International Communication Pathways of China's Textile Intangible Cultural Heritage Based on Cross-Cultural Communication Theory

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ABSTRACT Efficient international dissemination of textile intangible cultural heritage increasingly relies on intelligent digital media, multimodal information transmission, and interactive communication technologies, which also provide important application scenarios for advanced information and communication engineering. To address cognitive bias and limited communication formats in the cross-cultural dissemination of China's textile intangible cultural heritage, this study develops a systematic international communication framework using Shu brocade as a representative case based on cross-cultural communication theory. Guided by Hall's high- and low-context cultural framework, semantic embedding techniques are employed to identify symbolic decoding differences across cultural groups, while multilingual social media comments are analyzed to construct audience cognitive maps and classify reception patterns. Based on these findings, localized multimodal narrative strategies integrating text, images, videos, and three-dimensional interactive content are designed, and an LSTM-based generation model is adopted to produce culturally adaptive communication content. Furthermore, a quantitative response model incorporating cultural distance, communication form, and audience acceptance intensity is established to evaluate communication effectiveness. Experimental results show that low-context cultural groups achieve a user engagement rate of 68.4% and an interaction depth score of 8.9 for three-dimensional interactive content, demonstrating that technology-driven immersive communication effectively bridges cross-cultural cognitive gaps and enhances the dissemination of textile intangible cultural heritage. The proposed framework provides a reusable methodological paradigm for digital cultural communication and offers valuable references for multimodal information delivery and intelligent communication systems supporting future wireless and interactive media applications.

INDEX TERMS cross-cultural communication, textile intangible cultural heritage, shu brocade, multimodal communication, semantic embedding

I. INTRODUCTION

CHINESE textile intangible cultural heritage, such as Shu brocade—renowned for its multi-colored weft weaving technique of "continuous warp and broken weft"—and Suzhou embroidery, characterized by its "flat, even, fine, and dense" weaving, are not only important cultural expressions of Chinese civilization but also treasures of craftsmanship that integrate complex weaving techniques, natural material science, and traditional aesthetics [1,2]. In the context of globalization, promoting their international dissemination is an inherent requirement for cultural inheritance and a key measure for enhancing a country's cultural soft power [3,4]. However, cross-cultural communication practice faces severe challenges, the core of which lies in the cognitive gap caused by differences in cultural contexts [5,6]. Within Hall's high- and low-context cultural theory, the implicit symbolic meanings in high-context cultures—such as the auspicious meanings of specific patterns—are often difficult to decode accurately in low-context cultures due to the lack of shared context, resulting in semantic discontinuities in information transmission [7,8]. One of the root causes of this cognitive barrier is the lack of depth in existing communication content. Current international communication focuses primarily on the visual aesthetics of finished products, while insufficiently explaining the complexity and technical logic of the weaving process, such as how warp and weft are used to achieve "different colors for each flower" and how the twist and tension of the silk thread affect the gloss. This results in overseas audiences remaining at a superficial level of appreciation, making it difficult to deeply appreciate

the value of the craftsmanship [9,10]. Furthermore, the fragmentation of communication channels exacerbates this dilemma. Communication activities largely rely on offline exhibitions and festivals, with sporadic digital applications and a failure to effectively leverage social media to build sustained, interactive engagement mechanisms, limiting the breadth and depth of communication [11,12]. The application of intercultural communication theory in various fields of practice continues to expand, and its core concepts—such as cultural competence, intercultural interaction, and identity negotiation—have gradually become important frameworks for analyzing intercultural adaptation and communication effectiveness. Wilczewski et al. [13] systematically reviewed the relevant literature of the past three decades on the cross-cultural adaptation of international students, revealing that language proficiency and host country interaction constitute the main research thread in this field. At the same time, they pointed out that there are differences in the conclusions on the role of communication in homologous groups, reflecting the limitations of the theoretical explanatory power. Eren [14] used pre-service teachers as the subjects, relying on Byram's common orientation of cross-cultural competence and Bennett's development model. Through remote collaborative intervention, they verified that cross-cultural sensitivity can be improved through structured interaction, and learners showed a deeper cognitive transformation when facing cultural differences and social inequality. Yu et al. [15] conducted a systematic review of LGBTQ+ (lesbian, gay, bisexual, transgender, queer or questioning, and others) cultural competence training and found that short-term multimodal training can bring about certain changes in knowledge, skills, attitudes, and behaviors, reflecting the actual effectiveness of structured intervention in improving the cultural responsiveness of professionals. Existing research still has certain shortcomings in the depth of theoretical integration, the robustness of methodological design, and the tracking of long-term communication effects, which restrict the explanatory power and guiding value of cross-cultural communication theory in complex real-world situations.

In recent years, academic research on China's textile intangible cultural heritage has shown a multidimensional development trend in terms of historical origins, cultural interpretation, and contemporary transformation. Tian et al. [16] used qualitative methods to integrate literature and physical evidence and, based on social memory theory, systematically sorted out the historical context of Guangxi Zhuang brocade. They explained the process of its evolution from daily weaving to collective cultural symbols in Zhuang society, reflecting the deep function of intangible cultural heritage in the construction of ethnic identity. Zou et al. [17] further extended their vision to the context of modern social change, analyzed the transformation process of its social function and cultural significance, and revealed the aesthetic reconstruction achieved by Shu brocade in its integration into painting, sculpture, and contemporary art practice, reflecting the inherent motivation of traditional crafts to actively adapt and reconstruct cultural values under the impact of modernity. Wang et al. [18] focused on its cross-border application in the field of modern design. Through case analysis, they presented the transformation path of its artistic themes in clothing and packaging design and proposed a feasible strategy for realizing living inheritance based on digital communication and collaborative mechanisms, reflecting the practical shift from cultural protection to innovative communication. Although existing research has made progress in historical construction, cultural significance interpretation, and design application, it still lacks systematic observation and theoretical integration in terms of audience cognition, symbol decoding differences, and international communication effectiveness evaluation in the context of cross-cultural communication [19,20].

To address these challenges, this paper, using Shu brocade as a case study, introduces a systematic international communication approach based on cross-cultural communication theory. The selection of Shu brocade is grounded in its structural complexity, symbolic density, and historical centrality within the broader category of Chinese textile intangible cultural heritage—features that reflect common challenges in the cross-cultural transmission of textile-based traditions. Its intricate weaving logic and context-dependent symbolism serve as a paradigmatic instance for examining decoding disparities across cultural frameworks, thereby providing a robust foundation for methodological generalization. This approach aims to enhance the comprehensibility and acceptance of textile intangible cultural heritage within heterogeneous cultural contexts through a closed-loop process of theoretical analysis, data insights, strategic design, and quantitative evaluation. The specific approach includes: (1) analyzing the cross-cultural cognitive differences of Shu brocade symbols based on high- and low-context theory; (2) leveraging social media data to construct a cognitive map of audiences and categorize their reception patterns; (3) designing multimodal, localized narrative content; and (4) establishing a quantitative model to dynamically evaluate communication effectiveness. This study aims to provide a replicable and verifiable theoretical framework and practical paradigm to address the challenges of cross-cultural communication of textile intangible cultural heritage.

II. CONSTRUCTING INTERNATIONAL COMMUNICATION PATHWAYS BASED ON CROSS-CULTURAL COMMUNICATION THEORY

A. CULTURAL CONTEXT MODELING AND IDENTIFYING SEMANTIC BREAKS

In cross-cultural communication, the patterns, colors, and craftsmanship of Shu brocade often lead to decoding errors due to differences in cultural backgrounds, resulting in inaccurate information transmission. Based on Hall's theory of high- and low-context cultures, this study employs natural language processing and semantic embedding techniques to analyze and model the symbols of Shu brocade in different cultural contexts, identifying semantic breakpoints

in communication.

Data were collected from January 2023 to December 2024 across platforms including Instagram, YouTube, Facebook, TikTok, and Weibo. These platforms were selected based on their global user reach, volume of multilingual content, and relevance to cultural communication. Search queries centered around the term "Shujin" were used across multiple languages and supplemented with phonetic variants and relevant technical and cultural descriptions to capture diverse expressions of interest. The informal nature of user-generated content leads to variations in intent and depth, which are mitigated through rigorous preprocessing and semantic normalization. A total of 15,238 reviews were collected in multiple languages, including English, Spanish, French, Japanese, and Korean. After data cleaning steps such as deduplication, deletion of ads and unrelated content—including eliminating machine-generated spam through behavioral pattern analysis, excluding accounts showing commercial automation metrics, and deleting verbatim copies of users and timestamps—a sample of 12,356 valid comments was obtained.

The distribution of valid comments across platforms is as follows: Instagram accounts for 28.7%, YouTube 24.3%, Facebook 19.6%, TikTok 16.8%, and Weibo 10.6%. The temporal distribution shows consistent monthly collection throughout the period, with minor fluctuations within $\pm 5\%$ of the average. Language representation among valid comments includes English at 42.1%, Spanish 18.4%, French 12.3%, Japanese 15.9%, and Korean 11.3%. Cultural group classification is based on two complementary frameworks: Hall's high- and low-context typology and geographic-cultural clustering. According to the former, 36.2% of comments originate from high-context cultures and 41.8% from low-context cultures. Within the latter framework, 13.7% are from East Asian, 43.1% from Western, and 8.3% from South Asian cultural regions. All categories maintain sufficient sample sizes to ensure statistical reliability.

All user-generated content was collected in compliance with the data usage policies of the respective platforms and under the principles of fair use for academic research. Personal identifiers were systematically removed during the preprocessing phase to ensure full anonymization of the dataset. No personally identifiable information was retained or analyzed throughout the study, prioritizing user privacy and data confidentiality without requiring formal institutional review due to the public and non-sensitive nature of the data.

To quantify cognitive differences across cultural groups, the study applied the multilingual BERT base model (mBERT) to encode comments into 768-dimensional semantic vectors, using mean pooling over the token embeddings to obtain sentence-level representations. The model weights remained unchanged except for fine-tuning the final classification layer with the collected multilingual corpus, ensuring domain adaptability while preserving the original multilingual alignment.

This model effectively captures semantic alignment across languages. Comments were classified according to the primary geographic region associated with the user's account and language of expression, aligned with established cultural clustering frameworks. This classification is based on user language usage, geographical distribution, and the mainstream cultural cluster model in cross-cultural research. It integrates the cognitive pattern clustering results formed by multi-source data. It corresponds to the cultural context types that show stable differences in the symbol decoding process. The basis for its division is the distribution consistency of different groups in the semantic vector space, rather than simple geographical affiliation. Cosine similarity is used to measure the divergence in semantic orientation between cultural groups in the interpretation of Shu brocade symbols, reflecting variations in cultural decoding mechanisms. Cognitive bias (D) is defined as:

$$D = 1 - \cos\_\mathrm{sim}(V_{\mathrm{group}}, V_{\mathrm{global\_avg}}) \tag{1}$$

D represents the cognitive bias of the cultural group, cos_sim is cosine similarity, V_{group} is the collective cognitive vector of the group, and $V_{\mathrm{global\_avg}}$ is the mean of all comment vectors. A higher D value indicates a greater deviation from the global semantic centroid, corresponding to reduced shared contextual understanding in cross-cultural communication. This deviation aligns with Hall's conceptualization of high- and low-context cultures, wherein symbolic meanings encoded within a high-context system become less accessible to audiences lacking the requisite cultural schema, thereby increasing the likelihood of semantic discontinuity.

The offset direction of the semantic vector reflects the differences in cultural decoding mechanisms. The high-context group focuses on symbolic associations, while the low-context group tends to prefer technical expressions. D reflects the differentiation of the two in the symbolic understanding structure. A semantic breakpoint is identified when the cosine similarity between the group's mean semantic vector and the global centroid falls below a threshold defined by two standard deviations from the mean similarity across all groups, indicating a significant shift toward functional interpretation.

After identifying semantic discontinuities, and based on the theoretical framework of high- and low-context cultures, a risk word list is generated to identify cultural symbols that may lead to misunderstandings. Based on the semantic bias of these symbols, the content of the communication is adjusted to ensure correct understanding of the symbols in the target culture. Through this series of steps, the study established a cross-cultural decoding path for Shu brocade symbols. Furthermore, Table 1 shows the cognitive biases of different cultural groups regarding Shu brocade symbols, further validating the influence of cultural background on information decoding:

TABLE 1. Cognitive Biases of Different Cultural Groups Regarding Shu Brocade Symbols

Cultural Groups	Cognitive Bias of Shu Brocade Patterns (D Value)	Shu Brocade Color Perception Bias (D Value)	Cognitive Bias of Shu Brocade Craftsmanship (D Value)
High-context cultural group	0.25	0.32	0.29
Low-context cultural group	0.41	0.54	0.47
East Asian cultural group	0.33	0.28	0.35
Western cultural group	0.52	0.61	0.59
South Asian cultural group	0.38	0.44	0.40

As shown in Table 1, the Western cultural group exhibited the highest cognitive bias values across all three dimensions: pattern, color, and craftsmanship. This indicates that, as a typical low-context culture lacking a shared cultural context, they faced the greatest difficulty in understanding the deep symbolic meaning and complex craftsmanship inherent in Shu brocade, resulting in the most severe semantic disjunction. In contrast, the high-context cultural group exhibited the lowest D values, indicating a stronger cultural affinity. This result validates the high- and low-context theory and provides direct data support for developing differentiated localized communication strategies for audiences with different cultural backgrounds.

The D values presented in Table 1 are derived from a holistic semantic analysis of all user comments, reflecting overall cognitive deviations in the interpretation of Shu brocade symbols across cultural groups. The risk word list is subsequently generated by identifying specific lexical items that exhibit significant semantic divergence within these high-bias categories, serving as actionable indicators for content localization.

As shown in Figure 1, a complete analytical process, from theory to data and output, was constructed. Guided by high- and low-context cultural theory, multilingual social media comments were input. Using the multilingual BERT model and cosine similarity calculations, the cognitive biases of different cultural groups were quantified, ultimately generating a risk word list and identifying semantic breakpoints.

B. CLASSIFICATION OF AUDIENCE CULTURAL RECEPTION PATTERNS

This section constructs an audience cognitive map of Shu brocade by collecting multilingual user comments from mainstream global social media platforms. Using semantic embedding and cluster analysis techniques, the paper categorizes audience groups into different cultural reception patterns and analyzes the differences in their understanding of Shu brocade symbols. The formula for the semantic embedding process is as follows:

$$v_w = \frac{1}{|C_w|} \sum_{i=1}^{|C_w|} x_{wi} \tag{2}$$

v_w is the vector representation of word w, C_w is the set of context words associated with word w, and x_{wi} is the vector representation of w in i.

User comment vectors were constructed by aggregating token-level embeddings from the multilingual BERT model using mean pooling. These sentence-level representations captured the semantic structure of individual expressions regarding Shu brocade. The K-means algorithm was applied to these comment vectors to identify natural groupings in audience perception, with the optimal number of clusters determined through elbow analysis and cosine distance as the similarity metric. The K-means algorithm groups data points by minimizing the squared error within clusters. Its objective function is as follows:

$$J = \sum_{k=1}^{K} \sum_{i=1}^{n_k} \|x_i - \mu_k\|^2 \tag{3}$$

J is the loss function, n_k is the number of data points within cluster k, x_i is the number of data points, and μ_k is the centroid of cluster k.

Furthermore, hierarchical cluster analysis was used to refine the audience's cognitive patterns and identify reception patterns that were primarily technically and aesthetically oriented. This process calculated the similarity between each pair of audience groups using the following formula:

$$\text{cosine}_{\text{sim}}(v_1, v_2) = \frac{v_1 \cdot v_2}{\|v_1\| \, \|v_2\|} \tag{4}$$

v_1 and v_2 represent the word vectors for the two audience groups, $\cdot$ represents the dot product, and $\|\cdot\|$ represent the L2 norm. Table 2 shows the classification and characteristics of the cognitive patterns of the aforementioned cultural groups.

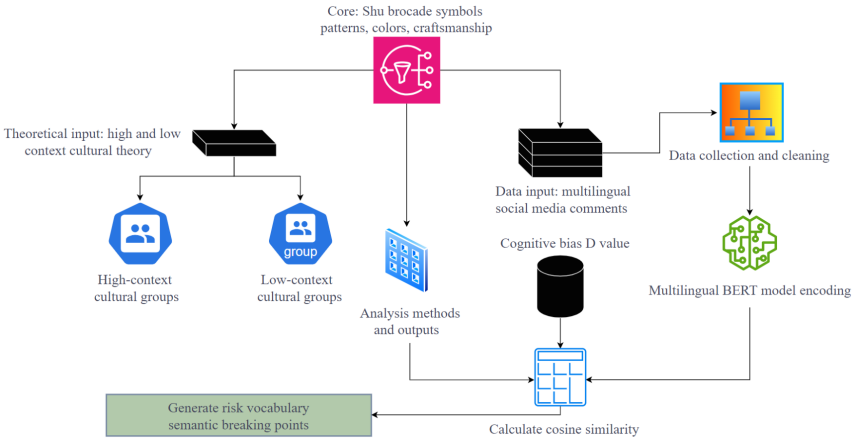

FIGURE 1. Analysis of Cross-Cultural Decoding Differences in Shu Brocade Symbols Based on High- and Low-Context Theory

TABLE 2. Classification of Shu Brocade Audience Reception Patterns Based on Cross-Cultural Cognition

Cultural Group	Cognitive Model	Cognitive Characteristic Patterns	Color Recognition Characteristics
High-context	Aesthetic-oriented	Emphasizes the symbolic meaning of the pattern	Prefers natural tones and connotations
Low-context	Technology-oriented	Focuses on the craftsmanship of patterns	Colors tend to be functional
East Asian	Hybrid	Emphasizes the integration of tradition and modernity	Pays attention to the balance of color and pattern
Western	Technology-oriented	Focuses on the structural logic and practical effectiveness of craftsmanship	Prefers bright, contrasting colors for visual functionality
South Asian	Technology-oriented	Focuses on traditional craftsmanship and details	Prefers bright colors and intricate patterns

As shown in Table 2, high-context cultural groups tend to be aesthetically oriented, focusing on the symbolic meaning of patterns and the naturalness of colors. Low-context cultural groups tend to be more technically oriented, emphasizing the craftsmanship of Shu brocade and the functionality of its colors. Within East Asian cultural groups, cognitive patterns exhibit a hybrid nature, comprehensively considering traditional and modern elements, as well as the balance of colors and patterns. This table provides strong support for subsequent cross-cultural communication strategies.

Figure 2 reveals the differences in the cognitive characteristics of Shu brocade among different cultural groups.

As shown in Figure 2, the high-context group scored 9 on the symbolic meaning dimension. Their cultural background shares similarities with the symbolic system of Shu brocade, giving them a natural understanding of the patterns' meanings and focusing their cognitive attention on cultural connotations. Western groups scored 9 on the technology orientation dimension and 8 on the functionality/practicality dimension, tending to analyze the structural logic and practical effectiveness of objects, focusing on the complexity of craftsmanship and the visual function of color. The low-context group scored 8 on the technology orientation dimension and 7 on the functionality dimension, similar to Western groups in cognitive orientation. However, their symbolic meaning score was only 3, indicating difficulty decoding non-functional symbols. These cognitive differences between groups stem from long-established decoding habits: high-context groups rely on implicit consensus, while low-context groups rely on explicit information. This difference determines the focus of information reception. This cognitive map provides data support for the precise formulation of communication strategies.

C. LAYERED COMMUNICATION STRATEGY DESIGN

During the multimodal content design process, this study used text analysis to extract the core cultural elements and emotional characteristics of Shu brocade. These elements include its patterns, craftsmanship, historical background, and symbolic meaning.

The semantic vector of user comments was extracted through the multilingual BERT model, and a polar classifier was used to distinguish the text's emotional orientation. Three types of emotional labels were output: positive, neutral, and negative, and the emotional distribution ratio in the group was used as the quantitative basis for the emotional tendency of cultural groups. This method relies on the alignment ability of pre-trained language models in cross-language semantic understanding to ensure the consistency and comparability of emotional judgments between different language comments.

Based on the results of sentiment analysis, multimodal content was designed, combining text, images, and videos to enrich the communication content about Shu brocade.

To achieve text generation in a cross-cultural context, LSTM was used to perform sequence modeling on multilingual social media corpora. Training data were derived from user comments and official releases related to textile intangible cultural heritage on mainstream platforms. After lan-

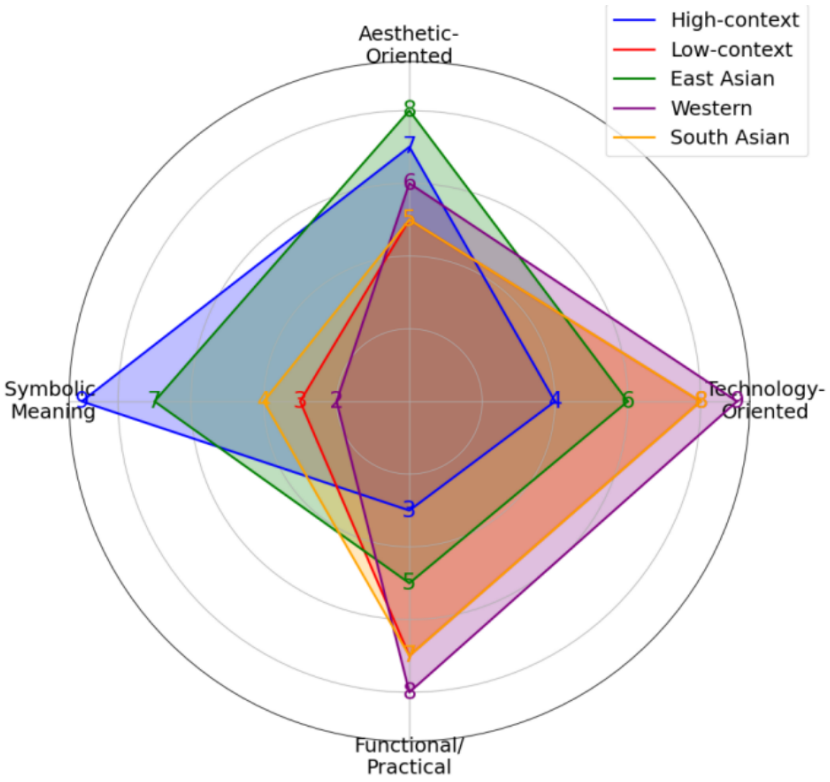

FIGURE 2. Cognitive Characteristics of Shu Brocade by Different Cultural Groups

guage identification and cultural affiliation annotation, bilingual text pairs were constructed. A word embedding layer mapped the input text into a distributed vector representation. LSTM units captured the semantic evolution of cross-lingual expressions over time, using an attention mechanism to weight key semantic nodes and strengthen responses to culturally specific concepts. A topic constraint strategy was introduced during the decoding phase to ensure that the generated content focused on pre-defined dimensions, such as craftsmanship or symbolic meaning. Three independent evaluators with expertise in intercultural communication and native-level proficiency in the target languages assessed the generated narratives across predefined dimensions of semantic fidelity, technical accuracy, and cultural resonance. Evaluation criteria were derived from the cognitive patterns identified in Section "Classification of Audience Cultural Reception Patterns", focusing on alignment with audience-specific symbolic interpretation tendencies and contextual expectations. Inter-rater reliability was established through iterative calibration, achieving a final Cohen's kappa coefficient of 0.87, indicating substantial agreement. Only texts meeting the consensus threshold were retained for dissemination.

In terms of image design, image enhancement technology and computer vision methods were used to enhance the visual quality of Shu brocade, showcasing its details and craftsmanship through high-resolution images.

The video content design combines short and long videos to showcase the weaving craftsmanship, historical background, and cultural value of Shu brocade. Based on the cultural differences of the target audience, the narrative content for high-context cultural groups emphasizes emotional expression, focusing on conveying the historical and symbolic meaning behind Shu brocade; while for low-context cultural groups, the focus is on technical content and craftsmanship. A bidirectional LSTM network with two stacked layers and an attention mechanism was employed for cross-cultural narrative generation. The model was trained on a curated multilingual corpus of 18,752 annotated textual instances derived from official releases and user-generated content related to textile intangible cultural heritage. Training proceeded over 120 epochs using the Adam optimizer with an initial learning rate of 0.001, achieving stable convergence of the cross-entropy loss by epoch 98. Gradient clipping at 1.0 and dropout regularization at 0.3 were applied to prevent overfitting. While Transformer-based architectures offer strong performance in many NLP tasks, the sequential modeling capacity of LSTM, combined with its lower computational overhead and superior handling of small-to-medium-sized datasets, made it more suitable for this domain-specific application requiring fine-grained control over culturally conditioned output structure. The formula is as follows:

$$h_t = \sigma(W_{hh}h_{t-1} + W_{xh}x_t + b_h) \tag{5}$$

$$y_t = W_{hy}h_t + b_y \tag{6}$$

h_t represents the hidden state of the LSTM, σ represents the activation function, W_{hh}, and W_{xh} represent the weight matrices, x_t represents the input text vector, and b_h, b_y represent the bias.

In terms of platform adaptation and dissemination strategies, customized designs were developed based on the dissemination characteristics of different social media platforms.

Based on differences in user behavior across platforms, Table 3 shows that a combination of content formats and communication strategies tailored to the characteristics of five major social media platforms has been designed to achieve a layered reach from "broad coverage" to "deep reach." Through differentiated content formats and interactive mechanisms, the adaptability and audience engagement of textile-related intangible cultural heritage in diverse digital contexts are enhanced.

TABLE 3. Cross-Platform, Niche Dissemination Plan

Social Platforms	Communication Strategy	Content Format
Instagram	Combination of pictures and text	High-quality image + short text
TikTok	Short videos + interactive content	Quick video + interactive text
YouTube	Video storytelling	Long video + process analysis
Facebook	Emotional narrative + image	Long text + emotional content
Weibo	Fast spread + tags	Picture + short text

D. CROSS-PLATFORM COMMUNICATION IMPLEMENTATION AND DYNAMIC OPTIMIZATION

Figure 3 illustrates the complete construction and validation process of the communication response model. The CDI and communication effectiveness index are input, the model is established through regression analysis, and then verified using online interaction and offline feedback data, forming a closed loop from theoretical hypothesis to empirical testing.

Cultural distance is used to quantify cognitive differences between different cultural groups, determining how information is interpreted and the resulting emotional responses. To this end, the Cultural Distance Index (CDI) is used to quantify the cognitive distance between cultural groups. The formula is as follows:

$$\mathrm{CDI} = \sum_{i=1}^{n} |C_i - T_i| \tag{7}$$

C_i and T_i represent the standardized cognitive values of cultural groups and target groups on the i-th semantic dimension, respectively, where i corresponds to each component in the 768-dimensional shared semantic space extracted by the multilingual BERT model, and $\sum_{i=1}^{n}$ represents the accumulation of cognitive differences in all dimensions.

The effectiveness of communication formats is quantified using the Efficiency Index (EI). Communication formats include images, videos, and text, and the choice of these formats is tailored to the cultural background of the audience and the characteristics of the platform. The formula for communication effectiveness is:

$$\mathrm{EI} = \frac{\sum_{i=1}^{m} (I_i \times P_i)}{M} \tag{8}$$

I_i represents the content's interactivity, P_i represents the audience preference weight for the communication format, and M represents the number of communication formats.

The communication response model uses regression analysis to quantify the combined impact of cultural distance and communication format on audience receptivity. The regression formula is as follows:

$$S = \beta_0 + \beta_1 \cdot \mathrm{CDI} + \beta_2 \cdot \mathrm{EI} + \epsilon \tag{9}$$

S represents the audience's acceptance intensity, β_0 is the constant term, β_1 and β_2 are regression coefficients, and ϵ is the error term.

To ensure comparability across indicators, this study normalized D, CDI, EI, engagement depth, and acceptance intensity. All raw values were normalized to the range [0, 1] using a minimum-maximum scale to minimize bias caused by dimensional differences. Weights were derived from two sources: theoretical assessments of the role of each indicator based on cross-cultural communication theory, and statistical significance verified through principal component analysis. D and CDI values ranged from 0 to 1, with larger values indicating a more significant cognitive gap. EI values ranged from 0 to 100, reflecting the expected effectiveness of the communication format. Engagement depth was calculated using dwell time and action frequency and normalized to the range [0, 10]. Acceptance intensity, the dependent variable in the model, was also standardized to the range [0, 100] to ensure consistency with the regression analysis results. The model was validated by comparing online interaction data with offline feedback. Online data were obtained from social platforms and combined with user behavior data from the platforms. Offline data were collected through questionnaires and audience feedback. Effectiveness was verified using the following formula:

$$\text{Fit Quality} = 1 - \frac{\sum_{i=1}^{N_2} |S_i - \hat{S}_i|}{\sum_{i=1}^{N_2} |S_i - \overline{S}|} \tag{10}$$

S_i is the actual value, $\hat{S}_i$ is the predicted value, $\overline{S}$ is the mean of the actual values, and N_2 is the sample size.

III. COMMUNICATION EFFECTIVENESS VERIFICATION AND MECHANISM ANALYSIS

A. THE IMPACT OF CULTURAL CONTEXT ON THE PERCEPTION OF CRAFT VALUE

In cross-cultural communication research, understanding the changing perceptions of the value of intangible cultural heritage craftsmanship among different cultural groups is crucial. This study evaluated the effectiveness of communication interventions across different cultural groups,

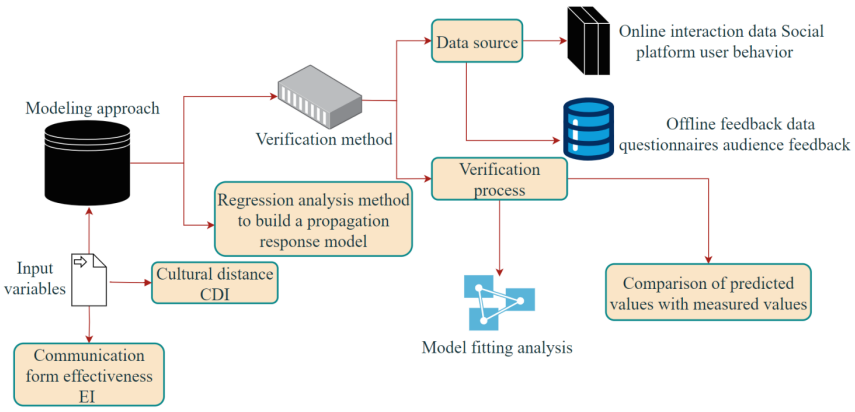

FIGURE 3. Prediction of Cross-Cultural Communication Effectiveness Based on Regression Analysis

exploring the adaptability of communication strategies and their impact on audience cognition. It also compared and analyzed the changes in recognition of the value of Shu brocade craftsmanship among high- and low-context cultural groups before and after the intervention, as well as the impact of different communication strategies on enhanced cognition. The percentage of cognitive recognition was derived from standardized questionnaire surveys administered before and after the intervention, where participants rated their recognition of Shu brocade craftsmanship on a five-point Likert scale, and the proportion of responses above the neutral threshold was converted into percentage values.

Figure 4 illustrates the changes in cognition across different cultural groups.

As shown in Figure 4, before the communication intervention, the high-context cultural group, due to their cultural affinity, initially recognized the value of Shu brocade craftsmanship at 60%. However, due to semantic gaps, the low-context cultural group initially recognized only 40%. After the localized narrative intervention based on data insights, recognition increased in both groups, reaching 80% for the high-context group and 78% for the low-context group. These results demonstrate that this communication approach effectively bridges the cross-cultural cognitive gap.

The sub-figure on the right further analyzes the impact of different communication strategies. The results show that technical content increased awareness by as much as 91% for the low-context group and by 72% for the high-context group, confirming that transforming complex weaving techniques into technical narratives is key to driving deep value identification among audiences from diverse cultural backgrounds.

B. DRIVING EFFECT OF MULTIMODAL COMMUNICATION ON AUDIENCE ENGAGEMENT

To explore the impact of multimodal communication on cross-cultural audience engagement, this study, based on high- and low-context cultural theory, analyzed the performance of five types of content: static graphics, interactive graphics, short videos, interactive short videos, and three-dimensional interactive content, in terms of user engagement rate and depth of interaction. Engagement rate reflects the intensity of the audience's response to content, while depth of interaction quantifies cognitive investment through dwell time and frequency of actions. Static graphics and text emphasize visual communication, interactive graphics enhance information accessibility, short videos improve narrative efficiency, and 3D interactive content fosters technological immersion. Figure 5 shows the performance of five communication formats for two cultural audiences.

In Figure 5, the user engagement rate for low-context audiences in 3D interactive content reached 68.4%, with an engagement depth score of 8.9, indicating that the technology-driven immersive experience effectively aligned with their preferences for process logic and structured information. The higher engagement of low-context audiences with 3D content did not arise from decoding symbolic meaning but from the structured and process-oriented presentation of craftsmanship, which reduced reliance on implicit cultural symbols and provided explicit functional cues that matched their decoding habits. The engagement rate for interactive short videos was 61.8%, with an engagement depth score of 8.1, demonstrating the synergistic effect of dynamic content and interactive mechanisms. High-context audiences had an engagement rate of 47.8% and an interaction depth score of 6.0 for static images and text, reflecting their sensitivity to visual aesthetics and symbolic meaning. This model effectively enhanced the target group's deeper understanding of the value of textile intangible cultural heritage craftsmanship.

C. COMPARATIVE ANALYSIS OF CROSS-PLATFORM COMMUNICATION EFFECTIVENESS

To evaluate the effectiveness of different social media platforms in promoting China's textile intangible cultural heritage, this study selected five major platforms: Instagram, YouTube, TikTok, Facebook, and Weibo, and analyzed their performance in four dimensions: information diffusion speed, user interaction rate, content persistence, and cumulative interaction volume. Information diffusion speed reflects the initial efficiency of content reaching the audience, while user interaction rate measures the number of likes, com-

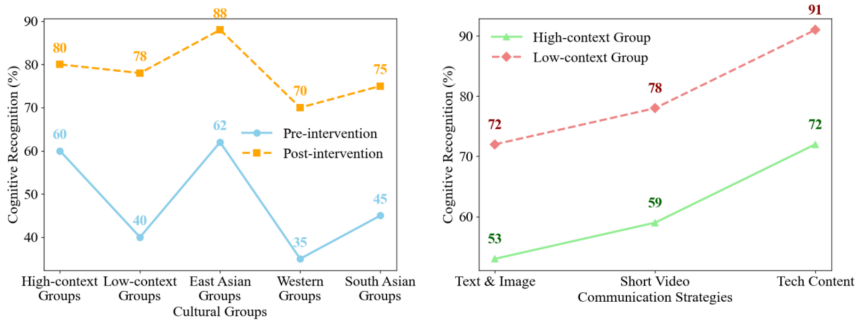

FIGURE 4. The Impact of Cultural Context and Communication Strategy on the Perception of the Value of Shu Brocade Craftsmanship

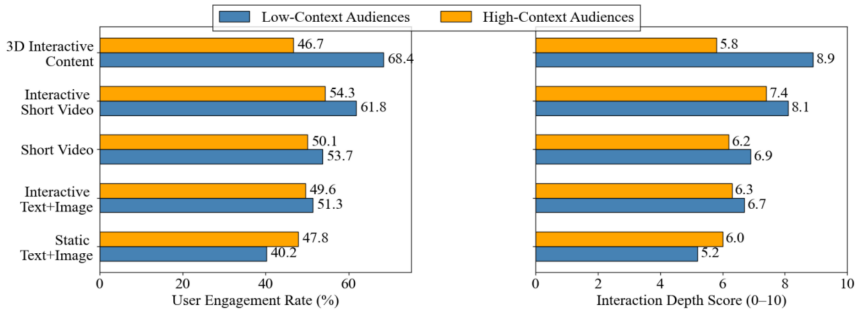

FIGURE 5. The Impact of Multimodal Communication on the Engagement Behavior of High- and Low-Context Audiences

ments, and other behaviors received per thousand impressions. Together, these two measures reflect the breadth of dissemination and immediate response. Content persistence refers to the lifecycle of information that maintains effective exposure, while cumulative engagement refers to the total number of interactions with content throughout its entire lifecycle. Together, they reveal the depth of its dissemination and its long-term impact. Figure 6 presents a multidimensional comparative analysis of various platforms.

In Figure 6, TikTok achieved the highest reach, with a 24-hour reach growth rate of 52.8% and an engagement rate of 61.3 times per thousand impressions. Its algorithm-driven, strong recommendation mechanism effectively enables rapid content proliferation, aligning with the low-context cultural audience's preference for technical, highly interactive content. Weibo, leveraging its social hotspot mechanism, followed closely behind in terms of diffusion speed and engagement rate, demonstrating its strong short-term mobilization capabilities.

YouTube's content has superior durability, with an average lifespan of 68.5 days. Its long-form narrative format is well-suited to in-depth technical explanations, ultimately achieving 15,340 cumulative interactions. The results indicate that the platform's algorithmic logic and content format profoundly influence the international dissemination of intangible cultural heritage. Effective dissemination must be tailored to the target audience's cognitive patterns and communication objectives.

D. VALIDATION OF THE COMMUNICATION RESPONSE MODEL AND MECHANISM SUMMARY

To validate the constructed "Cultural Distance – Communication Form – Reception Intensity" quantitative response model, the study conducted a systematic analysis of key variables. The CDI measures the degree of cognitive disparity between the target audience and the Chinese cultural background. Higher values indicate greater potential barriers to cross-cultural decoding. The EI comprehensively assesses the expected effectiveness of a specific communication format within a specific cultural context. Its calculation incorporates content engagement and audience preference weights. The model's dependent variable is audience acceptance, measured through a combination of online interaction data and offline feedback. Figure 7 compares these indicators for different cultural group–communication format combinations.

As shown in Figure 7, the CDI value for Western cultural groups is 0.58, higher than that for East Asian cultural groups. Within the same cultural context, the EI for long-form YouTube videos is 82.5, higher than that for short-form TikTok videos, which is 75.3. This is due to the advantage of long-form videos in providing in-depth insights into the craftsmanship process. Three-dimensional interactive content achieved the highest EI value of 86.0 among South Asian cultural groups, demonstrating the effectiveness of technology-driven immersive experiences for audiences who value the details of traditional craftsmanship.

The results show that the predicted values are quite close to the measured values. The predicted acceptance intensity for the combination of Western cultural groups and long

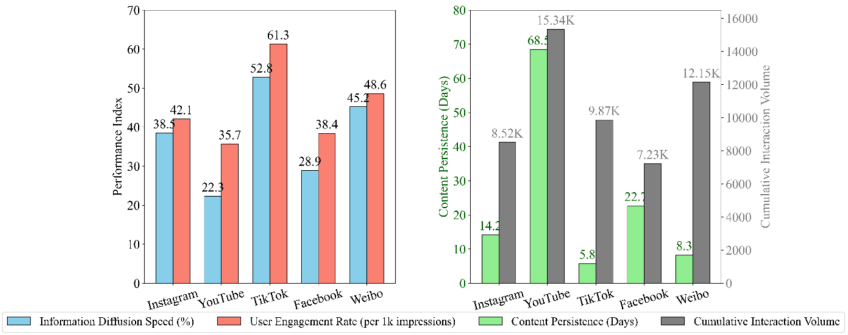

FIGURE 6. Comparison of the Multi-Dimensional Effectiveness of Mainstream Social Media Platforms in the Promotion of Textile Intangible Cultural Heritage

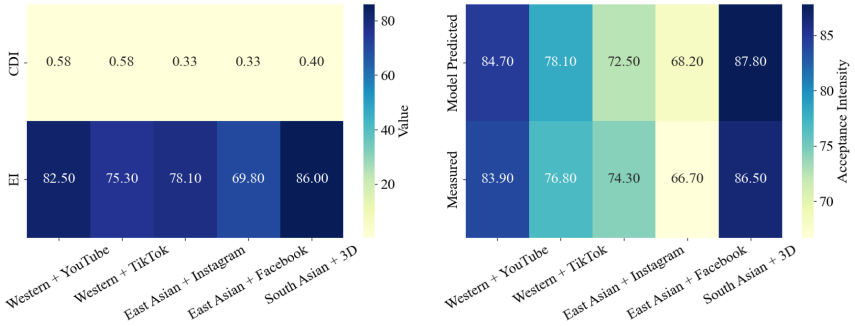

FIGURE 7. Comparison of Indicators Across Different Cultural Groups and Communication Formats

YouTube videos is 84.7, while the measured value is 83.9. This demonstrates that the quantitative model effectively captures the combined impact of cultural distance and communication format on audience acceptance intensity and has good predictive power. While the proximity of predicted and measured values indicates strong explanatory power, it also raises the possibility of model overfitting. To reduce this risk, cross-validation was conducted by randomly partitioning the dataset, and the error margins remained stable across folds, suggesting that the high accuracy reflects consistent structural relationships rather than excessive dependence on specific samples.

IV. CONCLUSION

Based on the theory of high- and low-context cultures, this study constructed a semantic embedding model to identify semantic breakpoints in the cross-cultural communication of Shu brocade symbols. This model, combined with audience cognitive maps, categorized cultural acceptance patterns, designed a multimodal localized narrative strategy, and utilized LSTM to generate technical and emotional texts adapted to different cultural contexts. Furthermore, a quantitative response model was established to assess cultural distance, communication form, and acceptance intensity. Results showed that the participation rate of low-context cultural groups in 3D interactive content reached 68.4%, with an interaction depth score of 8.9. This validates the role of technology-driven immersive content in bridging cross-cultural cognitive gaps and confirms that the constructed closed-loop pathway can effectively enhance heterogeneous cultural understanding and acceptance of textile-related intangible cultural heritage. This pathway, based on cross-cultural decoding modeling, cognitive map construction, and a dynamic evaluation mechanism, provides a reusable methodological paradigm for the international communication of high-context intangible cultural heritage. The role of technology-driven immersive narrative in bridging cognitive gaps reveals the inherent logic of the transformation of cultural communication from one-way presentation to interactive cognition in the digital age. Future research can further explore the cross-cultural adaptation mechanism of multimodal symbol systems, long-term communication effect tracking, and cultural fidelity assessment of AI-generated content to further improve the theoretical and practical system of global cultural heritage dissemination.

AUTHOR CONTRIBUTIONS

All work in this study was independently completed by Haixia Xu.

CONFLICTS OF INTEREST

The author declares no conflict of interest.

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REFERENCES

[1] W. J. W. Ariffin, S. Shahfiq, F. Ahmad, A. Ibrahim, and F. S. Ghazalli, "Handicraft Innovations: A Strategic Approach to Preserving Intangible Cultural Heritage of Malaysia," ISVS e-Journal, vol. 10, no. 7, pp. 137-146, 2023, [Online]. Available: https://isvshome.com/pdf/ISVS_10-7/ISVSej_10.7.6.pdf.

[2] A. Chantamool, C. Suttisa, T. Gatewongsa, A. Jansaeng, N. Rawarin, and H. Daovisan, "Promoting traditional ikat textiles: Ethnographic perspectives on indigenous knowledge, cultural heritage preservation and ethnic identity," Global Knowledge, Memory and Communication, vol. 73, no. 8-9, pp. 1140-1158, 2024, doi: 10.1108/GKMC-08-2022-0198.

[3] A. Rabêlo Neto, J. M. Sousa-Filho, and A. Carneiro Lima, "Internationalization of culture and soft power," European Business Review, vol. 34, no. 1, pp. 103-126, 2022, doi: 10.1108/EBR-09-2019-0240.

[4] Z. Luosang, "Study on the Role of Cultural Soft Power in International Communication," Academic Journal of Humanities & Social Sciences, vol. 6, no. 19, pp. 139-146, 2023, doi: 10.25236/AJHSS.2023.061923.

[5] Y. Zou, C. Zhao, P. Childs, and D.-B. Luh, "Cross-cultural design in costume: Case study on totemic symbols of China and Thailand," Humanities and Social Sciences Communications, vol. 11, no. 1, pp. 1263, 2024, doi: 10.1057/s41599-024-03707-w.

[6] S. Aririguzoh, "Communication competencies, culture and SDGs: Effective processes to cross-cultural communication," Humanities and Social Sciences Communications, vol. 9, no. 1, pp. 96, 2022, doi: 10.1057/s41599-022-01109-4.

[7] G. S. Leotescu, "Communicating Meaning across High-and Low-Context Cultures – a Comparative Analysis," Buletinul Stiintific al Universitatii Politehnica din Timisoara, Seria Limbi Moderne, vol. (22), pp. 5-13, 2023, [Online]. Available: https://www.ceeol.com/search/article-detail?id=1217598.

[8] Z. Guo and C. Li, "Translating Discourse with Chinese Characteristics Guided by High and Low Context Cultures Theory: A Case Study of the Series of Understanding Contemporary China," Translation and Linguistics (Transling), vol. 5, no. 2, pp. 125-138, 2025, doi: 10.20961/transling.v5i2.103109.

[9] M. S. Abdel Halim, G. E. Ibrahim, and F. M. Abdel Tawab, "Utilizing Artificial Intelligence Technical to develop some Textile Craft Industries," International Design Journal, vol. 14, no. 5, pp. 43-63, 2024, doi: 10.21608/idj.2024.372636.

[10] J. Hu, E. Hur, and B. Thomas, "Value-creating practices and barriers for collaboration between designers and artisans: A systematic literature review," International Journal of Fashion Design, Technology and Education, vol. 17, no. 1, pp. 25-36, 2024, doi: 10.1080/17543266.2023.2228337.

[11] L. J. Cabeza-Ramirez, S. M. Sánchez-Cañizares, L. M. Santos-Roldán, and F. J. Fuentes-Garcia, "Exploring the effectiveness of fashion recommendations made by social media influencers in the centennial generation," Textile Research Journal, vol. 93, no. 13-14, pp. 3240-3261, 2023, doi: 10.1177/00405175231155860.

[12] K. F. Oguntegbe, N. Di Paola, and R. Vona, "Communicating responsible management and the role of blockchain technology: Social media analytics for the luxury fashion supply chain," The TQM Journal, vol. 35, no. 2, pp. 446-469, 2023, doi: 10.1108/TQM-10-2021-0296.

[13] M. Wilczewski and I. Alon, "Language and communication in international students' adaptation: A bibliometric and content analysis review," Higher Education, vol. 85, no. 6, pp. 1235-1256, 2023, doi: 10.1007/s10734-022-00888-8.

[14] O. Eren, "Raising critical cultural awareness through telecollaboration: Insights for pre-service teacher education," Computer Assisted Language Learning, vol. 36, no. 3, pp. 288-311, 2023, doi: 10.1080/09588221.2021.1916538.

[15] H. Yu, D. D. Flores, S. Bonett, and J. A. Bauermeister, "LGBTQ+ cultural competency training for health professionals: A systematic review," BMC Medical Education, vol. 23, no. 1, pp. 558, 2023, doi: 10.1186/s12909-023-04373-3.

[16] Y. Tian and S. Sikka, "In The Context of Social Memory: A Historical Study of the Guangxi Zhuang Brocade," Journal of Multidisciplinary in Humanities and Social Sciences, vol. 7, no. 5, pp. 2924-2942, 2024, [Online]. Available: https://so04.tci-thaijo.org/index.php/jmhs1_s/article/view/272160.

[17] J. Zou and M. Sirisuk, "Reinvention of Tradition and Cultural Continuity of Shu Brocade in the Context of Chinese Modern Society: Aesthetic Innovation and Cultural Inheritance," Journal of Roi Kaensarn Academi, vol. 8, no. 10, pp. 448-463, 2023, [Online]. Available: https://so02.tci-thaijo.org/index.php/JRKSA/article/view/265715.

[18] Q. Wang and V. Niyomrit, "Cultural Interweaving on the Silk Road: An Artistic Exploration of the Intangible Cultural Heritage-Shu Embroidery," Journal of Dhamma for Life, vol. 31, no. 1, pp. 363-372, 2025, [Online]. Available: https://so08.tci-thaijo.org/index.php/dhammalife/article/view/3722.

[19] Z. Sun and F. Wang, "From Artifact Decoding to Value Resonance: The Path of Cognitive Upgrading of Jiangnan Folk Crafts in Sino-foreign Humanities Exchange," Humanities & Language: International Journal of Linguistics, Humanities, and Education, vol. 2, no. 1, pp. 43-54, 2025, doi: 10.32734/27p2rj42.

[20] J. Li, H. M. Adnan, and J. Gong, "Exploring Cultural Meaning Construction in Social Media: An Analysis of Liziqi's YouTube Channel," Journal of Intercultural Communication, vol. 23, no. 4, pp. 01-12, 2023, doi: 10.36923/jicc.v23i4.237.