Spatial Layout

Maneesh Agrawala

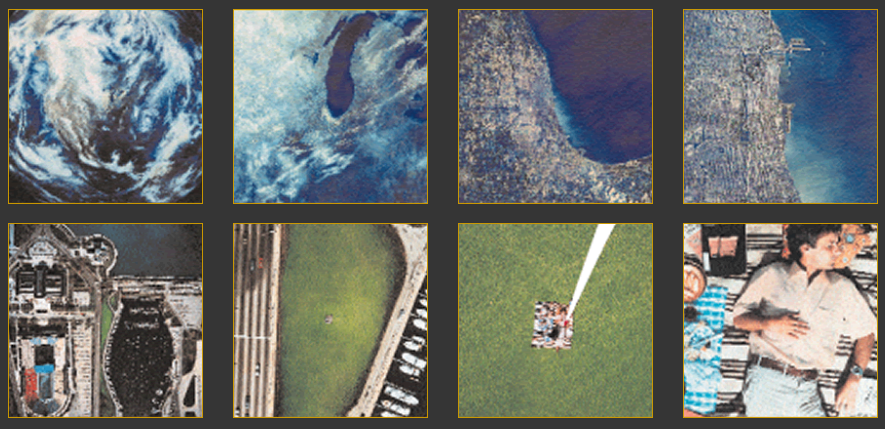
CS 448B: Visualization
Spring 2016

Last Time: Using Space Effectively: 2D

Topics

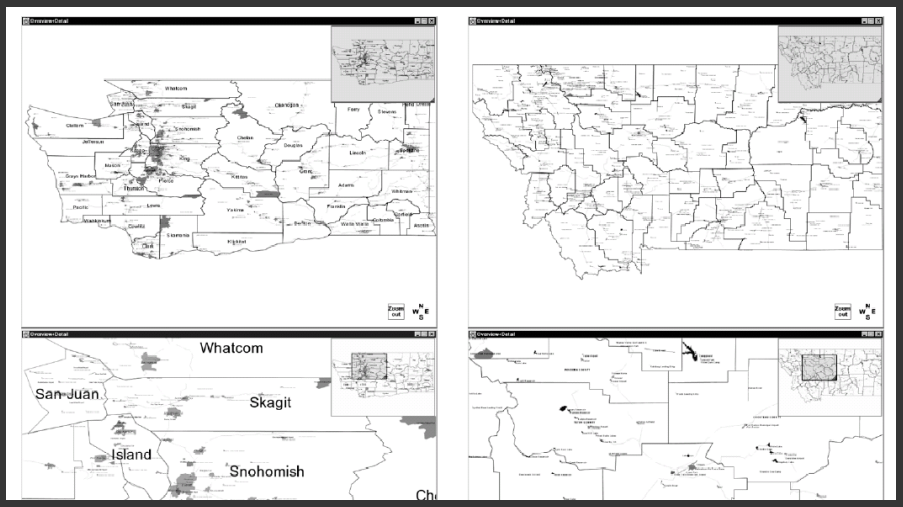
Displaying data in graphs
Selecting aspect ratio
Fitting data and depicting residuals
Graphical calculations
Zooming and Focus + Context
Cartographic distortion

Zooming



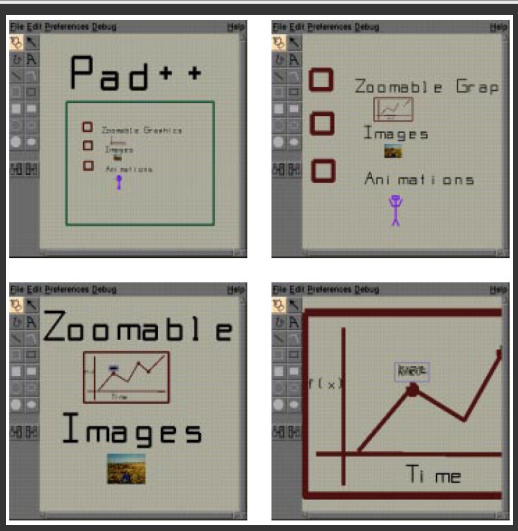
Eames' Powers of Ten [http://www.eamesoffice.com/the-work/powers-of-ten/]

Overview + details



[Hornbaek et al. 2002]

Interactive zooming

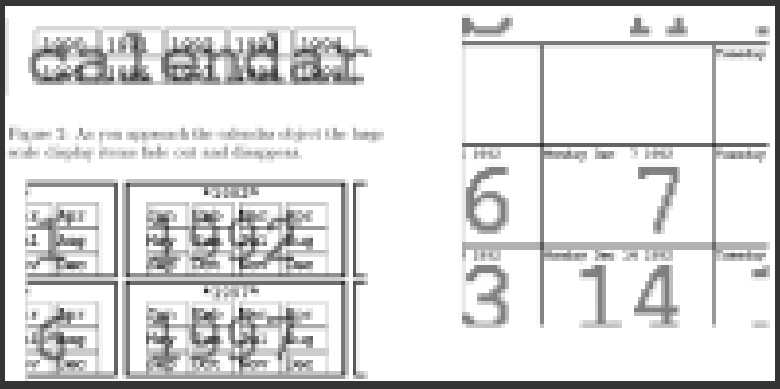


Pad++ [Bederson and Hollan 94]

Pad++

Semantic zooming

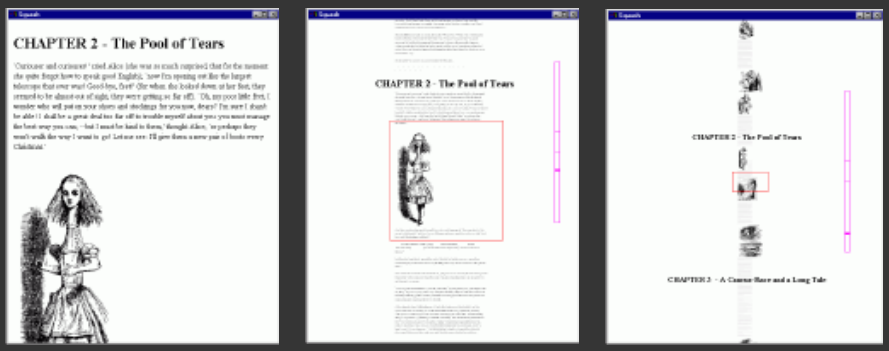
Change visual representations as zoom level changes



PAD [Perlin and Fox 93]

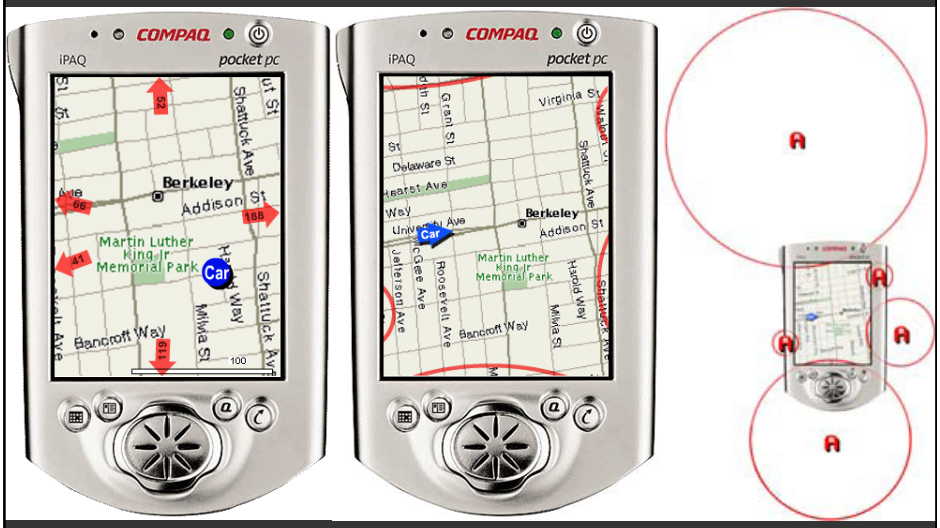
Speed-Dependent Zooming

Integrate Pan and Zoom into single interation
Automatically zoom to maintain optical flow
Semantic zooming can simplify zoomed-out view



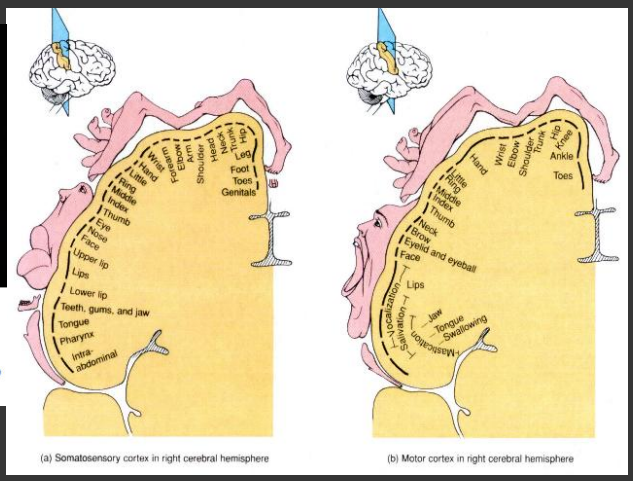
http://www-ui.is.s.u-tokyo.ac.jp/~takeo/java/autozoom/autozoom.htm [Igarashi 00]

Halo [Baudisch 03]



Focus + Context

This model shows what a man's body would look like if each part grew in proportion to the area of the cortex of the brain concerned with its sensory perception. The hands and lips dominate — but the feet are also disproportionately large, indicating their sensory importance.



(a) Somatosensory cortex in right cerebral hemisphere

(b) Motor cortex in right cerebral hemisphere

Degree-of-Interest [Furnas 81, 06]

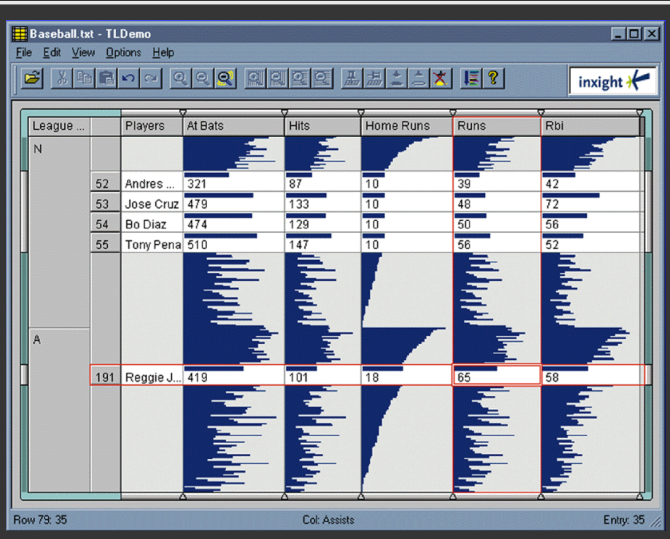
Estimate the saliency of information to display
Can affect *what* is shown and/or *how* to show it

DOI ~ f(Current Focus, A Priori Importance)

Example: Google Search

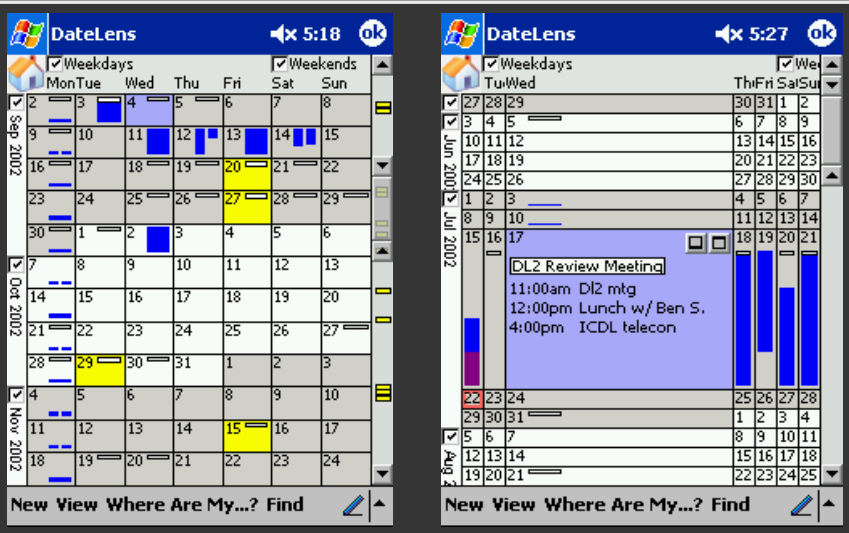
- **Current Focus = Query Hits (e.g., TF.IDF score)**
- **A Priori Importance = PageRank**
- ***What*: Top N results, *How*: List**

TableLens [Rao & Card 94]



http://www.youtube.com/watch?v=qWqTrRAC52U

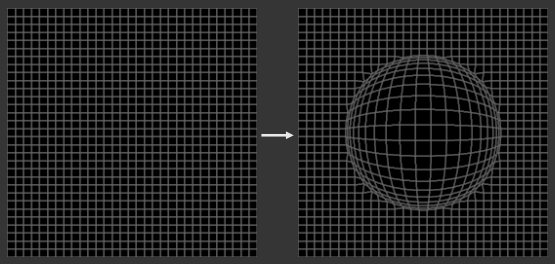
Datelens

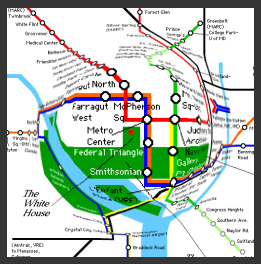


[Bederson et al. 04]

Single view detail + context

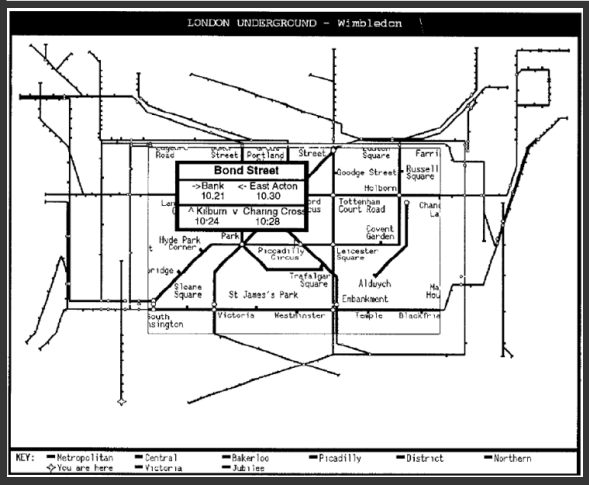
- Focus area – local details
- De-magnified area – surrounding context
- Like a rubber sheet with borders tacked down

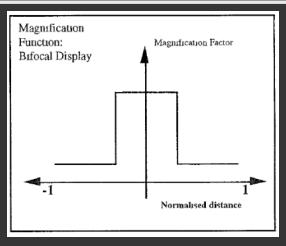


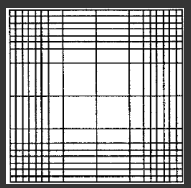


Nonlinear Magnification Infocenter [http://www.cs.indiana.edu/%7Etkeahey/research/nlm/nlm.html]

Bifocal display [Leung and Apperley 94]

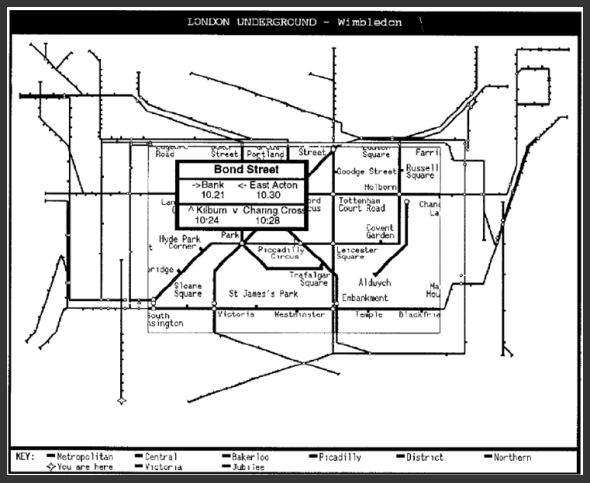


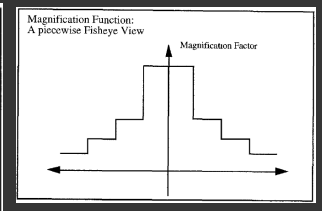




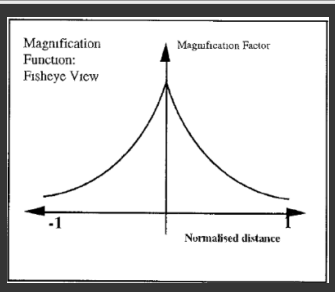
2D distortion

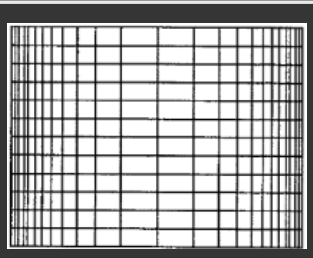
Multifocal display [Leung and Apperley 94]



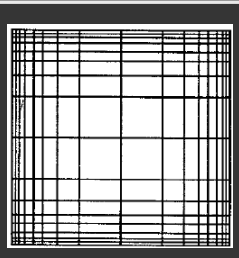


Fisheye [Leung and Apperley 94]

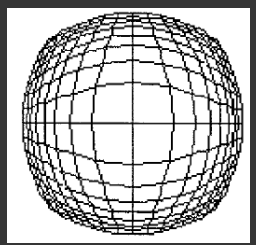




1D

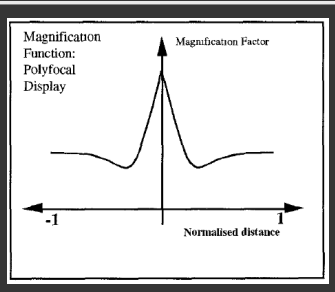


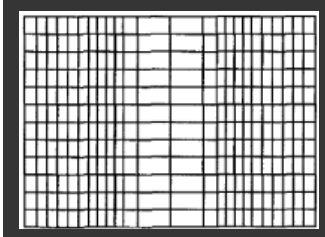
2D



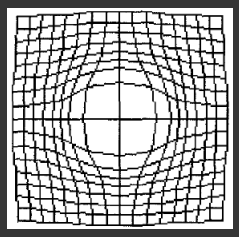
Polar

Nonlinear magnification [Leung and Apperley 94]

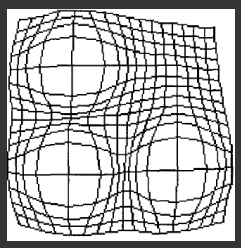


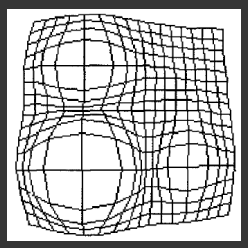


1D



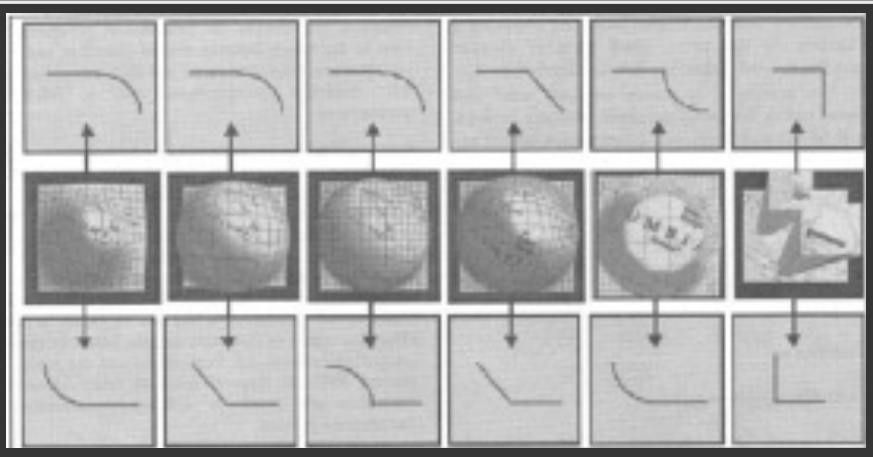
2D





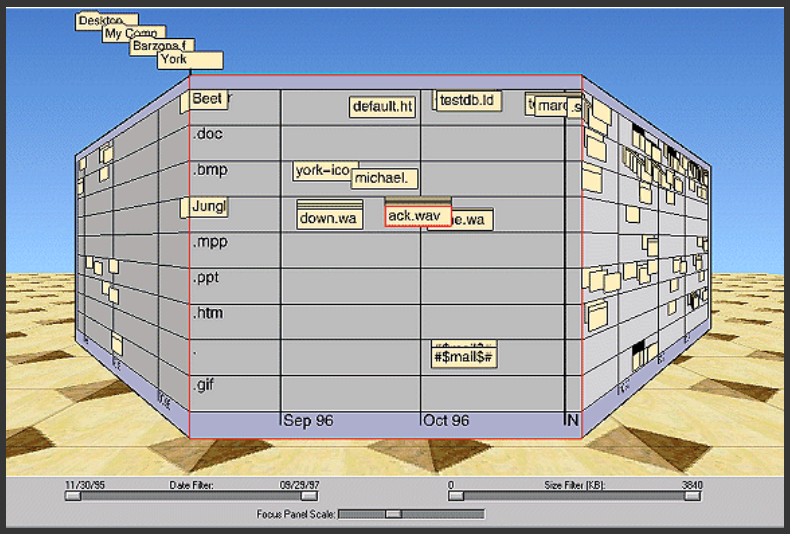
Multifocal

6 types of distortions [Carpendale & Montagnese 01]



Gaussian, Cosine, Hemisphere, Linear, Inverse Cosine and Manhattan. Top row shows transition from focus to distortion, bottom row from distortion to context.

Perspective allows more context



Perspective Wall [Mackinlay et al. 91]

Uses (and abuses) of distortion

Often more harm than help, unless

- Builds on experience (e.g., perspective wall) and enables a particular task
- Intended to elicit response, capture attention
  - In which case it should draw attention directly to the phenomenon of interest.

Pan and zoom more familiar—and visually stable—than "rubber sheet"

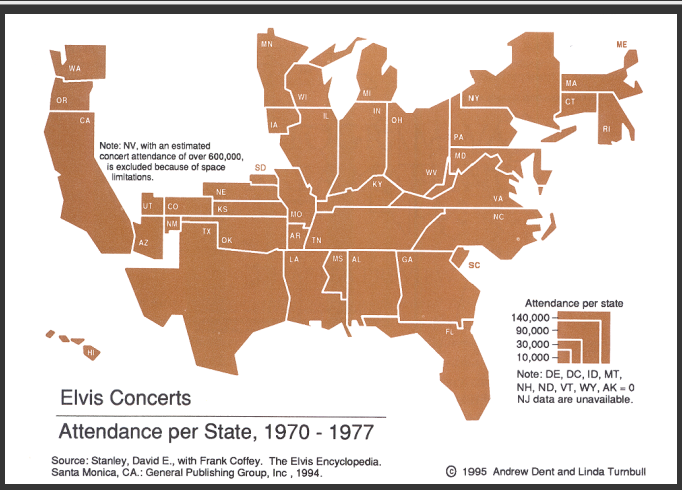
Consider F+C of data rather than view

Distortions

Transmogrifiiers [Brosz et al. 13]

http://www.transmogrifiers.org/

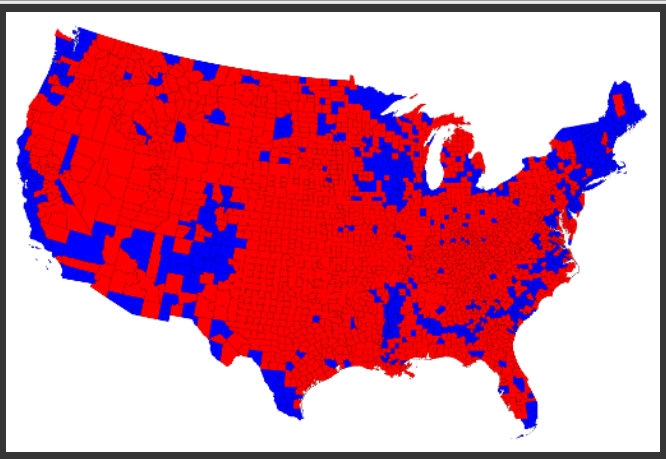
Cartograms: Distort areas



Scale area by data

[From *Cartography*, Dent]

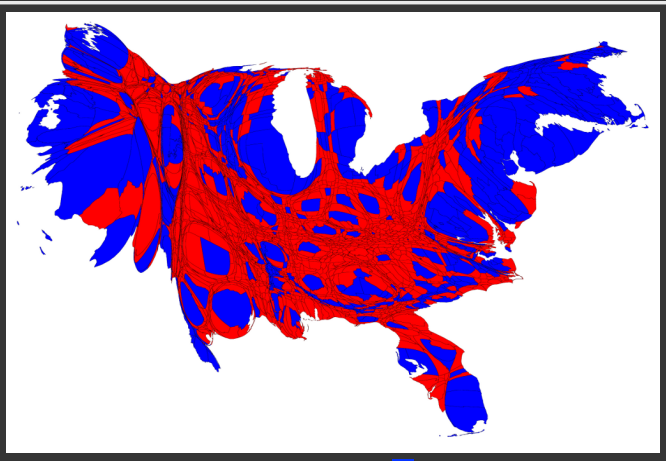
Election 2012 map



% voted democrat
% voted republican

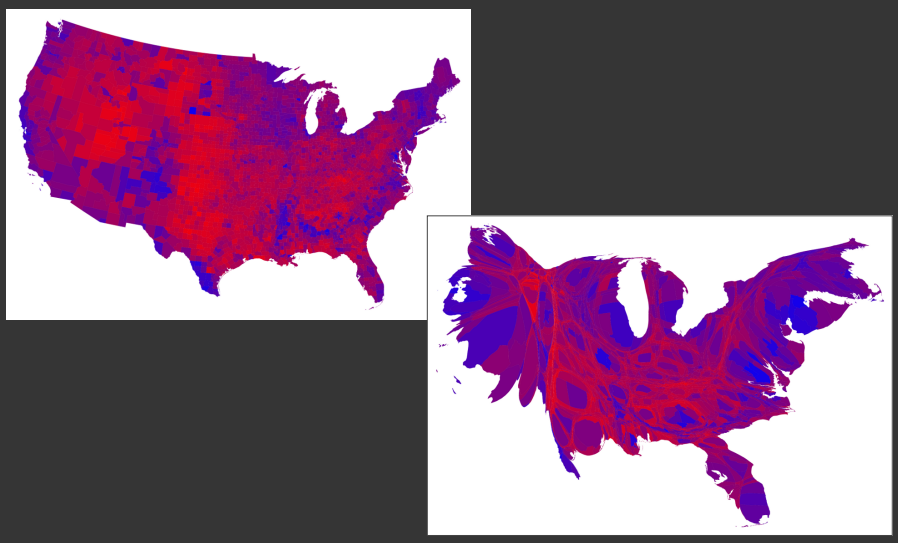
http://www-personal.umich.edu/~mejn/election/

Election 2012 map



http://www-personal.umich.edu/~mejn/election/

Election 2012 map



http://www-personal.umich.edu/~mejn/election/

Statistical map with shading

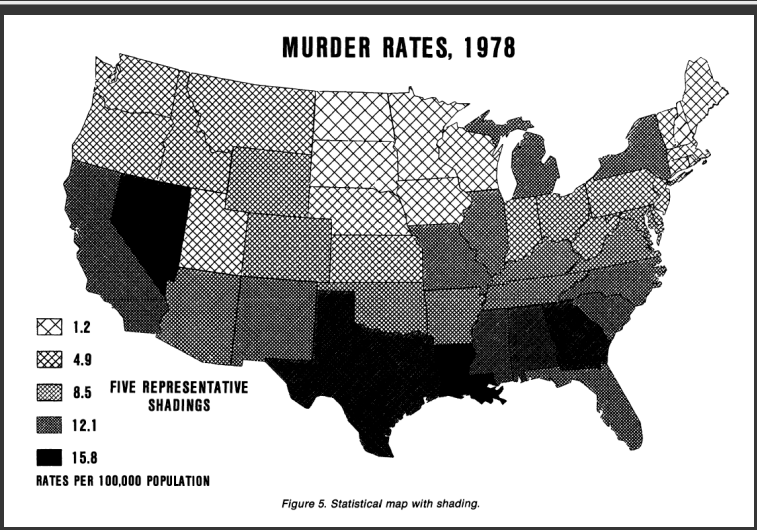
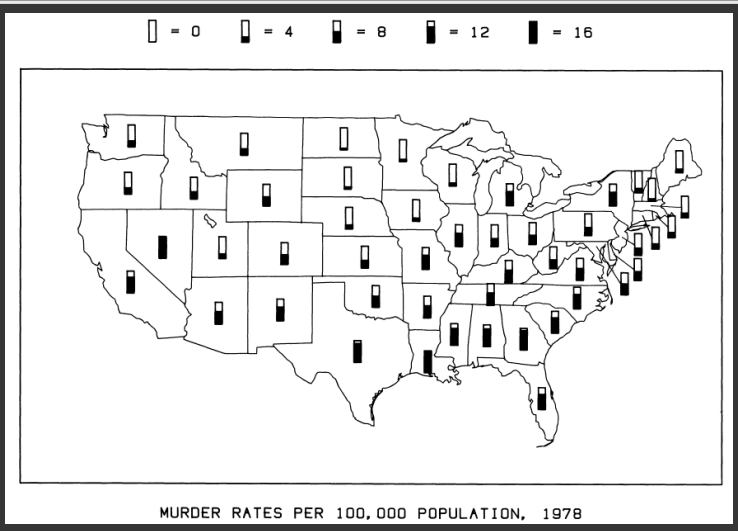


Figure 5. Statistical map with shading.

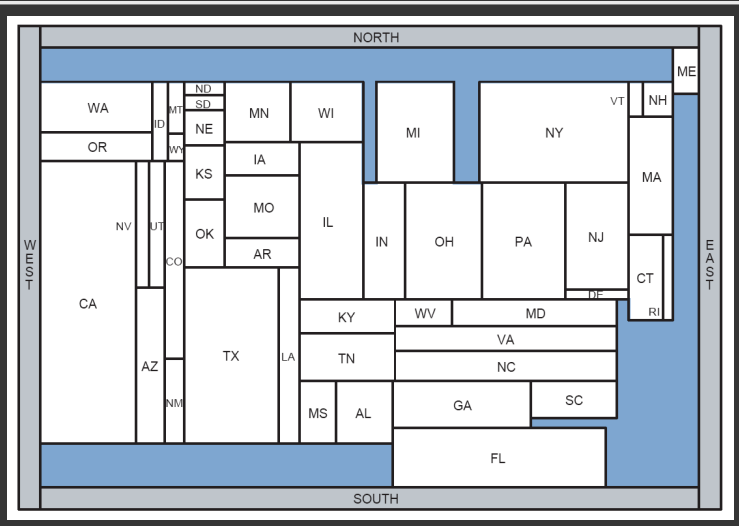
[Cleveland and McGill 84]

Framed rectangle chart



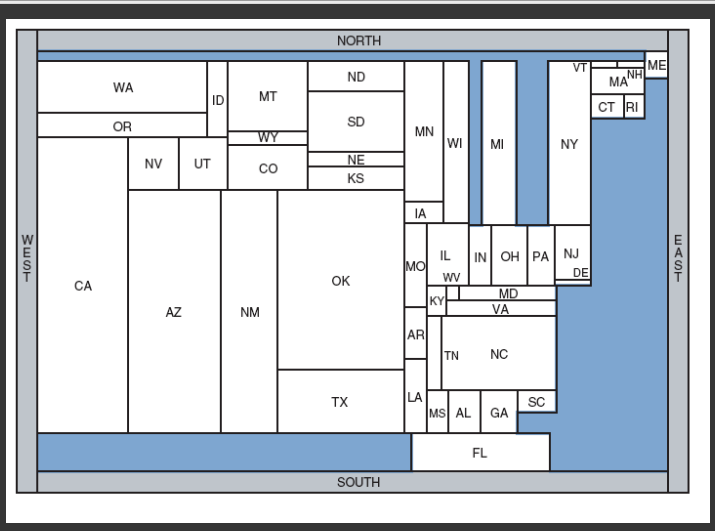
[Cleveland and McGill 84]

Rectangular cartogram



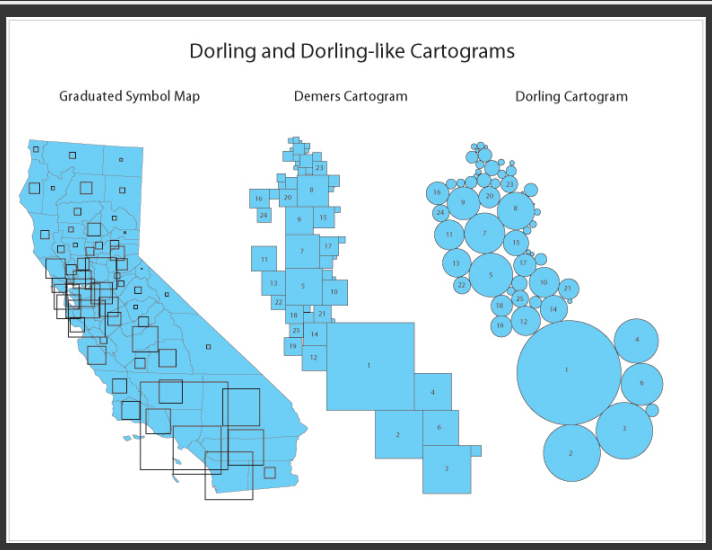
American population [van Kreveld and Speckmann 04]

Rectangular cartogram



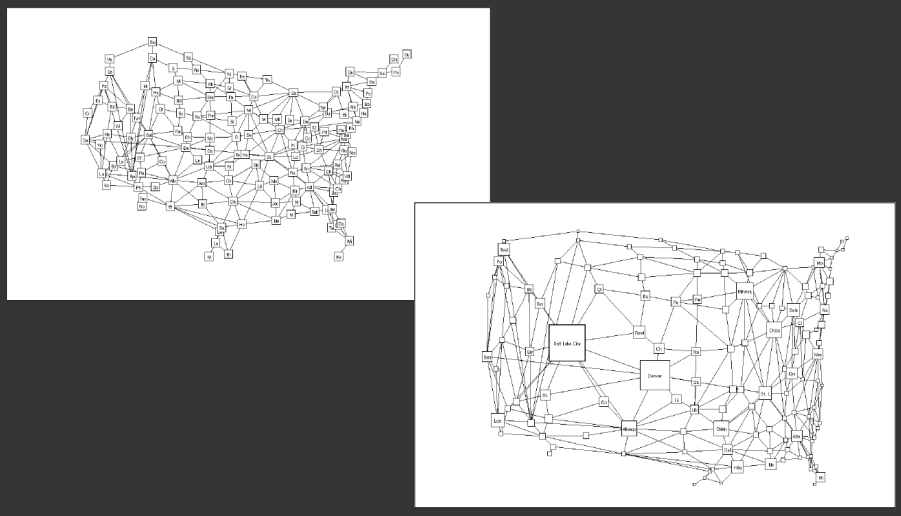
Native American population [van Kreveld and Speckmann 04]

Dorling cartogram



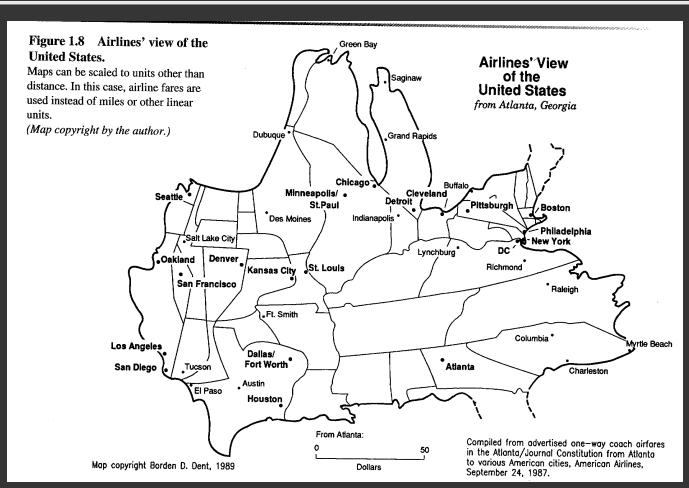
http://www.ncgia.ucsb.edu/projects/Cartogram_Central/types.html

States as nodes in a graph



Graphical fisheye views of graphs [Sarkar & Brown 92]

Distorting distances



Scale distance by data

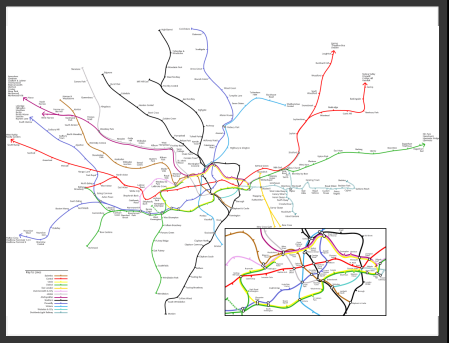
[From *Cartography*, Dent]

London underground

http://www.thetube.com/content/history/map.asp

Comparison to geographic map

Distorted



Undistorted

Announcements

Assignment 3: Dynamic Queries

Create a small interactive dynamic query application similar to Homefinder, but for SF Crime Data.

1. **Storyboard interface**
2. **Implement interface and produce final writeup**
3. **Submit the application and a final writeup on the wiki**

Can work alone or in pairs

Final write up due before class on May 4, 2016

Final project

Design new visualization method (e.g. software)

- Pose problem, Implement creative solution
- Design studies/evaluations less common but also possible (talk to us)

Deliverables

- Implementation of solution
- 6-8 page paper in format of conference paper submission
- Project presentations presentations

Schedule

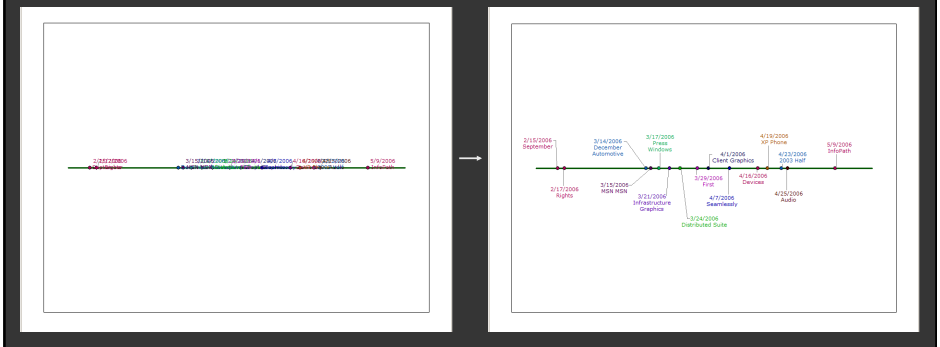
- Project proposal: 5/11
- Project progress presentation: 5/23 in class (3-4 min) slide presentation
- Final poster presentation: likely 6/3 evening
- Final paper: TBD

Grading

- Groups of up to 3 people, graded individually
- Clearly report responsibilities of each member

Spatial Layout

Example: Timeline label layout

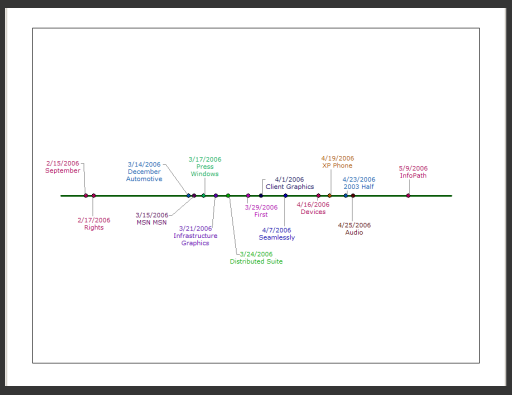


Problem

Input: Set of graphic elements (scene description)

Goal: Select visual attributes for elements

- **Position**
- Orientation
- Size
- Color
- …



Approaches

Direct rule-based methods

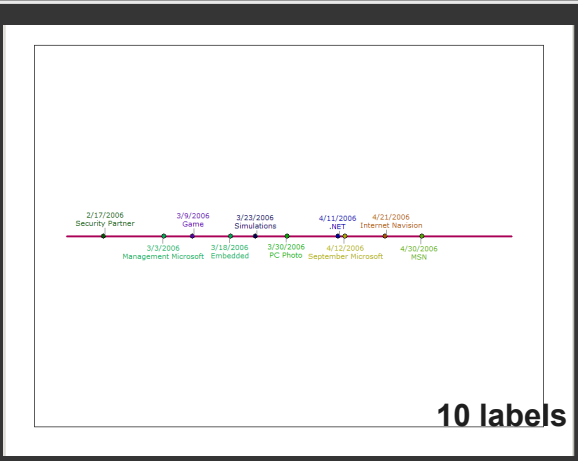
Constraint satisfaction

Optimization

Example-based methods

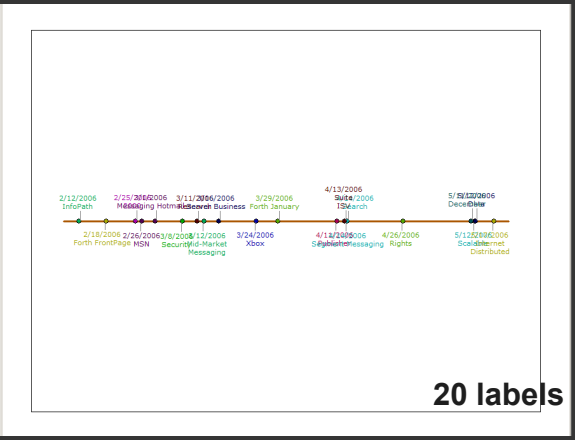
Direct Rule-Based Methods

Rule-based timeline labeling



- Alternate above/below line
- Center labels with respect to point on line

Rule-based timeline labeling



- Alternate above/below line
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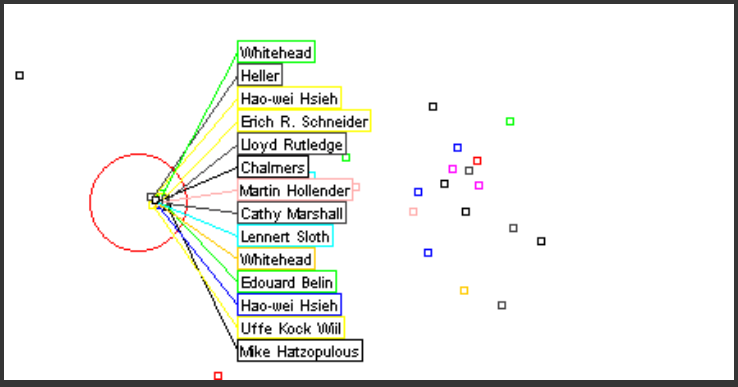
Excentric labeling [Fekete & Plaisant 99]



http://www.cs.umd.edu/hcil/excentric/