

# Depth- and Breadth-First Processing of Search Result Lists

Kerstin Klöckner, Nadine Wirschum, and Anthony Jameson

DFKI, German Research Center for Artificial Intelligence

Stuhlsatzenhausweg 3, 66123 Saarbrücken, Germany

<first name.last name>@dfki.de

## Author Keywords

World-wide web, search, eye tracking

## ACM Classification Keywords

H.5.4 Hypertext/Hypermedia: Navigation, User issues

## INTRODUCTION

A good deal of research has looked at the question of how to facilitate the processing of search result lists such as those of web search engines (see, e.g., [1, 2]). Typically, aspects of the user's behavior such as the opening of documents and overall search times have been recorded. But a more basic question has received less attention: In what order do users look at the entries in a search result list? In particular, the usual design of such lists suggests a strictly *depth-first* strategy: The user examines each entry in the list in turn, starting from the top, and decides immediately whether to open the document in question. But a more *breadth-first* strategy is also possible: The user looks ahead at a number of list entries and then revisits the most promising ones to open the documents. The extent to which users follow such a strategy can be determined only through eye tracking. The present abstract summarizes some recent relevant results that were obtained in the context of two experiments that also investigated other issues.

## EXPERIMENTS

In Experiment 1, each of 41 subjects was given 10 minutes to obtain information about “assessment centers” by opening relevant documents returned by Google in response to an appropriate query. A search results list comprising 25 results had been prepared in advance and presented on a single web page, in which subjects had to scroll. The subjects' eye movements and mouse clicks were recorded with the help of an ASL 504 remote eye tracker. On the basis of the video recordings made through the eye tracker, for each subject the order in which the search results were processed was analyzed. Three categories were identified: Most subjects (65%) applied a strictly *depth-first* strategy. By contrast, a nonnegligible minority (15%) of the subjects applied an ex-

treme *breadth-first* strategy, looking through the entire list before opening any document. A partially *breadth-first* pattern was shown by the remaining 20% of the subjects, who sometimes looked ahead at the next few entries before deciding which documents to open.

In Experiment 2, each of 27 subjects was asked to perform two tasks similar to those of Experiment 1, with 5 minutes allowed for each task. To create a situation in which *breadth-first* processing seemed relatively attractive, we allowed the subjects to open at most 10 of the 25 documents listed, rewarding them for each relevant document found (about half of all documents were relevant). Here again, contrasting strategies were identified: 52% of the subjects showed virtually no tendency to look ahead in the list. A minority of 11% used the extreme *breadth-first* strategy, scanning the entire list before opening any document; the remaining 37% applied a mixed strategy, looking ahead at an average of 2 to 6 documents within each list.

## IMPLICATIONS

The design of search result lists should take into account the fact that a minority of users may process the list in a partially or entirely *breadth-first* manner—especially in situations where resource limitations (e.g., long download times) encourage selective opening of documents. We are currently investigating forms of support for *breadth-first* processing. For example, the subjects in Experiment 2 who applied strongly *breadth-first* strategies tended to respond positively to the option of having a checkbox next to each entry in the list that could help them to keep track of promising items. More subtle forms of support involve formatting enhancements that make it easier to switch attention back and forth between elements of the results list.

## ACKNOWLEDGMENTS

This research is being supported by the German Ministry of Education and Research (BMB+F).

## REFERENCES

1. S. Dumais, E. Cutrell, and H. Chen. Optimizing search by showing results in context. In *Proc. CHI 2002*, pages 277–284. ACM Press, 2001.
2. A. Tombros and M. Sanderson. Advantages of query biased summaries in information retrieval. In *Proc. SIGIR*, pages 2–10. ACM Press, 1998.