

Big See: Large Scale Visualization

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Display size and resolution has been increasing at a steady pace with the economies of scale of personal computing. Wall-sized displays, previously only seen in control centres like NASA's are now affordable and being used for information visualization. But what do we know about the constraints and opportunities design of information displays for such Large Scale Information Displays (LSIDs)? How can one design text visualizations to take advantage of the large scale and public space of a LSID? In this paper we will:

1. Describe the variety of technologies being used to create LSIDs and some example installations.
2. Discuss the literature about LSID design and selected examples of visualizations we believe suitable. In this context we will present the design principles that we have drawn up to guide our work.
3. Conclude by showing two text visualization implementations for LSIDs.

1. Technology

There are a variety of technologies for creating LSIDs from tiling LCDs to creating a wall display with rear projection data projectors. In Canada the most common form of LSID in universities are the Access Grid nodes installed at Compute Canada high performance computing (HPC) locations such as the WestGrid node at the University of Alberta.¹ These typically have three coordinated displays (either LCD or projectors) and are used for multi-point video conferencing and interaction. The Big See grew out of collaboration between the SHARCNET HPC consortium and the TAPoR project at McMaster to explore visualization. Other relevant technologies include control devices like multi-touch (popularized by the iPhone) that let multiple users use a display at the same time and 3D technologies that provide a more immersive experience. In this paper we will talk about three example technologies, the important and early Liveboard project which was part of Xerox's Ubiquitous Computing research in the 1990s², the HiPerWall set up by the Software Studies Initiative at UCSD³, and the more modest Access Grid technology we are working with.

2. Design

Much of the research around LSIDs focuses on the technology, it is only recently that research has focused on usability of and information design for visualization. Bezerianos and Balakrishnan in "View and space management on large displays" provide a nice overview of the challenges for interaction design for LSIDs:

- "Remote Reaching" – on LSIDs users can't reach items (with a mouse) in the display the way they do on desktop displays. The challenge is to provide ways to reach over the distances of the canvas.
- "Space and Layout Management" – from any given distance parts of the LSID may not be visible to the user or they may not be able to see detail if they are standing back. The challenge is how to manage the layout of a LSID, especially if there are borders between

¹ Access Grid <accessgrid.org> is a coordinated set of technologies for group interaction. It includes display, videoconferencing, and control technologies. For a concrete example see the U of Alberta page:

<www.ualberta.ca/CNS/RESEARCH/AccessGrid/progress.html>

² See <www.kraka.com/DesignPortfolio/liveboard.html>

³ See <vis.ucsd.edu/mediawiki/index.php/Research_Projects:_HiPerWall>

tiled screens.

- “Aided Context Switching” – the way different panels (windows) of information interact on a LSID, especially if it is being used by multiple people, is different. The challenge is how to help users switch contexts.

In addition we note that LSIDs are typically used by groups of people, not individuals before a “personal” computer. Groups include people at different distances who may interact with each other, approach the screen or stand back, depending on the design of the room. There is much to learn from mural painters about how they manage layout for large spaces where viewers approach and pass. In the paper we will review some conclusions from the literature about designing for LSIDs like Yost and North (2003) who concluded that while using a large display, it is spatial organization that takes precedence over the attributes presented on screen when attempting a specific task. This will lead to a review of selected influential visualization designs that we believe have the capability to scale to LSIDs like the Trendalyzer⁴, developed by Hans Rosling, the Newsmap⁵, and TextArc⁶. We will conclude this part of the paper with the design principles we have drawn from the literature and our experience:

1. LSIDs are for **coordinated views**. They can show many panels with different, but coordinated information. They make possible showing many views on the same phenomenon that are synchronized.
2. LSIDs are **shared in time and space**. They are in public spaces that are shared. They make possible the shared use by many people at the same time.
3. LSIDs **show breadth and depth**. They can show all of the items in a dataset and all the detail of each item.
4. LSIDs are **seen to be approached**. The way to approach is designed so that you can see at different distances, moving close and back.
5. LSIDs **need not show control**. Control (like menus and toolbars) can be moved off the screen to other devices (like tabletops or handhelds.)

3. Demonstration

We will conclude the paper by presenting two demonstrations of text visualizations designed for LSIDs. The first, the Big See, was developed with SHARCNET to explore high performance visualization and it generates an interactive 3D visualization of a text like a pipe of distributions that can be manipulated for different views. It was written for 3D viewing and parallelization. The second, Lava, draws on archaeological informatics to propose a layered 3D interactive view of a collection that again, can be manipulated to view parts without losing the context of the whole.

4. References

Bezerianos, A., & Balakrishnan, R. (2005). “View and space management on large displays.” *Computer Graphics and Applications, IEEE*, 25(4), 34-43.

Yost, B., & North, C. (2006). “The perceptual scalability of visualization.” *IEEE Transactions of Visualization and Computer Graphics*, 12(5), 837-844.

⁴ Trendalyzer by Gapminder <www.gapminder.org/> is now available as a web-service at Gapminder World, <www.gapminder.org/world/>.

⁵ See <newsmap.jp/>

⁶ See <www.textarc.org/>