

Trees and Networks

Thursday 1 Nov 2007
 Polle Zellweger

Today's Lecture

- Goals of tree & network visualization
 - View structure & connectivity, node properties
- Challenges of trees & networks
 - size, structure, navigation, animation
- Trees / hierarchies
 - Node-link: 2D & 3D
 - Space-filling: rectangular & radial
- Networks / graphs
 - Social networks
 - Animated exploration

Challenges

Especially for large trees & graphs...

Performance considerations

Hard to see contents

- nodes & edges may occlude

Hard to select & interact

Hard to see & understand structure

Guidelines for good layouts

For trees & networks

- Minimize edge-crossings
- Distribute nodes & edges evenly
- Make edges have similar lengths
- Edges should be straight lines (minimize bends)
- Display similar substructures in similar ways
- Use space efficiently

Specifically for trees

- Place nodes with same depth in a line or at a visual level
- (usually) Keep a fixed distance between sibling nodes

When changing layout dynamically

- Minimize movement of nodes & clusters to preserve user's mental map of the space

2D Tree: SpaceTree

Node-link tree browser

Grosjean et al, U Maryland 2002

Video 1 biology 0:11 Video 2 org charts 0:18



<http://www.cs.umd.edu/hcil/spacetree/>

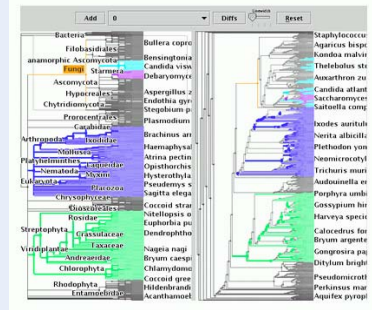
Comparing trees: TreeJuxtaposer

Munzner et al

UBC et al

2003

Video 4:59

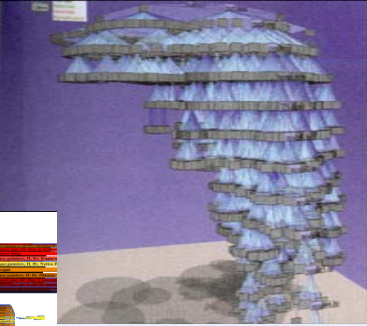
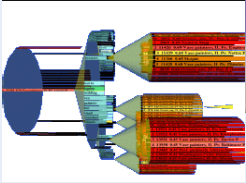


<http://olduvai.sourceforge.net/tj/index.shtml>

Cone Tree

Mackinlay et al
Xerox PARC
1991


Video 1:06

Cam Tree
Hemmje 1994

2D hyperbolic tree: StarTree

Lamping et al
Xerox PARC, Inxight
1995



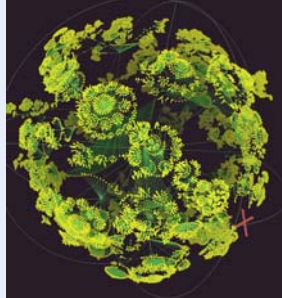
Demo

<http://www.inxight.com/products/sdks/st/>

3D hyperbolic tree: Walrus

Hyun [Munzner]
2001

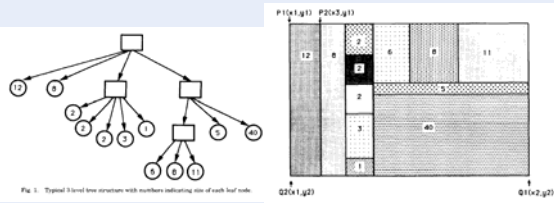
Demo



<http://www.caida.org/tools/visualization/walrus/>

Case Study: The Journey of the TreeMap

(Johnson & Shneiderman '91)



Slide adapted from Marti Hearst

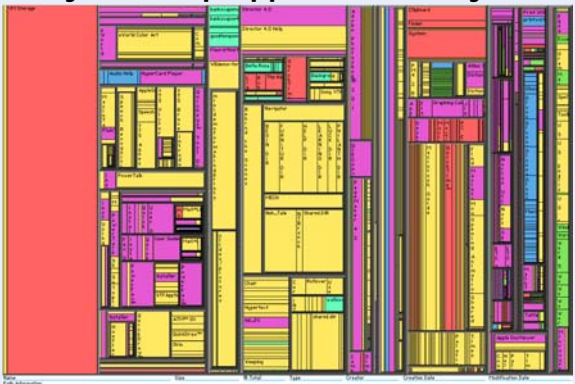
Case Study: Treemap

TreeMap idea:

- Show a hierarchy as a 2D layout
- Fill up the space with rectangles representing objects
- Nested rectangles indicated levels of hierarchy
- Size on screen indicates relative size of underlying objects

Slide adapted from Marti Hearst

Early Treemap Applied to File System



Treemap Problems

Too disorderly

- What does adjacency mean?
- Aspect ratios uncontrolled leads to lots of skinny boxes that clutter

Hard to understand

- Must mentally convert nesting to hierarchy descent

Color not used appropriately

- In fact, is meaningless here

Wrong application

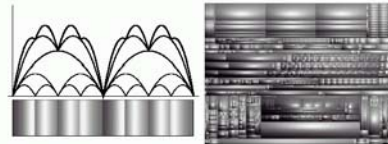
- Don't need all this to just see the largest files in the OS

Slide adapted from Marti Hearst

Cushion Treemaps

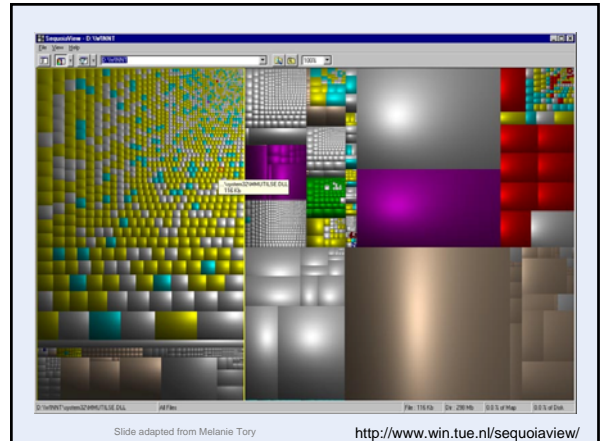
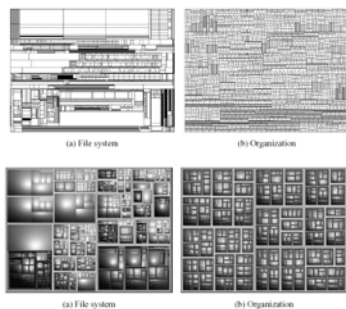
show structure with shading

- scale parameter controls global vs. local



Squarified Framed Cushion Treemaps

Bruls, Huizing, van Wijk, Eindhoven U 1999



Slide adapted from Melanie Tory

<http://www.win.tue.nl/sequoiaview/>

Successful Application of Treemaps

Think more about the use

- Break into meaningful groups

Make appearance more usable

- Fix these into a useful aspect ratio
- Do not use nesting recursively

Use visual properties properly

- Use color to distinguish meaningfully
 - Use only two colors:
 - Can then distinguish one thing from another
 - When exact numbers aren't very important

Provide excellent interactivity

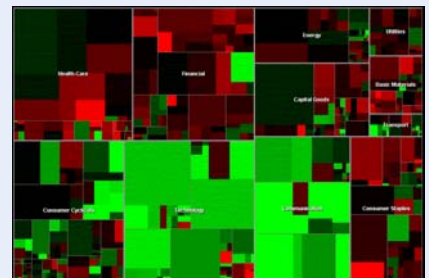
- Access to the real data
- Makes it into a useful tool

Slide adapted from Marti Hearst

Treemap: Map of the Market

[Smart Money](#)

Demo



Treemap: Marumushi newsmap

Google News content

Demo



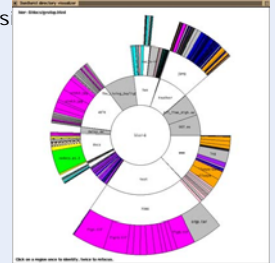
<http://www.marumushi.com/apps/newsmap/newsmap.cfm>

2D radial space-filling: SunBurst

Stasko, Georgia Tech 2000

angle shows file/directory structure
color shows file type

Video 3:53



<http://www-static.cc.gatech.edu/gvu/ii/sunburst/>

Network vis: social structures

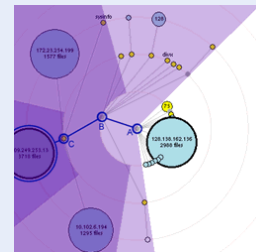


http://www.mpi-fg-koeln.mpg.de/~lk/netvis/Int_football/clubs6.jpg

Animated radial graphs

Yee, Hearst et al
UC Berkeley 2001

Video 3:50

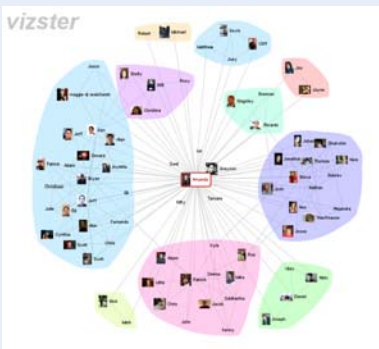


<http://bailando.sims.berkeley.edu/infovis.html>

vizster

Heer, Boyd
UC Berkeley
2005

Video 3:34



<http://heer.org/vizster/>

Summary

Challenges: size, structure, navigation, animation
Trees / hierarchies

- Node-link
 - SpaceTree: 2D
 - TreeJuxtaposer: 2D, support comparison
 - Cone trees/cam trees: 3D
 - StarTree: 2D hyperbolic
 - Walrus: 3D hyperbolic
- Space-filling
 - Treemap: 2D rectangular
 - Cushion, squarified, framed treemaps
 - SunBurst: 2D radial

Networks / graphs

- 2D animated radial
- Vizster: 2D force-directed

Lab Tomorrow

Exercise with trees
Comparing Treemaps, Tableau

P3 Data & Task Visualization
Feedback to groups

Prep for P4 Project Design Presentation
Details & discussion

Links

SpaceTree <http://www.cs.umd.edu/hcil/spacetree/>
TreeJuxtaposer <http://olduvai.sourceforge.net/tj/index.shtml>
StarTree <http://www.inxight.com/products/sdks/st/>
Walrus <http://www.caida.org/tools/visualization/walrus/>
Smart Money's Map of the Market
<http://www.smartmoney.com/marketmap/>
Marumushi newsmap
<http://www.marumushi.com/apps/newsmap/newsmap.cfm>
SunBurst <http://www.cc.gatech.edu/gvu/ii/sunburst>
Animated radial graphs
<http://bailando.sims.berkeley.edu/infovis.html>
vizster <http://jheer.org/vizster/>