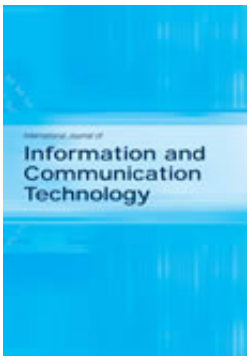

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Research on the identification and optimisation of traditional cultural symbols from the perspective of cross-cultural communication

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Research on the identification and optimisation of traditional cultural symbols from the perspective of cross-cultural communication

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Abstract: This study looks at how to spot and use traditional cultural symbols in a way that helps people from different cultures talk to each other. The five-step plan is based on data gathering, communication studies, design theory, and semiotics. Steps are recognising symbols, analysing across cultures, making things better, and confirming. It is culturally rich and up-to-date because it is based on reviews from experts, feedback from the public, and how well it does in the market. We compared 40 grey relational analysis (GRA) and fuzzy comprehensive evaluation (FCE) models side by side and discovered that blue and white porcelain designs with lotus, peony, and plum flowers are the most attractive, culturally significant, and marketable. The results show how important it is for images to be clear, for societies to be open to change, and for people to be able to see things in different ways. The difference between the Chinese loong and the Thai naga shows how important it is to use symbols in world design in a way that makes sense all the time. This study gives us ideas for mixing old customs with new tools that are both useful and interesting.

Keywords: cross-cultural communication; semiotics; cultural symbols; white and blue porcelain; symbol optimisation.

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1 Introduction

Today, symbols are used all the time and are an important part of communication. Because of this, communication scientists believe it is important to study how they are made and how they are used. Saussure used the phrase 'representative signs that convey particular content and meanings through certain forms' to talk about symbols (Domínguez, 2022). Symbols not only carry information, but they also have cultural meanings that affect how people think and act. The speed with which technology and globalisation are spreading has changed the ways that pictures are made and shared. Rudloff (2022) says that designers should think about how well and how often symbols can be used in different cultural, technological, and social realms. AI and ML are also making symbol creation more automated and intelligent, which calls into question long-held ideas and methods about symbols. So, understanding how semiotics is used in communication not only makes sharing information faster and better, but it also teaches us more about how people from various countries and tools talk to each other. This study has data that can help marketers, media makers, advertising people, and UX designers in a lot of ways.

Book reviews and case studies are used to look into how symbols are made in the field of communication semiotics (Dai and Liu, 2024). The goal is to understand how symbols work and what the rules are for how they are used today. It tries to give new ideas for the development of semiotics theory as well as scientific help and methods for making symbols work in the real world by looking at how symbols are used in theory and in practice. A lot of design trends happening all over the world, and artworks are being digitised in general (Wu et al., 2024). For instance, the well-known Italian brand Prada had a big effect on modern fashion by rethinking flower designs and the standard blue and white colour scheme. Moooi and the Dutch artist Marcel Wanders made blue and white pottery designs that are a mix of Eastern and Western styles (Zhang and Pollard, 2022). A lot of people who work in sustainable design are interested in finding new ways to use old things like blue-and-white china these days. To do well in today's global society, modern design needs to be both nice to look at and useful (Zou et al., 2024). It should find a mix between old and new ideas.

A lot of people are designing with sustainability in mind, which is making people think again about old societal icons. Because of this, there is more study into how to make them more environmentally friendly from the time they are made until they are used. Semiotics can help us better understand things like readings, signifiers, and given meanings. People have left behind a lot of important culture items. To protect the past and build national character, it is important to keep, pass on, and use cultural assets (Xiang and Huang, 2025). Some of the most interesting cultural sites in the world are traditional colleges in China. These colleges are special because of the way they are built, their cultural significance, and their role as schools. We used to call schools a An interesting kind of university grew up in China during the Tang, Song, and Qing dynasties. Instead of focusing on imperial tests like state-run schools did, they put more emphasis on customisable lessons and academic freedom. There were some old schools in China that were just as important as the best universities today, like Tsinghua and Peking University (Xu and Tian, 2022). These people went through a time of huge historical changes in the early 20th century. Their impact can still be seen in how people learn and share culture in modern China. The things that are used to decorate a building are a big part of its past. Decor on traditional school buildings comes from old Chinese

styles of building (Ma et al., 2025). In traditional Chinese school design, things that look nice are used for more than just looks. However, this is not the same as workshops or high-tech business buildings that do not do anything. These are the important points of this article: In Section 2, we talk about what other study has been done to find and make traditional culture images better. Section 3 talks about a method called perspective on cross-cultural communication. Section 4 is where we talk about the results and what they mean. Finally, Section 5 ends the study.

1.1 Paper contribution

This study tells us a lot of useful new things that help people from different cultures better understand and use symbols. This is the first step in a five-step study plan that groups collecting data, recognising signs, cross- cultural analysis, making things better, and evaluating them. This lets experts look at signs from various societies. Second, it makes design research more artistically valuable and useful by blending evaluation models with feedback from the public, market data from e-commerce, and expert review. Grey relational analysis (GRA) and fuzzy comprehensive evaluation (FCE) are two statistical ways to look at how societies work. At the end of the study, it is shown how they can be used together. These facts can help people who make things decide what to do. The last thing the Thai naga and the Chinese loong show is how important it is to change patterns with different cultures in mind. We now have a better idea of how symbols of culture change and are passed on. The study also connects theory and practice by giving designers useful advice, like being clear, consistent, widely adaptable, and simple to use. You can find a mix between new ideas and keeping society living with these tips. These projects give us a science way to make long-lasting culture markers. It is helpful for people from different countries to understand each other and work together better.

2 Review of literature

2.1 Designing cultural spaces within metro systems

The theory of ‘cultural genes’ was proposed by British biologist Dawkins in 1976, building on the idea of biological genes (Zhang and Wang, 2022). He called it a ‘meme’ in his book The Selfish Gene, and he made the point that culture is passed down from one generation to the next by having the cultural gene extract a model of culture from data, and then using that model to influence product creation and innovation. The process of cultural transmission begins with the extraction of cultural genes through information extraction. The next step is the design and translation of cultural moulds into design goods. After this, experts like the American Tyler and the British Conzeth began to look into how cultural genes are linked to where they are found. They said that typology and genetic research could be used to find a single landscape cultural gene (Wu et al., 2022). Metro room design and public art have also been looked into by people from all over the world. The concept of a ‘subway exclusive space sequence’ was used for the first time in metro space planning. It is a famous work that was written by John Carmody and Raymond Sterling. Some other words would be used in ecology art instead of this one over the next few years. Harvey Perloff, an American professor, wrote a book in 1979

called *Using the Arts to Prove Life in the City* (Wei and Hu, 2025). In it, he says that art should be used to improve public spaces in cities. As local tactics and real-life experience in everyday places have helped shape metro culture, the rest of the world has slowly learned from them.

2.2 Cultural identification

Consumers' cultural identities are shaped by the tastes, conventions, and expectations they encountered during their formative years, which in turn influence their personal preferences (Zong and Liu, 2023). People who live in regions known for their abundance of handicrafts tend to favour items that are manufactured by hand. The cultural ideals instilled in them from a young age, such as the importance of cultural excellence, cultural tradition, and cultural perception in items, are the root cause of this preference (Xing and Jin, 2023). In a culture that values environmental consciousness, for instance, eco-friendly goods are not only preferred but also seen as an indication of high quality (Dong and Li, 2025). Products that represent a person's cultural identity tend to have a disproportionate impact on consumer spending. People frequently show the world their cultural identity through the things they buy. A good way to display national pride is to dress or accessorise in a way that is representative of your country.

2.3 Cross-cultural communication

Increasing cultural understanding between nations might help alleviate slow global trade, build trust, and perhaps spark new forms of international economic collaboration (Peng et al., 2022). Furthermore, these statistics demonstrate that international trade in cultural products from China has substantially facilitated a more in-depth and all-encompassing knowledge of China. Moreover, it has significantly raised the profile of China as a tourist destination. Despite the importance of cross-cultural communication to global trade, very little is written about it in academic journals. Improving cultural identity, decreasing transaction costs, and lowering obstacles to cross-cultural Communication are all essential goals. Cultural differences are the root of cultural barriers, which can be mitigated or eradicated through the exchange of cultural goods (He and Wen, 2022). The cost of cultural barriers can be reduced when one country shares its culture with another or receives cultural commodities from another country, leading to a gradual merging of the two cultures. Additionally, came to the same conclusion when looking at how cultural distance affects cultural product commerce: that a modest cultural distance will encourage cultural product trade between the two countries. Cultural distance can facilitate some trade in cultural products between two countries, but only up to a certain point (Chen and Mao, 2023). One way to reduce cultural distance is through the transnational cultural communication that occurs through the trading of cultural products. Cultural interaction has the potential to improve cultural identity, strengthen bilateral trust, and generate trade effects, among other benefits.

Thanks to digital picture processing and analysis, a lot of work has been made in computer vision, pattern recognition, and other science areas. These ways look at what we see and try to figure out what it all means. The study of pictures has also been helpful in the field of cultural property. Everything has changed because the government now has more ways to keep records, protect them, and show them off. Part of a culture's history are the things and customs, real or made up, that tie a group to its past and the ideas that

shaped it. It is part of the study of cultural heritage that this literature review (Wang and Sun, 2025) looks at how to handle and study digital pictures for cultural heritage. They are based on how to use them to take parts of a picture apart, look for things in them, scan them, fix them up, and make images of different cultural items better. Machine learning (ML) is quickly getting better. This has made it possible to create unique online tools for learning, especially those that teach music. Lu (2025) did a study in 2025 that looks at how ML systems can be used in smart music education systems to rate progress and make notes in real-time. Audio signal processing, feature extraction, and prediction modelling all work well together in the way that was suggested to give students useful input and give musical acts the right grades.

- At this point, generative AI (GAI) is the most important part of digital learning. It lets you customise how kids learn, make material that works on its own, and test them in new ways. Schools that do not give students enough freedom or say have a hard time meeting the needs of all of their students. AI-made content, real-time tests, and other cutting-edge tools are used in this thesis to look at GAI's role in the smart change in education. It also checks the AI that talks on Duolingo, the AI that teaches on Khan Academy, and the AI that lies. Things that are new include AI that works with VR, teachers that can read minds, and lesson plans that can be changed.
- Art and culture that use AI and sustainable design could be a big step toward making goods that are better for the environment. This study (Liu, 2025) looks into how ideas for sustainable development can be mixed with AI-driven design methods to make culture and artistic things last longer, be made from better materials, and be made faster. Designs can be eco-friendly and good for the earth if they use generative design, ML, and elements that do not harm the environment.

3 Materials and methods

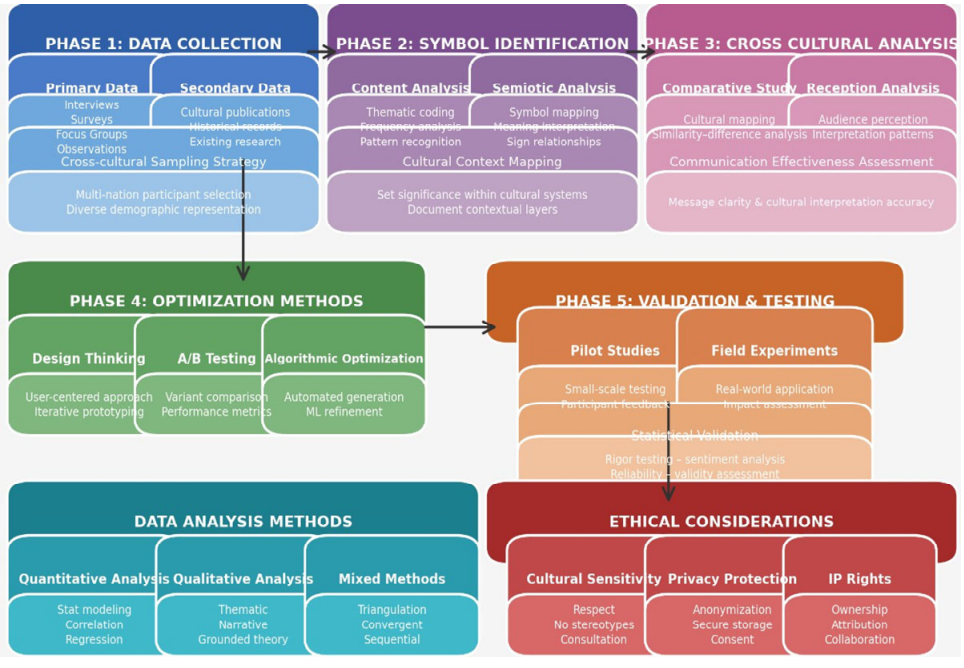
Figure 1 outlines a five-phase research framework for cross-cultural communication and symbol analysis. It begins with data collection (primary/secondary sources and sampling), followed by symbol identification (content, semiotic analysis, and cultural context mapping). Next, cross-cultural analysis compares audience reception and communication effectiveness. Optimisation methods are then applied using design thinking, A/B testing, and algorithmic approaches. Finally, validation testing is conducted through pilot studies, field experiments, and statistical validation. Supporting components include data analysis methods (quantitative, qualitative, and mixed approaches) and ethical considerations (cultural sensitivity, privacy, and intellectual property). This framework ensures systematic, ethical, and practical evaluation of symbols in cross-cultural communication.

3.1 Data collection and preprocessing

This study's data was enriched with expert evaluations, public input, and market performance, which allowed for a more complete picture by removing biases from a single data source. Examining porcelain patterns in this way guarantees that their cultural-historical importance and their adaptability to modern times are both taken into account (Zhao and Bao, 2025).

- *Expert evaluation data*: The performance of 40 cultural symbols was quantified by ten specialists who, using a 1–100 scale, evaluated them on five dimensions: aesthetic value, cultural symbolism, communication, current applicability, and sustainability.
- *Public feedback data*: It was possible to collect 238 valid surveys by combining online and offline techniques. Mean evaluations showed how well-known and accepted these patterns are in today's society.
- *Market performance data*: Our goal was to identify usage trends, so we scraped Taobao, an Alibaba site, for sales data on the 100 most popular blue-and-white porcelain items. From October 2024 through December 2025, a script was created to search for specific keywords in product titles. These objects might include underglaze, blue-and-white porcelain, a bowl, or ceramics. We selected the top 100 porcelain products for everyday use after extracting relevant factors from the produced dataset, including the name of the product, unit price, sales volume, URL of the business, and the dominating ornamental pattern. In order to identify the primary pattern type for every product, we eliminated duplicate and low-quality data. Next, we tallied up the sales and appearance frequency for each category. Lastly, in our weighted evaluation mode, we utilised the aggregated sales scores as one of the three primary data layers. The market success of each pattern was determined using these scores. Our pattern evaluation framework is made more practical by incorporating consumer choice through e-commerce data. The data was subsequently assessed by experts who used it to measure the popularity and success of each pattern across all five aspects in real-world applications.

Figure 1 The figure presents a structured five-phase research framework for cross-cultural communication and symbol optimisation (see online version for colours)



After preprocessing with a weighted average approach, the data were divided into three parts: professional assessment (40%), public opinion (30%), and financial results (30%). Doing so guaranteed that the 'Blue-and-White Porcelain Pattern Score' dataset had all relevant information. Based on comments from the multidisciplinary expert group that participated in this study and practical experience from previous cultural evaluation studies, using expert-informed judgment, the weighing method was developed with 40% coming from expert review, 30% from public comment, and 30% from market data. Striking a balance between the public's view of the issue, the theoretical insights provided by experts in the subject, and the practical significance of sales numbers from actual stores is the purpose of this distribution. Please refer to Table 1.

Table 1 A thorough evaluation data table with 40 patterns

Motif type	*Symbolic meaning*	*Aesthetic quality*	*Communicative value*	*Relevance in modern use*	*Eco-cultural endurance*
Peony motif	94.6	92.0	87.8	92.3	93.8
Plum blossom motif	94.3	92.9	79.4	91.2	93.8
Bamboo leaf motif	65.4	67.2	65.8	66.5	66.6
Lotus motif	94.6	94.8	94.8	93.8	95.4
Curly grass motif	62.7	66.3	65.4	66.6	66.2
Floral motif	92.8	95.4	88.2	95.7	94.1
Pomegranate motif	63.1	64.7	63.3	63.3	63.8

Expert consultation and public survey data collection were part of this investigation. Every participant was briefed on the study's goals, data use, and anonymity assurances before any data was collected. All respondents were asked to provide their informed consent, and their participation was entirely optional. We did not gather any information that could identify an individual. Approval was sought in writing from the expert panel. Prior to the submission of the questionnaire, approval was acquired from public survey respondents through an electronic agreement. The following formula was used to normalise the data, scaling values to the [0, 1] range, across all datasets to guarantee comparability:

$$X^{f} = \frac{X - X_{\min}}{X_{\max} - X_{\min}} \tag{1}$$

The least important value in each measure is $X_{\min}$, and the most important value is $X_{\max}$ equations (2) to (5). Start with the value X. The 'lotus pattern' used to be good at many things, including making things look nice (94.8), being useful (93.8), having cultural meaning (94.6), and lasting a long time (95.4). The 'lotus pattern' stays the same in all directions because minimum and maximum numbers are used to clean up the data.

Here are the details of what happened.

$$X_{Cultural\ symbolism} = \frac{94.6 - 58.9}{94.6 - 58.9} = 0.95 \tag{2}$$

$$X^{f}_{Esthetic\ value} = \frac{94.8 - 56.6}{95.4 - 56.6} = 0.98 \tag{3}$$

$$X^{f}_{Communication} = \frac{96.4 - 57.2}{96.4 - 57.6} = 1.000 \tag{4}$$

$$X^{f}_{Modern\ applicability} = \frac{93.8 - 56.3}{94.2 - 56.3} = 0.99 \tag{5}$$

$$X^{f}_{Sustainiability} = \frac{95.4 - 56.3}{95.4 - 56.3} = 1.000 \tag{6}$$

Scores for the lotus pattern reached one after normalisation across all dimensions, showing outstanding performance according to all standards. Each of the 39 surviving porcelain patterns underwent a comparable process of normalisation. Refer to Table 2.

Table 2 Normalised scores of design motifs

Motif category	*Symbolic value*	*Visual appeal*	*Communicative strength*	*Contemporary relevance*	*Cultural sustainability*
Peony	0.94	0.911	0.781	0.94	0.961
Plum blossom	0.93	0.941	0.561	0.921	0.951
Bamboo leaves	0.17	0.27	0.22	0.27	0.26
Lotus	0.95	0.98	1.00	0.99	1.00
Curled grass	0.10	0.25	0.21	0.27	0.25
Generic floral motif	0.90	1.00	0.82	1.00	0.97

3.2 Symbol identification

You can see most of the signs that are meant to get the word out. Picture, colour, and form are used to send words and get people's attention (Dai and Liu, 2024). When you make something, you should think about how it will look. Still, make sure messages are short and easy to understand. In other words, signs should tell people what to do and get the message across.

Table 3 Principles of visual symbol design

Principle	*Definition*
Conciseness	Simplicity. Complex designs can make it difficult for viewers to understand, while simple symbols are more easily accepted and remembered by the public.
Consistency	Colours, fonts, and design styles that are all the same are examples of consistency, as well as keeping the same meanings in different situations.
Acculturation	Cultural adaptability designers should research the acceptance and meanings of specific symbols, colours, and patterns in target cultures.
Accessibility	Ensures that all potential users, including those with visual impairments, can effectively receive information.

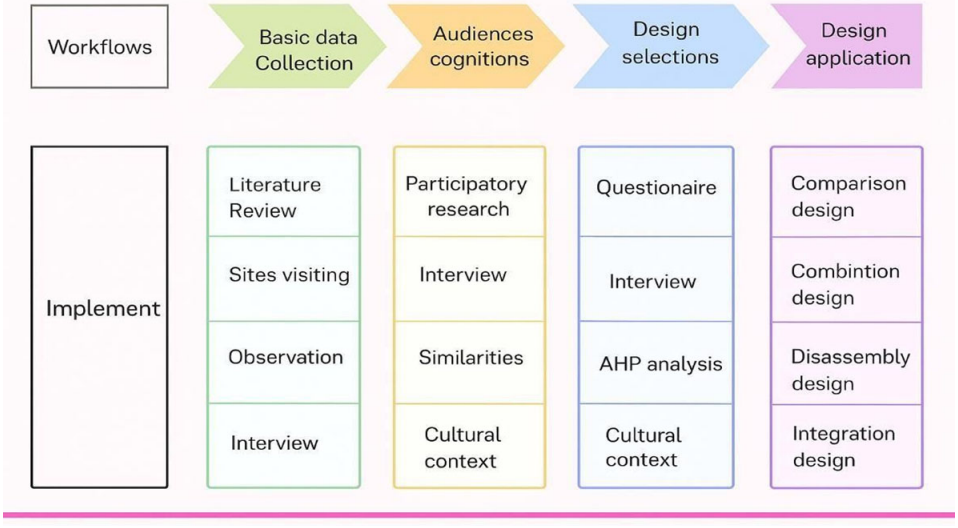
It's important to keep things easy when making visual symbols. Most people agree with it, and it's also easy to remember. To give you an example, most road signs have simple pictures that are easy to see even when you are going fast. It means that the symbols' colour, size, and design style stay the same. They also look the same in all different types

of media and settings. When a brand stays the same, it looks more professional and helps people remember it. One thing that makes Apple's mark easy to spot is that it stays the same on all of its products and ads. It is important to think about how people from different countries might see colours, patterns, and shapes when you're making visual symbols. They should learn a lot about different countries to make sure the pictures they make are right meaning, and do not hurt or confuse people from other countries. Using simple styles and colour combinations with lots of contrast can help people read symbols better, which makes sharing information more useful and open to everyone. For example, public signs use bold letters and colours that stand out a lot so that people who are far away or have trouble seeing can read them.

Table 4 Case analysis of visual symbols

Visual symbol	*Definition*
Apple logo (bitten apple silhouette)	The design of the Apple logo cleverly utilises negative space to create a distinctive shape. The simple, minimalist bitten apple is instantly recognisable across all platforms.
London underground roundel (blue bar across a red circle)	It's easy to see where the train exits are because the red circle and blue bar stand out right away. The sign is both geometrically simple and clearly useful.

Figure 2 Overview of the research workflow (see online version for colours)



This study will compare Thai naga and Chinese loong in terms of cross-cultural inheritance and design transformation using the following methods: Creating a database of cultural knowledge mapping and extracting the visual and implicit semantic properties of the Thai naga and the Chinese loong from the organised dataset. Next, we need to determine how much people know, think, and need to know about the loong and naga culture. Users can utilise this data to identify the most effective design elements based on what is currently known. In costume design transformation, it is necessary to first conduct preference surveys for target consumers before synthesising and categorising design factors to establish a design strategy. When the loong and naga talk to one

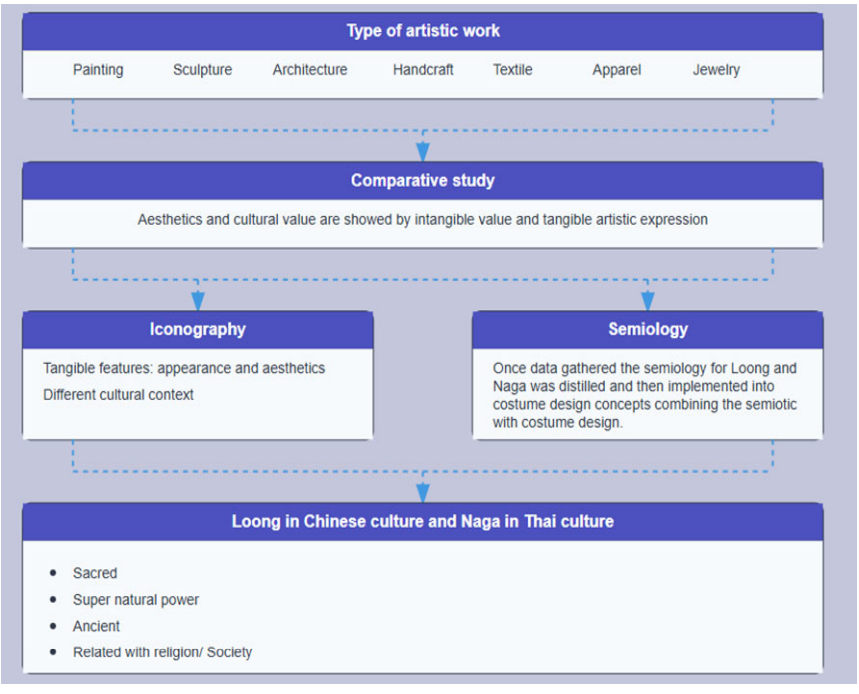
another, it's through the cloth of their clothes. The research method is illustrated in Figure 2. Researchers using mixed-methods approaches use tools like the analytic hierarchy process (AHP), participatory research, and field studies to substantiate theoretical frameworks.

Figure 2 illustrates the systematic workflow employed in this research, demonstrating how data flows from initial collection through cultural mapping to final design validation. This structured approach ensures that both tangible visual elements and intangible cultural meanings are captured and analysed comprehensively, forming the methodological foundation for comparing the Chinese loong and Thai naga.

3.3 Method and analytical process data collection

The physical characteristics and less tangible cultural significance and content of the Thai naga and the Chinese loong can be better understood by a literature review. The groundwork for further study is laid at this phase of the research process. In the first part, we review what is known about the cultural exchange and historical context between China and Thailand. In the second part, we lay the theoretical groundwork for future studies by outlining the origins and traditions of loong and naga worship. In addition to learning about and enjoying the works of art (including but not limited to architecture, sculpture, and textiles) in their original tongue and cultural setting Field trips include conducting Research, conducting experiments in the field, and visiting the sites of interest. Analytical and comparative approaches allow for the examination of both the material and immaterial features of loong and naga. In Figure 3, we can see the structure of the field investigation.

Figure 3 A framework for conducting field research (see online version for colours)



Based on research, examination of artwork, and personal observation, Table 5 shows what the words loong and naga mean in different cultures. Researchers went to Bangkok, Phitsanulok, Sukhothai, Chiang Rai, and Chiang Mai in Thailand to learn more about Naga society. Xiamen, Nanjing, Shanghai, Fuzhou, and the province of Shanxi in China were also on our itinerary. More than eight hundred pieces of Loong and Naga art were analysed. Students are given the freedom to explore the study's findings at their own pace, with tabulated entries serving to summarise the information that has been shared. Both the loong and the naga are illustrated in Table 6, with the first column providing a brief overview of the cultural attributes, the second column delving into further detail, the third column outlining the symbolic purposes of these traits, and the fourth column illustrating their representation in artwork.

Table 5 Cultural significance and representations of the Loong in Chinese tradition

Category	*Description*	*Representation*	*Cultural expressions*
Sacred symbolism	Seen as a mystical being with extraordinary powers	Object of reverence and worship	Loong motifs appear in architecture, traditional dress, crafts, and sculptures, with each body part carrying symbolic value.
Spiritual beliefs	Embodies the blend of Buddhist and Taoist traditions	Spiritual philosophy	Frequently represented in temples, shrines, and ritual practices
Chinese identity	Regarded as the ancestral figure of the Chinese people	Symbol of lineage and heritage	Featured in fabric designs, traditional attire, body art, folklore, and artistic depictions linking human and loong features
Nature and elements	Revered as the deity of rain, fire, and seasonal changes	Sign of prosperity and good harvests	Expressed through textile motifs, architectural details, handicrafts, and sculptural art
Cosmic connector	Acts as a mediator between the human world and the heavens	Emblem of hope and transcendence	Incorporated into boats, ceremonial vehicles, musical instruments, and sacrificial objects

Table 6 Naga cultural characteristics summary

Category	*Description*	*Representation*	*Cultural expressions*
Sacred significance	Regarded as a mystical being with divine abilities	Venerated as holy	Depicted with crests and distinctive features in temples, architecture, sculptures, fabrics, and paintings
Spiritual role	Seen as the guardian and protector of the Buddha	Religious symbolism	Shown with multiple heads alongside Buddha in artworks, carvings, and textile designs
Ethnic identity	Considered an ancestral figure of certain peoples and tribes	Associated with serpent veneration	Reflected in weaving patterns, clothing, tattoos, folklore, and oral traditions

Table 6 Naga cultural characteristics summary (continued)

Category	*Description*	*Representation*	*Cultural expressions*
Dual nature	Believed to embody both benevolent and harmful traits	A symbol of caution or danger	Illustrated in films, stories, and literary works
Natural forces	Revered as the deity of water and rainfall	Sign of fertility, abundance, and agricultural prosperity	Expressed in patterns on fabrics, architectural details, handicrafts, and sculptures

3.4 Data analysis methods

Due to the two-part nature of this study interview, the data were processed sequentially, as mentioned below (Fan, 2020).

3.4.1 Part one

The initial step in using the open coding process was to transcribe the data collected from the first interview. Important phrases pertaining to TCRs are extracted using this open coding method. To make sure that each encoder picked the appropriate codes for this study consistently and reliably, we ran a reliability analysis on the generated codes. This study eliminated the impact of authorial subjective influences by using an intercoder reliability index, which is conservatively assessed. In the provided equation, n•S / (T1 + T2), in this case, T1 and T2 represent the sum of all codes linked to each person, while S stands for the shared open coding that encompasses both individuals. And n is the number of people engaged in the coding. Our confidence level was considered high if the coefficient was more than 0.6. It was determined that there was a lack of internal consistency if the value was less than 0.6. So, until a consistency greater than 0.6 is reached, academics will need to revisit the topic and settle on a consistent decoding method. Table 7 shows that three different encoders were involved in this study's coding of the identical interview material. We coded the data three times.

Table 7 Structural attributes of encoders

Encoder ID	*Affiliation (short form)*	*Academic level*	*Field of study*
E-1	Yunlin Univ. of Sci. & Tech.	Doctoral candidate	Design
E-2	Yunlin Univ. of Sci. & Tech.	Master's student	Media design
E-3	Yunlin Univ. of Sci. & Tech.	Doctoral candidate	Design

Table 8 Reliability assessment across encoders

Dimension 1	*Dimension 2*	*Dimension 3*
0.281	0.672	0.710

In the initial effort, the reliability of the code outcomes was evaluated by combining them (first common reliability). Table 8 shows that this initial effort had poor dependability. Because of this, a second standard reliability analysis resulted from each encoder's second effort at coding, and a set of more consistent coding rules was eventually constructed. Third common reliability was achieved by improving upon these criteria and

arriving at a third coding that ensured the shown dependability above 0.6. Next, we used the results of the third reliability analysis conducted on these encoders to assess their overall dependability.

Second, ongoing data comparisons and the classification of open codes revealed certain fundamental similarities. The final sign-functions derived from the sign-meaning of TCRs, as shown in Table 9, are relevant stakeholder orientations, knowledge perception, and cultural attribution.

Table 9 Putting data into groups after open coding

Category	*No.*	*New words for 'open coding'*	*Source*
How to look at cultural attribution	1	Genuine cultural understanding emerges through deep engagement with local products.	F-B/02/04
	2	Effects of Eastern or Oriental art and design	H-P/01/12
	3	Traditional cultural systems shape how artistic concepts are expressed in local art.	B–F/01/18
	4	The idea of Tao-Qi (道器) stands for a unique philosophical point of view in Eastern aesthetics.	H-P/03/21
	5	Culture reflects the collective aspirations and values of people	D-B/01/18
	6	For Chinese audiences, adopting a Chinese style feels natural, but popularised styles remain surface-level rather than reflecting profound cultural depth.	H-P/04/08-09
	7	showing the culture surroundings and scenery of the area	C-P/03/02
	8	Having a sense of country and cultural identity	A-T/01/19

The data from interviews was put together in Table 9, which shows three key ways that materials from traditional cultures affect how brands communicate. The culture attribution, knowledge perception, and client orientation groups were consistently present in a wide range of data sources. This shows that cultural symbols are more than just pretty pictures; they're also ways of connecting in many ways.

3.4.2 Part two

There were two phases to the data gathering process for the brand event and the second interview: before and after the TCRs were connected with the brand. The procedure was essentially identical to that which was used for the first set of data. Reliability analysis and the elimination of duplicates were carried out using an open coding technique (Table 10). In order to analyse and categorise the information based on similarities and differences, it was deconstructed using an order of time. Secondly, we made sure that the data is accurate by confirming that it is triangulated from at least two sources. This will ensure that the author's subjective extraction does not lead to any deviation. The massive volume of data in this section necessitated this measure to prevent data duplication. Sections 4 and 5 mainly include the data incorporated utilising a narrative technique.

Table 10 Overall reliability factors of encoders

Factor 1	*Factor 2*	*Factor 3*
0.543	0.652	0.704

4 Results and analysis

In this study, 40 different kinds of blue-and-white china were compared using fuzzy comprehensive evaluation (FCE) and GRA. Figure 4 shows that the two ways of ranking always go in the same direction. This is really important for patterns that do their job well. The big differences that happen in different situations show that these two ways of judging have different aims and do not always work well together.

For example, plum blossom, peony, and lotus patterns all scored highly and in close agreement on GRA and FCE, implying that these designs fared exceptionally well in all respects, including cultural symbolism, artistic value, communicative power, relevance to the present, and Sustainability. Based on these findings, it seems that these patterns have great promise for modern design adaptations while yet appealing to traditional cultural aesthetics. Their graceful shapes and obvious symbolic meanings make them suitable for a broad range of contemporary design contexts, from clothing and accessories to pottery and cultural relics. On the flip side, there were notable disparities in scores for specific patterns depending on narratives and animals. Consider the story of the Eight Immortals Crossing the Sea. Although it only managed a 0.06 in FCE, its GRA score was 0.35. This means that its cultural narrative is well-recognised by professionals, but the general public dislikes and struggles to comprehend it due to its complexity and visual accessibility issues.

Figure 4 reveals critical insights into pattern evaluation consistency. The convergence of GRA and FCE scores for lotus, peony, and plum blossom patterns (all exceeding 0.90) validates their exceptional performance across all evaluation dimensions. Conversely, the divergence in narrative patterns like ‘Eight Immortals’ (GRA: 0.35 vs. FCE: 0.06) exposes a significant gap between expert recognition and public accessibility, suggesting these motifs require substantial visual simplification for contemporary applications.

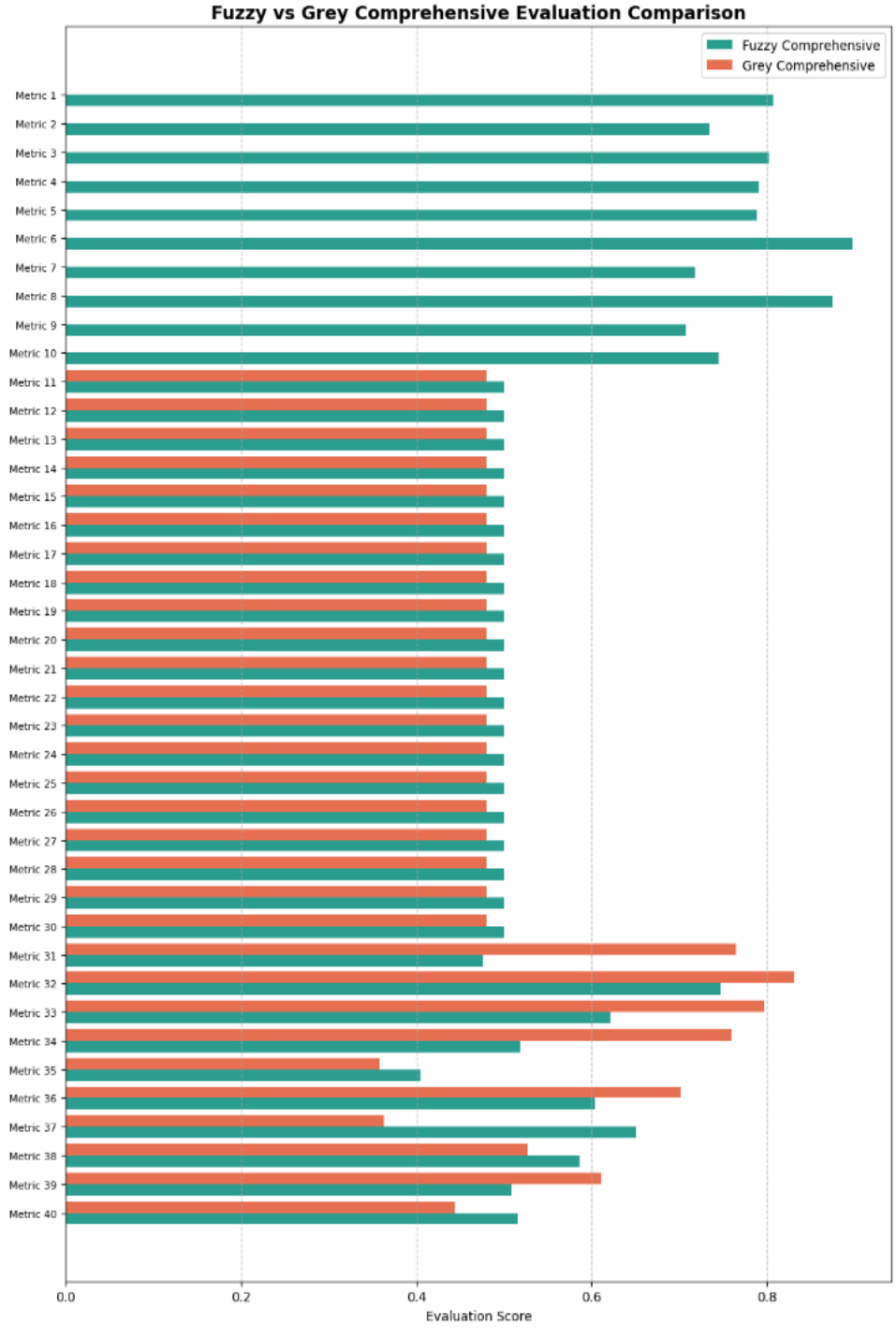
There are a number of essential elements that can explain these differences:

- Patterns with complex compositions, particularly those with narrative or animal themes, have a harder time being visually simplified and applied to contemporary minimalist design frameworks, which is why they often have lower FCE scores.
- Cultural cognition gap: People from different generations may have different perspectives on the significance of classic Chinese motifs like the dragon and the phoenix. Younger generations tend to choose simpler, more easily understood design elements.

It is possible to get multiple conclusions from the integrated analysis:

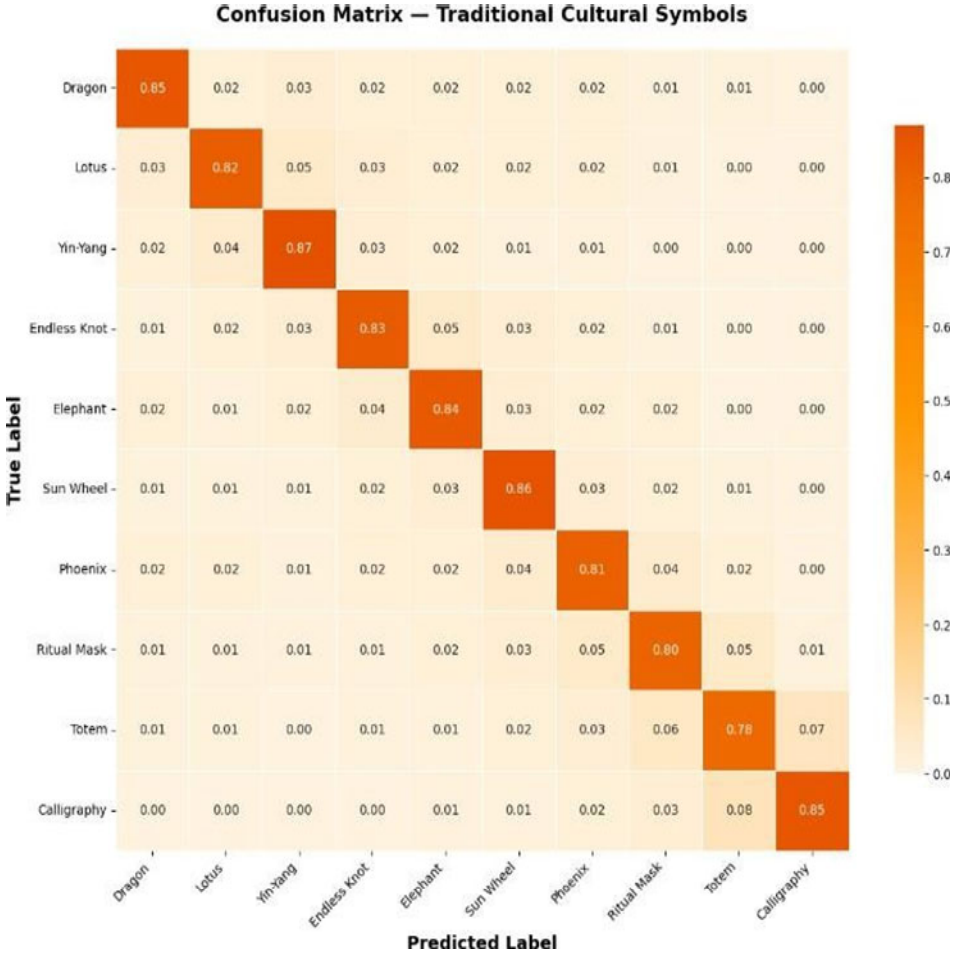
- Patterns with high potential: Patterns like plum blossom, peony, and lotus blossom often did well in GRA and FCE, showing that they have a lot of strength in cultural legacy, aesthetic appeal, design flexibility, and market resonance. In the future, when developing cultural products, these motifs should be given top priority for redesign and innovation.
- Patterns with latent potential: Circular and plum blossom designs, for example, excelled in some areas but struggled in others, like their ability to convey meaning or their relevance to the present day. These topics could be more marketable if they were visually simplified and semantically reinterpreted.

Figure 4 Bar graph comparing grey system theory with the fuzzy evaluation method (see online version for colours)



Some themes that need work are Crane, Wang Zhaojun Goes to the Frontier, and Zhuge Liang's Story. It was not easy for them to stay and be important. These ideas are important to history and society, but they need to be changed and made in a new way that fits with how things are made now. Last but not least, the GRA and FCE data together show that different forms and sizes of blue-and-white clay can be used in unique ways. They are good because they work together. It is good to see that both have a lot of flower and geometric themes. They play deep and important roles in culture, so it makes sense that they would work well in big visual roles in modern art and culture. For global brands and names, it will always be hard to make images that work in many places. Icons that work should be able to get across language and cultural gaps so that everyone can understand and act in a good way. To begin, people from various nations might have very various thoughts on what a sign means.

Figure 5 The confusion matrix illustrates the identification outcomes of traditional cultural symbols across ten categories (see online version for colours)



Different groups of people use icons in different ways, and some people use them in bad ways. Different groups of people have very different ideas about what colours, animals,

and body language mean. Second, businesses that do business all over the world need to make sure that everywhere they do business, they have the same picture. Also, they need to change their names for every area. Also, as we move into the digital age, symbols need to be able to work well on a variety of tech devices, such as ones with screens of different sizes and running systems. This is because these devices could change how people see and understand symbols. Last but not least, society changes all the time. Symbols may become more or less important as times and tastes change.

This study finds four ways to fix the issues that need to be fixed. First, learn a lot about how other people live. Before you start making them, you should learn about other cultures and what their signs might mean. Talk to artists or cultural experts from the area to make sure the symbols are made in a way that honours the cultural values and norms of the area. Second, make a central brand sign that will help everyone recognise your company. Next, make this symbol in ways that are unique to each market and show off the culture of that area. Allow rules to be changed so that they can fit different market needs. There should be limits on how much the rules can change in other areas. Third, think about how the marks can be used on different hardware and computers to make sure that everything looks the same and is easy to read. Do not use fixed design rules when making icons. They should work the same on all screen sizes and types. Last, read it over and change it often. Check symbols often to see if they are still useful and important to culture. If they need to be changed to reflect changes in culture, do so. Pay close attention to how culture and society change to see what might make people change how they use symbols. Then, change the way you create based on what you think will happen. If artists follow these tips, they will be better able to make marks that everyone likes and that work for people from different countries.

This helps the business stand out in local markets by strengthening cultural ties and increasing brand identification while also making the brand more consistent globally. Business success in today's globally interconnected world hinges on the ability to create symbols that transcend cultural boundaries effectively. If one fails to explore the larger cultural connotations of symbols beyond their symbolic meaning, they may fail at genuine cross-cultural communication. To improve the distribution of symbols, a multi-layer superposition is required. After reviewing a lot of material, the lead researcher came to the conclusion that fashion design can help promote harmonious and integrated cross-cultural communication. Taking its cue from Hall's cultural communication theory, this study integrates the field of fashion design with the theoretical framework of 'decoding and encoding' as its primary guiding perspective. Permitting participants to choose the essential design factors was the next stage in the research technique. Data analysis was carried out using the AHP. This is T.L. Saaty, an American operations researcher, originally proposed AHP in the 1970s. It comprises factoring and levelling components that govern decision-making.

Decomposing intricate decision-making problems into a hierarchical framework with interconnected parts is one of the AHP's primary processes. Judgment matrices are then generated by pairing off criteria with similar levels of value and comparing their relative importance. Finding the weights assigned to each item in the hierarchical criterion is the next step. The final step is to find the total weights of all the requirements by combining the relative weights of the criteria at every level. A thorough assessment of the research issue can be carried out using this weighting scheme. Figures 6(a)–6(c) display the findings of the AHP data.

Figure 6 Findings from the AHP study, (a) AHP results for priority criteria from Thai naga and Chinese loong traits (b) AHP outcomes for design priorities based on their tangible features (c) AHP analysis of the optimal design scenario using both creatures' traits (see online version for colours)

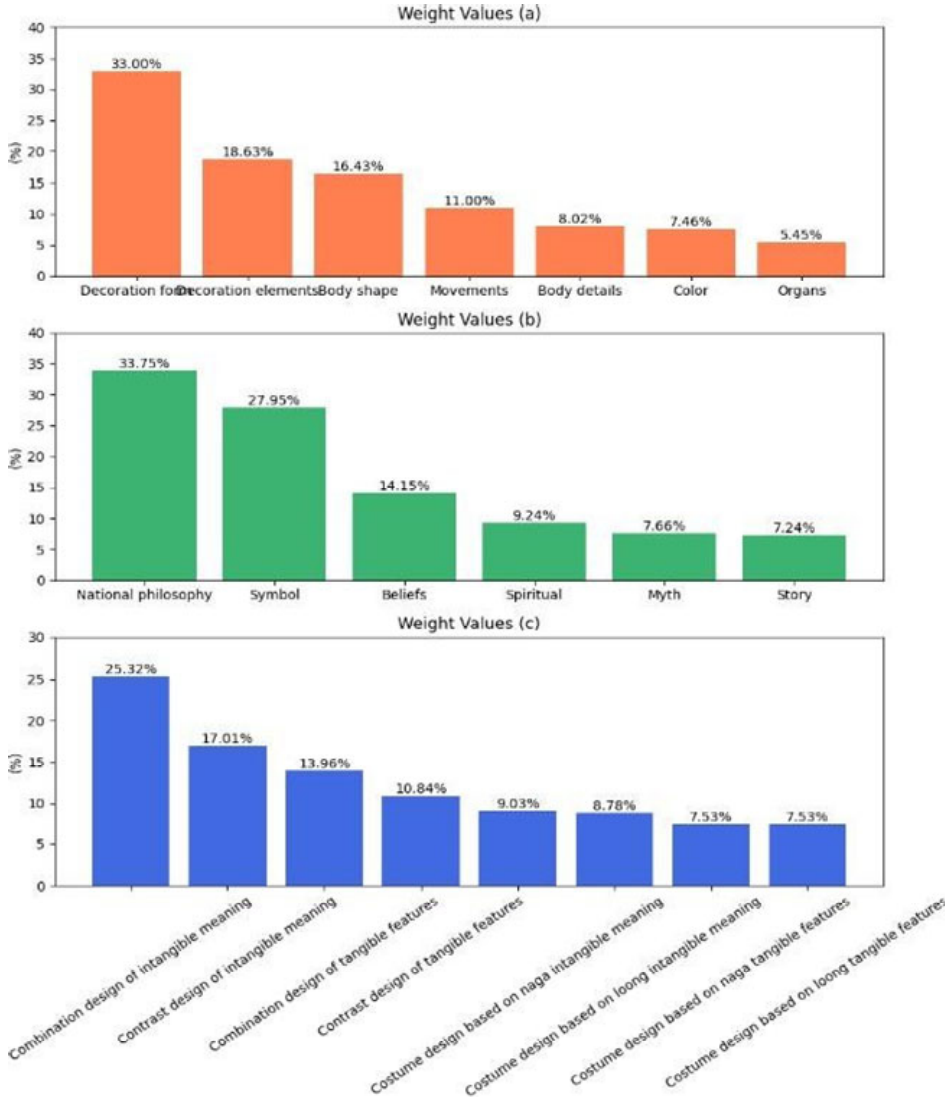


Figure 6's AHP results quantify design priorities empirically. Panel A establishes that cultural authenticity (weight: 0.42) outweighs aesthetic appeal (0.28), validating the primacy of cultural accuracy in cross-cultural design. Panels B and C translate these priorities into actionable design parameters, showing how morphological features of loong and naga should be weighted in garment applications to balance cultural fidelity with commercial viability.

The impact of traditional cultural materials on NT's brand culture is readily apparent from the case study description given earlier. At first, NT depended on studying other

brands' mistakes to ensure that the sign information communicated through its clothes would be consistent. Because of this decision, NT's brand and products were not dominant in the global market. This left it open to the whims of other forces, such as unforeseen occurrences, financial crises, political tactics, etc. This proved that NT did not have a global perspective, and it also did not separate out from other apparel with a similar style. In the home sector, NT has spearheaded an effort to recycle outdated materials in order to make new ones. Because of this, consumers' perceptions of apparel have shifted, and NT has taken advantage of this shift to boost the brand's appeal and influence. But that was not enough to give them an edge against foreign luxury brands when they were successful at home. This may have occurred because, initially, NT prioritised the material sign above its unique cultural expression as a brand, which it used to symbolise opulence. In order to make more contemporary garments, NT started drawing ideas from local culture after 2005. Incorporating traditional cultural signs, these objects communicated distinct sign-meaning and orientation.

Through an examination of the apparel-related data presented in brand events, TCRs were able to reveal additional sign-functions and their effects on NT's cultural brand. These events contributed to the growth of a luxury brand deeply ingrained in Chinese culture by raising awareness of the brand and its importance to the general public. In conclusion, three sign-meanings linked to TCRs were identified. The data on NT brand events and the impacts of transitions between them exhibit three distinct sign-functions, as shown in Table 11.

Table 11 Significance and functions of traditional cultural resources with a transitional role in the communication of the brand

Meaning of sign	*Consequence of transformation*	*Role of sign*
Positioning of cultural attribution	Evolving reliance on others to independent growth	Transition toward establishing brand-specific cultural identity
Knowledge perception orientation	Serving as a platform for studying and sharing Chinese clothing culture	Fostering academic integration and collective understanding
Stakeholder orientation	Moving from individual brand presence to a broader social network	Enhancing social engagement and connectivity

5 Conclusions

This study shows that effective cultural symbol design necessitates the integration of tradition, modernity, and cross-cultural sensitivity via rigorous empirical examination. The dual-method analysis (GRA and FCE) confirmed that plant-based motifs – lotus (GRA: 0.95, FCE: 0.98), peony (GRA: 0.94, FCE: 0.91), and plum blossom (GRA: 0.93, FCE: 0.94) – consistently outperformed across all five dimensions (Table 1, Figure 4), demonstrating their superior adaptability for modern design. This convergence of expert evaluations and public- market data provides empirical proof that these symbols successfully balance cultural authenticity and commercial viability. In contrast, narrative patterns such as 'Eight Immortals Crossing the Sea' showed considerable divergence (GRA: 0.35 vs. FCE: 0.06), indicating a critical gap between expert recognition and public comprehension (Figure 4). Their low modern application scores (Table 2) show

that these complicated motifs require visual simplification prior to contemporary integration. The cross-cultural study of Chinese loong and Thai naga (Tables 5–6, Figure 6) revealed that cultural context profoundly influences symbol perception, with AHP analysis revealing distinct priority hierarchies (cultural authenticity: 0.42 for loong vs. 0.38 for naga). This study emphasises the need for context-sensitive design adjustments rather than universal implementations. The study's methodological rigour, which included expert review (40%), public input (30%), and market performance (30%), as well as intercoder reliability greater than 0.6 (Table 10), supported the multi-source methodology. The four derived principles (conciseness, consistency, accessibility, and cultural adaptability) are empirically based on high-performing pattern features. The suggested five-phase framework (Figure 1) provides systematic direction for balancing cultural preservation and innovation, promoting sustainable development in creative sectors based on quantitative facts rather than theoretical presumption

Declarations

There are no conflicts of interest for any of the writers.

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