

Depth/Occlusion

Lecture 8 CPSC 533C, Spring 2004

4 Feb 2003

Depth and Occlusion

Space Perception

- depth

Layering and Separation

- visual layering

Clustered Calendar

- 2D after processing is better than 3D occlusion

3DPS

- graphs embedding in 3D vs. 2D

EdgeLens

- interactive occlusion control of 2D graph edges

Cheops

- deliberate occlusion for compact representation

Smart Jitter

- intelligently resolving point occlusion

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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)

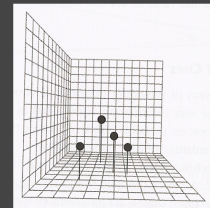
binocular

- binocular disparity (stereopsis)
- convergence
 - amount eyes rotate toward center of interest
 - like optical range finder

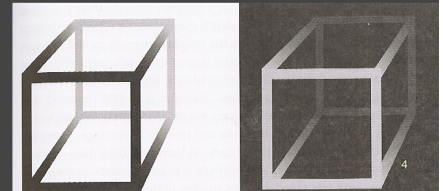
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Space Perception

droplines,
background grids



depth cueing



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Binocular

less strong than occlusion

autostereopsis demo

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

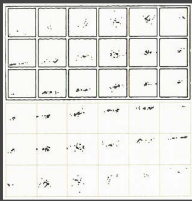
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Layering And Separation



Visual Clutter

subtler background than foreground



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Time-series Data Analysis

data: N pairs of (value, time)

· N large: 50K

tasks

- find standard day patterns
- find how patterns distributed over year, week, season
- find outliers from standard daily patterns
- want overview first, then detail on demand

possibilities

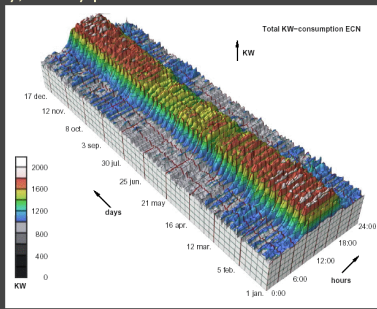
- predictive mathematical models
 - details lost, multiscale not addressed
- scale-space approaches (wavelet, fourier, fractal)
 - hard to interpret, known scales lost
- 3D mountain: x hours, y value, z days

excellent example, emulate for project writeups! 8

3D Time-series Data

3D extrusion pretty but not useful

- daily, weekly patterns hard to see



[van Wijk and van Selow, Cluster and Calendar based Visualization of Time Series Data, InfoVis99, citeseer.nj.nec.com/vanwijk99cluster.html]

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Hierarchical Clustering

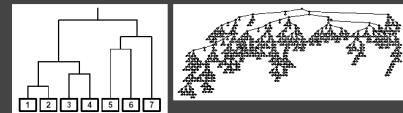
start with all M day patterns

- compute mutual differences, merge most similar: M-1
 - continue up to 1 root cluster
- result: binary hierarchy of clusters

choice of distance metrics

dendrogram display common

- but shows structure of hierarchy, not time distribution

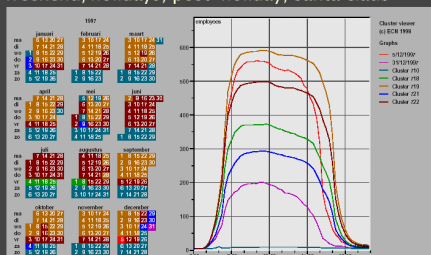


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Link Clusters and Calendar

2D linked clusters-calendars shows patterns

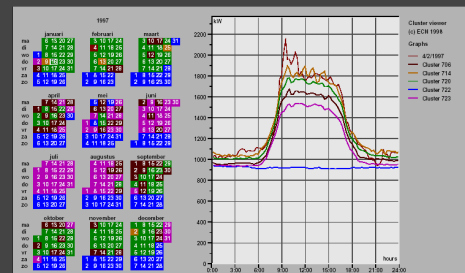
- number of employees:
- office hours, fridays in/and summer, school break
- weekend/holidays, post-holiday, santa claus



[van Wijk and van Selow, Cluster and Calendar based Visualization of Time Series Data, InfoVis99, Figure 4, citeseer.nj.nec.com/vanwijk99cluster.html]

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Power Consumption



[van Wijk and van Selow, Cluster and Calendar based Visualization of Time Series Data, InfoVis99, Figure 5, citeseer.nj.nec.com/vanwijk99cluster.html]

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van Wijk Lessons

derived space: clusters
visual representation of time: calendar

- linked display
- interactive exploration

clear task analysis guided choices

- reject standard 3D extrusion
- reject standard dendrogram

critique

- color choice not so discriminable especially legend

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3DPS

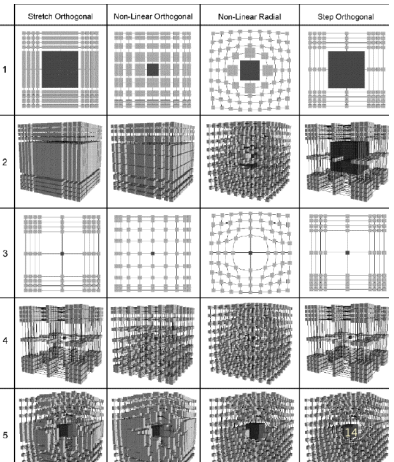
1: 2D displace+magnify

2: 3D displace+magnify

3: 2D displace only

4: 3D displace only

5: visual access distortion



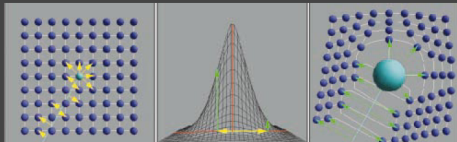
Visual Access Distortion

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

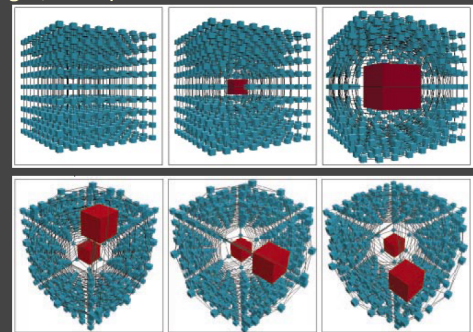


focus+context issues deferred to lecture 12

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Results

single, multiple foci

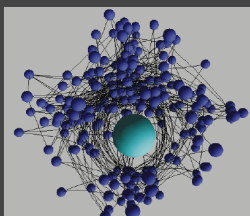


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Results

randomly positioned nodes instead of grid

- closer to real dataset



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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

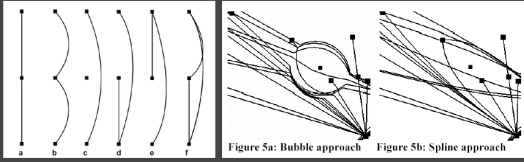
never shown on real data

- hard to draw conclusions from toy datasets

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EdgeLens

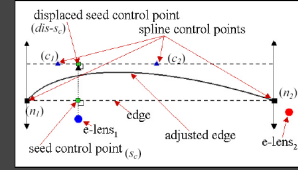
interactive control over edge occlusion



user study: spline better than bubble

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EdgeLens Final Algorithm

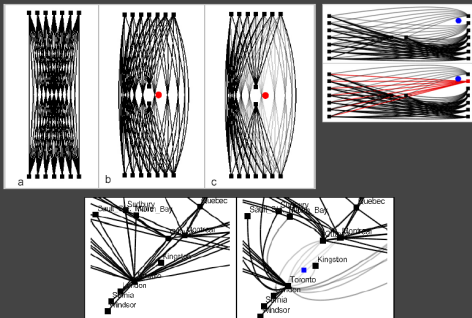


decide which edges affected
calculate displacements
calculate spline control points
draw curves

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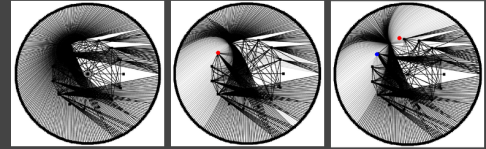
EdgeLens Techniques

transparency, color



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EdgeLens Results



critique

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

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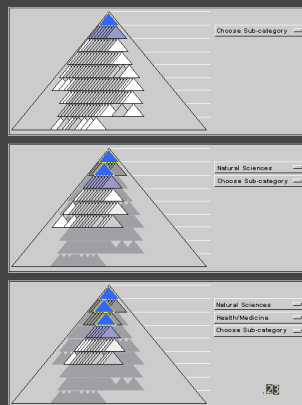
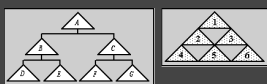
Cheops

compact

show paths through tree

extreme occlusion
deliberately

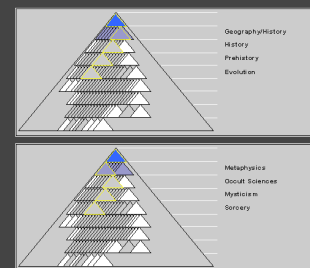
browsing/exploration, not
topological analysis



Cheops Interaction

"pre-selection"

- flip through overloaded visual representation choices



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Cheops Critique

pro

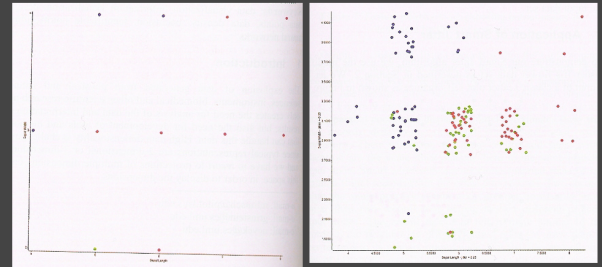
- tiny footprint
suitable when main user focus is other task
- interaction techniques investigated
informal usability

con

- relatively hard to understand
- singular nodes very salient, but not so important
- "pre-selection" name is confusing
perhaps "node cycling" instead?

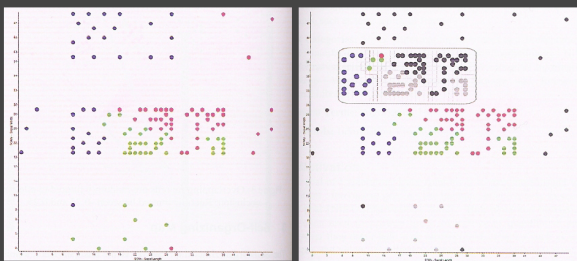
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Jittering As Occlusion Solution



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SmartJitter



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Jitter vs. Parallel Coords

