Presentation on
Trees

Anika Mahmud
University of British Columbia

Papers Covered:

- J. J. van Wijk and H. van de Wetering, "Cushion Treemaps:Visualization of Hierarchical Information", IEEE Symposium on Information Visualization (INFOVIS'99), San Francisco, CA, 1999.
- E. Kleiberg, H. van de Wetering, and J. J. van Wijk, "Botanical Visualization of Huge Hierarchies", InfoVis 2001: IEEE Symposium on Information Visualization, San Diego, CA, 2001, pp. 87-94.
- Alfred Kobsa , " User Experiments with Tree Visualization Sytems.", Proc InfoVis 2004, IEEE Symposium on Information Visualization, Austin,TX.

Concentration:

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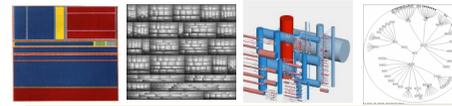
Goal:

- 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
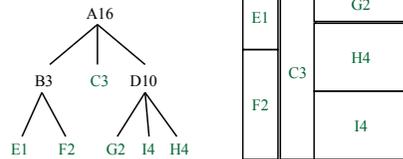

**Alternating directions, area represents size**

1400 files
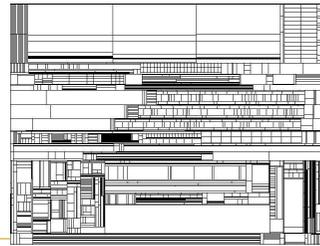
3060 employees
"Can You See The Structure?"

Shading to the rescue:

Binary tree

Ridges

Creating Bump:

$Height = h (x_2 - x_1)$

$x_1 = 0$

$x_2 = 0$
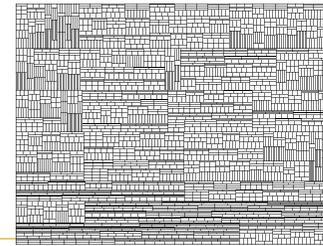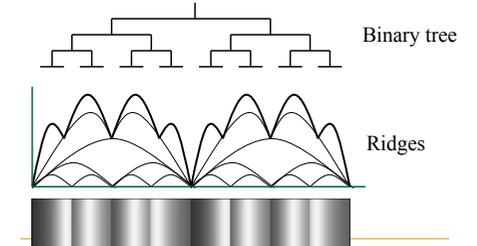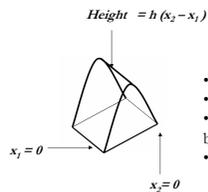
- Parabola is used to create the bump
- Value of h is same for each level
- $h_i = f^i h$ (f is a scaling factor between 0 to 1.)
- Diffuse reflection

Ridge + rotated ridge = cushion

+ =

Result:

h= 0.5, f = 1   **h= 0.5, f = .75**
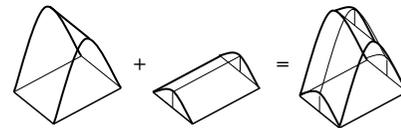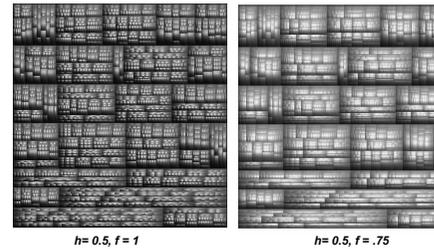
Interaction:

- 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:
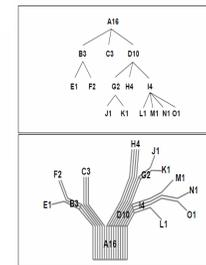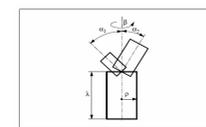
- **Each directory is a branch**
- **Each file is a leaf**

Result:
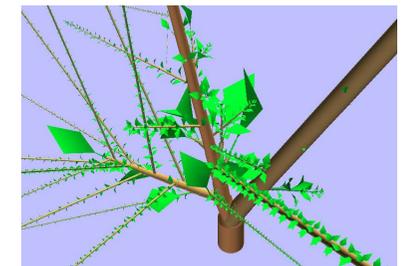
Three problems

- Continuing branches are hard to see
- Long, thin branches emerge
- Leaves are messy

## Smoothed continuing branches
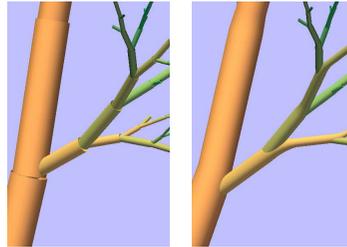
Contract long branches
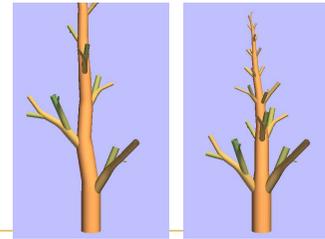
Files: Phi-balls-Bigger surface bigger file
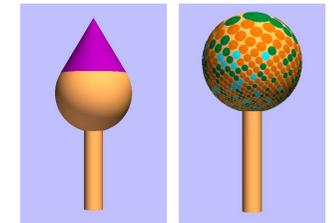
One big file   Many small files

C:\Winnt\system32
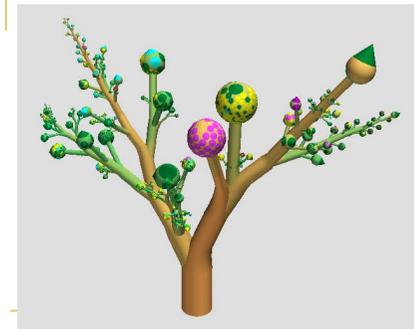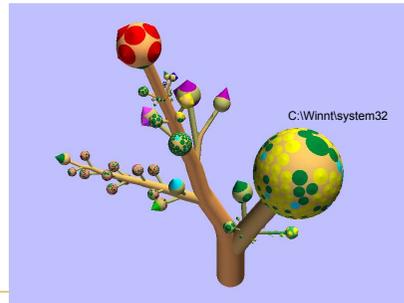
Interaction??

- 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

file   directory
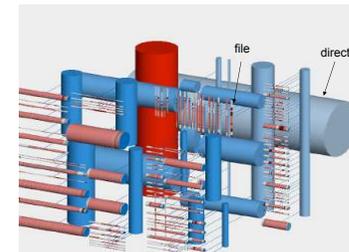
Surprise!!
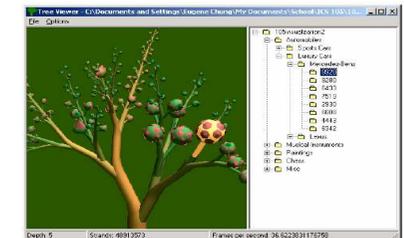
Tasks:

- 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
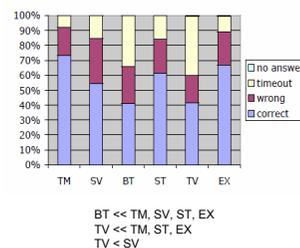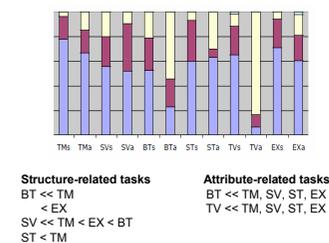
BT << TM, SV, ST, EX
    < EX
TV << TM, ST, EX
TV < SV

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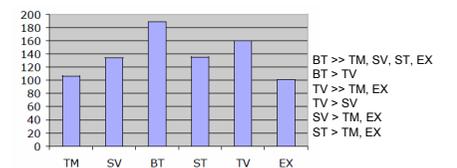
Result: Average task completion time (in seconds) con..
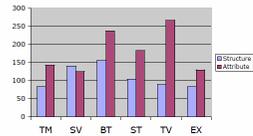
Structure-related tasks
BT >> TM, TV, EX
BT > ST
SV >> TM, TV, EX
SV > ST
ST > EX

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

Result: User satisfaction
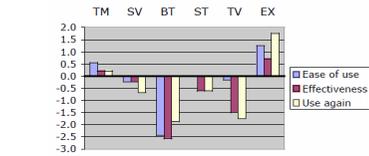
Ease of use
BT << TM, SV, ST, TV, EX
BT < ST
EX > SV, TV

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: con..

- Sequoia View: Average performance
  - Cons
    - Hard to solve both attribute and structure related task
    - Users cant 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
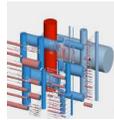
Qualitative Analysis from Video: con..

- 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?