

Trailblazer - Towards the Design of an Exploratory Search User Interface

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ABSTRACT

When conceptualizing user interfaces (UIs) to support exploratory search, designers need to take into account various aspects. In contrast to ordinary information retrieval UIs, exploratory search user interfaces (XSIs) need to support users in a more complex and often long term use scenario. An XSI needs to provide a visually appealing overview over retrieved search results, it should offer simple ways to interact with the result set and offer easy ways of interaction to enhance the user's search experience by direct or indirect query refinement options. In this paper we identify the requirements of a specific XSI concept, describe this XSI concept and its features & present first results of a conducted usability study.

Author Keywords

Search User Interface, Exploratory Search, Search Trails.

ACM Classification Keywords

H.5.2 Information Interfaces and Presentation: User Interfaces.

General Terms

Design, Human Factors.

MOTIVATION

Adhoc-searches are well-supported by current web search engines and their front-ends. Beyond that, complex information needs or investigations that rely on multi-session search processes are not very well supported [11]. New concepts to satisfy such requirements are being developed and investigated under the term *exploratory search* (XS) [11, 19]. It is based on advances in technology as well as novel insights from psychology. However, there is a growing need of users to get supported in complex search tasks like exploratory searches. Ergonomically designed user interfaces should support users by easy-to-use switches between overview and context views [16] since this is one of the key tasks of an ergonomic *Exploratory Search User Interface* (XSI, see also [19]). Noël [12] modelled the exploratory search process in

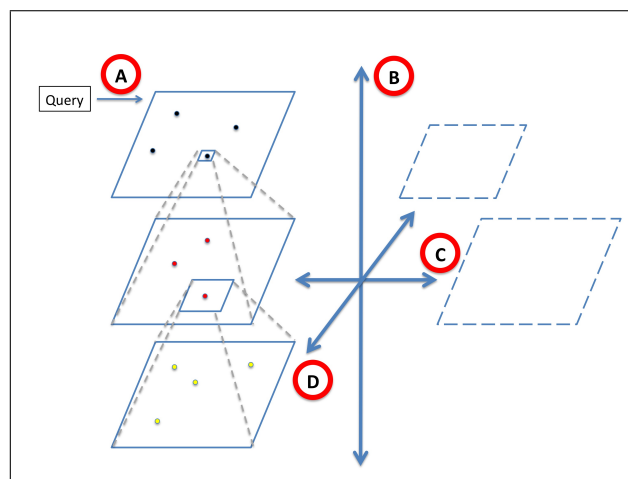


Figure 1. Three dimensions of movement in exploratory searches [12]: (A) query input, (B) vertical axis for filtering (C) horizontal axis for similarity measures and (D) transversal axis.

general by providing three axes of freedom a user can make use of in order to navigate in an (unknown) information space (Fig. 1). Thereby, also overview visualizations of search paths or *search trails* are helpful to support the XS process.

In this work we present a possible solution to address this requirement. Furthermore several novel interaction techniques and methods are proposed that were evaluated as useful enhancements to support exploratory search tasks.

RELATED WORK

Modern search engines have been engineered and tested to be good in finding answers to relatively straightforward questions. However, if the user has a more complex information need, traditional search engines can only partly - if at all - assist in finding sources that could satisfy the demand [7]. Furthermore, the user experience suffers in these cases, as usually search interfaces are not well equipped for exploratory search behaviour, and thus users employ non-expedient strategies out of necessity [17].

A lot of innovative interface ideas have been developed over the last years, but only the most promising ones have found their way into major search engines [8]. Many features have also come up and disappeared again, as one can see observing the permanent minor and major changes and optimizations taking place in Google's¹ interface. While this is also moti-

¹<http://www.google.com> (03.08.2012)

vated by company policy - e.g. the integration of Google+² and YouTube³ in the starting page, to name a few - most modifications focus on the *usability* and *user experience*. Beyond search user interfaces that are solely based on user queries, a myriad of systems to explore information spaces exist. "The goal of information exploration is the refinement of a vague information need that leads, through interaction with information objects and information resources, to a more thorough understanding of the problem." [18]

Further characteristics of this kind of exploration is a defined conceptual area [17] and the examination of metadata of information sources [6]. In this area, filtering techniques can be useful to reach the informational goals. Exploratory data analysis is an example for information exploration [17]. One exemplary information exploration system is the dynamic queries interface [1]. It is characterized by an interactive graphical visualization of a database and a query formulation via direct manipulation of widgets such as sliders.

Although the focus on exploratory search has only arisen recently, the need to change the focus in research has been highlighted before, for example by Ingwersen [9] or O'Day & Jeffries [13]. Preceding the influential paper of Marchionini [11], this type of search tasks was called for instance "subject searches, general tasks, decision tasks, and open-ended tasks" [5]. Exploratory search can be characterized by the problem context and the search process [19], while the corresponding tasks differ in motivation, search objective, complexity, uncertainty, activities, and task product [5]. They are generally "more engaging, less well-defined, and require[s] more a priori information to be known" [5].

Exploratory searches are motivated by - also personal - work tasks, e.g. writing a report [20], and these make up the problem context. The searcher is aware that he needs information in order to solve an ill-structured problem for proceeding in this task [15]. Moreover, the "actor's mental models lack concepts and relations between concepts for accurately representing the task" [15] and thus precisely defining the problem. This is also referred to as an anomalous state of knowledge [3] and mostly based on a lack of prior domain knowledge [19] and/or that the target of the search may be (partially) unknown [18]. Nevertheless, "the user defines the problem internally as a task with properties that allow progress to be judged and a search strategy to be selected" [19]. According to Rose & Levinson [14], around 20-30% of searcher's goals are undirected queries.

The objective is mostly to "create a knowledge product or shape an action" [19], or to "collect information through a variety of means, and to combine the discovered information to achieve a coherent understanding of some topic" [7]. Beyond knowledge acquisition, the search process yields higher-level intellectual capabilities of the searcher within a particular subject area [19].

Aula & Russell [2] distinguish between measures of (procedural) complexity and explorativeness, where the latter can be

measured with a goal abstraction level. Prior to that, for instance Byström & Järvelin [4] studied the task complexity in a conceptual sense and its implications for information need. Complex tasks require understanding and sense-making to process results from different sources. The complexity and difficulty of the task, or the imprecisely defined problem context can result in uncertainty [5]. This generally decreases as the search progresses [10].

PROPOSED SOLUTION

The general layout of our proposed XSI is shown in Fig. 2.

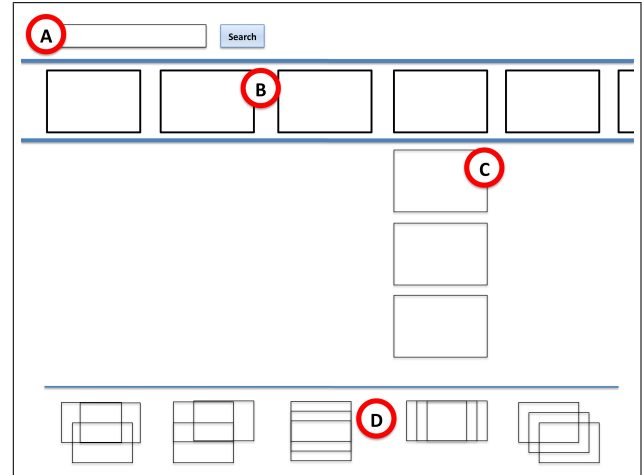


Figure 2. Basic concept of "Trailblazer": A - text-based entry field, B - results ranked horizontal from left to right, C - orthogonal search trail (opens when result above is clicked), D - iconic representations of past search sessions.

Using a domino metaphor, single query results will be arranged orthogonal to each other in order to visualize when and at which specific position a query refinement took place. Technically this might happen by simple enhancement of the origin query by a representative term or multiple terms, derived from the selected search result. Thereby users become aware of their own search processes and firstly get the possibility to go back to a certain exploratory search step in order to choose an alternative way, since path enhancements only take place in an orthogonal direction to right or to bottom. The so created search trails provide users with an interactive search history that can be easily enhanced.

Following an old concept ("Design follows Function."), the proposed XSI is supposed to ...

- support easy overviews of search results,
- show interconnections between search results,
- provide users in keeping their focus while searching,
- provide easy ways to break out of known waters to explore unknown country (explore all three dimensions of exploratory search [12]),
- support re-capturing older researches in order to follow alternative paths,

²<https://plus.google.com> (03.08.2012)

³<http://www.youtube.com> (03.08.2012)

- prevent users from switching between use modes (e.g. if PIM is necessary, directly support it in the XSI) and
- support easy query refinement.

USED XSI DESIGN PRINCIPLES

The proposed approach is called "Trailblazer" and features:

- horizontal instead of vertical result listing (Fig. 3)
- Website preview in overview, interactive InFrame-Browsing in detail view (Fig. 4)
- orthogonal layout of search refinements (implicit searches) - down or right to identify biunique starting points (Fig. 5)
- moving whole research paths to the left upper corner of the UI, when new searches are going to be conducted
- fading out non-followed paths (Fig. 6)
- automatic loading of further results if user reaches the right or bottom end of the display
- support of explicit searches like user expect of ordinary search user interfaces (in this case automatic archiving of previous search paths)
- saving and loading of search paths (supported by iconic representations, see Fig. 7)
- enhancing search paths is done transparently (also in the implicit interaction mode) by showing the actual query send to the IR system

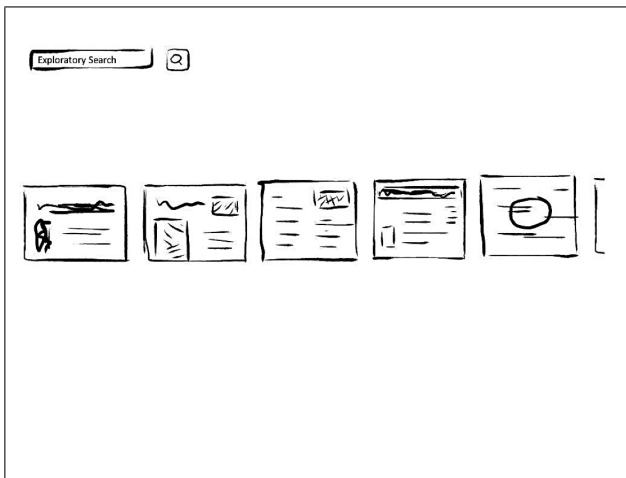


Figure 3. Horizontal layout of first results as document previews.

EVALUATION RESULTS OF FIRST PRE-STUDY

A study with a paper prototype was conducted to gain insights on the reception of the overall concept. The six volunteering participants were between 24 and 31 years old - with an average of 27.5 years -, three of them were female. The idea of search trails was received positive, even if it is a total new concept. Users liked the possibility to choose from alternative ways, but they suggested to use it primarily for investigative tasks like exploratory searches, since it might overwhelm users

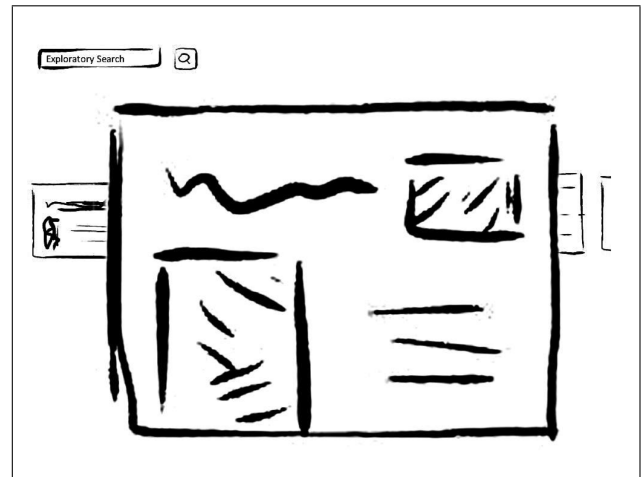


Figure 4. Preview in context of other results (left and right) and active browsing support by InFrameBrowsing.

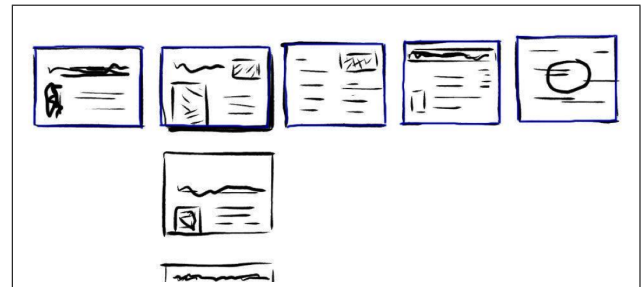


Figure 5. Orthogonal layout of results that were retrieved by an implicit query enhancement.

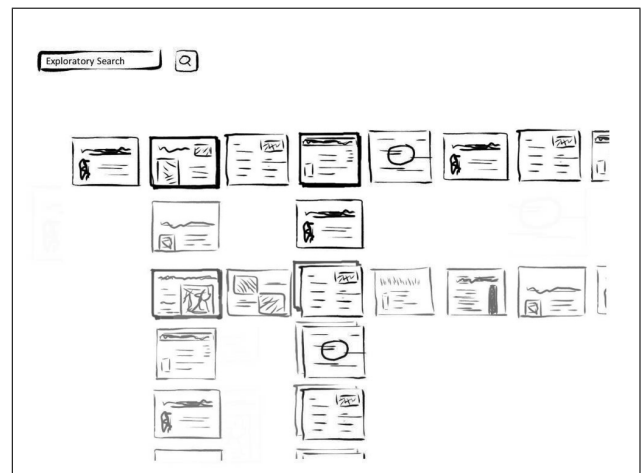


Figure 6. Multiple paths and overlapping issues.

when conducting simple look-up searches. Critic comments were to preserve clarity, let the interface be not so crowded, and provide only a minimum amount of animations and shifts. Another suggestion was to let the tool be a browser plug-in to ease integration into current practices. Five subjects would like most to test the system with a desktop computer or a laptop. Two would like to use a tablet. Many participants could imagine using the search interface on a regular basis. Four would use it daily instead of their current favourite search

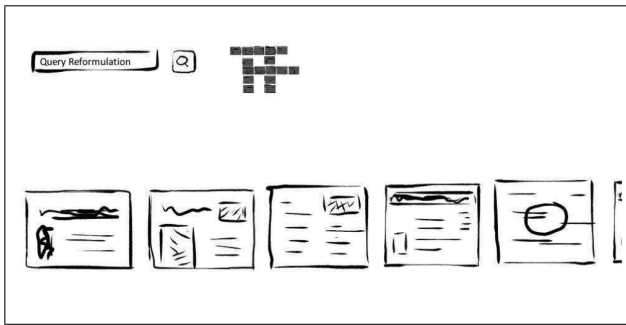


Figure 7. Iconic representation of search trails. Here, the search trail of Fig. 6 is symbolized at the top as a characteristic representation.

interface - not wanting to have separate systems to search. One test user stated, "if it provides more useful results than Google" as a reason, another one "if it's a customized perfect search engine". Three would use it for grounded specialist research, with one subject saying, "the system would be a good support, one only has to use one platform". Two of them would separate between their ad-hoc search system and a special tool for exploratory searches.

DISCUSSION & OUTLOOK

In this paper we describe the general requirements towards an ergonomic exploratory search user interface (XSIs). Furthermore, we propose a XSI concept that addresses a lot of these requirements. We call this concept *trail-based interaction* and evaluated it in a first user study. The results are that promising that we will implement this concept and conduct further usability studies to evaluate its effective, efficiency and user satisfaction; also compared to standard web SUI.

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