

Models of Information Seeking Behaviour: A Comparative Study

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Abstract - This study explores a qualitative analysis of information needs and information-seeking behaviour models. The methodology includes a study of various information behaviour models selected randomly, a systematic review of the subject literature and the exploration of relevant qualitative research methods. The paper shows how the different factors influence the information needs of user groups. Different viewers' opinions on various models have been analysed and at the same time the testing groups of each model have also been identified. The study concludes that each model represents a different but also an overlapping or similar approach to information-seeking behaviour research.

Key words: information needs, information behaviour models, qualitative research, testing groups

Introduction

Information can be defined as “what are ought to have for his work, his research, his education, his recreation etc.” Information in technical sense, can be depicted as a sequence of symbols that can be interpreted as a message. H. Shera (1972) defines information as a message, a signal or a stimulus that possesses a response potential. However, Davies (1976) defines information as processed data into a form that is meaningful to the recipient and is of real or perceived value to take present decision or in future. The term information seeking behavior has been developed after the first half of the twentieth century. Thereafter it took several decades for the subject to be presented as a major field of information science. Any analysis of the literature of information-seeking behaviour must be based upon some information behavior models, of which information seeking and information-seeking behaviour are two parts. Information behaviour is meant by the activities of a person that may be engaged in identifying their own needs for information, searching for such information in any way, and using or transferring that information. Information seeking behaviour refers to the way people search for and utilize information. Wilson describes information behaviour as the totality of human behaviour in relation to sources and channels of information, including both active and passive information-seeking, and information use. He also suggests that information seeking behaviour is purposive seeking of information as a consequence of a need to satisfy some goal. During the time of seeking, the individual may consult with formal and informal information sources.

Objectives

The objectives of the present paper are furnished below.

- To get idea about various information behaviour models;
- To make a comparative study of various models of information behaviour;
- To know how the models relate one to another and make an integration between the models;

Methodology of the Study

The models of Information behaviour are numerous. The models that have been developed to date by information scientists are not necessarily applicable to all user groups. The present study is based on the qualitative method and the analysis of few models selected randomly applicable to information users. The data have been obtained from various journals. Here nine models have been studied and evaluated to reach the findings.

Models of Information Seeking Behaviour

Most of the information seeking behaviour models are of variety: they are statements that attempt to describe an information-seeking activity, the causes and consequences of that activity, or the relationships among stages in information-seeking behaviour. Very few models do search advance to the stage of specifying relationships among theoretical propositions, rather, they are at a pre-theoretical stage, but may suggest relationships that might be fruitful to explore or test. Models of information behaviour, however, appear to be fewer than those devoted to information-seeking behaviour or information searching. The models have been discussed one by one.

Wilson's (1981) Model of Information Behaviour

The aim of Wilson's 1981 model shown in figure 1 is to outline the various areas covered by what he proposed as 'information-seeking behaviour' as an alternative to 'information needs'.

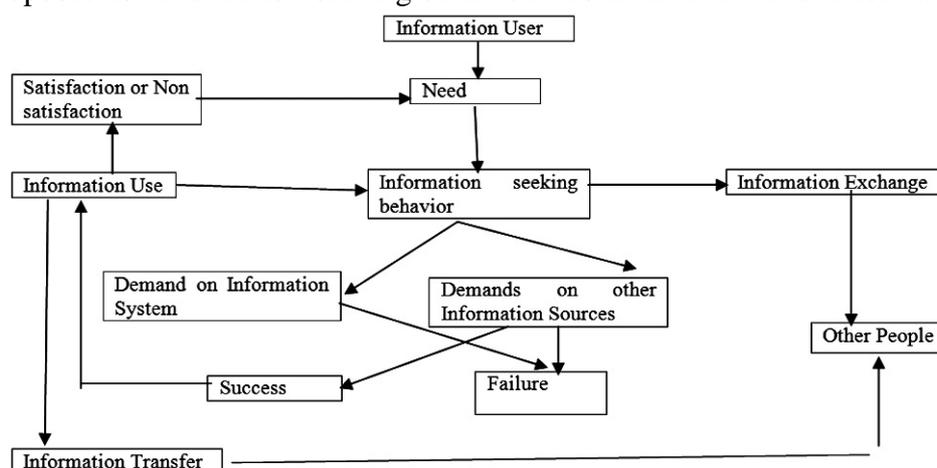


Fig.1: Wilson's information behaviour model

Wilson suggests that information-seeking behaviour arises due to the need perceived by an information user in different stages or sequences. In order to satisfy that need, user makes demands upon formal or informal information sources or services. These demands for information result in success or failure to find relevant information. If the result becomes successful, the individual then makes use of the information found and may either fully or partially satisfy the perceived need or indeed. The model also highlights that part of the information-seeking behaviour may involve other people through information exchange and that information perceived as useful may be passed to other people, as well as being used or instead of being used by the person himself or herself.

Wilson's (1996) Model of Information Behaviour

Wilson made another model which is revision to his 1981 model of information behaviour. In this model shown in figure 2, various cycles of information activities occur, arise from the

information need to the phase when information is being used (information processing and use). The primary structure of Wilson's 1996 model is based on his first one. Here the 'intervening variables' that fall under third group in the picture show how the information-seeking barriers evolve during the needs of information. These are psychological, demographic, role-related or interpersonal, environmental and source characteristics. The 1996 model now also identifies 'information-seeking behaviour' (the fifth group of concepts in the figure), namely passive attention, passive search, active search and on-going search.

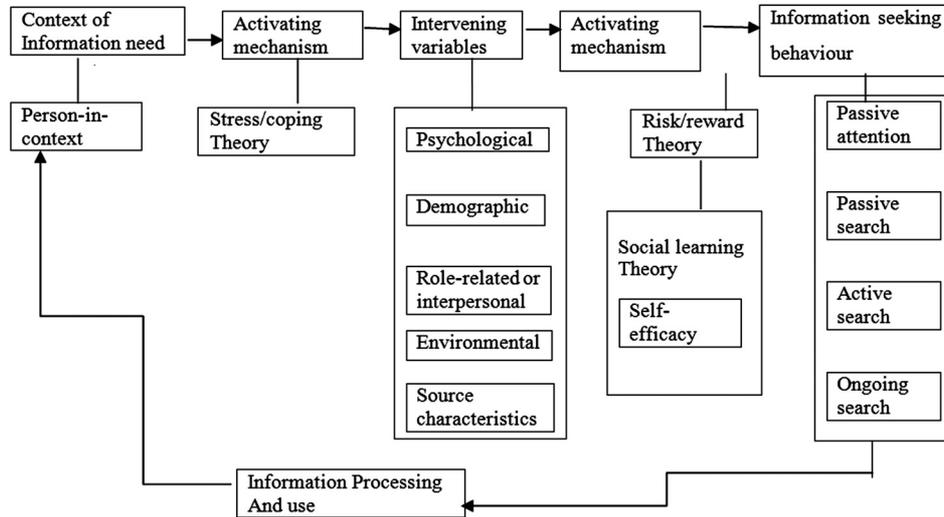


Fig.2: Wilson's (1996) model of information behaviour of information behaviour

The main principle in this revised model is that if information needs are to be satisfied, 'information processing and use' becomes an essential part of the feedback loop shown at the bottom of the model. The 1996 model also presents four relevant criteria as information seeking behaviour to explain users' behaviour. In the second and fourth group of concepts in figure 2.3 these mechanisms are represented as and the stress/coping, risk/reward, social learning theory and 'self-efficacy'. The activating mechanisms are psychological factors which are explained by these different theories and which prompt the user to proceed with the information seeking process. Thus, Wilson identified characteristics of a number of human behaviour models in his model. In this manner, the model draws attention to the interrelated nature of information behaviour theory, whether the theory is drawn from other disciplines or from the research traditions of Information Science. Wilson also incorporated Ellis' "behavioural characteristics" of information-seeking. These characteristics describe information-seeking activities such as "active search" and "ongoing search" while Erdelez's.

Dervin's Model (1983)

Dervin's sense-making theory has developed over a number of years, and can not be seen simply as a model of information-seeking behavior. She indicates this theory as a set of assumptions, a theoretic perspective, a methodological approach, a set of research methods, and a practice' designed to cope with information perceived as a human tool designed for making sense of a reality assumed to be both chaotic and orderly. However, sense-making is implemented in terms of four constituent elements - a situation in which information problems arise; a gap, which identifies the difference between the contextual situation and the desired situation an outcome, that is, the consequences of the sense-making process, and a bridge, that is, some means of closing the gap between situation and outcome. To bridge this gap, individuals seek information to make new sense and use this information to help them in everyday life. The outcome represents the use of information to complete a task. This makes the sense-making experience a holistic experience Situation Gap. Dervin presents these

elements in terms of a triangle factors: situation, gap/bridge, and outcome, which is represented by figure 3.

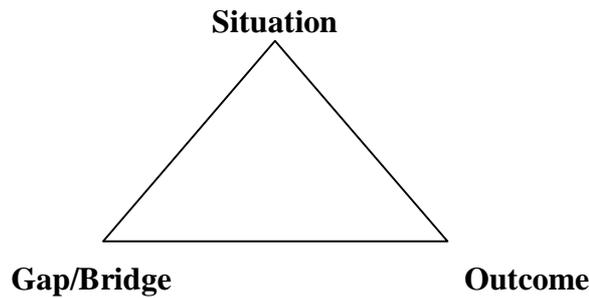


Fig.3: Dervin's 'sense-making' triangle

However, it may be preferable to use the bridge metaphor more directly and present the model in Fig.4 as below. The central activities of sense-making are information-seeking, processing, creating and using. By using the Sense-making approach to study users' information behaviour, researchers are able to discover people's strategies, expectations, attitudes, and anxieties within their lives and work situations(Solomon 1997).

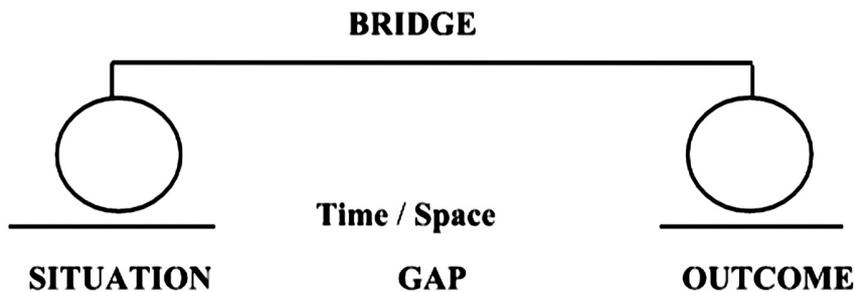


Fig.4: Dervin's sense-making model re-drawn

Sense-making provides a theoretic perspective on information needs, but it is also a methodological approach that could be used to study information usage behaviour.

Cheuk Wai -Yi's (1998) Information-Seeking and Using Process Model

Cheuk Wai- Yi's information-seeking and using (ISU) process model is based on Dervin's Sense-making approach. The model was tested on different professional user groups. Cheuk Wai-Yi developed the ISU process model to illustrate the dynamic and diverse information-seeking behaviour exhibited by each "individual-in-situation". The model states that "human information-seeking and using behaviour" create the situations that prompt the information need. The ISU Process model is made up of the following crucially different situations and information-seeking aspects that form the framework for the identification of information behaviour associated with each ISU situation. The seven situations are: task initiating; focus forming; ideas assuming; ideas confirming; ideas rejecting; ideas finalising; and the passing on of ideas. The information-seeking aspects are: use and choice of information sources, information relevance judgement criteria, information organisation and information presentation strategies, feelings, and definition of information. Cheuk Wai-Yi finds in his theory a relationship between the above mentioned seven situations and information-seeking aspects. The model establishes that people move between the seven ISU situations in multi-directional paths. Cheuk Wai-Yi contends that this makes the process of human information seeking and use systematic and predictable. Cheuk Wai-Yi also determined that although

“people-belonging-to-the-same professional-group” use similar information sources and channels but they do not have the same information needs.

Sandstrom’s (1994) Optimal Foraging Theory

Sandstrom’s (1994) referred the terms “information foraging” as the activities which is connected to assessing, seeking and handling of information sources in the networked environment. The key assumption of this theory is that individuals are motivated by self-interest that is individualism factors are most important. These interests are defined in terms of some specific goal that highlights the content of the individual’s choices. Sandstrom found a continuum of two types of foraging strategies:

- i) Specialists, who focus on a single high-density ‘patch’ of sources encountered via informal communication and draw heavily on sources in their personal collections; and
- ii) Generalists who gather sources from a wide variety of “patches”, a strategy that requires deliberate searching and other labour intensive techniques.

Sandstrom believes that the optimal foraging theory offers a behavioural and quantitative theory or approach for studying a complex social phenomenon. It operationalises concepts such as goals, currencies, alternative strategies and specific tactics in the context of scholars’ pursuit and creation of information. The theory also provides a vehicle and an impetus to formulate and test hypotheses about scholars’ decision-making and environmental constraints.

Blom’s Task Performance Model

A study of the factors that influence the information needs and information-seeking behaviour of consulting engineers within the contexts of problem-solving and decision-making in work situations can also be illuminated by studying Blom’s Task Performance model. Blom’s (1983) Task Performance Model is based on Blom’s research into scientists’ information needs and its use. The theory is based on the following hypothesis:

- the aim of an *information service* is to contribute to successful task performance of the potential users of such a service.
- *information* is an input to problem solving, decision making, planning, any planned activity, or to the increase of knowledge.
- *information needs* or *task performance needs* are the requirements for information to fulfil a certain task.
- the following factors are in interaction with each other:
 - ✓ the purpose, problem area, and methods of the scientific discipline
 - ✓ environmental factors, especially in an employing organisation
 - ✓ the personal attributes of the scientist.

This means that the demands placed on an information service is given precedence over the demands of the user. Figure 5 shows that the task of the scientist is always performed within the context of the scientific discipline; the environment; and the scientist as an individual. The different steps involved in the research process as illustrated in Blom’s model are the problem statement, methodology, data gathering, analysis and synthesis, report and the application in practice. These steps can be equated with the steps in the information process. The most important environmental factors influencing the task performance of the scientist and his information needs are those concerned with the employing organisation. Another

important influence on the mutual exchange of information is interpersonal relations and social intercourse, as well as patterns of friendship within the organisation.

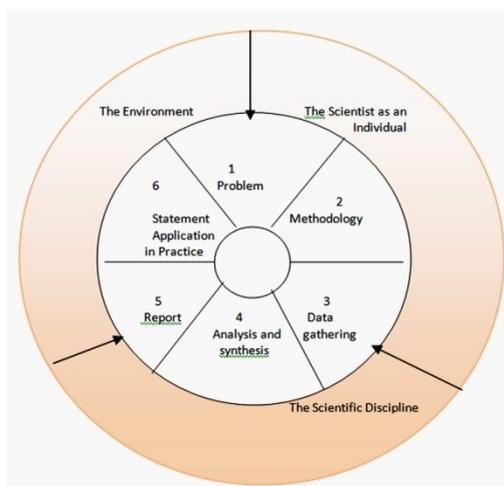


Fig.5: Blom's (1983) scientific communication system

Leckie Et Al's (1996) Model of the Information-Seeking of Professionals

According to Leckie et al this model is a general model, the research scholar decided to group the model with task performance and task based models in work related contexts. Leckie et al focused on how the professional's work roles and tasks influence his or her information seeking behaviour. The study was conducted to examine the information-seeking behaviour of librarians, academics, researchers, doctors, nurses, engineers, lawyers, and many others. She notes that these studies examine how information practices embedded within professional work, how those information-related practices function to contribute to the professional's work, and whether or not those practices can be improved or changed for the better.

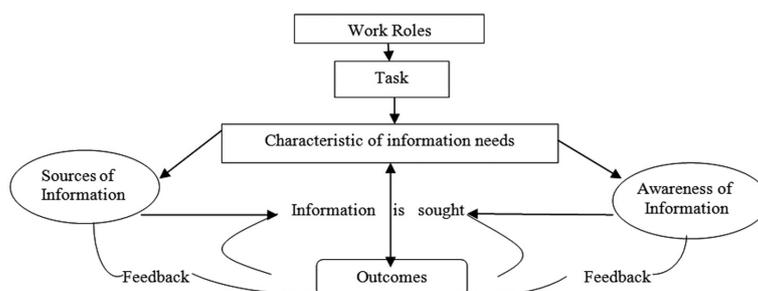


Fig 6: Leckie et al's (1996) model

Fig 6: Leckie et al's (1996) model

The six components of Leckie et al's model are interrelated and dependent on each other. The components are as follows:

Work roles and associated tasks

Professionals lead complicated work lives because they have to play a multiplicity of roles in the course of their daily work, such as, service provider, administrator or manager, researcher, educator, and student. Leckie found that different jobs have to be performed by a single professional. For example, engineers are involved both in an operational unit as well as the supervisory responsibility for those who operate the unit. The impact on the roles

undertaken by engineers could have a bearing on the types of information required and the ways in which such information are sought and used.

Factors influencing information needs

Information needs arise when a person assigns to a specific task that is associated with one or more of the work roles played by the professional. Leckie had found that the information needs of the engineer are determined or characterised by their context, frequency, predictability, importance, and complexity, age, profession, specialisation, career stage, and geographic location.

Factors affecting information-seeking

Leckie *et al.* (1996) clarified various factors that affect the information seeking behaviour. These factors involve the sources of information, an awareness of information and the outcomes of the information-seeking process.

Kuhlthau's Information Search Process

Kuhlthau's information search process (ISP) model in 1991 focuses on two aspects: affective and cognitive during the process of information searching. This ISP of Kuhlthau is a six-stage process of information seeking behaviour in library and information science. Kuhlthau identified the following stages in the information seeking process: (1) task initiation: uncertainty; (2) topic selection: confusion, sometimes anxiety; (3) pre focus exploration: confusion, frustration, sometimes threat and doubt; (4) focus formation: optimism, confidence of ability to complete task; (5) information collection: realization of extensive work to be done, direction, confidence; (6) presentation: relief, sometimes satisfaction and dissatisfaction.

Kuhlthau characterized the first stage, **initiation** as the stage when a person becomes aware that information will be needed to "complete an assignment". This stage of the information seeking process is filled with feelings of apprehension and uncertainty. In the next stage, **selection** where a person has chosen an idea, topic, or problem to proceed. At this point, the person is now less uncertain, and feels a sense of optimism and a readiness to start the information search process. The third stage, the **exploration process**, is when students or information seekers become confused when they encounter "inconsistent or incompatible" information. It is at this point that information seekers may become discouraged, express feelings of doubt and plan of abandoning their search process. Kuhlthau considers this stage as the most difficult stage. The fourth stage namely **focus formulation**, which is considered as the key point, states that a focused perspective is formed, and uncertainty gradually decreases, and clarity is achieved. The information seeker starts to evaluate the gathering information. At this point, a focused perspective begins to form and there is not as much confusion and uncertainty as in earlier stages. Formulation is considered to be the most important stage of the process. The information seeker will here formulate a personalized construction of the topic from the general information gathered in the exploration phase. The fifth stage, **collection** where information seeker gather the information which is relevant to the topic. At this point, the information seeker understands about the direction; he or she must have confidences. Consequently his/her uncertainty diminishes and becomes interested and deeply involved in the search process. At this point, confidence grows in the search process. The sixth stage, **presentation** is when the individual has completed the information search and information seekers prepare to present or use their findings that were found through the process. They experience relief and a sense of satisfaction if the search process is successful or disappointed if they feel that the search was a failure. Kuhlthau states that these stages of

the ISP encompass three aspects - "the affective" i.e feelings, the cognitive, i.e thoughts, the physical, i.e actions.

Initiation		Uncertainty of getting information
Selection		Start the information search process
Exploration process		Inconsistent information.
Focus formulation		Uncertainty decreases
Collection		Confidence grows and uncertainty Diminishes
Presentation		Completed the Search Process, i.e closure of searching

Fig.7: Kuhlthau’s six stages Information Search Process

Ellis’s Behavioural Model of Information Searching Strategies

Ellis studied the activities and perceptions of social science scholars consisting of psychologists, educationalists, economists, sociologists, historians, geographers and political scientists at the University of Sheffield of United Kingdom. From the results, Ellis identified 6 major categories to cover the characteristics of the information seeking patterns of social scientists, namely 1) starting, 2) chaining, 3) browsing, 4) differentiating, 5) monitoring, and 6) extracting. According to Ellis, **starting** refers to seeking information on a new topic and gathering initial relevant information. Starting includes activities that form the initial search for information. These could be familiar sources used before or less familiar sources that can provide relevant information. These initial sources can lead to additional sources or references. Following up on these new leads from an initial source is the activity of Chaining. **Chaining**, as referred by Ellis, refers to following references in a work to its cited works (backward) and finding new citations to this work (forward). Backward chaining occurs when pointers or references from an initial source are followed, while forward chaining identifies and follows up on other sources that refer to an initial source or document. The next category, according to Ellis is **browsing** in which the individual often simplifies browsing by looking through tables of contents, lists of titles, subject headings, names of organizations or persons, abstracts and summaries, and so on. Browsing takes place in many Browsing involves looking through tables of contents, lists of titles, subject headings, names of organizations or persons, abstracts and summaries of the required topic.

Next stage after browsing is **differentiating**, where the information seeker filters and selects from among the sources by taking note of the differences between the nature and quality of the information offered. In this situation the information seeker has the capability to judge whether the information is ready to fulfill his/her needs. **Monitoring**, as described by Ellis is the process of keeping abreast of knowledge about the latest developments in areas of research interests. By monitoring, the information seeker concentrates on core sources of information which may include personal contacts and publications. **Extracting** is the process an information seeker is able to achieve extracting by directly consulting the source, or by

indirectly looking through bibliographies, indexes, or online databases. So in this sequence the information seeking process is supposed to be ended. Two other categories are identified by Ellis, namely; **Verifying** which is checking the accuracy of information and **Ending** which may refer to as 'tying up loose ends' through a final search are also identified.

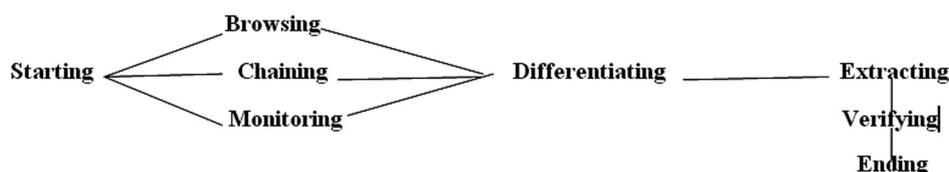


Fig.8: Ellis's Model of Behaviour

Ending

Ellis's model is not only applicable to the academics and researchers, but also the categories may be applicable to other groups of users as well.

Choo's (1998) Behavioural Model of Information-Seeking on the Web

Choo *et al's* (1998) behavioural model of information-seeking on the Web should be regarded as an information retrieval model. The model's name suggests it is a behavioural model. The model also has many elements similar to Aguillar's (1967) modes of environmental scanning. Choo combined and extended Aguilar's modes of environmental scanning and Ellis's information-seeking behaviour model into a new behavioural model of information-seeking on the Web. Choo identified four main modes of information-seeking on the Web: undirected viewing, conditioned viewing, informal search and formal search.

Being a hybrid model based on Ellis (1989) and Aguillar (1967), the Behaviour Model of Information-Seeking on the Web demonstrates the value of using multiple methods to collect data and has the potential to be extended or mapped to other information-seeking activities such as an information search. As such the model now also provides a systematic method to examine the relationship between information needs, search strategies and search tactics.

Evaluation

The different models that seem to be the most relevant models for this study are summarised in the following table. The important outcome of the analysis of Wilson's 1981 model is the recognition that information use had received little attention and, within information science, that statement is still relatively true today. Nor has much attention been devoted to the phenomenon of the informal transfer of information between individuals. The identification of these areas as relatively lacking in research attention demonstrates one of the functions of these models. The limitation of this kind of model, however, is that it does little more than provide a map of the area and draw attention to gaps in research: it does not provide any suggestion of causative factors in information behaviour and, consequently, it does not directly suggest hypotheses to be tested.

Dervin's (1983) Sense-making approach focuses on the need for information experienced by users within the context of their personal situations. This shifts the focus from the information-seeking processes characterised by Ellis, Kuhlthau, and Choo to the user and the context of the user's personal situation. The model highlights the existing gap between an information related problem that constitutes an information need and the information source that could provide the solution to the problem.

Table—Comparison between different models

Model Name	Model Type/Focus	Summary of Model	Test Group	Review
Wilson's Information Behaviour Models (1981 & 1996)	Wilson's model is a static, broad, general summary model	Wilson's Model offers a three-fold view of information-seeking: 1. The context of the seeker. 2. The 'system' employed (which might be manual or machine and navigated either personally or by an intermediary). 3. The information resources that might be drawn upon Wilson developed various models over a period of time.	Not tested	Wilson (1999) Wilson (2000) Case (2002) Niedwiedzka (2003) Ingwersen & Järvelin(2005) Wilson (2005)
Ellis' Behavioural Model of Information-Seeking	Ellis' Model is: 1. A process model. 2. A summary model, not directly suggesting analysable relationships. 3. A general model, claiming applicability and validity over a range of empirical domains	This model identifies eight features of information-seeking behaviour which characterise the information-seeking patterns of social scientists, scientists and engineers: 1. Starting/surveying. 2. Chaining. 3. Browsing. 4. Differentiating. 5. Filtering. 6. Monitoring. 7. Extracting. 8. Ending.	1. Social scientists 2. English literature researchers. 3. Physicists and chemists. 4. Engineers and research scientists in an industrial environment	Ellis (1984) Ellis & Haugan (1997) Wilson (1999) Kalbach (2000) Wilson (2000) Järvelin & Wilson (2003) Meho & Tibbo (2003) Ellis (2005) Ingwersen & Järvelin(2005)
Kuhlthau's Information Search Process (ISP) Model	Kuhlthau's ISP Model is: 1. A process model. 2. An analytical model suggesting a relationship between process stages and feelings, thoughts and actions. 3. A general model	The ISP Model incorporates three realms: the affective (feelings), the cognitive (thoughts), and the physical (actions) common to each stage. The stages of this model are: 1. Initiation. 2. Selection. 3. Pre-focus exploration. 4. Focus formulation. 5. Collection. 6. Search closure	Field studies with actual library users: 1. 26 academic high school seniors. 2. High-, middle-, and low-achieving high school seniors. 3. Longitudinal surveys of the first group.	Kuhlthau (1993) Wilson (2000) Kuhlthau (2004) Kuhlthau (2005) Ingwersen & Järvelin(2005)
Dervin's Sense-making approach	The Sense-making approach is: 1. A process model. 2. An abstract model. 3. A summary model and does not directly suggest analysable relationships. 4. A general model of Ingwersen & Järvelin 5. An information-seeking model 6. A meta theoretic tool	1. The approach consists of: 1.1 A set of assumptions about human reality includes assumptions on moving, process, discontinuity, situationality, gap bridging, and information-seeking. 1.2 A theoretic perspective. 1.3 A methodological approach. 1.4 A set of research 2. The theory implements four constituent elements: 2.1 A situation in time and space. 2.2 A gap between the contextual and the desired situation. 2.3 An outcome - the consequences of the sense-making process. 2.4 A bridge- the means of closing the gap between the situation and the outcome	Professional group tested: 1. Auditors 2. Engineers 3. Architects	Dervin (1983) Cheuk Wai-Yi (1998) Dervin (1998) Cheuk Wai-Yi & Dervin(1999) Wilson (2000) Kuhlthau (2004) Ingwersen & Järvelin (2005) Tidline (2005)
Cheuk Wai-Yi's Information-seeking and Using (ISU) Process Model	ISU Process Model employs the Sense making approach	The model is made up of seven different situations: 1. Task initiating situation. 2. Focus forming situation. 3. Ideas assuming situation. 4. Ideas confirming situation. 5. Ideas rejecting situation. 6. Ideas finalising situation. 7. Passing on ideas situation.	1. Auditors 2. Engineers 3. Architects	Cheuk Wai-Yi (1998)
Sandstrom's Optimal Foraging Theory	The Optimal Foraging Theory is a deductive middle-range theory explaining particular behaviour. It is generalising in approach	Optimal Foraging Theory is a collection of methodologies or heuristic tools to clarify how and why individuals make the strategic choices they do'.	Generically tested on scholars, as if humanists, scientists, and engineers were a single class of information seekers and users	Sandstrom (1994) Choo et al. (1998) Sandstrom (1999) Bates (2002) Jacoby (2005)
Choo's Behavioural Model of information-Seeking on the Web	Behavioural model	It is an extension of Ellis's seeking behaviour. It consists of four main modes: 1. Undirected viewing. 2. Conditioned viewing. 3. Informal search. 4. Formal search	1. Managers. 2. Information technology(IT) specialists. 3. Information specialists.	Choo <i>et al.</i> 1998
Blom's Task Performance Model	Focuses on the research process as the context of information needs and the application of information to satisfy needs	The task performance model sees the scientific discipline, environmental factors, and the scientist as an individual as three groups of variables. Each group affects the task performance of the scientist as well as information needs. There is also a mutual influence of the different groups on each other	Not tested by Blom.	Blom (1983) Gericke (1996)
Leckie et al's General Model of the Information-Seeking of professionals	A general model	Assumes that the roles and associate tasks undertaken by professionals in their daily practice prompt particular information needs, which in turn give rise to the information-seeking process. Information seeking is greatly influenced by a number of interacting variables, which can affect the outcome of information use. The model comprises six components: 1. Work roles 2. Associated tasks 3. Characteristics of information needs and the factors affecting information-seeking 4. Awareness 5. Sources 6. Outcomes	1. Engineers 2. Health Care professionals 3. Nurses 4. Physicians 5. Dentists 6. Lawyers	Leckie, Pettigrew, & Sylvain (1996) Case (2002) Leckie (2005)

Ellis's (1989) model and Kuhlthau's (1993) information process model characterise the information-seeking patterns of information users. This characterisation of the different information-seeking processes such as browsing or monitoring can assist in acquiring an understanding of how engineers go about finding information. Kuhlthau's information search process model is a detailed analysis of the cognitive and affective stages in the active search

for information. The Ellis and Kuhlthau models may be brought together with the merger of the two models. Both the similarities and the differences appear to be that Ellis specifies the modes of exploration or investigation. Ellis does not present his characteristics as stages but as elements of behaviour that may occur in different sequences with different persons or with the same person at different times. Thus, the two models are fundamentally opposed in the search process of information behaviour. Kuhlthau posits stages on the basis of her analysis of information behaviour, while Ellis suggests that the sequences of behavioural characteristics may vary.

Niedzwiedzka (2003) used Wilson's (1996) model of information behaviour as a conceptual framework for a study on the current information needs, preferences and the limitations of Polish health care managers as information users. Niedzwiedzka found that the model is applicable to information users who mainly acquire information through intermediaries. The model also proved not to be general enough to encompass the predominant information behaviour of the group of managers investigated in Niedzwiedzka's study. In Wilson's (2005) view, his 1996 model of information behaviour remains a general model while the inclusion of other human behaviour and information behaviour models makes the model a rich source of hypotheses for further research. Wilson also incorporated Ellis's "behavioural characteristics" of information-seeking. These characteristics describe information-seeking activities such as "active search" and "on-going search". Sandstrom's (1994) optimal foraging theory provides a framework for understanding information gathering behaviour by explaining specific stages in information-seeking behaviours in an online information environment. Cheuk Wai-Yi's (1998) Information-Seeking and Using (ISU) Process model is based on Dervin's (1983) Sense-making approach. The strength of this model lies in the fact that the model stresses the relationship between different situations that participants gather experience in their workplaces and their use and choice of information sources. Choo's (1998) behavioural model of information-seeking on the Web can better explain the information seeking patterns in different information environments such as the business environment and the World Wide Web.

Conclusion

The models of information behaviour focus on the micro-processes in the daily lives of users within particular contexts and social settings that could potentially influence users' information behaviour. The models developed by Ellis and Kuhlthau focus on the different activities involved in the information-seeking process. Dervin's Sense-making approach and Cheuk Wai-Yi's Information seeking and using process model provide for the study of the way in which individuals perceive and bridge cognitive gaps to make sense of their world. An understanding of the sense-making process is very relevant to a study of consulting engineers' information behaviour in their quest to retrieve relevant information that could assist in problem-solving.

The model of the information seeking of professionals developed by Leckie *et al.* is used to provide the framework for a discussion of research findings reported in the subject literature on the information needs and information-seeking behaviour of engineers. As shown above, it is a comprehensive model and when considering the research problem, it also seems to be the best model to systematise the data collected in the current empirical study of consulting engineers. As a method, Sense-making could be invaluable in identifying consulting engineers' specific information needs that arise from their work roles and associated work tasks and in investigating their selection of information sources. Sense-making questioning,

through the use of ‘micro-moment or time-line interviews’ can lead to insights that could influence information service design and delivery.

It is evident from the discussion that each model represents a different in nature but also an overlapping or similar approach to information-seeking behaviour research. Common factors existed in all the models are that information usage is a process involving multiple phases. These phases include the identification of information needs, the decision to use information, selecting and acquiring information sources, finding and gathering, interpreting and processing the information, and putting the information to use. The outcome of the information seeking process is the utilisation of the required information to complete a task.

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