Scientific Visualization

CSCI 297b, Spring 2023

April 24, 2023

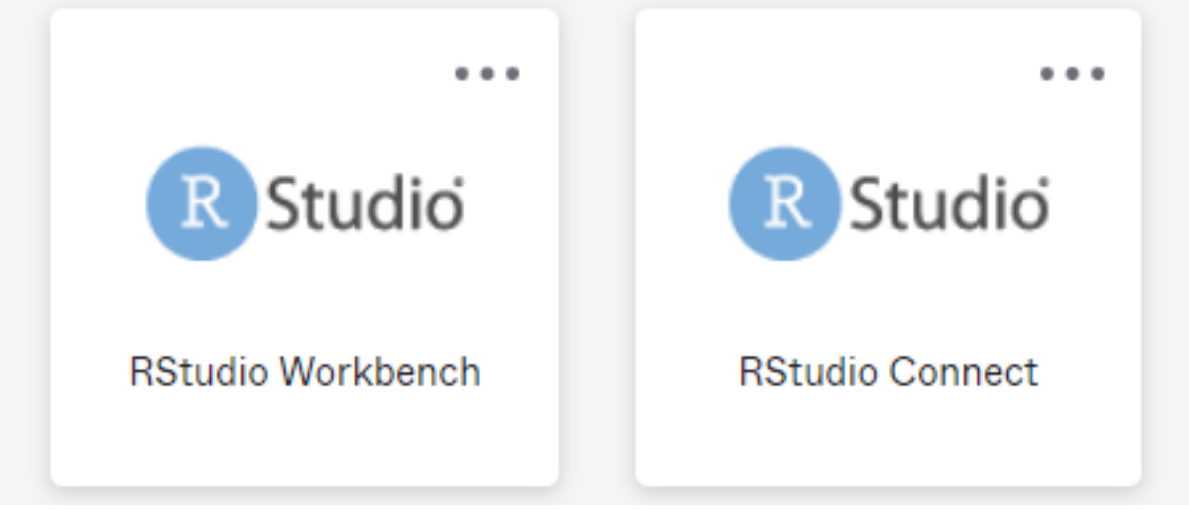
csci297b Scientific Visualization

- Instructor: Geoffrey Matthews `gmatthews@wlu.edu`
- `https://github.com/geofmatthews/csci297b`
- MTWRF, 10:30 AM - 12:30 PM, Parmly 405
- Office hours: 9:30 MWF and by appointment

A bit about me and you

RStudio Workbench and Connect

`https://rstudioworkbench.wlu.edu/`



Installing R and RStudio on your own computer

- https://www.r-project.org/
- https://posit.co/download/rstudio-desktop/

Our textbooks

- `https://alexd106.github.io/intro2R/index.html`
  An Introduction to R
- `https://r4ds.had.co.nz/`
  R for Data Science
- `https://clauswilke.com/dataviz/`
  Fundamentals of Data Visualization

Schedule

		Lab		Principles
Date	Day	intro2r	RfDS2e	FoDV
2023-04-24	Monday	1		
2023-04-25	Tuesday	2		1,2,3
2023-04-26	Wednesday	2		4,5
2023-04-27	Thursday	3		6,7
2023-04-28	Friday	3		8
2023-05-01	Monday	4		9,10
2023-05-02	Tuesday	4		11,12
2023-05-03	Wednesday	5		13,14
2023-05-04	Thursday	5		15
2023-05-05	Friday	8		16
2023-05-08	Monday	8		17
2023-05-09	Tuesday		10	18,19
2023-05-10	Wednesday		10	20,21
2023-05-11	Thursday		11	22
2023-05-12	Friday		11	23,24,25
2023-05-15	Monday		12	26,27
2023-05-16	Tuesday		12	28,29
2023-05-17	Wednesday	Student presentations		
2023-05-18	Thursday	Student presentations		
2023-05-19	Friday	Student presentations		
Final Exam				

Student presentations

- Each student will prepare a presentation on a dataset that interests them.
- Each presentation will feature at least five graphs.
- Presentations will be done in Rmarkdown.
- There will be a class presentation by the student during the final days of class.

Daily Schedule

Time	Activity
10:30	Lecture on R and in-class exercises
11:40	Break
11:50	Graph of the Day
11:55	Lecture & Discussion on Fundamentals
12:30	Class ends

Graph of the Day

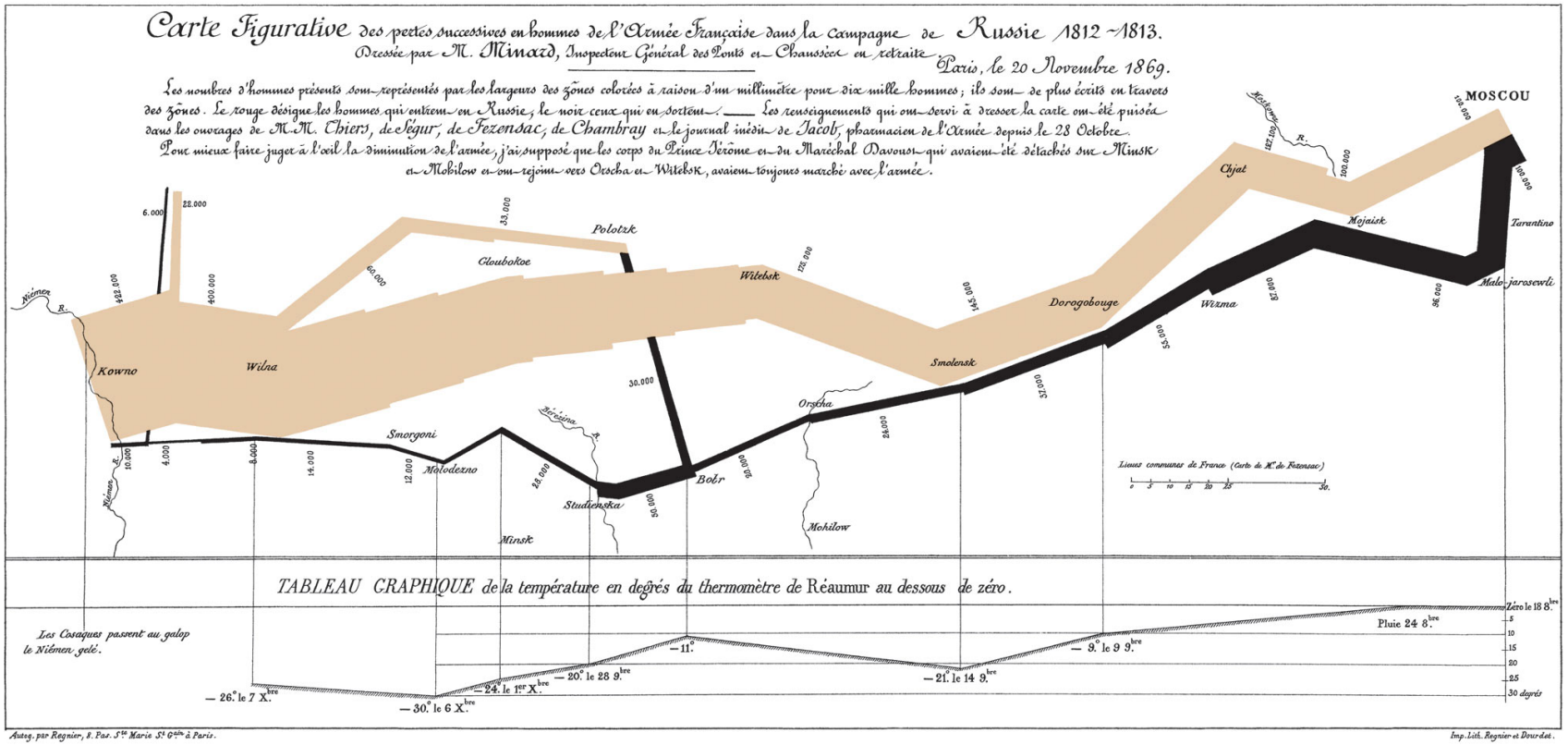
- Every day we will have a student presenation of the "Graph of the Day"
- You will select a graph from the internet that is particularly bad, good, or interesting in some way.

Ugly graphs

- https://flowingdata.com/category/visualization/ugly-visualization/
- https://www.pinterest.com/simonlafosse6/ugly-dataviz/
- https://www.reddit.com/r/dataisugly/
- https://www.businessinsider.com/the-27-worst-charts-of-all-time-2013-6
- https://venngage.com/blog/bad-infographics/
- https://www.usu.edu/math/symanzik/talks/2021_SouthwestMichiganChapter.pdf
- https://getdolphins.com/blog/the-worst-graphs-of-2017/
- https://analythical.com/blog/examples-of-awful-data-visualization

Set up ugly graph schedule

Good graphics



Good graphics

- `https://www.perceptualedge.com/`
- `https://www.edwardtufte.com/tufte/`
- `https://www.youtube.com/watch?v=jbkSRLYSojo`
- Hans Rosling's 200 countries, 200 years, 4 minutes

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- What are some issues that could use clarification?

Visualization vs. Statistics

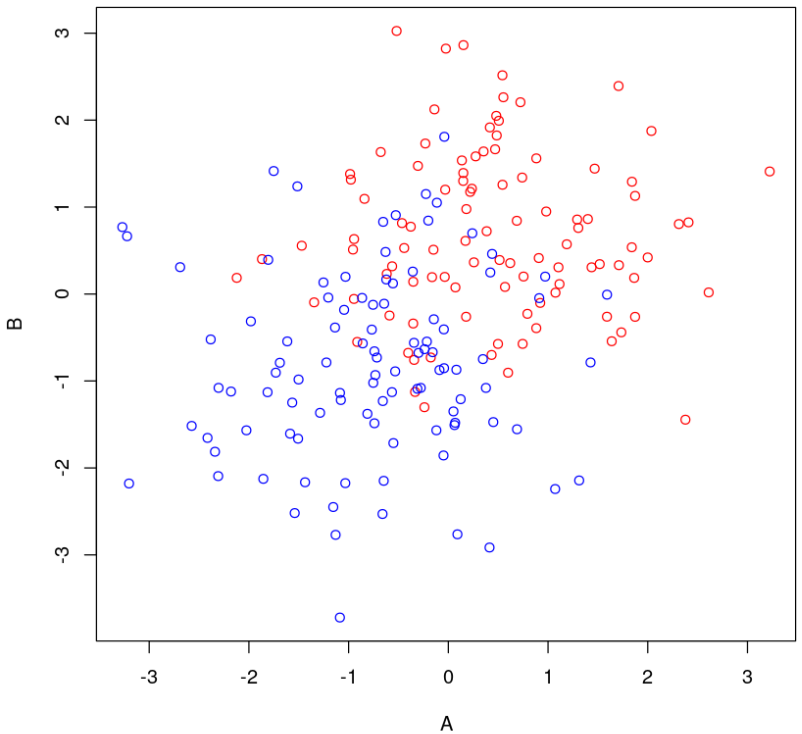
Visualization

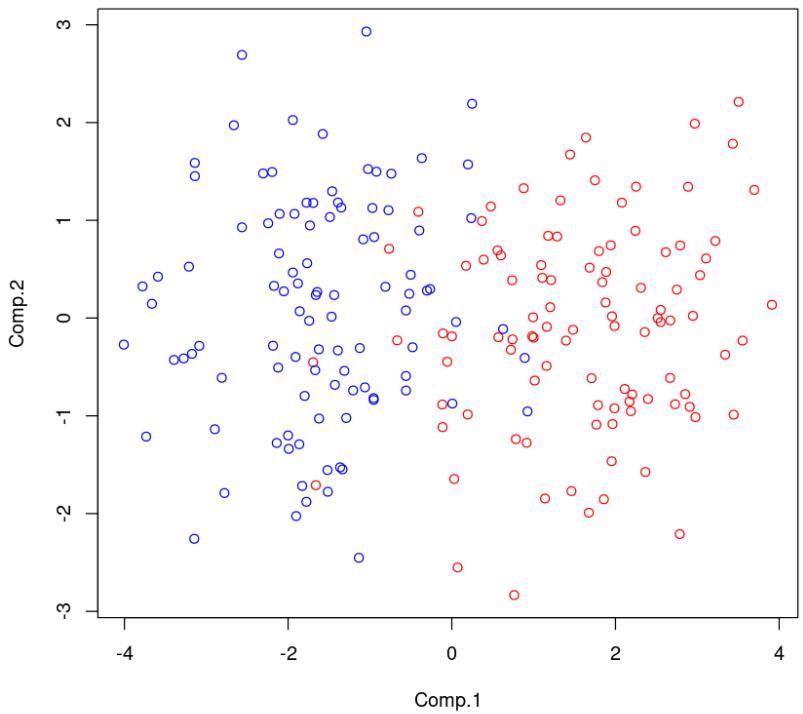
- Exploration
- Communication
- Persuasion

Statistics

- Confirmation
- Data transformations
- Data summaries

Data transformations





Your Brain

- 90% of the information transmitted to the brain is visual
- The human brain can process an image in just 13 milliseconds
- 50% of the brain is active in visual processing
- Human brains process visuals 60,000 times faster than they do text
- 93% of communication is nonverbal
- We are exposed to 5x more information today than we were in 1986

Sources: `https://blog.csgsolutions.com/15-statistics-prove-power-data-visualization`

Communication

- High quality infographics are 30x more likely to be read than plain text
- People who follow directions with illustrations do 323% better than those who follow text-only directions
- If a scientific claim is presented in pure words or numbers, 68% of people will believe that the information is accurate and truthful. But if you put a simple graph with the claim, the number rises to 97%
- The Wharton School of Business found that while only half of an audience was convinced by a purely verbal presentation, that number jumped to over two thirds when visuals were added

Sources: `https://blog.csgsolutions.com/15-statistics-prove-power-data-visualization`

Online resources

- https://www.r-project.org/ ..... **R home**
- **Books**
  - https://alexd106.github.io/intro2R/index.html ..... An Introduction to R
  - https://rbasics.netlify.app/index.html ..... Getting Used to R, RStudio, and R Markdown
  - https://moderndive.netlify.app/index.html ..... A ModernDive into R and the Tidyverse
  - https://rstudio-education.github.io/hopr/ ..... Hands-On Programming with R
  - https://bookdown.org/rdpeng/rprogdatascience/ ..... R Programming for Data Science
  - https://datasciencebook.ca/ ..... Data Science: a First Introduction
  - https://r4ds.had.co.nz/ ..... R for Data Science
  - https://ggplot2-book.org/ ..... ggplot2: Elegant Graphics for Data Analysis
  - https://clauswilke.com/dataviz/ ..... Fundamentals of Data Visualization
  - https://www.tmwr.org/ ..... Tidy Modelling with R
  - https://bookdown.org/yihui/rmarkdown/ ..... Rmarkdown: the Definitive Guide
- **Other**
  - https://www.w3schools.com/r/default.asp ..... R tutorial
  - https://education.rstudio.com/learn/beginner/ ..... R Studio Education Links
  - https://posit.cloud/learn/primers ..... Online primers
  - https://rladiessydney.org/ ..... Video tutorials
  - https://rmarkdown.rstudio.com/ ..... Rmarkdown videos