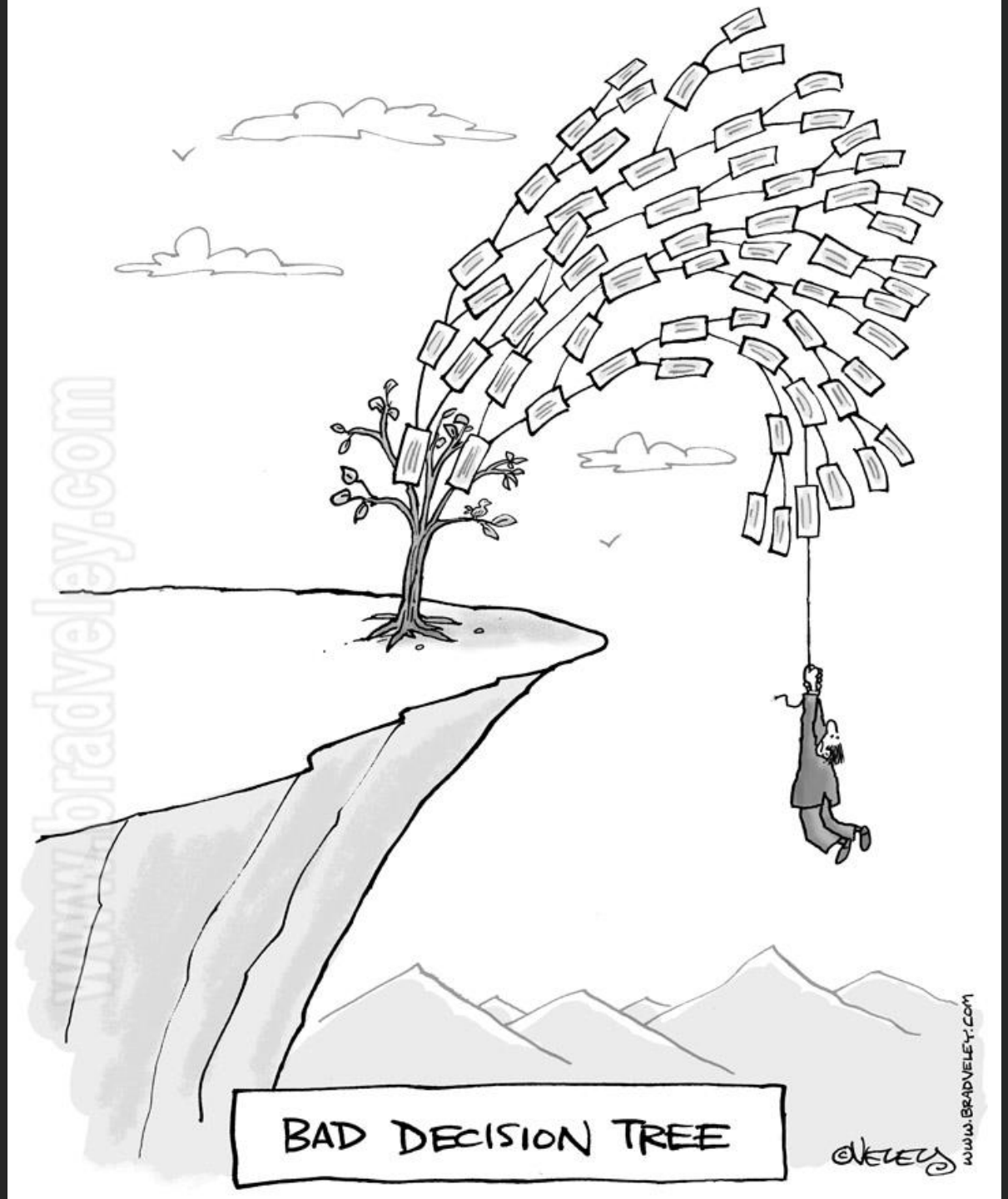
Hierarchical Visualization
SI649/EECS598

Eytan Adar

November 15, 2021

Some slides modified from Stasko ‘09



http://www.slido.com
event code **#M749**

Administrivia

Temporal

Multidimensional

Hierarchical

Network

Text

Geovis

Temporal
Multidimensional
Hierarchical
Network
Text
Geovis

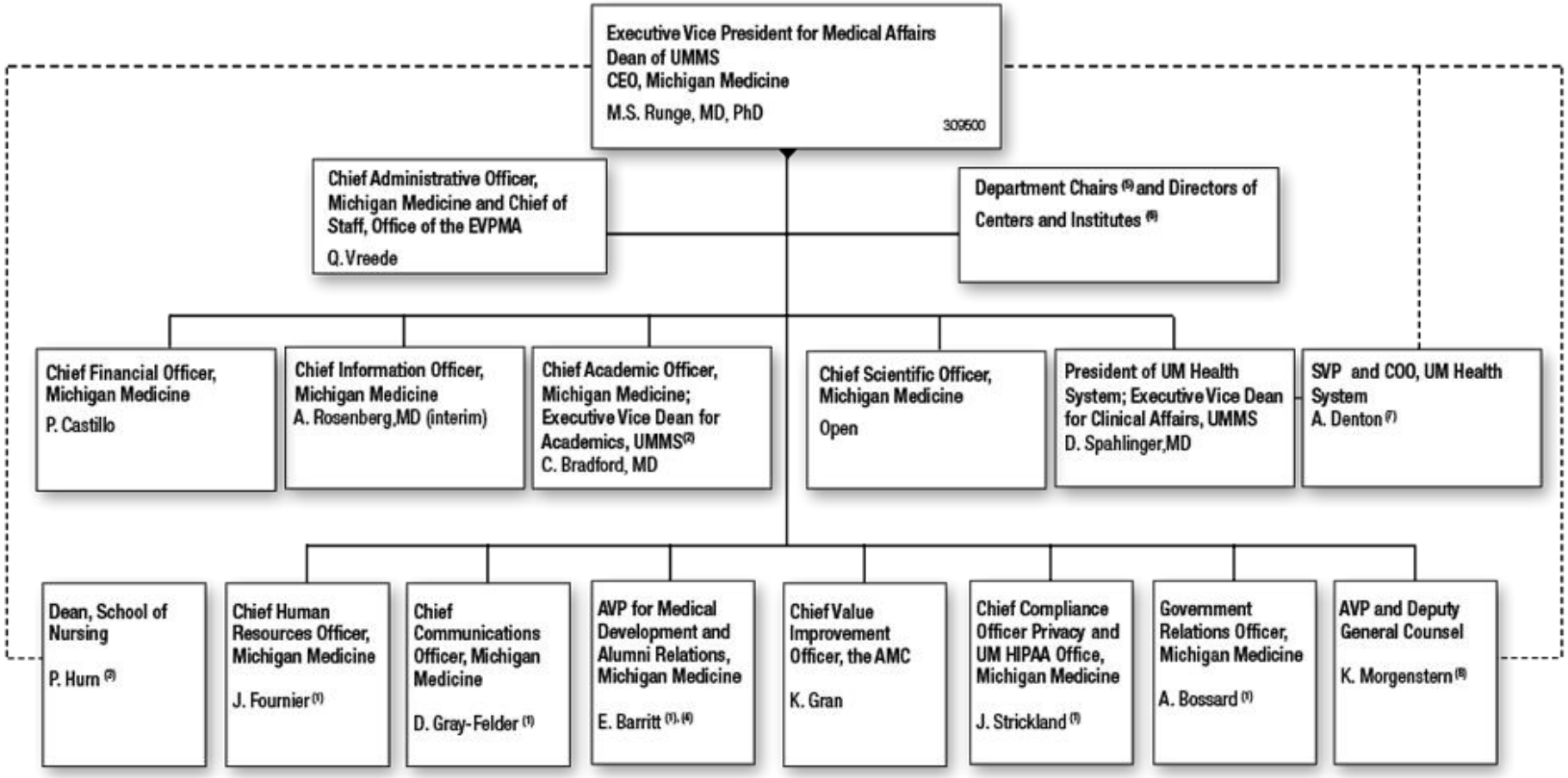
Trees/Hierarchies and Networks

- Trees/hierarchical datasets can be represented as networks but not all networks can be represented as trees
- Edges in hierarchical datasets often speak to some ordered/ranking/containment relationship
  - *Father-of* versus *Friend-Of*

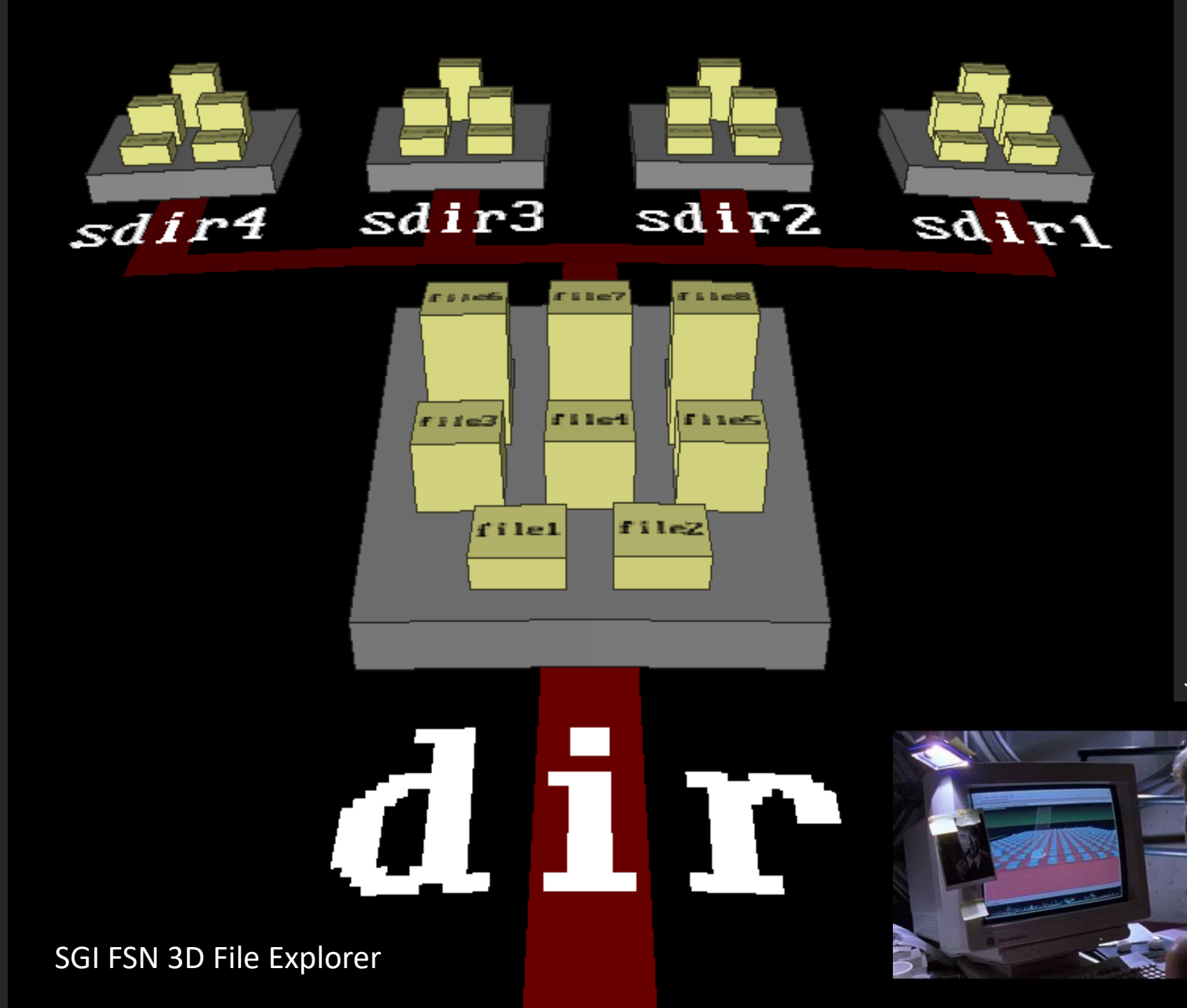
Lecture

- Video:
  - Hierarchical Data
  - Visual representations
    - Node-Link
    - Space-Filling
- Today:
  - Some extension case studies

http://spg.umich.edu/org-charts/309500

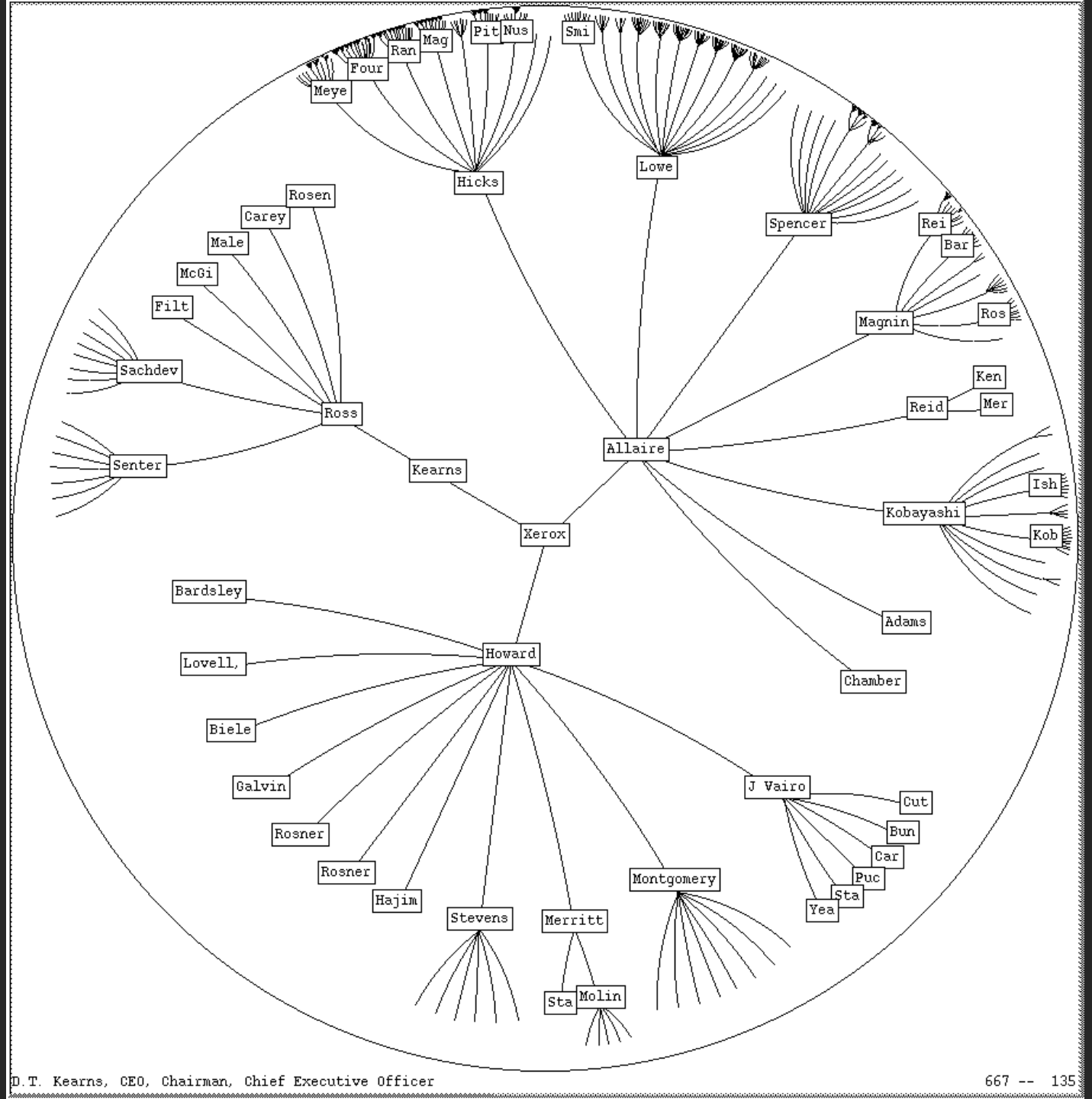


[1] Administrative responsibilities delegated by the EVPMA to the Chief of Staff
[2] Dual reporting relationship to Provost
[3] Primary reporting relationship to Provost; dotted line to EVPMA for clinical activity only
[4] Dual reporting relationship to University Vice President of Development
[5] Dotted line reporting relationship to Executive Vice Deans and Chief Scientific Officer delegated by EVPMA/Dean
[6] Dotted line reporting relationship to Executive Vice Deans and Chief Scientific Officer or other medical school senior leadership delegated by EVPMA/Dean
[7] Solid line reporting relationship to President of Clinical Enterprise, dotted line to EVPMA for AMC facilities planning and health equity and inclusion matters in collaboration with the Vice Dean for Academic Affairs
[8] Solid line reporting relationship to University Vice President & General Counsel; dotted line reporting relationship to Office of the EVPMA



SGI FSN 3D File Explorer

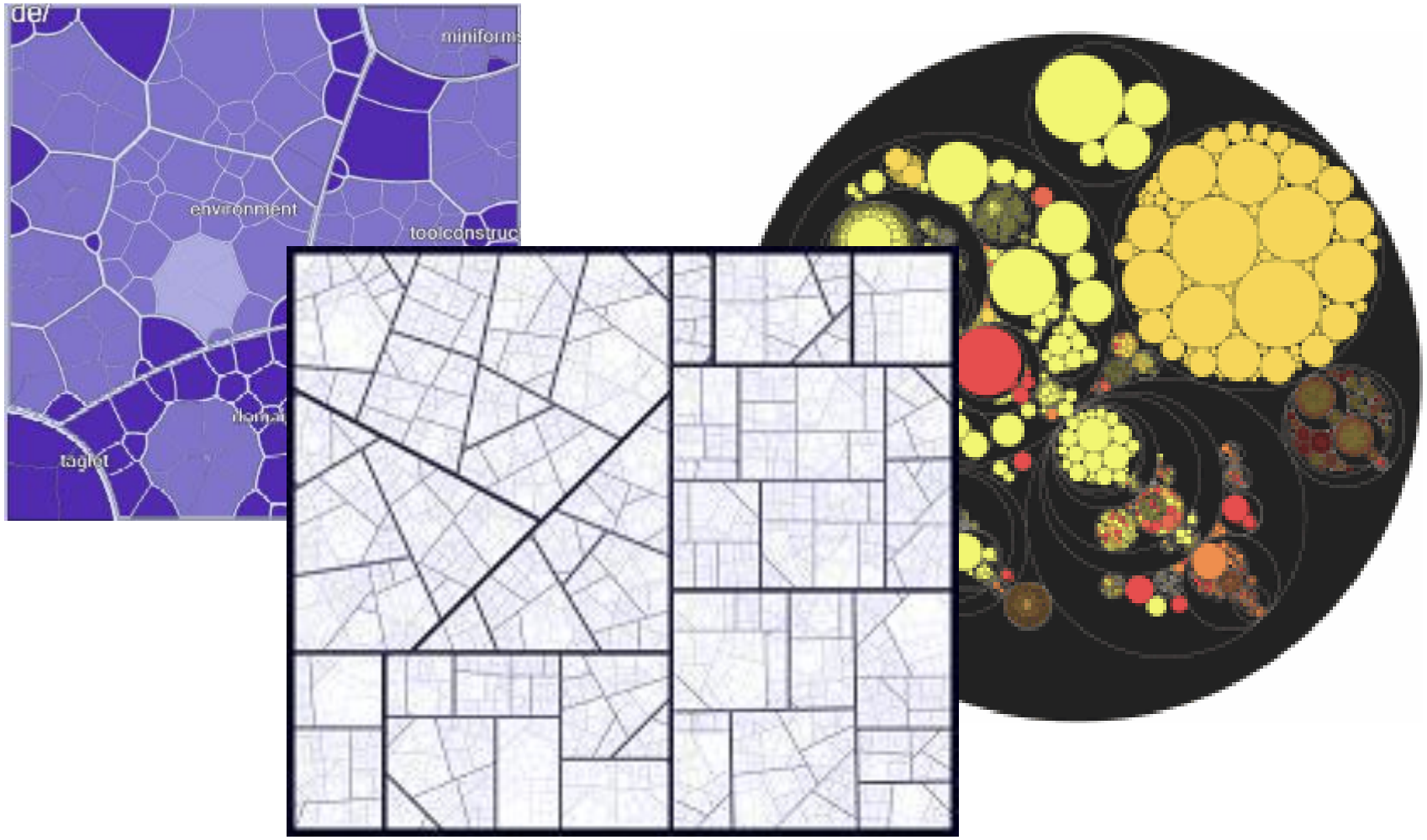
Jurassic Park



Up to 10x as many nodes regular tree vis

Lamping et al, 1995

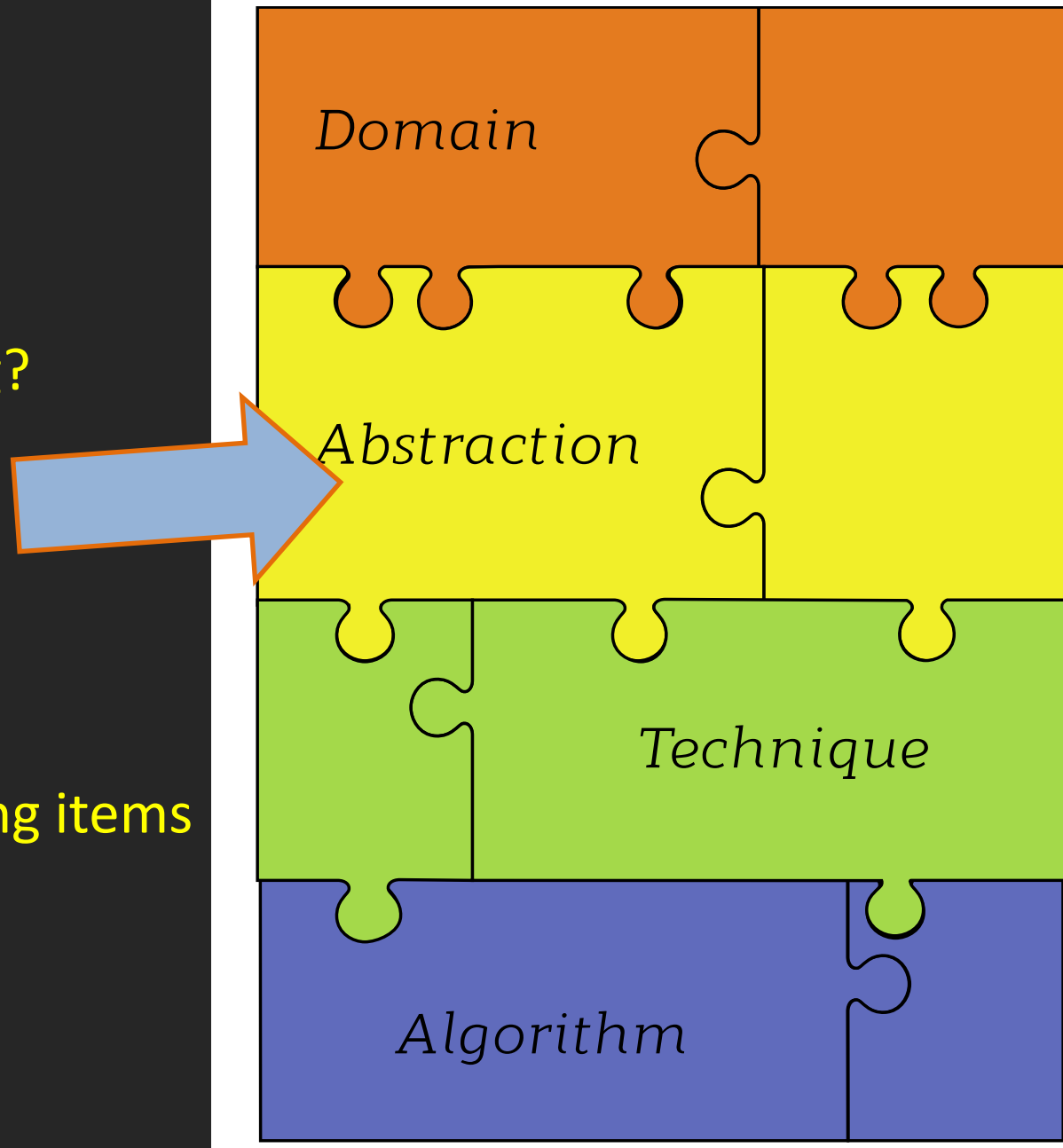
Other Space Filling Systems



http://www.cs.umd.edu/hcil/treemap-history/

Hierarchical Vis

- Tasks
  - How much depth? How much fanning?
  - How far are two nodes?
  - How many subclasses?
  - How far down the hierarchy?
  - Which subtree contains entity?
  - Which subtree contains matches?
  - Which subtree contains more matching items than others?
  - Etc.



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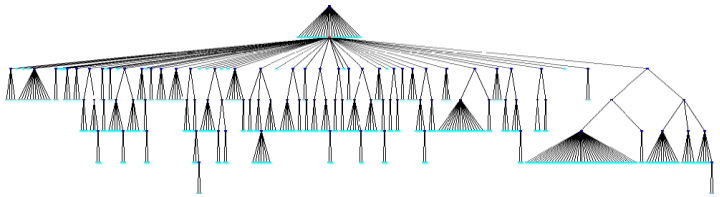
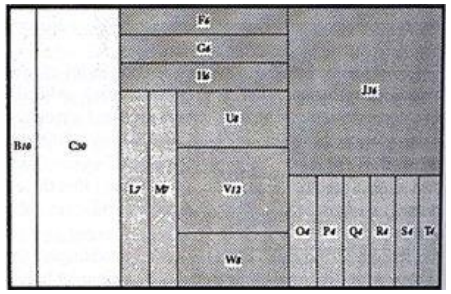
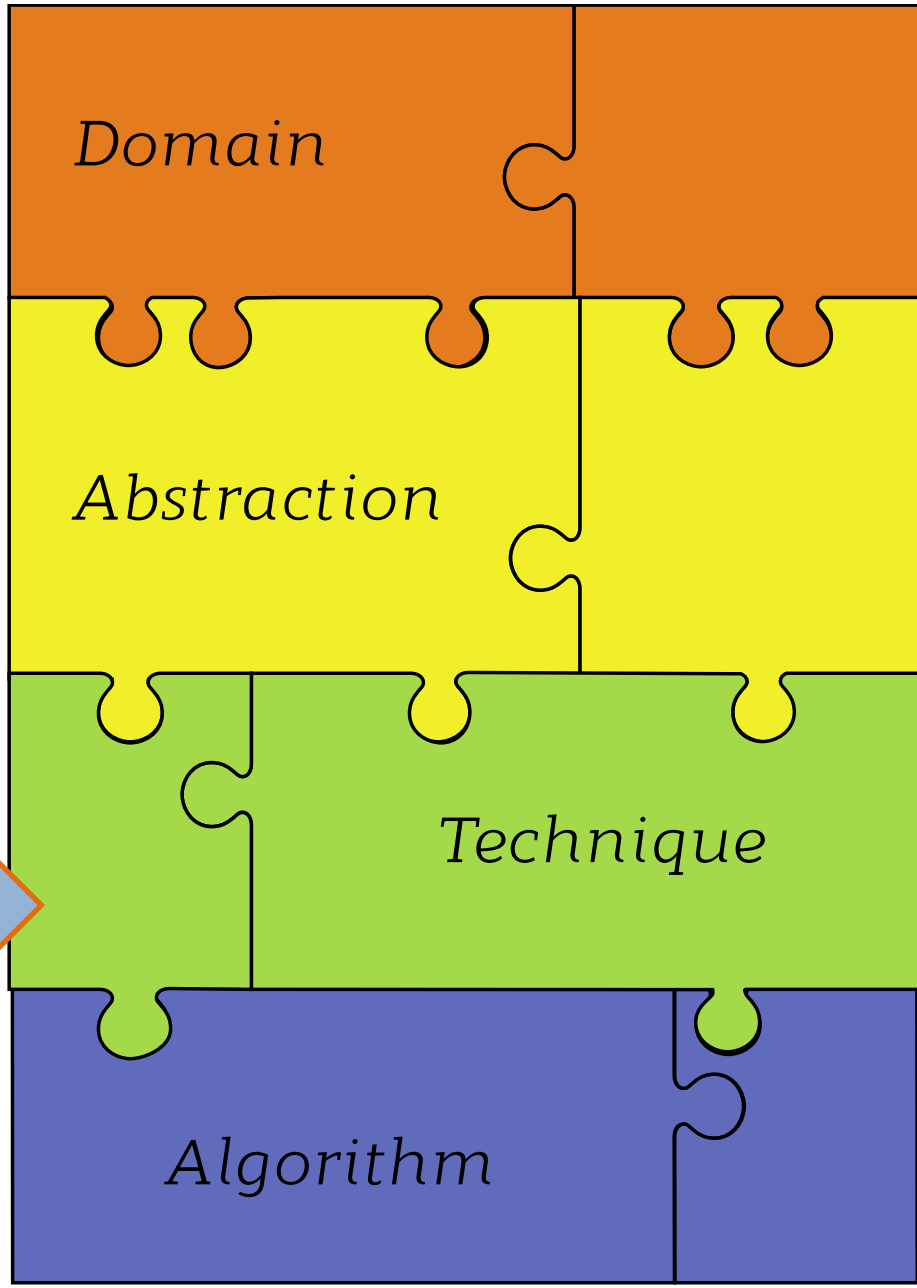
  - Etc.
- Techniques
  - Trees + SpaceFilling







Hierarchical Vis

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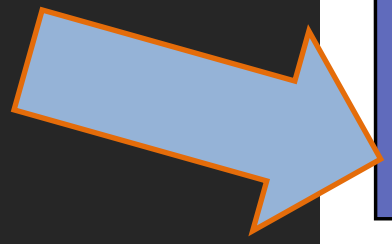
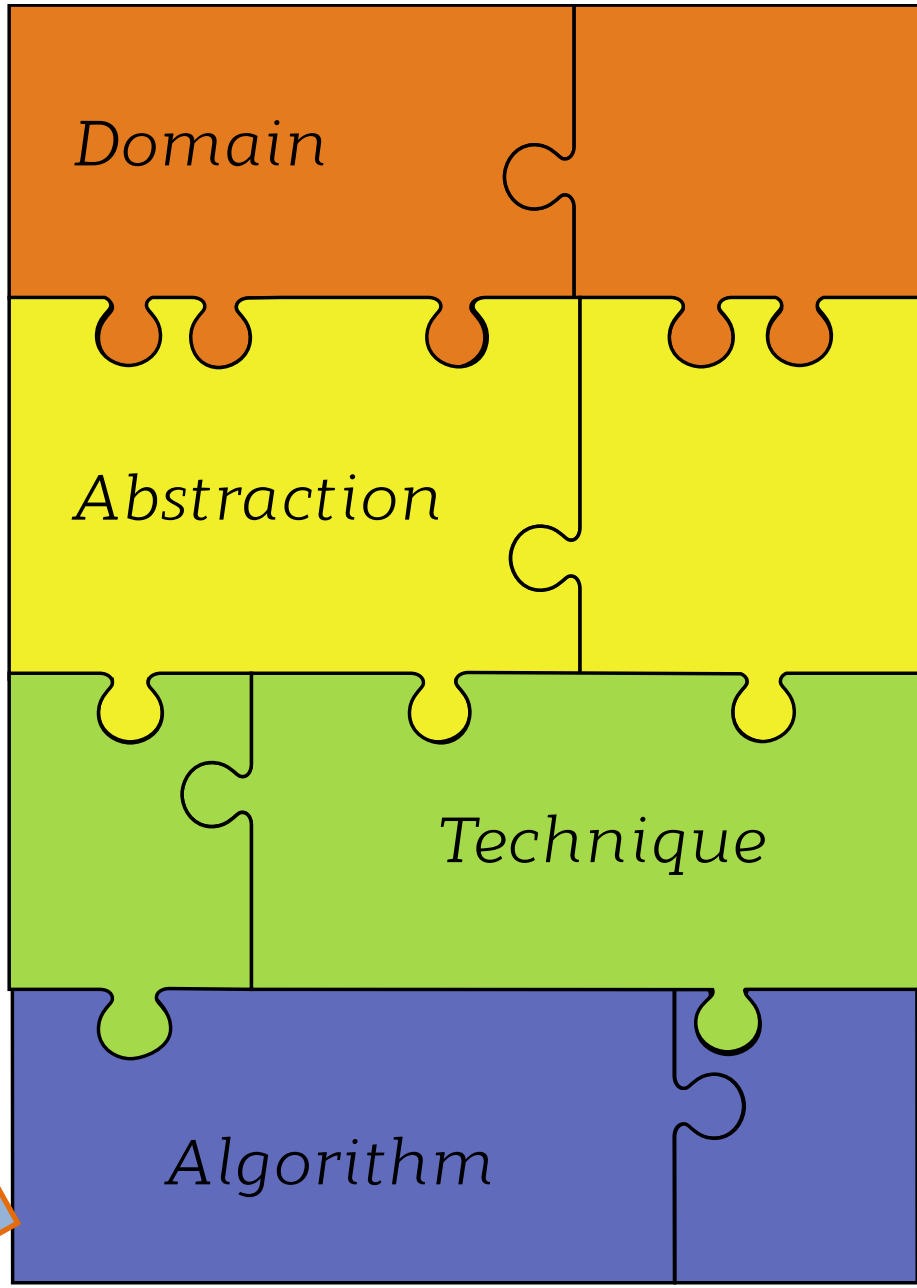
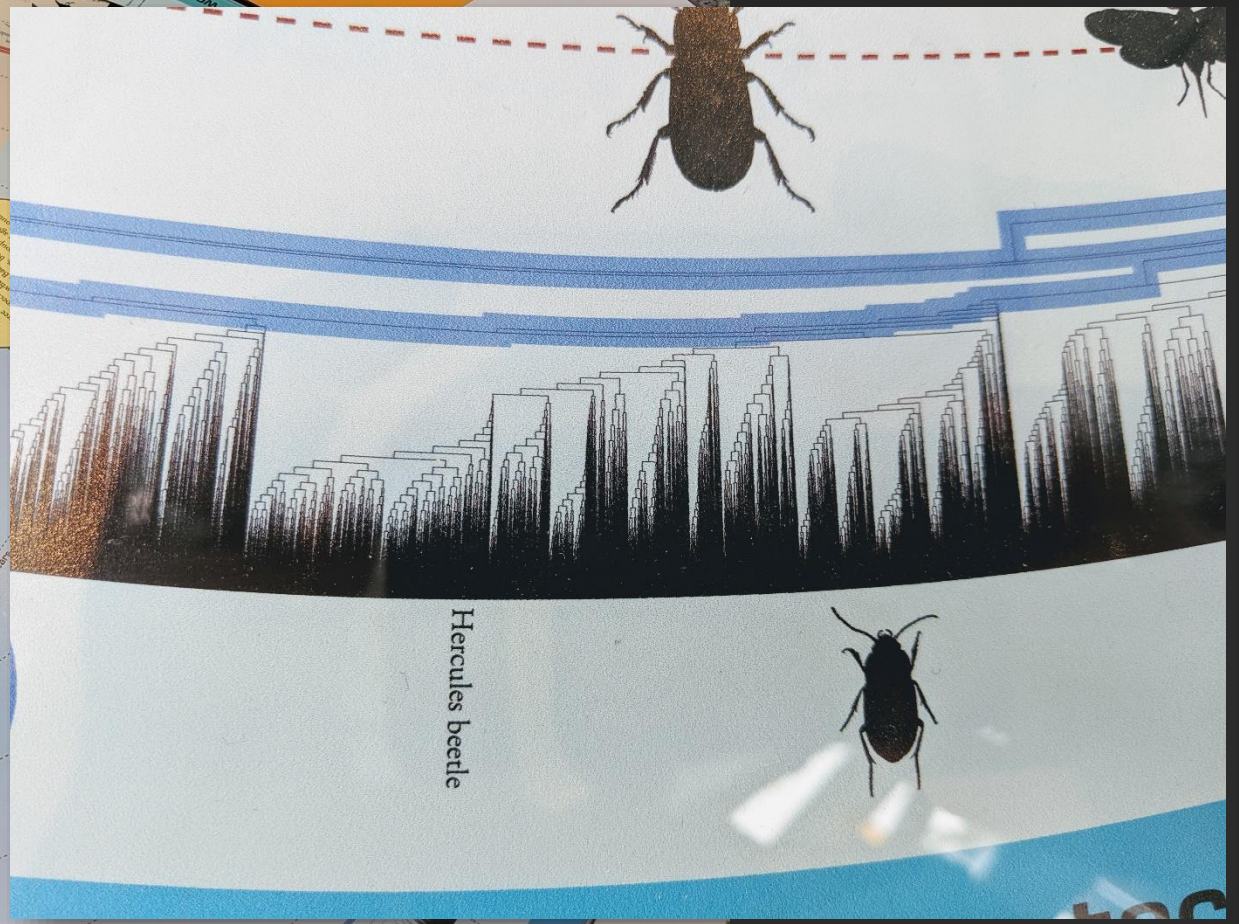
  - Etc.
- Techniques
  - Trees + SpaceFilling
- Algorithms
  - Render nice images
  - Scale
    - Deal with excessive fan/depth issues



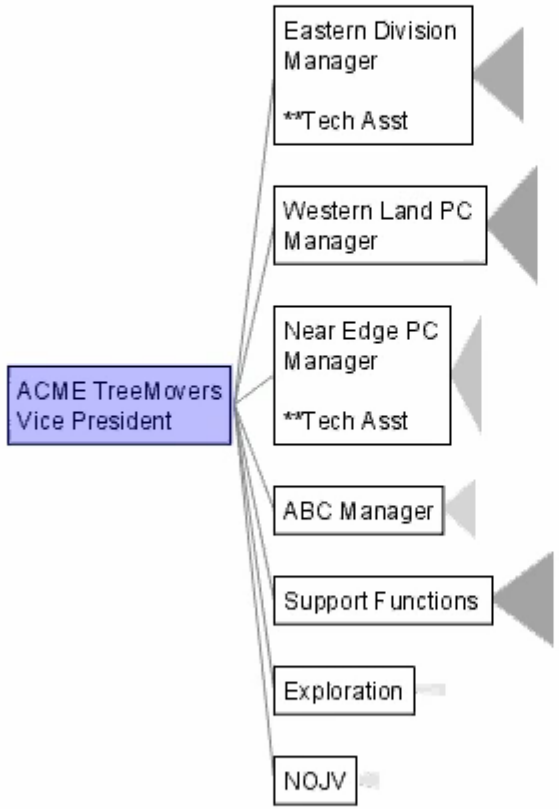



Hercules beetle

File Tree

Search: Prune

Query: Greater Than Grow

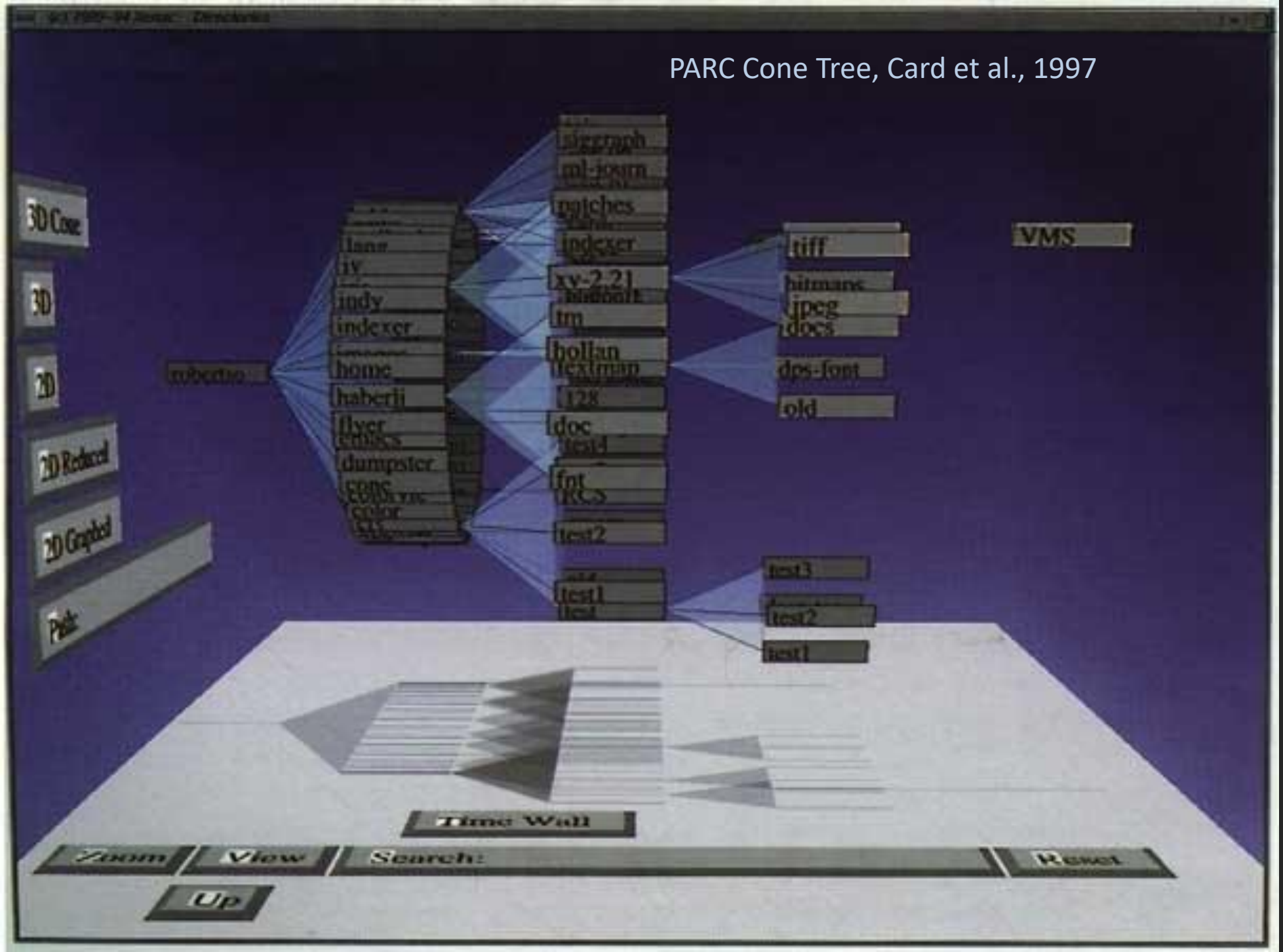


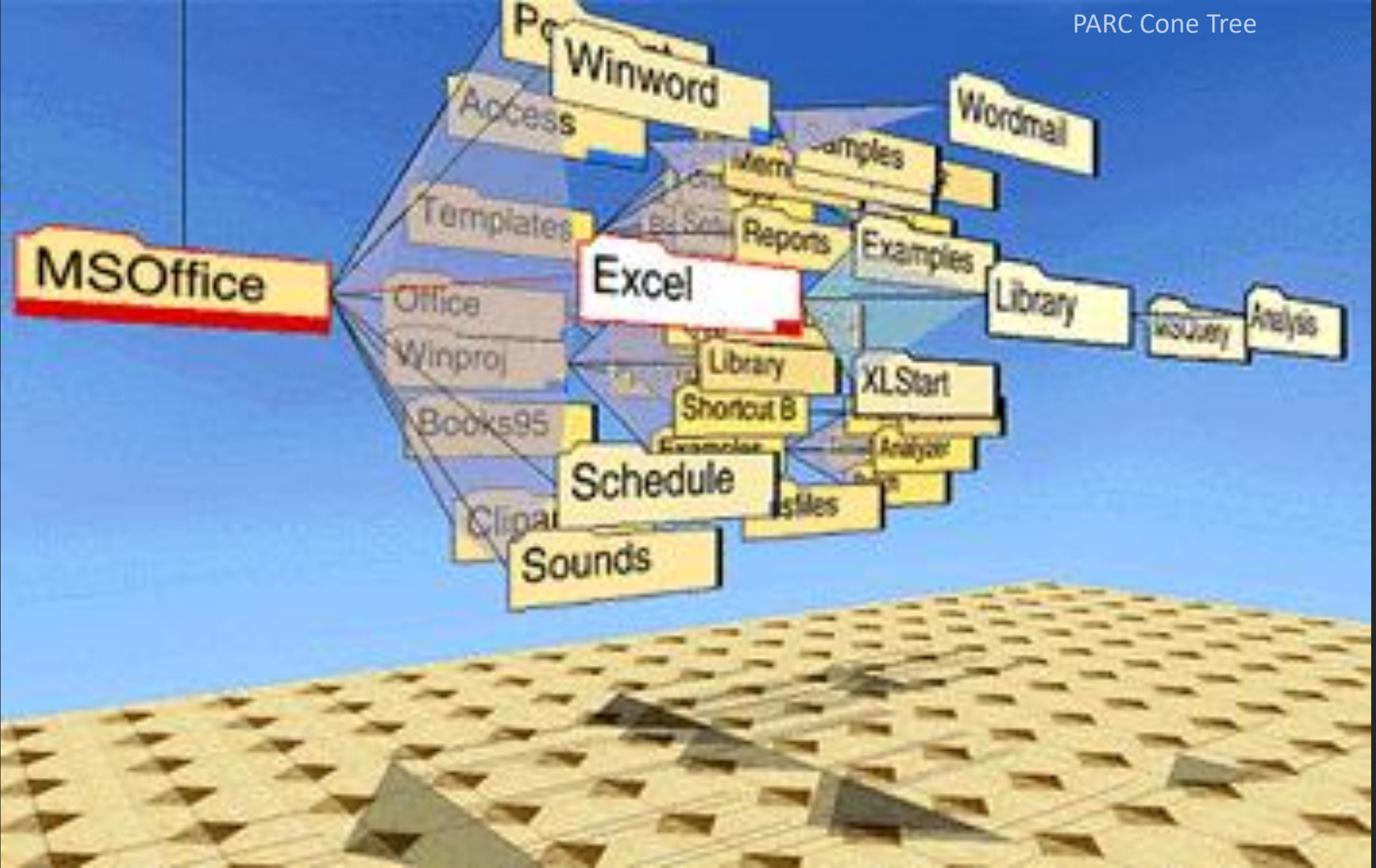
Related: 3D Approaches

- 3rd Dimension to fit more data
- Children sit in cylinder “below”

Cone Tree, Robertson et al., 1991

PARC Cone Tree, Card et al., 1997




PARC Cone Tree
MSOffice
Winword
Access
Templates
Office
Winproj
Books95
Clipart
Sounds
Excel
Reports
Library
Shortcut B
Schedule
Wordmail
Examples
Library
XLStart
Analysis

Group question: What are the +/-'s of cone trees (think expressiveness/effectiveness)

http://www.slido.com
event code **#M749**

+/- of Cone Trees?

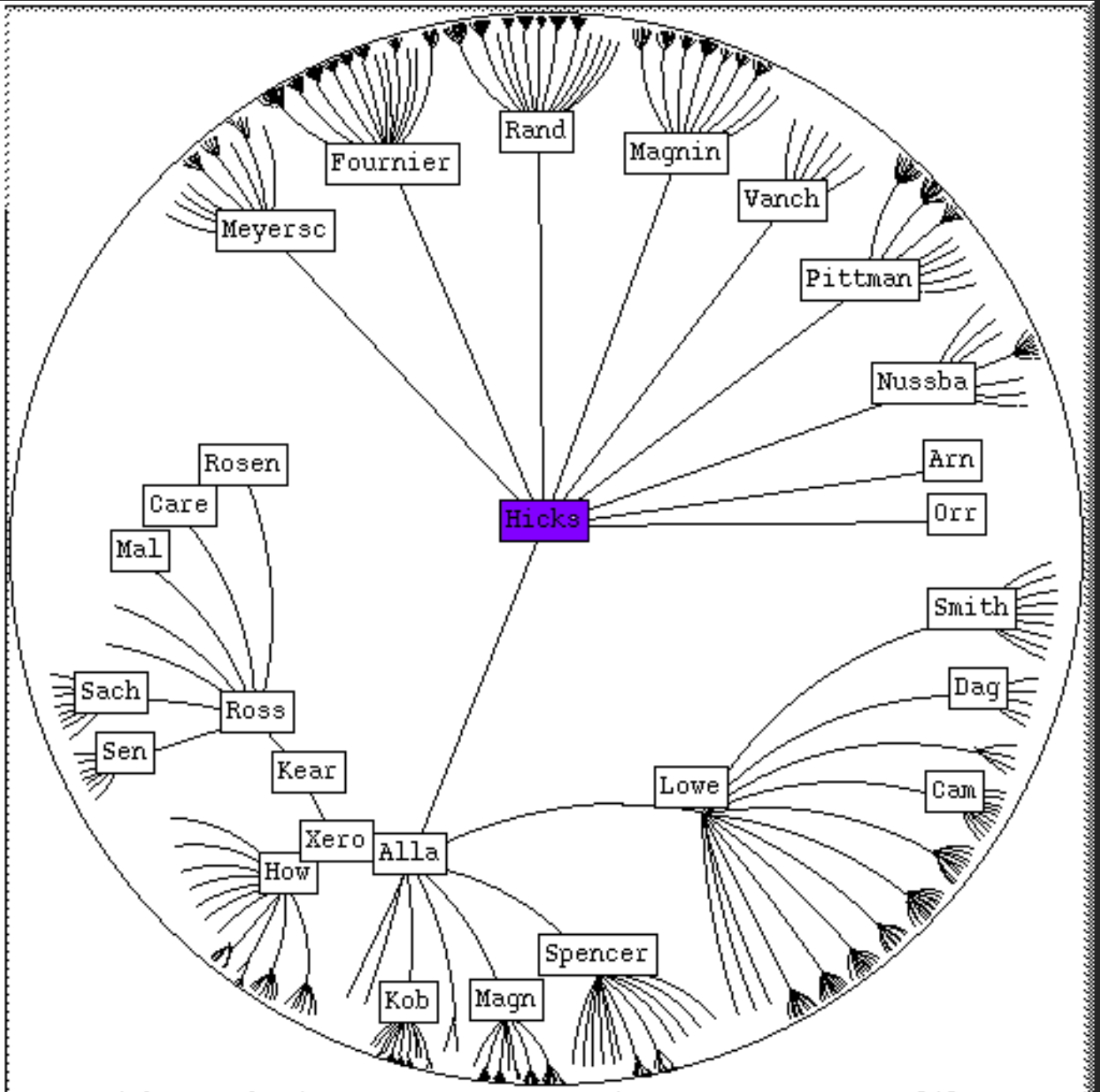
Positive

- Aesthetics
- Animation space
- Layout space

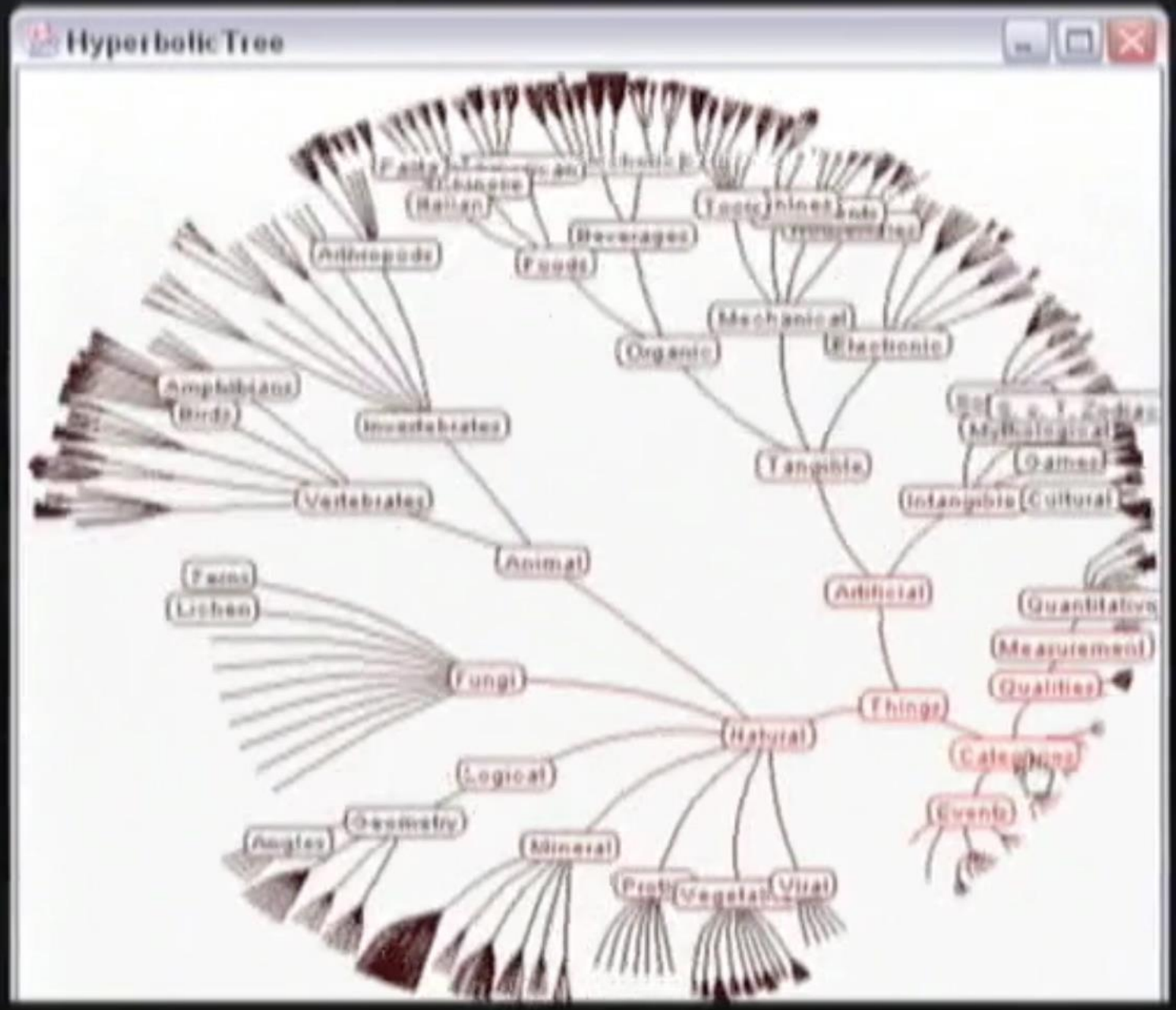
Negative

- Occlusion
- Graphical horsepower
  - Not so much an issue anymore?

Mostly as expressive, but maybe not as effective



W. R. Hicks, Marketing & Customer Operations, Execut 343 -- ???

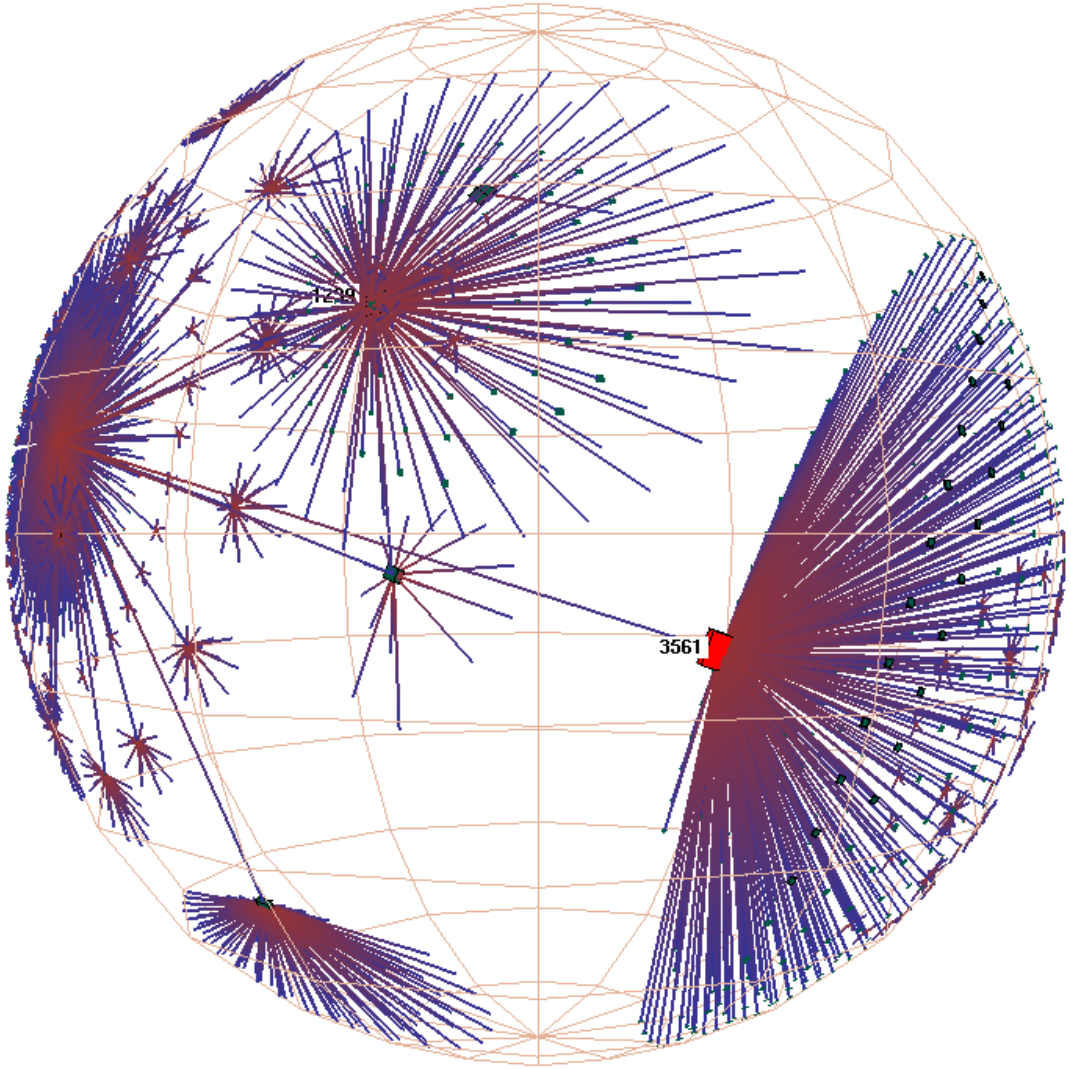

HyperbolicTree
Arthropods
Beverages
Foods
Mechanical
Electronic
Organic
Amphibians
Birds
Invertebrates
Tangible
Games
Intangible
Cultural
Vertebrates
Animal
Artificial
Plants
Lichen
Fungi
Things
Natural
Logical
Geometry
Angles
Mineral
Viral
Events

Group question: any -’s for hyperbolic displays?

http://www.slido.com
event code **#M749**

Issues?

- Disorienting
- Rotation
- Not symmetric (Euclidean distances don’t hold)



H3Viewer

Munzner, 1998

https://www.youtube.com/watch?v=fhbQy_NCwWI

Large Graph Exploration with H3Viewer and Site Manager

(Demo)

Group question: reactions? Expressive (or not) for what? Effective (or not) for what?

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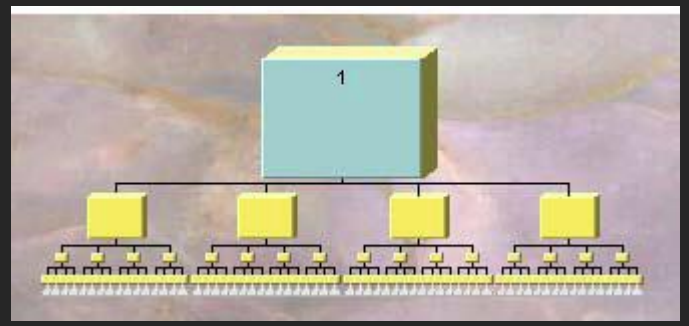
Degree-of-Interest (DOI) Trees

341 Nodes



Card et al., 2002

Card et al., 2002

DOITree++ 0.8
294 nodes
Total time: 0.461
Frames: 6

Xerox PARC organization chart

PALO ALTO RESEARCH CENTER

Michael R. Paige
4540
paige
Xerox PARC
VP, Center Manager
35-3340


An

Bruce
4447
RBruce
Comp.

deKleer
4398
dekleer
SPL

S. Elrod
5060
elrod
Device

Bauer
4200
bauer
ASDL

Mark Stefik
4366
stefik@parc.xerox.com
Inf. Sci. & Techn. Lab.
Manager
35-2426

Rich Gold
4825
RGold
RED

Rosenh
4390
rruth
UIP

Sarp
4271
sarpan
Mgr.,

H. Baird
4481
baird
DID

Stefik
4366
stefik
HDI

Stefik
4366
stefik
Active

Kaplan
4348
Kaplan
NLTT

Chen
4354
Fchen
QCA

Stuart Card
4362
card
User Int. Res.
Research Fellow, Area Manager
35-2434

Ed Chi
4312
echi
MRS

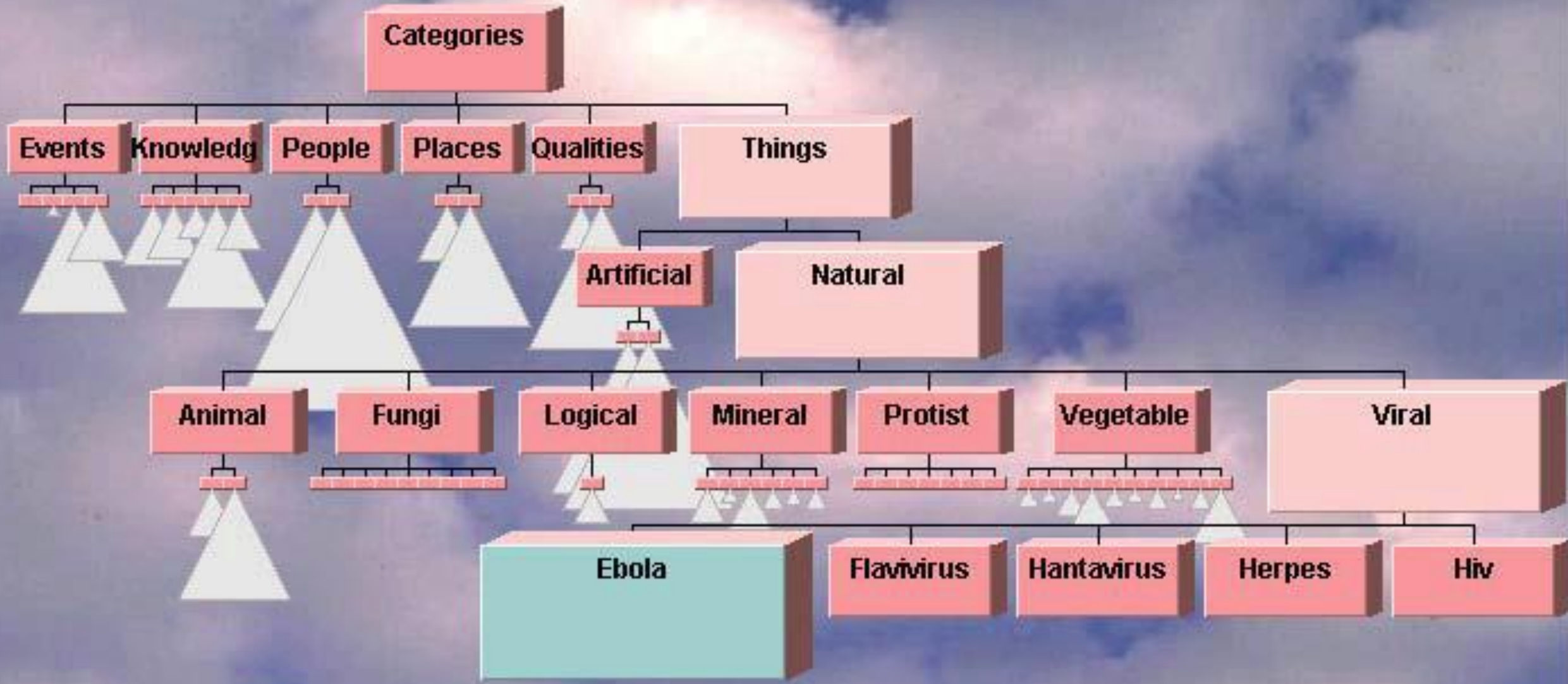
Heer
4373
heer
MRS

Hong
4798
hong
MRS

Mackin
4335
mackinla
MRS

Pirolli
4483
pirolli
Principal

Royer
4395
royer
Xerox



Card et al., 2002

Group question: which tasks do you think DOI trees are specifically effective for?

- Sample tasks
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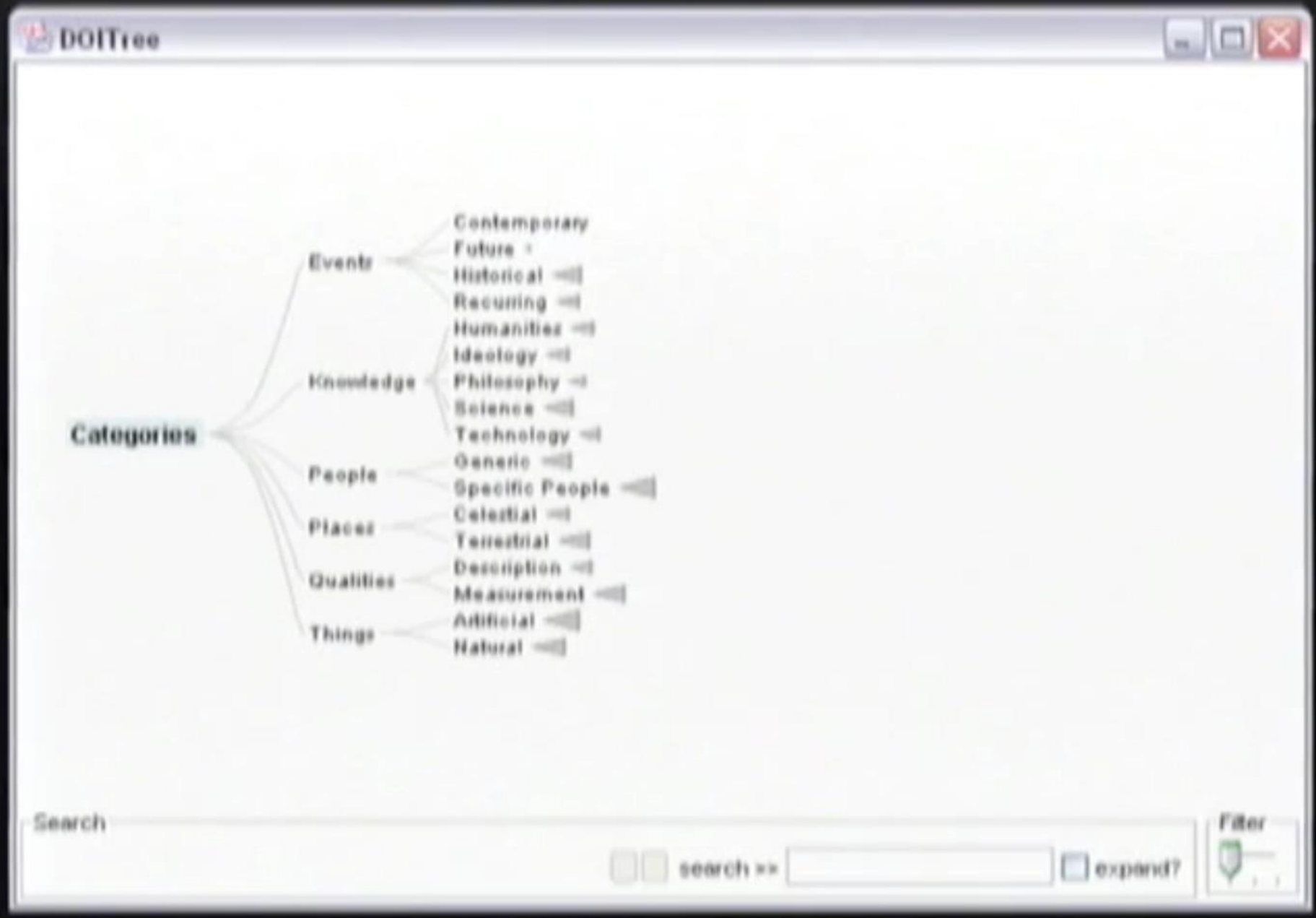
  - Etc.

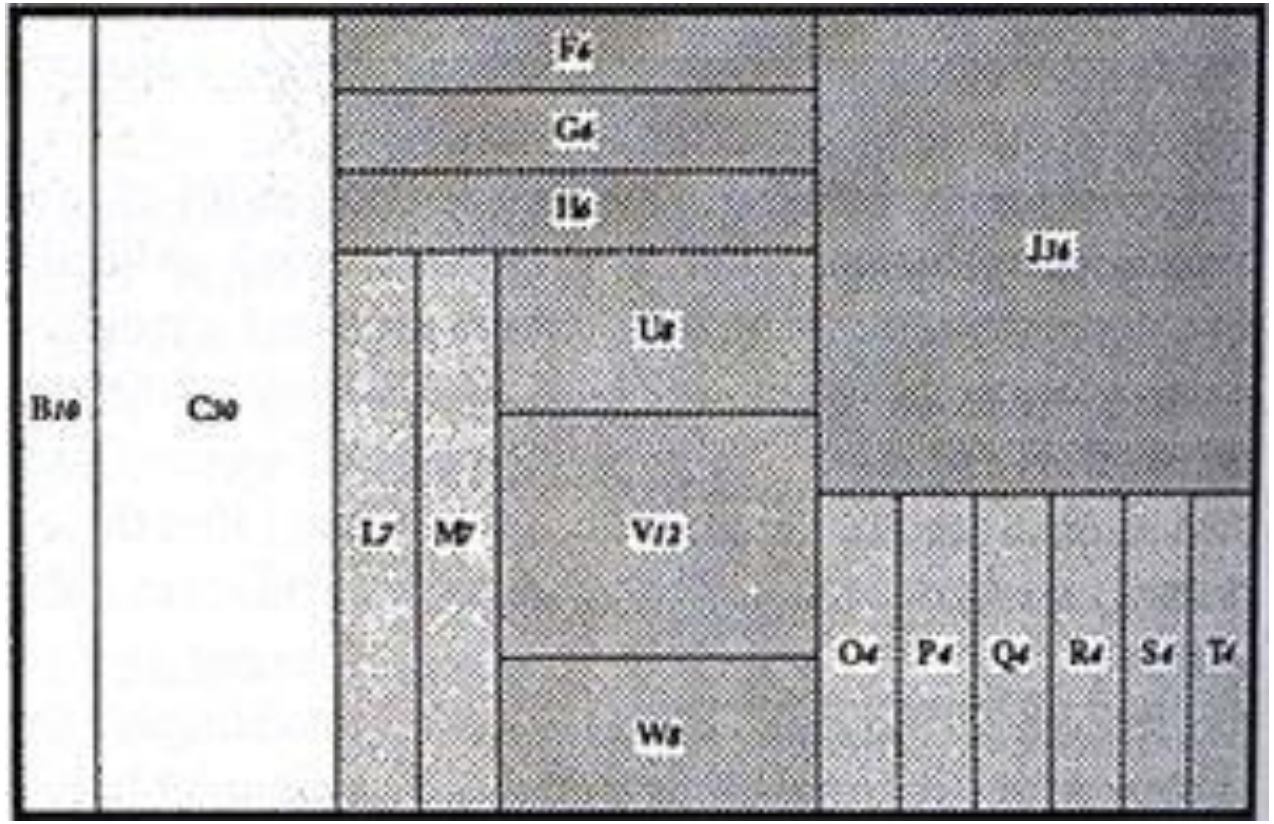
http://www.slido.com
event code **#M749**

DOI Tree

- Improving effectiveness, by…
  - Degree of interest computation
    - Expanded (takes into account distance)
  - Semantic zooming/scaling
    - Data deletion
    - Word abbreviation
    - Node rotation
  - Clustered representation
  - Animation – mental model preservation


DOITree
Categories
Events
Contemporary
Future
Historical
Recurring
Knowledge
Humanities
Ideology
Philosophy
Science
Technology
People
Generic
Specific People
Places
Celestial
Terrestrial
Qualities
Description
Measurement
Things
Artificial
Natural
Search
search >>
expand?
Filter

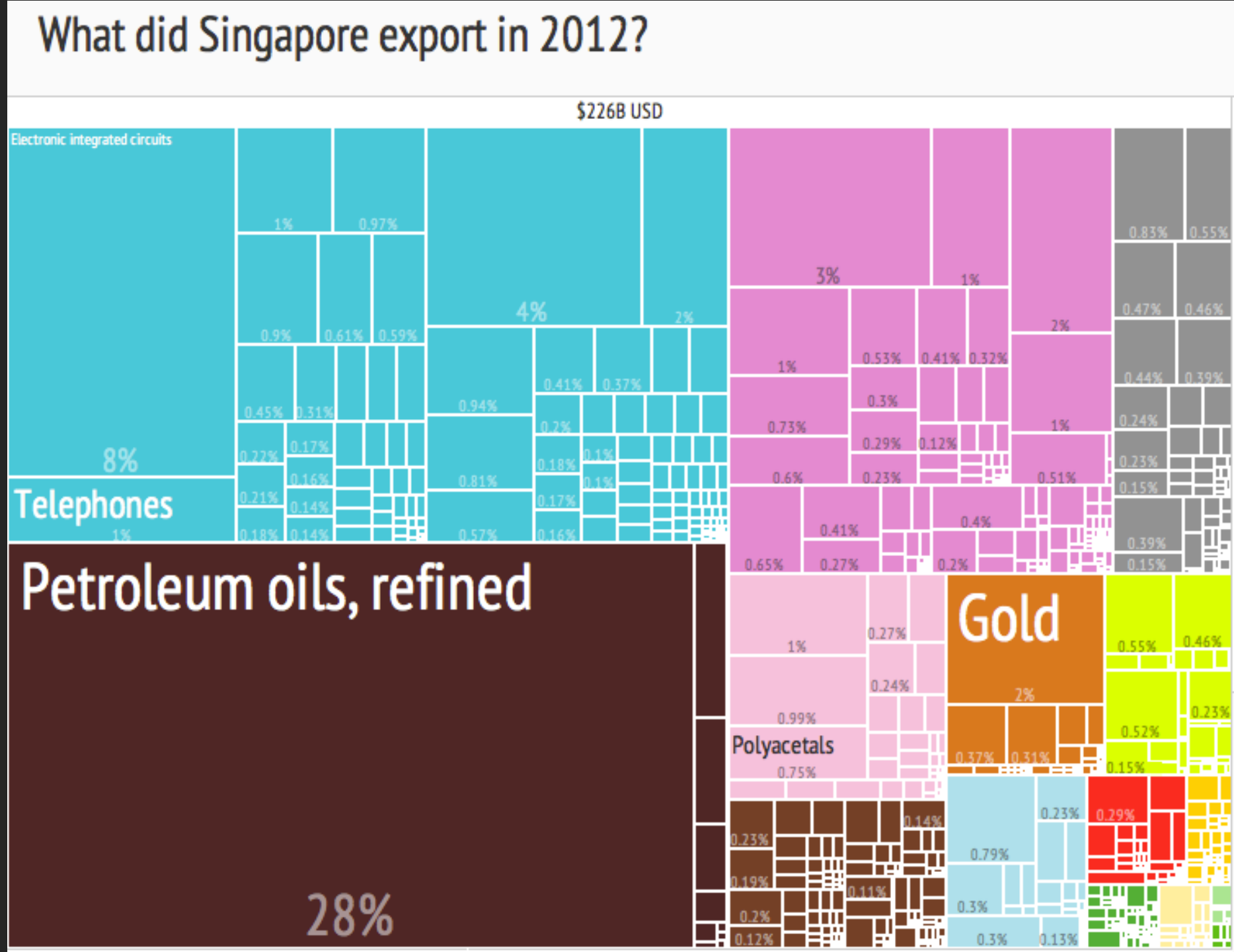
TreeMaps

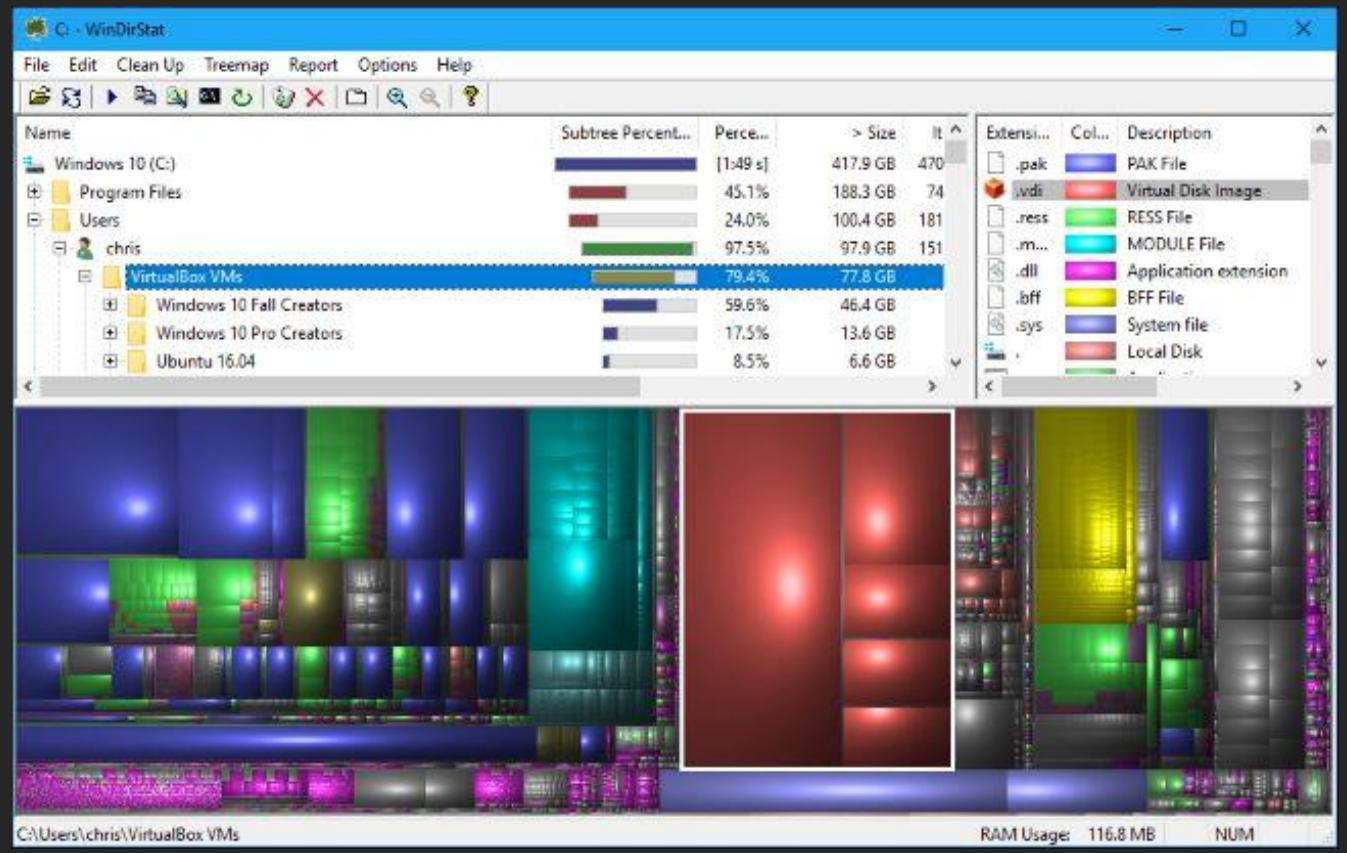


Johnson + Shneiderman, 1991

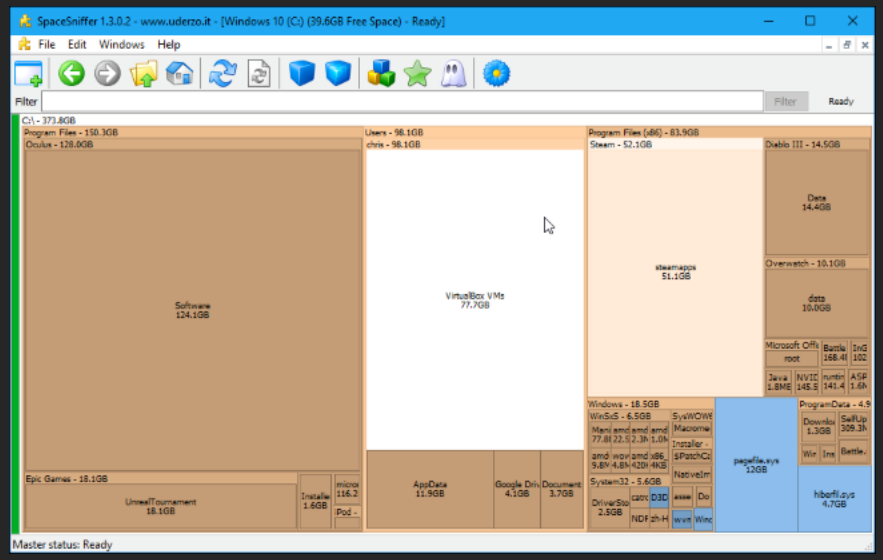
Group question: Treemaps are effective for…

http://www.slido.com
event code **#M749**

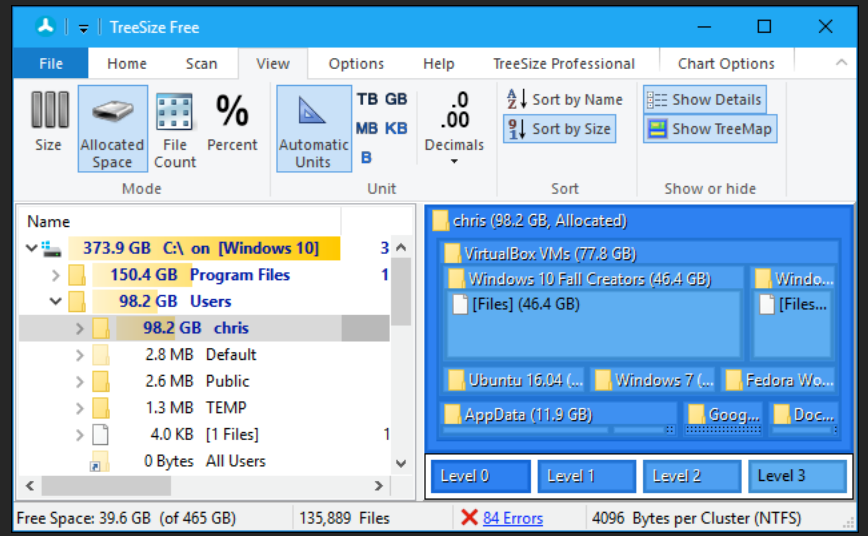




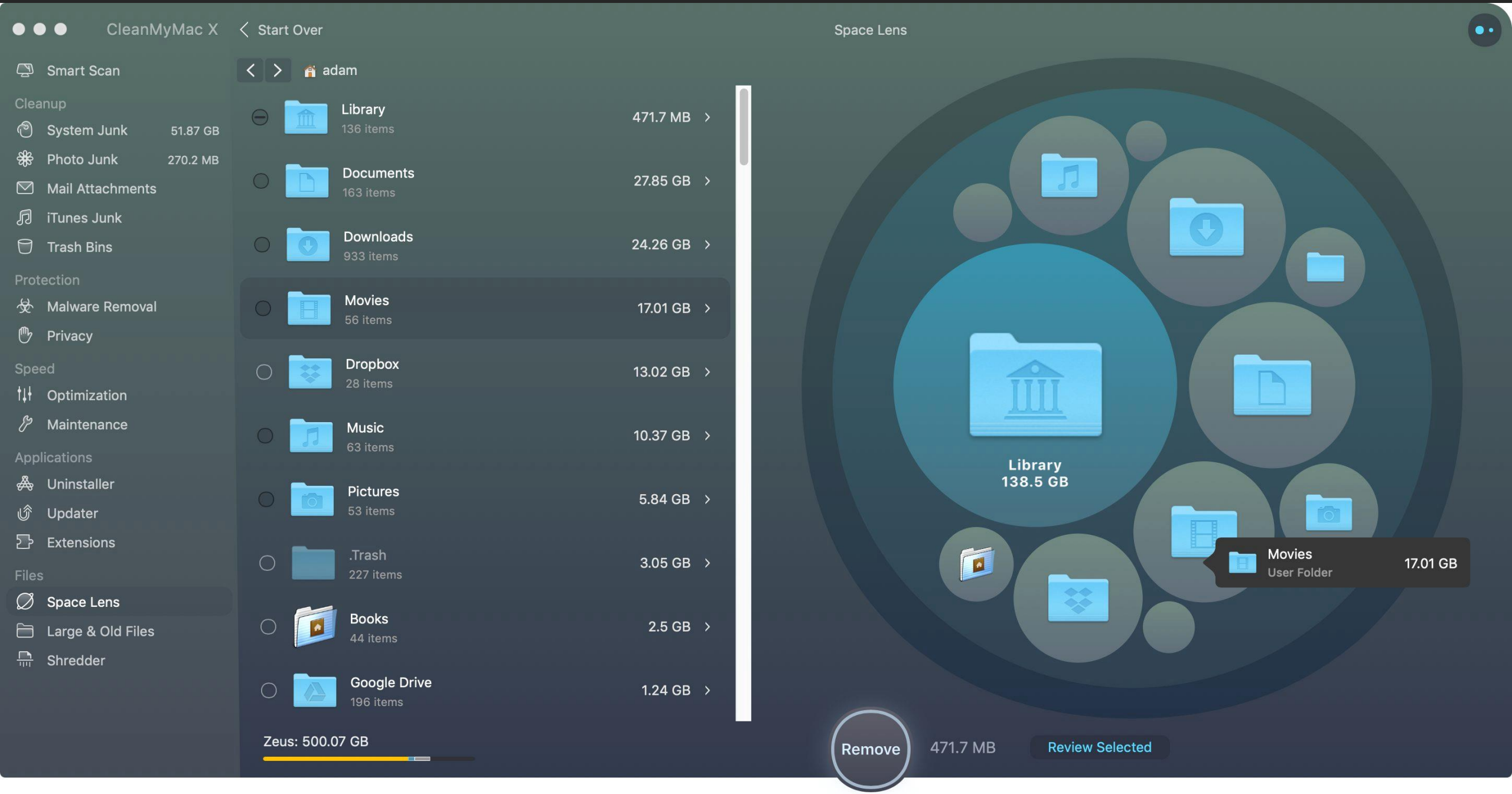
WinDirStat



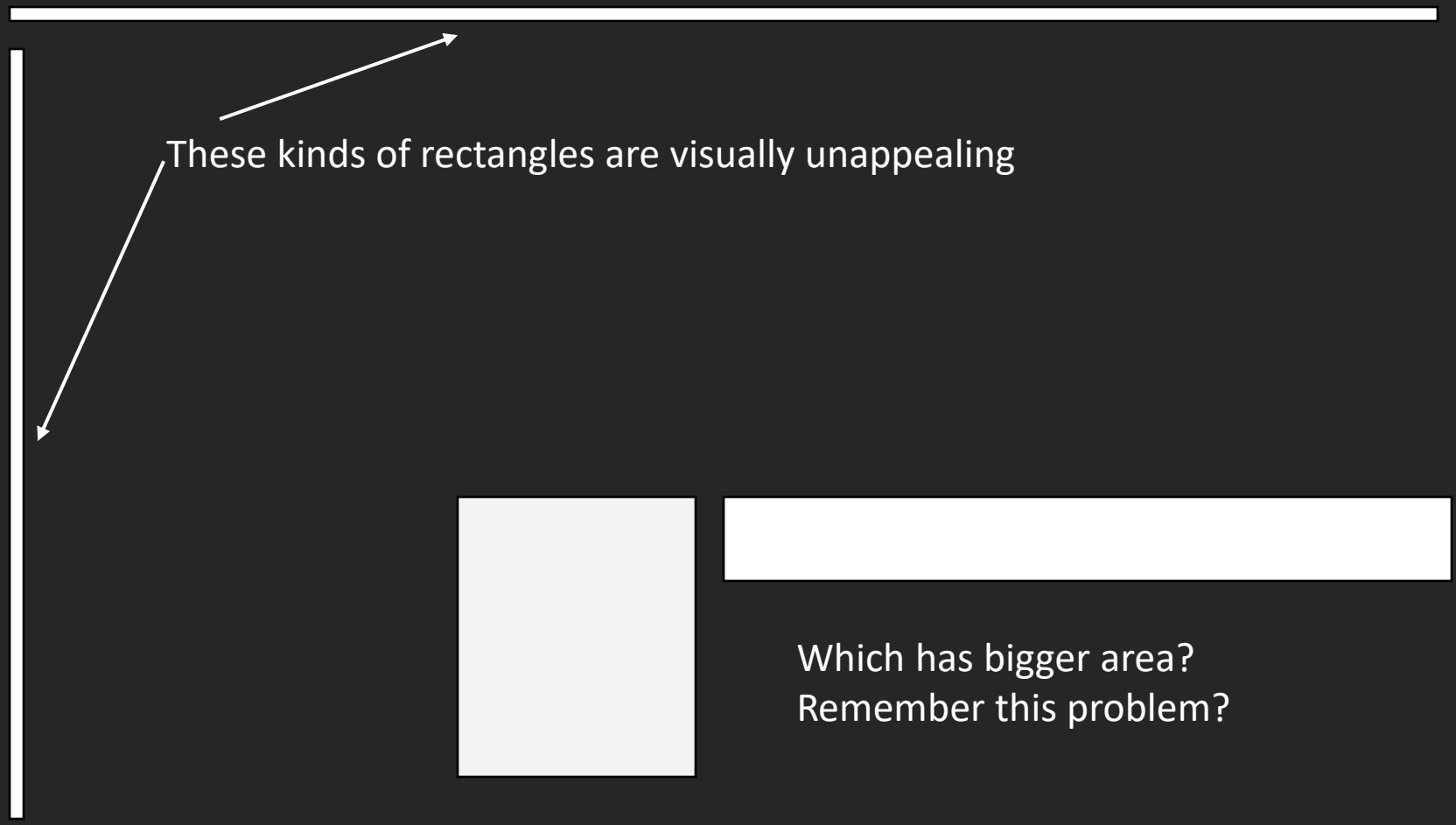
SpaceSniffer



TreeSize

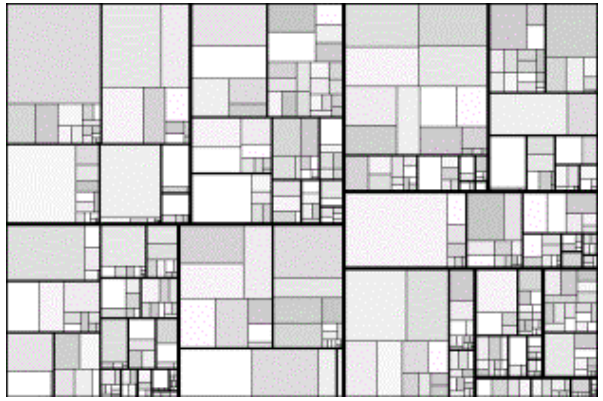

CleanMyMac X
Start Over
Space Lens
Smart Scan
Cleanup
System Junk 51.87 GB
Photo Junk 270.2 MB
Mail Attachments
iTunes Junk
Trash Bins
Protection
Malware Removal
Privacy
Speed
Optimization
Maintenance
Applications
Uninstaller
Updater
Extensions
Files
Space Lens
Large & Old Files
Shredder
adam
Library 136 items 471.7 MB
Documents 163 items 27.85 GB
Downloads 933 items 24.26 GB
Movies 56 items 17.01 GB
Dropbox 28 items 13.02 GB
Music 63 items 10.37 GB
Pictures 53 items 5.84 GB
.Trash 227 items 3.05 GB
Books 44 items 2.5 GB
Google Drive 196 items 1.24 GB
Zeus: 500.07 GB
Library
138.5 GB
Movies
User Folder
17.01 GB
Remove
471.7 MB
Review Selected

Aspect ratios

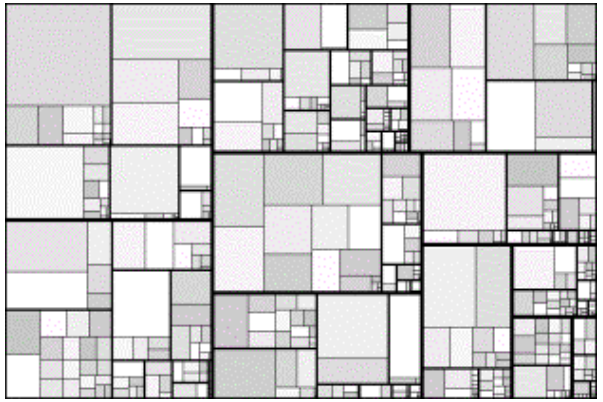


Which has bigger area?
Remember this problem?

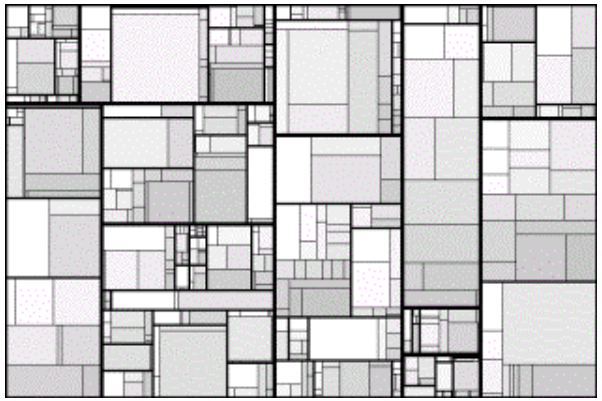
Slice-and-dice



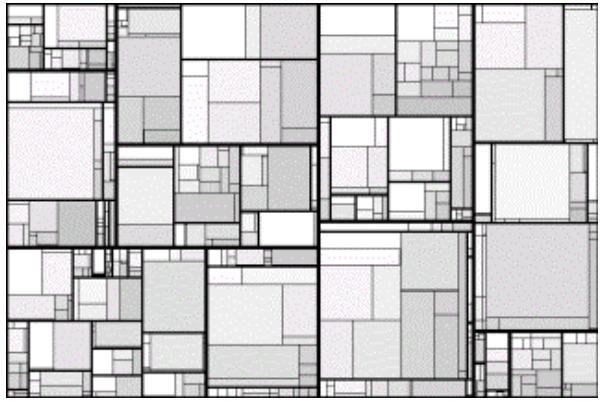
Cluster



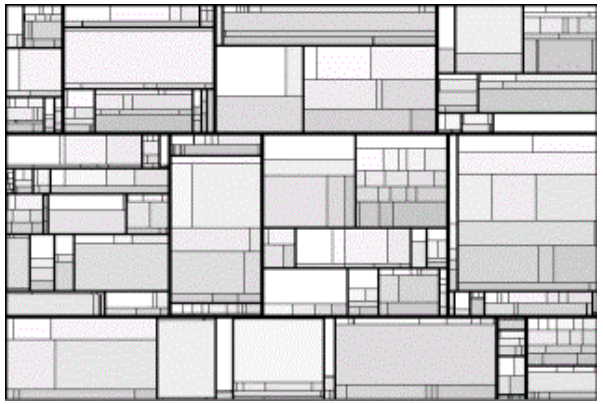
Squarified



Pivot-by-middle

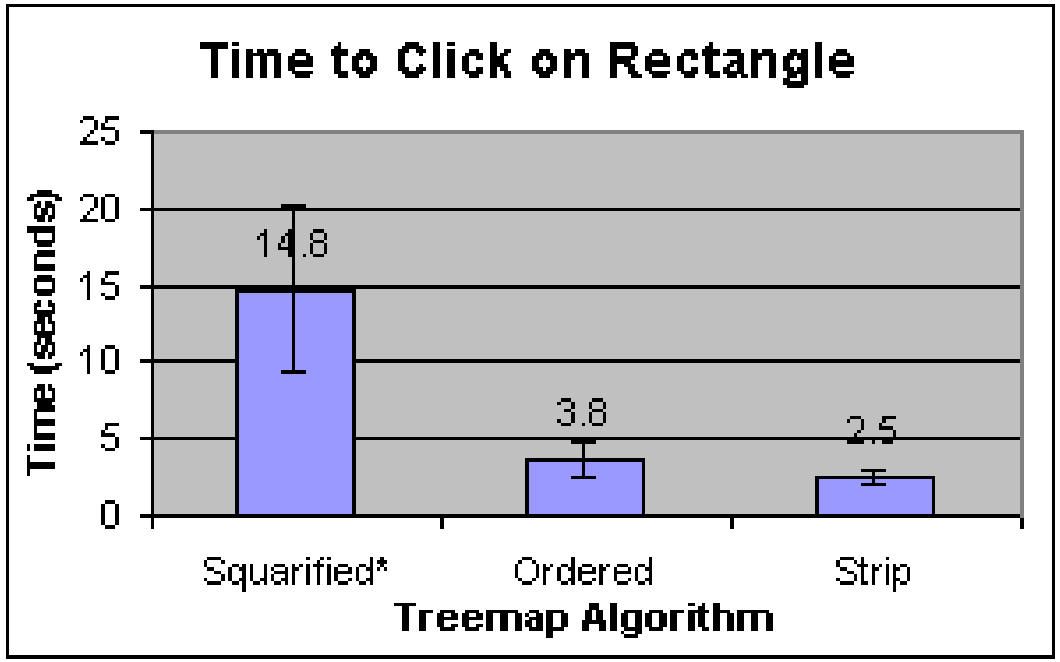


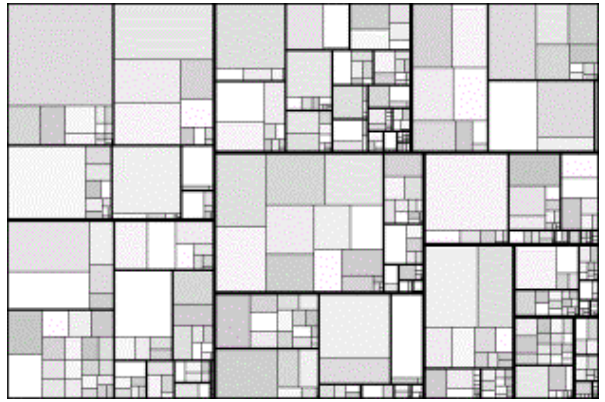
Pivot-by-size



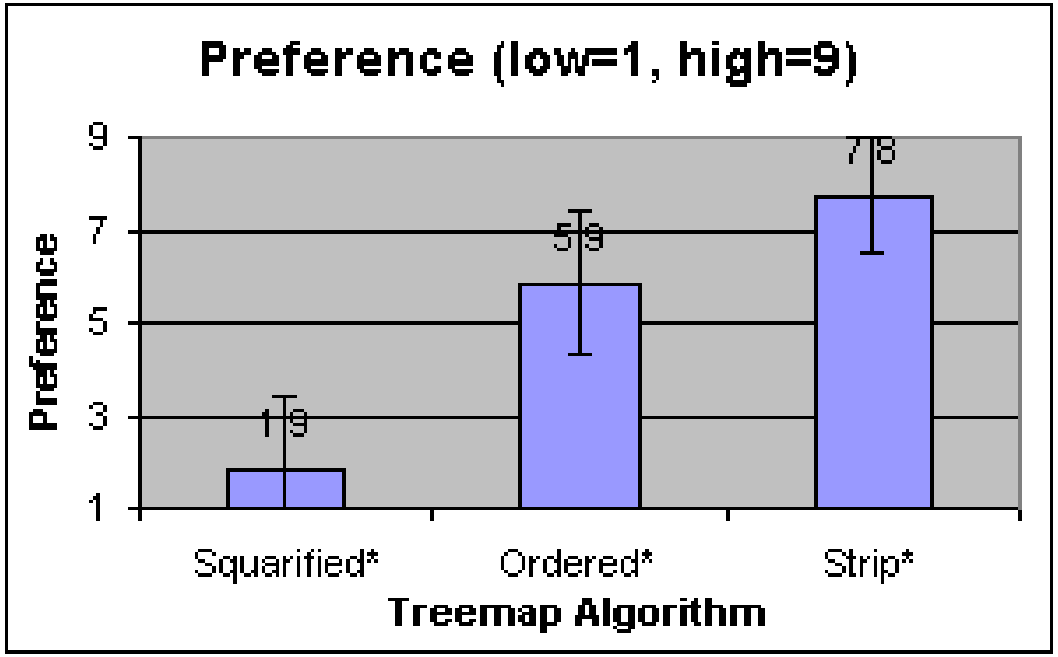
Strip

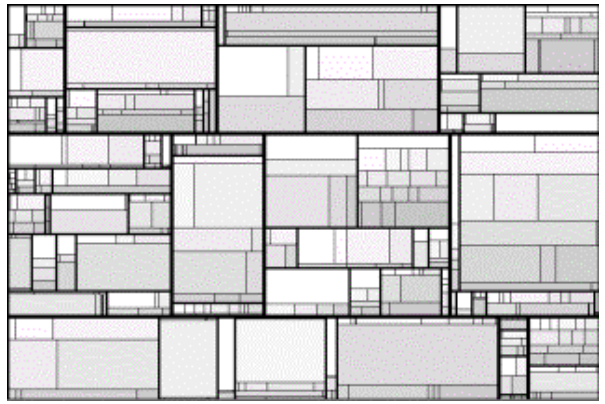
Bederson et al., 2002





Squarified

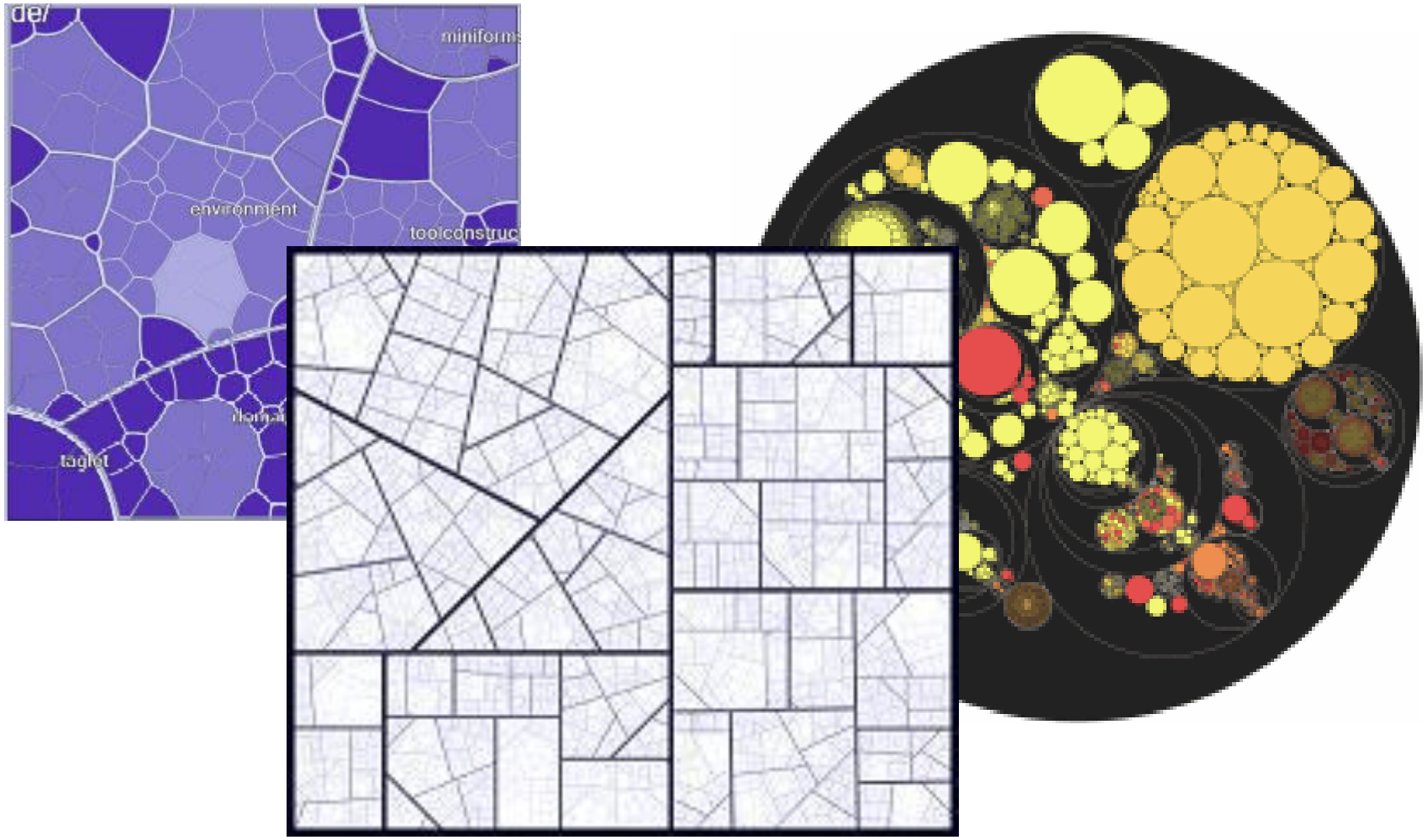




Strip

Bederson et al., 2002

Other Space Filling Systems



http://www.cs.umd.edu/hcil/treemap-history/

https://twitter.com/icpcconf2018/status/1001036144560300037

Group question: what interaction techniques might help make treemaps better?

http://www.slido.com
event code **#M749**

Interaction Techniques for Zoomable Treemaps

UIST 2006 Demonstration

Renaud Blanch & **Éric Lecolinet**, ENST (GET)
http://www.infres.enst.fr/~elc/

Learn more about treemaps

- http://www.cs.umd.edu/hcil/treemap-history/
- http://datavizcatalogue.com/blog/3d-treemaps-that-use-extrusion/

Summary

- Hierarchical Data
- Visual representations
  - Node-Link
    - 2D, 3D, Distortions, Interaction Techniques
  - Space-Filling
    - TreeMaps