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The Differential Impact of User Interaction on Social Tagging Behavior: A Case Study of Douban Postprint

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Abstract

[Purpose/Significance] To provide a basis for improving tag quality and optimizing information services in social tagging systems, this study examines the differences in tagging behaviors among users with varying interaction characteristics from the perspective of user interactions within social tagging systems. [Method/Process] Using Douban Book as a research sample of social tagging systems, this study investigates the distribution characteristics of Douban users' tagging behaviors from five perspectives: tag quantity, tag structure, tag semantics, tagging motivation, and activity level. The number of followings, number of followers, and years of usage are employed to represent users' degree of association and interaction with other users in the social tagging system. Differences in tagging behaviors among users with different interaction characteristics are explored through comparative analysis, and the extent of influence of interaction characteristics on these differences is examined via multiple regression analysis. [Results/Conclusion] Empirical research demonstrates that significant differences exist in social tagging behaviors among users with different interaction characteristics: users with stronger interactions with others possess tag datasets containing more tags; users who follow more other users and users who are followed by more users utilize a greater quantity of tags. Users with longer years of usage on Douban Book exhibit greater average tag length and tag reuse rate, while their follow relationships with other users have minimal impact on average tag length and tag reuse rate. Users' ratio of special-language tags is significantly influenced by their years of usage, but the number of followers a user has does not substantially affect their ratio of special-language tags. Users who follow more other users demonstrate higher activity levels in the tagging system. Consequently, social tagging systems can implement measures to strengthen user interactions within the system, thereby regulating users' social tagging behaviors through mutual influence among users and ultimately improving tag quality.

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Preamble

Research on the Differential Impact of User Interaction on Social Tagging Behaviors: A Case Study of Douban.com

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Abstract:
[Purpose/Significance] To provide a basis for improving tag quality and optimizing information services in social tagging systems, this study explores differences in tagging behaviors among users with varying interaction characteristics from the perspective of user interactions within social tagging systems. [Method/Process] Using Douban Book as a research sample, we examine the distribution characteristics of Douban users' tagging behaviors from five dimensions: tag quantity, tag structure, tag semantics, tagging motivation, and user activity. We employ the number of users one follows, the number of followers, and the length of system usage as indicators to represent users' degree of association and interaction with others in the social tagging system. Through difference analysis, we investigate variations in tagging behaviors among users with different interaction characteristics, and use multiple regression analysis to examine the degree of influence that interaction characteristics have on these differences. [Result/Conclusion] Empirical research demonstrates that significant differences exist in social tagging behaviors among users with different interaction characteristics: users with stronger interactions with others have tag datasets containing more tags; users who follow more others and have more followers use a greater number of tags; users with longer Douban usage histories exhibit greater average tag length and tag reuse rates, while their follow relationships with other users have minimal impact on average tag length and reuse rates; users' ratio of special-language tags is significantly influenced by their usage history, but the number of followers does not significantly affect this ratio; users who follow more others demonstrate higher activity in the tagging system. These findings suggest that social tagging systems can implement measures to strengthen inter-user interactions and regulate users' social tagging behaviors through mutual influence, thereby improving tag quality.

Keywords: user; interaction; tagging behavior; difference
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Social tagging systems represent an important Web 2.0 application—systems for describing, organizing, managing, and classifying online resources. In these free and open environments, users comprehend network resources based on their knowledge levels and cognitive styles, then select terms from their cognitive

structures to add natural language annotations (social tags) to resources. Users can leverage tags on social tagging systems for information organization and retrieval, thereby facilitating information dissemination and sharing. However, due to the free indexing approach of social tagging, some tags cannot accurately describe resource content, exhibiting issues such as arbitrary tagging, disorder, and lack of semantic relationships among tags, which affect the effectiveness of tag-based information organization and retrieval to some extent. Tags represent the outcome of user tagging behavior, making research on user social tagging behavior a sustained focus since the emergence of social tagging systems. Most existing studies select quantitative indicators describing tags to characterize user tagging behavior, employing statistical analysis or questionnaire surveys to examine overall user tagging behaviors in tagging systems and differences among different user types. Nevertheless, social tagging systems are essentially novel, interactive information spaces [1]. Therefore, research on user social tagging behavior should not only classify users based on objective characteristics but also consider how various interaction behaviors with other users in social tagging systems produce differences in tagging behavior. A deeper understanding of user tagging behavior provides theoretical foundations for optimizing social tagging system design, improving social tag quality, and enhancing tag-based information organization and retrieval.

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1 Related Research

1.1 Statistical Characteristics of User Tagging Behavior

Understanding user tagging behavior represents an enduring topic in social tag research. Most descriptions of user tagging behavior begin with tagging outcomes—tags themselves—exploring user behavior through tag statistical characteristics. For example, U. Farooq et al. analyzed user tagging behavior from perspectives of tag growth, tag reuse, tag explicitness/implicitness, tag discrim-

ination, tag frequency, and tagging methods [2]; V. Mirzaee et al. examined how tagging motivation affects behavior from angles including number of tags per resource, tag selection and usage, and tagging frequency [3]; X. Wang et al. analyzed user tagging behaviors on StumbleUpon and Delicious from perspectives of user tag quantity, tag sharing, and high-frequency tag usage [4]; A. Guyot analyzed book tags in LibraryThing from dimensions of tag length, tag count, high-frequency tags, multi-language tags, and tag long-tail characteristics [5]; S. A. Golder and B. A. Huberman conducted comprehensive analyses of user tagging patterns in Delicious regarding tag usage purposes, tag types, and tag frequency distributions on resources [6]; Hu Qian et al. examined the relationship between user tagging behavior and book themes from perspectives of average tags per user and tag type distribution [7].

1.2 Research on Differences in User Tagging Behavior

Many studies analyzing tag data have investigated differences in tagging behaviors among different user types. Users with different knowledge backgrounds and personal capabilities exhibit distinct tagging behaviors: research shows American users generally add significantly more tags than Chinese and Indian users [8], and tend to add more tags representing subjective judgments or attitudes [9]; scientific users with different professions, specialties, and titles also demonstrate tagging behavior differences [10]; veteran users are more willing to share tagging results than new users [11]; expert users show higher consistency between their selected tags and original keywords when tagging academic texts [12]; users without training in artificial or "machine-readable" languages tend to prefer compound tags and multi-character tags with stronger explanatory functions for target resources [13]. Additionally, research indicates users with different cognitive characteristics display different tagging behaviors [14-17], with users of varying cognitive difficulty and cognitive styles exhibiting different tag usage patterns [18]. Experimental studies also reveal that users with different tagging motivations show distinct behaviors: users motivated by resource classification tend to use fixed tag sets, adding consistent numbers of tags to similar resources and rarely using synonymous tags; users motivated by resource description have more open tag sets, often adding inconsistent numbers of tags to each resource and frequently using synonyms [19]. Tagging motivation also affects tagging intensity and frequency [20].

1.3 Research on Factors Influencing User Tagging Behavior

In studies of user tagging behavior differences, researchers categorize users into different groups based on characteristics to examine how user factors affect social tagging behavior. Beyond user characteristics, external environmental factors such as system properties and resource nature also influence tagging behavior [7, 21]. Social tagging system factors primarily include system functions, interface design, tagging rules, and other users' tags, which substantially impact user tagging behavior. Existing research focuses on tag recommendations, tagging

rules, and influences of other users' tagging behaviors. Wu Dan et al. [22] compared user tagging behaviors between Wuhan University Library and Douban, identifying differences between library and book-sharing websites. Xie Jialin et al. [23] studied how university library tagging system quality affects user tagging behavior using the information systems success model. Zhuang Qian et al. [24] explored how social tagging system quality influences user tagging intention using the same model. Beyond system functions and interfaces, based on social identity theory, tagging rules, tag recommendation mechanisms, and other users' tags exert greater influence on user behavior—meaning interactions between users and between users and systems significantly impact tagging behavior. J. B. Philip [25] found through surveys that social identity affects user tagging behavior; tag recommendations and other users' tagging behaviors in social tagging systems serve similar functions, creating higher consistency among different users' tags. T. Kowatsch et al. [26] found through experiments that 50% of users employed predefined terms pre-loaded into the system. C. Dan et al. [27] discovered in Movielens recommendation system experiments that recommendation systems guide user tagging behavior toward consistency, with all users influenced by system recommendations. M. Cameron [28] studied tag vocabulary overlap among Flickr users, finding that friends had higher tag vocabulary overlap than randomly selected users.

Resource type as the object of user tagging also constitutes an important influencing factor. Users exhibit significant differences in tag usage behavior across different network resources such as images, books, and videos. Y. Choi et al. [29] found significant differences in average tag quantity and tag types between non-textual and textual resources in humanities digital archives. M. Heckner et al. [30] studied user tagging behaviors across different social tagging systems, finding that users employ different tag types when tagging different resources. Hu Qian et al. [7] conducted empirical analysis based on Douban data, discovering that book themes significantly affect user tagging behavior. M. Strohmaier et al. [31] found through empirical research that consistency in user tag usage manifests more in resource description than in resource classification.

In summary, scholars have selected quantitative indicators such as tag count and tag length to explore differences in tagging behaviors among different user types and potential influencing factors. However, user tagging behavior in social tagging systems remains a research hotspot [32]. While tags can organize and index information within personal information spaces, through implicit or explicit sharing and collaboration, tagged information becomes browsable and searchable by other users [33-34], reflecting the communicative nature of tags. Creating socially meaningful tags enhances the possibility of sharing information and ideas with other taggers. Therefore, user interaction in social tagging systems represents an important factor affecting tagging behavior. However, existing research has mostly explored the impact of user interaction on tagging behavior through experiments, without deeper investigation into how different degrees of association and interaction among users in social tagging systems produce patterns and regularities in tagging behavior differences. To more com-

prehensively and systematically reveal the patterns of user tagging behavior and provide theoretical foundations for personalized and differentiated user services in social tagging systems, this study classifies users based on their degree of association and interaction with other users in social tagging systems, examines the distribution characteristics of quantitative indicators of user tagging behavior from multiple perspectives, and explores differences in social tagging behaviors among different user types.

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2 Data and Quantitative Indicator Design

To investigate differences in user social tagging behavior, this study collected user tagging information from Douban to classify users from different perspectives based on their interaction information, calculated quantitative indicators of user tagging behavior, and thereby explored differences in tagging behaviors among different user types.

2.1 Data Collection

Douban represents a typical social tagging system in China. Douban users can add social tags to resources such as books, movies, and music, while also using social tags to find interesting resources, achieving both personal resource organization and information retrieval through user-generated tags. Therefore, this study selected Douban Book tagging data as the research sample, which well represents the characteristics and attributes of social tagging systems.

All experimental data were collected from Douban Book. Starting from a selected user, we collected all books they had tagged, then obtained all users who tagged those books, and iteratively expanded the dataset. By December 6, 2017, after cleaning, we obtained 15,597 user tagging records. The dataset includes user ID, registration date, number of followings, number of followers, and all tags used since registration.

2.2 User Interaction Feature Indicator Design and Analysis

Different social tagging systems have different tagging rules and user permissions. This study focuses on broad social tagging systems where users can freely assign tags. In such systems, any user can add any number of uncontrolled natural language tags to any resource. Users can choose whether to view tags added by other users for a resource and can select other users' tags as their own, as seen in Delicious, Flickr, and Douban. Thus, users achieve information exchange through tags and resources, forming a degree of online social interaction [35]. In social media like Zhihu and Weibo, social interaction is realized through various functions such as posting, commenting, forwarding, collecting, liking, following, and sharing [36-37]. However, in social tagging systems, such associations and interactions are difficult to capture and record. The tagging process can be

simplified into two steps: users discover a resource through browsing or word-of-mouth, then store it in an appropriate collection and annotate it with relevant topic tags. User interaction may already play a role during resource discovery—users might find interesting resources and their tags through others' annotations or sharing. During tagging, users can reference others' tags. Therefore, user interaction may influence tagging behavior throughout the entire process but cannot be systematically recorded, which explains why most existing research uses experimental methods to study interaction effects, though experiments struggle to capture authentic tagging motivations and behaviors.

User-customized tags reflect user behavior and preferences to some extent, enabling users to easily find acquaintances, collaborators, and eventually form communities or discover interesting resources. Douban provides a "following" function allowing users to discover and follow interesting others during tagging, while also being followed by those interested in them. Following users makes it easier to access resources and tags from followed users, reflecting user interaction to some degree. This mutual following relationship is also affected by registration time, as tagging is a continuous and lengthy process requiring time to find like-minded "friends" and be discovered by others. Therefore, system usage duration also reflects the depth of user interaction. Based on this, this study uses three indicators—number of users one follows, number of followers, and usage duration—to characterize user association and interaction features.

Figure 1 [Figure 1: see original paper] shows the statistical distributions of user followings, followers, and usage duration, with logarithmic scales for the x and y axes of followings and followers. The distributions of followings and followers both follow power-law distributions, where few users have many followings/followers while most users have few. Usage duration distribution approximately follows a normal distribution. To more clearly compare how these three interaction features affect tagging behavior, we divided users into high-interaction groups (top 25%) and low-interaction groups (bottom 25%) based on followings and followers, and used the mode of 8 years as the cutoff for usage duration.

2.3 User Tagging Behavior Quantitative Indicator Design

Existing research on user tagging behavior uses tag statistical characteristics, primarily from structural and semantic perspectives, including tag frequency, tag reuse rate, and tag quantity. Based on previous research and Douban user characteristics, this study selects indicators from multiple angles: tag quantity to describe behavior volume, average tag length and special-language tag ratio to describe tag structure, tag reuse rate to describe tag semantics (which also reflects tagging motivation [38]), and user activity to describe tagging intensity. Specific indicators include:

1. **Tag Quantity**: The total number of tags a user has used from registration to data collection, reflecting tagging enthusiasm.

2. **Average Tag Length**: Average character count per tag (1 Chinese character = 1 character; 1 English letter = 1 character), reflecting preferences for tag word length.
3. **Special-Language Tag Ratio**: The proportion of tags containing non-Chinese characters, reflecting preference for personalized tags that often express personal understanding or emotions rather than objective resource description.
4. **Tag Reuse Rate**: The ratio of total tag usage frequency to distinct tag count (value ≥ 1), reflecting tag semantics and tagging motivation. Classification-motivated users tend to use fixed tag sets with high reuse rates, while description-motivated users show lower reuse rates [11].
5. **User Activity**: Annual average number of tags annotated, describing tagging intensity while accounting for usage duration effects.

Table 1 details these quantitative indicators.

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3 Results Analysis

3.1 Analysis of User Tagging Behavior Quantitative Indicators

Social tagging systems are complex systems with mass participation, where power-law distributions more authentically reflect system complexity. Power-law distributions are typically divided into head (few high-frequency elements) and tail (many low-frequency elements), known as the "long tail" [39]. This study conducted statistical analysis on the five quantitative indicators.

Figure 2 [Figure 2: see original paper] shows the distributions of tag quantity, tag reuse rate, and user activity in log-log coordinates. All three follow long-tail distributions, indicating that like Delicious and Flickr, a small portion of Douban users generate numerous tags while most users use few tags; most users have low tag reuse rates with only a few repeatedly using fixed tags, suggesting most Douban users are motivated by resource description rather than organization; and most users show low activity while few demonstrate high activity.

Figure 3 [Figure 3: see original paper] displays the distribution of average tag length, showing that users employing average tag lengths of 1 are rare, while those using lengths of 2, 3, or 4 characters constitute approximately 94% of all users, with 61% using length 3. This reflects Chinese language habits where single-character words are rare and most terms consist of 2-4 characters, demonstrating that tagging behavior follows the principle of least effort—users prefer using minimal characters.

The special-language tag ratio distribution (Figure 4 [Figure 4: see original paper]) shows a long-tail characteristic where few users employ many non-Chinese tags. Most users' ratios fall between 0 and 0.1, indicating that while most Douban users use some personalized tags, they constitute a small proportion, with users preferring more popular Chinese tags. However, a few users have a

ratio of 1, using entirely non-Chinese personalized tags, which contributes to lower social tag quality [40].

3.2 Relationship Between User Interaction Features and Tagging Behavior

To verify whether interaction features create differences in tagging behavior, we conducted independent samples tests on categorized variables (high/low followings, followers, usage duration). Due to non-homogeneous variance, we used Mann-Whitney U tests in SPSS 26.

Table 2 shows significant differences (Sig. < 0.05) between high and low interaction groups across all five tagging behavior dimensions. High-interaction groups consistently outperformed low-interaction groups in tag quantity, average tag length, tag reuse rate, special-language tag ratio, and activity (both means and medians). Longer-usage groups also significantly outperformed shorter-usage groups across all dimensions.

These results demonstrate that users with different interaction characteristics show significant differences across all five quantitative indicators, indicating that user interaction influences tagging behavior.

3.3 Multiple Regression Analysis of User Tagging Behavior

To further examine the strength of influence of different interaction features, we conducted multiple regression analysis using the complete dataset of 15,597 users.

3.3.1 Multiple Regression Analysis of Tag Quantity With tag quantity (TN) as the dependent variable and followings (CN), followers (CDN), and usage duration (UY) as independent variables, stepwise regression showed all three variables were included. The model showed no multicollinearity (tolerance $>$ 0.94, VIF < 1.06) and was significant: $F(3, 15593) = 441.824$, $p < 0.001$. The regression equation is:

$$\mathbf{TN = 0.178CN + 0.171CDN + 0.045UY} \text{ (Equation 1)}$$

3.3.2 Multiple Regression Analysis of Average Tag Length With average tag length (TL) as the dependent variable, all three independent variables were included. The model was significant: $F(3, 15593) = 79.73$, $p < 0.001$. The regression equation is:

$$\mathbf{TL = 0.044CN + 0.017CDN + 0.103UY} \text{ (Equation 2)}$$

3.3.3 Multiple Regression Analysis of Tag Reuse Rate With tag reuse rate (TR) as the dependent variable, all three independent variables were included. The model was significant: $F(3, 15593) = 71.97$, $p < 0.001$. The regression equation is:

TR = 0.023CN + 0.027CDN + 0.104UY (Equation 3)

3.3.4 Multiple Regression Analysis of Special-Language Tag Ratio With special-language tag ratio (TC) as the dependent variable, followers (CDN) was excluded while followings (CN) and usage duration (UY) were included. The model showed no multicollinearity (tolerance = 0.96, VIF = 1.041) and was significant: $F(2, 15594) = 272.137$, $p < 0.001$. The regression equation is:

TC = 0.039CN + 0.172UY (Equation 4)

3.3.5 Multiple Regression Analysis of User Tagging Activity With tagging activity (TA) as the dependent variable, all three independent variables were included. The model was significant: $F(3, 15593) = 223.63$, $p < 0.001$. The regression equation is:

TA = 0.185CN + 0.040CDN + 0.032UY (Equation 5)

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4 Discussion of Research Results

4.1 Individual Differences in User Tagging Behavior

The results show that followings, followers, and usage duration all contribute to differences in tagging behavior. High-interaction groups outperform low-interaction groups across all five dimensions, and long-duration users outperform short-duration users. This likely occurs because social tagging systems are free, open environments with extensive content and functions, requiring users to undergo prolonged contact, trial, and learning to effectively classify, organize, and retrieve information. Users with more interactions can complete this process more easily and quickly. Higher tag reuse rates indicate motivations beyond description, evolving toward using tags for personal resource classification. Greater average tag length and special-language tag ratio suggest users have mastered the tagging process and begun creating personalized tags. Proficiency in tagging functions increases user satisfaction and interest, promoting higher activity and more tags.

However, this also suggests that social tagging system interface design and navigation functions need improvement. Better prompts and navigation would reduce trial-and-learning time, enabling low-interaction users to achieve tagging behaviors similar to high-interaction users.

4.2 Influence of User Interaction Features on Tagging Behavior

Multiple regression analysis reveals that followings, followers, and usage duration all positively influence tag quantity, average tag length, tag reuse rate, and activity, with relatively small coefficients. Usage duration has the smallest effect on tag quantity, indicating that earlier registration does not necessarily mean

more tags, as some users may discontinue tagging after initial dissatisfaction. Usage duration has the greatest relative impact on tag reuse rate, suggesting that increased system understanding over time leads users to attempt resource classification and organization. Followings have the highest impact coefficient on tagging activity (0.185), as following more users increases the probability of discovering interesting resources. Special-language tag ratio is only affected by followings and usage duration (coefficients 0.039 and 0.172), likely because initial tagging is influenced by others and system recommendations, while experienced users begin expressing personal emotions and characteristics through tags.

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5 Conclusion and Outlook

To comprehensively reveal patterns of user tagging behavior and provide theoretical foundations for personalized services in social tagging systems, this study used Douban as a research platform to classify users by interaction characteristics and examine statistical features of tagging behaviors under different interaction levels. Key findings include:

1. **Statistical Characteristics**: Douban users' tagging behaviors align with findings from typical social tagging systems like Delicious and Flickr, confirming Douban as a suitable research platform. Users prefer 2-4 character tags, consistent with Chinese language features. Most users employ some personalized tags, but in small proportions, indicating a preference for popular tags.
2. **Significant Differences**: Users with different interaction characteristics show significant differences across all tagging behavior dimensions: high-interaction users have more tags; users with more followings and followers use more tags; longer-usage users have greater average tag length and reuse rates, though follow relationships minimally affect these; usage duration greatly affects special-language tag ratio, but follower count does not; users following more others are more active.

These conclusions have theoretical and practical value. They quantitatively verify the impact of user interaction on tagging behavior using large-scale real data, addressing limitations of experimental methods. For system optimization, improving "following" function navigation and interfaces, enhancing user "friend" relationships, and increasing interactions between new and veteran users can boost activity and tagging willingness, regulate behavior, and improve tag quality.

Limitations and Future Work: First, this study only collected partial data from Douban Book; future research should expand data sources and scale. Second, while we added the special-language tag ratio indicator, our dimensions do not include specific tag semantics, which could be explored further. Third,

we used only indirect static indicators (followings, followers, usage duration) to represent interaction; dynamic evolution and direct interaction data could provide deeper insights into how interactions affect tagging behavior.

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Author Contributions:

Zhuang Qian: Conceptualized research questions and framework, revised manuscript;
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Research on the Influence of User Interaction on the Difference of Social Tagging Behaviors——A Case Study of Douban.com

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Abstract:
[Purpose/significance] From the perspective of users interacting with other users in social tagging systems, this study explores differences in tagging behaviors among users with different interaction characteristics to improve tag quality and optimize information services. [Method/process] Using Douban Book as a sample, we study the distribution characteristics of tagging behavior from five perspectives: tag quantity, tag structure, tag semantics, tagging motivation, and user activity. We use the number of users one follows, the number of followers, and usage duration to represent users'degree of association and interaction, analyze behavioral differences through difference analysis, and investigate influence degrees through multiple regression. [Result/conclusion] Results show significant differences: users with stronger interactions have more tags; users who follow more and have more followers use more tags; longer-usage users have greater average tag length and reuse rates; usage duration greatly affects special-language tag ratio but follower count does not; users following more others are more active. Social tagging systems should strengthen user interactions to regulate tagging behavior and improve tag quality.

Keywords: user; interaction; tagging behavior; difference

Note: Figure translations are in progress. See original paper for figures.

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