Eye-tracking in Practice: The Path to Evaluating a New Interface for Personal Desktop Search

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ABSTRACT
Analysis of eye movement data provides a valuable methodology to evaluate and inform user interface design. However, there are a number hurdles that must be overcome on the path to successfully gaining meaningful eye movement data. We describe how we used a commercially available eye tracking system to evaluate a new interface for personal desktop search called *Phlat*. A small eye-tracking user study was conducted, which presented a number of challenges in order for participants to search data situated on their own remote desktop machine while in the eye-tracking laboratory. The convergence between the results of this eye-tracking study and a larger analysis of application logs points to at least one area were Phlat's user interface might be improved.

Author Keywords
Eye-tracking methodology, user interfaces.

ACM Classification Keywords
H5.2. User Interfaces: Evaluation/methodology.

INTRODUCTION
Eye movement protocols provide a moment-to-moment behavioral index of users' human-computer interactions. Because of this fine-grained analysis, there is the potential for eye-tracking to provide a useful methodology to evaluate and inform user interface (UI) design. For instance, the analyst can identify which features of the UI receive the user's visual attention during task performance, which in turn, might point to potential problems in the UI design. Importantly, information gleaned from eye tracking studies can be complimentary to that available from other methodologies, such as analysis of usage logs (i.e., click-through data). However, there are certain methodological hurdles that must be overcome in order to successfully gain eye movement data during live application user studies.

We describe our experience of using a commercial available eye tracking system to evaluate a new interface for personal desktop search called *Phlat* [4]. Eye tracking methodologies for personal desktop search pose several unique difficulties. We describe how we overcame these problems to allow participants to search their own corpora remotely while in our eye-tracking laboratory.

Phlat is a system aimed to optimize searching for personal information [4]. Phlat was designed to provide an intuitive interface that merges searching and browsing through a variety of associative and contextual cues. In particular, the UI provides filter widgets for easily defining property-restricted queries on meta-data (e.g., Date, Tags, Path, People, and Type).

Cutrell, Robbins, Dumais and Sarin [4] report an analysis of usage logs to understand how people used Phlat to locate personal information during their daily work lives. This log analysis found that people were using the functionality afforded by the filter widgets. Indeed, almost half (47%) of all queries that were issued by the user involved some kind of filter. Of interest here, was the observation that filtering by *date* was the least frequent query (accounting for only 11.4% of queries, compared to filtering by *people*, which accounted for 30.8% of queries).

Analysis of usage logs has frequently been used to understand how people search for information, most notably on the web [5, 7, 8]. In this domain, eye-tracking studies [1, 2, 3, 6] have brought significant advantages in understanding peoples' search strategies. These methodologies go well beyond the granularity that can be gleaned from log analysis alone. We wanted to use an eye-tracking methodology to evaluate Phlat. We hoped that such an analysis might lead to additional information that could not have been gained otherwise. In particular, we were interested in about how people interacted with the UI and whether users' bothered to look at the filter widgets during search.

STUDY
There were a number of technical and methodological restrictions that provided significant challenges to using an eye-tracking methodology to evaluate Phlat. First, the Phlat interface is highly dynamic in terms of the layout and size of the UI features on the screen. Mapping eye movements to regions of interest on the screen, therefore, required an integration of logs from the separate streams of eye movement data and application events. Second, Phlat was designed as a tool to support search for personal information [4]. In order to conduct a meaningful study, it was necessary for participants' to access and search data

situated on their own remote desktop machines (i.e., located in their office) while in the eye-tracking laboratory.

In the study, eye tracking was performed using the Tobii x50 eye-tracker (see, http://www.tobii.se/). A benefit of the Tobii eye-tracking system is that it provides a software development kit (SDK) with application programming interfaces (APIs). This allowed us to develop an instrumented version of Phlat that was able to send events, such as the screen locations of UI features, through a TCP/IP connection to the eye-tracking machine. An integrated log of eye movement data and application events was generated that allowed us to map eye movement fixations to UI features on the screen during task performance, even as the shape and location of UI features varied during the task.

In the study, participants completed 24 search tasks that required them to find specific emails or attached documents, which had previously been widely distributed within the organization (e.g., *Find the email from earlier this year with the URL for the Christies auction of documents from the history of computer science*). All target items were planted in participants' inboxes, in case participants had deleted these items. Sets of initial query words were provided (e.g., *computer auction*); participants were free to reformulate query words and/or add filters after this initial query had been issued. The study manipulated whether participant could use filter widgets (on vs. off) and whether the default sort for the results items was by relevance (with only title and rank information) or by date (with additional meta-data, such as author and date).

During the study participants accessed their own computer (often located in their office) using Microsoft's Remote Desktop Connection software. Eleven full-time employees from within the organization took part in the study. All participants had at least some previous experience of using Phlat.

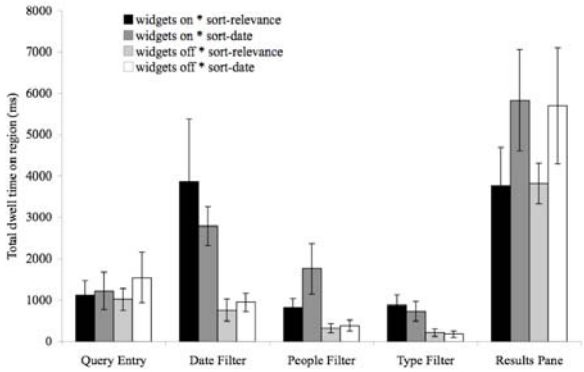

Figure 1. Mean total dwell time spent looking at Phlat UI regions during search.

Due to space limitations only a very brief observation from the eye-tracking data is presented. Figure 1 shows the total dwell time for UI regions during search. It can be seen that when participants were free to use the filter widgets they did indeed spend time looking at them. What is of interest is that the date filter, which was used the least frequent of all the filters in the study (10.85% of 53.49%), nonetheless received the greatest amount of users' visual attention during search (Fig. 1). Coupling this finding with that of its low frequency of usage found in usage logs [4], clearly indicates that there is a UI problem with the date filter.

CONCLUSION

We have described how a commercial available eye tracking system was used to evaluate a new interface for personal desktop search. A small eye-tracking user study was conducted, which presented a number of challenges in order for participants to search data situated on their own remote desktop machine while in the eye-tracking laboratory. The convergence between the results between this eye-tracking study and a larger analysis of application logs points to at least one area were Phlat's user interface might be improved.

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