Miscellaneous

Today's Class

- Sign up for Final Project Presentation Slots
- Quiz on Friday
- Today's Readings
  - "Scatterplots: Tasks, Data, and Designs" Sarikaya & Gleicher, InfoVis 2017
  - "Guidelines for Effective Usage of Text Highlighting Techniques", Strobelt et al.
  - "What Makes a Visualization Memorable?", Borkin, Vo, Bylinskii, Isola, Sunkavalli, Oliva, & Pfister, INFOVIS 2013.
- User Study of your Final Project / Progress Post #3

Final Project Presentation Schedule

Tue Apr 24

2:00 Evan & Tim

2:20 Alec & Alexandra

2:40 *Noah*

2:52 Jerry & Justin

3:12 Helen & Shreya

3:32 *Garret*

3:44 done!

Fri Apr 27

2:00 Peter & Gavin

2:20 Alex & Valerie

2:40 *Richard*

3:52 Annie & Lorelei

3:12 Max & Glenn

3:32 *Karan*

3:44 Casey & Euan

4:04 Melissa & Henry

4:24 done!

Tues May 1

2:00 Andrew & Brendan

2:20 John H. & Jared

2:40 John N. & Zeana

3:00 Madeline & Claira

3:20 Erik & Darren

3:40 Brandon & Nate

4:00 done!

10 min (individual)
+2 min questions/setup

18 min (team of 2)
+2 min questions/setup

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Quiz 2 on Friday

- Similar format to Quiz 1
- Art supplies will be provided (and/or bring your own)
- Mostly focused on Readings
- You can bring 1 page of notes
  (8.5x11, double-sided, handwritten or typed)

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“Scatterplots: Tasks, Data, and Designs” Sarikaya & Gleicher, InfoVis 2017

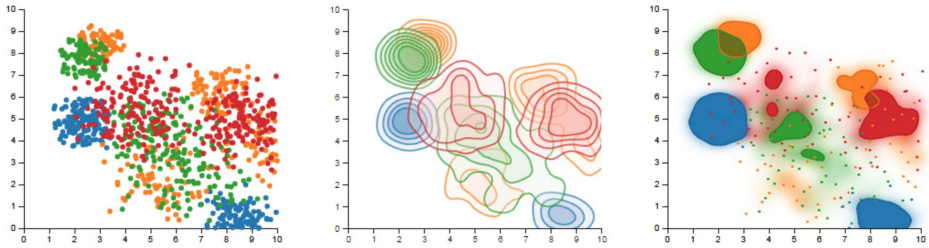

Fig. 3. Three different designs (left-to-right: traditional scatterplot, contour map [19], and Splatterplot [49]) display different information about the same 100 item, four class (mapped to color) dataset. While the traditional scatterplot exhibits some overdraw, the two alternative approaches use point grouping techniques to emphasize numerosity and distribution comparison tasks. The contour map conveys density gradients, while the Splatterplot uses thresholded regions to convey dense areas.

- Depending on viewer task:
  - Identify outliers
  - Comparing distributions
- Concerns:
  - Too much data -> Overdraw (& drawing order)
- Possible Solutions:
  - Reduce data / sampling
  - Bin the data
  - Density estimation
  - SPLOMS (scatterplot matrix) & scagnostics (scatterplot diagnostics)
- Developed taxonomy of scatterplot analysis tasks & collected range of scatterplot design decisions (survey of visualization papers)
- Developed a table of recommendations
- Some open problems remain… handling large total data sizes & large # of categories (> # of visibly distinct colors)

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"Guidelines for Effective Usage of Text Highlighting Techniques", Strobelt, Oelke, Kwon, Schreck, Pfister, IEEE InfoVis 2015

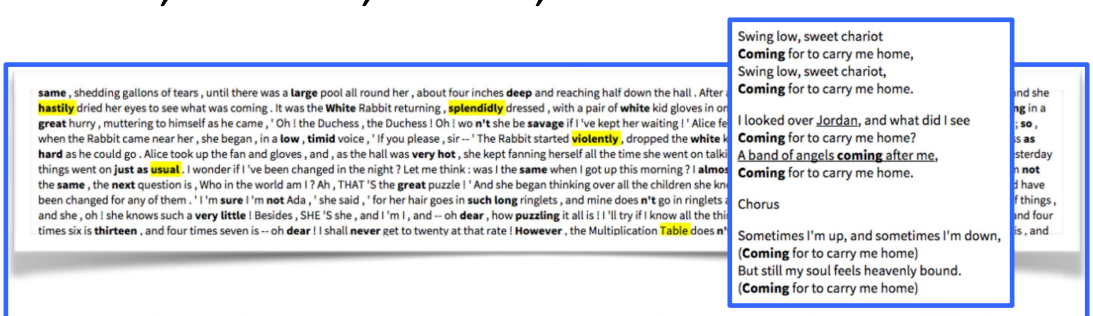

Fig. 1: Text highlighting techniques are commonly used to mark text features in documents. In this excerpt of "Alice in wonderland" all occurrences of adjectives and adverbs derived from part-of-speech tagging are highlighted in bold font, while words with typical adjective/adverb endings are highlighted with yellow background.

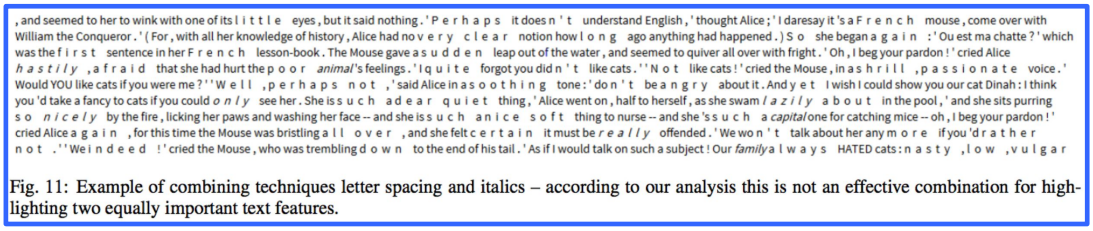

Fig. 11: Example of combining techniques letter spacing and italics – according to our analysis this is not an effective combination for highlighting two equally important text features.

- Why highlight text?
  - Make sure Data Structures students read the instructions
  - Make sure the reviewers of my paper/proposal understand my most important contributions
  - Challenge: I can't highlight everything!

thermore, the user can browse through the aggregated time bins in this window by *selecting* individual bins.

Task 3: Comparing the dynamics.
A user must also be enabled to *discover* the relationship between multiple traffic flows selected by multiple instances of Task 2. The user must *explore* and *compare* the dynamics of these traffic flows. Similarly to Task 2, we do this by *aggregating* and *annotating* the dynamics of the selected traffic flows in windows. To enable the *comparison* of selected traffic flows, the time bin selection in all windows is linked. Additionally, the user can *compare* multiple traffic flows by *arranging* their respective windows on top of each other, which automatically *aggregates* the visualization of both windows.

Task 4: Infographic-style visualizations.
In the final task, the user may want to create an infographic-style visualization, in which case a visualization is *produced* for a third party. For this task, any combination of the previous tasks may serve as input. While this task does not follow from the requirements, we find it interesting to explore, nonetheless.

Overview The user can visualize, select, and analyze traffic flows using our approach as follows: We show the user an overview of the traffic flows in a user-defined time window by combining a density map [31] with animated particles. The density map shows the spatial

From Scheepens et al.

- How/why/when do you take notes/highlight when reading?
  - Technology vs. Strategy?
  - How do you use/review your notes/highlighting?

- 9 commonly used highlighting techniques
  - How strong is the pop-out effect for each highlighting technique?
  - How much visual interference do the pairs of effects have with each other?
  - Provide guidelines for usage
- Interview NLP researchers (a target user group)
- Test effectiveness of technique
  - in isolation
  - when surrounded by distractors
  - In tasks requiring combination with another technique

Technique
- Font color
- Background color
- Underlined
- Font size
- *Font style*
- **Font weight**
- Rectangular border
- Spaced out font
- Text shadow
- Font family
- CAPITALIZATION
- ~~Strike-through~~
- * Blinking *

- Artificial text without semantics
- Required minimum screen size
- Mouse (not touchpad)
- Avoid learning curves & fatigue effect

- They screened for colorblind users…
  - But did they screen for dyslexia?
- Recommendations
  - What about the overall legibility of the text? (increased spacing seems destructive/disruptive!)

Dyslexie is a font that is altered in a way that lets people with dyslexia read better.

OpenDyslexic is a free typeface/font designed to mitigate some of the common reading errors caused by dyslexia. The typeface was created by Abelardo Gonzalez, who released it through an open-source license.[1] Like many dyslexia-intervention typefaces, most notably Dyslexie, OpenDyslexic adds to dyslexia research and is a reading aid, but it is not a cure for dyslexia.[2] The typeface includes regular, bold, italic, bold-italic, and monospaced font styles. In 2012, Gonzalez

https://en.wikipedia.org/wiki/Dyslexia

- Interviewed experts and their use cases! Great!
- Doesn't study understanding of text, just visual attention grabbing.
- Maybe surprising relative results conjunctive vs. disjunctive?
- Now curious about different colors
- Prefer techniques that are more than binary (on/off) instead have many values (e.g., color highlighting)

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

Fig. 1. **Left:** The top twelve overall most memorable visualizations from our experiment (most to least memorable from top left to bottom right). **Middle:** The top twelve most memorable visualizations from our experiment when visualizations containing human recognizable cartoons or images are removed (most to least memorable from top left to bottom right). **Right:** The twelve least memorable visualizations from our experiment (most to least memorable from top left to bottom right).

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

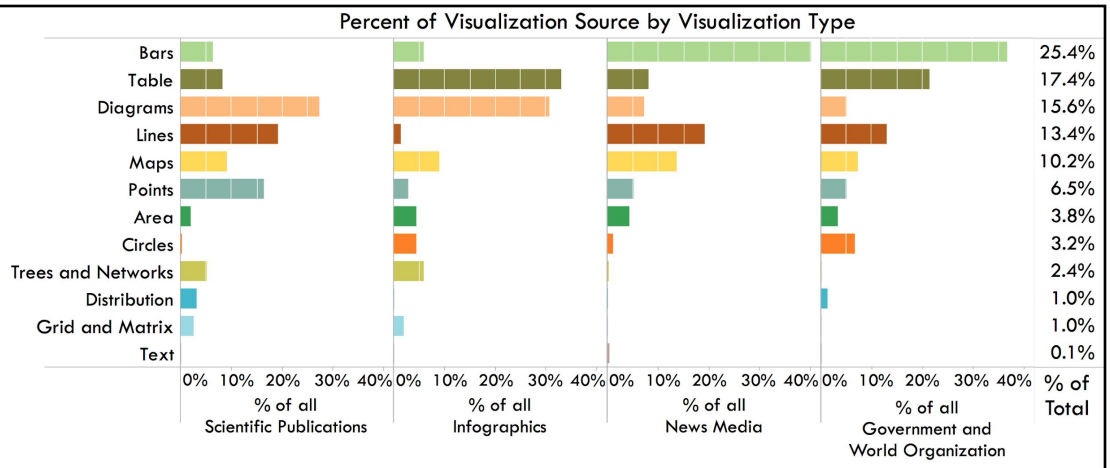


Fig. 2. Breakdown of visualization categories by visualization sources based on 2,070 single, static visualizations.

- Multi-panel visualizations 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.

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

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).

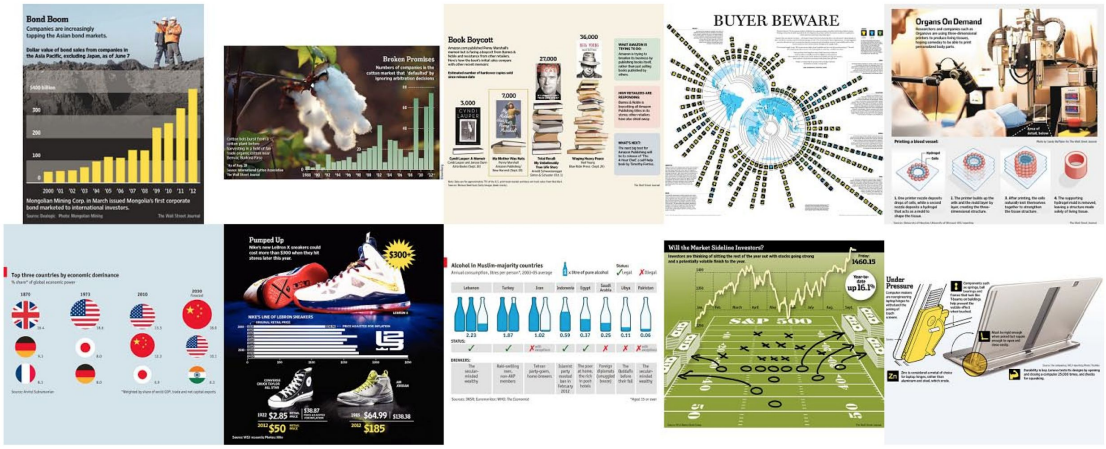
H.7 A visualization is less memorable if it comes from a scientific publication venue.

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

- 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



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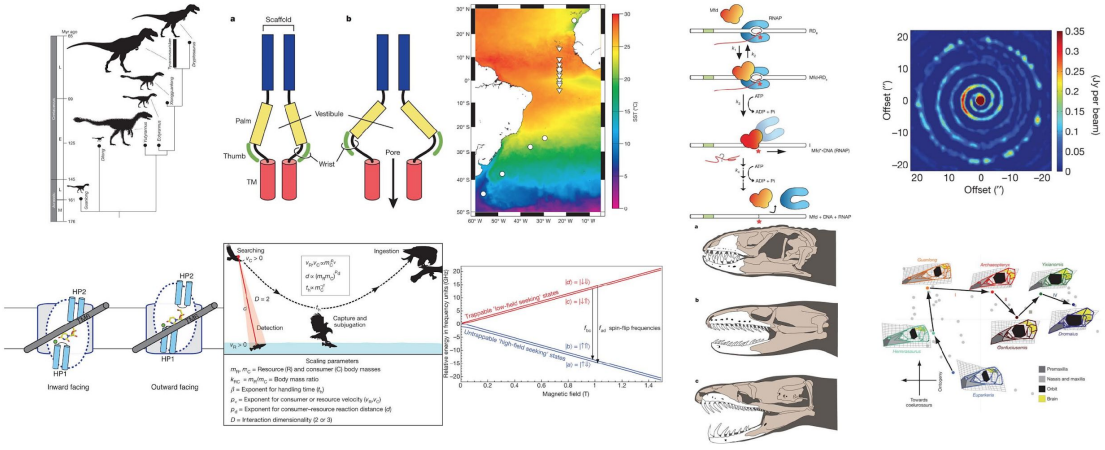
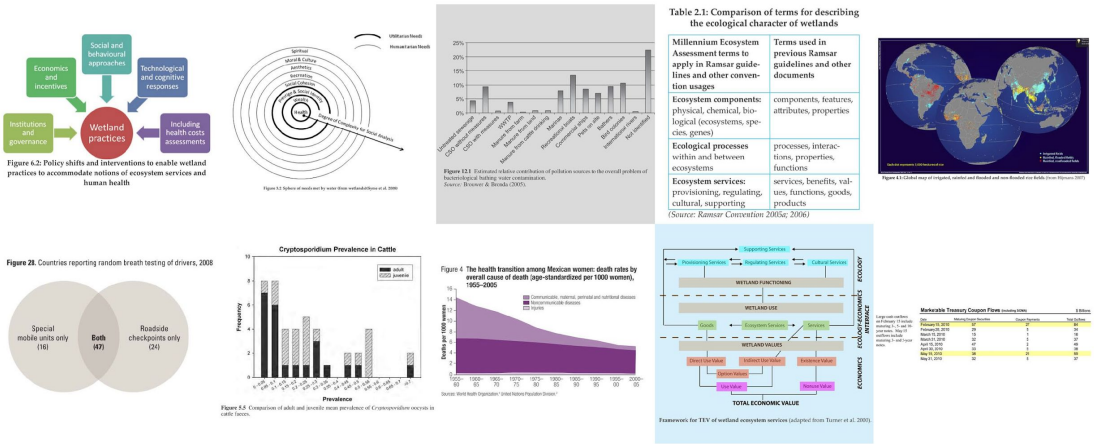
Top Ten: Scientific Publications



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

Top Ten: Government/World Organization



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

- 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]

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

- 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

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- Homework for Thursday April 19th:
  Progress Post #3: Design of a formal user study
  - Summarize the results of your "pilot study" (peer feedback) from Friday
  - If you had unlimited time/money….
    How could you validate the effectiveness of your (completed) final project?
    Be specific!

User Study Design

- Have a hypothesis(es), ask questions that relate to the hypothesis
- Compare to contemporaries
- Who are you asking for feedback? Are you asking a designer or engineer or a potential user?
- Who is your audience? Usable by novices and/or experts?
- Feelings/experiential Questions (Qualitative) vs./in addition to Quantitative
- Get more data then you think you need. Might need to separate outliers, account for other factors
- Provide clear instructions, so they know what you want them to do, have training exercise prior to actual data collection
- Sometimes limited instructions can yield more creative/unexpected usage
- If data is large, be prepared with filtering (automated) tools
- Sufficient quantity of users, different people, good representation of your target audience, Make sure they have skills/background to use the tool

User Study Design

- Why:
  - What is your research question?
  - What is your hypothesis?
- Who:
  - Details on both
    - participants &
    - researchers/observers/data collectors

    (off the street or expert?)
  - How many, age, gender, background, skills, education, physical/mental capabilities

User Study Design

- Where & When:
  - Is location/environment significant?
  - Experiment duration?
- What:
  - Prepare a detailed "script", to be read aloud to each participant
    - explain necessary background
    - explain experimental procedure/tasks
  - time to complete experiment/tasks
  - post-experiment survey questions
- What data & how will you collect the data?

User Study Design

- Think about cost (time & money), but assume you have access to the resources necessary
- Justify the importance/necessity of the proposed study design

- What do you need to convince the reviewers (& eventual readers in a class like ours…) of the significance and impact an academic paper related to your final project?