

Browsing Hyperdocuments with Multiple Focus+Context Views

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ABSTRACT

We present an interactive focus+context environment based on zooming and hierarchical representations for browsing large data sets. It gives an *overview* of the data and provides *multiple views* for visualizing the content and the *local* organization of documents of interest. This multi-view system has been applied to the World Wide Web browsing as a first practical demonstration.

KEYWORDS: Information visualization, World Wide Web, multi-view system, focus+context, zooming interfaces, hierarchical representations, animation.

PRESENTATION

With typical Web browsers, users navigate through Internet information intuitively by association, following their interests by following links. Such systems only present a small fraction of the information at a given time. So, it is often unclear how this information is related to others. People have difficulty to understand idea associations and to remember where they come from and which links they have followed. They can rapidly become confused by the large range of navigation choices available to them. They are confronted to the disorientation problem [2].

The proposed approach consists in providing contextual multiple views for favoring idea associations and for facilitating the localization of the user. The system is composed of two graphical workspaces. The first workspace provides an overview of the structure which represents the pages organization and uses a concentric representation for displaying it. This view of the *global* context is used for exploring an important set of pages in order to find interesting areas. The second workspace allows to visualize the content of several pages of interest simultaneously and to give a general idea of their *local* context. This representation provides multiple local views where the pages are shown at varying scales [1][3]. Interactive zooming allow to resize the displayed pages in order to explore and to compare them.

THE MULTI-PAGE ZOOMING REPRESENTATION

This system makes it possible to focalize on several pages as shown in Figure 1. This favors idea associations by enabling comparisons between pages which are visualized in a clear way. In this figure, the other pages, which are visualized at a smaller size, compose the local context of the focus pages. This gives a general idea of the content of different page sets and of their local organization. This dual representation of the context in terms of links and content provides complementary information for the navigation. First, visual marks enable the user to localize the explored pages. Second, giving an idea of the content of the contextual pages helps the user to make navigation choices. So, these choices are not only determined by the meaning of the link anchors.

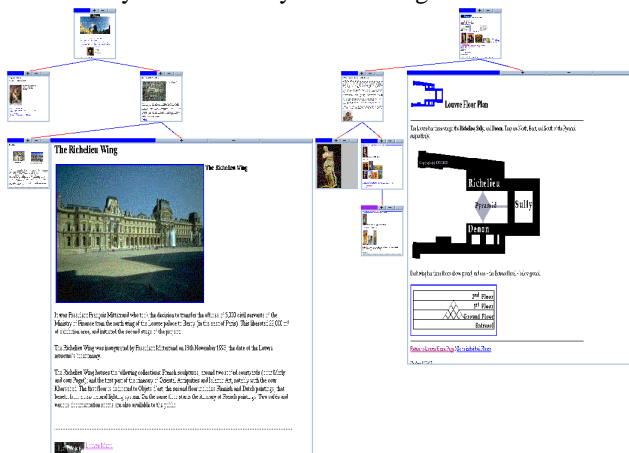


Figure 1: Two focus pages and their local context.

Each displayed page can become a focus point. The user defines his focus pages and their context by interactive zooming. So, the user has an explicit control of how much context is viewed at any time. The windows which contain the pages (see figure 1) can be interactively resized by using the mouse. Several zooming modes are provided for resizing a group of pages:

1. *Hierarchical zooming* makes it possible to resize the selected window and all its children. The initial size difference between the windows is kept when they are resized. This provides an efficient way to magnify or reduce several pages in a single interaction.
2. *Contextual zooming* allows to resize all the pages in function of their relationships with the selected window. All pages that are directly or indirectly linked to the selected page (i.e. the ascendants and the descendants) are resized in a way that is proportional to their distance, in terms of links, from this page. Conversely, the pages which are not connected to the selection are resized in the opposite way.

As shown in Figure 2, the pages of the first set have been magnified in function of their distance to the selected window. The pages of the second tree, which are not linked to the selection, have been decreased in size.

3. At last, the system provides global zoom capabilities for resizing all pages simultaneously.

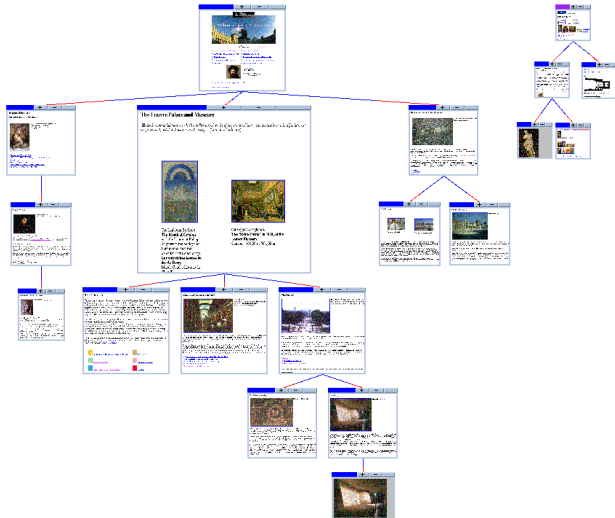


Figure 2: A resulting view of a contextual zooming.

As with usual Web browsers, the user can navigate through the pages by clicking on their hyperlinks. If the destination page is already displayed, the corresponding window is magnified. Otherwise, the new page is loaded and displayed as a child of the page which contains the anchor of the link. Previously viewed documents remain visible. This feature provides a kind of history mechanism.

If the number of pages becomes too large, the user can close the corresponding windows by decreasing their size. When a window reaches a minimum size (previously defined by the user), it is automatically closed. So, zooming is used as a powerful interaction way which enables to realize different tasks for organizing the display.

Zooming and closing operations cause the representation to restructure itself. The display is transformed and the windows are automatically repositioned and/or resized. If a visual transformation is too complex, an *animation process* is automatically performed for helping users to understand this reorganization. This animation allows the user to track the transformations, and thus reduces the cognitive overload that is necessary for understanding the new layout of the pages.

THE HIERARCHICAL CONCENTRIC REPRESENTATION

This view shows the global organization of an important set of pages and allows to explore it. It is inspired from the Hyperbolic Browser developed by Xerox [4]. Our representation evolves dynamically when the user browses the Web: The URLs of the pages are recursively searched from a specific page (the root) while the system builds in parallel an internal representation of the graph which depicts the pages organization. The URL search process is stopped when a maximum exploration depth, previously defined by the user, is reached. Each page can be interactively selected for becoming the new root of the representation. This

generates a dynamic reorganization of the display. New pages are loaded and laid out from the new root. The previously displayed pages, which move away from this root, are hidden.

This view is based on a hierarchical concentric display. A tree is extracted from the graph of links and is used for laying out the nodes which represent the pages. The tree layers correspond to circular concentric regions on the display. The other links, which are not part of the extracted tree, can also be displayed. The system can show all of them or only those which are related to the nodes previously specified by the user.

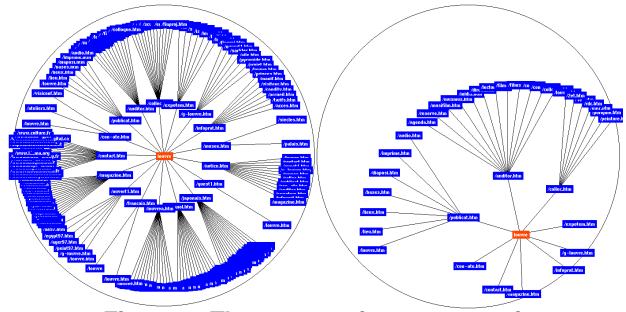


Figure 3: The concentric representation.

The display can be smoothly transformed to bring another node towards any position by dragging this node interactively. Circular layers are consequently moved and the view is globally transformed as shown in Figure 3. Components which move near the center become magnified while nodes which move away decrease in size. This representation can also be zoomed interactively in order to increase or decrease the number of displayed layers.

Selecting a node in this global view allows to load the corresponding page and its descendants (the local context) in the multi-view workspace. Conversely, double clicking on a window in a local view brings the corresponding node to the center of the global view.

CURRENT STATUS

This system has been developed in C++ with the X-Motif toolkit. It is also intended for supporting the editing and the browsing tasks in an hypermedia environment devoted to the research on Literary Works [5].

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