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
SmartJitter
- intelligently resolving point occlusion

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

Binocular

less strong than occlusion

autostereopsis demo

[www.mrl.nyu.edu/~perl/demos/autosrshutter-talk.html]

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!

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**3D Time-series Data**

3D extrusion pretty but not useful

- daily, weekly patterns hard to see

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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

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**Power Consumption**
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

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

3DPS
1. 2D displace+magnify
2. 3D displace+magnify
3. 2D displace only
4. 3D displace only
5. visual access distortion

Results
- single, multiple foci

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

**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?

Jittering As Occlusion Solution

SmartJitter

Jitter vs. Parallel Coords