concept combination techniques support creative thinking[6]. Case-based reasoning (CBR) facilitates the identification of creative and valuable ideas[7]. However, these creative reasoning methods have limitations. They do not facilitate the in-depth exploration of cultural elements during creative reasoning for designers. The reasoning search results are limited to precise search terms and cannot generate randomly combined sentences, making it difficult to consider various cultural elements such as pattern form, color, materials, craftsmanship, and art. As a result, they fail to generate creative designs that represent the cultural connotations of patterns.

This paper presents a creative design reasoning model based on the five cultural elements of “form, color, material, craftsmanship, and art” using traditional animal patterns as an example. The main contributions are as follows:

We integrate the cultural elements of form, color, and craftsmanship from traditional animal patterns with modern products, personalized needs, and scenarios. The model generates random sentences to assist in creative design. This combination provides new ideas and practical approaches for innovation in traditional patterns and handicrafts.

We conduct random reasoning and associations between keywords representing cultural elements from traditional animal patterns and other relevant concepts to help designers generate more creativity.

We integrate the cultural elements of traditional patterns into modern products and life scenes, allowing users to perceive the cultural symbols and connotations, such as ethnic aesthetics, values, and graphic semantics, contained within animal patterns.

The integration of cultural elements from traditional animal patterns with modern life scenes helps protect and inherit traditional pattern designs. It effectively guides designers in incorporating traditional cultural elements into creative design, providing an innovative approach and promoting the fusion and development of traditional culture and modern design.

2. Analysis of cultural elements of traditional animal prints

The cultural significance and diverse representation techniques of animal patterns, particularly those based on ethnic totem designs, make them the most profound aspect of ethnic pattern art [7]. Animal patterns hold a significant position in traditional Chinese culture, not only possessing high artistic value but also reflecting the histories, cultures, and lifestyles of various ethnic groups. These patterns are commonly used in the textiles, embroidery, and clothing of China’s ethnic minorities, featuring animal motifs and patterns with a strong natural style. The designs and patterns often depict animals such as lions, tigers, deer, horses, cattle, birds, etc., showcasing strong decorative and ethnic characteristics.

Figure 1 extracts common animal motifs, such as birds, tigers, snakes, fish, butterflies, dragons and so on, from the ethnic patterns of Chinese ethnic minorities according to the categories of "birds, beasts, reptiles, fish and insects, totems", and sums up the cultural elements of these motifs in terms of the specific animal forms, colour

compositions, commonly-used objects, implied meanings, commonly-used techniques and so on. The keywords of these patterns are summed up from specific animal forms, colour composition, common objects, implied meanings, common techniques and other aspects to form the five cultural elements of "form, colour, object, meaning, technique and technology".

Patterns category	Shape (specific animal)	Color (color)	Object (item)	Meaning (significance)	Technology (traditional craft)
Avian	Mandarin ducks	Red、 green	children's clothing, couples clothing and supplies	Beauty, love, fidelity	Paper-cutting, batik, embroidery
	Bird	Red, blue, green	Clothes Sling piece	Free, beautiful	
	Crane	White, gray	Costumes, decorative paintings, etc.	Elegance, peace, longevity and good fortune	
	Rooster	Red, yellow, orange	Costume, embroidery, etc.	Courage, strength	
Walking animals	Tiger	Orange, black	child hat, etc.	Mighty, brave	
	Bull	Brown, black	black Clothing, decoration	Stability, endurance	
	Horse	Brown, black, white, gray	Hat, headband	Freedom Success	
	Sheep	Brown, white	Costume, decoration	Beautiful	
	Dogs	Brown, White	Costume, decoration	Loyalty, fraternity	
	Deer	Brown or gray	Costume, decoration	Happiness, prosperity	
Reptile	Snake	Yellow, green	Costume, decoration	Survival and reproduction, wisdom	
Fish and insects	Butterfly	Red, yellow, blue	Women's Clothing Wedding Shoes	Spirit of all things, beauty, double life	
	Fish	Red, golden yellow	Costume, decoration	Seeking to conceive many children, harvest, abundance	
	Cicada	Green, brown	Costume, decoration	Life force	
	spider	Black, brown	Costume, decoration	Fulfillment of wishes, removal of diseases	
Mysteries	Dragon	Red, Yellow	Costume, decoration	Power, mystery, spirituality	
	Phoenix	Red, Yellow	Costume, decoration	Auspiciousness, happiness	

Figure 1. Keyword table of some cultural elements of animal prints.

The animal motifs in Figure 1 vividly reflect the traditional cultural characteristics of China's ethnic minorities. These motifs are entirely derived from nature and people's perception of life, as well as folk tales, legends and totem worship, and contain rich cultural connotations.

For example, the butterfly pattern contains unique graphics that convey the distinct semantic connotations of the history, culture, and aesthetic consciousness of China's ethnic minorities. The unique graphics conceal unique semantic connotations of the Minority history and culture, esthetic consciousness, etc[8]. The morphological characteristics of butterfly patterns present realistic or abstract graphics of butterflies. The butterfly's wings typically have complex patterns and designs, and the pattern composition has aesthetic features such as orderliness and symmetry [9]. Usually, bright colors such as red, yellow, blue, etc., are used to increase visual impact. Butterfly patterns often appear on the chest of women's clothing and wedding shoes, symbolizing beauty and happiness. They are also considered to protect people from evil and misfortune, representing love, beauty, and freedom. How to develop innovative product design based on the original cultural connotations of ethnic motifs, rather than simply pasting the motifs onto the product in a raw manner, is a problem that must be solved by creative reasoning for ethnic cultural and creative products.

3. A two-way creative reasoning experiment between animal prints and modern products

3.1. Experiment 1: Creative Reasoning from Product to Animal Patterns

Experimental Objective: Explore designers' commonly used creative reasoning patterns.

Participant Selection: 12 industrial design graduate students with more than four years of product design experience were selected as participants (5 males and 7 females, aged 22-29).

Stimuli: The goal was to cover as many categories and usage environments of products as possible. Eight common products were selected: drones, eye masks, pillowcases, sunglasses, notebooks, cars, chairs, and speedboats, covering both complex and simple products.

Experimental Procedure: Assuming that the participant is researching product design ideas, they were asked to write down as many animal words as possible based on the eight stimuli. After completing the reasoning task, the participants were required to write a brief sentence explaining the reason for each product and animal combination. Only the product words were presented throughout the entire reasoning process.

Experimental Results: The results showed that each participant inferred about three corresponding animals for each product. The common reasoning patterns from product to organism can be divided into "product-animal emotional perception reasoning", "product-animal form reasoning", "product-animal function reasoning", "product-animal scene occurrence reasoning", and "product-animal material reasoning". Tables 1-5 show six reasoning patterns.

Table 1. Affective perception reasoning of "product -Animal"

Produc	Animals	Reason
Chairs	Horse	Gentle horses give people a feeling they can rely on.
Sunglasses	Fish	Light and smooth for a lighter feel.
Car	Tiger, Lion	Some brave and fast animals - design cars.

Table 2. Morphological Reasoning of "product -Animal"

Product	Animals	Reason
Unmanned aircraft	Crane	The way it flies in the sky.
Pillowcase	Cicada	The pillowcase is similar to the wings of a cicada.
Notebook	Butterfly, Cicada	Wings and pages are very similar to the book, and can be opened and closed.

Table 3. Function Reasoning of "product -Animal"

Product	Animals	Reason
Pillowcase	Dogs	Held in the body are soft and very comfortable.
Speedboat	Mandarin ducks, Crane	All can float on the surface of the water, the palms of the feet flapping forward.
Eye Mask	Spider	Eye patch brings darkness, spiders like darkness.

Table 4. Environment Reasoning of "product -Animal"

Product	Animals	Reason
Speedboat	Fish, Snake	All can go fast in the water.
Drones	Bird	live in the sky.
Speedboat	Fish, Snake	All can go fast in the water.

Table 5. Material reasoning of "product -Animal"

Product	Animals	Reason
Chairs	Horse	Gentle horses give people a feeling they can rely on.
Sunglasses	Fish	Light and smooth for a lighter feel.
Car	Tiger, Lion	Some brave and fast animals design cars.

3.2. Experiment 2: Creative Reasoning from Animal Patterns to Products

Experimental Objectives and Participant Selection are consistent with Experiment 1.

Stimuli: The goal was to cover as many animal patterns as possible. Eight common animal patterns were selected: birds, tigers, sheep, fish, snakes, spiders, dragons, and butterflies, covering different categories of traditional patterns. In Luo and Dong's 2017 study, they found that text descriptions can achieve higher innovation in creative design processes [10]. Therefore, only the key names of the animal patterns were provided during the reasoning process.

Experimental Procedure: Assuming that the participant is researching product design ideas, they were asked to write down modern product words associated with the

eight stimuli and explain the reasoning behind each animal pattern and its corresponding product in one sentence.

Experimental Results: The results showed that each participant inferred two corresponding modern products for each animal pattern. The common reasoning patterns from animal patterns to products can be divided into "animal-product form reasoning", "animal-product emotional perception reasoning", "animal-product function reasoning", and "animal-product material reasoning". Tables 6-9 show six reasoning patterns and examples.

Table 6. Form reasoning of "Animal - product"

Animals	Produc	Reason
Spider	Refrigerator,sticker	Refrigerator stickers and spiders are shaped like a small..
Bird	Scissors	The bird's wings and scissor handles are similar in outline.
China Dragon	Whip	China Dragon.

Table 7. Affective perception reasoning of "Animal - product"

Animals	Produc	Reason
sheep	Cold repellent supplies	Sheep look warm.
Bird	Infinity Headphones	Free as a bird.
Tiger	King's Crown	Majestic, dignified.

Table 8. Function reasoning of "Animal - product"

Animals	Produc	Reason
Snake	Fans	Winter can not be used to hibernate.
Butterfly	Seeder	Butterfly pollen collection is similar to sowing seeds with a seeder..
Spider	Mosquito Killer	Both can eliminate mosquitoes.

Table 9. Material reasoning of "Animal - product"

Animals	Produc	Reason
Tiger	Leather and fur products	The tiger's fur pattern is very characteristic.
Fish	Necklace	Fish scales have the same shine as jewelry.
Sheep	Sweaters, Blankets	Same hair texture.

During the bi-directional creative reasoning from animal patterns to modern products experiment, it was found that each participant could infer about three matching animal patterns for each product and about two corresponding modern products for each animal pattern.

In the experiment, some participants had a relatively narrow range of reasoning methods, focusing only on emotional perception or functional reasoning. In addition, some participants' reasoning methods also involved cultural connotation interpretation. For example, when thinking of butterfly patterns, they associated it with mothers and inferred baby products accordingly.

It was found in the experiment that emotional perception and form reasoning are the most commonly used reasoning patterns in creative reasoning. However, in the creative design process of traditional ethnic patterns, if animal patterns and modern products are matched one-to-one based solely on emotional perception reasoning, image reasoning, function reasoning, and environment reasoning, the inspiration for creativity is limited.

The historical culture, color characteristics, semantic connotations, and other cultural elements contained in animal patterns cannot be extracted. Moreover, these cultural elements cannot be appropriately combined with traditional crafts to present them on products, and the five cultural elements of "form, color, material, technique, and art" contained in animal patterns cannot be integrated into the design, as summarized in Table 1. Therefore, this paper proposes a creative design reasoning model based on cultural elements.

4. Concept of creative reasoning model based on cultural elements

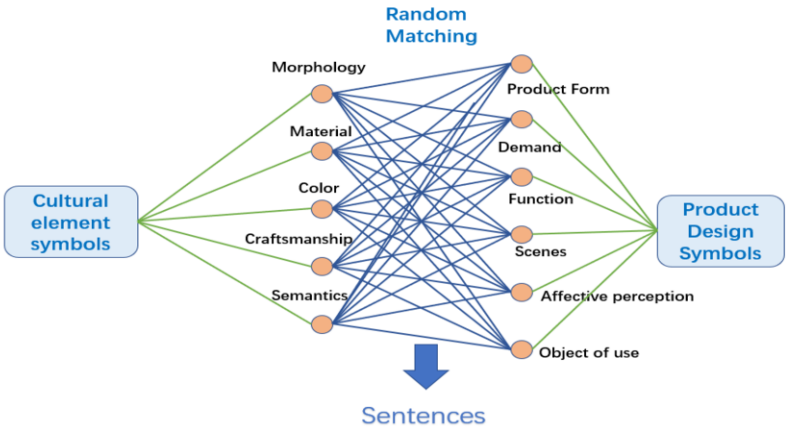

Figure 2. CRPS creative reasoning model based on cultural elements..

To avoid the limitations of creative inspiration brought by one-to-one correspondence between animal patterns and modern products in bi-directional creative reasoning, this paper proposes a "CRPS Creative Design Reasoning Model" based on the five cultural elements of animal patterns: "form, color, material, technique, and art", which encompass the historical culture, color characteristics, semantic connotations, and other cultural elements contained in ethnic animal patterns.

This reasoning model extracts keywords for "Morphology", "Material", "Color", "Craftsmanship", "Semantics", "Product Form", "Function", and "Affective Perception" based on the cultural element symbols of animal patterns and product design symbols. In addition, three keywords from personalized user requirements, "Object of use", "Demand", and "Scenes", are added to the product design symbol dimension. By inputting the animal pattern keywords and corresponding product keywords from Experiments 1 and 2 into the model, along with other cultural element keywords corresponding to the animal patterns and user use keywords, random sentences were generated in the order of "animal pattern, color, craftsmanship, material, product, scene, function, user, emotional expression" to complete creative reasoning based on the five cultural elements of animal patterns: "form, color, material, technique, and art". The generated random sentences were further filtered based on the conditions that the selected manual craft techniques can achieve, helping designers incorporate the cultural elements of patterns and personalized user requirements into product creative design. This model extends the combination of cultural factors in theory, practice, and design

process, providing a comprehensive and effective framework for incorporating cultural elements into creative design.

In the specific application of the model, traditional crafts that can present products were used as limiting conditions. In the model validation, the combination of butterfly patterns and eye mask products was selected. The reasoning result of the random sentence generated by the "CRPS Creative Design Reasoning Model" included "butterfly", "blue and white", "batik dyeing", "silk", "eye mask", "resting place", "sleep aid", "mother", and "care". A new creative product combining animal patterns and modern products was designed, as shown in Figure 2. The cultural implication of "Butterflies give birth to all things" was deeply explored in the product promotion concept, positioning the emotional expression of the product as the theme of "attachment" and expressing love and high praise for mothers.

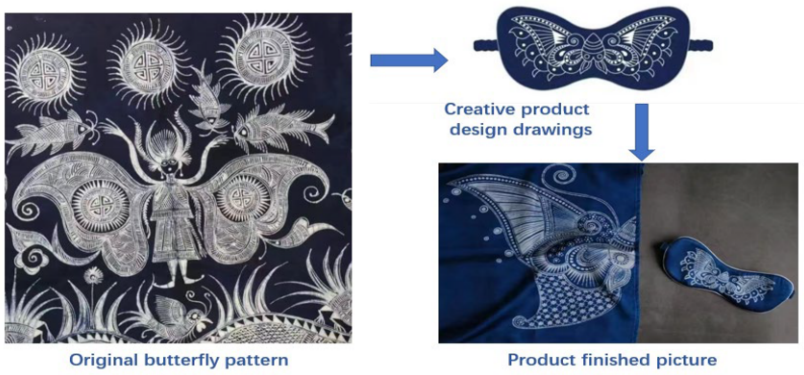

Figure 3. Case diagram of the use of CRPS creative reasoning design based on..

Using this reasoning pattern for creative product design not only allows traditional cultural elements to be incorporated into modern products, enabling users to perceive the cultural symbols and connotations of ethnic aesthetics, values, graphic semantics, and other elements contained within animal patterns but also supports traditional handicraft artisans through the use of traditional manual processing techniques, empowering the inheritance of handicrafts.

5. Conclusion

This article mainly studies the reasoning pattern between traditional animal patterns and modern products, and their application in the creative design of cultural and creative products. This paper proposes a reasoning pattern for creative design that combines the cultural elements of traditional animal patterns with traditional handicrafts and is based on individual user requirements. By identifying the relationship between cultural elements and user requirements, selecting appropriate traditional manual techniques, and generating creative designs based on randomly generated statements according to the reasoning pattern, this study explores an innovative path combining animal pattern graphic cultural elements with modern product creative reasoning. The CRPS creative reasoning pattern was used to practice modern product creative reasoning design for butterfly-patterned animal patterns. By combining user requirements with animal pattern

cultural elements, the creative design reasoning preserved the cultural connotations of traditional patterns while allowing pattern graphics and traditional handicrafts to enter people's daily lives in the form of modern products, facilitating their inheritance and development. Therefore, we believe that a product creative design reasoning pattern based on cultural elements is a method worth exploring and applying. In the future, we can further study the relationship between cultural elements and handicrafts, find more cultural elements to apply to creative reasoning, promote innovation and reform of traditional handicrafts, and enable them to play a greater value in modern society.

Acknowlegment

The work was supported by the Zhejiang Social Science Foundation, research on the realization path of creative design integrating intelligent technology to enhance new economic dynamics(No. 21XXJC01ZD).

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