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

<table>
<thead>
<tr>
<th>Apr 9, Quiz 2 sample problems</th>
<th>Apr 11, Final Project Progress Post #3 due @ 11:59pm</th>
<th>Apr 12, Lecture 22: Final Project Peer Demo &amp; Feedback Day Pass/No Credit deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apr 16, Final Project Presentations</td>
<td>Mar 18, Final Project Written Report due @ 11:59pm</td>
<td>Apr 19, Final Project Presentations</td>
</tr>
<tr>
<td>Apr 23, Final Project Presentations</td>
<td>Apr 24, Last day of classes</td>
<td>Apr 25-26, Reading days No classes</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Tuesday April 16th</th>
<th>Friday April 19th</th>
<th>Tuesday April 23rd</th>
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</thead>
<tbody>
<tr>
<td>2:00</td>
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<tr>
<td>2:18</td>
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<td>3:03</td>
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<td>3:12</td>
<td>3:21</td>
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<td>3:21</td>
<td>3:39</td>
<td>3:39</td>
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<tr>
<td>3:39</td>
<td>3:57</td>
<td>3:57</td>
</tr>
<tr>
<td>3:57 done!</td>
<td>4:15 done!</td>
<td>4:15 done!</td>
</tr>
</tbody>
</table>
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
• 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!

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

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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

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From Scheepens et al.

9 commonly used highlighting techniques

<table>
<thead>
<tr>
<th>Technique</th>
<th>Font color</th>
<th>Background color</th>
<th>Underlined</th>
<th>Font size</th>
<th>Font style</th>
<th>Font weight</th>
<th>Rectangular border</th>
</tr>
</thead>
<tbody>
<tr>
<td>Text shadow</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spaced out font</td>
<td>Font family</td>
<td>CAPITALIZATION</td>
<td>Strike-through</td>
<td>Blinking</td>
<td>*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Thence, 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
• 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

• 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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Reading for Today


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

What Makes a Visualization Memorable?*, Borkin, Vo, Bylinskii, Isola, Sunkavalli, Oliva, & Pfister, INFOVIS 2013
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 charts)]
  - 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