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An Exploration of Visualizing Help Sub-Systems for Design Application Software

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Abstract

Information access for the help sub-systems of software applications has traditionally focused on text-based, on-line systems, using a book-type format with its table of contents and indices as the primary means of assisting users in performing the specific tasks required for finding the information they need. Such systems are often inadequate for allowing users, especially those who are graphically oriented, to access the targeted information. Most incomplete tasks are the results of tedious searching or losing context in navigation.

This thesis presents research in the application of information visualization techniques to the problem of navigating and finding information in help sub-systems built within software applications. It provides a methodology for graphically presenting detailed information about a specific topic in an interactive way to accommodate the users who are graphically oriented while also presenting a complete overview of all the information available. A prototype has been developed for visualization of the help sub-system of Adobe Illustrator 10. Limitations of that prototype and future direction of work have also been discussed.

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I Introduction

With the ever-increasing rate of technological innovation, the computer has become an integral part of modern society. The relationship between humans and the computer is so close that people now rely on computers to fulfill numerous tasks, even those they previously did without a computer. Meanwhile, more and more software applications are being developed and increasingly widely used. These new applications provide us with additional capabilities and flexibility in working; they also challenge our ability in learning and using them. We encounter all kinds of problems in using software applications, and the easiest way to get help is to look up information on the help system built into the application. However, finding useful information within current help systems is often difficult and time consuming.

Many of today's software applications provide text-based on-line help, using a book-type format with its table of contents and indices as the primary means of assisting users in performing the specific tasks required for finding the information they need. However, these do not adequately reflect the dynamic nature of modern graphical user interfaces and often make the help system very hard to use. In a 1995 study, Roesler found that, with the computer application he had chosen for the study, only 32% of help requests from users could be answered or found in the current documentation. Could this situation be changed? Substantial research has been conducted upon this subject. Harrison (1995) describes a study in which 176 undergraduates received on-line help instructions while completing seven computer-based tasks. "Instructions were provided with or without still graphic or animated visuals. Results consistently revealed that visuals, either still graphic or animated, in the on-line help instructions enabled the users to significantly perform more tasks in less time and with fewer errors than the users who did not have visuals accompanying the on-line help instructions. The results of this study suggest additional empirically-based guidelines to designers for the development of effective on-line help systems."

As one of the latest streams in a long-established trend in the modern user interface design, information visualization (IV) aims at reducing the complexity of the examination and understanding of information for computer users, by designing proper techniques for the visual display of data. "This relatively new information representation technique uses perception to amplify cognition with high level interactivity to increase the engagement of the user in the observed data and enhance his/her exploration abilities" (Chittaro, 2001). The purpose of this thesis is to design a help information model that explores IV representational techniques in order to improve navigation, comprehension, utilization, user friendliness, visual appeal, engagement, and accessibility for users with different levels of expertise. Adobe Illustrator is used as an example to analyze and simulate the possible solution of applying IV techniques to the help system. Better-designed help systems should be able to accommodate the designers' mental model in addition to engaging other users who are comfortable with graphical user interfaces.

1.1 Background and Significance

1.1.1 Human-Computer Interaction

What Is Human-Computer Interaction?

In a broad sense, human-computer interaction (HCI) is the dialogue that takes place between a user and a computer. Hewett, Baecker, etc. (2003), provide a working definition in detail: Human-computer interaction is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them. Further, they also list some of its special concerns: Human-computer interaction is concerned with the joint performance of tasks by humans and machines; the structure of communication between human and machine; human capabilities to use machines (including the learnability of interfaces); algorithms and programming of the interface itself; engineering concerns that arise in designing and building interfaces; the process of specification, design, and implementation of interfaces; and design trade-offs. Human-computer interaction thus has science, engineering, and design aspects. Because human-computer interaction studies a human and a machine in communication, it draws from supporting knowledge on both the machine and the human side. On the machine side, techniques in computer graphics, operating systems, programming languages, and development environments are relevant. On the human side, communication theory, graphic and industrial design disciplines, linguistics, social sciences, cognitive psychology, and human performance are relevant. And, of course, engineering and design methods are relevant.

Seven Stages of Action Model

Many theories have been developed to explore how people interact with computers, and most of these theories are relatively abstract. While these theories do not provide specific guidelines for interface design, they do help designers develop an overall idea or mental model of the user, including a description of the kinds of cognitive activity taking place during software use (Wickens, Gordon, and Liu, 1998). One model that has been useful in guiding user-oriented interface design is Norman's (1986) seven stages of action model. This model suggests that no matter what the task, users will progress through a series of activities that can be divided roughly into seven steps or stages:

1. Establish the goal.

Carry out an action by:

2. Forming the intention
3. Specifying the action sequence
4. Executing the action

Assess the effects of the action by:

5. Perceiving the system state
6. Interpreting the state
7. Evaluating the system state with respect to the goals and intentions

The discrepancy between psychological variables and system variables and states may be difficult to bridge. Even if the user successfully identifies needed input actions, the input device may make them difficult to carry out physically. Norman notes that the entire sequence must move the user over the "gulf of execution." (See figure 1.) A well-designed interface makes that translation easy or apparent to the user, allowing him or her to bridge the gulf. A poorly designed interface will result in the user not having adequate knowledge and/or the physical ability to make the translation and therefore be unsuccessful in performing his or her task.

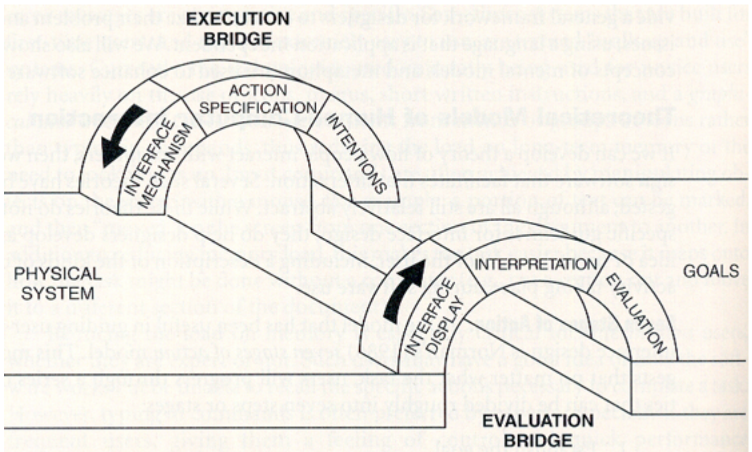

Figure.1

1.1.2 Information Design

What Is Information Design?

In his book *Information Design* (1999), Jacobson defines the concept of information design as the art and science of preparing information so it can be used by human beings with efficiency and effectiveness. Further, he discusses the primary objectives of information design as:

1. To develop documents that are comprehensible, rapidly and accurately retrievable, and easy to translate into effective action.
2. To design interactions with equipment that is easy, natural, and as pleasant as possible. This involves solving many problems in the design of the human-computer interface.
3. To enable people to find their way in three-dimensional space with comfort and ease—especially urban space, but also, given recent developments, virtual space.

The Understanding Process of Information

We are living in a world full of information. Wurman (1989) points out that when information doesn't tell us what we want to know, it creates information anxiety. It is the ever-widening gap between what we understand and what we think we should understand. It is the black hole between data and knowledge. To have informational value, data must be organized, transformed, and presented in a way that gives it meaning (Wurman, 1989). Still, the meanings or patterns of the information should be able to be learned or understood by others.

How do we gain some knowledge from the new information? Wurman (1989) tells us that to comprehend new information of any kind—be it financial reports, appliance manuals, or a new recipe—you must go through certain processes and meet certain conditions before understanding can take place. You must have some interest in receiving the information; you must uncover the structure or framework by which it is or should be organized; you must relate the information to ideas that you already understand; and you must test the information against those ideas and examine it from different vantage points in order to possess or know it.

Shedroff has a chart describing the overview procedure of understanding. (See figure 2.) He thinks that just as data can be transformed into meaningful information, so too can information be transformed into knowledge and, further, into wisdom. Knowledge is a phenomenon that we can build for others just as we can build information for others from data. This is done through interaction design and the creation of experiences. We must understand and properly structure the information and data which we use to build experiences (Shedroff, 1999).

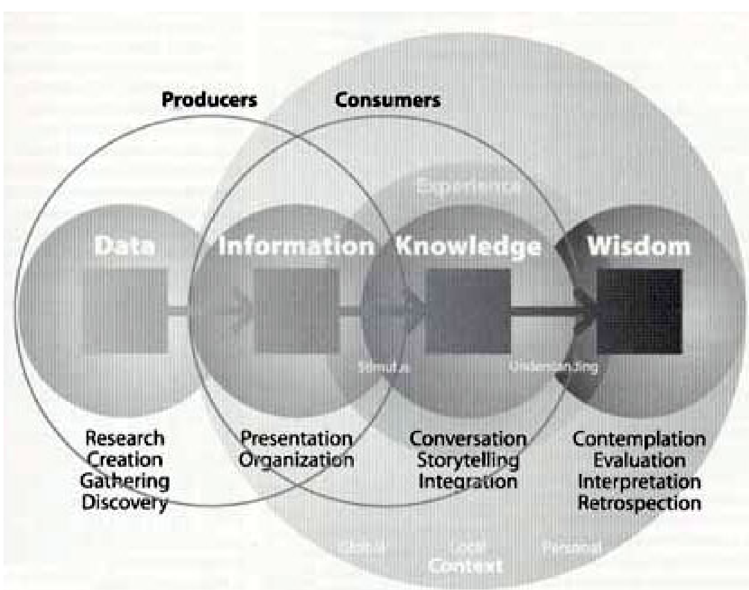

Figure 2.

Information Design in the Digital Age

In the digital age, you need to focus on the connections among all of your design elements: medium, words, pictures, and sound. You'll have to look at each message and explore all the ways to communicate it. Then, in your quest to stay connected, don't forget to be clear, too. Where words meet pictures meet sound creates understanding. We test communication by conveying a message and having the recipient understand it, be interested in it, and remember it. Any other measure is unimportant and invalid (Wurman, 2001). Wurman further argues that the medium has to influence the design. He thinks that the relationship between the Web and a book is very similar. Both are one-to-one conversations through words. These words make a connection, allowing the transfer of ideas.

1.1.3 Information Visualization

What Is Information Visualization?

Defined by Gershon (1998), information visualization (IV) is “the process of transforming data, information, and knowledge into visual form making use of humans’ natural capabilities” or, more concisely, as “the computer-assisted use of visual processing to gain understanding” (Card, 1997). “It has two fundamentally related aspects: (1) structural modeling and (2) graphical representation. The purpose of structural modeling is to detect, extract, and simplify underlying relationships. These relationships form a structure that characterizes a collection of documents or other data sets. The aim of the graphical representation is to transform an initial representation of a structure into a graphic one, so that the structure can be visually examined and interacted with” (Chen, 1999).

The Purpose of IV

“IV aims at reducing the complexity of the examination and understanding of information for humans, by designing proper techniques for the visual display of data” (Chittaro, 2001). In other words: “The purpose of IV is to use perception to amplify cognition” (Card, 1999). “These techniques are aimed at achieving a number of goals, such as: (i) allowing users to explore available data at various levels of abstraction, (ii) giving users a greater sense of engagement with data, (iii) giving users a deeper understanding of data, (iv) encouraging the discovery of details and relations which would be difficult to notice otherwise, and (v) supporting the recognition of relevant patterns by exploiting the visual recognition capabilities of users” (Chittaro, 2001). Interactivity is a typical feature of IV systems: “A high level of interactivity is indeed important to increase the engagement of the user in the observed data and enhance his/her exploration abilities" (Chittaro, 2001). Figure 3 shows that graphical performance has increased by about a factor of 10 every four years, making possible the computation of visual images at interactive time rates (DeFanti, Brown, and McCormick, 1999).

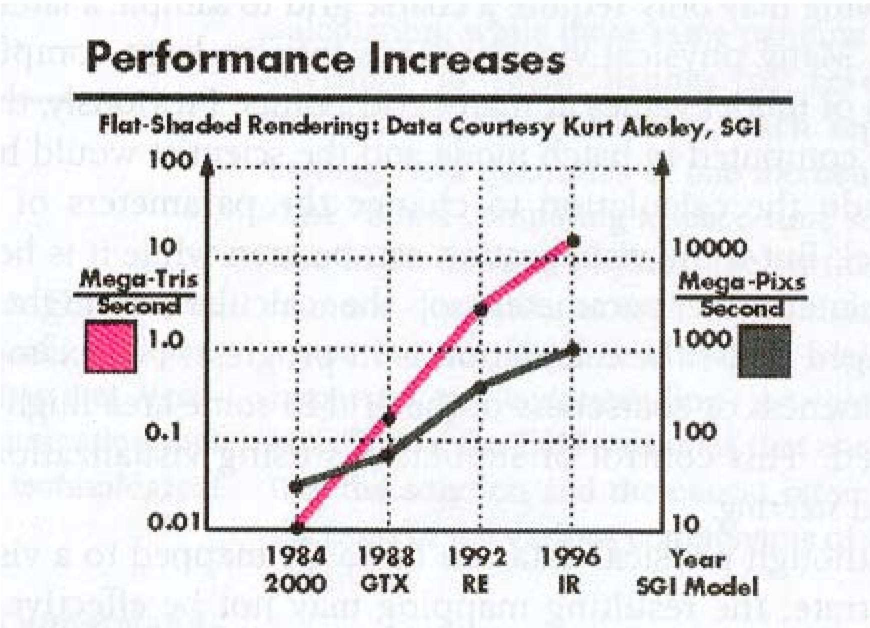

Figure 3.

This interweaving of interior mental action and external perception (and manipulation) is no accident. It is the essence of how we achieve expanded intelligence. As Norman (1993) says, "The power of the unaided mind is highly overrated. Without external aids, memory, thought, and reasoning are all constrained. But human intelligence is highly flexible and adaptive, superb at inventing procedures and objects that overcome its own limits. The real powers come from devising external aids that enhance cognitive abilities. How have we increased memory, thought, and reasoning? By the invention of external aids: it is things that make us smart."

The History of IV

As a distinctive field of research, IV has less than ten years of history but has rapidly become a far-reaching, interdisciplinary research field. (See figure 4.) "It involves a large number of representational structures, some of them well understood, and many new. Furthermore, new ways of representing information are being invented all the time" (Chen, 1999).

Information visualisation	Year	Publication
SemNet	1988	(Fairchild, Poltrock, and Furnas, 1988)
Cone Trees	1991	(Robertson, Mackinlay, and Card, 1991)
Self-Organised Maps	1991	(Lin, Soergel, and Marchionini, 1991)
Tree-maps	1991	(Johnson and Shneiderman, 1991)
BEAD	1992	(Chalmers, 1992)
Envision	1993	(Fox *et al.*, 1993)
VIBE	1993	(Olsen, Korfhage, and Sochats, 1993)
LyberWorld	1994	(Hemmje *et al.*, 1994)
SCI-MAP	1994	(Small, 1994)
Starfield/FilmFinder	1994	(Ahlberg and Shneiderman, 1994)
Butterfly	1995	(Mackinlay, Rao, and Card, 1995)
Narcissus	1995	(Hendley, Drew, Wood, and Beale, 1995)
SageBook	1995	(Chuah, Roth, Kolojejchick, Mattis, and Juarez, 1995)
SPIRE	1995	(Thomas, 1995)
TileBars	1995	(Hearst, 1995)
VR-VIBE	1995	(Benford *et al.*, 1995)
Elastic windows	1996	(Kandogan and Shneiderman, 1996)
WebBook	1996	(Card, Robertson, and York, 1996)
Cat-a-Cone	1997	(Hearst and Karadi, 1997)
GSA/StarWalker	1997	(Chen, 1997)
H3 (Hyperbolic 3D)	1997	(Munzner, 1997)
NicheWorks	1998	(Wills, 1998)

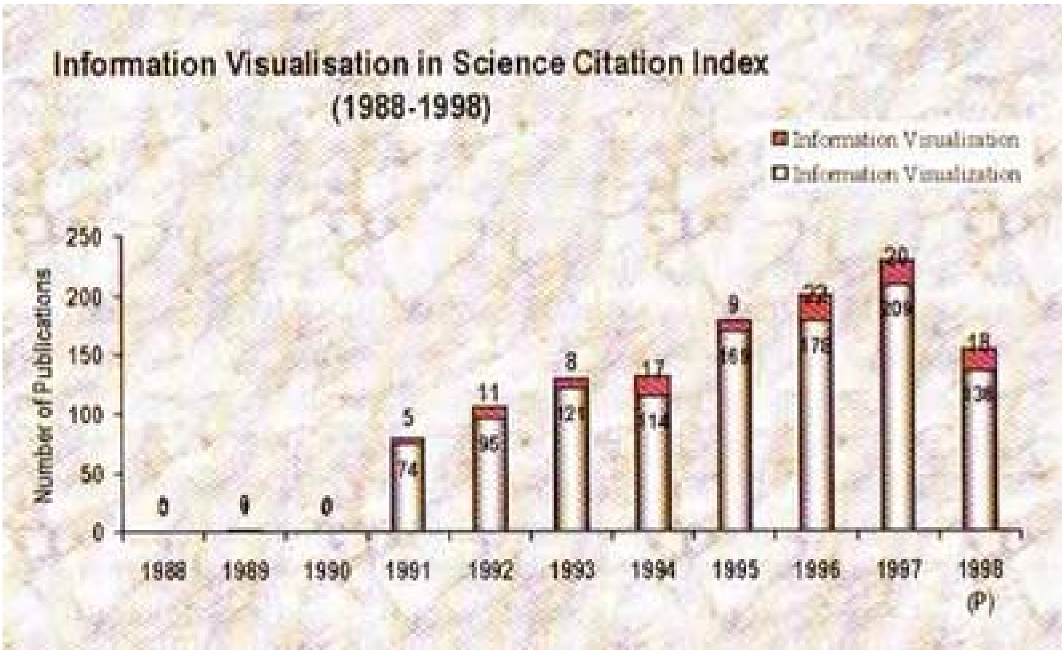

Figure 4.

Graphic aids for thinking have an ancient and venerable history. What is new is that the evolution of computers is making possible a medium for graphics with dramatically improved rendering, real-time interactivity, and dramatically lower cost. This medium allows graphic depictions that automatically assemble thousands of data objects into pictures, revealing hidden patterns. It allows diagrams that move, react, or even initiate. These, in turn, create new methods for amplifying cognition, new means for coming to knowledge and insight about the world.

Seven Data Types

“Seven data types for the items to be displayed are identified: 1D (linear data organized in a sequential manner, such as alphabetical list of names, program source code, or textual documents), 2D (planar or map data covering some part of an area, such as maps, newspaper layouts, or photographs), 3D (data with volume and potentially complex relations with each other, such as molecules, the human body, or buildings), temporal (data with a start time, finish time, and possible overlaps on a timescale, such as that found in medical records, project management, or video editing), multi-dimensional (data with *n* attributes which becomes points in a n-dimensional space, such as records in relational and statistical databases), tree (collections of items linked hierarchically by a tree structure, such as computer directories, business organizations, genealogy trees), network (collections of items linked by a graph structure, such as telecommunication networks, World Wide Web or hypermedia structures)" (Shneiderman, 1996).

"The data items in each above mentioned category can have multiple attributes (e.g. a 3D object could have additional attributes such as color, level of transparency, and brightness; a node item in a tree could have additional attributes such as a name, a creation date, and modification date; and so on). Therefore, the separation among the different categories is not always strict, e.g. temporal data can be also seen as an instance of multi-dimensional data. However, this separation is useful for considered data, display techniques that give a central role to time (such as a timelines to visualize personal histories, temporal animations to show the evolution of physical phenomena using a familiar VCR metaphor, and so on) can give better results than more general techniques which do not assume specific relations among the multiple attributes. Similar considerations hold between pairs of other data types where one data type can be seen as a specialization of the other (e.g. tree and network, 3D and multi-dimensional)" (Chittaro, 2001). Some examples in color are listed in the back of this thesis to demonstrate the variety types of IV exploration.

How IV Amplifies Cognition

A classic study by Larkin and Simon (1987) illustrates some reasons why visualizations can be effective. Larkin and Simon compared solving physics problems using diagrams versus using non-diagrammatic representation. Specifically, they compared the effort that had to be expended to do search, recognition, and inference with or without the diagram. Their conclusion was that diagrams helped in three basic ways: (1) By grouping together information that is used together, large amounts of search were avoided. (2) By using location to group information about a single element, the need to match symbolic labels was avoided, leading to reductions in search and working memory. (3) In addition, the visual representation automatically supported a large number of perceptual inferences that were extremely easy for humans.

We propose six major ways in which visualizations can amplify cognition:

1. Increased Resources

   - High-bandwidth hierarchal interaction—the human moving gaze system partitions limited channel capacity so that it combines high spatial resolution and wide aperture in sensing visual environments (Resnikoff, 1987).
   - Parallel perceptual processing—some attributes of visualizations can be processed in parallel compared to text, which is serial.
   - Offload work from cognitive to perceptual system—some cognitive inferences done symbolically can be recoded into inferences done with simple perceptual operations (Larkin and Simon, 1987).
   - Expanded working memory—visualization can expand the working memory available for solving a problem (Norman, 1993).

- Expanded storage of information—visualization can be used to store massive amounts of information in a quickly accessible form (e.g., maps).

2. Reduced Search

- Locality of processing—visualization groups information used together, reducing search (Larkin and Simon, 1987).
- High data density—visualization can often represent a large amount of data in a small space (Tufte, 1983).
- Spatially indexed addressing—by grouping data about an object, visualization can avoid symbolic labels (Larkin and Simon, 1987).

3. Enhanced Recognition of Patterns

- Recognition instead of recall—recognizing information generated by visualization is easier for the user than recalling that information.
- Abstraction and aggregation—visualizations simplify and organize information, supplying higher centers with aggregated forms of information through abstraction and selective omission (Card, Robertson, and Mackinlay, 1991)
- Visual schemata for organization—visually organizing data by structural relationships (e.g., by time) enhances patterns.
- Value, relationship, trend—visualizations can be constructed to enhance patterns at all three levels (Bertin, 1977/1981)

4. Perceptual Inference

- Visual representations make some problems obvious—visualizations can support a large number of perceptual inferences that are extremely easy for humans (Larkin and Simon, 1987).

- Graphical computations—visualizations can enable complex specialized graphical computations (Hutchins, 1996).

5. Perceptual Monitoring

- Visualization can allow for the monitoring of a large number of potential events if the display is organized so that these stand out by appearance or motion.

6. Manipulable Medium

- Unlike static diagrams, visualizations can allow exploration of a space of parameter values and can amplify user operations.

1.1.4 On-Line Help System

There are a variety of sub-specialties under human-computer interaction. On-line help is included in user support, which refers to a variety of assistance mechanisms such as: software manuals, on-line help, stand-alone tutorials, on-line or context-sensitive tutorials, and human help (help desk or help line, etc.) (Wickens, Gordon, and Liu, 1998). Defined by Kearsley (1988), an on-line help system is “one or more programs designed to provide user assistance embedded in a larger program or computer system.” It is a vital part of nearly every computer system of any significant size. Designers frequently integrate help programs into the application for the purpose of answering immediate questions about the application, providing the user with the necessary information to use the application to complete some given task. Notenboom and Vose (1990), however, define the help system is nothing more than a data retrieval tool. It takes a string and maps it to the appropriate topic text. It simply searches the data structure that is a help file and makes the desired information available to an application (Notenboom and Vose, 1990).

1.1.5 Individual Differences

Individual differences have been a unique area of study in related disciplines, such as psychology and human-computer interaction. According to Gregor (2000), “two user characteristics considered important are the user’s level-of-expertise and need for cognition.”

Three levels of user expertise have been identified by Mayhew (1992): “**True novices** are users who have little or no experience with computers in general and little or no training on the system at hand. **Experts** are users who are very experienced with a particular computer system. They may or may not have wide experience with computers in general. **Intermediate users** fall somewhere in between. They might have considerable computer experience and may even have used other systems like the one they are about to learn. However, they are using the new system for the first time. They bring considerably more knowledge to the learning task than do true novices, but they are far from being experts on the new system.”

The individual differences in cognition are various and comprehensive. The most influential and updated work on the study of individual differences in psychology is presented by Carroll (1993). Cognitive factors are grouped into a three-level hierarchy: the top level is general intelligence, the second level consists of eight ability categories, and the third level includes first order factors derived from these general ability types.

At the second level, the eight general ability categories are: crystallized intelligence, fluid intelligence, general memory and learning, broad visual perception, broad auditory perception, broad retrieval ability, broad cognitive speed, and processing speed.

The third level further divides each of these general ability types into first order factors (for example, memory is divided into associative memory, visual memory, episodic memory, and memory span); this hierarchical organization has been highly praised as the likely standard conceptualization for the foreseeable future (Dillon and Watson, 1996).

According to Egan (1988), “differences between users can be in the order of 20:1 for common computing tasks, such as programming and text editing. Such differences can be understood and predicted, as well as modified through design.” In fact, there are two general views on individual differences. One believes that the differences can be reduced though education and training, while the other believes that these differences are difficult to change but may be accommodated through the use of specially designed tools. Benyon and Murray (1993) found a clear influence of spatial ability on navigation in a database with a command interface. They showed that many limitations on subjects’ performance on the command interface, which related to their spatial ability, could be overcome with experience. The experimental studies by Chen and Rada (1996) show that not all the limitations of low spatial ability were compensated for by high experience. Chen suggests that normally individuals with good associative memory are more likely to prefer the spatial user interface to the textual one. She also expects that enhancing visual cues in the virtual environment may compensate for differences in associative memory, making it easier for users to identify and locate local structures in the global semantic space (Chen, 1999).

1.2 Nature and Scope of the Research

The field of information visualization is relatively new, and the help systems of software applications are rather complex, so the nature of this research is somewhat explorative. The scope of the research has been specified to the help information built within Adobe Illustrator. Illustrator is an industry-standard software application for the creation of vector graphics for print and the Web; it has been widely used by designers and by people in other fields as well. And compared with other design applications (i.e. Flash), it makes less sophisticated use of graphics and interactivity and does not require complicated script writing. Its user group is also less varied in levels.

II. Problem

2.1 Problem Statement

As an industry-standard software application for the creation of vector graphics for print and the Web, Adobe Illustrator has been widely used by designers and by people in other fields. It is powerful, fast, and flexible in transforming creative ideas into sophisticated graphics. For designers, learning and using it is not always a pleasure. Most obstacles could be overcome by accessing the help information built within the software application, but finding the needed information is not always fast and easy. After analyzing existing help information within Illustrator, one could characterize the problems as follows:

1. Help information is difficult to use and read.

   What Adobe Illustrator has adopted is the typical text-based, on-line help system, using a book-type format with its related table of contents and indices as the primary navigational aids to assist users in performing specific tasks. As we discussed in the introduction, research done by Roesler (1995) shows that only 32% of help requests from users could be answered or found in the current documentation.

2. Abstract information is hard to process.

   Merely abstract text or data is much less powerful than human visual processing in combination with complex graphics. This is determined by human nature, which shows the ability to more rapidly perceive visual information as opposed to narrative descriptions.

3. The table of contents doesn’t present a high-level overview but an exhaustive list, which makes the search tedious and difficult.

   The structure of help information is vital for target searching. Lazar, Bessiere, etc., (2003), in a study on user frustration in web navigation, showed that much of the frustration experienced was due to either poor design or unpredictable interfaces. The major problem of the table of contents is that it doesn’t provide enough context information. Context information is defined as the explanation of the user’s current situation in the Web environment. It is important for effective navigation because each navigation process takes place in a particular information environment and is inextricably tied to the specificity of the environment (Jul & Furnas, 1997). If users do not have appropriate context information, they may become disoriented, because context information provides the temporal and structural cues of locations. At the same time, users without context information tend to experience cognitive overload induced by cognitive overhead, because context information also provides valuable cues for users’ actions and take flows (Park and Kim, 2000).

4. Finding information is sometimes difficult.

   Illustrator provides three methods to get to the targeted information: contents, index, and search. Under contents, there are different categories, subtopics, sub-subtopics, and related topics. Many people found it very easy to get lost at the bottom level or in some related-topic links. The index gives you a large number of topics alphabetically; it will not provide very much help unless you know exactly what you are looking for. The same is true for the search engine; it can be confusing for users who are not familiar with how to form appropriate queries—a common problem for novice users (Marchionini, 1995). The newer version of Illustrator (10.0) also puts all the topics together as a sitemap, which includes a wealth of detail but is extremely overwhelming.

5. Too much jumping is required between sections.

   Many help information topics are related to each other and yet do not belong to the same category. The current structure of help information is not very effective in accommodating a nonlinear document. It creates a lot of jumping but does not provide enough context information, users often experience disorientation and cognitive overhead—cannot identify where they are, cannot return to previously visited locations, and cannot remember the key points they have learned during their navigation.

6. More examples are needed.

   Examples or demonstrations make procedural information more concrete and explain actual steps of performance more clearly and effectively. They are very important for novice and even intermediate users, although they require more storage space.

7. Content is sometimes redundant, outdated, or missing.

   More or less, every help information system has problems with redundant, outdated, or missing information. Therefore, ideal help information should have space for periodic updates. If the information has grown piecemeal without a solid architecture as a foundation, new content may end up in the wrong category or with the wrong label, or out-of-date content may inadvertently remain on-line. Some content may unintentionally be placed in several areas in the system, while dead links or content gaps may result from misplaced or haphazardly removed content.

2.2 Goals and Objective

With the help information of Adobe Illustrator as an example, the goals and objective of this thesis is to design a help information model that utilizes 2D representational techniques of information visualization to transfer information into a visual form and therefore to improve the navigation, comprehension, utilization, user friendliness, visual appeal, engagement, and accessibility for users at different levels of expertise.

2.3 Parameters and Limiting Factors

The intention of this research is not to provide comprehensive help system that can accommodate all users, whatever their experience, and allow them to immediately understand and use the system. Rather, it is intended to support those intermediate users who have at least a limited ability in application use and to enable them to employ its functionality more fully and effectively. Note that many other software applications have help systems that are more complicated than that of Adobe Illustrator, and there are numerous possible approaches for applying information visualization to the help information, so the prototype proposed by this thesis is explorative in nature and is meant only as a reference for future studies.

III. Thesis Research

3.1 Hypothesis/Proposals

According to the discussion in the first chapter, information visualization has two fundamentally related aspects: (1) structural modeling and (2) graphical representation. The aim of the graphical representation is to transform an initial representation of a structure into a graphic one, so that the structure can be visually examined and interacted with (Chen, 1999). It is a process that involves both human and computer. Successful visualizations can reduce the time it takes to get the information, make sense out of it, and enhance creative thinking. But finding a good spatial representation of the information at hand is one of the most difficult tasks in the visualization of abstract information. To create a visualization, we need to map the information into a physical space that will represent relationships contained in the information faithfully and efficiently. This can enable the observer to use his/her innate abilities to understand spatial relationships (Chen, 1999). This thesis proposes the following hypothesis to reach the visualization and problem-solving purpose.

1. Visualize the structure of the help information.

Help information is different from pure quantitative data. The key issue of visualizing the structure is to show the overview of the whole system's construction as well as the context between each section and topic. This will enable users to form a general idea of the whole structure, as well as context information they can relate to. It is very similar to navigation in a big city. The whole image of the city structure can help people get a sense of the general direction and the relationship between highways and streets, and can help people decide whether they are on the right track to the destination. Among the existing successful methods, Sitebrain provides an innovative, easy-to-use system for organizing and sharing information especially in showing the context relationship within an intricate information system. (See figure 3.1-1.)

Figure 3.1-1

Astra SiteManager (figure 3.1-2) gives a good overview of the system structure, and the viewing pan is flexible in the screen display. Both systems relate to Nicheworks, which is a system for investigating and exploring large, complex datasets by displaying both graph structure and node and edge attributes so that patterns and information hidden in the data can be seen. (Wills, 1999)

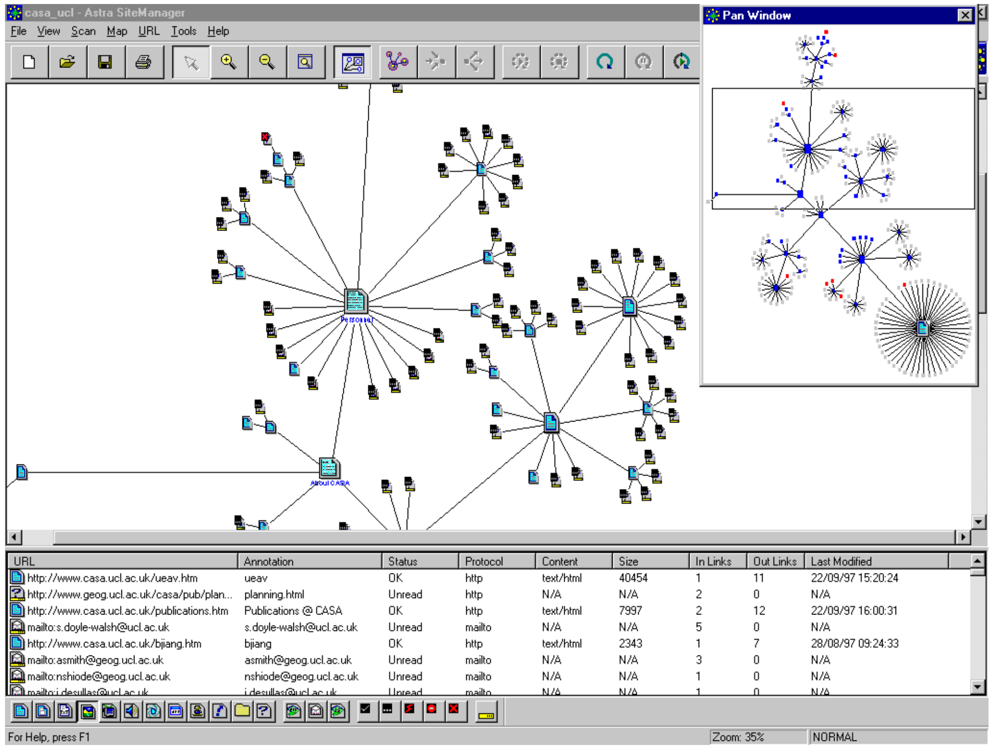

Figure 3.1-2

So this thesis proposes a new visual structure for help information by combining the methods of SiteBrain and Astra SiteManager to maximize effective use of available screen space and enable visualization of the whole structure. Interactive animation is used to shift some of the user's cognitive load to the human perceptual system.

2. Provide illustration and demonstration; instructions are always easier to follow when there is a picture or an example to refer to.

As we discussed in the first chapter, "a high level of interactivity is indeed important to increase the engagement of the user in the observed data and enhance his/her exploration abilities" (Chittaro, 2001). There is also information that shows graphical performance as increasing by about a factor of 10 every four years. Providing more illustrations and visual demonstrations can amplify human cognitive abilities and help to reduce the workload, which makes it an effective way to increase interactivity and productivity. It is like teachers giving their students demonstrations during their lectures; it helps the students understand and absorb the teaching materials in a much more efficient way.

3. Make consistent use of spatial, visual, and locational cues.

Use space, location, and other visual cues, such as highlighting, color, font, borders, symbols, and underlining, to tag different kinds of information, such as examples, syntactic rules, warnings, and special notes.

4. Separate different types of information, and use a consistent visual cue for each type.

The amount of information in the help sub-system is overwhelming. Under each topic, according to Mayhew (1992), we can separate and identify the information into at least four different types: motivational—information explains why a feature is useful and in what situations it might be useful; conceptual—information explains what the feature actually does, what the end result of using it will be; procedural—information tells what actual steps are necessary on the system to use the feature; and examples—make procedural information more concrete. Providing consistent visual cues to identify and separate different types of information would help the users to get a better understanding of the structure of the help sub-system, reduce their cognition workload in searching, and therefore save them time in finding the targeted information. For instance, examples are normally very helpful for true novices but not necessary for intermediate users or experts, so when an expert searches for certain information, he or she can easily skip the examples by recognizing their visual labels. And when novices search for demonstrations of procedural information, they can focus on the visual cue for that specific information.

3.2 Methodology

Based on the hypothesis, a prototype of the Adobe Illustrator 10 help sub-system is proposed in this thesis. The simulation of the prototype is demonstrated with Multimedia Flash.

The top portion of the prototype utilizes Sitebrain technology to organize and demonstrate context relationships in this information system.

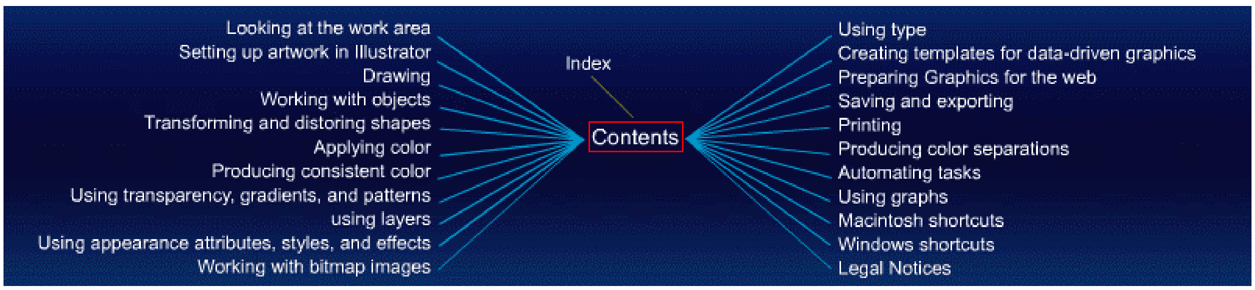

Figure 3.2-1

The topic in the middle, with the red frame, labels the content of the current page. The related topics are listed on the side with lines in different colors linking them to the current topic. Topics linked with lines in the same color are in the same level. Therefore, in figure 3.2-1, “Contents” is the topic for current page; “Index,” with the yellow line linking it to the current topic, is at the same level with current topic; and the rest of the topics, with blue lines linking them to the current topic, are the sub-links. Clicking on one of these topics listed on the page takes the user to the page related to this topic. For example, clicking on “Looking at the work area” makes this topic move to the middle of the space, and the related links change accordingly. (See figure 3.2-2 and simulation 1.)

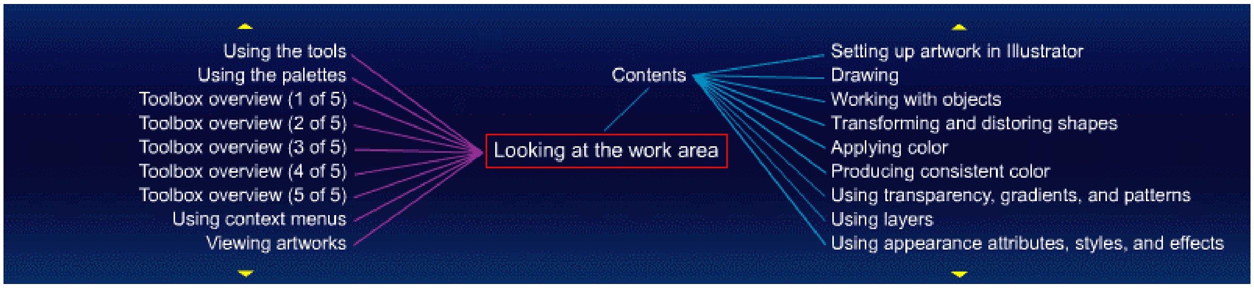

Figure 3.2-2

Figure 3.2-2 shows that the current topic is "Looking at the work area." It links to "Contents" with a blue line and, in the same way, to the topics "Setting up artwork in Illustrator," "Drawing," "Working with objects," etc. So "Looking at the work area" is at the same level with "Setting up artwork in Illustrator," "Drawing," "Working with objects," etc., and they are all sub-links of "Contents." On the left side, "Using the tools," "Using the palettes," "Toolbox overview (1 of 5)," etc., are sub-links of "Looking at the work area" because they all link to it with lines in the same color. Because the space is limited, the yellow arrow buttons here are used to scroll up and down to show the entire list of topics. Clicking on one of the sub-link topics takes the user to the next level. (See figure 3.2-3 and simulation 1.)

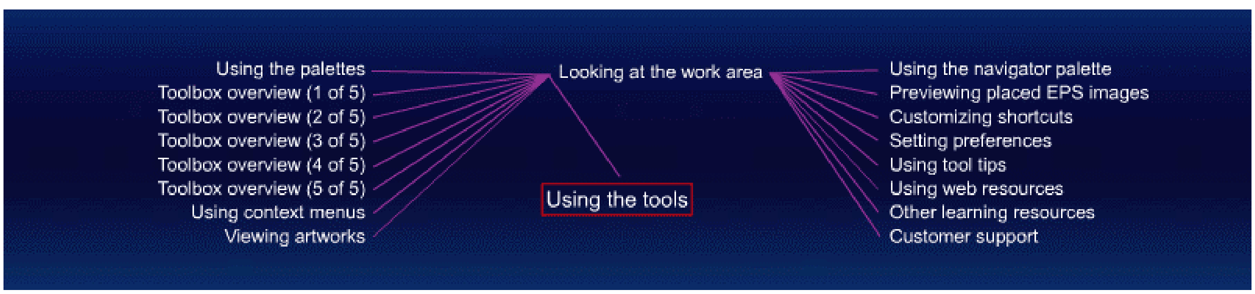

Figure 3.2-3

In figure 3.2-3, the current topic is "Using the tools." It is one of the sub-links of "Looking at the work area" and is on the same level with all the rest of the links, such as "Using the navigator palette," "Previewing placed EPS images," "Customizing shortcuts," etc.

The top portion of the prototype always shows at least two different levels of related links along with the current topic, so the context information is very obvious and easy to navigate through.

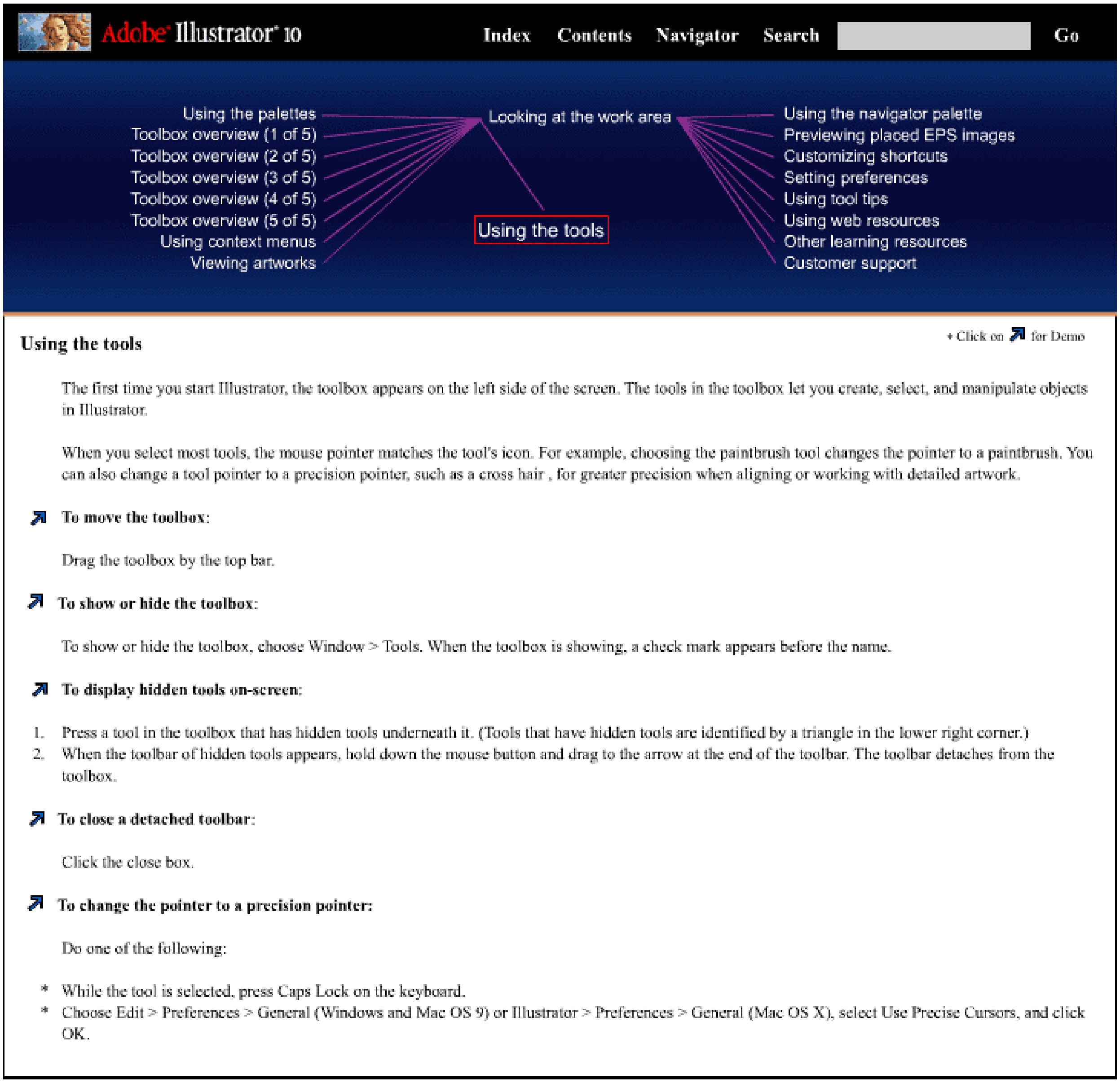

Figure 3.2-4

Figure 3.2-4 shows a single page of the prototype. The top bar, index, contents, and search buttons give different options for information search, while the navigator button utilizes Astra SiteManager technology to show the overview of the help sub-system's structure. Clicking on the navigator button brings up a viewing pan, which is shown in figure 3.2-5.

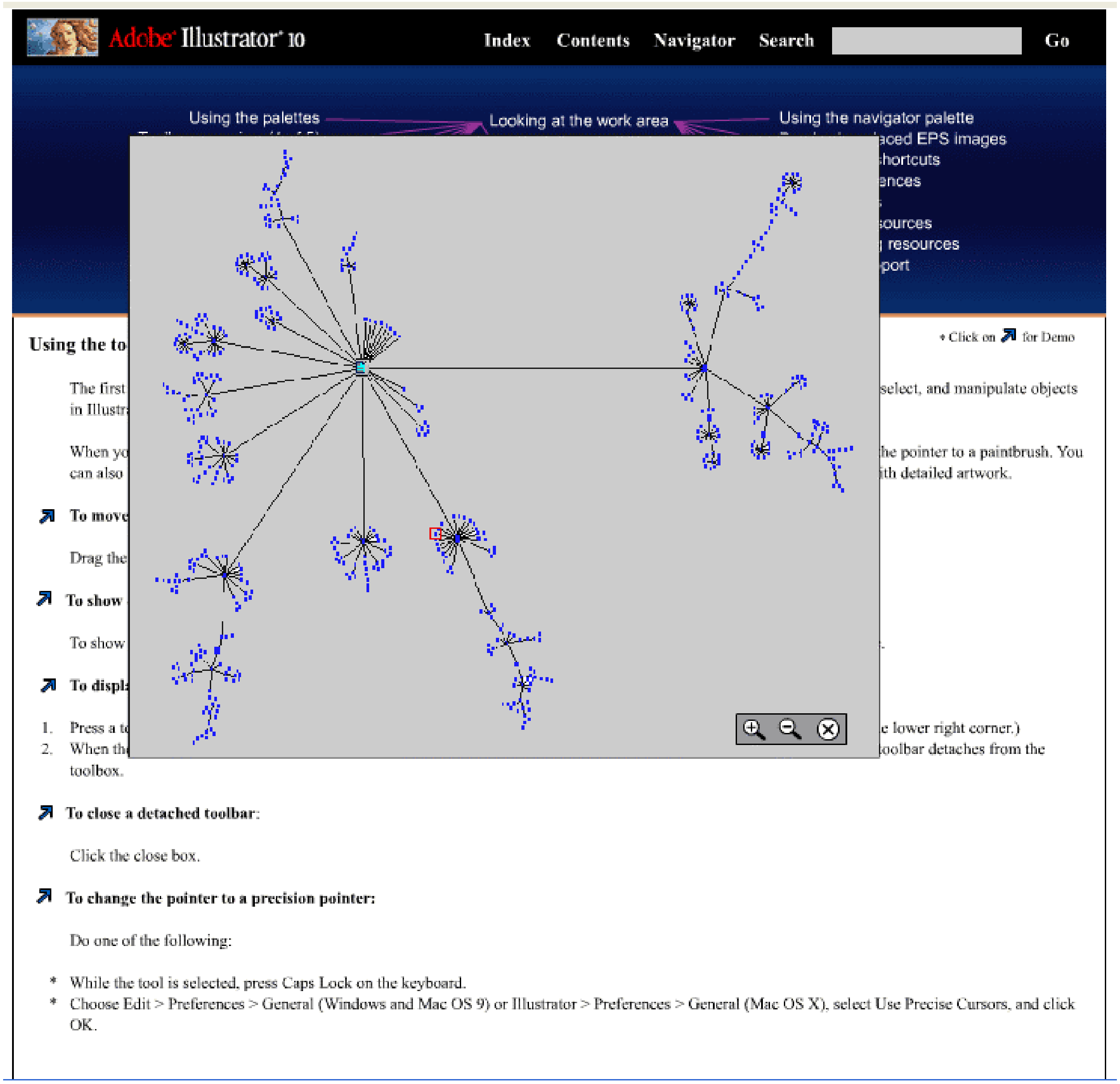

Figure 3.2-5

The viewing pan contains the whole structure of the help sub-system, and the current position is framed with the red square. With the help of Zoom-Out and Zoom-In buttons, users can navigate to the details of the structure map, and when they finish, they can click on the Close button to close the viewing pan. Figure 3.2-6 shows the detail of the zoom in the viewing pan.

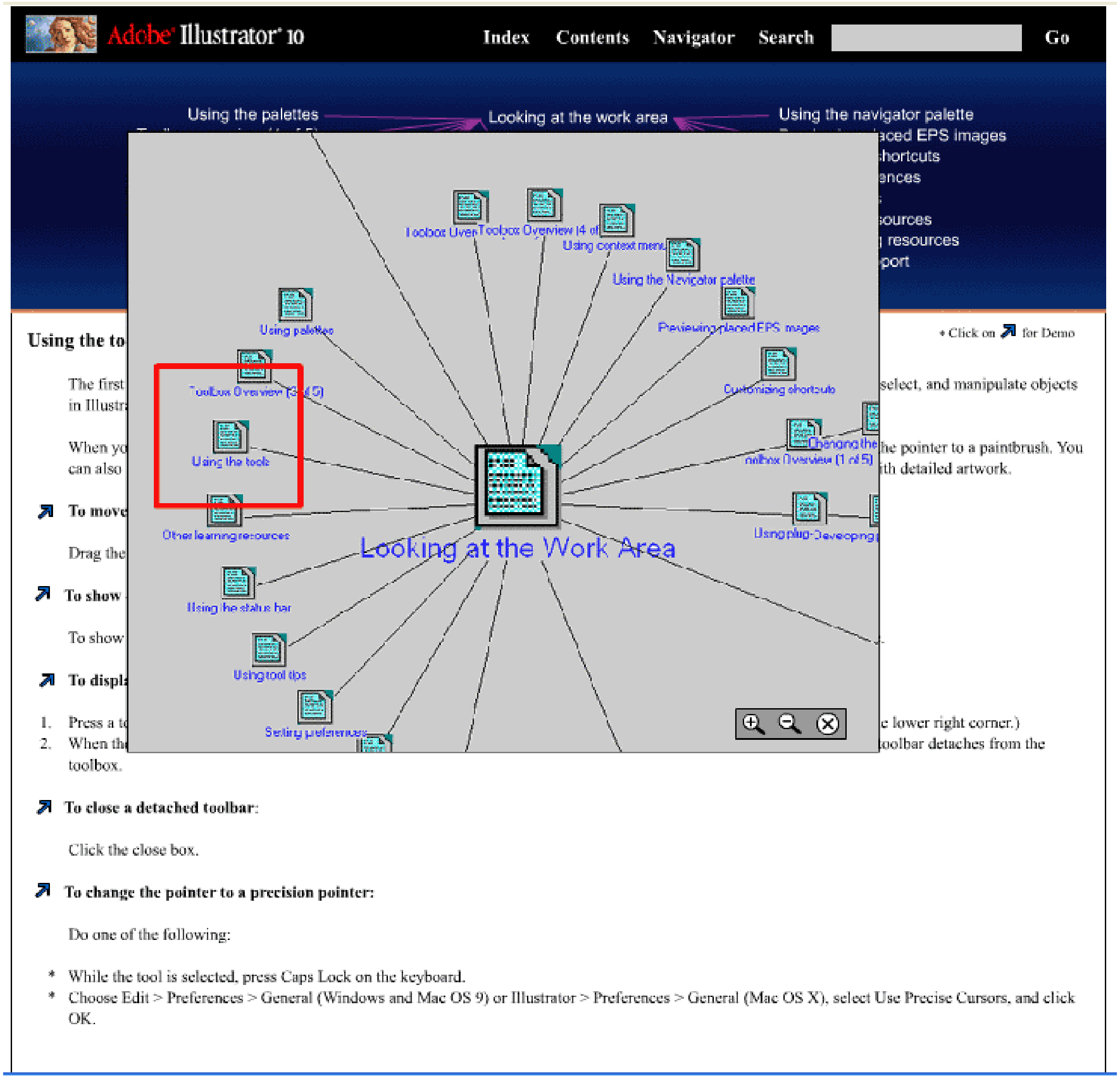

Figure 3.2-6

Dragging the red frame to a different topic will change the content of the current page, but this function is not shown in the Flash simulation.

Different symbols are used in front of different types of help information to serve as locational cues. Respectively, symbols of arrow, book, question mark, and hand are used in this thesis to indicate procedural, conceptual, motivational information, and example. Most of the symbols for procedural and example information are also used as buttons for demonstrations. Clicking and holding the symbol button invokes a small Flash movie that shows the demonstration. The demonstration disappears when the button is released. (See figure 3.2-7, figure 3.2-8, and simulation 2.)

Figure 3.2-7

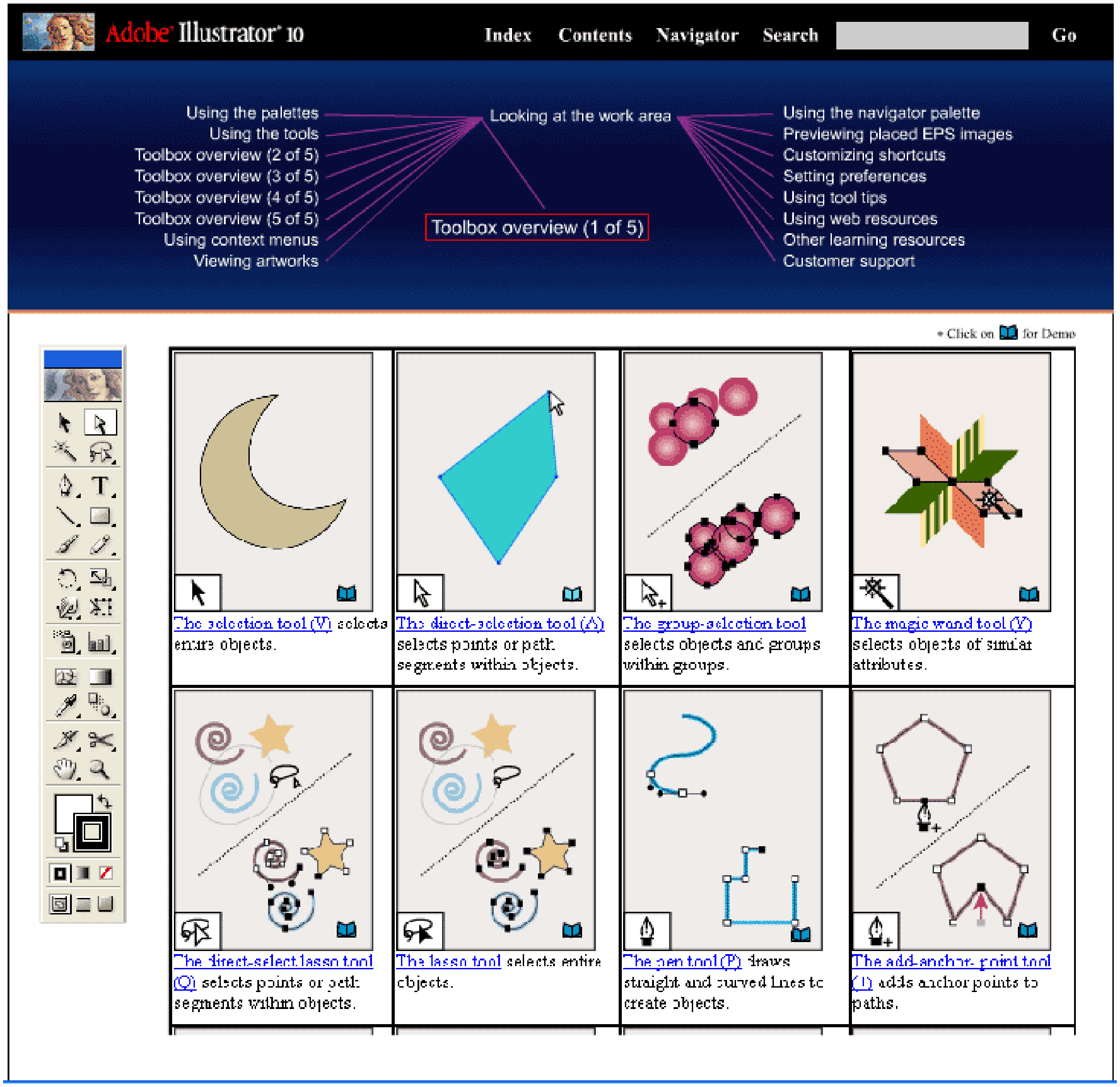
Adobe Illustrator 10
Index
Contents
Navigator
Search
Go
Using the palettes
Using the tools
Toolbox overview (2 of 5)
Toolbox overview (3 of 5)
Toolbox overview (4 of 5)
Toolbox overview (5 of 5)
Using context menus
Viewing artworks
Looking at the work area
Toolbox overview (1 of 5)
Using the navigator palette
Previewing placed EPS images
Customizing shortcuts
Setting preferences
Using tool tips
Using web resources
Other learning resources
Customer support
Click on for Demo
The selection tool (V) selects entire objects.
The direct-selection tool (A) selects points or path segments within objects.
The group-selection tool selects objects and groups within groups.
The magic wand tool (Y) selects objects of similar attributes.
The direct-select lasso tool (Q) selects points or path segments within objects.
The lasso tool selects entire objects.
The pen tool (P) draws straight and curved lines to create objects.
The add-anchor-point tool (+) adds anchor points to paths.

Figure 3.2-8

IV Critique & Conclusion

IV is a relatively new but rapidly growing research field in which there are a large number of existing representational structures as well as many ongoing studies. This thesis, which presents research into the use of IV technology in the help systems of software applications, is explorative in nature and is meant to provide a reference for further studies.

The goals and objective of this thesis are to design a help-system model that utilizes 2D representational techniques of information visualization to transfer information into a visual form, thereby improving navigation, comprehension, utilization, user friendliness, visual appeal, engagement, and accessibility for users at different levels of expertise.

This thesis presents a prototype that utilizes the technologies of SiteBrain and Astra SiteManager. To a certain extent, this prototype is successful in maximizing the effective use of available screen space and enabling visualization of the whole structure as well as the contextual information. Interactive animation is found to be helpful in shifting some of the user's cognitive load to the human perceptual system. But limitations precluded a lab control performance test in this study, and no objective data has been collected. Therefore, there is no information in this thesis to support how well the goal has been met. Although this prototype utilized SiteBrain and Astra SiteManager, many other information representation technologies might be used to the same end. The solution suggested in this thesis is not the only solution and is in no way presented as the best.

Furthermore, the scope of this study has been specified to the help information built within Adobe Illustrator. Compared to other software applications (i.e., Flash), Illustrator is less sophisticated in terms of level of interactivity and functional complexity, and there is less disparity in level of expertise within its user group. Therefore, further research is needed to determine whether this prototype can be adapted to other software applications.

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