Available online at www.sciencedirect.com
ScienceDirect
Information Processing and Management 44 (2008) 957–962
INFORMATION PROCESSING & MANAGEMENT
www.elsevier.com/locate/infoproman

Collaborative information seeking: The combined activity of information seeking and collaborative grounding

Morten Hertzum *

Computer Science, Roskilde University, Building 42.1, P.O. Box 260, DK-4000 Roskilde, Denmark

Received 2 January 2007; received in revised form 9 March 2007; accepted 9 March 2007
Available online 26 April 2007

Abstract

Since common ground is pivotal to collaboration, this paper proposes to define collaborative information seeking as the combined activity of information seeking and collaborative grounding. While information-seeking activities are necessary for collaborating actors to acquire new information, the activities involved in information seeking are often performed by varying subgroups of actors. Consequently, collaborative grounding is necessary to share information among collaborating actors and, thereby, establish and maintain the common ground necessary for their collaborative work. By focusing on the collaborative level, collaborative information seeking aims to avoid both individual reductionism and group reductionism, while at the same time recognizing that only some information and understanding need be shared.

Keywords: Collaborative information seeking; Collaborative grounding; Common ground

1. Introduction

Information needs and the activities involved in seeking and using information are frequently collaborative. This has instigated research on collaborative information seeking in general (Foster, 2006; Karamuftuoglu, 1998), in specified domains such as command and control (Prekop, 2002; Sonnenwald & Pierce, 2000), education (Hyldegård, 2006; Lazonder, 2005), and engineering (Allen, 1977; Fidel, Pejtersen, Cleal, & Bruce, 2004), as well as research on technologies supporting collaborative information seeking (Lieberman, van Dyke, & Vivacqua, 1999; Romano, Roussinov, Nunamaker, & Chen, 1999). In this research, collaborative information seeking is typically defined inclusively and in contrast to contemporary models of information seeking (e.g., Kuhlthau, 1991; Wilson, 1999), which are seen as focusing predominantly on the individual information seeker. This, however, makes collaborative information seeking a vague concept, especially with regard to whether the collaborating actors *as a group* are informed by the information-seeking activities.

* Tel.: +45 4674 3077; fax: +45 4674 3072.
E-mail address: mhz@ruc.dk

0306-4573/$ - see front matter
doi:10.1016/j.ipm.2007.03.007

Following Karamuftuoglu (1998), this paper contends that information seeking is just as much about making coherent sense of information as it is about finding extant information. In a collaborative context, information is typically distributed unevenly across actors, and they may interpret the information known to them in different ways or be unable to make coherent sense of it. On the one hand, this is what makes communication and information seeking worthwhile activities. On the other hand, it also emphasizes the considerable work and constraints involved in making coherent sense of information within a group of actors. This may be particularly evident in relation to knowledge work (e.g., Kidd, 1994) and engineering projects (e.g., Curtis, Krasner, & Iscoe, 1988), the two domains primarily underlying this paper. This paper proposes that the uneven distribution of information and the different meanings actors may derive from the information known to them make collaborative information seeking inextricably related to an essential aspect of collaboration:

- Collaboration requires a certain level of agreement and shared understanding, often termed common ground (Clark & Brennan, 1991; Olson & Olson, 2000). The collaborating actors need not, and in practice do not, agree about everything but without common ground collaboration is unlikely to succeed.
- Establishing common ground is often a lengthy process (e.g., Potts & Catledge, 1996) while the result is a temporary agreement, necessitating continual efforts to maintain common ground. The complexity of establishing and maintaining common ground increases with the size of the collaborating group.

The acquisition of information by some actors in a group will lead to a gradual disintegration of common ground unless information is continually shared and a common understanding reached, at least about core issues (Schmidt & Bannon, 1992). Depending on the amount and frequency of information sharing the group will either maintain common ground, disintegrate into subgroups with various kinds of interrelations, or become more closely knit through the creation of more extensive common ground. If the pattern of sharing remains stable over extended periods of time it becomes constitutive of how actors perceive the purpose and closeness of their collaboration (Talja, 2002). Hence, collaborative information seeking must include information sharing in order to encompass processes of making coherent sense of acquired information among the members of a group. While information sharing is included in some definitions of collaborative information seeking (e.g., Karamuftuoglu, 1998) it is, however, explicitly excluded in other definitions (e.g., Hansen & Järvelin, 2005) and tacitly excluded or assigned a borderline status in yet others (e.g., Prekop, 2002). It will be argued that this exclusion involves an under-recognition of the importance of common ground and may lead to either individual or group reductionism.

2. Definition

In his review, Foster (2006, p. 330) defines the research field of collaborative information seeking as "the study of the systems and practices that enable individuals to collaborate during the seeking, searching, and retrieval of information". This is an example of a definition that assigns information sharing a borderline status and thereby dissociates acquisition of information from being informed by it, a dissociation this paper argues against. Instead, this paper proposes that *collaborative information seeking* is defined as the information-seeking activities performed by actors to inform their collaborative work combined with the collaborative-grounding activities involved in making this information part of the actors' shared understanding of their work:

- *Information seeking* is construed as the activities involved in realizing a need for information, exploring this information need, identifying possible information sources, consulting selected sources, adapting information to work problems, as well as coming across information without actively looking for it. These activities occur in a collaborative context but can be performed by individual actors or by several actors in collaboration.
- *Collaborative grounding* is construed as the active construction by actors of a shared understanding that assimilates and reflects available information. This involves that information items are shared and their meanings debated and resolved, at least locally and temporarily. As collaborations become larger, the work

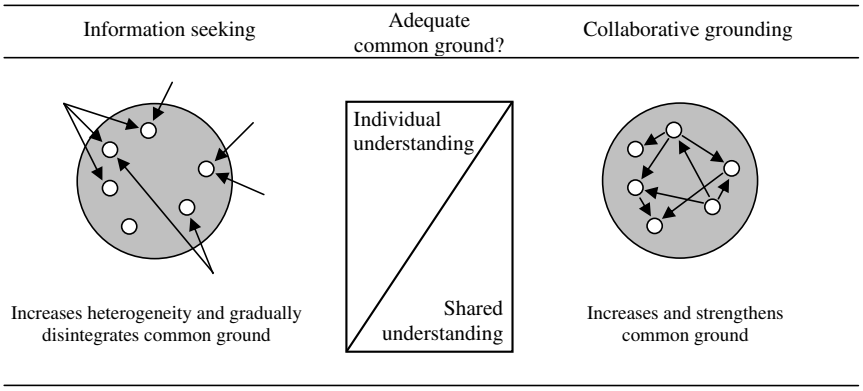

Fig. 1. Collaborative information seeking involves activities of both information seeking and collaborative grounding in order to establish and maintain the common ground necessary for collaborative work, while at the same time recognizing that only some understanding will be, and need be, shared.

involved in collaborative grounding escalates and collaborative grounding is increasingly restricted to core information.

Over time, the two activities of information seeking and collaborative grounding will dynamically and repeatedly change the balance between individual and shared understanding. Fig. 1 illustrates that information-seeking activities tend to shift the balance between individual and shared understanding toward a larger proportion of individual understanding because information seeking is often delegated to subgroups of actors or information is encountered by individual actors. Conversely, collaborative-grounding activities drive the balance toward a larger proportion of shared understanding and thereby counter the effect of information seeking. Collaborative information seeking entails a continual effort to maintain the balance between individual and shared understanding at a level that provides the common ground necessary for working together while at the same time recognizing the crucial importance of information and understanding specific to individual actors (Schmidt & Bannon, 1992; Talja, 2002).

An often-cited example of collaborative information seeking is Allen's (1977) description of the gatekeeper, who takes the responsibility to look for information and forward it to colleagues in her organization. Another example highlights project groups as a core forum for collaborative information seeking. When one project participant formulates an information need, another may know an appropriate source, the actual consulting of this source may be delegated to a third project participant, the information obtained is then discussed at a project-group meeting, and this partly advances the participants' shared understanding and partly spawns new questions and thereby continued collaborative information seeking (Hertzum, 2002).

3. Discussion

Collaborative information seeking is often studied in relation to project work because projects provide a very common frame for collaboration. Collaborative information seeking is, however, not restricted to projects but can also take place, and be studied, at more fine-grained levels such as individual search sessions as well as at more coarse-grained levels such as entire organizations. Such variations in granularity constitute one dimension of collaborative information seeking with far-reaching implications for the issues to be addressed, the means for addressing them, the research methods appropriate for studying them, and so forth. Research on collaborative information seeking has treated variations in collaborative information seeking along, at least, six main dimensions:

- *Purposes*, that is the overall reasons for which collaborative information seeking is done, such as current awareness, routine search needs, and exploring a new or unfamiliar area (Hirsh & Dinkelacker, 2004) or strategic, paradigmatic, directive, and social information sharing (Talja, 2002).

- *Types*, that is the types of information sought, such as factual information (Lazonder, 2005), assessment (Hansen & Järvelin, 2005), and opinion and creative discourse (Zipperer, 1993).
- *Roles*, that is patterns of activities and responsibilities assumed by or assigned to actors, such as information gatekeeper (Allen, 1977), information-seeking instigator (Prekop, 2002), and information sharer.
- *Activities*, that is prototypical actions and interactions performed by actors, such as specifying information needs (Bruce et al., 2003), assessing information sources (Hertzum, 2002), browsing (Twidale, Nichols, & Paice, 1997), people finding (Yiman-Seid & Kobsa, 2003), searching project files (Hertzum & Pejtersen, 2000), and consolidation meetings (Beyer & Holtzblatt, 1998).
- *Granularity*, that is the level at which collaborative information seeking is performed or studied, such as conversational turns (Clark & Brennan, 1991), search sessions (Lazonder, 2005), projects (Bruce et al., 2003), organizations (Allen, 1977), and professions.
- *Coupling*, that is the interconnections between different actors' activities in performing collaborative information seeking, ranging from loose couplings among actors who mainly work individually (Hertzum, Pejtersen, Cleal, & Albrechtsen, 2002) to tight couplings among actors whose performance involves frequent interactions (Hyldegård, 2006).

The dimensions convey a diversity we have only begun to systematically address in the research on collaborative information seeking. Typically, individual studies focus on some dimensions and are conducted without reference to a broader framework. Without positioning studies in a landscape spanned by, for example, the six abovementioned dimensions of collaborative information seeking it becomes difficult to integrate the insights gained from different studies.

Collaborative grounding provides multiple illustrations of interrelationships among the dimensions. If most activities are performed individually (coupling dimension), collaborative grounding becomes an essential, distinct activity. If information-seeking activities are mostly performed collaboratively (coupling dimension) they subsume collaborative grounding, and the distinction between information seeking and collaborative grounding becomes predominantly analytic. Collaborative grounding is particularly important to the success of tightly coupled activities because actors' need for common ground increases as activities become more tightly coupled (Olson & Olson, 2000). Collaborative grounding is, however, partial in several respects. In a project context (granularity dimension), collaborative grounding may, for example, unfold around a few core actors (role dimension) that are able to articulate the project vision clearly (type dimension). The other actors may be unaware of some information or simply unable to make out how the various pieces of information hang together, and they depend on the core actors' sense of the project and ability to direct the project (activity dimension). Furthermore, collaborative grounding can only be achieved when a shared understanding can be reached, which is surely not always the case, and it is restricted to the points where the actors' individual perspectives come together (purpose dimension).

Collaborative information seeking, as defined in this paper, has much in common with learning-in-working (Brown & Duguid, 1991, 2001). In discussions of how organizations learn we find a distinction between individual and social learning, which resembles the distinction between individual and collaborative information seeking. The distinction between individual and social learning concerns a difference between knowledge residing in individual humans and knowledge that is embedded in cooperative work arrangements. At the individual end of the spectrum Simon (1991, p. 125) states that "all learning takes place inside individual human heads; an organization learns in only two ways: (a) by the learning of its members, or (b) by ingesting new members who have knowledge the organization didn't previously have." Conversely, at the social end of the spectrum Brown and Duguid (1991, p. 46) conclude from a study of service technicians that "not only is the learning in this case inseparable from working, but also individual learning is inseparable from collective learning. The insight accumulated is not a private substance, but socially constructed and distributed." The difference between the two viewpoints is to some extent a matter of the dominant level of analysis. They concur that both skilled individuals and elaborate collaborative practices are needed to accomplish many complex tasks. Similarly, the gap between models of individual information seeking (e.g., Kuhlthau, 1991; Wilson, 1999) and of collaborative information seeking is primarily a matter of the level of analysis, not a disagreement about whether collaborative practices exist and matter. Further, Brown and Duguid's (1991) work suggests that information seeking may be collaborative to an extent that goes beyond previous work on

collaborative information seeking and certainly merits taking the collaborative level as one's point of departure.

A focus on the collaborative level entails that collaborating actors are seen as actively and continually constructing their collaboration (Schmidt & Bannon, 1992). Thereby, such a focus seeks to avoid two reductionisms:

- An individual reductionism in which focus is on the individual actor and collaboration is neglected or reduced to the sum of the individual actors' activities.
- A group reductionism in which the group is seen as a unitary actor and collaboration is, hence, blackboxed, suggesting it is a smooth and near automatic process.

Hitherto, collaborative information seeking has mostly been defined and discussed in contrast to individual reductionism. Group reductionism is, however, common and renders invisible a complex aspect of working together. Group reductionism is, for example, apparent in most software-engineering methods (e.g., Sommerville, 2004), which contain numerous techniques for acquiring and recording information but seldom provide guidance about how to systematically share and discuss acquired information within the project group. In terms of the two sets of activities that constitute collaborative information seeking these software-engineering methods are biased toward information seeking to the extent of largely bypassing collaborative grounding.

4. Conclusion

Collaborative information seeking is an important, yet complex aspect of collaboration. As defined in this paper, collaborative information seeking is the combined activity of information seeking and collaborative grounding. This definition is proposed to anchor collaborative information seeking in the common ground necessary for collaborative work, to avoid both individual and group reductionisms, and to provide a basis for investigating how information can be effectively acquired and assimilated by collaborating actors. As foci of future work, this paper points, in particular, to an elaboration of the balance between common ground and the information and understanding acquired by and specific to individual actors.

References

Allen, T. J. (1977). *Managing the flow of technology: Technology transfer and the dissemination of technological information within the R&D organization*. Cambridge, MA: MIT Press.

Beyer, H., & Holtzblatt, K. (1998). *Contextual design: Defining customer-centered systems*. San Francisco, CA: Morgan Kaufmann.

Brown, J. S., & Duguid, P. (1991). Organizational learning and communities-of-practice: toward a unified view of working, learning, and innovation. *Organization Science, 2*(1), 40–57.

Brown, J. S., & Duguid, P. (2001). Knowledge and organization: a social-practice perspective. *Organization Science, 12*(2), 198–213.

Bruce, H., Fidel, R., Pejtersen, A. M., Dumais, S., Grudin, J., & Poltrock, S. (2003). A comparison of the collaborative information retrieval behaviour of two design teams. *New Review of Information Behaviour Research, 4*, 139–153.

Clark, H. H., & Brennan, S. E. (1991). Grounding in communication. In L. Resnick, J. M. Levine, & S. D. Teasley (Eds.), *Perspectives on socially shared cognition* (pp. 127–149). Washington, DC: APA.

Curtis, B., Krasner, H., & Iscoe, N. (1988). A field study of the software design process for large systems. *Communications of the ACM, 31*(11), 1268–1287.

Fidel, R., Pejtersen, A. M., Cleal, B., & Bruce, H. (2004). A multidimensional approach to the study of human-information interaction: a case study of collaborative information retrieval. *Journal of the American Society for Information Science and Technology, 55*(11), 939–953.

Foster, J. (2006). Collaborative information seeking and retrieval. In B. Cronin (Ed.). *Annual review of information science and technology* (Vol. 40, pp. 329–356). Medford, NJ: Information Today.

Hansen, P., & Järvelin, K. (2005). Collaborative information retrieval in an information-intensive domain. *Information Processing & Management, 41*(5), 1101–1119.

Hertzum, M. (2002). The importance of trust in software engineers' assessment and choice of information sources. *Information and Organization, 12*(1), 1–18.

Hertzum, M., & Pejtersen, A. M. (2000). The information-seeking practices of engineers: searching for documents as well as for people. *Information Processing & Management, 36*(5), 761–778.

Hertzum, M., Pejtersen, A. M., Cleal, B., & Albrechtsen, H. (2002). An analysis of collaboration in three film archives: a case for collaboratories. In H. Bruce, R. Fidel, P. Ingwersen, & P. Vakkari (Eds.), *CoLIS4: Proceedings of the fourth international conference on conceptions of library and information science* (pp. 69–83). Greenwood Village, CO: Libraries Unlimited.

Hirsh, S., & Dinkelacker, J. (2004). Seeking information in order to produce information: an empirical study at Hewlett Packard Labs. *Journal of the American Society for Information Science and Technology, 55*(9), 807–817.

Hyldegård, J. (2006). Collaborative information behaviour – Exploring Kuhlthau's information process model in a group-based educational setting. *Information Processing & Management, 42*(1), 276–298.

Karamuftuoglu, M. (1998). Collaborative information retrieval: toward a social informatics view of IR interaction. *Journal of the American Society for Information Science, 49*(12), 1070–1080.

Kidd, A. (1994). The marks are on the knowledge worker. In *Proceedings of the CHI conference on human factors in computing systems* (pp. 186–191). New York: ACM Press.

Kuhlthau, C. C. (1991). Inside the search process: information seeking from the user's perspective. *Journal of the American Society for Information Science, 42*(5), 361–371.

Lazonder, A. W. (2005). Do two heads search better than one? Effects of student collaboration on web search behaviour and search outcomes. *British Journal of Educational Technology, 36*(3), 465–475.

Lieberman, H., van Dyke, N., & Vivacqua, A. (1999). Let's browse: a collaborative browsing agent. *Knowledge-Based Systems, 12*(8), 427–431.

Olson, G. M., & Olson, J. S. (2000). Distance matters. *Human–Computer Interaction, 15*(2&3), 139–178.

Potts, C., & Catledge, L. (1996). Collaborative conceptual design: a large software project case study. *Computer Supported Cooperative Work, 5*(4), 415–445.

Prekop, P. (2002). A qualitative study of collaborative information seeking. *Journal of Documentation, 58*(5), 533–547.

Romano, N. C., Roussinov, D., Nunamaker, J. F., & Chen, H. (1999). Collaborative information retrieval environment: integration of information retrieval with group support systems. In *HICSS 1999: Proceedings of the 32nd Hawaii international conference on system sciences*. Los Alamitos, CA: IEEE Computer Society Press.

Schmidt, K., & Bannon, L. (1992). Taking CSCW seriously: supporting articulation work. *Computer Supported Cooperative Work, 1*(1), 7–40.

Simon, H. A. (1991). Bounded rationality and organizational learning. *Organization Science, 2*(1), 125–134.

Sommerville, I. (2004). *Software engineering* (7th ed.). Boston, MA: Addison Wesley.

Sonnenwald, D. H., & Pierce, L. G. (2000). Information behavior in dynamic group work contexts: interwoven situational awareness, dense social networks and contested collaboration in command and control. *Information Processing & Management, 36*(3), 461–479.

Talja, S. (2002). Information sharing in academic communities: types and levels of collaboration in information seeking and use. *New Review of Information Behaviour Research, 3*, 143–159.

Twidale, M. B., Nichols, D. M., & Paice, C. D. (1997). Browsing is a collaborative process. *Information Processing & Management, 33*(6), 761–783.

Wilson, T. D. (1999). Models in information behaviour research. *Journal of Documentation, 55*(3), 249–270.

Yiman-Seid, D., & Kobsa, A. (2003). Expert-finding systems for organizations: problem and domain analysis and the DEMOIR approach. *Journal of Organizational Computing and Electronic Commerce, 13*(1), 1–24.

Zipperer, L. (1993). The creative professional and knowledge. *Special Libraries, 84*(2), 69–78.