Presentation:
Design, Organization, Simplification, Photography, Website Design, User Interface Design, ...

Today

• Selection of Results from Assignment 2
• Photography tips
• Principles of Effective Website Design
• Principles of Good User Interface Design
• Principles of Good Visualization Design
• “Useful Junk? The Effects of Visual Embellishment on Comprehension and Memorability of Charts”
Figure 2.1: MG-RAST infrastructure drawn with GraphViz
The class graph, with bolded lines for people who knew each other before, normal lines for roommates, dashed lines for meeting in DS, and dotted lines for meeting at RPI.
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  - Canonical Viewpoints
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Figure 1: Visualizations of the class social network data using a collection of Graphviz graph drawing programs. Red lines represent "before RPI" connections, blue represent "lived with" connections and black represent "Data Structures" connections.
“Canonical” Viewpoints

• From Dictionary.com:
  – authorized; recognized; accepted
  – the body of rules, principles, or standards accepted as axiomatic and universally binding in a field of study or art: the neoclassical canon
  – a fundamental principle or general rule: the canons of good behavior
  – a standard; criterion: the canons of taste

“What object attributes determine canonical views?” Blanz, Tarr, & Bulthoff, Perception 1999
Suppose you were making a brochure and you tried to give your customers the best possible impression of the objects shown on the static page. Which views would you choose?

• Salience and significance of the features
• Stability of viewpoint to small transformations
• Minimize number of occluded features
• Familiarity, Functionality, Aesthetic criteria
Rule of Thirds


- align subject with guide lines and intersection points, discourage placement of the subject at the center
- placing the horizon on the top or bottom line, avoid dividing picture in half
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Principles of Effective Website Design

- Guiding the eye (position, color, contrast, size, design elements)
- Spacing, padding, white/empty space, reduce cognitive load
- Navigation/orientation
- Typography (font, size, color, paragraphs)
- Usability/standards/conventions be obvious, “Don’t make users think”
- Consistency
- Alignment, polished, simplicity
- Effective writing
- Clarity, sharpness, contrast exaggeration

http://psd.tutsplus.com/tutorials/designing-tutorials/9-essential-principles-for-good-web-design/
http://uxdesign.smashingmagazine.com/2008/01/31/10-principles-of-effective-web-design/
Principles of Good User Interface Design

- **Consistency and standards**
  - Match real world: words, phrases and concepts familiar to the user, real-world conventions, natural and logical order, coherency
- **Flexibility and efficiency of use**: cater/tailor to both inexperienced and experienced users
  - Know your user, user testing, listen to the user
- **User control and freedom**: clearly marked "emergency exit" to leave the unwanted, support undo and redo
- **Aesthetic and minimalist design**: every extra unit of information competes with and diminishes visibility of relevant information
  - System status: keep users informed
- **Recognize, diagnose, and recover from errors**
  - Error prevention: good error messages, eliminate error-prone conditions, confirmation option
- **Help and documentation**
  - Recognition rather than recall: information/instructions should be visible or easily retrievable

http://www.useit.com/papers/heuristic/heuristic_list.html

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- Principles of Effective Website Design
- Principles of Good User Interface Design
- **Principles of Good Visualization Design**
  - **Scientific Visualization vs. Information Visualization**
  - Simple clean design vs. “Chart Junk”
  - Managing & leveraging huge amounts of data
  - Understanding your Audience
    - E.g., Visualization for Science, Communication, Education, Debugging, etc.
  - Importance of companion text (title, axis labels, legend, caption)
  - Targeting visualization design to human perception & low-level vision processing
- “Useful Junk? The Effects of Visual Embellishment on Comprehension and Memorability of Charts”
Paul Butler
http://www.facebook.com/notes/facebook-engineering/visualizing-friendships/469716398919

http://www.ptable.com/
- **Scientific Visualization (SciVis)**
  - really large quantities of data
  - data that has inherent structure
  - often has a spatial and/or temporal component
  - often appropriate to use of 3D visualization techniques
  - such as medical, hurricane, CFD data
- **Information Visualization (InfoVis)**
  - smaller datasets
  - data that does not have an inherent structure
  - financial stock market data, demographic census data, genetic data, etc.
- **Visual Analytics**
  - involves a cycle of rapidly creating visualizations to answer and generate new questions about a dataset
- **Infographics**
  - typically in the realm of InfoVis, and often they show the results of the visual analytics process, but SciVis is not really a part of most infographics.
- **Annual IEEE Visualization and IEEE InfoVis (Information Visualization) conferences are two separate entities. The set of people organizing, attending and involved one conference is almost disjoint from the other set.**

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**Active Forces II**
Number of soldiers per 100,000 people

- North Korea 4,711
- Eritrea 4,012
- Israel 2,482
- Djibouti 2,064
- Iraq 2,045

**Information is Beautiful.net**

source: Guardian Datablog, milexdata.sipri.org 2008
http://www.gatesnotes.com/Health/Most-Lethal-Animal-Mosquito-Week

http://www3.gehealthcare.com/en/Products/Categories/Healthcare_IT/Quality_Management#tabs/tab1900328377C74CAC8AD7E8D4A2072591
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National Telecommunications and Information Administration, October 2003.  
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Week of Jan 23, 2012

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http://sis.rpi.edu

These charts show movie character interactions. The horizontal axis is time. The vertical grouping of the lines indicates which characters are together at a given time.

LORD OF THE RINGS

http://imgs.xkcd.com/comics/movie_narrative_charts_large.png
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https://www.scienceworksmuseum.org/Files/The%20Great%20Tree%20of%20Life%20Poster.pdf
First name
BEGINs WITH (vertical axis)
ENDS WITH (horizontal axis)

Are some letters more feminine or masculine?

Names beginning with 'W'
are usually male, while
names ending with 'A' are
usually female.

Hardly any names end in 'J',
'Q', or 'U'.
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What is “Chart Junk”

• Extraneous elements in a chart or visualization
• Does not represent data
• Data-to-ink ratio (aim to convey more data with less ink)
• According to Edward Tufte: It’s not just unnecessary, it’s harmful (distracting)
• According to Nigel Holmes: Visualization should engage the reader’s interest

Reading for Today

• “Useful Junk? The Effects of Visual Embellishment on Comprehension and Memorability of Charts” Bateman et al., CHI 2010.

• Article discussed here: http://eagereyes.org/criticism/chart-junk-considered-useful-after-all
Study Design

• Compare embellished charts to plain ones
• Measured:
  – interpretation accuracy
    *was no worse for embellished charts*
  – long-term recall (2-3 weeks later)
    *was better for embellished charts,
      topic & details of the chart were more memorable*
• Prior work:
  – Higher data-to-ink ➔ faster response & greater accuracy
    [Gilan & Richman]
  – Other work shows a somewhat weak correlation between
    data-to-ink and interpretability or aesthetics
• Author’s caution:
  – Not an endorsement of chart junk
  – Embellishments can lead to bias!

• Relatively small sample pool
  – 10 tested with ~5 min recall
  – 10 tested with 2-3 week recall
• Found no difference in time to read & describe
  embellished vs. non-embellished
• Participants preferred the embellished charts and
  found them more attractive

“Useful Junk? The Effects of Visual Embellishment on
Comprehension and Memorability of Charts” Bateman,
Mandryk, Gutwin, Genest, McDine, & Brooks, CHI 2010
• Viewing time was unlimited for this study
  – Participants ended up spending the “same amount of time on embellished vs. non-embellished
  – Effect of limiting time not measured

• Chart junk for these examples was tightly coupled with subject & details of chart
  – Quote from Holmes: “I think [Tufte] missed the point of much that I was trying to do: TIME magazine charts were aimed at lay readers, not unintelligent ones, but busy ones. I knew they’d get the point quicker if they were somehow attracted to the graphic.”

• What about charts from paper on last slide? What was their point? How good is your recall? Will your recall them in 2-3 weeks? Why didn’t the authors use embellishment?

• When to use embellishments?
  – Don’t overdo it, don’t clutter
  – Only if they are well-executed (requires skill & time)
  – Can this be automated? An ‘embellish’ button in Excel?
  – Embellishment shouldn’t negatively affect the use of other good design principles (e.g., color choice)

• Paper was highly experimental
  – To some, conclusion wasn’t shocking (predicted the outcome before reading it)
  – To others, some of the results were surprising
  – Benefit to having it proven scientifically

• Bias
  – Even the title of an illustration (not just embellishments) can cause bias
  – Choosing to present data (or not) and how is already introducing bias

• More research is necessary...
  – Not enough people. What is appropriate sample size? (ANOVA?)
  – Only studied chart embellishments of single designer
  – What about color blind users?
  – What about less extreme/exaggerated embellishments? (unfair choice to users, should have middle choice)
  – Examples of charts with embellishments that are not relevant to the data?

• Can embellishments really improve comprehension?
  – Paper neglects “readability” of chart.

• Simple chart embellishments might trivialize and stereotype the topic
“Info Chart” vs. Visualization?

http://ngm.nationalgeographic.com/big-idea/05/carbon-bath
http://nigelholmes.com/graphic/carbon-bathtub/

Reading for Friday

Homework Assignment 3: due Thursday @ 11:59pm

Intro to (Web-Based) Interaction

- Explore the examples on the D3: Data-Driven Documents
- [http://d3js.org/](http://d3js.org/) website (download the examples, modify them, start to read the documentation)
- Make an interactive (visualization) artifact:
  - Depends on your level of prior experience with Web Development tools (if you’re already a D3 expert, you can choose another new-to-you tool)
  - Purpose: Can be silly & possibly exemplify our “bad visualization” traits (pie charts, chart junk, etc.)
  - Types of “interaction” may include:
    - pop up text messages
    - data hide/reveal/emphasize/restructure
    - font/size/color/transparency change