Construction of Behavioral Spectrum and Behavioral Hierarchy Model for User Engagement on Social Media Platforms: Postprint

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Abstract

[Purpose/Significance] By systematically reviewing extant research on user engagement behaviors in social media platforms and integrating information generation theory with information processing theory, this study establishes a behavioral ethogram of user engagement on social media platforms, thereby constructing a hierarchical model of user engagement behavior. This model aims to identify one or multiple engagement behaviors that users may exhibit when confronted with different event types, laying a theoretical foundation for user profiling based on engagement behavior, identifying user activity and participation levels toward specific topic categories, and predicting user engagement behaviors.

[Method/Process] Grounded in the structural and functional characteristics of mainstream social media platforms and guided by the methodology employed in developing primate ethograms, this study applies observational experimental methods. Through a dual-observer approach involving participants with diverse disciplinary backgrounds, engagement behaviors exhibited by users during social media platform usage were discovered, culminating in the construction of a behavioral ethogram of social media user engagement comprising 8 categories and 21 specific engagement behaviors.

[Results/Conclusions] Centered on the behavioral ethogram of social media user engagement and employing cognitive effort as the unit of measurement, a three-factor two-level hierarchical model is constructed, structured around active engagement behavior versus passive engagement behavior, positive engagement behavior versus negative engagement behavior, and deep engagement behavior versus shallow engagement behavior.

Full Text

Construction of a Behavior Spectrum and Hierarchical Model of User Participation on Social Media Platforms

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Abstract

[**Purpose/Significance**] By reviewing current research on user participation behaviors on social media platforms and integrating information generation theory with information processing theory, this study establishes a behavior spectrum of user participation on social media platforms and constructs a hierarchical model of such behaviors. The model identifies one or multiple participation behaviors that users may exhibit when facing different event types, providing a theoretical foundation for building user profiles based on participation behaviors, recognizing user activity and engagement levels regarding specific topics, and predicting user participation behaviors.

[**Method/Process**] Based on the structural functions of mainstream social media platforms and drawing from the formulation process of primate behavior spectra, this study employs observational experiments. Dual observers with different disciplinary backgrounds were invited to identify user participation behaviors during social media usage, resulting in a behavior spectrum comprising 8 categories and 21 specific participation behaviors.

[**Result/Conclusion**] Centered on the behavior spectrum of user participation on social media platforms and using cognitive effort as the measurement unit, a three-factor, two-level hierarchical structure is constructed: active participation vs. passive participation, positive participation vs. negative participation, and deep participation vs. superficial participation.

Keywords: social media platform; information processing theory; behavior spectrum of user participation; cognitive effort
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2. Behavior Spectrum of User Participation on Social Media Platforms

2.1 Concept of Behavior Spectrum

The concept of behavior spectrum originates from biology, where it serves as a checklist for describing and defining animal behaviors that can be reliably identified and recorded, with provisions for future additions, modifications, and deletions as needed. In 1936, biologist K. Mellanby first applied this concept to

study the European painted long-snout weevil, after which it was widely adopted in animal behavior research. In human ethology, founded by I. Eibl-Eibesfeldt, humans are considered advanced animals, making ethological methods applicable to human behavior recording. Recently, scholars have introduced this concept to other disciplines. For instance, X. Zang et al. defined and proposed the concept of traffic behavior spectrum for traffic flow research, using it as a data system foundation that comprehensively records regional traffic characteristics, internal patterns, and common features of traffic participants. J. Kang et al. expanded behavior spectrum theory to develop behavioral indicators for studying children's street-crossing behavior.

In real society, humans possess social attributes manifested through identifiable and recordable relationships with surroundings and people. The behavior spectrum of user participation on social media platforms represents an aggregation of user activity behaviors, reflecting a list of actions with similar patterns while separating emotional cognition from behavior to highlight individual expression and potential transformation under group influence. User participation behaviors on social media platforms exhibit high similarity due to the consistent Web 2.0 core philosophy across platforms—targeting end users and emphasizing user-generated content, platform usability, participatory culture, and interoperability. The interactive social media environment places users within a matrix of power, technology, and culture, where each domain influences information reception and dissemination. Audiences exhibit differential receptivity, active receptivity, and blind receptivity during information consumption.

2.2 Connotation and Extension of Social Media User Participation Behavior Spectrum

The connotation of the behavior spectrum refers to users fully exercising subjective initiative, representing the manifestation of their emotions and cognition on single or multiple platforms. While consciousness and complex information processing in the human brain are difficult to depict, platform functional constraints produce fixed, identifiable, and reliably recordable behavior lists. This study defines the behavior spectrum of social media user participation as: the identifiable and recordable behaviors produced by users as the minimal unit within a single platform or across multiple platforms, generating similar effects in content creation or dissemination. The spectrum may include interactions (e.g., commenting and replying), voicing (e.g., posting information), or unconscious actions (e.g., mindless scrolling and liking). Despite its specificity and limitations in temporal, spatial, and categorical scope, the behavior spectrum remains flexible for use in similar environments and future repetition.

The extension concerns users' views on real-world social issues or events that attract public attention, potentially generating participation behaviors. Social media platforms provide communication spaces where users' perspectives transcend temporal and geographical constraints, forming online public opinion. In reality, the behavior spectrum represents users' operations that can influence

real-world events through platform-based viewpoints. Although users may have no direct contact or involvement with events, their interactions through platform functions affect public opinion formation and evolution, representing the real-world extension of the behavior spectrum.

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3. Construction of Social Media User Participation Behavior Spectrum

3.1 Definition of User Participation

The term "user participation" has long described relationships between users and organizations. In 1988, N. Sharma et al. defined it from a value-creation perspective, viewing participation as behaviors that generate value for communities or groups. With internet technology development, A. L. M. Cavaye (1995) conceptualized internet-based user participation as "a set of operations and activities performed by users during system development." In 2011, Zhao Ling proposed a concept based on online platforms, dividing virtual community participation into emotional and practical dimensions.

This study defines social media user participation as a "behavioral process" rather than a cognitive or emotional state, separating cognitive and emotional engagement from behavioral processes to more clearly identify participation behaviors and their impacts. Design psychologist D. Norman's (1988) visibility principles for cognitive web design emphasize that users should see available operations, receive immediate feedback, and understand consequences—principles that align with how users execute predefined interface functions.

3.2 Discovery of User Participation Behaviors Based on Platform Functional Structure

Modern social media users typically employ multiple platforms simultaneously. While previous research often examined one or two functional interactions on single platforms, this study takes a holistic approach. As shown in Figure 1 [Figure 1: see original paper], the study uses Weibo's main page post-login as the core, categorizing displayed functional modules as primary page functions and their generated options as secondary functions. For instance, clicking the personal profile allows users to edit basic information, access photo albums, view follows, and check likes and collections. Similar mappings were created for WeChat and Douyin.

Comparative analysis reveals that Weibo, WeChat, and Douyin share similar functional module designs, including text/image/video posting and interactive features like commenting, forwarding, and @-mentioning. However, platforms prioritize these functions differently based on their positioning: Weibo emphasizes open, real-time information sharing; WeChat focuses on relationship-based

instant messaging; and Douyin centers on music-inspired short video creation and sharing.

User-Generated Content (UGC) serves as a crucial component for demonstrating platform functions. As shown in Figure 2 [Figure 2: see original paper], the study examines UGC production behaviors across the three platforms to identify potential user participation behaviors, providing a practical foundation for the behavior spectrum.

3.3 Construction of the Behavior Spectrum

The behavior spectrum was constructed through observational experiments to validate and align with actual platform usage. Observers with relevant research experience and platform familiarity were invited to understand usage patterns and establish research parameters.

3.3.1 Preparation Phase Two primary observers (with backgrounds in social sciences and psychology) were trained to understand unwritten platform usage rules and establish research parameters. UGC behaviors were coded by intensity (e.g., posting behavior = F) for experimental recording. Observers were instructed to objectively record complete behavioral processes, noting that target users' usage patterns might differ from their own. Key parameters included: registration methods, multiple accounts per user, and platform preferences.

To discover complex behaviors beyond functional structures, observers conducted multiple weekly sessions, recording typical social media participation behaviors until data saturation was reached (no new behaviors observed). These recordings formed the basis for the behavior spectrum.

3.3.2 Design and Application of Behavior Spectrum Based on observer usage and observations, a non-protocol-driven list of social media participation behaviors was organized into 8 categories (Table 1), with each category containing 2-4 specific actions (totaling 21 specific behaviors, Table 2). Categories were constructed by grouping similar operations.

Table 1. Categories of Social Media User Participation Behaviors

Behavior Category	Code/Intensity
Unconscious browsing of platform-recommended content	B
Leaving traces of interest (liking) with complex underlying motivations	L
Adding content to personal collection folder	C
@-mentioning users to draw attention	A
Providing feedback based on personal cognition	F
Sending content to specific users or groups	S
Sharing content to personal profile page	P
Creating original content or reposting with personal perspective	O

Table 2. Complete Social Media User Participation Behavior Spectrum

Specific Behavior	Description
Reposting existing content to personal account	O1
Posting original non-private content	O2
Immediate commenting after being touched by content	F1
Commenting after fully digesting content	F2
Commenting on a comment after brief browsing	F3
Commenting on a comment after full digestion	F4
Liking content (positive/negative/neutral)	L1
Liking a comment	L2
Sharing content within same platform	S1
Sharing content across platforms	S2
Forwarding content to a friend within platform	S3
Forwarding to multiple friends or groups within platform	S4
Forwarding to external platform users	S5
Forwarding to multiple external users/groups	S6
@-mentioning a friend	A1
@-mentioning multiple users	A2
Unconscious browsing	B1
Partial reading after losing interest	B2
Complete reading	B3
Collecting content for future reference	C1
Collecting a comment	C2

Usage instructions: Intensity levels range from 1 (lowest) to 4 (highest). Observers record behaviors in the format: "Actor Code + Behavior Code + Intensity" (e.g., B4Ss2). If multiple behaviors occur simultaneously, the highest intensity behavior is recorded. Independent interactions of different intensities are recorded separately.

3.3.3 Role and Atmosphere Codes The behavior spectrum uses 21 behaviors and 4 common participant social types (Table 3), with letter codes: uppercase B+number for persons (e.g., B1 = Observer 1), uppercase for behaviors (e.g., S), lowercase for intensity (e.g., s2). Accompanying persons are distinguished (e.g., B6, B7). Same roles share identical codes.

Table 3. Participant Role Codes (Partial)

Code	Gender	Age	Identity/Occupation
B1	Male	15-29	Undergraduate
B2	Female	15-29	PhD student
B3	Male	30-44	Automotive engineer

Code	Gender	Age	Identity/Occupation
B4	Female	15-29	Freelancer (streamer)

Every 10 minutes, the general atmosphere is recorded as positive (o), neutral (u), or negative (g) (Table 4).

Table 4. Indoor Atmosphere Intensity Codes

Atmosphere	Code	Description
Positive	o	Interesting, exciting, high-spirited
Neutral	u	Normal, quiet, appropriate, mild
Negative	g	Tense, argumentative

3.3.4 Inter-Observer Reliability Assessment Inter-observer reliability evaluates the consistency of observation data susceptible to subjective interpretation. Cohen's Kappa coefficient was used, achieving 83% agreement after training. Two observers collected 537 minutes of data, recording 207 social media usage behaviors and interactions.

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4. Hierarchical Model of Social Media User Participation Behaviors

4.1 Three Dimensions of Social Media User Participation

4.1.1 Active vs. Passive Participation Most social media platforms allow predefined activities that can be divided into active and passive use. Active participation facilitates direct communication with others, generating information through status updates, link sharing, or private messages. Passive participation involves browsing or viewing without direct communication, such as scrolling through recommended content or viewing profiles without interaction.

4.1.2 Positive vs. Negative Participation In human-computer interaction models, users are often categorized as "active process operators" and "passive process operators." V. Soroka et al. identified lurkers as an intermediate state between positive and negative participants. Positive participants spend more time on platforms, willingly share life experiences, and frequently create text, audio, or video content while interacting with others. Negative participants (or "lurkers") tend to observe and maintain low interaction levels.

4.1.3 Deep vs. Superficial Participation C. G. Escobar-Viera et al.'s research on social media use and mental health measured low-level and high-level

usage indicators. Deep participation involves creating high-value, rich-form original content with active information interaction, such as browsing and replying to comments. Superficial participation involves observation and low interactivity, such as browsing content, reading comments, and liking without interactive information exchange.

4.2 Discreteness of Social Media User Participation Behaviors

To understand user behaviors and their impact on information dissemination, this study proposes a behavioral typology using the SMEB (Social Media Engagement Behaviour) framework, comprising seven types: co-creation, positive contribution, consumption, dormancy, disengagement, negative contribution, and destruction. Similar to R. Dolan et al.'s (2016) analysis of online word-of-mouth, these behaviors represent discrete levels of participation (Figure 4 [Figure 4: see original paper]).

1. **Co-creation** represents the highest positive SMEB level, where users initiate positive contributions and interact as co-creators of information content.
2. **Positive contribution** reflects medium-level positive SMEB, where users contribute positively to existing content through likes, forwards, and shares, becoming secondary information disseminators.
3. **Consumption** reflects lower-level positive SMEB, representing passive participation like reading content and comments without contributing to dissemination.
4. **Dormancy** represents a temporary state of zero contribution, where users consume information without active or passive participation.
5. **Disengagement** represents low-level negative SMEB, where users refuse to browse content, hide similar information, or unsubscribe—terminating interaction.
6. **Negative contribution** represents medium-level negative SMEB, where users make negative evaluations to influence others' perceptions, potentially causing public opinion crises when accumulated.
7. **Destruction** represents high-level negative SMEB, where users actively create negative content and engage in destructive discussions to vent negative emotions.

4.3 Hierarchical Model of Social Media User Participation Behaviors

Information processing theory posits humans as active information processors who make selective responses. This cognitive activity involves memory retrieval and new information integration, requiring varying cognitive effort levels. Based on this, the 21 behaviors are divided into 8 hierarchical levels (Figure 5 [Figure 5: see original paper]):

1. **Viewing/Browsing**: The lowest level, involving passive consumption of platform-pushed content without cognitive generation.

2. **Liking**: Requires minimal cognitive effort, often serving as emotional expression rather than reflecting true intent.
3. **Collecting**: Higher than liking, as it involves psychological identification and future utility.
4. **@-mentioning**: Similar to collecting but with explicit intent to direct specific users' attention, requiring more cognitive effort.
5. **Commenting**: Requires cognitive processing of original content and other comments, enabling interaction among users and with content.
6. **Forwarding**: Involves sending content to other users, distinct from sharing.
7. **Sharing**: Higher than forwarding, as it increases content exposure and represents self-presentation, requiring users to evaluate personal values.
8. **Posting/Creating**: The highest level, involving original content creation with rich forms and high value.

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Author Contributions

Sun Yue: Literature collection, data collection, manuscript writing and revision.
Huang Wei: Research proposition and framework design, manuscript revision.

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