

Platformed Participation and the Digital Reconfiguration of Intangible Cultural Heritage on Douyin

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ABSTRACT

In the media environment dominated by digital platforms, the dissemination of Intangible Cultural Heritage (ICH) increasingly is embedded in the platform-based interactive structure. The public is no longer merely recipients of cultural information; instead, they participate in the generation and reproduction of cultural significance through daily interactions such as liking, commenting, and sharing. However, most existing studies start from the communication effect or the scale of participation, tending to equate interaction with cultural participation, and pay less attention to the structural differences and cultural consequences implied behind platform-based interaction. Based on this problem awareness, this paper takes the short videos of ICH on the Douyin platform as the research object, and combines the theories of media accessibility and participatory culture to analyze how digital platforms reconstruct the ways and conditions for public participation in ICH through differentiated interactive models. Through principal component analysis and cluster analysis of large-scale user interaction data, this paper identifies multiple interaction structure types with significant discrimination and examines their distribution differences among different content categories, account types, and video features. Research has found that the interaction of ICH on the platform does not unfold uniformly but presents a distinct hierarchical structure: there is a systematic differentiation in the form of interaction and the depth of participation between high-interaction and low-interaction videos. Meanwhile, there is a non-linear relationship between the scale of followers and actual interaction, indicating that platform visibility does not necessarily translate into substantive cultural participation. Furthermore, different types of ICH content and account subjects occupy unequal positions in the platform's interactive structure, reflecting the screening and reconstruction role that digital platforms play in cultural dissemination. The research in this paper indicates that public participation on digital platforms is not merely an expansion process but is redefined in the interweaving of platform logic and cultural practice. By revealing the interactive structural characteristics of ICH in a platform-based environment, this paper provides empirical support and theoretical reflection for understanding the socio-cultural implications of public participation in digital cultural dissemination.

Keywords: Intangible cultural heritage; Platform-based participation; Construction of cultural significance; Digital platform User interaction

INTRODUCTION

As digital media permeates social and cultural life, the dissemination of Intangible Cultural Heritage (ICH) is undergoing a significant transformation. The traditional top-down dissemination mechanism, historically dominated by government agencies, is being supplemented and partially reshaped by decentralized, participatory

dissemination models driven by social media ^[1]. Platforms like Douyin (TikTok) have emerged as vital digital spaces for ICH content production, circulation, and public engagement ^[2]. With low barriers to entry, high dissemination efficiency, and flexible content formats, short videos transcend geographical and generational boundaries. They offer unprecedented possibilities for contemporary expressions, cross-cultural dissemination, and public reinterpretation of ICH content^[3-4].

Within the digital environment, the public's role has shifted from passive content consumers to active participants and even co-creators. Through interactions such as liking, commenting, sharing, and bookmarking, users engage in content dissemination. These actions not only express interest in ICH videos but also subtly influence their reach and sociocultural impact ^[5]. Therefore, understanding the user interaction patterns in ICH short videos is of great significance for analyzing how digital platforms reconstruct the conditions for public participation and its social and cultural consequences.

This study is grounded in Media Affordance Theory and Participatory Culture Theory. Media Affordance Theory emphasizes that short video platforms provide operational possibilities for user interaction through features like likes, comments, shares, bookmarks, algorithmic recommendations, audiovisual editing tools, and social networks ^[6]. Participatory Culture Theory highlights that users are not merely content consumers but actively engage in cultural production through creation, commentary, sharing, and imitation, collaboratively forming community identity and generating value ^[7]. Within the context of ICH short videos, user interactions embody both the communicative possibilities enabled by platform technologies and the public's capacity to proactively shape content and digital cultural ecosystems.

Recent academic attention has focused on how short video platforms reshape the content structures and participatory mechanisms of ICH dissemination. Existing research predominantly examines symbolic expressions, narrative strategies, and media transformation ^[8-10], but these studies are predominantly case analyses lacking systematic user behavior data research ^[11]. Furthermore, research remains insufficient on the differences in functional positioning, interactive performance, and dissemination strategies among various communication actors, such as official institutions and individual creators.

Addressing these gaps, this study employs multidimensional interaction index analysis, K-Means clustering, and ordinary least squares (OLS) regression methods to systematically explore the dissemination patterns and influencing factors of ICH short videos on the Douyin platform. Thus, an attempt is made to reveal how user interaction in a platform-based environment presents differentiated and hierarchical characteristics, and how these characteristics reflect the screening and reconstruction role of digital platforms in cultural dissemination.

Based on this, this paper focuses on the following research questions:

RQ1: What are the typical user interaction patterns and dissemination types for ICH short videos on Douyin?

RQ2: How do different account types (official institutions vs. individual creators) and follower counts influence dissemination patterns? Are there nonlinear effects?

RQ3: How do different ICH categories, video lengths, and posting times affect dissemination patterns and interaction performance?

LITERATURE REVIEW

An Analytical Perspective on Media Availability and Participatory Cultures

This study constructs a research framework for short video dissemination of ICH based on media affordances theory and participatory culture theory. The affordance theory, first proposed by American ecological psychologist Gibson (1979) ^[8], explains the interactive relationship between organisms and their environment—specifically, how the environment provides perceptible and actionable possibilities for organisms. In the field of communication studies, Wellman et al. (2003) ^[6] noted that technological innovations in the internet era have created new social affordances, enabling users to access, share, and exchange information more efficiently. Within the context of short-video platforms, media affordances manifest as behavioral possibilities enabled by platform functions and technical features. These include interactive capabilities such as liking, commenting, reposting, and bookmarking, alongside algorithmic recommendations, audio-visual editing tools, and social linking. From the perspective of media availability and participatory culture, short-video platforms are not neutral communication tools ^[12]. Instead, they jointly shape the ways and conditions for users to participate in cultural dissemination through a series of technologies and social mechanisms. Specifically, interactive functions such as liking, commenting, sharing and collecting, as well as algorithmic recommendation mechanisms, audio-visual editing tools and embedded social links within the platform, together form the action space for users to engage in cultural interaction on the platform. These functions not only lower the participation threshold, enabling the public to immediately get involved in the dissemination process of cultural content, but also, in an intangible way, guide and regulate which forms of interaction are more likely to be magnified, seen and continuously circulated.

Simultaneously, this study draws upon Henry Jenkins' participatory culture theory to explain the active role transformation of users in the dissemination of ICH through short videos. Jenkins et al. (2009) ^[13] argue that in convergent cultures, media consumption is a collective collaborative process of constructing meaning. Within digital media environments, users actively participate in cultural production and dissemination through creation, commentary, sharing, and imitation, thereby forming a cultural ecosystem characterized by low barriers to entry, high engagement, and strong community belonging. On the Douyin platform, non-official creators interpret folk crafts, traditional skills, and festive customs from grassroots perspectives, with their dissemination pathways embodying the co-creation and negotiation features emphasized by participatory culture. In this platform-based environment, algorithmic recommendation and social mechanisms do not merely "enhance" user autonomy. Instead, they profoundly influence the circulation mode and meaning construction process of ICH content in the interactive network through continuous regulation of visibility and dissemination paths. ICH short videos are not disseminated in a homogeneous manner. Instead, they are constantly screened, sorted and recontextualized in a decentralized interactive network based on the logic of the platform. This process makes cultural dissemination present dynamic and differentiated characteristics, and at the same time triggers further thinking about the depth of participation, cultural authority and the production of meaning.

Based on the above theories, this study proposes the following research framework: Platform media functions provide possibilities for user behavior, upon which users engage in proactive interaction and participatory creation, forming differentiated interaction patterns. These patterns are influenced by factors such as content characteristics, account types, and follower counts, ultimately determining the dissemination effectiveness and cultural value of ICH in short videos. This framework integrates technological empowerment with user participation, providing theoretical support for analyzing interaction patterns, clustering outcomes, and dissemination trajectories. This thus reveals how digital platforms reconstruct the socio-cultural conditions for public participation in the dissemination of ICH.

User Participation and the continuity of Cultural Transmission

The dissemination of ICH has long been a central topic in heritage studies. Early research focused on institutional frameworks at the national level, official discourse dissemination, and traditional transmission methods like live performances and museum exhibitions ^[14]. Under this paradigm, government agencies, cultural institutions, or certified inheritor groups typically served as primary disseminators, while the public remained passive recipients ^[15].

With the advancement of digital technology, social media has become a vital platform for users to access information, share perspectives, and establish connections. The conceptualization of heritage participation is fraught with tension, embodying ideals of equality, inclusivity, and diversity while simultaneously entangled in the paradoxes of structural inequality, cultural exclusivity, and power dynamics ^[16]. Unlike traditional media's one-way dissemination, digital media emphasizes interactivity. Users are no longer mere recipients of information but become evaluators, disseminators, and even co-creators of content.

Based on the Usage and Satisfaction Theory, Yang and Ha (2021) ^[17] found that entertainment serves as the primary motivation for TikTok usage. Users seeking social connections are more likely to establish psychological trust with content creators, thereby enhancing content acceptance and participation willingness. This indicates that social media engagement is not merely behavioral but involves emotional identification and trust formation. Research on health-related videos on Douyin reveals that users respond more positively to videos featuring concise narration, original background music, and subtitles. Likes and saves are the most common forms of interaction, while comments and shares are less frequent ^[18]. Mohammad et al. (2024) ^[19] found that social media content influences user engagement metrics—including likes, shares, comments, and total brand interactions—demonstrating a strong link between digital participation and behavioral decisions. Jacques et al. (2025) ^[5] analyzed TikTok videos and comments to explore public engagement patterns, focusing particularly on interaction indicators like likes, comments, shares, and saves.

Although existing research has examined the psychological mechanisms of interactive behaviors, most studies focus on commercial or educational content ^[20], lacking systematic analysis of user behaviors toward cultural content, especially ICH videos. Furthermore, the academic community's systematic exploration of the combination patterns of different interactive behaviors and their relationship with video attributes is still insufficient. However, these video attributes have a significant impact on the visibility, dissemination paths, and cultural significance construction of ICH content in a platform-based environment.

The Digital Transformation and Structural Reconstruction of ICH Dissemination

The rapid growth of short-video platforms has profoundly transformed the digital dissemination models of ICH. Short videos have emerged as vital mediums for promoting the sustainable development of ICH, enhancing its recognition and cultural identity among younger audiences. ICH embodies ethnic wisdom and historical memory,

traditionally transmitted through offline rituals ^[21], family handicrafts, and collective community memory ^[22]. The evolution of the information society has led to generational gaps ^[23] and audience attrition ^[24]. Short videos have pioneered new pathways for ICH dissemination, enabling traditional culture to reach the public—particularly younger audiences—through intuitive, contextualized means ^[25].

On short video platforms, users transcend passive observation by participating in the re-creation of ICH through imitation challenges, such as mimicking Peking Opera excerpts or crafting dishes inspired by intangible heritage. This engagement represents a digital extension of living heritage transmission^[26]. Influential ICH inheritors forge emotional connections with audiences through interactive comments, enhancing user loyalty and cultural identity ^[2]. Visual elements, background music, and editing rhythms in short videos make ICH more visible and accessible, boosting dissemination appeal ^[27]. These analytical methods help to reveal the formation mechanism of the dissemination structure of ICH in the digital platform environment, as well as how different interaction patterns are continuously produced and redistributed under the influence of platform logic.

Machine Learning-Based Analysis of User Behavior Patterns and Dissemination Sustainability

With advances in data science technology, an increasing number of scholars are applying machine learning methods to model and classify user behavior on social platforms. Clustering, as an unsupervised learning method, is widely used in user profiling, content recommendation, and behavior prediction ^[28]. Grouping user behaviors through clustering algorithms helps identify latent behavioral patterns and underlying mechanisms, providing data-driven insights for optimizing short-video content and cultural dissemination strategies, thereby revealing the combination methods of different interactive practices in the platform environment and their potential generation mechanisms.

Carvache-Franco et al. (2025) ^[29] employed clustering to identify niche markets, establishing relationships between tourism demand segmentation and satisfaction/loyalty levels, demonstrating how data-driven analysis can optimize resource allocation. In the context of digital dissemination of ICH, similar approaches help to understand how different interaction patterns are distinguished, magnified or marginalized on the platform, thereby influencing the presentation and dissemination patterns of cultural content.

However, traffic mechanisms on short-video platforms may lead to excessive commercialization or dramatization of cultural content, undermining cultural authenticity ^[30]. ICH projects in central-western or rural regions often lack dissemination capacity, resulting in visual imbalances ^[31]. This leads to structural inequality in cultural visibility and participation opportunities.

An Integrated Analytical Perspective on the Dissemination of ICH

Overall, existing research has yielded preliminary findings on ICH dissemination, short-video user interactions, and machine learning applications, yet lacks systematic empirical exploration integrating these three dimensions. This study aims to fill this gap by focusing on ICH short videos on the Douyin platform. Utilizing large-scale user behavior data, it employs K-means clustering to identify dissemination patterns and combines video attribute analysis to examine the characteristics and drivers of different dissemination types.

Overall, this study does not aim to propose specific communication strategies or normative suggestions. Instead, through empirical analysis of the interactive structure of platforms, it promotes theoretical discussions on the communication mechanisms of ICH in the digital context, providing a new research perspective for understanding public participation, visibility differentiation, and meaning construction in platform-based cultural communication.

RESEARCH METHODOLOGY

Data Sources and Sample Composition

This study utilized the keyword “FEIYI” (ICH in Chinese) to search for users on the Douyin platform from September to October 2025, aiming to construct a short video dataset on ICH . This keyword was selected due to its authority and widespread recognition in academic research, policy documents, and public communication, ensuring thematic purity of the sample. The initial search yielded 336 user accounts. After manual screening by two researchers and consensus discussion (Cohen’s Kappa $\kappa=0.87$), 192 highly relevant accounts were retained.

Short videos posted by these accounts between October 1, 2023, and September 30, 2025, were obtained through Feigua Data, China’s authoritative new media data platform, totaling 55,318 videos. Filtering for titles containing the keyword “Fei Yi” yielded 22,723 directly relevant videos. These were further manually coded for attributes including video length, posting time, account source (individual/official), and ICH type (based on China’s national ICH ten-category system), ultimately constructing an analytical dataset comprising 156 accounts and 21,243 videos. This sample composition ensures the representativeness and reliability of research findings regarding digital dissemination and sustainability analysis of ICH .

Variable Setup and Metric Explanation

Core interaction variables include likes, comments, shares, and saves, reflecting user recognition, emotional resonance, dissemination intent, and perceived knowledge value, respectively. Independent variables encompass total followers, account origin, ICH type, video duration, and posting time, used to analyze how different account attributes and content characteristics influence user engagement. Interaction metrics are calculated based on view counts—such as like rate, comment rate, share rate, and save rate—to minimize the interference of exposure volume differences on results.

This variable setup not only measures users' immediate responses to ICH short videos but also reflects the potential sustainable contribution of public engagement on digital platforms to cultural heritage transmission.

Analysis Methodology

This study analyzes user interaction patterns through the following steps:

Data Preprocessing: Calculated mean, median, skewness, and proportion of zeros. Applied $\log(x+1)$ transformation to highly right-skewed data and Winsorized extreme values (1st and 99th percentiles) to improve distribution.

Principal Component Analysis (PCA): Selected principal components based on cumulative variance contribution ($\geq 85\%$). Integrated four interaction metrics into a composite indicator for cluster analysis.

Cluster Analysis: Employ K-means, GMM, and HDBSCAN algorithms for clustering. Optimal cluster number ($K=2$) selected via contour coefficient, BIC value, and cluster size distribution. Robustness validated through extreme value sensitivity, variable systems, and random initialization to ensure reliable and reproducible results.

Regression Analysis: Ordinary Least Squares (OLS) was employed to examine the influence of video content and account attributes on interaction behavior. Robustness checks included excluding extreme samples and repeating analyses with different interaction metrics. Continuous variables (video length, posting duration) were discretized into quantiles to construct $2 \times k$ contingency tables. Chi-square (χ^2) tests and Cramer's V coefficient measured association strength between variables, integrating overall patterns with single-indicator analysis.

Through these methods, this study not only identifies user interaction patterns for ICH short videos on the Douyin platform but also analyzes how content attributes and account characteristics influence engagement. This provides empirical evidence for optimizing ICH dissemination strategies on digital platforms and ensuring long-term cultural sustainability.

RESEARCH RESULTS

Data Preprocessing and Principal Component Dimension Reduction Results

This study calculated the mean, median, skewness, and proportion of zero values of four core interaction metrics: likes, comments, shares, and collections. Table 1 details the statistical characteristics of each interaction metric, from which we can draw the following observations: all four indicators are highly right-skewed with longer tails, and the mean is significantly higher than the median, indicating that several highly interactive videos have raised the overall level. Likes were the most common form of interaction, followed by comments and collections. Sharing was the least common and had the highest proportion of zero value.

Table 1. Distribution Statistics of Key User Interaction Metrics

Metric	Mean	Median	Skewness	Kurtosis	ZeroRate
Likes	7256.2664	119	73.4736	6540.4907	0.0093
Comments	448.3776	9	44.1541	2532.094	0.1288
Shares	742.5354	4	62.9246	4453.0745	0.2488
Favorites	595.5469	12	53.4752	3829.5796	0.1214

To reduce the influence of extreme values, the subsequent analysis adopts the $\log(x+1)$ transformation and performs a 1%-99% quantile truncation. By comparing the distribution before and after the transformation, it could be seen that after $\text{Log1p} + \text{Winsorization}$ processing, the data density is more concentrated in the low-value range, the skewness is significantly reduced, and the distribution tends to be compact.

To extract the latent structural features of the four core interaction metrics (likes, comments, shares, and saves), principal component analysis was conducted. The KMO value is 0.809, and Bartlett's sphericity test was

significant ($\chi^2 = 113726.596$, $p < 0.001$), indicating that the data are highly suitable for principal component analysis.

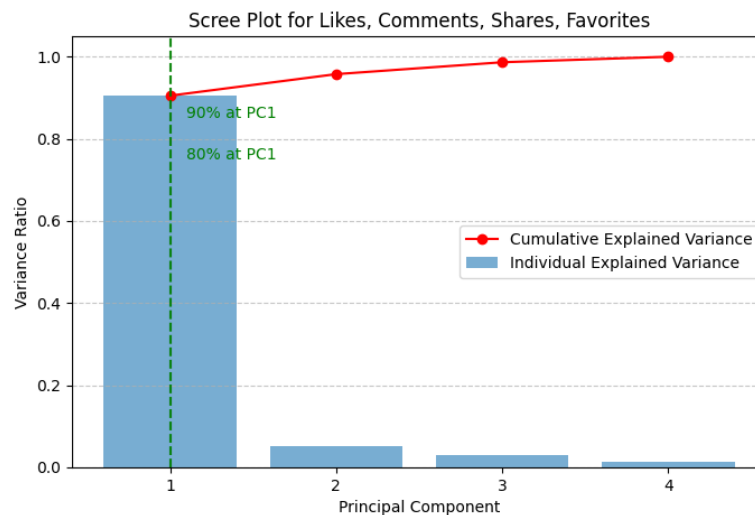


Figure 1. Principal Component Analysis Scatterplot: Variance Explained by Social Interaction Indicators

The first principal component (PC1) explained 90.52% of the total variance, representing overall interaction intensity; the explanatory power of the subsequent principal components declined significantly. Figure 1 presents the principal component analysis results in a scatterplot format, which aids in determining how many principal components should be retained. The chart indicates that the first principal component (PC1) alone explains approximately 90% of the variance, suggesting that these four social interaction metrics are highly correlated and can be simplified through dimensionality reduction for analysis. KMO Overall Value: 0.809, Bartlett's test: chi-square = 113726.596, $p < 0.001$.

As shown in Table 2, the loadings of the four variables on PC1 are all positive and similar, indicating that they jointly constitute the “comprehensive interaction intensity” dimension.

Table 2. The loadings of the four variables on PC1

Likes	Comments	Shares	Favorites
0.510213082	0.4901	0.4946	0.5048

In the sensitivity analysis, after excluding the top 0.5% of high-interaction samples, the explanatory variance of PC1 was 89.85%, and the results were consistent, indicating a robust principal component structure. Therefore, PC1 was selected as the comprehensive interaction intensity indicator for subsequent clustering and regression analysis.

Data preprocessing and principal component dimension reduction lay the groundwork for subsequent analysis of the relationships between different content types, account attributes, and interactive behaviors, while also providing reference points for the sustainable optimization of digital dissemination strategies for ICH.

Clustering Model Construction and Validation

Comparison of Clustering Approaches (Absolute Values vs. Interaction Rates)

We performed a cluster analysis using both raw interaction metrics (likes, comments, shares, and favorites) and relative interaction rates (interactions divided by views) as features. The K-Means algorithm was applied within the range of $K=2-6$, and the optimal number of clusters was determined based on the Silhouette Score.

The Silhouette Scores for raw interaction metrics were: $K=2$ (0.499), $K=3$ (0.439), $K=4$ (0.375), $K=5$ (0.340), and $K=6$ (0.311), indicating $K=2$ as the optimal structure with moderate yet reasonable cluster separation. The Silhouette Scores for relative interaction rates were significantly higher: $K=2$ (0.958), $K=3$ (0.951), $K=4$ (0.723), $K=5$ (0.722), and $K=6$ (0.698), further supporting $K=2$ as the optimal cluster number. Figure 2 shows that the silhouette coefficient exhibits a monotonically decreasing trend as the number of clusters increases, indicating that interaction-rate based clustering achieves clearer separation and higher consistency, enabling more effective differentiation between distinct video or account types. From the visualization perspective in Figure 3, both clustering methods achieved satisfactory results, but interaction rate clustering provided clearer group boundaries. Absolute value clustering exhibited a relatively continuous distribution, whereas interaction rate clustering showed distinct discontinuities, potentially reflecting inherent differences between the two features in the data.

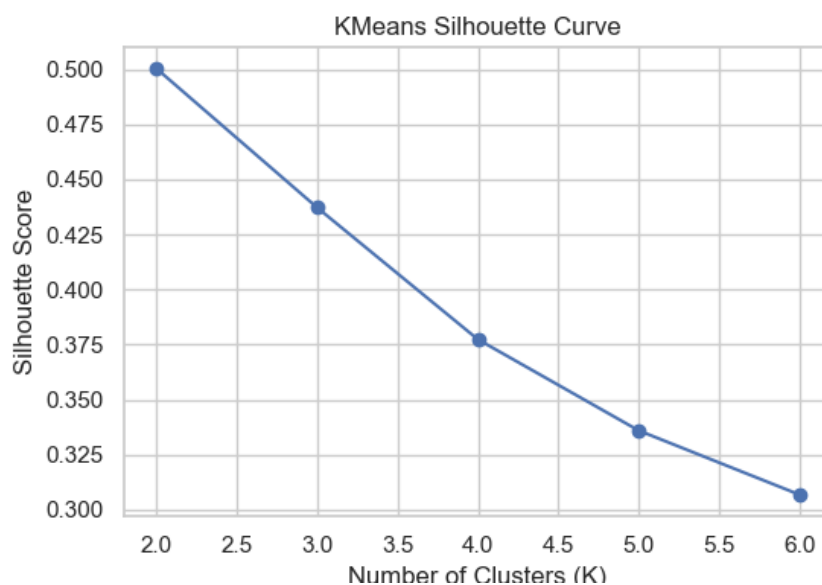
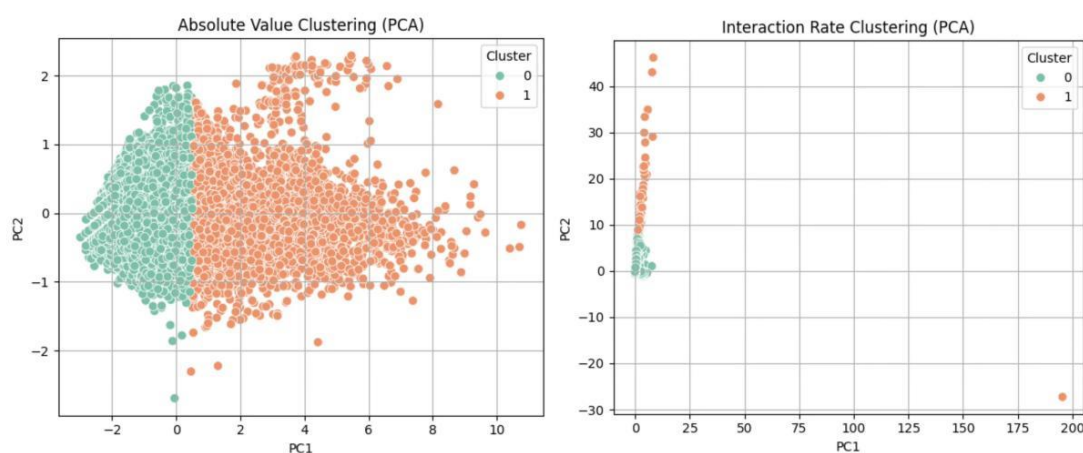


Figure 2.
Means
Scores Variation at Different Cluster Numbers

Curve of K-
Silhouette



Figure

3. Comparison of PCA-Based Absolute Value and Interaction Rate Feature Clustering Results

Stability and Consistency of Clustering

To assess the robustness of the clustering results, validation was conducted from multiple perspectives.

First, by repeatedly performing K-Means clustering on 70%–80% random subsamples of the original data, the ARI and NMI were calculated. The results in Table 3 showed exceptionally high ARI/NMI values (ranging from 0.97 to 1.0, with most approaching 0.99–1.0). This indicates near-complete consistency in cluster partitioning, demonstrating that the K-Means clustering results for the original data were highly robust to sample perturbations and exhibited stable cluster structures.

Table 3. Stability Evaluation Results of Clustering Algorithms (Multiple Runs)

Run #	ARI	NMI
1	1.0000	1.0000
2	0.9889	0.9738
3	0.9942	0.9848
4	1.0000	1.0000
5	0.9997	0.9990
6	0.9967	0.9907
7	1.0000	1.0000
8	0.9975	0.9926
9	0.9944	0.9855

10	0.9949	0.9866
11	0.9912	0.9785
12	0.9992	0.9974
13	0.9977	0.9933
14	0.9944	0.9855
15	1.0000	1.0000
16	0.9896	0.9752
17	0.9997	0.9990
18	0.9997	0.9990
19	0.9924	0.9810
20	0.9977	0.9933

Second, to assess the impact of extremely high-interaction samples, we excluded the top 0.5% of highly interactive videos and performed clustering again. The results showed the highest Silhouette Score (0.494) at $K=2$, which gradually decreasing to 0.429–0.299 for $K=3$ –6, consistent with the original data. This indicated that the clustering structure was insensitive to extreme samples.

Third, we employed the BIC and elbow rule for evaluation (Figure 4). The analysis indicated that the BIC criterion suggested $k=6$, while the elbow rule pointed to $k=3$ or $k=4$ as the inflection point. Despite these inconsistent results, we ultimately selected $k=2$ as the final number of clusters, based on model interpretability and simplicity. Compared with the $k=6$ partition, the $k=2$ clustering produced clearer, more interpretable groups, whereas $k=6$ generated multiple small clusters with blurred boundaries that were theoretically difficult to interpret and practically challenging to manage. $K=2$ produced clearer and more interpretable groups, whereas $K=6$ generated multiple small clusters with blurred boundaries, which were theoretically difficult to explain and impractical for application.

The silhouette coefficient serves as a comprehensive metric for evaluating clustering quality, while simultaneously assessing intra-cluster cohesion and inter-cluster separation. $K=2$ ensures high cohesion within clusters while achieving a clear separation between them, aiding in revealing the key differences in user interaction patterns. We acknowledge that selecting $k=2$ may overlook potentially finer substructures within the data, thereby providing a direction for future exploration.

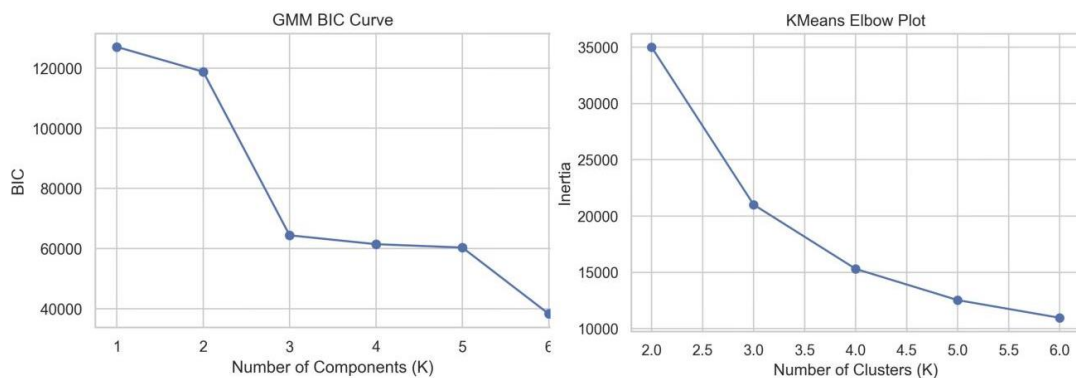


Figure 4. Cluster evaluation using Gaussian Mixture Model BIC and K-Means elbow method.

Finally, as shown in Table 4, the clustering results for the same dataset exhibited significant differences across the algorithms. K-Means and K-Medoids demonstrated the highest consistency, achieving ARI and NMI values of 0.724 and 0.679 respectively, indicating that these two distance-based partitioning clustering algorithms produced highly similar cluster structures on this dataset. In contrast, HDBSCAN generally exhibits lower consistency with other algorithms, even yielding a negative ARI value (-0.030) with K-Means. This indicates that the cluster structures discovered by this density-based clustering algorithm fundamentally differ from those of partition-based algorithms. As a probabilistic model-based algorithm, GMM showed moderate consistency with K-Means and K-Medoids (ARI values of 0.403 and 0.562, respectively), but its consistency with HDBSCAN remained weak. These results indicate that the intrinsic mechanisms of the algorithms—distance partitioning, probability distribution, and density connection—are the key factors influencing clustering outcomes.

Table 4. Consistency Evaluation Results Among Clustering Algorithms

Algorithm Comparison	ARI	NMI
K-Means_vs_K-Medoids	0.7245	0.6790

K-Means_vs_GMM	0.4033	0.4351
K-Means_vs_HDBSCAN	-0.0304	0.1054
K-Medoids_vs_GMM	0.5624	0.5139
K-Medoids_vs_HDBSCAN	0.0415	0.1356
GMM_vs_HDBSCAN	0.1636	0.1716

Note: ARI is the adjusted Rand index, and NMI is the normalized mutual information. Both values range from [0, 1], with values closer to 1 indicating higher consistency.

Analysis of Interaction Patterns Across Two Clusters

cluster_K-Means	Likes	Comments	Shares	Favorites
0	20264.9984	1248.1741	2084.3518	1660.6886
1	85.0294	7.4791	2.8412	8.3734

Based on K-Means clustering results, this study categorized the samples into two clusters (Cluster 0 and Cluster 1) and calculated the mean values for core interaction metrics across each cluster. Table 5 displays the cluster centers for the two clusters across the four metrics.

Table 5. K-Means Clustering Center Eigenvalue Table

Low-Interaction Cluster (Cluster 1): With low levels of likes, comments, shares, and saves, this cluster indicates limited audience reach and low engagement activity. Such videos typically correspond to ordinary accounts or non-trending content, suggesting that the dissemination of ICH on digital platforms has yet to foster broad societal participation, highlighting issues of insufficient sustainability in dissemination.

High-Interaction Cluster (Cluster 0): Core interaction metrics significantly exceed those of the low-interaction cluster, indicating broad audience reach and active dissemination. These videos more effectively promote the digital transmission of cultural content and public engagement, demonstrating the sustainable dissemination potential of ICH on short-video platforms.

The Impact of Account Characteristics on Interaction Clustering

To examine the impact of account characteristics on interaction performance and the sustainability of ICH content dissemination, this study employed account type (Account_origin) and follower count (Totalfollowers_log) as the primary independent variables. Controlling for view count (Views_log), video length (VideoLength_log), and release duration (ReleaseDuration). Using an OLS regression model, we analyzed the logarithms of likes (Likes_log), comments (Comments_log), shares (Shares_log), and favorites (Favorites_log) as dependent variables. All interaction metrics were log-transformed to mitigate the effects of skewed distributions.

Table 6. K-Means Clustering Center Eigenvalue Table

Variable	Comments_log	Favorites_log	Likes_log	Shares_log
Official Account	-0.602***	-0.366***	-0.467***	0.126***
Intercept	8.532***	13.103***	16.053***	17.016***
Followers (log)	-1.907***	-2.771***	-3.044***	-3.568***
Views (log)	0.660***	0.826***	0.882***	0.753***
Followers ² (log)	0.075***	0.106***	0.119***	0.144***

Note: *** means $p < 0.001$.

The results of the regression analysis are shown in Table 6 which indicate a good model fit, with all primary independent variable coefficients showing consistent and significant directions. View count (Views_log) exerted a significant positive influence on all four interaction metrics ($p < 0.001$), demonstrating a strong correlation between video exposure and engagement performance. Regarding account type, compared to individual creators, official accounts exhibit significantly lower interaction levels on comments ($\beta = -0.602$, $p < 0.001$), favorites ($\beta = -0.366$, $p < 0.001$), and likes ($\beta = -0.467$, $p < 0.001$), but exhibited a positive relationship with reposts ($\beta = 0.126$, $p < 0.001$). Official accounts are better equipped to drive widespread content dissemination, thereby enhancing the long-term visibility and sustainable reach of cultural content.

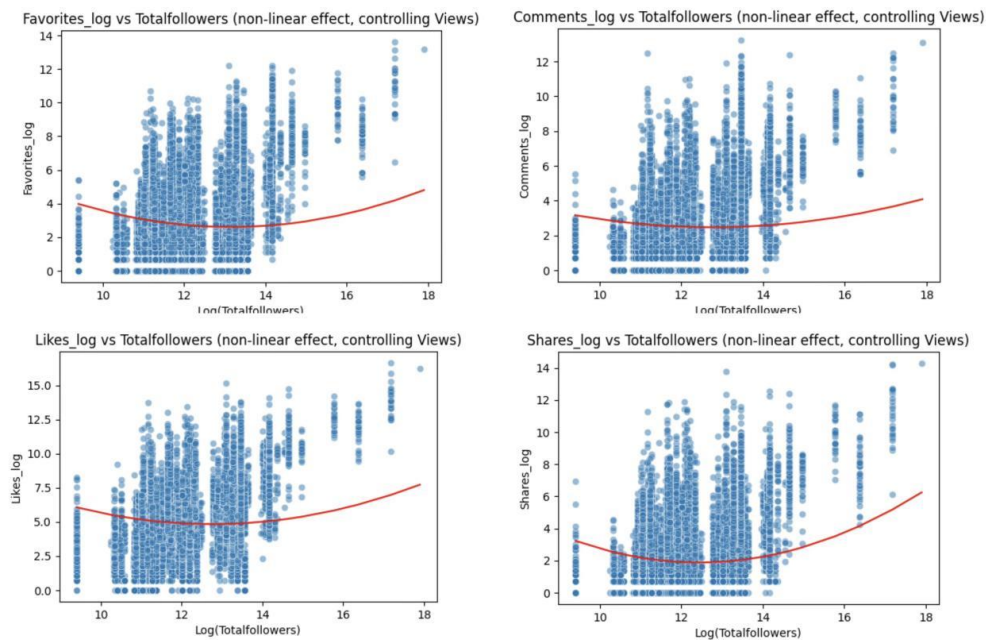


Figure 5. Nonlinear Trends in Social Interaction Metrics and Follower Counts

As presented in Figure 5, the follower size effect exhibited a pronounced U-shaped pattern (negative linear term and positive quadratic term for $\text{Log}(\text{Total_followers})$), both $p < 0.001$). Specifically, the interaction volume decreased as follower count increased within the low-to-medium range ($\text{Log}(\text{Total_followers}) < 12$). Beyond this threshold, interaction volume rose significantly with increasing follower count. This pattern holds across all four interaction metrics, with the quadratic term coefficient being highest for shares (Shares_log) ($\beta = 0.144$, $p < 0.001$). This indicates that high-follower accounts demonstrate the strongest promotional effect in content redistribution, effectively expanding the public reach of ICH and enhancing its long-term dissemination potential.

In summary, account type and follower scale not only influence engagement metrics but also significantly impact the sustainable dissemination of ICH digital content: official accounts help broaden audiences and boost sharing rates, while high-follower creators amplify content reach, providing sustained momentum for cultural preservation.

The Impact of Video Features on Interactive Clustering

This study employs OLS regression analysis with four interaction metrics (Comments_log , Favorites_log , Likes_log , and Shares_log) as the dependent variables. The core independent variable is ICH type, while controlling for account type (Official/Individual), follower count ($\text{Total_followers_log}$), and view count (Views_log). By employing a no-intercept model, the coefficients for each category can be directly interpreted as the category's mean value. The relationship between video length (VideoLength_log) and release time (ReleaseDuration) classifications and interaction metrics was examined. The reliability of the analytical results was validated through different binning schemes. The analysis results not only reveal differences in audience engagement across various ICH types on digital platforms but also help understand which content characteristics and account strategies can promote the long-term visibility and sustainable dissemination of ICH.

The Impact of Types of ICH on Interaction Metrics

The regression results in Table 7, with Types of ICH as the core independent variables, reveal that the coefficients for each category reflect the average level across the four interaction metrics after controlling for other variables. A higher coefficient indicates greater average interaction intensity for videos in that category, reflecting their dissemination activity on digital platforms and potential cultural sustainability value.

Table 7. Regression Results on the Impact of ICH Type on Interaction Metrics

Variable	Comments_log	Favorites_log	Likes_log	Shares_log
Traditional sports, games, and acrobatics	-0.755***	-2.940***	-0.982***	-3.997***
Traditional music	-1.830***	-2.941***	-1.664***	-4.409***

Traditional arts	-2.084***	-2.897***	-1.730***	-4.127***
Quyi (Chinese opera)	-1.859***	-3.053***	-1.691***	-4.539***
Traditional drama	-1.374***	-2.540***	-1.484***	-3.824***
Folk literature	-2.037***	-3.018***	-1.588***	-4.103***
Folk customs	-1.342***	-2.766***	-1.344***	-3.720***
Traditional dance	-1.486***	-2.935***	-1.027***	-3.813***
Traditional fine arts	-2.003***	-2.744***	-1.687***	-4.287***
Traditional medicine	-2.020***	-2.328***	-1.389***	-3.759***
C(Account_origin)Official	-0.731***	-0.296***	-0.473***	0.087***
Totalfollowers (log)	-0.126***	-0.180***	-0.128***	-0.075***
Views (log)	0.641***	0.839***	0.877***	0.757***

Note: *** means $p < 0.001$.

Types with higher interaction performance include “Folk customs,” “Traditional drama,” “Traditional sports, games, and acrobatics,” and “Traditional dance.” These categories exhibit relatively larger coefficients across all four metrics, indicating that the relevant content not only elicits active audience engagement but also achieves greater long-term visibility and cultural continuity, demonstrating high digital sustainability.

Types with moderate engagement included “Traditional medicine” and “Traditional arts,” where interaction coefficients were centered, indicating balanced engagement levels. It holds potential value in promoting the dissemination of ICH knowledge and fostering community cultural identity.

Types with low interaction performance include “Traditional music,” “Quyi (Chinese opera),” “Traditional fine arts,” and “Folk literature.” All four interaction metrics for these categories exhibited negative and low coefficients, with particularly weak performances in bookmarking and sharing. This indicates that such content has relatively limited potential for dissemination and sustainable engagement on digital platforms, necessitating improvements through content optimization, creative strategies, or platform recommendation mechanisms to enhance its long-term dissemination value.

Regarding metric fluctuations, likes and comments exhibit minimal variation across most categories, while saves and shares show significant differences. This indicates that certain types are more conducive to fostering deep engagement and sustained interest, thereby supporting the sustainable digital dissemination of ICH.

Chi-Square Test of Video length and Release Duration on Engagement Metrics

To further explore the relationship between video characteristics and the effectiveness of digital dissemination for ICH, this study examined the influence of video duration (VideoLength_log) and release duration (ReleaseDuration). Release duration represents the survival period of a video from its release date to the data collection date (October 2025), measured in months. It reflects the video's lifecycle on the platform and its potential cumulative exposure.

Using quantile binning, video length and duration were categorized into 3–5 tiers (short/medium/long), while four core engagement metrics (likes, comments, shares, saves) were divided into “high engagement” and “low engagement” based on the median. A 2×k contingency table was constructed, and the strength of associations between variables was assessed using chi-square tests and Cramér's V coefficient.

Results (Table 8) revealed a highly significant association between video duration and engagement metrics ($p < 0.001$), with effect sizes (Figure 6) ranging from weak to moderate ($V = 0.05–0.13$). Heatmaps revealed that longer videos excelled in bookmarking ($V = 0.125$) and sharing ($V = 0.110$), indicating their greater capacity to drive deep user engagement. This suggests that by increasing content detail and information density, ICH projects are more likely to achieve sustained visibility on digital platforms, thereby enhancing the sustainability of their cultural dissemination.

Simultaneously, video longevity showed a significant positive correlation with comment accumulation (Comments_log, $V \approx 0.104$), indicating that long-standing videos have greater opportunities to gather audience feedback and foster community engagement. This suggests that the sustained release and prolonged presence of ICH content not only boosts interaction volume but also cultivates stable audience communities, facilitating the long-term transmission of cultural knowledge and traditional skills.

Overall, video duration exerts a significantly stronger influence on user engagement depth than posting duration, though both factors play crucial roles in digital dissemination sustainability. Results remain highly

consistent across different quantile intervals (3rd–5th percentiles), further validating the robustness and long-term potential of video characteristics for ICH digital transmission.

Table 8. Chi-square Test and Cramér's V of Video Features and Engagement Metrics Across Different Binning Schemes

Feature	Target	Bins	Chi-square	P_value	dof	Expected_min	Cramers_V
ReleaseDuration	Comments_log	5	228.3585	0	4	1695.0781	0.1037
ReleaseDuration	Favorites_log	4	112.6986	0	3	2257.3535	0.07284
ReleaseDuration	Likes_log	5	70.1114	0	4	1714.1421	0.0575
ReleaseDuration	Shares_log	3	137.7885	0	2	3032.8555	0.08055
VideoLength_log	Comments_log	5	198.4556	0	4	2023.0303	0.0967
VideoLength_log	Favorites_log	5	330.0497	0	4	2036.1418	0.1247
VideoLength_log	Likes_log	5	118.2035	0	4	2045.7826	0.0746
VideoLength_log	Shares_log	5	257.9863	0	4	1960.9434	0.1102

Association Strength (Cramér's V) between Video Metrics and Interaction metrics

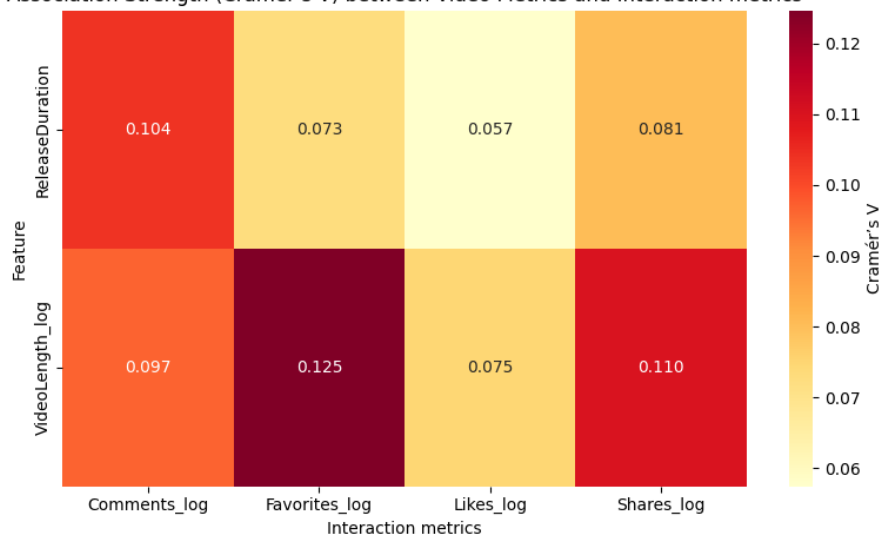


Figure 6. Cramér's V between Interaction Metrics and Content Features

DISCUSSION

The Hierarchical Coexistence Structure of Short Video Dissemination Of ICH: A Structural Explanation of Platform-Based Participation (Research Question 1)

Based on interaction data from ICH short videos on the Douyin platform, this study employs a participatory cultural theory perspective to analyze how user engagement patterns, content characteristics, and account attributes influence dissemination behavior. Results reveal a stratified coexistence structure in the dissemination of ICH short videos on digital platforms: Low-interaction videos (Cluster 1) exhibit limited audiences with predominantly passive consumption, while high-interaction videos (Cluster 0) demonstrate significantly higher metrics in likes, comments, shares, and saves compared to low-interaction videos, reflecting active user participation and co-creation.

This hierarchical structure is not merely a difference in the "effect" of communication, but reflects the way public participation is structured in a platform-based environment. Highly interactive videos often occupy higher visibility positions under the combined effect of algorithmic recommendations and social diffusion mechanisms, thus forming relatively concentrated interactive nodes. These videos are often associated with celebrity accounts or highly watched creators, and their dissemination paths exhibit a distinct centralized feature, leading to the repeated viewing, discussion and reproduction of specific intangible cultural content on the platform [32].

Meanwhile, although low-interaction videos are on the periphery in terms of platform visibility and interaction density, they are not meaningless. This kind of content together constitutes the "background layer" of the platform's cultural ecosystem, providing space for the diverse presentation and differentiated expression of ICH.

It can be seen from this that the dissemination of ICH on the platform is not simply concentrated in a few highly interactive contents, but unfolds in a structure where centralization and marginalization coexist.

Nonlinear Regulation of Participation Behavior by Fan Size and Account Attributes: Interaction Differentiation under Platform Logic (Research Question 2)

The research results further indicate that account types and the scale of followers play an important moderating role in shaping user interaction patterns. Compared with official institutional accounts, videos posted by individual creators perform more prominently in terms of absolute interaction indicators such as likes, comments and collections, while official accounts have a slight edge in terms of forwarding rates. This difference indicates that different types of communication subjects occupy different positions in the platform's interactive structure: individual creators are more likely to form interaction-intensive communities through emotional expression and daily narrative, while official accounts are more inclined to be forwarded and redistributed as information sources within the platform network^[16].

In addition, there is a significant nonlinear relationship between the number of followers and interactive behavior. Specifically, the interaction level of medium-sized accounts is relatively low, while high-following accounts have shown a significant rebound in diffusion-based interaction behaviors such as sharing. This phenomenon indicates that the influence of a platform does not accumulate linearly but rather presents a differentiated interactive logic within different scale ranges. Accounts with high attention are more likely to trigger secondary dissemination mechanisms in the platform structure, thereby enhancing the content's diffusion ability and visibility.

It is worth noting that different clustering algorithms show a high consistency in the recognition results of high-interaction and low-interaction patterns, indicating that these interaction stratification are not accidental phenomena but relatively stable components in the platform-based participation structure. This stability further indicates that user participation in the platform environment presents a repeatable pattern rather than being randomly determined by individual preferences.

Differentiated Dissemination Paths of ICH Types and Video Characteristics: Participation Thresholds and Interaction Conditions (Research Question 3)

The research also found that different types of ICH content show significant differences in the interactive structure of the platform. Categories such as folk customs, traditional sports and acrobatics, traditional drama and traditional dance are more likely to receive various forms of interaction such as likes, comments, collections and shares, while the interaction level of categories such as music, folk art, traditional fine arts and folk literature is relatively low.

This difference can be understood from the perspective of participation threshold and interactive plasticity. ICH content with high physical, performative and imitative characteristics is more likely to be transformed by users into practical participation, thereby stimulating interactive behaviors such as comments, imitation and secondary creation^[13]. In contrast, ICH types with higher cognitive thresholds or those mainly for appreciation, although they possess cultural value, are more difficult to be transformed into high-density interaction in a platform environment.

Video features also have a significant impact on the interactive structure. Longer videos usually contain more abundant information and narrative threads, providing conditions for in-depth interactions such as commenting, collecting and sharing. Furthermore, the longer a video remains on the platform, the higher the possibility of accumulating discussions and interactions, enabling ICH content to be repeatedly watched and reinterpreted in the platform environment. This indicates that the technical features of the platform and the form of content jointly shape the structural conditions for user participation.

Comprehensive Discussion: ICH Dissemination and Public Participation in a Platform-based Environment

Overall, this study reveals the systematic differences presented by short videos of ICH on the Douyin platform in terms of interaction mode, content type, account attributes and video characteristics. Highly interactive content occupies a relatively core position in the platform structure by concentrating users' attention and amplifying their participation in practice. Low-interaction content, on the other hand, forms the outer layer of cultural expression, jointly maintaining the diversity of the platform's cultural ecosystem.

These findings indicate that the dissemination of ICH on digital platforms is not solely determined by content quality or user interests, but is continuously restructured under the interwoven influence of platform technical mechanisms, account structures, and participation practices. Understanding this platform-based participation structure helps deepen our understanding of the process of power distribution, visibility differences and cultural meaning construction in digital cultural dissemination.

CONCLUSION

Main Research Findings

Based on large-scale user interaction data, this paper systematically analyzes the dissemination structure and influencing factors of short videos on ICH on the Douyin platform. Through a research approach that combines descriptive statistics, principal component analysis, cluster analysis and regression models, this paper identifies two representative interaction patterns: high-interaction videos and low-interaction videos. The research results show that different interaction modes have significant and stable systematic differences in the types of communication subjects, content categories, account attributes and interaction behavior structures.

Further analysis reveals that this disparity is not accidental but rather the result of the structuring of public participation in the digital platform environment. Interactive behaviors show a distinct hierarchical distribution among different videos, reflecting the synergistic role of platform mechanisms, account influence and content characteristics in shaping the cultural dissemination path. As a result, the dissemination of ICH on short-video platforms is no longer a single linear process, but unfolds in an interactive structure where centralization and marginalization coexist.

At the methodological level, the results of principal component analysis indicate a high degree of correlation among the core interaction indicators, while multiple clustering algorithms and sensitivity tests all yield highly consistent classification results. This robustness indicates that the user interaction patterns on the platform possess inherent regularity and repeatability, providing a reliable empirical basis for understanding structural participation in the dissemination of digital culture.

Theoretical Contributions

This study has made theoretical contributions to the research on digital culture and ICH in three aspects.

Firstly, the research expands the application boundaries of user participation research in the field of digital culture by taking interactive behavior as the core of analysis and concretizing the theory of participatory culture into actionable empirical indicators. Interaction is no longer merely regarded as the result of communication effects, but is understood as a form of cultural practice that is continuously shaped within the platform structure.

Secondly, this paper reveals the hierarchical structure characteristics of the dissemination of ICH on digital platforms, indicating that cultural visibility and participation opportunities are not evenly distributed in the platform environment, but are jointly influenced by multiple factors such as account types, the scale of followers, and content characteristics. This discovery helps to deepen the understanding of power relations and the mechanism of attention distribution in platform-based cultural dissemination.

Thirdly, by introducing unsupervised machine learning methods to systematically identify user interaction patterns, this paper provides a data-driven analytical path for cultural communication research and demonstrates the potential of computational methods in revealing complex cultural communication structures. This method helps bridge the long-standing gap between qualitative cultural research and large-scale data analysis.

RESEARCH LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

Although this study provides a systematic analysis of the dissemination structure of ICH on the Douyin platform, there are still several limitations. Firstly, the research data is mainly based on the observable interaction indicators of the platform, making it difficult to directly reflect users' subjective motivations, emotional experiences and cultural understanding processes. Future research can combine interview or text analysis methods to deepen the understanding of the significance level of participation.

Secondly, this study focuses on a single-platform environment. The differences in algorithm logic, user structure, and cultural positioning among various platforms may lead to different dissemination and participation models. Cross-platform comparative studies will help to test the universality and contextual dependence found in this paper.

Finally, although cluster analysis reveals stable interaction patterns, the interaction structure itself may still evolve with changes in platform policies, technological updates, or cultural hotspots. Subsequent research can adopt longitudinal data to further explore the dynamic change process of the digital cultural communication structure.

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Institutional Review Board Statement: This study didn't involve human participants .

Data Availability Statement: The raw data and code used in this study contain sensitive information and cannot be publicly shared due to privacy, copyright, and confidentiality restrictions. Limited access to anonymized summary data and the analysis code can be provided upon reasonable request to the corresponding author.

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