Week 6: Rules of Thumb, Networks
Discussion: Bringing It All Together

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• Rules of Thumb, Networks
• Discussion: Vis in the News – recent articles
• Break
• Evaluations – 1B be outside room
• Lab – Start on final assignment – I’ll circulate to answer questions about any/all past stuff
• consolidation, not new material

Now

Structure: Revised plan
• 85% Assignments (6 of them)
  – Lab 1: 15%
  – Lab 2: 15%
  – Lab 3: 10%
  – Lab 4: 10%
  – Lab 5: 10%
  – Lab 6: 25% (two weeks to complete)
• 15% Participation
  – The lowest of the first five lab marks will be dropped.

Rules of Thumb
• No unjustified 3D
  – Power of the plane
  – Disparity of depth
  – Occlusion hides information
  – Perspective distortion dangers
  – Tilted text isn’t legible
• No unjustified 2D
  – Eyes beat memory
  – Resolution over immersion
  – Overview first, zoom and filter, details on demand
  – Responsiveness is required
  – Function first, form next

No unjustified 3D: Power of the plane
• high-ranked spatial position – planar spatial position – not depth!
  (Magnitude-Channels/Ordered Attributes)
  Position on common scale
  Length (2D)/Width (3D)
  Area (2D)/Depth (3D position)

No unjustified 3D: Danger of depth
• we don’t really live in 3D: we see in 2.5D
  – acquire more info for depth slower, from head/body motion

No unjustified 3D: Tilted text isn’t legible
• text legibility – for worse when tilted from image plane

Occlusion hides information
• occlusion
• interaction complexity

Perspective distortion loses information
• perspective distortion – interferes with all size channel encodings – power of the plane is lost!

3D vs 2D bar charts
• 3D bars never a good idea!

No unjustified 3D example: Time-series data
• extruded curves: detailed comparisons impossible

No unjustified 3D example: Transform for new data abstraction
• derived data: cluster hierarchy
• juxtapose multiple views: calendar, superimposed 2D curves

No unjustified 3D: Shape perception
• benefits outweigh costs when task is shape perception for 3D spatial data
  – interaction navigation supports synthesis across many viewpoints

3D needs very careful justification for abstract data
– enthusiasm in 1990s, but now skepticism
– be especially careful with 3D for point clouds or networks

Eyes beat memory
• principle: external cognition vs. internal memory
  – easy to compare by moving eyes between side-by-side views
  – harder to compare visible item to memory of what you saw
• implications for animation
  – great for choreographed storytelling
  – great for transitions between two states
  – poor for many states with changes everywhere
  – consider small multiples instead

Constraints
• responsiveness is required
• less important for navigation

Resolution over immersion
• overview first, zoom and filter, details on demand

Responsiveness is required
• function first, form next

Interaction complexity
• consolidation, not new material

Performance
• speed: complex designs
• accuracy: complex designs

Responsiveness is required
• function first, form next

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Perspective distortion loses information
• perspective distortion
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We can only see the outside shell of the world

[Cluster and Calendar based Visualization of Time Series Data. van Wijk and van Selow, Proc. InfoVis 99.]
Overview first, zoom and filter, details on demand
• influential mantra from Shneiderman
• overview = summary

Responsiveness is required
• three major categories
  – 0.1 seconds: perceptual processing
  – 1 second: immediate response
  – 10 seconds: brief tasks
• importance of visual feedback

Change blindness
• if attention is directed elsewhere, even drastic changes not noticeable
  – door experiment
• change blindness demos
  – mask in between images

Function first, form next
• start with focus on functionality
  – straightforward to improve aesthetics later on, as refinement
  – if no expertise in-house, find good graphic designer to work with
• dangerous to start with aesthetics
  – usually impossible to add function retroactively

Further reading
  – Chap 6: Rules of Thumb
  – Chap 12: We Have Time Requirements

Eyes beat memory example: Cerebral
• small multiples: one graph instance per experimental condition
  – same spatial layout
  – color differently by condition

Why not animation?
• disparate frames and regions: comparison difficult
  – as contiguous frames
  – as small region
  – as coherent motion of group
• safe special case
  – animated transitions

Resolution beats immersion
• immersion typically not helpful for abstract data
  – do not need sense of presence or stereoscopic 3D
• resolution much more important
  – pixels are the scarcest resource
  – desktop also better for workflow integration
• virtual reality for abstract data very difficult to justify

Idiom: sfdp (multi-level force-directed placement)
• data
  – original network
  – derived cluster hierarchy stop it
• considerations
  – better algorithm for some encoding technique
  – some fundamental use of space
  – hierarchy used for algorithm speedup but not shown explicitly
  – more on algorithm vs encoding in aftermath
• scalability
  – nodes, edges: 1K-10K
  – hard problem eventually hits

Idiom: adjacency matrix view
• data: network
  – transform into same data/encoding as heatmap
  – derived data: table from network
  – query attributes
  – weighted edge between nodes
  – 2 valued attributes: node list x 2
• visual encoding
  – cell shows presence/absence of edge
• scalability
  – 1K nodes, IM edges

Idiom: radial node-link tree
• data
  – tree
  – 1 quant attr as leaf nodes
• encoding
  – point node marks
  – radial axis orientation
  – angular proximity edges
  – distance from center: depth in tree
• tasks
  – understanding topology, following paths
• scalability
  – 1K-10K nodes

Idiom: treemap
• data
  – tree
• encoding
  – size encodes quant attr
• tasks
  – query attributes at leaf nodes
• scalability
  – IM leaf nodes

Arrange networks and trees
• visual encoding
  – link connection marks, node point marks
  – node size
  – textual
  – interactive, no trained reading
• tasks
  – explore topology, locate paths, clusters
  – scalability
  – node/edge density E = 4N

Connection vs. adjacency comparison
• adjacency matrix strengths
  – predictability, scalability supports reasoning
  – some topology tasks trainable
• node-link diagram strengths
  – topology understanding, path tracing
  – interactive, no training needed
• empirical study
  – node-link best for small networks
  – matrix best for large networks
  – if task doesn’t require topological structuring

[Shneiderman, Cerebral]
Tree drawing idioms comparison

• data shown
  – link relationships
  – tree depth
  – sibling order

• design choices
  – connection vs containment link marks
  – rectilinear vs radial layout
  – spatial position channels

• considerations
  – redundant? arbitrary?
  – information density?
  – avoid wasting space

Further reading
  – Chap 9: Arrange Networks and Trees


Further reading
  – http://www.thefunctionalart.com/
  – great blog
  – coming soon: The Truthful Art
  – great data journalism visualization resources

• Communicating Data with Tableau. Ben Jones. O’Reilly 2014
  – for more on Tableau
  – (also, LAVA Hackathon Oct 24-25

Discussion
• 156 families
  – analysis vs presentation

• chicken/coffee maps

• Canadian elections

• what else?

Lab/Assignment 6
• putting it all together
  – find or create a newsworthy dataset
  – don’t reuse one you used in a past lab
  – create Tableau visualization(s) visualizing it
  – at least one static
  – at least one linked/interactive
  – write up story suitable for public consumption, featuring your visualization at its heart
  – upload your viz to Tableau public so that you can embed the interactive material in your story
  – in separate document, write up design rationale and reflections
  – note that you have two weeks
  – due Tue Nov 3 9am

• Break

• Evals