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How are we searching the World Wide Web? A comparison of nine search engine transaction logs

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Abstract

The Web and especially major Web search engines are essential tools in the quest to locate online information for many people. This paper reports results from research that examines characteristics and changes in Web searching from nine studies of five Web search engines based in the US and Europe. We compare interactions occurring between users and Web search engines from the perspectives of session length, query length, query complexity, and content viewed among the Web search engines. The results of our research shows (1) users are viewing fewer result pages, (2) searchers on US-based Web search engines use more query operators than searchers on European-based search engines, (3) there are statistically significant differences in the use of Boolean operators and result pages viewed, and (4) one cannot necessarily apply results from studies of one particular Web search engine to another Web search engine. The wide spread use of Web search engines, employment of simple queries, and decreased viewing of result pages may have resulted from algorithmic enhancements by Web search engine companies. We discuss the implications of the findings for the development of Web search engines and design of online content.

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Keywords: Web search engines; Web searching; Transaction log analysis

1. Introduction

The Web is now the primary source of information for many people (Cole, Suman, Schramm, Lunn, & Aquino, 2003; Fox, 2002). Over 80% of Web searchers use Web search engines to locate online information

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or services (Nielsen Media, 1997). There is a critical need to understand how people use Web search engines. Amichai-Hamburger (2002) presents a review of the effect of the Web and the lack of awareness of the user in the design of Web systems and site content. The research reported in this article attempts to contribute to such a dialogue. Most research of Web searching provides little longitudinal, regional, or across system analysis. We need a clearer understanding of emerging Web searching trends across different global regions and between different Web search engines in order to design better searching systems.

This important research area directly impacts pay-per-click marketing, Web-site-optimization strategies, and Web and Intranet search engine design. It complements research such as that conducted by Liawa and Huangb (2003), who showed that individual experience, individual motivation, search engine quality, and user perceptions of technology acceptance are all factors affecting individual desire to use Web search engines.

In this paper, we present a comparison of nine major Web studies, four European and five US-based Web search engines, over a seven-year period. We provide a temporal comparison of differences in Web searching among and between US and European-based Web searches as one might expect some divergence due to linguistics and interface factors (Spink, Ozmutlu, Ozmutlu, & Jansen, 2002b). We specifically investigate the interactivity between searchers and Web search engines, identifying changes in the complexity of Web search interactions. In addition, we present a longitudinal analysis of the types of information people are searching for on the Web.

We center our research analysis on the interactions between the user and the search engine. Interaction has several meanings in information searching, although the definitions generally encompass query formulation, query modification, and inspection of the list of results, among other actions. Belkin, Cool, Stein, and Theil (1995) have extensively explored user interaction within an information session. Eftimiadis and Robertson (1989) present and categorize interaction at various stages in the information retrieval process from information seeking research. Bates (1990) presents four levels of interaction, which are move, tactic, stratagem, and strategy. Lalmas and Ruthven (1999) present two groups of interaction, that which occurs across sessions and that which occurs within a session.

This within-session category is the type of interaction that we examine in this study. We consider an interaction as any specific exchange between the searcher and the system (i.e., submitting a query, clicking a hyperlink, etc.). We define a searching episode as a series of interactions within a limited duration to address one or more information needs. This duration is typically short, with Web researchers using between 5 and 120 min to define a session duration (c.f., He, Göker, & Harper, 2002; Montgomery & Faloutsos, 2001; Silverstein, Henzinger, Marais, & Moricz, 1999). The searcher may be multitasking (Spink, 2004) within a searching episode, or the episode may be an instance of the searcher engaged in successive searching (Lin, 2002; Spink, Wilson, Ellis, & Ford, 1998).

We begin with an extensive review of literature concerning the rapidly growing area of Web search engine research. We then present the datasets used in this study. We discuss the analysis, results, and implications of the results for the design of Web searching systems.

2. Related studies

There have been a few review articles on Web searching. Jansen and Pooch (2001) provide a review of Web transaction log research of Web search engines and individual Web sites through 2000. Hsieh-Yee (2001) reviews studies conducted between 1995 and 2000 on Web search behaviors. The researcher reports that many studies investigate the effects of certain factors on search behavior, including information organization and presentation, type of search task, Web experience, cognitive abilities, and affective states. Hsieh-Yee (2001) also notes that many studies lack external validity. Bar-Ilan (2004) presents an extension and integrative overview of Web search engines and the use of Web search engines in information science

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