Designing and Evaluating 3-Dimensional Collaborative Information Spaces

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Overview

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1. Background

**Name:** Katy Börner

**Research:** Collaborative Information Visualization

**Teaching:** 3-D Collaborative Information Spaces
Human Computer Interaction
Information Visualization

**JCDL Workshop 2001**

Visual Interfaces to Digital Libraries - Its Past, Present, and Future

Workshop Organizers:
K. Börner, Indiana University, US & C. Chen, Brunel University, UK

Program Committee:
A. Blandford, K. Boyack, M. Dodge, X. Lin, J. MacCull, S. Mukherjea, S. O'Hare & H. Small
AkuVis  (Interactive Visualization of Acoustic Data, 1997/98)

Purpose:
3D visualization and interactive audio-visual exploration of acoustic noise data collected by the German TÜV used for governmental decisions about noise protection regulations for new streets, industrial areas etc.

Technology: iDesk
Mode: Single User

VegoWelt (Virtual Lego World, 1998/99)

Purpose:
Uses a children's playroom scenario for demonstrating and evaluating the support of manipulation activity.

Technology: CAVE
Mode: Single User

2. Visual Interfaces to Digital Libraries

Today’s digital libraries are
- Content rich, multimedia, multilingual collections.
- Distributed and accessed worldwide 24/7.
- Huge & growing.

Visual interfaces to DLs draw on progress in the new field of Information Visualization.

Major strategy:
Shift user’s mental load from slow reading to faster perceptual processes such as visual pattern recognition.
Well Designed Visual Interfaces ...

- 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.
- Are effective sources of communication.
- Facilitate communication & collaboration.
LVis (Digital Library Visualizer, 1999/2000)

Purpose:
Aims at the support of the navigation through complex information spaces.

Technology: CAVE
Mode: Single User


See also http://ella.slis.indiana.edu/~katy/InfoVis/
LVvis (Digital Library Visualizer, 1999/2000)

Present search results not as rank-ordered lists of matching documents but as clusters of semantically similar documents
LVis (Digital Library Visualizer, 1999/2000)

Data Analysis

- Latent Semantic Analysis
- Hierarchical Clustering
- Selection of Best Partition
LVIs (Digital Library Visualizer, 1999/2000)

System Architecture

Preprocessing Time

Data Analysis

Latent Semantic Analysis → Document-Document Similarity Matrix

Retrieval Time

Display

Spatial Layout

Clustering

List of Matching Documents

Search Engine

Query

Document Databasis
LVis (Digital Library Visualizer, 1999/2000)

Prototype Systems

Science Citation Index, ISI

DIDO Image Data Bank, IU

Slide Library Collection

Your search returned 27 possible images

Mark the images to save

If your search has more than 15 hits, please check the boxes of those you'd like to see. Searchers with 15 hits or less automatically display thumbnail images. Check the box by the images you'd like to see, then click on "Save your Selections".

- Mount Haystacks in the Snow, MONET, CLAUDE, Haystacks in the Snow, 1891, col. 65.4 x 92.1 cm., N.Y., Met. Mus., Metropolitan: 2/14/79.BB.96, 19 PTG FRANCE
- Mount Royal Cathedral, Morning, MONET, CLAUDE, Royal Cathedral, Morning, 1894, col. 100 x 65 cm., Philadelphia Museum, Rosenbach: 139/2/19/4 BB.96, 19 PTG FRANCE
- Mount Poppens on the Bank of the Epte River, MONET, CLAUDE, Poppens on the Bank of the Epte River, 1881, col. 100 x 65 cm., Philadelphia Museum, Morisseau: 139/2/19/4 BB.96, 19 PTG FRANCE
Dido Image Bank: The MONET Cluster
LVVis (Digital Library Visualizer, 1999/2000)

Data Visualization: 3-D Immersive VE

“head” into a search result - “get inside a head”
LVis (Digital Library Visualizer, 1999/2000)

Data Visualization: 3-D Immersive VE
LVis (Digital Library Visualizer, 1999/2000)

Data Visualization: 3-D Immersive VE
LVIs (Digital Library Visualizer, 1999/2000)

LVIs - Usability Studies

Comparison of text-based and 2-D desktop interface and 3-D immersive CAVE interface

- Error rates and completion times for a range of different tasks
- Learning curves (2-D visualization & Wand)
- Free sorting tasks
- Navigation 3-D immersive Virtual Environments
LVis (Digital Library Visualizer, 1999/2000)

Students Working in LVis

Data Analysis:
- Andrew J. Clune, Department of Computer Science

Interface Design:
- Ryan Schnizlein, Department of Computer Science
- Ho Sang Cheon, Dept of Telecommunication
- Kevin Kowalew, UITS & Jose Montalvo, SLIS

Usability Studies:
- Sumayya A. Ansari, SLIS
- Tyler Waite, SLIS
3. Collaborative Information Visualizations

IVs:

- Use computer-supported, interactive, visual representations of abstract data to amplify cognition (user’s mental load is shifted from slow reading to faster perceptual processes such as visual pattern recognition).

CIVs:

- Can be examined (in 3-D) by groups of users. Computer acts as communication facilitator.
Collaborative 3-D VWs Offer

- Natural, multi-perceptual interaction engagement - spatial sound, animation, video, ... (Brill, 1993).
- Exploitation of spatial metaphors. Connecting information to space. Spatial maps that ease navigation can be build more easily, e.g., Memory Palaces.
- Sophisticated self representation (avatars wave, dance, ..., interact).
- Change of perspective - avatar view or third person view (Loftin, et al., 1993; Dede, et al., 1996)
- Presence (Barfield & Weghorst, 1993) & Telepresence (Steuer, 1995; Biocca, 1995).
- Real context of interaction. Environment supports talk, triggers discussion.
- Shared awareness promotes informal communication - brief, unplanned, frequent (Kraut et al., 1988; Whittaker et al., 1994).
- Abstract concept representation (Byrne, 1996; Winn, 1993).
- Physical proximity is fundamental to structuring and visualizing a semantic space for informal communication and social construction of knowledge (Chen, 2000).
- Worlds are available online 24/7.
- Bots.
- User logs.
3-D Online Browser Systems

- Community Place [www.community-place.com](http://www.community-place.com)
- Blaxxun's online community client-server architecture [www.blaxxun.com/community](http://www.blaxxun.com/community)
Active World: 2-D Web Space & 3-D VW

- Toolbar for Avatar Actions
- List of Worlds
- 3-D Graphics Window
- Web Browser
- Chat Window
The Active Worlds Educational Universe or EduVerse (http://www.activeworlds.com/edu/) is a special universe with an educational focus.

It hosts more than 150 worlds including University of Colorado at Boulder, University of California at Santa Cruz, Cornell University, University College London, Center for Advanced Learning Technologies, and United Nations, etc.

It provides a very active research environment.
VLearn3D Initiative began in December 1998 as part of the Contact Consortium [http://www.ccon.org/].

The goal of VLearn 3D is to provide immediate access to people, tools, resources, and ideas to educators who are developing, adopting and pioneering virtual environments for education.

**VLearn3D 2000 “Live 3D, Learn 3D”**
[http://www.vlearn3d.org/conference/proceedings.html]

**VLearn 3D 2001** will be on Dec 1st, 2001

One of the real world sites will be hosted at IU.

**VLearn 3D journal in 2002**
iUniverse (Collab. Info. Universe for IU, 2000/01)

Purpose:
Aims at the design and evaluation of collaborative 3D online ‘Learning Environments’ for IU faculty.

Technology: Active Worlds, Desktop
Mode: Multiple User


See also http://ella.slis.indiana.edu/~katy/iUni/
iUniverse (Collab. Info. Universe for IU, 2000/01)
Learning Environments in iUni

**Quest Atlantis - Educational theme park for Boys & Girls Club, BL**
Client: Sasha Barab, School of Education
Designers: Mark Dial & Hakan Tuzun

**Natural Disaster Area & Science House**
Client: Bill Harwood, School of Education
Designers: Maggie Swan & Kent Holaday

**Virtual Collaboration Area**
Client: Alan Dennis, Kelley School of Business
Designers: Tim Bowman & Randy Fisher

**Art Cafe**
Client: Lilly Lu, School of Education
Designers: Symiaw Lin & Lilly Lu & Gertrud Peters
iUniverse (Collab. Info. Universe for IU, 2000/01)
Memory Palace (Collab. Info. Visualizations, 01/02)

Purpose:
Provide intuitive, efficient, and collaborative document access for a scholarly community.

Technology: Active Worlds
Mode: Multiple User


See also http://vw.indiana.edu
Mirror Garden (Collab. Info. Visualizations, 01/02)

Purpose:
Visualizes user interaction data to evaluate the effectiveness and usability, to optimize design properties, or to examine the evolving user community of a world.

Technology: Active Worlds
Mode: Multiple User

See also http://vw.indiana.edu
Usage Patterns of Interest (I)

**General usage patterns**
- Where do users login from?
- Who are they?
- How long do they stay?
- Do they login regularly or irregularly?
- How many people are in the world at which time?
- Are there general bursts of activity?

**Navigation patterns**
- Which general routes do users take?
- What are the most popular places?
- How do people move and place themselves in urban space?
- Are there well-traveled paths that may indicate a particular problem solving strategy?
- Which places are multi-way branching places, pass through places, or (final) destination areas?
Usage Patterns of Interest (II)

**Manipulation patterns**
- Who manipulates which objects, when?

**Conversation patterns**
- Where do people talk?
- Which places in 3D are used for long, intricate, never-ending discussions and which are sites of quick exchanges?
- How long, about what, whom do people talk to?
- What is the size of conversational groups?
- How do conversational topics evolve?
- How does the environment influence conversational topics?

**Web access patterns**
- Which webpages are accessed by whom, when, from where, and how often?

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- AVL/UIT/S, IU collaborating with SLIS to bring up an AW universe server for IU faculty in Fall 2001.
- ActiveWorld providing free hosting of 3-D VWs and an active research environment in EduVerse.
4. Discussion

- Collaborative Information Visualizations aim to improve shared information access and to evaluate 3D VE's/VWs.
- CIVs offer high availability/low quality via desktop VR & limited availability/high quality in the CAVE.

Questions:
- How to attract users?
- How should user interaction shape the VW/VE?
- What worlds are most successful?

“What attracts people most, in sum, is other people.”
(William H. Whyte)
Come Visit Our Worlds!

Download the free Eduverse 3-D browser from
http://objects.activeworlds.com/browsers/eduverse.exe

Install it by double clicking the eduverse.exe file, launch
the browser, enter as a tourist, and visit us in the worlds
‘iUni’, ‘iScape’, ‘i-Palace’ or ‘i-Garden’.

More information is available at http://vw.indiana.edu.