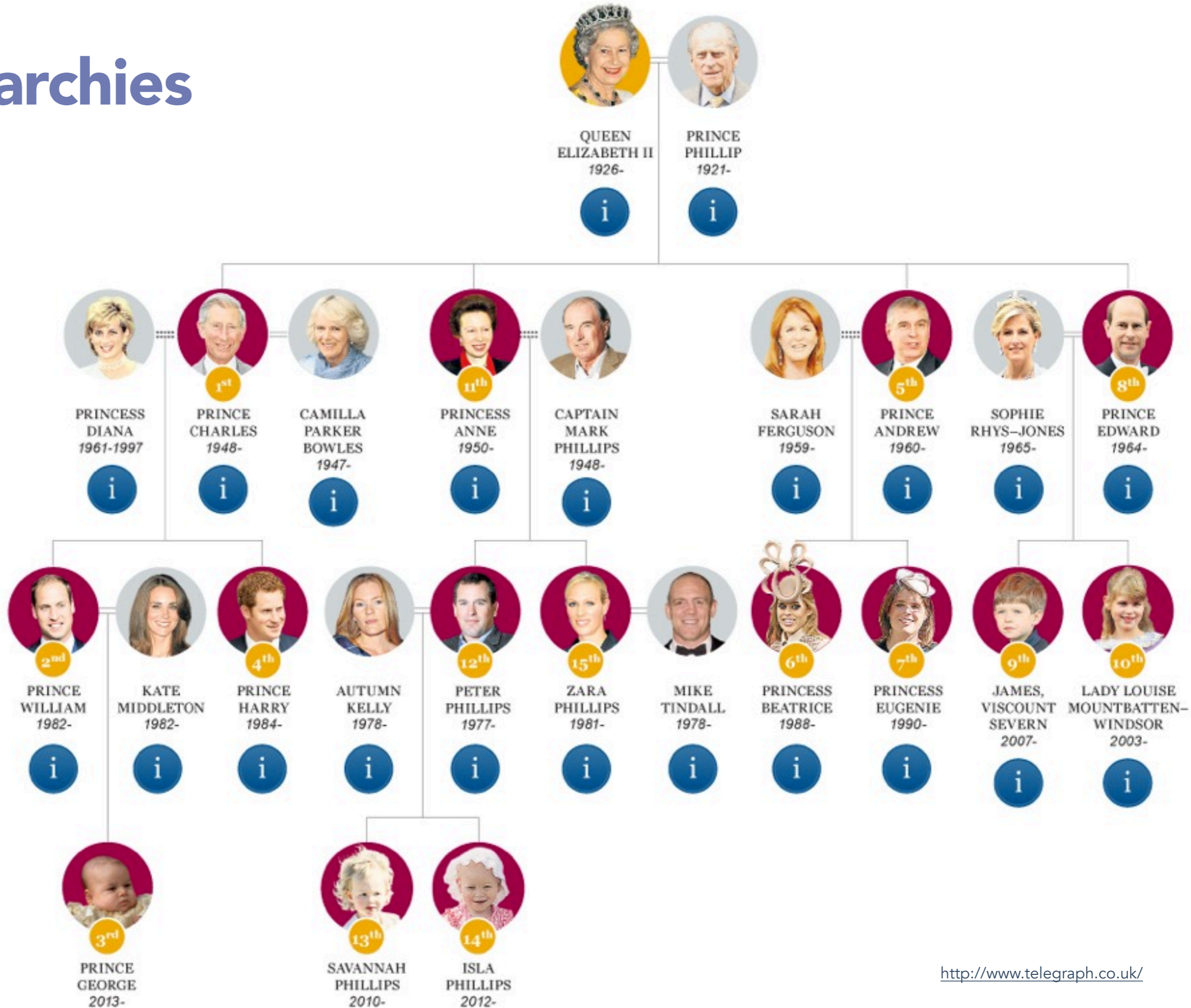# Hierarchies, Graphs, and Networks (oh my) part one

C. Andrews

2014-04-15
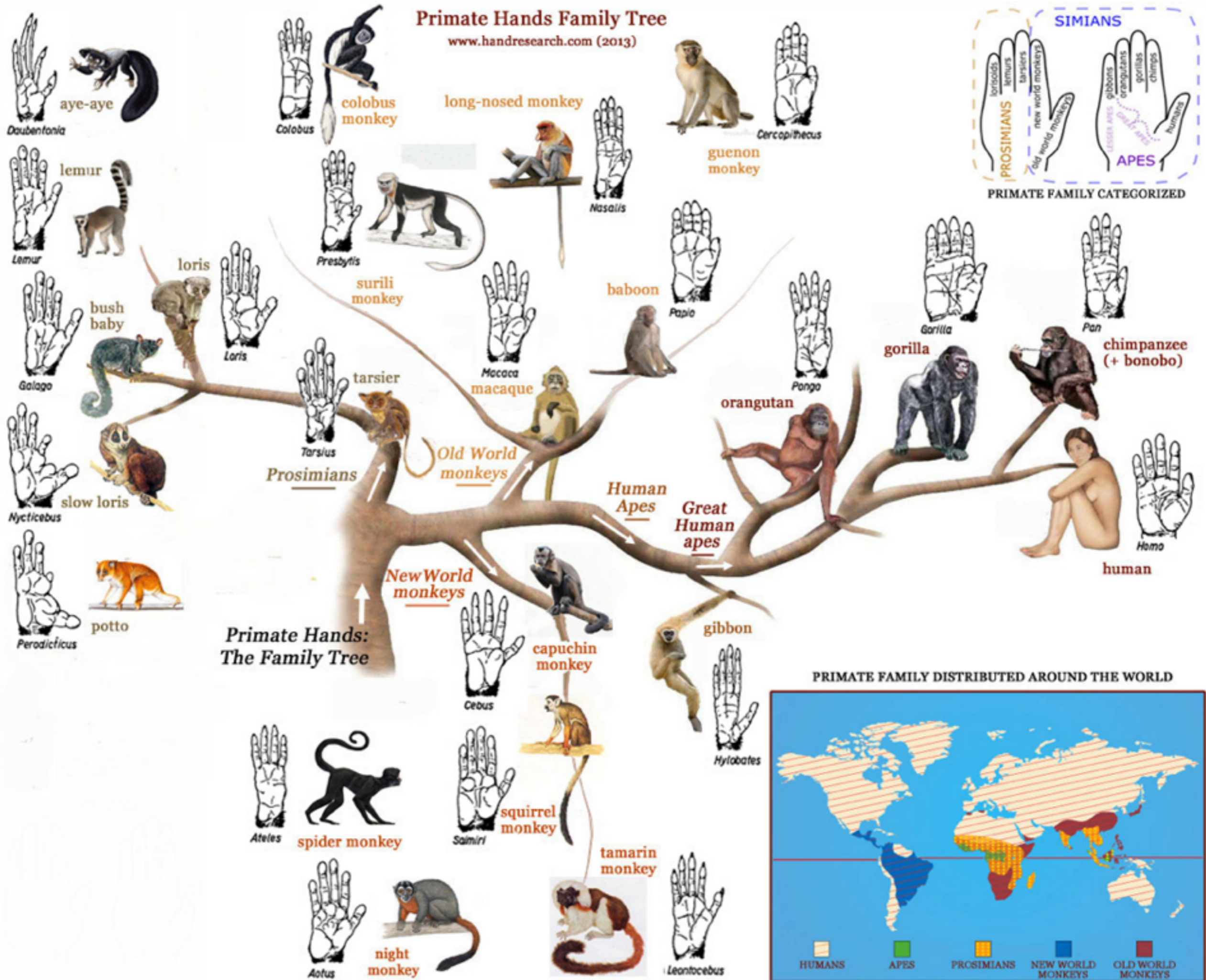
Hierarchies
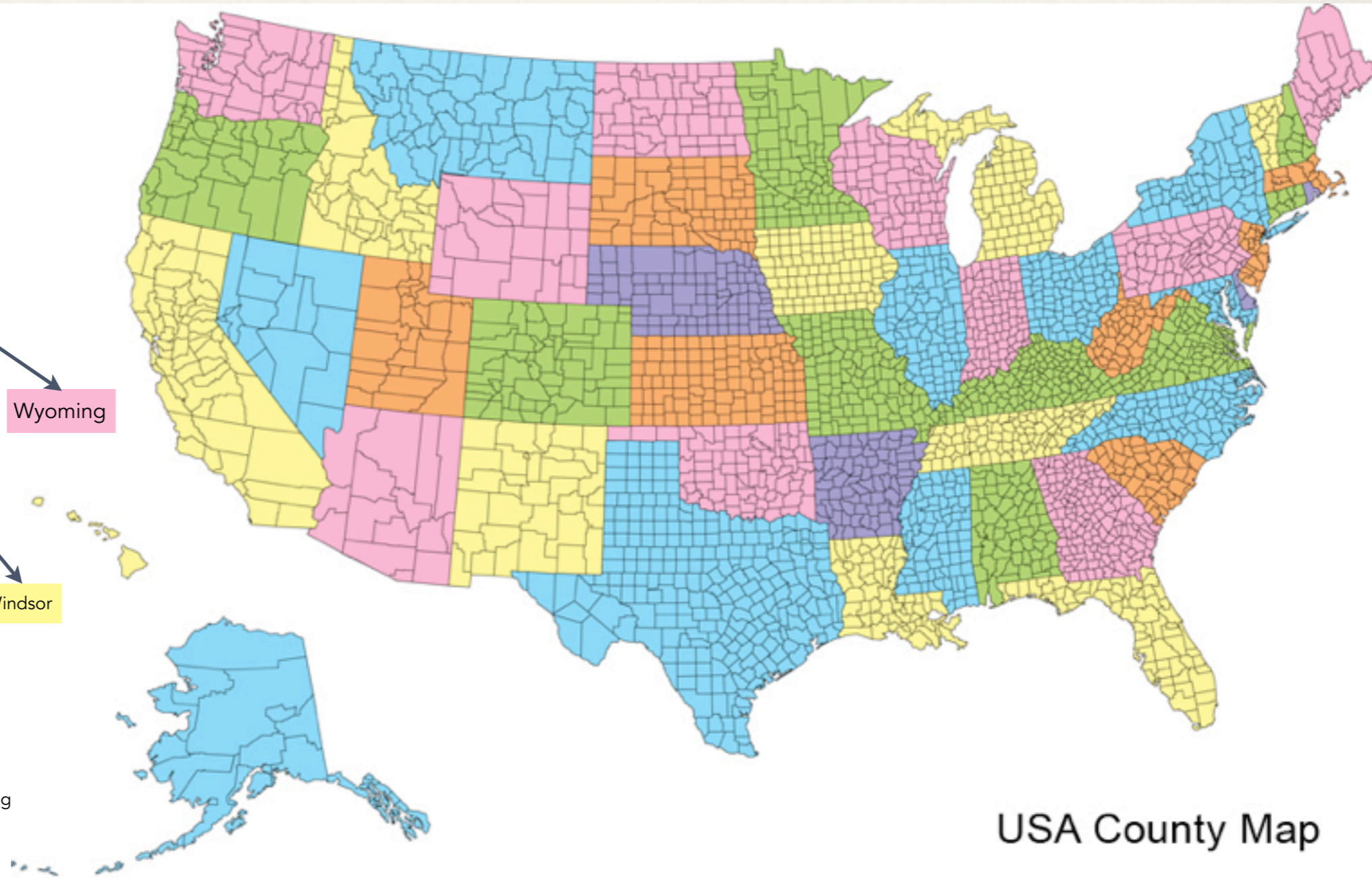

QUEEN ELIZABETH II 1926-

PRINCE PHILLIP 1921-

PRINCESS DIANA 1961-1997

PRINCE CHARLES 1948- (1st)

CAMILLA PARKER BOWLES 1947-

PRINCESS ANNE 1950- (11th)

CAPTAIN MARK PHILLIPS 1948-

SARAH FERGUSON 1959-

PRINCE ANDREW 1960- (5th)

SOPHIE RHYS–JONES 1965-

PRINCE EDWARD 1964- (8th)

PRINCE WILLIAM 1982- (2nd)

KATE MIDDLETON 1982-

PRINCE HARRY 1984- (4th)

AUTUMN KELLY 1978-

PETER PHILLIPS 1977- (12th)

ZARA PHILLIPS 1981- (15th)

MIKE TINDALL 1978-

PRINCESS BEATRICE 1988- (6th)

PRINCESS EUGENIE 1990- (7th)

JAMES, VISCOUNT SEVERN 2007- (9th)

LADY LOUISE MOUNTBATTEN–WINDSOR 2003- (10th)

PRINCE GEORGE 2013- (3rd)

SAVANNAH PHILLIPS 2010- (13th)

ISLA PHILLIPS 2012- (14th)

http://www.telegraph.co.uk/

Primate Hands Family Tree
www.handresearch.com (2013)

Primate Hands: The Family Tree

aye-aye — *Daubentonia*
lemur — *Lemur*
loris — *Loris*
bush baby — *Galago*
slow loris — *Nycticebus*
potto — *Perodicticus*
tarsier — *Tarsius*
Prosimians

colobus monkey — *Colobus*
surili monkey — *Presbytis*
long-nosed monkey — *Nasalis*
guenon monkey — *Cercopithecus*
baboon — *Papio*
macaque — *Macaca*
Old World monkeys

capuchin monkey — *Cebus*
spider monkey — *Ateles*
squirrel monkey — *Saimiri*
night monkey — *Aotus*
tamarin monkey — *Leontocebus*
New World monkeys

gibbon — *Hylobates*
orangutan — *Pongo*
gorilla — *Gorilla*
chimpanzee (+ bonobo) — *Pan*
human — *Homo*
Human Apes
Great Human apes

PRIMATE FAMILY CATEGORIZED
SIMIANS
PROSIMIANS — lorisoids, lemurs, tarsiers, new world monkeys, old world monkeys
APES — LESSER APES: gibbons, orangutans, gorillas, GREAT APES: chimps, humans

PRIMATE FAMILY DISTRIBUTED AROUND THE WORLD
HUMANS · APES · PROSIMIANS · NEW WORLD MONKEYS · OLD WORLD MONKEYS

Hierarchies

United States

- Alabama
- Alaska
- ...
- Vermont
  - Addison
    - Addison
    - Bridport
    - ...
    - Middlebury
    - ...
    - Whiting
  - Bennington
  - ...
  - Windsor
- ...
- Wyoming

USA County Map

This is a royalty free image that can be used for your personal, corporate or education projects. It can not be resold or freely distributed, if you need an editable PowerPoint or Adobe Illustrator version of this map please visit www.bjdesign.com or www.mapsfordesign.com. This text can be cropped off. © Copyright Bruce Jones Design 2009

Hierarchies

Office of the Secretary of Defense

Chart reflects PAS officials and those reporting directly to the Secretary and Deputy Secretary of Defense
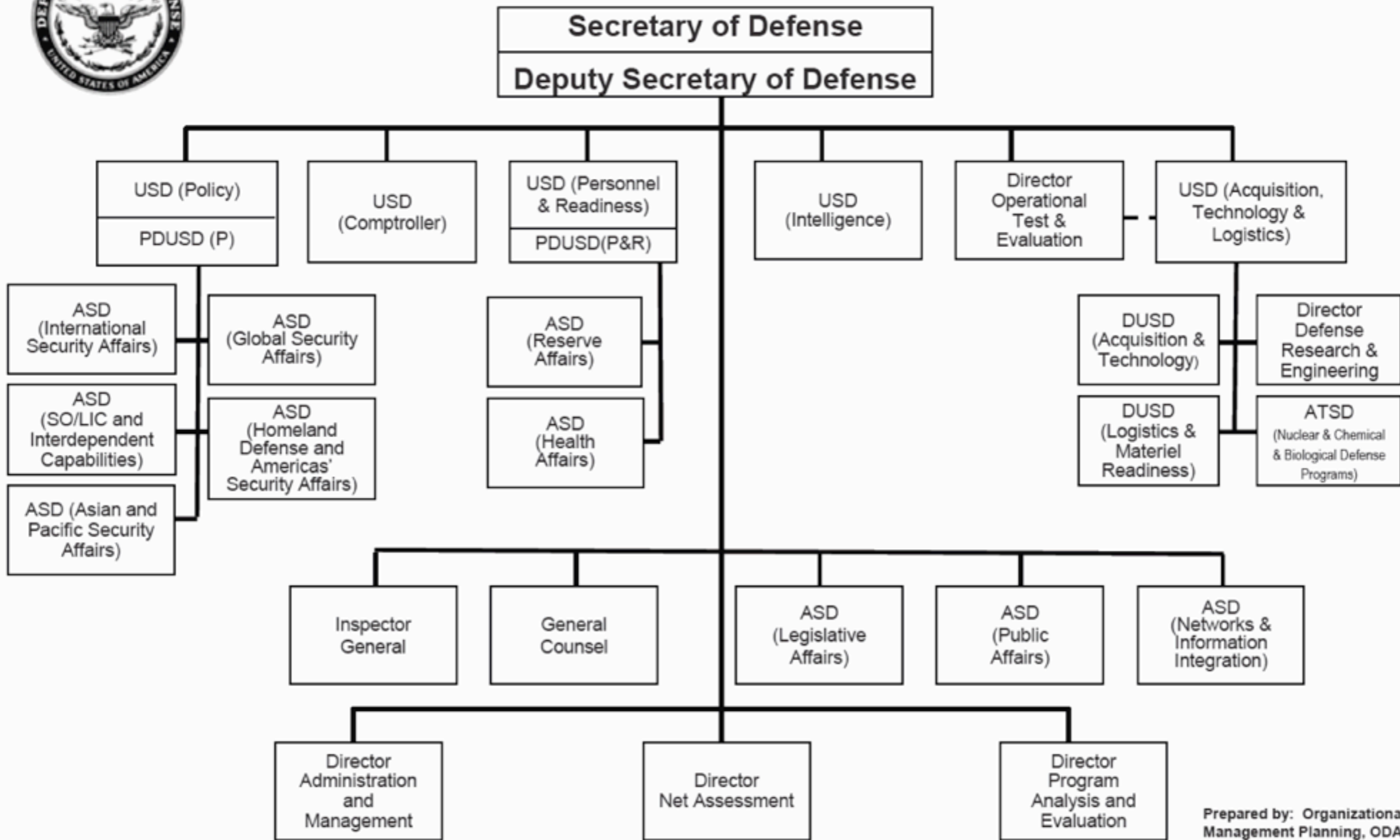
Prepared by: Organizational & Management Planning, ODA&M, OSD
Date: January 2008

Hierarchies
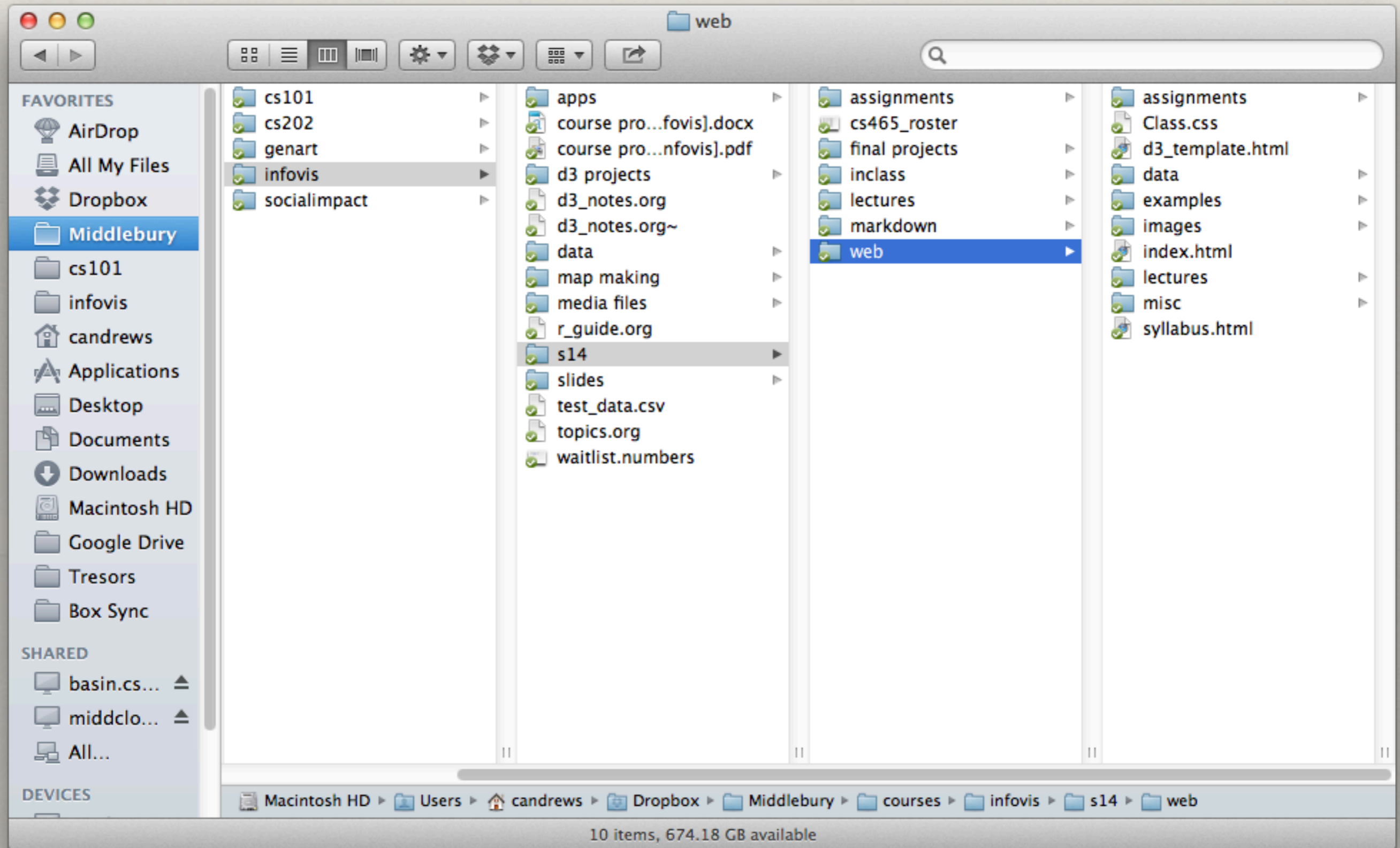
What are we trying to discover?

It is all about structure and relationships

descendants

ancestors

grandparent

parent

child

sibling

dense

height

depth

sparse

Trees

Node-link graph

root

nodes

link

leaf
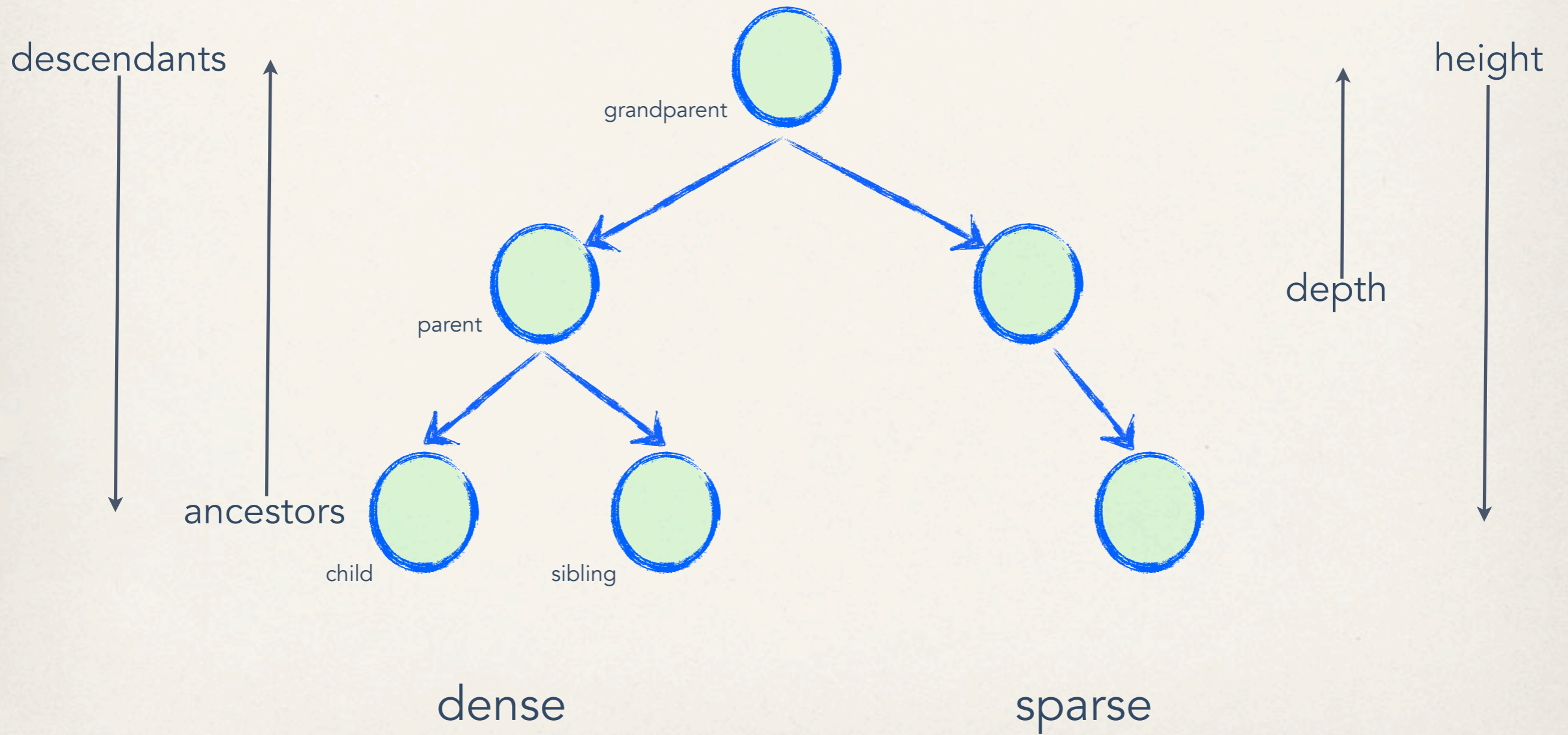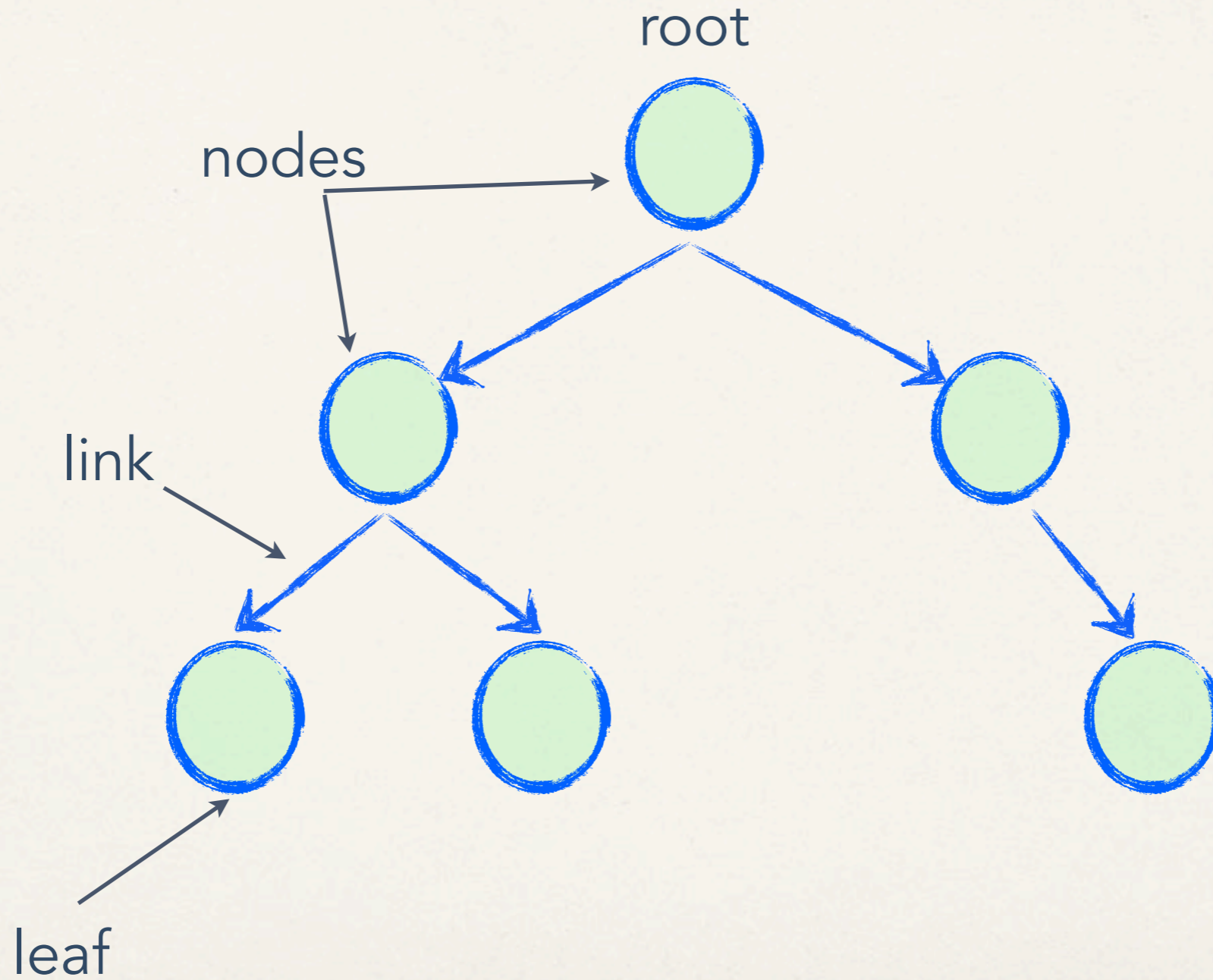
Trees
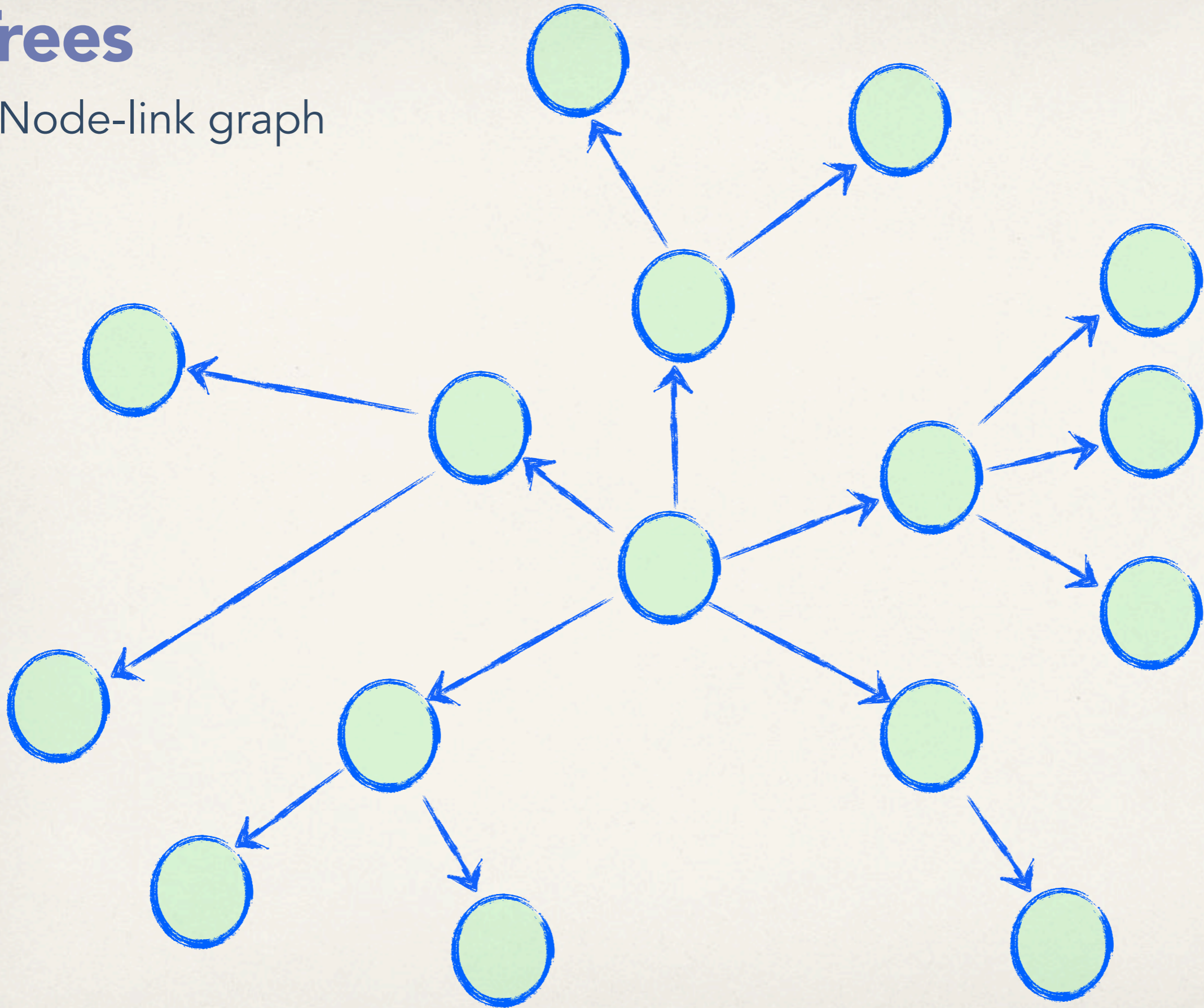
Node-link graph

Trees
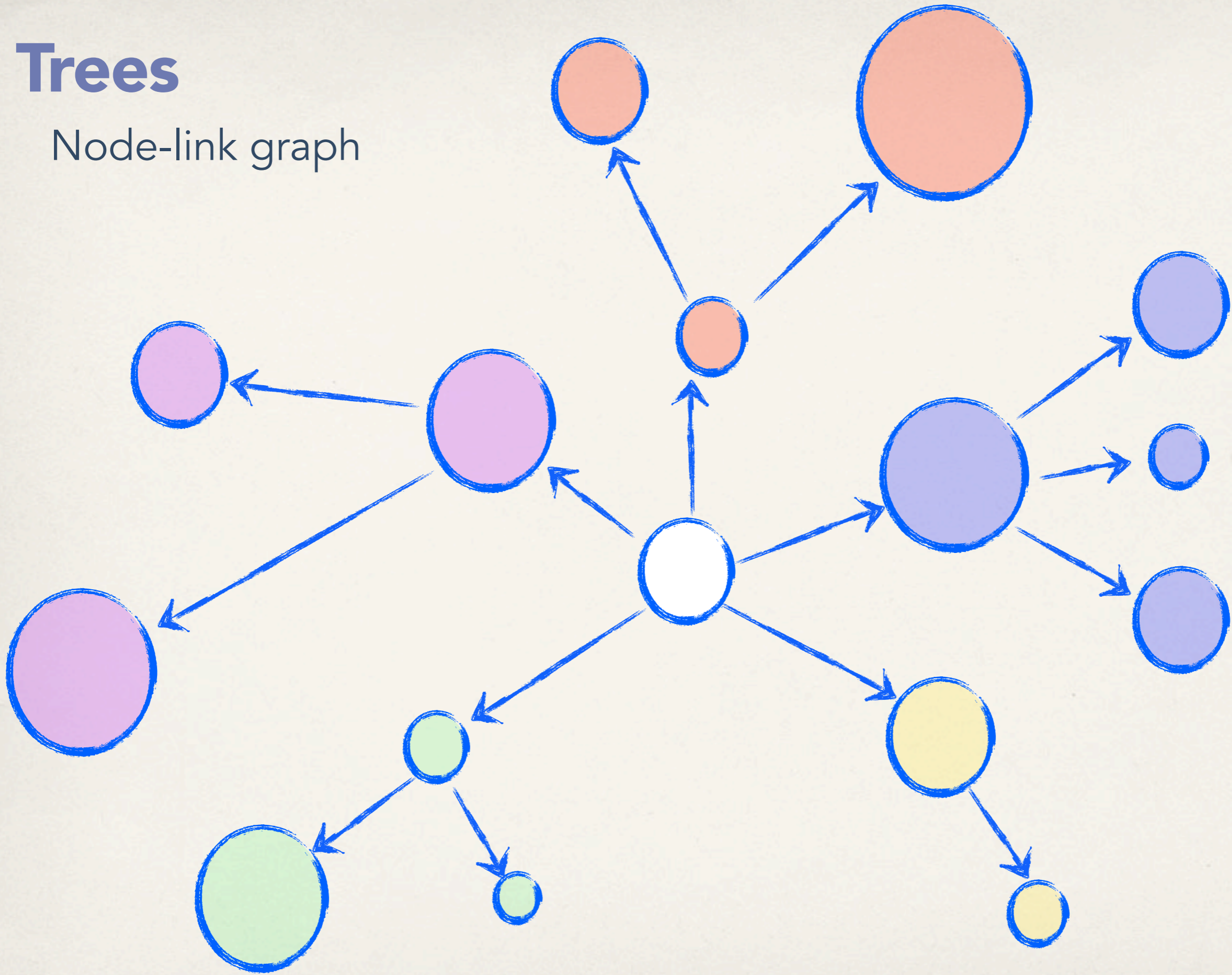
Node-link graph

Trees

Node-link graph
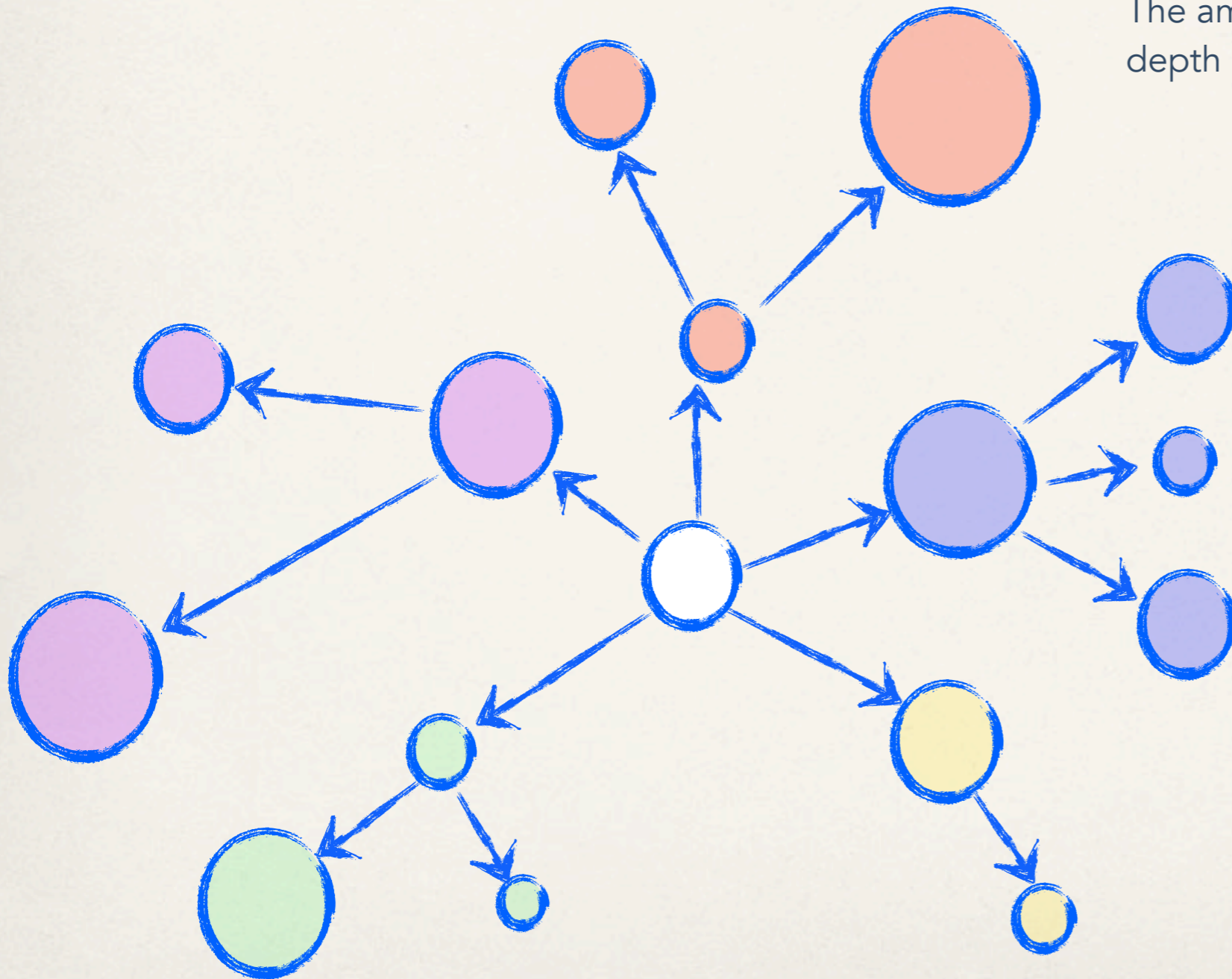
Challenges

We need to display both structure **and** data

Structure consume space

The amount of data grows exponentially with the depth

Conventional tree visualization

http://www.informatik.uni-koeln.de/ls_juenger/research/vbctool/

Radial layout

http://bl.ocks.org/mbostock/4339607
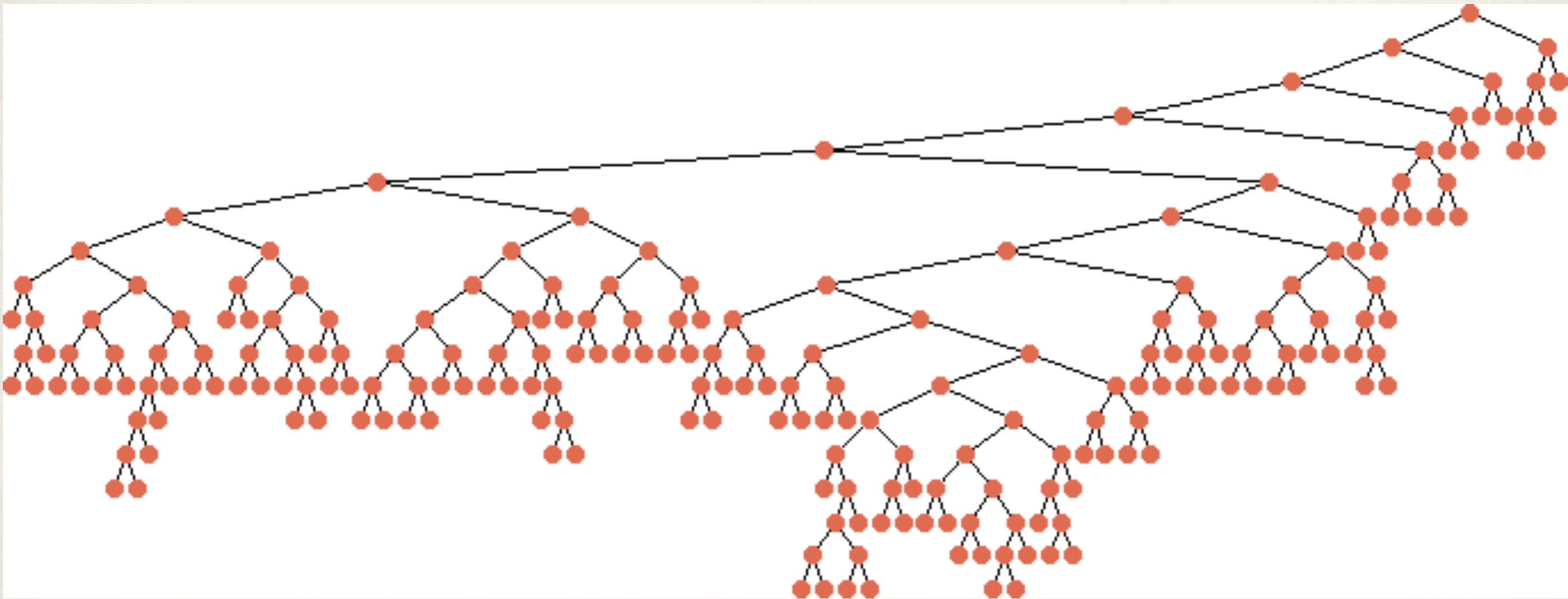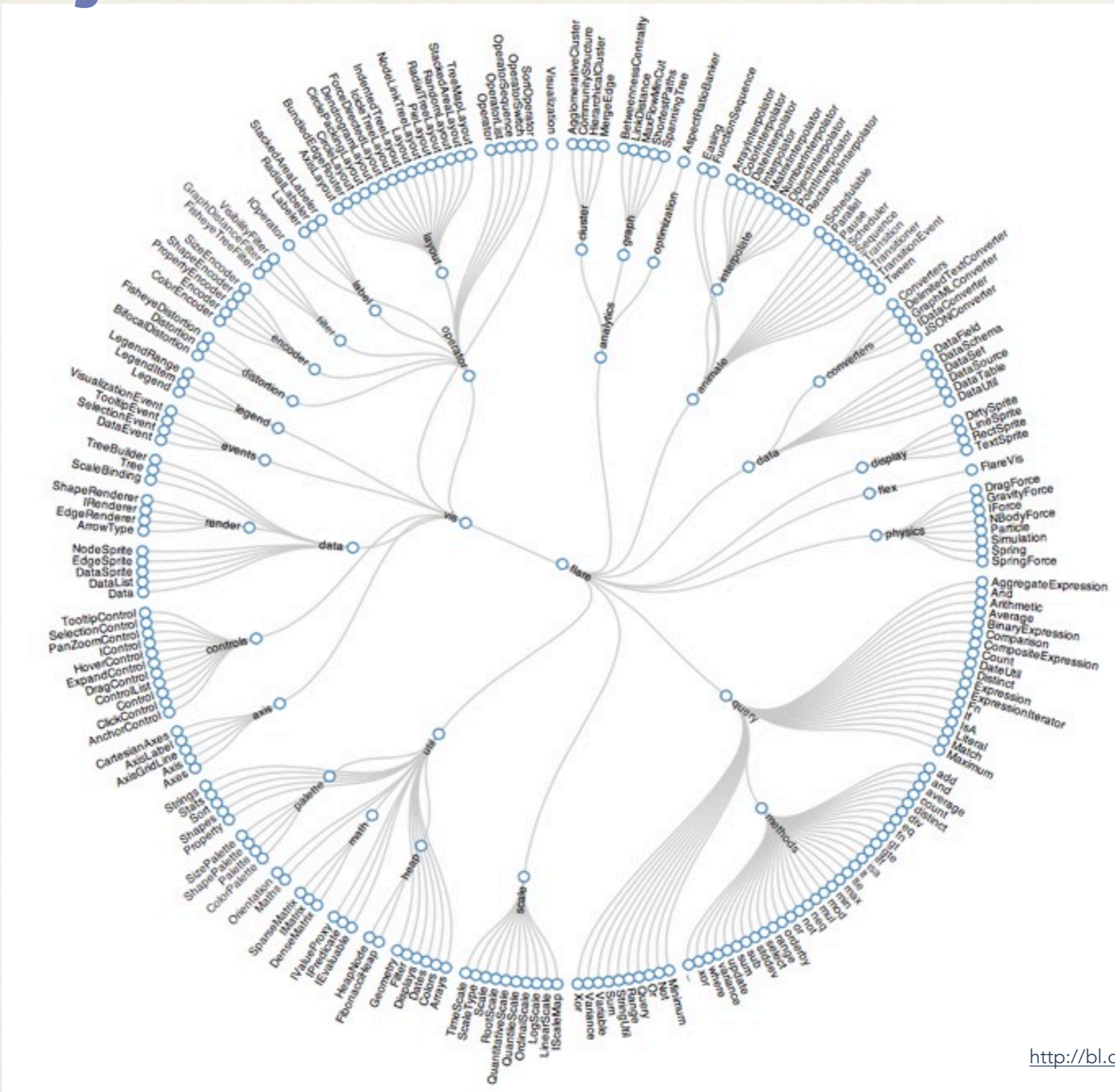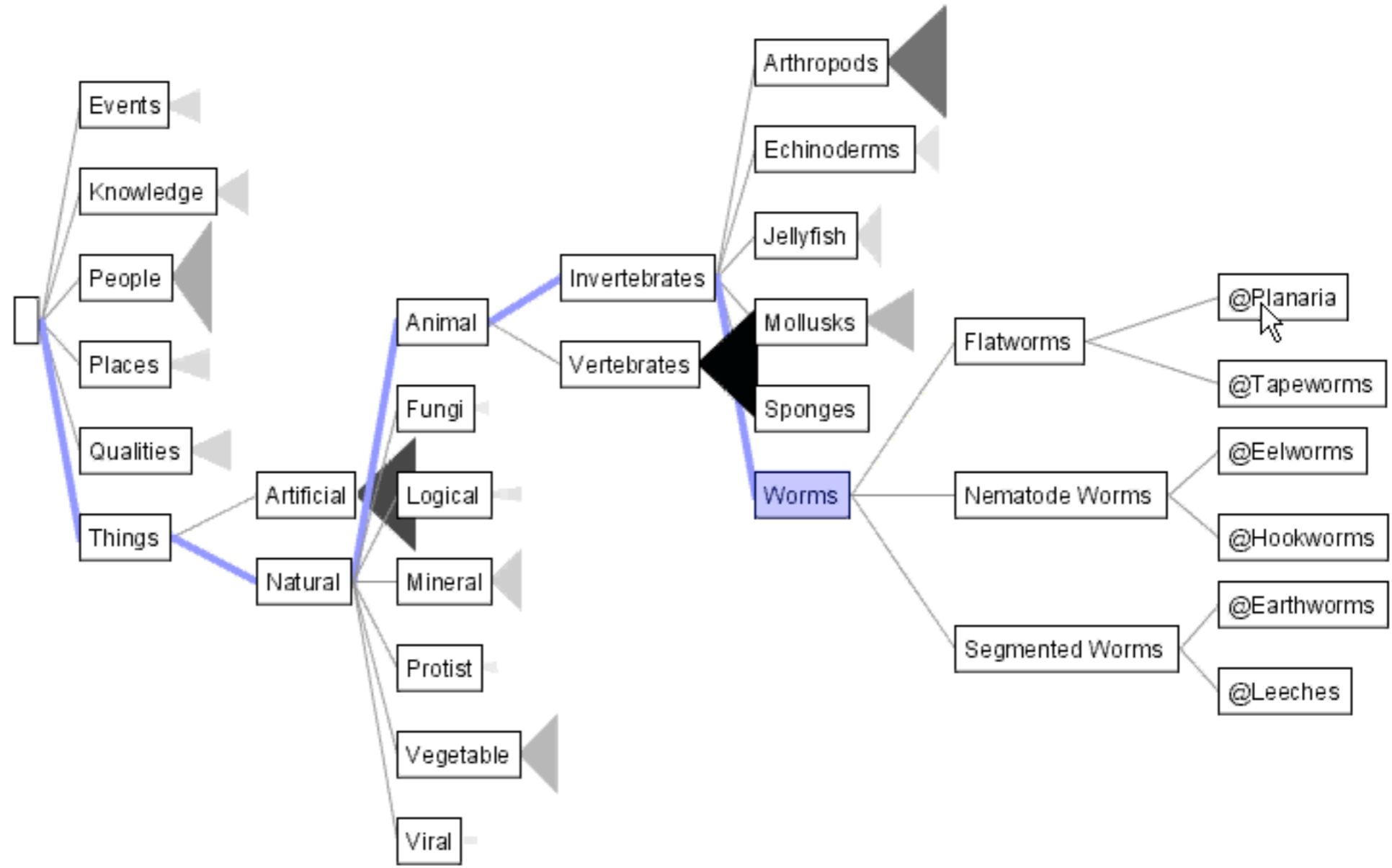
SpaceTree

Grosjean, et al. "SpaceTree: Supporting Exploration in Large Node Link Tree, Design Evolution and Empirical Evaluation"

Two views of a tree
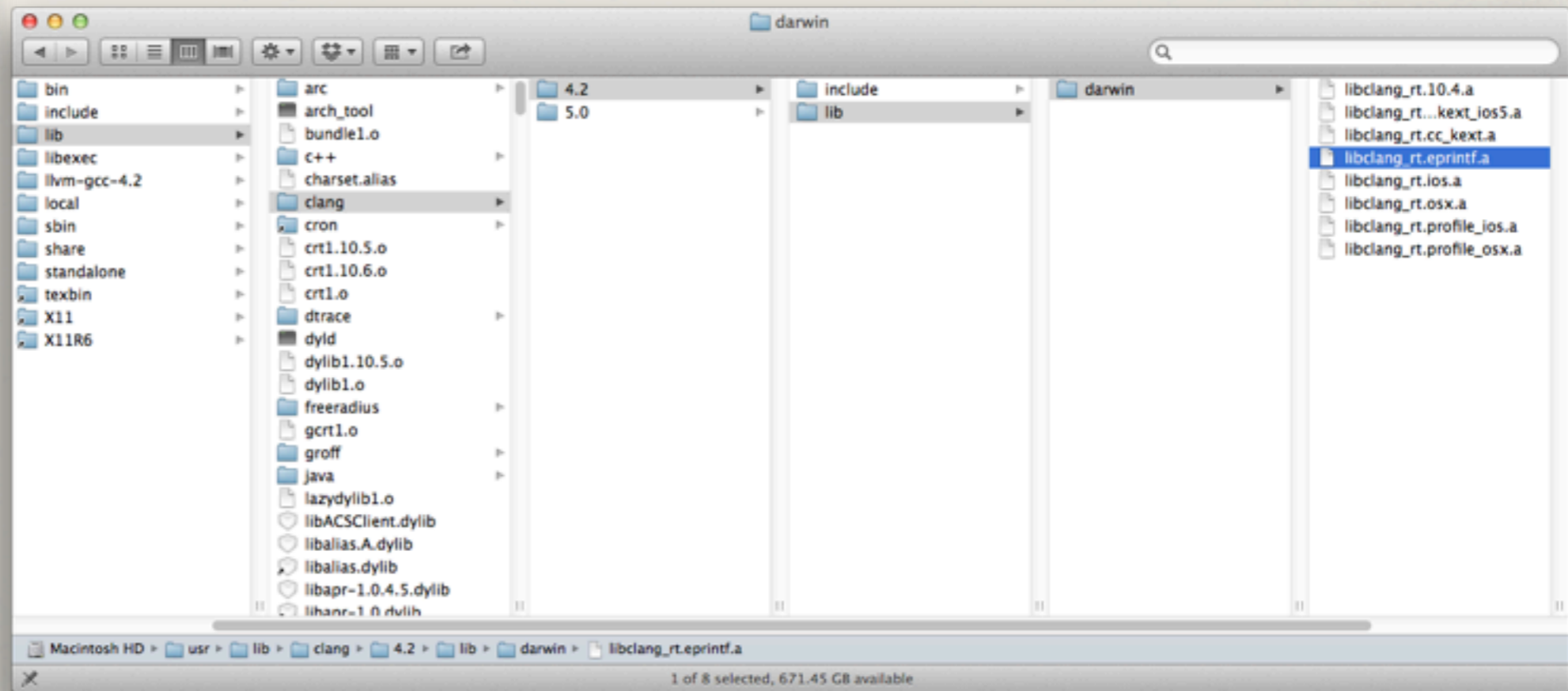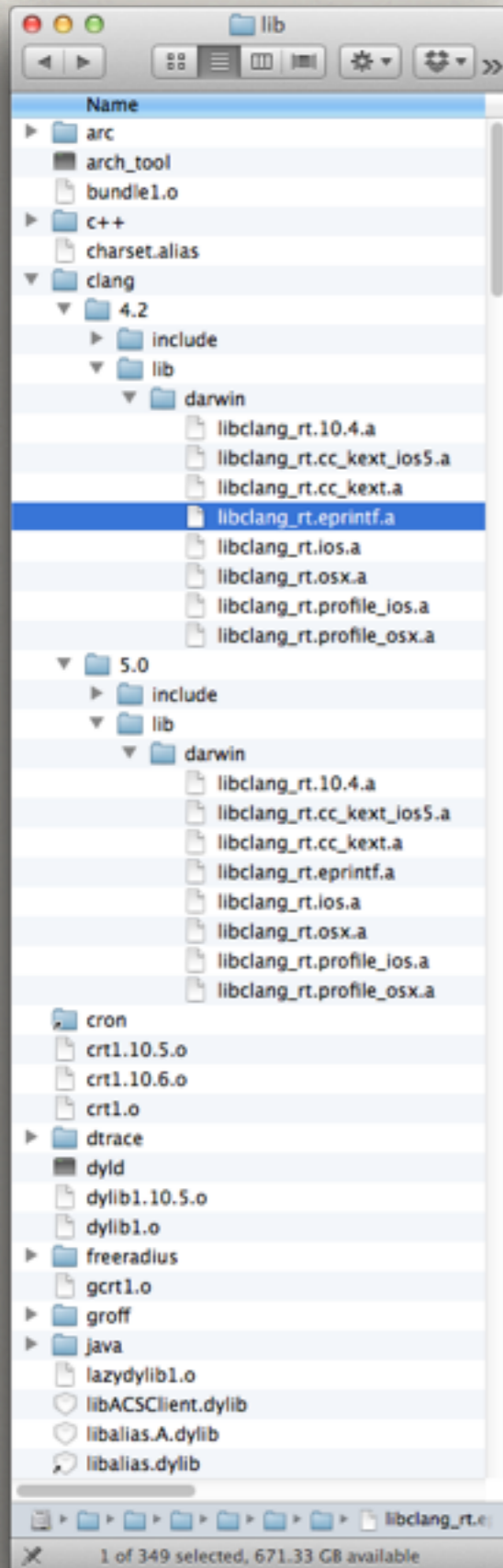
Cone Trees
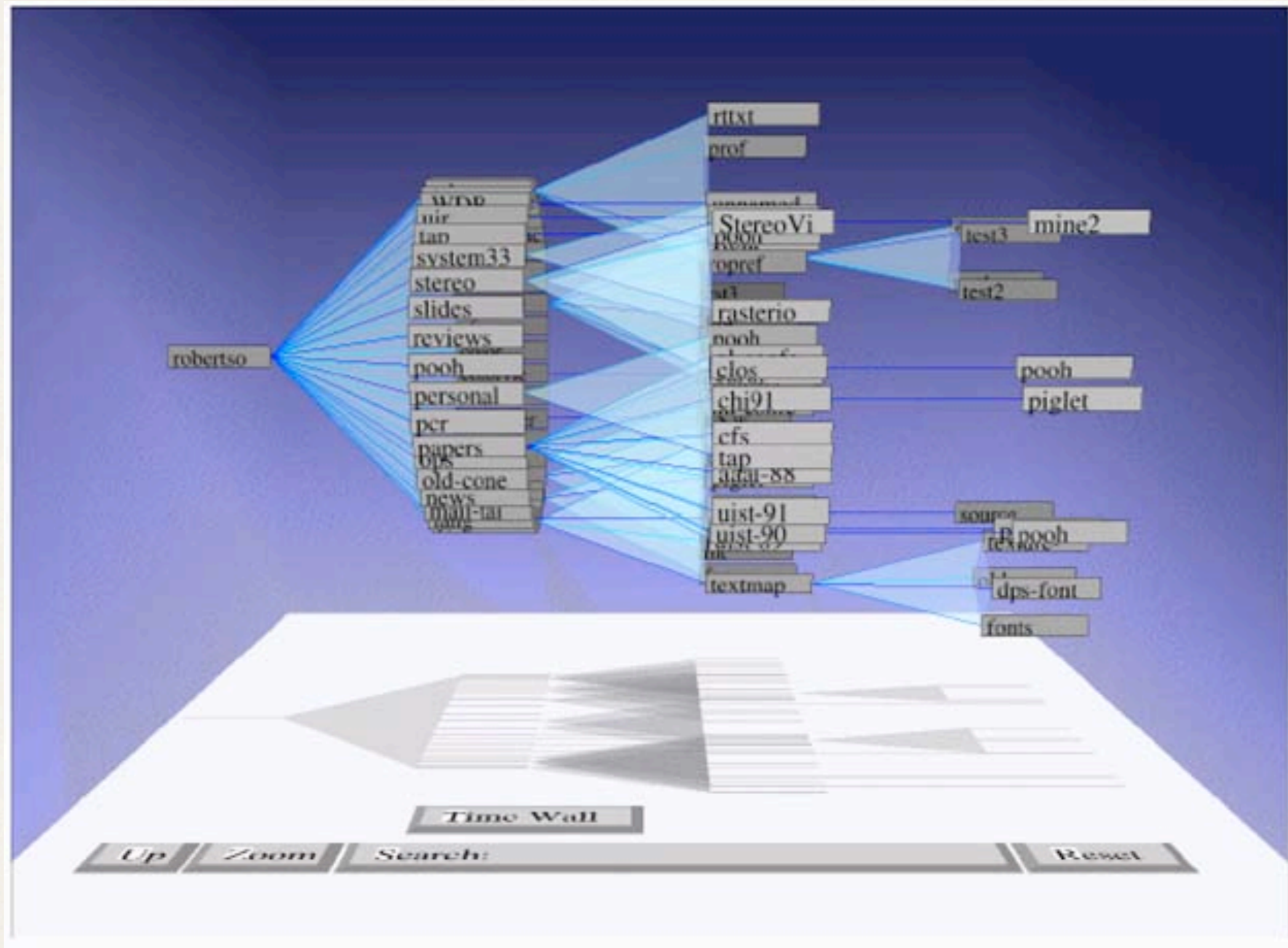
Robertson et al., "Cone Trees: Animated 3D Visualizations of Hierarchical Information"

Hyperbolic browser

The tree is laid out in hyperbolic space and mapped back to the unit circle.

Can show 10x the number of nodes of a standard 2D approach (1000 vs. 100)

Lamping et al. "A Focus + Context Technique Based on Hyperbolic Geometry for Visualizing large Hierarchies"
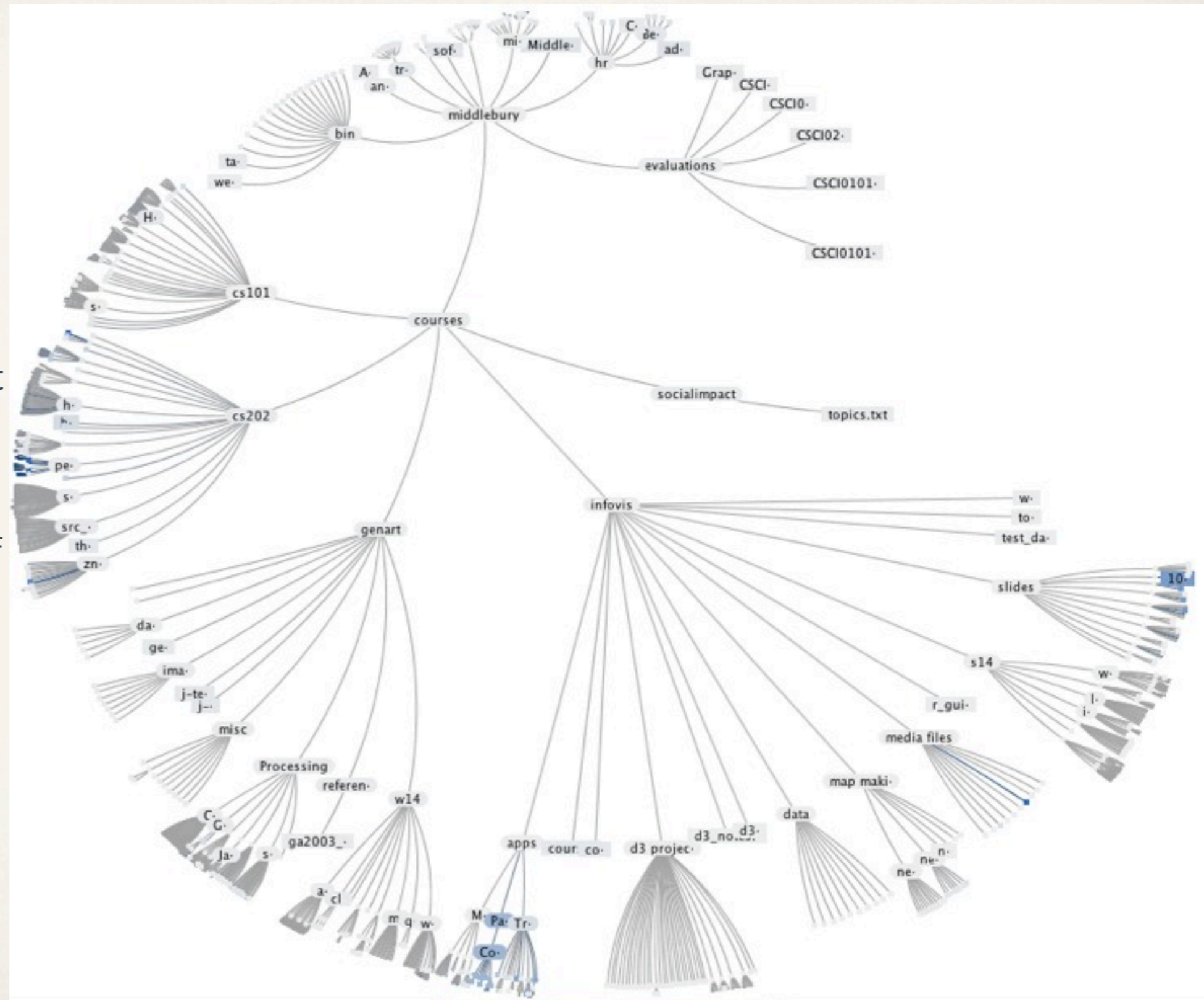
3D Hyperbolic Tree
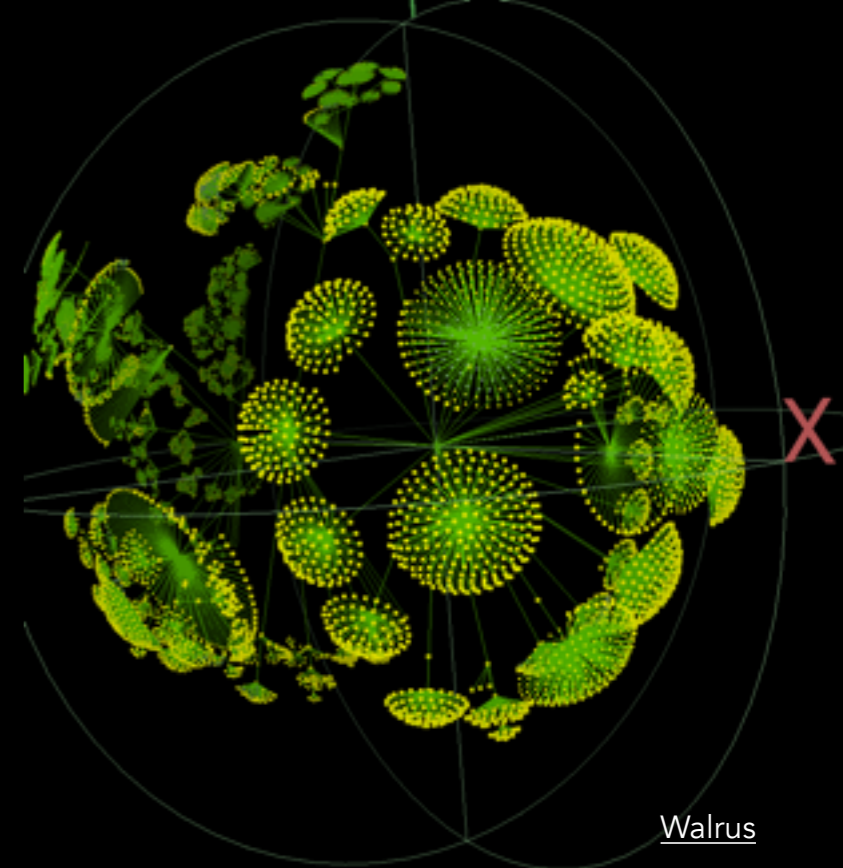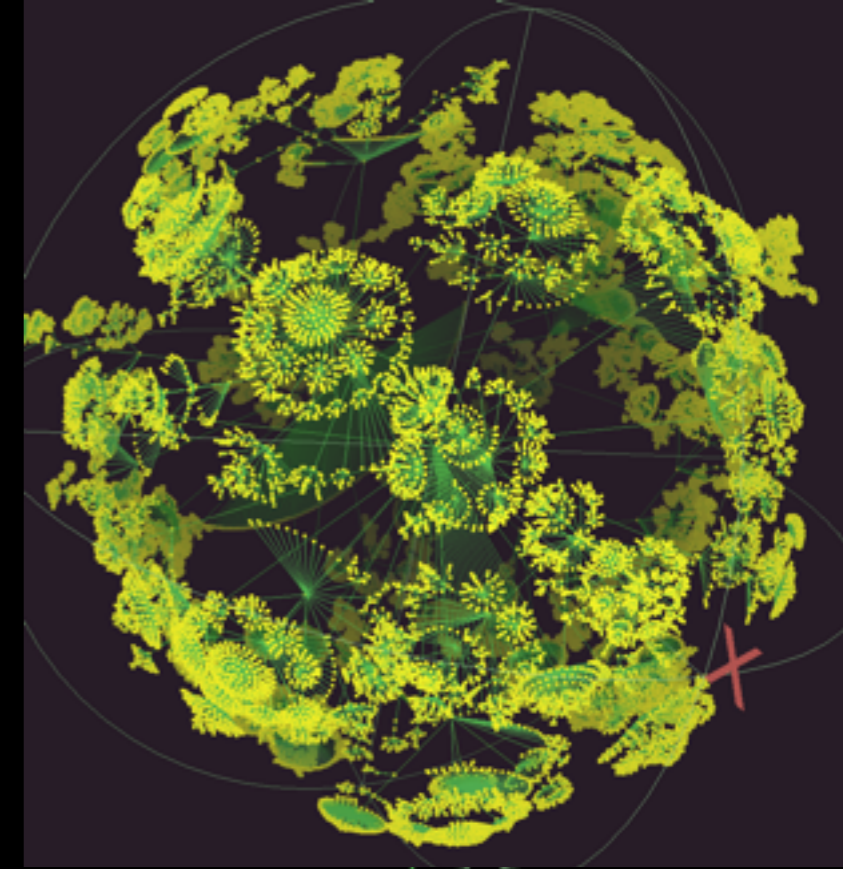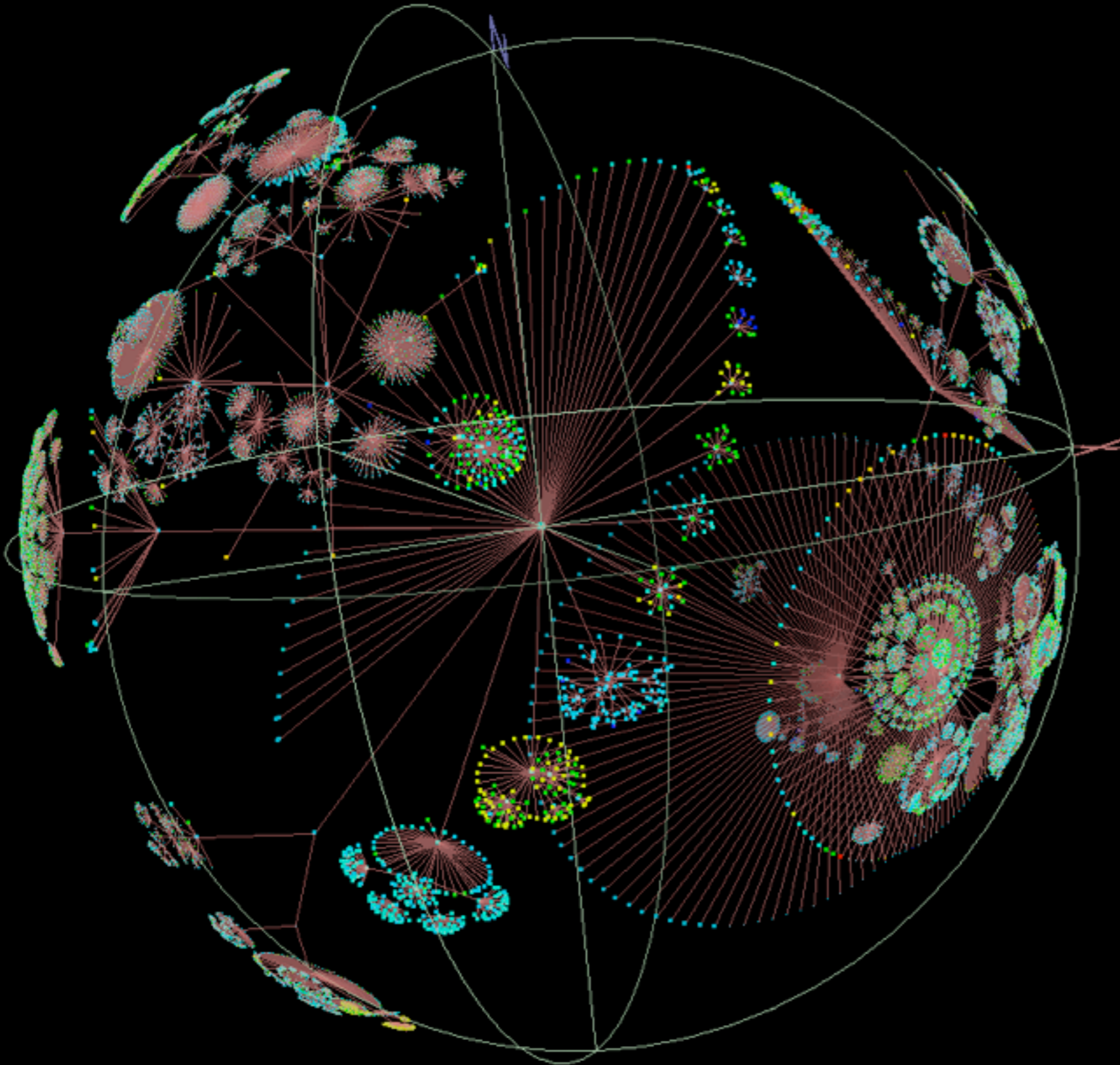
Walrus

Force-directed radial layout

Jan 07, 2008

Mar 26, 2009

http://www.autodeskresearch.com/projects/orgorgchart
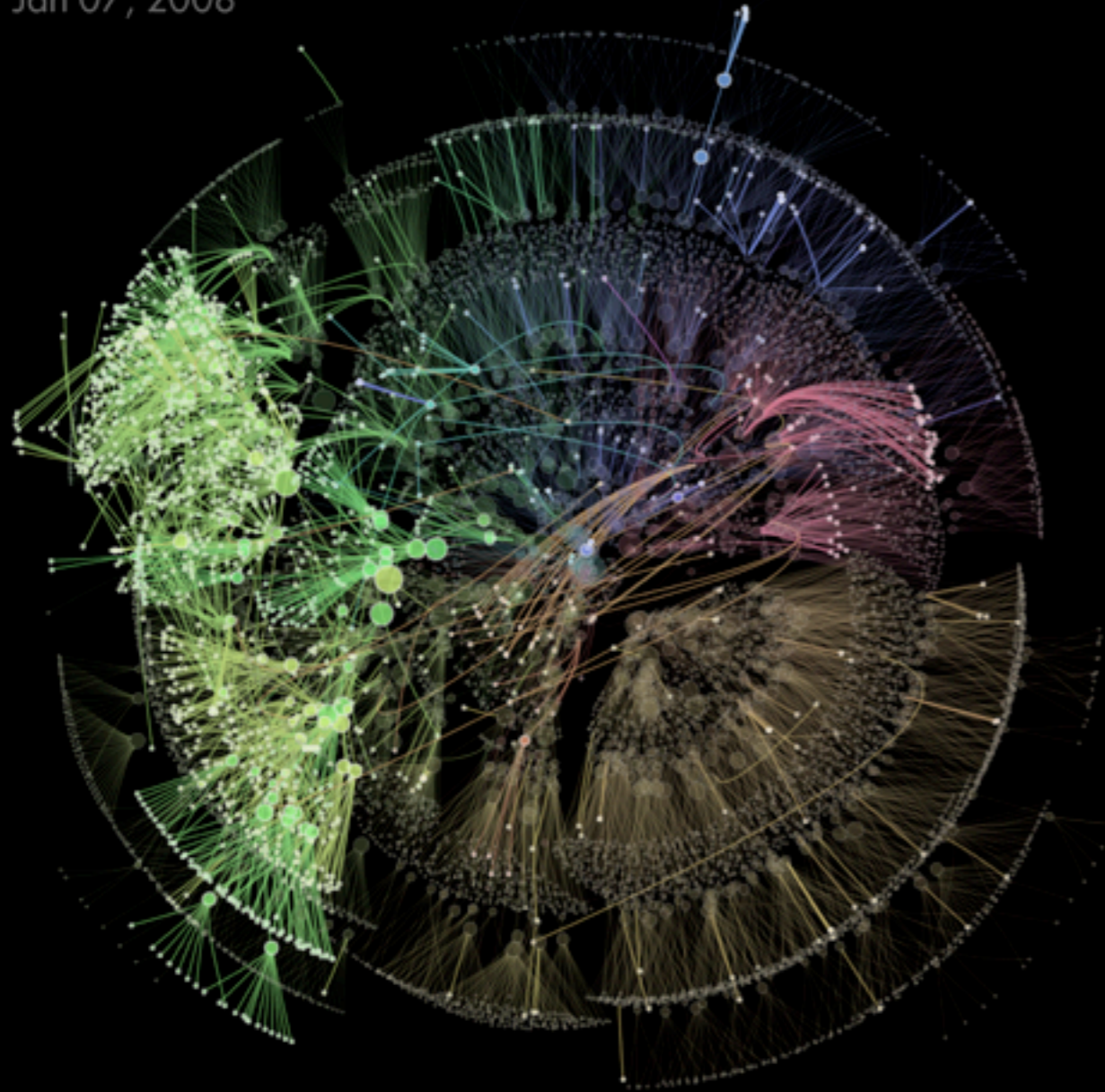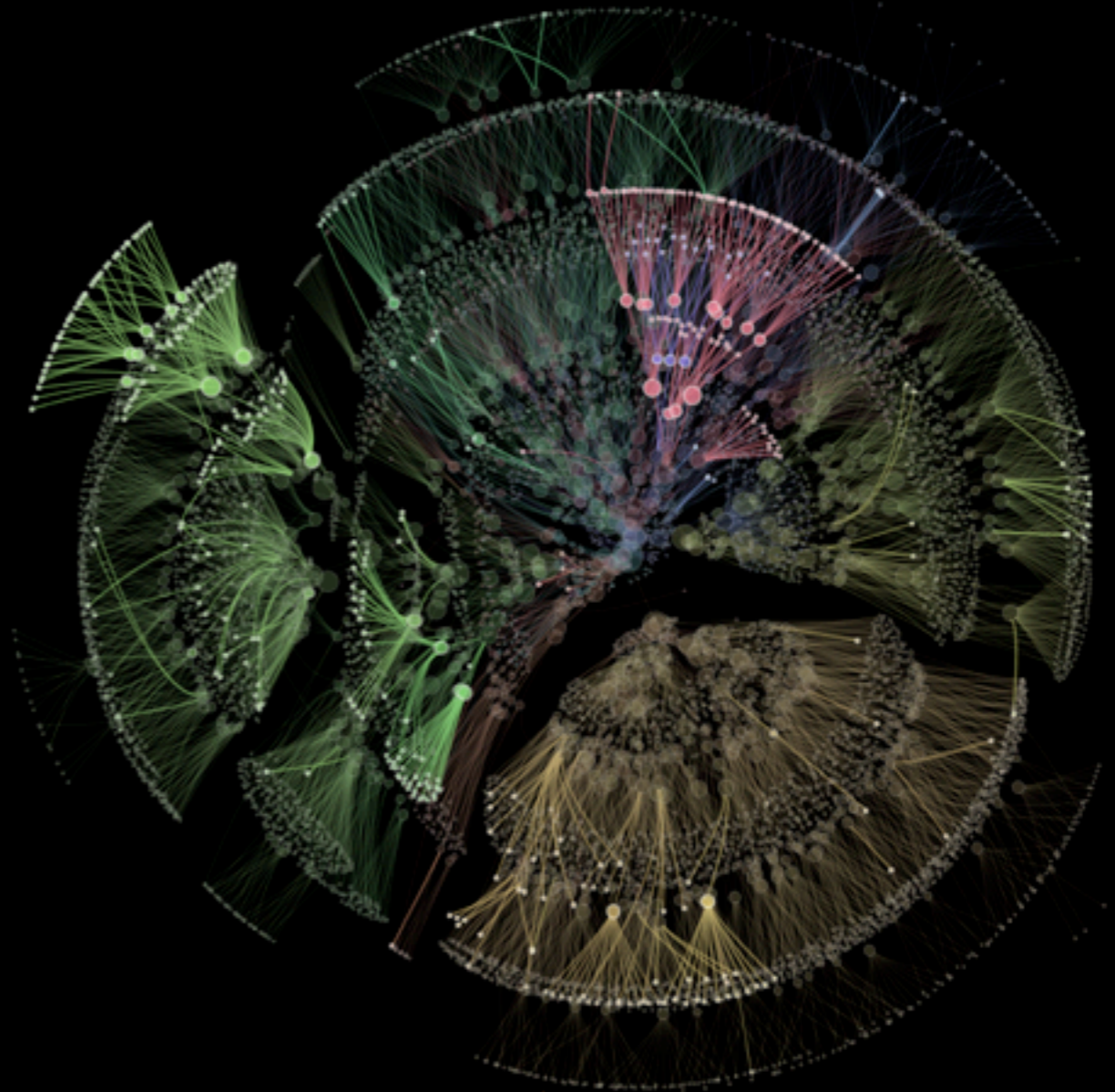
Degree-of-Interest (DOI) Trees
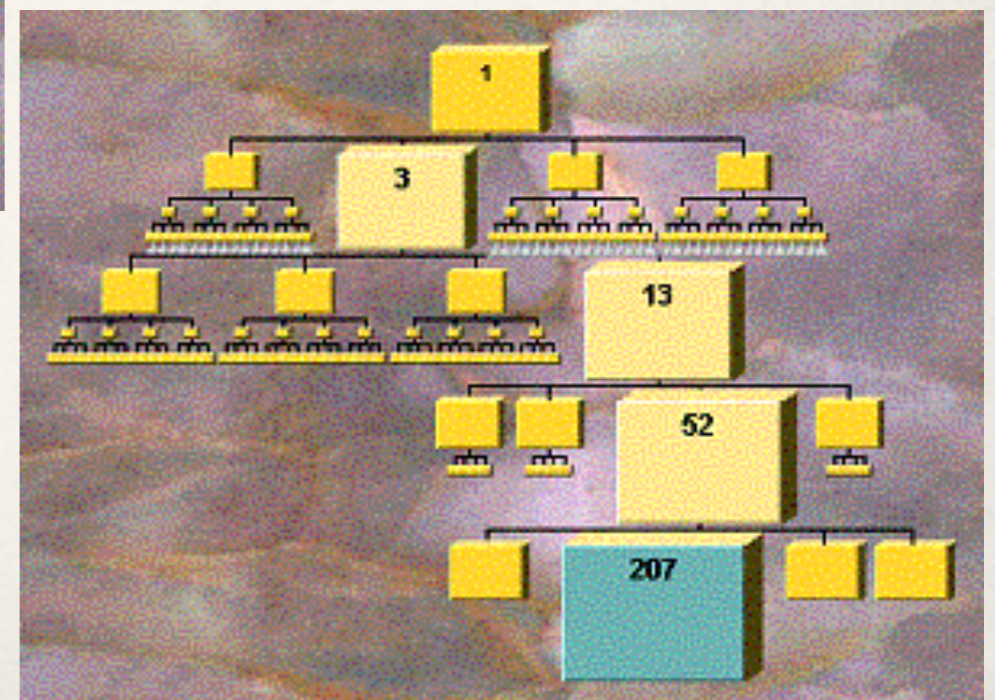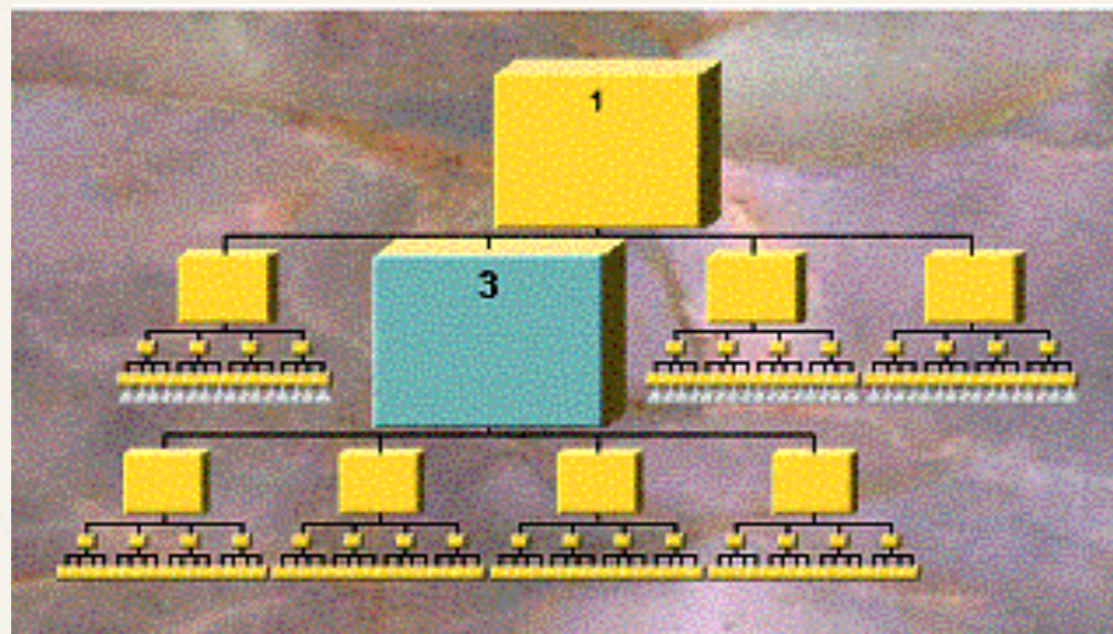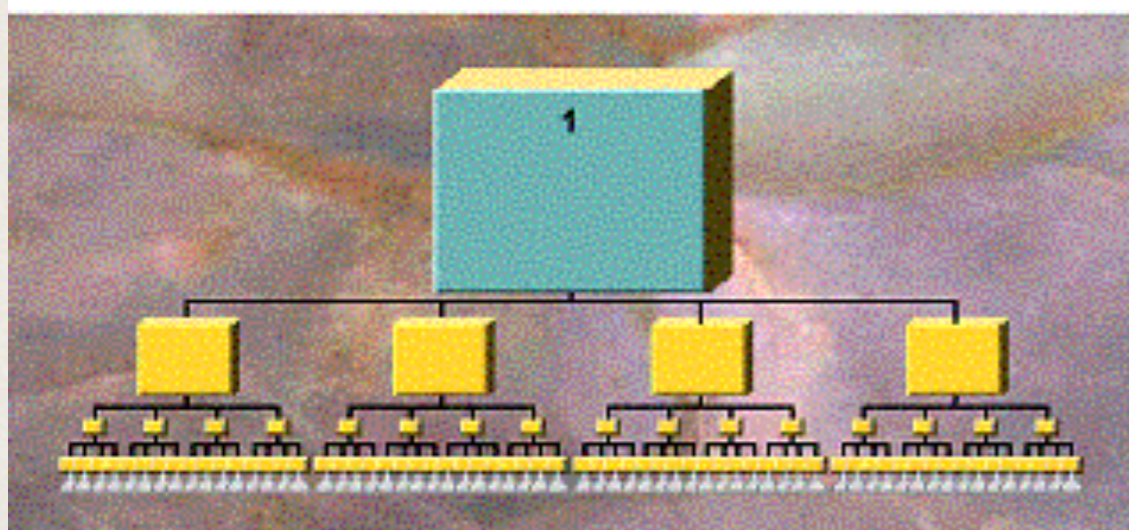
Card and Nation, "Degree-of-Interest Trees: A
Component of an Attention-Reactive User Interface"

Degree-of-Interest Trees
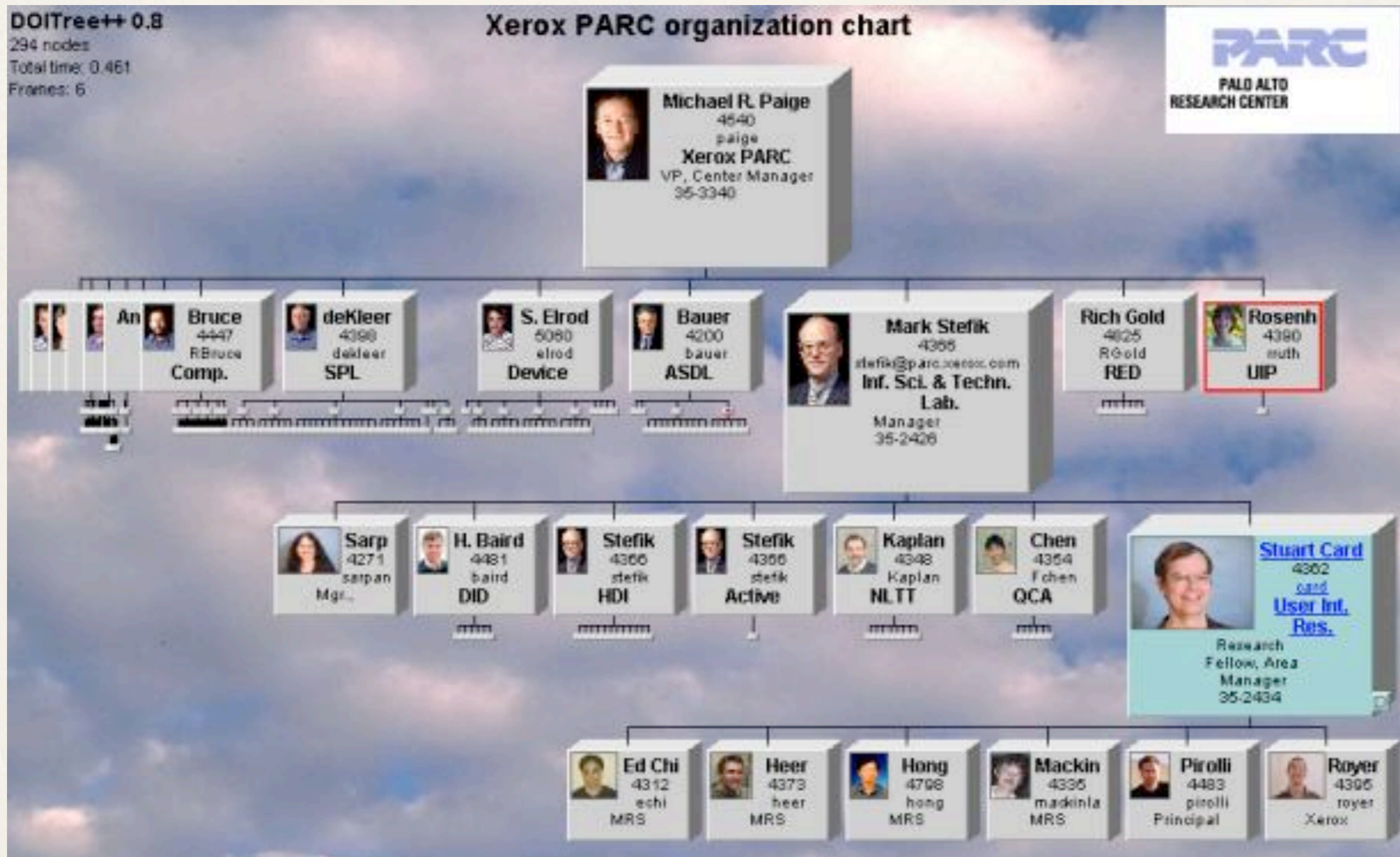
Card and Nation, "Degree-of-Interest Trees: A
Component of an Attention-Reactive User Interface"

Space filling trees
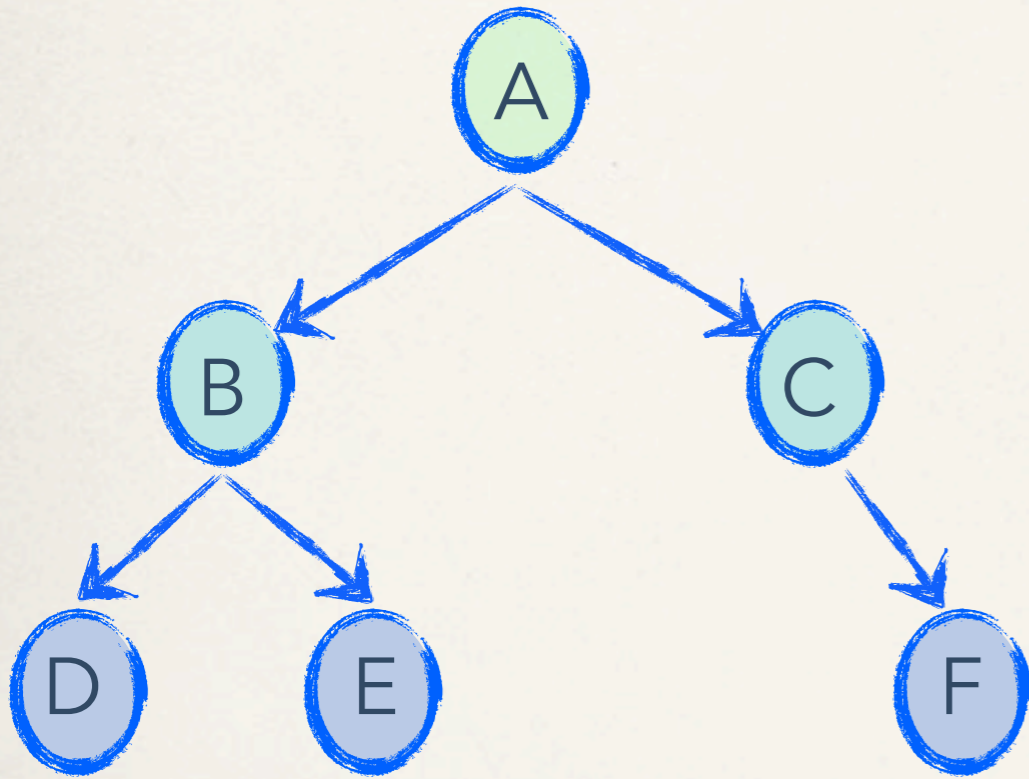
Connections
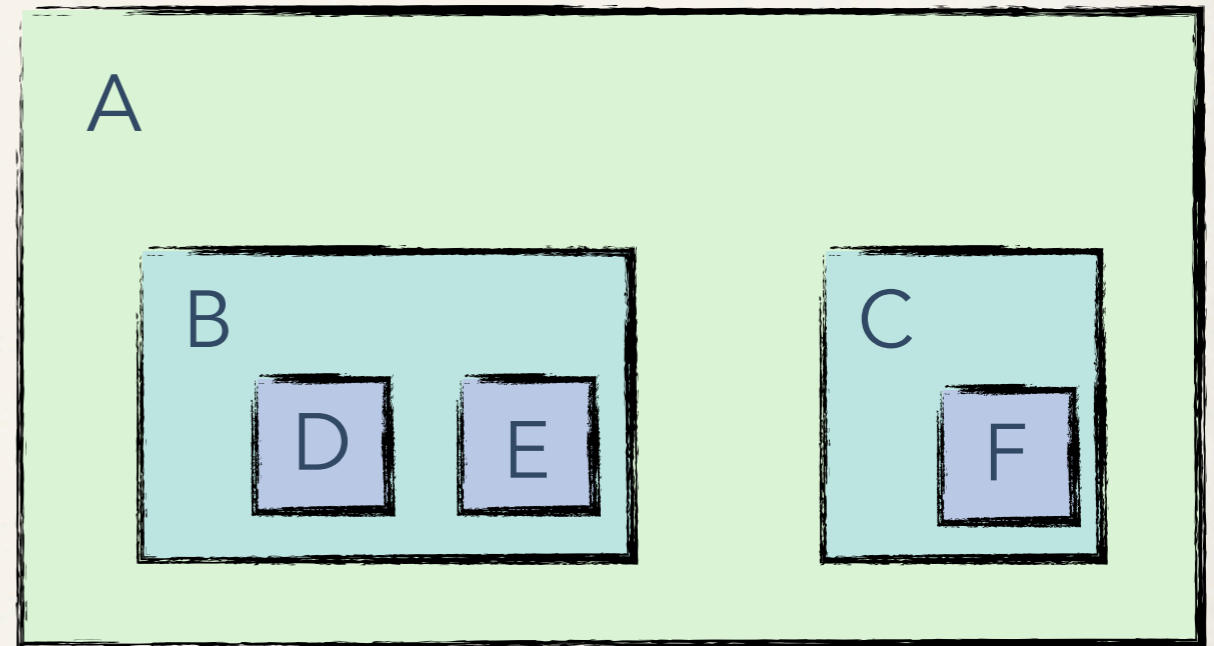
Containment

Icicle Plot

TreeViz
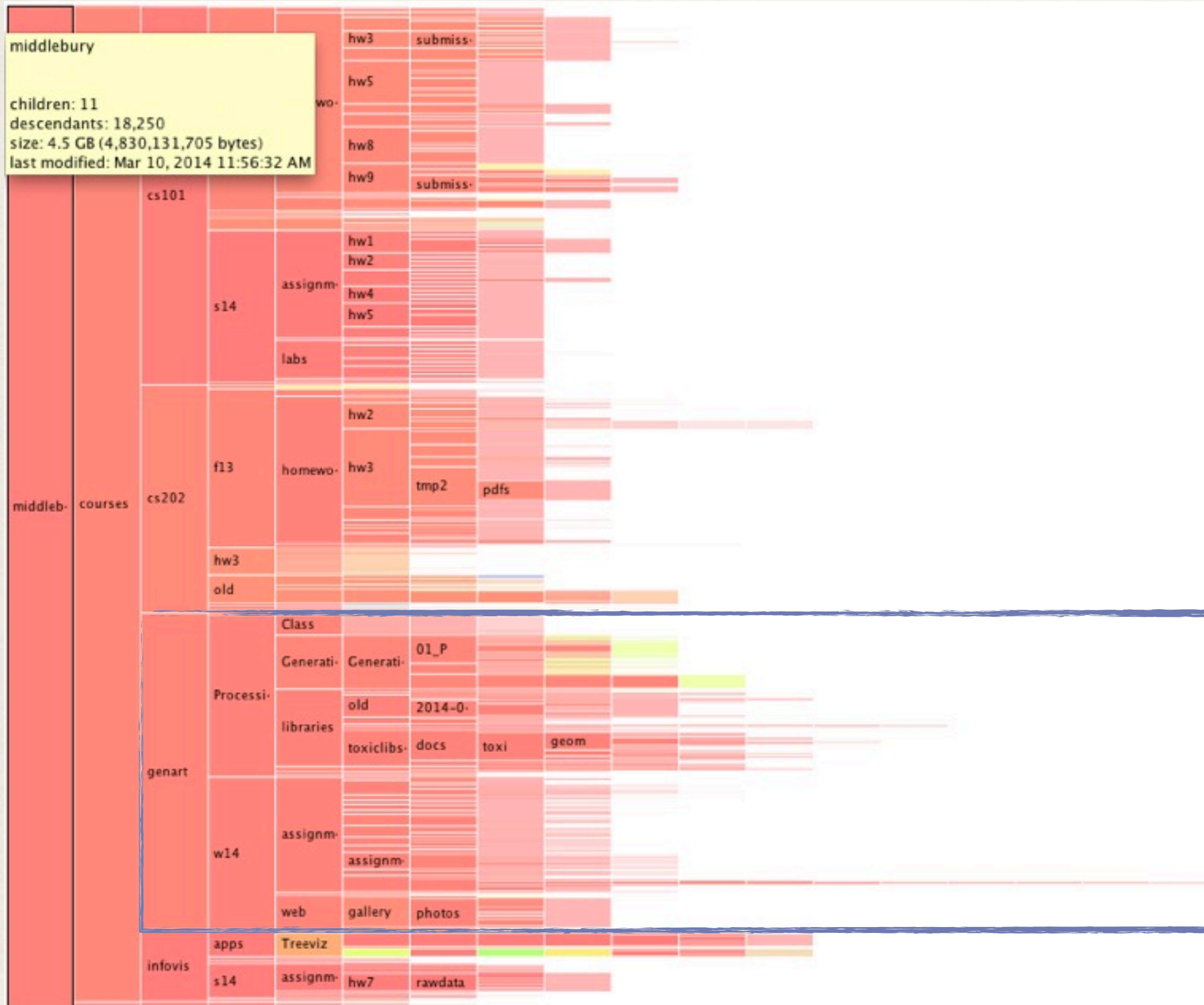
Aside: Sankey Diagram
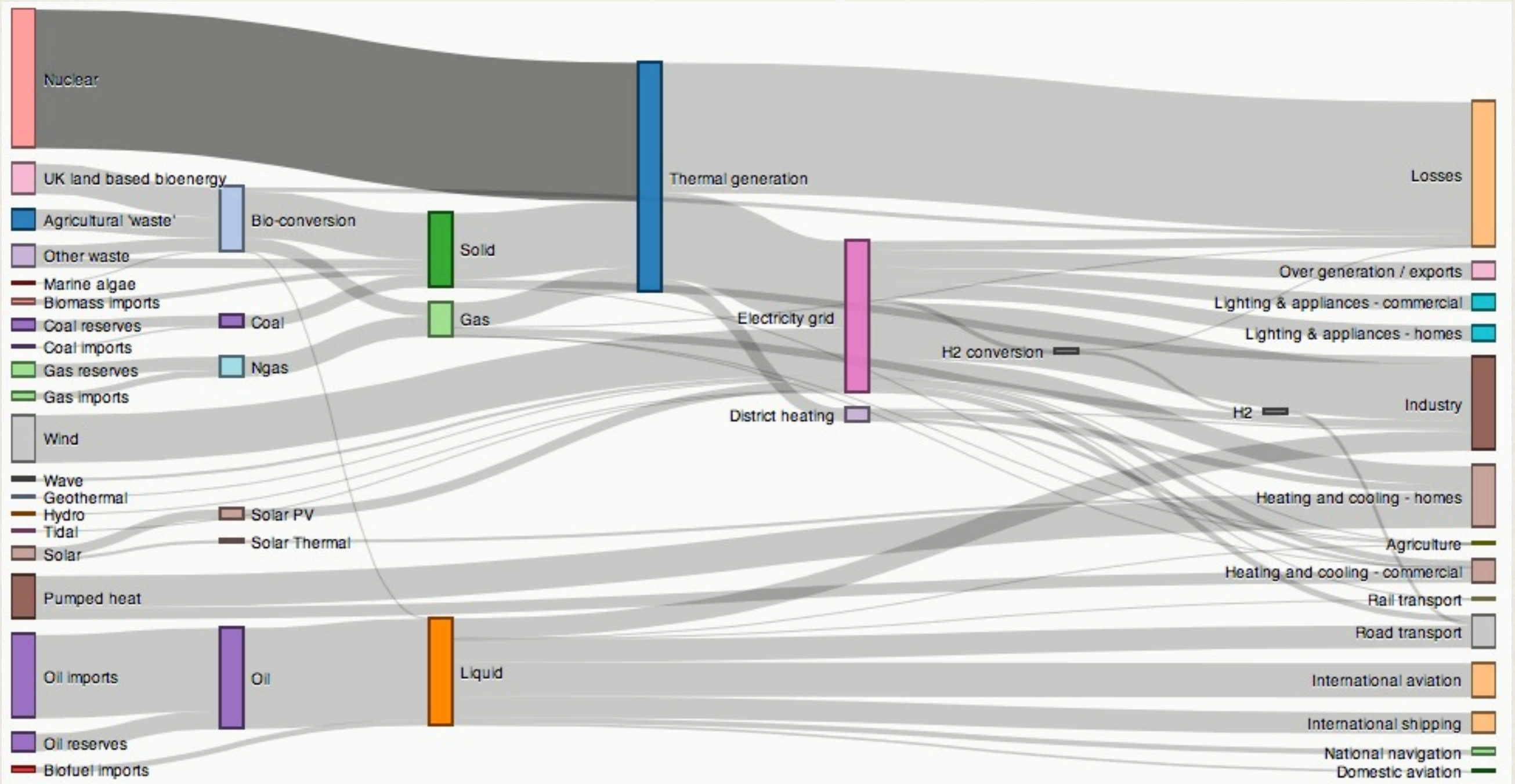
Treemaps
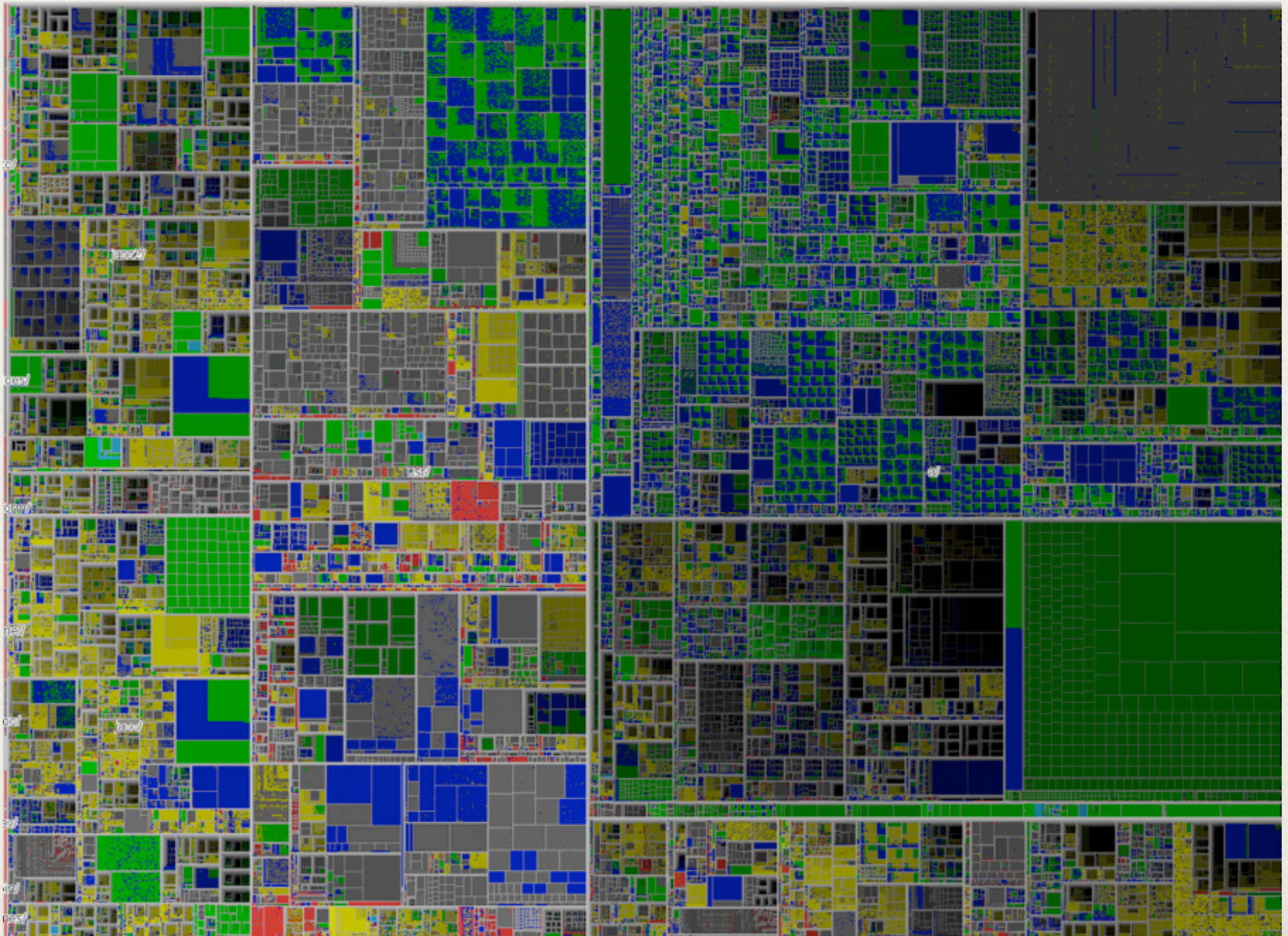
Building a treemap

```
makeTreeMap(node, orientation)
  for each child of node
    if orientation is vertical
      create rectangle with width scaled as proper
      percentage of node
      if child has children
        makeTreeMap(child, horizontal)
    else
      create rectangle with height scaled as proper
      percentage of node
      if child has children
        makeTreeMap(child, vertical)
```

Treemaps

Example: Sales figures ($M)

North America
  United States ($200)
  Canada ($200)
Europe
  Germany ($150)
  Austria ($100)
  Russia ($150)
  Sweden ($100)
Asia
  S. Korea ($50)
  China ($50)
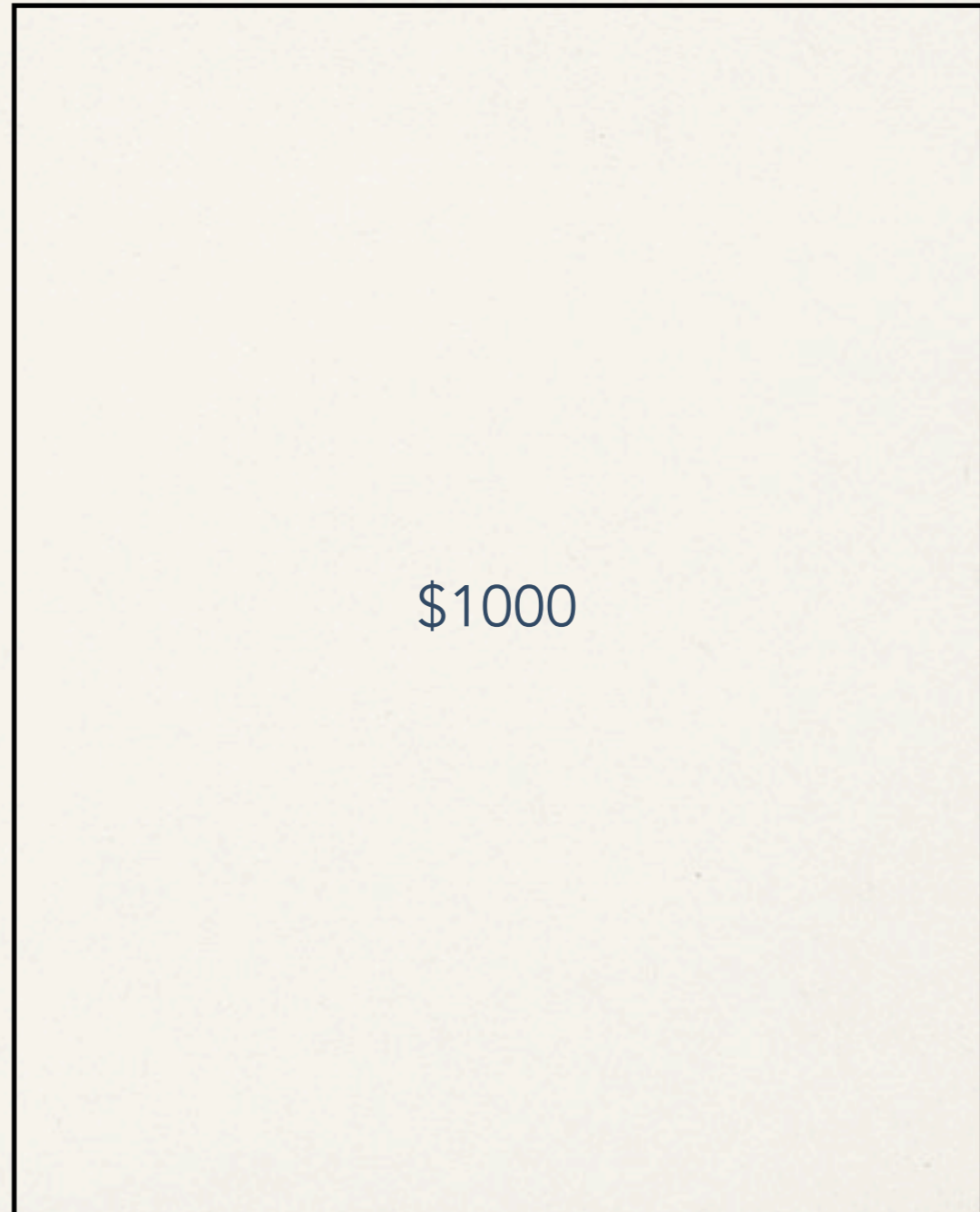
$1000

borrowed from M. Porath

Treemaps

Example: Sales figures ($M)

North America ($400)
    United States ($200)
    Canada ($200)
Europe ($500)
    Germany ($150)
    Austria ($100)
    Russia ($150)
    Sweden ($100)
Asia ($100)
    S. Korea ($50)
    China ($50)

$400
$500
$100

borrowed from M. Porath

Treemaps

Example: Sales figures ($M)

North America ($400)
  United States ($200)
  Canada ($200)
Europe ($500)
  Germany ($150)
  Austria ($100)
  Russia ($150)
  Sweden ($100)
Asia ($100)
  S. Korea ($50)
  China ($50)

$200	$200

$150	$150	$100	$100

$50	$50

borrowed from M. Porath

Treemaps

Example: Sales figures ($M)

North America ($400)
United States ($200)
Canada ($200)
Europe ($500)
Germany ($150)
Austria ($100)
Russia ($150)
Sweden ($100)
Asia ($100)
S. Korea ($50)
China ($50)
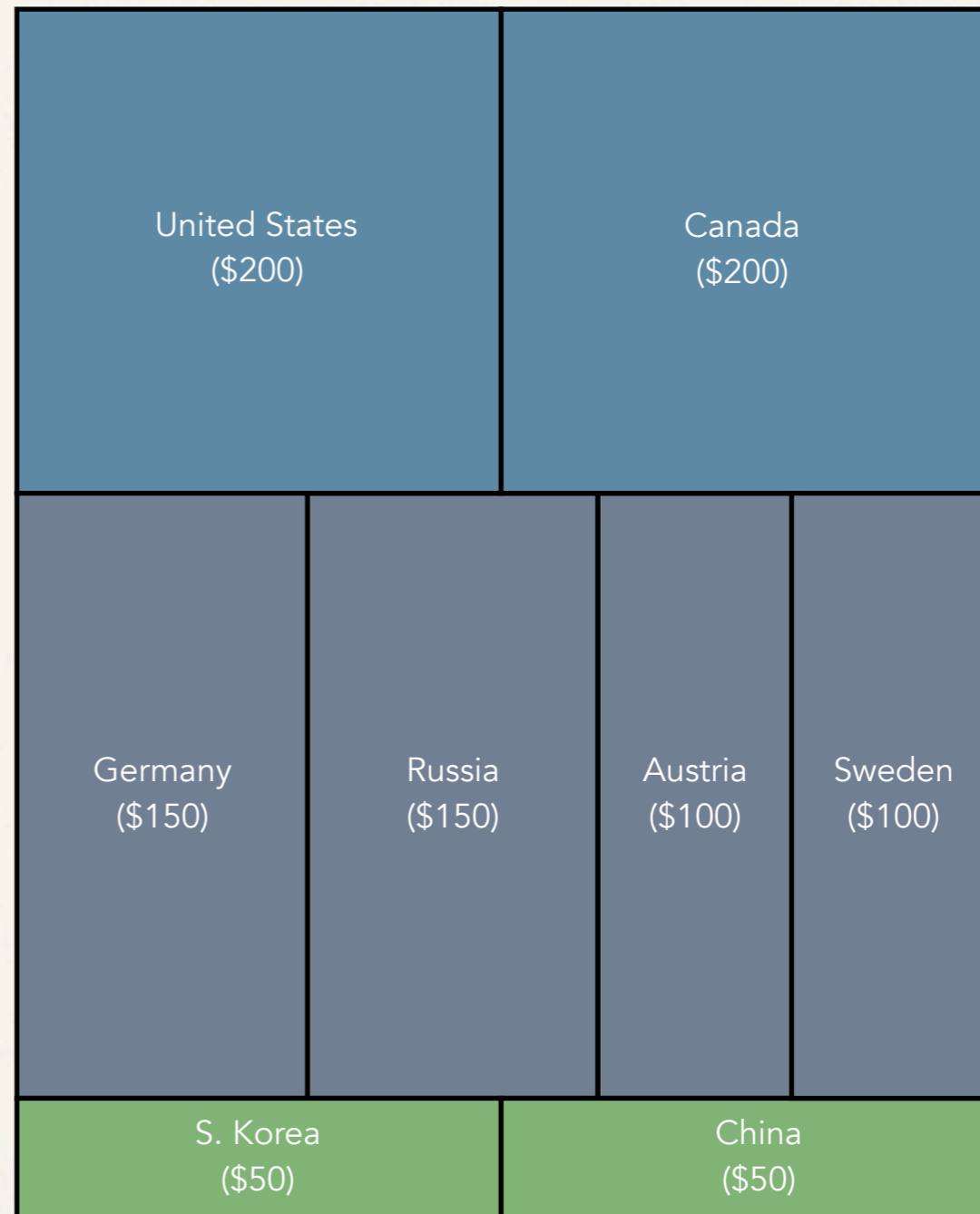
borrowed from M. Porath

Nested treemap
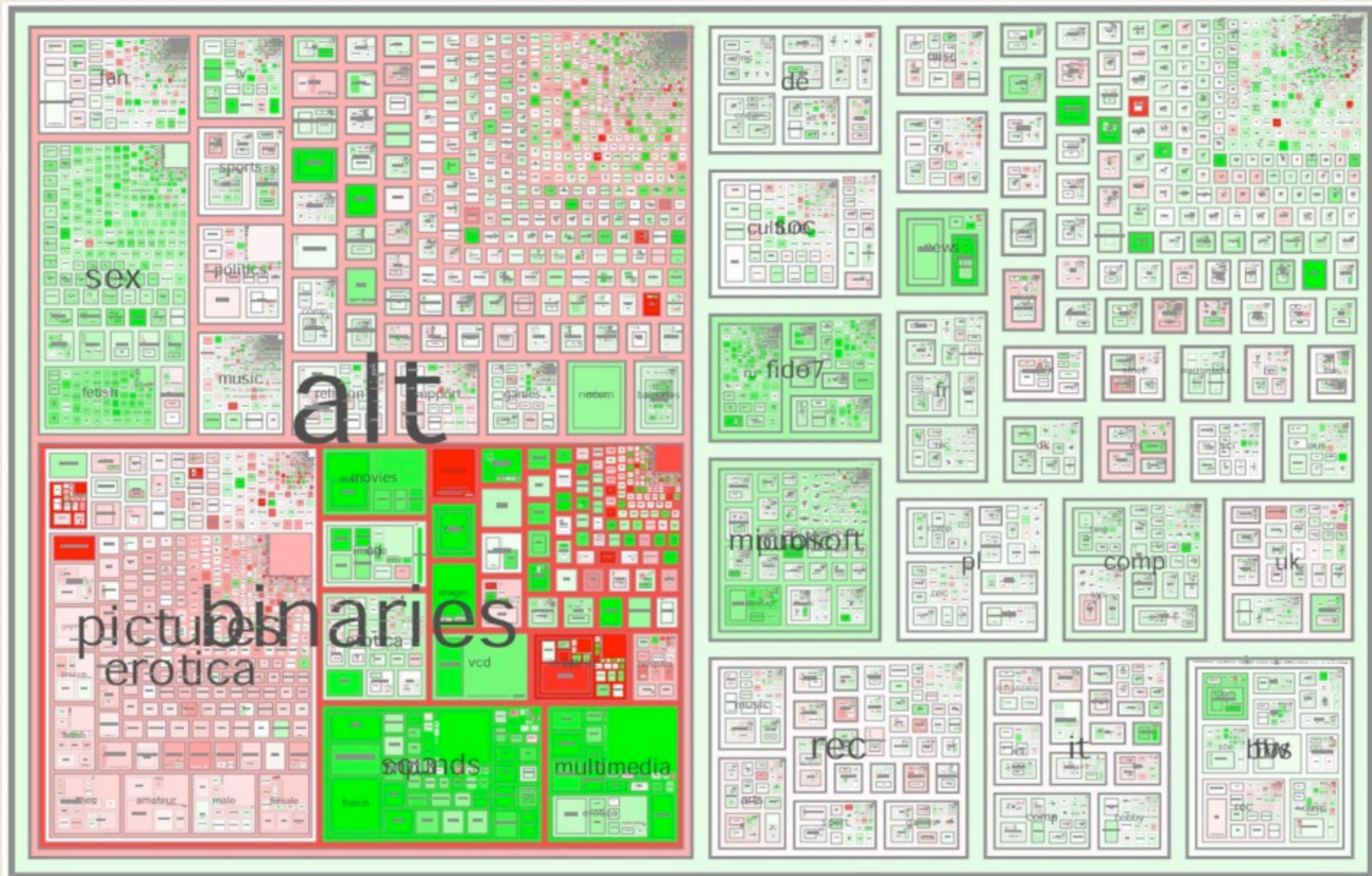
Cushion treemaps
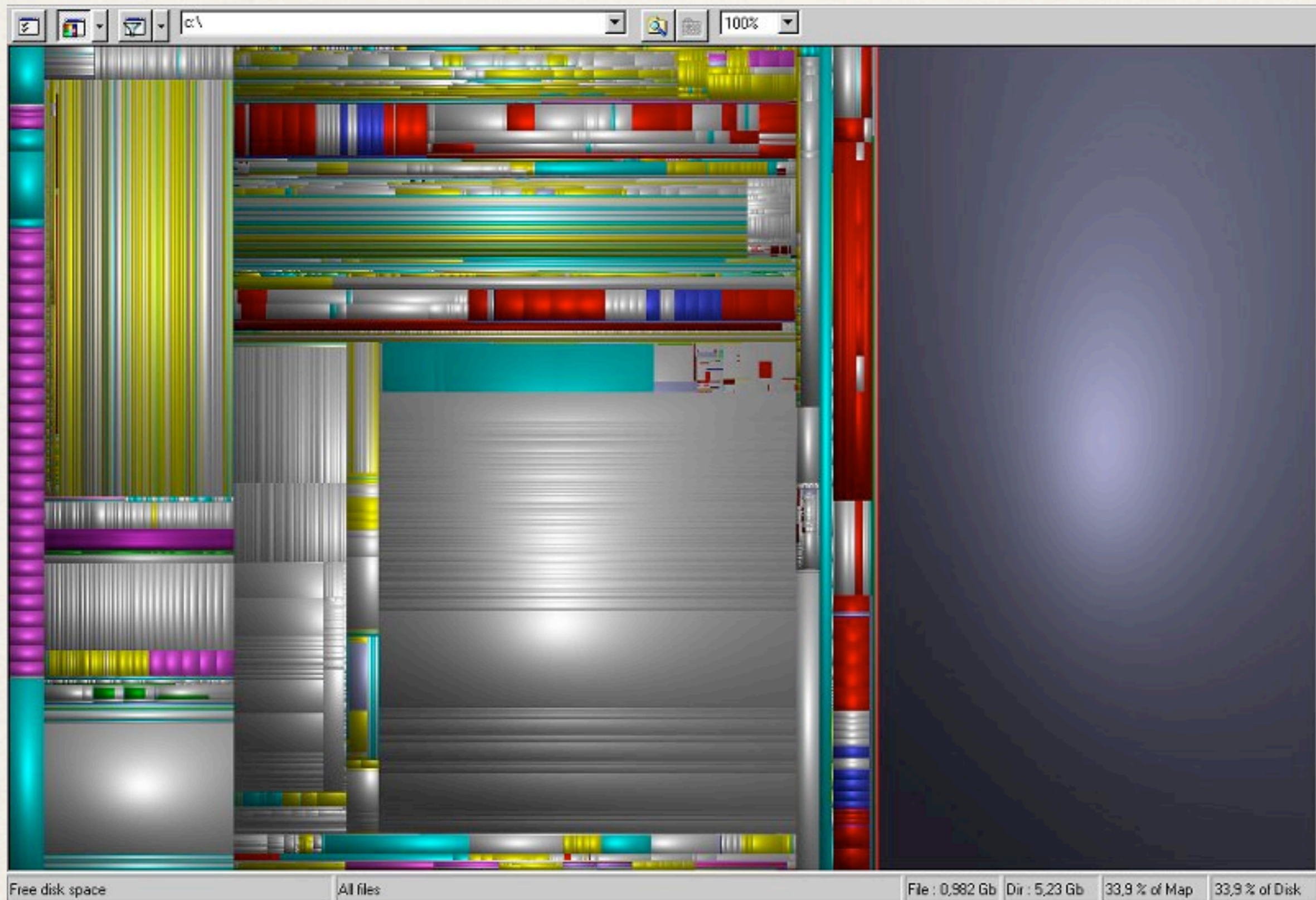
Sequoia View

Not a cushion treemap
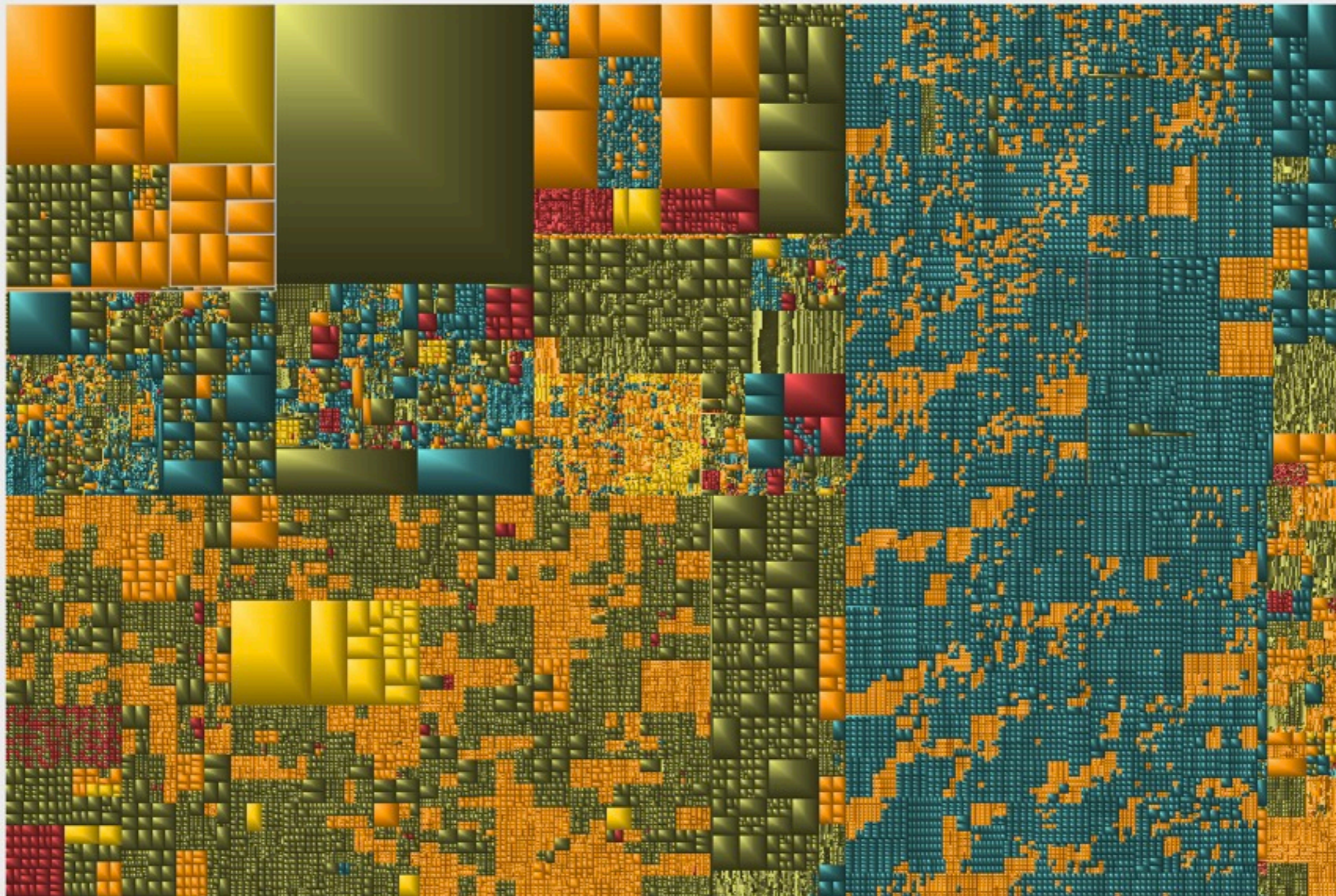
Grand Perspective

The aspect ratio problem...
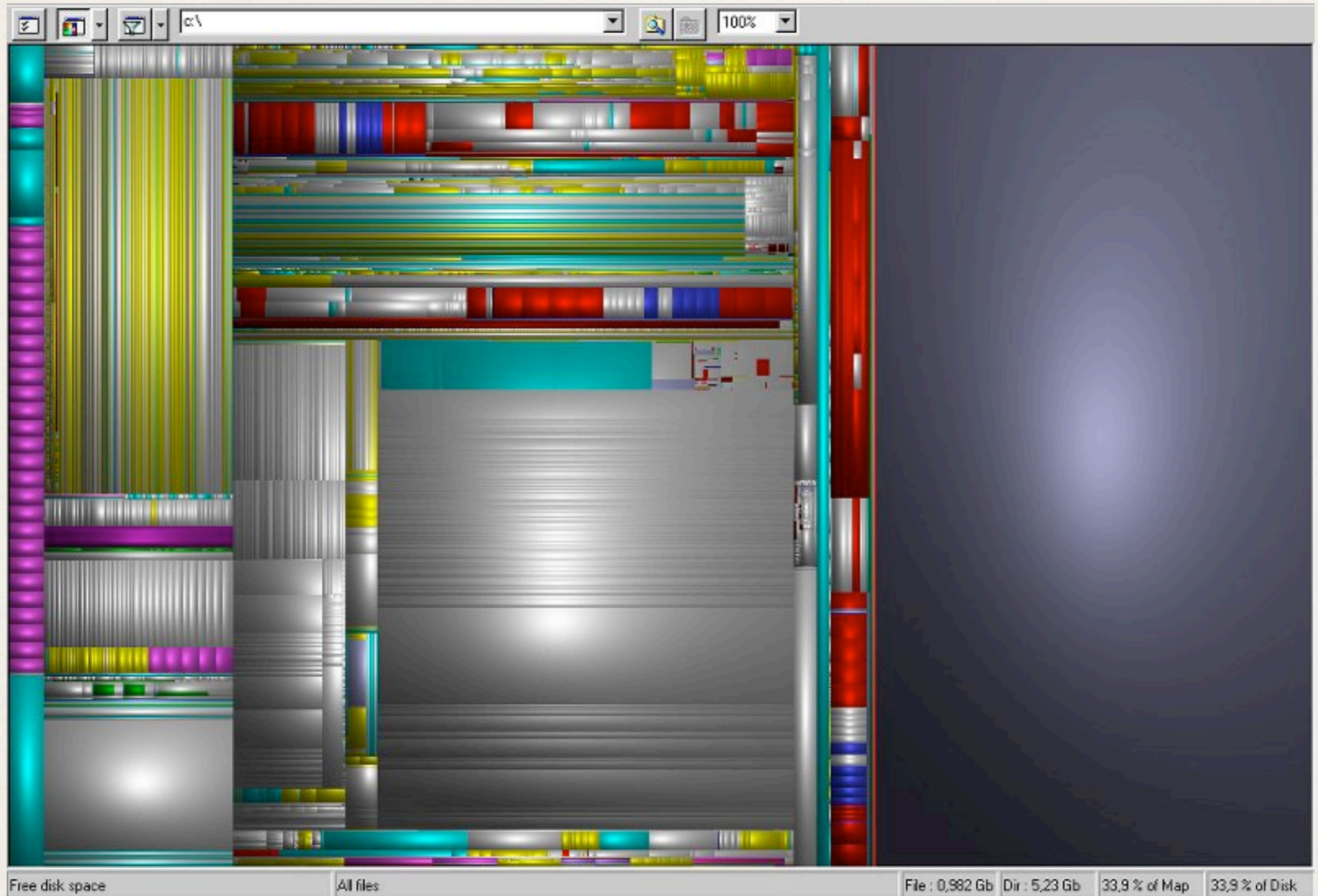
Sequoia View

The aspect ratio problem...

900

100

300

300
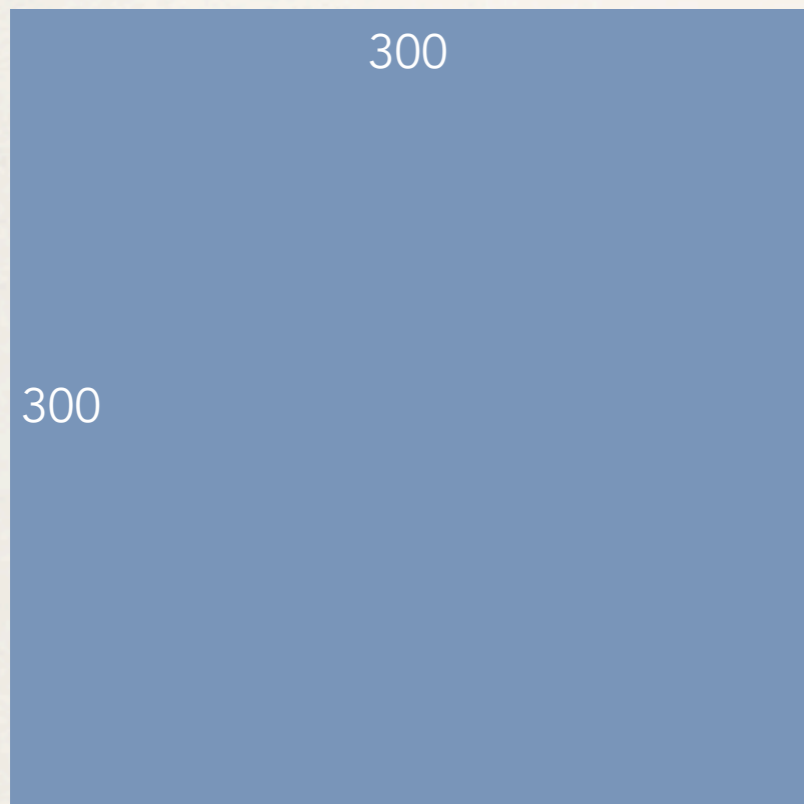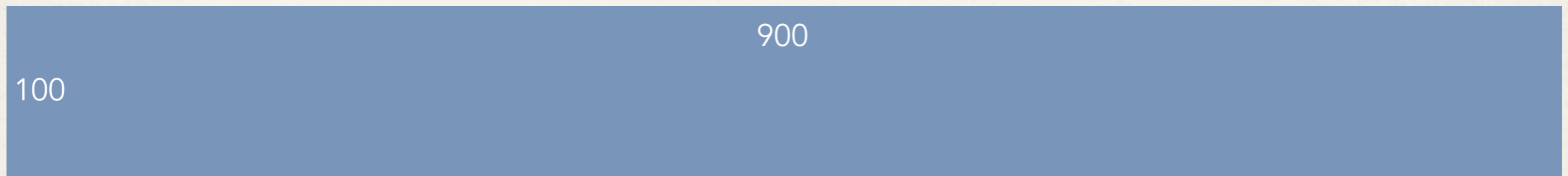
Which one is bigger?

Trick Question!

Squarified treemaps

Bruls, et al. "Squarified Treemaps"
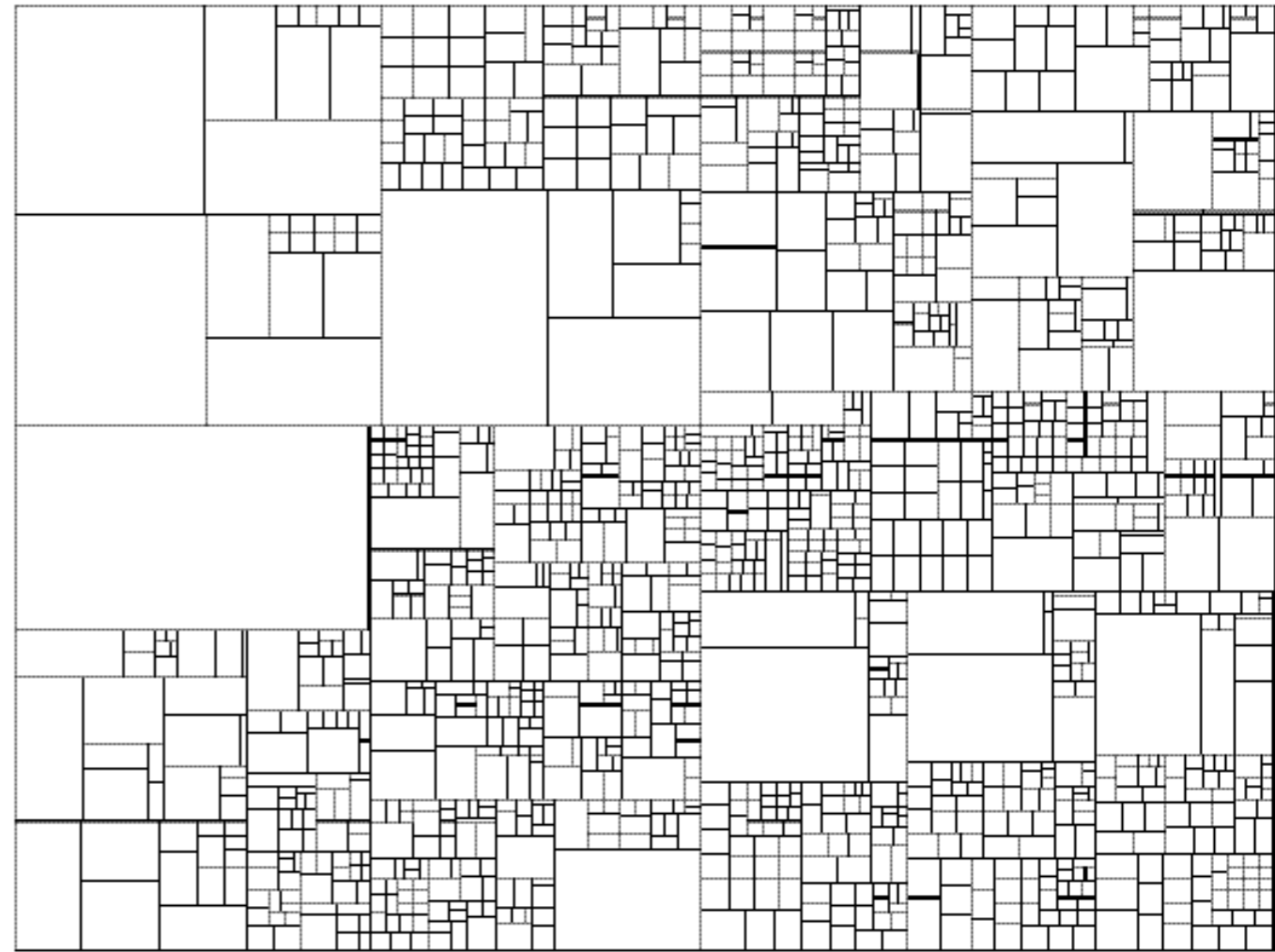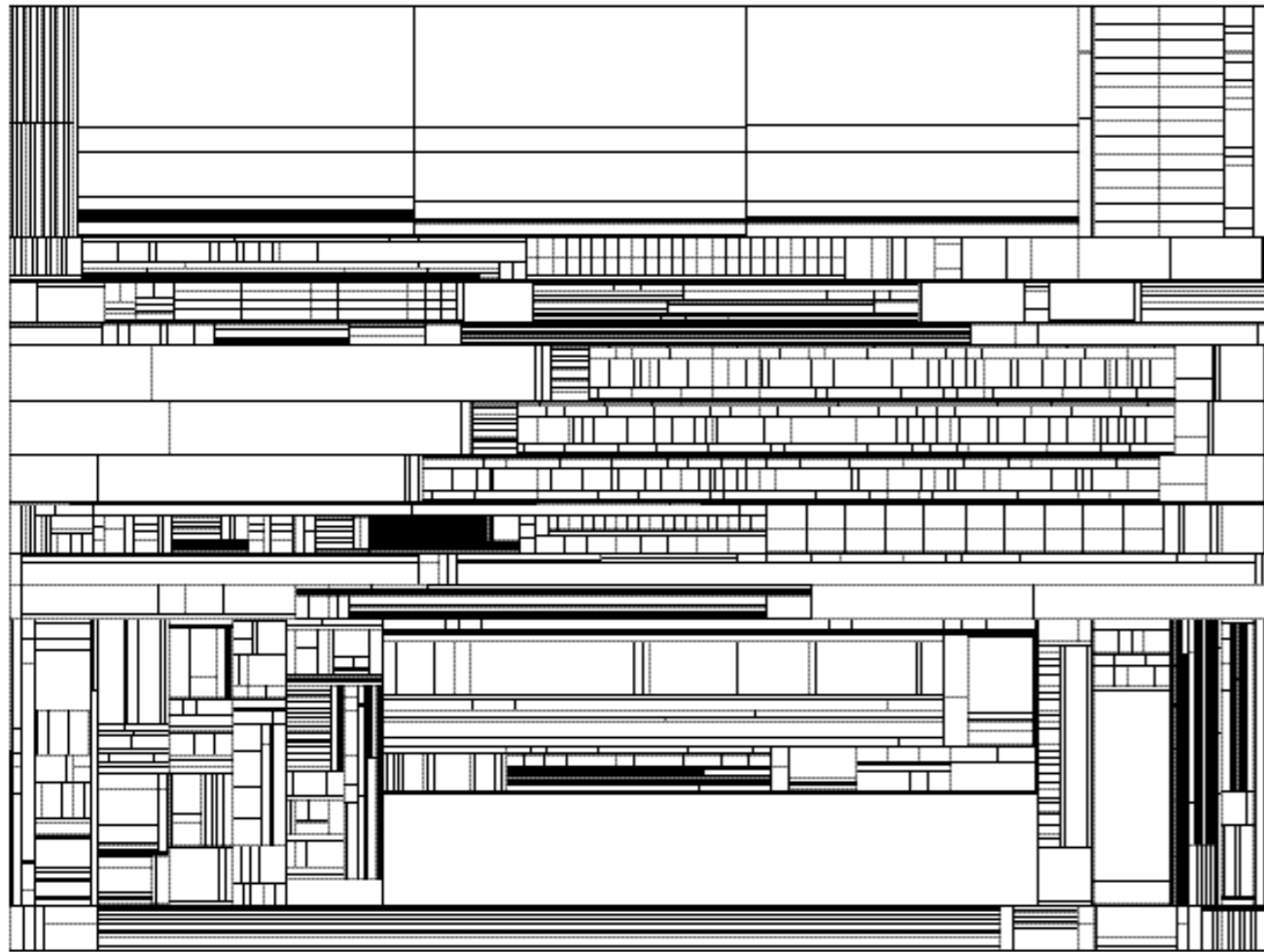
Even more approaches...
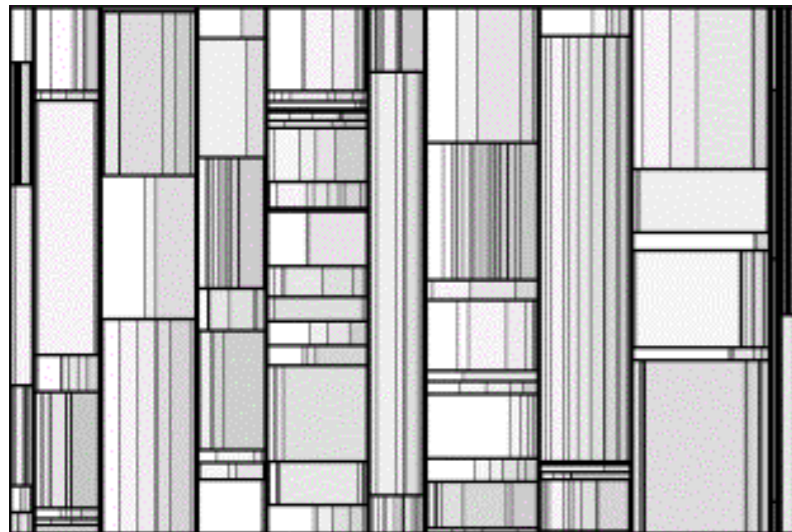
Slice-and-dice
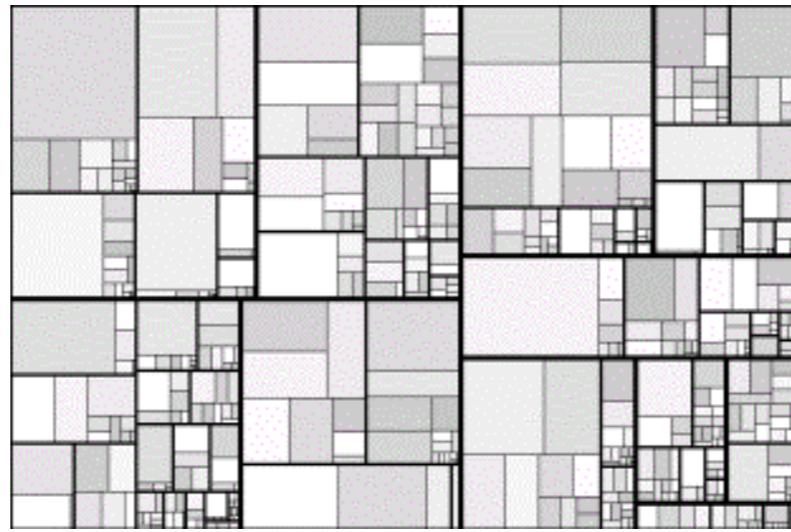
Cluster
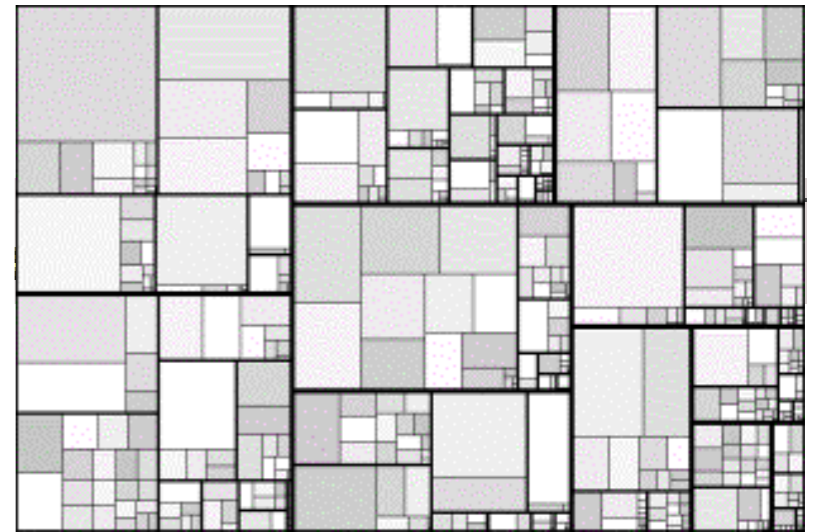
Squarified
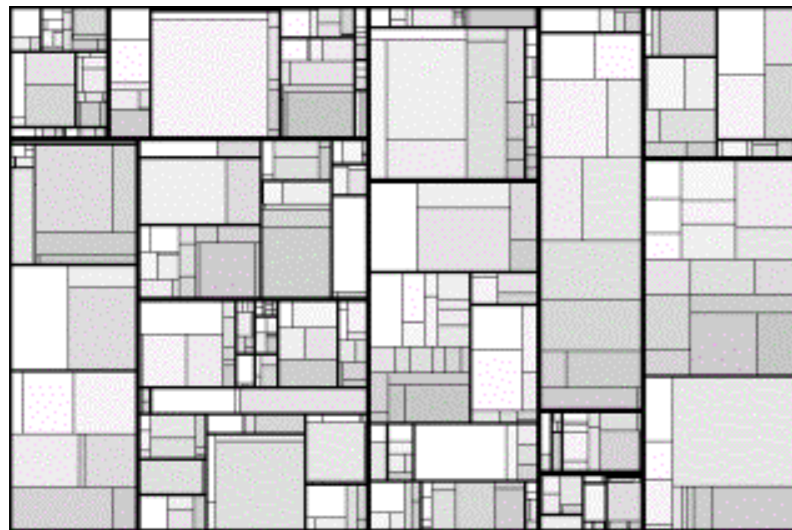
Pivot-by-middle
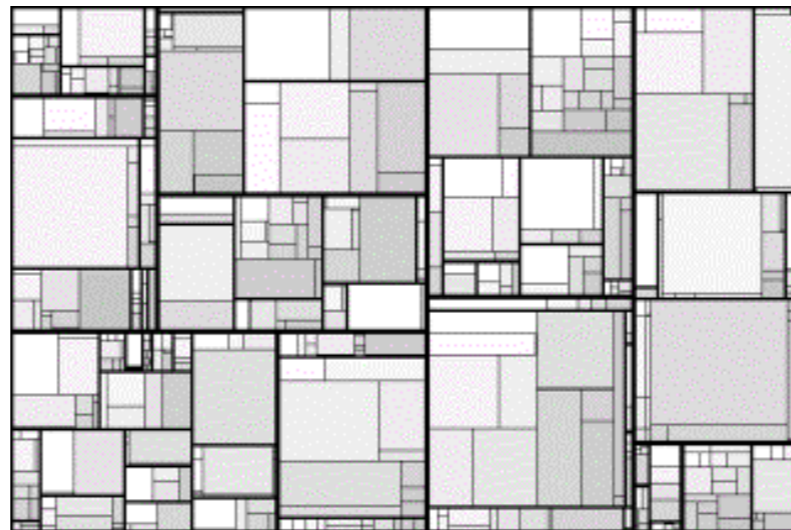
Pivot-by-size

Strip

borrowed from J. Stasko
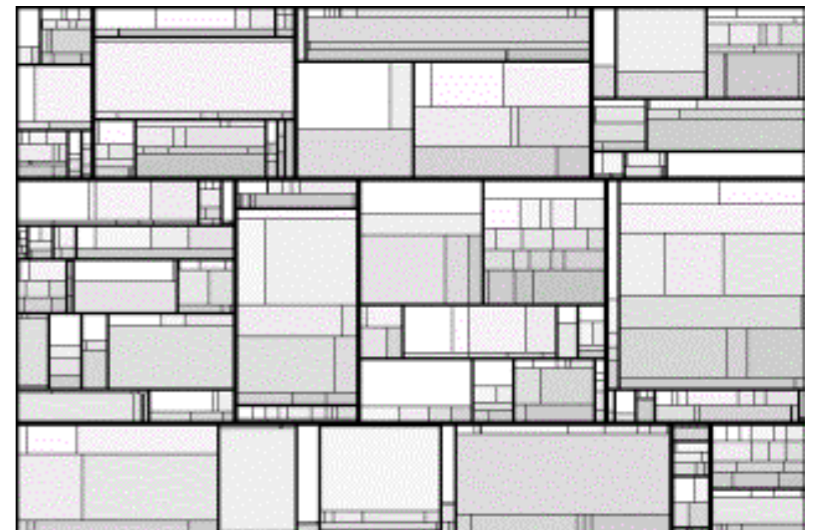
Example: Presidential election 2012
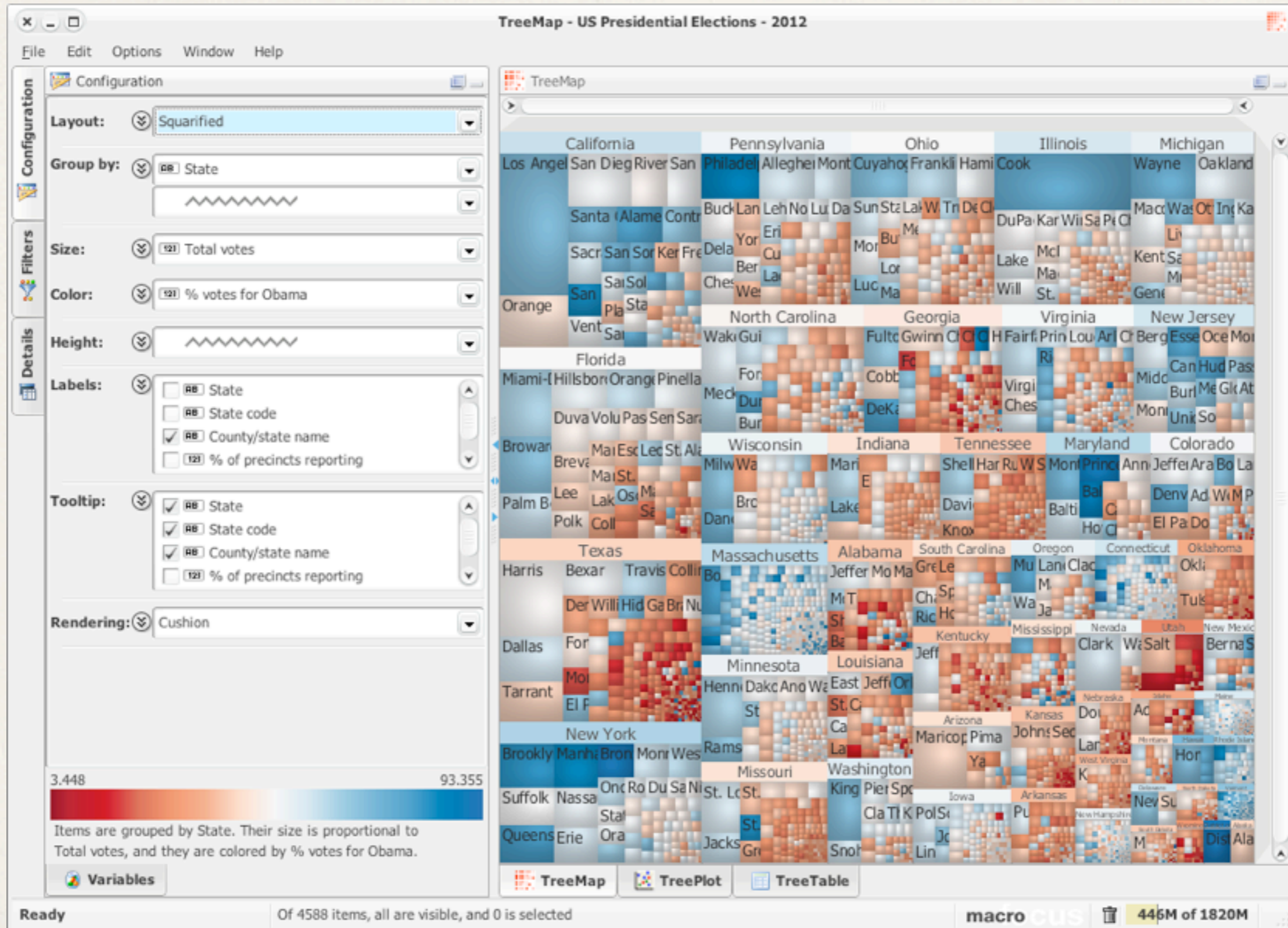
Example: Movie budgets

Example: News stories

Circular partition treemaps
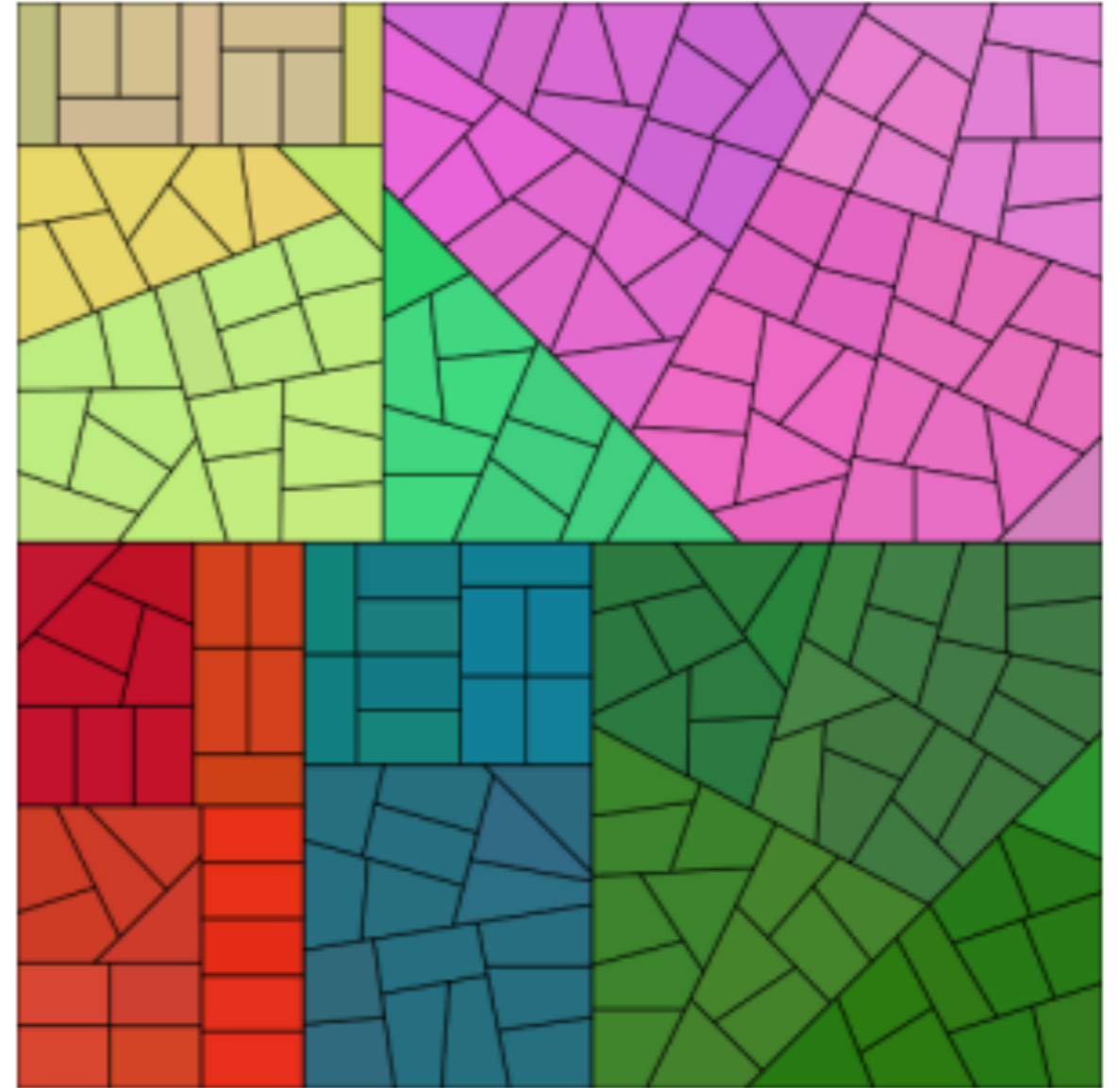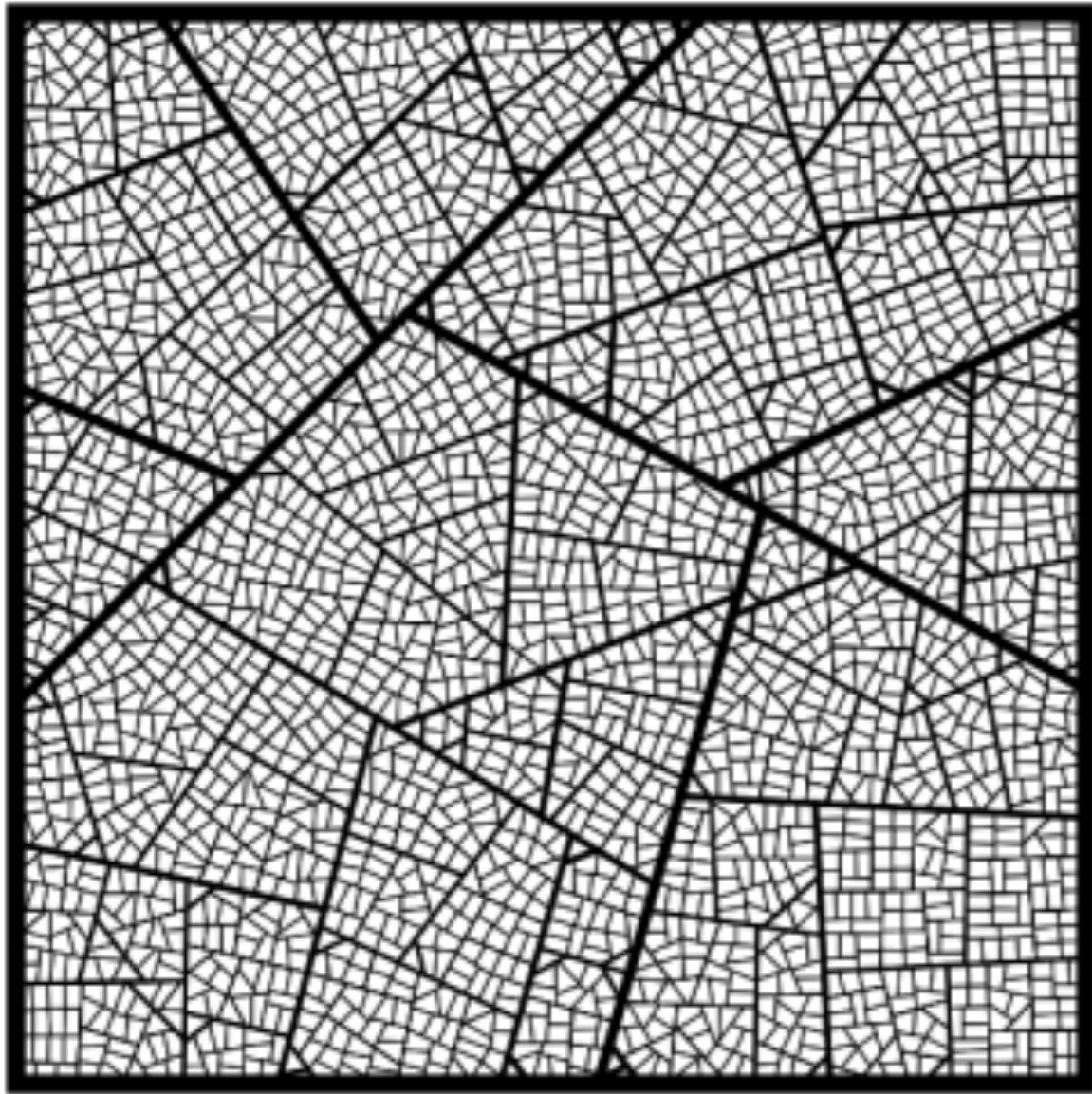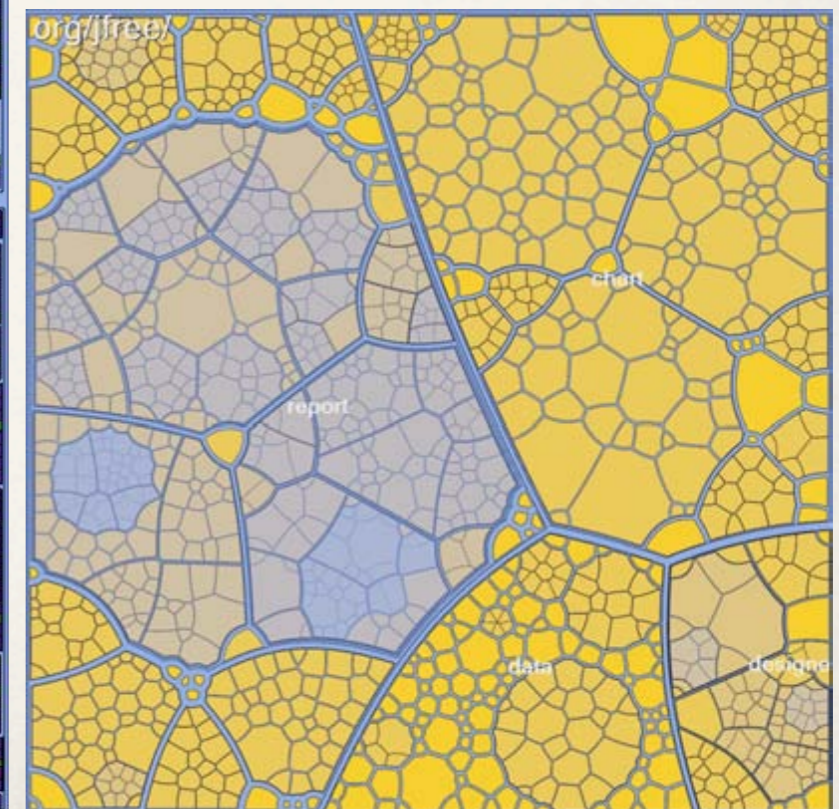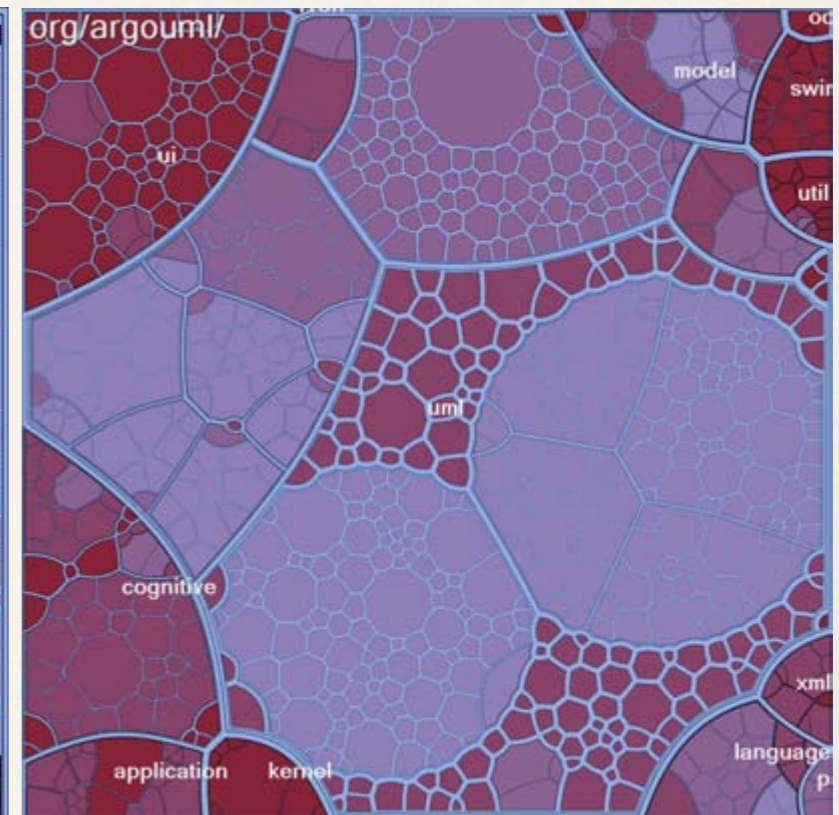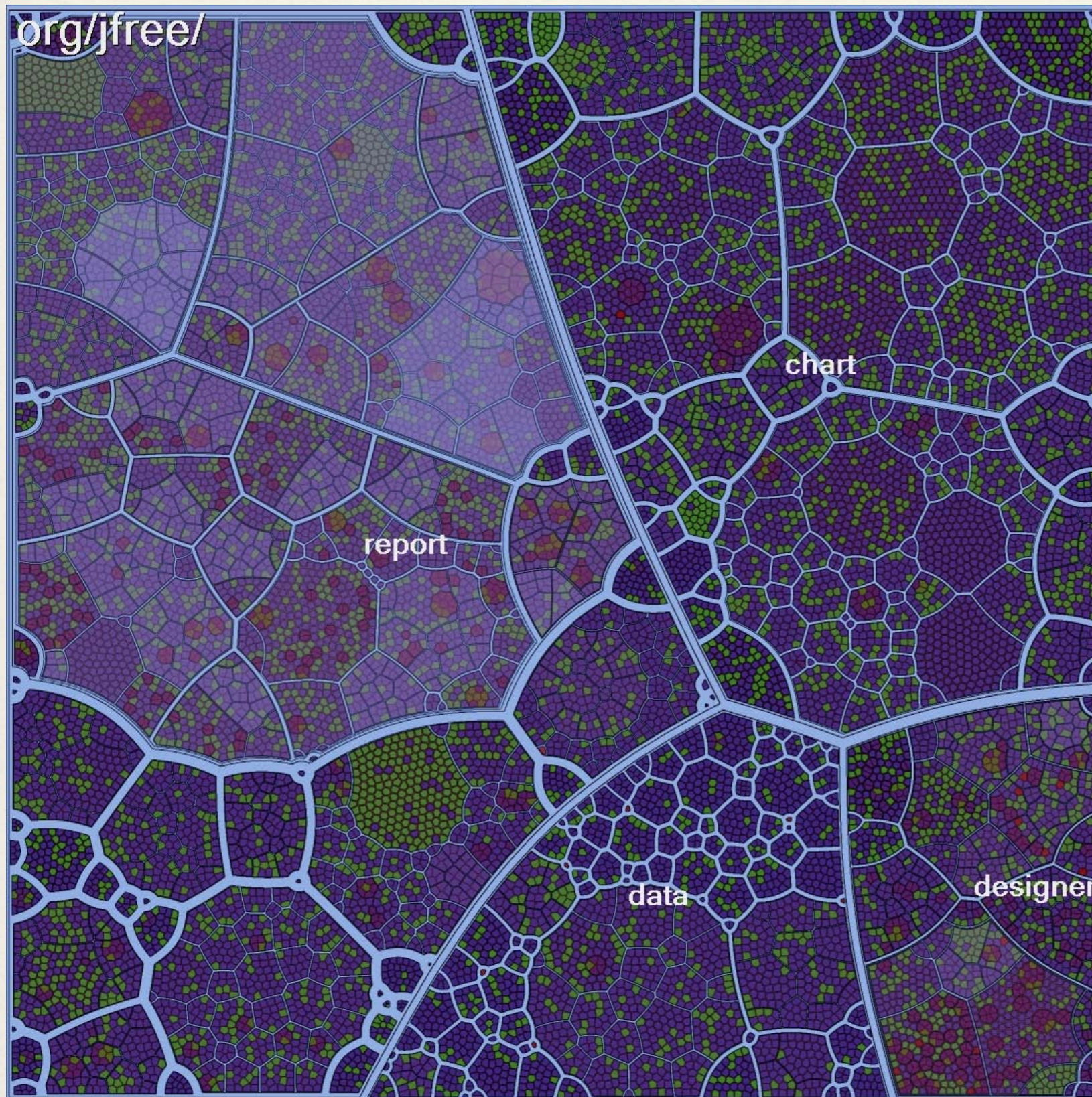
Voronoi treemaps

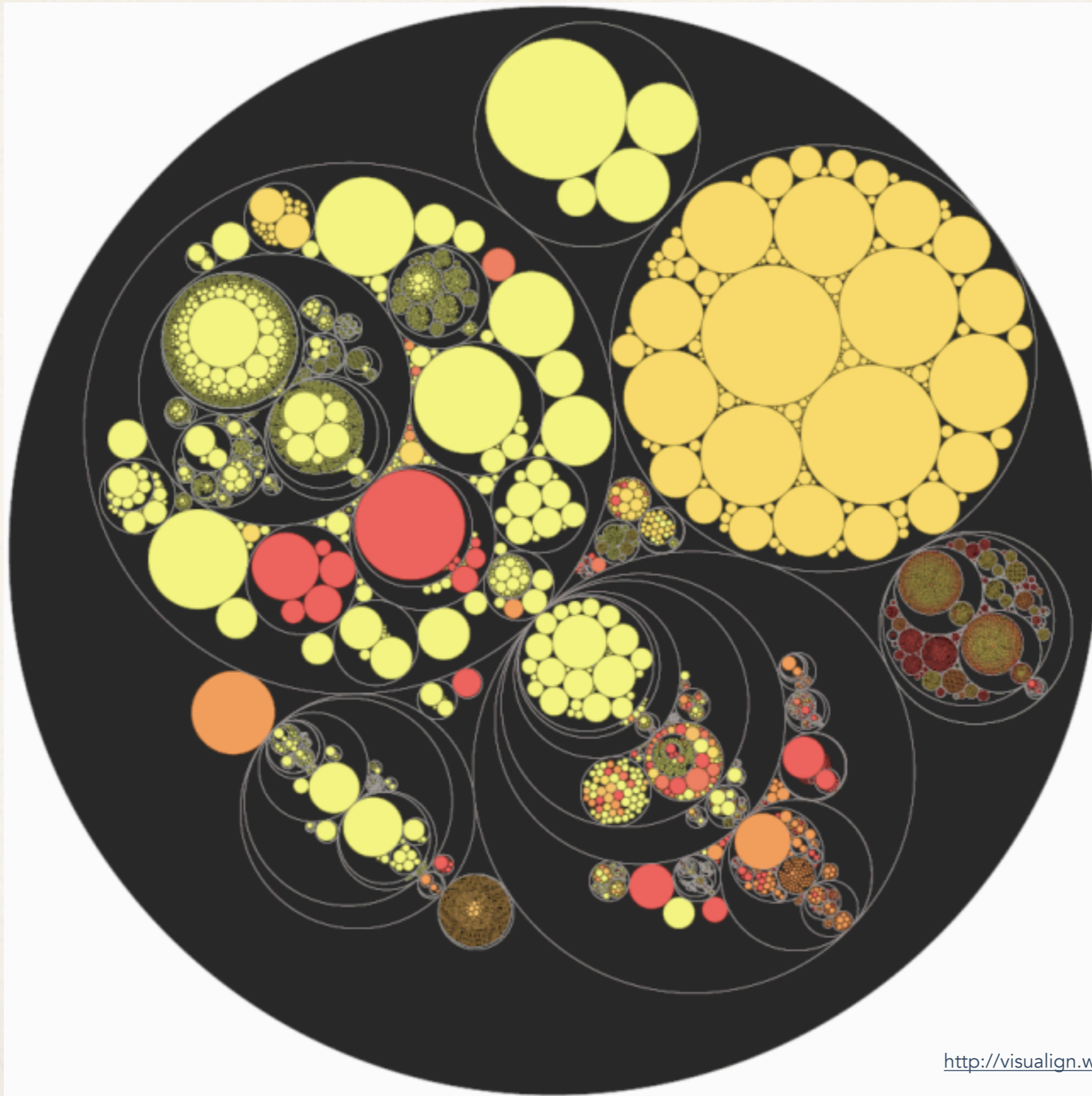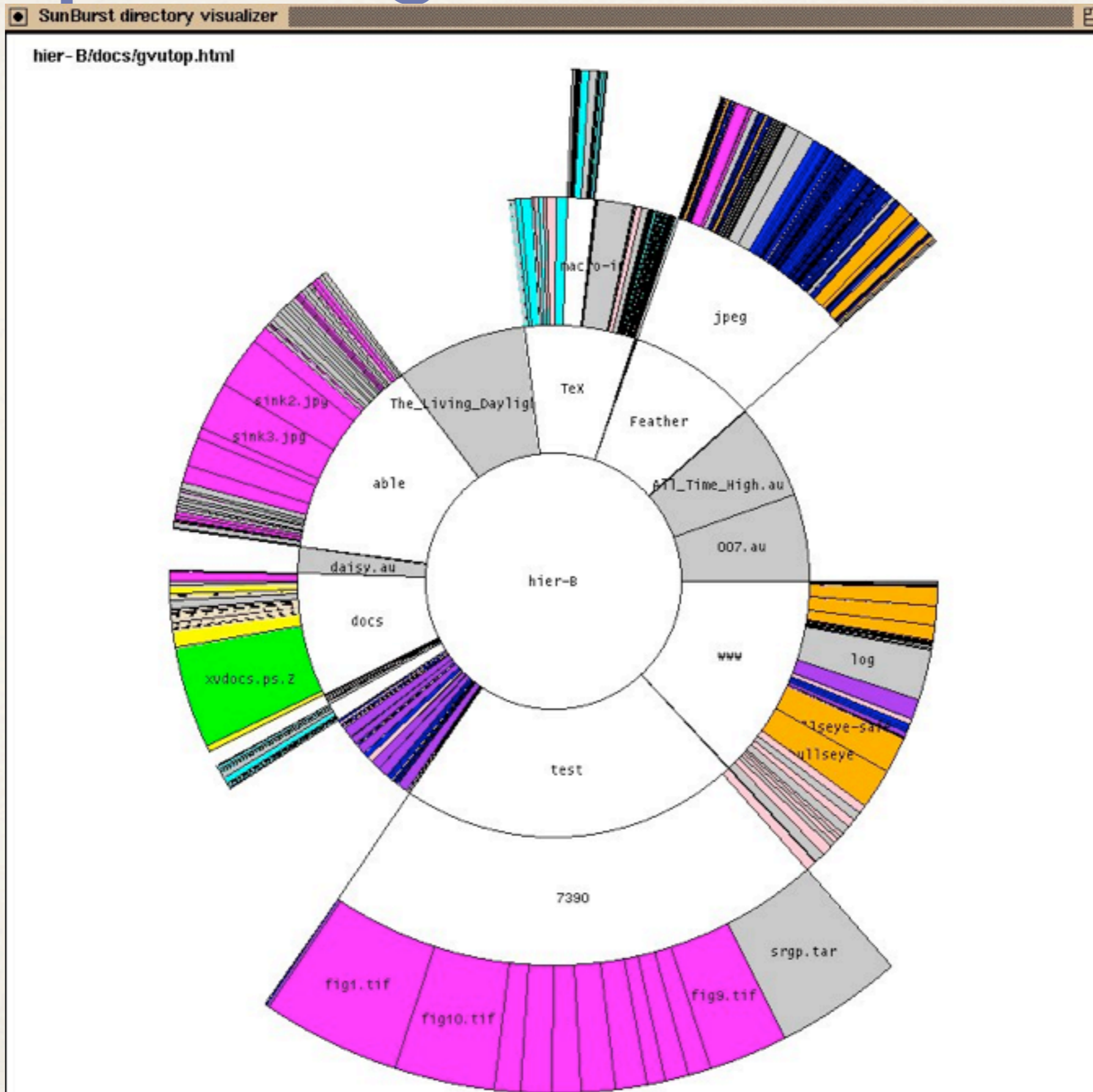Balzer et al. "Voronoi Treemaps for the Visualization of Software Metrics"

Voronoi Treemaps
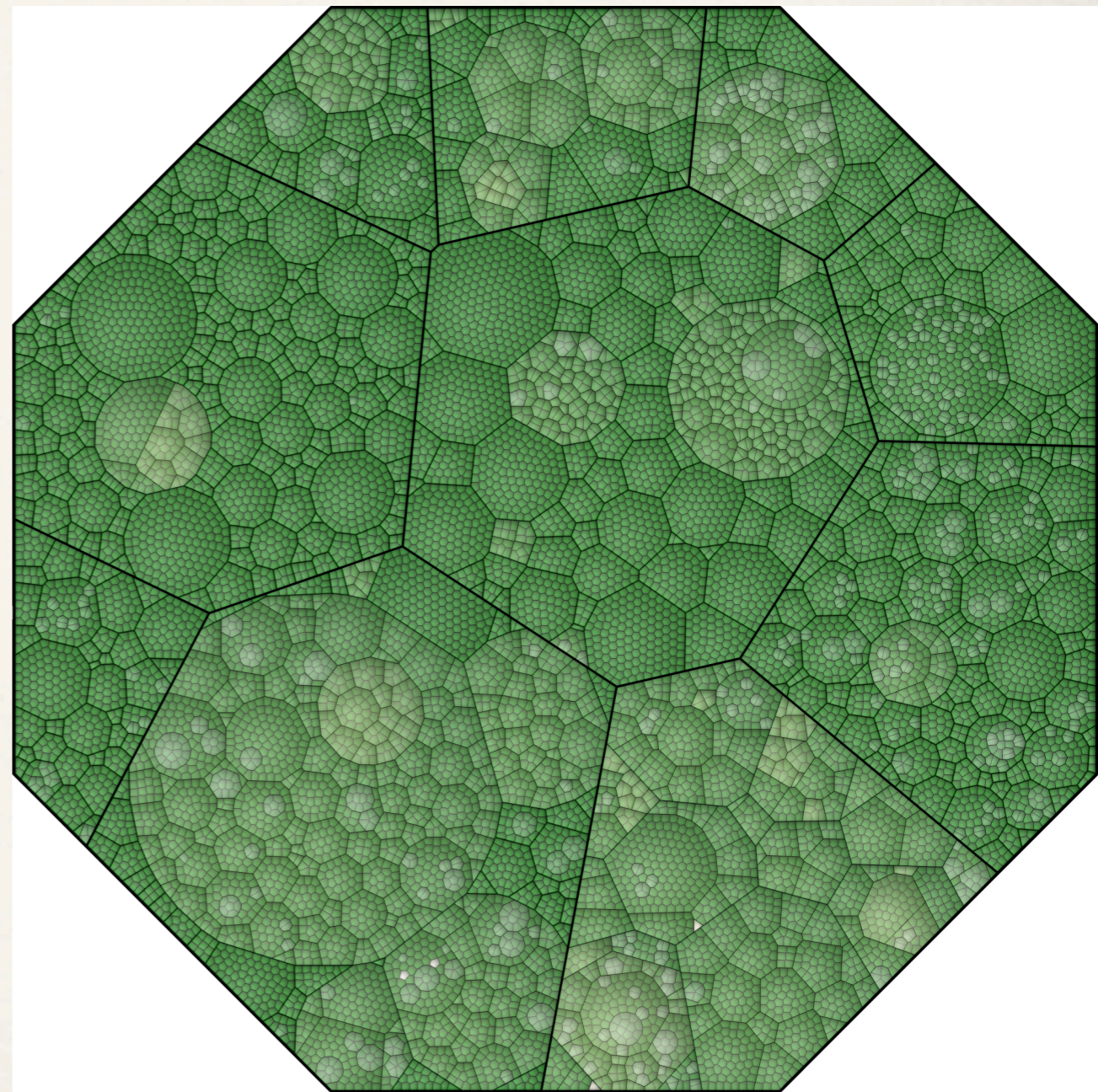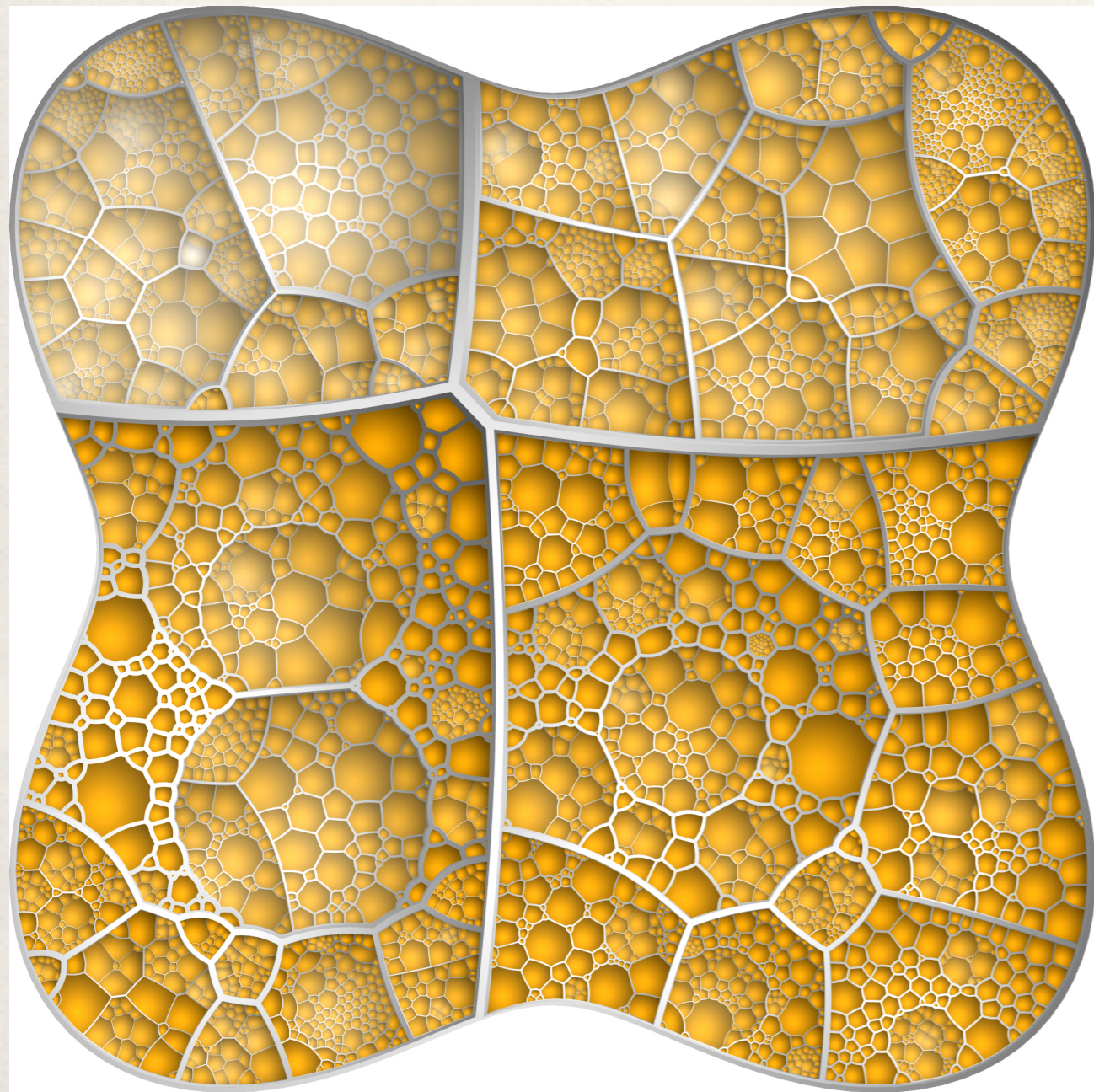
Circular treemaps

Radial Space-filling

SunBurst

Demo: DaisyDisk