

# MY472 – Data for Data Scientists

## Week 3: Data Visualisation

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<https://lse-my472.github.io/>

# Course outline

1. Introduction
2. Tabular data
3. Data visualisation
4. Textual data
5. HTML, CSS, and scraping static websites
6. (Reading week)
7. XML, RSS, and scraping non-static website
8. Working with APIs
9. Creating and managing databases
10. Interacting with online databases
11. Cloud computing

# Outline

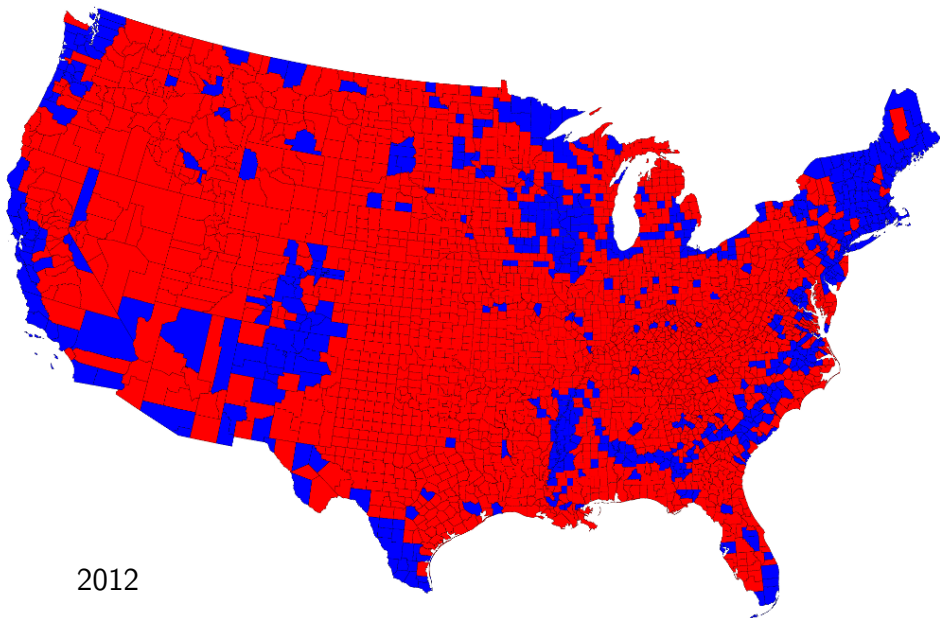
1. Introduction
2. Some principles of data visualisation
3. ggplot2
4. Coding

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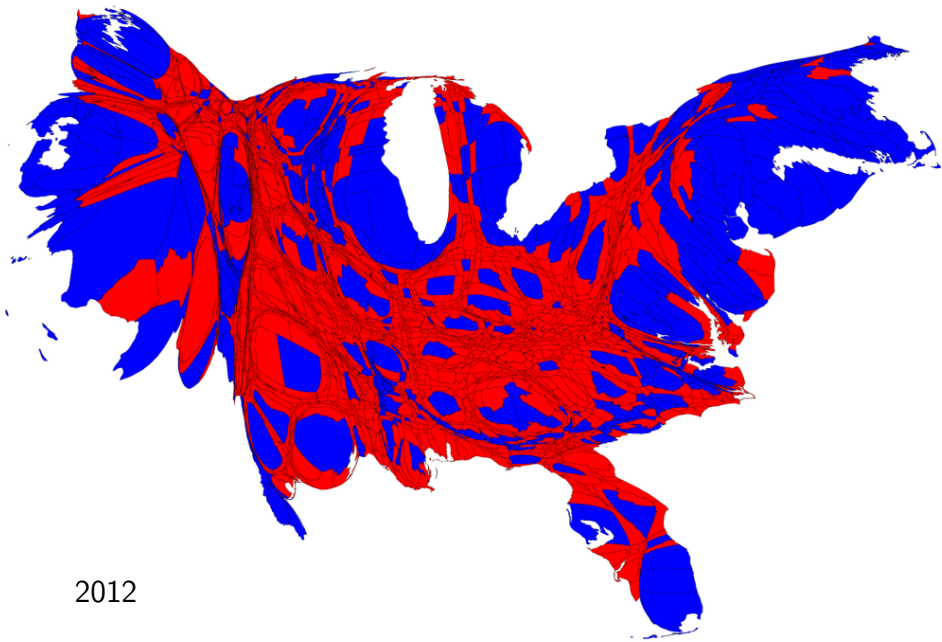
## Why visualisation can be helpful: Anscombe examples

01-anscombe.Rmd



2012

**Source:** Mark Newman (Michigan)

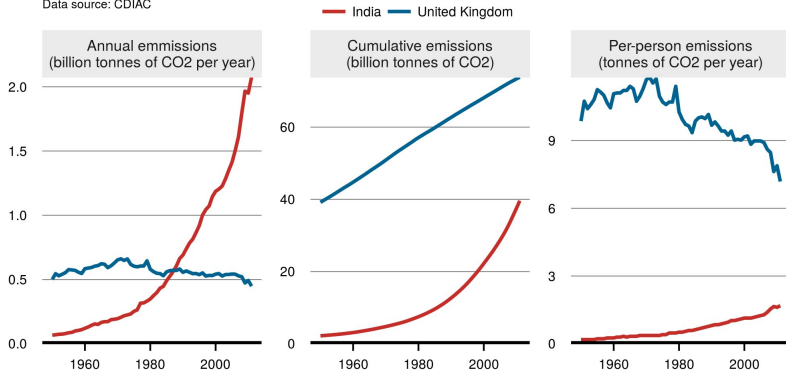


2012

**Source:** Mark Newman (Michigan)

### 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](mailto:robert.wilson@strath.ac.uk)

Source: New York Times



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# Principles by Edward 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 can reveal data (e.g. Anscombe Quartet)

# General 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 contextualise. Add annotations
- ▶ Appropriate use of scales (x/y axes, color, size, shape...)
- ▶ Use small multiples to facilitate comparisons
- ▶ Always cite sources

# Outline

1. Introduction
2. Some principles of data visualisation
3. `ggplot2`
4. Coding

# 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 visualisation with ggplot2

## Why **ggplot2**?

- ▶ Based on “Grammar of Graphics” (Wilkinson, 1999)
  - ▶ Rather than thinking of isolated plot types such as bar plots, scatter plots, etc. define abstract features of graphics
  - ▶ Consistent, modular, and very flexible
- ▶ Sensible defaults for quick exploratory plots
- ▶ But also easy to customize and extend
- ▶ Excellent online resources

# Grammar



Source: Thomas Lin Pedersen [[link](#)]

# Grammar

**data** Data to visualise, for ggplot2 in a 'tidy' format

**(aesthetic) mapping** Linking variables in the data to components of the graphic

**stats** Statistical transformations of the data, e.g. binning or averaging

**scales** Translation between variable ranges and graphical properties, e.g. linking values to colours/shapes

**geom** Geometric objects that are drawn to represent the data: bars, lines, points, etc. (plots can have multiple geometries)

**facets** Breaking up the data into subsets e.g. to be displayed independently on a grid

**coordinates** Coordinate system that e.g. provides axes and gridlines

**theme** Parts that do not follow from the data: Background colours, fonts, etc.



## Online resources

- ▶ Main documentation page: <https://ggplot2.tidyverse.org/>
- ▶ Book by Hadley Wickham, Danielle Navarro, and Thomas Lin Pedersen: <https://ggplot2-book.org/>
- ▶ R Graph gallery for ggplot2  
<https://www.r-graph-gallery.com/ggplot2-package.html>
- ▶ Two recent video workshops by Thomas Lin Pedersen, [video 1](#), [video 2](#), and the repo with associated [exercises](#)
- ▶ StackOverflow, tag: ggplot2  
<https://stackoverflow.com/questions/tagged/ggplot2>

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## Coding

02-ggplot2-basics.Rmd

03-scales-axes-legends.Rmd