Research on the Formation Mechanism of Online Health Information Search Abandonment Behavior: Postprint

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Abstract

[Purpose/Significance] An in-depth exploration of the mechanisms through which task, contextual, and emotional factors in complex network environments influence online health information search abandonment behavior, along with the development of user behavior guidance and system intervention mechanisms, is of great significance for promoting effective health information acquisition. [Method/Process] Based on SSO theory, this study proposes a conceptual framework for the formation mechanism of health information search abandonment behavior and conducts empirical research through search experiments and questionnaire surveys to reveal the significant effects of task complexity, task importance, time urgency, and emotion on search abandonment behavior. [Results/Conclusions] The findings demonstrate that emotion fully mediates the effects of task complexity and time urgency on the triggering of health information search abandonment behavior, while task importance directly influences such behavior, with emotion exerting a greater impact than task importance. Finally, behavioral guidance is proposed for health information search users, and design ideas are presented for healthcare platforms to construct intervention mechanisms for user search abandonment behavior.

Full Text

Research on the Formation Mechanism of Online Health Information Search Discontinuation Behavior

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Abstract:
[**Purpose/Significance**] This study deeply explores the action mechanism of

task, situational, and emotional factors on online health information search discontinuation behavior in complex network environments. Forming user behavior guidance and system intervention mechanisms is important for promoting effective acquisition of health information by users.
[**Method/Process**] Based on SSO theory, this paper proposes a conceptual framework for the formation mechanism of health information search discontinuation behavior, and conducts empirical research through search experiments and questionnaires to reveal the important influence of task complexity, task importance, time urgency, and emotion on search discontinuation behavior.
[**Results/Conclusion**] The study shows that emotion plays a completely mediating role in the triggering of health information search discontinuation behavior by task complexity and time urgency, task importance directly affects health information search discontinuation behavior, and the impact of emotion on discontinuation behavior is greater than that of task importance. Finally, behavior guidance is provided for health information search users, and design ideas are proposed for healthcare platforms to construct intervention mechanisms for user search discontinuation behavior.

Keywords: health information search, discontinuation behavior, search tasks, emotion
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Health is a common aspiration and pursuit of humanity. With the improvement of material and cultural living standards, people are paying increasing attention to health issues, and health information needs have become more diverse and complex. Due to its rich resources, convenience, and privacy, the Internet has become the preferred channel for obtaining health information, and online health information search behavior has become increasingly common. The latest survey data from CNNIC [1] shows that the proportion of netizens using search engines to query professional knowledge such as health and medical information is as high as 70.5%, and 29.8% of non-netizens consider "convenient access to professional information, such as health and medical information" as an important factor for going online. However, the volume, structure, and content of online health information···

2 Related Research

2.1 Health Information Search Behavior Research

Health information refers to information related to physical and mental health, diseases, nutrition, and wellness that meets users' health needs [2]. E.R. Lenz, who proposed the concept of health information seeking behavior (HISB), regarded it as a series of information behaviors that change along two dimensions: degree and method [3]. The Internet has given rise to a new paradigm for health information behavior research. Researchers have conducted studies on the motivations, channels, influencing factors, and health information literacy of online

health information search from different perspectives [4], and have attempted to construct behavior models for specific populations [5]. The emergence of research results in different fields has made online health information search behavior an interdisciplinary research hotspot.

2.2 Research on the Impact of Task, Cognition, and Emotion on Information Search Behavior

A large number of studies have confirmed the impact of personal factors on the search process and results, with task factors receiving the most attention. Search behavior decisions depend on task type, time constraints, and a series of special internal perceptions [6], but existing views are not consistent regarding the impact of task characteristics on search behavior. For example, some studies suggest that tasks with low importance are easily abandoned, while conflicting views argue that task importance does not have a significant impact on search effort [7].

Research from cognitive and emotional perspectives has emerged with the paradigm shift in search behavior research toward users. Existing studies have established a series of search behavior cognitive models [8-10], and on this basis have conducted rich empirical research to quantitatively reveal the patterns of cognitive changes during the search process, with cognitive load becoming a powerful research tool. J. Gwizdka [11] combined dual-task methods and subjective measurement methods to reveal the patterns of average cognitive load changes among search users, and domestic scholars have also conducted related research based on academic and other contexts. In addition, existing studies have confirmed the mutual influence between emotion and search behavior efficiency, as well as the patterns of emotional changes during search [12-14]. Research suggests that self-emotion control, emotional skills, and optimistic emotions have positive effects on search effectiveness, and that searchers' information behavior in team work interaction states is influenced by others' attitudes and emotions.

2.3 Search Failure Behavior Research

Although some search discontinuation behaviors are based on perceived success and stop early, in reality the search results are not sufficient to reduce the uncertainty faced in scientific decision-making and cannot be classified as search success. Search discontinuation behavior is a typical search failure. However, search failure has long been regarded as a kind of "research anomaly" and has not been seriously examined. Fragmented results are scattered in a large number of search behavior empirical studies, from which only "fragments" of the patterns of search discontinuation behavior can be glimpsed: time urgency in search will induce individuals to abandon information search [15]; when users encounter search frustration, they will experience physiological and behavioral changes including reduced blood volume pressure and increased mouse clicks [16]; searchers in a state of cognitive overload will most likely abandon the task. How-

ever, systematic research on search failure is still in the stage of basic theoretical construction. Related research includes: dividing three types of personal search failure by drawing on the uncertainty degree of information "being there" in the network information visibility model [17], namely unexpected failure in the hidden area, inexplicable failure in the dark area, and expected failure, revealing the cognition and psychology of search failure subjects toward their predicament [18]; proposing a series of cognitive and motivational stopping rules to quantify and explain search stopping behavior; combining search stopping with search operations to distinguish stopping sessions, stopping topics, stopping keywords, and stopping browsing [19]. These results provide some theoretical support for discontinuation behavior research, which belongs to search failure. Discontinuation behavior research has not yet truly been carried out domestically, but current explorations of interrupted information behavior [20-21] and continuous search behavior [22] provide beneficial references for revealing the mechanism of discontinuation behavior.

In summary, the fruitful results of online health information search behavior research have laid a good foundation for this study, but there is still considerable room for depth in theory and perspective: (1) the interaction patterns between subjective and objective influencing factors of search behavior need to be further explored; (2) process-based search behavior research needs to be extended to the stopping of the search process, and from search success to search failure. To comprehensively reveal the patterns of search discontinuation behavior rather than seeking bits and pieces from related research, this study, based on the historical background of the major task of "comprehensively promoting the construction of a healthy China," explores the internal logic of search behavior from search tasks to psychological changes to discontinuation behavior.

3 Research Model

G.F. Koeske et al. [23] proposed the Stressors-Strain-Outcomes Framework (SSO Framework). In this framework, stressors are the troubles and perceptions of potential destructiveness that actors experience from objective event stimuli, strain is the negative reactions generated by actors due to stimuli, including negative impacts on attention, physiology, and emotion, and outcomes are the consequences of stress on user behavior or psychology. The SSO model has a concise structure and clear logic and has been widely applied in user behavior research. In the progressive process from search tasks to psychological changes to discontinuation behavior, stressors mainly consider the pressure perception caused by task and situational factors. Tasks are the objectively existing search problems, and situations are the resources available to users and constraints that exist to solve current tasks. Both produce strong external stimuli for health information searchers; strain is the problem emotions that users may generate under the influence of search task stressors; the outcome is discontinuation behavior. Based on this, the theoretical research model shown in Figure 1 [Figure 1: see original paper] is constructed.

This model refines the impact of tasks and situations on search discontinuation behavior through emotion. Task complexity and task importance correspond to the internal and external characteristics of search tasks, respectively. Related research [24-25] views time as a scarce resource that users can utilize, and users always conduct information searches under different time constraints. Therefore, this study classifies time urgency as a situational factor. Task complexity, task importance, and time urgency together constitute the stressors S of user health information search. Task complexity is a function of users' information processing needs [26]. As the complexity of health information search increases, the help provided by internal information channels becomes more limited, so users need to consume more cognitive resources to conduct broader and deeper external information searches to combat information overload. At the same time, increased task complexity also inhibits users' task decomposition ability to identify various task elements [27], and both information overload and reduced task decomposition ability lead to task failure. Task importance refers to the degree to which the task being undertaken can impact work and life. When the importance of health information search rises, users' engagement and sense of responsibility increase accordingly, and they exhibit clearer goal orientation, tending to obtain more "quality" information at the cost of more search effort. When search task time urgency increases, users will prioritize efficiency over task quality, tending to narrow the range of information sources they use and reduce the amount of information they collect. Emotion corresponds to strain S. Emotion is usually a temporary attitude experience generated by the subject when stimulated by external stimuli, depending on whether basic needs are met [28]. Users' emotional experiences play an important role in information search behavior, and positive and negative emotions have different impacts on health information search behavior [29]. When health information search users feel frustrated or even dissatisfied, it will inevitably affect the behavioral intention of discontinuation behavior O. This research vein from task stressors S to emotional strain S to discontinuation behavior outcome O fully aligns with the "perception-emotion-behavioral intention" research paradigm of search behavior.

4 Research Design

4.1 Research Methods

The advantage of the experimental method is that it can control experimental conditions according to research questions to test various potential relationships and patterns in user search behavior. This study sets search tasks with different complexities, importance levels, and time constraints, requiring experimenters to complete designated search tasks on mobile phones. The experimenters' search processes will be recorded through mobile phone screen recording. The reason for choosing to complete experimental tasks on mobile phones is: (1) the widespread popularity of mobile phone search for health information. The "China Netizen Science Popularization Demand Search Behavior Report" [30] shows that health and medical care were among the 8 fastest-growing science

topics in 2019, and search behavior continues to shift toward mobile terminals; (2) the portability of mobile phones brings great convenience to the conduct of experiments. In addition to using screen recording to capture the complete search behavior of experimenters, experimenters are also required to submit search results, and post-experiment interviews are conducted to obtain experimenters' emotional states during search and satisfaction with search results. Finally, search videos, search results, and interview data are analyzed to verify the research model in Figure 1.

4.2 Search Tasks

To manipulate task complexity, based on D.J. Campbell' s typology [31] which proposes that task information processing needs include the number of information cues available and the number of different actions that must be performed by decision-makers, this study sets search tasks as simple factual tasks (S) and complex analytical tasks (F). Factual search tasks involve searching for specific, concrete facts and information, while analytical tasks have uncertain search scopes and require performing multiple decomposed tasks, continuously integrating and analyzing to capture limited information clues. These characteristics are consistent with the measurement standards for complex tasks.

Since it is necessary to distinguish task importance, each search task needs to be assigned a score representing different importance levels. Referencing the results of J. Dunlosky et al. [32], this study sets the score ratio of high-importance tasks to low-importance tasks at 2:1, i.e., important tasks are worth 20 points, and unimportant tasks are worth 10 points. Organizers emphasize before the experiment that important tasks have greater weight in experimental scores, and experimental compensation is positively correlated with experimental scores to ensure that task importance is an effective observation variable.

M.W.H. Weenig et al. [33], in their study on the impact of time constraints on information search, set time constraints at three levels: loose, moderate, and strict. Loose time limits are the maximum time required to complete the experiment, moderate time limits are 75% of the average experiment time, and strict time limits are 50% of the average experiment time. For generalizability, this study sets time urgency at two levels: loose (K) and strict (Y), using the standards of maximum time and 50% of average time.

The specific health information search experimental tasks designed in this study are shown in Table 1 .

Table 1 Search Experimental Tasks

Task Type	Strict (Y)	Loose (K)
Factual (S)	SY-10: What are the causes and symptoms of neurofibromatosis?	SK-10: A friend was bitten by a rove beetle and the wound is now infected and inflamed. After learning about this, you are very worried and want to know how to handle this situation.
Analytical (F)	FY-10: Long-term worry and irritability are detrimental to health. How does this anxious emotion affect human health? What other negative emotions affect human health?	FK-10: A relative often experiences dizziness, chest tightness, and other symptoms after activity, and even faints in severe cases. Please help him find possible causes.

To meet the research needs of three independent variables—task complexity, time urgency, and task importance—the experimental tasks adopt a 2$×2×$2 Graeco-Latin square design to reduce the experimental load on each experimenter. Task assignment and order are shown in Table 2 . Each experimenter only needs to complete one experimental task package consisting of 4 search tasks. Tasks are assigned sequentially according to experimenter numbers, with every 8 experimenters forming a cycle. Taking Experimenter No. 20 as an example, No. 20 is the 4th person in the third cycle, so they will complete the experimental task package numbered 4 in Table 2. The 4 tasks in the package are: the "dizziness and chest tightness" task (FK-20) and the "rove beetle bite" task (SK-20) under loose time constraints, and the "neurofibromatosis" task (FY-20) and the "anxious emotion" task (FY-10) under strict time constraints.

Table 2 Experimental Task Latin Square Design

Task Package No.	1	2	3	4	5	6	7	8
Task 1	SK-10	FK-20	FY-10	SY-20	FK-10	SK-10	SY-20	FY-20
Task 2	SK-20	FK-10	FY-20	SY-10	FK-20	SK-20	SY-10	FY-10
Task 3	SY-10	FY-20	FK-10	SK-20	SY-20	FY-10	FK-20	SK-10
Task 4	SY-20	FY-10	FK-20	SK-10	SY-10	FY-20	FK-10	SK-20

4.3 Discontinuation Behavior Determination

Although discontinuation is a type of stopping, discontinuation occurs during the search process if the physical and mental state is sufficient to cope, ending the search early under time-limited conditions, or abandoning or redirecting the search without time constraints. Therefore, the biggest difference between discontinuation and stopping is that discontinuation is search failure. Given this essential difference, stopping rules (such as the satisfaction rule) are obviously no longer applicable to discontinuation behavior determination, but the system and user perspectives of stopping rule research remain important references. For example, current research on search difficulty identification [34] includes system characteristics (such as changes in SERP ranking on search result pages) and user characteristics (such as users' self-assessed topic familiarity). Therefore, discontinuation behavior determination criteria can also be formulated from both system and user aspects.

The system criterion for discontinuation behavior determination is search failure, which is the primary condition. Because health information search discontinuation behavior is objectively unsuccessful, meaning users have not found the needed search results and cannot meet their information needs. This can be judged by the overlap between the keywords in the search results submitted by experimenters and the key points of standard answers. Objective scoring of search results is divided into 5 levels: 0% overlap, below 50% overlap, 50% overlap, above 50% overlap, and 100% overlap, with scores of 1-5 points respectively. Scores of 3 and below (half similarity or less) are defined as search failure.

The user criterion for discontinuation behavior determination is the ratio of page browsing time and subjective evaluation of search results. The former is the secondary condition for discontinuation behavior determination, and the latter serves as a reference condition. A. Diriye et al. [35] pointed out that discontinuation behavior is a process "from reduction to termination," and users' dwell time on search result pages is a signal of abandoning search. The last browsing before discontinuation behavior occurs is often quick and brief, serving only to confirm the discontinuation decision. This forms a great contrast in time consumption with the careful learning process at the beginning of the search when each search result is examined to capture information clues and identify information content. Therefore, the browsing time of the last page will rapidly decrease until there are no clicks. Organizers review videos one by one to record experimenters' initial page browsing time and last page browsing time when performing each health information search task, and calculate their ratio. After statistical summary, it is found that this ratio is concentrated in two intervals: 31%-49% and 52%-70%. The median value of 50% between the two intervals is taken as the threshold point for health information search discontinuation and non-discontinuation behavior in terms of browsing time. D. Maxwell et al. [36] interpret the satisfaction rule of search stopping as searchers stopping information search behavior by listening to their intuition of "good enough," while discontinuation behavior is just the opposite. Searchers expe-

rience cognitive frustration and anxiety before discontinuation [37], and often feel dissatisfied when implementing discontinuation actions. Experimenters' subjective evaluation of whether they are satisfied with search results is obtained through interviews.

Based on the above analysis, the health information search discontinuation behavior determination process is formed, as shown in Figure 2 [Figure 2: see original paper].

4.4 Experimental Procedure

Due to the generally high difficulty of implementing search experiments, the number of experimenters is difficult to meet large-sample requirements. In domestic and foreign related studies [38-39], the number of experimenters is mostly 20-30. At the same time, the implementation of search experiments requires experimenters to have a certain educational background to better understand experimental requirements. Therefore, this study recruited 35 experimenters through platforms such as Campus Today, WeChat, and QQ. The experiment lasted 12 days, and 32 sets of valid data were collected, including 32 search results, interview records, and search videos each. The male-to-female ratio of experimenters is 3:2, which is relatively balanced.

A pilot experiment is conducted before the formal experiment to improve research design details, including obtaining the time for experimenters to complete search tasks for time urgency manipulation in the formal experiment. The longest time for pilot experiment subjects to complete a single task is 5 minutes, and the average time is 4 minutes. Therefore, this experiment sets strict time at 2 minutes and loose time at 5 minutes.

The formal experimental procedure is as follows: Explain the experimental process and precautions, emphasize to experimental subjects that search task scores are linked to experimental compensation; experimenters complete 4 health information search tasks according to task assignment. To avoid the impact of emotional states from previous tasks on subsequent tasks, experimenters are required to listen to a piece of soothing and relaxing pure music for about 5 minutes with headphones between each task. Mobile screen recording is started at the beginning of the experiment, and after completing 4 tasks, screen recording is stopped and search results are submitted.

A brief interview is conducted with each experimenter after each task. The purpose of the interview is to obtain experimental subjects' emotional states and evaluations of search results. Two interview questions are set: (1) For interview question one, "Please describe your emotional state during the search process,"this study, based on P. Ekman's [40] classification of 6 types of emotions and combined with experimental reality, deletes strong emotional states such as sadness and anger, providing experimenters with 5 emotional choices: happy, relaxed, calm, awkward, and angry, and requires brief explanations; (2) For interview question two, "How do you evaluate your performance in this search

process," experimenters are provided with 5 choices: very satisfied, satisfied, average, dissatisfied, and very dissatisfied, and are required to briefly describe.

5 Data Analysis

5.1 Discontinuation Behavior Determination

According to the evaluation criteria in Figure 2, 44 health information search discontinuation behaviors were identified, including 16 discontinuations in factual tasks: 3 in SY-10 tasks, 6 in SK-10 tasks, 2 in SK-20 tasks, and 5 in SY-20 tasks; and 27 discontinuations in analytical tasks: 8 in FK-10 tasks, 10 in FY-10 tasks, 4 in FK-20 tasks, and 6 in FY-20 tasks. Non-discontinuation behaviors are determined in the following two situations: (1) The primary condition is not met, i.e., search result scores are 4 points and above; (2) The primary condition is met, but both secondary and participation conditions are not met, i.e., search result scores are 3 points and below, but the ratio of last page to first page browsing time is greater than 50% and the experimenter' s subjective evaluation of search results is satisfied. Taking the FY-10 task as an example, Table 3 lists all 16 observations of this task and the determination results of 10 discontinuation behaviors.

Table 3 FY-10 Observation Data and Discontinuation Behavior Determination

No.	Search Result Score	First Page Browsing Time	Last Page Browsing Time	Ratio	Subjective Evaluation	Discontinuation?
1	2	59.55	25.26	42.4%	Dissatisfied	Yes
2	2	46.18	47.89	103.8%	Satisfied	No
3	1	48.46	48.60	100.3%	Satisfied	No
4	2	55.77	43.20	77.5%	Dissatisfied	No
5	2	52.41	46.71	89.1%	Satisfied	No
6	1	51.62	53.23	103.1%	Satisfied	No
7	1	48.76	55.12	113.1%	Satisfied	No
8	2	45.99	43.02	93.5%	Dissatisfied	Yes

Based on the discontinuation behavior determination results for each task, 1 is assigned for discontinuation behavior occurrence and 0 for non-discontinuation. Similarly, difficult tasks, strict time control, and important tasks are assigned 1, while simple tasks, loose time, and unimportant tasks are assigned 0. Happy, relaxed, and calm emotions (positive/neutral) are assigned 0, while awkward and angry emotions (negative) are assigned 1. Since all research variables are binary, binary logistic regression analysis and chi-square analysis are used below to reveal the formation mechanism of health information search discontinuation behavior under the SSO analysis framework.

5.2 SSO Analysis Framework for Health Information Search Discontinuation Behavior Formation Mechanism

5.2.1 Stressors S-Strain S Analysis To verify the impact of tasks and situations as stressors on health information searchers' emotions, binary logistic regression analysis was conducted on the three categorical data of task complexity, task importance, and time urgency on emotion. The results are shown in Table 4 . The Omnibus test of model coefficients indicates that the model is overall meaningful (p=0.000). In the Hosmer-Lemeshow test, sig=0.711>0.05, indicating high model goodness-of-fit.

Table 4 Stressors S-Strain S Binary Logistic Analysis

Variable	B	Significance	OR	95% CI
Task Complexity	1.740	0.000**	5.696	[2.368, 13.699]
Task Importance	-0.184	0.664	0.832	[0.311, 2.225]
Time Urgency	1.493	0.001**	4.449	[1.860, 10.640]
Constant	-2.442	0.000	0.087	

** p<0.01

The regression results in Table 4 show that the regression coefficient for task complexity as an internal task characteristic is 1.740 and shows significance at the 0.005 level (p=0.000), meaning task complexity has a significant positive impact on the generation of negative emotions among searchers. The regression coefficient for task importance as an external task characteristic is -0.184 but does not show significance (p=0.664>0.05), meaning task importance does not affect the generation of negative emotions among searchers. The regression coefficient for time urgency as a task environmental factor is 1.493 and shows significance at the 0.005 level (p=0.001), meaning time urgency has a significant positive impact on the generation of negative emotions among searchers. Interpretation of the OR values shows that difficult tasks generate negative emotions at 5.696 times the rate of simple tasks, and strict time control generates negative emotions at 4.449 times the rate of loose time. The summary analysis shows that the more complex the task and the more urgent the time, the higher the probability that searchers will be in a negative emotional state, with task complexity having a greater impact than time urgency.

5.2.2 Strain S-Outcome O Analysis To verify the impact of emotion as strain on the outcome of discontinuation behavior, chi-square analysis was conducted on the categorical data of emotion and discontinuation behavior. The results are shown in Table 5 .

Table 5 Strain S-Outcome O Chi-Square Analysis

Emotion	Discontinuation (%)	Non-Discontinuation (%)	Total
Positive/Neutral	11 (12.8%)	75 (87.2%)	86
Negative	33 (78.6%)	9 (21.4%)	42
^{2} = 54.128, p = 0.000**			

** p<0.01

Table 5 shows that there are significant differences in discontinuation search behavior among health information searchers with different emotional states (^{2} = 4.540, p = 0.000 < 0.01). Through percentage comparison, it can be seen that the proportion of search discontinuation behavior when negative emotions occur is 78.6% (significantly higher than the average level of 43.4%), while the proportion of search discontinuation behavior when positive/neutral emotions occur is only 12.8%. This indicates that the more negative the emotional state of health information searchers, the more likely they are to discontinue search, and the probability of search discontinuation behavior occurring under positive/neutral emotional states is lower.

5.2.3 Stressors S-Strain S-Outcome O Analysis Hierarchical regression was used to verify the impact mechanism of tasks and situations as stressors and emotion as strain on health information search discontinuation behavior. The Enter method was used, first regressing task complexity, task importance, and time urgency on discontinuation behavior, then introducing the emotion variable for regression of all variables on discontinuation behavior. The results are shown in the model summaries of Model 1 and Model 2 in Table 6 .

Table 6 Mediating Effect Test of Emotion

Variable	Model 1 (Without Emotion)	Model 2 (With Emotion)
	B	Significance
Task Complexity	0.814	0.039*
Task Importance	-0.753	0.056
Time Urgency	0.839	0.034*
Emotion	-	-
Constant	-0.753	0.056

- p<0.05, ** p<0.01

The summary of Model 1 shows that the total effects of task complexity and time urgency on discontinuation behavior are significant (p=0.039, p=0.034). After introducing the emotion variable, the summary of Model 2 shows that their direct effects on discontinuation behavior become non-significant (p=0.489, p=0.921). At the same time, the regression coefficient for emotion is 3.559 and shows significance at the 0.005 level (p=0.000), indicating that negative emotions have a significant positive impact on discontinuation behavior. Comparing

the total and direct effects before and after the introduction of emotion, it can be considered that the introduction of the emotion variable completely mediates the direct impact of task complexity and time urgency on discontinuation behavior. Model 2 results also show that the regression coefficient for task importance is -1.081 and shows significance at the 0.05 level (p=0.041), meaning task importance has a significant negative impact on the occurrence of discontinuation behavior. The summary analysis shows that the lower the task importance and the more negative the emotion, the greater the probability of health information search discontinuation behavior occurring. Task complexity and time urgency lead to discontinuation behavior through the "transmission"of negative emotions. From the comparison of OR values, the impact of emotion on discontinuation behavior is far greater than that of task importance.

6 Conclusion Analysis

Based on the above analysis results, the formation mechanism model of online health information search discontinuation behavior is constructed as shown in Figure 3 [Figure 3: see original paper].

6.1 Emotion Plays a Completely Mediating Role in Triggering Health Information Search Discontinuation Behavior by Task Complexity and Time Urgency

First, task complexity and time urgency have no direct impact on discontinuation behavior. Compared with general information search, health information search is more difficult. Because health information is highly professional and covers a wide range, there are barriers in expressing needs such as describing conditions. Searchers consume more cognitive resources and face greater challenges, often behaving more cautiously. On the other hand, the quality of health information on the Internet is uneven, with too much redundant, false, or even rumor information in search results. Faced with complex online health information, users' information selection pressure greatly increases, and the path to goals becomes longer and more tortuous, requiring more time consumption. It can be considered that task complexity and time urgency are basic attributes of health information search, and users have a low probability of directly choosing to discontinue search due to task complexity and urgency.

Second, negative emotions will cause health information searchers to give up searching. From the perspective of search behavior stopping rules, A.D. Blay et al. [29] believe that users with different emotions differ in their use of stopping rules. Emotion affects perception. In a negative emotional state, the brain amplifies perception of negatives and is not easily satisfied. The aversion rule for search stopping illustrates this dissatisfaction accumulating to a certain amount, leading to discontinuation behavior. From the perspective of the operation of users' own emotional systems, when negative emotions occur, cognitive dissonance arises between negative emotions and behavior. To balance this cognitive dissonance, people tend to change behavior rather than emotional factors to

maintain cognitive balance. In health information search behavior, users' own decision behavior changes are most likely to be abandoning information activities that cause them negative impact, i.e., from active continuous effort to passive abandonment.

However, task complexity and time urgency are undeniable antecedents of discontinuation behavior. They indirectly promote discontinuation behavior by stimulating negative emotions among health information searchers. The mediating role of emotion in the impact of task and situational factors on discontinuation behavior fully demonstrates the importance of strain in the SSO framework and verifies that the SSO framework has strong explanatory power for search discontinuation behavior.

6.2 Task Importance Directly Affects Discontinuation Behavior

Health information search has stronger goal orientation. Researchers have found that in health information search contexts, information needs are driven by clear or relatively clear motivations [43], such as self-diagnosis and treatment in daily situations, prevention and control dynamics in public health emergencies, and health science popularization. Although core health information needs are diversified and difficult to focus on due to group differences and health status differences, the role of health information search is consistent: to increase people' s health knowledge, reduce disease risk, help users predict diseases, and improve health status, thereby enabling informed decision-making with the assistance of health information, which helps establish good health concepts. In certain specific situations, the health problems that health information search aims to solve are even life-or-death. Therefore, health information search driven by important tasks will most likely experience more persistent search effort, ultimately stopping rather than discontinuing due to "good enough." Not only individual search but also proxy search is like this. Data from Pew Internet surveys show that 57% of users searching for health information have engaged in proxy search behavior to help others search for health information [44]. J.A. Abrahamson et al. [45] point out that proxy searchers have high self-efficacy and, driven by empathy, altruism, and the satisfaction of helping others, show stronger beliefs when searching for health information. They also persist in searching until needs are met rather than giving up easily. Combining these two situations, it can be considered that task importance does not act through the mediation of emotion but directly affects discontinuation behavior. The more important the task, the less likely the search will end with discontinuation.

6.3 Compared with Task Importance, Emotion Has a Greater Impact on Discontinuation Behavior

Among the influencing factors of health information search discontinuation behavior, emotion influenced by task complexity and time urgency is an internal factor that plays a dominant role. A series of studies on the impact of emotional factors on search strategy use and search performance [46-47] provide effective

support for this view. "Query escalation" [48] is one of the manifestations of emotion-dominated search behavior, i.e., the process of users' search terms evolving from common symptoms to serious diseases. Task importance is an external factor for discontinuation behavior, a secondary influencing factor that plays a relatively smaller role. Under negative emotions that trigger discontinuation behavior, users often ignore task importance or reduce their sensitivity to importance perception. The lower the perception, the lower the impact in health information search discontinuation behavior.

In summary, discontinuation behavior is a dynamic and complex process, the result of the game between multiple enabling and inhibiting factors. Among them, enabling factors composed of task internal characteristics represented by task complexity and task situational characteristics represented by time urgency indirectly promote discontinuation behavior occurrence through negative emotion transmission, while inhibiting factors composed of task external characteristics represented by task importance directly inhibit discontinuation behavior. Furthermore, the formation mechanism of health information search discontinuation behavior is specifically explained by cost-benefit analysis: the cognitive barriers brought by task complexity, the pressure brought by time urgency, and the frustration caused by search failure under negative emotions are the behavioral costs of users' health information search. The emotional value of self-identity obtained from completing important health information search tasks, the practical value of increased health knowledge, and the social value obtained from communicating with patients or doctors are collectively called benefits. During health information search, users choose search behavior patterns based on their cognition of search task complexity and time urgency, seeking relative optimal solutions in the process of weighing minimum cognitive effort and maximum benefits. When costs exceed benefits, health information search discontinuation behavior occurs.

Existing research pays far more attention to the occurrence of online health information search behavior than to its ending, and far more to successful search than to failed search. However, discontinuation is search behavior that ends in failure, and related research is extremely lacking. This study reveals the formation mechanism of health information search discontinuation behavior, representing the in-depth development of online health information search behavior research. This granular research will have a positive impact on the construction of search failure research frameworks, the formation of complete research chains for search behavior processes, and the enrichment of health informatics theories.

Although technological progress continuously improves search performance, serious problems such as lack, overload, conflict, narrowing, and misinformation/misleading of online health information force people to face the dilemma of not getting what they need or even getting nothing, ultimately choosing to discontinue search. In this regard, this study also brings some insights. For health information search users, in the context of increasingly strong public demand for health information, facing excessive push, casual sharing, and un-

avoidable online rumors, they should strive to improve their own information literacy and health literacy, strengthen their ability to select, evaluate, and identify health information, always clarify search purposes during the search process, efficiently filter useful information, use decomposed cognitive strategies to reduce task difficulty, learn methods to cope with time pressure, be good at emotion management, exercise search resilience, and try to avoid missing important information due to discontinuation. When necessary, they should seek help from professional medical and health institutions or personnel to improve health information search experience and enhance healthy living levels. For healthcare information platform builders and managers, they should monitor changes in users' emotional states during the search process, attach importance to users' negative emotions, not only find the causes of negative emotions but also use emotional states as important identification features, more accurately interpret and predict discontinuation behavior through algorithm design, and introduce intervention mechanisms. The basic assumption of cognitive behavioral therapy is that human cognition has a particularly important impact on emotion and behavior, and changing health information searchers' cognition to correct their attitudes and behaviors is effective. Therefore, the core of the intervention mechanism lies in changing searchers' cognition of task complexity. Specific measures include more accurately identifying user needs and reducing unnecessary display elements. Generally speaking, high-quality health information is accurate information based on scientific research or expert opinions. It is not only credible but also presented in non-technical terms to reduce users' cognitive load. Reduce unnecessary medical consultation operations and buttons to avoid increasing users' unnecessary time expenditure. When designing web pages, refer to design aesthetics and introduce game elements to enhance the hedonism and fun of search.

Since the behavioral experimental method used in this study cannot avoid the differences between simulated experimental situations and real situations, as well as the limitations of experimental samples, and this study does not consider the moderating effects of demographic factors, personality traits, and network usage preferences, and the emotion factor only distinguishes between positive and negative without considering complex emotions, given the complexity of search discontinuation behavior and the diversification of its causes, subsequent research will incorporate more research variables, conduct more detailed characterization of research variables, and use big data technology to non-invasively obtain and analyze users'long-term actual behavioral data, conduct more precise and novel expansion research to enhance the validity and explanatory power of the model, thereby more deeply exploring the complex patterns behind health information search discontinuation behavior.

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