Depth/Occlusion

Lecture 9 CPSC 533C, Fall 2004

18 October 2004

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

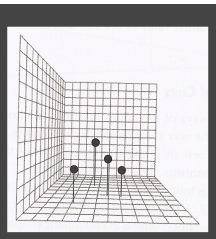
- Space Perception
  - depth
- Layering and Separation
  - visual layering
- 3DPS
  - graphs embedding in 3D vs. 2D
- EdgeLens
  - interactive occlusion control of 2D graph edges
- Smart Jitter
  - intelligently resolving point occlusion
- Cheops
  - deliberate occlusion for compact representation

Space Perception

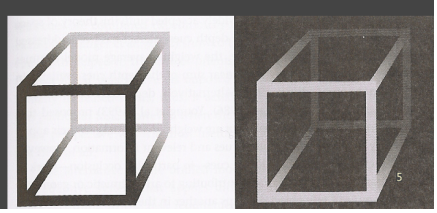
- static
  - occlusion
  - perspective projection
    - linear, texture gradient
  - depth of field
  - atmospheric (fog, depth cueing)
  - lighting and shadows
    - shape from shading
    - cast shadows
- moving
  - structure-from-motion
    - motion parallax (head motion)
- binocular
  - binocular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

Space Perception

droplines,
background grids



depth cueing



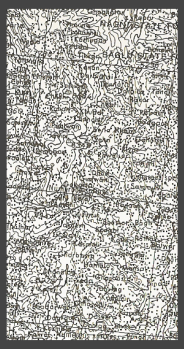
Binocular

less strong than occlusion

autostereopsis demo

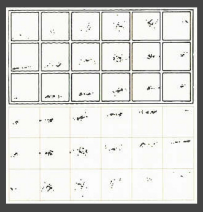
[www.mrl.nyu.edu/~perlin/demos/autoshutter-talk.html]

Layering And Separation



Visual Clutter

subtler background than foreground



3DPS

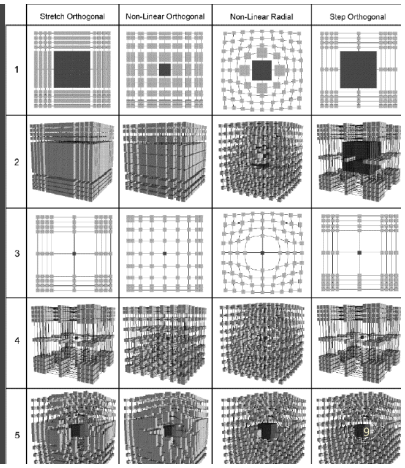
1: 2D displace+magnify

2: 3D displace+magnify

3: 2D displace only

4: 3D displace only

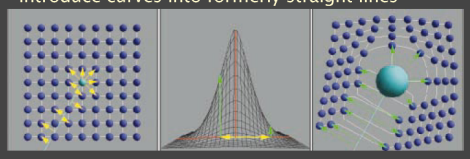
5: visual access distortion



Visual Access Distortion

naive 2D -> 3D extension yields occlusion
- same problem as van Wijk

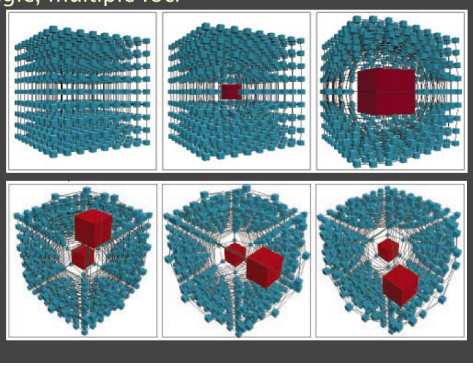
graph-based solution
- move geometry according to viewpoint
- magnify focus only
- introduce curves into formerly straight lines



focus+context issues deferred to lecture 12

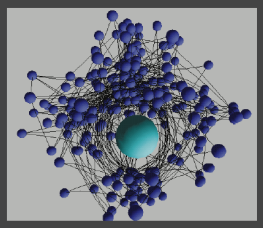
Results

single, multiple foci



Results

randomly positioned nodes instead of grid
- closer to real dataset



Critique

sophisticated way to navigate 3D graphs

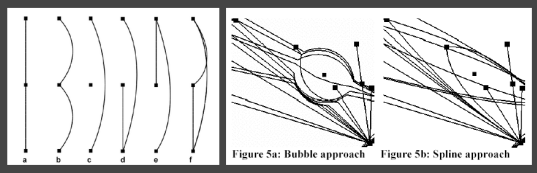
nice technique paper
- not a design study

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

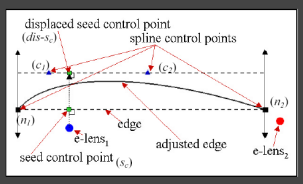
EdgeLens

interactive control over edge occlusion



user study: spline better than bubble

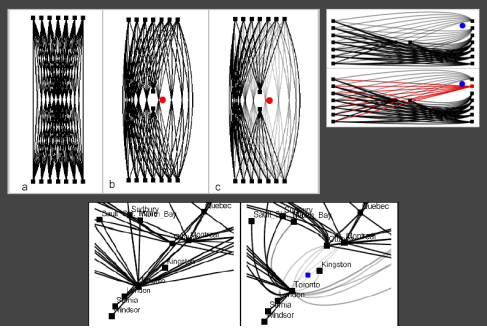
EdgeLens Final Algorithm



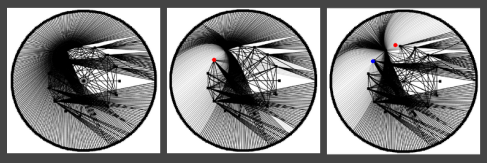
decide which edges affected
calculate displacements
calculate spline control points
draw curves

EdgeLens Techniques

transparency, color

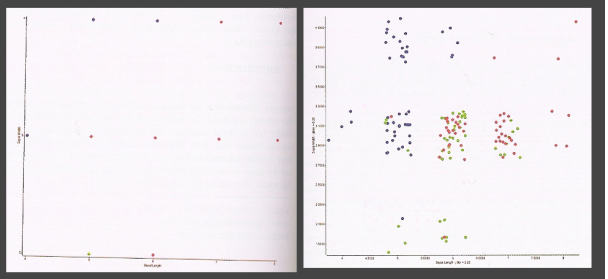


EdgeLens Results

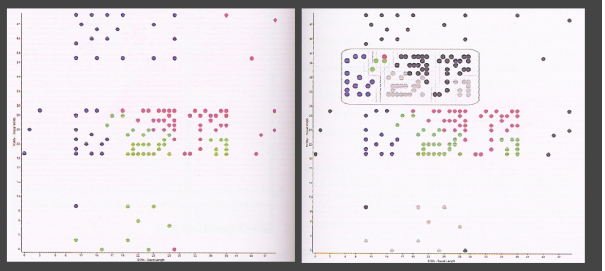


critique
- very nice technique
  - compelling need
- shown on real data

Jittering As Occlusion Solution



SmartJitter



Jitter vs. Parallel Coords

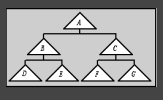
Cheops

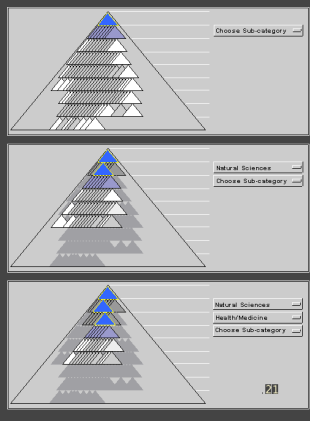
compact

show paths through tree

extreme occlusion
deliberately

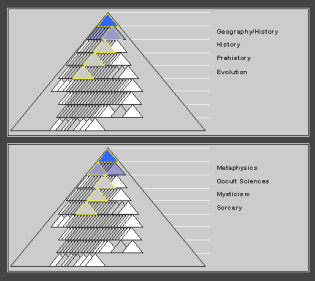
browsing/exploration, not
topological analysis





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

software viz
document collection viz
computer networks viz
databases/datamining viz
cartographic viz
social networks viz
time-series data viz
frameworks/taxonomies
perception
high dimensionality
interaction
focus+context
navigation/zooming
hierarchy visualization
graph drawing
evaluation
glyphs
animation
brushing/linking

Presentations

send me topics by Thursday Oct 21 at 5pm

slides due 10am day of class if using my laptop

Projects

reminder: meet with me before Nov 5

software/data resources link from course page