

Lecture 9: Space/Layers/Order

Information Visualization

CPSC 533C, Fall 2009

Tamara Munzner

UBC Computer Science

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News

- no class next week (Mon Tgiving, Wed also no class)
- project meetings required by Fri Oct 23
 - I'm gone all next week
 - so only 2 weeks left - this one + week after next!

Readings Covered

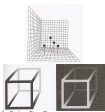
Ware, Chapter 8: Space Perception and the Display of Data in Space
 Tufts, Chapter 3: Layering and Separation
 Hierarchical Edge Bundles: Visualization of Adjacency Relations in Hierarchical Data. Danny Hutten, Proc. InfoVis06, to appear http://www.win.siu.edu/~dholten/papers/bundles_infovis.pdf
 Tufts, Chapter 6: Narratives of Space and Time
 VisDB: Database Exploration using Multidimensional Visualization, Daniel A. Keim and Hans-Peter Kriegel, IEEE CG&A, 1994 <http://www.dlsb.informatik.uni-muenchen.de/dlsb/projects/papers/visdb.ps>

Ware: 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

Ware: Space Perception

- droplines,
- background grids



[Ware, Information Visualization: Perception for Design, Chap 1]

Layering And Separation



[Tufts, Envisaging Information, Chap 3]

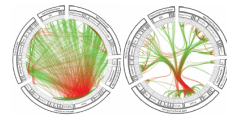
Visual Clutter

- subtler background than foreground



[Tufts, Envisaging Information, Chap 3]

Hierarchical Edge Bundles



[Hierarchical Edge Bundles: Visualization of Adjacency Relations in Hierarchical Data. Danny Hutten, Proc. InfoVis06]

Hierarchical Edge Bundles

- alpha blending



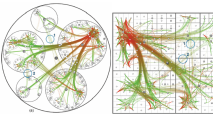
- bundling strength



[Hierarchical Edge Bundles: Visualization of Adjacency Relations in Hierarchical Data. Danny Hutten, Proc. InfoVis06]

Hierarchical Edge Bundling

- (mostly) agnostic to layout



[Hierarchical Edge Bundles: Visualization of Adjacency Relations in Hierarchical Data. Danny Hutten, Proc. InfoVis06]

Critique

- flexible and general idea
- simple - after you see it
- successful example of creating foreground layer

Space vs. Time: Showing Change

literal abstract
 time for time space for time

- animation: show time using temporal change
 - (not transitions)
 - good: show process



[www.gnom.alac.edu/docs/instreach/01/inst01.mpeg]

Space vs. Time: Showing Change

literal abstract
 time for time space for time

- animation: show time using temporal change
 - (not transitions)
 - good: show process
 - good: compare by flipping between two things



[www.gnom.alac.edu/docs/instreach/01/inst01.mpeg]
 [www.scribble.com/colalpha/pkalpha.gif]

Space vs. Time: Showing Change

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- animation: show time using temporal change
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 - bad: compare between many things



[www.gnom.alac.edu/docs/instreach/01/inst01.mpeg]
 [www.scribble.com/colalpha/pkalpha.gif]

Space vs. Time: Showing Change

literal abstract
 time for time space for time

- animation: show time using temporal change
 - (not transitions)
 - good: show process
 - good: compare by flipping between two things
 - bad: compare between many things
 - interference from intermediate frames



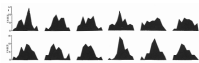
[www.gnom.alac.edu/docs/instreach/01/inst01.mpeg]
 [www.scribble.com/colalpha/pkalpha.gif]

Space vs. Time: Showing Change

literal abstract

time for time space for time

- small multiples: show time using space
- overview: show each time step in array
- compare: side-by-side easier than temporal
- external cognition instead of internal memory



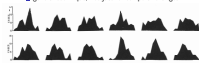
[Edward Tufte, The Visual Display of Quantitative Information, p 172]

Space vs. Time: Showing Change

literal abstract

time for time space for time

- small multiples: show time using space
- overview: show each time step in array
- compare: side-by-side easier than temporal
- external cognition instead of internal memory
- general technique, not just for temporal changes




[Edward Tufte, The Visual Display of Quantitative Information, p 172]

Space vs. Time: Showing Change

literal abstract

time for time space for time

- small multiples: show time using space
- also can be good for showing process



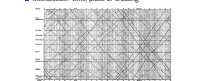
[www.globe.edu/graphics/jn/Video_Production/Outside-In/postcard_comp.html]

Animation vs. Small Multiples

- Tversky argument: intuition that animation helps is wrong
 - meta-review of previous studies
 - often more info shown in animation view so not a fair comparison
 - carefully chosen segmentation into small multiples better than animation if equivalent information shown
- [Animation: Can It Facilitate? Barbara Tversky, Julie Morrison, Mireille Beত্রacourt. International Journal of Human Computer Studies 57.4, pp 247-262, 2002.]

Derived Spaces: Slope

- narrative of space and time
- Marray train schedule, 1885
 - horizontal line length: stop length
 - slope: speed
 - intersection: time/place of crossing




[Table 1 p. 33, www.map.edu/html/ho_marray/schedule1.jpg.gif]

Sorting and Ordering

- derived spaces for ordering
- spatial position as strongest perceptual cue
- finding the right order
 - automatically
 - through exploration

Manual Ordering: Bertin

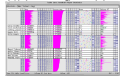
- reorderable matrices - manually!



[Bertin, Graphics and Graphic Information Processing, p 34]

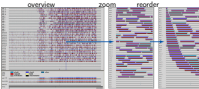
Interactive Ordering: Table Lens

- click to sort by columns
- also, is focus+context approach
- video: <http://open-video.org/details.php?videoid=8304>



Interactive Ordering: Rivet

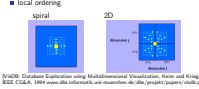
- performance analysis of parallel system
- order: machine name vs. lock acquisition time



[Boesch, Performance Analysis and Visualization of Parallel Systems Using SimOS and Rivers: A Case Study, NPGC, 2000. graphics.stanford.edu/papers/rivet_argm]

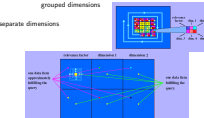
VisDB: Spacefilling Pixels

- how to draw pixels?
 - sort, color by relevance
 - local ordering



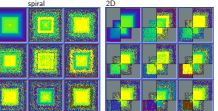
[VisDB: Database Exploration using Multidimensional Visualization, Kain and Krügel, IEEE CGGA, 1994 www.dbs.informatik.uni-muenchen.de/dbv/projects/papers/vldb94]

VisDB Windows



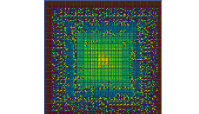
[VisDB: Database Exploration using Multidimensional Visualization, Kain and Krügel, IEEE CGGA, 1994 www.dbs.informatik.uni-muenchen.de/dbv/projects/papers/vldb94]

VisDB Results: Separate Dimensions



[VisDB: Database Exploration using Multidimensional Visualization, Kain and Krügel, IEEE CGGA, 1994 www.dbs.informatik.uni-muenchen.de/dbv/projects/papers/vldb94]

VisDB Results: Grouped Dimensions



[VisDB: Database Exploration using Multidimensional Visualization, Kain and Krügel, IEEE CGGA, 1994 www.dbs.informatik.uni-muenchen.de/dbv/projects/papers/vldb94]

Another Pixel-Oriented Example

- SeeSoft from AT&T



[Bai and Erick, Software Visualization in the Large, IEEE Computer 20.4, 1990 cse.wisc.edu/research/see/see/see.htm]

VisDB Critique

- pixel-oriented methods have power
- but studies needed
 - are spacefilling curves understandable
 - when does visual complexity overwhelm

Readings For Next Time

- Tufte, Chapter 2: Micro/Macro Readings
Ware, Chapter 10: Interacting with Visualizations: second half, p 325-345
- A review of overview+detail, zooming, and focus+context interfaces.
Andy Cockburn, Amy Karlson, and Benjamin B. Bederson. ACM Computing Surveys 41(1), 2008.
- OrthoZoom Scroller: 1D Multi-Scale Navigation. Catherine Appert and Jean-Daniel Fekete. Proc. SIGCHI 06, pp 21-30.