MY472 – Week 9: Data Visualisation

MY472: Data for Data Scientists

November 26, 2019

Course outline

1. Introduction to data
2. The shape of data
3. Cloud computing
4. HTML and CSS
5. Using data from the Internet
6. (Reading week)
7. Working with APIs
8. Textual data
9. Data visualisation
10. Creating and managing databases
11. Interacting with online databases

seminars schedule

9. Data visualisation
   - 4th marked assignment (individual)
   - Deadline: December 6
10. Creating and managing databases
11. Interacting with online databases
    - 5th marked assignment (groups)
    - Deadline: December 19

Take-home exam due January 17, 15:00.

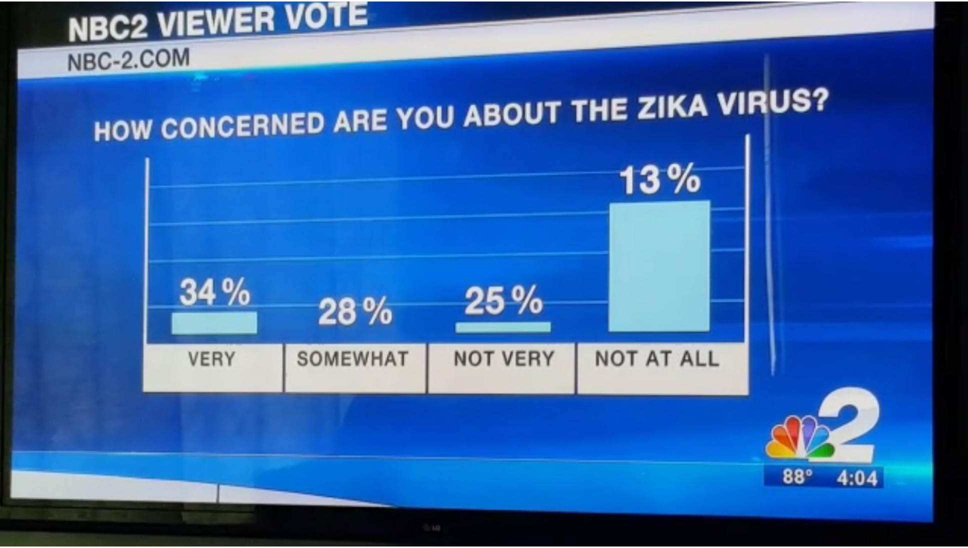
Plan for today

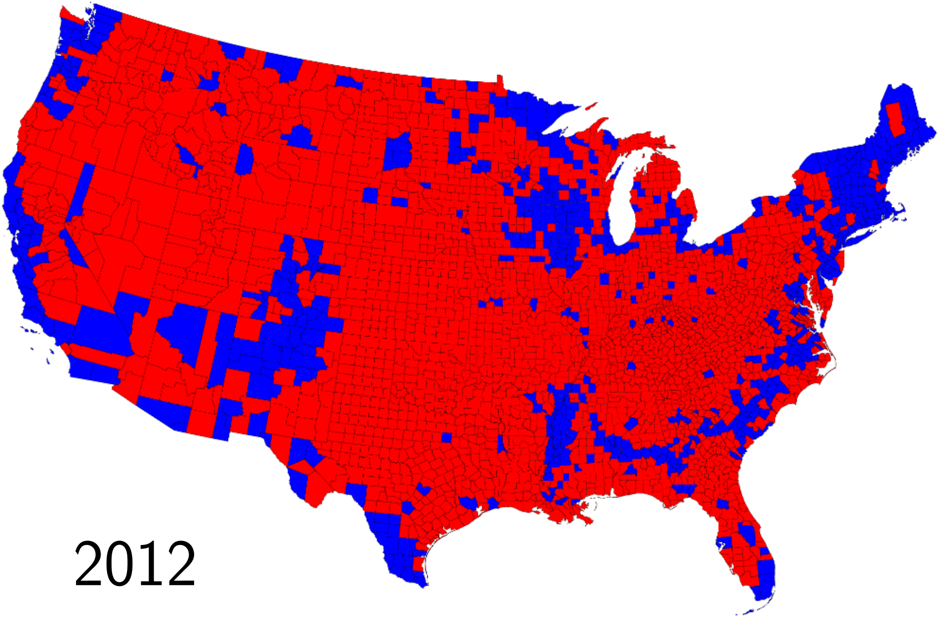
- Data visualization
  - How (not) to lie with graphs
  - Principles of data visualization
  - `ggplot2`
- Teaching evaluations

Data visualization: why?

Often the most effective way to describe, explore, and summarize data...is to visualize the data

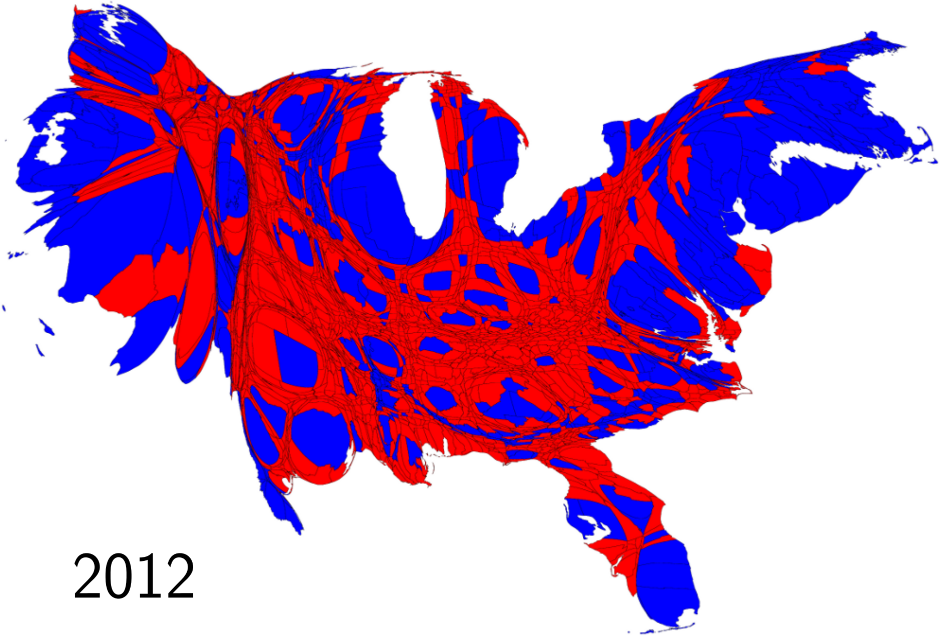
see `01-anscombe.Rmd`


NBC2 VIEWER VOTE
NBC-2.COM
HOW CONCERNED ARE YOU ABOUT THE ZIKA VIRUS?
34 %
28 %
25 %
13 %
VERY
SOMEWHAT
NOT VERY
NOT AT ALL
2
88°
4:04



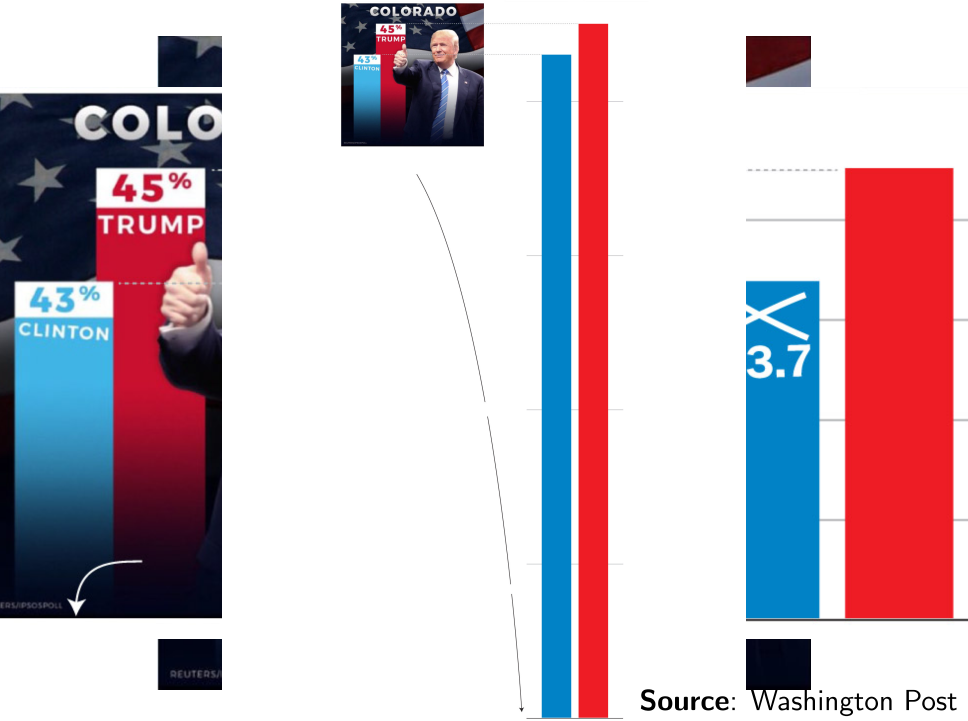
2012

Source: Mark Newman (Michigan)



2012

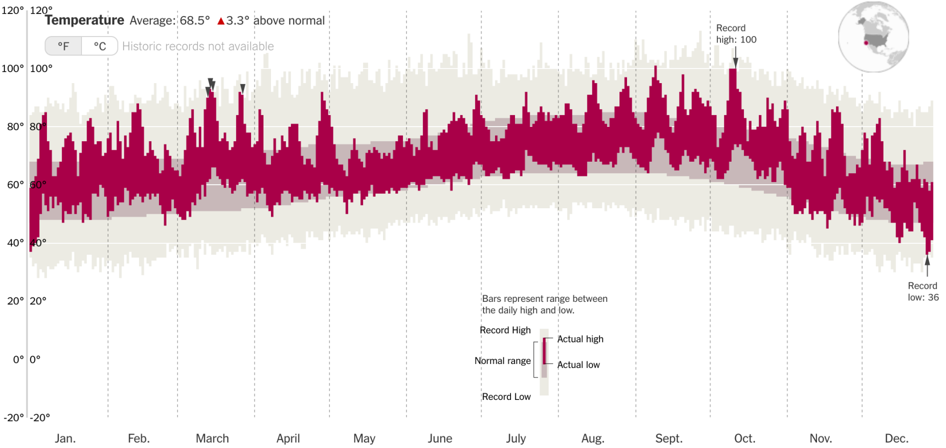
Source: Mark Newman (Michigan)



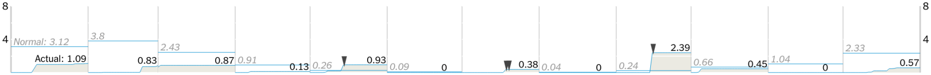
Source: Washington Post

◀ Los Angeles, Calif. ▶

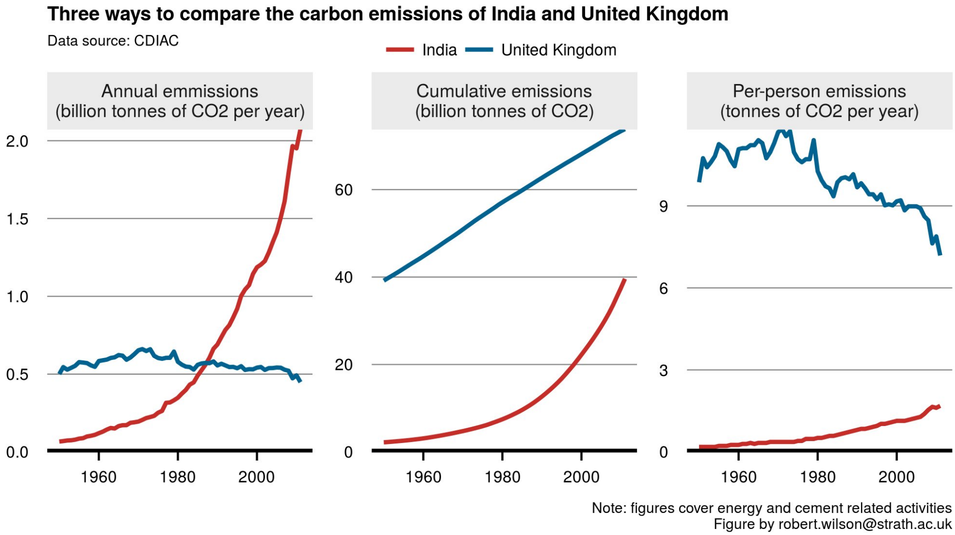
Temperature Average: 68.5° ▲3.3° above normal



Precipitation Total: 7.66" ▼-6.6" less



Cumulative monthly precipitation, in inches, compared with normal. Precipitation totals are rainfall plus the liquid equivalent of any frozen precipitation.

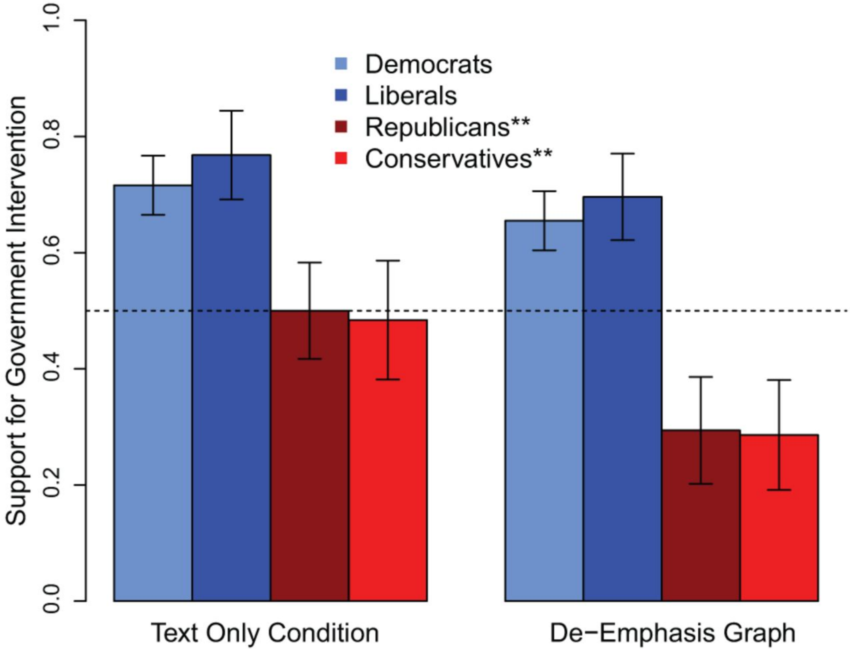


Three ways to compare the carbon emissions of India and United Kingdom

Data source: CDIAC

Note: figures cover energy and cement related activities
Figure by robert.wilson@strath.ac.uk

Source: New York Times



Source: Hughes (2015)

Data visualization

General principles (Tufte)

- Show the data
- Avoid distorting what the data have to say
- Allow viewer to compare
- Serve a clear purpose: description, exploration, tabulation or decoration
- Be closely integrated with the statistical and verbal descriptions of the dataset
- **Graphics reveal data**: e.g. Anscombe Quartet

Data visualization

Specific guidelines

- Maximize data-to-ink ratio
- Avoid misleading decisions:
  - Y axis starts at 0
  - Comparison of areas is hard
  - Use comparable units
  - Erase chart junk
- Use text to inform and contextualize. Add annotations
- Appropriate use of scales (x/y axes, color, size, shape...)
- Use small multiples to facilitate comparisons
- Always cite your sources

What is the grammar of graphics?

The grammar of graphics.

A statistical graph is a mapping from data to aesthetic attributes (color, shape, size) of geometric objects (points, lines, bars). The plot may also contain statistical transformations of the data and is drawn on a specific coordinate system. Faceting can be used to generate the same plot for different subsets of the data. It is the combination of these independent components that make up a graphic.

Hadley Wickham, *ggplot2, page 3*

Data visualization with **ggplot2**

Why **ggplot2**?

- Based on “Grammar of Graphics” (Wilkinson, 2005)
  - → powerful, consistent, modular.
- Compact, parsimonious code
- Sensible defaults for quick exploratory plots
- But also easy to customize, extend
- Excellent online resources (and easy to Google)

What is the grammar of graphics?

Components of a graph:

data What you want to visualize, including variables (columns) to be mapped to aesthetic attributes.

geom Geometric objects that are drawn to represent the data: bars, lines, points, etc.

stats Statistical transformations of the data, such as binning or averaging.

scales Map values in the data space to values in an aesthetic space (color, shape, size...)

coord Coordinate system; provides axes and gridlines to make it possible to read the graph.

facets Breaking up the data into subsets, to be displayed independently on a grid

“Easy to Google”

- Main documentation page: https://ggplot2.tidyverse.org/
- R Graph gallery for **ggplot2**
  https://www.r-graph-gallery.com/ggplot2-package.html
- StackOverflow, tag: ggplot2
  https://stackoverflow.com/questions/tagged/ggplot2

ggplot2

see `02_ggplot2_basics`

see `03_scales_axes_legends`