Using a Mobile Device to Vary the Pace of Search

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Abstract. Although online, handheld, mobile computers offer new possibilities in searching and retrieving information on-the-go, the fast-paced, "sit-forward" style of interaction may not be appropriate for all user search needs. In this paper, we explore how a handheld computer can be used to enable interactive search experiences that vary in pace from fast and immediate through to reflective and delayed. We describe a system that asynchronously combines an offline handheld computer and an online desktop Personal Computer, and discuss some results of an initial user evaluation.

1. Introduction

Almost all web searches are carried out while the user is sitting at a conventional, desktop Personal Computer (PC) connected to the Internet. It is likely, though, that search needs take shape away from the desktop, stimulated by activities a user is involved in, such as attending a meeting or listening to a presentation or lecture.

Mobile, handheld devices are beginning to be used to provide online search access. Clearly, these services will be useful, especially to meet specific, focused and urgent information needs. However, these approaches ask much of the user who has to engage in a cognitively demanding, "sit-forward", foreground information seeking process [3].

For some use-contexts and information needs, this burden is unhelpful and inappropriate. Sometimes search is a background user activity – the information need does not have to be satisfied immediately and the process of satisfying the need is not the user's main focus. For example, a seminar participant might be interested in discovering more about something mentioned by the speaker; however, if they began to search online immediately, they would quickly lose track of the rest of the talk.

In this paper, we present a prototype system that aims to support background information seeking while still enabling more engaged, focused searching. The work explores how a mobile device can be combined asynchronously with a desktop PC to permit such shifts in the user's interactive pace.

2. The Laid-Back Search Tool

The laid-back tool enables users to capture background information needs *in situ* over time. It also provides them with facilities to use search results, later, in a number of ways and at varying paces of interaction. The approach asynchronously combines a handheld computer with a desktop PC. Myers and his group have combined these two types of device, in synchronous ways, for other sorts of user needs [6].

The user enters search terms on an offline handheld computer. They can record simple keyword searches and use the "advanced search" interface to restrict the scope of the search to a particular web site etc. (Fig. 1). The handheld application checks for duplicate entries and allows the complete set of queries to be viewed and edited.

The handheld, then, gives the user greater support for query noting than when they simply use paper and pen; but, as with paper and pen, the user's main focus – such as listening to a talk – is not disrupted greatly while their search need is captured.

When the handheld is reconnected to the PC, the queries are automatically sent to a search engine (Google ™). For each query, the search engine returns a result set and this, along with the web pages associated with each result, is copied to the handheld. In this way, the user's searches are guaranteed to be performed, even if the user has forgotten about the notes they made, or has no time to do the searches manually.
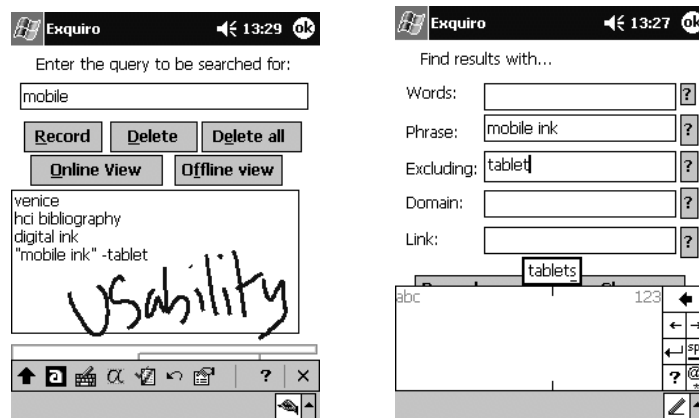

Fig. 1: Handheld application for query capture. In the left-hand screenshot, the user is entering a new query ("mobile usability"), using handwriting recognition input, and a list of all previously entered queries is shown. One of the queries ("mobile ink" –tablet) was entered using the "Advanced Search" interface (see screenshot to the right).

Later, the user can browse the search results on the handheld *offline*, wherever they are. They can view a list of all the queries recorded – along with the date and time each was input – and access the downloaded result sets and associated web pages (see Fig. 2). Millions of handheld users are already using services such as Avantgo (www.avantgo.com) to read web pages offline; our approach extends this popular activity to search.
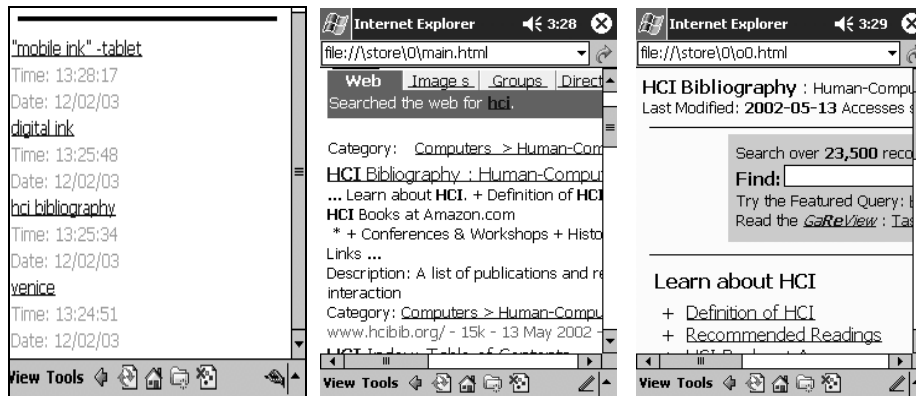
Fig. 2. Viewing the search results, offline, on a handheld computer. User views a list of queries captured over time (left). After selecting a query, e.g., "hci bibliography", a search result list is then available (centre). For each result, a set of web pages (to a depth specified by the user) are accessible offline: the screenshot on the right shows the top-level page for the first search engine result; clicking on further links (e.g. "Definition of HCI") will retrieve further cached pages.

As well as accessing queries and results on the handheld, this information is also available on the desktop PC via a specially built browser tool. This tool also allows the user to carry out further searches online, thereby interactively refining the results of the initial, handheld captured queries.

To explore an alternative, further use of the handheld gathered queries, we are adapting the Collage Machine [4], developed by Kerne. The approach involves extracting images and key text from each search result web page. As the analysis proceeds, for each handheld captured query, a composite collage of this information is built (Fig. 3). The aim is to investigate the benefits of a calmer approach to information discovery. The Collage can be displayed on a desktop and much larger displays. We are also investigating the use of the technique on the handheld screen.

Google™ has recently begun to offer a search result "viewer"[1]: this displays results for a *single* query as a continuously scrolling slide show. The user can "lean-back" and watch as the results are automatically presented. We are investigating how *sets* of search queries captured by the handheld, over time, could be presented using this sort of viewer to further provide a "relaxed" form of search.

The prototype, then, allows the user to vary the pace of their search activities. They can use the conventional, fast-paced, "sit-forward" approach to follow-up results of recorded queries online. At the other end of the pace spectrum, they can "lean-back" and simply observe a collage or slide-show of results. Half-way between the "sit-forward" and "lean-back" is, what could be called, the "laid-back" pace that is seen when terms are captured and a user browses results offline on the handheld. Here, the interaction is not as fast, time pressured and transient as the "sit-forward" mode but also it is not as slow, passive or minimally engaging as "lean-back".

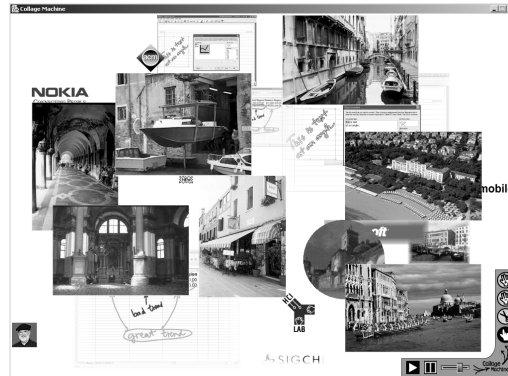[1] http://labs.google.com/gviewer.html

Fig. 3. Collage created by the Collage Machine [4] given search queries captured by the handheld device. This collage is made up of images extracted from web pages that match the query terms shown in Figure 2 – for example, there are graphics from Nokia (the logo is on the "mobile hci" website), Venice tourist sites and digital ink screenshots from Microsoft.

3. Related Approaches

Aridor *et al* [1], have demonstrated a related offline/online search system. Their scheme "pushes" information from a PC-based intelligent agent to a handheld device. The laid-back system, in contrast, is a "pull" technology, with the user directly requesting searches that arise in their everyday contexts.

Other researchers have looked at linking physical contexts while mobile with later online information access. The InfoPoint [5], for instance, is a hand-held device that allows users to capture information from objects tagged with a visual code. One of the applications discussed by the researchers, is a conference aid that allows users to grab web URLs from research posters. On return from the conference, the data is transferred from the InfoPoint and the associated information viewed on a web browser.

4. User Evaluation

Three experienced handheld computer users were given the prototype system for a two-week initial user study. We asked them to record observations about the system each day in a diary. At the end of the trial, we interviewed each user individually.

An analysis of their diaries and the interview transcripts showed that the subjects used the handheld system in a range of contexts: e.g., while watching television; during meetings; while on the telephone; and, at their desk when planning their daily tasks. Although they all noted the potential benefits of the system, they also encountered three interesting problems.

Firstly, the users saw their handheld device as a medium to make "rough" notes. For example, they said they paid less attention to spelling when they used their device. For the search application, such "inaccuracies" caused problems.

Secondly, all three users regularly used other handheld applications like the notepad during meetings. They indicated a preference for a search capture tool that integrated better with these other applications. The XLibris digital library appliance [7] illustrates a possible approach. It is a handheld device that enables users to read and manipulate documents. Readers can highlight terms and make annotations. The system generates hypertext links to related documents based on these user interactions.

Finally, in common with many other systems, they also reported frustrations in trying to read web pages designed for the large screen on the handheld device [2].

5. Conclusions

In this paper we have challenged the notion of the fully connected "eager" mobile computer user whom many mobile HCI researchers focus on. We wish to put forward the notion that this type of interaction is not always appropriate and that mobile users have a range of tasks with varying degrees of urgency. The design goal for our system was to present a tool which supports a variety of urgencies (sit-forward, laid-back & lean-back) for a common task (searching). Our hope is that other interaction designers will not become lured into supporting only sit-forward tasks, simply because the technology now allows it, but will remember that being laid-back is also a noble goal.

References

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