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A Visualization Tool Using PAD++ to Browse Information Structure

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Abstract

Explosive growth in information has led to an information overload. To ease the problem, Meta-Content Format (MCF) was developed by Apple Computers to separate structure from content. Apple also developed a browser, called HotSauce, to browse data encoded in MCF format. We did user evaluations of HotSauce to understand its strengths and weaknesses. Based on these evaluations, we developed a new browser using PAD++. Our browser overcomes some of the deficiencies of HotSauce.

Introduction

The World Wide Web has been growing at a very fast pace, doubling in size every 100 to 125 days (Morgan 1996). Apart from the web pages, other information objects like word-processing files, spreadsheets, e-mails, and databases have also been growing at a tremendous pace. Absence of proper tools to organize these disjointed information objects has led to ‘information overload’. Researchers at Apple Computers tried to address this problem by developing an architecture known as Meta-Content Model (Guha 1997). MCF is an implementation of this. Apple also developed a browser (called HotSauce) to browse information encoded in MCF. In this paper we first briefly describe MCF. Then we describe how user evaluations were done to evaluate HotSauce as a browsing interface. Lastly we describe the interface developed by us using PAD++ and how it addressed visualization problems encountered in HotSauce. The paper ends with suggestions about possible future directions for research.

Meta-Content Format (MCF)

The goal of MCF is “to abstract and standardize the representation of the structures we use for organizing information” (Guha 1997). It allows for information management utilities such as browsers to work across different applications, by allowing for: 1. Semantically rich descriptions of content and its relationships to objects 2. Structured and standardized descriptions of content 3. Extensible descriptions, and 4. Compositable descriptions. MCF encoding can be done for any data structure (e.g. e-mail, databases, text, graphics etc.). The encoding separates the user interface from data format. Thus for a broad array of back end structures MCF allows for an open choice of user interface.

Evaluation of HotSauce Browser

HotSauce is a 3D MCF browser developed by Apple Computers (available for most platforms). It presents content in a view with floating nodes. Mouse can be used to fly through the space in 3D. Quick navigation through branching structures is allowed due to the capability of flying forward, flying backward, steering, and jumping to a node. It also allows viewing the space hierarchy in traditional ‘Finder’ interface.

We chose to encode the Encyclopedia Americana (EA) collection (of Human Text Initiative at University of Michigan) which originally is in SGML format. Translating the SGML into MCF format allowed for a compact representation of meta-data free from content.

Visualization of EA in HotSauce (refer to figure 1 for a typical screen shot) was compared to the standard HTML interface (Netscape browser) available (10 users were involved in this). Although the testing was primarily formative in nature, we tried to model our efforts after the GUIDE process (Redmond-Pyle et.al. 1995). Attributes of the system that we evaluated were: Task correspondence, Interface consistency, Elements of visual display, Menu/Command structure, System response time, Error recovery, Help/Training issues, Time taken to complete a task, Incidental learning, Correctness of searches, Ease of visualizing structure, Ease of random searching, Ease of navigation, Availability of context while browsing, Ease of switching back & forth, Ease of remembering history of traversal, Collection size restrictions, and Ease of updating the collection.

Some of the shortcomings of the HotSauce that were apparent after these evaluations were: 1. The display was typically crowded and difficult to read due to hidden nodes and high branching factor. 2. Control over movements, speed, and navigation was found to be poor. 3. The nodes are presented in apparent random order. 3. Available features of HotSauce varied with the platform.
Implementing PAD++ Browser

The evaluations of HotSauce guided us in developing a browser using PAD++. PAD++ is a “general purpose substrate for exploring visualizations of graphical data with a zooming interface” (Benderson et. al. 1994). It is implemented in Tcl/Tk and supports “creation and manipulation of multiscale graphical objects, and navigation through the object space”. Our design utilized following ideas: 1. It allowed for an integrated view of information structure and content. 2. Given the hierarchical structure of the collection and its multi-scaled nature, we decided to use the ‘containment’ paradigm for visualizing the actual information content. 3. Tree graphs were used as the representation for the information structure. 4. We used fisheye view techniques (Furnas 1986) to present both the context of a specific information item and the structure of the entire collection. We allowed for multiple focus fisheye views. 5. We integrated the structure and content views by forcing the content viewer to follow the user’s movements in structural presentation.

A typical view while using our browser for browsing the EA collection is shown in figure 2. A few faculty and students did evaluations of this prototype browser. It was found that our browser had successfully addressed some of the concerns with HotSauce browsing. They were: 1. Nodes in our browser were not obscured as we presented all sibling nodes in a vertical fashion. 2. Nodes were possible to be ordered according to characteristics such as alphabetical order or date. 3. Display in our browser was rendered uncrowded. 4. We avoided the process context switching by integrating content and structure. 5. Navigation controls seemed to be better in our browser.

Future Directions

Our browser implemented in PAD++ is still in formative stages. A number of extensions could be done to it. Specifically: 1. Currently searching capability is not available. This could be implemented. 2. We need to sort out about how to handle cross-links in information structure. 3. Multiple occurrences of information items are currently handled by replicating the node in each place. This needs to be refined. 4. Evaluations could be carried out more rigorously.

Conclusions

In this paper we first evaluated some of the deficiencies of HotSauce browser used to browse files in MCF format. We then proceeded to describe a prototype browser (developed using PAD++) for visualizing similar structure. It was found that our browser showed improvements over HotSauce. But much further work needs to be done to improve the functionality of our browser.

References
Morgan, C. “The Search is On”, Windows magazine, 711, November 1996
Figure 1

Figure 2