

A Functionalist Perspective on Translating Traditional Chinese Patterns: A Comparative Analysis of Large Language Models vs. Human Translation

Jing Guo^{1*}, Yueyan Pan², Zixuan Ye¹, Mengyuan Dou³

¹School of Foreign Languages, Wuhan Textile University, Wuhan 430073, Hubei, China

²School of Management, Wuhan Textile University, Wuhan 430073, Hubei, China

³School of Economics, Wuhan Textile University, Wuhan 430073, Hubei, China

***Corresponding author:** Jing Guo, guojing1_6@qq.com

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Abstract: Grounded in the functionalist Skopos Theory, this study systematically compares the English translations of traditional Chinese patterns produced by professional museum translators and Large Language Models (LLMs). It constructs a four-dimensional evaluation system covering cultural information accuracy, visual imagery fidelity, cultural adaptability, and linguistic expression quality.

The findings indicate that human translation significantly outperforms LLMs in in-depth cultural transmission, systematic symbolic interpretation, and reader reception. By flexibly employing strategies such as annotation, cultural adaptation, and free translation, human translators effectively achieve the cross-linguistic transfer of cultural functions. Conversely, while LLMs demonstrate high linguistic fluency and efficiency, they struggle with highly culture-loaded symbols, often leading to metaphor loss, contextual dislocation, and cultural simplification, revealing a lack of genuine interpretive capabilities.

Based on these insights, this paper proposes an optimized “human-led, LLM-assisted” collaboration model to enhance both the quality and efficiency of pattern translation. This study provides a theoretical basis and practical strategies for the international dissemination of traditional cultural symbols.

Keywords: Traditional Chinese Patterns; Large Language Models (LLMs); Skopos Theory; Museum Translation; Translation Quality Assessment

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1. Introduction

In the context of deepening global cultural exchange, traditional Chinese patterns—as composite carriers of material culture, aesthetic systems, and spiritual values—serve not only as repositories of historical memory

but also as an indispensable visual language in the dialogue between civilizations. Unlike ordinary texts, these patterns constitute a highly symbolized and contextualized signification system. Translating them is not a mere linguistic conversion but a dual operation of cultural decoding and recoding^[1]. However, due to systemic differences between China and the West in historical traditions, symbolic systems, and aesthetic cognition, the translation of traditional patterns often faces misinterpretation, superficial reading, and cultural information loss^[2,3]. These challenges severely hinder the high-quality international dissemination of Chinese culture.

In recent years, the rapid advancement of Artificial Intelligence, represented by Large Language Models (LLMs) such as ChatGPT and DeepSeek, has introduced new technological dynamics into traditional translation models. Leveraging powerful natural language generation and contextual understanding capabilities, LLMs exhibit outstanding performance in terminology unification and real-time generation. They show significant potential in scenarios requiring high-volume output, such as museum captions, artifact descriptions, and cultural product texts. Nevertheless, existing studies indicate that LLMs still face limitations when handling highly culture-loaded terms and specific cultural contexts. Their outputs often rely on literal correspondence, lacking cultural depth and cultural adaptability, and thus have not yet become a reliable substitute for human experts in the field of cultural translation^[4].

Grounded in functionalist translation theory—specifically the Skopos Theory proposed by Hans Vermeer—this study compares the English translations of pattern terminology produced by professional human translators in museums with those generated by mainstream LLMs. It aims to reveal their respective strengths and weaknesses in cultural function transmission and addresses the following research questions:

- (1) To what extent can LLM translation align with the core principles of functionalist translation theory under current technical conditions, and what are its primary limitations?
- (2) In the specialized field of traditional pattern translation, in which dimensions does the unique value of human translation lie?
- (3) How can an effective quality evaluation system and a “human-led, LLM-assisted” collaboration model be constructed to improve the efficiency of translating patterns for global outreach?

By addressing these questions, this study not only expands the theoretical application of functionalism to non-textual cultural symbols but also provides empirical evidence and strategic references for museums and translation practitioners, ultimately serving the goal of promoting the accurate and aesthetic communication of traditional Chinese culture.

2. Literature Review and Theoretical Foundation

2.1. Current Research on Culture-Loaded Terms and Visual Symbols

The translation of culture-loaded terms and cultural symbols has long presented a significant challenge in translation studies. Traditional scholarship has largely revolved around the classic dichotomy between “foreignization” and “domestication,” highlighting the tension between preserving source-culture specificity and ensuring target-text acceptability.

Eugene Nida’s concept of “dynamic equivalence” prioritizes the functional principle, arguing that translation should aim for equivalent reader response rather than formal correspondence. Conversely, from the perspective of the Manipulation School, André Lefevere argues that translation is never a neutral linguistic transfer but is invariably constrained by ideology, poetics, and patronage^[5].

However, existing research on culture-loaded terms has predominantly focused on textual entities within

the language system, such as kinship terms, folk idioms, and institutional names. In comparison, scholarship on visual cultural symbols—such as patterns, totems, artifact shapes, and color systems—remains relatively scant^[6].

Traditional patterns, as visual symbols that are non-textual yet culturally dense, constitute a unique signification system. Their translation transcends mere nomenclature accuracy; it entails the decoding and recoding of an entire visual imagery system, symbolic network, and cultural context^[1].

Currently, specialized research on pattern translation remains in a nascent stage, characterized by fragmentation and case-specific studies. For instance, in the fields of costume and craftsmanship, scholars have discussed the translation of common motifs such as “dragon patterns,” “phoenix patterns,” “cloud patterns,” and “interlocking branch patterns.” Yet, most studies remain at the level of practical summary, lacking a unified theoretical framework or systematic strategies^[7].

In recent years, driven by the growing demand for museum cross-cultural communication^[8], some scholars have proposed strategies such as “explanatory translation” and “adaptive translation,” suggesting the use of cultural annotations, imagery analogies, or functional interpretations to bridge cultural gaps. However, these proposals have yet to establish a systematic theoretical framework or a comprehensive evaluation system grounded in a holistic functionalist perspective^[9].

2.2. Application and Challenges of Large Language Models (LLMs) in Translation

Large Language Models (LLMs) such as GPT-4.0 and DeepSeek, relying on the Transformer architecture and their powerful pre-training mechanisms, have made breakthrough progress in the field of machine translation.

Their advantages are primarily reflected in robust contextual awareness and semantic reasoning, enabling them to handle ambiguity and metaphor to a significant degree. LLMs excel at generating natural, fluent translations that align with target-language norms, while also supporting multilingual interoperability and high-efficiency processing of large-scale texts. These capabilities make LLMs highly effective in scenarios such as general text translation, real-time translation assistance, and multilingual content generation^[10].

However, the application of LLMs in cultural translation remains fraught with challenges. Since LLM learning derives from statistical patterns within training corpora rather than lived cultural experience or contextual immersion, these models often fail to capture the historical depth, collective psychology, and emotional resonance behind cultural symbols. Furthermore, LLMs exhibit poor consistency in handling specialized terminology and low-frequency cultural concepts, often leading to terminological discrepancies or cultural misinterpretations due to noise or bias in the data.

Crucially, LLMs lack genuine “Skopos awareness” (purpose-driven consciousness). They struggle to dynamically adjust translation strategies and expressive styles according to specific tasks (e.g., academic research vs. public communication vs. commercial application). Consequently, their outputs tend to be “generalized,” lacking the necessary cultural adaptability^[11].

2.3. Functionalist Skopos Theory and Its Applicability in Cultural Symbol Translation

Functionalist translation theory, particularly the Skopos Theory proposed by German scholar Hans Vermeer in the 1970s, provides a robust theoretical foundation for addressing the above issues. The core proposition of Skopos Theory is that translation is a purposeful action; consequently, the final form of a translation is determined by its intended function (Skopos) in the target context^[12]. The theory is governed by three hierarchical rules: the Skopos Rule, the Coherence Rule, and the Fidelity Rule.

- The Skopos Rule is paramount, dictating that the purpose of the translation determines the translation method and strategies. It emphasizes that translations should function effectively within the target cultural context.
- Subordinate to this is the Coherence Rule (also known as Intratextual Coherence), which requires that translations must conform to the cognitive habits of target readers to ensure readability and make sense within the communicative situation of the target culture.
- Finally, the Fidelity Rule (Intertextual Coherence) stipulates that translations should maintain a certain degree of correspondence with the source text; however, the degree and form of this fidelity are ultimately subordinate to the purpose of the translation. The Skopos Rule is at the highest level, so the motivation of translation should be considered first, which emphasizes that translations should achieve their required functions in the target cultural context.

Skopos Theory liberates translators from the constraints of static “equivalence” in traditional translation theory, offering greater flexibility and a wider range of strategic choices. Especially for cultural symbols like patterns, which possess multiple functions such as informative, expressive, and operative functions, Skopos Theory emphasizes that translators should prioritize the specific requirements of the translation task. Depending on whether the purpose is accurate transmission for academic research, cultural popularization for the general public, or aesthetic appeal for commercial application, translators may select appropriate methods ranging from literal translation and free translation to annotation, cultural adaptation, or symbolic reconstruction.

From this theoretical perspective, pattern translation no longer seeks absolute “literal correspondence” but takes function realization as the ultimate goal. This requires translators to deeply understand the historical background, symbolic meanings, and usage contexts of patterns in the source culture, while accurately grasping the cultural cognition and horizon of expectation of target readers. Through effective cultural mediation strategies, the cross-linguistic transmission of cultural functions can be achieved. Skopos Theory provides a theoretical framework for pattern translation that balances cultural respect for the symbols themselves with reader acceptance and communication effectiveness, demonstrating high explanatory power and applicability.

2.4. Evaluation System for Pattern English Translation

To rigorously evaluate the quality of traditional Chinese pattern English translation, this study constructs a systematic, multi-dimensional evaluation framework grounded in functionalist Skopos Theory. This system comprises the following four core dimensions:

2.4.1. Cultural Information Accuracy

This dimension assesses whether the translation accurately conveys the core cultural information of the patterns, including historical origins, craftsmanship features, usage contexts, and religious or philosophical implications. It focuses on the faithful transmission of the pattern’s historical lineage, symbolic connotations, and philosophical depth.

2.4.2. Visual Imagery Fidelity

This measures whether the translation enables target readers to visualize the traditional patterns and comprehend their deep symbolic meanings. It examines the effective reconstruction of the unique visual features and aesthetic aura (Yi-jing) of the patterns, ensuring that cultural misunderstandings are avoided through necessary interpretation.

2.4.3. Cultural Adaptability

This evaluates whether the translation maximizes acceptability within the target cultural context to ensure the effectiveness of cultural communication. It emphasizes minimizing cultural conflict and bridging cognitive gaps for readers from diverse cultural backgrounds.

2.4.4. Linguistic Expression Quality

This checks whether the translation conforms to the grammatical norms, idiomatic usage, and stylistic appropriateness of the target language, while maintaining terminological consistency.

These four dimensions are interrelated, forming a comprehensive and systematic evaluation framework centered on functional realization. They cover the primary functional aspects of pattern dissemination across languages, providing a theoretical basis and practical tool for the subsequent case comparison and quality assessment.

3. Research Methods and Data Collection

3.1. Research Subjects and Sample Selection

This study centers on representative traditional Chinese patterns, selecting three distinct categories based on their typology and cultural functions. The first category comprises plant patterns—such as lotus, peony, and interlocking branch motifs—which symbolize auspiciousness, prosperity, and the continuity of life. The second category consists of animal patterns, including dragon, phoenix, bat, and fish motifs, which are frequently associated with power, good fortune, and abundant harvests. The third category encompasses composite patterns, such as the “Fortune and Longevity,” “Eight Trigrams,” and “Four Loves” motifs, which fuse multiple visual elements to convey complex cultural meanings.

The primary data samples were collected from three museums renowned for their extensive collections and established translation practices: the Hubei Provincial Museum, specializing in ceramic patterns and Han Opera costumes; the Henan Museum, known for its bronze ware patterns; and the Zhengzhou Museum, focusing on textile, embroidery, and costume patterns. These samples span a broad historical timeframe from the Shang and Zhou Dynasties to the Ming and Qing Dynasties, covering diverse material carriers such as bronze, ceramics, textiles, and lacquerware to ensure both typological diversity and cultural representativeness.

3.2. Data Sources

Between June and August 2025, the research team collected official museum translations using multiple methods. Team members conducted on-site research at the museums mentioned above. With institutional permission, they photographed artefacts, exhibition labels, and English exhibition texts, resulting in 32 valid datasets. In addition, 28 datasets were collected from official museum websites, exhibition catalogues, and authoritative publications such as *The Complete Collection of Chinese Patterns* and *Museum Pattern Specimens*. From these sources, the Chinese names of the ornamental pattern motifs, their cultural background descriptions, and their official museum translations were extracted. In total, 60 ornamental pattern samples were obtained. Each sample includes a clear image, the original Chinese name, an official museum translation, and a cultural background description.

DeepSeek and ChatGPT-4.0 were selected as the large language models for translation generation in this study. As widely used models with strong performance in multilingual text generation and semantic understanding, they are suitable for examining the ability of large language models to handle culturally specific

ornamental pattern translation tasks. A structured prompt strategy was applied during translation generation. The prompts consistently included task instructions requesting the translation of traditional Chinese ornamental pattern motifs into English, background information such as historical period, material form, and symbolic meaning, and clear output requirements that restricted the response to the translated text only. This approach helped maintain input consistency, ensured comparability across generated outputs, and reflected realistic user query conditions. At the same time, it balanced the provision of necessary background information with control over the generation process.

4. Multidimensional Evaluation of Translation Quality

4.1. Data Preparation and Sample Selection

The core dataset for this study was compiled using Microsoft Excel, comprising traditional Chinese patterns collected from museum exhibitions. Each pattern is paired with three distinct English translations: the professional museum translation, and the versions generated by ChatGPT-4.0 and DeepSeek.

For the sample selection, priority was given to patterns that exhibited significant divergence among the three translation versions. This criterion was intended to accentuate the variations in translation strategies and outcomes. Ultimately, ten patterns characterized by high cultural complexity were selected as the core samples for detailed analysis. This selection strategy served to minimize evaluation redundancy and more sharply reveal the comparative strengths and weaknesses of each version in terms of semantic and cultural transmission.

4.2. Evaluation Process Design and Implementation

4.2.1. Rater Training and Calibration Process

To ensure the reliability and validity of the subjective scoring process, standardized rater training and calibration procedures were applied.

Before the formal evaluation, all raters took part in structured training sessions. First, detailed scoring criteria were developed based on the four main evaluation dimensions established in Chapter 2. The full criteria are provided in the appendix titled Detailed Scoring Criteria. Next, raters reviewed the criteria in detail and participated in group discussions to reach a shared understanding of the scoring standards for each dimension. This was followed by pilot scoring and calibration. A small set of ornamental pattern translations that were not included in the final ten samples was used for trial scoring. This step helped raters become familiar with the scoring process and improved consistency among evaluators.

4.2.2. Formal Grading Process

After the calibration stage, each evaluator independently assessed the ten selected ornamental pattern motifs. For each motif, the three translation versions, namely the official museum translation, the ChatGPT-4.0 translation, and the DeepSeek translation, were scored on a scale from 1 to 10, with 1 representing the lowest score and 10 the highest. The assessment was carried out across four predefined evaluation dimensions.

4.3. Statistical Analysis of Consistency and Comparison

4.3.1. Rater Reliability Analysis

To ensure the reliability and validity of the scoring data, this study employed the Intraclass Correlation Coefficient (ICC) to assess agreement among the ten raters across the four evaluation dimensions.

Initially, a pairwise correlation matrix was computed for all raters. The mean correlation coefficients among raters were consistently high, indicating a strong positive correlation. This result provides preliminary evidence of robust inter-rater consistency. To further quantify this reliability, a formal ICC analysis was conducted. The results are presented in **Table 1** and **Table 2** below:

Table 1. Reliability Statistics

Cronbach's Alpha	Number of Items
.986	10

Table 2. Intraclass Correlation Coefficient (ICC)

Intraclass Correlation ^b	95% Confidence Interval		F Test with True Value of 0				
	Lower Bound	Upper Bound	Value	df1	Df2	Sig.	
Single Measures	.872 ^a	.838	.902	69.049	107	963	.000
Average Measures	.872 ^c	.981	.989	69.049	107	963	.000

Two-way mixed effects model where people effects are random and measures effects are fixed.

a. The estimator is the same, whether the interaction effect is present or not.

b. Type C intraclass correlation coefficients using a consistency definition. The between-measure variance is excluded from the denominator variance.

c. This estimate is computed assuming the interaction effect is absent, otherwise it is not estimable.

As illustrated in the reliability tables, the Cronbach's Alpha coefficient is .986, and the Average Measures ICC reached .986 ($p < .001$). These values significantly exceed the standard acceptance threshold of 0.8. Even the Single Measures ICC stands at .872, indicating excellent inter-rater reliability. Such a high level of agreement confirms the stability of the scoring process. It suggests that different raters applied the scoring criteria in a highly consistent manner, with minimal random error or individual bias. Consequently, the scoring data produced by this panel can be regarded as reliable and robust, providing a solid foundation for the subsequent comparative analysis of the translation versions.

4.3.2. Performance Analysis of Translation Versions Across Dimensions

To facilitate a systematic comparison of the different translation versions across the four evaluation dimensions, this study calculated the mean scores and standard deviations for each version. Based on these metrics, the versions were ranked to identify the most effective translation approach.

4.3.2.1. Overview of Overall Performance

Overall, the professional museum translations demonstrate superior performance compared to LLM-generated translations, particularly in terms of Cultural Information Accuracy and Visual Imagery Fidelity. These human translations exhibit greater strength in conveying deep cultural content and intended symbolic significance. However, translations produced by LLMs occasionally achieve higher scores in Linguistic Expression Quality, reflecting their advantage in fluency and readability.

4.3.2.2. Representative Case Analysis

To illustrate the performance comparisons across dimensions, the pattern found on the “Blue and White Plum Vase Depicting the Four Noble Pursuits” (or Blue and White Meiping with Four Loves) is selected as a representative case. The comparative scores for its three translation versions across the four evaluation dimensions are presented in the table below.

Table 3. Comparative Scores for the “Blue and White Meiping with Four Loves Design”

Translation source	Translation Version	Cultural Information Accuracy	Visual Imagery Fidelity	Cultural Adaptability	Linguistic Expression Quality	Overall Ranking
Museum Translation	Blue and White Vase with Four Loves of Plum Blossom in Yuan Dynasty	8.7	7.9	7.5	7.3	1
GPT-4	Blue-and-White Meiping Vase with “Four Loves” Scenes	6.3	5.6	5.2	4.6	2
DeepSeek	Blue-and-White Meiping Vase with “Four Loves” Design	5.2	4.3	3.7	3.4	3

As indicated in **Table 3**, the professional museum translation clearly outperforms the LLM-generated versions in terms of cultural transmission. It achieved the highest scores across all dimensions, particularly in Cultural Information Accuracy (8.7) and Visual Imagery Fidelity (7.9). This demonstrates the human translator’s superior capacity for intention restoration, successfully conveying the specific cultural motif of the “Four Loves” and its historical context.

In contrast, the translations generated by Large Language Models remained limited in cultural depth and contextual accuracy. Unlike their performance in general texts, LLMs struggled with this highly culture-loaded artifact, resulting in significantly lower scores even in linguistic expression. This underscores that without genuine cultural interpretation capabilities, LLMs fail to effectively reconstruct the symbolic meaning of traditional Chinese patterns.

4.3.2.3. Standard Deviation Analysis

The standard deviation values across translation versions are generally low, with most falling between 0.5 and 1.0. This indicates a low level of disagreement among raters. The stability of the scores suggests that the evaluation results are reliable and consistent. These findings further support the conclusions drawn from the rater reliability analysis.

4.4. Analysis of Representative Pattern Examples

To further examine the differences in translation strategies and the degree to which cultural functions are realized, this study selected several representative patterns for detailed analysis. Three cases are presented below to illustrate how different translation versions handle cultural meaning and symbolic depth.

4.4.1. Case Study 1: The “Fu-Shou” (Fortune and Longevity) Pattern (Source: Qing Dynasty Embroidered Cloud Shoulder)

Pattern Description: This pattern is a common auspicious design found on women’s Yunjian (Cloud Shoulder

capes) from the Qing Dynasty. The central visual elements are the Chinese characters “Fu” and “Shou”, written in seal script (Zhuan Shu). These characters are often surrounded by interlocking floral motifs or auspicious cloud patterns. “Fu” signifies happiness and good fortune, while “Shou” symbolizes longevity. Collectively, the pattern expresses sincere wishes for a prosperous and long life, reflecting the traditional Chinese pursuit of well-being and security.

Translation Versions:

- Professional Museum Translation: “Embroidered Yunjian (Shoulder Cape) with ‘Fu’ (blessing) and ‘Shou’ (longevity) Patterns. The design combines Chinese characters in seal script with interlaced floral motifs, symbolizing wishes for a fortunate and long life.”
- LLM Translation (GPT-4): “Fu Shou pattern”
- LLM Translation (DeepSeek): “Pattern of ‘Fu’ and ‘Shou’ (meaning blessing and longevity) with surrounding flowers”

Translation Strategy Analysis: The professional museum translation employs a combination of annotation, cultural adaptation, and free translation. This multi-faceted approach ensures that key cultural elements are fully explicated and clearly conveyed. In contrast, the ChatGPT-4 version relies primarily on transliteration, resulting in a significant loss of cultural information. While the DeepSeek version adds brief parenthetical explanations to the transliterated terms, it fails to capture specific cultural features such as the “seal script” style and the symbolic structure of the surrounding motifs.

Reasons for Differences: Museum translators possess domain expertise and cultural sensitivity, enabling them to decode multiple symbolic layers within a pattern and employ flexible strategies to preserve its cultural value. Conversely, LLMs are constrained by the statistical patterns in their training data. They tend to identify only the most surface-level lexical tokens, lacking the capability for deep cultural interpretation.

4.4.2. Case Study 2: The “Double Phoenix Holding Ribbons” Pattern (Source: Tang Dynasty Bronze Mirror Design)

Pattern Description: This pattern is a ubiquitous motif on Tang Dynasty bronze mirrors, typically depicting two Luan birds (mythical birds similar to phoenixes) facing each other, each holding a long ribbon (Shou) in its beak. The Luan bird is a traditional auspicious creature symbolizing good fortune. The ribbon (Shou) forms a homophonic pun with the character for “to confer” (Shou 授) and is also associated with longevity (Shou 寿). Historically, these ribbons represented official seals and rank. Consequently, the motif articulates a dual wish for longevity and success in official service, reflecting the social values and career aspirations of the Tang Dynasty elite.

Translation Versions:

- Professional Museum Translation: “Bronze Mirror with Design of Two Phoenixes Holding Ribbons in Beaks. The phoenixes (luan birds) symbolize auspiciousness; the ribbons (shou dai) represent official rank and longevity. A popular motif in the Tang Dynasty expressing wishes for career success and family prosperity.”
- LLM Translation (GPT-4): “Pattern of Two Phoenixes Holding Ribbons (an auspicious design from the Tang Dynasty meaning successful official life and wealth)”
- LLM Translation (DeepSeek): “Double phoenixes carrying ribbon pattern”

Translation Strategy Analysis: The professional museum translation employs a mixed strategy comprising

literal translation, annotation, and interpretive explanation. Crucially, it explicates the homophonic connection between “ribbons” and “official rank,” bridging the cognitive gap for target readers. The ChatGPT-4 version attempts interpretive translation but simplifies the rich cultural connotation into generic terms (“wealth”). The DeepSeek version relies exclusively on literal translation, failing to convey the symbolic function of the “ribbons” entirely.

Reasons for Differences: Museum translators possess specialized historical knowledge, enabling them to decode the specific visual puns (e.g., Ribbon = Rank) embedded in the design. LLMs, however, process visual elements as isolated lexical tokens. They lack the contextual inference capability to link a physical object (ribbon) to its specific institutional metaphor (official rank) in the Tang Dynasty context.

4.4.3. Case Study 3: The “Bagua” (Eight Trigrams) and Floral-Fruit Pattern (Source: Qing Dynasty Embroidered Cloud Shoulder)

Pattern Description: This complex pattern integrates Bagua (Eight Trigrams) symbols with auspicious flora such as peaches, pomegranates, and Buddha’s Hand citrons. The Bagua represents cosmological order and the fundamental principles governing heaven and earth. In the accompanying floral system, peaches symbolize longevity, pomegranates represent fertility (due to their many seeds), and Buddha’s Hand citrons symbolize good fortune (Fu). The composition harmoniously blends Taoist philosophy with folk secular beliefs, reflecting the traditional Chinese worldview of “Harmony between Heaven and Humanity” alongside the pursuit of abundant blessings.

Translation Versions:

- Professional Museum Translation: “Embroidered Yunjian with Bagua (Eight Trigrams) and Auspicious Fruit-Flower Patterns. The Bagua symbols represent the fundamental principles of reality in Chinese philosophy; the peaches, pomegranates, and Buddha’s hand citrons symbolize longevity, fertility, and fortune respectively.”
- LLM Translation (GPT-4): “Eight Trigrams with flowers and fruits pattern (Bagua with peaches and pomegranates, meaning good luck and happiness)”
- LLM Translation (DeepSeek): “Bagua and fruit-flower pattern”

Translation Strategy Analysis: The professional museum translation utilizes annotation and thick description (deep explanation) to decode the pattern’s philosophical layers. It accurately distinguishes the specific symbolic meaning of each fruit. The ChatGPT-4 translation adopts a literal approach with a generalized summary, reducing the distinct symbolism of “fertility” and “cosmology” to the vague label of “good luck.” The DeepSeek version offers a bare literal translation, resulting in substantial cultural information loss.

Reasons for Differences: Museum translators exhibit strong cross-cultural awareness, recognizing that concepts like Bagua require explicit philosophical framing for Western readers. They bridge these cultural gaps through precise explanation. In contrast, LLMs are limited by algorithmic generalization, often collapsing specific cultural nuances (e.g., “pomegranates for fertility”) into broad, universal categories like “happiness,” leading to a semantic flattening of the cultural text.

4.5. Comprehensive Evaluation

The preceding analysis demonstrates that professional museum translations employ a significantly richer and more precise repertoire of strategies. Human translators flexibly integrate literal translation, free translation, annotation, and cultural adaptation, tailored to the specific cultural attributes of each pattern. This

methodological flexibility ensures that cultural functions are conveyed with clarity and completeness.

In contrast, translations produced by Large Language Models predominantly rely on literal translation and superficial annotation. They lack depth in cultural explication and exhibit limited consideration for the target reader's cognitive context. Consequently, these models face distinct limitations in fulfilling the *Skopos* (purpose) of cultural translation.

This disparity underscores the irreplaceable advantages of human translators: cultural sensitivity, contextual judgment, and strategic decision-making. These cognitive capabilities currently constitute a critical bottleneck for LLM technology in the realm of high-context cultural communication.

5. Discussion

5.1. Evaluation of LLM Translation Performance Based on Skopos Theory: Partial Competence and Cultural Aphasia

Large language models(LLMs) present their ability to follow instructions and adapt to functions at the level of purpose. They can generate texts for different uses based on prompts. However, this adaptation remains mechanical and passive. It lacks the strategic grasp of the ultimate communicative goal in translation. Human translators demonstrate contextual judgment and intentionality.

In terms of coherence, LLMs ensure smoothness at the sentence level and coherence within the language. Yet at the discourse level, their texts often miss deeper cultural narrative logic. Their explanations rely mainly on statistical patterns of co-occurrence rather than an understanding of inner cultural logic. This makes it hard to build a consistent cultural context. As a result, the overall coherence of the translation suffers in the view of readers from the target culture.

Cultural fidelity marks the most notable gap in the abilities of LLMs. Their core mechanism of generating text from probability predictions brings inherent weaknesses in cultural transmission. Their outputs easily repeat cultural stereotypes present in training data. They also offer generalized or even factually wrong background details. Professional human translators provide culturally sensitive and academically accurate cultural explanations, which LLMs cannot match.

In summary, under the present technological framework, LLMs act more like efficient processors of cultural information than true interpreters of cultural meaning. The source of their limitations lies in the absence of embodied recognition of deep cultural structures and real intentionality rooted in communicative situations. This finding leads to the next important discussion, which concerns the dimensions where human translators still hold irreplaceable core value.

5.2. The Irreplaceable Nature of Human Translation: Cultural Interpretation, Communicative Strategies, and Ethical Agency

From the analysis above, the value of human translation goes far beyond what machines can replace. In particular, its irreplaceable quality appears mainly in three interconnected dimensions. These include the cultural dimension, the communicative dimension, and the ethical and aesthetic dimension.

Professional translators serve as interpreters and adapters of culture. They draw on deep knowledge in the field. They carefully examine the historical meanings and emotional values behind pattern symbols. They then carry out interpretive translation. This active operation based on understanding effectively prevents cultural misunderstandings and ensures accuracy in cultural transmission.

Human translation actively supports the communicative purpose of translation. Translators can weigh

and choose between acceptability and adequacy for different target audiences and text types. This conscious decision-making relies on context. It aims to achieve the expected communicative effect to the fullest degree. Rigid translations from large language models based on big data statistics cannot reach this level.

At the aesthetic level, translators focus on artistic re-creation. They reproduce the aesthetic value of the source text in the target language as much as possible. At the ethical level, human translators take responsibility as subjects of translation. They are accountable for every choice in cultural representation and explanation. They make sure the translation is not only factually correct but also culturally appropriate. LLMs as mere tools lack this agency to accept consequences.

In summary, in the broad context of globalization and cultural dissemination, the role of human translators has not weakened. Instead, it has become even more critical. This conclusion shows the direction for building effective human-machine collaboration models in the future.

5.3. Human-Machine Collaboration: Possible Paths for Future Optimization

LLMs have limitations in deep cultural translation. Still, their strengths in efficiency, consistency, and support for multiple languages cannot be overlooked. The practical path ahead is not to replace humans with machines, but rather to foster human-machine collaboration. A systematic plan is needed that combines evaluation and partnership.

An operational evaluation system must first be set up. It should abandon the traditional absolute standards of right or wrong. Building a multidimensional quality assessment framework for the English translation of traditional Chinese patterns guided by functionalism forms an important first step^[13]. The inter-rater reliability analysis and comparative analysis of translation versions in this study, together with earlier data, confirm that the evaluation theory system for pattern translation built in Chapter 2 applies widely and generally.

The key to improving performance in the future lies in making the best use of the strengths of both large language models and human translation. This project has set up a closed-loop workflow for human-machine collaboration based on the research. It forms a cycle of initial handling by LLMs, followed by deep human review and interpretation, and then feedback to optimize the model. Large language models act as basic assistants. They handle large amounts of text with initial drafts, create terminology banks, offer several translation choices, and spot clear errors. This frees up human effort greatly. Humans lead and make decisions. They concentrate on weak areas of LLMs, such as cultural adjustment, deep interpretation, style polishing, and final quality control. They raise the output of large language models to the level of true cultural translation. The final feedback loop uses human-reviewed results as high-quality data. It feeds back to the large language model for domain-specific fine-tuning. This improves performance steadily in the specialized field and creates a positive cycle.

This three-level collaboration model complements human and machine strengths. It maintains translation efficiency. At the same time, it greatly raises the quality and effectiveness of disseminating traditional cultural symbols through translation.

6. Conclusion

This study uses the theoretical lens of functionalist Skopos Theory. It systematically compares authoritative professional human translations from museums with the performance of LLMs in English translations of traditional Chinese patterns. The research confirms that human translation retains irreplaceable core value in

deeply transmitting cultural functions, systematically interpreting complex symbolism, and adapting to readers. Large language models remain efficient but surface-level language processing tools. They do not yet have real cultural translation ability.

However, this project has some limitations. The samples come mainly from large comprehensive museums in China. They may not fully cover patterns with strong local or ethnic features, such as Miao embroidery patterns and Tibetan metal engraving patterns among others. The chosen large LLMs are limited and do not include all major ones. LLMs also update quickly, so research conclusions may change with technological progress. Moreover, some dimensions in the evaluation system, such as aesthetic effects and reader acceptance, involve subjectivity. Multiple ratings and discussions helped ensure reliability. Future work should still add empirical methods like audience surveys for further checks.

Based on the main findings of this study, the paper offers suggestions at both practical and academic levels. When spreading Chinese pattern culture abroad, translations should always focus on the purpose of dissemination. Projects should clarify from the start why to translate, for whom, and in what setting. This helps form clear dissemination strategies. Translation practice must rest on deep research into pattern history, symbolic systems, and craft features. It should use methods like extratextual notes, cultural interpretation, and cross-cultural comparisons. These fully transmit knowledge, aesthetic, and cultural values. At the level of technology use, a mechanism of human-led and technology-assisted collaboration should be built. It fully employs the core role of professional translators in cultural accuracy and audience adaptation. At the same time, it uses artificial intelligence to raise efficiency. Efforts should speed up building specialized databases for cultural heritage translation and domain-optimized models. Enhanced cultural context input and automatic detection of mistranslation risks will improve AI understanding and transformation of deep cultural meanings. In academic research, studies can expand to more diverse cases like minority ethnic patterns. They can keep tracking progress in cultural awareness of large language models. They can also bring in empirical methods such as reader surveys and eye-tracking experiments. These scientifically evaluate dissemination effects and push Chinese cultural translation research toward systematization and scientific development.

Cross-cultural translation of traditional Chinese patterns is a long-term and complex systematic project. It needs deep collaboration across multiple disciplines. These include translation studies, museology, computational linguistics, and cultural studies. Only with deep understanding of cultural functions can technology be used well without being controlled by it. In the end, this achieves accurate dissemination and deep acceptance of Chinese cultural symbols.

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