Lecture 18: Focus+Context
Visualization
SFU Compt 467/767, Fall 2010
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Survey: Unified Framework

- Taxonomy
  - overview+detail: spatial separation
  - zooming: temporal separation
  - focus+context: integrated
  - cue-based: selectively highlight/suppress
  - crosscutting
- empirical study results
  - low-level task: target acquisition
  - high-level task: explore search space


Overview+Detail

- multiple views: same data, different resolution
- spatial separation between views
- linked navigation
- shortcut navigation, thumbnail to detail
- explore overview without changing detail
- if fully synchronized could not explore
- detail changes immediately shown in overview


Zooming

- single window, changing view
- temporal multiplexing
- not side by side views: pix below from different times


Survey: Focus+Context

- embed focus and context in same view


F+C vs. O+D

- two windows: overview + detail
- conjecture: cognitive load to correlate
- solution
- merge overview, detail
- “focus+context”


Metaphor: Rubber Sheet

- stretch and squish, orthogonal order maintained
- Document Lens, Table Lens

TreeJuxtaposer: guaranteed visibility
- scaling up when many more items than pixels
- video


Scaling Up Stretch and Squish

Metaphor: Move Surface Closer To Eye

- Perspective Wall

Perspective Wall, Mackinlay, Robertson and Card 1991

Pliable Surfaces

- general framework for distortion-based F+C


Recreational Reading


http://citeseer.nj.nec.com/lamping96focuscontext.html

Required Reading


Survey: Overview+Detail


Terminology Issue

- their defn: lens as O+D
- since O and D separated in z/depth
- nonstandard usage, I’m not a fan
- common use: lens as F+C
- Toolglass and Magic Lenses, Bier/Stone/Pier/Buxton/DeRose


Yet More Reading

Generalized Fisheye Views. Furnas. CHI ’86.

A Fisheye Follow-up: Further Reflection on Focus + Context. Furnas. CHI ’86.

The Document Lens, Robertson and Mackinlay 1993.

Table Lens, Rao and Card 1994.

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2002.


http://citeseer.nj.nec.com/lamping96focuscontext.html


http://www.cs.ubc.ca/˜tmm/papers/tj

Proc InfoVis 97.


Klein vs Poincare
Klein
- straight lines stay straight
- angles are distorted
Poincare
- angles are correct
- no parallels

2D Hyperbolic Trees
- fisheye distortion effect from hyperbolic geometry
- video: open-video.org/details.php?videoID=4567

3D Hyperbolic Trees/Graphs
- 3D vs 2D justification: information density at periphery

Avoiding Disorientation
- F+C problem
  - maintain user orientation when showing detail
  - hard for big datasets

Exponential Amount Of Room
- trees require exponential amount of space
- node count exponential in tree depth
- hyperbolic space has exponential amount of space
- available area exponential not quadratic

Noneuclidean Geometry
- Euclid’s 5th Postulate
  - exactly 1 parallel line
- spherical
  - geodesic = great circle
- no parallels
- hyperbolic
  - infinite parallels

Parallel vs. Equidistant
- euclidean: inseparable
- hyperbolic: different

3D Hyperbolic Space
- 3-hyperboloid projects to solid ball
- H3 layout:
  - 3D hyperbolic cone tree with good information density
  - circumference = hemisphere

3D vs. 2D Hyperbolic Scalability
- bottom-up: allocate space for nodes
- top-down: place child on parent hemisphere

Further reading:
Distortion Challenges
- how to visually communicate distortion
  - gridlines, shading
  - target acquisition problem
  - lens displacing items away from screen location
  - unsuitable if must make relative spatial judgements
  - mixed results with empirical comparison to O+D, pan/zoom
- cautions that geometric distortion was not his main point

Survey: Evaluation
- complex picture of costs/benefits
  - spatial separation
  - costs: real estate, mental integration overhead
  - zooming
    - costs: cognitive load
    - anim transitions help, but don’t solve
  - concurrent, unimanual over serial or bimanual
  - focus+context
    - strengths: overview, graphs
    - costs: distortion
  - can combine: e.g. zooming + multiple views

Evaluation: Further Reading
- design guidelines from systematic review of 22 studies
  - UBC CS TR-2010-11. (monograph soon)
- four-point decision tree
  - single or multi-level interface
  - create the high-level displays (overviews)
  - simultaneous or temporal display of visual levels
  - sim: embedded or separate display of visual levels
- three design guidelines
  - number of levels in display and data should match
  - high visual levels should display only task-relevant info
  - simultaneous display not temporal switching for tasks with multi-level answers

Spanning Tree Layout
- problem
  - general graph layout problem is NP-hard
- solution
  - tractable spanning tree backbone
  - appropriate iff matches mental model
  - quasi-hierarchical
  - use domain knowledge to construct
    - select parent from incoming links
    - required as input, not automatically computed
  - draw non-tree links only on demand