Report on Hypertext and Hypermedia Related Issues at CHI'94

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Introduction

This year's ACM conference on Human Factors in Computing Systems (CHI'94) took place in Boston, USA from April 24 to April 28. The conference program featured tutorials, papers, panels, live demonstrations, interactive experiences and a doctoral consortium on key topics of Human-Computer Interaction. This report is an overview of current trends and developments related to hypertext and hypermedia technology. I will not summarize the complete conference, nor will I describe any particular system.

Human-Computer Interaction and Hypertext/Hypermedia

I propose to use the three layer structure shown in Figure 1 to convey the links between HCI issues addressed at CHI'94 and Hypertext and Hypermedia (HyperMM) systems. Level 1 of the framework, the *Information space*, defines the structure and organization of the information used in an HyperMM system. Level 2 denotes the *Interaction space*, that is, the interaction that takes place between the user and the system whereas the *Mental space* of Level 3 portrays the user's perspective.

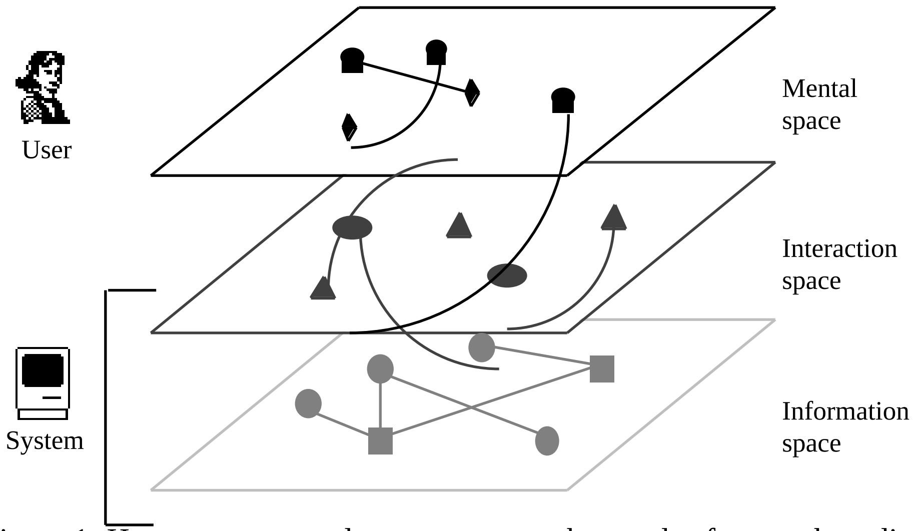

Figure 1. Hypertext system: layers to convey the trends of research studies.

HyperMM technology has been primarily concerned with the first two low levels of the framework. At CHI'94, most presentations addressed HyperMM through the two higher perspectives: the interaction and the mental spaces, although some researchers covered the three spaces transversally.

In the next section, I report on the emerging problem and required properties that user interfaces of HyperMM systems should satisfy. Then I will present some interesting issues according to the structure of Figure 1: bridging the gap between the mental space and the interaction space, then focus on the Interaction space and its links with the information space.

The underlying problem and required user interface properties

Shafir introduces the crucial design problem: "Finding answers in a maze of hyper-linked information is disorienting and frustrating for computer users." [Shafir94] Two characteristics of such systems may justify this statement:

- hyperMM systems are characterized by the non linear fashion to arrange and access a large set of information [Vora 94],

- casual users and non-computer-experts are using hypertext systems, such as public information system [Vaanaen 94].

The conference was rich in terms of topics and insights, but there were two issues that struck me as being prevalent:

- presentation of a large set of organized data to be perceivable by the user,
- efficient navigation through the hyperspace without getting lost.

Although it is difficult to consider input and output interfaces independently, “presentation” primarily refers to output while “navigation” relates to input. Vaanaen pointed out that presentation itself, as an organization metaphor, should support navigation features [Vaanaen 94]. Although navigation results from specific goals, its success relies on general features such as [Vora 94]:

- awareness of the location in the hyperdocument,
- envision of the next destination,
- planification of the pathway to access the next destination.

Therefore, the output interface must convey cues that support the above three general parameters.

Results

Between mental and interaction spaces...

The fundamental recommendation is that designing the interaction space must be related to the mental space and consequently to the end-user. As stressed in [Vora 94], "...the incoherence is actually caused by designing hypertext interfaces without understanding the user behavior." The distinction between mental and interaction spaces is thus rather subtle. In this section I report on a study that bridges the gap between the two spaces. Then I will present design solutions for the interaction space with their consequences onto the mental space.

Based on the psychological model of text comprehension, a comparative study of four types of interface is carried through in [Vora 94]. The underlying principle is that interfaces must provide the attainment of a coherent mental representation: in particular the coherence can be partially achieved by being able to link the information. The four types of interfaces considered by Vora are the following:

- textual with embedded links (such as the electronic proceedings of IWANNT’93 [Allen 94]),
- textual with separate links, and
- graphical (trees) with or without labelled links.

According to Vora, textual interfaces with embedded links and graphical interfaces with labelled links are more promising: links are explicit and consequently require less cognitive load. In addition the author observed that within a textual interface with embedded links, the user focuses on the links (highlighted link-markers) and does not read the context. As a result, relationships between nodes are lost. Vora concludes that graphical interfaces with embedded links help the user to construct a quick mental representation of information organization. This result must be completed by the following recommendation: multiple views and organizations of information must be supported enabling the user to efficiently perform the task.

The interaction space...

Interface metaphors can help solve problems by offering familiar structure and interaction possibilities to the end-user. Interface metaphors are to a great extend studied at CHI’94. Their benefits are threefold [Vaananen 94]:

1) They offer familiar and motivating presentation.
2) They impose further structure on node-and-link networks.
3) They visualize interaction affordances.

Requirements for a good hypertext metaphor are listed in [Vaananen 94]:

- Organizational metaphors which may allow navigation by inherent actions,

- functional metaphor presenting recognizable objects on which direct manipulation is allowed,
- navigational metaphor such as guided tour.

A single metaphor cannot fulfill all these requirements at once. Multiple recognizable metaphors couple navigation possibilities with content organization [Shafrir 94]. As an example, in the help system presented in [Shafrir 94], the 'Geographical Terrain' metaphor is linked with the 'Office metaphor'. Furthermore the use of a visual design language reduces confusion at the affordance level. For example, presentations of topics and landmarks are visually different.

Based on a particular kind of navigational metaphor implementing smooth zooming, Bederson [Bederson 94] defines a software platform Pad++ for hypermedia authoring and information visualization. The principle consists in displaying the whole set of information and, to access more details, the user has to "take a closer look". Therefore, the user maintains a constant feeling of where the information is located with respect to the rest of information. Bederson claims that such navigational metaphor, defining multiscale interfaces, becomes so intuitive that the user interface becomes cognitively invisible. A graphical interface of a directory browser has been implemented using Pad++. This study focuses on navigational metaphor and may be fruitfully coupled with data visualization solutions such as the Starfield displays [Ahlberg 94].

Confirming the experimental results of [Vora 94], Mukherjea claims that node and link diagrams are one of the best tools [Mukherjea 94]. However, to enhance the usability of the interface, the presentation of the topology is not enough and some cues about data of the information space must be provided. For doing so, visual properties such as color or size can be used to provide extra guidance. However, the number of visual properties that the user can perceive is much less compared to the amount of data to be conveyed: therefore only the important pieces of information must be presented. The mapping must be customizable by the user according to his/her skills and tasks. Navigational View Builder has been developed for this purpose [Mukherjea 94].

Between interaction and information spaces...

Multitree [Furnas 94] is a new type of structure for representing and visualizing information. In the framework of Figure 1, it is related both to the information space and the interaction space. At the interaction space level, multitree is a concrete metaphor [Vaanenen 94] and defines a good way for viewing and navigating. As pointed out by [Furnas 94], a fixed structure of the tree is not suitable for everyone: the user wishes a quick access to a subpart of a tree corresponding to the focus of interest. One solution to this requirement implies the construction of fragments of some existing tree to be reused and reorganized into new trees. Multitree seems appropriate for such caces of reuse of sub-trees and creation of new trees.

Conclusion

Most articles presented at CHI'94 focused on the interaction space in relation to the mental space: they address the problems of large set of data visualization (outputs) and efficient navigation within the hyperspace (inputs). Although information may be multimedia, the interfaces for hyperMM stick to the graphical metaphors without considering the contribution of multimodal interaction. As an example, I will consider landmarks in Raison d'Etre [Carroll 94], an hypertext developed to capture design history and demonstrated at the conference. In this system, landmarks can be reused as search criteria. A landmark can only be textual. As an extension, I suggest, sonic landmarks which can be fruitfully exploited while navigating: The magnitude of the signal can translate the semantic distance between the landmark and the current point within the hyperspace.