A Sense-Making Perspective on the Mobile Internet Information Encountering Process: Postprint

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Abstract

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Full Text

Preamble

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Research on the Process of Information Encountering in Mobile Internet from the Perspective of Sense-Making

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Abstract

[**Purpose/Significance**] This study aims to deepen and improve theoretical research on information encountering, providing a theoretical foundation and insights for users to enhance their information encountering capabilities and for service providers to optimize service content and improve service models. [**Method/Process**] Through semi-structured interviews, 30 critical incidents of mobile internet information encountering were collected. Based on grounded theory, Nvivo11 was used for data coding and analysis. After conceptualization and categorization of relationships among free nodes, 13 tree nodes and 7 core tree nodes related to the information encountering process were ultimately identified. [**Result/Conclusion**] The mobile internet information encountering process can be divided into three stages: pre-encountering, during encountering, and post-encountering, comprising seven steps: "attention," "initiation," "tracking," "capture," "utilization," "return," and "termination." These three stages respectively undergo cognitive division, covering division, and spanning division to complete the sense-making of encountered information.

Keywords: information encountering; process model; mobile internet; sense-making; critical incident technique; Nvivo11
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According to scholar T.D. Wilson's definition of information behavior [1], human information behavior includes not only purposeful active information seeking but also passive information acquisition, which has become an important way for people to obtain information in the network environment. A crucial form of passive information acquisition is information encountering, which refers to accidentally obtaining interesting or useful information without purpose or low expectation during network information activities [2]. In the mobile internet environment, the ubiquitous information environment and user behavior characteristics such as increased network dependency, frequent internet usage, and fragmented behavior have made information encountering an important mode of information seeking and discovery. Analyzing the behavioral characteristics of each stage and studying the occurrence process can not only deepen and improve information encountering research but also provide theoretical foundations and methodological guidance for enhancing users' information encountering capabilities. However, literature review shows that existing research on information encountering processes mostly explores task contexts such as information browsing, searching, and interaction, with no studies specifically addressing the mobile internet environment—only research on social network information encountering intersects with the mobile environment. Therefore, this study employs the critical incident technique to investigate this area, aiming to clarify the specific process of mobile internet user information encountering and further interpret this process based on sense-making theory.

1. Review of Information Encountering Process Models

Existing influential information encountering process models can be categorized into conceptual feature-based frameworks and structured flow-based models. Models by M.P.E. Cunha [3], L. McCay-Peet et al. [4], and V.L. Rubin et al. [5] focus on conceptual features. Cunha proposed a framework model from an organizational management perspective, comprising four components: "precipitating conditions," "search for problem A," "bisociation," and "unexpected solution for problem B." McCay-Peet et al. analyzed interview data from 10 historians regarding "information seeking processes" and proposed a knowledge work information encountering process model based on Cunha's model. Rubin et al. studied information encountering in daily life contexts, elaborated on all elements involved, and constructed an information encountering element model. Scholars such as S. Erdelez [6], Kuramura [7], J. Lawley [8], S. Makri et al. [9], and T. Jiang et al. [10] explored information encountering process models from a structured flow perspective. Erdelez proposed a five-function-element model for information encountering in search contexts: attention, stop, examination, capture, and return. Kuramura revised this model to emphasize the utilization of encountered information. Lawley proposed a six-stage model based on individual perception. Makri et al. developed an empirically-based model highlighting the core element of establishing "new conscious connections." Jiang et al. studied the process and influencing factors through interviews with 16 subjects, collecting 27 critical incidents, and constructed a comprehensive online information encountering model based on McBirnie's [11] concept of "process-perception duality." Unlike McCay-Peet and Makri's models, Jiang's model emphasizes measurable behavioral characteristics.

This review shows that research has evolved from early conceptual frameworks to structured flow models, with model elements expanding from process evolution and user cognition to external contextual factors, developing toward greater element diversity and multi-contextual applications. With mobile internet popularization, ubiquitous network characteristics and changing user behavior patterns present more complex contexts for information encountering research. This review aims to provide references for further research on information encountering processes in complex contexts.

2. Research Methods and Tools

2.1 Critical Incident Technique

Critical Incident Technique (CIT) is an important qualitative research method. American scholar J.C. Flanagan proposed this method in 1954, describing it as "a set of procedures for collecting direct observations of human behavior and effectively extracting their underlying value to solve practical problems" [12]. An "incident" refers to a complete human activity occurring in a context with clear goals and intentions that can be observed, inferred, and predicted. "Critical" means the incident plays a significant role (positive or negative) regarding activity goals. CIT belongs to the content analysis category, differing from factor or cluster analysis. Its analyzed "data" consists of collected "event descriptions" (stories, experiences, etc.), making it essentially a qualitative method. CIT transforms subjective "event" information into analyzable data through examination of time, place, plot, and context, enabling collaborative analysis of scenarios and individual feelings to effectively uncover emotions and motivations in behavioral activities. Due to its ability to objectively and comprehensively analyze individual perceptions of specific event objectives, obtain information on behavioral effect influencing factors, and conduct in-depth analysis of typical cases according to research needs, CIT has become an effective method for studying user information behavior [13].

2.2 Semi-Structured Interviews

First, the target population was defined: university students (from Xinxiang Medical University and Henan Normal University) who use mobile phones (via WiFi or mobile networks) for browsing, searching, and communication (using web pages, apps, search engines, etc.). Respondents were explained the concept of "information encountering," then asked the core question: "Have you experienced information encountering? Please describe in detail a typical, memorable information encountering incident (from noticing certain information to accidentally discovering interesting or useful information, and whether and how you utilized it)." Supplementary questions were flexibly used to address missing or unclear elements. Thirty-four interviews were conducted via face-to-face or phone calls, each lasting 30-40 minutes. Four records that did not meet information encountering characteristics were excluded, yielding 30 valid interview records numbered 1-30.

2.3 Data Analysis Tool: Nvivo11

Using qualitative analysis software for standardized coding is crucial for ensuring research reliability. This study employed Nvivo11, a computer-assisted qualitative data analysis software developed by QSR International. In qualitative research, data organization and analysis involves coding—naming and categorizing research phenomena through examination and analysis. Nvivo's strength lies in its powerful coding functions, where codes are called "nodes" that aggregate relevant coding, data, and sources. Using Nvivo11 for critical incident data coding analysis is essentially a grounded theory research process comprising three aspects [14]: 1) Project establishment and data import—creating new projects and importing interview documents; 2) Coding—coding content and organizing relationships to form free nodes, tree nodes, and core nodes; and 3) Model establishment and theory formation—revealing associations between concepts through analysis and visualization functions. Nvivo supports two coding approaches: pre-defined and inductive. This study used inductive coding, repeatedly comparing and examining coded content to add, delete, or merge free codes into a hierarchical tree structure.

3. Data Collection and Coding Analysis

3.1 Data Collection

Interview subjects were university students (a primary group using mobile phones and networks), covering five majors: management, information science, medicine, computer and communication technology, and psychology. Thirty-four people were interviewed, and after excluding four invalid records, 30 valid critical incident records were obtained.

3.2 Data Coding and Analysis

3.2.1 Critical Incident Coding to Generate Free Nodes Based on respondents' detailed descriptions, "critical behavioral" elements in the information encountering process were coded to form free nodes. Coding objects were extracted original information points—sentences or words describing behavioral characteristics, task contexts, or process factors. For example, coding critical incident 1 yielded nine process-related nodes [Figure 1: see original paper]. Across all 30 incidents, 259 free nodes were established.

3.2.2 Classification of Free Nodes Classification involves repeatedly interpreting critical incidents and free node content to identify core issues (attributes) and conduct connotation and relational analysis to clarify category boundaries and themes. This process is key to effective data analysis and theme establishment, progressively determining tree nodes and core tree nodes from free nodes. To minimize subjective bias, this study adopted Wang Ping et al.'s [15] classification method: 1) Two researchers (A, B) divided the first half of free nodes into detailed, indivisible categories; 2) Two other researchers (C, D) categorized the same nodes into A and B's categories; 3) Researcher E classified and categorized the first half; 4) The second half underwent the same process. If new categories emerged, the ongoing task was re-categorized into the new system. Through these steps, 259 free nodes were divided into 13 categories: triggering, perception, connection, matching, examination, evaluation, acquisition, re-evaluation, preservation, sharing, use, return, and termination. The process is shown in [Figure 2: see original paper].

3.2.3 Reliability and Validity Testing **(1) Inter-coder Reliability.** Holsti's formula measured inter-judge reliability [15]:

Formula (1): $R = 2M/(N1+N2)$

Where R is the reliability index, M is the number of categories where coders agreed, and N1, N2 are the numbers of categories from the first and second coders. Gremler [16] considers $R \geq 0.8$ as acceptable reliability; when $R < 0.8$, coders can negotiate reclassification. Each step's inter-coder reliability (R1-R6) is shown in [Figure 2: see original paper].

(2) Composite Reliability. This tests consistency and stability among multiple coders in critical incident studies. Using Perreault and Leigh's formula [17], Ir $\geq$ 0.8 indicates good composite reliability:

Formula (2): Ir = (F0/N - 1/K) × √[K/(K-1)], where F0/N $\geq$ 1/K

Where Ir is the reliability index, F0 is the number of events with agreement, N is total sample size, and K is number of categories.

Five coders established 259 free nodes (N=259) with 212 agreements (F0=212) across 13 categories (K=13). Thus, Ir = 0.90, indicating good composite reliability.

(3) Validity Testing. Expert evaluation determined: 1) critical events' relevance to research objectives, and 2) whether coding results covered main research aspects. Content Validity Index (CVI) [18-19] was used—the most widely accepted validity indicator. Six experts (associate professors or PhDs in information science from Xinxiang Medical University and Henan Normal University) rated each category's relevance on a 4-point scale (4=very relevant, 3=relevant, 2=irrelevant, 1=very irrelevant). Item-level CVI (I-CVI) equals the proportion of experts rating 3 or 4. Lynn [20] considers I-CVI $\geq$ 0.78 acceptable with $ $6 experts. Random consistency was corrected using Polit et al.'s method [21]. The ratings, CVI calculations, random consistency corrections, and Kappa values are shown in .

All 13 categories achieved I-CVI $\geq$ 0.78, confirming acceptable content validity.

3.2.4 Establishment of Tree Nodes and Core Tree Nodes The 259 free nodes were conceptually and categorically analyzed by five researchers to form 13 categories as tree nodes. Based on temporal and process relationships at the conceptual level, these were further synthesized into seven core tree nodes: "attention," "initiation," "tracking," "capture," "utilization," "return," and "termination," as shown in .

The Nvivo11 operation process and results are illustrated in [Figure 3: see original paper], [Figure 4: see original paper], and [Figure 5: see original paper].

4. Information Encountering Process Model Construction

The seven core tree nodes were organized into three stages: pre-encountering (attention, initiation), during encountering (tracking, capture), and post-encountering (utilization, return, termination), forming the information encountering process model [Figure 6: see original paper].

4.1 Pre-Encountering Stage

This stage occurs within specific task and spatiotemporal contexts, based on individual cognitive states, where users "notice" and "perceive" encountered information. Guided by "interest relevance" or "background problems," connections and matches are established between information and individual interests or needs, with vague perception of its value and awareness of an "information need." It comprises "attention" and "initiation."

4.1.1 Attention. "Attention" is the first and core step. Noticing information is fundamental to encountering. Interviews revealed that in mobile internet contexts, attention shift from initial tasks is often triggered by external stimuli like information pushes or links. Eighteen incidents mentioned triggering (incidents 1-7, 9-11, 15-17, 22, 24-25, 29-30), with fifteen related to system pushes or links. For example: "While reading news about Ke Jie vs. AlphaGo, a pop-up titled 'Eight photography ideas to open your mind' appeared" (incident 2); "When searching deep learning auto-encoding materials, the sidebar pushed many deep learning figures and new models like GAN, SAE" (incident 22). Information interaction chats also triggered attention (incident 6).

"Perception" completes the attention shift based on individual interests, needs, and information factors, where knowledge structure and association ability play crucial roles. For example: "Seeing a news article about doctor-patient relationships with cartoons, one showing patients crowded in an IV room reminded me of my ER experience… suddenly wondering if a device could automatically detect fluid levels and alert nurses?" (incident 14). Information titles and popularity also relate to perception (incidents 5, 7).

4.1.2 Initiation. After noticing information, users conduct preliminary cognition to establish associations between potential needs (interests, problems) and information, vaguely perceiving its value. This involves "connection" and "matching."

"Connection" establishes links between information and individual experience, knowledge structure, or latent needs. Nine incidents (4, 6, 10, 14, 16, 20, 24, 27, 29) showed connection processes, such as: "Opening an article 'We have tickets ready, just waiting for you!' with tourist photos, their poses reminded me of our freshman welcome play rehearsal—some scene positions could reference this" (incident 27).

"Matching" refers to alignment with individual interests or hobbies. Twenty-three incidents (1-3, 6-10, 13, 15, 16, 18, 19, 21-23, 25, 26, 29, 30) involved matching, such as: "Using Youdao APP to look up a word, I was attracted by a link below: 'Words are up to you—songs you can't stop hearing in British/American dramas.' As I like Western music and wanted new songs, I clicked to listen while reading introductions" (incident 29).

Analysis revealed that mobile internet users' information needs cover three levels: cognitive (interest/hobby-related), comprehension, and creative (background problem-related). Most incidents involved matching with interests/hobbies rather than connecting to experience/knowledge structures, likely due to mobile users' fragmented time/behavior and predominant focus on shallow information needs.

4.2 During Encountering Stage

This stage involves examining and evaluating encountered information based on individual interests, problems, and knowledge structures to discover its positive effects, clarify its value, perceive "unexpected gains" (information encountering occurs), and further assess its utility. It comprises "tracking" and "capture."

4.2.1 Tracking. After establishing associations, users browse, follow links, or conduct further searches to understand details and evaluate value. This involves "examination" and "evaluation."

"Examination" refers to browsing, following links, or searching to understand details and strengthen associations. Twenty-nine incidents (1-19, 21-30) included examination, such as: "The teacher asked us to select topics on IoT applications. I suddenly realized my idea fit perfectly, got excited, and immediately searched IoT application papers" (incident 14).

"Evaluation" judges the information's utility based on interests and latent needs. Twenty-two incidents (1-4, 16, 18-19, 21, 23-24, 26, 28-30) involved evaluation, such as: "A link '2017 latest job postings (Ganji.com)' attracted me. As graduation approaches, I paid close attention, opened it, and found it very useful" (incident 4).

4.2.2 Capture. After clarifying value, users perceive having accidentally obtained interesting/valuable information (encountering occurs) and further evaluate utility. This involves "acquisition" and "re-evaluation."

"Acquisition" means the information's role and value become clear, and users perceive unexpected gains. All 30 incidents included acquisition, such as: "Indeed found lots of recruitment information, very relevant to our major—this casual chat was very rewarding" (incident 6).

"Re-evaluation" occurs after use and verification, further judging utility. Seventeen incidents (1-6, 8-12, 15, 18, 23, 24, 26, 28) included re-evaluation, such as: "After installing this APP, I found many great resources, especially psychology videos—very useful for my major" (incident 9).

4.3 Post-Encountering Stage

This stage includes "utilization," "return," and "termination."

4.3.1 Utilization. Post-encountering utilization includes preservation, sharing, and use. Preservation typically uses APP "favorite" functions or screenshots for future reference (incidents 2, 8, 13, 21, 24, 27, 29, 30). Sharing often accompanies preservation and use, such as sending screenshots to class groups (incident 27) or sharing blog posts with interested classmates via WeChat (incident 24).

Use may be immediate or delayed. Urgent needs or strong interest prompt immediate use, such as downloading images as WeChat avatars (incident 26). Non-urgent needs lead to delayed use, such as comparing products later after collection (incident 10). Task, temporal, and network contexts also influence use, as reflected in descriptions like "considering time constraints," "using mobile data," or "urgently searching auto-encoding materials" (incidents 14, 22, 26). Users continuously track and browse information meeting cognitive-level needs, while delaying use of comprehension/creative-level information requiring further verification.

4.3.2 Return. Returning from encountering-related pages to previous task contexts (browsing, searching, interacting). For example, incident 22 mentions returning to search tasks due to time constraints.

4.3.3 Termination. Exiting encountering-related and previous task pages. Most collected incidents occurred during breaks or before sleep—time-pressured contexts for students—leading to frequent termination.

5. Information Encountering Process Based on Sense-Making Theory

B. Dervin's sense-making theory posits that "information sense-making results from the interaction of internal behavior (cognition) and external behavior (process)," emphasizing individual agency in information activities. The model comprises four elements: "situation" (spatiotemporal context, history, experience, cognitive state), "gap" (cognitive discontinuity representing problems/obstacles), "bridge" (means to narrow/eliminate gaps), and "use" (post sense-making utilization). Dervin's metaphor explains that as individuals progress through time-space absorbing knowledge and repeating behaviors, they continuously assign meaning. When encountering cognitive gaps that force stops, they must construct new concepts to build bridges for crossing. As a metatheory in information behavior research, sense-making provides a framework for interpreting information encountering.

5.1 Pre-Encountering Stage: Cognitive Division. This stage ("attention" and "initiation") corresponds to the "gap" element—recognizing information discontinuity. In specific spatiotemporal and task contexts (browsing, searching, interacting), users "notice" information through "triggering" or natural "perception," then establish connections and matches with interests/problems. Initial tasks stop, attention shifts, and users vaguely perceive value, recognizing an "information need" and "cognitive gap." Unlike active seeking where gaps are goal-driven, here gap recognition is triggered by noticing encountered information. The comparison between active seeking and encountering cognitive division is shown in [Figure 8: see original paper].

5.2 During Encountering Stage: Covering Division. This stage ("tracking" and "capture") corresponds to "bridge"—clarifying encountered information's value, perceiving unexpected gains, and capturing information to fill gaps related to interests or background problems. Users fully associate encountered information with cognitive gaps, examining and evaluating to clarify value. Encountered information can expand resources for interests (incidents 13, 23) or provide new solutions for background problems (incidents 20, 21). Both types build bridges over gaps.

5.3 Post-Encountering Stage: Spanning Division. This stage ("utilization," "return," "termination") corresponds to "use"—employing the information bridge to cross gaps. Unlike active seeking with clear use intentions, encountering gaps may involve interests or non-urgent problems, leading to immediate or delayed use. Incidents 26, 27, 28 mention immediate download/use due to strong interest; incidents 2, 10, 15, 22 show delayed use due to non-urgency. Thus, spanning division may be continuous or delayed from previous stages.

This study constructed an information encountering process model based on 30 mobile internet critical incidents, interpreting the process through sense-making theory's three stages: cognitive division, covering division, and spanning division. The findings deepen information encountering theory and provide user guidance and business insights for mobile service optimization. Future research should further explore behavioral evolution dynamics and influencing mechanisms in mobile contexts.

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Author Contributions

Tian Mei: Conceptualization, research design, data acquisition and analysis, writing.
Zhu Xuefang: Topic guidance and research design supervision.
Zhang Junliang: Interview assistance and critical incident collection.

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