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Modeling the interplay of information seeking and information sharing

A conceptual analysis

Reijo Savolainen
Department of Information Technology and Communication Sciences, Tampere University, Tampere, Finland

Abstract

Purpose – The purpose of this paper is to contribute to the creation of a holistic picture of information behavior by examining the connections between information seeking and sharing.
Design/methodology/approach – Conceptual analysis is used to focus on the ways in which the researchers have modeled the interplay of information seeking and sharing. The study draws on conceptual analysis of 27 key studies examining the above issue, with a focus on the scrutiny of six major models for information behavior.
Findings – Researchers have employed three main approaches to model the relationships between information seeking and sharing. The indirect approach conceptualizes information seeking and sharing as discrete activities connected by an intermediating factor, for example, information need. The sequential approach assumes that information seeking precedes information sharing. From the viewpoint of the interactive approach, information seeking and sharing appear as mutually related activities shaping each other iteratively or in a cyclical manner. The interactive approach provides the most sophisticated research perspective on the relationships of information seeking and sharing and contributes to holistic understanding of human information behavior.
Research limitations/implications – As the study focuses on information seeking and sharing, no attention is devoted to other activities constitutive of information behavior, for example, information use.
Originality/value – The study pioneers by providing an in-depth analysis of the connections of information seeking and information sharing.

Keywords Human Information Behaviour, Information sharing, Information seeking,
Models for information behaviour, Conceptual analysis,
Connection of information seeking and information sharing

Paper type Conceptual paper

Introduction

Human information behavior (HIB) is a complex phenomenon constituted by activities such as information seeking, information use and information sharing (Wilson, 2000). Most HIB models developed so far focus on information seeking, while there is a paucity of frameworks conceptualizing the issues of information sharing (Wilson, 2010b). On the other hand, the conceptual growth in HIB research is hampered by the fact that researchers tend to focus on the development of separate models depicting diverse aspects of information behavior (Case and Given, 2016, pp. 141-175). Less attention has been devoted to the construction of integrative models specifying the relationships of components constitutive of HIB, for example, information seeking and sharing.

The present study contributes to information behavior research by scrutinizing how HIB models developed so far have conceptualized the interplay of information seeking and sharing. Moreover, an attempt will be made to assess the strengths and weaknesses of such

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models from the perspective of the increasing significance of the networked information environments in HIB. Particularly social media platforms such as Q&A sites and online discussion forums provide new opportunities for the combination of information seeking and sharing because an individual can act in double roles as a seeker and provider of information. Therefore, one of the tasks of the present study is to reflect the extent to which the HIB models developed so far would be relevant for the conceptualization of the interplay of information seeking and sharing occurring in interactive online forums.

Information seeking is a multi-faceted phenomenon that has been modeled in diverse contexts ranging from work task (WT) performance (Leckie *et al.*, 1996) and learning (Kuhlthau, 2004) to health (McKenzie, 2003) and leisure (Hartel, 2006). The analysis of HIB models is complicated due to various terms used in studies on information seeking. For example, terms such as information acquisition and information search are often used interchangeably with information seeking. The terminology can be clarified by making use of Wilson's (2000, pp. 49-50) nested model of information behavior. In this model, HIB is posited as an umbrella category covering all aspects of human information interactions with various forms of information. A subset is information seeking behavior, which encompasses the range of ways employed in discovering and accessing information resources (both humans and systems) in response to goals and intentions. Information searching behavior is a subset of information seeking – a micro-level behavior – referring to the purposive actions involved in interacting with an information search system, including information retrieval (IR) systems and the Word Wide Web (WWW). The present study uses the term information seeking in the above sense. For the sake of simplicity, the terms information seeking and its subset, i.e. information search will be used interchangeably. Similarly, for the sake of terminological simplification, the term information acquisition is understood as a synonym with information seeking.

There is also terminological variation in studies on information sharing. The term information sharing is preferred in library and information science in particular, while researchers coming from fields such as management science, strategic management and human–computer interaction favor the term knowledge sharing (Savolainen, 2017b). The present investigation prefers the term information sharing because it is a natural counterpart of information seeking. Moreover, the HIB models examined in the present investigation conceptualize the phenomena of information seeking, not "knowledge seeking." Information sharing is approached a set of activities by which information is provided to others, either proactively or upon request (Sonnenwald, 2006). There are two major perspectives on the study of information sharing. On the one hand, it can be understood as a one-way communication process in which information is transferred or disseminated from a sender to recipients (Haythornthwaite, 2010). On the other hand, information sharing can be conceptualized as a two-way communication process in terms of mutual information exchange occurring within small groups or online communities (Burnett, 2000; Pettigrew, 1999).

In HIB research so far, information seeking and information sharing have mainly been examined as separate activities. On the other hand, there are empirical studies reviewing both information seeking and information sharing but leaving open the question about their relationships (e.g. Chatman, 1992; Fleming-May and Miller, 2010; Khoir *et al.*, 2015; Murgatroyd and Calvert, 2013). The present study fills gaps in HIB research by conducting a conceptual analysis of the ways in which researchers have modeled the connections of information seeking and sharing. In the study of the above issues, the analysis of HIB models is particularly important because they explicate most clearly the relationships between information seeking and sharing.

To give background, the paper first characterizes the nature of HIB models, followed by the specification of research questions and methodology. The findings section reviews three major

approaches to modeling the relationships of information seeking and sharing: indirect, sequential and interactive. The final sections discuss the research findings and draw conclusions of their significance to HIB research.

The features of HIB models

Scientific models are constructs that represent a phenomenon, covering all relatively stable and general features of the world that are interesting from a scientific point of view (Frigg and Hartmann, 2012). Models therefore simplify complex reality in order to make it understandable. Empirically validated models can be referred to as theories. However, so far, there is no consensus among researchers about the existence of genuine, empirically validated (explanatory) theories of HIB (Case and Given, 2016, pp. 183-187; Cole, 2013, pp. 14-19; Wilson, 2016). For this reason, the present study uses the term HIB model while referring to conceptualizations specifying the connections of information seeking and sharing.

Wilson (2010a, p. 2392) identified two major types of scientific models relevant to HIB research. Textual models are based on the description of a set of theoretical propositions in words. For example, Ellis (1989) developed a model for information seeking by characterizing the features of diverse information activities such as starting, chaining and monitoring. Models can also be graphical in nature; in this case, diagrams or flow charts may be used to depict the relationships of concepts (e.g. Meho and Tibbo, 2003). Many models of HIB include both a textual and graphic representation so that diagrams are used to express actual or theoretical relationships, or ideal processes of interaction with information (Wilson, 2010a, p. 2393). The components of such models may include, for example, the information user, the context of information seeking and the information resources available to the user.

Research questions

Previous studies have reviewed the nature of diverse models for information behavior (e.g. Case and Given, 2016, pp. 141-175) or scrutinized the features of individual frameworks such as Ellis's (1989) model for information seeking (Savolainen, 2017a). However, so far, we lack investigations examining how information seeking and information sharing are related as key activities of HIB. The present study fills gaps in HIB research by addressing the following research questions:

RQ1. In which ways have researchers conceptualized the interplay of information seeking and information sharing in the models for HIB?

RQ2. What are the main strengths and weaknesses of such models for the study of information seeking and sharing occurring in the networked information environments in particular?

The focus of the study was strengthened by excluding investigations examining the relationships of knowledge seeking and knowledge sharing (e.g. He and Wei, 2009). This is mainly due to that the number of relevant studies preferring the above terms appeared to be low. Investigations of this type seldom reflect how knowledge seeking and knowledge sharing are related; the emphasis is placed almost exclusively on the latter activity. Moreover, models for collaborative information behavior (CIB), including collaborative information seeking (e.g. Shah, 2012) and social search (Evans and Chi, 2010; Shah, 2017) were excluded from the study. It is evident that due to space restrictions alone, the analysis of the ways in which CIB models have approached the interplay of information seeking and sharing would require a separate study.

Research material and analysis

To identify relevant literature, key studies reviewing the conceptualizations of information seeking and sharing were scrutinized (Case and Given, 2016, pp. 141-175; Pilerot, 2012;

Wilson, 2010a; Wilson, 2010b). To substantiate the research material, four major databases were searched in autumn 2018: EBSCO Academic Search Premier, Google Scholar, Library and Information Science Abstracts and Scopus. Queries used in the searches included, for example, "information seeking AND information sharing," "information searching AND information sharing" and "information seeking AND information exchange." These efforts resulted in the identification of 60 items relevant to the research topic. After having excluded redundant studies mainly reviewing the findings of previous investigations, the final sample included 27 studies examining the interplay of information seeking and information sharing. The focus was placed on the scrutiny of six major models specifying the connections of information seeking and sharing: Du (2014); Krikelas (1983); McKenzie (2003); Rioux (2005); Robson and Robinson (2015) and Wilson (1981, 1999).

Conceptual analysis is a method that treats the components of the study objects as classes of objects, events, properties or relationships (Furner, 2004). The analysis involves defining the meaning of a concept and its attributes by identifying and specifying the contexts in which it is classified under the concept in question. To conduct the conceptual analysis, relevant text portions (paragraphs and sentences) characterizing the main objects of the study, that is, information seeking and information sharing were identified. Second, their properties – named as constituents – were identified; constituents of this kind include, for example, work-task oriented information seeking (Du, 2014), information seeking by proxy (McKenzie, 2003), information transfer (Wilson, 1999) and sharing information encountered for others (Erdelez and Rioux, 2000). Third, it was examined how researchers have defined and described such constituents. Fourth and most importantly, the analysis was concentrated on the ways in which the relationships between diverse constituents of information seeking and sharing have been conceptualized in the above models. To this end, the diagrams and texts explaining them were scrutinized in order to identify similarities and differences between diverse conceptualizations modeling interplay of information seeking and sharing.

Findings

The conceptual analysis indicated that researchers have modeled the interplay of information seeking and sharing in three major ways. First, information seeking and sharing are approached as discrete activities that are connected by an intermediating factor, for example, information use. Second, the relationships of the above activities are approached in terms of a sequential connection: information seeking occurs first, followed by information sharing. Third, the relationship is approached as an interactive connection: information seeking and sharing affect mutually each other. The prefix inter means "between," "among," "in the midst of," indicating something that is happening between two or more distinct things (Latham, 2014, p. 548). Therefore, the term interactive has dualistic overtones, suggesting the information seeking and sharing are separate and distinct entities on one another. The approaches are illustrated in Figure 1.

Figure 1 is schematic because the nature of the connections is not specified; they are merely labeled to provide an introductory view. Moreover, for the sake of simplicity, interactive connection is depicted without devoting attention to the fact that the interactions may entail several rounds or cycles. The findings will be presented by starting with the analysis of studies characterizing the indirect connection. Consequently, this viewpoint is labeled as the indirect approach. The analysis continues by the review of the sequential approach, followed by the examination of the interactive approach.

Indirect approach

The indirect approach conceptualizes information seeking and sharing as discrete activities that are connected through intermediating factors such as information use and information need.

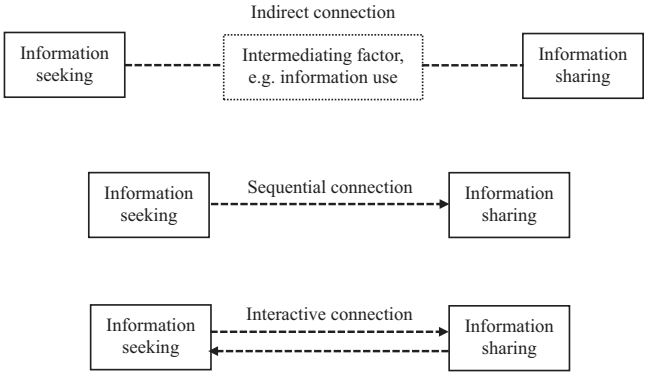


Figure 1.
Approaches to the connections of information seeking and sharing

One of the earliest attempts to characterize the connections of information seeking and sharing from this perspective was made by Wilson (1981) in an article characterizing the field of user studies and the nature of information needs. To illustrate the interrelationships among concepts employed in user studies Wilson (1981, p. 4) presented a diagram. Later on, Wilson (1999) slightly modified the diagram and proposed a model of information behavior shown in Figure 2.

The model suggests that a particular need leads a user to seek access to information systems such as libraries or other information sources. If information is found, it can be used and may fully or partially satisfy the perceived need, or it may fail to do so, in which case the user may look for further information. A person may also seek information from other people and this is termed in Figure 2 as information exchange. Wilson (1999, p. 251) preferred the above term in order to draw attention to reciprocity as a fundamental aspect of human interaction occurring in face-to-face information seeking.

In Wilson's model, information sharing is approached in terms of information transfer, thereby suggesting a one-way transmission of information from a user to recipients referred to as "other people." Information thus transferred draws on the use of information sought from sources of various types. The interplay of information seeking and sharing is

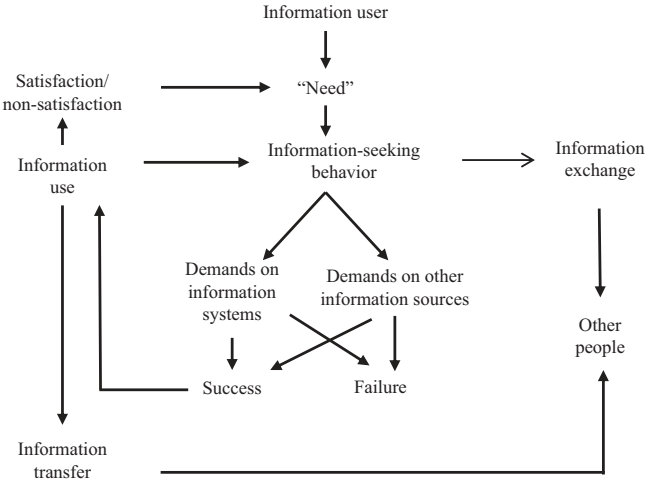


Figure 2.
Model of information behavior

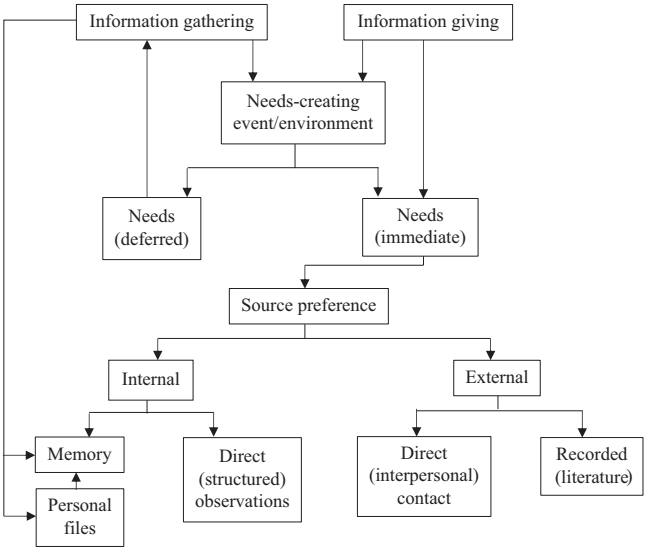
Source: Wilson (1999, p. 251)

characterized by adopting an indirect approach so that the category of information use is posited as an intermediating factor. Information acquired from information systems and information sources is used (interpreted) in some way. Information perceived as relevant may be used by the person himself or herself; information may also be passed (transferred) to other people. On the other hand, Wilson's model does not provide a pure example of the indirect approach because there are elements of the sequential approach, too. This is because information sharing (depicted as information transfer) is preceded by information use. As a whole, however, the sequential viewpoint is secondary and Wilson himself does not emphasize this aspect in the explication of the model.

The model for information-seeking behavior developed by Krikelas (1983) provides another example of the indirect approach. In his model, the category of need functions as an intermediating factor that triggers information seeking and sharing (see Figure 3).

Krikelas (1983, p. 18) labeled information activities associated with satisfying immediate needs as information giving – a category describing "the act of disseminating messages." In turn, activities associated with satisfying deferred needs are referred to as information gathering dealing with the "acceptance and holding of stimuli […] in storage to be called on demand. Such efforts may have a purpose (directed but not problem-specific)" (Krikelas, 1983, p. 9).

Despite the above specifications, the connections of information giving, i.e. information sharing denoting one-way communication from senders to recipients, and information gathering, i.e. information seeking remain somewhat vague. Similar to Wilson's (1999) model reviewed above, information seeking and sharing are linked by a third factor. Different from Wilson's framework, the intermediating factors is need, either immediate or deferred. The two-pronged arrow depicted in Krikelas's model suggests that needs of these kinds can shape each other in the context of needs-creating events or environments. Nevertheless, it remains unclear how the interaction of needs affects information seeking and sharing. They are characterized as discrete activities; as a whole, the picture of their connection remains vague.



Source: Krikelas (1983, p. 17)

Figure 3.
The model of information seeking behavior

As the above models were developed in a pre-internet era, it is evident that they are less suitable for the conceptualization of information seeking and sharing occurring in networked information environments. Krikelas (1983) emphasized the role of traditional sources of information such as memory, other people, personal files and recorded literature. Wilson's (1999) model is more flexible in this regard because the component of "other information sources" may also incorporate information resources available in the internet. Interestingly, Wilson (1999, p. 258) echoed the future developments by stating that IR systems could become genuine tools for collaborative work. Thinking the new type interplay of information seeking and sharing in the context of collaborative work, Wilson drew attention to a pertinent issue by pointing out that "the potential for this has been made real by the development of the internet and by modern software tools that allow the 'desk-top' to act as the interface to the internet and World Wide Web." This perspective suggests the need to develop the models drawing on the indirect approach. However, the lack of newer models of this kind evidences that researchers have shifted their interest to conceptualizations that more tightly connect information seeking to information sharing.

Sequential approach

An alternative way to conceptualize the interplay of information seeking and sharing departs from the assumption that the former activity precedes the latter. One-way connection of this kind suggests that information has first to be sought or acquired before it can be shared to others. An early example of this approach is provided in Allen's (1977) study on information sharing among engineers. According to Allen (1977), the gatekeeper takes the responsibility to look for information and forward it to colleagues in his or her team or organization.

More recently, the sequential approach has been used in studies characterizing information encountering. According to Erdelez (2005, p. 180), encountering can be understood as "an instance of accidental discovery of information during an active search for some other information." Erdelez and Rioux (2000) introduced other relevant categories for the characterization of the connection of information seeking and sharing, that is, sharing information encountered for others, and sharing information found for others on the Web. The elaboration of the above concepts resulted in the development of the model for Information Acquiring-and-Sharing (IA&S) (Rioux, 2004, 2005). Different from the models reviewed above, Rioux (2005) did not present his framework by means of a diagram; only a textual description is provided. In general, IA&S refers to a set of combined behaviors and processes in which an individual:

- cognitively stores representations of other people's information needs;
- recalls those needs when acquiring (in various contexts) information of a particular type or quality;
- makes associations between the information that a person acquired and someone he or she knows who needs or wants this information; and
- finally shares this information in some way.

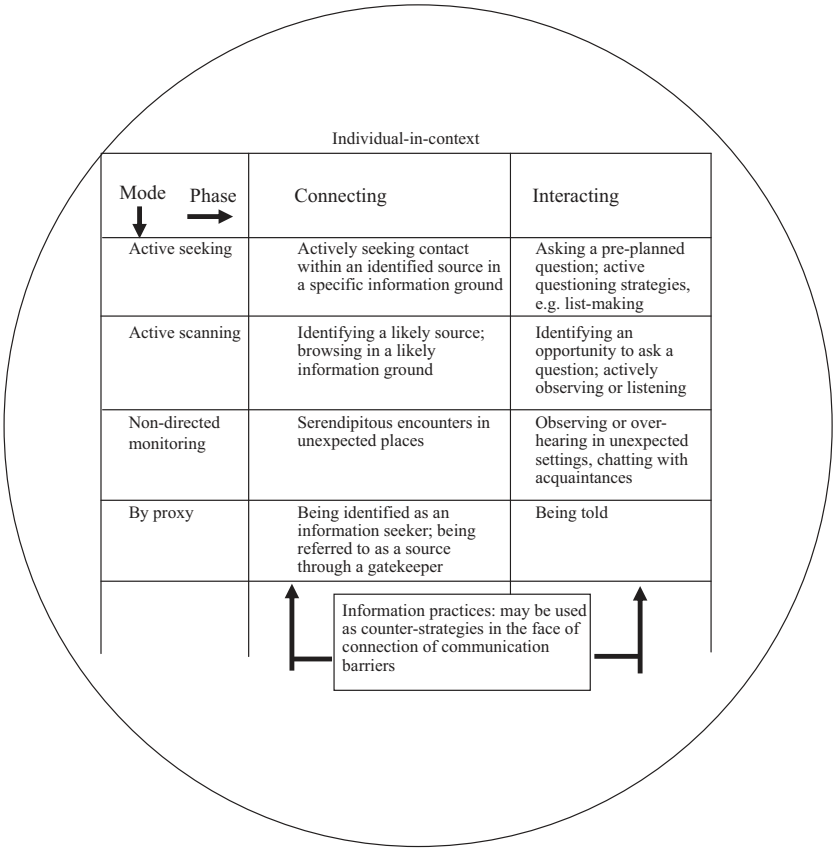
Rioux (2004) examined the nature of IA&S in virtual environments. WWW, e-mail and electronic mailing lists appeared to be the primary information sources that are acquired and subsequently shared online. Information was acquired through a mix of directed (e.g. purposeful searches), semi-directed (e.g. information encountering) and undirected processes (e.g. receiving information via e-mail from others). When users acquired a useful piece of information in an internet-based environment, they usually cut and pasted a URL into an e-mail message and hit the "send" button. The above characterization provides a concrete example of the sequential approach to the connection of information seeking and sharing depicted as activities performed

in a certain temporal order. However, the relationship is not causal because the acquisition of information does not automatically lead to its sharing to others. Rioux (2004) found that before sharing a piece of information or a document, the user may consider, case by case, whether they would be relevant for the recipient in the current situation.

The model of IA&S has similarities with the concept of information seeking by proxy proposed by McKenzie (2003). It is one of the modes constitutive of the model for information practices. This framework identifies three other modes of information practice: active seeking, active scanning and non-directed monitoring. The model depicted in Figure 4 also specifies two phases of information practices: connecting and interacting.

The modes of active seeking and active scanning deal with purposeful information seeking, while non-directed monitoring and information practice by proxy are also relevant for the conceptualization of the interplay of information seeking and information sharing. McKenzie's model suggests that the interplay occurs in two phases. During the connecting phase, a potentially useful source of information is identified and accessed, while at the phase of interacting, the main attention is placed on the utilization of the information content.

In the case of non-directed monitoring, information is acquired through serendipitous encountering with information available in unexpected places. The interplay of information seeking and sharing occurs at the interacting phase when a person occasionally engaged in



Source: McKenzie (2003, p. 26)

Figure 4.
Two-dimensional model of the information practices

face-to-face discussion about a topic may present specifying questions and obtain answers from others. However, the aspect of information sharing is emphasized more strongly when information is sought by proxy. Activities constitutive of this mode occur in situations in which individuals contact with or interact with information sources through the initiative of another agent, either the information source or some other gatekeeper or intermediary. In other words, proxy connections occur when an individual other than the primary information seeker engages in active seeking or active scanning on the primary seeker's behalf or identifies the primary seeker as an information seeker through non-directed monitoring (McKenzie, 2003, p. 30). Thus, the connection of information seeking and sharing is conceptualized from a sequential point of view so that information is sought or acquired first, followed by the sharing of such information. Information sharing results in "being told," suggesting that information sharing is primarily conceptualized from the perspective of one-way information transfer.

Drawing on similar ideas about information seeking by proxy, Veinot (2009) demonstrated that people with HIV/AIDS were sometimes "exposed" to HIV/AIDS information by others. The concept of network-mediated exposure to information was used to refer to incidents where participants did not actively seek information, but social proximity exposed them to HIV/AIDS-related information in ways that were either human-related or document-related. Similar to McKenzie (2003), Veinot (2009) found that as a part of the network-mediated exposure interactions, there was an "agent" of the information, a person who presented information, or brought it forth; and another person, who experienced the interaction as "exposure." This agent exposed the other person to information conversationally, or by actively or passively sharing his/her print or electronic documents. Veinot (2009) concluded that network-mediated exposure can thus be thought of as a specific type of network-mediated information acquisition and sharing, incorporating both active and explicit and less goal-oriented exchanges of "already acquired" information (Talja and Hansen, 2006, p. 114).

Compared to the indirect approach, the frameworks drawing on the sequential approach enable a more detailed examination of the interplay of information seeking and sharing. The models proposed by McKenzie (2003) and Rioux (2005) emphasize the importance of face-to-face conversation as a context of such an interplay. On the other hand, as demonstrated by Rioux (2004) and Veinot (2009), the ideas of the sequential approach can also be utilized while specifying the connections of information seeking and sharing occurring in the networked information environments. Nevertheless, the sequential approach is limited because it assumes a fixed order between information seeking and sharing; the former necessarily occurs first. Moreover, as the sequential approach emphasizes the role of gatekeepers or "intermediating agents," information sharing is primarily approached in terms of a one-way information transfer. However, this approach may be too restrictive for the needs of examining the interactions occurring between information seekers and information providers in social media forums such as online discussion groups.

Interactive approach

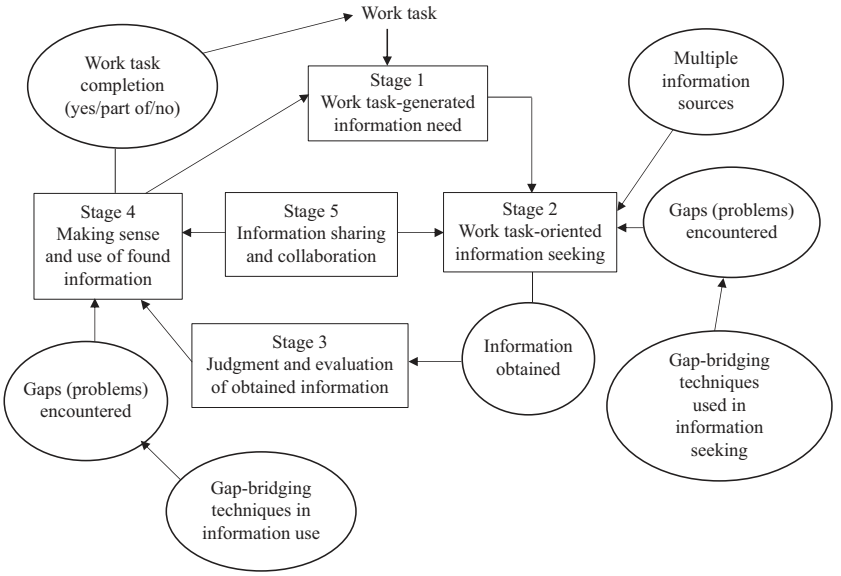
Different from the sequential approach, information seeking and sharing can be conceptualized as activities occurring in a varying temporal order: information sharing may take place before or after the information seeking process. The activities may also shape each other so that information sharing can result in a new round of information seeking which in turn may lead to sharing of additional information. The whole process may incorporate several cycles of information seeking and sharing, and this process can evolve at least some time, depending on a task at hand, interest in an issue or other triggers of information behavior. Conceptualizations of this kind are central to the interactive approach to connection of information seeking and sharing.

The interactive approach has been utilized in the context of Information Journey – a model of information behavior originally developed by Adams and Blandford (2005). Information

journey refers to users' evolving cycle of information interactions, encompassing the cycles based around user needs and activities. More recently, Blandford and Attfield (2010) depicted the information journey as encapsulating four phases: recognizing an information need, acquiring/finding information, interpreting and validating that information in the context of goals and using the interpretation to support activities.

Du (2014) elaborated this model while examining the connection of information seeking and sharing among marketing professionals. In Du's (2014) empirical investigation, information seeking was defined to represent where, how and why they looked for information for current WTs, as well as problems they faced during information seeking and strategies they used to obtain further information. In turn, the information-sharing category was defined as the extent to which and how the participants communicated the information to others. Du (2014) extended the model of information journey by adding a fifth stage depicting information sharing and collaboration. Stage 1 focuses on the articulation of WT-generated information needs, while Stage 2 deals with WT-oriented information seeking and Stage 3 with judgment and evaluation of obtained information. Furthermore, Stage 4 concentrates on making sense and use of found information, while the final stage deals with information sharing and collaboration. Du's (2014) model is presented in Figure 5.

The model depicted in Figure 5 addresses WTs that require information seeking, gathering, judging, interpreting, use and sharing over a certain period of time. The model helps to clarify the nature of information behavior from the viewpoint of cyclic information journey with an attempt to include information use in relation to information seeking and information sharing, information judgments and the human behavioral dimensions of sense making and work information environments. On the other hand, Du's framework does not purely exemplify the interactive approach, even though it is predominant. First, the model contains elements of the sequential approach because information seeking (Stage 2) precedes information sharing (Stage 5). Second, there are elements of the indirect approach because information seeking and sharing are linked through Stage 4 (making sense and use of found information) and Stage 1 (work-task generated information need). As a whole, however, Du's



Source: Du (2014, p. 1863)

Figure 5. Information journey model

model represents an interactive approach because it proposes that information seeking and sharing can shape each other, as the information journey evolves cyclically through five stages. Information sharing may give rise to a new round of information seeking, as indicated by the arrow from Stage 5 to Stage 2. In turn, information seeking can affect information sharing through Stages 3, 4 and 1.

Finally, a recent example of the use of an interactive approach is provided by Robson and Robinson (2013, 2015). They developed an information seeking and communication model (ISCM). The revised version of the model is presented in Figure 6.

Compared to the diagrams reviewed above, the ISCM model is fairly complicated. The flowchart presented in Figure 6 provides a detailed picture of the interplay of information seeking and information sharing. In addition to information users seeking for information, the model identifies information providers, i.e. individuals, groups and organizations who produce, supply or communicate information, or who facilitate or control access to it. The model defines user and provider roles as interchangeable with a user acting as a provider and vice versa.

In the ISCM model, information seeking is defined as a set of active searching, ongoing searching and passive searching (Robson and Robinson, 2013, pp. 188-189). The activities of information sharing are approached in terms of communication (or information provision). Primarily, the ISCM model conceptualizes information sharing from the perspective of information exchange suggesting a two-way flow of information between information providers or between users, as represented by Arrow 7 in Figure 6. Further, as indicated by Arrow 2, information providers, for example, speakers making presentations at meetings,

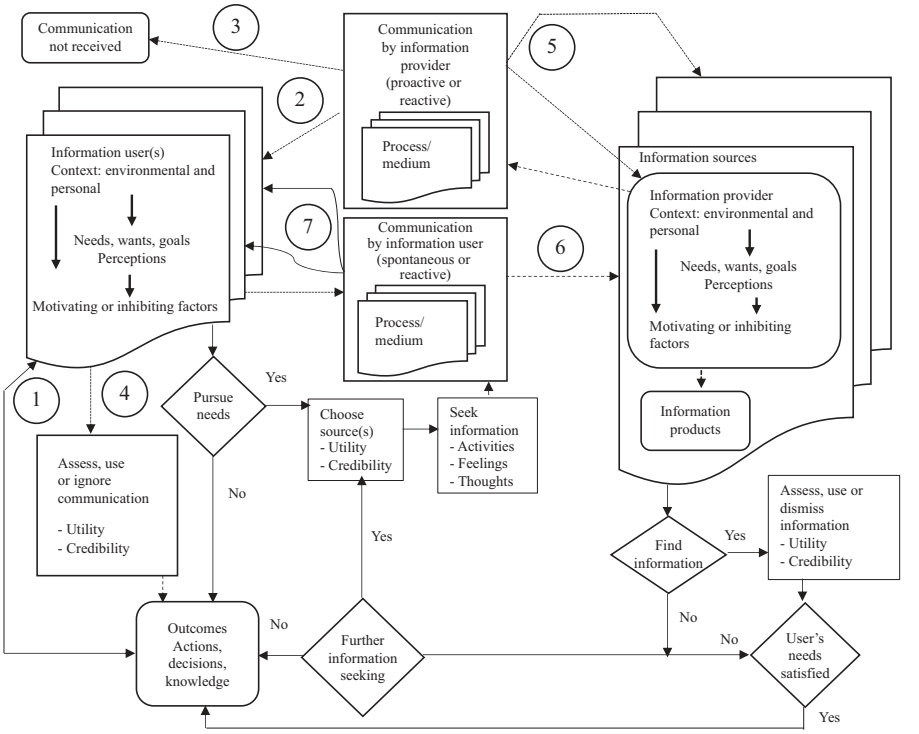


Figure 6.
Revised information seeking and communication model (ISCM)

Source: Robson and Robinson (2015, p. 1056)

may communicate directly with users. However, as indicated by Arrow 3, communication may also be reactive, for example, when the provider makes information available through a website. A user who has received a message (Arrow 4) may assess its information content, use it or ignore it, depending on its perceived utility and credibility. If used, the information may lead to actions or decisions and these may subsequently be reviewed depending on changes in needs, perceptions, motivating or inhibiting factors (Arrow 1). In addition, as indicated by Arrow 5, information providers may communicate with each other. An information user can also communicate with an information provider, for example, librarian (Arrow 6). This may be done proactively, for example, when a user asks for information. Alternatively, it can be done reactively such as when a provider requests feedback on an information service. Finally, as indicated by a two-way Arrow 7, there may be collaboration between users such as members of a work team, and they may communicate with each other while sharing information.

Most importantly, the main connection of information seeking and sharing is located in the middle of Figure 6 where the component of "Seek information" is linked to the component of "Communication by information user (spontaneous or proactive)." The key idea is that depending on situational requirements of task performance or problem solving, the individuals can alternate in the roles of information seeker (or user) and information provider. An information user can ask information directly from another user, for example, a colleague who in turn can provide information to the information seeker. In another situation, the roles may be changed: the information provider becomes an information seeker. In the ISCM model, however, the picture of connections of this type has remained somewhat implicit.

Compared to indirect and sequential approaches reviewed above, the models proposed by Du (2014) and Robson and Robinson (2015) are more hospitable to the elaboration of the interplay of information seeking and sharing occurring in face-to-face conversation and the networked information environments such as the platforms of social media. Du's (2014) model focuses on work-related information seeking and sharing while the framework proposed by Robson and Robinson (2015) is generic in nature and can thus be applied to the conceptualization of the interplay of information seeking and sharing in non-work contexts, too. Most importantly, the interactive approach highlights the nature of information behavior as a cyclic process within which the processes of information seeking and sharing may alternate and shape each other.

Discussion

The present study contributed to basic research on HIB by identifying three main approaches to the modeling of the interplay of information seeking and sharing. First, the indirect approach conceptualizes information seeking and sharing as activities that are connected through an intermediating factor. Second, the sequential approach suggests that information seeking precedes information sharing. Finally, the interactive approach conceptualizes information seeking and sharing as mutually related activities shaping each other in a cyclical manner. The main findings are condensed in Table I.

A key strength common to all three approaches is that they place information seeking and sharing in a broader context of HIB. In other respects, however, the approaches differ from each other. The indirect approach is exemplified by the early models proposed by Wilson (1981, 1999) and Krikelas (1983). However, Wilson's model does not represent a pure example of the indirect approach because there are elements of the sequential approach, too. A sequential feature is incorporated in his model because information sharing (depicted as information transfer) is preceded by information use. As a whole, however, the sequential viewpoint is secondary because the main idea of Wilson's model is that information use functions as an intermediating factor between information seeking and sharing. Overall, the

Approach to the connection of information seeking and sharing	Key assumptions of diverse approaches	Main strengths (+) and weaknesses (–) of diverse approaches	Examples of studies
Indirect	– information seeking and sharing are discrete activities connected by a third factor, for example, information need or information use – information sharing appears as information transfer	+ information seeking and sharing are reviewed in a broader context of information behavior – the picture of the connections between information seeking and sharing remains unspecific – limited applicability in the study of information seeking and sharing occurring in the networked information environments	Krikelas (1983); Wilson (1981, 1999)
Sequential	– information seeking precedes information sharing; however, the connection is not causal – the connection can be characterized by constructs such as information encountering for others, information acquisition & sharing, and information seeking by proxy – information sharing appears as information transfer or information exchange	+ information seeking and sharing are reviewed in a broader context of information behavior or information practice – the sequential approach results in a one-dimensional picture of the relationships between information seeking and sharing – not flexible enough to the needs of analyzing interactive information seeking and sharing occurring in the networked information environments	Allen (1977); Erdelez and Rioux (2000); McKenzie (2003); Rioux (2004, 2005)
Interactive	– information seeking and sharing are activities that can occur in varying temporal order – information sharing mainly appears as information exchange – the interaction can result in several rounds or cycles of information seeking and sharing – information seeking and sharing can mutually shape each other	+ allows a holistic and dynamic picture of the iterative and cyclical nature of the processes of information seeking and sharing in diverse contexts, including the networked information environments – the interactive approach is difficult to model in detail, due to the complexities of the cyclical processes constitutive of information seeking and sharing	Du (2014); Robson and Robinson (2013, 2015)

Table I.
Summary of the main findings

indirect approach exemplified by the above models is limited in that the interplay of information seeking and sharing is characterized only generally.

The sequential approach provides a clear and fairly straightforward picture of the connection of information seeking and sharing, as indicated by the models developed by McKenzie (2003) and Rioux (2005). The sequential approach is limited by a one-dimensional view on the connection of information seeking and sharing. Although information seeking is often a necessary precondition for the presence of information sharing, the process of information behavior may not end with the act of providing information to others. The interactive approach is more sophisticated because it allows a dynamic picture of the interplay

by depicting a series of cyclic processes of information seeking and sharing mutually shaping each other. However, the flipside of the interactive approach is the difficulty of characterizing the interplay in detail in case of several cycles of information seeking and sharing.

The findings also indicate that the interactive approach holds the best potential for the modeling of the connections between information seeking and sharing occurring in the networked information environments. As exemplified by the models developed by Du (2014) and Robson and Robinson (2015), this potential is mainly due to the assumption that HIB is a dynamic phenomenon constituted by cyclic processes of information seeking and sharing mutually shaping each other, coupled with other processes such as evaluation and use of information. Cyclic processes such as these are particularly characteristic of information seeking and sharing occurring in social media platforms, for example, online discussion groups and social Q&A sites.

The findings summarized in Table I can be reflected further by presenting a few comparative notions to studies that have characterized the connections of information seeking and sharing, without developing an explicit model for information behavior, however. In an empirical study on the ways in which scholars transmit or exchange information, Talja (2002) proposed the concept of strategic sharing. It manifests itself most clearly in cases in which scholars locate relevant articles and deliver their copies to colleagues. This practice is indicative of the sequential approach. A similar approach was evident in the case of paradigmatic sharing: a research group sought and "knew from a wide sector everything there is" (Talja, 2002, p. 148). The group members identified the classics of the field and important new works and shared their findings and interpretations not only with group members but also on the group's homepage (Talja, 2002, p. 149). The sequential approach can also be identified in the case of directive sharing. Researchers sometimes benefited from the searching done by graduate and doctoral students, and students benefited from the projects' cumulated document stores. Directive sharing took place when the process is two-way, when senior and junior scholars both benefit from the results of each other's searches, and when they have mutual interests and goals (Talja, 2002, p. 150).

Pettigrew (1999) provided an excellent example of the interactive approach in her study on seniors seeking and sharing information at a foot clinic. Pettigrew (1999, p. 812) found that information needs were rarely stated as direct requests but instead emerged subtly as nurses and seniors shared their situations with one another and chit-chatted. The findings also demonstrated that information sharing gave rise to occasional seeking of information. On the other hand, information was shared in the context of information encountering, because the information received this way was passed on to others. Different from the interactive approaches described above, Pettigrew (1999) characterized information seeking, encountering and sharing as discursive phenomena that occurred during conversational interaction among two or more people. Overall, Pettigrew's findings suggest that the discursive approach is particularly hospitable to research settings focusing on small-group face-to-face interaction. As information seeking and sharing are increasingly occurring in online forums, based on written discourse, the interactive approach may be strengthened further by examining how the interplay of the above activities is constructed in dialogs incorporating questions and responses presented by the online discussion participants.

Conclusion

The present study elaborated the picture of information behavior by identifying three main approaches by which researchers have conceptualized the interplay of information seeking and sharing. The findings suggest that the most sophisticated conceptualizations of such connections draw on the interactive approach. As the present study focused on the analysis of the strengths and weaknesses of a few HIB models, no attempts were made to integrate them. However, this is a significant topic for further research. It would seek answers to

questions such as what kind of situations, contexts and requirements of WT performance give rise to the interplay of information seeking and sharing. Moreover, as there are plenty of instances where information is sought but not shared, or shared but not explicitly sought, there is a need to find out what kind of integrative models would best describe such situations. To further elaborate interactive approach to HIB more generally, there is a need to extend the research setting by examining how information seeking, encountering and sharing are related to information use particularly in social media forums such as social question and answer (Q&A) sites, blogs and online discussion groups and ResearchGate (Albright *et al.*, 2016; Panahi *et al.*, 2016; Thelwall and Kousha, 2017). Moreover, research on the interplay of information seeking, use and sharing could be substantiated by examining the features of CIB and social information search (Evans and Chi, 2010; Shah, 2012, 2017). Comparative studies would be particularly welcome because they may result in a more holistic picture of HIB, thus complementing investigations solely focusing on information seeking, information use or information sharing.

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Corresponding author
Reijo Savolainen can be contacted at: Reijo.Savolainen@uta.fi