

Collaborative Information Seeking (CIS): Challenges and Opportunities

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ABSTRACT

The notion that information seeking is not always a solitary activity, and that people working in collaboration for information intensive tasks should be studied and supported, has become more prevalent in the recent years than ever before. Several new research questions, methodologies, and systems have emerged around this notion that may even prove to be useful beyond the field of collaborative information seeking (CIS), with relevance to the broader area of information seeking and behavior. This position paper attempts to identify challenges and opportunities for both seasoned and novice CIS researcher/practitioner. While the context for this paper is set around CIS, it is my hope that just as this narrative has benefited from fields of Information Retrieval (IR), Computer-Supported Cooperative Work (CSCW), and Human-Computer Interaction (HCI), the lessons presented here will in turn be helpful to researchers working in those domains.

1. INTRODUCTION

While it is natural for us to work in collaboration for difficult or complex tasks (Denning, 2007), many situations involving search, retrieval, and synthesis of information are not typically conceived as such processes. The apparent paradox can be seen in many daily scenarios. Imagine planning a vacation with your family (example often used by Morris, 2007; Morris & Horvitz, 2007, as well as Golovchinsky, Pickens, & Beck, 2008). There are many parts of this complex project that revolves around looking for relevant information, comparing and synthesizing various pieces of it from multiple sources, making decisions, and finally using the synthesized solution(s). It is not atypical for the interested people (friends, family members) to be involved in some or all of these parts. This is an example of people working together in information seeking task.

Other day-to-day life examples include co-authors working on a scholarly article, an engaged couple doing wedding planning, and a recruitment committee working on their new hiring project (Shah 2008, 2010b). Notice that these examples go beyond simply searching together; they include information lookup, sharing, synthesis, and decision-making. In addition, they all have an end-

goal that is mutually beneficial to the parties involved. Such collaborative information seeking (CIS) projects typically last several sessions and the participants are joined with an intention to contribute and benefit. Not surprisingly, the whole process is highly interactive. To incorporate these characteristics, this position paper will focus on collaborative processes that are intentional, interactive, and possibly mutually beneficial.

The discussion will also assume collaborative projects that have a strong component of information seeking, particularly in the Web environment. Having said that, there are two ways of looking at collaboration and information seeking connecting each other.

1.1 Collaboration to help information seeking

Collaboration is used for solving problems that are too difficult or complex for an individual. Information seeking could be such a problem. Take for example, searching for a house to buy. This project is quite complex in nature and typically involves multiple parties, including the buyers (e.g., a husband and a wife), the real estate agent, and the mortgage consultant. They all have the same mutually beneficial goal. Thus, this information seeking project is inherently collaborative, making it an example of CIS.

1.2 Information seeking to help collaboration

Another way to look at the connection between collaboration with information seeking is that often a collaborative project requires information seeking. Think about the example of a family vacation. The whole project is collaborative, and a part of it (planning) is focused on information seeking.

To summarize, one could come to CIS from an information seeking project or a collaborative project. It is often difficult to distinguish these two kinds of scenarios, and for the most part, it will not affect the discussion in this article. However, it is important to point out these intertwined relationships among information retrieval/seeking and collaboration for conceptual understanding.

2. CIS – GOING FORWARD

Collaborative information seeking (CIS) stands at a very interesting intersection. It is both a long-standing domain within CSCW, and a relatively young field that has been shaped by several veteran domains such as IR, CSCW/groupware, and HCI. Another way to think about CIS as a field of research is that while we have seen a tremendous amount of interest and outcomes in the recent years as evident by the publications, systems, and events around CIS, many ideas have come from previous research in well-established forums of SIGIR, CSCW, and CHI. Having said that, it is worth noting that while CIS today retains the traces of these domains because of its interdisciplinary nature, it is also constantly evolving and creating its own identity through carving out a unique

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space of research problems. Figure 1 depicts CIS as an interdisciplinary field that is at the intersection of Information seeking, collaboration, CSCW, HCI, and social media/networking.

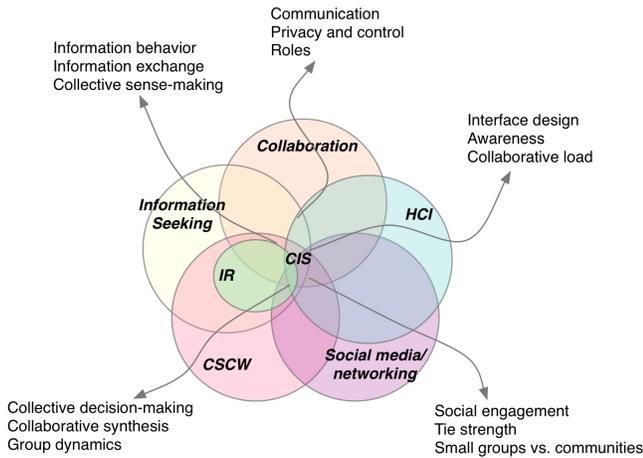


Figure 1: CIS as an interdisciplinary field, along with some of the issues stemming from different parts of it.

This figure is not drawn to scale by any measure; it is rather an attempt to provide a view of various fields as they connect with CIS with their scholarly works and contributions by corresponding researchers and practitioners. Some of the concepts in this figure have come from recent workshops on CIS and related topics. For instance, at a workshop on CIS at the ACM CSCW 2010 conference,¹ the participants brought together views and ideas from CSCW, IR, and HCI to investigate issues with CIS. Similarly, a CIS workshop at ASIST 2011² demonstrated how researchers from Library and Information Science (LIS) and social media domains could address rising challenges of CIS domain.

Also shown in the figure are some of the issues that emerge from different aspects of CIS field. For instance, one interested in the HCI aspect of CIS may need to think about issues such as interface design for CIS systems, reducing collaborative load to the participants, and providing appropriate amounts and kinds of awareness.

The following two subsections will take a detailed look at many of these issues in CIS that are divided into theoretical and experimental categories.

2.1 Theoretical Issues

Despite the importance of studying CIS and providing solutions that support it, there is a lack of comparable CIS theories and models similar to those that exist for individuals information seeking, such as Belkin (1980), Marchionini (1989), and Wilson (1999). Development of sustainable CIS models will depend on addressing some of the fundamental issues in the field, including user motivations and methods for collaboration, social aspects of working in collaboration, individual and group benefits, user roles, CIS system design challenges, as well as evaluating a number of aspects about the user and the system in a CIS environment.

Similarly, there is a need to identify and understand information synthesis and sense-making processes that take place when people

work in collaboration. We have models for information search processes (ISP), such as the one by Kuhlthau (Kuhlthau, 2005, 1994), and a mapping of this model to CIS (Hyldegard, 2006, 2009; Shah & González-Ibáñez, 2010). Similar extensions need to be explored that look at not only ISP, but also other processes in collaboration context, as well as extending such mappings beyond office environments.

A few works, such as Reddy and Jansen (2008), have looked at collaborative information behavior (CIB) in specific setups such as healthcare. Such efforts need to be extended further encompassing more situations and domains.

Following is a list of specific issues and questions on the theoretical front of CIS that we need to address next.

1. We have a fairly good understanding of why people collaborate. However, these motivations are often not identified in the context of situations in which collaboration occurs. Often, even if collaboration can be useful, people do not see the value in collaborating. We need to identify such situations and learn to promote collaboration to people. Similarly, the literature points us to a list of tools and methods that people use for collaborating. However, the relative merits of these tools and methods are not very clear. Often, people collaborate using tools that were not specifically designed for collaboration. One could argue that we need specialized tools to support CIS, but we do not know what such tools may look like and how we could promote them to people without causing additional burden to them.
2. We have seen a number of works done to understand people working with collaborative systems such as SearchTogether (Morris & Horvitz, 2007), and people's behavior in online communities and social networking sites. A link that connects these two is missing. In other words, we do not know how we can leverage people's engagement in social networking sites to promote collaborations or support various social activities with collaborative systems.
3. How to measure the costs and benefits of collaboration? We saw that providing awareness induces additional cost, but if we are careful designing our CIS system, we can harvest many benefits of this awareness without causing any significant burden on the user. Similar investigations for other important issues for CIS, such as control and communication, are needed for developing a comprehensive understanding of various design issues in CIS.
4. What are the information seeking situations in which collaboration is beneficial? When does it not pay off? We acknowledge that collaboration is not always useful or desired, and then focused on only those situations where it is intentional and beneficial. Further investigations are needed to also study the situations where collaboration is potentially harmful. This understanding can help us do a better cost-benefit analysis of doing collaboration in a given situation. See González-Ibáñez et al. (2012b) for some preliminary work on this issue.
5. How to extend individual information seeking, synthesis, and sense-making models to incorporate collaboration? This paper was focused on people working on information seeking process in collaboration. It is possible that certain form of information synthesis and sense-making are also taking place during such information seeking process. For the sake of simplifying the studies, such possibilities were ignored here and needs further investigation in the future studies.

¹ <http://workshops.fxpal.com/csw2010cis/Overview.aspx>

² <http://collab.infoseeking.org/events/asist2011workshop>

6. How can we convert a social tie to a collaborative tie and vice versa? Through relevant literature review, this article suggested that there might be ways to facilitate collaborative processes in social environments. Given the ubiquitous nature of online social networks, this issue merits further investigation.

While CIS is still trying to take a more defined shape as a field and lacks a strong theoretical foundation that information seeking and related fields enjoy, there are opportunities to learn from theories and concepts from other disciplines. For instance, one could look at cognitive load theory (Sweller, 1988) to understand to what extent an individual deems to participate in a CIS project. There are also several rich theories that one could borrow from Computer Mediated Communication (CMC) to develop a communication-focused theoretical framework for CIS. For instance, the media richness theory (Daft & Lengel, 1984) considers media according to their capability to provide feedback in terms of the number of channels they support (e.g., audio, visual). This can be useful in understanding the effectiveness or appropriateness of communication channel while collaborating in a given time-space situation (see e.g., González-Ibáñez et al., 2012a).

2.2 Experimental and Practical Issues

Since CIS has emerged as an interdisciplinary field, it is no surprise that it has borrowed methods and experimental frameworks from IR, HCI, and CSCW, among others. Some of the most common methods for conducting experiments have been laboratory studies, interviews, surveys, observations, and to some extent field studies and simulations. There are opportunities to explore other ways to collect and analyze data that are more tailored to CIS research needs. Following are some of the pressing issues concerning experimental and practical aspects of CIS research.

1. Several of the research studies reported in the literature are targeted toward a specific population - college students, professionals in social sciences, and knowledge workers. Further, investigations are needed to study other specialized populations, such as families with health issues, and intelligent analysts working in teams. This may require employing different methods of studying collaboration, including cognitive walkthroughs, and empirical observations.
2. The laboratory studies, which many of the research works employ, can be extended to field studies, allowing the participants to work without several limitations the controlled lab study had. The participants in a field study could work with the system as they please, creating their own projects of interest, and initiating collaborators with their colleagues and friends as they see fit. Running a field study over a long period of time (at least a few weeks) will also allow one to study long-term adoption effects, appropriation factor, and specialization with various features of the system.
3. What type of visualization methods can be useful for CIS interfaces? Systems such as SearchTogether (Morris & Horvitz, 2007) and Coagmento (Shah, 2010a) provide a very basic interface for viewing personal and shared information. However, the issue of having new kinds of dynamic and interactive interfaces appeared highly important during the participatory design sessions reported here. This issue deserves more advance treatment with interface designs and experiments.
4. What additional tools are required to enhance existing methods of collaboration, given a specific domain? Such domains may include office environments, educational settings, or

even domestic projects. We know that in order to extend an individual information seeking process to collaborative information seeking, we need to not only create a support system that connects the collaborators and makes it easy for them to communicate, but also provide appropriate and adequate awareness (Shah & Marchionini, 2010). Such requirements and specifications may vary from domain to domain.

5. One way to extend analyses done for many of the collaborative experiments is by considering a team, instead of an individual, as the unit of analysis. Allowing any size of group for a collaborative project, and studying the group dynamics can be a very complex procedure, but can also provide us with very insightful details into how people collaborate and what type of support they need to make their collaborations more effective and engaging.
6. The CSCW literature identifies three major issues in a CIS environment: control, communication, and awareness (Roden, 1991). Control is domain specific; communication is system specific; but awareness may depend on several factors, including task, distribution of responsibilities among the collaborators, roles of the collaborators, nature of the final product, need for privacy and sharing among the collaborators, and the nature of their collaboration (synchronous vs. asynchronous, co-located vs. remote). The issue of awareness is highly understudied in the CIS literature and a good understanding of implementing support for awareness in a CIS system would add considerable value to CIS theory and practice. In general, there is a need to sketch out good design practices for building specialized CIS systems.
7. There are a few works in the literature with suggestions for evaluating a CIS system as well as users' performance while working with such a system (e.g., Baeza-Yates & Pino, 1997). However, it remains unclear what factors we should measure and how. This is likely to depend on the domain of the application. For instance, for a time-bound recall-oriented task such as the one reported in Pickens et al. (2008), we can use relevance and efficiency as measures. But, such metrics may not be appropriate for an education setting, where learning is probably a more important factor to measure. A taxonomy of evaluation metrics for different CIS situations is needed.

Once again, CIS can benefit from other related fields for further work concerning such system design, development, and deployment issues. For instance, Grudin's (1994) guidelines for groupware system developers are still both valid and relevant to those building and evaluating CIS systems.

3. SUMMARY

In different fields and contexts, researchers have recognized the need to study and support people working in collaboration. In IR and LIS, this has been primarily focused on extending single-user environments to accommodate multiple participants in information intensive situations. However, most of these approaches have been application-driven, and we still lack a set of models, specialized tools, and best practices that help us support collaborative information seeking (CIS) effectively. Such a need is identified in the present article in order to sketch out a research agenda. A set of key works, from different fields, was first recognized, putting both collaboration and CIS in perspective. The early works for supporting collaboration in information intensive domains were primarily focused on office environments or library

settings, whereas recent projects for CIS have been targeted more specifically for online information seeking situations.

The advent of Web 2.0 and the fact that an increasing number of people have access to online information sources have driven new developments in CIS to focus more on building tools that leverage on these provisions. However, it is time we start paying more attention to some of the fundamental issues in CIS. They include understanding user requirements and behavior in CIS environments, identifying motivations and best practices for people doing collaboration, and sketching good design guidelines for CIS systems. Above all, there is a dire need to devise new models, theories, and evaluation matrices for CIS. These issues are at the core of the CIS domain, and studying them could help us get closer to having a better understanding of people's behavior in CIS environments, as well as designing better CIS systems.

4. ACKNOWLEDGEMENT

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