

Lecture 6: Space/Order

Information Visualization CSPC 533C, Fall 2006

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UCB Computer Science

28 September 2006

Readings Covered

The Visual Design and Control of Trellis Display R. A. Becker, W.S. Cleveland, and M. J. Shyu Journal of Computational and Statistical Graphics, 5:129-155, (1996).
<http://cm.bell-labs.com/istat/doc/trellis.jpgs.col.pdf>

Choosing Information. Edward Tufte. Graphics Press, 1990. Chapter 4: Small Multiples, Chapter 6: Narratives of Space and Time
VisDB: Database Exploration using Multidimensional Visualization, Daniel A. Keim and Hans-Peter Kriegel, IEEE CGGA, 1994
<http://www.dbs.informatik.uni-muenchen.de/dbis/projekt/papers/visdb.ps>

Space and Order

- Trellis
 - find order automatically: main-effects
 - dot plots, matrices of small multiples
- VisDB
 - choice of spaceliffing pixel pattern
- small multiples
 - side by side better than comparing to memory
- narratives of space and time
 - using spatial position to encode temporal data
 - derived spaces

Manual Ordering: Bertin

- reorderable matrices - manually!



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

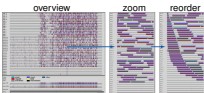
Interactive Ordering: Table Lens

- click to sort by columns
- also, is focus+context approach
- demo: www.inxight.com/products/sdks/tl



Interactive Ordering: Rivet

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



[Bosch, Performance Analysis and Visualization of Parallel Systems Using SimDcS and Rivet: A Case Study, HPCA6, 2000. graphics.stanford.edu/papers/rivet_arg.pdf]

Automatic Ordering: Trellis



[The Visual Design and Control of Trellis Display. Becker, Cleveland, and Shyu. JCSG 5:129-155, 1996. cm.bell-labs.com/istat/doc/trellis.jpgs.col.pdf]

Trellis Structure

- conditioning/trellising: choose structure
 - pick how to subdivide into panels
 - pick x/y axes for indiv panels
 - explore space with different choices
 - multiple conditioning
- ordering
 - large-scale: between panels
 - small-scale: within panels
- main-effects: sort by group median
 - derived space, from categorical to ordered

Confirming Hypothesis

- dataset error with Morris switched?
- old trellis: yield against variety given year/site
- new trellis: yield against site and year given variety
 - exploration suggested by previous main-effects ordering

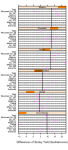


[The Visual Design and Control of Trellis Display. Becker, Cleveland, and Shyu. JCSG 5:123-155, 1996. cm.bell-labs.com/istat/doc/trellis.jpgs.col.pdf]

Partial Residuals

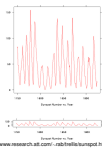
- fixed dataset, Morris data switched
- explicitly show differences
 - take means into account
 - line is 10% trimmed mean (loss outliers)

[The Visual Design and Control of Trellis Display. Becker, Cleveland, and Shyu. JCSG 5:129-155, 1996. cm.bell-labs.com/istat/doc/trellis.jpgs.col.pdf]



Banking to 45 Degrees

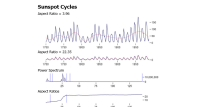
- mentioned but not explained in this reading
- perceptual principle: most accurate angle judgement at 45 degrees
- pick aspect ratio (height/width) accordingly



[www.research.att.com/~rad/trellis/sinplot.html]

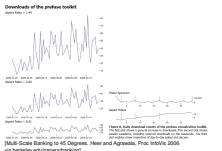
Multiscale Banking to 45

- frequency domain analysis



[Figure 5. Sampled observations, 1700-1967. The first plot shows the frequency spectrum of the samples of stream runoff. The second plot shows the original data with a 45-degree banking angle. [Multi-Scale Banking to 45 Degrees. Heer and Agrawala, Proc InfoVis 2006. vis.berkeley.edu/papers/banking/]

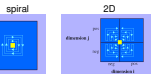
Multiscale Banking to 45



[Multi-Scale Banking to 45 Degrees. Heer and Agrawala, Proc InfoVis 2006. vis.berkeley.edu/papers/banking/]

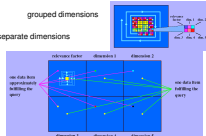
VisDB: Spacefilling Pixels

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



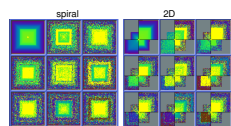
[VisDB: Database Exploration using Multidimensional Visualization, Keim and Kriegel, IEEE CGGA, 1994 www.dbs.informatik.uni-muenchen.de/dbis/projekt/papers/visdb.ps]

VisDB Windows



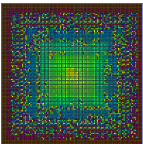
[VisDB: Database Exploration using Multidimensional Visualization, Keim and Kriegel, IEEE CGGA, 1994 www.dbs.informatik.uni-muenchen.de/dbis/projekt/papers/visdb.ps]

VisDB Results: Separate Dimensions



[VisDB: Database Exploration using Multidimensional Visualization, Keim and Kriegel, IEEE CGGA, 1994 www.dbs.informatik.uni-muenchen.de/dbis/projekt/papers/visdb.ps]

VisDB Results: Grouped Dimensions



[VisDB: Database Exploration using Multidimensional Visualizations. Helm and Krigel, IEEE CGA, 1994 www.dbis.informatik.uni-muenchen.de/dbisgrip/papers/visdb.pdf]

Space vs. Time: Showing Change

literal abstract

time for time space for time

- animation: show time using temporal change
 - good: show process



[www.gnom.ac.uk/edu/ibcc/outreach/loewert.html]

Navigation icons: back, forward, search, etc.

Space vs. Time: Showing Change

literal abstract

time for time space for time

- animation: show time using temporal change
 - good: show process
 - good: compare by flipping between two things



[www.gnom.ac.uk/edu/ibcc/outreach/loewert.html]

[www.astronhow.com/odpho/pluto.gif]

Navigation icons: back, forward, search, etc.

Space vs. Time: Showing Change

literal abstract

time for time space for time

- animation: show time using temporal change
 - good: show process
 - good: compare by flipping between two things
 - bad: compare between many things



[www.gnom.ac.uk/edu/ibcc/outreach/loewert.html]

[www.astronhow.com/odpho/pluto.gif]

Navigation icons: back, forward, search, etc.

Space vs. Time: Showing Change

literal abstract

time for time space for time

- animation: show time using temporal change
 - good: show process
 - good: compare by flipping between two things
 - bad: compare between many things
 - interference from intermediate frames



[www.gnom.ac.uk/edu/ibcc/outreach/loewert.html]

[www.astronhow.com/odpho/pluto.gif]

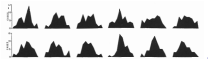
Navigation icons: back, forward, search, etc.

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



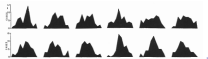
Navigation icons: back, forward, search, etc.

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



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.gnom.ac.uk/edu/graphic/pw/Video_Productions/Outreach/loewert.html]

Navigation icons: back, forward, search, etc.

Animation vs. Small Multiples

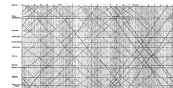
- Tversky argument: intuition that animation helps is wrong
 - meta-review of previous studies
 - often more info shown in animation view so not a fair comparison
- carefully chosen segmentation into small multiples better than animation if equivalent information shown

[Animation: Can It Facilitate? Barbara Tversky, Julie Morrison, Mireille Beirancourt. International Journal of Human Computer Studies 57:4, pp 247-262, 2002.]

Navigation icons: back, forward, search, etc.

Derived Spaces: Slope

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



[Table 1 p. 21. www.nyu.edu/html/tah/nash/images/US.gif]

Navigation icons: back, forward, search, etc.