The Exaggerated Role of Perception Within Collaborative Information Seeking

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ABSTRACT
This position paper proposes a taxonomy of perception in Collaborative Information Seeking. Individual searchers can have limited perceptions of their own information needs. In Collaborative Information Seeking, however, individuals must convey this need to other people, who then may have a limited perception of the message. Further, the information need may be shared by a group and perceived differently by each member. This paper draws upon the notions of perception from key related fields and defines three dimensions of perception in Collaborative Information Seeking: Direction, Communication, and Subject.

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Collaborative, Information, Seeking, Perception, Need

ACM Classification Keywords
H5.3. Group and Organization Interfaces: Theory and Models. H3.3. Information Search and Retrieval: Search Process.

INTRODUCTION

Perception plays an implicit, pervasive, and significant role in resolving a given information need. In Collaborative Information Seeking (CIS), however, the role of perception may be either: a) exaggerated as individual's try to resolve their own perception of a shared group need; or b) compounded as they help to resolve what they perceive to be another person's need, based on that other person's perception of their own need.

The aim of this position paper is to externalise an initial taxonomy of where perception plays a role in CIS, so that it can be discussed, studied, and improved by the community. This paper first reviews the current understanding of perception in related academic fields and then describes the three dimensions of perception that are included in the taxonomy: Direction, Communication, and Subject. Design considerations are then briefly discussed before concluding that lessons must be combined from each related field.

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This position paper will, of course, be based on how I perceive CIS, how I perceive the findings of IS literature, how those authors perceived their own findings, how those pieces of literature perceive the findings of other work, and how I perceive that these findings apply to CIS.

RELATED WORK

Although collaboration has been implicit in much of the history of IS, the regular frequency that people collaborate on shared information needs was highlighted by Morris in 2008 [12]. In the few years both before and after that survey, several CIS interfaces (e.g. SearchTogether [13]) have been produced. Several models have also been introduced. Notably, Golovchinsky and colleagues defined dimensions of CIS that included synchronisation, co-location, and automation [7]. Shah also noted that there are many layers that make up CIS, including corroboration and communication [18]. These and other papers include more detailed reviews of CIS.

Perception is a natural and critical part of human information processing, and so has been involved, at least implicitly, in many areas of research; including Human-Computer Interaction (HCI), IS, and Computer Supported Cooperative Work (CSCW).

Perception in Human-Information Processing

Human-Information Processing is an area of research focusing on how the brain applies itself to information as it arrives, in terms of the memory stores, attention, and perception. While the research into memory stores, such as Short Term and Long Term Memory, have investigated how captured data is processed and stored, attention describes how we filter and focus on different pieces of incoming information. Finally, perception focuses on how we interpret the incoming information.

In fact, perception is our only means to understand incoming information. It is this fact, and any surrounding philosophy of how our only knowledge of the world is in what we perceive of it, that played a part in Descarte's reductionist dictum 'I think, therefore I am'. That is that we have no firm evidence that what we perceive is true, and not a trick or illusion. In visual perception, for example, our eyes simply see light-levels reflecting off of surfaces, which, based upon our knowledge and experience, we perceive to be real-world objects. Thus, we do not see real-world objects, but perceive, based on incoming information,

what is around us. Our depth perception, for example, is based on our knowledge and experience of shadows, overlap, movements, and texture. There are many optical illusions that can exploit such factors to make objects appear, for example, to be distant or 3D when they are not.

One of the main theories of perception is constructivism [21], where we build representations and respond accordingly, based upon changing knowledge and evolving needs. We also know that perception, constructed from memory, can be heavily influenced by language, such as leading questions. In 1974, Loftus and Palmer [11] asked 45 participants to watch 7 videos of two cars crashing. Shortly after each video participants were asked to recount the accident onto paper. They were then asked specifically how fast the two cars were going when they collided, varying the use of five possible verbs of increasing strength, including 'smashed' and 'bumped'. Such variation had a statistically significant effect on the retrospectively perceived speed of the two cars.

Perception in Information Seeking

There have been many implicit, and a few explicit, discussions of perception in IS literature. Most notably, Ingwersen and Jarvelin [10] reviewed Ingwersen's previous cognitive model of IS [9] and created the diagram shown in Figure 1. The main message being portrayed in Figure 1 is that for every element of IS, there are factors of how we perceive them. For example, we cannot know the full details of every item in a corpus, but we do have a perception as to what it contains. We do not know the exact inner workings of the Google algorithm, yet we have a perception of how it works, which is affected by our knowledge of information retrieval algorithms and indexes.

Jarvelin and Ingwersen also identify 9 key dimensions of IS. While these dimensions include typical aspects such as human searchers, algorithms, and corpora, two are notably: Perceived Work Task and Perceived Search Task. These are separated from the Work Task and Search Task dimensions.

The notion that perception plays a role in IS is most commonly associated with unclear, or under-defined goals. In originally defining the Exploratory Search problem space, for example, White and colleagues noted three key scenarios: 1) when a user has little knowledge of the domain of information, 2) when the user a limited understanding of how the search system works, and 3) when the user has a limited understanding of their information need. The last of these cases relates to the Ingwersen and Jarvelin's dimensions of Perceived Work Task and Perceived Search Task. In the first scenario, however, the user has a limited ability to perceive what information is in the domain or how they can use it to describe their need. Finally, the user in the second scenario has a limited ability to perceive the functionality of the search system, and how they can leverage it for their search. We see this idea of perceived functionality in Human-Computer Interaction (HCI) principles too.

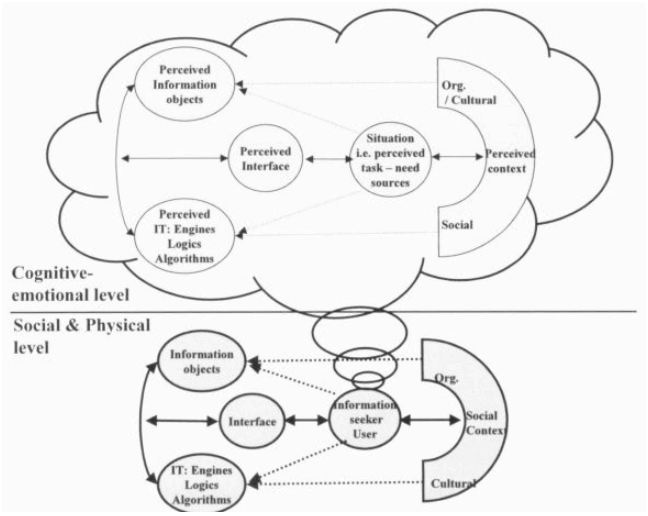

Figure 1: Perception of Information Seeking factors, from [10]

Perception in Human-Computer Interaction

The notion of perception, having learned in part from Human-Information Processing, is also implicit in many design philosophies. Visibility, for example, is one of Nielsen's 10 heuristics [14] that builds on the notion that users do not use functionality of a system if they do not perceive that it is there. Such notions are used to explain why novel technology becomes increasingly hard to understand for aging users. With the experience and a mental model of how a Video-Cassette Recorder works, for example, users can find it hard to perceive how they should play recordings within a hard-drive based Personal Video Recorder. Similarly, with a mental model of analogue televisions, it can be a hard for users to perceive that they can now pause, rewind, and fast-forward live television.

Beyond the application of the leading-language problem to interview and questionnaire technique, perception has had a large affect on the use of observation techniques. The think-aloud technique [20], for example, was designed because an evaluator is only able to perceive a participant's visible physical actions and not their thought processes. Conversely, however, both activity logging and observation techniques are encouraged because participants are known to incorrectly perceive their own problems or behaviours.

Another philosophy within HCI, is in the externalisation of design ideas into increasing-fidelity prototypes. Sketching is a technique recommended by Buxton [2] that encourages designers to externalise design ideas so that colleagues can more easily perceive and discuss them. The next section looks more closely at collaborative work.

Perception in Collaborative Work

The idea that users have a limited perception of their required work task, from IS theory, is grounded in the wider theories of how people collaborative in the work place. Feldman, for example, examined the affect that digital communication was having on how employees perceived the organization they worked for, and the tasks they had been set [6]. Her hypothesis was that people who were

physically or organizationally distant did not communicate frequently, because they could not perceive any shared or mutual interest. Her evidence indicated that while electronic communication reduced the cost of communicating with distant colleagues, the digital medium increased the chances of miscommunication and error.

Feldman's work investigates one of many factors captured under the banner of 'awareness', which Schmidt analysed in great detail in 2002 [17]. Such awareness can be broken down into elements such as social awareness (as with Feldman), awareness of others' actions, and awareness of collective progress. Further, the production of work outputs are designed based on how they perceive their colleagues will judge the contribution [3]. Similarly, in his book, Clark describes the notion of 'Common Ground' as shared knowledge, beliefs, and suppositions. Reviewing much previous work, he describes how shared knowledge allows collaborators to better coordinate and work together [4].

In a similar vein, the theory of distributed cognition suggests that groups and communities of people cultivate and share perceptions of systems or ideas [8]. Such work was later used to construct theories of shared mental models of systems, where empirical evidence was collected (e.g. [5]) to show that group-work can be achieved more effectively if members have a good perception of member-expertise, and how their work will contribute to the expected outcome.

One common theme in collaboration, whether explicit or implicit, is communication. In a study of asynchronous collaboration of medical staff and how they hand-off between shifts, Sharma and colleagues noted the importance of pitching information at the appropriate level of expertise and experience for the recipient [19]. The pitch level chosen, of course, depends on a speaker's perception of the receiver's knowledge. Further, Paul studied how medical staff perceive and make sense of the current state of play. Each staff member will have a perception of priorities and the status of patients. She reports on, for example, the use of whiteboard and software artefacts to ground the shared mental model held by the staff [15]. She found that different members, dependent on their tasks, often created separate artefacts to represent specific additional knowledge not captured by the group artefacts. In such circumstances, shared knowledge artefacts, and increased communications are used to reduce individualized perceptions.

PERCEPTION IN COLLABORATIVE INFORMATION SEEKING

In the sections above, the role of perception in several academic fields is described. As a specialism of Human-Computer Interaction and Information Retrieval, focussing on collaboration, Collaborative Information Seeking (CIS) has to learn from each of these subject groups. To summarise, this means that we should consider the following aspects of perception in CIS behaviour:

- Users will have a perception of a shared information need, which may differ from other group members
- Users will have a perception of their own information need, which may be a sub-need of a shared need
- Users will have a perception of what other people may need in a group
- Users will have a perception of other people in the group, their roles, and their expertise.
- Users will have a perception of what their role in the group is, which may differ from how other people perceive their role.
- Users will have a perception of the actions other people are likely to have taken in pursuit of a shared information need.
- A user's perspective of another person's need may be based on the way that person perceived their own need.
- The language that a person uses to describe their need will influence another user's perceptions of it.
- A user's perception is based on their knowledge constructs, which will vary from person to person in the team, and evolve throughout the CIS period.
- The group's shared-mental model of an information need will evolve based on the members' evolving needs.
- Users may have different perceptions of any software or artefact used within CIS, such as whether data and representations are, current, declarative, or subjective, fixed, or modifiable, etc.

Dimensions involved in CIS Perception

In reviewing these factors listed above, there are three clear dimensions of perception involved in CIS behaviour. These dimensions are described below and presented in Table 1.

Direction: Introspective or Extrospective

This dimension focuses on whether the perception is of a person's own participation in CIS, or other peoples behaviours. The latter of these is more open to subjective interpretation and can be supported by, or in deed heavily influenced by, communication in some form. Extrospection may, however, be further deconstructed into the reflection of one person's behaviour, or the behaviour of a group, but such division is not directly addressed in this paper and may be a viable research focus for the future.

Communication: Written, Spoken, or Imagined

The perceived information need during individual IS is based on a person's evolving knowledge and understanding. This is typically imagined and unspoken. However, it may be that a person has been asked to find something, or given a documented task to achieve. The language used in both written and spoken communications may heavily influence the perceptions of the receiver.

Subject: Person or Information Need

The literature reviewed above makes it clear that both the coordination of roles and actions are involved in collaboration. This dimension refers to whether the user's perception is of a person and their role, or an information

Table 1: A Proposed Taxonomy, with suggested examples, of Perception in Collaborative Information Seeking

	Introspective		Extrospective	
	Person	**Information Need**	**Person**	**Information Need**
Written	e.g. Interpretation of a documented work role	e.g. Interpretation of a documented CIS need	e.g. Interpretation of another persons work role	e.g. Interpretation of the research group's objectives
Spoken	e.g. Interpretation of assigned role in task	e.g. Interpretation of an assigned CIS need	e.g. Interpretation of another persons temporary role	e.g. Interpretation of an informal group's shared aim
Imagined	e.g. Self-assumed role in CIS group	e.g. A Self-conceived element of a CIS need	e.g. Interpretation of another persons skills or input	e.g. A notion of what another person might find informative

need. Perception of role and need may be either introspective or extrospective.

Potential Design Considerations

The main design aim should be to move up and left in the taxonomy described in Table 1. There are, however, many possible design considerations that could be drawn from the analysis above, some of which are being partially addressed by existing projects. With the aim above, however, let us consider the design of an example collaborative information seeking application: SearchTogether [13]. While SearchTogether supports people in communicating about their collaborative searches, the exact information need of a person may remain informal or implicit. SearchTogether could support collaborative search by providing a to-do list, similar to the queued queries in the CoSearch system [1]. With a per-person to-do list, the information need would become written, instead of imagined or spoken, in both Introspective and Extrospective conditions. Similarly, each person's profile could be made more explicit in the user interface, providing information about hobbies, interests, or employment. Such detail could also move both the Introspective and Extrospective Person perceptions up from Imagined (or Spoken) to Written.

In a more extreme example, Pickens and Golovchinsky designed a system where the person roles are explicitly separated on the server side [16]. By abstracting the communication between two searchers, their system potentially removes the notion of extrospective, perceived, information needs during collaborative information seeking. Users, however, may still search or rate results differently, depending on their unspoken perception of their collaborator. A searcher may recommend sites with high technical detail for a colleague, or a summary document for a boss, for example. In such a case, a specific profile or expertise of the other person, made explicit in the system, may again reduce any incorrect assumptions about their skills or existing knowledge.

While these two examples focus on the perception of what another person might want or need, the introduction also mentioned the occasion when a need is shared amongst a whole group, such a group holiday. In such occasions, where different people may have different perceptions of what makes a good holiday, a system, like SearchTogether, could also have a more elaborate project definition stage. Currently, the system provides space for a name and short description but could instead provide a space to break the project into sub-projects, in a way that can be discussed or revised collaboratively like a wiki. Finally, CIS designers may want to consider, based on the working context, whether factual declarative language could be enforced (e.g. in legal circumstances) or if creative influential language is appropriate (e.g. in negotiation). With the larger information need more formally defined, the shared information need would move up in the extrospective half of the taxonomy, from imagined or spoken, to written.

CONCLUSION

This position paper has begun to address the concept of perception in Collaborative Information Seeking (CIS), by reviewing the literature surrounding perception in related academic fields. Three dimensions of perception within CIS have been captured in an initial proposed taxonomy: Direction (Introspection or Extrospection), Communication (Written, Spoken, or Imagined), and Subject (Role or Need). This taxonomy may help CIS designers to think about the types of perception that need supporting in different ways, whilst being considerate of externalisation, influence of language, and shared knowledge. While methods of addressing perception can be learned from the expertise of each related field, they must be brought together to support CIS effectively.

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