Visual Interfaces to Digital Libraries – The First International Workshop at the First ACM+IEEE Joint Conference on Digital Libraries

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Backgound Today's digital libraries are content rich, multimedia, multilingual collections that are distributed and accessed world wide 24/7. They store large amounts of digital data and might contain the all human knowledge soon. However, their interfaces provide very limited capabilities (simple string search, formal Boolean etc.) to access, understand, and manage this knowledge. The gap between the amount of knowledge available and the tiny portions human users are able to understand and process is increasing steadily.

Visual interfaces to DLs aim to shift the user's mental load from slow reading to faster perceptual processes such as visual pattern recognition. They draw on progress in the new field of Information Visualization. In short, Information Visualization "…is a process of transforming data and information that are not inherently spatial, into a visual form allowing the user to observe and understand the information." (Gershon and Eick, First Symposium on Information Visualization). It uses "…computer-supported, interactive, visual representations of abstract data to amplify cognition." (Card et al., 2000).

Information Visualization is rooted in geography, scientific visualization; not even 10 years old but growing fast. It is far reaching (IR, WWW, DL, HCI, etc.); has an interdisciplinary nature: computer graphics, electronic engineering, information systems, geography, information science, to name just a few; and a tremendous potential to improve/change the way we access, process, and manage information. It is facilitated by the decreasing cost of storage and computing power; the explosion of information available digitally (on the WWW); fast graphics processors; larger hard disk sizes; high resolution color monitors; alternative, multi-modal user interfaces Idesk, CAVE (Cruz-Neira et al., 1993); rapidly expanding connectivity between systems; increasing visual intelligence, among others. In addition, work is becoming more 'knowledge-oriented'. Information visualization is also facilitated by the current mismatch between computer displays and the human perceptual system as well as the mismatch between computer controls and human motor functions.
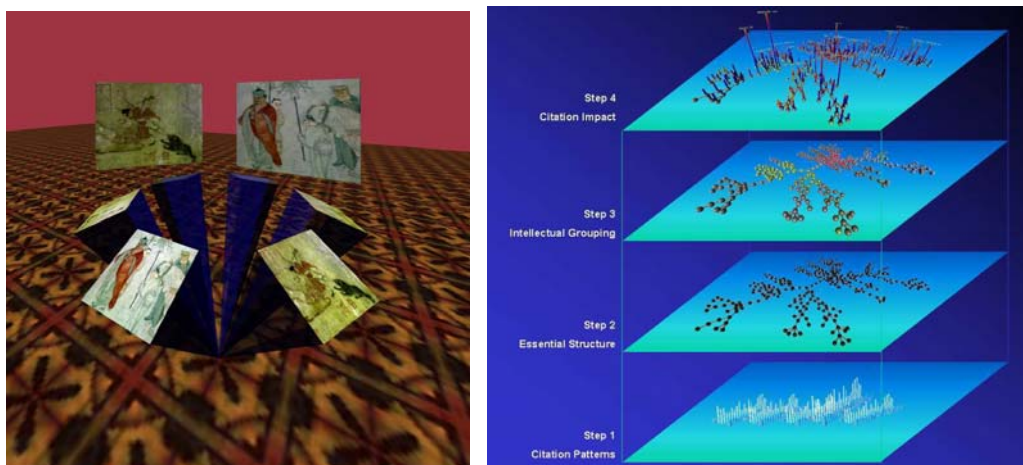
Figure 1: Sample visual interfaces to digital lbraries

Examples of Visual Interfaces are depicted in Figure 1. The LVis Digital Library Visualizer uses Latent Semantic Analysis (Landauer et al, 1998) to extract salient semantic structures and citation patterns automatically. Cluster techniques and a modified Boltzman algorithm are

used to spatially visualize co-citation patterns and semantic similarity networks of retrieved documents for interactive exploration (Börner et al., 2000). Work by Chen & Ray (2001) aims to visualize a knowledge domain's intellectual structure. Traditional author co-citation analysis (ACA) is extended by extracting structural patterns from the scientific literature and representing them in a 3D knowledge landscape. Integrating citation and co-citation patterns provides a rich, ecological representation of a knowledge domain. Users can apply visualizations to discover patterns and make valuable connections among data.

Well Designed Visualizations help
- Reduce visual search time (e.g. by exploiting low level visual perception).
- Provide a better understanding of a complex data set (e.g., by exploiting data landscape metaphors).
- Reveal relations otherwise not being noticed (e.g., by exploiting the mind's ability to see relationships in physical structures).
- Enable to see a data set from several perspectives simultaneously.
- Effectively communicate information

It is our belief that visual interfaces to DL's can assist
- To provide rapid and efficient access to enormous amounts of multi-media knowledge and information.
- To analyze document collections in new ways.
- To leverage information (annotations, digital dog ears, footsteps) from previous users.
- To facilitate information sharing & collaborations.

The First International Workshop on "Visual Interfaces to Digital Libraries" was held at the first ACM+IEEE Joint Conference on Digital Libraries in Roanoke, VA, USA on June 28th 2001. The one-day workshop draw an international audience of 37 researchers, practitioners, and graduate students in the areas of information visualization, digital libraries, human-computer interaction, library and information science, computer science, and geography.

Figure 2: Almost all workshop attendees. Photo taken by Doug Pearson.

The primary aim of the workshop was to raise the awareness of several interconnected fields of research related to the design and use of visual interfaces to digital libraries, especially in information visualization, human-computer interaction, and cognitive psychology.

The workshop started with Katy Börner's introduction and overview, followed by an invited talk from Stephen Eick of Visual Insights, entitled "Visualizing On-line Activity". Stephen explained how their eBizInsights provides a rich visual interactive workspace for analyzing users' access to a given website and discovering browsing patterns.

In a self-introduction session, all participants introduced themselves, especially on their interests and what they expected from the workshop. Eight papers were presented in two

sessions. The topics ranged from literature visualization, spatial hypertext, to geographic information systems.

1. Buzydlowski et al.: Co-Cited Author Analysis as an Interface for Digital Libraries
2. Weiss-Lijn et al.: Supporting Document Use Through Interactive Visualization of Metadata
3. Buchanan et al.: Spatial Hypertext as a Reader Tool in Digital Libraries
4. Sullivan: Hilbert Problems in Visual Interface Development/Evaluation
5. Skupin: Cartographic Considerations for Map-like Interfaces to Digital Libraries
6. Cai: GeoVIBE: A Visual Interface to Geographic Digital Library
7. Boyack et al.: Information Visualization, Human Computer Interaction, and Cognitive Psychology: Domain Visualizations
8. Christel: Accessing News Video Libraries through Dynamic Information Extraction, Summarization, and Visualization

Figure 3: Interactive demo's on large screens. Many participants experienced 3-dimensional virtual reality at VRCO's VGeo system demo for the first time.

Two interactive demonstration sessions included a demo of VRCO's VGeo system and demos from many WS attendees. An expert panel discussed the future of research and development and started formulating top-ten research challenges for visual interfaces to digital libraries to help focus and guide research. In his concluding remark, Chaomei Chen outlined promising areas for future information visualization research: Visual Information Retrieval, Visual Information Exploration, Visual Information Organization, Accommodating Individual Differences, Supporting Collaborative Work, Information Visualization for Bibliometrics, Information Visualization for Scientometrics, Knowledge Tracking, Knowledge Discovery, Designing and Deploying Tangible and Meaningful Visual-Spatial Metaphors in Digital Libraries.

Figure 4: Expert panel. Several experts have been purposefully placed in the audience resulting in a very lively discussion.

The workshop has achieved its goal to bring together people across disciplines and stimulate people's interests in this multidisciplinary research. In response to the enthusiastic audience, the high-quality inputs, and many promising work in progress, we plan to hold the workshop again at the next JCDL Conference in Portland, Oregon, US, July 14-18, 2002.

Papers, presentation slides, and other information are available from the workshop's homepage http://vw.indiana.edu/visual01/.

The workshop was sponsored by Virtual Reality Software & Consulting. Their homepage is http://www.vrco.com/. We would like to thank the JCDL organizing committee for their support.

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