Is Serendipity Merely a "Determined" Behavior? An Empirical Study of Users from an Information Ecology Perspective

Authors: Liu Chunmao, Zhou Yue

Date: 2023-05-05T00:00:00+00:00

Abstract

Purpose/Significance: This study demonstrates that user individual characteristics cause differences in information encountering outcomes, identifies the "first-principle element" of users from the perspective of information ecology, and proposes an alternative view that encountering is also a self-determined information behavior of users, thereby providing support for user-oriented information encountering services. Method/Process: Combining qualitative, quantitative methods and experiments, this research analyzes the differences in user information encountering based on individual characteristics and objectively examines the proposed research hypotheses with internal consistency. Results/Conclusion: Based on eight personality traits of users, 30 research hypotheses were validated, identifying that differences across multiple dimensions of users are causal factors influencing their encountering outcomes. The study reached understandings such as that the encountering process is essentially a complex adaptive and self-similar process, and that seemingly passive information encountering behavior and outcomes also contain factors of user active matching.

Full Text

Preamble

Is Information Encountering Only a "Determined" Behavior?
An Empirical Study of Networked Users from the Information Ecology Perspective

Liu Chunmao (School of Management, Tianjin Normal University, Tianjin 300387)
Zhou Yue (Liaoning Academy of Agricultural Sciences, Shenyang 110161)

Abstract:
[Purpose/Significance] This study demonstrates that individual user characteristics cause differences in information encountering (IE) outcomes. From the perspective of information ecology, it identifies users as the "first-principal factor" and proposes an alternative view that IE is also a "self-determined" information behavior, thereby providing support for user-oriented IE services. [Method/Process] Combining qualitative, quantitative, and experimental methods, this research analyzes differences in user IE based on individual characteristics and objectively examines the proposed hypotheses with internal consistency. [Result/Conclusion] Based on eight user personality traits, 30 research hypotheses were validated, revealing that differences across multiple user dimensions are causal factors affecting IE outcomes. The study concludes that the IE process is essentially a complex, self-adaptive, and self-similar process, and that seemingly passive IE behaviors and outcomes also involve active matching by users.

Keywords: information encountering; information behavior; information characteristics; user traits

1 Research Background and Significance

Information encountering is typically regarded as a "passive" process of discovering information, filled with uncertainty and unpredictability. This non-linear information acquisition behavior can bring unexpected surprises to people. Particularly under the context of increasingly strong national innovation-driven strategic demands, increasingly prominent characteristics of complex information systems, and increasingly sophisticated AIGC (AI-Generated Content), research on differences in networked users' information encountering can inform the design of personalized environments that facilitate encountering, thereby enhancing users' innovative efficiency in cognitive association. Clearly, seemingly "determined" encountering outcomes should also contain elements of "self-determination." Research on personalized differences in user information encountering helps excavate and highlight this easily overlooked factor of "determined versus self-determined" information behavior.

2.1 Research on the Concept of Information Encountering

Although derived from "serendipity" [2], the concept of information encountering has evolved through various formulations: "casual information gathering" in 1983 [3], "information encountering" defined in 1995 [4], "incidental information acquisition" in 1998 [5], "serendipitous information retrieval" in 2000 [6], and "intentional acquisition of information" and "opportunistic acquisition of information" in 2004 [Error: Reference source not found]. Until 2019, Erdelez and Makri again proposed "information encountering" as the professional term for

IE, emphasizing its scope, form, subjects, environment, and objects [7]. While different scholars' expressions show certain differences in cognitive perspective and form, they all converge in indicating that IE can occur when users actively browse or search for information, or when they accidentally discover useful or interesting information without purpose or expectation. All IE processes contain three factors: insight, unexpectedness, and valuable outcomes [8].

2.2 Research on Information Encountering Models

"Models tell us what the objective world is like." Research on IE models has long been a focus for scholars both in China and abroad. These studies can be broadly categorized as follows: process and element models of IE, such as Erdelez's six components of IE behavior (noticing, stopping, examining, storing, using, and returning) [9]; Kurata's dual-direction model of search tasks [9]; Tian Mei et al.'s model reflecting three stages of cognitive gap, crossing the gap, and filling the gap [11]; and models by Rubin, Makri, McCay-Peet, Lawley & Tompkin, Jiang, etc., focusing on perceptual process and outcome elements [13, 9, 9, 9, 16]. These findings increasingly enrich and refine the perceptual links, elements, and processes in IE behavior. The above IE model research also implicitly reflects temporal dimension changes in physical and cognitive space.

2.3 Research on Influencing Factors of Information Encountering

Research aimed at improving the probability of IE has become a hotspot in recent years. Existing literature examines the influence and comparative analysis of IE from three dimensions: user, information, and context. The user dimension primarily focuses on demographic characteristics such as gender, age, educational background, and profession [17]. The personality trait dimension concentrates on aspects like character, thinking style, and cognitive style [17]. Emotional states revolve around the positive, negative, and tense states' positive and negative impacts on IE outcomes [23]. Users' search styles and information literacy also amplify IE effects. For instance, broad browsing is more likely to lead to IE than deep digging [24], and numerous scholars have discussed the importance of information literacy for IE [19, 5, 25, Error: Reference source not found], emphasizing the need to focus on activating users' information needs, cultivating IE awareness, utilizing encountered information, and strengthening IE experience [Error: Reference source not found].

The information factor is the object of IE. Scholars' explorations can be broadly divided into two aspects: information content (such as quality, relevance, interest, information source, visibility, acquisition cost, information environment) and contextual factors (task and non-task contexts). For example, the corre-

lation between information content, information quality, and IE shows diverse perspectives [19, 23, 30]. Users tend to obtain information from trustworthy or popular sources, and social media development has promoted information acquisition efficiency. IE may occur through communication with others and internet browsing [16]. Under specific tasks, time pressure is negatively correlated with IE [31]. In non-task contexts, users are more likely to encounter information in leisure situations [Error: Reference source not found].

2.4 Summary

Based on the literature review of relevant concepts, models, and influencing factors, IE is found to be a non-linear behavior that can occur when users actively browse or search for information, or in non-search contexts. Information behavior process evolution factors, personal cognitive factors such as curiosity, and information and contextual factors jointly influence IE. However, existing research often only considers the impact of a single dimension, lacking integrated research on the correlation between IE factors. Furthermore, most existing research perspectives are positioned in theories such as cognitive theory, self-efficacy, and non-linear systems [7, 33, 7], and still lack support from information ecology theory and experimental methods. Therefore, based on the network environment, this paper explores the correlation between IE factors and empirically excavates the differences in encountered information caused by the correlation between users, information, and environment from the perspective of information ecology.

---

3 Interview Study on User and Information Characteristics in Information Encountering

To explore differences in users' encountered information in the network environment, the authors used interviews as an entry point to analyze user characteristics in IE behavior. Grounded theory was employed to code and analyze information characteristics in IE behavior, thereby establishing a research model of "differences in users' encountered information in the network environment" to propose specific research hypotheses.

3.1 Interview Design

The interview outline was divided into core and auxiliary content. Core content included respondents' basic information (gender, occupation, age, education, major, etc.) and IE experiences (context of IE occurrence, task status, how they noticed encountered information, and how they handled information after encountering). Auxiliary content included inducing factors of IE, such as information literacy, personality traits, IE frequency, what types of information

would attract them, and types of encountered information. The interview subjects were 17 master's and doctoral students aged 20-25 from different regions, with backgrounds in science, engineering, agriculture, medicine, literature, history, philosophy, and management, from 985, 211, and ordinary universities, with evenly distributed gender. (Interviews were conducted in May 2021; interview outline and subjects omitted.)

3.2 Extraction and Analysis of Encountered Information Characteristics

In the information characteristic extraction phase, Strauss and Corbin's procedural version of grounded theory was adopted. Interview data were imported into NVivo 11 software for three-level coding analysis: open coding, axial coding, and selective coding.

Based on 17 original interviews, the interview data were organized and decomposed, conceptualizing and categorizing the materials to form 28 sub-categories. On this basis, by organizing and merging sub-categories with the same logical relationship, main categories were formed. Through integration and induction of the 28 sub-categories from open coding, the article ultimately formed 7 main categories, see Table 1 . Selective coding involves systematically analyzing and selecting a core category from all discovered main categories based on open coding and relational coding.

Encountered Information Characteristics | Encountered Information Performance

3.3 Research Model and Hypotheses

Table 1 Selective Coding of Encountered Information Characteristics

A1 Information Content Characteristics
A2 Information Form Characteristics
A3 Information System Characteristics
A4 Encountered Information State
A5 Handling Encountered Information
A6 Value of Encountered Information
A7 Attitude Toward Encountered Information

Interview results revealed that when users encounter information in the network environment, the characteristics of encountered information are not identical, and encountered information outcomes should be influenced by user traits. Therefore, this study proposes the following research model, as shown in Figure 1 [Figure 1: see original paper].

Figure 1 Hypothetical Model of Differences in Encountered Information

To further refine the research content, based on the research model, the relevant research hypotheses are proposed as follows:

Question 1: In the network environment, do users with different traits show differences in encountered information characteristics?

- Hypothesis 1.1: Users of different genders show differences in encountered information characteristics
- Hypothesis 1.2: Users of different ages show differences in encountered information characteristics
- Hypothesis 1.3: Users with different education levels show differences in encountered information characteristics
- Hypothesis 1.4: Users from different academic disciplines show differences in encountered information characteristics
- Hypothesis 1.5: Users with different occupations show differences in encountered information characteristics
- Hypothesis 1.6: Users with different internet usage durations show differences in encountered information characteristics
- Hypothesis 1.7: Users with different cognitive styles show differences in encountered information characteristics
- Hypothesis 1.8: Users with different information literacy levels show differences in encountered information characteristics
- Hypothesis 1.9: Users with different personality traits show differences in encountered information characteristics

Question 2: In the network environment, do users with different traits show differences in encountered information performance?

- Hypothesis 2.1: Users of different genders show differences in encountered information performance
- Hypothesis 2.2: Users of different ages show differences in encountered information performance
- Hypothesis 2.3: Users with different education levels show differences in encountered information performance
- Hypothesis 2.4: Users from different academic disciplines show differences in encountered information performance
- Hypothesis 2.5: Users with different occupations show differences in encountered information performance
- Hypothesis 2.6: Users with different internet usage durations show differences in encountered information performance
- Hypothesis 2.7: Users with different cognitive styles show differences in encountered information performance
- Hypothesis 2.8: Users with different information literacy levels show differences in encountered information performance
- Hypothesis 2.9: Users with different personality traits show differences in encountered information performance

---

4.1 Data Collection and Analysis Methods

To further verify differences in encountered information among different users, the article employed a questionnaire to compile the "User Encountering and Information Item Scale" for measurement and analysis.

4.2 Survey Questionnaire Design

The questionnaire design integrated user and information factors extracted from the grounded theory research, dividing the questionnaire into three parts: Part 1 covered user background and subject factors (11 items); Part 2 covered encountered information situations (22 items); and Part 3 covered user personality traits (60 items). The "personality traits" section was only administered to respondents who reported having experienced IE in Part 1. (Survey questionnaire omitted.)

4.3 Data Collection and Validation

First, a pre-survey questionnaire was distributed via WeChat groups, receiving 52 responses. After testing, both Cronbach's α and KMO values were greater than 0.7, indicating good reliability and validity of the scale.

Second, the formal survey was distributed through the "Wenjuanxing" platform via QQ, WeChat, Weibo, and other channels, collecting 612 questionnaires, including 108 from respondents without IE experience and 504 from those with IE experience. Among these, 36 were invalid questionnaires. The formal survey yielded 468 valid questionnaires, with an effective rate of 76.47%.

Since questions 21 and 22 were not 5-point scale items, they did not require reliability or validity testing. The reliability and validity analysis of all 20 scale items showed α (0.909) and KMO (0.935), both reaching ideal levels. Reliability analysis of the 14 items on encountered information characteristics showed α (0.909) and KMO (0.948), both reaching ideal levels. Reliability and validity analysis of the 6 items on encountered information performance characteristics showed α (0.742) and KMO (0.755), both performing well. This questionnaire scale has good reliability and validity and can be used for subsequent data analysis.

4.4.1 Sample Descriptive Statistical Analysis

This study conducted basic statistical analysis of users' demographic characteristics and internet usage duration. Specific results are shown in Table 2 .

Table 2 Statistical Analysis Results of Demographic Characteristics and Internet Usage Duration

Statistical Item	Category
Age	Under 18, 18-25, 26-30, 31-40, Over 40
Education	High school and below, Junior college, Undergraduate, Master's/PhD
Occupation	Civil servant or public institution staff, Teaching and research personnel, Enterprise staff, Student, Other
Internet Usage	$2h < T \leq 4h$, $4h < T \leq 6h$, $6h < T \leq 8h$, $T > 8h$

4.4.2 Preliminary Results of Descriptive Statistical Analysis of Information Encountering

For the 468 samples with IE experience, the percentage and mean scores of different scales were calculated to obtain users' ratings of encountered information. For example, over 90% of samples considered encountered information to be useful or interesting, with users encountering interesting information more than useful information. Sixty-five percent of users felt annoyed by excessive platform information and pop-up ads, and prolonged browsing limited IE occurrence. Ninety-two percent of users approved of system-recommended information. Twenty-two point eight percent and 22.4% of users particularly agreed that encountered information was novel and visible. Seventy-three percent of users believed that in purposeless browsing states, users have lower expectations and weaker purposefulness, which aligns with IE occurrence conditions and makes it easier to obtain valuable information.

4.4.3 Differential Analysis of User Information Encountering

Building on the preliminary statistical results, user characteristics were divided into background information and subject factors, while encountered information situations were divided into two dimensions: encountered information characteristics (content, form, and system) and encountered information performance (state, handling method, value, and attitude). The authors used non-parametric tests and chi-square tests to compare differences in IE situations among different users, with chi-square tests analyzing differences in encountered information sit-

uations (questions 21-22). The following presents only the test results showing significant differences.

4.4.3.1 Differential Analysis Results of Users with Different Backgrounds (1) Gender

- Hypothesis 1.1: Users of different genders show differences in encountered information characteristics ($p<0.05$)
- Hypothesis 2.1: Users of different genders show no differences in encountered information performance ($p>0.05$)

Table 3 Non-parametric Test of Encountered Information Characteristics by Gender

Encountered Information Dimension	Information Content Characteristics	Information Security

According to Table 3 results, in the "encountered information characteristics" aspect, users of different genders show differences in information security concerns. Compared to males, females are more worried about personal privacy infringement when obtaining encountered information.

(2) Age

- Hypothesis 1.2: Users of different ages show differences in encountered information characteristics ($p<0.05$)
- Hypothesis 2.2: Users of different ages show differences in encountered information performance ($p<0.05$)

Table 4 Non-parametric Test of Encountered Information Characteristics and Performance by Age

Encountered Information Dimension	Under 18	18-25	26-30	31-40	Over 41
Information Usefulness	…	…	…	…	…
Information Interestingness	…	…	…	…	…
Information Credibility	…	…	…	…	…
Information Novelty	…	…	…	…	…
Information Novelty (Novelty)	…	…	…	…	…
Information Accessibility	…	…	…	…	…
Information Visibility	…	…	…	…	…
System Convenience	…	…	…	…	…
Information Security	…	…	…	…	…
Information Overload	…	…	…	…	…
Purposeless Browsing	…	…	…	…	…
Saving Encountered Information	…	…	…	…	…
Using Encountered Information	…	…	…	…	…

Encountered Information Dimension	Under 18	18-25	26-30	31-40	Over 41
Sharing Encountered Information	…	…	…	…	…

Table 5 Chi-square Test Cross-tabulation of Encountered Information Attitude by Age

Encountered Information Attitude	Under 18	18-25	26-30	31-40	Over 41
Positive-Positive	30a, b	11a, b	35a, b	2a, b	…
Positive-Negative	…	…	…	…	…
Negative-Positive	…	…	…	…	…
Negative-Negative	…	…	…	…	…

Note: 3 cells (15%) have expected count less than 5. Minimum expected count is 1.44. Fisher's exact test…

As shown in Table 5, significant differences exist between the "18-25" and "31+" age groups in "positive-negative," "negative-positive," and "negative-negative" attitudes. Among "18-25" users, 60% had "positive-positive" attitudes after IE, 37% experienced attitude shifts (from positive to negative or negative to positive), and less than 5% had consistently negative attitudes before and after IE. Among "31+" users, only 30% were "positive-positive," while attitude-shifting users accounted for 55%. As age increases, attitudes before and after IE transform, with higher judgment and lower evaluation of encountered information characteristics. Overall, the proportion of "positive" attitudes after IE is higher than "negative" attitudes.

(3) Education Level

- Hypothesis 1.3: Users with different education levels show differences in encountered information characteristics ($p<0.05$)
- Hypothesis 2.3: Users with different education levels show differences in encountered information performance ($p<0.05$)

Table 6 Non-parametric Test of Encountered Information Characteristics and Performance by Education Level

Encountered Information Dimension	High School and Below	Junior College	Undergraduate	Master's/PhD
Information Usefulness	…	…	…	…
Information Interesting-ness	…	…	…	…

Encountered Information Dimension	High School and Below	Junior College	Undergraduate	Master's/PhD
Information Credibility	…	…	…	…
Information Novelty	…	…	…	…
Information Novelty (Novelty)	…	…	…	…
Information Accessibility	4.04	…	…	…
Information Form Diversity	4.20	…	…	…
System Convenience	…	…	…	…
Information Security	…	…	…	…
Information Overload	…	…	…	…
Purposeless Browsing	…	…	…	…
Saving Encountered Information	4.00	…	…	…
Using Encountered Information	3.90	…	…	…
Sharing Encountered Information	4.06	…	…	…

According to Table 6 results, in the "encountered information state" dimension, "junior college," "undergraduate," and "master's/PhD" groups encountered information more in "time-available" states than "relaxed-comfortable" states, while "high school and below" encountered information more easily in "relaxed-comfortable" states. "Junior college" users had higher IE frequency in "purposeless browsing" states than "undergraduate" and "master's/PhD" users.

In the "handling encountered information" dimension, both "high school and below" and "junior college" groups scored higher than "undergraduate" and "master's/PhD" groups in saving, using, and sharing encountered information. "High school and below" and "junior college" groups focused more on sharing encountered information with others, while "undergraduate" and "master's/PhD"

groups found encountered information more useful for themselves, focusing on "saving encountered information."

Table 7 Chi-square Test Cross-tabulation of Encountered Information Attitude by Education Level

Encountered Information Attitude	High School and Below	Junior College	Undergraduate	Master's/PhD
Positive-Positive	5a, b	…	…	…
Positive-Negative	…	…	…	…
Negative-Positive	…	…	…	…
Negative-Negative	…	…	…	…

Note: 2 cells (12.5%) have expected count less than 5. Minimum expected count is 2.94. Fisher's exact test…

According to Table 7 results, in the "encountered information attitude" dimension, about 50% of "undergraduate" and "master's/PhD" users were "positive-positive," while "high school and below" and "junior college" users showed balanced proportions across attitude categories, with the former having the most "negative-positive" and the latter having the most "positive-negative."

(4) Academic Discipline

- Hypothesis 1.4: Users from different academic disciplines show differences in encountered information characteristics ($p<0.05$)
- Hypothesis 2.4: Users from different academic disciplines show differences in encountered information performance ($p<0.05$)

For analysis convenience, the 12 disciplines involved in the sample were divided into three categories: Natural Sciences (engineering, science, agriculture, medicine), Social Sciences (management, education, economics, law), and Humanities (literature, history, philosophy, arts). Among the 468 samples, in addition to these three categories, there were some "other" categories from "high school and below" education. The following test results only include 440 samples from natural sciences, social sciences, and humanities.

Table 8 Non-parametric Test of Encountered Information Characteristics by Academic Discipline

Encountered Information Dimension	Natural Sciences	Social Sciences	Humanities
Information Credibility	…	…	…
Information Accessibility	3.72	…	…
Information Visibility	…	…	…

Table 9 Chi-square Test Cross-tabulation of Encountered Information Value by Academic Discipline

Encountered Information Value	Natural Sciences	Social Sciences	Humanities
Solving Academic Research Confusion	…	…	…
Solving Daily Life Information Needs	…	…	—
Pearson Chi-square	…	…	…

Note: 0 cells (0%) have expected count less than 5. Minimum expected count is 21.55.

In the "information content and form characteristics" dimension, humanities users rated higher than natural science and social science users. From the perspective of value evaluation and research content, natural science evaluation criteria are objective and logical, with research content often involving technical challenges, evaluating information with rigorous attitudes. Social science evaluation criteria are practical and diverse, focusing on new methods, theories, and knowledge for improving social management and institutional construction, emphasizing information novelty and timeliness, with higher requirements for encountered information. Clearly, disciplinary background is an important factor causing actual differences in user IE behavior, as disciplines implicitly contain users' thinking characteristics, purposes, and motivations, which are constrained by values and evaluation criteria.

(5) Occupation

- Hypothesis 1.5: Users with different occupations show differences in encountered information characteristics ($p<0.05$)
- Hypothesis 2.5: Users with different occupations show differences in encountered information performance ($p<0.05$)

Table 10 Non-parametric Test of Encountered Information Characteristics and Performance by Occupation

Encountered Information Dimension	Civil Servant/Public Institution	Enterprise Staff	Student	Teaching/Research Personnel	Other
Information Credibility	…	…	…	…	…
Information Accessibility	3.71	…	…	…	…
Sharing Encountered Information	3.57	…	…	…	…

According to Table 10 results, in the "information content characteristics" dimension, the "student" group spends longer time online daily and cannot accurately judge information value when facing mixed information, thus having lower "information credibility." The "teaching and research personnel" group has richer information experience and more IE experiences, thus obtaining information more easily than other user groups. Compared to the "student" group, "teaching and research personnel" pay more attention to hot information and are more willing to share encountered information.

Table 11 Chi-square Test Cross-tabulation of Encountered Information Attitude by Occupation

Encountered Information Attitude	Civil Servant/Public Institution	Enterprise Staff	Student	Teaching/Research Personnel	Other
Positive-Positive	13a	38b, c	63a, c	20a, b	3a, b
Positive-Negative	…	…	…	…	…
Negative-Positive	…	…	…	…	…
Negative-Negative	…	…	…	…	…

Note: 4 cells (20%) have expected count less than 5. Minimum expected count is 1.15. Fisher's exact test…

According to Table 11 results, in the "encountered information attitude" dimension, most users across "student," "civil servant/public institution," "enterprise

staff," "teaching and research personnel," and "other" groups showed "positive-positive" attitudes before and after IE, with no significant differences. "Civil servant/public institution" and "enterprise staff" groups had higher proportions of "positive-negative" attitude shifts than "negative-positive," as these groups are mostly in working states with "positive" information search attitudes, but encountered information cannot directly solve current information needs, leading to "negative" attitude shifts. Conversely, "student" and "teaching and research personnel" groups had higher proportions of "negative-positive" than "positive-negative," as these groups have relatively free time. When experiencing learning or research difficulties with "negative" attitudes, encountered information facilitates heuristic divergent association, leading to "positive" attitude shifts.

4.4.3.2 Differential Analysis of Users with Different Subject Factors
This section divides information literacy into three levels: poor (1-2 points), average (3 points), and good (4-5 points).

(1) Internet Usage Duration

- Hypothesis 1.6: Users with different internet usage durations show differences in encountered information characteristics ($p<0.05$)
- Hypothesis 2.6: Users with different internet usage durations show no differences in encountered information performance ($p>0.05$)

Table 12 Non-parametric Test of Encountered Information Characteristics and Performance by Internet Usage Duration

Encountered Information Dimension	$T \leq 2h$	$2h < T \leq 4h$	$4h < T \leq 6h$	$6h < T \leq 8h$	$T > 8h$
Information Credibility	…	3.61	…	…	…

According to the 51st China Internet Development Statistics Report (2023), average weekly internet usage is about 26.7 hours. Table 12 results show that within the "$T \leq 4h$" daily usage range, the longer the internet usage, the lower the credibility of encountered information. When daily usage exceeds the average ($T > 4h$), consistent with the above results, as internet usage increases and more information is contacted, users tend to question the credibility and quality of information sources.

(2) Cognitive Style

- Hypothesis 1.7: Users with different cognitive styles show differences in encountered information characteristics ($p<0.05$)
- Hypothesis 2.7: Users with different cognitive styles show differences in encountered information performance ($p<0.05$)

Table 13 Non-parametric Test of Encountered Information Characteristics and Performance by Cognitive Style

Encountered Information Dimension	Field-Independent	Field-Dependent
Information Form Characteristics	...	...
Information Form Diversity	...	...
Encountered Information State	...	...
Relaxed-Comfortable	...	...

"Field-independent" users have poor social sensitivity, are more confident, prefer solitary environments, focus more on their current tasks, and are not influenced by external factors. "Field-dependent" users are more susceptible to environmental influence, have stronger information sensitivity, and can discover valuable information among numerous sources. In the "information form characteristics" dimension, field-dependent users encounter more diverse information forms than field-independent users. Moreover, the more relaxed and comfortable the environment, the higher the IE frequency for field-dependent users.

(3) Information Literacy

- Hypothesis 1.8: Users with different information literacy levels show differences in encountered information characteristics ($p<0.05$)
- Hypothesis 2.8: Users with different information literacy levels show differences in encountered information performance ($p<0.05$)

Table 14 Non-parametric Test of Encountered Information Characteristics and Performance by Information Literacy Level

Encountered Information Dimension	Poor	Average	Good
Information Usefulness	...	...	...
Information Interestingness	...	...	...
Information Content	Information Credibility	...	...
Information Novelty	...	...	...
Information Novelty (Novelty)	...	...	...
Information Accessibility	...	...	...
Information Source Diversity	...	...	...
Information Form	Information Visibility	...	...
Information Form Diversity	...	...	...
System Convenience	...	...	...
Information System	Information Security	...	...
Information Overload	...	...	...
Purposeless Browsing	...	...	...
Saving Encountered Information	...	...	...
Using Encountered Information	...	...	...
Sharing Encountered Information	...	...	...

Encountered Information Dimension	Poor	Average	Good
Encountered Information Handling	…	…	…

Overall, users with good information literacy scored higher than those with poor literacy on "encountered information." The "good information literacy" group also worries about information security as their digital footprint increases and feels 厌倦 psychology toward "information overload." Compared to "poor or average information literacy" groups, "good information literacy" users more frequently experience IE in time-available and relaxed-comfortable situations, where weaker purposefulness allows them to notice more information, increasing IE probability.

(4) Personality Traits

- Hypothesis 1.9: Users with different personality traits show differences in encountered information characteristics ($p<0.05$)
- Hypothesis 2.9: Users with different personality traits show differences in encountered information performance ($p<0.05$)

Table 15 Non-parametric Test of Encountered Information Characteristics and Performance by Personality Traits

Encountered Information Dimension	Conscientiousness	Neuroticism	Openness	Agreeableness	Extraversion
Information Content Characteristics	Information Novelty	…	…	3.69	…
Information Source Diversity	…	…	…	…	…
Information Form Characteristics	Information Form Diversity	…	…	…	…
Encountered Information State	Relaxed-Comfortable	…	…	…	…

In the "information content characteristics" dimension, "openness" users encounter more novel information than other personality trait users. "Conscientious" users are methodical and self-disciplined, better able to resist external

temptations, continuing current tasks before moving to the next, making it difficult to shift attention and hindering IE occurrence. In the "information form characteristics" dimension, "agreeable" users encounter more diverse information sources than other users. High "agreeableness" users are cooperative and caring, having more social support, so encountered information itself or information acquisition channels often come from friend recommendations and sharing.

4.4.3 Summary of Hypothesis Testing Results for User Encountered Information Differences

Table 16 Summary of Hypothesis Testing Results for User Encountered Information Characteristics and Performance

User Characteristic	Encountered Information Characteristics	Encountered Information Performance
Gender	Not Supported	Supported
Age	Supported	Supported
Education Level	Supported	Supported
Academic Discipline	Supported	Supported
Occupation	Supported	Supported
Internet Usage Duration	Supported	Not Supported
Cognitive Style	Supported	Supported
Information Literacy	Supported	Supported
Personality Traits	Supported	Supported

Table 16 synthesizes the empirical results of the above research hypotheses. To further verify differences in user encountered information and objectively analyze the characteristics and performance of user IE, the authors also employed network experimental methods through screen recording experiments to observe user browsing behavior and encountered information characteristics, providing further validation of the research hypothesis results.

5.1 Experimental Purpose, Design, and Process

The article employed network experimental methods based on "Weibo" to observe encountered information characteristics and performance through screen recording video analysis, providing strong support for replicating research hypothesis results.

Experimental Subjects: A total of 74 high school, junior college, undergraduate, and graduate students aged 17-30 were recruited through Weibo and WeChat platforms. The gender ratio was controlled at 1:1, and all participants had used Weibo for over one year.

Experimental Environment and Equipment: All participants used their own mobile devices and built-in screen recording software. Since the recording process might involve personal privacy, participants were advised to organize their device privacy settings autonomously.

Experimental Process: To effectively observe user IE situations, the experiment was set in relaxed-comfortable, time-available contexts, allowing participants to browse Weibo content without purpose. Based on pilot experiments with 5 participants, the minimum browsing duration was determined to be 10 minutes. Before the formal experiment, participants received screen recording software training to ensure they could correctly record and save their Weibo browsing processes. After screen recording, each participant completed a questionnaire on personal information and descriptions and ratings of IE events. After post-processing, 69 valid videos were received.

5.2 Data Collection and Analysis

Data included participants' personal information, descriptions of IE events, and ratings of encountered information characteristics. Personal information included gender, age, education level, self-assessed information literacy, current environment, and whether the environment was relaxed-comfortable. The article statistically analyzed: information from 69 participants (gender, age, education level, information literacy composition and proportions); IE event frequency and browsing duration; encountered information characteristics, presentation forms, and information sources (tables omitted). The following experimental findings were discovered:

5.3 Experimental Findings

(1) **Discovery of User Browsing Behavior Types:** Through observing screen recordings of 69 participants, three main types were identified: rapid browsing type, deep digging type, and broad browsing type.

(2) **Age Differences in Encountered Information:** Different age groups show differences in encountered information content characteristics.

(3) **Education Level Differences in Encountered Information:** Different education level groups show differences in encountered information content characteristics, form, sources, handling of encountered information, and value.

(4) **Information Literacy Differences in Encountered Information:** Different information literacy groups show differences in encountered information content characteristics and sources, but no differences in encountered information form and value.

(5) **Replication and Support for Above Survey Results:** The experimental findings replicate and support the above questionnaire-based survey research results.

---

6 Research Results and Discussion

Through empirical research primarily based on surveys and supplemented by experiments, this study obtained results that three-dimensionally validate how different "user" characteristics affect the content and form of their encountered information. The research reveals the understanding that IE is a "determined and self-determined" process embedded with individual factors, clarifying the central position of "users" in the information ecology structure.

The article synthesizes two different methods of consecutive empirical research, reaching the following results and understandings:

(1) Macroscopically, it verifies and reveals the research hypotheses from foundational interviews; microscopically, it clarifies relevant relationships.

(2) For eight user personality characteristics, it specifically validates 30 research hypotheses, providing support for distinguishing the relationship between users and encountered information.

(3) Across the eight dimensions of user characteristics, their correlation strength with the seven indicators of information characteristics and performance, respectively, is: age (6 items), education level (6 items), information literacy (5 items), occupation type (4 items), academic discipline (3 items), cognitive style (2 items), and gender (1 item).

(4) It empirically demonstrates that factors such as user age, education level, information literacy, and occupation type are key factors causing differences in users' IE abilities and states.

(5) From the perspective of "information ecology," which emphasizes internal consistency of "content, user, and environment"—the concept that a good information ecology emphasizes "providing specific information content for specific users in specific information environments"—this philosophy should also be reflected in IE information services and support conducive to divergent association.

(6) The solidification of information ecology emphasizing balance and harmony will inevitably create a certain degree of "information cocoon effect,"

making "decocooning" an increasingly new observation point in information architecture and services conducive to IE.

(7) The IE process is essentially a complex self-adaptive and self-similar process, where individual differences across the above-mentioned dimensions are causal factors determining "what it is" IE outcomes.

(8) The IE process is also a "black box" system reflecting the brain's associative function. The bidirectional docking and matching between specific information and multi-dimensional personalized users "emerges" unexpected IE outcomes. Although this "unintentional querying" only looks at results, it is indeed a combination of complex mechanisms in information ecosystems.

(9) "Social epistemology" emphasizes studying knowledge production and sharing from the perspective of social connections. Information ecology obviously also reflects the essential characteristics of "social information ecology" in the social dimension of "social trait" users. Therefore, research on user IE from the information ecology perspective should also reflect and reveal the social dimension of "birds of a feather flock together."

(10) In the context of increasingly prevalent recommendation algorithms and artificial intelligence (such as ChatGPT), research on IE mechanisms for "decocooning" is becoming increasingly important as a prerequisite for reflecting user creativity. The study of user personalized differences and their associated subjective and objective "determined and determining" factors is the initial condition that needs to be excavated.

---

7 Research Conclusions

1. Network users have vastly different characteristics that vary from person to person. The multi-level differences existing among individual network users cause differences in their encountered information, and the role of users' "personalized" characteristics has been clearly proven. At the operational level, users must be understood as having "personality combinations."

2. Subjectively environment-related factors, such as cognitive style, education level, academic discipline, and information literacy, overall occupy an important position and should be the main factors for user-oriented personalized services.

3. "Information encountering" is not merely a traditionally understood passive "accidental" behavior, but also implicitly contains users' "self-determined" active "inevitable" outcomes. The seemingly passive behavior and results of IE also involve users' intangible active matching

factors—that is, the IE of specific users is also an "emergent" result of active docking between personalized users and specific information.

4. From the perspective of information ecology conducive to IE, users hold a key core position. Users are the "first-principal factor" that combines environment and content. In information architecture, content matching and environmental support must highly correspond to specific users' cognitive spaces.

5. Viewed dialectically, users' "purposeless" information behavior is actually "maximally purposeful" behavior. This also aligns with the "unconsciousness" law in user information behavior. The negative correlation between "internet usage duration" and encountered information also reflects the psychological characteristic of "moderate satisfaction" in user IE behavior.

6. The "tunnel vision" effect of intelligent era information services is becoming increasingly prominent, while the user-end "creating something from nothing" function reflecting IE characteristics is increasingly degenerating. Therefore, new models of artificial intelligence should particularly focus on this emergent effect of IE that concerns innovative capability.

References

[1] Foster A.E. & Ford N.J. Serendipity and information seeking: An Empirical study[J]. Journal of Documentation, 2003(9):321−330.
[2] Krikelas J. Information-Seeking Behavior: Patterns and Concepts[J]. Drexel Library Quarterly, 1983,19(2):4-20.
[3] Erdelez S. Information encountering: An exploration beyond information seeking[D]. New York: Syracuse University, 1995.
[4] Williamson K. Discovered by chance: The role of incidental information acquisition in an ecological model of information use[J]. Library & Information Science Research, 1998.
[5] Toms E G. Serendipitous information retrieval[C]//Proceedings of the First DELOS Network of Excellence Workshop on Information Seeking, Searching and Querying in Digital Libraries, 2000. ERCIM, 2000:11-12.
[6] Erdelez S. Information encountering[M]// Theories of Information Behavior. Information Today, 2004.
[7] Erdelez S. & Makri S. Information encountering re-encountered: A conceptual re-examination of serendipity in the context of information acquisition[J]. Journal of Documentation, 2020.
[8] Makri S. & Ann B. Coming across information serendipitously Part 1: A process model[J]. Journal of Documentation, 2012,68(5):684-705.
[9] Erdelez S. Towards understanding information encountering on the web[C]//Proceedings of the ASIS Meeting, 2000.
[10] Wamura N A. Rethinking the Information Behavior Model of Information

Encountering: An Analysis of the Interviews on Information Encountering on the Web[J]. Library and Information Science, 2006 (55):47-69.
[11] Tian Mei, Zhu Xuefang, Zhang Junliang. Research on the Process of Mobile Internet Information Encountering from the Perspective of Sense-Making[J]. Library and Information Service, 2018,62(16):72-81.
[12] Rubin V L, Burkell J, Quan-Haase A. Facets of serendipity in everyday chance encounters: a grounded theory approach to blog analysis[J]. Information Research, 2011,16(3):488.
[13] Tian Mei, Liu Xiwen, Zhang Junliang. Review of Information Encountering Process Models[J]. Library Theory and Practice, 2018(09):45-50.
[14] McCay Peet L, Toms E G. Investigating serendipity: How it unfolds and what may influence it[J]. Journal of the Association for Information Science and Technology, 2015, 66(7): 1463-1476.
[15] Lawley J, Tompkins P. Maximising serendipity: The art of recognising and fostering potential[EB/OL]. [2021-07-28]. http://www.cleanlanguage.co.uk/articles/articles/224/0/MaximisingSerendipity/Page0.html.
[16] Jiang T, Liu F, Chi Y. Online information encountering: modeling the process and influencing factors[J]. Journal of Documentation, 2015,71(6):1135-1157.
[17] Tian Lizhong, Yu Biyang. Research on Influencing Factors of Information Encountering Among Scientific Researchers[J]. Information Science, 2013,31(04):69-75+83.
[18] Du Xue, Liu Chunmao. Survey and Experimental Study on the Influence of Personality Traits on Web Information Encountering[J]. Library and Information Service, 2015,59(11):119-126.
[19] Yang Yukun, Huang Yeman. Research on Influencing Factors of User Information Encountering Behavior in Social Network Environment[J]. Digital Library Forum, 2017(06):65-72.
[20] Toms E G. Serendipitous Information Retrieval[C]//Proceedings of the 2012 international conference on Information Retrieval Meets Information Visualization. Springer-Verlag, 2001:76-85.
[21] Yang Yuqi. Research on the "User" Influence Dimension of Information Encountering Based on Meta-ethnography[J]. Information Science, 2018,36(09):46-51+56.
[22] Nutefall J E, Ryder P M. The serendipitous research process[J]. The Journal of Academic Librarianship, 2010, 36(3): 228-234.
[23] Pan Shuguang. Research on Information Encountering[D]. Southwest University, 2010.
[24] Heinström J. Psychological factors behind incidental information acquisition[J]. Library & Information Science Research, 2006,28(4): 579-594.
[25] Yang Min, Xie Yangqun, Xie Xiao. Research on Information Encountering in Social Media Software[J]. Library Science Research, 2016(06):65-68+9.
[26] Yang Yukun, Huang Yeman. Research on Influencing Factors of User Information Encountering Behavior in Social Network Environment[J]. Digital Library Forum, 2017(06):65-72.
[27] Zhang Yue, Hu Cuihong. Research on Influencing Factors of Information

Encountering Process[J]. Information Exploration, 2017(06):15-19.
[28] Rubin V L, Burkell J, Quan Haase A. Everyday serendipity as described in social media[J]. Proceedings of the American Society for Information Science and Technology, 2010,47(1):1-2.
[29] Tian Mei, Zhu Xuefang. Research on Influencing Factors of College Students' Web Information Encountering Based on Support Vector Machine[J]. Library and Information Service, 2018,62(08):84-92.
[30] Jiang Guanqun. Discussion on How to Promote Readers' Information Encountering in the New Media Era[J]. Library Research, 2015,45(05):116-118.
[31] Yuan Hong, Wang Zhipeng. Research on Information Encountering Phenomenon in Digital Library Utilization[J]. Library and Information Service, 2014,58(17):104-111+135.
[32] Kang Menglan. Research on Influencing Factors of Saving Behavior of Encountered Information in Web Browsing[J]. Inner Mongolia Science Technology and Economy, 2019(12):110-
[33] Tian Mei. Analysis of Theoretical Foundations of Information Encountering and Its Research[J]. Modern Intelligence, 2017,37(12):42-47.
[34] Liu Chunmao, Fan Mengyuan, Zhou Yue. An Empirical Study on Influencing Factors of "Semantic Information Encountering" from the Perspective of Complex Systems[J/OL]. Information Theory and Practice:1-17[2023-03-22]. http://kns.cnki.net/kcms/detail/11.1762.G3.20230113.1358.001.html

Author Introduction: Liu Chunmao, male, born in 1963, Professor at the School of Management, Tianjin Normal University. Research direction: Network informatics theory and methods. Zhou Yue (corresponding author), female, born in 1998, Research Assistant at Liaoning Academy of Agricultural Sciences.

Author Contribution Statement: Liu Chunmao: Topic selection, research content and technical route formulation, integrated analysis. Zhou Yue: Data investigation and initial analysis.

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