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Simplifying the Learning Process Over the Internet

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Information and communication technologies, on which new training and learning media are based, have improved the transmission and access of data. But they have not facilitated enough interaction between the user and the information. This interaction is very important for someone trying to learn. Until now, new Internet technologies were taught to improve the speed of access and the quantity of information accessed. There is a need to develop tools to help the user interact with the large amount of information available on the Internet. In this context, we propose a set of computer-aided tools to ease the process of interaction and understanding of the user who is absorbed by the Web.

Navigating Difficulties

The Web is an open, evolving, heterogeneous and nonmoderated space of information with problems related to any large hypermedia system. It contains problems specific to choices and routing through heterogeneous information (Barker 1993). These problems can be characterized as disorientation and cognitive overload (Souza and Dias 1996). Users become disoriented because the link between the subject being searched for and the information shown on-screen is lost (Rhéaume 1997).

With only a screen to work with, users experience cognitive overload because they do not know with what the information shown on-screen is associated. Many decisions must be made in a hypermedia environment, such as which link to follow and how to retrieve important links from those visited or to be visited. The user should be able to find the information they seek by following links to different pages. But getting to important information quickly requires accessing information in a smart way. This entails having

the ability to go from one place to another, identify the document reached, evaluate it, save it or memorize its address, and relate it to other documents and information.

Solutions to Browsing Difficulties

The difficulties with browsing would make any user unhappy, especially with the amount of time they spend. In our research, we have found users are aware that there is limited knowledge of the local use of computers. For this development to succeed, those learning to browse the Internet must have a way to keep in touch with experts, even after the research team has left. This point is very important because it shows that the development of a local Internet culture depends on the capacity of the user to move from a situation where the experts are present, to one where help is available when needed.

This last point seems to be one of the most important lessons learned from this research because the use of NTIC (new technologies for information and communication) will depend on it. The availability of a staff to help from a distance, which is a particular form of groupware, is a necessary condition for the development of NTIC. This is not limited to the use of a file or a Web site from a distance, because the notion of distance is transparent to the user. Instead, it is extended to those cases where users are alone and need in-house help. A few years ago, researchers in the area of distance learning studied this problem and determined two main issues: the anxiety of being alone and the inability to organize the work (Moore 1990). Since then, more issues have emerged (Perriault 1996). These mainly concern individual abilities such as:

- Identifying the communication tool being used from a distance.

- Choosing the mode of communication (synchronous, asynchronous, point-to-point or multipoints) based on the situation.

- Evaluating and managing time while using multimedia (Jaeckle 1998).

- Precisely and clearly describing the problem in the communication language.

We assume that these competencies are acquired by experience and/or training. This will help to eliminate the two major handicaps previously mentioned.

Navigational Help

Help with navigation can be provided in two ways. First, a method to construct Web sites should be adapted to make it easy for the user to access and search sites. For example, Quarteroni (1996) proposes to limit page depth to four levels, meaning only three nodes can be active at the same time. In addition, Quarteroni believes each screen should have about five active links. To be clear and efficient, links to general ideas of dependent information are favored. This approach should result in hypermedia with a simple, more efficient structure. The only drawback to this method is that the user must split a complete design into subsections that are accessed separately. But that can be resolved by indirectly linking those subsections to each other.

Another way is to provide a set of computer-aided tools that allow the user to navigate the Web easily using his or her preferred browser. General browsers such as Netscape and Internet Explorer propose some functionality, including history and bookmarks, but these kinds of help are insufficient. In addition, those that use hypertext systems create different representations.

Many computer-aided systems have been proposed. Among them are NESTOR and Broadway, which are the closest to our design of computer-aided tools to navigate the Internet. The NESTOR browser is similar to Netscape or Explorer and runs on Windows 95 or later. Its main screen is divided into two windows - a classic browser based on the Active X component with which Internet Explorer is displayed, and a graphical and interactive help window. As the user browses the Internet, a map of sites visited is automatically drawn. The user can edit the map and use it to go directly to a previously visited site. This navigator was built to achieve two main goals: to help new users become active learners and to make browsing easy. But while NESTOR is a complete and excellent navigator, it is platform-dependent and does not keep track of time.

Broadway is a computer-aided tool for navigation that uses case reasoning to recommend pages according to the user's browsing behavior. The system keeps track of four parameters related to the user's navigation that describe the address, content, explicit evaluation and the display ratio of each Web page users visit. They function as the base from which to extract useful cases to be used in the future. Evaluating the sequence of pages gives an indication of the user's behavior. The index model allows the modeling of these types of cases. Broadway is extended with a new tool that keeps track of the user's behavior in a large number of variables. Detailed and flexible behavior management is possible due to the extensive observation capabilities combined with the indexing model (Trousse, Jaczynski and Kanawati 1999).

The NaVir System

We designed and implemented a computer-aided system for virtual navigation called NaVir. This system, which is implemented in Java, can be used with any browser. Themain screen is made up of many windows. Its kernel is made up of two important modules: one to collect the different URL addresses, and another to build and interact with the graphical map and time management. Users can also access dictionary and system help.

To guarantee our system is independent of the browser, we used a proxy server to recuperate addresses of sites and pages visited. This server sits between Web clients and information servers using different protocols, and passes information from one end to the other. Each user's request is sent by the client to the proxy server, which responds directly if it has the information in its cache or passes the request to the destination server. The proxy server keeps a copy of each document it sends in its cache for variable amounts of time. This way there is no need to always retrieve a document from the destination server. Cache management is conducted on the date of the most recent document update, the maximum time a document is stored in the cache and the amount of time an idle document is stored. This service, which is transparent to the user, makes responses to user requests more efficient and reduces traffic on the network.

The proxy server receives requests from the browser, rearranges them if needed and sends them to the module that builds the map. This server is installed locally on the user's machine to serve as a link for HTTP requests. The browser must be configured to use this proxy server. Each HTTP request will be intercepted and sent by the proxy after extracting the necessary information (address requested, elapsed time since the address was requested) and saves it. This data is stored in a file that will be used by the module responsible for building the map later.

Graphical Map for Navigation

The development of a graphical map and its use as a computer-aided tool for Web browsing is based on the studies of cognitive processes that occur during the navigation of distributed hypermedia. It is a graphical representation of the conceptual and geographical path a user follows while searching for a topic. The navigation map we designed is based on the idea used in conceptual maps (Gaines and Shaw 1995), which is also a computer-aided tool for navigation. It allows a hypertext reader to view the titles of information units and links that connect them in a form of a network. It is drawn with a goal in mind, within well-defined references, and according to a graphical representation suitable for

browsing problems.

The major role of the graphical interface is to make information found online easy to comprehend. This is based on the graphical representation of the different pieces of information and the relations that connect them. The graphical interface between the users and the system constructs the image of the system. The navigation map makes it possible to keep track of the user's search paths and is modeled by a directed graph. Page addresses, topics or titles of pages and the time spent connected to each page are kept in the nodes. Users can display the map at any stage of browsing.

A directed graph representation of the map is most suitable for its visualization. Each node contains the name of each page visited and respective information, which should be kept without affecting the clarity of the graph. Nodes are connected to each other, indicating that the user has moved from page to page, and should be displayed with a minimum amount of edges and intersections.

Our research found that a circular representation is most suitable for this because it makes the information represented readable, since the nodes do not touch and are uniformly distributed. The edges may cross, but the intersection is concentrated around the center; though this can be modified.

Educational Server

We developed a system to experiment with distance learning, which offers users a graphical interface through which to access a set of courses, and to communicate with each other and the instructor. The system is made up of a server for different educational activities that are accessible to the general public, students and instructors. The server is structured into a set of practical sessions with content that is in accordance with the teaching of information and communication technologies, such as data and document management, Internet tools, multimedia and Web site development. Each course contains an online table of contents, a presentation page, subject index and a bibliography. The educational server must follow a graphical and pedagogic chart prepared in advance.

The quality of an educational site depends mainly on the organization of textual and graphical information, the flexibility of the browser and the level of interactivity. The pedagogic concept is used to structure the content of the page to simplify the learning process. This helps in reaching the educational goals and solving problems raised by users. It is done based on many phases, including identifying specific objectives for training; setting goals; structuring the content in logical training units; developing a complete scenario

of a site; designing the complete chart of navigational and logical links of the site; and constructing a page model. A prototype is built so that we can have a uniform presentation of the different semantic units of the site.

Conclusion

The computer-aided tools dis-cussed here help solve many navigation problems, but it is time to start solving issues related to use and control. We plan to allow the user to add comments about each site or page visited and start the browser from the graph. We also plan to evaluate the system in a cooperative learning environment, allowing us to measure the system's success.

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