Design Iteration & Memorable Visualizations

Today

• Today’s Crayon Exercise
• Mini-Presentations
  – Courtney, Jorel, others?
• Reading for Today
• Reading for Next week & Next Assignment
Today’s Crayon Exercise:
Feedback & Revision!

- Form a team of 3, at least 1 person you have not worked with before. Also at least one person needs a laptop to look at LMS posts, etc.
- Each person spend 2 minutes and pick one of the more polished visualizations from their own homework this term
- Show your visualization to the other 2 people, and provide the minimum introductory explanation necessary to understand the purpose & data display
- Then, listen as the other 2 people discuss the strengths and limitations of the visualization. The author of the visualization should not talk here!
  - What is most effective about the visualization?
  - What may be confusing about the style of the visualization?
  - What could been done differently?
- Based on this feedback, the original author should propose and sketch 1 moderate-size change to the visualization style
  - Submit the “before” (HW image) & “After” (crayon sketch) & a few bullet points summarizing the feedback

How to Solicit Useful Feedback

- Welcome criticism
  - Avoid becoming defensive
  - Remember you’re looking for feedback, not just approval
- Listen carefully & Listen actively
  - Seek to understand accurately
  - Ask for clarification
- Don’t decide [accept/dismiss] the feedback right away
  - Write it all down, and sort through it after you take a break
- Have a hypothesis
  - Be prepared for feedback
- Consider having a focus for feedback
  - Direct the conversation

Some material from: http://oregonstate.edu/instruct/comm440-540/criticism.htm
How to give Constructive Feedback

- Understand why and on what you are giving feedback
- Be direct & sincere
- Emphasize observation, rather than evaluation
  - Describe what you see, use “I” statements
- Invite collaborative discussion rather than just giving advice
  - Present criticism that allows the other party to make decisions
- Avoid overload the person, don’t give more feedback/criticism than he/she can handle at this time
- Include positive feedback and areas for improvement

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Readings for This Week:

• “Stacked Graphs – Geometry & Aesthetics”
Lee Byron & Martin Wattenberg, IEEE TVCG 2008
• “Engaging & polarizing graphic”, emotional
  - It’s unusualness for The Times was part of the appeal!
  - Internet feedback was a large part of paper, w/ vulgar language ;(, seemed unprofessional
  - Cannot measure “organic and emotionally pleasing”, proper analysis of comments beyond ‘some people liked it/some did not’ was not attempted/difficult/impossible
  - yes... not there is “sentiment analysis”, from NLP
• “Listening History was created by the first author for a class project at Carnegie Mellon University.”
• “A rigorous content analysis of these comments is beyond the scope of this paper.”
• Layout
  - Tufte’s macro/micro: show both the sum and the individual values
  - Minimize “wiggle” of extremes & middle curves, thicker layers weighted more highly
  - Keep graph centered (don’t drift up or down)
  - Border/space between layers? If required by media
  - Labels are important
  - Interaction is good

• Colors
  - Natural & pleasing, not too loud or distracting
  - For a particular dataset is it necessary to match disjoint regions by color?
  - Choose color from relevant 2D axes mapped to color & saturation
  - Don’t all need to be unique, aren’t limited by # of distinguishable colors
• Local contrast
  - Display data, e.g., time of onset, popularity,
  - Bias color selection to keep image balanced
• Order
  - Sort by time of offset or “measure of volatility”
  - Generally alternating top & bottom seems to be best
  - Entrance position discussion interesting
• This is not a black box one-size-fits-all visualization technique. It requires thought to choose colors & tweak layout. It won’t work for all data.
  - Difficult for newbies - no clear, straightforward solution/guidance for layout or color
  - Waviness of output appropriate for music data
• Anecdotal evidence rather than controlled studies
• Paper started off as a story or documentary rather than an academic paper, too casual? Strange
  — Internet comments were spot on
  — Connection between designers and consumers is exciting!
  — Motivation was very good and complete before the technical details started
• Abstract was awkward talking about an image that wasn’t right there
• Layer ordering strategy was too simple
• Insufficient comparison images within the paper (copyright thing? page limit? assumed to be “common knowledge”?)
• Personalized visualizations are cool
• Purpose of this visual: to look cool & be engaging & draw interest or to scientifically measure & conclude things?
• Some sloppy figure callouts/captions/labels. Some captions too short. Why was this image included? Need to do more than just describe the source of the data
• Vertical vs horizontal: horizontal most appropriate for time data.

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Reading for Next Week: (choose one)

• “LabelMe: online image annotation and applications”
  Torralba, Russell, & Yuen, IEEE, 2010

![LabelMe Image](image.png)

Reading for Next Week: (choose one)

• “QSplat: A Multiresolution Point Rendering System for Large Meshes”,
  Rusinkiewicz & Levoy,
  SIGGRAPH 2000

![QSplat Image](image.png)
Homework Assignment 6 & 7: Interaction & User Interfaces

• Make a visualization with interesting, non-trivial user interaction
  – Your primary focus this week is on implementation. Try a new toolkit if needed, recommendations: d3, OpenGL (if you already know it), Processing, OpenFrameworks, VTK
  – You are encouraged (but not required) to team up with a classmate for this assignment, and to work with someone you haven't already worked with.
• Describe your interaction design and technical implementation details and challenges
• Submit a public url (if webbased), or a video or a sufficiently detailed sequence of screenshots
• Focus: Visualization Execution (primary)
  Visualization Design (secondary)
• Consider this a 1.5 week assignment (since we have gotten a bit behind)
  For Monday’s HW6, you need to make a short LMS post with your plan for this homework. For the following Tuesday’s HW7 you need to present the results.

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What Makes a Visualization Memorable?

- **Related to:**
  - What makes a visualization engaging?

But not the same as:
- What makes a visualization comprehensible?
- What makes a visualization effective?

- **Graph-type, color, aesthetics, context, & individual biases influence cognitive workload & retention**
- **Collected 2070 static visualizations**
  - “scraped” many online data sources, could only do what was possible to automate, while avoiding duplicates, etc.
  - Annotated by undergrads who had taken a visualization course
- **Categorized by type** (area chart, bar chart, line graph, maps, diagrams, point plots, tables, etc.)
- **Labeled by data-ink ratio & visual density**
- **Other labels:** dimension (2D, 3D), single or multi-panel/combination, pictogram, time series, B&W/# of distinct colors, human recognizable objects
Mul0-­‐panel visualiza0ons are necessary when explaining a concept or story (esp. when standing alone w/o an article)

Scientific publications have lots of diagrams

News & government use lots of bar charts & other common charts. Government uses lots of circle charts.

Tree & network diagrams only appear in scientific & infographic publications. Grid & matrices primarily scientific.

Fig. 2. Breakdown of visualization categories by visualization sources based on 2,070 single, static visualizations.

H.1 Participants will perform worse (i.e., overall have a harder time remembering visualizations) as compared to natural images/photos.

H.2 A visualization is more memorable if it includes a pictogram or cartoon of a recognizable image.

H.3 A visualization is more memorable if there is more color.

H.4 A visualization is more memorable if it has low visual density.

H.5 A visualization is more memorable if it is more “minimalist” (i.e., “good” data-ink ratio).

H.6 A visualization is more memorable if it includes a “familiar” visualization type (i.e., basic graph type taught in school).

H.7 A visualization is less memorable if it comes from a scientific publication venue.
• Selected ~400 visualizations
• Had 261 Mechanical Turk users play a memory game: watch a sequence of visualizations, press a key if you see a visualization repeat
• Subjects were paid for each “level” of the memory game they completed. Each level had 120 images and took ~ 5 minutes to complete. Image shown for 1 second, 1.4 second blank screen before next image appears
• Lots of checks to make sure Turks were skilled and taking the task seriously

Top Ten: Infographic
Top Ten: News Media

What Makes a Visualization Memorable?; Borkin, Vo, Bylinskii, Isola, Sunkavalli, Oliva, & Pfister, INFOVIS 2013

Top Ten: Scientific Publications

What Makes a Visualization Memorable?; Borkin, Vo, Bylinskii, Isola, Sunkavalli, Oliva, & Pfister, INFOVIS 2013
Top Ten: Government/World Organization

• Visualizations were more memorable with:
  – Pictograms
  – Low data-to-ink, high visual density (more chart junk & clutter)
  – lots of color (at least 7 colors)
  – Unique visualizations (e.g. diagrams)  
    [vs. common visualizations (e.g. bar chars)]
  – Grid/matrix, trees & networks
  – Natural objects “Natural looking” (??)
  – Round edges/circles
  – Scientific & infographic (content or source author?)  
    [government & world organization visualizations]
• Some visualizations are specifically and carefully designed to be engaging, eye-catching, and memorable (Visualization vs. Advertising?)

• Some sources of visualization are required to conform to the source’s overall presentation style (thus lacks uniqueness)

• Visualization creators don’t just want a visualization to be memorable, they need the purpose of the visualization to be memorable.

• Future work
  – Want to do more fine-grained study of memorability
  – Break into subcategories

What Makes a Visualization Memorable?, Borkin, Vo, Bylinskii, Isola, Sunkavalli, Oliva, & Pfister, INFOVIS 2013