Depth/Occlusion

Lecture 9 CPSC 533C, Fall 2005

12 October 2005

Reading

Ware, Chapter 8: Space Perception and the Display of Data in Space

Tufte, Chapter 3: Layering and Separation

Intelligently resolving point occlusion.
Marjan Trutschl, Georges Grinstein, Urska Cvek, Proc. InfoVis 2003, pp 131–136.

Extending Distortion Viewing Techniques from 2D to 3D Data.
M. Sheelagh T. Carpendale, David J. Cowperthwaite, and F. David Fracchia,
IEEE Computer Graphics and Applications, Special Issue on Information Visualization, 17(4), pp 42 – 51, July 1997.

EdgeLens: An Interactive Method for Managing Edge Congestion in Graphs.
Nelson Wong, M. Sheelagh T. Carpendale, Saul Greenberg, Proc. InfoVis03, pp 51–58.

Optional:

Cheops: A Compact Explorer For Complex Hierarchies.
Luc Beaudoin, Marc-Antoine Parent, Louis C. Vroomen,
Proc. IEEE Vis 1996, pp 87–92.

Depth and Occlusion

Space Perception
- depth

Layering and Separation
- visual layering

3DPS
- graphs embedding in 3D vs. 2D

EdgeLens
- interactive occlusion control of 2D graph edges

Smart Jitter
- intelligently resolving point occlusion

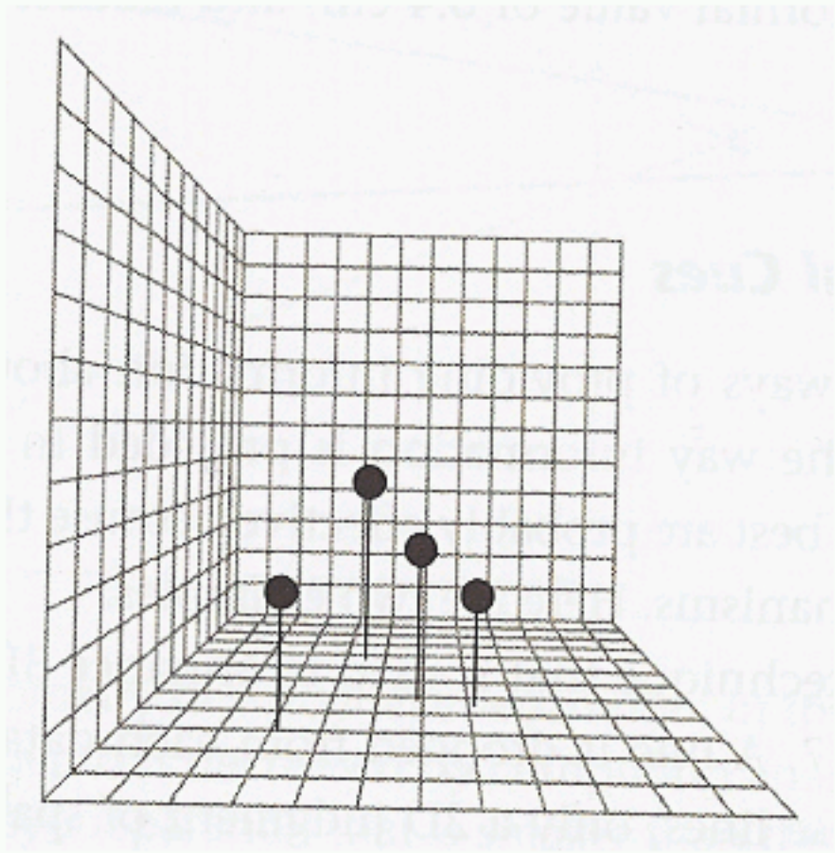
Cheops
- deliberate occlusion for compact representation

Space Perception

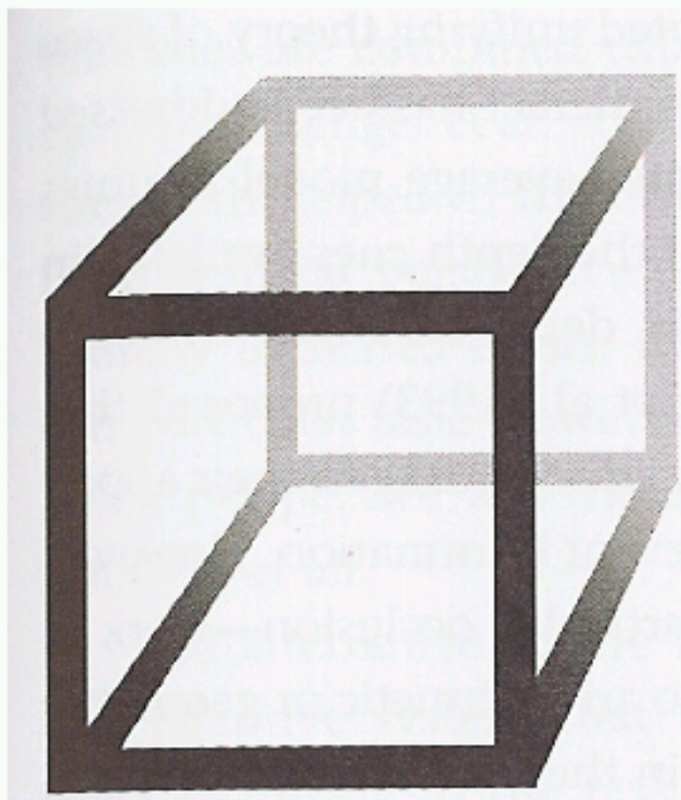
- static
  - occlusion
  - perspective projection
    - linear, texture gradient
  - depth of field
  - atmospheric (fog, depth cueing)
  - lighting and shadows
    - shape from shading
    - cast shadows
- moving
  - structure-from-motion
    - motion parallax (head motion)
- binocular
  - binocular disparity (stereopsis)
  - convergence
    - amount eyes rotate toward center of interest
    - like optical range finder

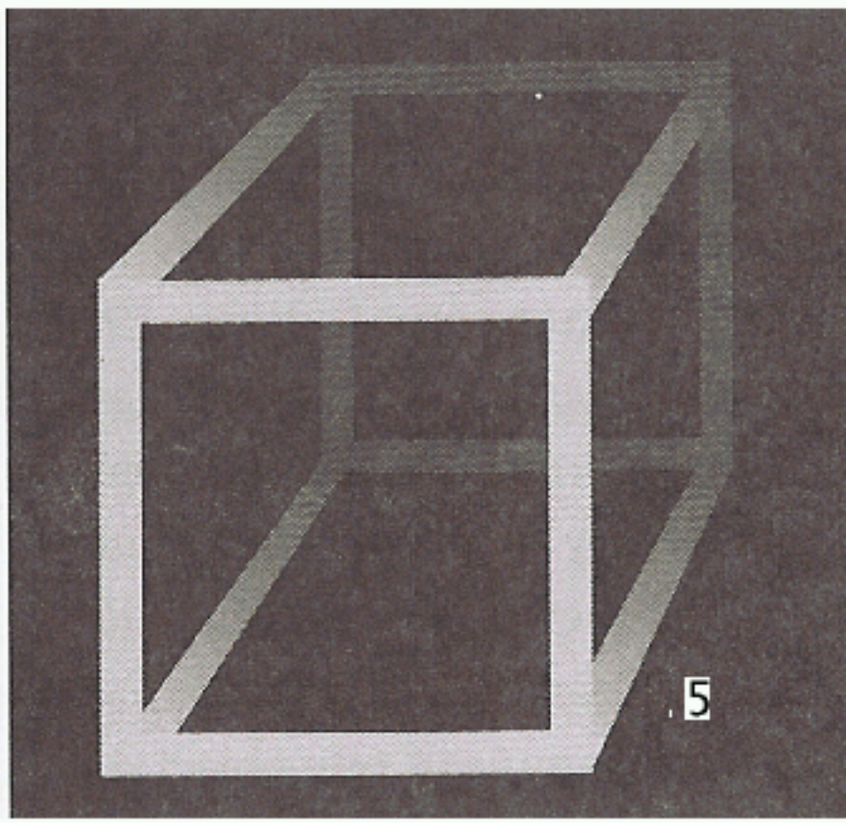
Space Perception

droplines,
background grids



depth cueing





Binocular

less strong than occlusion

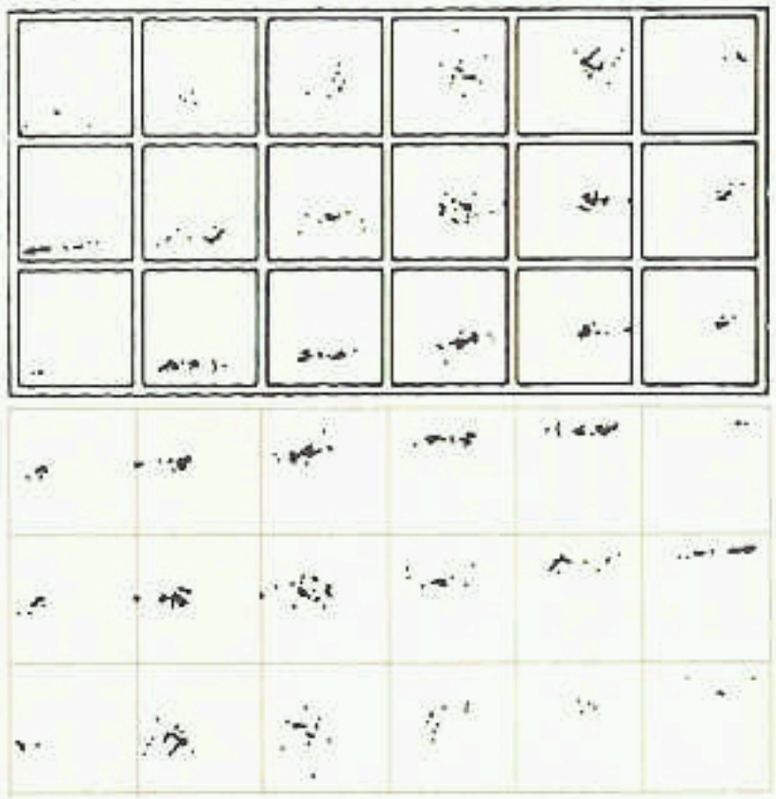
autostereopsis demo

[www.mrl.nyu.edu/~perlin/demos/autoshutter-talk.html]

Layering And Separation

Visual Clutter

subtler background than foreground



3DPS

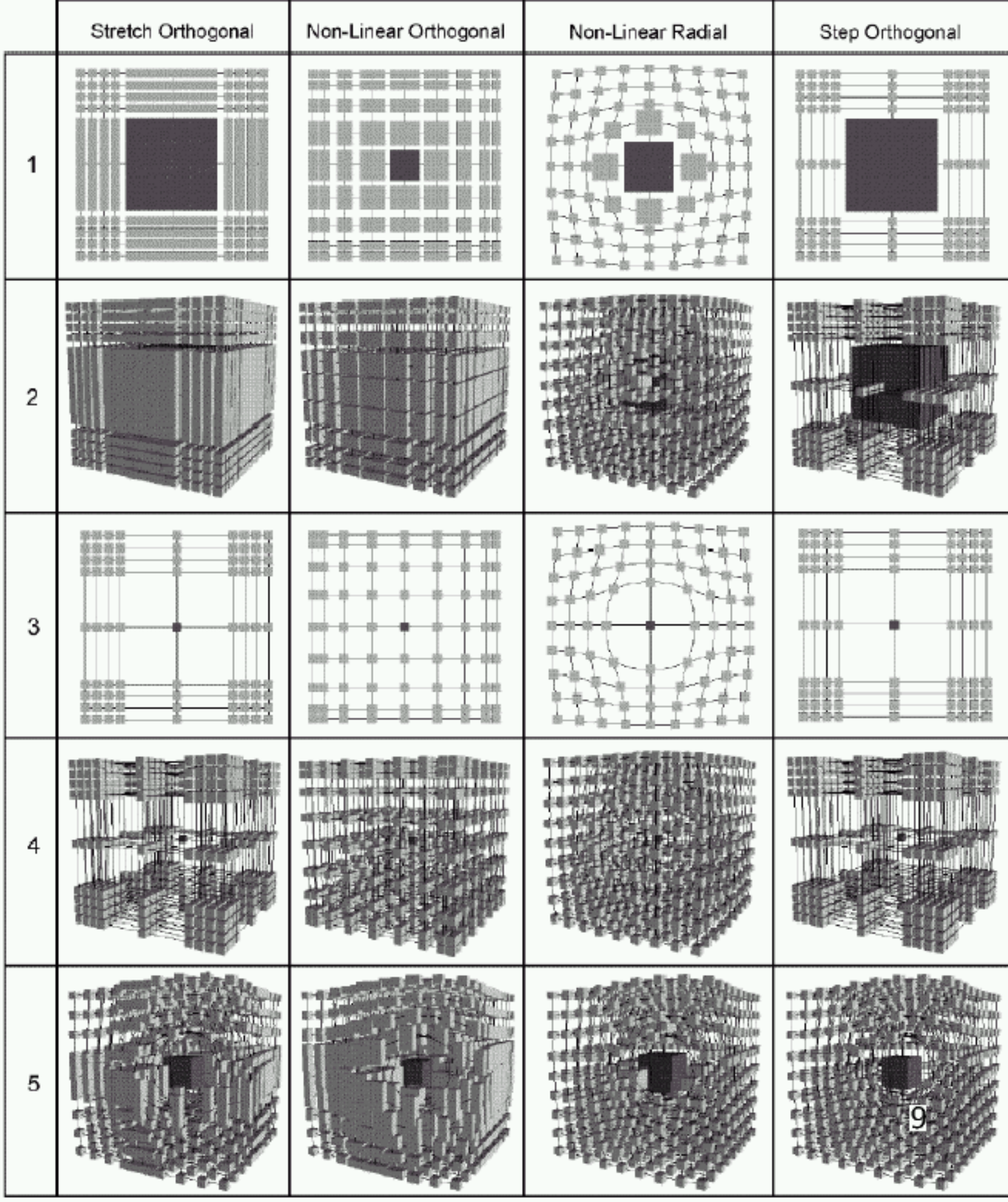
1: 2D displace+magnify

2: 3D displace+magnify

3: 2D displace only

4: 3D displace only

5: visual access distortion



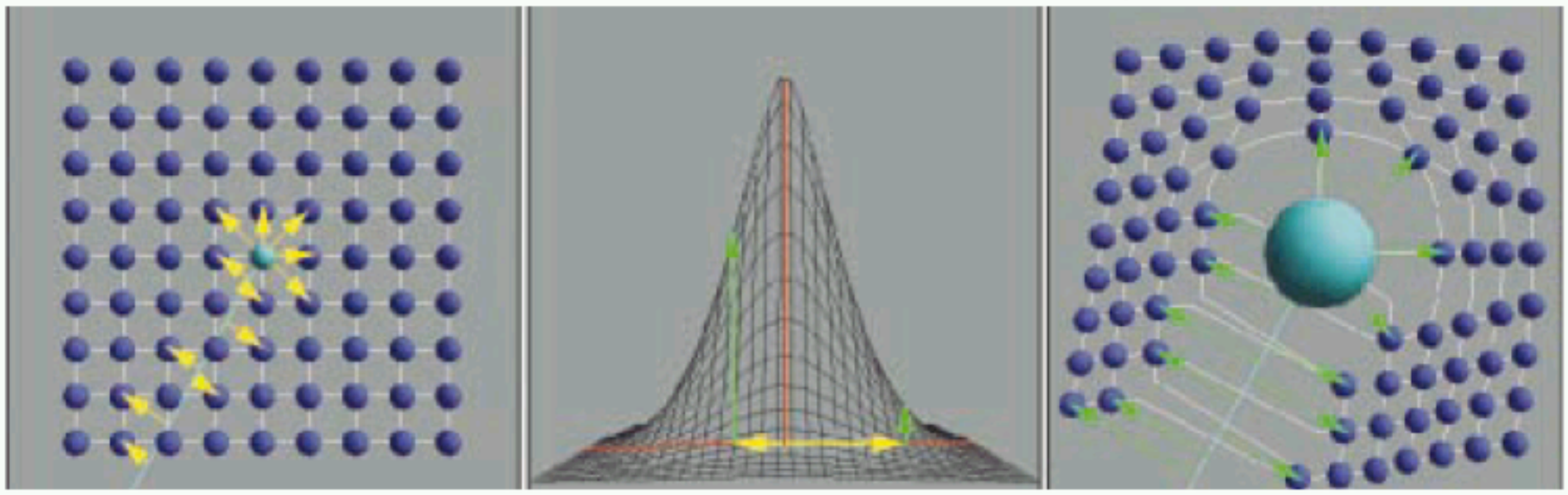
Visual Access Distortion

naive 2D -> 3D extension yields occlusion

- same problem as van Wijk

graph-based solution

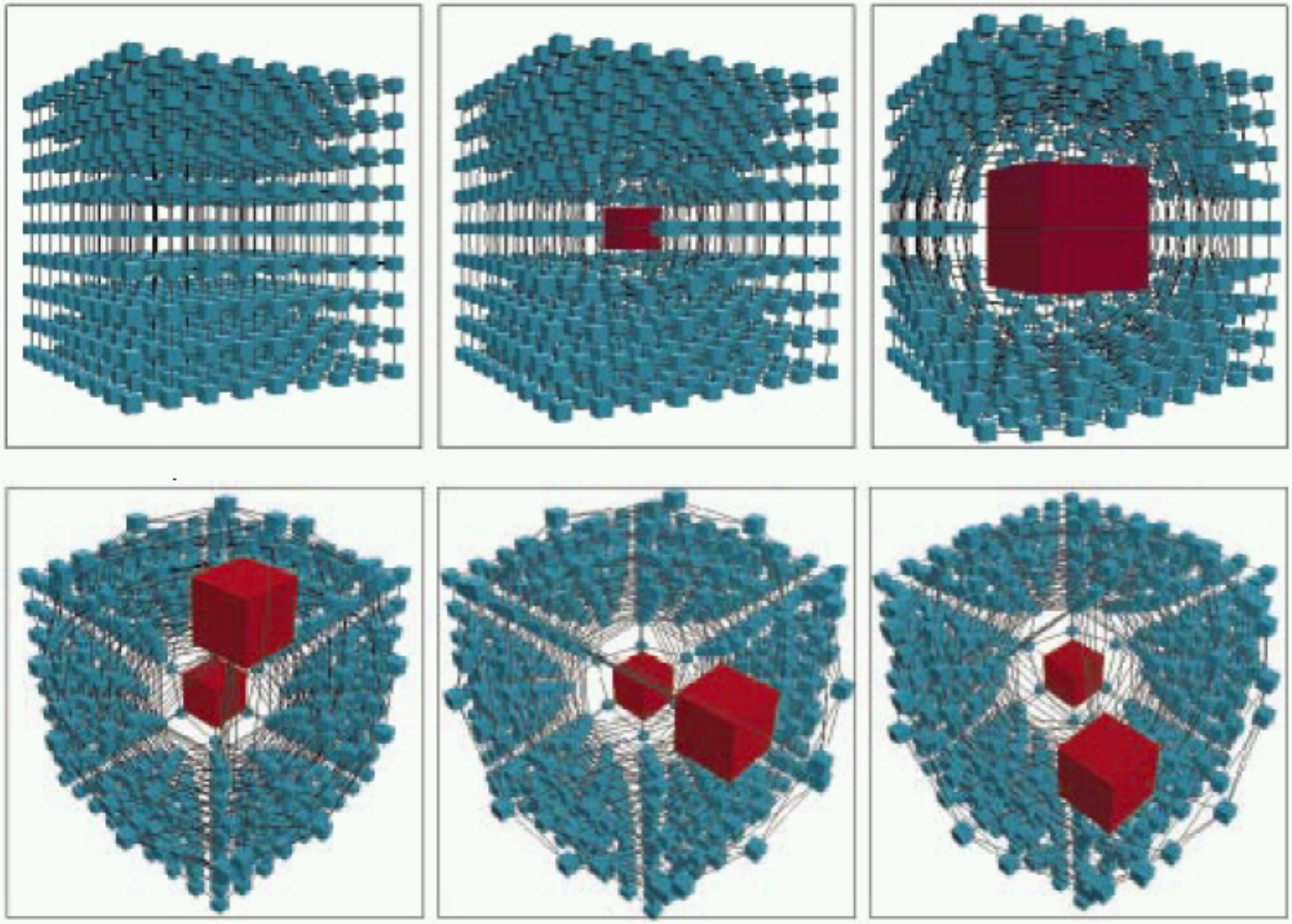
- move geometry according to viewpoint
- magnify focus only
- introduce curves into formerly straight lines



focus+context approach

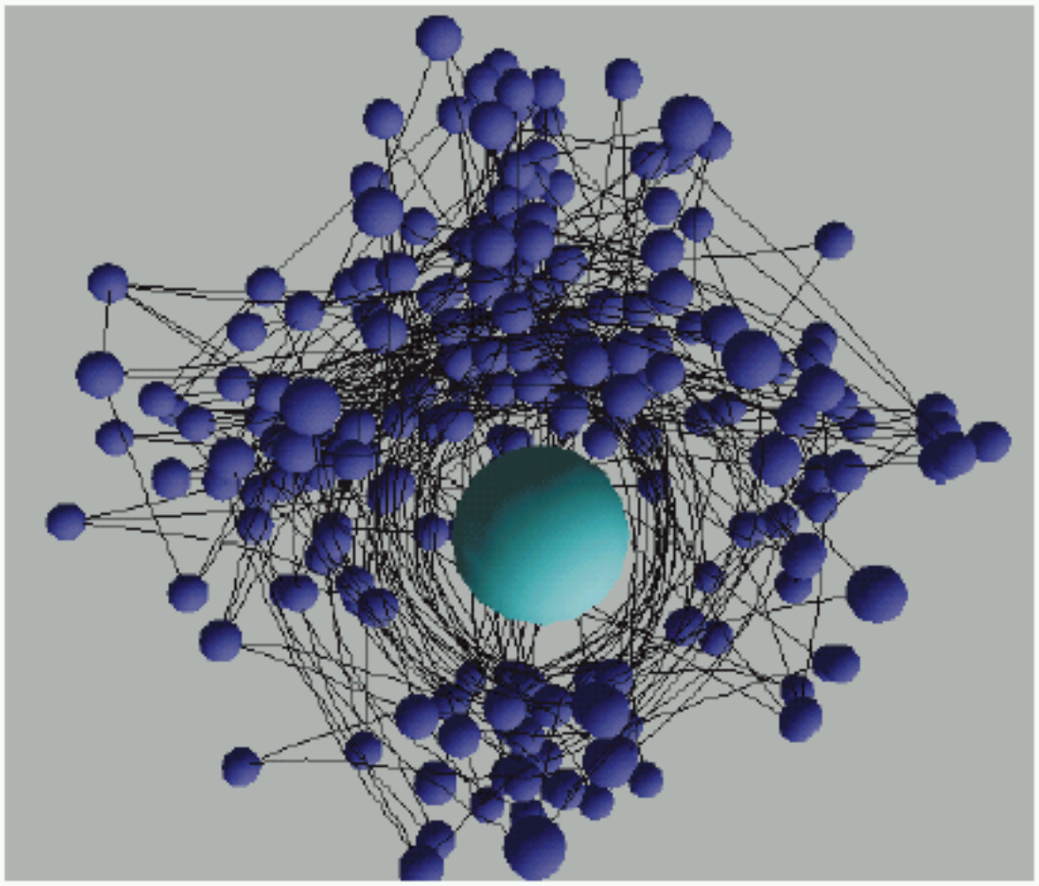
Results

single, multiple foci



Results

- randomly positioned nodes instead of grid
  - closer to real dataset



Critique

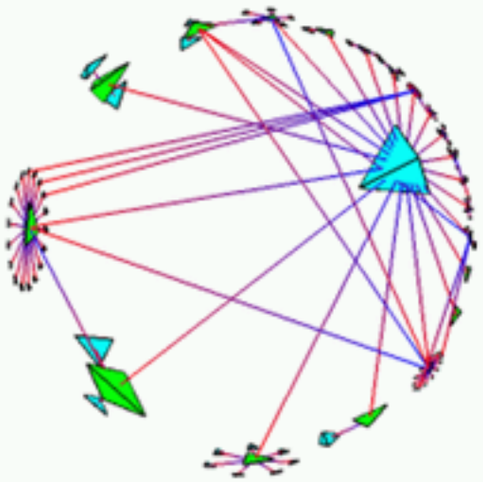
sophisticated way to navigate 3D graphs

nice technique paper
- not a design study

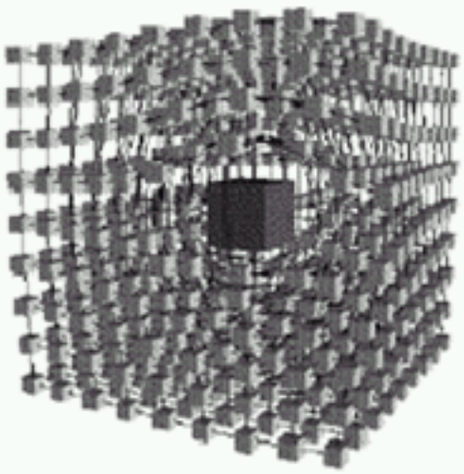
interesting discussion I'd like to see
- more analysis of why 3D necessary
  - cites Ware 3x improvement
- occlusion workaround vs. occlusion avoidance

never shown on real data
- hard to draw conclusions from toy datasets

Information Density: Codimension



- want balance between clutter and void
- topological approach to describing density
- difference between structure and surrounding space



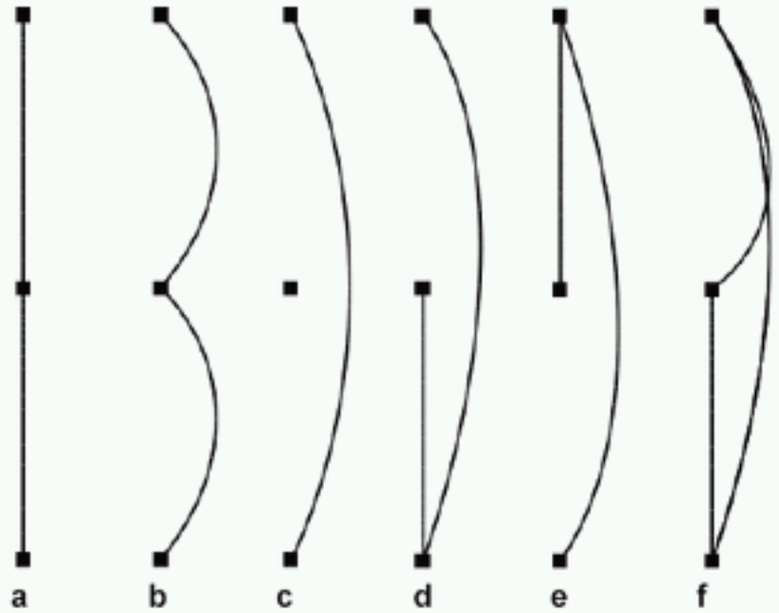
	dim space	-	dim structure	=	codim
webviz	3		1 circle		2
H3	3		2 hemisphere		1
(Carpendale)	3		3 cubic grid		0

sparse

dense

EdgeLens

interactive control over edge occlusion



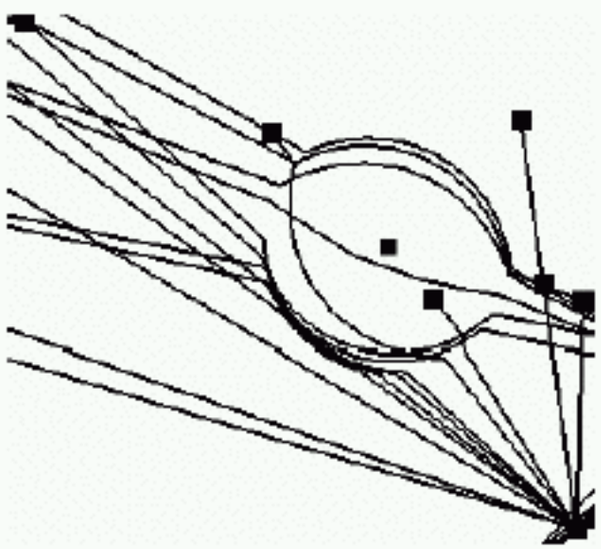


Figure 5a: Bubble approach

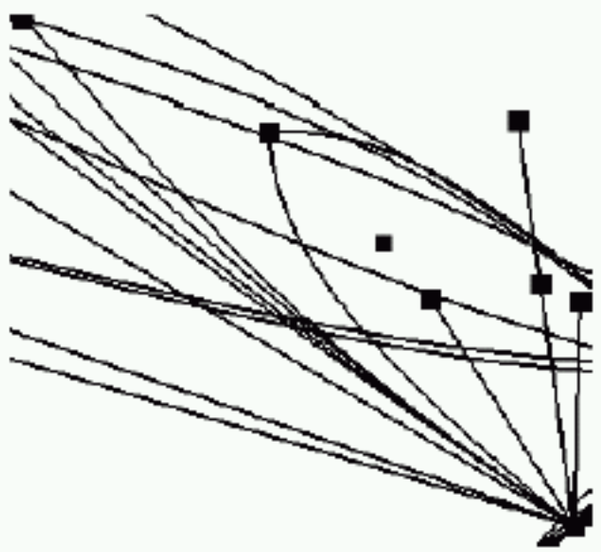
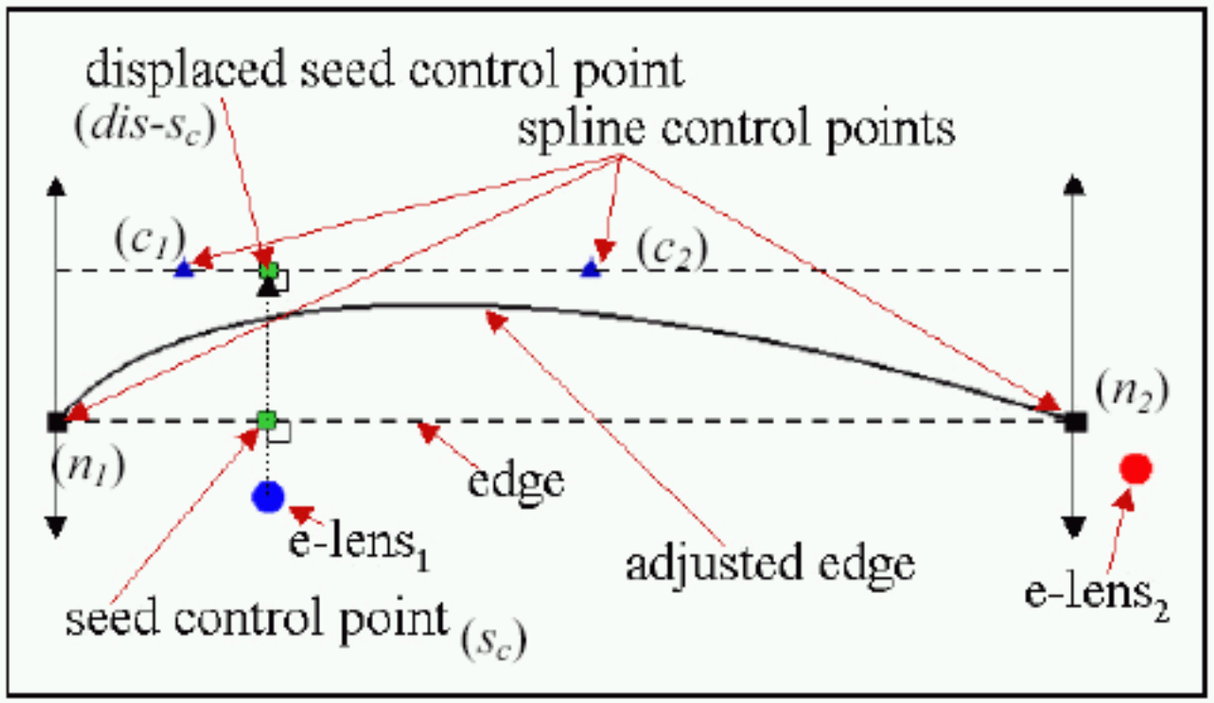


Figure 5b: Spline approach

user study: spline better than bubble

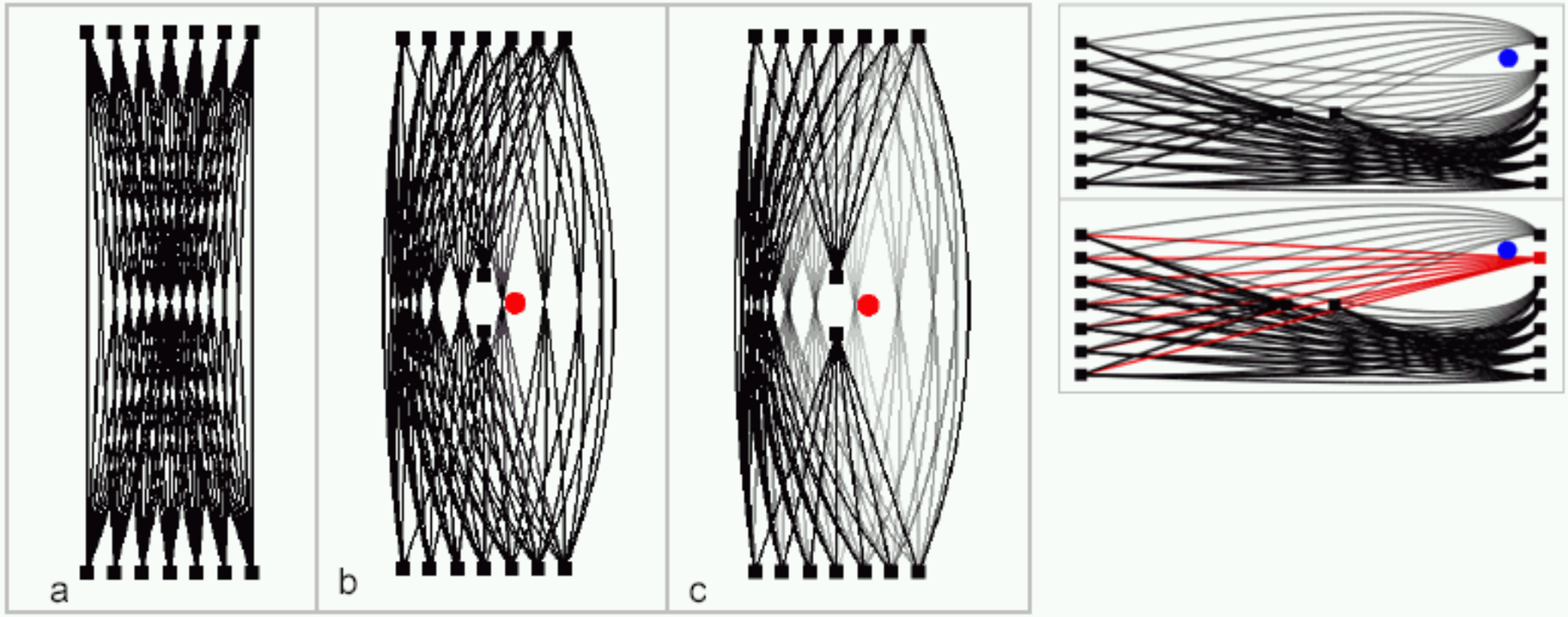
EdgeLens Final Algorithm

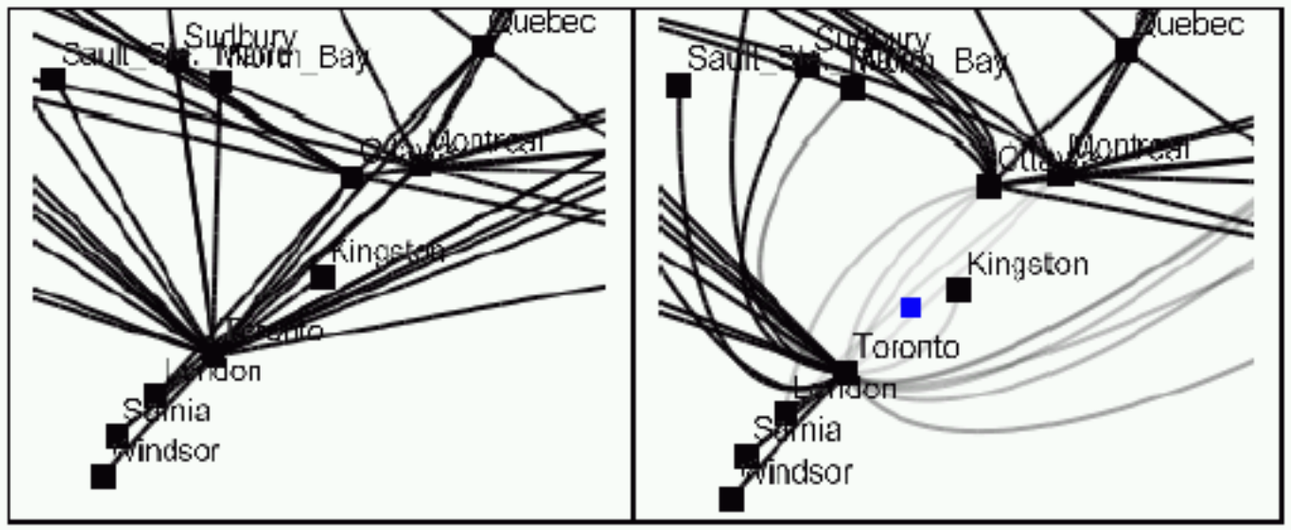


decide which edges affected
calculate displacements
calculate spline control points
draw curves

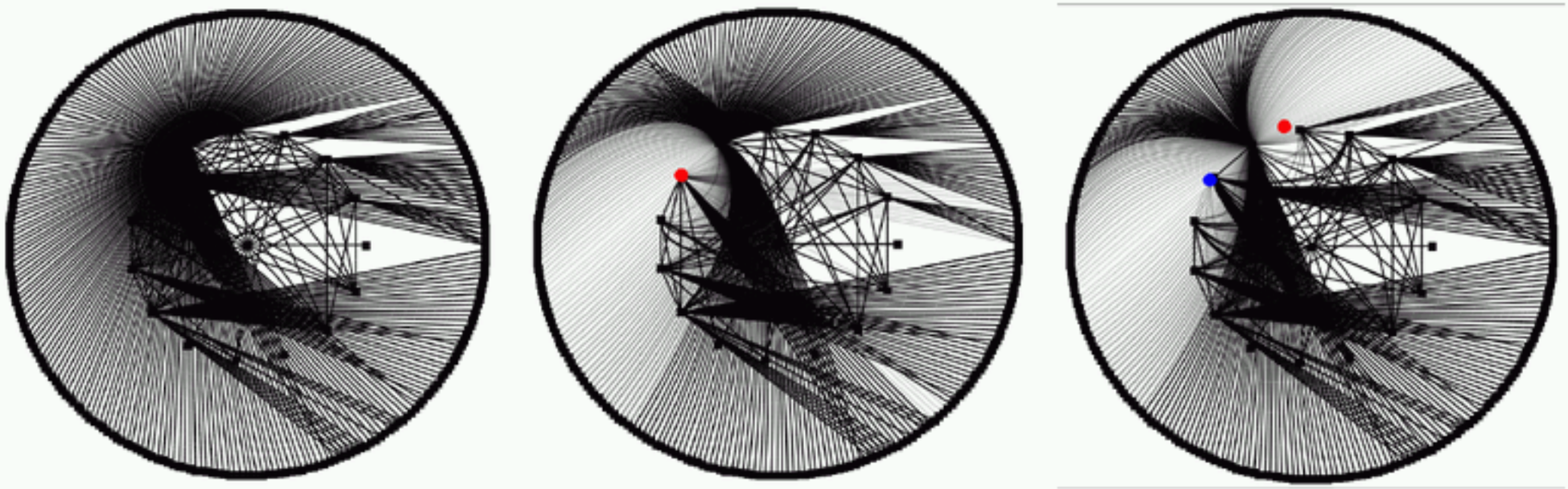
EdgeLens Techniques

transparency, color





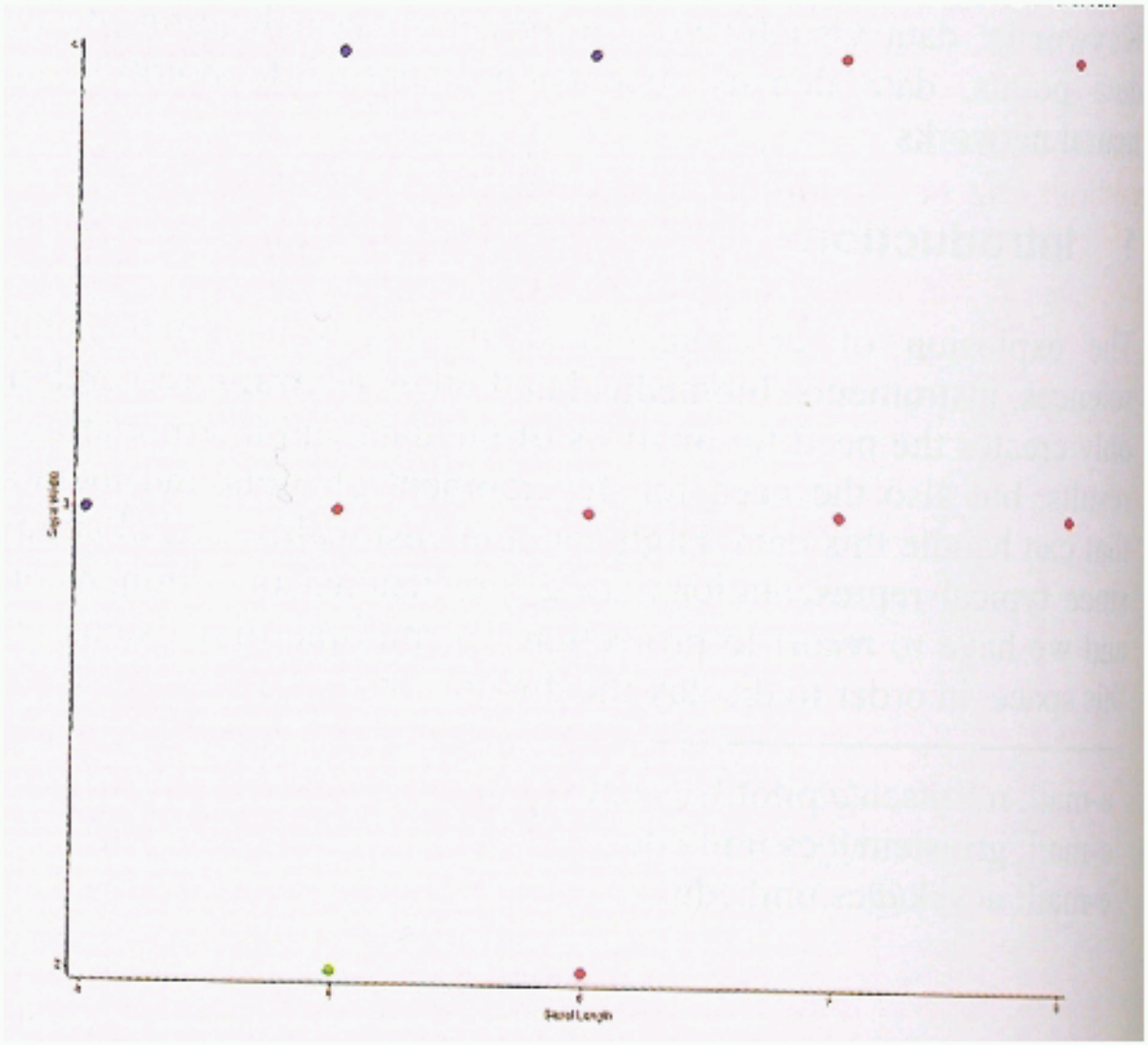
EdgeLens Results

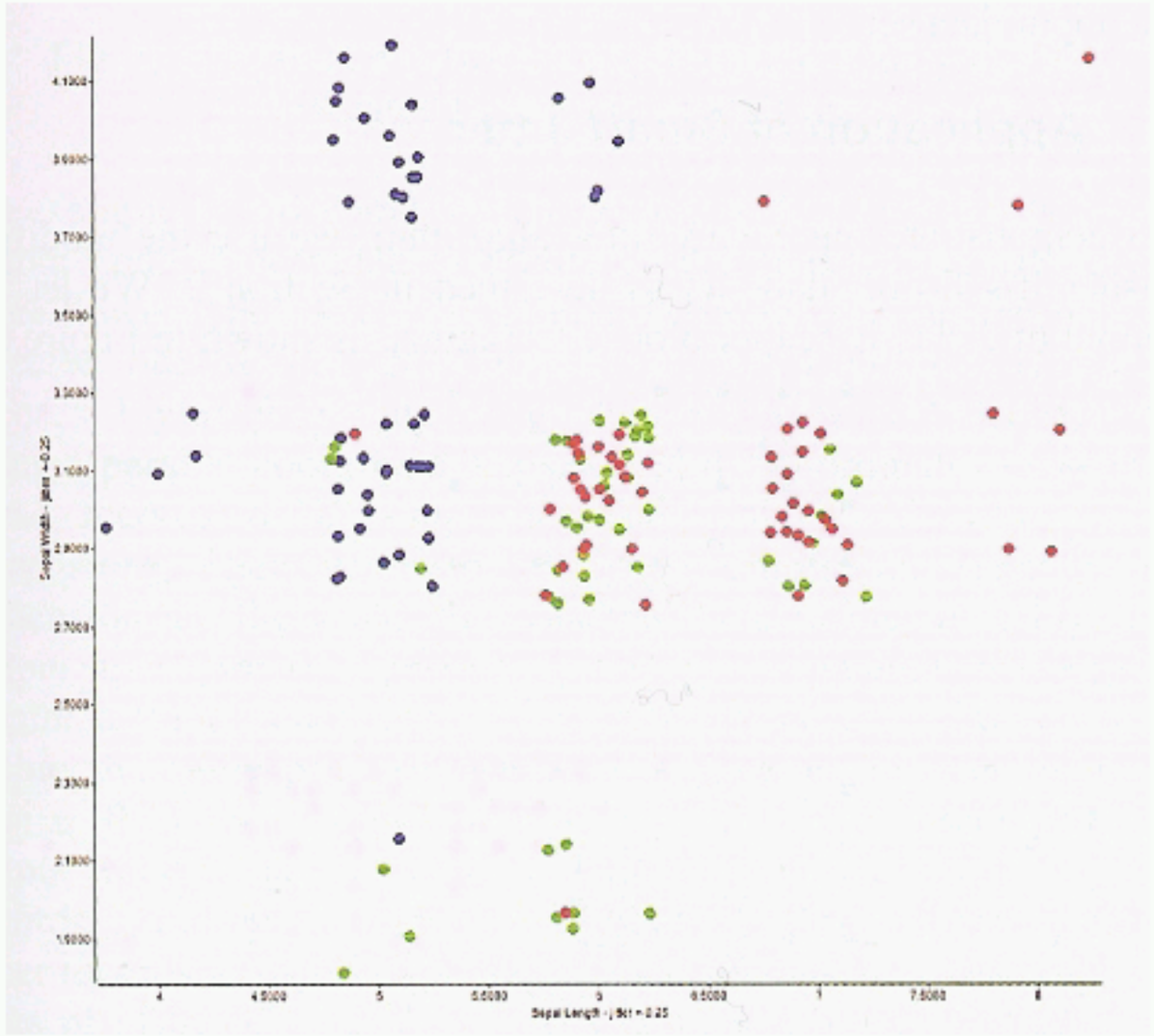


critique

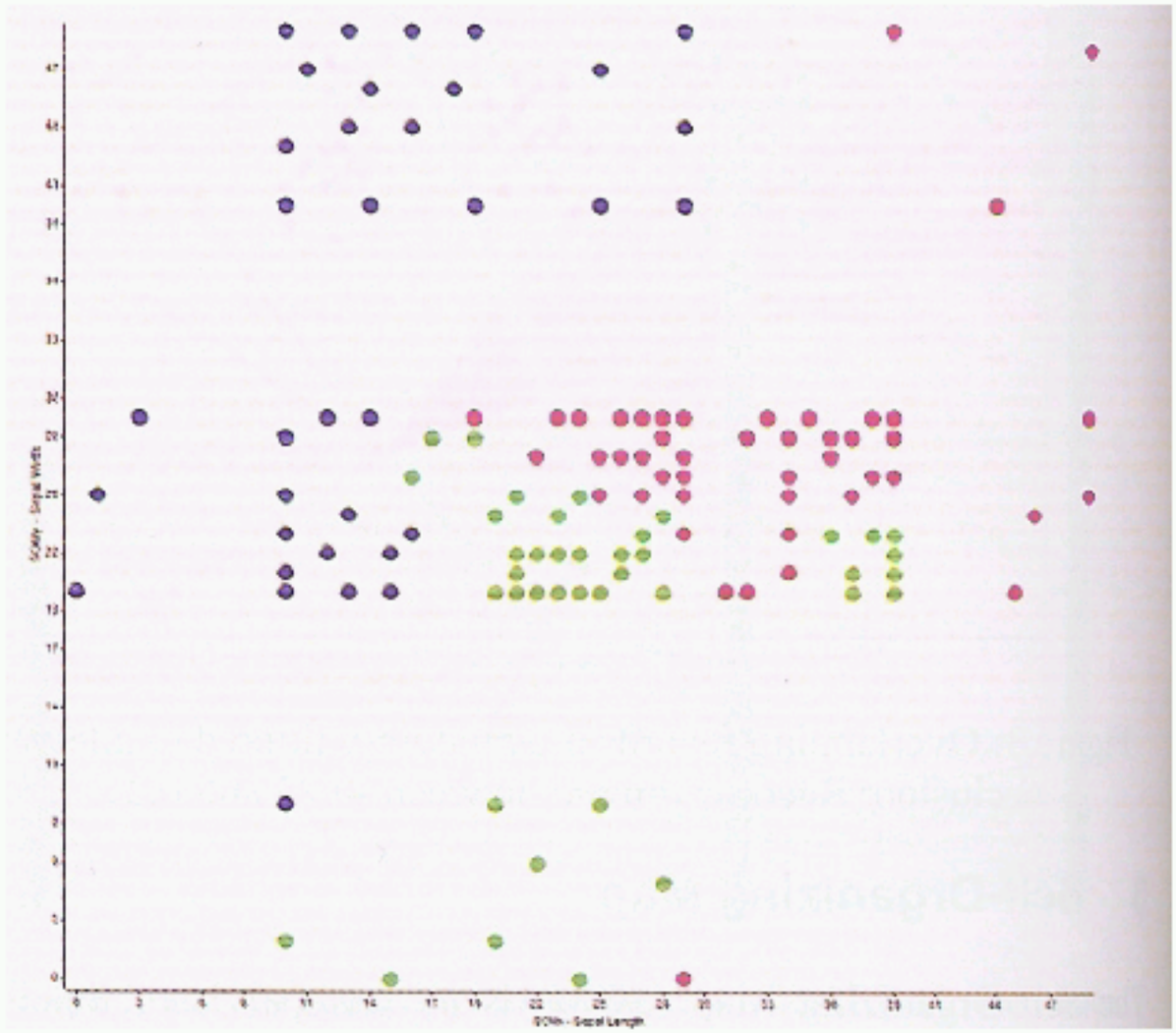
- very nice technique
  compelling need
- shown on real data

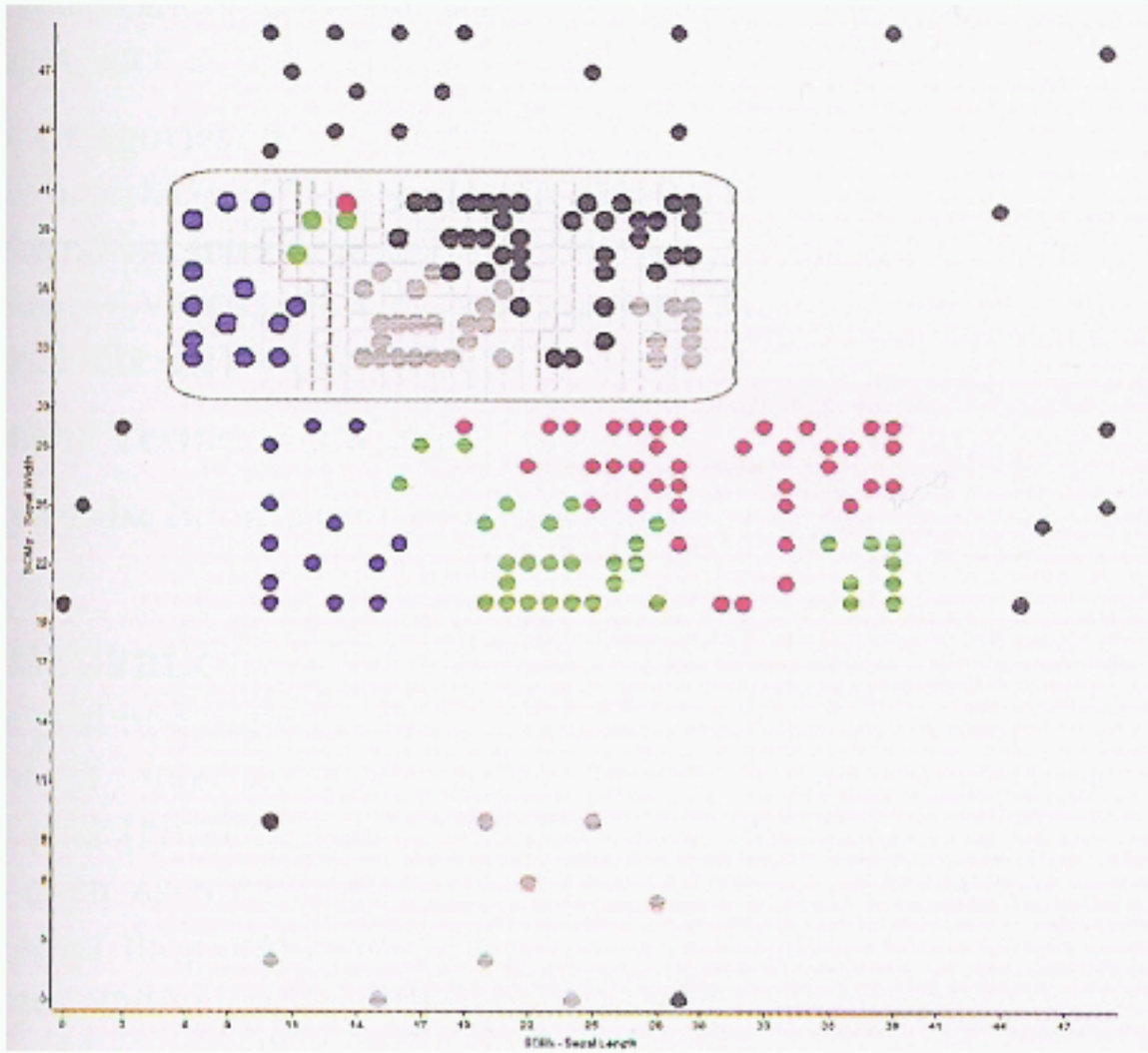
Jittering As Occlusion Solution



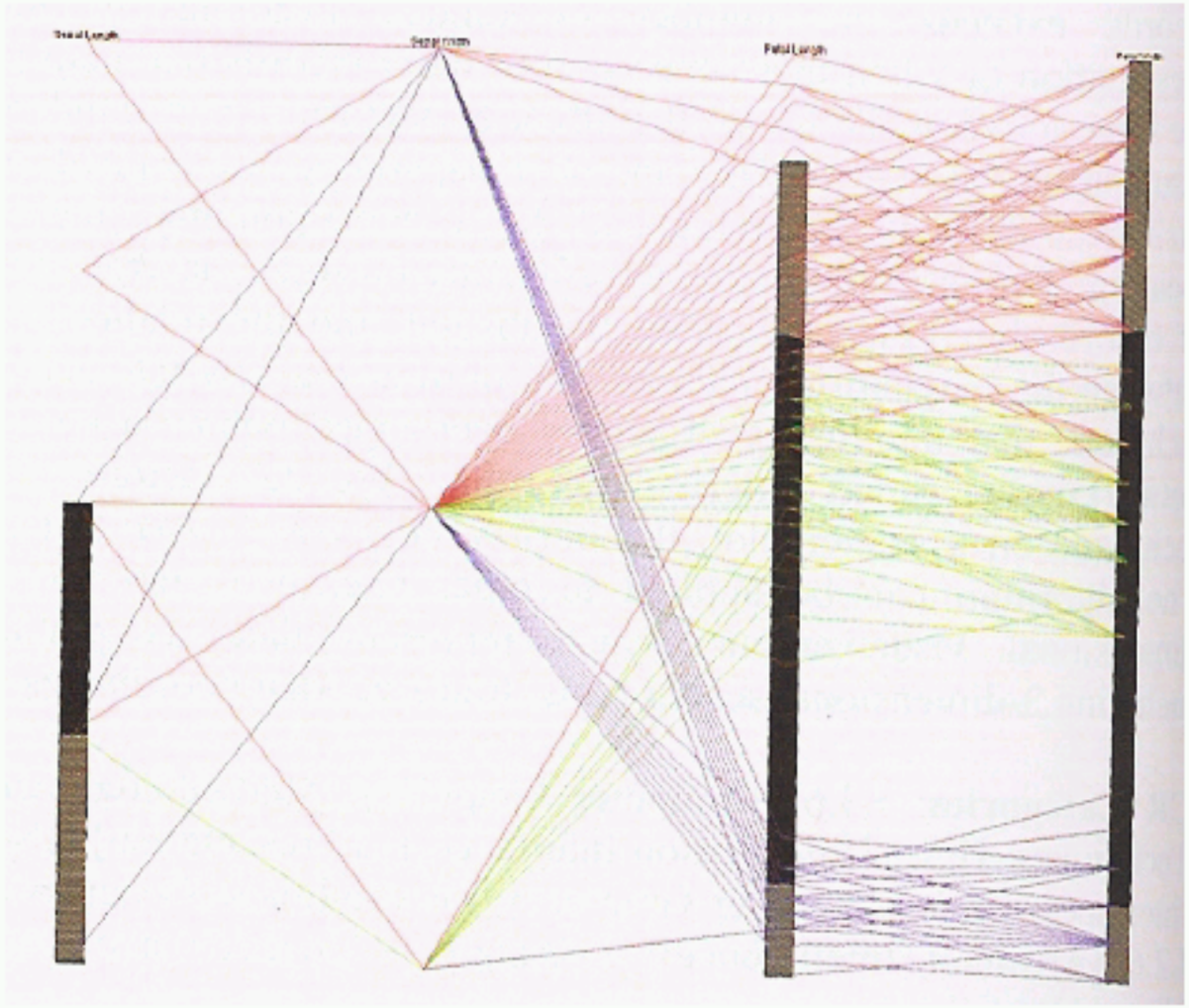


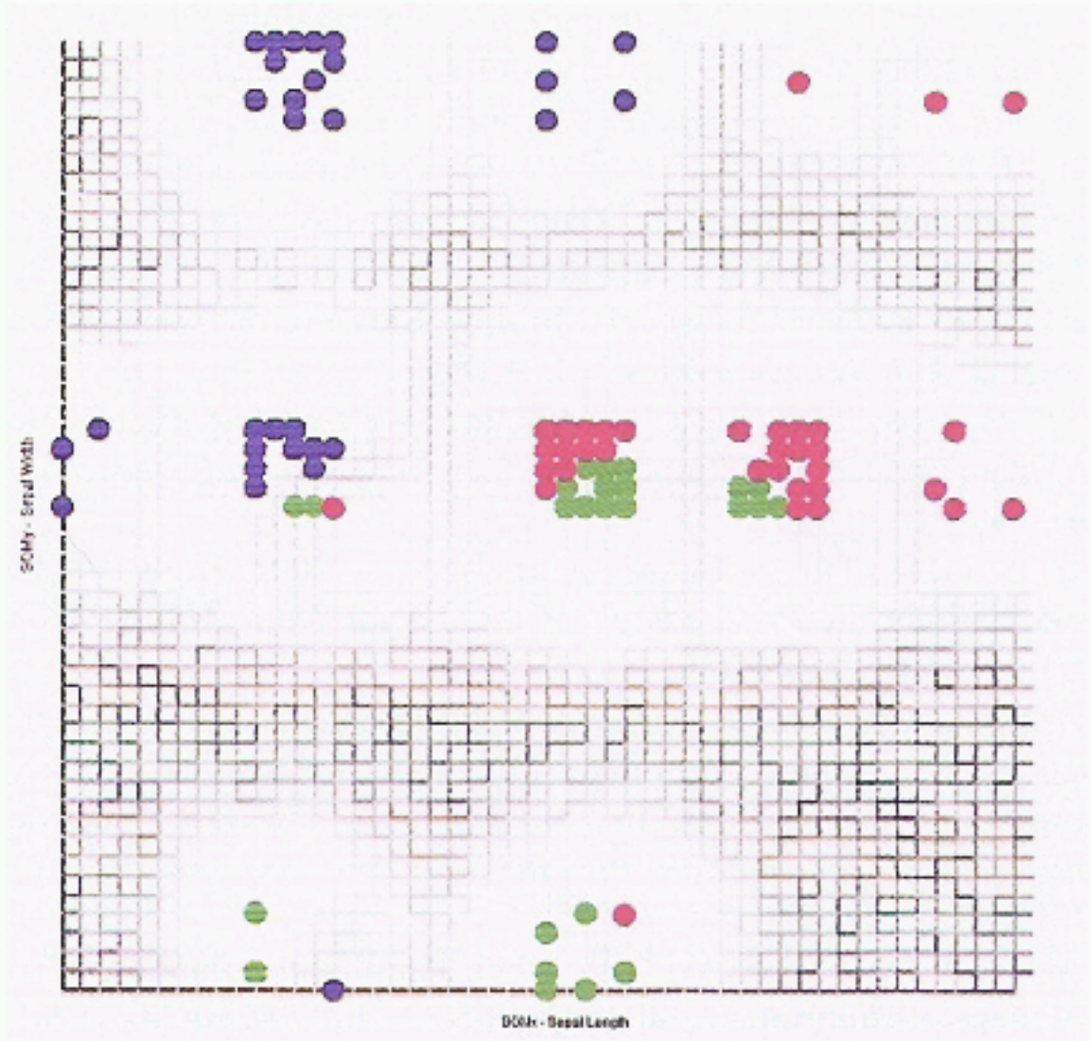
SmartJitter





Jitter vs. Parallel Coords





Critique

theoretically, can work with many techniques

but how much better than simple random?

- case is not made
- toy dataset
- no compelling example

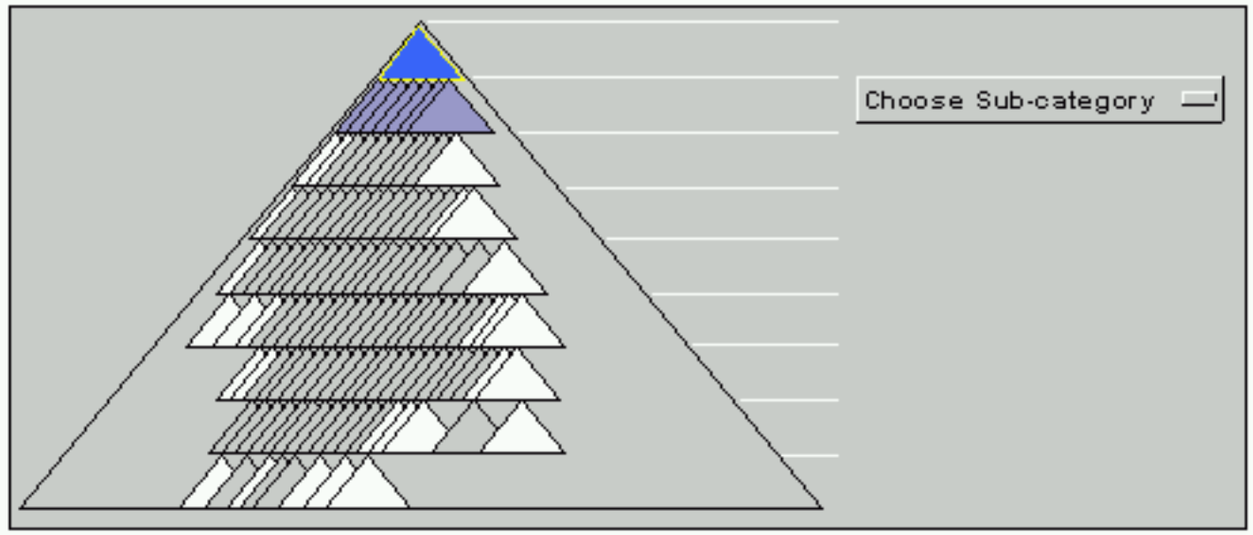
Cheops

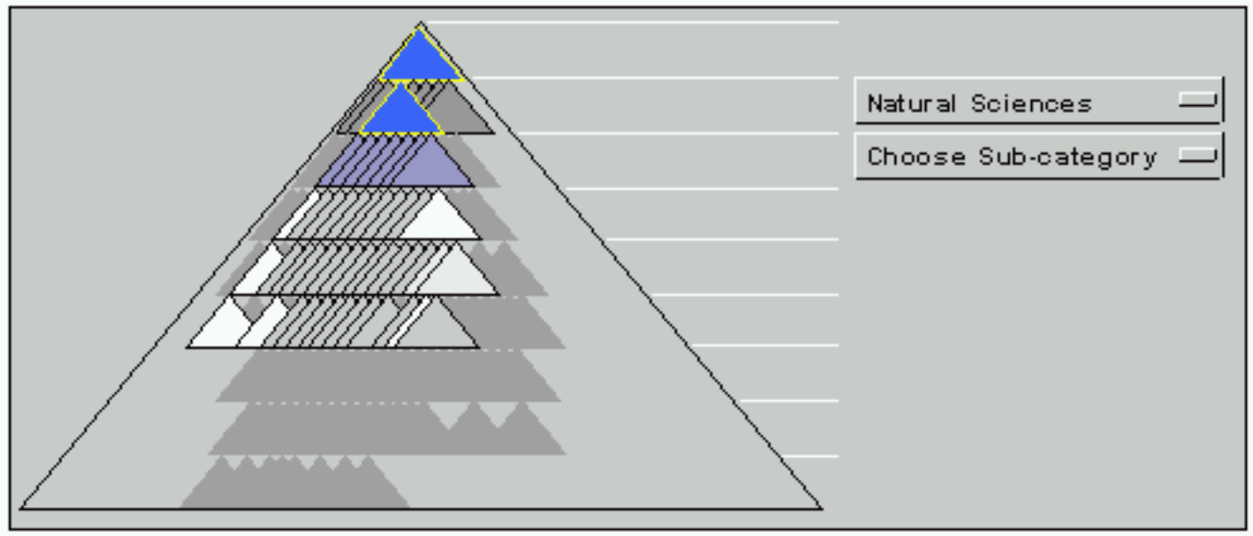
compact

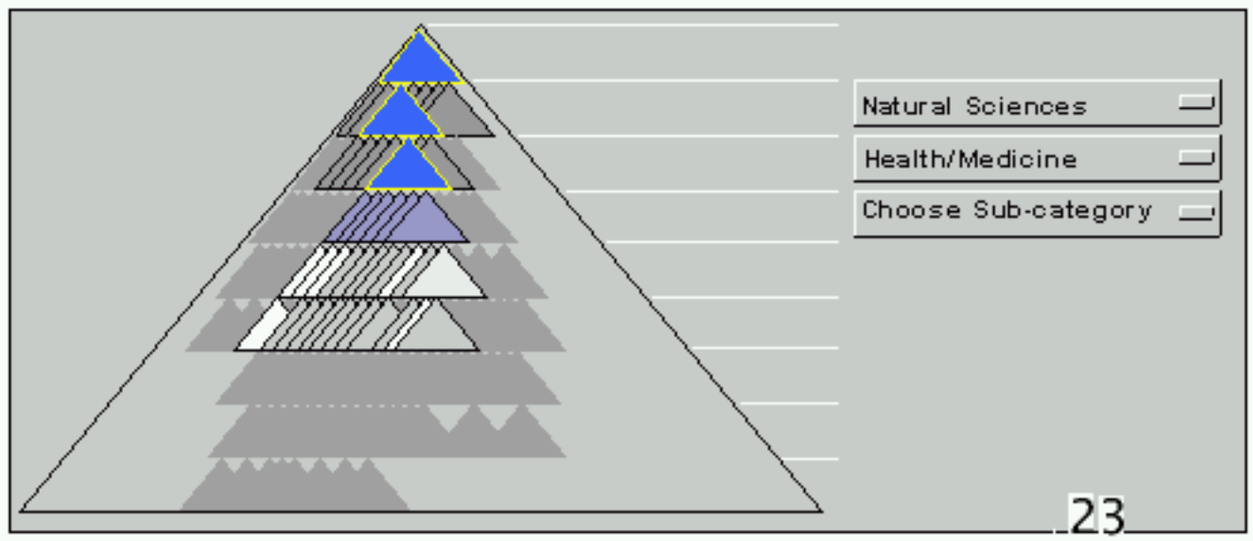
show paths through tree

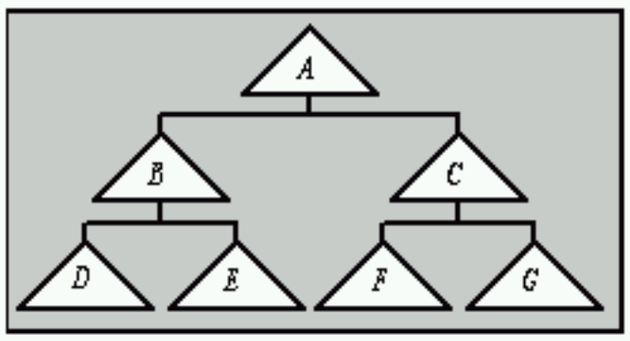
extreme occlusion
deliberately

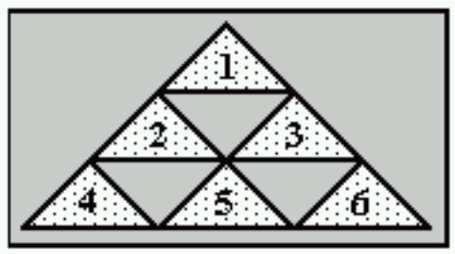
browsing/exploration,
not topological analysis







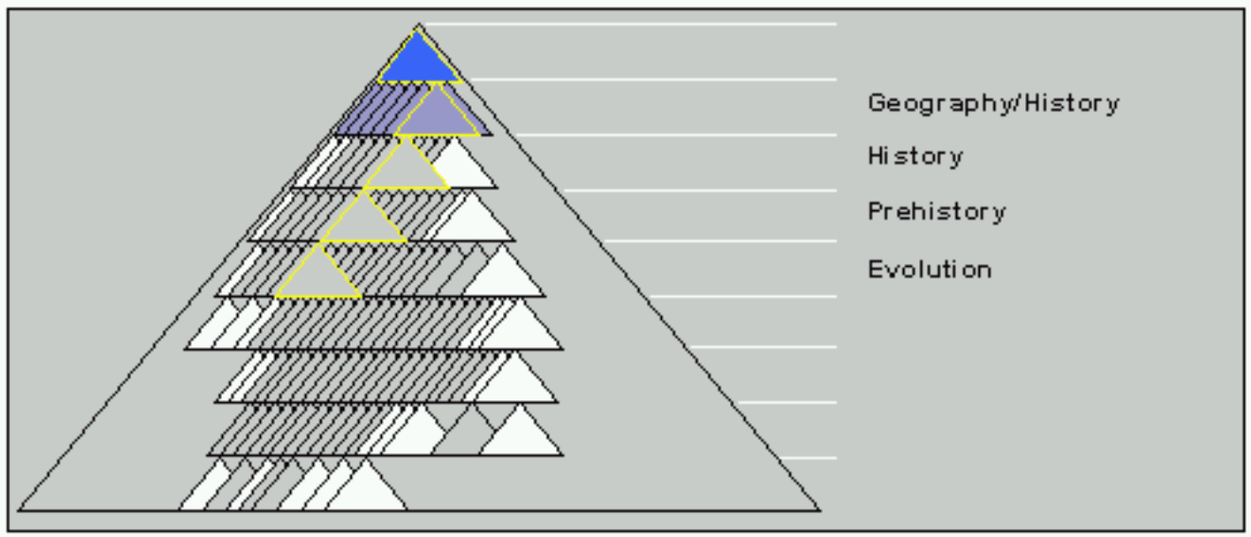


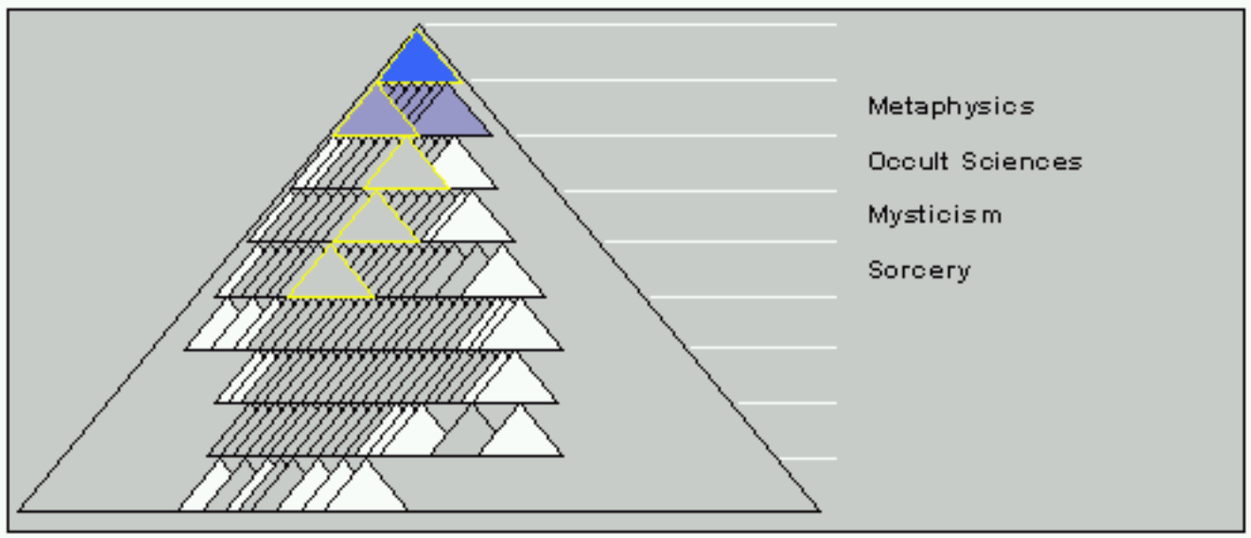


Cheops Interaction

"pre-selection"

- flip through overloaded visual representation choices





Cheops Critique

pro

- tiny footprint
  suitable when main user focus is other task

- interaction techniques investigated
  informal usability

con

- relatively hard to understand

- singular nodes very salient, but not so important

- "pre-selection" name is confusing
  perhaps "node cycling" instead?

Presentation Topic Choices

send me by Oct 20

- top three topic choices
- two days when you don't want to present

later you hear

- who does what topic when

later I post for each topic

- set of papers from which you pick one
- other paper is free choice

Project Resources