CSCI 4550/6550 Interactive Visualization

https://www.cs.rpi.edu/~cutler/classes/visualization/S24/

Lecture 21: Additional Topics

Today

- Quiz 2 - *in class April 9th*
- Optional Makeup Reading - *due April 9th @ 10am*
- Sign up for Final Project Presentation Slots
- Plan for lecture time on Friday April 12th
- Readings for Today
  - “When Red Means Good, Bad, or Canada: Exploring People’s Reasoning for Choosing Color Palettes”
  - "Exploring D3 Implementation Challenges on Stack Overflow"
  - “Guidelines for Effective Usage of Text Highlighting Techniques”
  - “What Makes a Visualization Memorable?”

Quiz 2 on Tuesday, April 9th

- During normal class time, 2-3:50pm
- No laptops/phones/watches/etc.
- 1 page (double-sided) of notes allowed, handwritten or printed
- Sample problems on the calendar
  - Note: This is the quiz from 2018 when we covered different papers!
- Crayons/colored pencils/markers will be provided

Remaining Class Schedule

	Apr 9, Quiz 2 sample problems		Apr 11, Final Project *Progress Post #3* due @ 11:59pm	Apr 12, Lecture 22: Final Project Peer Demo & Feedback Day *Pass/No Credit deadline*
	Apr 16, Final Project Presentations		Mar 18, Final Project *Written Report* due @ 11:59pm	Apr 19, Final Project Presentations
	Apr 23, Final Project Presentations	Apr 24, *Last day of classes*	Apr 25-26, *Reading days* *No classes*	
Apr 29-May 3, *Other RPI Final Exams* *(no Final Exam for Interactive Visualization)*				

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Final Project Presentation Schedule

8 min for individual + 1 min for questions, 16 min for team of 2 + 2 min for questions

Tuesday April 16th	*Friday April 19th*	*Tuesday April 23rd*
2:00	2:00	2:00
2:18	2:18	2:18
2:27	2:36	2:36
2:45	2:54	2:54
2:54	3:03	3:03
3:12	3:21	3:21
3:21	3:39	3:39
3:39	3:57	3:57
3:57 done!	*4:15 done!*	*4:15 done!*

Final Presentation

- Summarize prior work as necessary
  Assume peers know algorithms/structures/papers from lecture
- Be technical:
  What were the challenges?
  How did you solve them?
- Live demo / video / lots of images (depends on project)
  Use plenty of examples (both of success & failure)
- Teams of 2: Both should present & make it clear who did what
- Use your time wisely! Practice! & Time yourself!
  I will stop you mid-sentence if you run over

Well-written Research Paper / Report

- Motivation / Context / Related Work
- Accomplishments / Contributions of this work
- Clear description of algorithm
  - Sufficiently-detailed to allow work to be reproduced
  - Work is theoretically sound (hacks/arbitrary constants discouraged, but must be documented)
- Results
  - Well chosen examples
  - Clear tables/illustrations/visualizations with descriptive captions!
- Conclusions & Potential Future Work
  - Limitations of the method are clearly stated

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Friday 4/12: Peer Feedback (Informal User Study)

- *Attendance Mandatory*
- Bring the current draft of your final project (demo/video/screenshots)
- Each member of a team-of-two must have their own copy - *you will be doing the feedback sessions as individuals*
- Bring a specific question about your project that you want to ask your peers to answer. *Think of this as an informal user study of your project.*
- We will do 3 or 4 rounds of feedback:
  - Pair up with another student (not your partner)
  - Person A presents/demos their project, Person B gives feedback
  - Person B presents/demos their project, Person A gives feedback
- *Take good notes about the feedback you receive during this session and include the feedback in your final project report.*

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Reading for Today

- “When Red Means Good, Bad, or Canada: Exploring People’s Reasoning for Choosing Color Palettes”, Ahmad, Huynh, & Chevalier, IEEE Visualization 2021

- Non-experts in visualization - not trained on human perception or reasoning for color choices in visualization)
- Sometimes they did follow standards/conventions and used correct reasoning and said the scheme was intuitive
- More likely to choose categorical scheme for pie chart (even when it didn't fit)
- Comments based on nationality, race, good/bad associations with colors were common
- *Should have also allowed participants to assign colors within the palette to each data category*
- *Should have given participants a larger set of palettes to select from*
  - *With more choices, they might make more mistakes?*
- *Did they ask participants to adjust the brightness of their monitor before starting the study – failing to do that could impact the final results*

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Reading for Today

- "Exploring D3 Implementation Challenges on Stack Overflow", Battle, Feng, & Webber, IEEE Visualization 2022

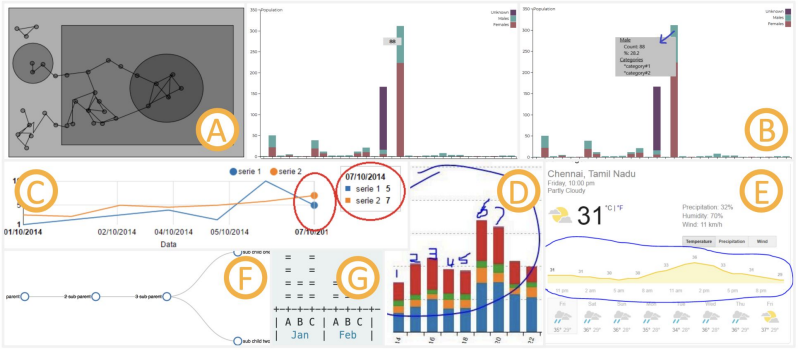

Figure 1: Example images shared online to convey desired visualizations (A, E, F, & G), interactions (B), and modifications (C & D).

- D3 is powerful, but it is difficult to learn and the examples are overly-complicated. Would be better to focus on one thing at a time.
- Stack overflow is more about bugs and unexpected behavior than documentation or simple examples
- How can we redesign D3's documentation to be better? More simpler, sequential examples? Less confusing terms? Better documentation search? An automated tool to help spot & fix errors in D3 code?
- More support for other languages (if javascript is not your favorite language)
- Should the D3 documentation be better? Why are they instead relying so heavily on community examples?

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Reading for Today

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

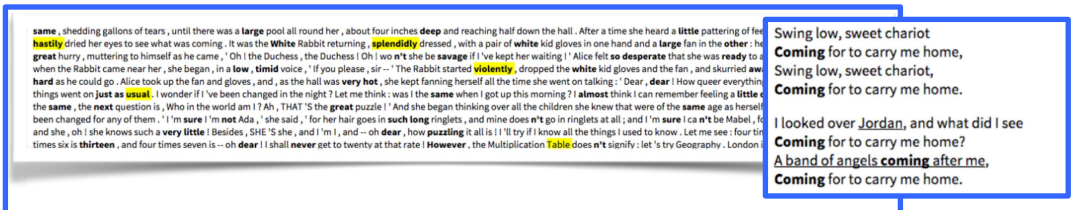


Fig. 1: Text highlighting techniques are commonly used to mark text features in documents. In this excerpt of “Alice in wonderland” all occurrences of adjectives and adverbs derived from part-of-speech tagging are highlighted in bold font, while words with typical adjective/adverb endings are highlighted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

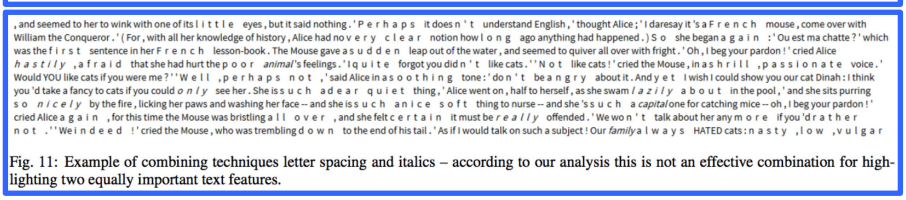
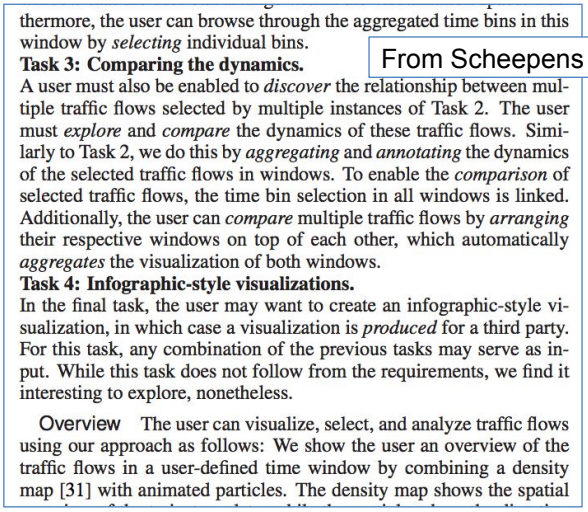


Fig. 11: Example of combining techniques letter spacing and italics – according to our analysis this is not an effective combination for highlighting two equally important text features.

- 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

- 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?"

Reading for Today

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

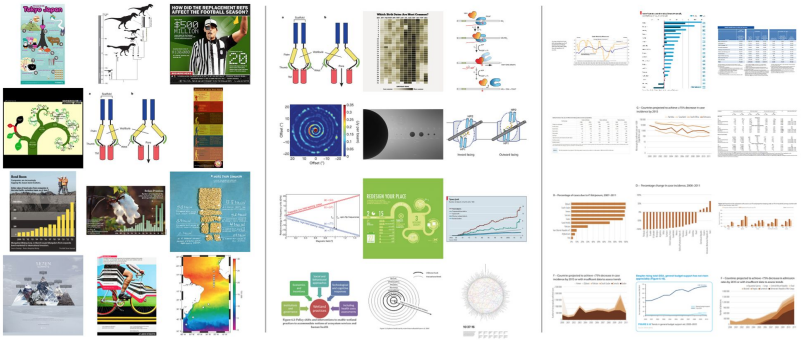


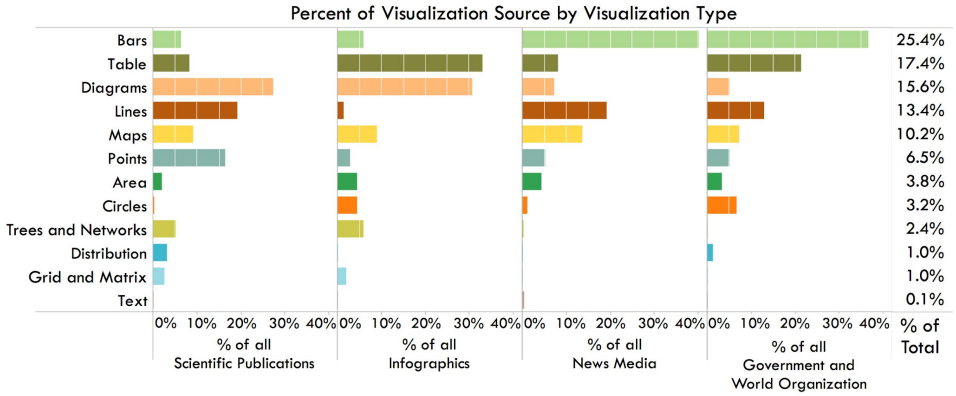
Fig. 1. **Left:** The top twelve overall most memorable visualizations from our experiment (most to least memorable from top left to bottom right). **Middle:** The top twelve most memorable visualizations from our experiment when visualizations containing human recognizable cartoons or images are removed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

- 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.



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.

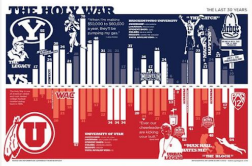
H.5 A visualization is more memorable if it is more "minimalist" (i.e., "good" data-ink ratio).

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.

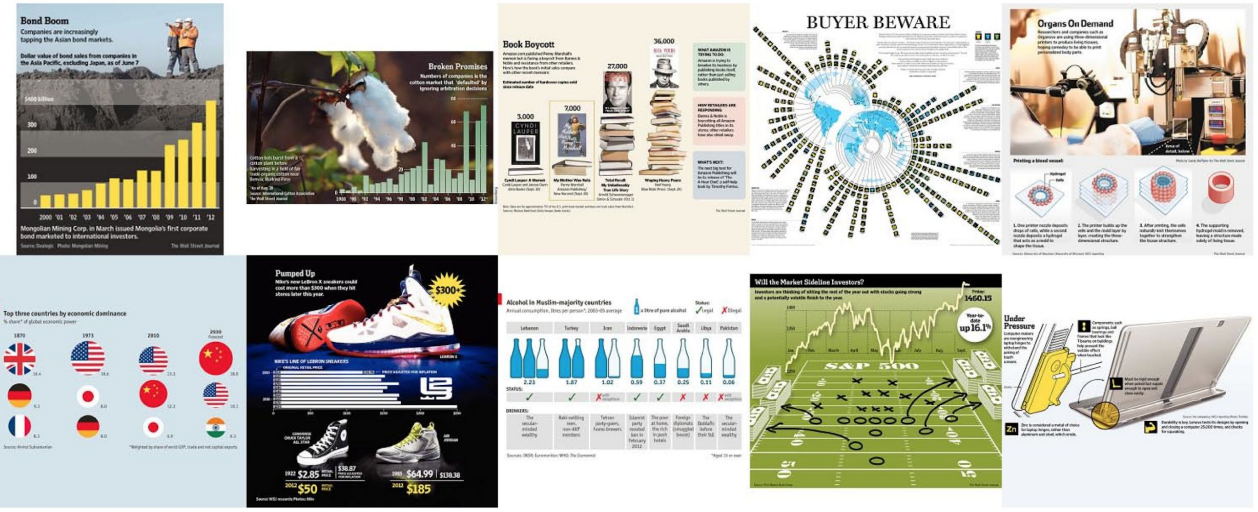
- Selected ~400 visualizations
- Had 261 Mechanical Turk users play a memory game: watch a sequence of visualizations, press a key if you see a visualization repeat
- Subjects were paid for each “level” of the memory game they completed. Each level had 120 images and took ~ 5 minutes to complete. Image 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



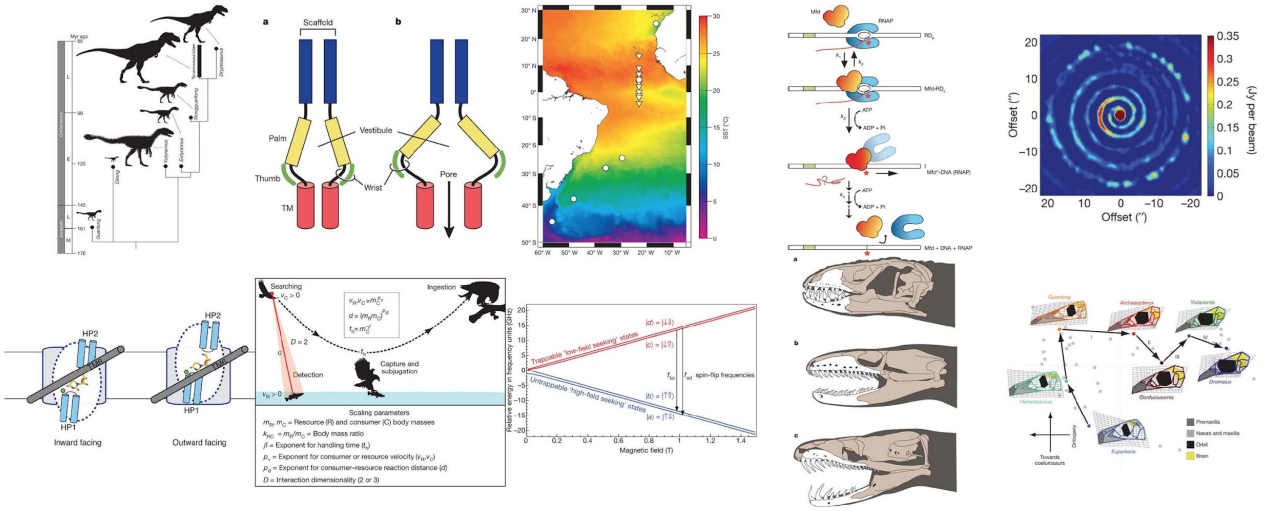
What Makes a Visualization Memorable?”, Borkin, Vo, Bylinskii, Isola, Sunkavalli, Oliva, & Pfister, INFOVIS 2013

Top Ten: News Media



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

Top Ten: Scientific Publications



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Top Ten: Government/World Organization

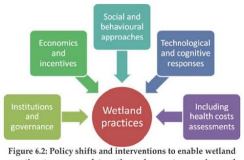
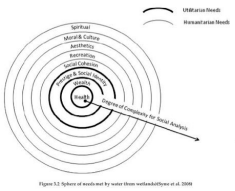


Figure 6.2: Policy shifts and interventions to enable wetland practices to accommodate notions of ecosystem services and human health



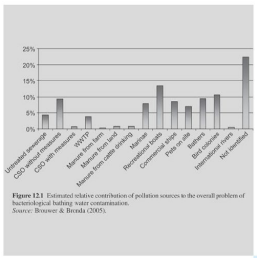


Figure 12.1 Estimated relative contribution of pollution sources to the overall problem of bacteriological bathing water contamination.
Source: Brouwer & Brouda (2005).

Table 2.1: Comparison of terms for describing the ecological character of wetlands

Millennium Ecosystem Assessment terms to apply in Ramsar guidelines and other convention usages	Terms used in previous Ramsar guidelines and other documents
Ecosystem components: physical, chemical, biological (ecosystems, species, genes)	components, features, attributes, properties
Ecological processes within and between ecosystems	processes, interactions, properties, functions
Ecosystem services: provisioning, regulating, cultural, supporting	services, benefits, values, functions, goods, products

(Source: Ramsar Convention 2005a; 2006)

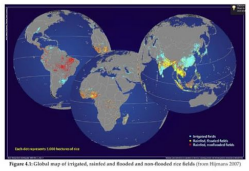


Figure 4.3: Global map of irrigated, rainfed and flooded and non-flooded rice fields (from Hijmans 2003)

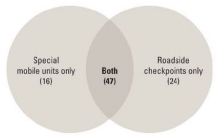


Figure 28. Countries reporting random breath testing of drivers, 2008

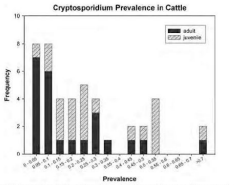


Figure 5.5 Comparison of adult and juvenile mean prevalence of *Cryptosporidium* oocysts in cattle faeces.

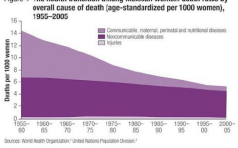
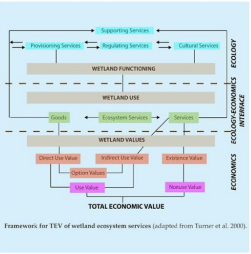
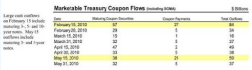


Figure 4 The health transition among Mexican women: death rates by overall cause of death (age-standardized per 1000 women), 1955–2005
Source: World Health Organization / United Nations Population Division



Framework for TEV of wetland ecosystem services (adapted from Turner et al. 2000).


Markerable Treasury Coupon Flows (including SOMA)

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]

- 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