

Graphs and Trees

Lecture 14 CPSC 533C, Fall 2004

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3 Nov 2004**

Topic Presentations

material

- 2 papers from my suggestions
- 1 paper found on your own

talk

- 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

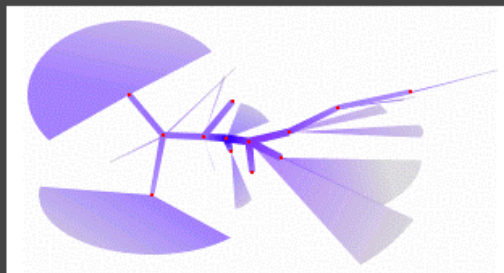
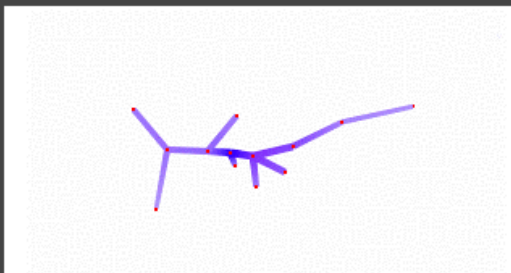
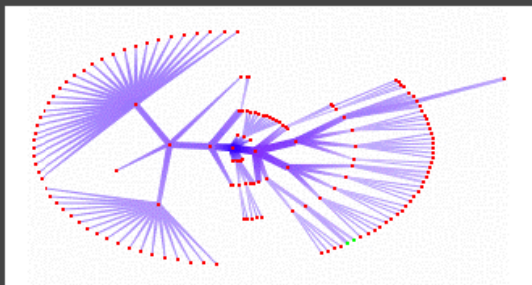
Multiscale Visualization of Small World Networks. David Auber, Yves Chiricota, Fabien Jourdan, Guy Melancon, Proc. InfoVis 2003. <http://dept-info.labri.fr/~auber/documents/publi/auberIV03Seattle.pdf>

Hermann survey

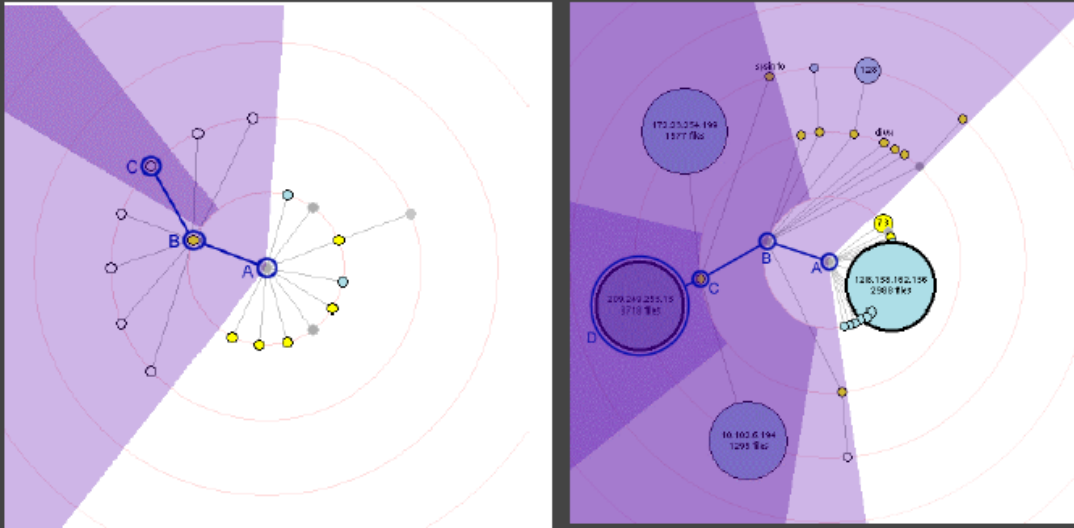
true survey, won't try to summarize here

nice abstraction work by authors

- Strahler skeletonization
- ghosting, hiding, grouping



Animated Radial Layouts



[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>]

Dynamic Graph Layout

static radial layouts: known algorithm

dynamic: little previous work

- DynaDAG [North, Graph Drawing 95]
- DA-TU [Huang, Graph Drawing 98]

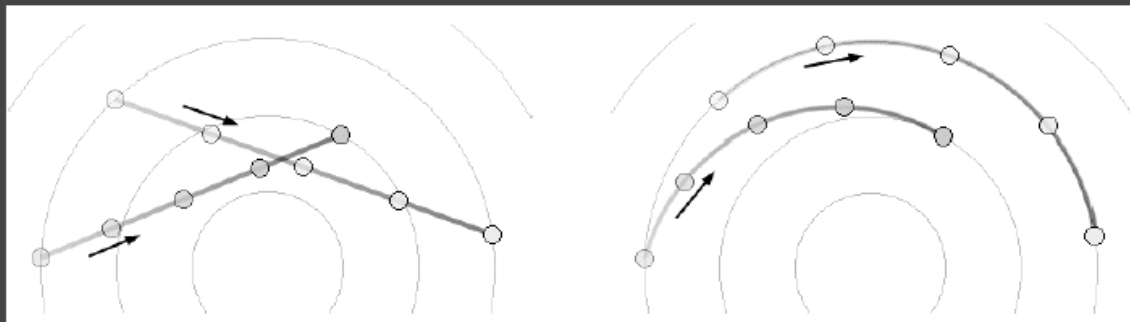
minimize visual changes

stay true to current dataset structure

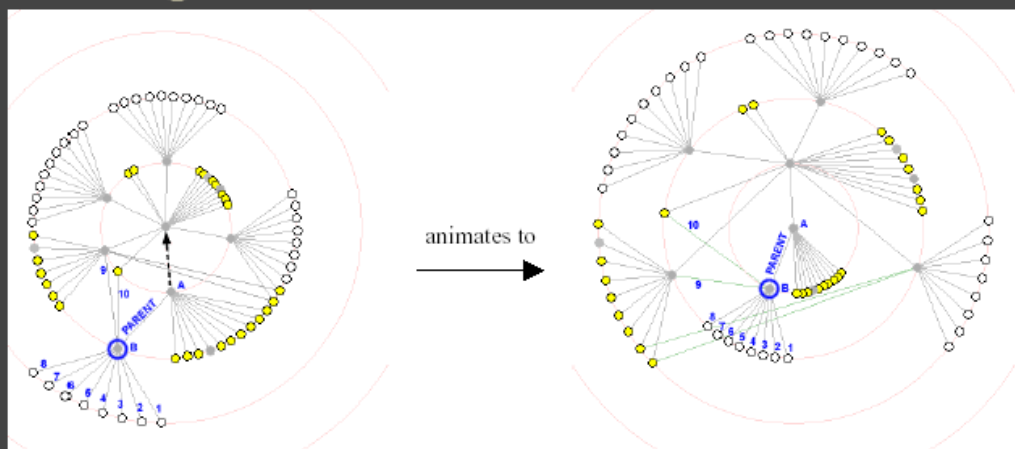
[video]

Animation

polar interpolation



maintain neighbor order



More Dynamic Graphs

[video]

Dynamic Drawing of Clustered Graphs

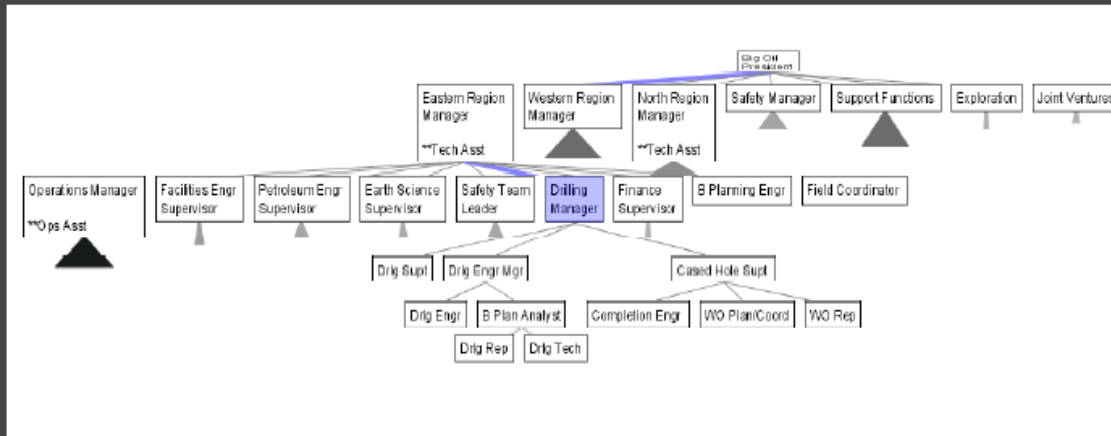
Yaniv Frishman, Ayellet Tal

InfoVis 2004 Video Proceedings

SpaceTree

focus+context tree

- animated transitions



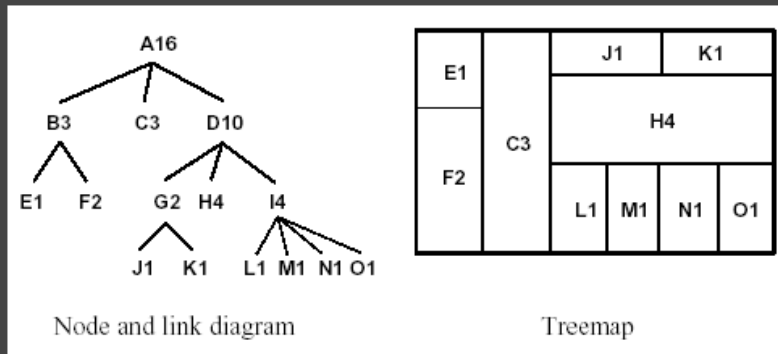
semantic zooming



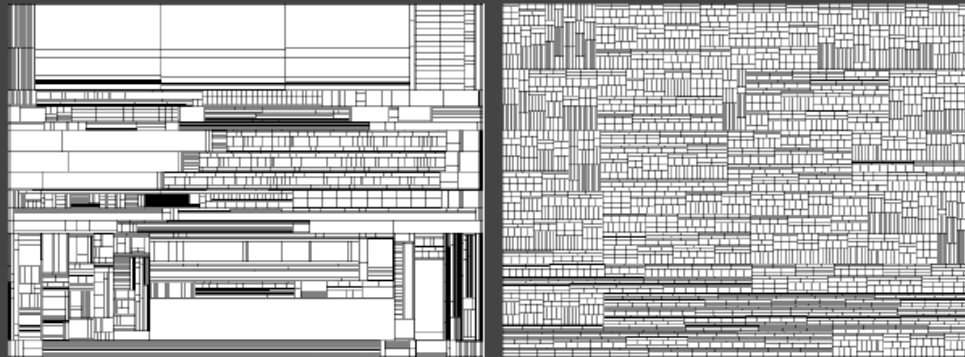
[demo]

Treemaps

containment not connection



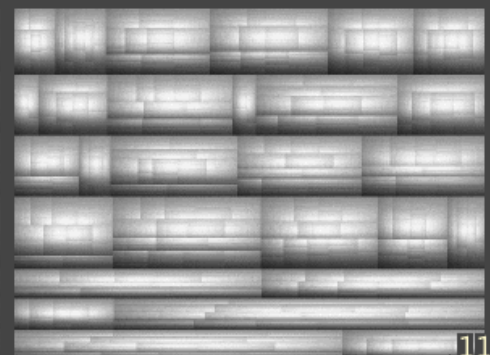
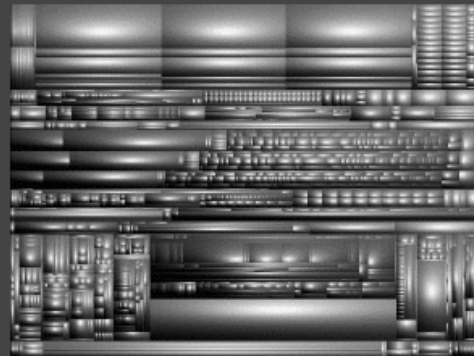
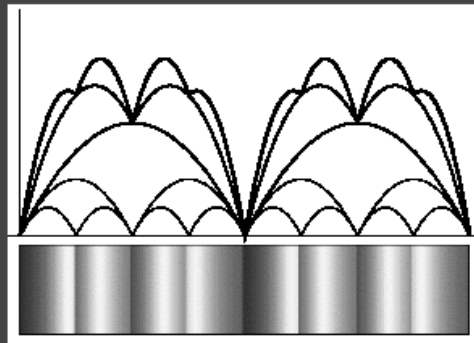
difficulties reading



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

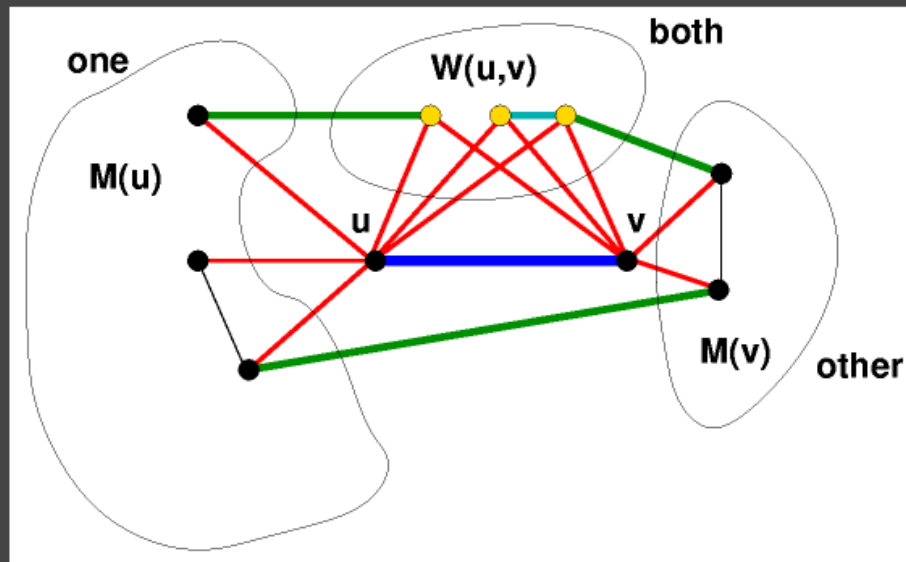
multiscale small-world networks

- exploit these properties for better layout

Strength Metric

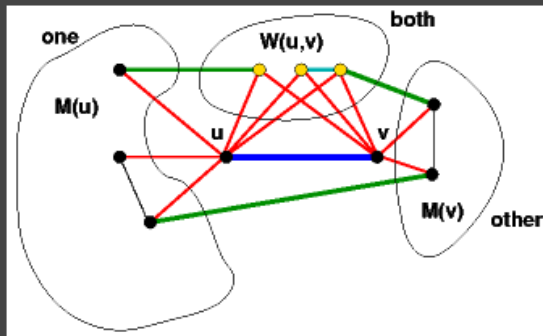
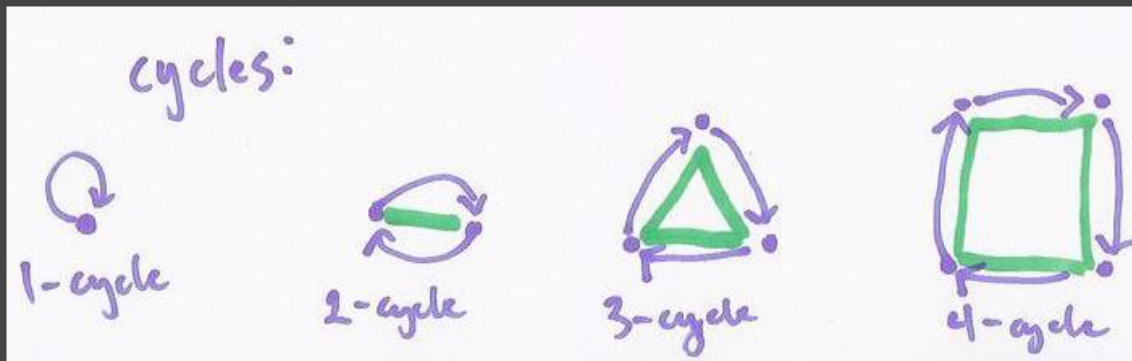
strength: contribution to neighborhood cohesion
calculate for each edge based on

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



Strength via Cycles

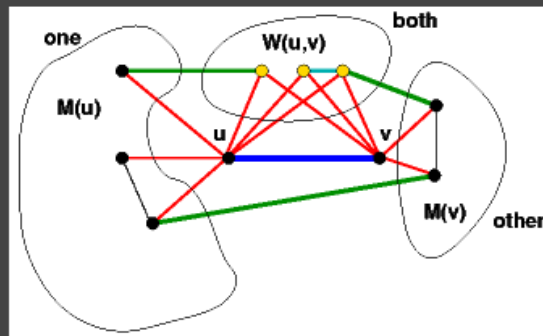
3-cycles through (u,v) + 4-cycles through (u,v)



Cycles: Cohesion Measure

3-cycles through u/v

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



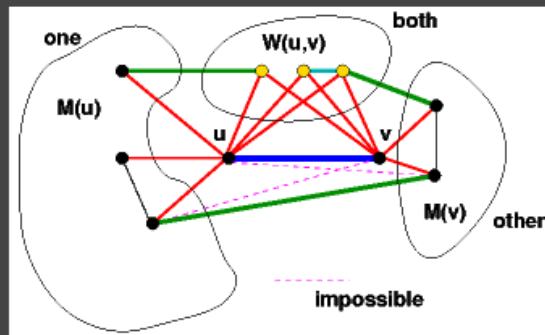
Cycles: Cohesion Measure

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

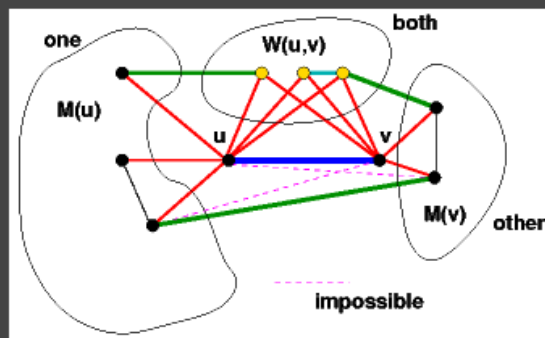
· blue + 2 red edges == yellow nodes in both

existing

all possible

yellow nodes

all nodes

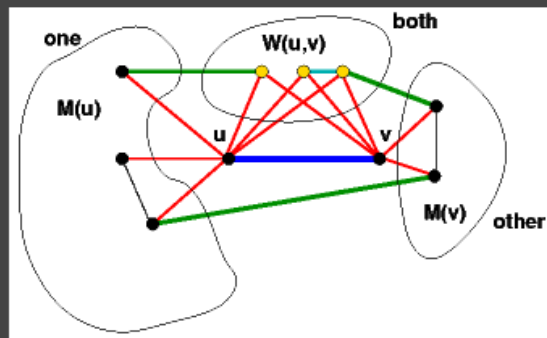


Cycles: Cohesion Measure

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]

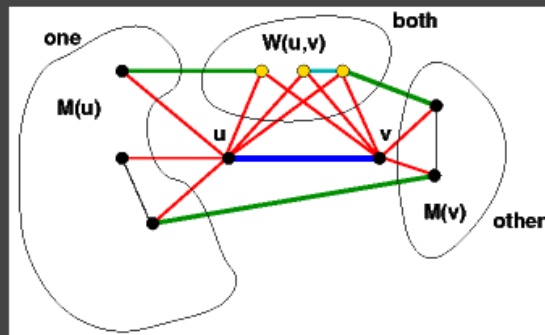
- one-both, other-both, one-other
- $s(M(u), W(u,v)) + s(M(v), W(u,v)) + s(M(u), M(v))$

4-cycles [cyan edges]

- both-both
- $s(W(u,v))$

3-cycles [yellow nodes in both]

- $|W(u,v)| / (|M(u)| + |M(v)| + |W(u,v)|)$

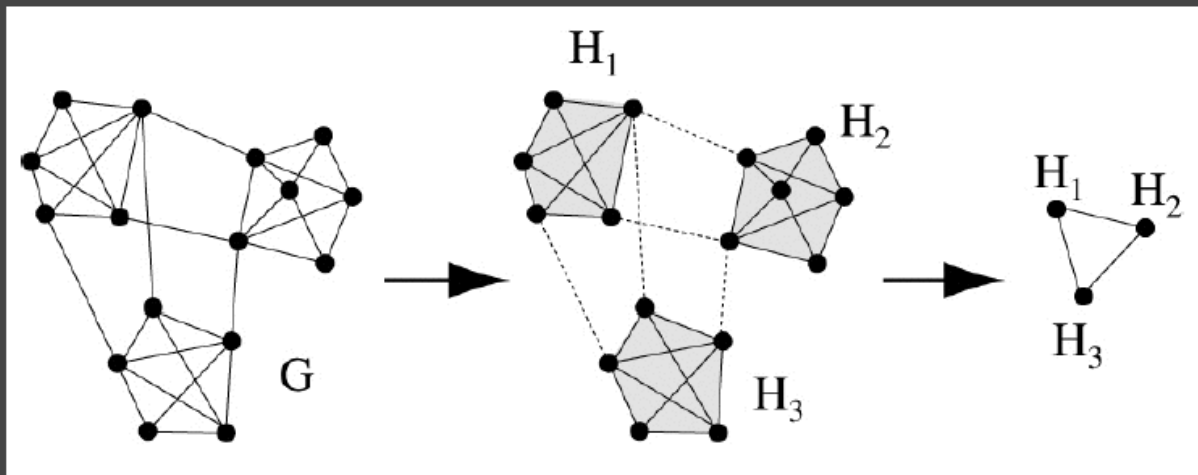


Hierarchical Decomposition

remove low-strength edges

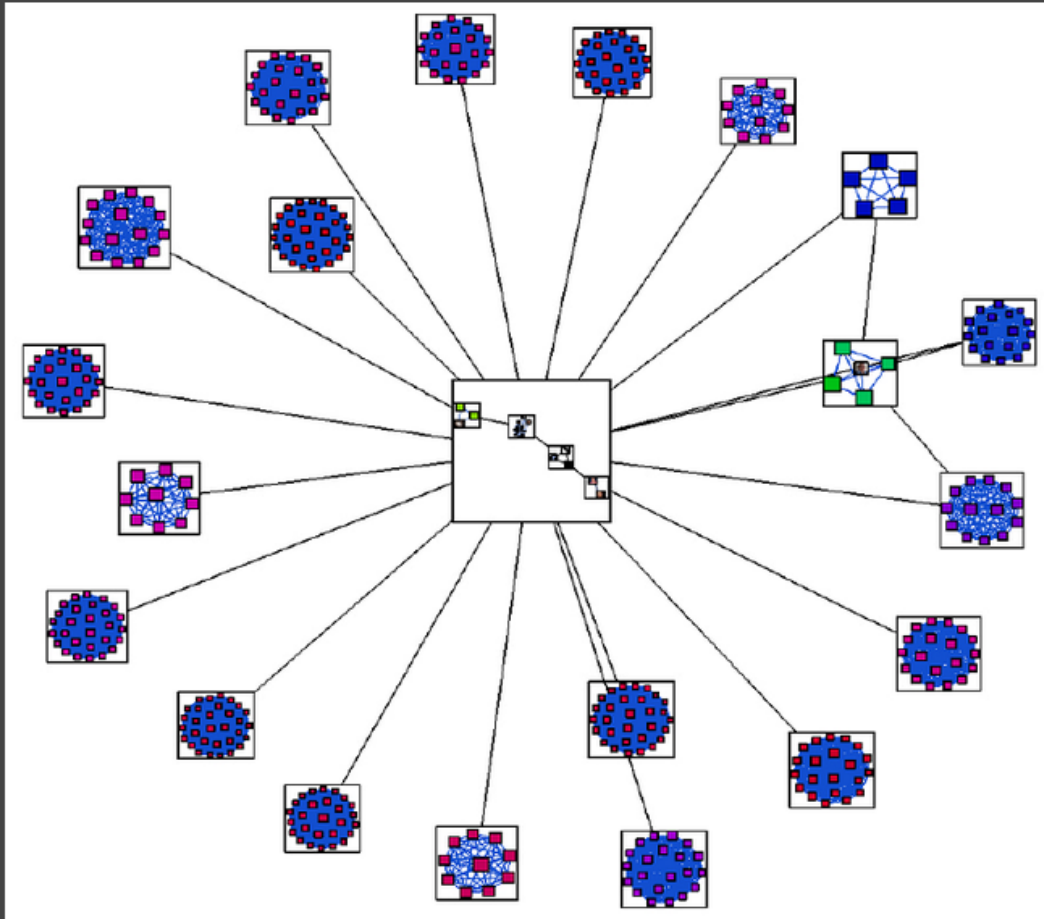
maximal disconnected subgraphs

quotient graph: subgraph = higher-level node

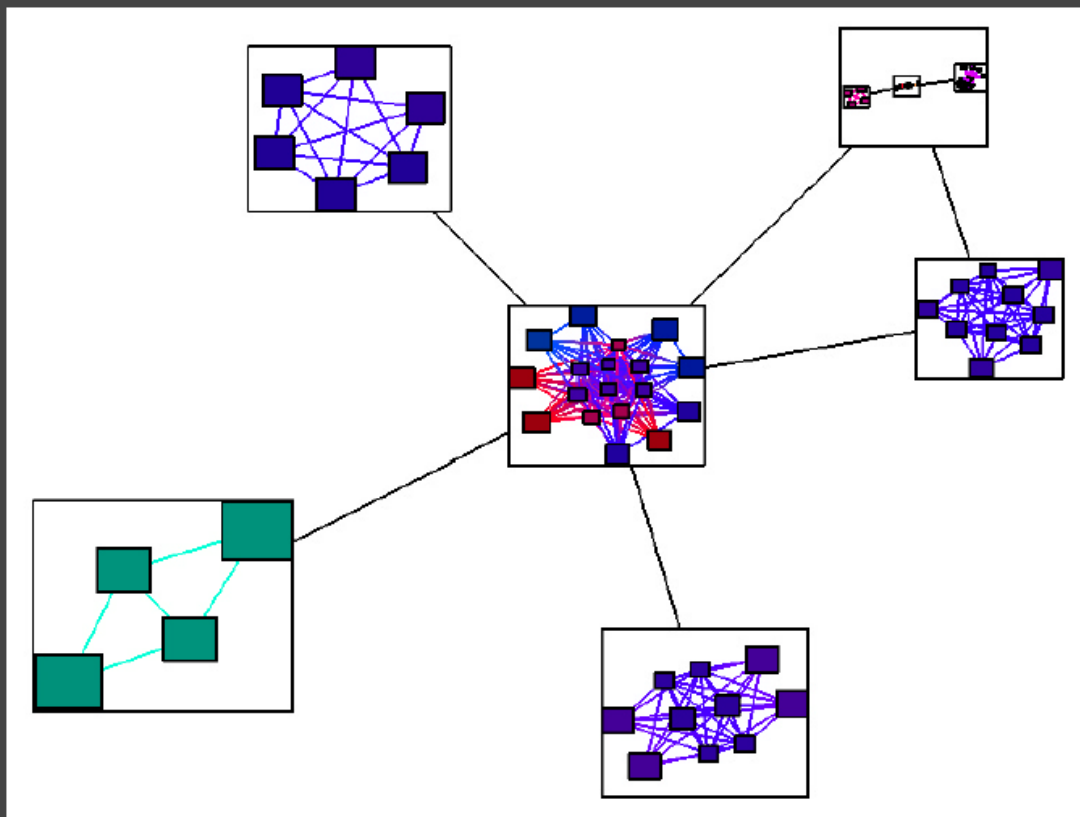


[Multiscale Visualization of Small World Networks. Auber, Chiricota, Jourdan, and Melancon. Proc. InfoVis 2003]

Nested Quotient Graphs



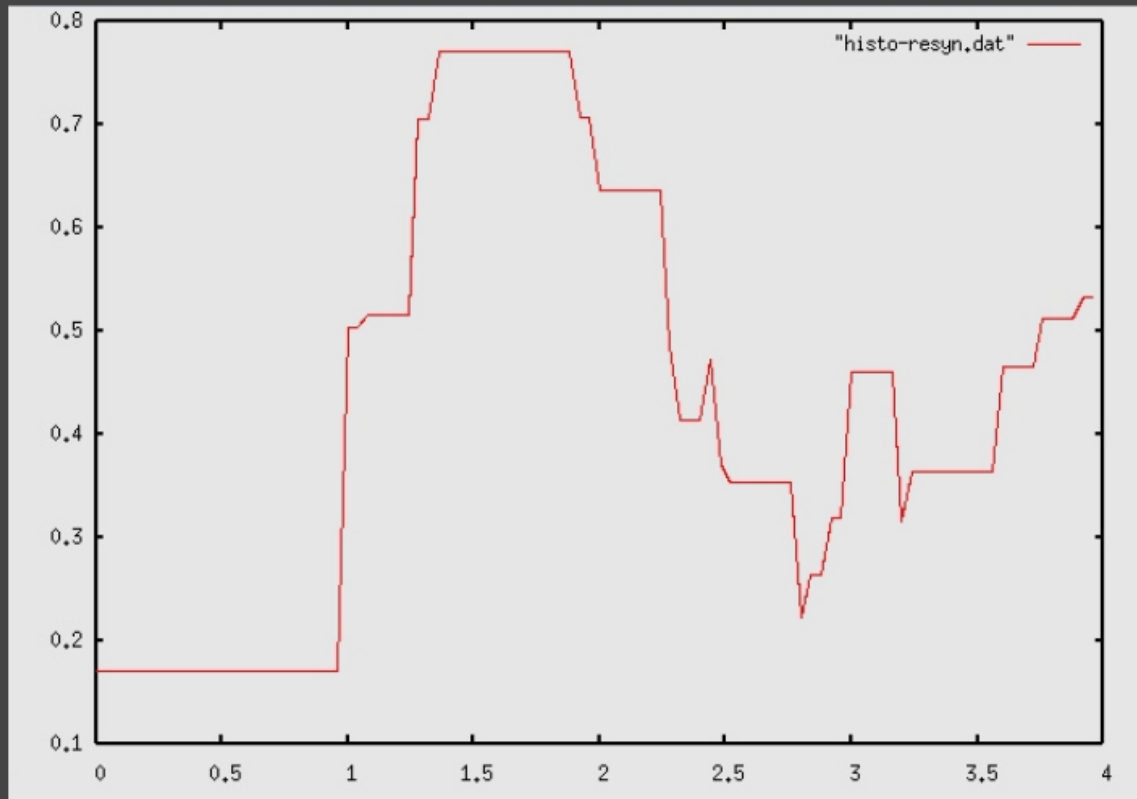
Nested Quotient Graphs



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

Clustering Quality Metric

automatically determine how many clusters



Critique

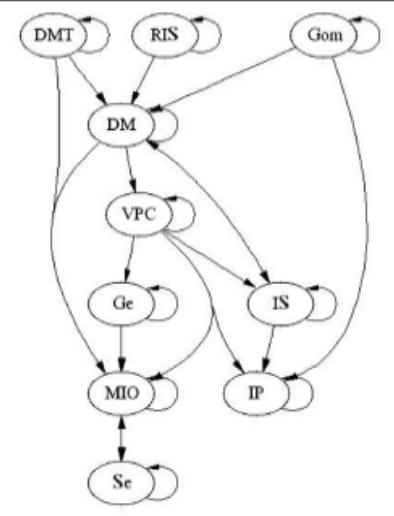
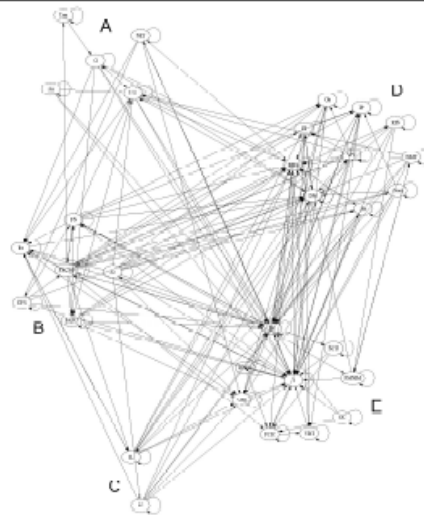
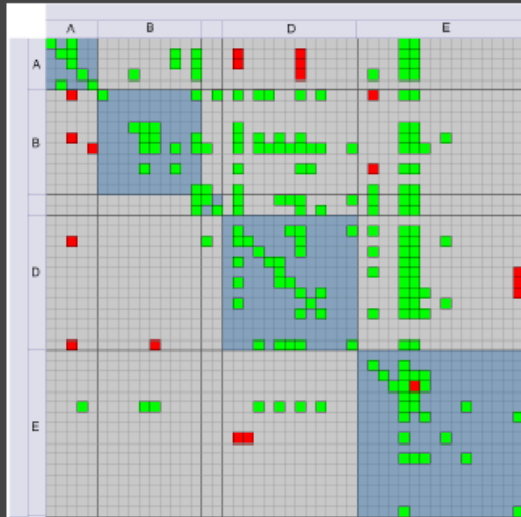
pros

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

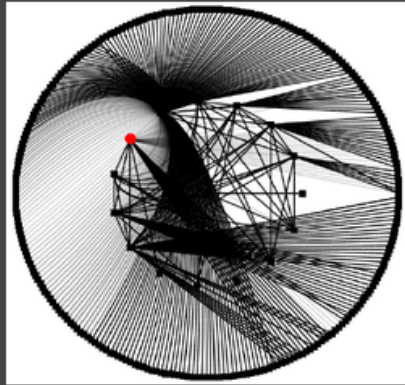
cons

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

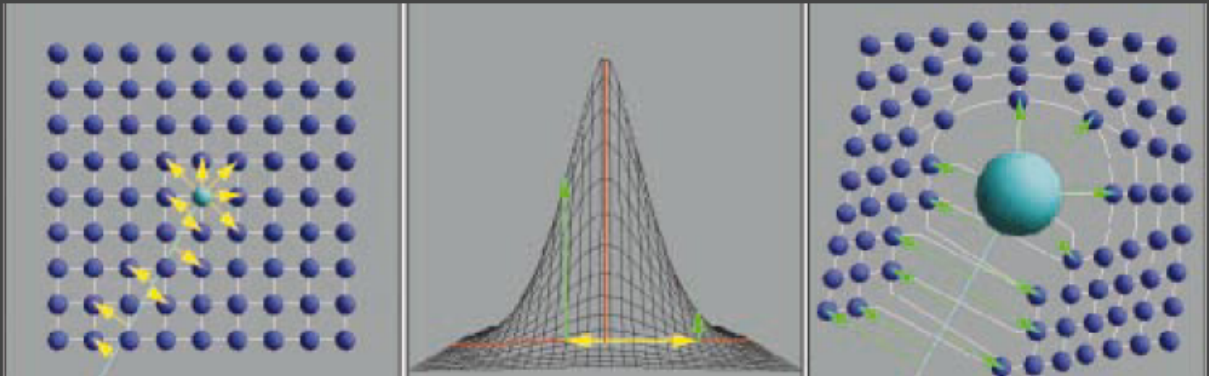
Previous: Multilevel Call Matrices



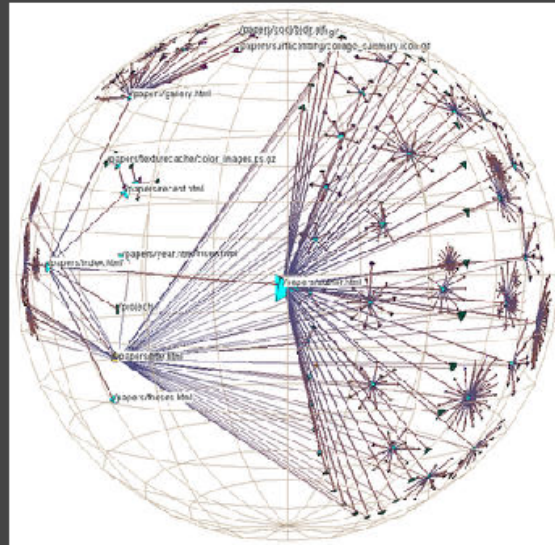
Previous: EdgeLens



Previous: Visual Access Distortion



Previous: H3



Previous: TJ

