State of the art review

Research agenda for social and collaborative information seeking

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A B S T R A C T

Scholars in diverse fields of inquiry have identified the need to expand individual-based information seeking and behavior models and systems to incorporate social as well as collaborative dimensions. However, the research areas of Social Information Seeking (SIS) and Collaborative Information Seeking (CIS) have been largely disconnected from one another despite a few notable attempts to study them under one umbrella. Researchers in these communities have recently realized the value of bringing SIS and CIS together for two main reasons: often it is impossible to separate social and collaborative dimensions in a project; and by considering these two aspects of information seeking, we may be able to support human information behavior in ways not previously possible. A brief synthesis of work in the domains of SIS and CIS is presented here. Then, an integrated view is presented to consider *Social and Collaborative Information Seeking* (SCIS) as an intersection and extension of SIS and CIS. Benefits of this approach are discussed and the integrated view is used as the basis to present a research agenda that outlines opportunities and challenges unique to SCIS.

1. Introduction

Today it is increasingly common for people to utilize collaboration and communication technologies to address needs in their professional and personal lives. As the importance of information access and processing becomes even more critical in everyday life, there are many problems that require the use of social and collaborative ties to search, retrieve, and use information. Examples include corporate teams doing business intelligence gathering, a couple planning their vacation, and a diabetes patient looking for information and support regarding treatment options.

For the past few years, many scholars in the fields of information and computer science have been investigating how people work in social and collaborative situations to seek and process information, and how information systems can support these users' needs. These investigations and related efforts for design and development have resulted in new tools and services for social and collaborative information seeking, as well as the development of systems for studying social or collaborative search behaviors. However, research that incorporates social or collaborative aspects, or both, in information seeking is still young, and there are many challenges to be addressed. These include creating suitable data collection and analyses methods, constructing new evaluation frameworks, and developing integrated systems that incorporate people's social and collaborative behaviors. There is a need

to consolidate some of the past efforts in the fields of social information seeking (SIS) and collaborative information seeking (CIS) and provide a more unified path for future research that can potentially have a greater impact. Here, this unified domain is referred to as Social and Collaborative Information Seeking (SCIS).

Why should people care about SCIS? What impact can it have? A straightforward answer to these questions is that SCIS can allow people to address problems that are too difficult or even impossible for one person to solve. SCIS allows people with different skills, knowledge, and backgrounds to share information and work together to solve problems (Talja & Hansen, 2006). SCIS technologies and tools should efficiently and effectively support people in many information seeking activities across a range of collaborative situations. Studying SCIS can offer insight into users' needs and behaviors in collaborative situations, enabling researchers to respond by creating tools that support both individuals and groups in their daily life and work situations. SCIS also has an impact on situations in which tools are needed to support human activities and responses during difficult situations such as emergencies, disasters, and logistical situations. The broad application of SCIS highlights its potential importance in focusing not only on leisure or everyday life situations or traditional work tasks, but also on situations in which SCIS tools and systems may act as part of a larger system of responsive or reactive tools. In these situations, useful tools include those that support intrinsic and implicit collaborations through estab-

lishing formal or informal contracts between parties without the need to preprocess the procedures of an established network of collaborators (Bjurling & Hansen, 2010).

2. Background

Several scholars have argued that seeking information, despite how it is currently perceived by most researchers, is a social activity (Twidale, Nichols, & Paice, 1997). While most of the systems for accessing or retrieving information are designed for individual users, people are increasingly seeking information with the help of others (Hansen & Järvelin, 2005; Morris, 2008; Morris, 2013).

Two related research areas have focused on studying how people seek information with the help of others: research on social information seeking (SIS) and research on collaborative information seeking (CIS). While these two areas have commonalities, SIS has largely focused on situations in which people seek information through or from other people, whereas CIS focuses on seeking information in conjunction with other people. Participants in SIS may have different roles and goals (information seeker or information provider, for example), but in CIS there are often shared goals or similar roles. Examples of SIS include people asking for advice and opinions on Yahoo! Answers, or someone looking for restaurant suggestions from friends and followers on Facebook or Twitter. These cases often include one person who is looking for information and consulting the crowd to receive answers or advice. SIS can be further subdivided into situations where information is sought through unknown people (that is, the crowd or community through avenues such as Yahoo! Answers), or where it is sought through known people (that is, through social networks such as Facebook). By contrast, CIS considers situations where people are working together to seek information. Examples of CIS include a group of students collecting relevant information for a term project or a team of analysts looking for interesting patterns by analyzing newswire data. In these cases the collaborators often have shared goals, although their specific roles and skills may differ.

Given the natural connection between the social and collaborative dimensions of information seeking, a few scholars have attempted to incorporate them into a single definition of a concept being studied. For instance, while talking about the concept of social search, Evans, Kairam, and Pirolli (2010) used "social search" as "an umbrella term used to describe search acts that make use of social interactions with others. These interactions may be explicit or implicit, co-located or remote, synchronous or asynchronous" (p. 657). This is an example of an attempt to generalize a very specific concept – here "search" is a specific form of method for information seeking, and "social" is an attribute of that method. One can imagine several scenarios where such a specific concept and technique could then transform into a more generalized form of information seeking that incorporates social and collaborative components. Similarly, Shah (2014a) argued that study of CIS should include (or could be expanded to) areas such as social media or networking, giving, or at least hinting at, another example of how scholars with a specific focus see the concept studied (in this case, CIS) as connected to something bigger.

In contrast, the analysis presented here considers both SIS and CIS as part of a larger model of social and collaborative information seeking (SCIS). Both SIS and CIS involve groups of people in the process of finding, identifying, and making sense of information. Figs. 1–4 outline how SCIS is considered here. The proposed research agenda for SCIS will include individual-based information seeking activities (single episode or several episodes over time) as well as group-based CIS and SIS as special cases of a comprehensive model of SCIS.

Fig. 1 depicts the dominant model of information seeking in which a single individual looks for specific information over time. Over the past few decades several scholars have explored this persistent or iterated information need, moving to the right along the T axis as shown here.

The proposed research agenda extends the space of information seeking activities into two important additional dimensions, as shown in Figs. 2 and 3. The first, shown in Fig. 2, is the collaborative dimension. The black dot represents a team of three who search on five different occasions. Fig. 3 adds the crucial third dimension which represents the social nature and degree of affiliation among the several searchers. It is shown as orthogonal to the other axes to indicate that it will vary independently of the other two characteristics of the search. Unlike the first two axes, the social axis represents possible relations among people, and is not necessarily expressible on a ratio scale, or even an ordinal scale.

The various components of the proposed research agenda can be situated in the three-axis conceptual space shown in Fig. 4. For example, the red dot represents an information seeking activity involving 3 collaborators, who share a strong and persistent emotional social relation, and have five episodes of information seeking. Note that collaboration can also be quite independent of social relations. In fact, much of the work in CIS has focused on characterizing collaborative activities along dimensions such as time (synchronous v. asynchronous) and space (remote v. co-located) (Twidale & Nichols, 1996), depth of collaboration (Golovchinsky, Qvarfordt, & Pickens, 2009), kind of mediation (Pickens, Golovchinsky, Shah, Qvarfordt, & Back, 2008), and intentionality of the collaborators (Golovchinsky, Pickens, & Back, 2008).

3. Current state of SCIS research

The literature is filled with terms and works that address searching or seeking for information by multiple people. Examples include collaborative search (Morris & Horvitz, 2007; Smyth, Balfe, Briggs, Coyle, & Freyne, 2003; Smyth et al., 2005), collaborative information retrieval (Fidel et al., 2000; Karamuftuoglu, 1998), concurrent search (Amershi & Morris, 2008; Blackwell, Stringer, Toye, & Rode, 2004), collaborative exploratory search (Pickens & Golovchinsky, 2007; Pickens et al., 2008), co-browsing (Esenther, 2002; Han, Perret, & Naghshineh, 2000), collaborative navigation (Esenther, 2002; Laurillau & Nigay, 2002), collaborative information behavior (Karunakaran, Reddy, & Spence, 2013; Reddy & Jansen, 2008), collaborative information synthesis (Blake & Pratt, 2006; Olson, Olson, Carter, & Storrøsten, 1992; Olson, Olson, Storrøsten, & Carter, 1993), and collaborative information seeking (Foster, 2006; Shah, 2012). These works address some form of CIS, focusing on information seekers working in small groups (often pairs). Researchers have also pointed out that CIS is different than collaborative filtering (Shah, 2008), an area of research in information retrieval (IR). Collaborative filtering can involve passive participation and less coordination among participants, whereas true CIS entails participants' explicit and intentional involvement.

Other studies focus on various forms of online question and answer (Q & A) exchanges, referred to as social Q & A (Gazan, 2011; Shah, Oh, & Oh, 2009), community-based Q & A (Agichtein, Castillo, Donato, Gionis, & Mishne, 2008), or collaborative Q & A (Shah, Kitzie, & Choi, 2014). While these and social search (Evans & Chi, 2009) are all examples of SIS, they could also have a component of collaboration as shown by Gazan (Gazan, 2010). In other words, researchers have missed opportunities that extend CIS with a social dimension, or SIS with a collaborative dimension.

It is clear from these works that social and collaborative dimensions of information seeking must be studied and supported as integrated aspects of information seeking. First, both social and collaborative behaviors share certain characteristics, including communication, coordination, and cooperation. Second, they both are often hard to separate in situations involving multi-session and multi-modal work. Finally, by studying SIS and CIS as a continuum with varying degrees of connection-strength among the involved participants, seamless solutions could be created that integrate individual, community-based, socially oriented, and small-group focused informational activities.