Graphs and Trees

Lecture 13 CPSC 533C, Fall 2005

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Topic Presentations

material

- 1 papers from my suggestions
- 1 paper found on your own (same topic)

talk: 20 min each

- slides required
- critical points of papers
- comparison and critique
  not just outline

Graphs and Trees

Hermann survey

Graph Visualisation in Information Visualisation: a Survey. Ivan Herman, Guy Melancon, M. Scott Marshall. IEEE Transactions on Visualization and Computer Graphics, 6(1), pp. 24-44, 2000. http://citeseer.nj.nec.com/herman00graph.html

Animated Radial Layouts

Animated Exploration of Graphs with Radial Layout. Ka-Ping Yee, Danyel Fisher, Rachna Dhamija, and Marti Hearst, Proc InfoVis 2001. http://bailando.sims.berkeley.edu/papers/infovis01.htm

SpaceTree

SpaceTree: Supporting Exploration in Large Node Link Tree, Design Evolution and Empirical Evaluation. Catherine Plaisant, Jesse Grosjean, and Ben B. Bederson. Proc. InfoVis 2002. ftp://ftp.cs.umd.edu/pub/hcil/Reports-Abstracts-Bibliography/2002-05html/2002-05.pdf

Cushion Treemaps

Cushion Treemaps. Jack J. van Wijk and Huub van de Wetering, Proc InfoVis 1999, pp 73-78. http://www.win.tue.nl/~vanwijk/ctm.pdf

Multiscale Small-World Graphs

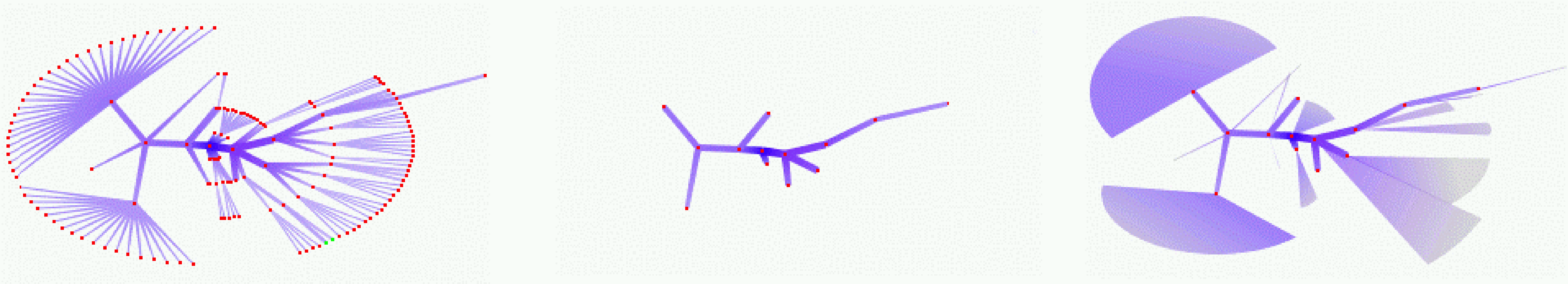
Multiscale Visualization of Small World Networks. David Auber, Yves Chiricota, Fabien Jourdan, Guy Melancon, Proc. InfoVis 2003. http://dept-info.labri.fr/~auber/documents/publi/auberIV03Seattle.pdf

Hermann survey

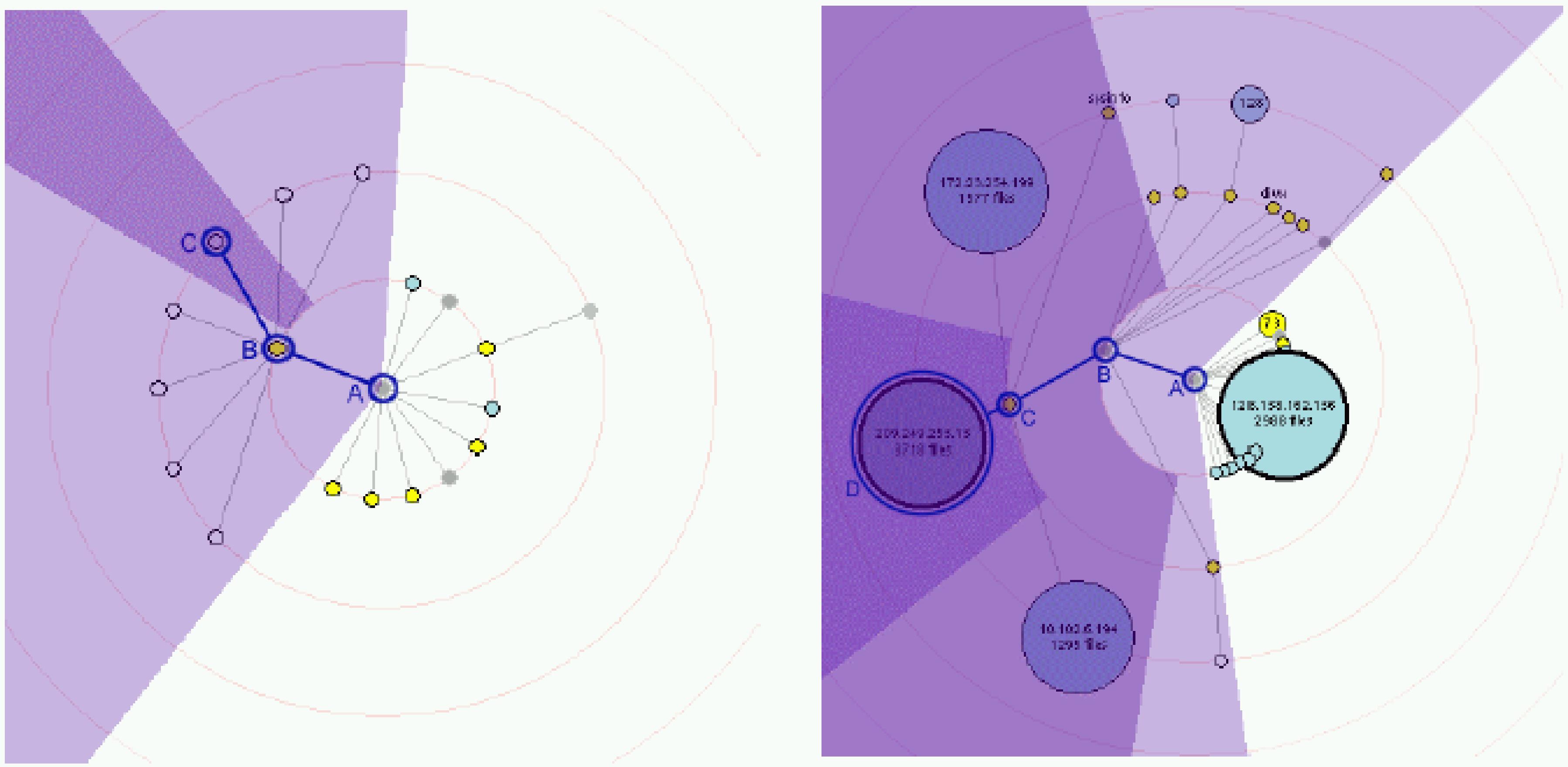
true survey, won't try to summarize here

nice abstraction work by authors

- Strahler skeletonization
- ghosting, hiding, grouping



Animated Radial Layouts



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http://bailando.sims.berkeley.edu/papers/infovis01.htm]

Dynamic Graph Layout

static radial layouts: known algorithm

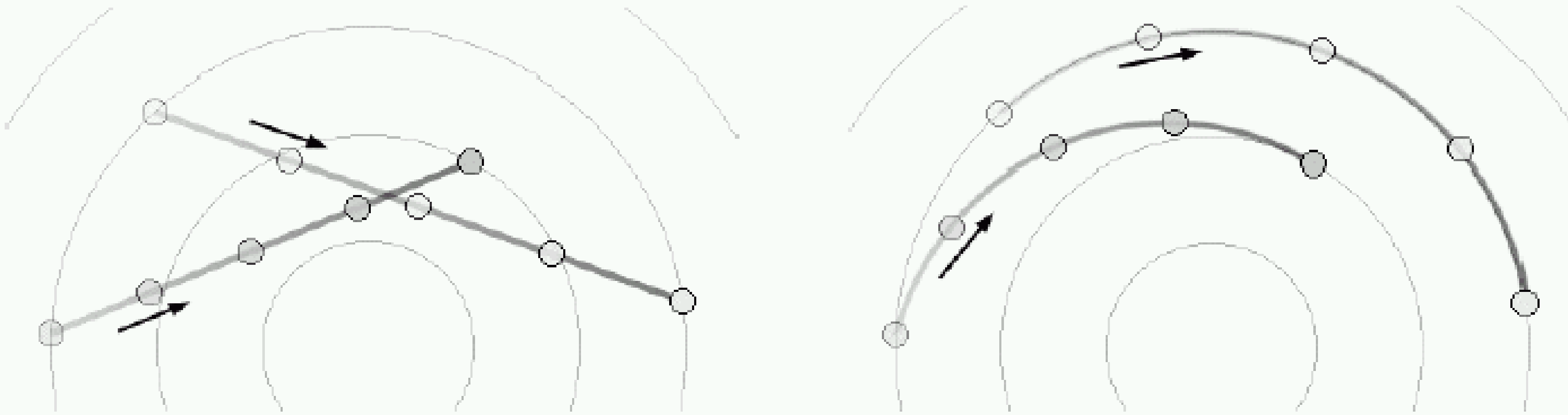
dynamic: little previous work
- DynaDAG [North, Graph Drawing 95]
- DA–TU [Huang, Graph Drawing 98]

minimize visual changes
stay true to current dataset structure

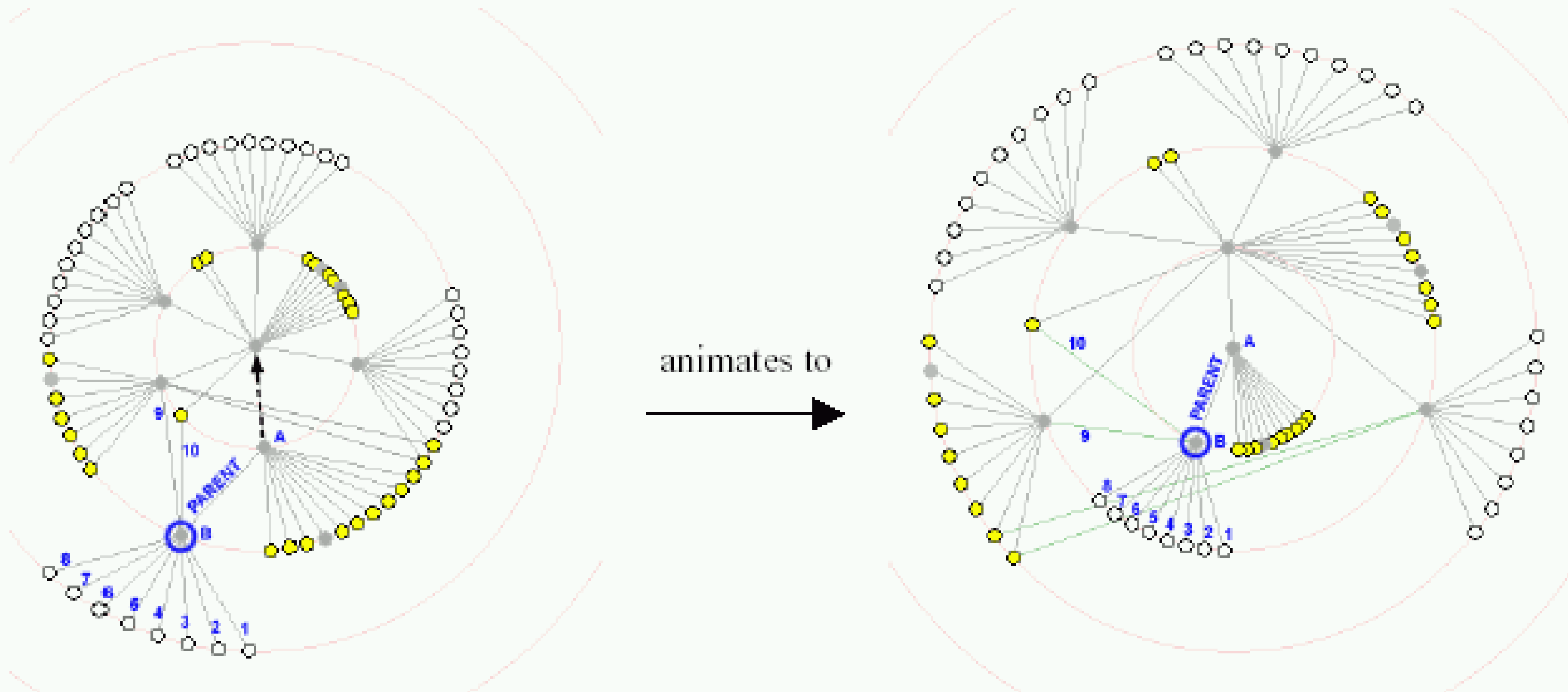
[video]

Animation

polar interpolation



maintain neighbor order



More Dynamic Graphs

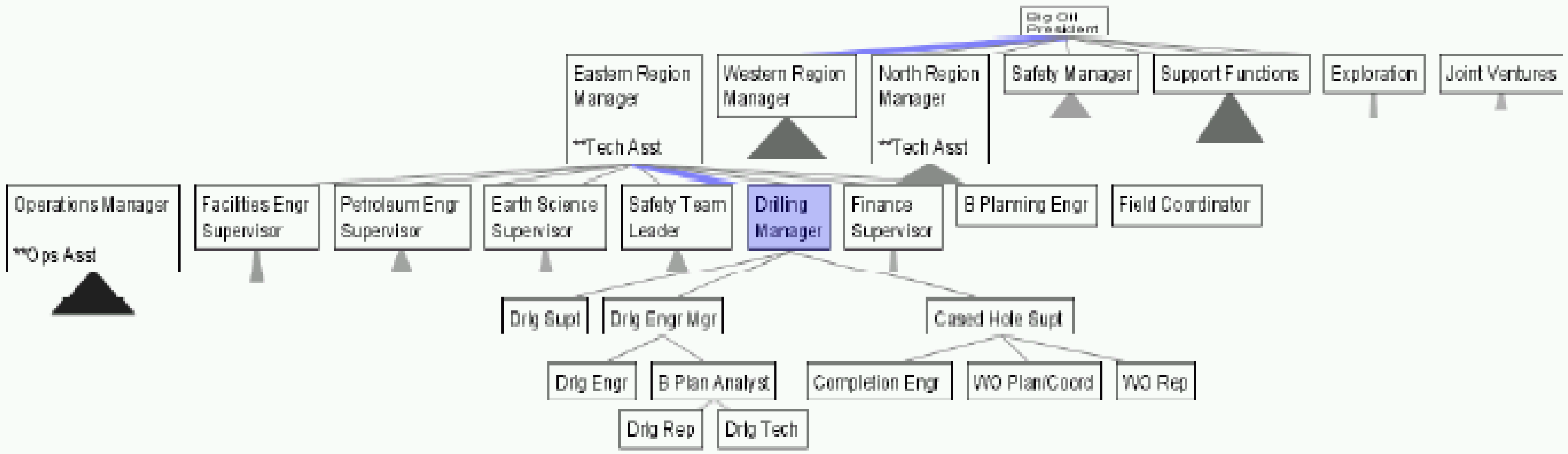
[video]

Dynamic Drawing of Clustered Graphs
Yaniv Frishman, Ayellet Tal
InfoVis 2004 Video Proceedings

SpaceTree

focus+context tree

- animated transitions

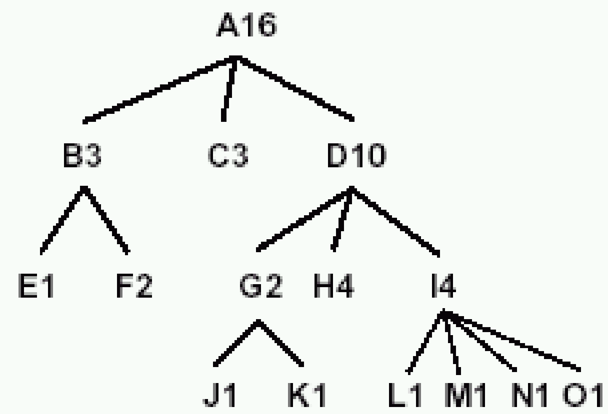


semantic zooming

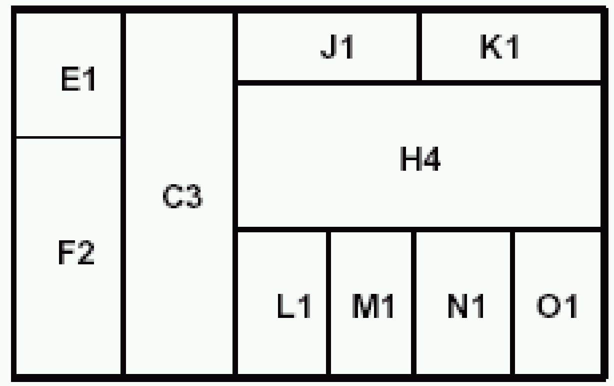
[demo]

Treemaps

containment not connection

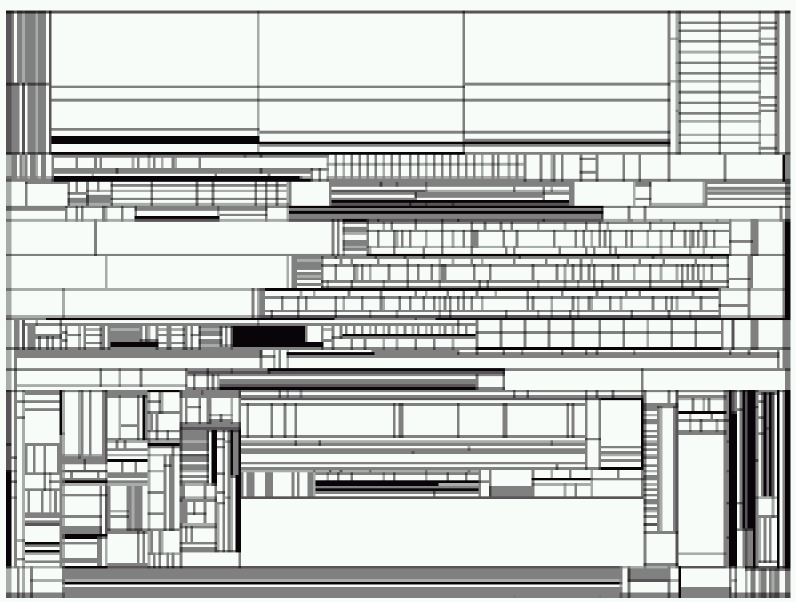


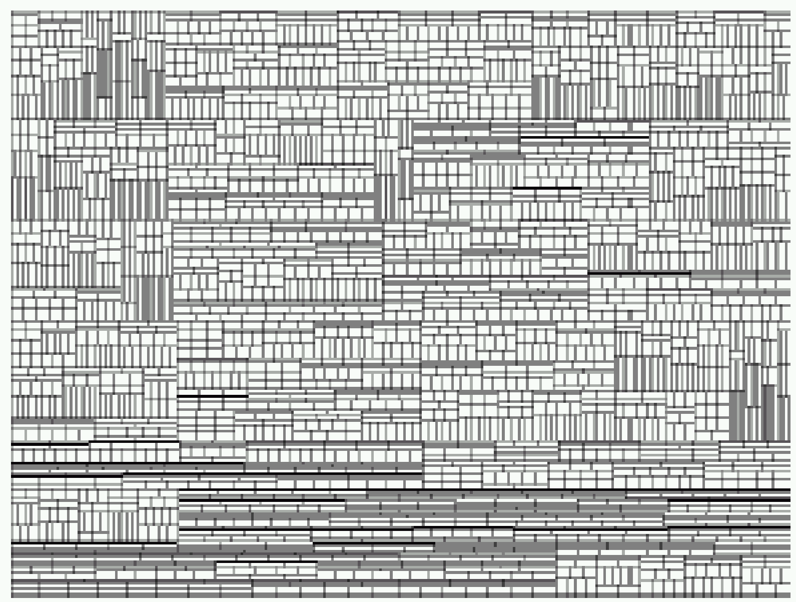
Node and link diagram



Treemap

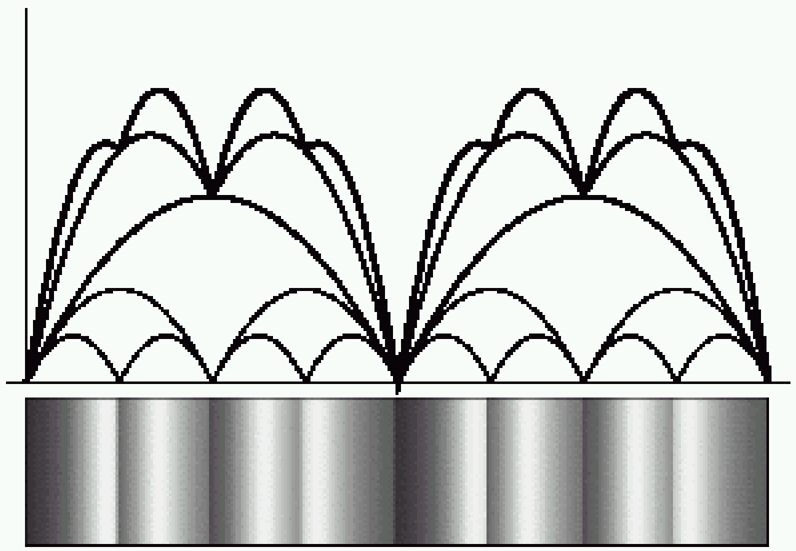
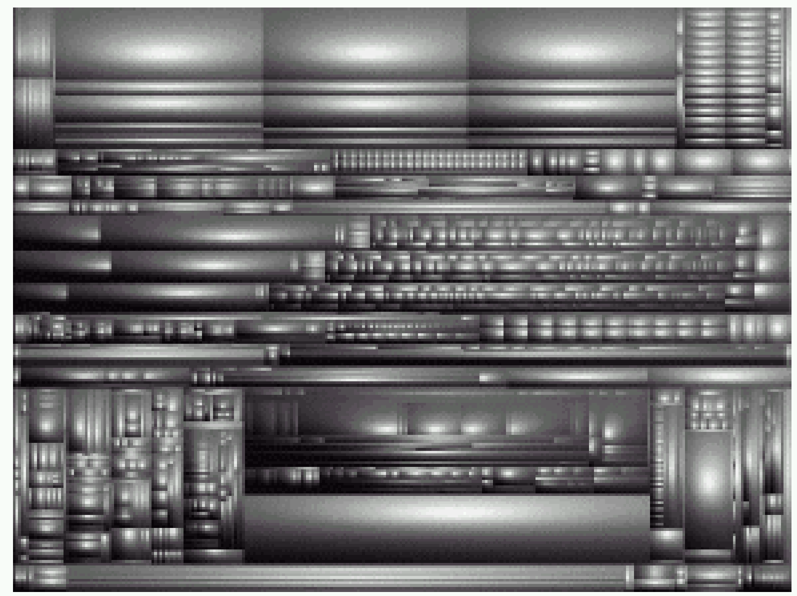
difficulties reading

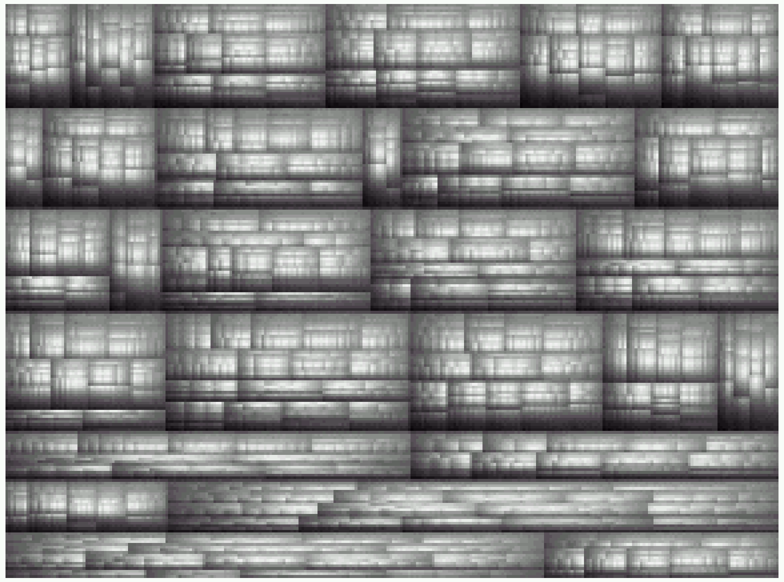
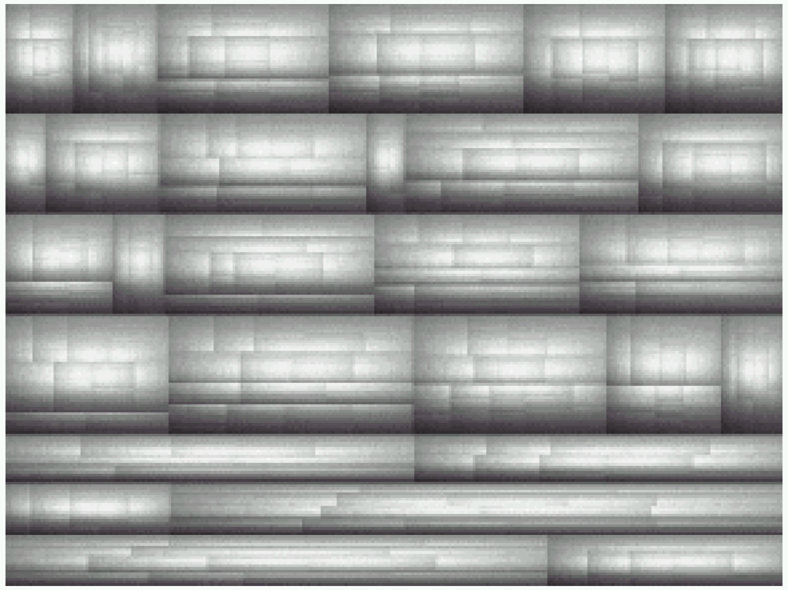




Cushion Treemaps

- show structure with shading
  - scale parameter controls global vs. local

Cushion Treemaps

application

- SequoiaView, Windows app
- hard drive usage
- http://www.win.tue.nl/sequoiaview/

Small-World Networks

high clustering, small path length

- vs. random uniform distribution

examples

- social networks
- movie actors
- Web
- software reverse engineering

multiscale small-world networks

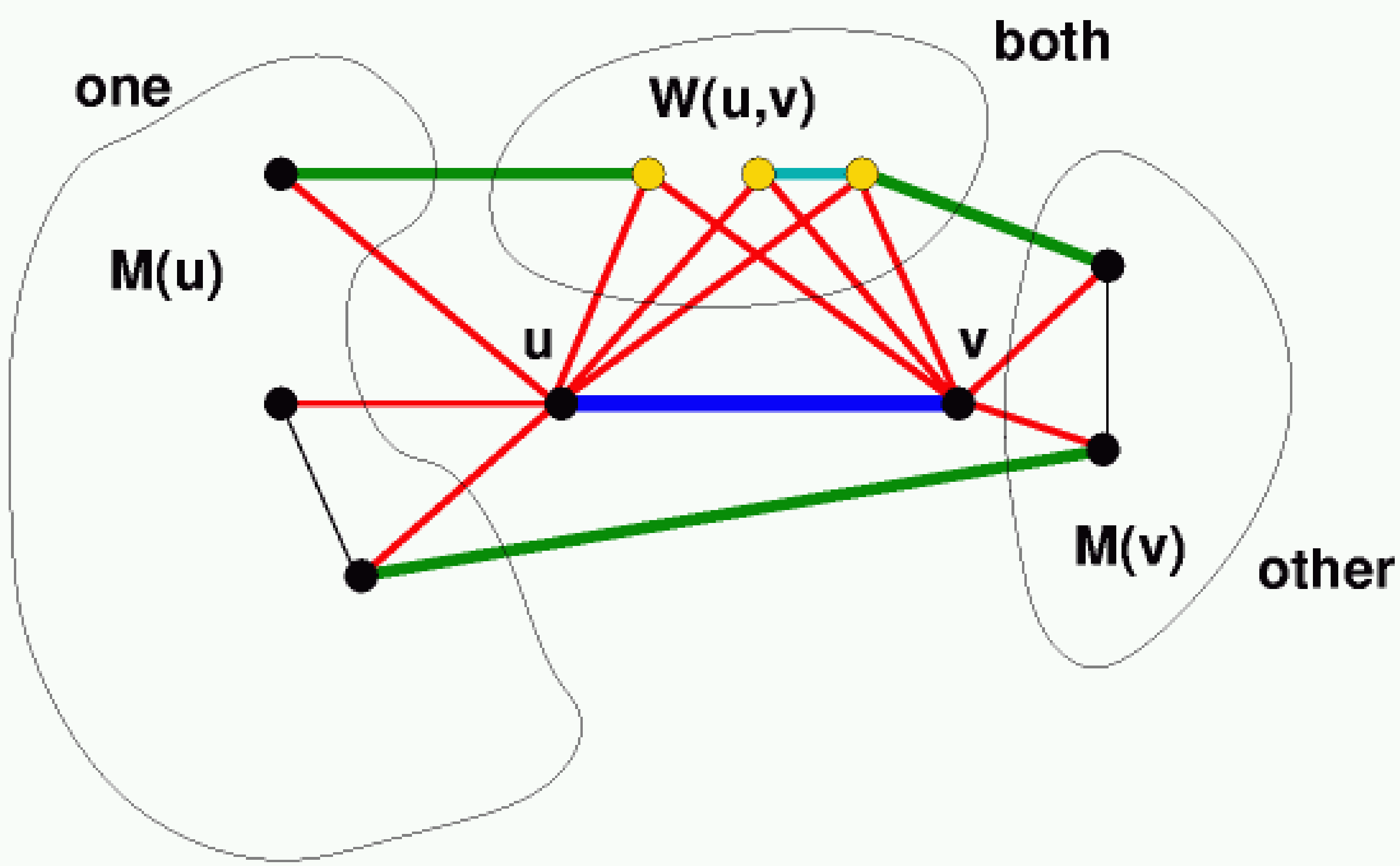
- exploit these properties for better layout

Strength Metric

strength: contribution to neighborhood cohesion

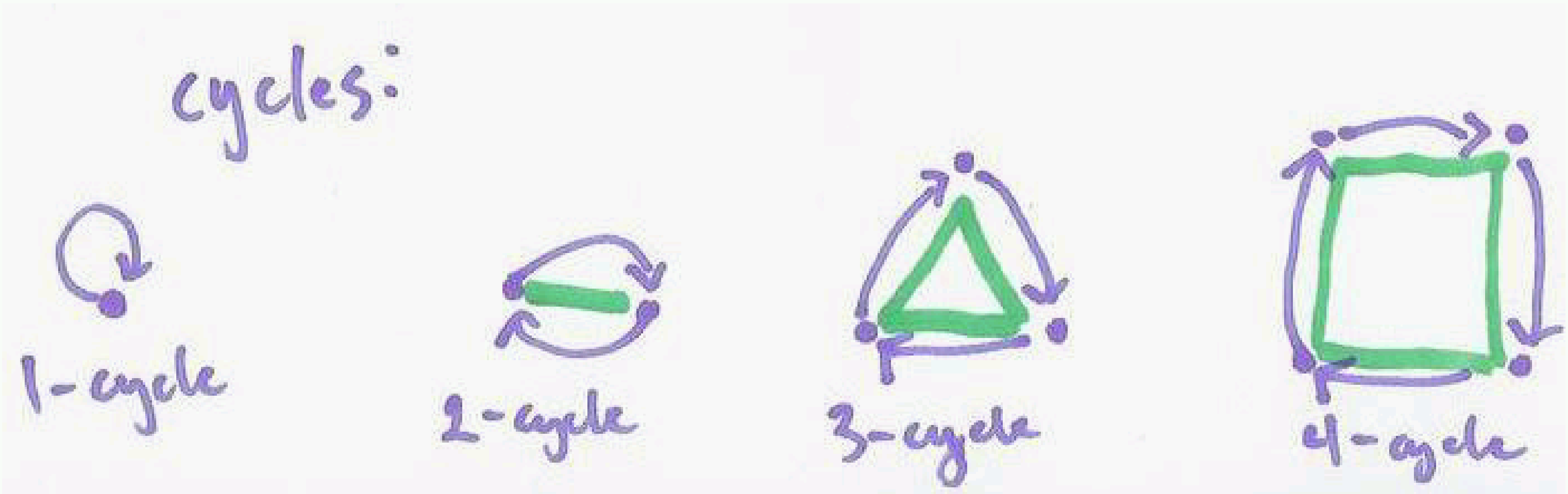
calculate for each edge based on

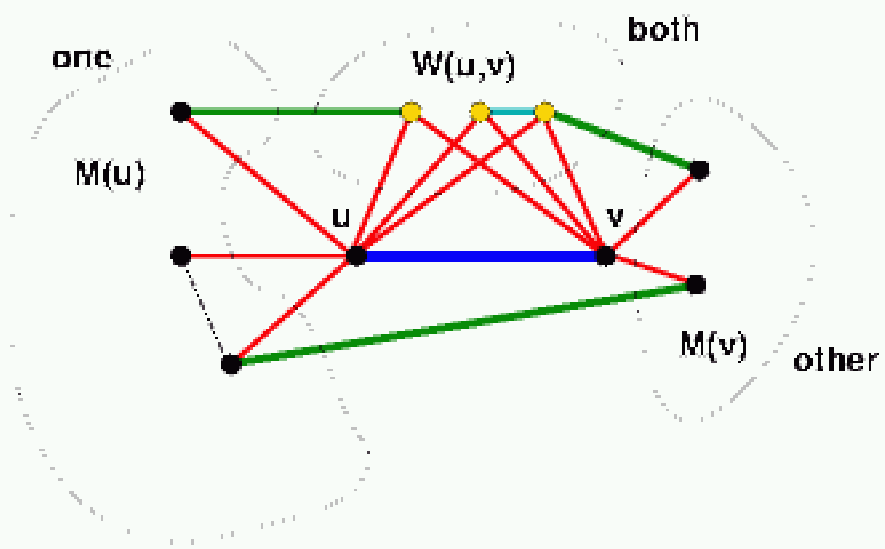
- edge's POV partition of graph: one, other, both



Strength via Cycles

3-cycles through (u,v) + 4-cycles through (u,v)

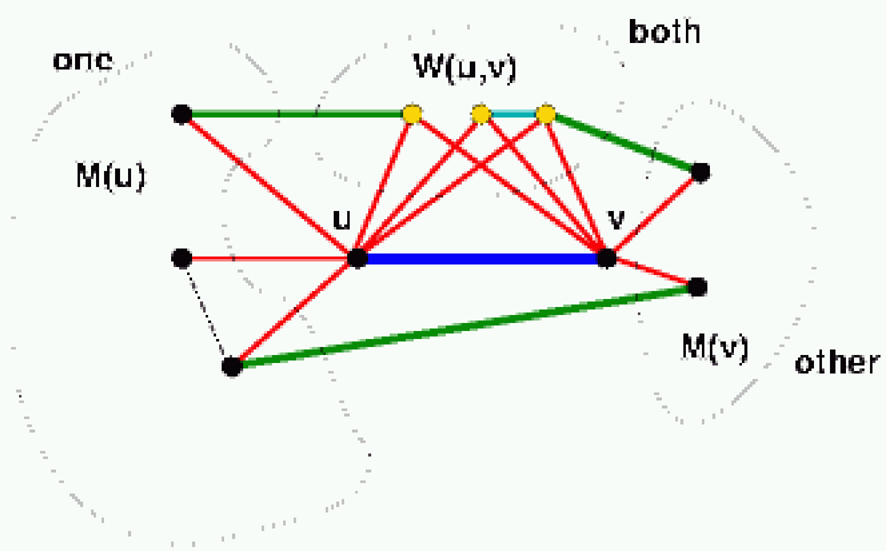




Cycles: Cohesion Measure

3-cycles through u/v

- blue + 2 red edges == yellow nodes in both



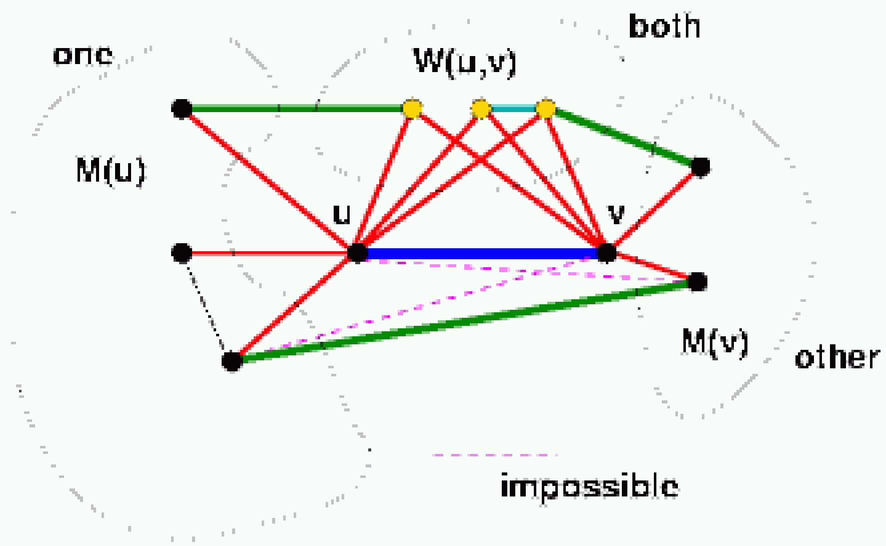
Cycles: Cohesion Measure

3-cycles through u/v

- blue + 2 red edges == yellow nodes in both

all other 3-cycles don't contain blue u/v edge

- magenta edges impossible
- black, red/green, red/black, etc

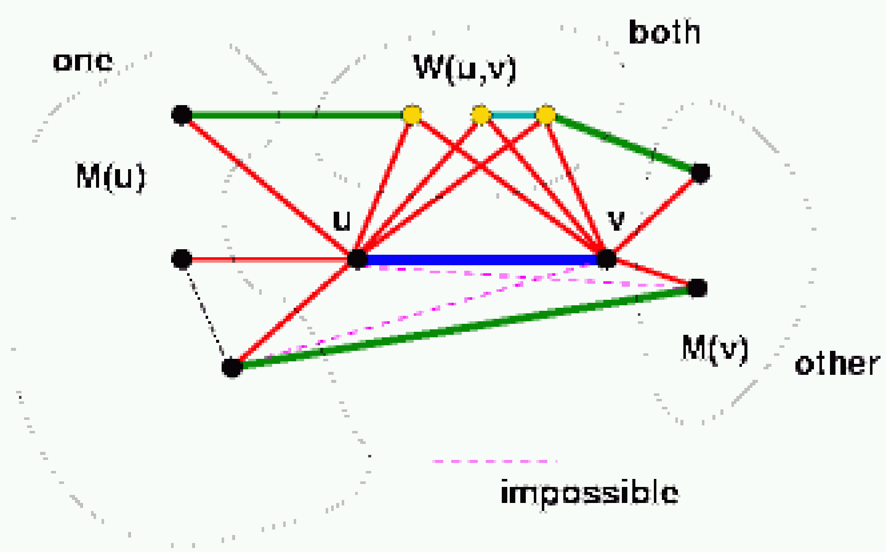


Cycles: Cohesion Measure

3-cycles through u/v

- blue + 2 red edges == yellow nodes in both

$$\frac{\text{existing}}{\text{all possible}} \qquad \frac{\text{yellow nodes}}{\text{all nodes}}$$

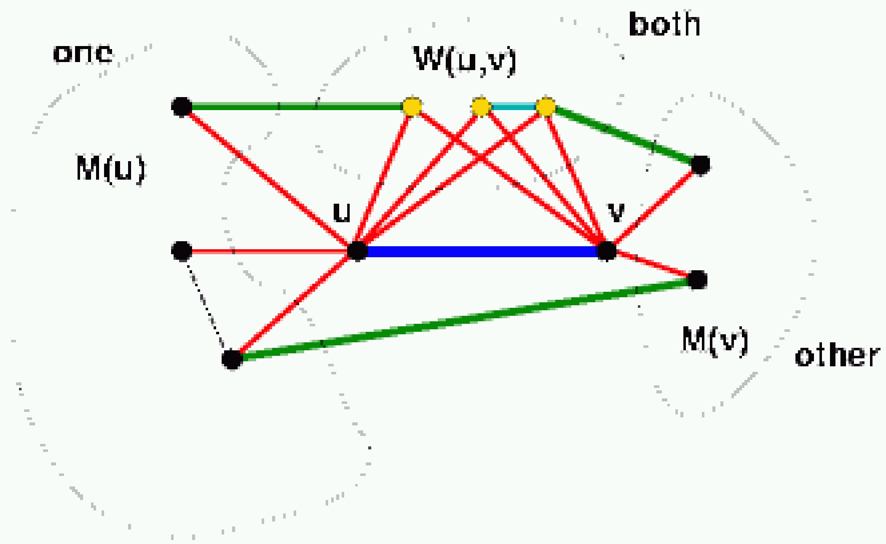


Cycles: Cohesion Measure

4-cycles through u/v

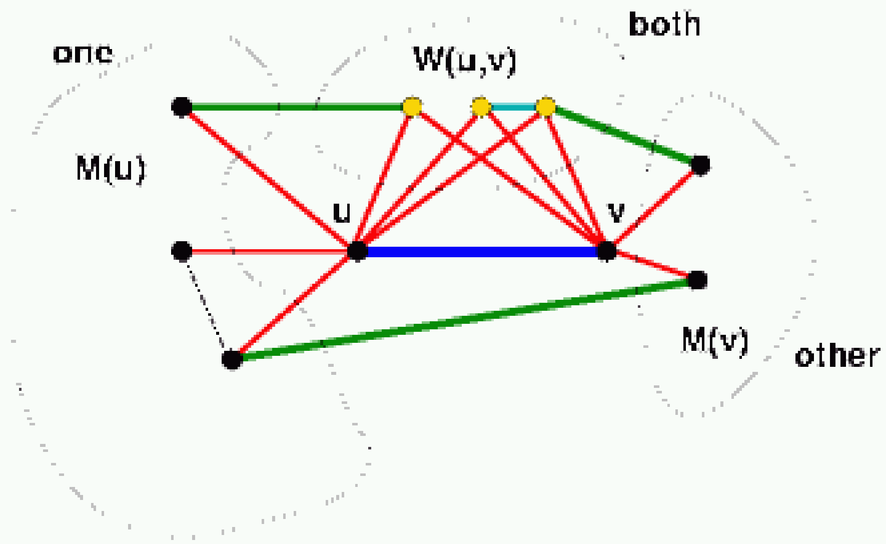
- blue + 2 red + 1 green
- blue + 2 red + 1 cyan

$$s(A,B) = \frac{\text{existing edges between sets}}{\text{all possible edges between sets}}$$



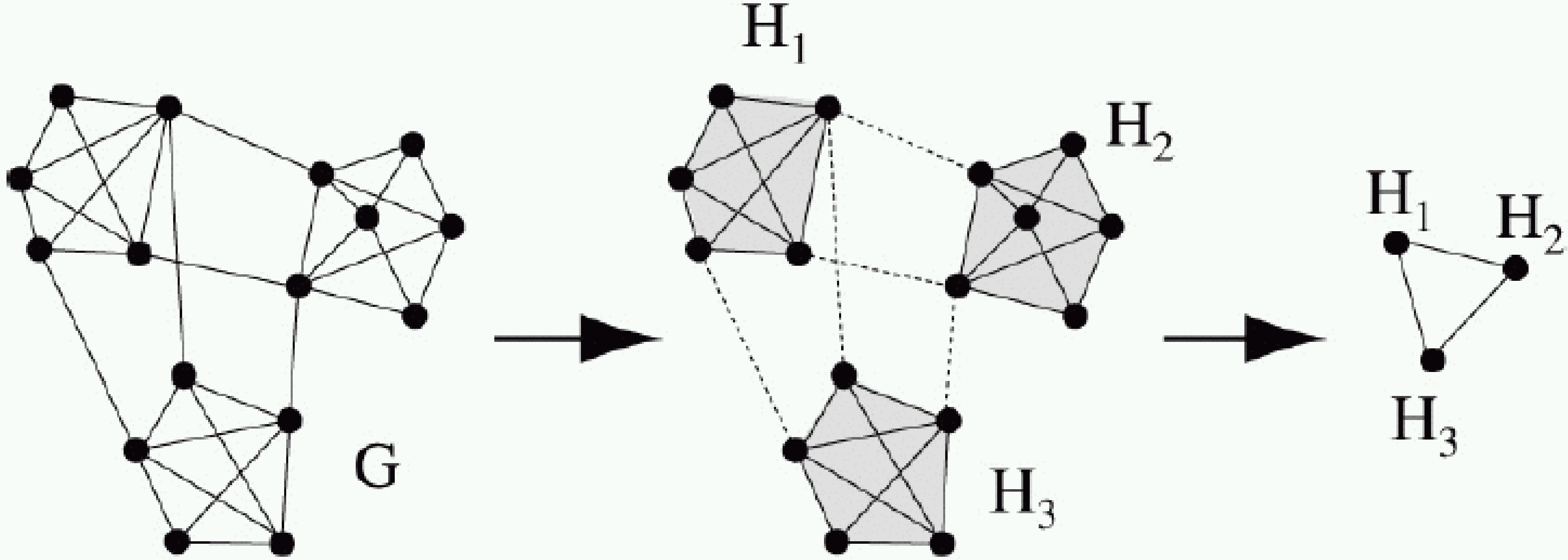
Strength

- 4-cycles [green edges]
  - one-both, other-both, one-other
  - s(M(u),W(u,v))+s(M(v),W(u,v))+s(M(u),M(v))
- 4-cycles [cyan edges]
  - both-both
  - s(W(u,v))
- 3-cycles [yellow nodes in both]
  - |W(u,v)| / (|M(u)|+|M(v)|+|W(u,v)|)



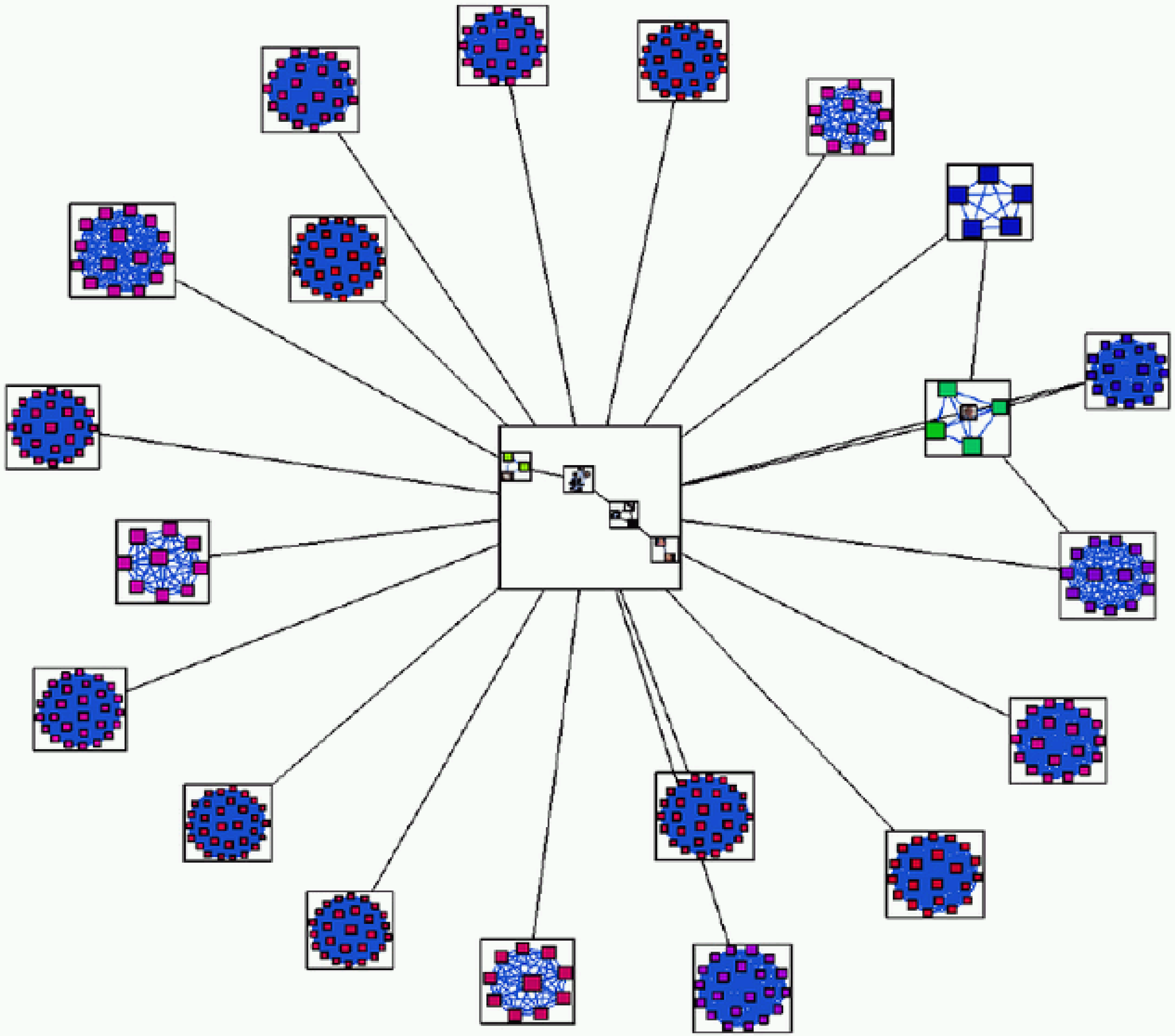
Hierarchical Decomposition

remove low–strength edges
maximal disconnected subgraphs
quotient graph: subgraph = higher–level node



[Multiscale Visualization of Small World Networks. Auber, Chiricota, Jourdan, and Melancon. Proc. InfoVis 2003]

Nested Quotient Graphs



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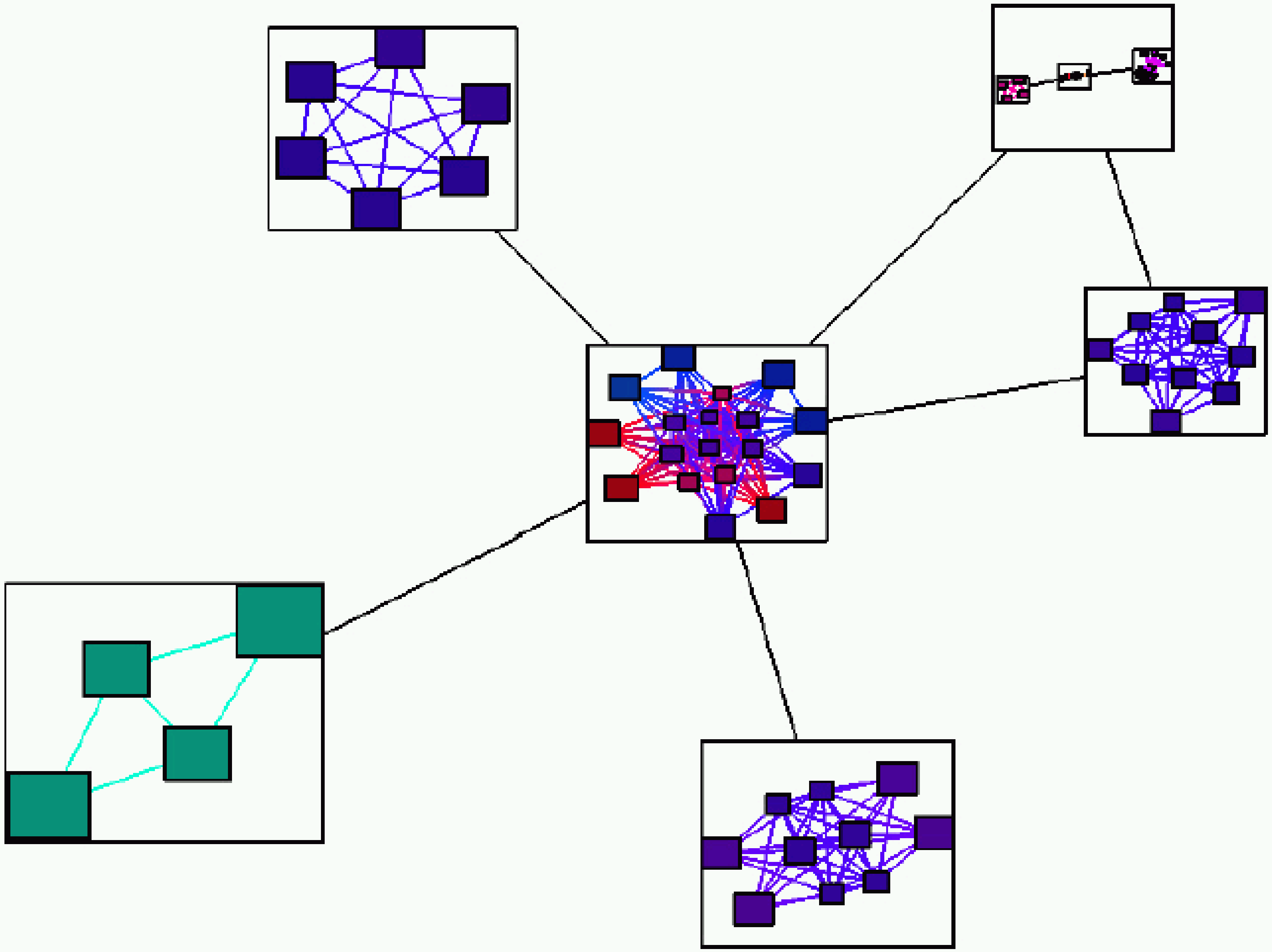
Nested Quotient Graphs



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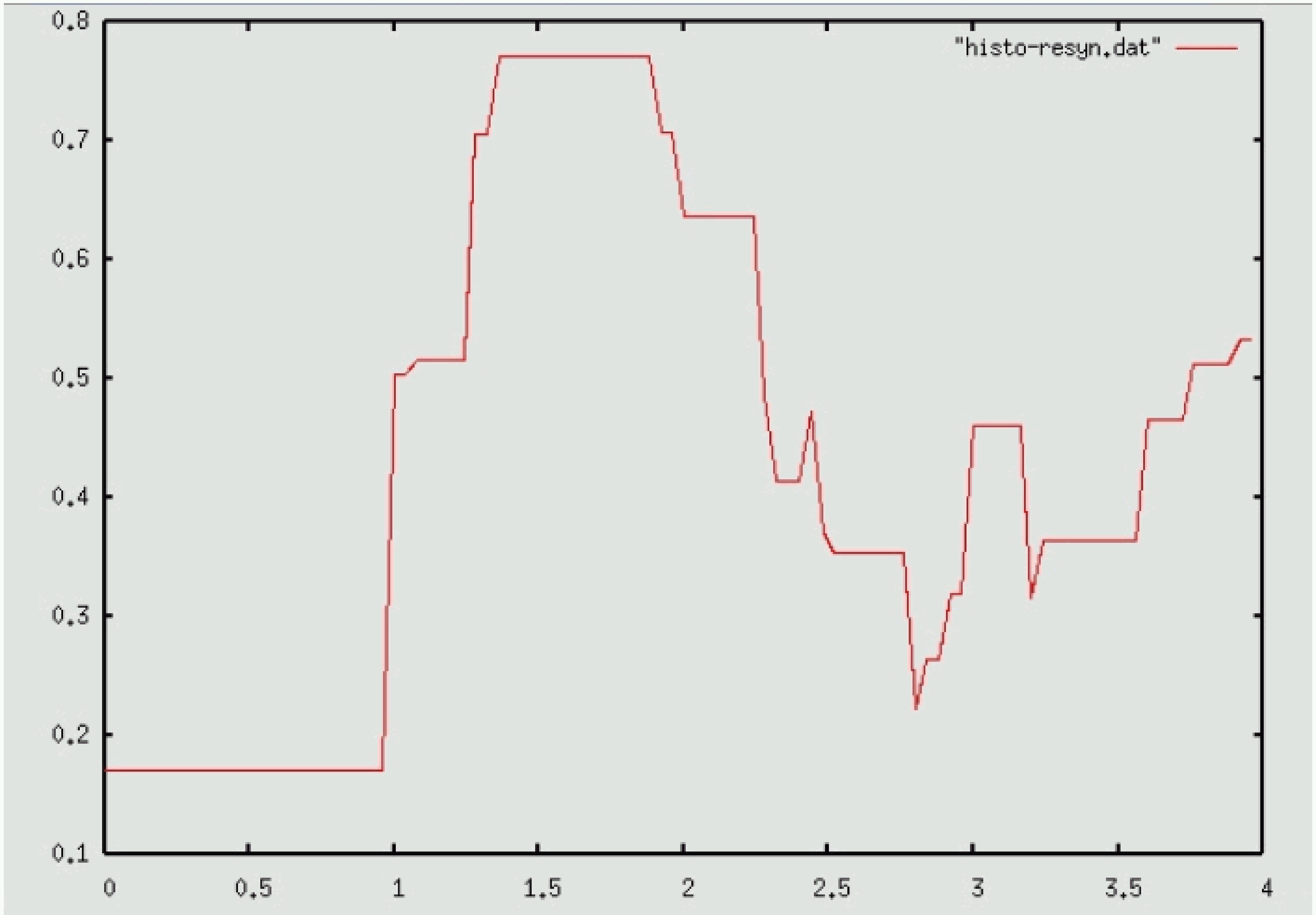
Clustering Quality Metric

automatically determine how many clusters



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Critique

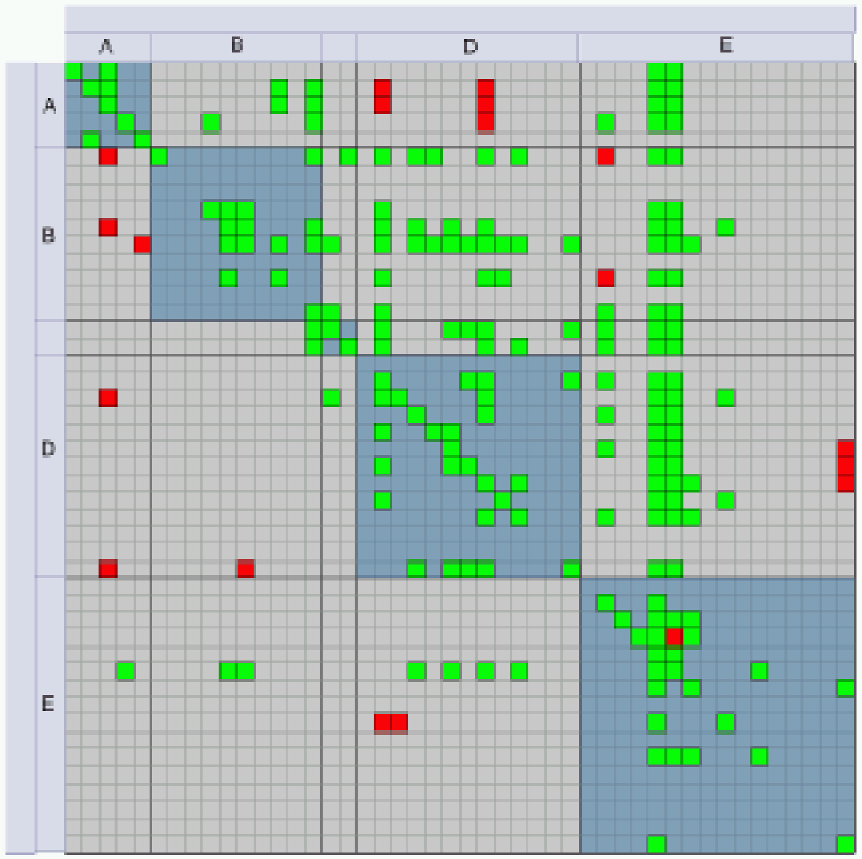
pros

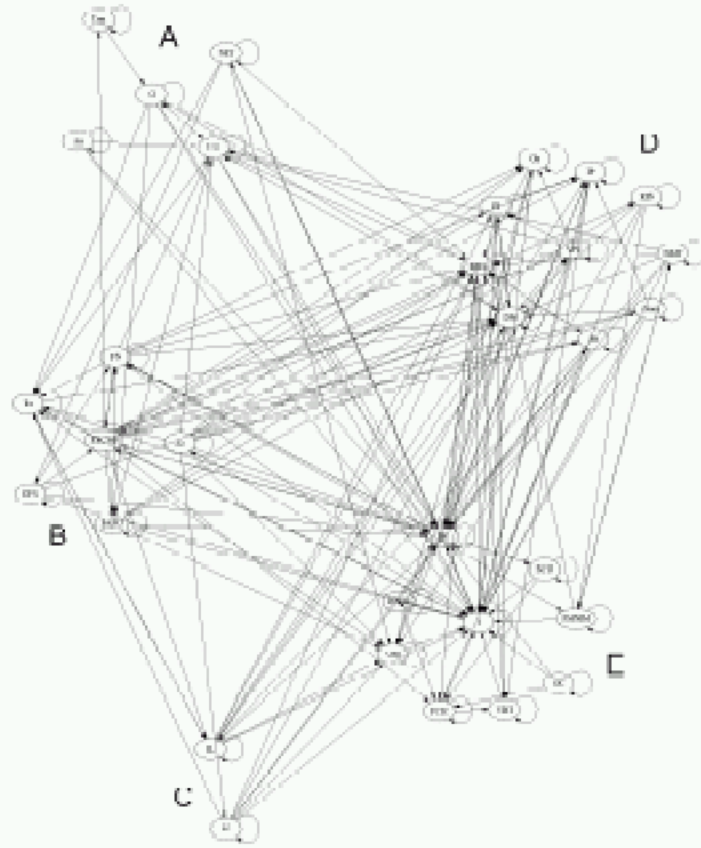
- exploit structure of data
- hierarchical structure shown visually
- automatically determine number of clusters
- nifty math

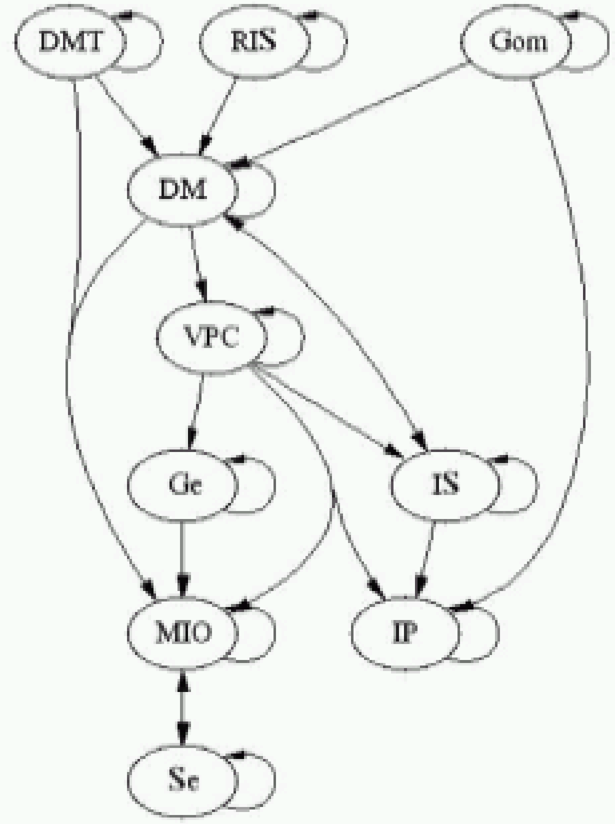
cons

- information density could be better
- what if mental model doesn't match clustering metric?

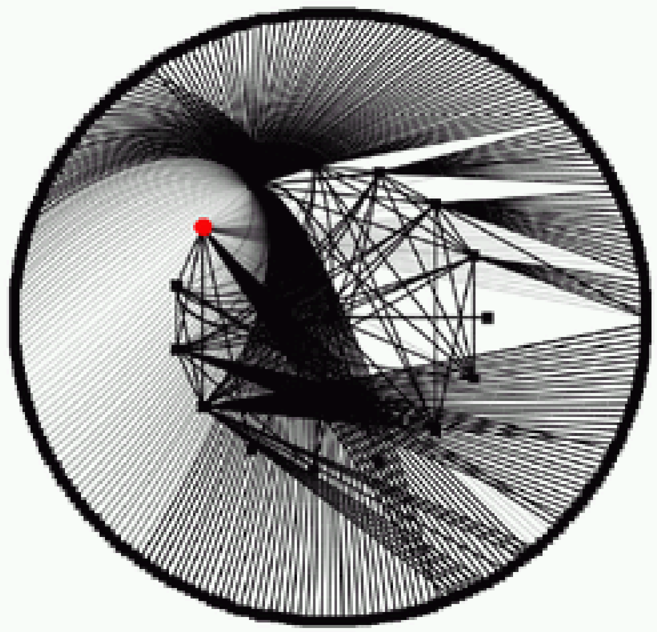
Previous: Multilevel Call Matrices



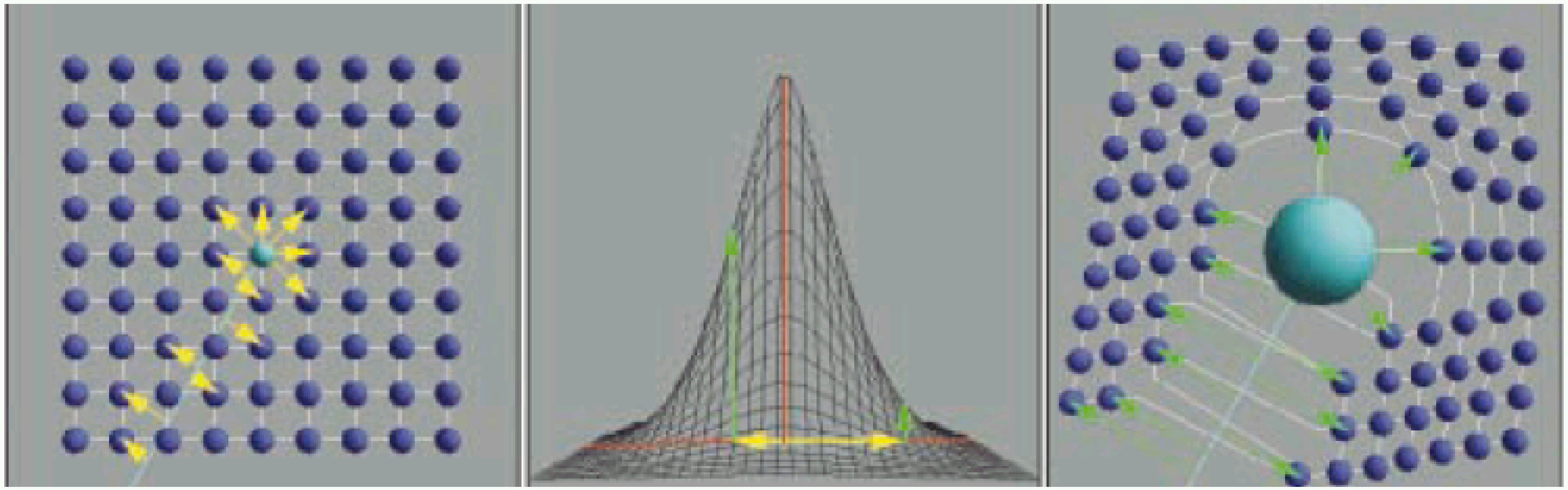




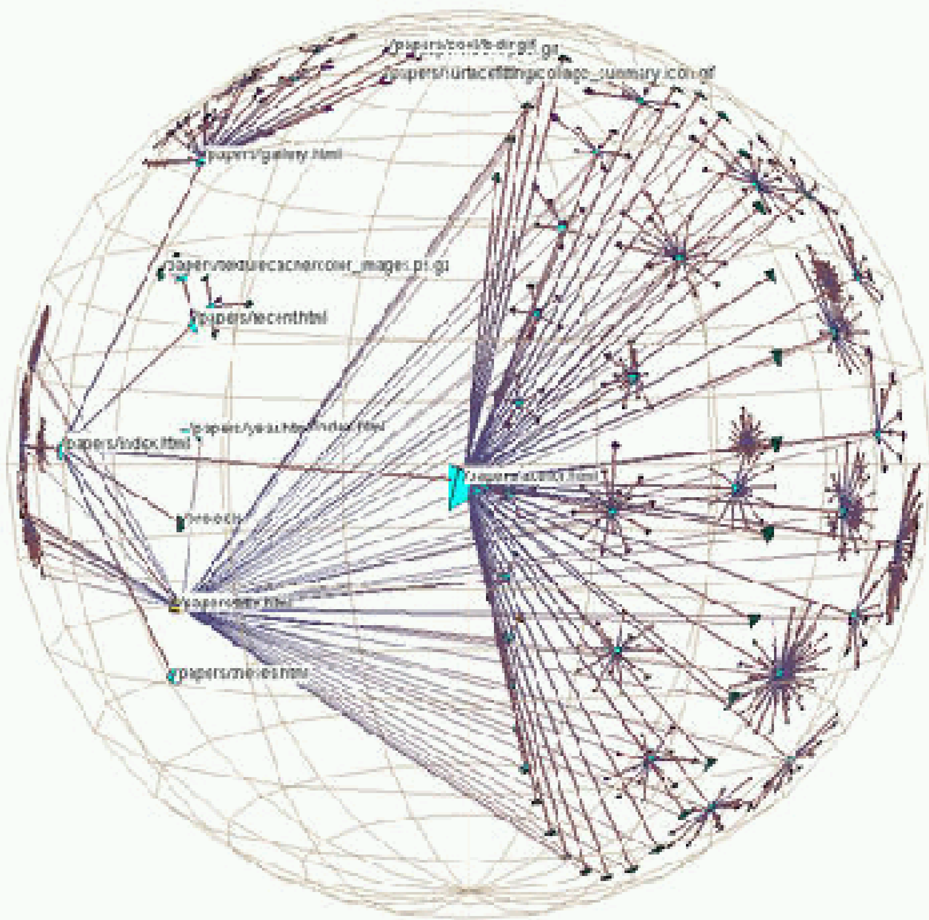
Previous: EdgeLens



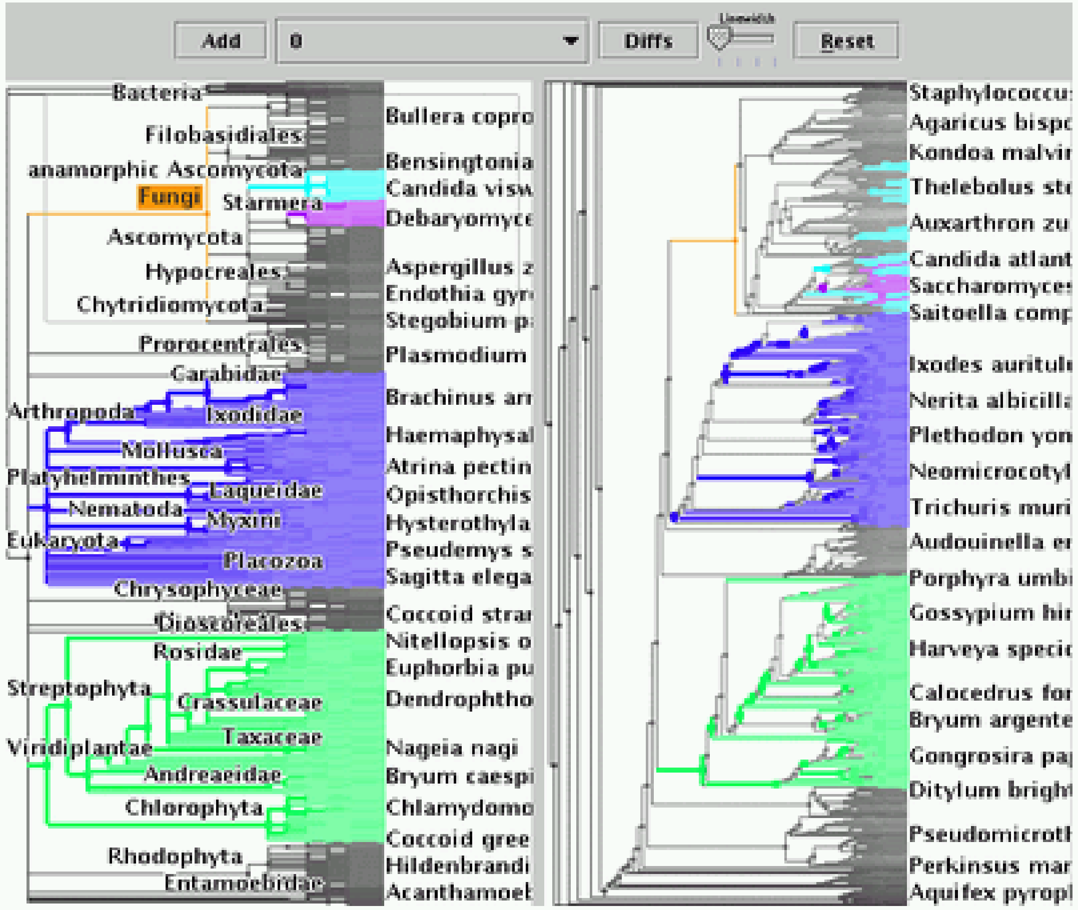
Previous: Visual Access Distortion



Previous: H3



Previous: TJ



Add
Diffs
Reset
Bacteria
Filobasidiales
anamorphic Ascomycota
Fungi
Starmera
Ascomycota
Hypocreales
Chytridiomycota
Prorocentrales
Carabidae
Arthropoda
Ixodidae
Mollusca
Platyhelminthes
Laqueidae
Nematoda
Myxini
Eukaryota
Placozoa
Chrysophyceae
Dioscoreales
Rosidae
Streptophyta
Crassulaceae
Taxaceae
Viridiplantae
Andreaeidae
Chlorophyta
Rhodophyta
Entamoebidae
Staphylococcu
Agaricus bispo
Kondoa malvi
Thelebolus st
Auxarthron zu
Candida atlant
Saccharomyce
Saitoella comp
Ixodes auritul
Nerita albicill
Plethodon yon
Neomicrocotyl
Trichuris muri
Audouinella e
Porphyra umb
Gossypium hi
Harveya speci
Calocedrus fo
Bryum argent
Gongrosira pa
Ditylum brigh
Pseudomicrot
Perkinsus ma
Aquifex pyrop