Information Visualization

L501 Guest Lecture
Sept 30th, 2002
Facing the Information Flood

Over the last decade

• **CPU speed & Hard disk sizes** have increased by *two orders of magnitude*.

• **Bandwidth:** Since the invention of the web browser, international IP bandwidth deployments have more than *doubled each year*.

• **Monitor Resolution** has increased by a *factor of 4* (800x600 -> 1600x1200).

• **Information** available in electronic form doubles every *18 months*.

• **Human perception** stays *constant*.
Information Access in the Information Age

Let’s see how much our means of accessing information have changed.

http://www.archive.org/index.html

Yahoo Oct 17, 1996

- Arts - Humanities, Photography, Architecture ...
- Business and Economy [Xiral] - Directory, Investments, Classifieds ...
- Computers and Internet [Xiral] - Internet, WWW, Software, Multimedia ...
- Education - Universities, K-12, Courses ...
- Entertainment [Xiral] - TV, Movies, Music, Magazines ...
- Government - Politics [Xiral], Agencies, Law, Military ...
- Health [Xiral] - Medicine, Drugs, Diseases, Fitness ...
- News [Xiral] - World [Xiral], Daily Current Events ...
- Recreation and Sports [Xiral] - Sports, Games, Travel, Arts, Outdoors ...
Yahoo Sept 2, 2002
Google, Sept 2, 2002
Amazon
Sept 02, 1999

Amazon.com—Earth's Biggest Selection - Netscape

Search

Amazon.com

Welcome to Amazon.com

Hello! Shopping at Amazon.com is 100% secure—guaranteed.
Already a customer? Sign In.

In Books
Child's Play

The extraterrestrial Bugs are back in "Ranger's Shadow," and only Bean can stop them. In a worthy companion piece to "Ranger's Games," Orion Scott Card revises his entire cast of child warriors but keeps the focus firmly on this brilliant, pint-size tactician. Go to Books.

In Video
Blair Witch Bonus

The scariest movie of the year just got scarier—with six "newly discovered" minutes of film from the ill-fated journey of Heather, Josh, and Mike. Also, see two minutes of other unseen footage online exclusively at Amazon.com, and pre-order your copy of The Blair Witch Project (in VHS, DVD, and CD-ROM).

Amazon.com 100 Hot Books

Updated Hourly

1. Harry Potter and the Prisoner of Azkaban
   by J. K. Rowling
2. In Pursuit of the Proper Sinner
   by Elizabeth George
3. Harry Potter and the Sorcerer's Stone
   by J. K. Rowling

K. Borner
Conclusion:
Almost no development. Can’t pack more text.

Opportunity & Challenge:
Shift user’s mental load from slow reading to faster perceptual processes such as visual pattern recognition.

A picture is worth a thousand words …
Information Visualization – Definition

“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.”

(Source: Gershon and Eick, First Symposium on Information Visualization)
Facts about Information Visualization

- Rooted in geography, scientific visualization.
- Not even 10 years old.
- Growing fast.
- Far reaching (IR, WWW, DL, HCI).
- Interdisciplinary nature: computer graphics, electronic engineering, information systems, geography, information science, ...
- Tremendous potential.
Books

Readings in Information Visualization: Using Vision to Think
by Stuart K. Card, Jock D. MacKinlay, Ben Shneiderman, Jan 1999

Information Visualization: Perception for Design
by Colin Ware, Dec 1999

Information Visualisation and Virtual Environments
by Chaomei Chen, Nov 1999

Information Visualization
http://www.ee.ic.ac.uk/research/information/www/Bobs.html

Mapping Cyberspace
by Martin Dodge and Rob Kitchin, Nov 2000
http://www.mappingcyberspace.com/

K. Borner
IV is facilitated by

- Decreasing cost of storage and computing power.
- The explosion of information available digitally (on the WWW).
- Fast graphics processors.
- Larger hard disk sizes -> more information available quickly.
- High resolution color monitors.
- Alternative user interfaces Idesk, CAVE (2 hands, audio, 3D).
- Connectivity between systems is expanding rapidly.
- Work is becoming more ‘knowledge-oriented’.
- Increasing visual intelligence.

- The mismatch between computer displays and the human perceptual system.
- The mismatch between computer controls and human motor functions.
Bad motivations for IV

- Dumb it down with graphics
- The future will be like “Neuromancer”, “Snow Crash”, “The Matrix”.
- “You should see this cool 3D thing I just cooked up”.

“Go for enthusiasm of users not of builders!”

Problem:
- Quantitative analytical skills are rare.
- Visual design skills are rare.
- Combination is very rare. Often there is active hostility between the two.
Well designed visualizations …

- Provide an ability to comprehend huge amounts of data.
- Reduce search time and reveal relations otherwise not being noticed (perception of emergent properties).
- Often reveal things not only about the data but how the data was collected - errors and artifacts jump out.
- Facilitate hypothesis formulation.
- Are effective sources of communication.
Scientific Visualization maps physical phenomena onto 2D or 3D representations. Not very interactive.

Information Visualization aims at an interactive visualization of abstract non-spatial phenomena.
Information Vis or Scientific Visualization?
Process Model

1. User and task analysis.
2. Visual perception criteria.
3. Data selection.
4. Data analysis/mining.
5. Graphical layout.
6. Usability and evaluation.

To be fully understood IV has to become an integral part of users’ activity (Chen, 1999).
L697: Advanced Topics Course in Information Visualization
Spring 2002
by Katy Borner, SLIS

Students from other departments with extensive knowledge of Java are welcome!

Course Description:
http://ella.slis.indiana.edu/~katy/L697
1. User and Task Analysis

User Analysis

• What is the main end user target population of the interface (computer knowledge, content knowledge, age)?
• What are their skills?
• Are they experts or one-time users or both?
• Which other technology do they use?
• How often will they use the tool?

Task Analysis

• What are the main user goals?
• What decision do they want to make?
• What typical tasks do users perform today and how will this improve with the new tool?
• What do users dislike about the current interface?
• Which functions are used most often?
2. Visual Perception

- All humans have more or less the same visual system.
- Visual system has evolved over tens of millions of years and is optimized to perceive and act within natural environment.
- Visual system is used for survival, for navigation, food seeking, tool use.
- If we can understand how it works we can produce better visualizations!
3 & 4. Data Mining and Layout

http://ella.slis.indiana.edu/~katy/L697/code/
5. Usability and Evaluation – Student Projects

Stock Tracker
Larry Mongin & Steve Rice
L542 Introduction to Human Computer Interaction
Examines the human factors associated with information technology and seeks to provide students with knowledge of the variables likely to influence the perceived usability, and hence the acceptability, of any information technology. In so doing it will enable students to progress further towards specialist work in the important field of human-computer interaction.

To view a grade distribution, please select the semester node, i.e. 1-2000, from the hyperbolic tree.

L542, 1-2000
BORNER

Course Grade Distribution for L542

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SLIS Student Academic Career Viewer
Jason Baumgartner & Tim Waugh
Newsgroup Votes Visualization
David Heald (Collaborator John C. Paolillo)
Hyperbolic Tree Visualization of Roget's Thesaurus
Jason Baumgartner & Tim Waugh (Collaborator John Old)
Bookmark Visualization

Ying Feng (Collaborator Katy Börner)

K. Börner
Fall 2002: 1.5 credit workshop by Jason Baumgartner

**L595 Java Primer**

[http://ella.slis.indiana.edu/~jlbaumga/l595java/](http://ella.slis.indiana.edu/~jlbaumga/l595java/)

Spring 2003: 3 credit course by Jason Baumgartner

**L575 Information Visualization (formerly L697)**

[http://ella.slis.indiana.edu/~katy/L697/](http://ella.slis.indiana.edu/~katy/L697/)
Visualizing Knowledge Domains
2002.06.20

Recent Publications


For more information please contact

Katy Börner, Indiana University
katy@indiana.edu
http://ella.sils.indiana.edu/~katy/research/
Kevin Boyack, Sandia National Laboratories
kboyack@sandia.gov
Visualizing Knowledge Domains
(Collaboration with Chaomei Chen & Kevin Boyack)

1. What are the major research areas, experts, institutions, regions, nations, grants, publications, journals in xx research?
2. Which areas are most insular?
3. What are the main connections for each area?
4. What is the relative speed of areas?
5. Which areas are the most dynamic/static?
6. What new research areas are evolving?
7. Impact of xx research on other fields?
8. How does funding influence the number and quality of publications?
Jan 17th, 1:30-2:45p, SLIS Doctoral Colloquium:

Techniques for the Visualization of Knowledge Domains
Visualizing 3-D Virtual Worlds & Their Users

3-D Graphics Window

ToolBar for Avatar Actions

List of Worlds

Chat Window

Web Browser
Visualizing 3-D Virtual Worlds & Their Users

Active World Mapper

This is a research project. Generated maps will be available at http://uni.sis.indiana.edu/map/html/maplist.html

Please enter

World Name: 

World Size: [How to determine worldsize]

Contact Person: 

Email: 

Please upload

World Props dump: 

World Registry (Optional): 

Map It  Start Over

Click on map to teleport to corresponding 3D space.

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Last Updated 01/22/02
Visualizing 3-D Virtual Worlds & Their Users

Chat Log Visualizations for Five Teams

Number and length of utterances

Time sequence of different activities (yellow=chat, red=web access) showing times of active chat interaction and solitary information search.
Spatial and Temporal Distribution of User Navigation Data for Team 2, 3 & 4
The Power of Visualizations

- Visualizations are not objective, neutral artifacts.
- They are created. They include or leave out information.
- They communicate particular messages.
- Commonly, the messages are those of the powerful who pay for the visualizations.

Deconstruct Visualizations!

By questioning who the visualization was made for, by whom, why, and based on which data!