

Designing an Integrated Bookmark / History System for Web Browsing

Shaun Kaasten
Department of Computer Science
University of Calgary
Calgary, Alberta, CANADA T2N 1N4
Tel: +1-403-220-7686
kaasten@cpsc.ucalgary.ca

Saul Greenberg
Department of Computer Science
University of Calgary
Calgary, Alberta, CANADA T2N 1N4
Tel: +1-403-220-6087
saul@cpsc.ucalgary.ca

ABSTRACT

Current commercial web browsers such as Netscape Navigator and Microsoft Internet Explorer attempt to make it easier for users to return to previously visited web pages. They offer three separate but important facilities: the back button, a bookmark system, and a history list. However, research indicates that users are not utilizing all of these systems effectively. In this paper, we present a single integrated history that unifies functionality similar to the back button, bookmarks and history lists. We also show how these mechanisms can be improved upon. We pay special attention to the ways pages are presented within a display, and on providing lightweight means for marking, recalling, and revisiting pages. The prototype we are developing works within Microsoft Internet Explorer. It presents a history list that represents pages by visual thumbnails as well as titles and URLs. It incorporates bookmark functions through a dog-ear metaphor, and it contains methods to filter a history list. Finally, it is tightly linked with the back/forward buttons.

Keywords

History, page revisitation, reuse, navigation, browser design, world wide web, hypertext.

1. INTRODUCTION

As the Internet continues to grow, the World Wide Web is becoming a mainstream information medium. People are relying on it more than ever for education, business and entertainment purposes. However, the World Wide Web is both enormous and largely unorganized, making it difficult to navigate effectively.

We all know how difficult it can be to find specific information on the web. One solution is better Internet Search Engines. This has become so important that the major players on the Web are in a race to provide effective search engines that can find what people ask of them, where the winner will get the most people and the most advertisers.

From the user's perspective, there is another problem that is getting less attention: how to return to information they have previously found. While a search engine might find the desired needle in the web's haystack, finding the same needle in the haystack later often requires them to search or navigate again, often with laborious efforts. Relocating a web page viewed days, weeks or even hours ago can be a frustrating and fruitless experience. Of course, current commercial web browsers such as Netscape Navigator and Microsoft Internet Explorer are not blind

to people's need to return to previously visited pages. Each provides almost identical functions for returning to these pages, with the major ones being Back, the history list, and bookmarks.

In theory, these mechanisms should be heavily used, for almost 60% of all pages a person visits are to ones that they had seen previously [9]. Yet research indicates several problems with these mechanisms. While Back is heavily used, people have an incorrect model of how it works, which leads to surprises when just-visited pages are no longer reachable through it [6, 7]. Bookmark and history systems are used infrequently in practice [1, 9]. We believe that one of the reasons for these problems is that browsers provide revisitation systems in a fragmented, un-integrated, and heavyweight manner. Back, history and bookmarks all use dissimilar underlying models, different interfaces, and various ways of sorting and presenting groups of candidate pages. Recognizing pages in history lists can be problematic. Remembering to bookmark a page and managing the clutter of pages in a bookmark list can be onerous.

In this research, our goal is to integrate the idea of Back, history and bookmarks into a single integrated revisitation system that captures the best features of existing systems while remedying their known deficiencies.

2. CURRENT SYSTEMS

2.1 Bookmarks

Bookmarks have been an important feature, included in even very early web browsers. The concept is simple – when a user finds a page worth returning to, he or she asks the web browser to create a bookmark for it. Some time later, the user selects the bookmark to get back to the particular page. Unfortunately, the system fails in practice. While users are consistently return to previously visited pages, they rarely do this through bookmarks. The Tauscher and Greenberg study found that bookmark navigations only made up 2% of all navigation [9]. This can be traced to some major shortcomings of bookmark systems.

First, bookmarks are inefficient. A study on bookmark usage found that users continually accumulate bookmarks, which remain long after they are actually needed [1]. Thus, the bookmark collection becomes cluttered with unimportant items that inhibit the user from seeing the newer, now important bookmarks. In an attempt to reduce this problem, bookmark systems allow the creation of folders for organization. However, the study found that most users put off organization until it becomes absolutely

necessary. Quite Simply, people are unwilling to devote the time needed to keep bookmarks organized.

Second, bookmarks are based on the notion that people know which pages they will need to return to. This requires a person to immediately determine the value of a page. However, circumstances can change, and a page that one decided to skip through last week can suddenly be valuable today. Users are poor predictors of what will be important at a later time.

2.2 History Lists

Web browser designers have recognized that people need a way to return to previously visited sites that have not been explicitly bookmarked. All contemporary browsers offer a fairly similar solution – the history list. A history list presents the user with a sorted list of every web page visited. The list can be sorted by the page title, URL address, the date of last visit, and even by number of times visited.

Like bookmarks however, history lists break down in real-world use. The Tauscher and Greenberg study found that users do not

the process of uncovering it from the menu very inconvenient. As well, the history list was in a separate window that incurred the added work of window management. Current browsers have attempted to bring the history list closer to the user. Microsoft's Internet Explorer 5, for example, provides a large history button along side the more familiar controls, encouraging the curious user to try it out (see top-right of Figure 1). It also includes it as a tiled window, called an 'explorer bar' (similar to the left panel in Figure 1), which lives within the main browsing window.

When a user does uncover the system, he or she must then try to find the desired page within the list. This could be problematic.

To begin, web pages are often represented by title. Studies have pointed out how web page titles are frequently meaningless to the user [4]. First, it is the web page author, not the user who creates it. The author-supplied title may not match how a user thinks of that page. Second the web page author often gets it wrong: they may forget to include a title, or they may give a page the same title they had given to other pages within a site. This could be by accident (e.g., as when a titled page template is used over and

over again and the author forgets to change it), or by intent (e.g., a title like 'FAQ' may identify a site full of 'FAQ's'). When the user is confronted with a list of such unreliable titles, it can be virtually impossible to recognize the needed page.

Web pages can also be identified by their URL address. This address allows an individual web page to be instantly accessed from anywhere in the world. While these addresses are globally unique, they are often long and obscure. Users cannot be expected to memorize most URLs, and even recognizing a page from its URL can be difficult. In the best cases, the URL offers clues about a web page, especially when it contains a recognizable name such as Microsoft. Even here, the small display space given to the history list may mean that the entire URL is not visible to the user. In the worst case, the URL is meaningless (such as those produced automatically by databases). Thus, a history list of URLs is, at best, a hit and miss proposition for most users [4].

3. PROTOTYPE SYSTEM

We are currently developing a prototype system that works within Microsoft Internet Explorer. Some of our ideas were first explored in earlier versions [4, 5]. Figure 1 illustrates one of our

prototypes. The unifying principle of this prototype is that all visited pages are organized as a recency-ordered history list, with duplicate pages shown only in their latest position.

3.1 Back Button Integration

Our first challenge was to integrate the back and forward buttons with the history list. All commercial browsers implement a stack

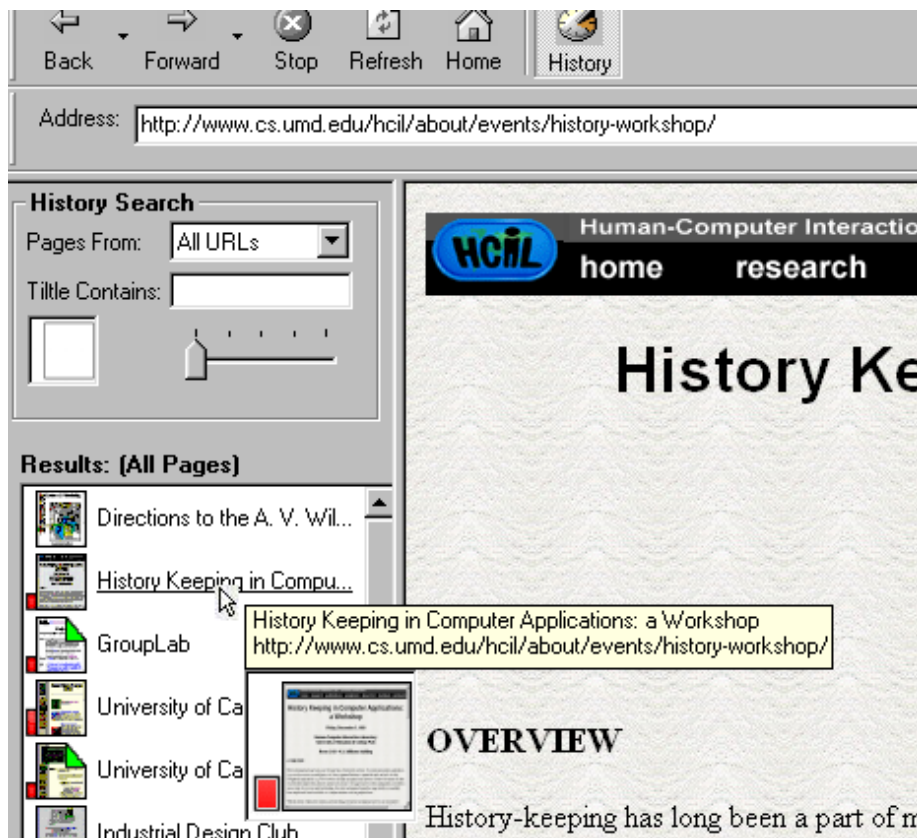


Figure 1 – Our prototype history revisitation system

take advantage of the history system, as it accounted for only 1% of web page navigation [9]. Like bookmarks, this finding is related to some shortcomings of current history systems.

The history list in early browsers had a great weakness- it was largely hidden from the user. Raising the history list required the user to select an option from a rarely used menu. While some users were not even aware of the option's existence, others found

rather than a recency ordered list. We altered the back and forward buttons so that they work on a recency-based model instead of a stack: the buttons are thus just shortcuts for moving up and down the history list [4]. By bolding the currently visited item on the list, users see immediate navigational feedback on their Back and Forward actions. Aside from the fact that Back and Forward are now integrated with history, there are several advantages [7]. First, a person can always return to a page with a recency-ordered back button because, unlike stack, pages are not pruned from the list. Second, people who were asked how the conventional stack-based back button works all had the incorrect model that it was based on a recency ordered list [6]. Thus our new back button reflects people's model of how they *think* Back should work.

3.2 Implicit / Explicit Bookmarks

Our next challenge was to integrate bookmarks into the history list. We have transformed bookmarks into two different features.

First, *implicit bookmarks* are pages that are visited frequently: these pages are automatically visually distinguished from pages visited rarely. Both Figure 1 and the small inset here shows how we mark these pages with a vertical red band, where the height of the band indicates the degree of the page's visit frequency. If there is no band, the page has been visited only once or twice. Modest sized bands often indicate a 'hub' page i.e., a page that contains many children pages that have been visited. Since a user typically returns to the hub page to chase the next link [9], these typically show a higher number of hits. Large bands often indicate important pages, such as home pages for frequently visited sites.



Second, *explicit bookmarks* are just pages on the history list that are tagged as special: we call these *dog-ears*. A user can quickly set a dog-ear by right-clicking over a page on the history list and selecting 'dog-ear' from a popup menu; users then have the opportunity to change the page's title if they wish. Dog-eared pages look different from non-dog-eared pages. For example, in Figure 1 (as well as this inset) we see that the 'GroupLab' and the second 'University of Calgary' page are dog-ears, as illustrated by the folded down corners in the upper right corners of the images.



3.3 Search Filters

To make this all work smoothly, users can perform dynamic queries [8] on the history list. By moving a slider (illustrated at the bottom of Figure 2), they rapidly and continuously filter the history list. As the slider is moved to the right, pages with low visit frequencies are immediately filtered from the list. When it is almost all to the right, only high frequency pages and dog-ears are visible. When positioned at the extreme right, only dog-eared pages are displayed: this transforms the general history list into a recency-ordered bookmark list.

We also have added a *search filter*, where the history list is filtered to display only those pages whose title contains the specified sub-string. As before, this is done through a dynamic query: as letters are typed, the list is immediately filtered to show only those matching pages.

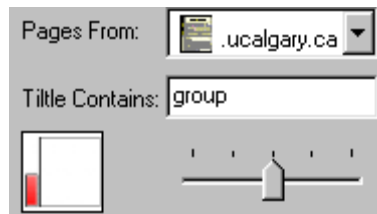


Figure 2 – Search filters

3.4 Page recognition

Finally, we try to make scanning the list for a particular page easier by representing pages not only by title and URL, but by a thumbnail image as well [4]. Whenever a browser completely loads its page, we automatically do a window capture on it. We then scale the image into a modest sized thumbnail and store it on the local file system. Within the history list, we show a small version of this thumbnail (as visible in the Figure 3).

Additional detail is provided as a tool tip. As a person moves over a particular item in the list, we immediately display the page's full title, URL, and full-sized view of the thumbnail (see Figure 3).



Figure 3 – Full-sized thumbnail and tool tip

4. USER TESTING

We are currently integrating this prototype into the standard Internet Explorer web browser. When this is complete, we will perform several studies on it. First, we will see how users perceive the differences between the standard stack-based back/forward buttons and our new recency-based model. Second, we will investigate how well users match web pages to the title, URL and thumbnail representations. Finally, we will conduct a field study by distributing our prototype system to volunteer users for use on their regular web needs. The browser will be instrumented to record the user's actions, just as previous studies have done [1, 9]. The analysis of these recordings will suggest which facets are utilized and well suited to the users' needs.

5. CONCLUSIONS

Studies have found that revisiting web pages is a frequent and important action. However, these studies also found that users of today's web browsers underutilize the functions to support this action. Our research suggests that today's web browsers can be improved by integrating these functions into a single system. We are developing a prototype incorporating this idea, and will soon begin our user evaluation process.

6. ACKNOWLEDGMENTS

NSERC Canada and Microsoft Research provided partial funding for this work.

REFERENCES

- [1] Abrams, D., Baecker, R. and Chignell, M. Information Archiving with Bookmarks: Personal Web Space Construction and Organization. In Proceedings of the ACM/SIGCHI Conference on Human Factors in Computing Systems (CHI'98), pages 18-23, 1998.
- [2] Ayers, E. and Stasko, J., Using Graphical History in Browsing the World Wide Web. In Proceedings of the Fourth International World Wide Web Conference, Dec 1995.
- [3] Catledge, L and Pitkow, J., Characterizing Browsing Strategies in the World Wide Web. In Proceedings of the Third International World Wide Web Conference, April 1995.
- [4] Cockburn, A., and Greenberg, S. Issues of Page Representation and Organisation in Web Browser's Revisitation Tools. In Proceedings of the Australian Conference on Human Computer Interaction (OZCHI'99), November 1999.
- [5] Cockburn, A., Greenberg, S., McKenzie, B., Smith, M. and Kaasten, S. WebView: A Graphical Aid for Revisiting Web Pages. In *Proceedings of the Australian Conference on Human Computer Interaction (OZCHI'99)*, November 1999.
- [6] Cockburn, A. and Jones, S. Which way now? Analysing and easing inadequacies in WWW navigation. In *International Journal of Human-Computer Studies* 45(1), 105-129, 1996.
- [7] Greenberg, S. & Cockburn, A., Getting Back to Back: Alternate Behaviors for a Web Browser's Back Button. In *Proceedings of the Fifth Conference on Human Factors and the Web*, June 1999.
- [8] Shneiderman, B., Williamson, C. and Ahlberg, C. Dynamic Queries: Database Searching by Direct Manipulation. In *Proceedings of Conference on Human Factors in Computing Systems (CHI'92)*, 1992.
- [9] Tauscher, L. and Greenberg, S., How People Revisit Web Pages: Empirical Findings and Implications for the Design of History Systems. In *International Journal of Human-Computer Studies*, pages 47(1), 97-138, 1997.
- [10] Hill, W.C. and Holland, J.D., Edit Wear and Read Wear. In *Proceedings of the ACM/SIGCHI Conference on Human Factors in Computing Systems (CHI'92)*, 1992.