

How young pupils read search engines results pages?

Jerome Dinet¹, Muneo Kitajima², Christian Bastien¹ & Gautier Drusch¹

¹ETIC - EA 4432

University Paul Verlaine - Metz, France

jerome.dinet@univ-metz.fr

christian.bastien@univ-metz.fr

gautier.drusch@univ-metz.fr

²National Institute of Advanced Industrial Science and Technology – AIST

Tsukuba, Japan

kitajima@ni.aist.go.jp

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Abstract

With an experiment conducted with 89 pupils recruited from Grade 5 to Grade 11, we investigated the visual strategies used by young people for scanning search results provided by a search engine, by focusing on the impact of typographical cuing (bottom-up processes) and domain knowledge (top-down processes) on the visual strategies. Results have mainly showed that visual explorations can vary according to typographical cuing and prior domain knowledge. Scientific and educational implications are discussed.

Summary

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I. Context and objectives

Ten years ago, only 4% of the Web pages users viewed were search results pages provided by search engines (e.g., Yahoo, Google; Jansen & Pooch, 2000). Today, approximately 93% of the Web pages users view are provided by search engines (Cutrell & Guan, 2007). Moreover, with the spread of information and communication technologies in educational systems, searching the Web through search engines and other devices has become a popular way for pupils and students to acquire information and/or to learn (Gerjets, Kammener, and Werner, 2010). So, to understand the behaviours of young information seekers and the strategies they currently adopted is crucial in order to have them develop appropriate skill for living in the information environment through educational systems.

Lots of studies investigated difficulties and strategies of children searching for information on digital environments (Bilal & Kirby, 2002; Tu, Shih & Tsai, 2008). But children's use of search engines emerged recently as an important topic in the research area (Greenfield & Yan, 2006). Previous experiments (Rouet *et al.*, 2011) suggested that young pupils tend to assign relevance based on surface cues (e.g., capitalization and/or boldface) rather than on the semantic overlap between the Website reference and the assigned topic. Moreover, several recent studies have demonstrated how Web searches differ across levels of domain knowledge (Park & Black, 2007; Tu, Shih & Rsai, 2008).

Even if eye-tracking techniques can provide lots of interesting information about visual exploration during online searching, only three previous eye-tracking empirical studies have specifically focused on search engines (Granka, Joachims & Gay, 2004; Klöckner, Wirschum & Jameson, 2004; Salojärvi, Kojo, Jaana & Kaski, 2003). And participants in these three previous studies were adults and sample was quite small. So, our two main questions are as follows:

- What are the visual strategies used by young people for scanning search results provided by a search engine (i.e. a search engine results page)?
- Are these strategies influenced by bottom-up processes (i.e., typographical cuing) and/or by top-down processes (i.e., domain knowledge)?

II. Method

In this experiment, we investigated the visual strategies used by young people for scanning search results provided by a search engine, and we investigated the impact of typographical cuing and domain knowledge on these visual strategies. 89 participants were asked individually to search for information by using Google related to two specific topics (one familiar and one unfamiliar).

In our study, we looked at how varying the typographical cuing in Web search results (Cuing versus No cuing) and the familiarity of the search topic (Familiar versus Unfamiliar) as well as their grade level affected user visual strategies.

III. Main results and implications

By applying the cluster visualizations provided by the Tobii Studio software on our data, six main results have been obtained:

(1) Four different visual strategies have been identified:

- F-shaped strategy: This reading pattern looks somewhat like an F and corresponds to the pattern described by Nielsen & Pernice (2010);
- Exhaustive strategy: The user reads all the pieces of information (title, abstract, and URL address) before to choose. Here, clusters are large and distributed on all pieces of information and the entire search engine results page;
- Cued visual jumps: The user “jumps” from a keyword to the following keyword, especially if these keywords are typographically cued (with boldface characters). Here, there are many small clusters, concentrated on the keywords cued, on the entire search engine results page;
- F-inverse strategy: This reading pattern looks somewhat like an F-inverse. In other words, the point of entry on the search engine results page is different by comparison to the F-shaped strategy. Here, clusters are concentrated on the lower part of the search engine results page before to move on the upper part of the page.

(2) Distribution of the visual strategies depends on the grade level and on the degree of familiarity of the search topic (i.e., the level of prior domain knowledge).

(3) The position of the first-click depends on the relevance of Website references displayed on search engine results page. And specific analyses reveal that this effect is different according to the grade.

(4) Cuing has a significant impact on first-click.

(5) This impact of cuing is different according to the grade. Relevance is the main criteria used for our participants to select Website references in the search engine results page. But typographical cuing tends to influence the selection performed by the youngest participants (in Grade 5 and 7).

(6) There are significant relationships between position of the first-click and visual strategy.

A particularly important outcome of the present study is the broad individual differences found in search behaviours. Another critical finding is the large inter- and intra-individual differences found in visual exploration: search behaviours can vary according to typographical cuing and prior domain knowledge. This finding differs from the results reported by Willoughby *et al.* (2009).

References

Bilal, Dania. (2002). Children's use of the Yahoo! search engine. III. Cognitive and physical behaviors on fully self-generated tasks. *Journal of the American Society for Information Science & Technology*, 53(13), 1170-1183.

- Cutrell, E., and Guan, Z. (2007). What are you looking for? An eye-tracking study of information usage in Web Search. In *Proceedings of CHI'07, Human Factors in Computing Systems*, (San Jose, April 2007), ACM Press, 407-416.
- Granka, L., Joachims, T., and Gay, G. (2004). Eye-tracking analysis of user behavior in WWW search. In *Proceedings of SIGIR'04*, ACM Press, 478-479.
- Gerjets, P., Kammener, Y., and Werner, B. (2010). Measuring spontaneous and instructed evaluation processes during Web search: Integrating concurrent thinking-aloud protocols and eye-tracking data. *Learning and Instruction*, 1-12.
- Greenfield, P., and Yan, Z. (2006). Children, Adolescents, and the Internet: A New Field of Inquiry in Developmental Psychology. *Developmental Psychology*, 42(3), 391-394.
- Jansen, B.J., and Pooch, U. (2000). A review of web searching studies and a framework for future research. *Journal of the American Society of Information Science and Technology*, 52, 235-246.
- Klöckner, K., Wirschum, N., and Jameson, A. (2004). Depth- and breadth-first processing of search result lists. In *Proceedings of CHI 2004*, ACM Press, 15-39.
- Nielsen, J., and Pernice, K. (2010). *Eyetracking Web usability*. New Riders, London.
- Park, Y., and Black, J. B. (2007). Identifying the impact of domain knowledge and cognitive style on web-based information search behavior. *Journal of Educational Computing Research*, 38(1), 15–37.
- Rouet, J.-F., Ros, C., Goumi, A., Macedo-Rouet, M. and Dinet, J. (2010). The influence of surface and deep cues on primary and secondary school students' assessment of relevance in Web menus. *Learning and Instruction*, In Press, Corrected Proof, Available online 10 April 2010.
- Salojärvi, J., Kojo, I., Jaana, S., and Kaski, S. (2003). Can relevance be inferred from eye movements in information retrieval? In *Proceedings of WSOM'03*, 261-266.
- Tu, Y.-W., Shih, M., and Tsai, C.-C. (2008). Eighth graders' web searching strategies and outcomes: The role of task types, web experiences and epistemological beliefs. *Computers and Education*, 51, 1142–1153.
- Willoughby, T., Anderson, S.A., Wood, C, E., Mueller, J., and Ross, C. (2009). Fast searching for information on the Internet to use in a Learning context: The impact of domain knowledge. *Computers & Education*, 52, 640-648.