

Models of Information Retrieval

Introduction

By information behaviour is meant those activities a person may engage in when identifying their own needs for information, searching for such information in any way, and using or transferring that information. The Royal Society conference literally thousands of papers and research reports have been produced on user needs, information needs, and information-seeking behaviour.

A model may be described as a framework for thinking about a problem and may evolve into a statement of the relationships among theoretical propositions. Rarely do such models 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.

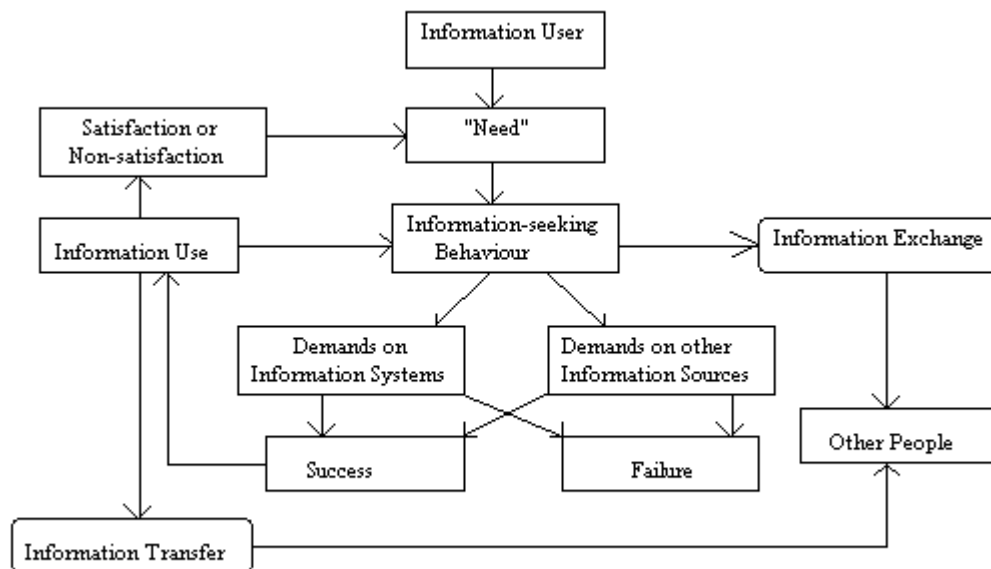


Figure : Wilson's information behaviour model

The aim of this model was to outline the various areas covered by what the writer proposed as information-seeking behaviour, as an alternative to the then common information needs, but it is clear that the scope of the diagram is much greater and that it attempts to cover most of what is included here as information behaviour.

The model suggests that information-seeking behaviour arises as a consequence of a need perceived by an information user, who, in order to satisfy that need, makes demands upon formal or informal information sources or services, which result in success or failure to find relevant information. If successful, the individual then makes use of the information found and may either fully or partially satisfy the perceived need - or, indeed, fail to satisfy the need and have to reiterate the search process. The model also shows 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 by the person himself or herself.

Limitation

This model explains 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 provides no suggestion of causative factors in information behaviour and, consequently, it does not directly suggest hypotheses to be tested.

Wilson, 1981

Wilson's second model of 1981 is based upon two main propositions: first, that information need is not a primary need, but a secondary need that arises out of needs of a more basic kind; and second, that in the effort to discover information to satisfy a need, the enquirer is likely to meet with barriers of different kinds. Wilson proposes that the basic needs can be defined as physiological, cognitive or affective. He goes on to note that the context of any one of these needs may be the person him- or herself, or the role demands of the person's work or life, or the environments (political, economic, technological, etc.) within which that life or work takes place. He then suggests that the barriers that impede the search for information will arise out of the same set of contexts.

This model is shown in a simplified is clearly what may be described as a macro-model or a model of the gross information-seeking behaviour and it suggests how information needs arise and what may prevent (and, by implication, aid) the actual search for information. It also embodies, implicitly, a set of hypotheses about information behaviour that are testable: for example, the proposition that information needs in different work roles will be different, or that personal traits may inhibit or assist information seeking. Thus, the model can be regarded as a source of hypotheses, which is a general function of models of this kind.

The weakness of the model is that all of the hypotheses are only implicit and are not made explicit. Nor is there any indication of the processes whereby context has its effect upon the person, nor of the factors that result in the perception of barriers, nor of whether the various assumed barriers have similar or different effects upon the motivation of individuals to seek information. However, the very fact that the model is lacking in certain elements stimulates thinking about the kinds of elements that a more complete model ought to include.

Wilson,1996

Wilson's 1996 model is a major revision of that of 1981, drawing upon research from a variety of fields other than information science, including decision-making, psychology, innovation, health communication, and consumer research.

The basic framework of the 1981 model persists, in that the person in context remains the focus of information needs, the barriers are represented by intervening variables and information-seeking behaviour is identified. However, there are also changes: the use of the term intervening variables serves to suggest that their impact may be supportive of information use as well as preventive; information-seeking behaviour is shown to consist of more types than previously, where the active search was the focus of attention; information processing and use is shown to be a necessary part of the feedback loop, if information needs are to be satisfied; and three relevant theoretical ideas are presented: stress/coping theory which offers possibilities for explaining why some needs do not invoke information-seeking behaviour; risk/reward theory which may help to explain which sources of information may be used more than others by a given individual; and social learning theory, which embodies the concept of self-efficacy, the idea of 'the conviction that one can successfully execute the behavior required to produce the outcomes'

Thus, the model remains one of macro-behaviour, but its expansion and the inclusion of other theoretical models of behaviour makes it a richer source of hypotheses and further research than Wilson's earlier model.

Ellis

Ellis's elaboration of the different behaviours involved in information seeking is not set out as a diagrammatic model and Ellis makes no claims to the effect that the different behaviours constitute a single set of stages; indeed, he uses the term 'features' rather than 'stages'. These features are named and defined below:

- Starting: the means employed by the user to begin seeking information, for example, asking some knowledgeable colleague;
- Chaining: following footnotes and citations in known material or 'forward' chaining from known items through citation indexes;

- Browsing: 'semi-directed or semi-structured searching' (Ellis, 1989: 187)
- Differentiating: using known differences in information sources as a way of filtering the amount of information obtained;
- Monitoring: keeping up-to-date or current awareness searching;
- Extracting: selectively identifying relevant material in an information source;
- Verifying: checking the accuracy of information;
- Ending: which may be defined as 'tying up loose ends' through a final search.

The strength of Ellis's model as with Kuhlthau's, is that it is based on empirical research and has been tested in subsequent studies, most recently in the context of an engineering company

Of the features, Ellis notes that, '...the detailed interrelation or interaction of the features in any individual information seeking pattern will depend on the unique circumstances of the information seeking activities of the person concerned at that particular point in time' However, it is clear that Starting must initiate a process and that Ending must end it. It also seems reasonable to suggest that Verifying is a penultimate stage in a process and that Extracting must follow on from specific search behaviour such as Browsing. Indeed, drawing attention to this fact, leads to the conclusion that Extracting is not an information behaviour of the same kind as Browsing, or Chaining or Monitoring. It further suggests that Differentiating is also a different kind of behaviour: browsing, chaining and monitoring are search procedures, whereas differentiating is a filtering process and extracting may be seen as an action performed on the information sources

The remaining behaviours do not necessarily take place in a specific sequence and may be initiated in different sequences at different times in the overall search process. Ellis's account, therefore, in terms of the different kinds of features it embodies, appears to sit between the micro-analysis of search behaviour (starting, chaining, extracting, verifying, ending) and a more macro-analysis of information behaviour generally (browsing, monitoring, differentiating).

Kuhlthau, 1991

Kuhlthau's work complements that of Ellis by attaching to stages of the 'information search process' the associated feelings, thoughts and actions, and the appropriate information tasks. This association of feelings, thoughts and actions clearly identify Kuhlthau's perspective as phenomenological, rather than cognitive. The stages of Kuhlthau's model are Initiation, Selection, Exploration, Formulation, Collection and Presentation. As an example, the Initiation phase of the process is said to be characterized by feelings of uncertainty, vague and general thoughts about the problem area, and is associated with seeking background information: the 'appropriate task' at this point is simply to 'recognize' a need for information. The remaining appropriate tasks are: Identify - that is, fix the general topic of the search; Investigate, or search for

information on that general topic; Formulate - focus on a more specific area within the topic; Collection, that is, gather relevant information on the focus; and Complete - end the information search.

Kuhlthau's model is thus more general than that of Ellis in drawing attention to the feelings associated with the various stages and activities. In this regard, Kuhlthau acknowledges her debt to Kelly's personal construct theory, which '...describes the affective experience of individuals involved in the process of constructing meaning from the information they encounter.' The fundamental proposition is that the feelings of uncertainty associated with the need to search for information give rise to feelings of doubt, confusion and frustration and that, as the search process proceeds and is increasingly successful, those feelings change: as relevant material is collected confidence increases and is associated with feelings of relief, satisfaction and a sense of direction.

In effect, what Kuhlthau postulates here (and confirms by empirical research) is a process of the gradual refinement of the problem area, with information searching of one kind or another going on while that refinement takes place. Thus, a successive search process is implicit in Kuhlthau's analysis of the search activity. Although Kuhlthau's early work was a series of longitudinal studies of high school students, more recently she has shown the applicability of the model to the work of a securities analyst

It is interesting to explore whether the Ellis and Kuhlthau models may be brought together, and this is attempted in Figure 6 below, where my representation of Ellis's categories is accompanied by the stages of Kuhlthau (the latter in *italic*):

Through this merger of the two models, we can see strong similarities and the major difference appears to be that Ellis specifies the modes of exploration or investigation. The point must be reiterated, however, that 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 minds of the authors: Kuhlthau posits stages on the basis of her analysis of behaviour, while Ellis suggests that the sequences of behavioural characteristics may vary.

Ingwersen's cognitive model

From the perspective of the interaction of users with IR systems. Ingwersen's cognitive model which '...concentrates on identifying processes of cognition which may occur in all the information processing elements involved.

Ingwersen's model is slightly simplified. When we examine this model, we can see its close family resemblance to other models of information seeking behaviour. In particular, the elements user's cognitive space and social/organizational environment,

resemble the person in context and environmental factors specified in Wilson's models and the general orientation towards queries posed to an IR system point to a concern with the active search, which is the concern of most information-seeking models. Ingwersen, however, makes explicit a number of other elements: first, he demonstrates that within each area of his model, the functions of the information user, the document author, the intermediary, the interface and the IR system are the result of explicit or implicit cognitive models of the domain of interest at that particular point. Thus, users have models of their work-task or their information need, or their problem or goal, which are usually implicit, but often capable of explication. Again, the IR system is an explication of the system designer's cognitive model of what the system should do and how it should function.

Secondly, Ingwersen brings the IR system into the picture, suggesting that a comprehensive model of information-seeking behaviour must include the system that points to the information objects that may be of interest to the enquirer.

Thirdly, he shows that various cognitive transformations take place in moving from the life-world in which the user experiences a problem or identifies a goal to a situation in which a store of pointers to information objects can be satisfactorily searched and useful objects identified.

Finally he points to the need for these models or cognitive structures and their transformations to be effectively communicated throughout the 'system', which will include the user, the author and the IR system designer.

Thus, Ingwersen's model, to a degree, integrates ideas relating to information behaviour and information needs with issues of IR system design, and this, together with the focus on cognitive structures and the idea of polyrepresentation, is an important strength of the model.

Conclusion

The various models of information behaviour, information-seeking behaviour and information searching represent different aspects of the overall problem: they are complementary, rather than competing. The key questions are: Specifically, in the case of information-searching behaviour; how does knowledge of modes of information-seeking behaviour aid our understanding of the search process, if at all? The answer of the question might best focus on that take a view of information searching as a complex process embedded in the broader perspective of information-seeking behaviour, and information behaviour in general, rather than on the micro-level of analysis that is typical of the dominant paradigm of information retrieval research.

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