ResultsSpace: An Experimental Collaborative Search Environment

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ABSTRACT
In this demonstration, we present a system called ResultsSpace to support collaborative information seeking by small groups. ResultsSpace is designed to help groups who are collaborating on searches asynchronously, and includes specific user interface features to increase awareness of collaborators' prior actions and progress. We present the main features of ResultsSpace including collaborative ratings and displays embedded into search results, a peripheral display of collaborators' previous queries, and a results filtering mechanism. We conclude with a summary of our current work to evaluate the system and describe scenarios of use that motivate our future work.

Keywords
Collaborative search, collaborative information seeking

INTRODUCTION
Collaborative information seeking (CIS) is a focus of recent attention in the information retrieval and information science research communities. An important issue for CIS researchers and designers is supporting users' needs for awareness and understanding of collaborators' (Paul and Morris, 2008; Shah and Marchionini, 2010; Golovchinsky et al., 2011). In the Results Space system that we present here, we focus on mechanisms to support awareness of collaborators' search actions in predominantly asynchronous collaborations. Asynchronous collaborative searching has been shown to comprise a significant portion of collaborative searches and is not well-supported by current tools (Morris, 2007; Evans and Chi, 2008; Capra, et al., 2010; Capra et al., 2011).

Specific features were designed into Results Space to increase awareness of collaborators' actions with a goal of increased flexibility in reviewing and understanding collaborators' work. These include ratings displays and controls embedded within the search results list and query histories and filter controls in the periphery of the interface.

In this demonstration paper, we present the main features of the Results Space system and discuss design rationale for user interface components. Parts of this summary are similar to descriptions of an earlier version of the system that are included in our ASIST 2012 full paper (Capra, et al., 2012a) and a demonstration at JCDL 2012 (Capra, et al., 2012b), but here we describe changes made to the system after initial testing and provide scenarios we are using to motivate our development.

RELATED SYSTEMS
It is outside the scope of this demonstration paper to provide a comprehensive review of prior work in this area. However, we note related collaborative search systems – SearchTogether (Morris and Horvitz, 2007), Cogamento (Shah and Marchionini, 2010) and (Shah and González-Ibáñez, 2010), Co-Sense (Paul and Morris, 2009), Querium (Golovchinsky et al., 2011), and a system developed by Pickens et al., (2008) which had features to algorithmically mediate aspects of collaboration.

THE RESULTS SPACE SYSTEM
The main Results Space interface is shown in Figure 1. Results Space was designed to support small groups of two to six people in conducting collaborative information seeking tasks. The version presented here is configured to search the AQUAINT corpus of newswire articles.

Query Box
The query box is at the top of the page and was designed to be easy to identify via a familiar magnifying glass icon.

Results Displays
Results are shown in the middle of the page using a layout similar to many search engine results pages (SERPs). To the left of each result is a set of three ratings available to all collaborators: relevant, maybe, and not relevant. These will be described in more detail below. The title and snippet of each result is highlighted in green or diminished (faded out) based on the overall consensus of the group ratings. This feature was designed to emphasize the collective rating of each document. For example, in Figure 1, we can see document #1 has been rated as relevant and is highlighted green, whereas document #2 has been rated not relevant and is faded out.

Document View Page
Clicking a result item takes the user to a new page (Figure 2) that shows the text of the article along with a set of ratings controls similar to those in the results listing, and a blue back arrow to return to the SERP.
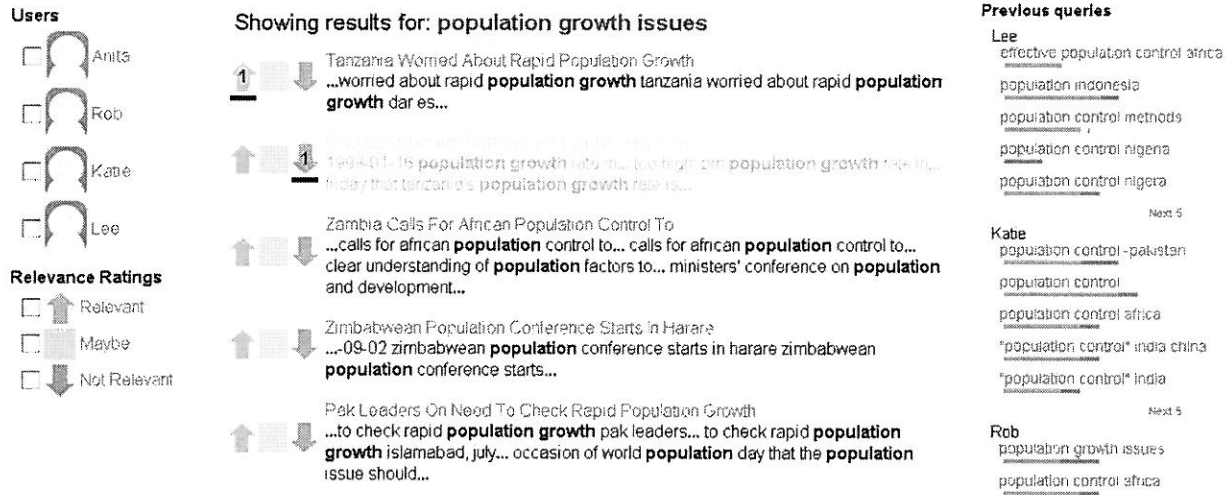
results space
an experimental search environment

population growth issues

✕ Q

Users

☐ Anita

☐ Rob

☐ Katie

☐ Lee

Relevance Ratings

☐ ⬆ Relevant

☐ Maybe

☐ ⬇ Not Relevant

Showing results for: population growth issues

1 ⬇ Tanzania Worried About Rapid Population Growth
...worried about rapid **population growth** tanzania worried about rapid **population growth** dar es...

⬆ 1 1994-01-15 population growth rate in... too high pm population growth rate in... in day that tanzania's population growth rate is...

⬆ ⬇ Zambia Calls For African Population Control To
...calls for african **population** control to... calls for african **population** control to... clear understanding of **population** factors to... ministers' conference on **population** and development...

⬆ ⬇ Zimbabwean Population Conference Starts In Harare
...-09-02 zimbabwean **population** conference starts in harare zimbabwean **population** conference starts...

⬆ ⬇ Pak Leaders On Need To Check Rapid Population Growth
...to check rapid **population growth** pak leaders... to check rapid **population growth** islamabad, july... occasion of world **population** day that the **population** issue should...

Previous queries

Lee
effective population control africa

population indonesia

population control methods

population control nigeria

population control nigera

Next 5

Katie
population control -pakistan

population control

population control africa

"population control" india china

"population control" india

Next 5

Rob
population growth issues

population control africa

Figure 1. The Results Space System

← results space
an experimental search environment

⬆ 1 ⬇ **Tanzania Worried About Rapid**
DAR ES SALAAM, September 22 (Xinhua)
Lowassa Wednesday expressed worries the

Figure 2. Document View Page Controls

Relevance Rating Display and Controls

The Results Space system allows collaborators to rate result items with one of three relevance ratings: relevant, maybe relevant, and not relevant. Combined display/control icons for these ratings are shown to the left of each search result as a green up arrow, yellow box, and red down arrow respectively (Figure 1). The rating icons are displayed in vertical columns to the left of each result to support easy scanning. Users can click on these icons to indicate their evaluation of a document. In addition, the icons serve as an awareness display of collaborators' ratings – numbers are displayed inside the icons to indicate the total number of collaborators who have made that rating. Users get immediate feedback when they click their own ratings by the display of a black bar underneath the icon of their rating. This makes it easy for a user to see that they have made or changed a rating without having to rely on recognizing that the count has changed. Using the mouse to hover over one of the rating icons will cause a small box to be appear next to the icon with a display of the names of the collaborator(s) who had made that rating.

Filter Mechanisms

The filter mechanisms on the left side allow users to filter by users (i.e., individual collaborators) and relevance ratings. The system allows the option of applying the filters to narrow the results of a specific query or to apply them over the entire collection of documents (with an empty query). The currently applied filters are reinforced by a grey box at the top of the results that displays a textual representation of the query and filters (Figure 3)
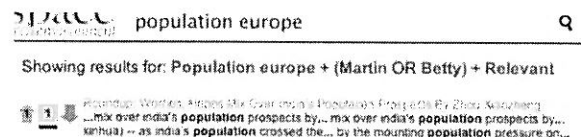
space *an experimental search environment* population europe Q

Showing results for: Population europe + (Martin OR Betty) + Relevant

⬆ 1 ⬇ Roundup: Worries Among Mix Over India's Population Prospects By Zhou Xiaohang
...mix over india's **population** prospects by... mix over india's **population** prospects by... xinhua) -- as india's **population** crossed the... by the mounting **population** pressure on...

Figure 3. Current query and filter display above results

Query Histories

On the right side of the screen is the previous queries display. The five most recent queries are shown for each collaborator in order to provide users a way to quickly get an overview of their collaborators' recent searches. Our original design showed the previous 10 queries across all collaborators, but after testing, we incorporated this change to ensure representation of each collaborator's work in the query histories. If a collaborator has issued more than five queries, "Next" and "Previous" controls are displayed for paging through their queries. The queries can be clicked to display the results for that query.

We also introduced a new awareness display element (a green, red, and grey bar) associated with each previous query. The bar is displayed under each query and indicates the overall relevance judgments of the first ten documents retrieved by the query. For example, in Figure 1, for Katie's third query, "population control africa," there are four documents that have been judged relevant by the team (green), one judged not relevant (red), and the rest have not been evaluated or were evaluated as "maybe" (grey). This bar display conveys quite a bit of information in a compact form. Users can quickly see which queries resulted in documents that their collaborators' rated as relevant or not, and they can also see which queries have already had many results rated. We anticipate that these displays will help users assess both new areas for exploration and in understanding which existing areas might benefit from more searching.

Current Work

We are currently conducting studies to examine how these awareness mechanisms will be used in collaborative search settings and to evaluate the effects of the awareness mechanisms on aspects of collaborative information retrieval including group recall and precision, group overlap, awareness of collaborators' actions, and qualitative differences in how users understand a search topic after using the system.

Exploratory Scenarios for System Use

We conducted a study with ResultsSpace in which participants used the system to search for articles for an academic group paper writing scenario (Capra, et al., 2012). The initial findings suggest that the system may be particularly useful in situations in which a group engages in collaborative information seeking that also involves components of sense-making. Below, we describe two exploratory scenarios that we are using to help guide our future work.

Collaborative Information Seeking in the Classroom

The search task we employed in our initial study was framed as a course activity, and the potential utility of the interface in class projects is particularly clear. ResultsSpace could serve as a platform for a group of students to collectively search for documents about a given subject. The interface currently offers features that enable them to see what documents others have found, and what they think of those documents. In addition, it would be helpful for students to be able to take notes about these documents that could later be viewed by collaborators, and have access to features that facilitate analysis of the documents found. Such note taking features have been included in other collaborative search systems. We chose to focus on the ratings and query awareness mechanisms in our current system, but anticipate including these note-taking features in a future version.

Health-Related Collaborative Information Seeking

Another context in which our system might be helpful is in the realm of health information seeking. As previous literature has observed, there is a collaborative aspect to health information management (Brashers, Goldsmith, & Hsieh, 2002). Members of a patient's support network, e.g. physicians, family, friends and concerned others, may attempt to share information with patients in order to help them manage their condition. In addition, patients often bring up information that they found on the Internet in the consultation; thus, a system that facilitates health-related collaborative information seeking could be enormously helpful.

However, health-related CIS also poses its own challenges. Previous research has also shown that information sharing among families can also be problematic because information provision by a family member might be perceived as attempted influence or interference (Veinot, Kim, & Meadowbrooke, 2011). The dynamics of health-related collaborative information seeking may also differ depending on the condition. Thus, in a system aimed at supporting health-related information sharing, it might be particularly important that users are able to have their own private space of information and be able to control various factors such as the timing and extent of document sharing. In prior work by our research group (Capra, et. al, 2010), we observed this need for users in some domains to collect information into a personal space and then easily share parts of it, and it seems particularly relevant to health-related CIS.

CONCLUSION

In this paper, we presented Results Space, a system to support small groups working on collaborative searches. Results Space includes user interface mechanisms to support awareness of collaborators' prior actions, including ratings of search result items and displays of collaborators' queries with bar displays to give users a visual preview of salient features of the query (relevant/not relevant documents, and how many documents have been rated). We outlined our current work on the system and described two motivating scenarios of use that are guiding our future directions.

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