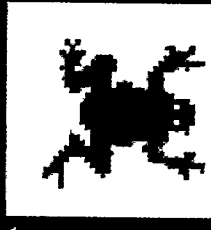

Investigating

Lake Iluka



GRAPHIC DESIGN FOR THE INTERFACE SUSAN E. METROS

The graphic designer's role

Few will argue that the expertise that a graphic designer brings to a multimedia project greatly enhances the end result. Effective graphic design does more than gain the attention of the user; it provokes an intellectual and emotional response. In Rand's (1985, p. xiii) words "Graphic Design is essentially about visual relationships—providing meaning to a mass of unrelated needs, ideas, words, and pictures. It is the designer's job to select and fit this material together—and make it interesting." Graphic design manages complex and disparate types of information through order, abstraction, simplification, grouping, coding, prioritizing, and assigning relative value to different types of information. Hicks and Essinger (1991, p. 78) state that "An aim of graphic design in relation to the user interface is to provide powerful structures and reinforcements that guide visual perception and communicate the hierarchy of information present in a system."

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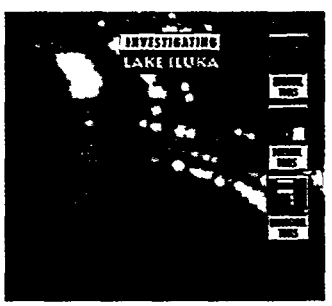
I served as principle graphic designer for an educational courseware project under development at The University of Wollongong, Australia titled "Investigating Lake Iluka." It is a CD-ROM based, interactive multimedia ecology simulation developed for the Apple Macintosh platform. It was authored in Apple Computer's HyperCard 2.1 using the BungDabba™ Productions Colorizing HyperCard 1.0 set of external commands.



"Investigating Lake Iluka" simulates a coastal lake environment, complete with four ecosystems, which are designed to support the teaching of ecology within a secondary-level biology curriculum. The learner measures, records, analyses, interprets, evaluates and presents data in order to explore fully these relationships. Additional information is gathered through searchable on-line databases, full-color illustrated reference books, newspaper clippings, "radio" news reports, full-motion "television" news broadcasts and informational video clips. In addition, the learner can enter information by keyboard or copy it from the wealth of on-line resources and paste it directly into a personalized notebook that ultimately serves as the nucleus for individualized reports. As in most interactive multimedia environments, the learner can navigate in a self-directed, self-paced, non-linear fashion. However, in this learner centered experience the student may choose to explore the lake by solving a series of problems that are based on a variety of social issues that are typical of such an environment. These problems are designed to encourage the student to develop a range of thinking and research skills. They vary in complexity from simple data collection to sophisticated problems that can only be solved by using a number of different information sources. At the highest levels students are required to hypothesize, predict and examine the results of natural and human-initiated changes in the environment.

Strengths of the project

When I arrived in Wollongong, "Investigating Lake Iluka" had been in development for over a year. The project had attracted a talented group of professionals, academics, graduate students, undergraduates, secondary-level teachers and assorted other specialists. The team consisted of a project director with expertise in educational technology and a degree in the biological sciences, instructional designers, curriculum designers, artists and illustrators, programmers, technical supporters, concept contributors, a musician/composer, a videographer, and numerous advisors with expertise in the natural sciences, cognitive psychology, education, software evaluation and multimedia design.

In addition to a unique and innovative approach to the study of ecology, "Investigating Lake Iluka" excels in numerous other areas. First, the content base of the program is current, comprehensive, intellectually diverse and visually rich. It employs a diverse set of data types including text, visuals, video and sound. Second, the "Lake Iluka" interface is not only highly interactive but also forgiving. This allows the learner to control the learning environment by directly manipulating materials, while also allowing him or her to undo decisions and retrace steps. Third, the quality of programming, coupled with the choice of the Macintosh platform, affords an interface that successfully conceals the complexity of the system. As a result, the learner is able to focus on the tasks, rather than on the tools.

Much of the initial success of "Lake Iluka" could be attributed to the fact that provisions had been made for informal and formal evaluations at regular intervals in the design process. Secondary-level science teachers and their students regularly evaluated "Investigating Lake Iluka" both in-house and on-site. User evaluation, combined with feedback from content specialists and colleagues, kept the development on track. Cowles (quoted in Hicks & Essinger, 1991, pp. 32-33) says an interface designer can best assess what is likely to prove most acceptable to the user "by sitting down next to users as they work with a computer system and by seeing what they find easy and what they find difficult, and what they like to do and what they don't like to do ... There's no point in conducting this type of observation exercise unless you have the courage to accept that you were wrong, swallow your pride and start again."

The stumbling blocks

As stated earlier, "Investigating Lake Iluka" had been in development for over a year before a professional graphic designer joined the team. Content specialists had collected a good portion of the required material and had already organized it into readily digestible units. During that period it had gone through numerous revisions, and although concept, content and coding had progressed, the prototype was stalled visually. If functionality, usability, and visual communication and aesthetics are equally important, then the intent, concept, code and program interface—with all of its visual elements— must evolve simultaneously. In the case of "Investigating Lake Iluka," the graphic design of the interface had taken a back seat compared to the other components integral to the program's development. Don Norman (quoted in an interview with Rheingold, 1990, p. 6) objects to this practice of treating the graphic design of the interface as an afterthought. He asserts that "it implies you already have done all the rest and now you want to patch it up to make it pretty for the user."

The major problem plaguing the project was the lack of a cohesive graphic vision. The team's composition was constantly in flux, a fact mostly attributable to the nature of academia. Individuals drifted in and out, depending on outside workloads and semester shifts. Since there was no one person assigned to art direction, a variety of individuals, with a diverse set of talents and styles, contributed to the graphic interface. As a result, the package was a hodgepodge: Structure was inconsistent and style was ill-defined. It is important to note at this stage that although the majority of artwork and design fell short of the quality required for a published project, it did play an important role in serving as a prototype to communicate the developer's rudimentary ideas to the professional graphic designer.

"Investigating Lake Iluka:" A case study

After carefully accessing the situation, the team agreed that a graphic designer could best serve the project in the following ways:

1. To support the package's metaphor visually.
2. To develop a consistent overall look.
3. To design a framework to maintain visual clarity.
4. To specify a typographical style and format, including a standard writing style.
5. To enhance the navigational schema visually.
6. To design a visual map to display the hierarchical organization of information.
7. To create the artwork required to illustrate the program's varied concepts.

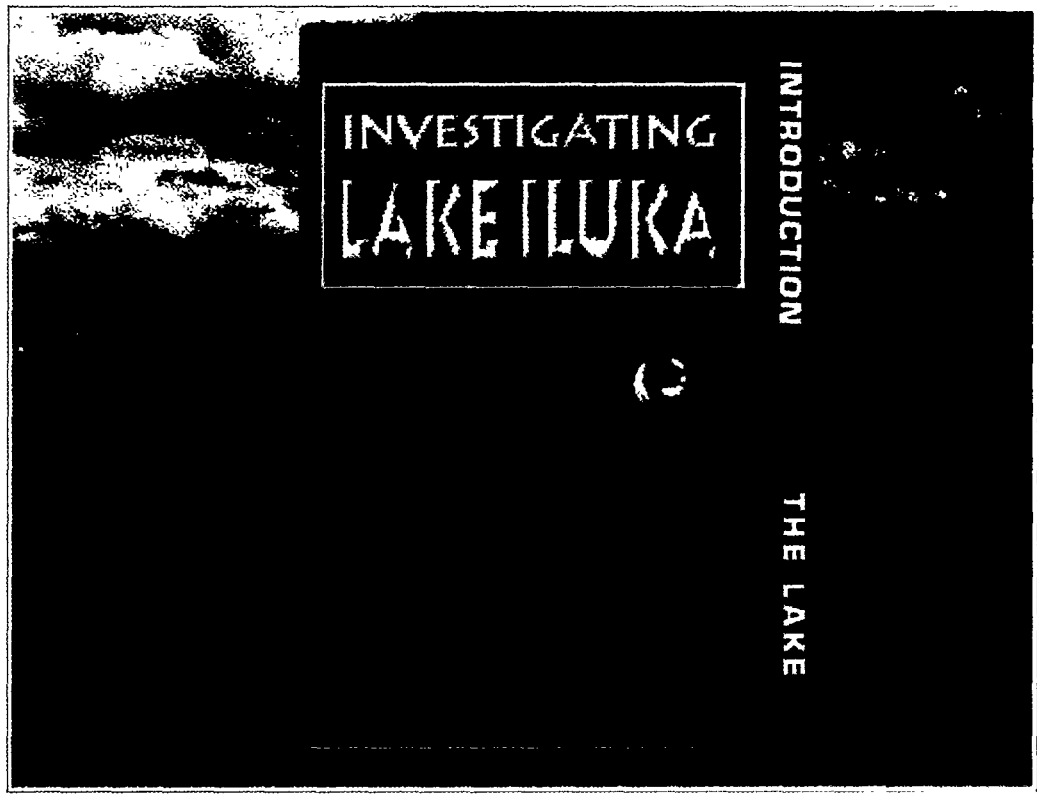


Figure 1b
The redesigned introductory screen.

Figure 1a
The original introductory screen.

Visual support for the package's metaphor

Mountford (1990, p. 25) describes metaphor as "a powerful verbal and semantic tool for conveying both superficial and conceptual similarities between familiar and novel situations." Distinct visual and auditory cues, as well as the associated vocabulary, enhance the meaning of the metaphor. Consistent use of the metaphor promotes learned associations, which in turn provide the familiar experiences that help users to grasp complex ideas. The beauty of a metaphor is that it can amplify what it represents.

A notebook, similar to the kind a scientist might carry on a field study expedition, served as the overall metaphor for "Investigating Lake Iluka." From conception "Investigating Lake Iluka" was loosely fashioned to simulate this type of notebook.

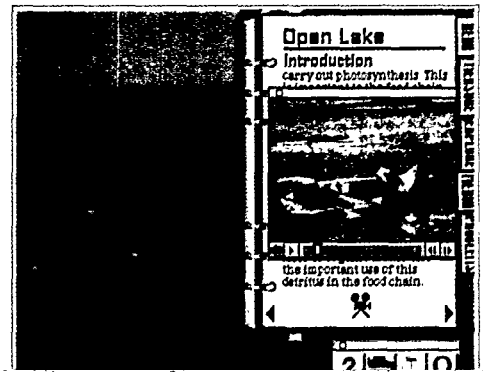


Figure 2
A notebook page with an active video window.

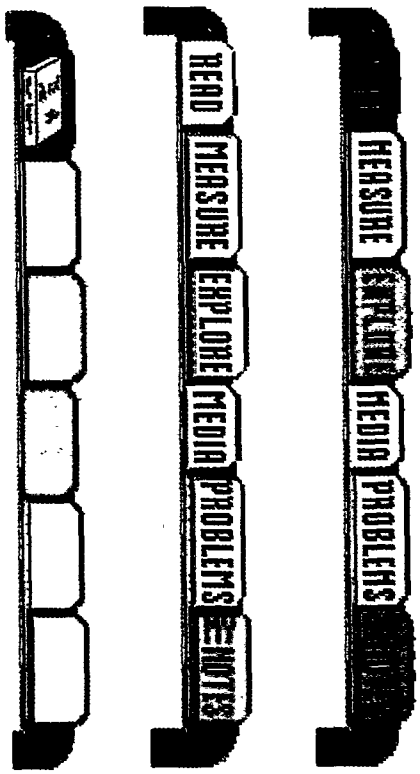
Initially, however, not all of the segments in the program supported the metaphor equally. These inconsistencies seriously affected content coherency, information hierarchy and visual comprehension. To solve this problem the team developed an infrastructure in which every element of the package, regardless of the operation or task, seamlessly conformed to the notebook metaphor. A photographic image of a lake, directly scanned from a book, originally served as program's introductory screen (Figure 1a). Not only was this image incompatible with other photographic elements, but the project director had not yet obtained copyright permission. The graphic designer redesigned this screen to depict the cover of the notebook, thus introducing the metaphorical concept at the outset of the learning experience (Figure 1b). The notebook was placed in the foreground of an original photograph taken at a nearby coastal lake. This background photograph was the same image used to repre-

Figure 3a
The notebook tabs originally depicted as icon-based labels.

Figure 3b
An abandoned attempt at reworking the icon-based labels.

Figure 3c
The text-based labels on multi-colored tabs.

Figure 3d
The final version of the tabs.



3a *3b* *3c* *3d*

sent the lake within the context of the program, further reinforcing the initial encounter (Figure 4b). Written material was organized onto "pages" and a series of "tabs" separated and provided access to the various activity sections (Figure 3d).

When required, the notebook metaphor was modified to take advantage of software-associated operations. Three of these examples follow. First, the page titled "My Notes" electronically scrolls so that users can easily enter, review and save a large amount of data (Figure 7b). Second, where applicable, video segments, represented by a standardized Macintosh interface movie icon, run in Apple Computer's QuickTime™ format upon the backdrop of the static page layout (Figure 2). Third, a sophisticated find command, in the form of the standard Macintosh dialog box, electronically searches and retrieves data from the collection of media resources (Figure 11).

Development of a consistent overall look

Consistency in the use of visual elements, tools, commands, operations, and organizational style forms the foundation of good interface design. Consistency also is effective in reducing memory load. It is enhanced when the learner knows what type of information will be covered and when and where it will appear. Overall, careful attention to detail in the design and flow of the interface promotes consistency.

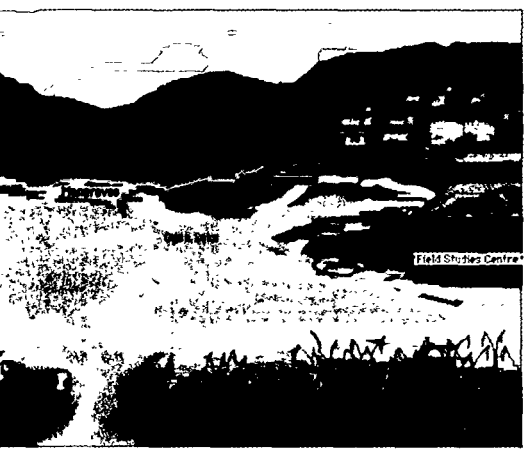
In "Investigating Lake Iluka" adhering to the notebook metaphor influences the entire program. Not only does this affect the visual appearance of the interface, but it also affects how the user behaves while interacting with the program. For example, tasks are divided into a series of attained closures, layered and separated by "tabs," comparable to chapters in a book (Figure 3d). Material in each section is clearly and succinctly organized, following a prescribed format. No matter what ecosystem the user chooses to explore, only the content varies; the commands, tools, operations and organizational style do not.

Design of a framework to maintain visual clarity

Clarity in the design of both visual elements and visual cues shortens data search time. In contrast, conflicting colors, illegible text, cluttered layout, ambiguous coding and hierarchies,

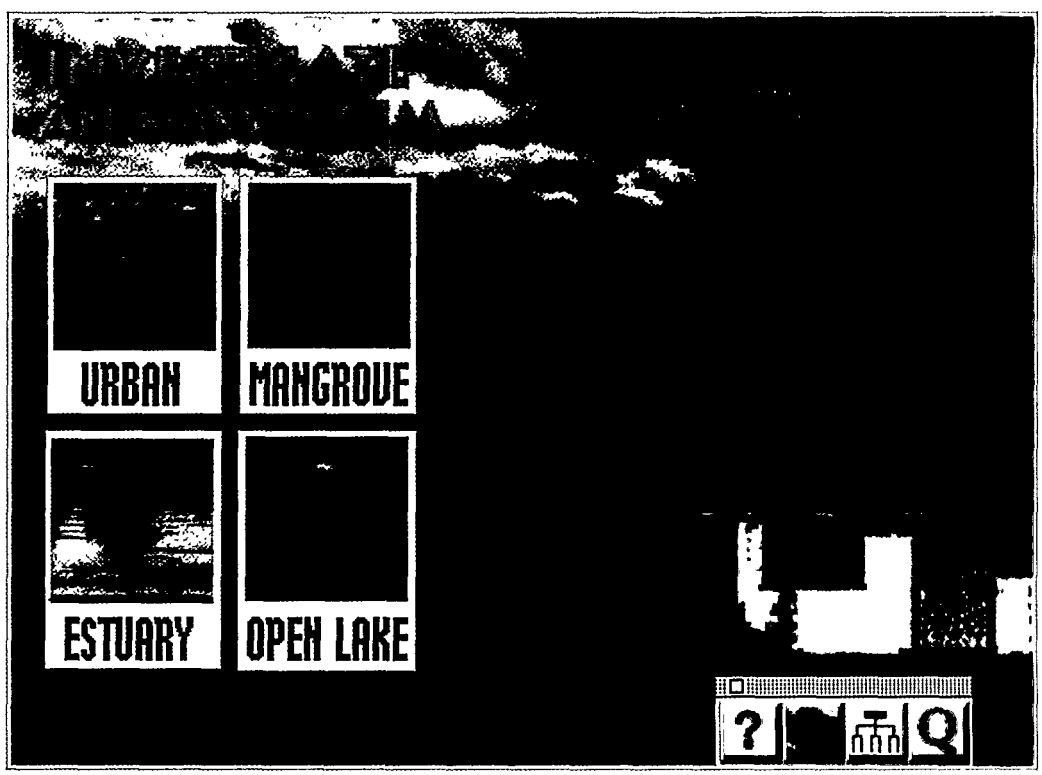
and inadequate spatial relationships affect visual perception negatively. Impaired perception caused by poor design serves to reduce user performance because of such phenomena as lack of concentration, fatigue, stress, and irritation (Hicks & Essinger, 1991). Furthermore, well-designed software uses visual cues and representations to help the user to remember things seen in one view in order to use other views more effectively. Dermot Browne, one of Britain's leading experts on human-computer interaction, points out that cognitive scientists suggest that recall for information represented visually is greater than that for written and verbal information (cited in Hicks & Essinger, 1991). He continues "It is known that memory capacity is strictly finite, so not only does a heavy burden on working memory tend to exhaust the user mentally, it is also likely to prevent him from effective use of working memory at other stages in the interactive process" (quoted in Hicks & Essinger, 1991, p. 25).

Figure 4a
The original illustrative "choice" screen.



The developers of "Investigating Lake Iluka" initially conceived it with a visual interface in mind. However, in many instances information was text-based when it could have been better represented visually. In some cases just the opposite is the case. The graphic designer's responsibility was threefold: First, to increase the frequency and to improve the clarity of the visual cues in order to reduce the user's dependency on memory. Second, to evaluate the existing visual cues and to determine whether they were coherent. The rendering of the notebook tabs is a good example of an instance in which the evaluators deemed the original icon-based labels ambiguous and suggested that they be replaced (Figure 3a). In Figure 3b the graphic designer reworked the "read" icon but quickly concluded that a visual representation was far too complex for such a small space. Hence, the graphic designer chose to redesign the icons as text-based instructions. Initially the tabs were multicolored to further differentiate the activities (Figure 3c). However, the advancing and receding properties of warm and cool colors gave the illusion of a false hierarchy. Therefore, the graphic designer opted for a monochrome palette and used an alternate color only to dis-

Figure 4b
The redesigned photographic "choice" screen.



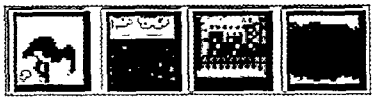


Figure 5
An early version of the ecosystem labels illustrated as symbols.

tinguish the "My Notes" and "Hide Notes" tabs (Figure 3d).

The graphic designer's third responsibility was to improve the overall visual clarity by redesigning the screens to better represent the various concepts. For example, the screen depicting the lake serves as the backdrop for the major navigational choices within the entire program (Figures 4b). The initial illustrative solution hampered decision-making because the size and placement of the various elements and their spatial relationships interfered with the hierarchy of information (Figure 4a). The redesigned screen repeated the introductory image of the lake to build familiarity. This screen employs photographic icons, cropped from the actual pictures that represent each of the ecosystems whereas an earlier version of the program depicted the four ecosystem icons symbolically (Figure 5). A bold, condensed type font (Modula Bold by Émigré), set in a large size, in all caps, further emphasizes and identifies the ecosystem labels. Most important, however, design elements are organized on a structural grid. Superfluous elements are removed. The grid provides a framework for grouping similar visual elements while separating those that are cognitively different. The redesigned screen instantly communicates the two major navigational paths, "Investigate an Ecosystem" and "Visit the Field Study Centre" (Figure 4b).

Specification of a typographical style and format, including a standard writing style

The typography incorporated within the initial graphic screens was replaced with fonts that were selected for their ease of readability. The monitor's 72 dpi resolution, 8 bit, 256 color palette required that type fonts be both legible and readable in this low resolution environment. The graphic designer reinforced consistency throughout the total package by determining type styles and regulating their application.

Colorizing HyperCard works by permitting the full-color PICT image to reside in the background—behind HyperCard's standard, bitmapped black and white fields, buttons and graphics. Therefore, text placed in fields must comply to the rather unsophisticated typographic conventions of HyperCard. In "Investigating Lake Iluka," the field text was reformatted to lineup evenly and whenever possible, additional "white" space was allotted to provide visual and mental relief from the density of information. Bold type emphasizes headings and bullets are used to separate concepts and create a visual rhythm. The writer, along with the content specialists and graphic designer worked together on rewriting and editing copy to conform to the newly defined, visual format. This group also worked closely with the programmers to insure that system-level dialog boxes and commands followed the style guidelines and were visually consistent, direct and understandable.

It should be noted that typographical and textual standards were some of the most difficult areas of the design to manage. It is almost impossible to oversee all the activity in these areas. There are numerous sections in the final package where copy was changed, deleted or added at a later date, and unfortunately, due to limitations on time and inaccessibility to the graphic designer, typographical standards were incorrectly followed or disregarded altogether. The next release will correct these typographical inconsistencies.

Visual enhancement of the navigational schema

The navigational system is one of the most complex components of the interface. It represents the action-oriented relationships between the learner and the material at hand. In order to encourage a self-directed, active, participatory learning style, the learner must be able to explore effortlessly what Florin (1990) refers to as the "information landscape." The structure of the learning experience must be apparent. There should be clear relationships between the user's actions and the machine's responses, the controls and their effects, and the state of the system and the interface (Norman. 1988 p. 52-53).

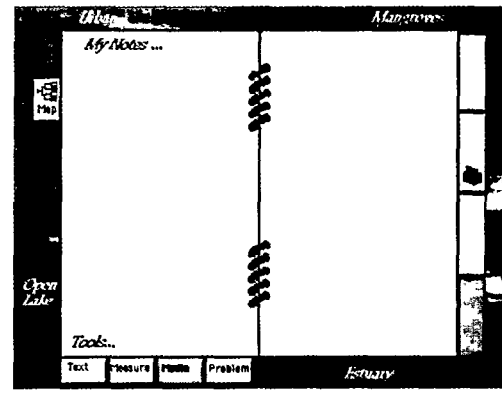
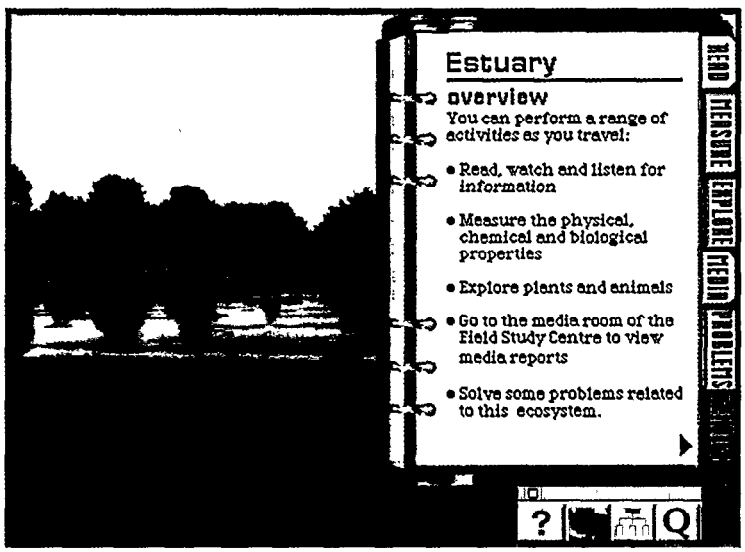


Figure 6
The original notebook's inside spread with "My Notes" selected.



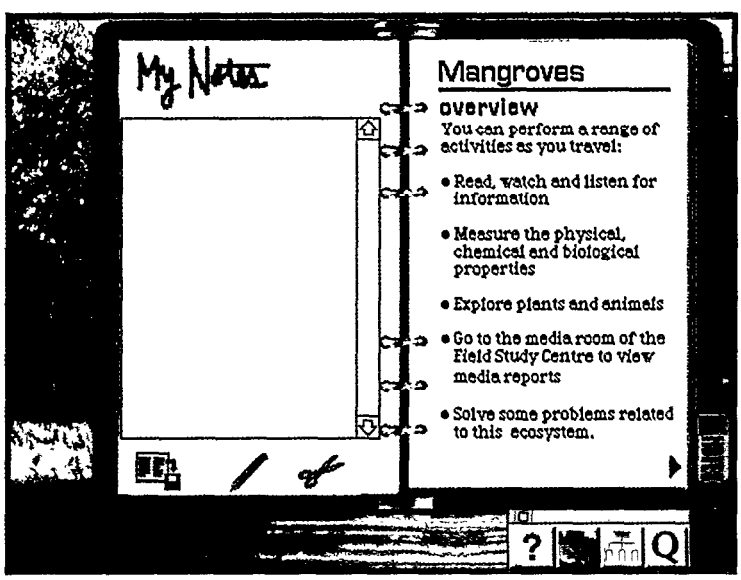


Figure 7a
The redesigned notebook's inside spread with "My Notes" closed.

Figure 7b
The redesigned notebook's inside spread with "My Notes" selected.

A navigational schema is composed of the various types of tools (buttons, menus, dialog boxes, maps, textual reminders, place and progress indicators, etc.), location of and access to these tools, and their various symbolic representations. The primary navigational device used throughout "Investigating Lake Iluka" is the HyperCard button. Buttons function as ecosystem choices, the notebook tabs representing the program's activities, and a set of permanent, system-level program commands. In the initial prototype tabs surrounded the notebook pages (Figure 6). Activities were intermingled with the system-level commands. The learner accessed the ecosystems by clicking labeled photographic representations bordering the notebook. The problems with this layout were multiple: The notebook took up too much screen "real estate;" the ecosystem choices were difficult to locate and identify; the user was forced to roam around the entire screen whenever switching between ecosystems, selecting specific activities, or choosing system-level commands.

The team solved the screen's "real estate" problem by visually representing the notebook folded back over itself on top of a photographic representation of the selected ecosystem (Figure 7a). The learner is provided with a tab titled "My Notes." When "My Notes" is selected, the notebook opens to a two-page spread, with "My Notes" occupying the left side (Figure 7b). This is depicted as a full page, scrolling field. The graphic designer applied a blue background to the page to differentiate it from the pages of main field study notebook. The "My Notes" page retains its own set of icons to perform specific saving, pasting and cutting operations.

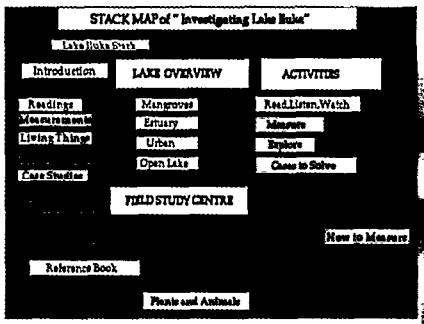
Navigational movement was further strengthened by grouping similar or often used

Figure 8a
The original floating navigation palette.

Figure 8b
A later version of the floating navigation palette.

Figure 8c
The final version of the floating navigation palette.

commands. As previously discussed, the tabs representing the program's activities were repositioned and aligned along the right hand side of the notebook (Figure 3d). The team designed a floating palette that incorporated the program's universal and system-level commands. This floating palette went through a series of behavioral and design modifications (Figures 8a-8c). The initial palette was composed of eight buttons, Help, My Notes, Lake, Field Study Centre, Next Page, Find, Previous Page and Back up a Level. Evaluation suggested that not only were there too many choices, but also that the icons representing the choices were ambiguous and confusing (Figure 8a). To address this problem, the team decreased the number of buttons to five by combining Field Study Centre and Lake into a single button that accessed the program's main choice screen, moving Next Page, Find and Previous Page to the specific pages that they controlled, and eliminating the My Notes command since it was already available as a tab on the notebook level. Back up a Level was redefined typographically to alleviate the confusion caused by the symbolic icon. Standardized icons for Quit and Stack Map were added (Figure 8b). In the final version the team rearranged the order of the buttons by what the evaluators reported as perceived importance. In addition, the graphic designer simplified the symbolic icons and optimized the typographic symbols to improve readability. The palette was



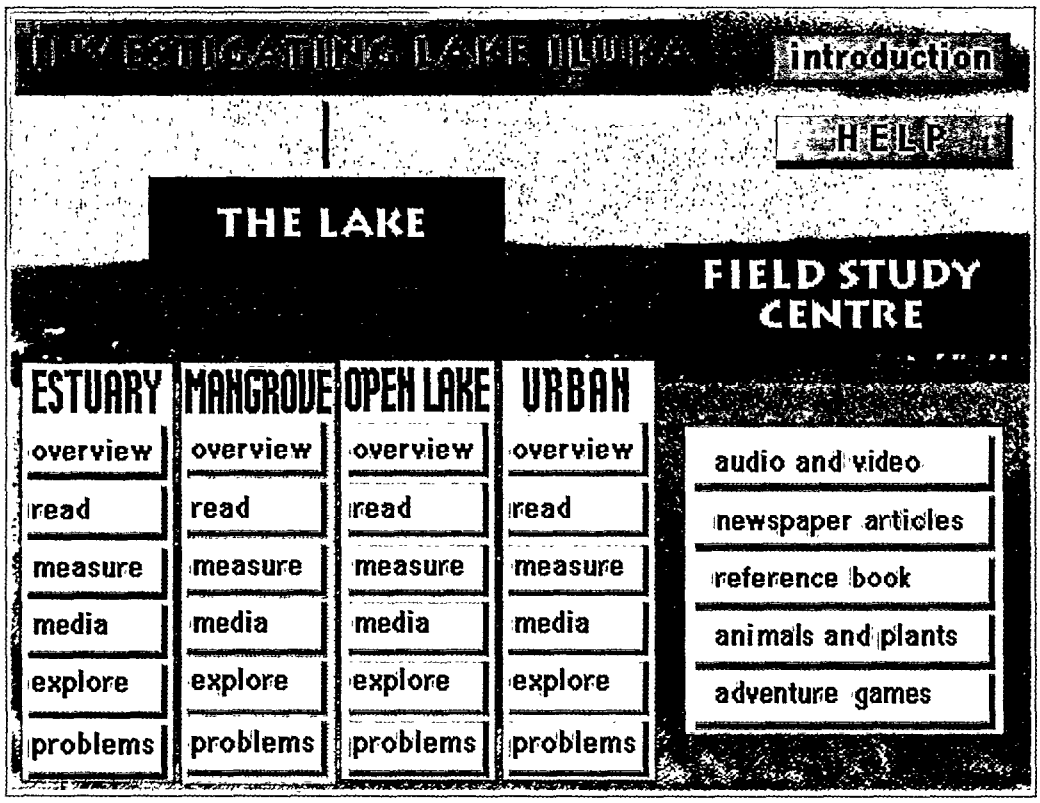


Figure 9a
An early version of the stack map screen.

Figure 9b
The final version of the stack map screen.

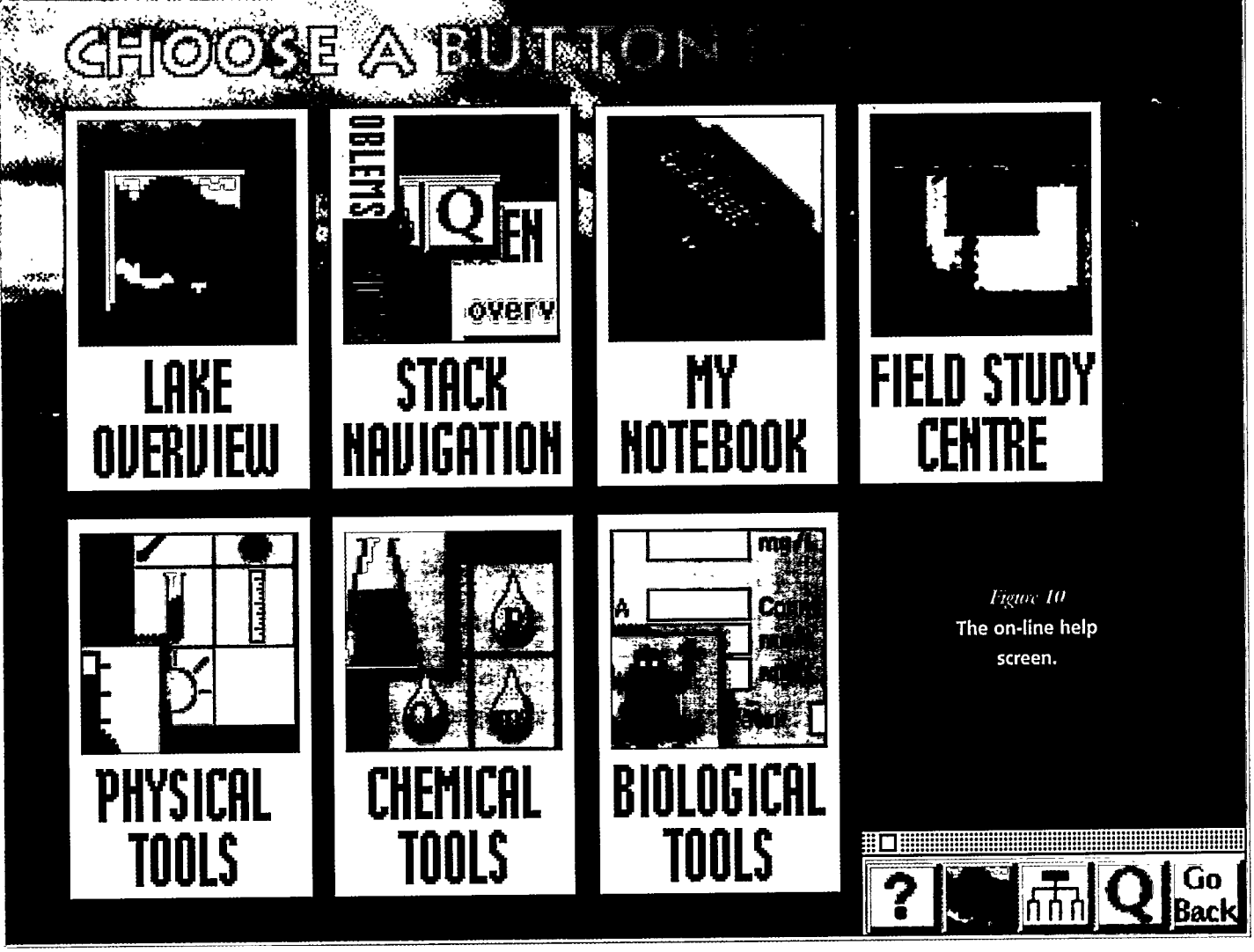


Figure 10
The on-line help screen.

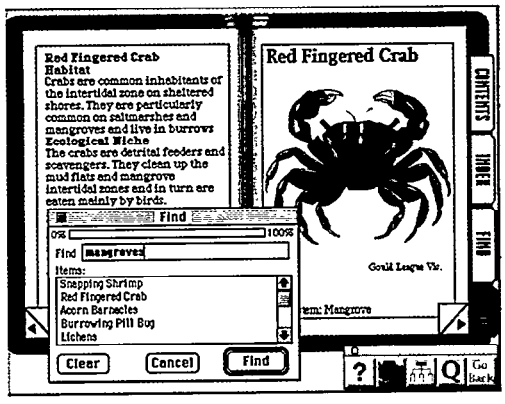


Figure 11
A spread from the "Animal and Plants" book with the find command active.

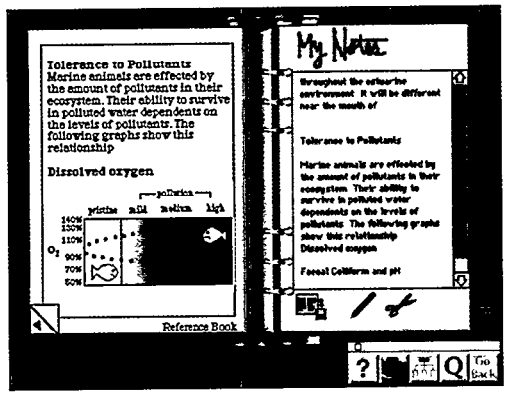


Figure 12
A spread from the "Reference" book.

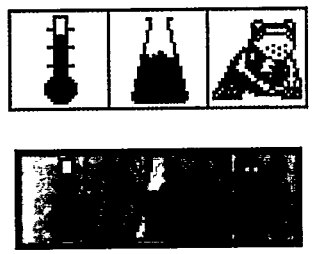


Figure 13a
The original "measure tools" palette representing the Physical, Chemical and Biological Toolkits.

Figure 13b
The redesigned "measure tools" palette.

visually strengthened by fine-tuning the style and detail of the icons to better complement each other. The designer also reduced the size of the entire palette so that it would fit within the designated space allotted on each of the screens (Figure 8c).

Design of a visual map to display the hierarchical organization of information

Hedberg and Harper (1990, p. 267) explain that a user can be easily confused because in complex interactive environments, there are multiple paths to the same or different endpoints. Users should be able to find out where they are quickly, and how to get back to where they were from anywhere in the information landscape. In addition, the software package must provide the learner with an easily understandable and accessible set of instructions describing how to use the program. Navigational tools that address this issue include: directional devices, maps, headings, visual effects, timelines, on-line help, user guidance facilities and even sound cues.

"Investigating Lake Iluka" incorporates both a stack map (Figure 9b) and an on-line help facility (Figure 10). The stack map, accessible from anywhere in the program via the floating navigation palette, provides an overview of the entire program. Not only is it used to navigate from within the program, but it also provides a clear visual outline of the various layers of information. Stratifying information in this manner reduces "noise" and therefore, enriches the content of the display. An earlier version of the stack map confused testers because the information hierarchy was ambiguous, the grid was not sustained, there were too many visual links between activities and they were too complicated, and conflicting color relationships interfered with legibility (Figure 9a).

The on-line help facility operates in a similar fashion to the stack map (Figure 10). Also selectable from the universally accessible, floating navigation palette, this screen depicts a series of help topics. To promote consistency, the graphic designer created the screen graphic from previously designed artwork. Selection of a topic prompts an on-screen video overview complete with definitions and step-by-step instructions.

Creation of the artwork required to illustrate the program's varied concepts

In a society that is so heavily conditioned by television, dynamic elements (moving images, music, sound effects) attract more attention than do text and static images. Nonetheless, all images, whether dynamic or static, have more fluid meaning than does text. Text is relatively explicit compared to the interpretive nature of video clips and pictures (Ambron 1990 in A & H p. 83). By definition, graphic elements visualize concepts, whereas text can only describe them.

It is important to choose or create illustrations that include imagery that is easy to recognize. This promotes simplicity, clarity, distinctness and emphasis. The graphic designer must avoid clichés and seek out innovative viewpoints. In discussing conventional illustration, Paul Rand proclaims, "Visual statements such as illustrations which do not involve esthetic judgment and which are merely literal descriptions of reality can be neither intellectually stimulating nor visually distinctive. The visual statement which seeks to express the essence of an idea, and which is based on function, fantasy, and analytic judgment, is likely to be not only unique but meaningful and memorable as well" (Rand, 1970 p. 36). When designing for the interface, visual elements should reflect the nature of the task, the abilities and preferences of the user, all within the abilities of the system (Allmendinger 1990 p. 2). Whenever possible, the interface should

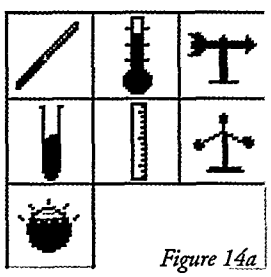


Figure 14a **The original Physical Toolkit palette containing a thermometer, a hygrometer, a light meter, a turbidity tube, a depth gauge and an anemometer.**

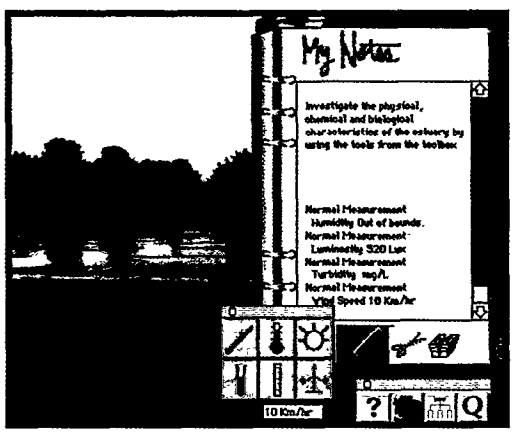
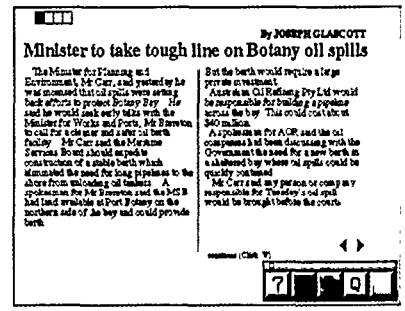
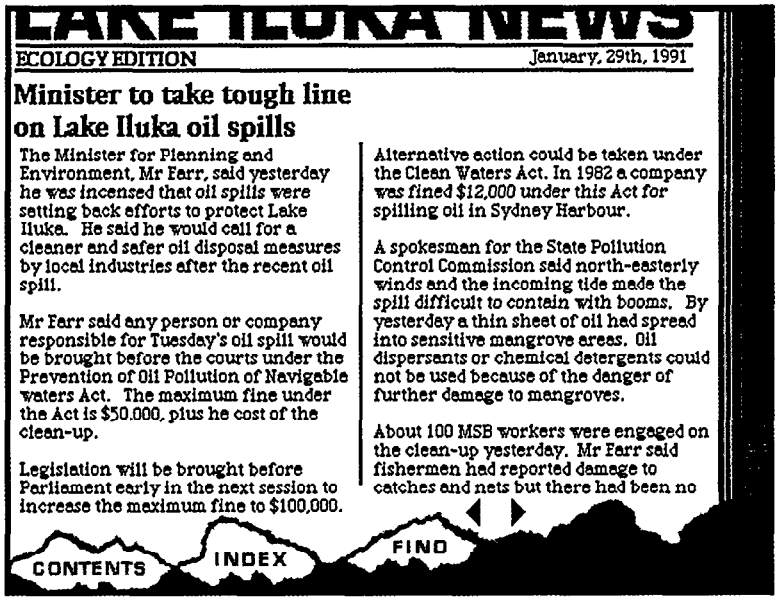


Figure 14b **The redesigned Physical Toolkit floating palette depicted on an active ecosystem screen.**


By JOSEPH GLASCOTT

Minister to take tough line on Botany oil spills

Figure 15
The original layout for the newspaper screen.


LAKE ILUKA NEWS

ECOLOGY EDITION January, 29th, 1991

Minister to take tough line on Lake Iluka oil spills

The Minister for Planning and Environment, Mr Farr, said yesterday he was incensed that oil spills were setting back efforts to protect Lake Iluka. He said he would call for a cleaner and safer oil disposal measures by local industries after the recent oil spill.

Mr Farr said any person or company responsible for Tuesday's oil spill would be brought before the courts under the Prevention of Oil Pollution of Navigable waters Act. The maximum fine under the Act is $50,000, plus he cost of the clean-up.

Legislation will be brought before Parliament early in the next session to increase the maximum fine to $100,000.

Alternative action could be taken under the Clean Waters Act. In 1982 a company was fined $12,000 under this Act for spilling oil in Sydney Harbour.

A spokesman for the State Pollution Control Commission said north-easterly winds and the incoming tide made the spill difficult to contain with booms. By yesterday a thin sheet of oil had spread into sensitive mangrove areas. Oil dispersants or chemical detergents could not be used because of the danger of further damage to mangroves.

About 100 MSB workers were engaged on the clean-up yesterday. Mr Farr said fishermen had reported damage to catches and nets but there had been no

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Figure 15b
The redesigned and final newspaper screen.

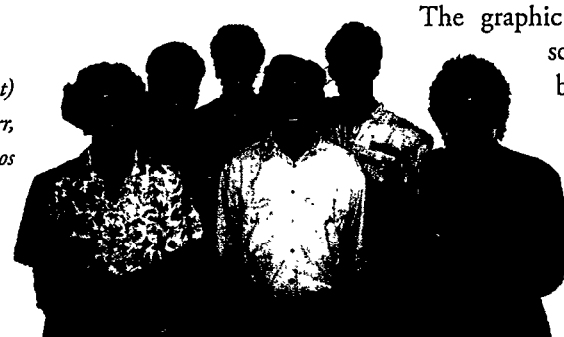
present subjects from multiple perspectives, including visual images, verbal messages, and other diagrams.

The majority of static imagery contained in "Investigating Lake Iluka" is photographic. Early in the project, a few of the amateur photographers on the team visited a nearby coastal lake to photograph the required scenes. Because "Lake Iluka" is a simulated environment, the photographs had to be void of recognizable landmarks. Generic in nature, they tended to be visually ordinary. Using Adobe PhotoShop™, a sophisticated photo-manipulation software package, the graphic designer was able to take each photographic image through an elaborate "makeover" process. The designer improved visual clarity by applying filters and manipulating each of the photograph's contrast, brightness, sharpness and color saturation settings.

The graphic designer also had the responsibility of adding or subtracting visual interest where appropriate. This involved rendering the Field Study Notebook and the two other reference books titled, "Animals and Plants" and "Reference" (Figures 11 and 12) more realistically than those depicted in the initial prototype, redrawing most of the icons that represented the tools contained in the measuring palettes (Figures 13a, 13b, 14a and 14b), and universally applying a brighter, consistent color palette to such elements as typography, backgrounds and icons. The newspaper screen is a good example of an instance in which the contrast between the color of the background, the foreground and the design elements (including typography) are intensified to improve the overall look and feel of the finished product (Figures 15a and 15b).

In the initial prototype, when the learner selected the Field Study Centre icon, he or she was dispatched to an exterior view of that building (Figure 16a). Clicking on the door permitted them to enter an interior view where they had access to reference books, newspapers, video news broadcasts and audio tape radio reports (Figure 16b). The team streamlined navigation by eliminating the exterior scene and adding a close-up, interior view. In the final version, the learner selects the Field Study Centre button and is routed directly inside the Centre (Figure 17b). If he or she chooses to view a video or to listen to an audio tape, the close-up view of the room replaces the full-view of the room (Figure 17c). A simulated remote control device manages video and audio play.

The graphic designer depicted both screens illustratively since a building structure that could be photographed did not exist. It is interesting that out-


The Team photo: (from left to right) Christine Brown, John Hedberg, Grant Farr, Barry Harper, Stephen Gass, and Susan Metros

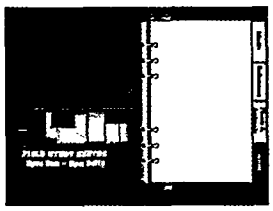


Figure 16a
The initial exterior view of the Field Study Center.

Figure 16b
The initial interior view for the Field Study Center.

side evaluators commented that the initial revisions of the interior views appeared inconsistent when compared to the predominantly photographic images used throughout the rest of the program (Figure 17a). The graphic designer revised these illustrations to include more realistic textures and shadowing techniques (Figure 17 a and 17b).

Conclusion

The interactive multimedia project is most successful when reckoned with holistically. This means that every member of the multimedia team, regardless of expertise, must be aware of and grasp all of the diverse components that make up the total project. Decision-making in interactive multimedia project design is interconnected and interwoven in such a way that a decision in one affects numerous other areas. Therefore, it is essential that the skills needed to complete a project be assessed at the outset and that knowledgeable individuals be identified to fill the required positions. Team members must

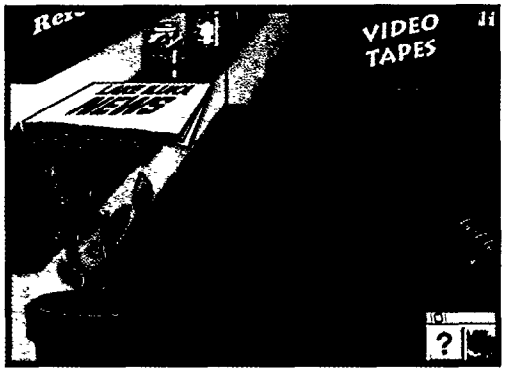


Figure 17a
A later version of the Field Study Center interior.

Figure 17b
The revised interior for the Field Study Center.

Figure 17c
The revised close-up view of the interior for the Field Study Center.

be readily available to interact with each other and to provide needed support. The Project Director must also insure that the team progresses forward, avoiding needless and time-consuming personality clashes. The confusion over duplication of roles, the need for specific direction, frustration over diverse working styles, sensitivity to ownership of ideas, and the constant interruptions of academia can play havoc with a team's morale and ultimately compromise the quality of the product.

My experience as a member of the multimedia development team that developed "Investigating Lake Iluka" was invaluable. Not only did they provide me with an opportunity to apply my conventional graphic design talents to an interactive environment, but I also learned about the other aspects of designing for the interface. The beauty of belonging to this interdisciplinary team was that not only were members encouraged to contribute within their own areas of expertise, but that the team also provided a forum for its members to expand their knowledge base beyond the boundaries of their respective disciplines.

Acknowledgments

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Bibliography

Allmendinger, L. (1990). Visualizing the Interface. Design Process Newsletter, Institute of Design, Illinois Institute of Technology, 3(4), pp. 1-5.

Ambron, S. (1990). Multimedia Composition: Is it Similar to Writing, Painting, and Composing Music? Or is it Something Else Altogether? In Ambron, S. & Hooper, K. (Eds.). Learning with Interactive Multimedia: Developing and Using Interactive Multimedia Tools in Education. Richmond, VA: Microsoft Press, pp. 69-85.

Florin, F. (1990). Information Landscapes. In Ambron, S. & Hooper, K. (Eds.). Learning with Interactive Multimedia: Developing and Using Interactive Multimedia Tools in Education. Richmond, VA: Microsoft Press, pp. 27-51.

Hedberg, J. & Harper, B. (1990). Cognitive Demands of Navigation in Interactive Multimedia. Interactive Learning International, 7, pp. 267-268.

Hicks, R. & Essinger, J. (1991). Making Computers More Human: Designing for Human-Computer Interaction. Oxford, UK: Elsevier Advanced Technology.

Metros, S. (1992). Interface Lift: Elective or Compulsory, In J. Hedberg and J. Steele (Eds). Educational Technology for the Clever Country: Selected Papers from ASET '92. Belconnen, Australia: AJET Publications, Lmt., pp. 110-150.

Metros, S. (1990). Process = Product: An Equation for Computer Enhanced Creative Problem-Solving. NCGA '90 Conference Proceedings. Fairfax, VA: National Computing Graphics Association. pp. 409-425.

Mountford, S. J. (1990). Tools and Techniques for Creative Design,. In B. Laurel (Ed.). The Art of Human-Interface Design. Reading, MA: Addison-Wesley Publishing Co., Inc., pp. 17-30.

Norman, D. (1988). The Psychology of Everyday Things. New York, NY: Basic books, Inc.

Rand, P. (1970). Thoughts on Design. London, UK: Studio Vista/Van Nostrand Reinhold Company.

Rand, P. (1985). Paul Rand: A Designer's Art. New Haven, CT: Yale University Press.

Rettig, M. (1992). Interface Design When You Don't Know How. Communications of the ACM. January, 35(1), pp. 29-34.

Rheingold, H. (1990). An Interview with Don Norman. In B. Laurel (Ed.). The Art of Human-Interface Design. Reading, MA: Addison-Wesey Publishing Co., Inc., pp. 5-10.

Tufte, E. (1989). Visual Design for the User Interface. Armonk, NY IBM Corporation.

Vertelney, L. Arent, M. & Liberian, H. (1990). Two Disciplines in Search for an Interface. In B. Laurel (Ed.). The Art of Human-Interface Design. Reading, MA: Addison-Wesey Publishing Co., Inc., pp. 45-56.