TreeViz™ 1.0 Manual

Introduction

Visualization has been receiving a great deal of attention in recent years. There are many reasons for this but chief among them is the simple observation that humans have difficulty extracting meaningful information from large volumes of data.

Visualization tools such as treemaps can expand the bandwidth of the human-computer interface. Our increasing ability to produce, disseminate, and collect information has created a demand for tools which aid in the analysis of this information. Treemaps graphically encode hierarchically structured information, and users analyze and search this graphical information space.

Treemaps map hierarchies onto rectangular display spaces in a space-filling manner, producing a hierarchical representation similar to a squared-off Venn diagram. This efficient use of space allows for the display of very large hierarchies (thousands of nodes). Interactive control facilitates the presentation of both structural (such as nesting offsets) and content (display properties such as color mapping) information. Appendix A contains figures illustrating the progression from traditional tree diagrams to treemaps.

Hierarchical information structures have long been natural ways of organization and space-filling approaches to their visualization have great potential. The treemap algorithms are general and the possibilities for mapping information about individual nodes to the display are appealing. Treemaps can aid decision making processes by helping users create accurate mental models of the content and structure of hierarchical information spaces.

TreeViz

TreeViz is a Macintosh implementation of treemaps. It was developed at the University of Maryland Human-Computer Interaction lab by Brian Johnson as part of his dissertation work on visualizing hierarchical information. The concept was first proposed by his advisor Ben Shneiderman, head of the Human-Computer Interaction Lab.

The treemap concept itself is quite general. TreeViz is intended primarily for visualizing Macintosh hierarchical file structures, a hierarchical information space which is accessible to many computer users. Throughout this document directories and files will often be referred to as internal nodes and leaf nodes respectively. This is because treemaps are a general tool and TreeViz is evolving in this general direction.

Visualizing Other Hierarchies

TreeViz is a general treemap visualization tool. TreeViz will read plain text files containing hierarchical representations of user data. Node attributes in these hierarchies are limited to a node name and weight only. Users may license the technology for customization if desired. The variety of potential applications is quite large, ranging from directory structure browsing to corporate hierarchies and financial portfolio analysis.

TreeViz Menu Organization

A description of the TreeViz menus and their contents follows.

File

The file menu is used to bring information into and out of the TreeViz application.

New

Select a new directory or volume to visualize.

Open

Open a plain text file of your own. The hierarchy must be in the format detailed later in this

document.

Close
   Close the current hierarchy window.
Save Picture/ Save Picture As
   Save the image as a standard Macintosh color picture (PICT2).
Page Setup / Print
Standard print dialogs.
Quit
   Close all windows and exit the TreeViz application.

Edit
   Only the show clipboard functionality is provided.
   Show Clipboard
      Show the current contents of the clipboard. This feature is currently of little use as relates
      to TreeViz.

View
   The view menu determines the basic look of the treemap. How the hierarchy will be
   represented, which nodes will be visible and whether connecting links and text labels will be
   provided.
   Slice & Dice
      Partition display space alternately along both the horizontal and vertical axes.
   Top Down
      Partition the display space only along the horizontal axis.
   All Nodes
      Show all nodes, both internal (directories) and leaves (files).
   Internal Nodes
      Show only internal nodes (Macintosh directories).
   Leaf Nodes
      Show only leaf nodes (Macintosh files).
   Tree Lines
      Draw lines connecting the top center of each node with the top center of its parent.
   Text Labels
      Place name label on node if space permits.
   TreeViz Defaults
      Reset all menu options.

Offsets
   The offset menu determines the degree to which child nodes will be nested within their parents
   and which nodes to nest.
   1, 2, 4, 8, 16 Pixels
      Nesting offset for child nodes within their parent.
   All Nodes
      Nest all nodes.
   Internal Nodes
      Only nest internal (directory) nodes, pack leaf (file) nodes together.

Weight
   The weight menu determines the relative display sizes of nodes in the hierarchy and which
   node attribute on which to base the display size.

Constant

Assign each leaf node a constant weight of 1. All nodes will have the same display space area, although aspect ratios will vary.

Size

Assign each leaf node a a weight equal to its size (in bytes).

Creation

Assign each leaf node a a weight equal to its creation date (as age in seconds).

Modification

Assign each leaf node a a weight equal to its modification date (as age in seconds).

Invert

Invert weights, the range of weight values is simply flipped about it's midpoint. Small values become large and large values become small.

Unscaled

Leave weights as assigned..

Scaled...

Scale weights according to input user specified power. Powers greater than 1.0 exaggerate node differences, powers between 0 and 1 diminish node differences.

Sound&Light

Size, **Creation**, **Modification**

Attribute on which to base node color and tone properties.

Invert

Invert color and tone values.

Normal

Hue based on file type, color saturation and lightness are constant.

Fade

Vary color saturation based on size, creation, or modification.

Darken

Vary color lightness based on size, creation, or modification.

Tracking Sound

"Play" nodes while tracking. Sound features are not available on low end Macs.

Drawing Sound

"Play" nodes while drawing. Sound features are not available on low end Macs.

Misc.

Node Shape...

Determines node shape when drawn within its bounding box.

Node Border...

Width of node border

Pop Zoom Stack

Zoom back one step. Internal nodes can be zoomed to full size by double clicking on them when offsets have been specified.

Depth Bound

Depth at which drawing is discontinued.

Draw

Force redraw.

TreeViz and Your Macintosh

Sound is not available on lower end Macintosh models. Sound has been tested on most MacII models and the Quadras, sound will not work on the LC. Memory requirements will increase for large hierarchies, a general rule of thumb is to allocate about ~1k per node. System 6 does not allow the selection of entire disks in the file picker dialog, only folders. To view an entire disk move everything to a single folder.

Example Tasks

Disk Space Usage:
Select TreeViz Defaults. The are of each file is proportional to its disk space usage. Specifying a nesting offset enhance presentation of the hierarchy structure and allow zooming.

Find Big Old Files:
What you want to do here is locate files with large file sizes and old modification dates. Select TreeViz Defaults, this will show the large files. Now select Modification Date and Fade from the Sound&Light menu. This will fade the color of files based on their modification dates. Large pale files are what you are looking for.

Explore and combine various menu combinations. Can you find files created long ago that haven't been modified recently (Hint: set weight based on creation date). There are many combinations.

Opening Plain Text Files

Plain text file of your other hierarchies must be in the format detailed below. This is simply a parenthesized outline format. This nested list of lists format is similar to lisp notation an allows portions of the hierarchy to be moved or inserted in other hierarchy.

Each node is consists of a name and an positive integral weight. Node names may include spaces if enclosed in quotation marks, e.g. "Brian Johnson". The name and weight portions of a node must be separated by whitespace (spaces, tabs, or carriage returns). The file must be plain text, i.e., it must not be a word processor specific file. The weights of leaf nodes are summed up to determine the weights of internal nodes, as such weights explicitly assigned to internal nodes are only placeholders. the following example hierarchy are the same.

```
(  (general)
   (A   100
     (B   5)
     (C   10)
     (D   4)
     (E   6)
     (F35
       (H   1)
       (I 6)
       (J 18)
       (K   10
         (L 2)
```

```
                    (M   2)
                    (N   2)
                    (O   2)
                    (P   2)
                )
            )
          (G  40
            (Q   8)
            (R   2)
            (S   30
                (T2)
                (U   4)
                (V   24
                    (W   3)
                    (X   6)
                    (Y   5)
                    (Z10)
                )
            )
          )
        )
    )
)
```

is equivalent to

((general)(A 1(B 5)(C 10)(D 4)(E 6)(F 1(H 1)(I 6)(J 18)(K 1(L 2)(M 2)(N 2)(O 2)(P 2)))(G 1(Q 8)(R 2)(S 1(T 2)(U 4)(V 1(W 3)(X 6)(Y 5)(Z 10))))))

Appendix A: Illustrating Hierarchy

The following three figures depict the same 26 node hierarchy. They are respectively:

1) Typical Tree Diagram
   Which leaf node has the largest weight? This is not an easy question to answer with this type of diagram.
2) Venn Diagram
   Hand drawn, node areas are not strictly proportionate.
3) TreeViz Treemap

The figures will appear in color on color monitors.

A_{100}

B_5 C_{10} D_4 E_6 F_{35} G_{40}

H_1 I_6 J_{18} K_{10} Q_8 R_2 S_{30}

L_2 M_2 N_2 O_2 P_2 T_2 U_4 V_{24}

W_3 X_6 Y_5 Z_{10}
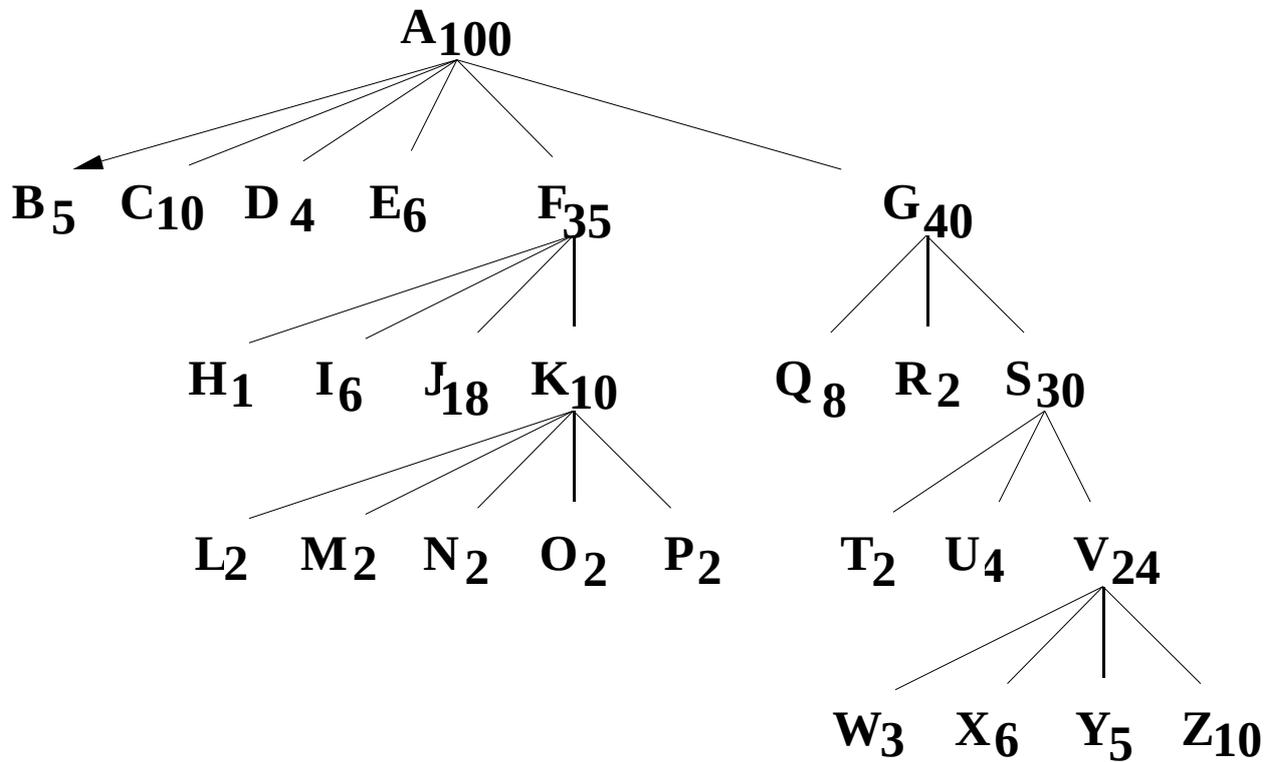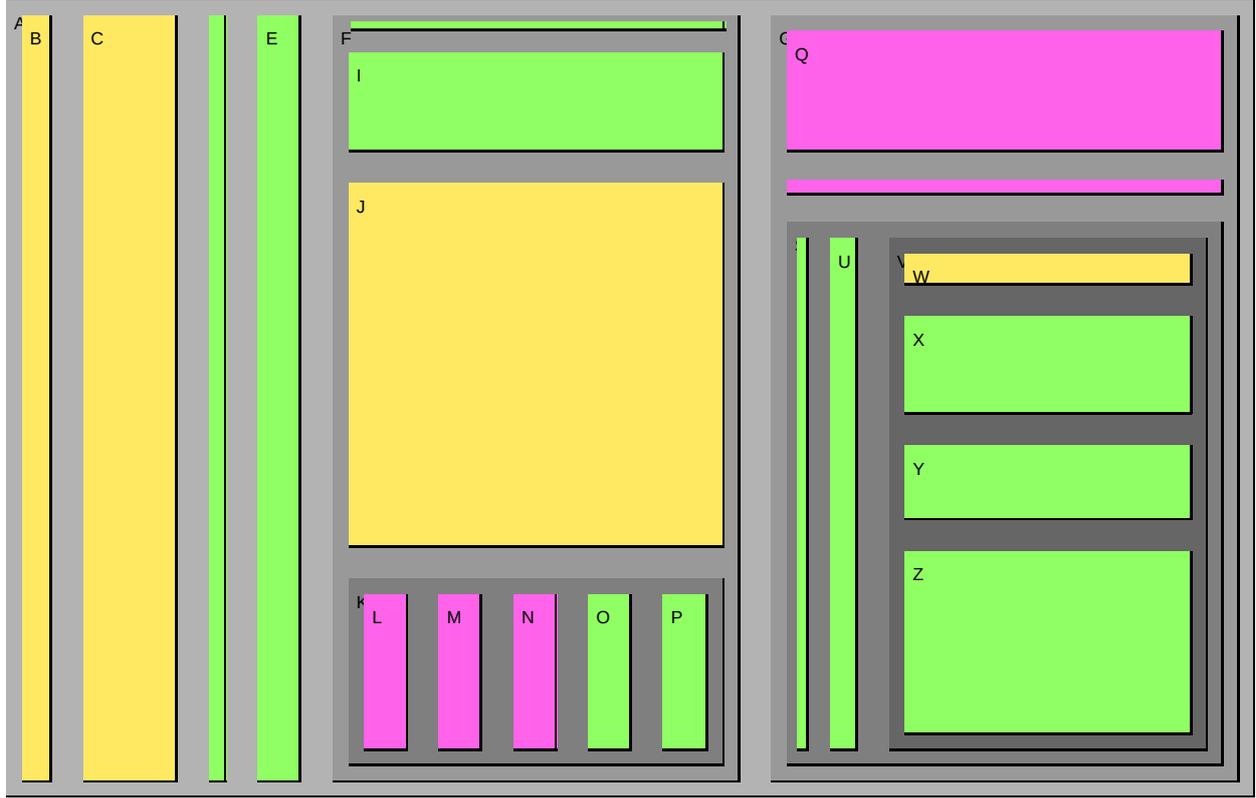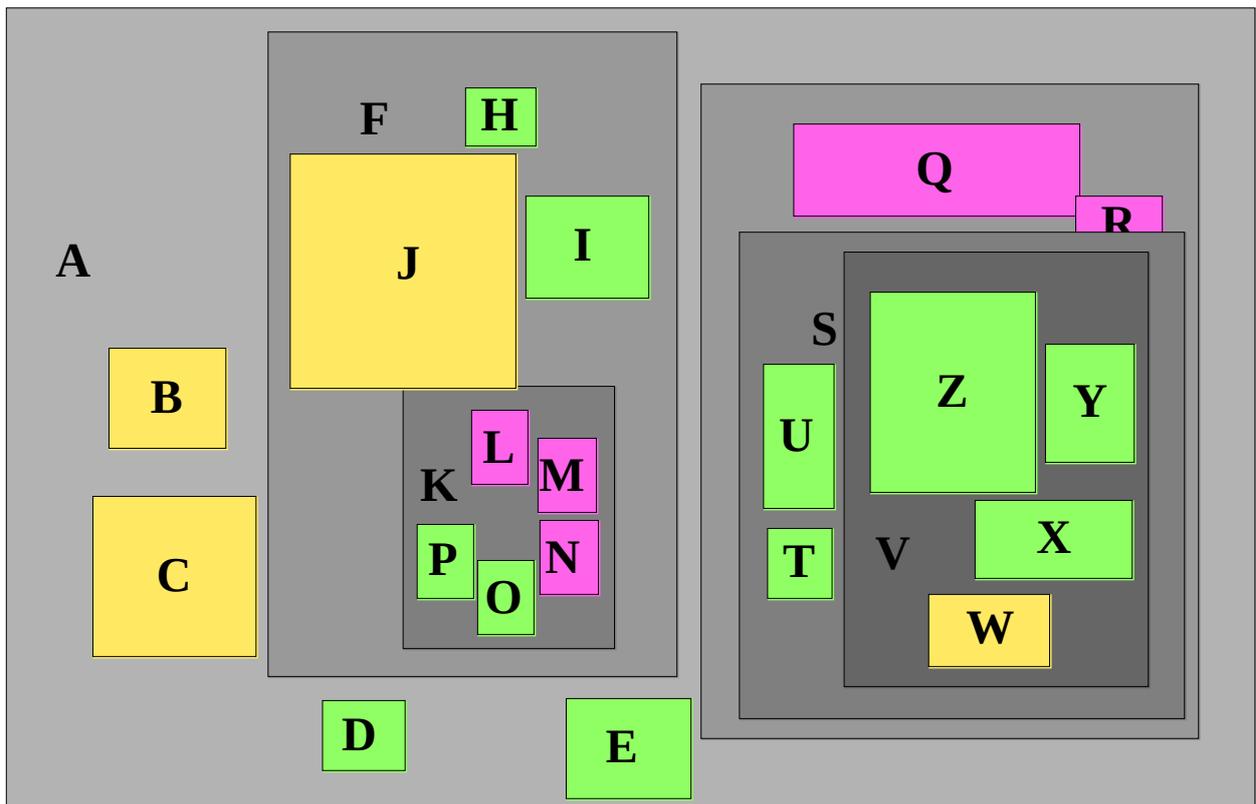
Appendix B: TreeViz Orders

TreeViz
A Macintosh Implementation of Treemaps

The University of Maryland is distributing TreeViz through the Office of Technology Liaison. The TreeViz program runs on all color Macintoshes and is accompanied by a small user manual. TreeViz is written in object oriented Think C on the Macintosh, source code licenses are available.

Purchasing and Licensing:

TreeViz Orders
Office of Technology Liaison
4312 Knox Road
University of Maryland
College Park, MD 20742

(301) 405-4208
FAX: (301) 314-9871

Submit a US bank check or money order for US$25 ($30 overseas) made out to the "Office of Technology Liaison" (no cash please).

Appendix C: Treemap Research

Related Technical Papers:

Brian Johnson and Ben Shneiderman. Tree-maps: A Space-Filling Approach to the Visualization of Hierarchical Information Structures. Proc. IEEE Visualization'91 (San Diego, California, October 1991), 284-291.

Ben Shneiderman. Visual User Interfaces for Information Exploration. Technical Report CAR-TR-577, CS-TR-2748, August 1991.

Ben Shneiderman. Tree visualization with Tree-maps: A 2-d space-filling approach. ACM Transaction on Graphics (11)1 (January 1992), 92-99.

Ben Shneiderman. Designing the User Interface - Strategies for the Effective Human-Computer Interaction, Second Edition. Addison Wesley, Reading, Massachusetts, 1992, Chapter 11, Information Exploration Tools, 432-434.

Brian Johnson. TreeViz: Treemap Visualization of Hierarchically Structured Information. Proc. ACM CHI'92 (Monterey, CA, May 1992), 369-370.

Dave Turo and Brian Johnson. Improving the Visualization of Hierarchies with Treemaps: Design Issues and Experimentation. May 1992, CAR-TR-626, CS-TR-2901, Department of Computer Science, University of Maryland.

This implementation is part of Brian Johnson's Ph.D. work on the visual representation of hierarchical information spaces. Persons with similar research concerns should contact:

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