Chapter Three

Navigational Aids in Current Systems

This chapter analyses the tools that are used for navigating hypermedia systems and discusses their use and utility, with detailed examples from specific systems being presented. The main tools and techniques discussed are: Paths, Webs, and Tours; Maps; and Guides and Agents. Some of the problems that these tools overcome will be described as well as some of their limitations.

Paths, Webs, and Tours

Paths, webs, and tours are filtering and structuring devices that present a simplified view of the system to the user. A path and a tour are relatively passive in some ways, in that a default path is usually provided which has some specific context. A default next move is always provided at each node so that it can be navigated very simply. However, sometimes more than one link is available so other routes can be taken off the default path. A web is different in that the control of the route that is taken is solely under the user's control. At any time, the user must decide which link to follow. What the web does is present only those links that belong to the context of the web. Each node may have many links, but only those that belong to the web will be displayed at each node. So the web is a filtered part of the whole system that has been saved previously on some subject, and this subject provides the context for the nodes and their connections.

Intermedia Web

The Intermedia Web is a set of links stored in a database that connects a number of documents into a network structure. The web is basically a filtered set of links from the database that is saved as a separate web document. Documents may belong to any number of webs. Users may access a particular network of documents and links by opening a web. Each document will only display links that belong to that web, even though there might be many more links contained in that document. To navigate the web, users may select from the available link-markers in the original document. Another way is to use the Web View (described in the next section) which is the main orientation aid for navigation in Intermedia. It provides a graphical view of the web and all nodes are selectable so that navigation can be carried out using it.

The Intermedia Web is primarily a filtering device. It is used to provide a specific context for documents and links. Documents may be created using one of the Intermedia applications, while links are only created once an existing web is opened or a new one is created [Walter, 1989]. This means that webs provide a context for documents and links. Without this context, links would have less meaning. They would also proliferate within the documents resulting in too much choice for the link follower and consequently they would be of less use.

Path replay is seen as an attractive goal [Utting, 1989]. It is an idea similar to the web in that it is a saved group of links that can be followed. However, the path in this case is seen as linear and might be used by a professor to find an interesting trail through a system, to save this path, and to pass it on to their students. Then the students could replay the path without having all of the system to explore — thus reducing the time and effort expended in learning what the teacher (or guide) wanted to pass on. That is, the students wouldn't have to learn the details of how to navigate the whole system to follow the same path that the professor did. They would be able to just replay the same path using some simple interface mechanism which reduces the complexity of the system by simplifying the structure to a linear path, and by providing a simple and easy-to-use interface for following the path. Of course, at a later time the students may need to learn how to navigate the full system.

NoteCards TableTop and Guided Tour

NoteCards uses the metaphors of a TableTop and a Guided Tour to assist users in navigation and orientation [Trigg, 1988]. The guided tour facility is similar to tools such as Hammond and Allinson's (1988) guided tour idea, Bush's (1945) trails and Intermedia's Web view. In NoteCards it is a system-controlled navigation facility consisting of a graphic interface to a network of special TableTop cards. It is a specialisation of the browser card already described, where the user navigates by clicking on the nodes on the graphical map.

The TableTop is a special card designed to capture the particular arrangement of cards on the screen. Since NoteCards enables more than one card to be displayed at the same time, there is a problem for users in capturing the author's intended meaning, because that meaning may be obtained both through the cards' contents as well as through the spatial layout of the cards. The TableTop card was seen as a solution for this. It is a snapshot that records the list of cards, the shapes of the windows, their positions on the screen, the scrolled locations (vertically and horizontally) of the windows' contents, and the order in which to open the windows so that the original (possibly overlapping) arrangement can be preserved. [Trigg, 1988]

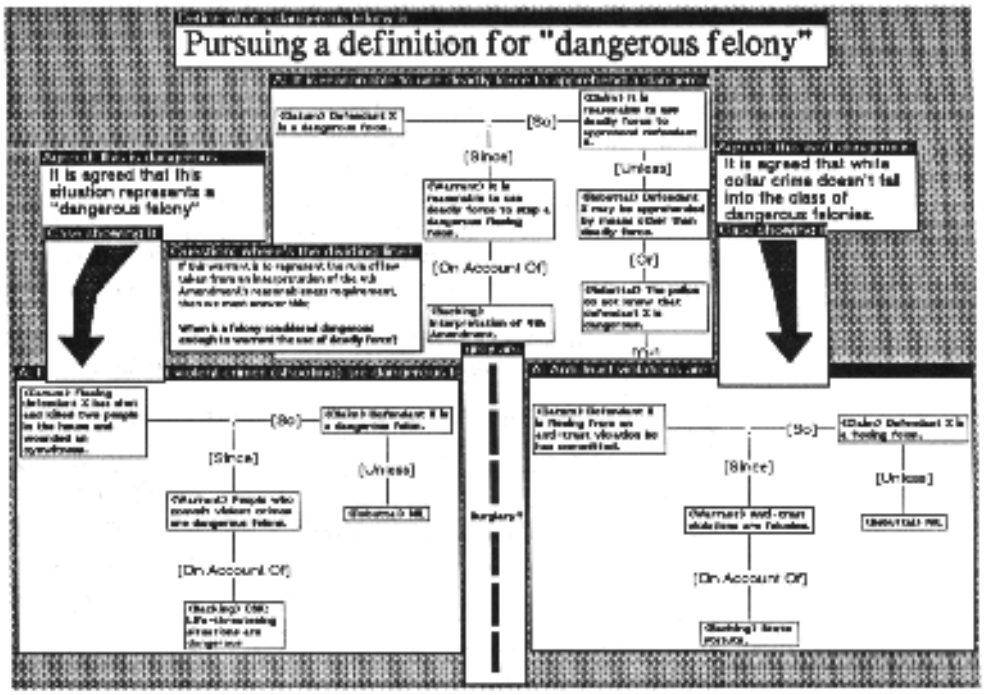

Figure 3.1 *NoteCards' TableTop card*

There are, however, problems with the TableTop cards. One is in indicating the context of individual cards on the TableTop. In what order should the cards be read — is it left to right, top to bottom, or some other order? In an on-line demonstration pointing can be done by a demonstrator using a mouse. In an on-line guided tour the author must communicate in absentia. One way of enabling this is to open the individual cards on the TableTop in a specified order, so that the resulting simple animation provides an indication to the reader of the expected reading order. Other ideas have been to provide graphical arrows, asterisks and other devices to function as a stand-in for a narrator's gestures and emphasis [Marshall and Irish, 1989].

A guided tour card in NoteCards consists of a graphic interface to a network of TableTop cards. Specifically, a guided tour is a graph whose nodes are TableTop cards and whose edges are GuidedTour links connecting the cards. The TableTop cards may have other links connecting them to other parts of the network. The guided tour is accessed via a graph-based interactive interface allowing both authors and readers to work from the same concise overview of the guided tour's structure [Trigg, 1988]. Authors create guided tours using this graph-based card — TableTops can be linked with just a few mouseclicks and the resulting structure can be modified easily.

A guided tour in NoteCards can have multiple paths through it — it does not have to be linear. To use a guided tour, five commands are available: start, next, previous, jump and reset. When the Next command is issued and there are multiple destination cards, then a menu, listing the possible next TableTops, is shown with the user having to select one. The Previous command displays the previous nodes that were visited in the order that they were visited. The user selects one of the previous nodes and effectively jumps to it. A Jump command can only be issued after selecting a node on the graph to jump to. The Reset command closes the current TableTop, turns off any highlighting of nodes and links on the graph, and clears the list of previously visited nodes.

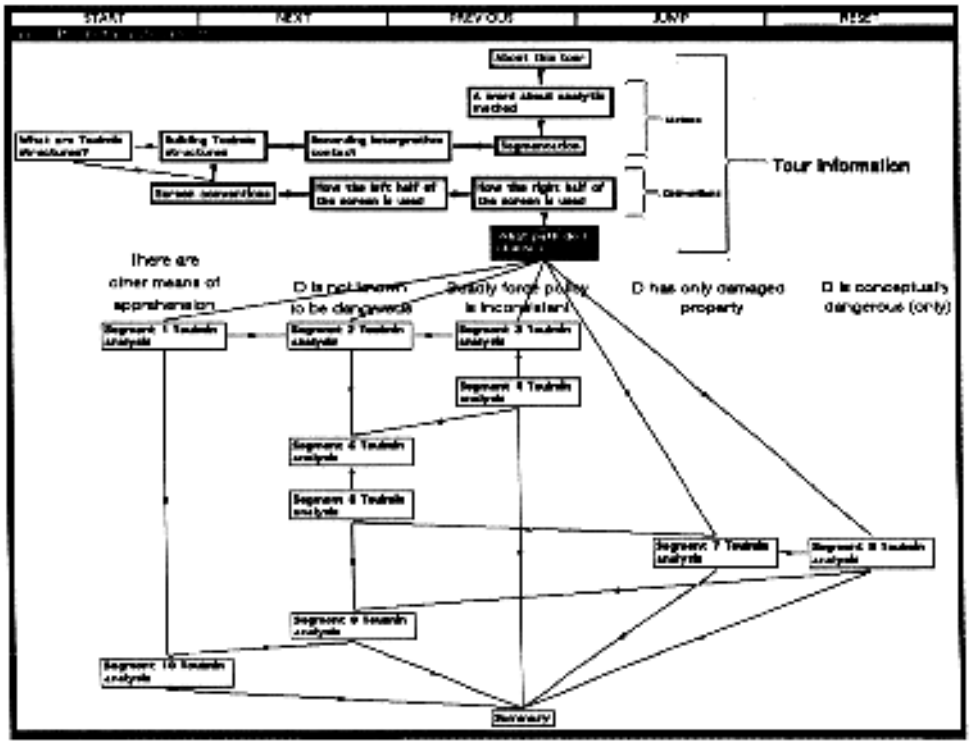

Figure 3.2 *NoteCards Guided Tour Card*

The guided tour card has some special features that assist the user in reducing the load associated with navigation. The current node is highlighted on the graph — this allows the user to quickly ascertain where they are located in the path. Nodes that have already been visited are outlined with a thicker line than normal, as are links that have been followed. This provides a quick summary to the user of where they have been, how much of the path they have seen as well as how much they haven't yet seen.

A problem with NoteCards guided tours is in their ability to provide branching at any stage. Unfortunately there is no capability to provide a default path through the network and so the reader must decide which one to follow at the time. Also, no hints exist (apart from the title) as to what is contained in the options. There is no guidance from the author as to which path is more appropriate at that time. So this will add to the cognitive overheads of navigation as the reader must decide which branch to take as well as remember which branches might already have been followed.

Maps

A common tool for information access that has been taken from geography is the use of the map, of which there have been 4 main kinds — temporal maps, local maps, global maps, and fish-eye maps. Most maps use some sort of graphical system using small icons and lines to connect the icons. The icons often indicate the type of the node — so a text document will have a different icon from a graphic document, for example. The layout of the icons will indicate their relationship to each other in some manner. Spatial layout will give some indication of their relationship — those being closer together have more connection than those farther away, while it might also indicate a temporal relationship — a node close to the current node may have been visited more recently than one farther away. The icons will often be named to more readily identify their contents.

A map allows for direct navigation. Any of the icons on a map can be selected which results in the display of that node. This sometimes enables quicker access and it certainly allows for fast backtracking, which is an essential part of any system.

Temporal Maps

Temporal maps show the user interaction history, similar to the Hypercard Recent function. This is a graphical display containing miniatures of the 42 most recently visited nodes. If a node is visited more than once it is not added to the display, so this is not a true historical trace. Instead, it is relying on the user's visual memory to differentiate the appearance of each card. A better example is the history contained in the Intermedia Web View. This shows the path taken through the system up to the current node, with each node's name and the time that it was visited beside it. Document Examiner provides two types of historical records — a command history in addition to a path history. The command history allows users to redo any command previously used in a session [Walker, 1987].

Global Maps

Global maps attempt to show the whole information landscape. A global map will show all nodes and all links between nodes, so in one sense it shows all

possible paths that a user may follow. A global map quickly becomes too complex as the number of nodes increases, however. In the end it has been deemed unusable [Utting and Yankelovich, 1989].

Local Maps

Local maps provide current context by showing the immediate area: nodes that have been recently visited and nodes that are accessible from the current node. In other words, a local map shows where you have been, where you currently are, and where you may go from here. Of course, local maps are quite dynamic. As different links are followed, the previous map that showed what nodes were accessible must change to reflect the new location. So the previous current node goes into the past, the previous accessible nodes, except for the current one, will disappear. Then the newly accessible nodes will appear. So each time a link is followed, the local map must change a great deal.

Sometimes local maps exist for a specific document and they help the user understand how the document is organised, so that they can have a better understanding of where they go within it. These maps generally are rather static, but they should automatically reflect changes to the document's contents as nodes are added and deleted. That is, the author should not have to make them or update them, they should be supported by the system.

Fisheye Maps

A fisheye map is a combination of global and local maps. It attempts to provide both local and global contexts through altering the map display depending on the Point of Interest (POI) [Furnas, 1986]. The point of interest might be defined as the current node, or in some cases it could be the cursor position. What the fisheye map does is display the immediate area in great detail, similar to the local map, but on the periphery it also displays some major details in order to provide wider context. So on the periphery icons representing multi-node documents might be seen, but in the POI area all the nodes within the current document and how they link up would be shown.

Map display could perhaps learn some lessons from geographical maps in terms of representation. Although different types of nodes have been represented differently on most maps, no indications of the node's size, interest, or other attributes seem to have been represented. This could perhaps be explored further.

For example, the size or amount of data contained in a node might be indicated by its icon size, font size, colour, or some other means. Also, if the map has been created as the result of a query, these characteristics might be part of the relevance feedback. As Frisse [1988] explains, the measure of a node's importance is not solely a function of the data contained within it, but also of the data contained in the nodes connected to it. There is the 'intrinsic importance' (the value of the data within a node) and the 'extrinsic importance' (the value of the data within the nodes connected to a node) of a node, and these might also be indicated through the use of different node attributes on a map.

An interesting idea for reducing the complexity of a map view of a network is the IBIS browser which enables the user to display or suppress the display of sub-networks or nodes and links [Begeman & Conklin, 1988]. Thus a sub-network of nodes is aggregated to form one node on the browser. This greatly simplifies the browser view and uses the dynamic abilities of the computer well. This might also be a way of providing a global map as described previously. A global map might display sites or aggregations of documents that might have been filtered as a result of a query. Then, by selecting a site, the local aggregates for that site might be displayed. Subsequent displays might result in a local display from which documents can be selected.

Intermedia Web View

The main navigational aid in Intermedia is the Web View facility which is a graphical browser that aims to give the user a sense of context or location within the web. Intermedia originally had three types of graphical browsers — a global map, a local map, and a local tracking map. The global map showed every node and the links between them. This became very large and complex as the number of nodes and links increased. The local map seemed more useful. It contained a map containing the current node and all the nodes connected to it. The local tracking map was found to be of most use. It was similar to the local map except that it was dynamic and would change to indicate the current state. Thus a user could leave the web view open and it would change its display as the user moved through the web.

However, it was decided [Utting, 1989] that only a single view of the web would be provided and a variant of the local tracking map was created. This was updated dynamically as the user travelled through the web and showed all the

nodes the user could visit from the current node. However, it also included a path of the nodes already visited, so that the user could see where they had recently been, and a scope line that indicated how big the web was.

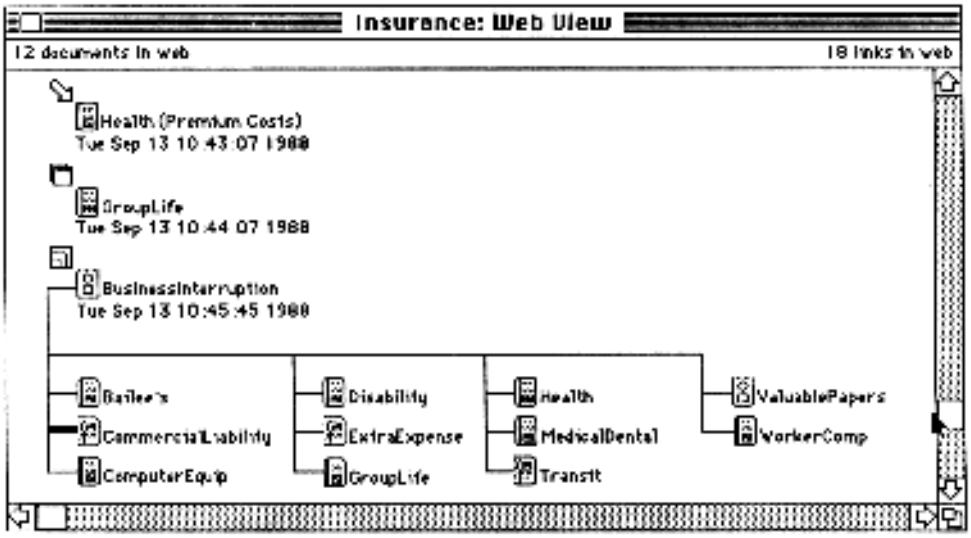

Figure 3.3 *The InterMedia Web View*

The new web view provides a history and rapid backtrack facility through its path of nodes recently visited. All the icons on the web view are directly selectable so the user may select any of the already visited nodes and return to them immediately.

Link previewing is provided by the web view in Intermedia. It is the map of nodes that are connected to the current node. Each node icon displays information about the node itself including its name and type. When the user selects a link marker icon in the original document, the link that is selected is highlighted in the web view with a thick line. This indicates which node the link will lead to without actually having to carry the action out.

The Web View facility provides a scope line that shows the number of nodes and links in the current web. This gives a quick indication as to the global scope of the web which, when used in conjunction with other web facilities, gives a reasonable indication of where the current position is in the web, what path was followed to get there, how a previous node can be returned to, and how many nodes remain in the web.

Some other significant features of the web view are that it is unintrusive, flexible and efficient [Utting, 1989a]. Being unintrusive means that it does not

require the user to help in any way in the creation of the map as some other systems require. The user should not have to spend time and thought manipulating the view of the web, they should be spending their time and thought on the web contents. The web view is there when and if they need it. Being flexible and efficient means that the view makes efficient use of valuable screen real estate. It will adapt itself to the amount of space that a user allots to it, allowing the rest of the screen to be used for the important task of viewing the other documents.

A number of enhancements have been suggested for the web view [Utting, 1989a]. The first is the issue of how long the path or history list should be. Some flexibility would be preferable but at the moment it is limited to the forty most recent nodes. The user should be able to specify how long the path should be. Another enhancement to the path would be to change the criterion for node inclusion, so that the user might include nodes by date or time, or perhaps by node type.

Another improvement would be to ensure that the web view showed the links at the block rather than document level, in order to ensure consistency of the interface. This was initially in the design of the web view. A user could select any document in the view and a series of hierarchical popup menus would display all the document blocks as well as the links associated with each block. This remains unimplemented at present.

NoteCards Browser and Guided Tour

NoteCards browser is an active structural overview diagram of the network of nodes and links. Each notecard is represented by its title in a box on the browser, and these may be selected to navigate the network. Different link types are indicated by different line patterns in the browser. The browser also enables the manipulation of the network so the structure can be modified. The browser is system supported so that as notecards and links are added and deleted, the browser card automatically updates the view of the network to reflect the changes.

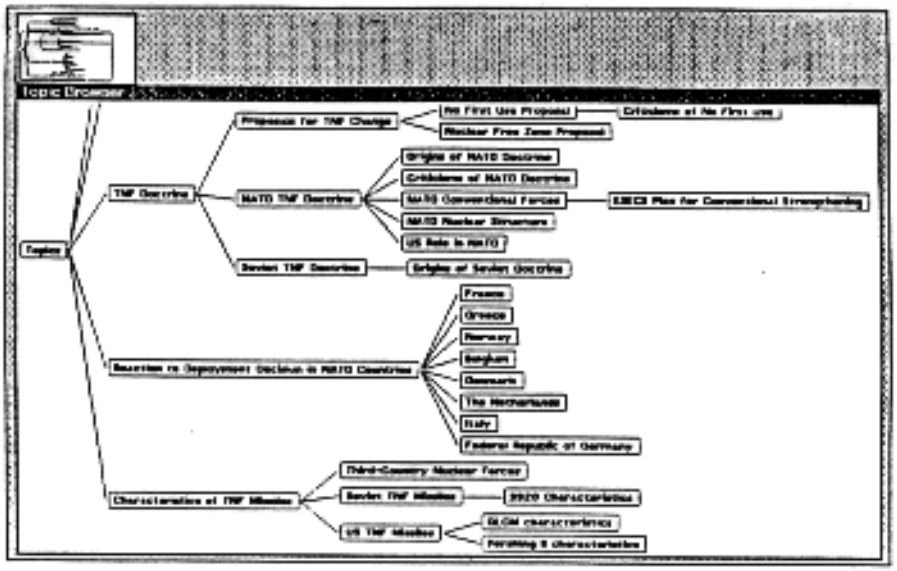

Figure 3.4 *NoteCards' Browser Card*

Note the View rectangle at the top left. This shows which part of the network that is visible on the Browser.

Guides / Agents

Guides and agents have been suggested as entities that can provide:

— narrative, and integration through point of view [Laurel, Oren & Don, 1990] [Oren, Salomon, Kreitman & Don, 1990];

— dynamic personalisation of paths through the information space [Oren, 1990];

— delegation of routine tasks, filtering of information, intercommunication, and execution of complex tasks [Negroponte, 1990];

— entertainment, tutoring, information filtering, scheduling, reminding and advice [Laurel, 1990]; and

— a personal news service (Alan Kay in [Linderholm, 1992]).

There currently seems to be a separation of function between the two concepts of Guide and Agent. A guide is an entity that merely suggests things whereas an agent takes an active part in our interactions. Oren et al. (1990) define an agent as:

> "*an autonomous software entity that makes choices and executes actions on behalf of the user. They embody the expertise to find and present information to the user, responding dynamically to the user's changing goals, preferences, learning style, and knowledge*."
>
> [Oren et al., 1990, p. 381]

This suggests that guides and agents may be more suited to differing user groups. A guide would be more suited to users who have little experience in some area and need assistance from a 'recognised expert'. An agent, on the other hand, might be more suited to expert users who have confidence that they can leave mundane chores to automatic agents. The agents would base their actions on the expert user's past actions which would show their interests and preferences. The agent would then automatically assess where to go in the information space depending on what the user had previously been interested in and what they appeared to be interested in at the current time. A guide is a more

passive version of an agent. It may have some of the underlying intelligence of an agent but will merely suggest actions to be taken, rather than carrying them out autonomously.

One of the main ways a guide has been used is to provide a narrative point of view. A guide is given some characterisation so that the user may expect a certain point of view and so get context on the path that is followed. The guide can assist in a number of ways: providing commentary, suggesting navigational moves, and selecting content related to their point of view.

Assessing point of view is important whenever information is read, because the filtering and arrangement of information that occurs are due to the information provider's ideas of order, relatedness, causality, salience, relevance, and importance [Laurel, Oren & Don, 1990]. Presenting a guide as a character can help the user assess the presenter's point of view and so assess the relevance and context of the selected information.

Guides have been used in a number of projects. Laurel, Oren & Don (1990) describe issues involved in the use of agents and guides in the prototype multimedia database "The Americana Series: A CD-ROM Sampler of United States History" developed by Apple Computer in conjunction with Grolier, Inc. In this project, ten 'generic' characters of the period AD 1800 — 1850 were featured, each with obvious traits of gender, occupation, and costume. Point of view was derived from the degree of interest each guide was assigned for various topics in the database. After selecting a guide, at each node the cognitive overhead of navigation was reduced through the guide suggesting a next choice or favourite article. If this was not wanted then, by clicking on the guide icon, a ranked list of "Next moves" based on their degree of interests would appear, with the top of the list being the default move. If a different guide was chosen then a different set of next moves would be displayed.

Users often wanted to get more perspective on the guide [Oren, Salomon, Kreitman & Don, 1990]. They often wanted to know the guide's 'life story' and how it related to the choices that were made. They also wanted to know if the content of a story was from the guide's point of view or not. This was not the case — guides were only there to assist with navigation. An interesting aspect of their use of guides was the propensity of the users to imbue the simple characters represented with traits, such as emotional qualities, far beyond those actually

represented. This could be a problem with the guide characterisation — human figures used as icons to represent a point of view might be better represented by a non-human symbol that offered similar contextual connotations. For example, the gold trail might be better represented by a pan and pick-axe than a gold-miner figure. Of course, some of the versatility and breadth of representation that a personality can offer might then be lost.

Summary

In this chapter some of the main navigational facilities available in some current hypertext systems were described. The main aids are:

— paths, webs and tours as exemplified by the Intermedia web and NoteCards' Tour;

— maps, as exemplified by the Intermedia Web View and other browser displays;

— guides and agents, as used in the prototype multimedia database 'The Americana Series: A CD-ROM Sampler of United States History' described by Laurel et al. (1990).

These aids attempt to alleviate some of the navigational problems presented by the complex structures present in a hypermedia system. Although they have been partially successful, additional aids, as well as refinements of the existing mechanisms, will be required to enable the multiple levels of hypermedia systems to be negotiated effectively by all levels of users.