# Inside the Search Process: Information Seeking from the User's Perspective

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**The article discusses the users' perspective of information seeking. A model of the information search process is presented derived from a series of five studies investigating common experiences of users in information seeking situations. The cognitive and affective aspects of the process of information seeking suggest a gap between the users' natural process of information use and the information system and intermediaries' traditional patterns of information provision.**

## Introduction

Information systems and the intermediaries who manage them traditionally have been driven by a bibliographic paradigm centered on collecting and classifying texts and devising search strategies for their retrieval. This has promoted a view of information use from the system's perspective and has concentrated retrieval on questions that best match the system's representation of texts rather than responding to users' problems. The bibliographic paradigm is based on certainty and order, whereas users' problems are characterized by uncertainty and confusion. There appears to be a gap between the system's traditional patterns of information provision and the user's natural process of information use.

This article describes the information search process (ISP) from the user's perspective as revealed in a series of studies. In the context of this research, the ISP is the user's constructive activity of finding meaning from information in order to extend his or her state of knowledge on a particular problem or topic. It incorporates a series of encounters with information within a space of time rather than a single reference incident. Uncertainty and anxiety are an integral part of the process, particularly in the beginning stages.

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In this context, information seeking is viewed as a process of sense-making in which a person is forming a personal point of view (Dervin, 1983). The individual is actively involved in finding meaning which fits in with what he or she already knows, which is not necessarily the same answer for all, but sense-making within a personal frame of reference. Information from various sources is assimilated into what is already known through a series of choices. Formal organized sources from information systems interact with informal sources from everyday life experiences. The ISP culminates in a new understanding or a solution which may be presented and shared. Evidence of the transformation of information into meaning is present in the products or presentations in which users share their new knowledge with others.

## Research on Information Seeking from the User's Perspective

In a recent survey of research on information needs and use, Dervin and Nilan found that most studies remain constrained by the system's definition of needs with the menu of responses coming from the system's world and not the user's (Dervin & Nilan, 1986). However, research related to human interaction in information systems reveals evidence of a shift in emphasis from concentration on document or text representations and associated search techniques to the study of users in information seeking situations (Belkin & Vickery, 1985; Borgman, 1984). The new approach centers on the user's problem in the process of sense-making, stressing the effectiveness of information retrieval must consider the integration of results into the user's own life as well as the user's evaluation of the usefulness of the information for the resolution of the problem (James, 1983; Hall, 1981; Ingwersen, 1982). The personal meaning that the user seeks from the information becomes as critical a consideration for system design and mediation as the content represented in texts

(Gould, 1983; Hollnagel & Woods, 1983; Dervin, 1982; Bates, 1986).

In order to address the user's problem and to promote communication between the system and the user, an image or model of the user is needed as well as an image or model of the texts represented in the system (Belkin, 1984). Belkin cautions, however, that it is far easier to build a model of the knowledge resource than to build a model of the cognitive and affective aspects of the user and the user's situation. He suggests that the state of the user's problem and the position of the user in the problem treatment process, e.g., formulating problem, problem well specified, etc. be included in this model.

A model representing the user's sense-making process of information seeking ought to incorporate three realms of activity: physical, actual actions taken; affective, feelings experienced; and cognitive, thoughts concerning both process and content. A person moves from the initial state of information need to the goal state of resolution by a series of choices made through a complex interplay within these three realms (MacMullin & Taylor, 1984). The criteria for making these choices are influenced as much by environmental constraints, such as prior experience, knowledge, and interest, information available, requirements of the problem, and time allotted for resolution, as by the relevancy of the content of the information retrieved. According to Bates (1986) the search process, particularly during the entry and orientation phases, is subtler and more complex, on several grounds, than current models assume.

Interaction between the user and the information system may be guided by affective needs as well as by cognitive needs (Wilson, 1981). While purely cognitive conceptions of information need are adequate for some research purposes, consideration of the affective dimension of users problems is necessary for a model to address a wider, holistic view of information use.

## Theoretical Foundation of the ISP

Among cognitive scientists some consensus is emerging about how humans think and find meaning in their world, although much still remains a mystery. People actively and constantly construct their view of the world by assimilating and accommodating new information with what they already know or have experienced. "The organism, with its structures already prepared for stimulation, itself manipulates and otherwise reorders the information it freshly encounters—perhaps distorting the information as it is being assimilated, perhaps recoding it into more familiar or convenient form once it has been initially apprehended" (Gardner, 1985). Since people have a limited capacity for assimilating new information, they purposefully construct meaning by selectively attending to that which connects with what they already know. The active process of forming meaning from information is the task of the user in the ISP. An information search is a process of construction which involves the whole experience of the person, feelings as well as thoughts and actions.

The theoretical basis of this research on the ISP is summarized in Table 1. Kelly's (1963) work on personal construct theory was used as a touchstone for investigating the user's experience in the ISP and for developing a model describing the process from the user's perspective. Kelly depicted the process of construction as occurring in phases experienced by individuals as they build their view of the world by assimilating new information. The phases of construction, as characterized by Kelly, formed the basis of the original hypothesis which led to the examination of affective as well as cognitive aspects of the ISP.

Personal construct theory describes the affective experience of individuals involved in the process of constructing meaning from the information they encounter. New information is assimilated in a series of phases beginning with confusion which increases as inconsistancies and incompatabilities are confronted within the information itself and between it and the constructs presently held. Confusion mounts, frequently causing doubt in the validity of the new information. The disruption caused by the new idea may become so threatening that the new information is discarded and the construction abandoned. At this point, according to personal construct theory, there is another alternative; that is to form a hypothesis that can be tested and assessed in order to move toward incorporating the new construct into the existing system of personally held constructs. Forming a tentative hypothesis is the critical turning point in construing and reconstruing.

Concentrating on cognitive aspects, Belkin and his colleagues (1982) describe the constructive process of information seeking in terms of the ASK (anomalous state of knowledge) hypothesis. An information search begins with the user's problem. The gap between the user's knowledge about the problem or topic and what the user needs to know to solve the problem is the information need. The user's state of knowledge is dynamic rather than static, changing as he or she proceeds in the process. Belkin describes a scale of levels in the ability to specify information need as beginning with a new problem in a new situation in which connections can be made with existing knowledge, and as ending with a defined problem in a well understood situation with an identifiable gap in knowledge. The user's ability to articulate requests to the information system can be expected to change according to his or her level of understanding of the problem. At the lower levels of the specificity scale, questions are most appropriate and experiential needs most apparent. At the upper levels of the specificity scale, requests can be made as commands of informative needs (Belkin, 1980). In

TABLE 1. Theoretical foundation for ISP.

| 1 Phases of Construction (Kelly) | 2 Levels of Need (Taylor) | 3 Levels of Specificity (Belkin) | 4 Expression (Taylor, Belkin) | 5 Mood (Kelly) |
|---|---|---|---|---|
| Confusion | Visceral | Anomalous States of Knowledge | | |
| Doubt | Conscious | New Problem | Questions Connections | Invitational |
| Threat | | New situation | | |
| Hypothesis Testing | Formal | Experiential Needs | Commands Gaps | Indicative |
| Assessing | Compromised | Defined Problem | | |
| Reconstruing | | Well Understood Situation | | |
| | | Informative Needs | | |
| | | Coherent State of Knowledge | | |

the initial stages of a problem specifying precisely what information is needed may be nearly impossible for the user.

Taylor's early work on levels of information need and his more recent writings on value-added information, place the user's cognitive process in the forefront of considerations of information provision (Taylor 1963; 1986). He describes four levels of information need evident in users' queries as: visceral, an actual but unexpressed need for information; conscious, a within-brain description of the need; formalized, a formal statement of need; and compromised, the question as presented to the information system.

Taylor also finds that, in the initial stages of a search, users are most likely to be able to express their need for information in the form of questions which make connections with their existing knowledge. Only in the latter stages, after specific gaps in knowledge have been identified, can users' requests be expected to be expressed in the form of commands for specific information. However, a less straightforward strategy seems to be employed by users in actual information seeking situations. While a continuum may be seen as proceeding from questions, to problems, to sensemaking, there do not seem to be definite boundaries between these activities (MacMullin & Taylor, 1984). An intricately interwoven process comprised of mental, physical, and perceptual activities moves the user toward the goal state of sense-making.

As users move through levels of information need and stages in an information problem, their judgments of relevance also are likely to change, reflecting their personal knowledge of the topic and their understanding of the problem (Saracevic, 1975). What is relevant at the beginning of a search may not be at the close and vice versa. There appears to be some correspondence between judgements of relevancy and levels of specificity.

Affective aspects, such as attitude, stance, and motivation, may influence specificity capability and relevance judgements as much as cognitive aspects, such as personal knowledge, and information content. Kelly describes two attitudes, referred to as moods, which an individual may assume during the phases of construction: invitational, which leaves the person open to new ideas and receptive to change and adjustment according to what is encountered; and indicative, which causes the person to depend on the construct he or she presently holds and to reject new information and ideas (Maher, 1969). An invitational mood may be more appropriate for the user to assume in the early stages of a search and an indicative in the latter. An invitational mood or attitude allows the user to assume a posture of expectancy and enables him or her to take risks and to profit from mistakes. On the other hand, the indicative mood leads to closure by limiting expectations and confining the user to the task at hand.

The relationship of the theories of Kelly, Taylor, and Belkin which provided a frame of reference for investigating users' experiences in the ISP is shown in Table 1. These theories suggest a series of stages with changes in feelings, as shown in the phases of construction; changes in thoughts, as shown in levels of information need and levels of specificity; as well as changes in expression and mood. Although the traditional way to describe a search is by the series of physical actions taken, investigation of users' cognitive thoughts and affective feelings, while more difficult to observe, are essential for defining the ISP.

## Methodology Used for Studying the Affective and Cognitive Aspects of the ISP

This article proposes a model of ISP incorporating affective and cognitive aspects exhibited by users in six

stages based on a series of five studies. The first of these was a small-scale study in a naturalistic setting augmented by case studies, resulting in the development of the model in the ISP (Kuhlthau, 1983). This model was then tested in two longitudinal studies and further verified in two large-scale field studies using more quantitative methods and statistical analysis.

All of the studies were conducted in field situations with actual library users, most of whom were responding to an imposed rather than a personally initiated information need. For the most part, the subjects were students in universities, colleges, and secondary schools who had been assigned a term paper. Approximately 50 of the participants in the most recent study, however, were public library users with personally initiated or job-related problems.

The initial study was a qualitative exploration of the search process of 26 academically capable high school seniors (Kuhlthau, 1983). Two research papers were assigned during the study, one each semester of the school year, in which students were given considerable latitude in selecting their topics. Instruments and methods were developed to reveal aspects of the search process that would otherwise be hidden from an observer. An overlap of data was sought to provide a multilayered description of the students' process. The students kept journals during the first assignment in which they were asked to record their feelings as well as the thoughts and actions related to their library search. During the second assignment, subjects kept search logs in which they recorded sources they used, procedures for finding sources, and whether sources were useful, highly useful, or not useful. Unlike the free writing of the journal, the search log did not offer an opportunity to include feelings. It did, however, provide data on the decisions made on the relevance of the sources consulted during a search and offered another way of examining the progression of thoughts and actions. Participants also were asked to write a paragraph about their topic two weeks after the assignment was made and again after they had submitted their papers. At the end of each assignment in addition to assigning a grade, the teacher characterized each student paper as having a vague, general, or clear focus.

In addition, a questionnaire was administered to examine students' perceptions of six areas of library use: topic selection, research assignments, focus formulation, procedures for gathering information, frequency of library use, and role of mediators. Thirty statements were designed on these areas and intermixed on a questionnaire using a 5-point Likert-type scale.

Case studies of six of the participants were conducted to verify and explain the data collected in the journals, logs, writings, and questionnaires. These subjects were interviewed in 45-minute taped sessions on six separate occasions during the two research assignments. The interviews were designed to examine the particular stage of the process that participants were experiencing at the time. Also, at the end of the first assignment, the six were asked to describe the progression of their search by drawing a timeline including all important decisions. At the end of the second assignment, they were asked to draw flowcharts of the process they had followed.

Through content analysis of the participants' descriptions of their perceptions and experiences in the questionnaires, journals, search logs, and short pieces of writing, as well as the case study subjects' interviews, timelines, and flowcharts, a six-stage model of the search process was developed (Kuhlthau, 1988a). The model was based on the finding that uncertainty, a natural and necessary aspect of the early stages of the ISP, causes discomfort and anxiety which in turn affects articulation of a problem and judgements of relevancy. These findings were in accord with the theories which provided the framework for this research and became the hypothesis for further investigation.

A second study addressed the problem of how these students' perceptions of the ISP had changed after four years of college and how they compared with the model (Kuhlthau, 1988c). The same questionnaire eliciting perceptions, which had been administered to this group in high school was used to provide longitudinal data on their perceptions, with 20 of the original 26 responding. Responses after college were compared with the responses they gave in high school, and statistical significance was determined through *t* Tests.

A longitudinal study also was conducted of the case study participants to offer fuller description of changes in perceptions of the search process over time (Kuhlthau, 1988b). Four of the six original case study subjects were interviewed after four years of undergraduate education in one-hour sessions. In addition, each participant drew a timeline of the process of a search as they commonly experienced it. Their responses and timelines were compared with their high school case studies.

These two studies showed that the model held over time for this select group of students. Further quantitative study was needed to test the model of the ISP with other types of library users. A study of a larger, more diverse population of high school students was planned as well as a large-scale study of users in academic and public libraries.

The fourth study examined the ISP of high, middle, and low achieving high school seniors (Kuhlthau, 1989). The purpose was to verify the model and to address three questions. Do other high achievers experience a process similar to those in the initial sample? Do low- and middle-level students experience a similar process? Does the search process relate to the teachers' assessment of the product?

The study took place in six high schools with 147 seniors in English classes selected as participants. Stu-

dents were identified as high, average, and low achievers by their scores according to national percentiles on standardized tests. A research paper assignment of four weeks' duration was made. Process surveys were administered at three points in the ISP—initiation, midpoint, and closure—eliciting thoughts and feelings at each point. The teachers assessed the students' papers for presence of focus and quantity of sources as well as grading the papers in the usual manner. Statistical analysis was made by using *t* Tests and ANOVA to determine significance, and Pearson product-moment measures to determine degree of correlation and measures of linear regression. The data from the 40 participants identified as low achievers were incomplete and could not be analyzed in the study. There was no significant difference, however, between the high and middle achievers, with the exception of grade; the high achievers received higher grades.

High and middle achieving high school participants showed a significant change in thoughts during the ISP moving from general background, to specific and more narrowed, to clearer and more focused. There was a similar significant difference in their confidence and feelings during the process, with confidence increasing throughout and feelings moving from confused to confident and relieved.

Some evidence of relationship between changes in feelings during the ISP and the outcome of the search was found. Slight correlation was noted between increase in confidence and the teachers' assessment of focus in the papers, shown in Figure 1 and also the grade on the papers, shown in Figure 2. No correlation, however, was found between increased confidence and the quality and variety of the sources used in the papers. According to the model, an increase in confidence corresponds to an increase in clarity and focus in thoughts and may also correspond to evidence of construction or sensemaking. Correlation between increased confidence and the quality of student papers indicates that there may be a connection between process and outcome, an important issue which warrants further investigation. On the other hand, within the context of the model of the ISP, the quality and variety of the sources used may not necessarily indicate construction, i.e., clarification of thoughts. Lack of correlation between the students' use of sources and the teachers' assessment of their papers, although not surprising within the context of this research, does not support the traditional view of information use.

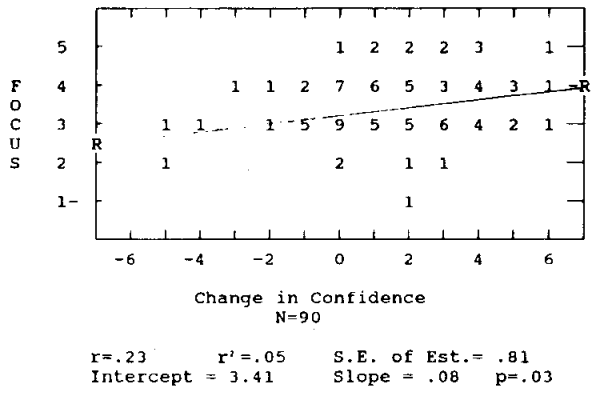


FIG. 1. Correlation between confidence and focus.

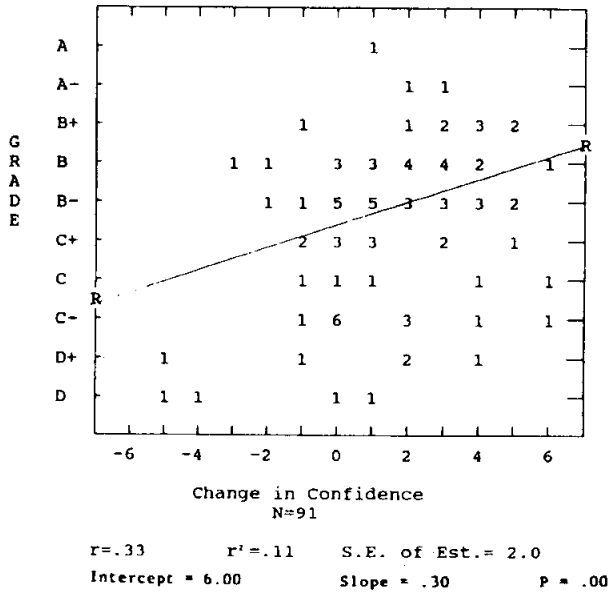


FIG. 2. Correlation between confidence and grade.

The fifth study in this series addressed the problem of validating the model of the ISP in a wider sample of library users. Up to this point, the research had been confined to high school students and a small sample of college students and had not addressed the question of whether there were similar patterns in the process of users in other types of libraries. Further testing of the model of the ISP was conducted in a large-scale study with 385 academic, public, and school library users in 21 sites (Kuhlthau et al., 1989). The instrument employed was a process survey similar to that used in the prior study, revised to include statements taken directly from the original model, which was administered to each participant at initiation, midpoint, and closure. Analysis was made first by descriptive statistics and next by inferential statistics, including measures of significant difference and analysis of variance in Paired *t* Tests, Chi Square, ANOVA, and Scheffe tests.

Findings revealed a similar process across types of library users, with participants seeking background information at initiation, information related to the general topic at midpoint and closure, and with some seeking information on a focused perspective of the topic at closure. Descriptions of thoughts were general and vague at initiation, narrowed and clearer at midpoint, with 50% making focused statements of their perspective of the topic at closure, shown in Figure 3.

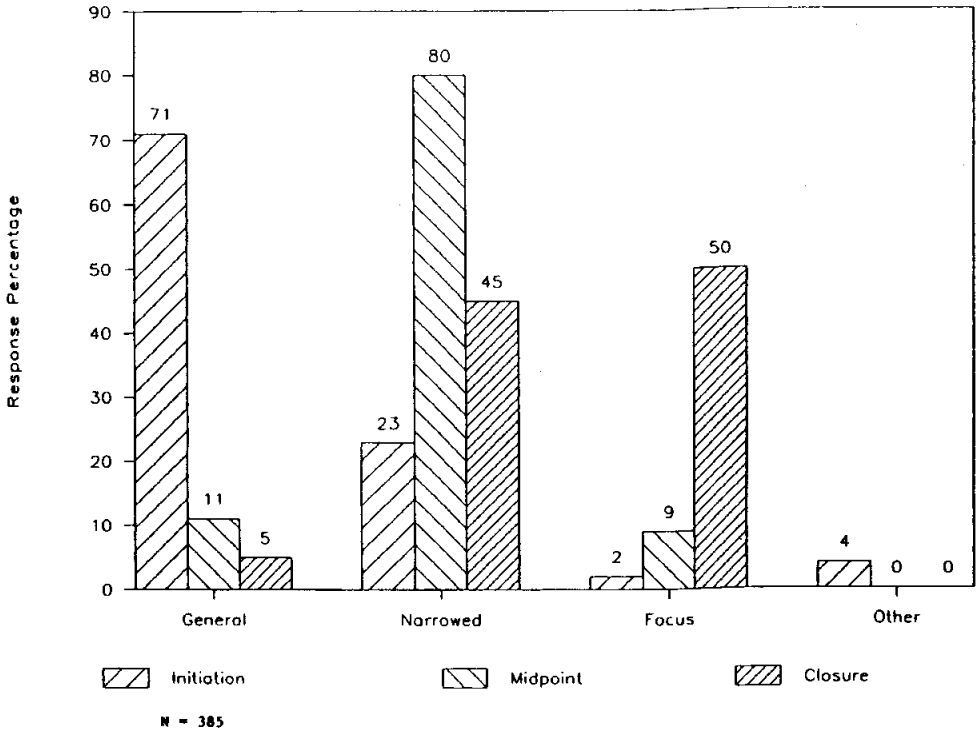


FIG. 3. Comparison of thoughts at initiation, midpoint, and closure.

Confidence increased significantly from initiation to closure, shown in Figure 4. The adjectives most used to describe feelings were confused, frustrated, and doubtful at initiation and satisfied, sure, and relieved at closure.

### Six Stages of the ISP

As shown in Table 2, the model of the ISP incorporates three realms: the affective (feelings), the cognitive (thoughts), and the physical (actions) common to each stage. The task considered most appropriate to move the process on to the subsequent stage is also included. Following is a description of the six stages of the ISP as revealed in the findings of the initial study.

At "initiation," when a person first becomes aware of a lack of knowledge or understanding, feelings of uncertainty and apprehension are common. At this point the task is merely to recognize a need for information. Thoughts center on contemplating the problem, comprehending the task, and relating the problem to prior experience and knowledge. Actions frequently involve discussing possible topics and approaches.

During "selection" the task is to identify and select the general topic to be investigated or the approach to be pursued. Feelings of uncertainty often give way to optimism after the selection has been made and there is a readiness to begin the search. Thoughts center on weighing perspective topics against the criteria of personal interest, assignment requirements, information available, and time allotted. The outcome of each possible choice is predicted and the topic or approach judged to have the greatest potential for success is selected. Typical actions are to confer with others. Some may make a preliminary search of information available, and skim and scan for an overview of alternative topics. When, for whatever reason, selection is delayed or postponed, feelings of anxiety are likely to intensify until the choice is made.

"Exploration" is characterized by feelings of confusion, uncertainty, and doubt which frequently increase during this time. The task is to investigate information on the general topic in order to extend personal understanding. Thoughts center on becoming oriented and sufficiently informed about the topic to form a focus or a personal point of view. At this stage an inability to express precisely what information is needed makes communication between the user and the system awkward. Actions involve locating information about the general topic, reading to become informed, and relating new information to what is already known. Strategies which open opportunities for forming new constructs such as listing facts which seem particularly pertinent and reflecting on engaging ideas, may be most helpful during this time. Strategies which foster an indicative rather than an invitational mood, such as taking detailed notes may thwart the process by seeking premature closure. Information encountered rarely fits smoothly with previously-held constructs and information from different sources commonly seems inconsis-

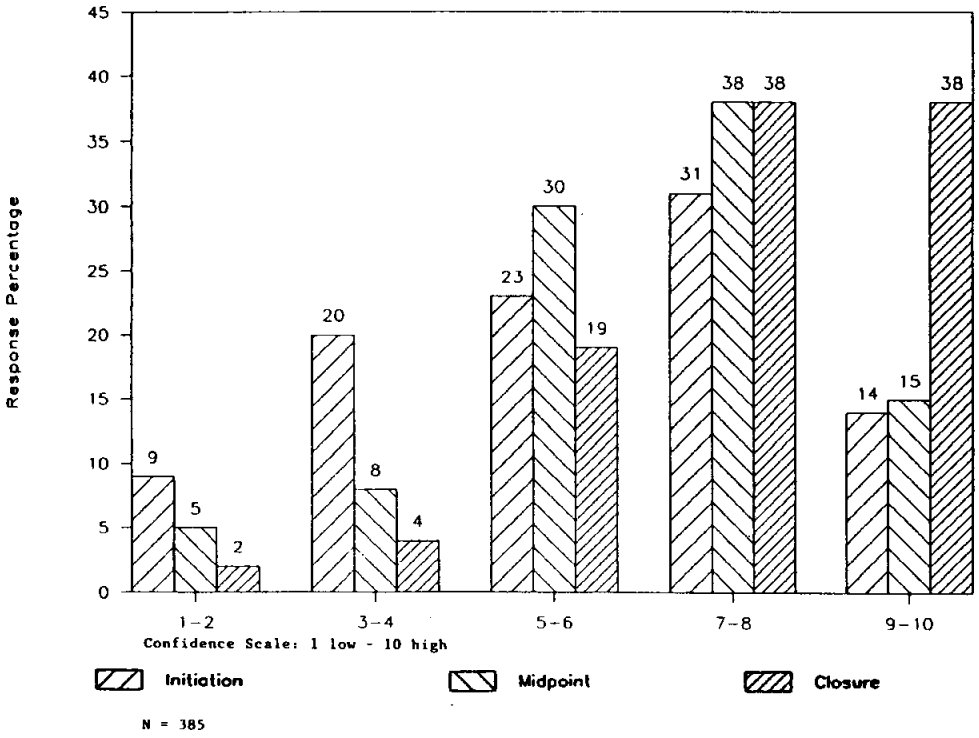


FIG. 4. Comparison of confidence at initiation, midpoint, and closure.

TABLE 2. Information search process (ISP).

| Stages in ISP | Feelings Common to Each Stage | Thoughts Common to Each Stage | Actions Common to Each Stage | Appropriate Task According to Kuhlthau Model |
|---|---|---|---|---|
| 1. Initiation | Uncertainty | General/ Vague | Seeking Background Information | Recognize |
| 2. Selection | Optimism | | | Identify |
| 3. Exploration | Confusion/ Frustration/ Doubt | | Seeking Relevant Information | Investigate |
| 4. Formulation | Clarity | Narrowed/ Clearer | | Formulate |
| 5. Collection | Sense of Direction/ Confidence | Increased Interest | Seeking Relevant or Focused Information | Gather |
| 6. Presentation | Relief/ Satisfaction or Disappointment | Clearer or Focused | | Complete |

tent and incompatable. Users may find the situation quite discouraging and threatening, causing a sense of personal inadequacy as well as frustration with the system. Some actually may be inclined to abandon the search altogether at this stage.

"Formulation" is the turning point of the ISP when feelings of uncertainty diminish and confidence increases. The task is to form a focus from the information encountered. Thoughts involve identifying and selecting ideas in the information from which to form a

focused perspective of the topic. A focus in the search process is comparable to a hypothesis in the process of construction. The topic becomes more personalized at this stage if construction is taking place. While a focus may be formed in a sudden moment of insight, it is more likely to emerge gradually as constructs become clearer. During this time, a change in feelings is commonly noted, with indications of increased confidence and a sense of clarity.

"Collection" is the stage in the process when interaction between the user and the information system functions most effectively and efficiently. At this point, the task is to gather information related to the focused topic. Thoughts center on defining, extending, and supporting the focus. Actions involve selecting information relevant to the focused perspective of the topic and making detailed notes on that which pertains specifically to the focus as general information on the topic is no longer relevant after formulation. The user, with a clearer sense of direction, can specify the need for relevant, focused information to intermediaries and to systems, thereby facilitating a comprehensive search of all available resources. Feelings of confidence continue to increase as uncertainty subsides with interest in the project deepening.

In "presentation" feelings of relief are common with a sense of satisfaction if the search has gone well or disappointment if it has not. The task is to complete the search and to prepare to present or otherwise use the findings. Thoughts concentrate on culminating the search with a personalized synthesis of the topic or problem. Actions involve a summary search in which decreasing relevance and increasing redundancy are noted in the information encountered. Organizing strategies, such as outlining, for preparing to present or otherwise using the information are applied.

### Differences Among the Groups Studied

To summarize the findings of this series of studies on the user's perspective of the ISP, the affective symptoms of uncertainty, confusion, and frustration prevalent in the early stages were associated with vague, unclear thoughts about a topic or problem. As the participants' knowledge state shifted to clearer, more focused thoughts a corresponding shift was noted in feelings of increased confidence and certainty. Satisfaction and relief were common at the conclusion of the ISP.

There were, however, some differences among the groups of library users studied. Comparison of users in three types of libraries revealed some differences in the levels of confidence reported as they progressed through the stages of the ISP. The public library users were more confident at initiation than the academic and school participants. While the academic and school library users indicated similar levels of low confidence at initiation, the college students were significantly more confident at closure than the high school students.

Comparison of the panel of participants when they were in high school and after four years of college revealed certain characteristics of more experienced information users. Significant changes were found in three of the six areas studied: research assignments, focus formulation, and procedures for gathering information. No significant differences were found in perceptions related to topic selection, frequency of library use, and role of mediators. The significant changes in perceptions related to the following expectations: that interest in a topic increases as a search progresses; that a topic changes as information is gathered; that a central theme evolves as information is gathered. In college, participants also showed a decreased emphasis on the card catalog as the only place to initiate a search and increased emphasis on the use of periodicals.

Examination of the case study participants reveals an understanding of the search process and a tolerance for the ambiguity and uncertainty of the earlier stages. They had gained a sense of their own pace in the ISP, expected to be uncertain at the beginning, and had developed tolerance for the early uncertainties in the formative stages. They also showed a sense of ownership in the process and the strategies they used to work through the stages, referring to "my process" and relating "this is the way I do it." While they described experiencing a sequence of stages, they related a somewhat recursive, iterative process in which they moved toward a clearer, focused perspective rather than one that is strictly linear.

For these users, the information search process had become an important way to learn rather than just a means for fulfilling requirements for a course. They showed an awareness of being involved in finding meaning by purposefully engaging in "focusing and narrowing," and in seeking "a thread," "a story," and "answers to all my questions." Discussion of the topics they chose for research assignments showed evidence of molding an imposed task to their own interests, building on prior searches, and developing areas of expertise. Further comparitive study of experienced and inexperienced information users is warranted.

### Differences in Perception of Task

An important finding in the study of three types of library users was that while participants' thoughts and feelings matched the model as anticipated, their identification of task did not, as shown in Table 3. The tasks predicted by the model show a progression from recognizing an information need, to identifying a general topic, to exploring information on a general topic, to formulating a specific focus, to gathering information pertaining to the specific focus, to completing the information search. Most participants, however, limited

TABLE 3. Comparison of tasks in ISP.

| Stages in ISP | Appropriate Task According to Kuhlthau Model | Task as Reported by Study Participants |
|---|---|---|
| 1. Initiation | Recognize Information Need | Gather |
| 2. Selection | Identify General Topic | Gather |
| 3. Exploration | Investigate Information on General Topic | Gather/Complete |
| 4. Formulation | Formulate Focus | Gather/Complete |
| 5. Collection | Gather Information Pertaining to Focus | Complete |
| 6. Presentation | Complete Information Search | Write or Present |

their responses to gathering and completing in all stages with few selecting the more formative tasks at any point in the process. While gathering and completing are traditional information seeking tasks, exploring and formulating may be more compatable with thoughts and feelings commonly experienced in the early stages of the ISP.

In addition, half of the users in academic, public, and secondary school libraries studied did not show evidence of reaching a focused perspective of their topic at any time during the search process. Although a significant change in thoughts was found, only 50% of the participants made focused statements of their topic at the close of their search. Furthermore, while most participants were seeking background information at initiation and information relevant to the general topic at midpoint, at closure only 25% reported that they were seeking information on a focused perspective of the topic, shown in Figure 3. These findings lead to the assumption that many people may enter the presentation or writing phase without clearly, focused topics. In some cases, forming a personal perspective may not be necessary to solve the information problem at hand. For some people, organizing and writing in preparation for presenting may enable them to focus their thoughts resulting in formulation occurring at a later point in the process than indicated in the model. On the other hand, lack of personal perspective may be the result of the notion that the purpose of a search is to reproduce an author's view rather than to make sense within one's own frame of reference, a perception which may inhibit the process of construction during the ISP.

## Implications for Future Research

This research on the ISP is exploratory work which provides insights into methodological issues while opening many questions for investigation. Research on the user's perspective of information seeking requires methods for exploring new issues combined with methods for testing and verifying findings. In these studies the sequence of research questions emerged from the findings of each study and were further investigated through a mix of qualitative and quantitative methods. A combination of methods provided explanation and elaboration underlying commonalities and patterns. The approach used in this research indicates ways to study the more perplexing, user-oriented issues in library and information science.

The basic research questions of why information seekers behave the way they do, which are addressed in this work, produce findings that also have practical application for professional practice of intervention and system design. Following are some issues needing further study.

Further verification of the model of the information search process is needed, particularly examination and comparison across disciplines and between expert and novice users. The question of what changes occur in specificity and relevancy during the ISP needs further study with the prospect of identifying characteristics common to each stage.

Study of users' perception of task in relation to the actual experience in the search process is needed. Indications are that perception of task may not match either level of thinking about a problem or affective experience within the process. A mismatch of perception and experience may increase user's confusion and anxiety in the early stages of a search.

Further investigation needs to be made of information problems which are self-initiated as opposed to those imposed by an assignment. While most of the participants in these studies were students, the sample of public library users which was limited to adults not enrolled in courses, indicate similar patterns in the ISP.

Investigation of search outcome in relation to the cognitive and affective aspects of the process of information seeking is another critical issue emerging from this work. These exploratory findings indicate that correlations between process and outcome may be identified and that construction in the ISP may relate to the product of a search.

Examination of the role of intermediaries and their interaction with users, particularly in the exploratory and formulation stages of the search process is an important area for future research. New patterns of interaction incorporating innovations in filtering, transmitting, and distributing information need to be explored.

Study of how the results of this research apply to system design are needed. Ways to design systems which incorporate the user's perspective and respond to vague requests for orienting and exploratory information in the formative stages in the ISP need further study and development.

## Discussion and Conclusions

The central premise of all this research is that the uncertainty which initiates the ISP causes confusion

and doubt and is likely to be accompanied by feelings of anxiety. These feelings are a function of constructing meaning and are natural in the ISP. Users' anxiety in information seeking situations is well documented (Ford, 1980; Mellon, 1986). Anxiety, however, has usually been associated with a lack of knowledge of information sources and technologies. While unfamiliarity with sources and technologies may indeed cause anxiety, the very nature of the ISP creates a climate for potential anxiety. User uncertainty may be anticipated by systems and intermediaries in order to improve information provision in early formative stages.

Formulation of a focus is a critical concept in the model of the ISP. While a focus rarely takes the form of a formal hypothesis, as depicted by Kelly, a clear formulation reflecting a personal view of the information encountered is the turning point of the search. At this point, confidence increases, confusion decreases, and interest intensifies. The user's ability to specify his or her problem is considerably enhanced after a focus has been formed.

The model of the ISP offers an articulation of users' common experiences which, when shared by the user, the intermediary, and the system, may provide a basis for interaction. The series of stages offers a way to communicate an approximation of common experiences which users have readily acknowledged as accurately describing their process. Although the findings in these studies reveal a more recursive, iterative process than described in the model, the stages summarize users' experiences in ways they can recognize and express. This manner of envisioning and describing the state of the user's problem may lead to radical changes in traditional patterns of filtering information needs. The reference interview, for example, might be adapted to identify unique information needs at each point in the search process.

The education of users of information systems is becoming more important with each technological advance. Merely devising better means for orienting people to sources and technology, however, does not adequately address the issue of uncertainty and anxiety in the ISP. The model of the ISP may be incorporated into user education programs, to enable people to become aware of their own evolving process and understand feelings which affect their information use.

Within the bibliographic paradigm, the message communicated by the information system is that the user's task is to gather and to complete regardless of the state of the problem. The system does not recognize different problem states. The possibility of more exploratory tasks leading to formulating and sense-making are not readily apparent. This is borne out by evidence that although information systems and intermediaries have been fairly successful at providing information in the latter stages of a search, they have not faired nearly so well in the early stages. The "best match" principle serves well after formulation but not before. Systems and intermediaries are presently directed to answering well-defined questions, not ill-defined ones reflecting uncertainty. These systems need to be made more proficient at accommodating a range of tasks in response to the users' articulation of the problem at all stages in the ISP, such as offering preliminary, exploratory, comprehensive, or summary searches according to the state of the user's problem.

This research is unique in that it goes beyond the cognitive aspects of information seeking to examine the feelings users commonly experience. As one participant noted, "Uncertainty is in the head but anxiety is in the pit of the stomach." The whole experience of users affects their information use, their feelings as well as their intellect, particularly in the exploration stage. By neglecting to address affective aspects, information specialists are overlooking one of the main elements driving information use.

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