Enhancing WWW Navigation

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ABSTRACT The overall goal of this research project is to investigate navigational issues relating to hypermedia information spaces such as the World Wide Web, particularly the problem of user orientation, in order to improve the general design principles of navigational interfaces by utilising visualisation techniques.

KEYWORDS World Wide Web, Hypertext, Navigation, Visualisation

1. Introduction

Despite its relative short history, the World Wide Web (WWW) is now emerging as a powerful resource which will have much impact on Internet users. The vast amount of information available on the WWW, coupled with its easy accessibility, has seen the exponential growth of users and WWW pages in recent months. However, the unprecedented success of the WWW has brought with it a number of problems which are constraining its usability.

One of the central problems relates to the vast amount of information that the web contains and the methods by which a user can access this information. It has been established that one of the usability problems associated with hypermedia information spaces such as the World Wide Web is the user's risk of disorientation whilst navigating (Nielsen, 1990; Jonassen & Mandl, 1990; Rivlin et al, 1994). Users, when presented with multiple paths to the same or different end points will quickly experience cognitive overloading as they struggle to maintain orientation (Hedberg & Harper, 1991). Whilst this problem has been recognised, there have been few usability studies to examine the nature and extent of the difficulties in web navigation (Cockburn & Jones, 1996).

Adequate help must be provided to maintain a user's sense of orientation and facilitate navigation within the context of the total information space. Hence there is a need for support for both the local navigation task of moving between pairs of specific nodes as well as the global navigation task which involves movements that spans many nodes (Kahn, 1995). Most browsers display a limited amount of orientation information consisting of document name and URL as well as the URLs of possible links from the current page. In addition, many browsers provide a history list of pages previously visited which enables the user to establish some notion of location and also provides the ability to backtrack.

Whilst these orientation clues do provide adequate support for navigation at the local level, they lack the contextual overview required for global orientation.

The use of overview diagrams as an aid to navigating traditional hypertext structures have provided a solution to the problem of global orientation (Nielsen, 1990). An overview diagram is a graphical map of the structure of the hypermedia system showing all nodes and links. Such diagrams act as a two dimensional table of contents and are particularly suitable for providing a level of orientation in non-linear hypermedia information spaces. These diagrams support the user in generating an appropriate mental model of how the information space is structured. There is evidence to suggest that an appropriate mental model improves the users' ability to interact with the system (Rumelhart and Norman 1981).

A number of key issues have been identified as a result of the initial literature review. These issues relate to visualisation, generation and design of overview diagrams:

2.1 Visualisation

Although image map overviews are an excellent tool for orienting and navigating a hypermedia system such as the World Wide Web, there are some drawbacks when they are applied to large information spaces which involve many nodes and links (Mukherjee et al, 1994). Large image maps give rise to the need to use of scroll bars to enable the user to change views of the map and as the entire map cannot be display in its entirety. Researchers (Beard and Walker II, 1990) have provided empirical evidence to suggest that users perform sub-optimally with scroll bars in tasks which require navigating a large two-dimensional space.

The use of visualisation techniques to facilitate overview diagrams has been suggested by a number of

researchers in order to provide users with both a local and global view of the information space (Lamping et al, 1995; Bederson & Hollan, 1994; Zizi & Beaudouin-Lafon, 1994). These techniques include the use of zooming, split screens, magnifying glasses, and distortion oriented displays such as fisheye lenses and bifocal displays. Generally these researchers agree that the solution to the navigation problems associated with hypermedia will result from the ability to visually represent the contents of the documents in the system and then to present these on a screen in such a way to provide the user with orientation and interactive navigation.

2.2 Generation

Overview diagrams may either be created manually or automatically. Manual methods are very time consuming and do not provide easy method of updating diagrams as systems grow and change. Automatic methods rely on computational techniques to generate maps dynamically as new documents are added to the system. One thread of research is examining methods by which a hypertext system may be automatically mapped into an overview diagram (Mukherjee et al, 1994; Masuda et al, 1994; Zizi & Beaudouin-Lafon, 1994). These methods are relatively primitive, produce highly complex structures and as yet have not been applied to the production of overview diagrams for the WWW. Other research (Cockburn & Jones, 1996; Mukherjee & Foley, 1995; Brown & Shiller, 1995) is concentrating on enhancing WWW browsers by providing a graphical history list and even a "possible links" list but is once again relatively primitive and have not been subjected to usability trials.

2.3 Design

A more general issue relates to the actual design and presentation of overview diagrams. Designing overview diagrams for complex systems is extremely difficult especially those that do not conform to regular hierarchies (Bernstein et al, 1991). There are few guidelines that have been developed for the production of overview diagrams (Zizi & Beaudouin-Lafon, 1994) and no evidence of usability studies to examine the features that make such diagrams effective. Furthermore, the use of metaphors is a powerful method for enhancing usability of systems. Many metaphorical tools such as footprints, compasses and magnifying glasses have been used in conjunction with overview diagrams but there is no evidence of usability studies within the context of the WWW to evaluate any perceived benefits.

3. Work to Date

Work on the project began mid-1996 with the development of a dynamic bifocal display for WWW

overview maps (Pilgrim & Leung, 1996). The Bifocal Display was first proposed by Spence and Apperley (1982) to overcome the classical "window" problem associated with viewing large databases through the concurrent presentation of local detail with global context. The dynamic bifocal display was implemented as a Java applet and allows the user to establish overall orientation within the system in the 'out-of-focus' region and to then navigate through to the detail of the section of interest by dynamically controlling the focal area of the map by mouse movements. The central focal region, outlined by a white rectangle, is not distorted in any way. The area of the overview diagram outside of the central focus region is distorted in such a manner that the user can place the central focus region in the context of the whole map. The links between the nodes do not lose continuity over the boundary of the focal area thereby allowing the user to visually follow a path. A small toolbar allows the user to choose either the 'Focus Control' mode which allows the central focus region to be controlled, or the 'Page Navigation' mode which allows the user to select a specific node on the map with the mouse in order to jump to the corresponding URL.

It is postulated that the bifocal display technique is an effective way of presenting World Wide Web overview diagrams by concurrently providing the user with a detailed local view and global context to assist with navigation. Usability studies are required to determine whether the user will establish a more efficient mental model of the hypertext structure and subsequently improve navigational decisions.

The initial research has also examined the history of hypermedia navigation in order to survey and systematise the nature of the navigation problem. Research into visualisation techniques, the nature of mental models and technical advances in the WWW is currently proceeding. An investigation of how the problem of user disorientation in large information spaces has been addressed in other domains such as geographical information systems and complex databases has also been proposed.

4. References

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