

PadPrints: Graphical Multiscale Web Histories

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ABSTRACT

We have implemented a browser companion called PadPrints that dynamically builds a graphical history-map of visited web pages. PadPrints relies on Pad++, a zooming user interface (ZUI) development substrate, to display the history-map. PadPrints functions in conjunction with a traditional web browser but without requiring any browser modifications.

Keywords

World Wide Web (WWW), Web Navigation, Web Browser, Pad++, Zooming User Interface (ZUI), Hypertext, Multiscale Interfaces, Information Visualization.

INTRODUCTION

Navigating hypertext structures like the World Wide Web (WWW) is difficult for users. After following a number of links, people can have difficulty remembering where they have been and returning to previously visited pages. According to a WWW usability study, 13.4% of subjects report not being able to find pages recently visited [4].

The same usability study found that while only 0.1% of page accesses were through the history list, 42% of page accesses used the Back-Button. So, while pages are revisited with a high frequency, the history list is largely unused.

A ZOOMING GRAPHICAL HISTORY

We built a browser companion, called PadPrints, to aid web navigation. Figure 1 shows the PadPrints history-map to the left of a browser window. Figure 2 shows a detail of the history-map and some of the PadPrints controls. PadPrints is similar to the MosaicG graphical history (MGGH) [1] in depicting a left-to-right hierarchical history of web pages visited during a browsing session.

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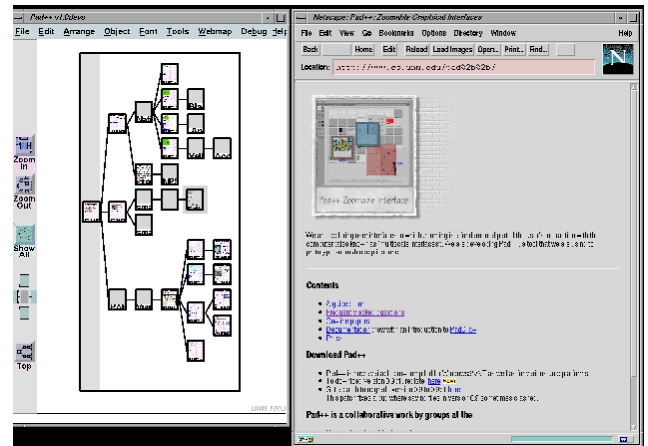


Figure 1: The PadPrints Browser Companion

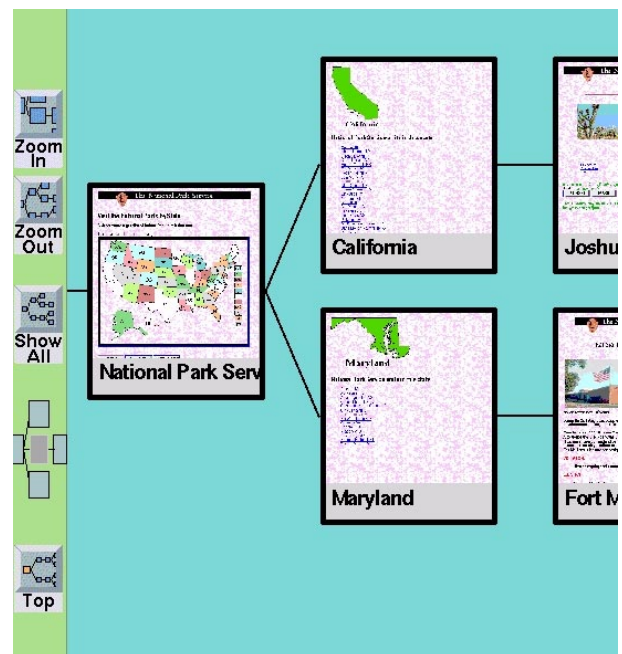


Figure 2. The PadPrints display, showing close-up of nodes in the graphical history hierarchy.

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As with MGGH, the PadPrints browser companion monitors and controls the web browser. When users access pages from the web browser those pages are added to the PadPrints display. Pages are added as children of the current node in the hierarchy, unless that page is already present in the hierarchy. A single click on a page in the PadPrints display sends the browser to the corresponding URL.

Three characteristics distinguish PadPrints from MGGH. First, PadPrints was implemented using Pad++, a substrate for building zooming user interfaces [2][3]. Pad++ allows users to zoom in and out to explicitly control how much context is viewed at any time. The multiscale nature of Pad++ allows geometric objects, text, and images to be displayed at arbitrary size on the screen. This permits the user to view the graphical history in its entirety or zoom in to focus on a particular part of the hierarchy. We conjecture that multiscale contextual display of the graphical history can provide important support for navigation. In addition, multiscale facilities of Pad++ allow natural ways to temporarily remove sub-hierarchies from view by shrinking them until they occupy minimal screen area. PadPrints was written as a Pad++ application using the Tcl scripting language.

The second difference between PadPrints and MGGH is the use of a proxy server to monitor browser behavior. Our proxy server notifies PadPrints when the browser (Netscape Navigator) retrieves a page. PadPrints then adds a new page to the graphical hierarchy or, if the URL is already present in the hierarchy, marks the existing page with a yellow outline to denote it as the current page. To achieve similar functionality in MGGH, Ayers and Stasko had to modify the Mosaic browser code to monitor page accesses. This has two drawbacks. Their graphical history is limited to use with one browser and their code changes must be reintegrated as the browser changes to support new HTML features. PadPrints was designed to work with any browser that supports a proxy server and should not require modification as browsers change to support new HTML additions.

Both systems display a small thumbnail sketch of a web page on each node in the hierarchy. The source of this small image represents the third difference between the two systems. Because they had direct access to the implementation of the Mosaic browser, Ayer and Stasko were able to re-render the web page into a hidden bitmap, subsample the resulting image, and display it in their graphical history. PadPrints, without direct access to the renderer, instead uses the X server to grab that portion of the screen associated with the browser. The resulting image data is subsampled and displayed with the node. We note that the multiscale nature of Pad++ supports displaying the full resolution view of a web page with each node, limited only by available memory.

USABILITY TESTING

We performed two usability studies to test the effectiveness of PadPrints, and found a significant reduction in the time to find a page previously visited, in the total number of pages accessed when searching for pages, and in subjective satisfaction. These tests are reported elsewhere [5].

CONCLUSION

PadPrints is a promising graphical multiscale history technique to aid web navigation. Providing users with a visual history map allowed them to more effectively return to information found in previously visited Web pages. By reducing the burden of navigation, more cognitive resources can be spent on finding, integrating, and processing new information, potentially making the World Wide Web a more useful information source.

ACKNOWLEDGEMENTS

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REFERENCES

1. Eric Ayers and John Stasko. "Using Graphic History in Browsing the World Wide Web", The 4th International World Wide Web Conference, www.w3.org/Conferences/WWW4/Program_Full.html, December 11-14, 1996.
2. Benjamin B. Bederson and James D. Hollan. "Pad++: A Zooming Graphical Interface for Exploring Alternate Interface Physics", *Proceedings of UIST'94* ACM Press, 17-26.
3. Benjamin B. Bederson, James D. Hollan, Ken Perlin, Jon Meyer, David Bacon, and George Furnas. "Pad++: A Zoomable Graphical Sketchpad for Exploring Alternate Interface Physics", *Journal of Visual Languages and Computing* (7), 1996, 3-31.
4. GVU's WWW Surveying Team. "GVU's 6th WWW User Survey", www.cs.gatech.edu/gvu/user_surveys/survey-10-1996, 1996.
5. Ron R. Hightower, Laura T. Ring, Jonathan I. Helfman, Benjamin B. Bederson, and James D. Hollan. "Graphical Multiscale Web Histories: A Study of PadPrints," in *Proceedings of Hypertext 98*, ACM, 1998 (In Press).