

MemoSpace: A visualization tool for Web navigation

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ABSTRACT

A central aspect of reducing orientation problems in web navigation concerns the design of adequate navigation aids. Visualization of users' navigation path in form of a temporal-spatial template can function as external memory of users' search history, thereby supporting the user to find previously visited sites, getting an overview of the search process and moreover, provide structure for the complex WorldWideWeb (WWW) environment. This paper presents an application for dynamic 2 and 3 dimensional visualizations of users' navigation paths, called MemoSpace. In an explorative study, users behavior and subjective evaluation of a MemoSpace application was examined.

Categories and Subject Descriptors

H.5.4 [Information Interfaces Presentation (e.g., HCI)]: User Interfaces – *Graphical user interface.*

General Terms: Design, Human Factors.

Keywords: Navigation, MemoSpace.

1. INTRODUCTION

The well known problem of users' disorientation in the WWW emerges from the high complexity of the WWW environment. Users easily loose track of their navigation path, and find it difficult to obtain a mental spatial representation of this multidimensional digital environment. Consequently, repeatedly reported problems in WWW navigation are not knowing where you are, not knowing how to get back to previously visited information, not knowing which sites have already been visited [3]. The challenge is best met by providing structure. It is widely agreed that adequate navigation aids support users' navigation task and reduce disorientation [1][2]. Navigation aids can provide a thematic overview. Moreover, navigation aids in form of maps can visualize the topological structure of the navigation space.

A map like navigation aid shows graphically visited sites, and the traversed navigation path. This temporal-spatial template of the traversed navigation space can function as external memory of users' search history. The visual representation of users' navigation path organizes and provides structure for the complex and difficult to comprehend multidimensional navigation space.

Moreover, it is generally assumed that the visualization of the navigation space facilitates the construction of a mental

representation of the navigation space by the user. This mental representation could be a survey type map or schema [3]. An adequate mental representation of the navigation spaces' typology can facilitate navigation and can reduce orientation loss [4]. In order to support WWW navigation and to reduce orientation loss, we developed an application for visualization and tracking of users' navigation path, called "MemoSpace".

2. MemoSpace

MemoSpace is a prototypical application of VisualWeb for web browsing. VisualWeb itself is a prototypical programming framework for dynamic 3D-visualizations of multi-dimensional data sets. It uses Java3D as programming library and provides base functionality to encapsulate data objects into graphical primitives that can be interactively manipulated. Visual objects can be animated and aggregated to form more complex visual structures.

MemoSpace generates 3D-visualizations of browsing histories that can be interactively explored in a separate navigation window besides the web browser. Figure 1 exemplary shows the visual representation of a search history in MemoSpace. The blue circles mark visited web sites which are labeled according to their web address. Users can change these labels according to their own preferences.

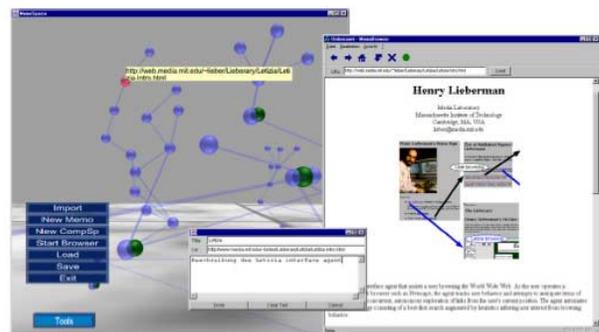


Figure 1. MemoSpace

The blue connection lines between web sites (see Figure 1) visualize users' search history, thereby generating a temporal-spatial template of users' navigation path through the web.

Alternatively, the user can visualize his/her browsing paths as a 2D-tree that grows from the bottom up as new web pages are explored. This tree-like visualization emphasizes the temporal order in which documents were explored as well as which hyperlinks have been chosen from a certain web page. The user can easily trace back his/her way from a dead end of a web search path in order to re-establish a former search task. Moreover, using

this as a starting point, users can experiment with various possibilities to enrich this representation even further by adding visual cues such as coloring or scaling up certain nodes and links to emphasize often visited or out-dated pages. In addition, it is possible to add comments on web pages, mark certain documents as bookmarks and link them together to a topic map, thus forming a complementary content-related visualization layer. This offers the possibility to observe a hypertext space easily from different viewpoints, switching between certain abstraction layers by navigation in 3D.

Furthermore, the user can choose between different visualization metaphors. For example, a 2D-Tree is not the optimal choice, if the complete hyperlink structure of a certain document base has to be visualized (especially if it contains cycles). In this case, a visualization metaphor that relies on spring-embedder algorithms may produce better results. Furthermore the result of a web search can be shared with other users (currently only offline as a file).

3. Evaluation of MemoSpace

A modified version of MemoSpace was used in an explorative study in order to observe users navigation behavior and to evaluate the application.

3.1 Method

Eleven students (six females and five males) at Chemnitz University of Technology took part in the study. Participants received credit points for participation.

Participants of the study were asked to search for information within a closed space of hypertext documents. The documents navigational structure was visualized with MemoSpace in a frame beside the text and participants could navigate within the document via MemoSpace. Participants' task was to find answers to questions presented by the experimenter as fast as possible within the document. A time limit of 2 minutes was set for each search and a time limit of 10 minutes was set for the total search session. When the 10 minutes had expired, participants had to evaluate the application according to orientation problems, learning, satisfaction, layout, handling and task adequacy. Before and after the search task a questionnaire regarding knowledge questions of the documents content were administered to participants. While participants searched for answers within the documents, eye movements and navigation operations were recorded.

3.2 Results

3.2.1 Subjective Evaluation

Participants rated experienced orientation problems, learning, satisfaction, layout, handling and task adequacy on 7-level rating scales (1=strongly disagree, 7=strongly agree). Items of the questionnaire were recoded in order to get a one-directional scale. After recoding, a high scale value indicates a positive evaluation whereas a low value indicates a negative evaluation.

Overall, participants evaluated MemoSpace positively. The average rating was 5, which corresponds with an evaluation of "I am rather satisfied with the system" (M=5.24; SD=0.72). Highest ratings could be found for handling (M=5.73; SD=0.73), orientation (M=5.67; SD=0.68), layout (M=5.33; SD=1.08) and satisfaction with the system (M=5.03; SD=1.08). Lowest ratings

were reported for learning (M=3.82; SD=1.31), and task adequacy (M=3.60; SD=0.71).

3.2.2 Search task

Participants fulfilled on average 18 searches within the time limit of 10 minutes, M=17.73, SD=3.98. For each search they needed less than 35 seconds which indicates an efficient search. On average 13 searches resulted in the correct answer, M=13.45; SD=4.38. Consequently, 25% of the searches led to a wrong answer which indicates a rather low search effectiveness.

3.2.3 Knowledge acquisition

Acquired knowledge was measured by subtracting participants' pre- and post-test results. Participants could reach on average four more points in the post-test compared to the pre-test, M=3.82; SD=1.78.

4. Discussion

Participants' evaluation suggests that MemoSpace is easy to handle and the visualization of the documents navigational structure prevented orientation loss. Also the layout of MemoSpace was positively rated. However, MemoSpace still needs to be improved in order to support knowledge acquisition and searching for specific information in a more efficient way. The existent prototype focuses on the search history which is related to users' retrospective behavior. MemoSpace should be extended in order to support also prospective behavior such as planning a navigational route or the selection of appropriate sites in regard of users' search goal.

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