Presentation on
Trees

Anika Mahmud
University of British Columbia
Papers Covered:


- Alfred Kobsa, "User Experiments with Tree Visualization Systems.", Proc InfoVis 2004, IEEE Symposium on Information Visualization, Austin, TX.
Concentration:

- Treemap
- Cushion Treemap
- BeemTrees
- Hyperbolic browser/Star Tree
- Botanical Tree
Goal:

- Visualizing Hierarchical information using-
  Cushion treemap
  Botanical tree.
- Performance measure for viewing hierarchical data of-
  Treemap,
  Cushion treemap,
  Beam tree,
  Hyperbolic tree and
  Botanical tree
Cushion Treemap: Visualization of Hierarchical Information

- Background- Space filling Treemap

Alternating directions, area represents size
1400 files
3060 employees

“Can You See The Structure?”
Shading to the rescue:

Binary tree

Ridges
Creating Bump:

\[ \text{Height} = h \left( x_2 - x_1 \right) \]

- Parabola is used to create the bump
- Value of \( h \) is same for each level
- \( h_i = f^i \cdot h \) (\( f \) is a scaling factor between 0 to 1.)
- Diffuse reflection
Ridge + rotated ridge = cushion
Result:

$h = 0.5, f = 1$

$h = 0.5, f = 0.75$
Interaction:

- Embedded in SEQUOIAVIEW
- Color option for file type, level
- Navigation
- Filtering
Critique:

- Good things
  - Simple Method
  - Fast Execution
  - Good for seeing overall structure
- Bad things
  - Ambiguity in size perception
  - Not specific about interaction option
  - No user experiment
Botanical Visualization of Huge Hierarchies

Background: Strand model (Holton, 1994)

- Mimics vascular system
- Each leaf is connected to one strand
- Branch = bundle of strands
Initial Attempt:

- Each directory is a branch
- Each file is a leaf
Three problems

- Continuing branches are hard to see
- Long, thin branches emerge
- Leaves are messy
Smoothed continuing branches
Contract long branches
Files: Phi-balls-Bigger surface bigger file

One big file  Many small files
Interaction??

- They say you can interact with the system
Critique:

- Innovative idea, as they say “natura artis magistra”
- Not says enough to understand the navigation
- Hard to get the level
- Hard to compare the size of file
- The sphere fruit makes occlusion of the files in the same directory
- No specific user experiment
User Experiments with Tree Visualization Systems

- Windows Explorer as the baseline
- Compare five tree visualization system
  - ✓ Treemap 3.2
  - ✓ Sequoia View 1.3 (Cushion Treemap)
  - ✓ Hyperbolic browser/Star Tree Studio 3
  - ✓ Botanical Tree/Tree viewer
  - 😞 BeemTrees
Goals:

- Quantitative analysis
  - task completion time
  - accuracy
  - user satisfaction
- Qualitative analysis
BeamTrees
Surprise!!
Tasks:

- Subset of a taxonomy of items on e-bay
- Contained 5 levels and 5799 nodes
- Relationship of the nodes required no domain specific knowledge
- 15 tasks
- Questions were both structure and attribute related
- Subjects answers were recorded
- Subjects interaction was recorded by screen capture software
- User satisfaction data were taken
- The video analysis was performed
Result: Correctness of answer

BT << TM, SV, ST, EX
TV << TM, ST, EX
TV < SV
Result: Correctness of answer con....

Structure-related tasks
- BT << TM
- < EX
- SV << TM < EX < BT
- ST < TM

Attribute-related tasks
- BT << TM, SV, ST, EX
- TV << TM, SV, ST, EX
Result: Average task completion time (in seconds)

- BT >> TM, SV, ST, EX
- BT > TV
- TV >> TM, EX
- TV > SV
- SV > TM, EX
- ST > TM, EX
Result: Average task completion time (in seconds) con.

Structure-related tasks
- BT >> TM, TV, EX
- BT > ST
- SV >> TM, TV, EX
- SV > ST
- ST > EX

Attribute-related tasks
- BT >> TM, SV, EX
- BT > ST
- TV >> TM, SV, ST, EX
- ST >> SV
Result: User satisfaction

Ease of use
BT << TM, SV, ST, TV, EX
BT < ST
EX > SV, TV

Effectiveness
BT << TM, SV, EX
TV << TM, EX

Use system again?
BT << EX
BT < TM
EX >> SV, TV
EX > ST
TM > TV
Qualitative Analysis from Video:

- **Treemap**: Better than other four visualization
  - **Pros**
    - Better user satisfaction
    - Color coding and filtering helped
  - **Cons**
    - Unable to solve time related question
    - Hard to solve global structure task
  - **Suggestion**
    - Search option can be increased
Qualitative Analysis from Video: cons.

- **Sequoia View: Average performance**
  - Cons
    - Hard to solve both attribute and structure related task
    - Users can’t track level
    - Color options are less visited
Qualitative Analysis from Video: con..

- Beam Trees: Worst performance
  - Pros
    - Better for local data visualization
  - Cons
    - Does not show relationship within same level
    - Length and size of beam bear little relationship
  - Suggestion
    - Needs functionality beyond visualization
Qualitative Analysis from Video: con..

- Star Tree: Average Performance
  - Pros
    - Average in all task
    - Easy to child/parent relationship
    - Local Search problems are easy to solve
  - Cons
    - Lacks file details
    - Rotation makes things hard to see
    - Misleading “Bottom Orientation”
Qualitative Analysis from Video: con..

- Star Tree: Better than the worst

  - Cons
    - Lacks basic search options
    - Lacks file attributes
    - Hard to follow directory from the branch
    - Subjects found to depend on explorer like panel

  - Suggestion
    - Needs functionality beyond visualization
Qualitative Analysis from Video: con...

- Windows Explorer: Very good overall performance

- Cons
  - Hard to solve file specific data
  - Hard to compare depth
Critique:

- Good overall analysis
- Analyzed the user activity
- Separated structural and attribute task
- Both good and bad parts were analyzed
- More specific suggestion required
Concluding Remark:

- All have their good things and bad things
- We look forward to find which works better for us
- Works well when complementing each other
Questions?