GRAPHICAL HISTORY LIST ON WORLD WIDE WEB VISUALISATION: A USABILITY PARADIGM

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ABSTRACT

The World Wide Web (WWW) is a fast emerging technology which enables users to view the information via a web browser such as Internet Explorer and Netscape Navigator. Studies have revealed that users often get 'lost' as they navigate deeper and deeper. Information visualisation is adopted by many researchers to construct the graphical representation of history list as text-based imposes a burden on users. Although information visualisation is a useful tool, questions arise on its usability and human short term memory. A prototype of a graphical history list is developed while taking the usability and human short term memory into considerations. The research results have significantly indicated a positive and promising outcome on a usable graphical history list on WWW visualisation.

KEYWORDS

Usability, short term memory, information visualisation, revisitation, history list.

1. INTRODUCTION

World Wide Web (WWW) technology only took four years to attract millions as compared to television and radio which needed thirteen and thirty eight years to mark their presence (Cockburn, Greenberg, McKenzie, Jasonsmith, and Kaasten, 1999; McKenzie and Cockburn, 2001). Indeed WWW has been graded to be the famous technology around the globe when it was initiated started. Additionally, WWW is a web that has entangled a countless number of people. In 1996, a popular index server reported the WWW (a large distributed hypermedia network) to be composed of 21millions web pages (Mendelzon, 1996). Just imagine the scenario now, after eight years! In 1998, Netscape shared approximately 45% of web-browser usage. It is also predicted that by the year 2001, the Internet Explorer would gain 65% share in web usage (McKenzie and Cockburn,2001). True enough, Netscape Navigator and Microsoft Internet Explorer are now the dominant web browsers used around the world. Due to the rapidly growing of WWW, web users have accessed to a wide variety of web pages and all they have to do is browse (to examine in a casual way) for the relevant information. The browsing act may result in users being 'lost' in the cyber space which generally means that the users are unable to find the way back to previously visited pages (Ayers and Stasko, 1995). This can be viewed as severe problems as it undoubtedly discourage web users from further exploring the WWW. Hence, it is not surprising that many researchers have taken interest in proposing information visualisation as a technology to address the severe problems of disorientation and information overload that are caused by interacting with such a large and chaotic information space (Mendelzon, 1996) over the unlimited boundaries of WWW. Information visualisation is broadly defined as a computer-aided process that aims to reveal insights into an abstract phenomenon by transforming abstract data into visual spatial forms (Chaomei , 2002). The goal of information visualisation is to support the exploration of large volumes of abstract data with computers. According to Card, Mackinlay, and Shneiderman (1999) information visualisation can be defined as "the use of computer-supported, interactive, visual representations of abstract data to amplify cognition."

As a result, the intention of information visualisation is to optimise the use of our perceptual and visual-thinking ability in dealing with phenomena that might not readily lend themselves to visual-spatial representations. Navigating hypertext structures like the WWW is indeed a difficult task for users

especially the web novice users. As the users become deeply engaged in the browsing of the many web pages available, the users often faces difficulties in:

(a) remembering where they have been,

(b) returning to previously visited pages.

2. RELATED WORK

Substantial graphical history maps which use the concept of information visualisation are available in the market. The limitatins with these products are that they do not satisfy the usability and short term memory (STM) issues. In the case of PadPrint (Hightowerl, Ring, Helfman, Bederson, and Hollan, 1998), the web users are not able to delete nodes, modify the content of a history-map and there is no significant difference in time to answer questions.

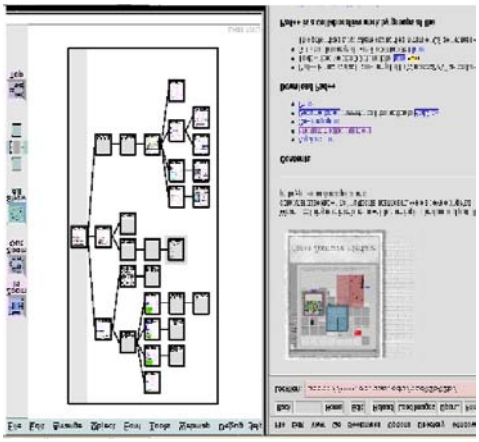

Figure 1. Overview of PadPrint

MosaicG developed by Ayers and Stasko (1995) is the derivative work of the National Center for Supercomputing Applications (NCSA) Mosaic Web browser, version 2.5.

In this case, web users have expressed interest in having more power to manipulate the documents and tree structure in general. Another shortcoming of the Graphic History View is related to the restriction of most colour workstations to display only 256 colours at a time. This loophole imposes severe restrictions on the thumbnails and produces an image which is not usually visually appealing.

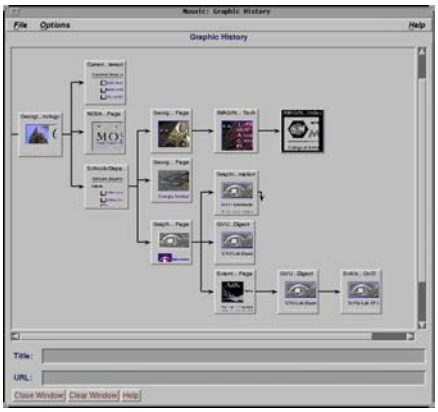

Figure 2. Overview of MosaicG

WebView (Cockburn, Greenberg, McKenzie, Jasonsmith, and Kaasten,, 1999) reports the subjects that the movements of thumbnails are extremely confusing. Some of the extended features of this

system are not catered for all the users. In addition, users returning after a long time may face difficulty in recalling on how to use the system. The architectural design for most of the web browsers appreciably lack of the emphasis on the usability concerns and human brain's constraint and capability. Thus, the aim of this paper is to propose a usable graphical history list while taking the usability criterion and human brain processing power into considerations.

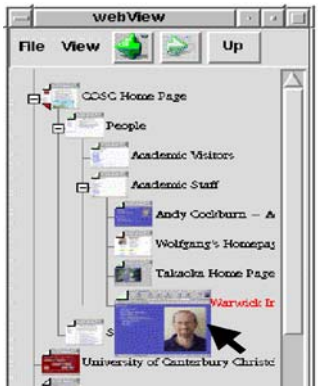

Figure 3. Hub and Spoke view

3. RESEARCH FINDINGS AND DISCUSSIONS

According to a usability study performed by Pitkow and Kehoe (1996), the users' main problems are 'finding known infomation' (34.09%) and being able to revisit a page (13.41%). Web browsers often provide features that support page revisitation – act of returning to previously seen pages. The 'Back' button is a standard browser feature that tolerating users to revisit recently seen pages sequentially, in what is essentially a reverse order of page visits. A history list is a text-based list of previously visited pages maintained by the browser. A research study carried out by Hightowerl, Ring, Helfman, Bederson, and Hollan (1998) reported that 42% of page accesses used the 'Back' button. The similar study discussed that only 0.1% of page accesses, which is a very minute percentage through the history list. Two concurrent research outcomes exemplify that about 58% and 61% of all pages of the web users visited are the ones they have been seen before (Cockburn, Greenberg, McKenzie, Jasonsmith, and Kaasten, 1999). Unambiguously, it can be concluded that the web users who had previously seen approximately three out of five pages visited. If web users have visited these pages before, they can very well retrieve the similar pages from the history list in the browser. There is no particular need for them to perform a search again to obtain the identical pages. The question is, why is the history list largely unused when the pages are revisited with a high frequency? This has essentially a gap for the researchers to investigate the history mechanism that discourages the web users from fully utilising it. The first problem with the history list is that it is incomplete. There is significantly large parts of the history list may disappear when web users follow a branch point. This happens when the user is trying to load a page, while at some point other than the top of the stack. It causes all pages above the current position in the stack to be lost. Unfortunately, it is then impossible to use the history list to retrieve those deleted pages (Hightowerl, Ring, Helfman, Bederson, and Hollan, 1998). Secondly, the history list is theoretical to be confusing and burdensome (Hightowerl, Ring, Helfman, Bederson, and Hollan, 1998). The possible discussion is it represents in a plain textual form. The only thing the web users are able to see are page titles or Uniform Resource Locators (URL) which fails to provide adequate cues to find a particular page accurately in a shortest time defined. This is where the term 'information visualisation' has been coined. Effective visualisation supports the visual representations of abstract data in order to strengthen the cognition (Fast, 2004). Moreover, successful visualisation reduces the time it takes to get to the information, make sense out of it and enhance creative thinking (Gershon, Card, and Eick, 1999). This is true as some titles in the current history list are greatly misleading and do not project the proper meaning. The appropriate representation can be the page itself. Titles representing a particular page should be replaced by thumbnails of that page so that the users are able to recognise it better. Conversely, a new question arises. How usable is information visualisation? Usability is defined by The International Organisation for Standardisation (ISO) ISO 9241-11, 1998 as 'the extent to which a product can be used by specified users to achieve specified goals with effectiveness,

efficiency and satisfaction in a specified context of use' (ISO/IEC, 13407, 1999). The usability definition is also discussed by Jokela, Iivari, Matero, and Karukka (2003). Two extra components, learnability and memorability are taken into consideration (Nielsen, 2003a). A study testifies that many studies jump to conclusion and claim that their product covers the usability issues when in actual they only seem to measure some of the components. They assume that one of these components is sufficient as an indicator of overall usability or that the selected measures are correlated with measures covering the other components of usability. This is a major misconception (Nielsen, 2003b). It is reported that more than half of the last three years of Computer- Human Interaction studies concerning complex tasks did not measure all aspects of usability (Frekjmr, Hertzum, and Hornbaek, 2000). This attitude of overlooking the usability issue has no doubt in resulting a working product but a barely usable one. Besides the usability issues, another obstacle in using the information visualisation is the short term memory in human. In 1956, Miller speculated that there is a limit on our capacity to process information. This is called the short term memory. Miller suggested that the limit is seven plus or minus two chunks of information which is known as the magic number (Miller, 1956). This is because the human brains and memory which are structured in a way which limits the quantity of information that can process at one time in an efficient and consistent manner. Since Miller's speculation, many other researchers studying the STM in human have suggested that there is a more precise capacity limit, which are only three to five chunks of information. A study suggests that a mean memory capacity in adults is about three to five chunks, whereas individual scores appear to range more widely from about two up to about six chunks (Cowan, 2001). In 2001, Cowan (2001) recommended that there is a new magic number – four! This finding essentially conveys a message that a human brain can only remember four information chunks in a given time frame. Another study done by Peter, Gobet, and Cheng (2003) provide a further support on the findings of Cowan (2001). The research findings and discussions evidently indicate that human brain cannot perceive large numbers of information unless it is memorised. If the users are required to remember too much then any hi-tech design is treated to be error-prone and hard to use (Peter, Gobet, and Cheng, 2003). This is because people intend to forget when too much of information is overloaded into their memory. As a result, the similar concept applies to WWW which helps the web users to visualise the information on the WWW.

An empirical evaluation and review done by Tauscher and Greenberg (1997) suggest that a history list should be composed of 6-10 items only. The reason is the previously visited URLs cover about 43% of all the inputs. It also advises that the list can be even shorter as the probability of a recurrence is at a distance between 1-6 items. These emphatically incur the wastage of space and memory if the design of the visualisation on the WWW is not investigated thoroughly.

3.1 DESIGN RATIONALE AND IMPLEMENTATION

The graphical history list visualisation is composed of 3 frames: Top, Main and Left. The focus of this work lies solely on the Left frame where the graphically represented history list is projected. Graphical elements are applied as it expressed quicker as compared to text-based element. The Left frame consists of five miniature thumbnails and check box on top of each window. Only five thumbnails are present here as we refer to the STM issue mentioned in (Cowan, 2001; Miller, 1956). Web users allow clicking on to save a particular page in the list. The URL of any page in the list can be viewed when the mouse is hovered on a particular page. A URL can be typed in the text box provided in the Top Frame to display the web page on the Main Frame and as a thumbnail on the first miniature thumbnail on the Left Frame as illustrated in Figure 4. When another URL is entered in the text box, the particular page is displayed. The previous web page thumbnail is transferred into the second miniature thumbnail as shown in Figure 5. The users' satisfaction is potentially increased when they are able to focus on the Left frame in performing their tasks when navigating and browsing the WWW.

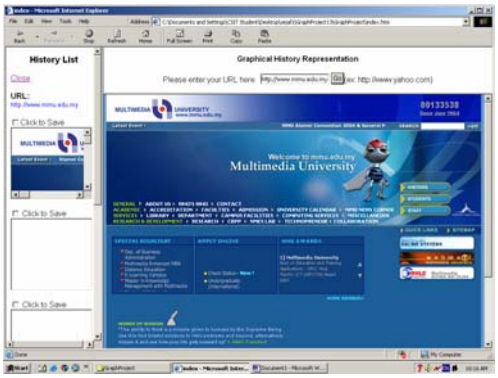

Figure 4. Overview of the first web page

Figure 5. The cyclic function of the thumbnails

The architecture follows the First In First Out (FIFO) concept. Once, a particular page(s) is saved, that particular space(s) is not be allocated to other pages. The process continues by skipping that particular saved space(s) as demonstrated in Figure 6. The web users are only allowed to save 3 pages at a time and when exceeded, the system prompts the users with an alert message. The web users are giving a list of categories, such as: urgent, follow up, and low priority for the users who decide which page to be saved for urgent attention, follow up later, or refer the page later on. Consequently, web users are able to keep whatever pages that they think will be used for further browsing. The wastages of spaces and memory are eliminated. The concepts of learnability and memorability in usability are demonstrated when the web users are more concentrated to the pages or links which are useful for the current and later use.

Figure 6. Overview of the 'skip' function when a thumbnail is saved

4. CONCLUSION

As the WWW evolves rapidly and the number of web pages increases drastically, it is noted that the percentage of page revisitation increases simultaneously. Furthermore, the percentage of usage of the history list which exists in the current browser is very minimal. The graphical history list promotes the intention of the usability and human cognitive issue when browsing. The architectural design and implementation have significantly address a positive and encouraging outcome of the usability criterion when visualising the WWW. The extraneous information which is not the concerned of the web users have been taken care of. The usable graphical history list suggests a practical way for the web users when dealing with the giant hypermedia structure likes WWW. It is actually an idea which can be

adapted by any browsers available in representing their history list in a graphical way to ease the page of revisitation by taking into account the usability and human short term memory issues into concerned.

5. FUTURE WORK

The following recommendations for future direction are suggested:

- Automates the features of expanding and collapsing in reducing the browser spaces while concerning the usability issues. Automation should be executed and update the bookmark list whenever possible. With the advances of mobile Internet technology (World Wide Wireless Web – WWWW), graphical history list can be integrated to facilitate and make feasible to any of the hand-held devices.
- Enhances the system in enabling people with disabilities to browse and visualise the information efficiently (Thomason, 2005).

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