CSE 412 - Intro to Data Visualization

Graphical Perception Pt. 2

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Guest Lecture: Color

Fri Apr. 30 - Guest: Jeffrey Heer (UW)

Figure 1: Colormaps under study. We evaluate four single-hue, three perceptually-uniform multi-hue, a diverging, and a rainbow colormap(s). We divide them into (a) assorted, (b) single-hue and (c) multi-hue groups, with two colormaps repeated across groups for replication.

Image(s): "Somewhere Over the Rainbow: An Empirical Assessment of Quantitative Colormaps." Liu & Heer. CHI 2018
Graphical Perception

The ability of viewers to interpret visual (graphical) encodings of information and thereby decode information in graphs.
Topics

Monday:
Signal Detection
Magnitude Estimation
Using Multiple Visual Encodings
Pre-Attentive Processing

Today:
Gestalt Grouping
Change Blindness

Final Project Discussion
Gestalt Grouping
Gestalt Principles

Figure/Ground
Proximity
Similarity
Symmetry
Connectedness
Continuity
Closure
Common Fate
Transparency
Figure/Ground

Ambiguous

Principle of surroundedness

Principle of relative size

http://www.aber.ac.uk/media/Modules/MC10220/visper07.html
Figure/Ground

http://www.aber.ac.uk/media/Modules/MC10220/visper07.html
Proximity

[Ware ‘00]
Similarity

Rows dominate due to similarity [from Ware ’04]
Symmetry

Bilateral symmetry gives strong sense of figure [from Ware ’04]
Connectedness

Connectedness overrules proximity, size, color shape [from Ware ’04]
Continuity

We prefer smooth not abrupt changes [from Ware ‘04]

Connections are clearer with smooth contours [from Ware ‘04]
Continuity: Vector Fields
Continuity: Vector Fields

Prefer field that shows smooth continuous contours [from Ware ’04]
Closure

We see a circle behind a rectangle, not a broken circle [from Ware ’04]

Illusory contours [from Durand ’02]
Common Fate

Dots moving together are grouped
Transparency

Requires continuity and proper color correspondence [from Ware ‘04]
Change Blindness
Change Blindness
Change Blindness
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Change Blindness

[Example from Palmer 99, originally due to Rock]
Summary

Choosing effective visual encodings requires knowledge of visual perception.

**Visual features/attributes**
Individual attributes often pre-attentive
Multiple attributes may be separable or integral

**Gestalt principles** provide high-level guidelines

We don’t always see everything that is there!
Administrivia
A3: Ethical & Deceptive Visualization

Use visualizations to communicate and influence insights.
Design both an ethical and deceptive visualization.

**Ethical Visualization:** honestly and transparently communicate the data with an effective and expressive visualization design that is easy to interpret for viewers.

**Deceptive Visualization:** intentionally influence viewer's perception to mislead their insights, without revealing it's role as the deceptive design.

Due by **11:59 pm PT, next Monday May 3rd**
A3: Ethical & Deceptive Visualization

**Deliverables** (upload via Canvas; see A3 page)
- Image of your visualization (.png or .jpg format)
- Images should be named **ethical** and **deceptive** accordingly
- Image itself **should not give away which design is which**
- Write-up including a short description + design rationale

Due by **11:59 pm PT, next Monday May 3rd**

**Assignment A3b: Peer Evaluation** (see course website)
- Provide constructive feedback on **four peer designs**
- Guess which visualization designs are deceptive and ethical

Due by **11:59pm PT, Monday May 10th** (the following Monday)
A3: Ethical & Deceptive Visualization

Must use the same dataset, but can ask different questions.

Both visualizations should emphasize communication.

Ethical visualization should be a clear, thoughtful design that is both effective and expressive, demonstrating course principles.

Deceptive design should not be incorrect or illegible, but rather subtly misleading. It should not be obviously deceptive!

Image filenames must be exactly "ethical" and "deceptive".

Due by 11:59 pm PT, next Monday May 3rd.

Please submit on time! Assignments submitted late will not receive any peer evaluations (which are due Monday 5/10).
Required Readings for Fri 4/30


Color Scheme Explorer.

How to pick more beautiful colors for your data visualizations. Lisa Charlotte Rost. 2020.
Optional Readings for Fri 4/30

**FRI** D3 color scales: d3-scale-chromatic

**FRI** Somewhere Over the Rainbow: An Empirical Assessment of Quantitative Colormaps.

**FRI** Colorgorical: Creating Discriminable and Preferable Color Palettes for Information Visualization.

**FRI** Color Crafting: Automating the Construction of Designer Quality Color Ramps.

**FRI** Color Crafter (Online Tool)
Readings for Mon 5/3

REQUIRED Chapters 6, 7, 8 in Interactive Data Visualization for the Web, 2nd Edition. Scott Murray.

OPTIONAL Critical Reflections on Visualization Authoring Systems.
Final Project
Final Project

Produce **narrative web-based visualizations**

Initial **prototype** and **design review**

**Final deliverables** and **video presentation**

Submit and **publish online** (GitHub)

Projects from previous classes (442, 512) have been:

- Published as research papers
- Shared widely (some in the New York Times!)
- Released as successful open source projects
Final Project Theme

Data Visualization for Communicating Scientific Advancements or Social Phenomena

Goal: find data of social or scientific import, design visualizations to communicate it effectively to a general audience.

The specific data domain is open-ended. Possibilities include transportation, campaign finance, education, economics, chemical engineering, sociology, statistics, atmospheric science, molecular interactions, scientific research, and so on...

Use Assignment 2 and 3 to explore a data set of interest prior to committing to final project teams and topic!
Inspiration...
Change In Times (CSE 442, Spring ’17)

Gunnar Olson, Halden Lin, Lilian Liang, and Shobhit Hathi
Locations of each train on the red, blue, and orange lines at 5:46 am. Hover over the diagram to the right to display trains at a different time.

Trains are on the right side of the track relative to the direction they are moving.

See the morning rush-hour, midday lull, afternoon rush-hour, and the evening lull.

Service starts at 5AM on Monday morning. Each line represents the path of one train. Time continues downward, so steeper lines indicate slower trains.

Since the red line splits, we show the Ashmont branch first then the Braintree branch. Trains on the Braintree branch "jump over" the Ashmont branch.

Train frequency increases around 6:30AM as morning rush hour begins.
Visualizing Galaxy Merger Trees

S. Loebman, J. Ortiz, L. Orr, M. Balazinska, T. Quinn et al. [SIGMOD '14]
Inspiration from the News

The Rise in Testing Is Not Driving the Rise in U.S. Virus Cases

By Matthew Conlon  July 22, 2020

New York Times

Emissions of Websites

- Parametric Press (you are here): 31 mg
- Google (search result): 10 mg
- The New York Times (interactive article): 50 mg
- Amazon (product page): 64 mg
- Facebook (newsfeed): 188 mg

Each bar represents the carbon emitted when scrolling through a website for 60 seconds. Car distance equivalent is calculated using the fuel economy of an average car. Click each bar to show a preview clip of the scroll.

SOURCE: Aylon et al. 2017 [2], EPA

Parametric Press
Final Project Schedule

Proposal          Fri May 07 (next Friday!)
Milestone         Fri May 21
Demo Video        Mon May 31
Video Showcase    Wed June 2 & Fri June 4
Deliverables      Mon June 7

Logistics
Final project description posted online (link)
Work in groups of up to 5 people
Start determining your project topic!
Final Project Teams

Work in groups of 3-5 people

Post your project ideas and interests on Ed, or respond to classmates about their projects

Mark thread as resolved when you are no longer looking for additional members

https://edstem.org/us/courses/4910/discussion/354324
Final Project Proposal

Form: https://forms.gle/D3WpCvdQkMa3kt6z6

Project Name - short name for GitHub
e.g., food-deserts or solar-panel-manufacturing

Abstract - describing goals and motivation

Team members - UW email, GitHub username

Due by 11:59 pm PT, next Friday May 7th
Repositories will be created by course staff based on the final project proposal form.

Please accept the GitHub invite as soon as you receive it; invites will expire.

Repositories will be initialized with recommended project structure and initial webpage.
Final Project Template

Repositories will be initialized with recommended project structure and initial webpage.

Free to modify the page in any way you see fit, but be sure to carefully consider all design decisions.

Project template leverages Idyll for page structure.
CSE412 Final Project Template

Use this structure to get started, but make the narrative your own!

By: Jane Hoffswell  
Apr 6, 2021

The final project will provide hands-on experience designing, implementing, and deploying interactive visualizations for the web. For this project, you will select a topic of interest and author a narrative article and accompanying visualizations to educate and inform a general audience. Think of your project as contributing to our own class newspaper or scientific magazine. The final deliverable will take the form of an explanatory narrative, deployed as an interactive web page using GitHub Pages. You will leverage the template and style provided here.

The theme is data visualization for communicating scientific advancements or social phenomena. How might data visualization help us better understand the workings of our society or our physical world?
Tips for a Successful Project

Focus on a compelling real-world problem. How will you gauge success?

Consider multiple design alternatives. Prototype quickly (use Tableau, R, etc…).

Seek feedback (representative users, peers, …). Even informal usage can provide insights.

Choose appropriate team roles.

Start early (and read the suggested paper!)
Start early
Ask questions often!

https://edstem.org/us/courses/4910/discussion/354324

Office Hours:
Mon 12:00-1:00pm - Dalton
Tue 5:30-6:30pm - Yueqian
Wed 11:20-12:20pm - Jane
Thur 2:30-3:30pm - Kalyani
Fri 6:00-7:00pm - Yue

**By Appointment:** Aayush, Yueqian
Tips for Asking Questions

Include **all the information** we need to answer. Project name, link to repo, demo in Observable...

**Give context!** Describe what you've already tried and **share resources** you thought might be helpful.

If you're comfortable doing so, **share questions publicly** on Ed to help your fellow students.
Questions?
Quiz Section: Intro to Git & Web

Tomorrow, Thursday April 29th

Introduction to Git and HTML/CSS
Useful skills for getting started with the final project

Next Week: Intro to Idyll
Section will include an overview of the project template and visualization embedding in Idyll

Up Next: Jane's Office Hour (link on Canvas)