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Innovations Affecting Us — Hyperbolic Browsers: From GUI to KUI

by **Norman Desmarais** (Acquisitions Librarian, Phillips Memorial Library, Providence College, Providence, RI 02918; Phone: 401-865-2241; Fax: 401-865-2823) <normd@providence.edu>

The World Wide Web has often been described as a library where all the books have been thrown on the floor. The challenge for librarians and information workers has been to try to organize a plethora of disparate material. The challenge for researchers has been to locate pieces of information relevant to their research.

Advances in computer storage have allowed digital information to grow exponentially. Websites are also growing in complexity, making it difficult for users to understand the contents and structure of a site by following hypertext links on individual Web pages. Researchers typically complain about information overload, unfriendly interfaces, the absence of intuitive search structures, and the need to learn special languages or conventions to search effectively.

GUI

The **graphical user interface (GUI)** vastly simplified the process of training researchers to use computers because it allowed them to visualize information. But there has been very little progress in user interfaces since **Douglas Engelbart** built the first GUI — in 1969! For instance, the amount of information displayed on a monitor hasn't increased much since 1993. And the pointing device or mouse has seen more modifications and improvements than the user interface.

Representing the quantity of information and its distribution within a set of linked documents poses one problem with visualizing information on the World Wide Web. Hypertext readers find this information along with the type of document (text, image, audio, video) useful in deciding on the suitability of a Website without spending a great deal of time browsing its structure. However, they find it difficult to navigate large document spaces. They often become disoriented and must remember their location in the network, make decisions about where to go next, and keep track of pages previously visited, as documented by **McKnight, Dillon, and Richardson**.¹ The problem of disorientation becomes more severe as the number of nodes increases.

GUIs, such as **Microsoft Windows**, focus on delivering information to the screen. They do not even begin the process of transferring knowledge to humans. A first step to knowledge acquisition requires understanding the relationship between various elements and how they affect one another. Just as a skilled manager must understand the technical or operational parts of a business as well as how they relate and affect one another to

run a successful operation, a researcher needs to see the various facets of a topic or problem and how these factors interrelate to get a complete picture and formulate a solution.

KUI

One way to improve hypertext design is to provide a structured overview of the hypertext contents so as to facilitate understanding.² A so-called **knowledge user interface (KUI)** uses visual cues rather than text or a combination of an underlying graphical structure with a textual component to visualize information. The **User Interface Research Group at Xerox PARC (Palo Alto Research Center Inc.)** [<http://www.parc.xerox.com/istl/projects/uir/projects/InformationVisualization.html>] defines information visualization as "the use of computer-supported interactive visual representations of abstract data to amplify cognition."

Work done at the **PARC** promises to go far beyond the traditional **GUI** in speeding up the rate at which people can understand information, not just see it. It uses visual hierarchies, webs of nodes, even head and hand tracking devices, retinal projection, and virtual environments to enable navigation through complicated knowledge bases by making more relevant information available within a single view.

Dr. Ben Schneiderman of the **University of Maryland** is responsible (both directly and indirectly) for much of the reported research on information visualization. His **Online Library of Information Visualization Environments (OLIVE)** [<http://www.otal.umd.edu/Olive/>] provides a wonderful resource for obtaining background information on the types of visual structures and their uses. It lets researchers read about eight structure types and follow links to current projects utilizing the technology.

Donald T. Hawkins³ effectively summarizes information visualization when he says, "It is important to note that what is being communicated in visualization is not the information itself, but its structure." Just because we do not readily perceive the structure does not mean it is not there. We must discover and impose structure if we are to apply technology to information management or information-intensive work because it is the structure that identifies the relationships between the various elements. Work on metadata and metalanguages like **SGML** and **XML** goes a long way to identifying information structure.

Hyperbolic Browser

John Lamping, Ramana Rao, and Peter Pirolli⁴ take another approach to information

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visualization. They explain how to map a hierarchical tree structure to a hyperbolic display that provides a “fisheye” representation of information. A traditional 2-D display, such as the **Windows** file manager, can only display about 100 nodes in a 600- by 600-pixel window. A tool like **InXight Categorizer**, developed by **InXight Software Inc.** [<http://www.inxight.com>], helps publishers and information aggregators arrange unstructured information into classifications or taxonomies. It uses a strong natural language processing system that automatically classifies documents by subjects and can display up to 1,000 nodes in the same 600- by 600-pixel window. A hyperbolic browser like **InXight Software’s Star Tree** navigator then makes it possible to navigate, visualize, and absorb far more complex sets of information.

John Lamping and **Ramana Rao** of **PARC** state that “the amount of information that can coherently be displayed on the screen of an interactive computer system can dramatically affect the ease of interacting with a large information structure.”⁵ They demonstrate the **Hyperbolic Browser** technique for displaying and manipulating large hierarchies and graphs, such as organization charts, file system hierarchies, and the link structure of Web servers and spaces. These structures have been converted to trees that initially display with the roots at the center with multiple branches off it. Different nodes continuously appear and disappear. As one moves along the roots, the display transforms smoothly to bring other nodes into focus.

For a library example, see **The Universal Library** at **Carnegie Mellon University’s** site [http://www.ulib.org/webRoot/_hTree/] which uses **InXight’s** software. This site is an excellent illustration of the technology both because of the size of its structure and because of the expectation that it will continue to grow with the addition of more material. This site shows what hyperbolic structures can do for the organization of knowledge; but it also demonstrates some of the limitations of the technology in its current state. **Rick Lugg** of **R2 Consulting** also uses **InXight’s Star Tree** to map the ebook industry. The various nodes branch off the central node (original content) in a star fashion as seen in the following graphic.

Fig. 1 Main screen of R2 Consulting’s map of the ebook industry.

The various topics appear in different colors to facilitate grouping, conceptualization, and navigation. Sub-topics overlap each other as can be clearly seen — particularly at the top and the right side of the screen. Moving the mouse or pointing device over a button operates much like a pop-up window, making the content of the button clearly visible. (Mouseovers are another navigational tool to highlight connections between nodes.) Clicking on a button re-focuses the display with the selected button at the center.

Looking at the eBook Formats button at the bottom of the screen, we see lines branching to nodes that are not identified. Clicking on this button brings it to the center, revealing several of the sub-topics. Clicking on Peanut Press centers on that button (fig. 2); and we notice several lines at the upper left that lead to other formats not displayed. To return to the initial display, one only needs to click on the Original Content button.

Fig. 2 Selecting the eBook Formats button followed by the Peanut Press button re-centers the display to focus on the desired sub-topic. Clicking on the Original Content button returns to the initial display.

Information Mapping

The information hierarchy is laid out on a hyperbolic plane which is a non-Euclidian geometry where parallel lines diverge from one another. In this construct, the circumference of a circle grows exponentially with its radius. This means that as distance increases, exponentially more space becomes available.

The mathematical construct is then mapped onto a circular display region. This allows laying out the hierarchies in hyperbolic space in a uniform manner so that the distance between parents, children, and siblings is roughly the same across the hierarchy — even the more detailed hierarchies. **Tamara Munzner**, a graduate student at **Stanford University**, has extended hyperbolic browser technology into three dimensions by plotting the nodes onto a hemisphere instead of a circle. This allows the software to handle over 100,000 nodes by hiding those not relevant to a particular search.

There are two ways of mapping the hyperbolic plane: the **Klein** model and the more common **Poincaré** model. The latter works better for visualizing hierarchies because it preserves the fan-out shapes at nodes and uses the screen real estate more efficiently. As one navigates the display and changes the focus at the center of the disk, the rest of the hyperbolic plane fades off toward the edge of the disk. The effect resembles that of the fisheye lens, giving more room on the display to a point at the center than to points around the periphery.

Clicking on any visible point or dragging any visible point to any other position changes the focus smoothly with that point at the center. Regions closer to the center appear magnified while those further from the center shrink as they move toward the edge, allowing researchers to concentrate on the portion of interest and reducing distraction caused by unnecessary information. Thus, a hyperbolic browser can display up to ten times as many nodes and provide more effective navigation around the hierarchy, allowing the reader to browse the tree structure while maintaining the visual context.

Examples

Examples of hyperbolic browsers include **InXight’s Star Tree**, **epixtech** [<http://www.epixtech.com>], **ClearForest** [<http://www.clearforest.com>] and **HyperProf Mapiit**, a hyperbolic browser that provides a graphical display of patent citation information for U.S. and European documents. **Cone-Tree** is a 3-D tree that focuses on nodes the user touches and allows manual or automatic culling to show only items of interest.

Hyper-G⁶ represents Websites as nodes on a 3-D tree; but it does not use the fisheye paradigm. **Virtual Integration Technology’s** knowledge management product, **Deliverymanager**,⁷ incorporates a hyperbolic browser that allows users to navigate a business information directory and to retrieve corporate information throughout an enterprise. Customers can display the entire directory on a single screen and find relevant information at a glance instead of navigating through several directories.

TheBrain Technologies [<http://www.thebrain.com>] consists of a relational database with a visual presentation similar to hyperbolic trees. However, it differs in that it does not follow a hyperbolic structure mapped

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tree. (Mohageg⁸ shows that a hierarchical linking structure allows a faster search than either a linear or network organization.) Instead, **TheBrain Technologies** displays the primary node in the center (like a hyperbolic browser). The branches lead to other related nodes which can also have links to other nodes outside of its particular branch, as in a relational database. When one selects a particular node, it automatically moves to the center with a new set of related nodes radiating out from there. This allows a researcher to see both the nodes that are members of the same branch and any other related nodes — a significant difference from a hyperbolic browser. A Web engine, called **WebBrain** [<http://www.webbrain.com>], also developed by **TheBrain Technologies**, lets users select from sixteen primary subject areas.

Visualization techniques that use the fisheye paradigm usually let a researcher navigate toward the target location with a smooth transition. While a table of contents and 2-D tree structures are easier to learn and comprehend (see the **Chimera**, **R.** and **Nation**, **David A.** articles in the Additional Reading section), the hyperbolic browser's ability to zoom lets one concentrate on a specific area of interest with a minimum of distraction caused by unnecessary information.

Drawbacks

Hyperbolic trees are good for browsing collections; but they become unwieldy and almost useless for finding specific documents or pages when one does not know their location in the hierarchy. Readers who select particularly dense areas of a tree and try to move them to the center of the display will notice that the labels crowd each other out, making them impossible to read. Also, hyperbolic browsers require a **JavaScript**-enabled browser such as **Netscape** or **Internet Explorer** to operate.

Circular hyperbolic trees and 3-D tree representations may also disorient new users, thus requiring more training than flat structures. However, as the number of nodes increases, a flat layout of tree hierarchy may become unwieldy. Information on the nodes may become too small to identify — a problem that can be corrected with higher resolution displays. Although it will always be more difficult to locate a node in such hierarchies because of information overload, the fisheye paradigm helps overcome this problem by showing the relevant portions of information.

George Lawton⁹ says that the weakest link in getting text information to people is the speed at which people can read from the computer. He cites studies that indicate that the average person reads between 240-400 words per minute (wpm) from paper but only 100-200 wpm from a monitor because of the lower resolution and the need to manually scroll the text. **Peter McLan**, president of **Softology** [www.softology.com/] believes that people can absorb a maximum of 800-900 wpm which is almost four times faster than the average person can read on a computer screen.

Other constraints limiting reading speed include subvocalization and poor eye movement. Subvocalization refers to our habit of "speaking" the words in our minds when we read them. Poor eye movement refers to a habit of the eyes stopping repeatedly throughout a line of text. These factors limit most people to reading rates under 400 words per minute.

Critics believe that although hyperbolic trees and visually orientated relational databases are good for browsing collections, they will not replace traditional search engines any time soon. Information professionals will have to make an enormous cultural shift in currently ingrained conventions for searching and information retrieval. Neither the 2-D nor the hyperbolic browsers contain a sophisticated text retrieval engine with Boolean search capabilities; and initial studies have found almost no significant differences between the tree browser and the hyperbolic browser.

to a circular display area, even though it comprises nodes in a hierarchical

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References

- McKnight, C., Dillon, A., and Richardson, J. A comparison of linear and hypertext formats in information retrieval. In R. McAleese & C. Green (Eds.), *Hypertext: The state of art* (p. 10-19). Oxford, England: Intellect Books, 1990.
- Rouet, J., Lovonen J. Studying and learning with hypertext: empirical studies and their implications. In Rouet Jean-Francois, Lovonen Jarmo J., Dillon, Andrew, Spiro, Rand J.(Eds.): *Hypertext and Cognition*. Lawrence Erlbaum, New Jersey, 1996.
- Hawkins, Donald T. Information Visualization: Don't Tell Me, Show Me! *Online* 23, No. 1, January/February 1999, pp. 88-90.
- Lamping, John; Rao, Ramana; and Pirolli, Peter. Visualizing Large Trees Using the Hyperbolic Browser. *Proceedings of the Conference on Human Factors in Computing Systems*, April 13-18, 1996, Vancouver, British Columbia, Canada [<http://www.acm.org/sigchi/chi96/proceedings/video/Lamping/hb-video.html>].
- ibid.
- Andrews, Keith. *Browsing, Building, and Beholding Cyberspace*, New Approaches to Navigation, Construction, and Visualisation of Hypermedia on the Internet, Doctoral dissertation, Graz University of Technology, September, 1996.
- Lawton, George. Building the New Knowledge Interface: The GUI is passe. Advanced software and hardware technologies are converging in machine-human interfaces that vastly extend knowledge transfer capacities. *Knowledge Management Magazine*, February, 1999.
- Mohageg, M.F. The influence of hypertext linking structures on the efficiency of information retrieval. *Human Factors*, 34(3), 351-367.
- Lawton, George. loc. cit.

Websites

Xerox PARC's User Interface Research Group [<http://www.parc.xerox.com/istl/projects/uir/projects/InformationVisualization.html>] and [<http://www2.parc.com/istl/projects/uir/projects/ii.html>].
The Online Library of Information Visualization Environments (OLIVE) [<http://www.otal.umd.edu/Olive/>].
Spotfire [<http://www.spotfire.com>].
Pacific Northwest National Laboratories [<http://www.pnl.gov/infviz/>].
InXight Software [<http://www.inxight.com>].
Carnegie Mellon University, The Universal Library [http://www.ulib.org/webRoot/_hTree/].
TheBrain Technologies [<http://www.thebrain.com>].
TheBrain Technologies WebBrain [<http://www.webbrain.com>].

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by Edward W. Collieran (Director, Publisher Relations, Copyright Clearance Center) <ecollieran@copyright.com>

Copyright issues are taking center stage on college campuses, much as they have in the news, courts, and Congress. Controversial enforcement efforts by the **Recording Industry Association of America (RIAA)** are shining a spotlight on illegal music downloading. At the same time, public developments, such as the enactment of the **Technology, Education and Copyright Harmonization (TEACH) Act** (see related article, page 34) and copyright infringement litigation efforts targeting coursepack providers, are breaking new ground by helping to clarify lawful versus unlawful content usage.

These measures reflect the realities of a digital environment in which the benefit of easier access to information has further complicated the already sensitive issue of copyright compliance. Central to the discussion are library professionals who have the complex task of balancing two seemingly competing, but equally compelling, positions: the need for ready access to information that furthers the educational process; and the protection granted to authors and publishers to encourage continued creation of useful materials.

Widely regarded as the campus experts on copyright compliance, librarians offer knowledge and experience that helps their institutions solve these information and compliance challenges. They are accustomed to collaborating with fellow educators, authors, publishers and other sources of research, instructional and other materials in order to facilitate access to information.

Because they have been in the forefront of efforts to develop today's copyright compliance solutions, they are also the ideal candidates to help frame the debate and to determine whether and how to adapt the old rules to new media.

The Truth About Usage Trends

The impact of the digitization of material that previously would have been restricted to print has been mixed. On the one hand are those who portend the demise of books, journals, and other forms of "hard copy." On the other are some who believe the content opportunities of new electronic formats to be wildly overstated. Not surprisingly, publicly available research, as well as our own experience at **Copyright Clearance Center**, indicate that the truth lies somewhere in the middle. In fact, a recent survey by **Outsell, Inc.** indicates that while students and faculty continue to rely on print media, they tend to supplement printed materials with electronic content.

Conducted in collaboration with the **Digital Library Federation (DLF)** and the **Council on Library and Information Resources (CLIR)**, the **Outsell** survey is one example of **DLF's** ongoing efforts to gauge changing patterns of information use and their impact on libraries and library professionals.¹ According to **CLIR's** report on the survey, entitled "Dimensions and Use of the Scholarly Information Environment," **Outsell** interviewed 2,208 faculty members and graduate and undergraduate students at public and private doctoral research universities, plus 1,026 faculty members and undergraduates at private liberal arts colleges, for a total of 3,234 survey respondents. Among the survey's findings:²

- Although more than 70 percent of faculty and graduate students rely heavily on print for teaching, almost 68 percent of faculty members also maintain Web pages for their students. In addition, they make course information available on reserve at the library, in the campus bookstore and in the copy center.
- Just over half of undergraduates say they rely on print sources all or most of the time, compared with more than 70 percent of graduate students and faculty.
- Graduate and undergraduate students turn to the physical and virtual library to meet 65 percent to 70 percent of their information needs. They also use the library's Web site as their gateway to online resources. In fact, more than 60 percent of their online sources are accessed via the library's site.
- About 16 percent agree with the statement, "The Internet has not changed the way I use the library."
- 41.5 percent say they work and study away from campus more than they used to.
- Over 98 percent of those surveyed trust their library to contain information "from credible and known sources." In contrast, 75.4 percent believe that the Internet "provides high-quality information."

These findings underscore the critical function of the library and the expanded responsibilities of library professionals in an evolving information landscape.

Librarians and library directors remain invaluable resources for those seeking access to both print and electronic information, be it for teaching, learning, or research. They are on the front line of the information revolution, bearing witness to emerging trends, identifying potential copyright and usage issues, and identifying solutions. They also play an integral role in fulfilling new requirements—particularly for institutions that take advantage of **TEACH**—to develop campus-wide copyright policies and follow through with the education that can ensure compliance.

What Does the Future Hold?

Not surprisingly, future challenges and opportunities have their roots in the current information environment. Digital technology will continue to drive changes in the way we access information and in the steps we take to ensure that such access complies with copyright law.

While there is every indication that paper and printed materials will remain integral to instruction and research, increasingly they will be supplemented by electronic information. Already evident in the growing use of electronic course materials, this trend is liable to continue in part because, as the **Outsell** survey indicates, younger students are more comfortable with electronic media. As authors and publishers become more convinced of the advantages of presenting information in this format, more adept at doing so, and more committed to providing users with convenient access to the rights to use such information, the digitizing of existing materials is likely to accelerate.

Today's successful copyright and licensing solutions are apt to serve as models for the solutions of the future. Online services, such as those at **Copyright Clearance Center's** www.copyright.com, which offer immediate access to content reuse rights are expected to continue to gain in popularity. Blanket licenses, currently offered to businesses as a convenient, economical option, may be modified to meet the needs of academic users and to encourage lawful use of copyrighted works by faculty and students alike.

Technological advances, such as more flexible, user-friendly versions of rights management tools, will ensure access to information for target audiences while protecting the rights of authors, publishers and other rightsholders. These same tools will enable library professionals to better meet the needs of information users. Content management software can, for example, automatically record usage patterns to assist librarians with collection management decisions. Little-used materials could then be replaced with additional copies of high-demand works, or with new publications of interest to library customers.

The current focus on copyright compliance is a harbinger of things to come. The most obvious example, of course, is the firm stance adopted by the **RIAA**. Equally significant, however, are the **TEACH Act** requirements that institutions educate users about copyright policies and mandate compliance. One way to respond to this would be

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Additional Reading

Allen, Maryellen Mott. The Hype Over Hyperbolic Browsers Online 26:3 (May/June 2002) pp. 20-22, 24, 26, 28.

Chimera, R., Wolman, K., Mark, S., Schneiderman B. (revised Sept. 1993) An exploratory evaluation of three interfaces for browsing large hierarchical tables of contents, *ACM Transactions on Information Systems*, vol.12., #4 (Oct. 94) 383-406. CS-TR-2620, CAR-TR-539] shows that tables of contents that allow the user to expand and contract levels of the hierarchy decrease browsing time compared to a stable, fully-expanded version.

Lamping, John and Rao, Ramana. The hyperbolic browser: A focus+context technique for visualizing large hierarchies. *Journal of Visual Languages and Computing*, 6:4, 1995.

Nation David A.; Plaisant, Catherine; Marchionini, Gary; and Komlodi, Anita. Visualizing Websites using a hierarchical table of contents browser: **WebTOC** [<http://www.cs.huji.ac.il/~sdbi/1999/elik/nation.html>] describes a method for visualizing the contents of a Website with a hierarchical table of contents using a Java program and applet called **WebTOC**. Early results from user studies suggest that **WebTOC** is easily learned and can assist users in navigating Websites.