How Do Users Search the Mobile Web with a Clustering Interface? 
A Longitudinal Study 

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ABSTRACT

Category-based search result organization holds promise as a means of facilitating mobile information access. This paper presents the results of a longitudinal user study that investigated how a mobile clustering interface is used to search the Web. The author describes the participants’ search behavior and discusses the benefits and limitations of category-based result access. Study results show that category-based interaction was considered situationally useful, for example when the participants had problems describing their information need or needed to retrieve a subset of results. The paper proposes design guidelines for category-based mobile search interfaces. These include improved strategies for presenting the categories in the search interface, the need to improve the categorization methods to provide more representative category structures, and accounting for the contextual aspects of mobile information needs.

Keywords: Design Guidelines, Longitudinal Evaluation, Mobile Search, Search Interface Design, Search Result Clustering

INTRODUCTION

Mobile Internet has become an indispensable medium of information access for users around the world. It is used increasingly as a tool for communication, information gathering, transactions and establishing one’s online presence (Taylor et al., 2008). A recent survey by Kaikkonen (2011) highlights the growing importance of search as a mobile information access method. The use of mobile Web search has increased significantly between 2007 and 2010, with tasks such as searching for contact information, locations and routes being even more common than on the desktop. Mobile search has been identified as an important information access tool in various social situations; specifically as a means to satisfy information needs as they arise (Church & Oliver, 2011; Heimonen, 2009). How people look for and interact with information on mobile devices is triggered by different contextual needs such as time, location and activity (Church & Smyth, 2009; Hinze, Chang, & Nichols, 2010; Sohn, Li, Griswold, & Hollan, 2008), and should therefore inform search systems design.

Commercial search engine providers offer mobile-oriented search services to facilitate mobile information access. Although these services are specifically designed for mobile devices and make use of many useful features such as location sensing and voice interaction, ultimately the search results themselves are of-

DOI: 10.4018/jmhci.2012070103
ten presented in flat, ranked result lists. Previous studies on mobile Web search patterns suggest that users experience difficulties with these interfaces (Kamvar & Baluja, 2006; Church, Smyth, Bradley, & Cotter, 2008). The search data analyzed by Kamvar and Baluja (2006) shows that mobile searchers did not explore the results actively, as only about 9% of searches went beyond the first result page. Results fulfilling the users’ information need may remain unseen simply because of ambiguous queries that do not produce relevant results in the first result page. Mobile searchers also remained focused on their initial search topics; only 25% of the subsequent queries were not directly related to the first. This lack of exploration can be explained by the relatively higher cost of interactions in the mobile environment, e.g., slow loading times and overhead of browsing through result pages. The study by Church et al. (2008) highlights other problems with mobile search user experience: almost 90% of queries and nearly 60% of search sessions do not lead to any result selections by the user. It is likely that in some cases the conventional approach to mobile search adopted by search engines results in users failing to find relevant information with the result lists (Church et al., 2008).

One of the key issues is that the ranked result list does not provide an effective overview of the themes present in the result set. This makes search challenging when one’s needs go beyond simple keyword lookup, or when the query is hard to specify. Users engaging in more exploratory search of an unfamiliar topic may require additional help in understanding the terminology and structure of the result set (White, Drucker, Kules, & Schraefel, 2006). Such assistance can be provided by categories, which can help information seekers make sense of search results and decide which actions to pursue (Hearst, 2006). Category-based search and browsing is commonly used in online stores such as Amazon.com to access titles organized into consistent product hierarchies. Previous research on mobile search interfaces suggests that categories could also be helpful in mobile search situations (Carpineto, Mizzarro, Romano, & Snidero, 2009; De Luca & Nürnberger, 2005; Heimonen & Käki, 2007; Karlson et al., 2006; Machado et al., 2009).

So far the benefits of category-based mobile search interfaces have been demonstrated in controlled laboratory studies, which motivated us to investigate category use in a realistic context of use in a four-week user study. We addressed the following research questions:

1. How are the categories used for result access during naturalistic mobile Web search?
2. In what kind of search scenarios do the categories benefit the users, how, and what are their limitations?

Our findings describe the participants’ search behavior with a clustering search interface and relate it to previous studies of mobile search behavior and cluster use in desktop and mobile search interfaces. We also identify benefits and limitations of category-based search grounded on the findings of this study and those of previous research. We propose design suggestions to alleviate these issues. These contributions are likely to be of interest to audiences in the mobile information access community.

The remainder of the article is organized as follows. First, we review previous research on category-based search interfaces and mobile search interface evaluation methodology. Following, we describe the interface utilized in the study, the details of the longitudinal study and its results. The paper concludes with a discussion of the key results and presents the design implications inspired by these insights.

RELATED WORK

Methods for Organizing Search Results

The main methods for organizing search results into category structures are category systems and document clustering (Hearst, 2009). In category systems, documents are assigned
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