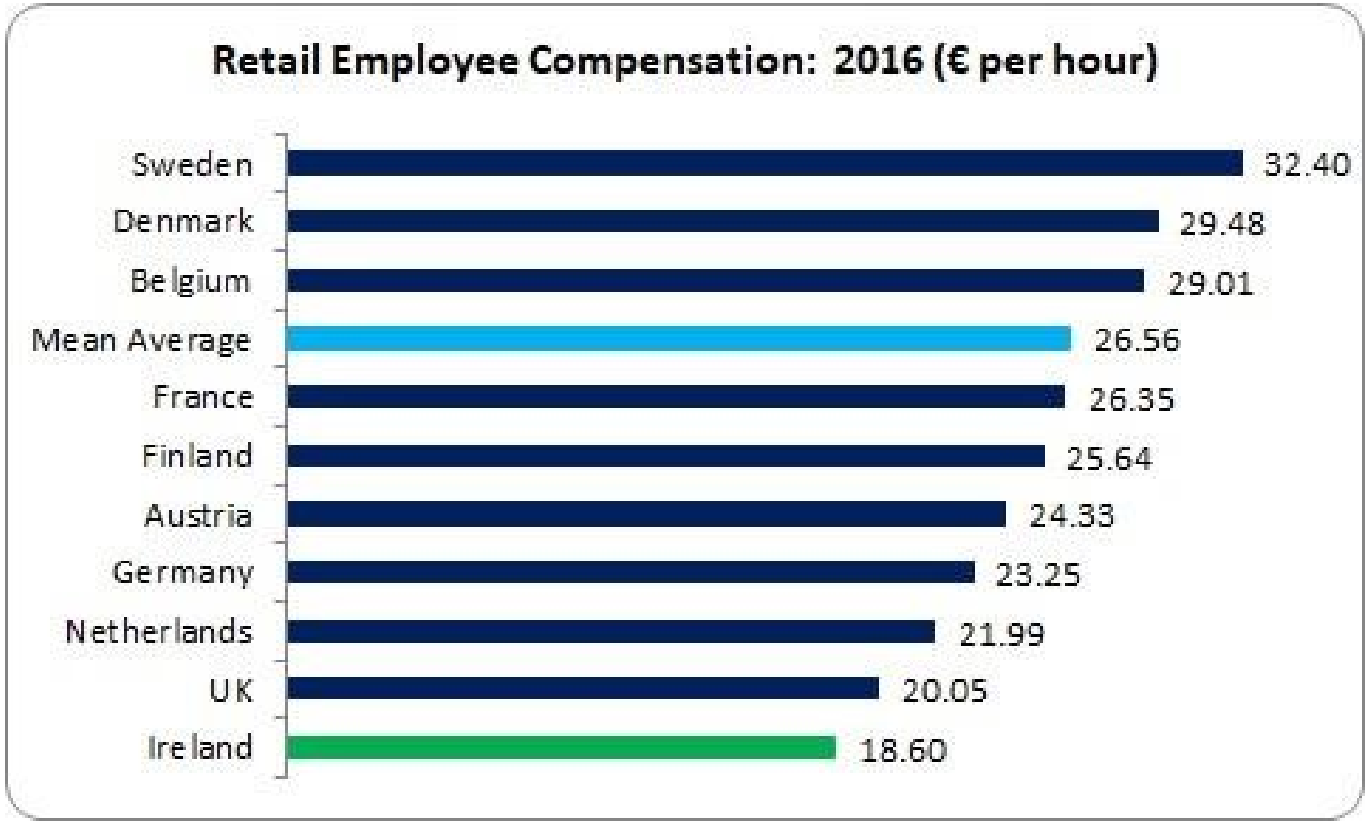
Data Visualisation

Summary

Agenda

- In this lecture we will cover:
  - Good practices
  - A short review
  - Sample exam paper

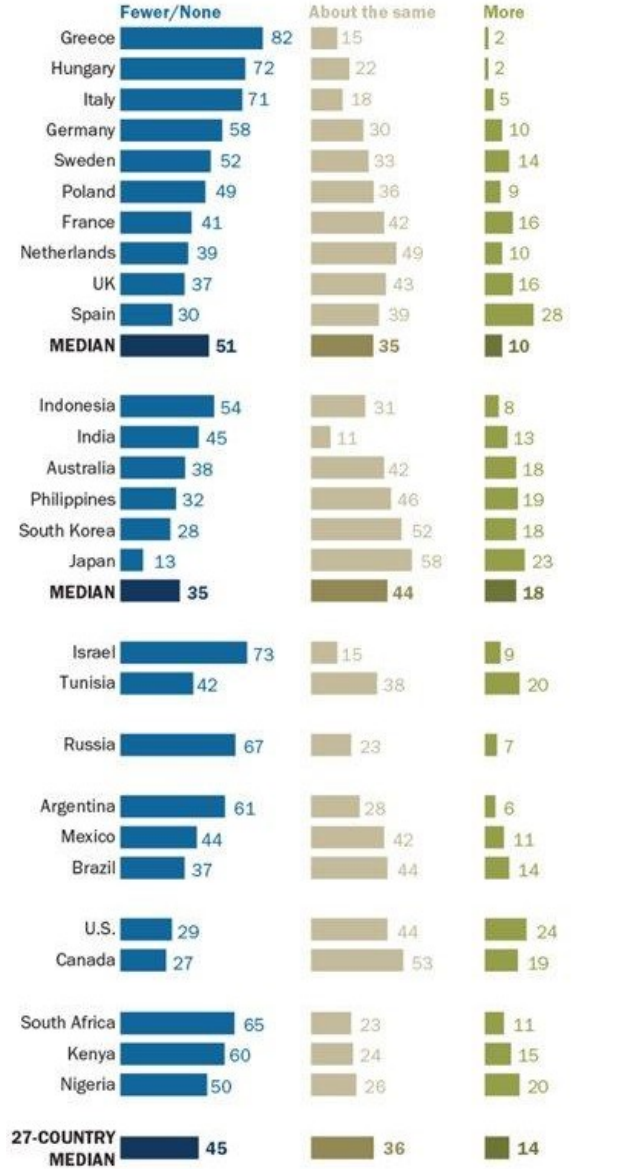
Good Practices



https://notesonthefront.typepad.com/

Around the world, few want more immigration

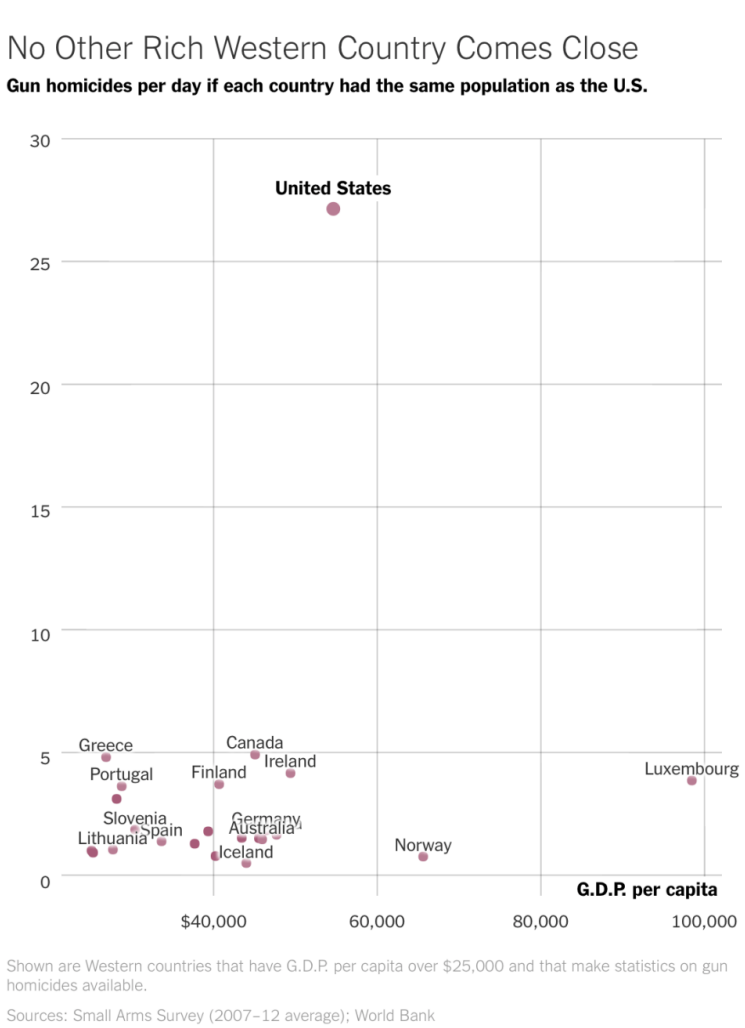
In your opinion, should we allow more immigrants to move to our country, fewer immigrants, or about the same as we do now? (%)

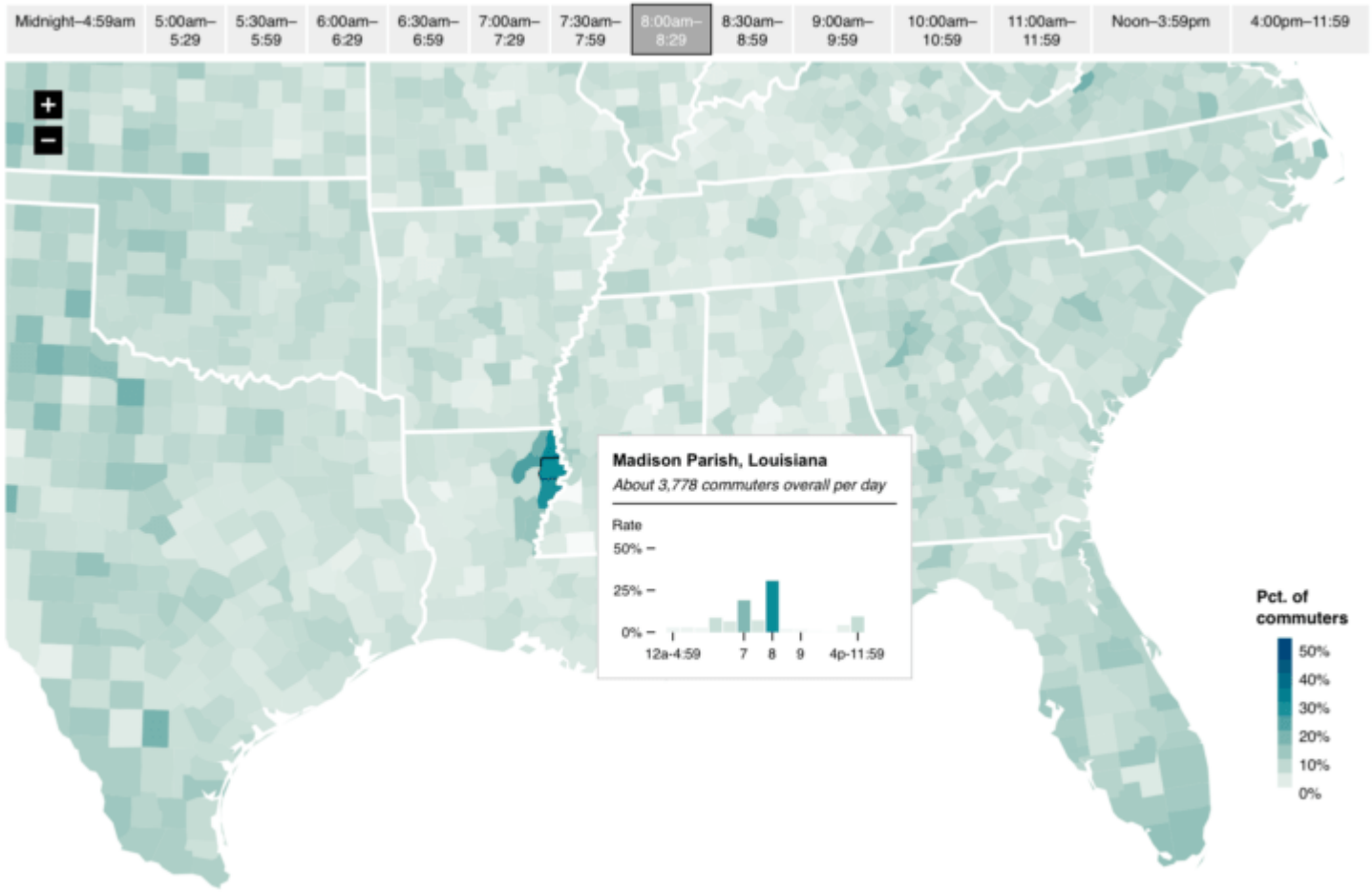


Note: Responses of "Fewer" and "None" are combined based on rounded numbers. Responses of "None" are volunteered. Voluntary responses of "Don't know" and "Refused" not shown.
Source: Spring 2018 Global Attitudes Survey. Q52.

PEW RESEARCH CENTER

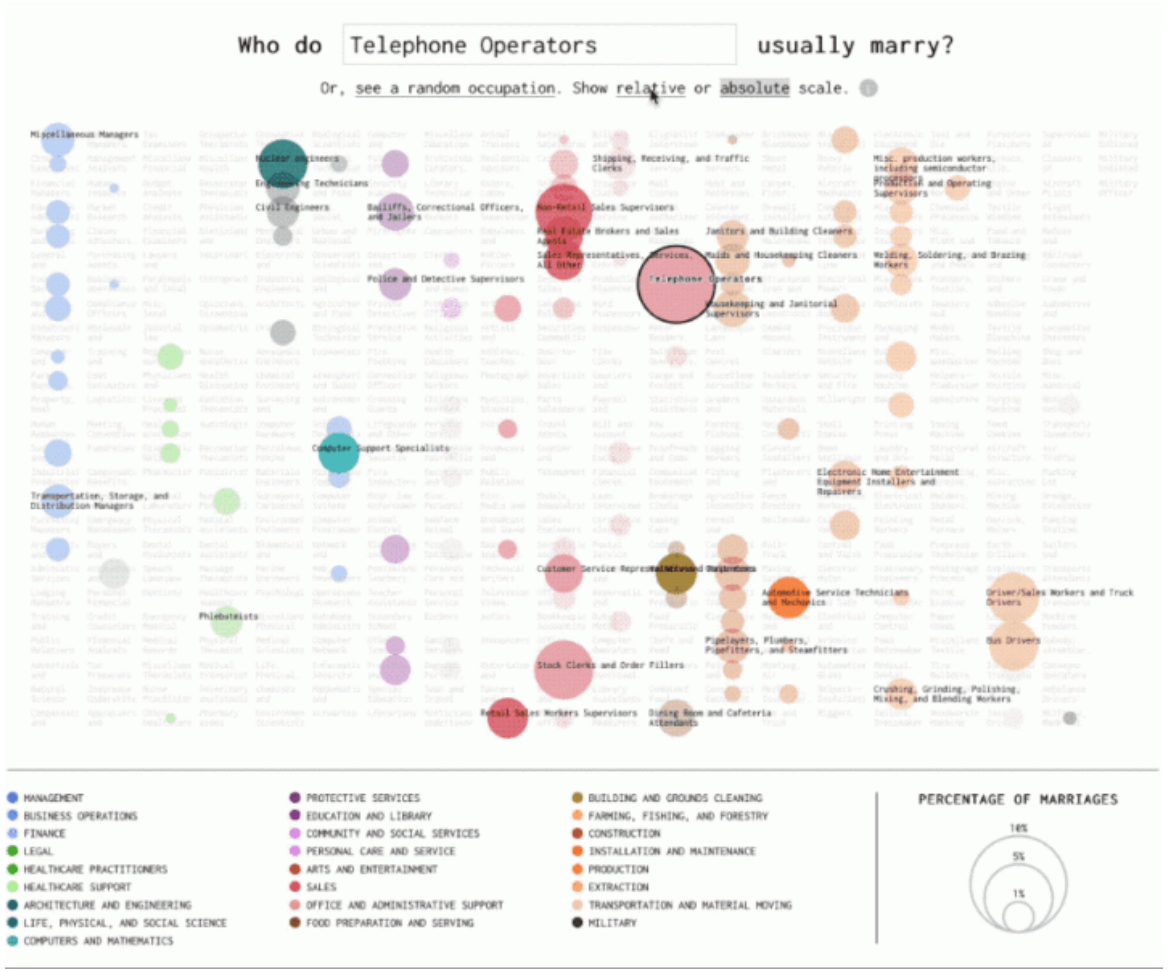
Outliers

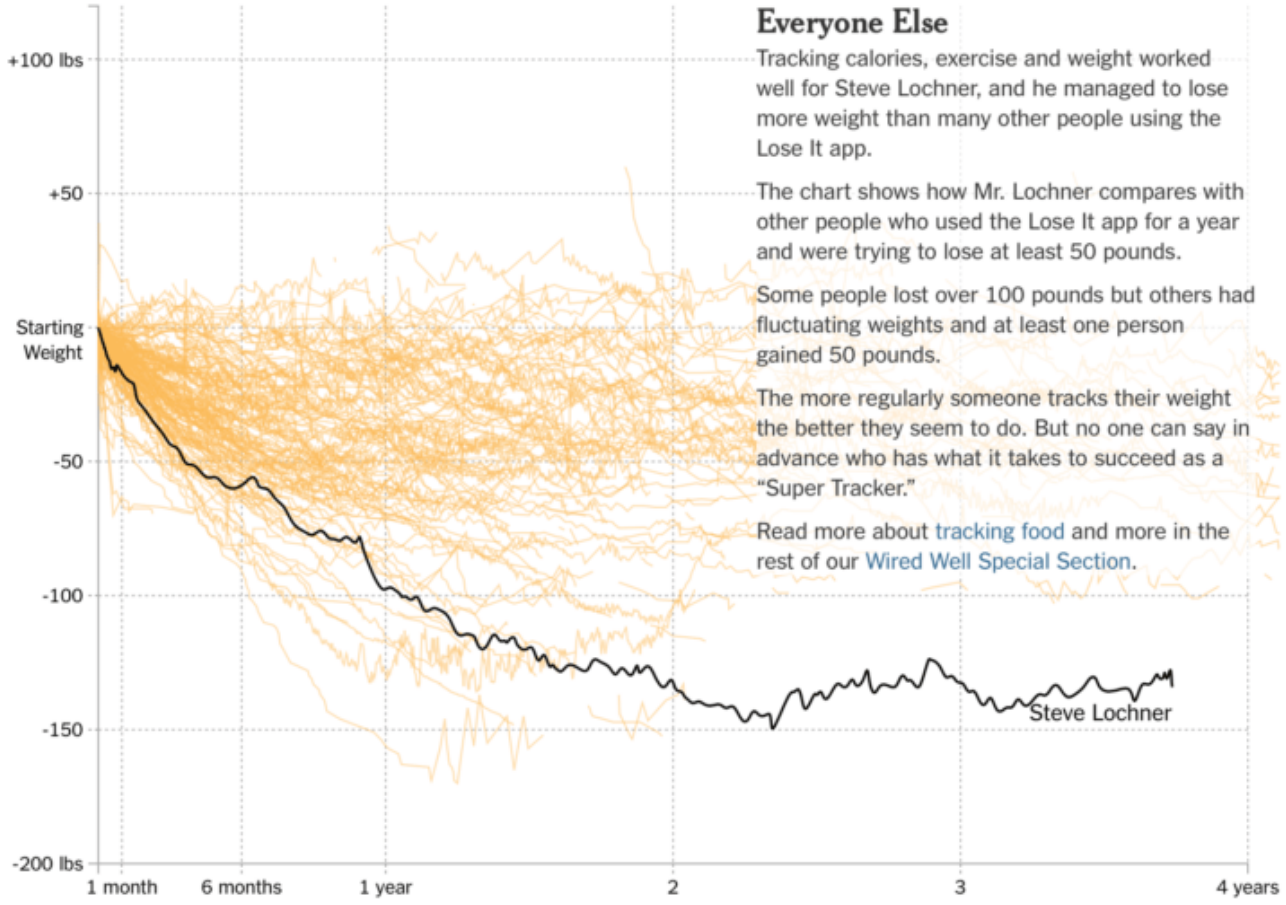




https://flowingdata.com/2018/03/07/visualizing-outliers/

Outliers





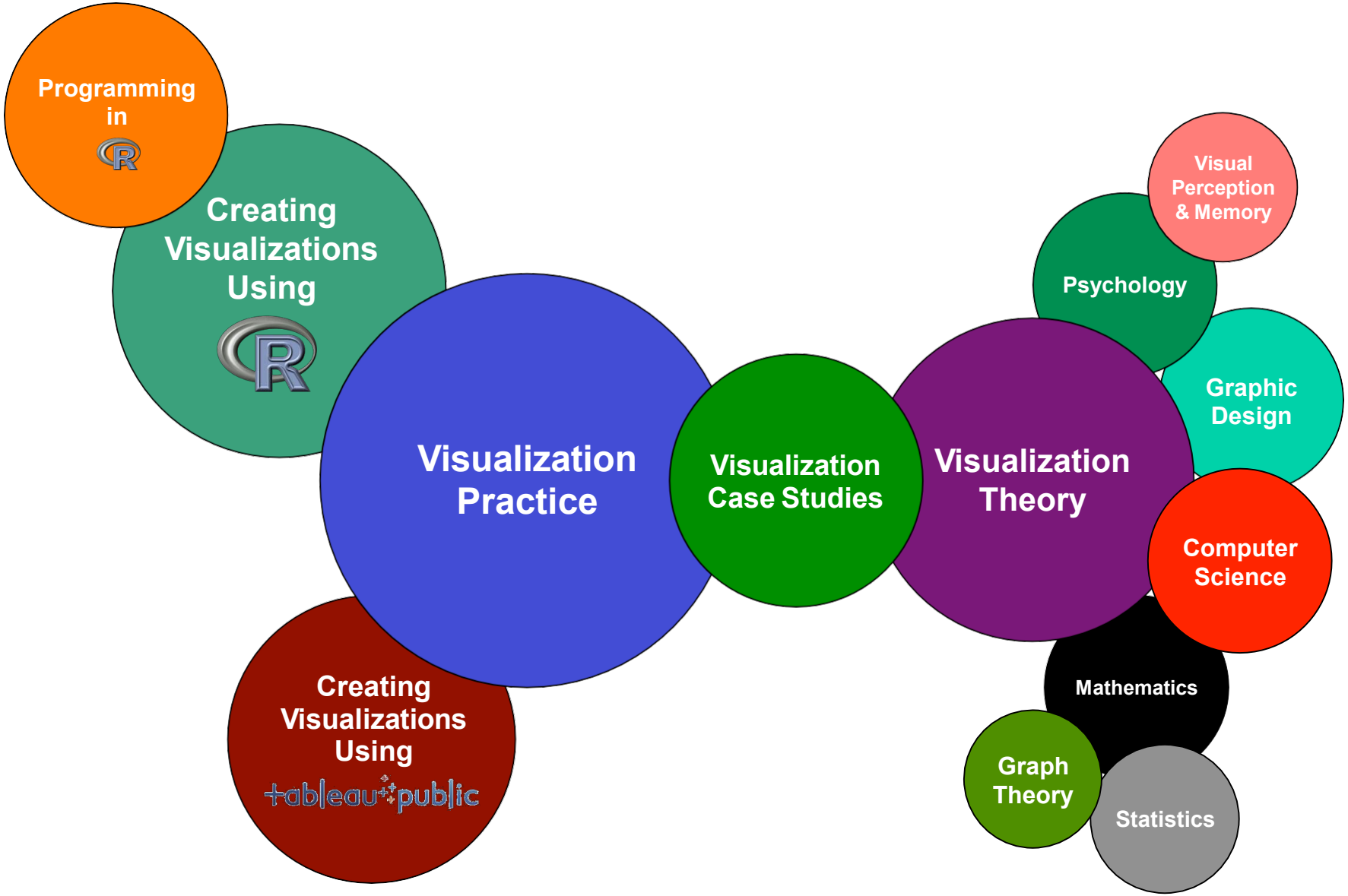
https://flowingdata.com/2018/03/07/visualizing-outliers/

Validation

- Always try to validate your visualisations
- You have seen the data too often to get an unbiased view

- Show the plot to someone not familiar with the data:
  - What does this chart tell you?
  - Is this the message you wanted to convey?
  - If they pick multiple points, do they choose the most important first?

Content


Programming in R
Creating Visualizations Using R
Visualization Practice
Creating Visualizations Using tableau public
Visualization Case Studies
Visualization Theory
Visual Perception & Memory
Psychology
Graphic Design
Computer Science
Mathematics
Graph Theory
Statistics

Human Visual Perception and Data Visualisation

- Data visualisation is an external aid to support our working memory
- Visual perception is selective
  - If we tune our awareness to everything, we will be overwhelmed. So we selectively pay attention to things that catch our attention
- Our eyes are drawn to familiar patterns
  - We see what we expect to see. So visualisation must take into account what people know and expect
- Our working memory is very limited
  - We can hold a very limited amount of information in our memory when looking at a visual
- We want more visual perception and less cognition

Remember!

Well-designed visual representations can replace cognitive calculations with simple perceptual inferences and improve comprehension, memory, and decision making

By making data more accessible and appealing, visual representations may also help engage more diverse audiences in exploration and analysis

The challenge is to create effective and engaging visualizations that are appropriate to the data, the audience and the message

Classifications of visualisations

1. Complexity
2. Infographics vs Data visualisation
3. Exploration vs Explanation
4. Informative vs Persuasive vs Visual Art

"Designing Data visualisations", N. Iliinsky & J. Steele, O'Reilly Media, 2011

VISUALISATION WORKFLOW

Visualisation

- Ben Fry's visualisation process - Designer

- Visualisation process – Viewer

"Visualizing Data: Exploring and Explaining Data with the Processing Environment", B. Fry, O'Reilly Media, 2007

Visualisation Workflow

Stage 1	Stage 2	Stage 3	Stage 4
• Formulating your Brief	• Working with data	• Establishing your **editorial thinking**	• Developing your design solution

Data Visualisation: A Handbook for Data Driven Design. Andy Kirk

Visualisation Workflow - Editorial Thinking

- Angle of analysis
  - Relevance: audience, context, message
  - Sufficiency: number of angles
- Framing
  - Reducing clutter
- Focus
  - Reducing noise

Data Visualisation: A Handbook for Data Driven Design. Andy Kirk

Data Representation and Encodings

- Data types Visual encodings
- Marks and attributes
- Selecting appropriate visual encodings for the data
- Gestalt Theory – principles about how our mind perceives the whole out of incomplete elements

Appropriate Visual Encodings

Choosing Appropriate Visual Encodings

- Natural ordering
- Distinct values
- Defaults versus innovative formats
- Readers’ context
- Compatibility with Reality
- Patterns and Consistency

Appropriate Visual Encodings

Choosing Appropriate Visual Encodings

- Colour
- Size
- Text and Typography
- Shape
- Illusions
- Legend vs. direct labels

Visualisation of data

- Trends over time
- Comparisons
- Relationships
- Text
- Spatial relationships

Visualisation of data resources

- From data to viz:
  - https://www.data-to-viz.com/

- Depict data studio:
  - https://depictdatastudio.com/charts/

from Data to Viz

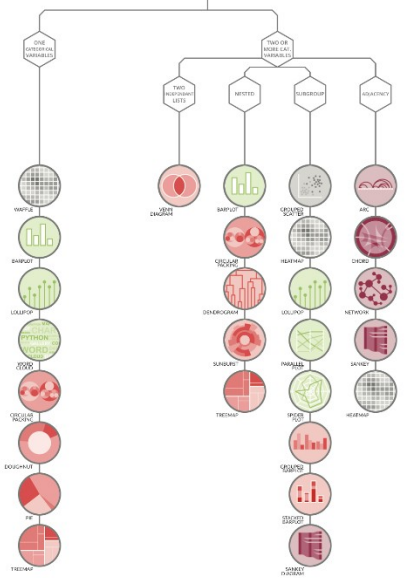
'From Data to Viz' is a classification of chart types based on input data format. It will help you find the perfect chart in three simple steps :

1. Identify what type of data you have.
2. Go to the corresponding decision tree and follow it down to a set of possible charts.
3. Choose the chart from the set that will suit your data and your needs best.

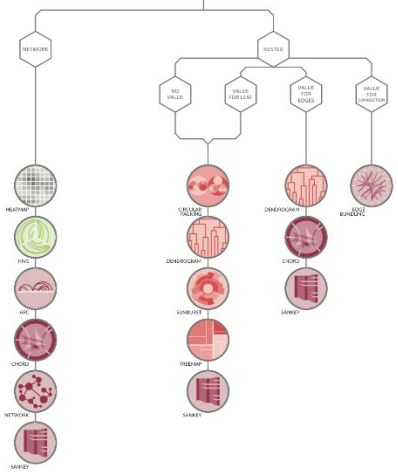
Dataviz is a world with endless possibilities and this project does not claim to be exhaustive. However it should provide you with a good starting point. For an interactive version and much more, visit:

data-to-viz.com

CATEGORIC

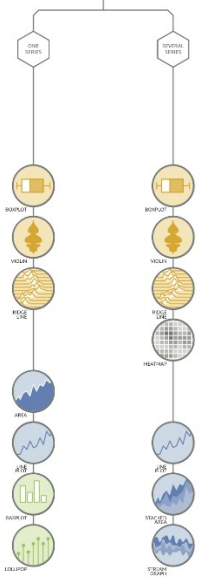


RELATIONAL



MAP

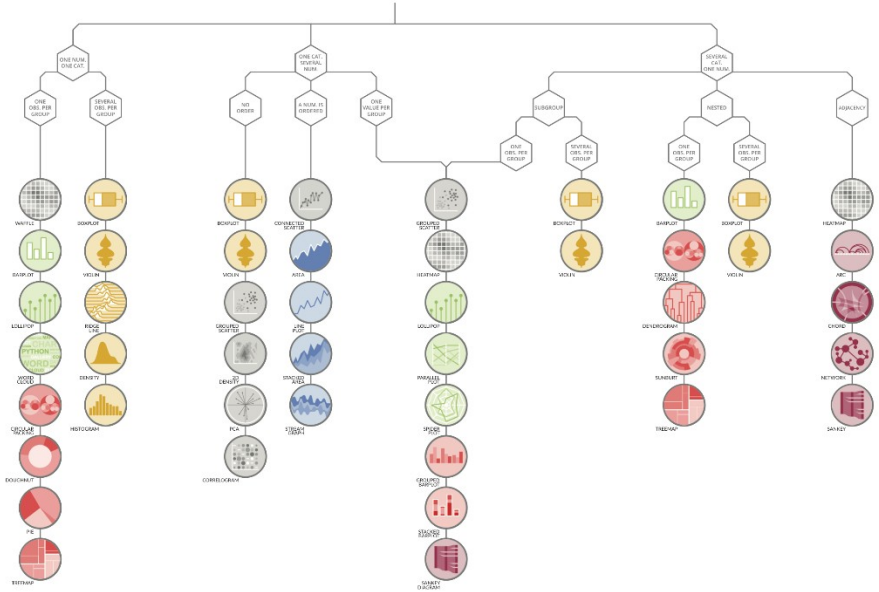
TIME SERIES



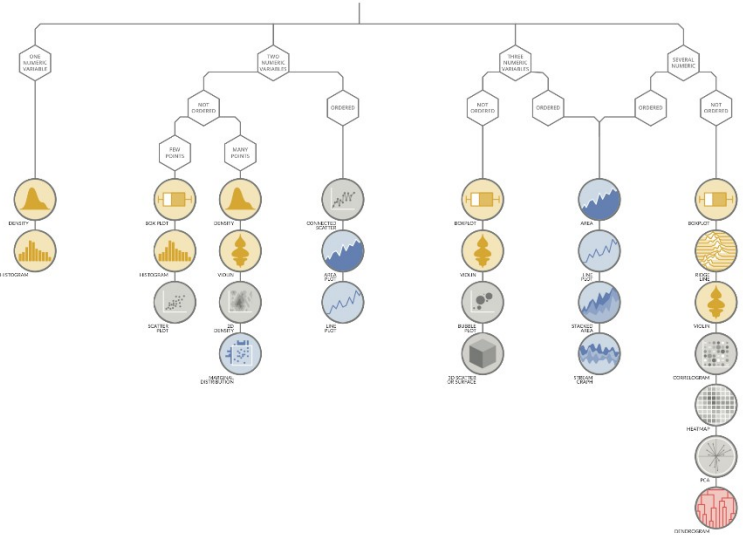
WHAT DO YOU WANT TO SHOW ?

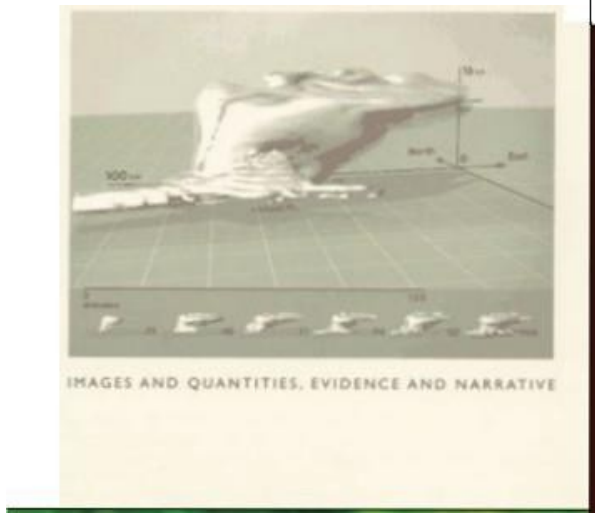
- Distribution
- Correlation
- Ranking
- Part of a whole
- Evolution
- Maps
- Flow

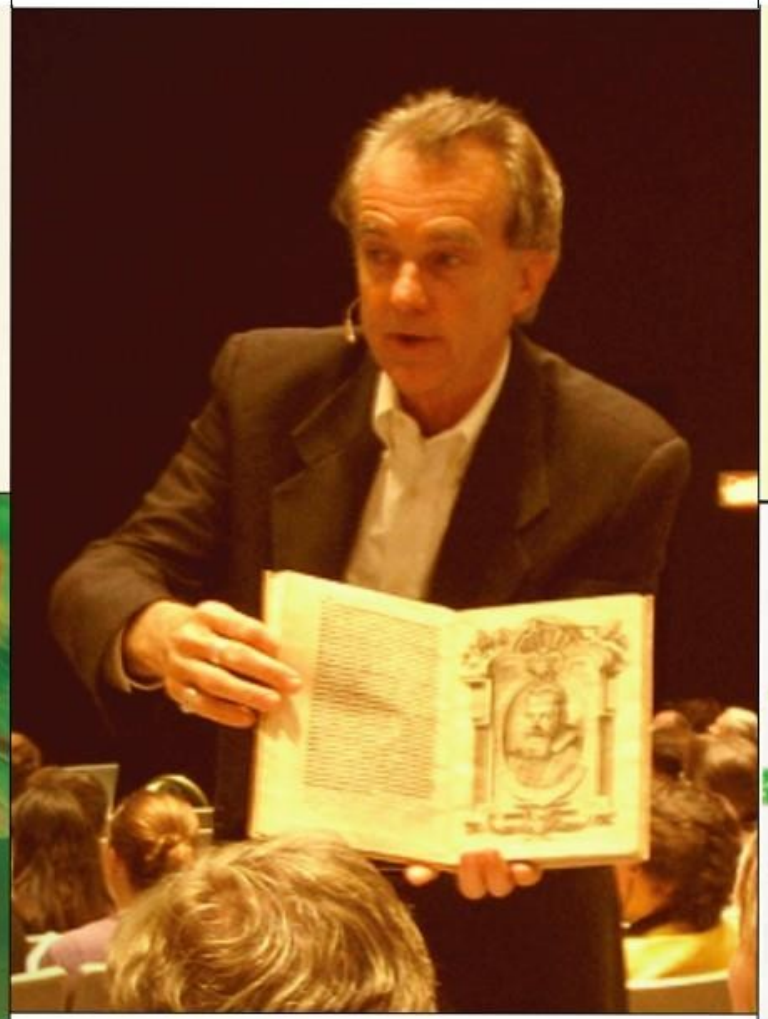
CATEGORIC AND NUMERIC

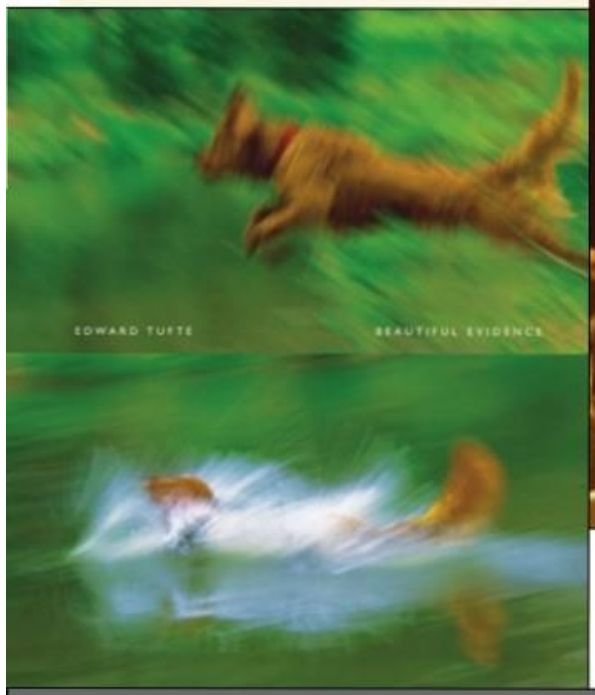


NUMERIC









www.edwardtufte.com/bboard/q-and-a-fetch-msg?msg_id=0001OR

Edward Tufte

- Some guidelines from Edward Tufte:

1. Show the data
2. Induce the viewer to think about the substance rather than about methodology, graphic design, the technology of graphic production, or something else
3. Avoid distorting what the data have to say
4. Present many numbers in a small space

Edward Tufte

5. Make large data sets coherent
6. Encourage the eye to compare different pieces of data
7. Reveal the data at several levels of detail, from a broad overview to the fine structure
8. Serve a reasonably clear purpose
9. Be closely integrated with the statistical and verbal descriptions of a data set

Suggested video

- David McCandless
- The Beauty of data visualization TED Talk

Open Book Exams

Some Links for Students

- Video explaining the process:
  - https://youtu.be/5fNLl-8MB-A

- Guide for Students:
  - https://docs.google.com/document/d/1FUUyVhEI6NfAN5Hm1GCFwI3zyYvao6_6D8tsPCCr8yM/edit?usp=sharing

Different from a Closed Book Exam

- You are allowed to have access to books, papers and on-line content while doing the examination
  - This doesn’t mean you have to study any less for this type of exam, it just means you focus more on understanding the key concepts, rather than memorizing facts
- Look at the guides to help you get your resources ready in advance of the exam
- Questions will be worded differently

Things to note

- All students have been presented with a Declaration of Academic Integrity in Brightspace. Students who accepted this declaration were granted continued access into Brightspace course material, assignments and assessments. This means that you agree to abide by the terms and conditions within the declaration as part of this assessment

- Please note that this is an individual assessment and cooperation and collaboration with other students or individuals is not permissible

Instructions

- If you have queries regarding the paper you should inform the invigilator within the first 2 hours of the exam start. Exams Office will contact me and I will review the query, and if a clarification is required on a question then I or the Exams Office will email all students using the Brightspace email system

- You should monitor your email for the first 2 hours after the start of an exam in the event of a clarification to a question being issued

Instructions

- Students must adhere to the general assessment regulations which deals with plagiarism. All material sources must be referenced and students must not “cut-paste” answers into their answer sheet.
- You are allowed multiple submissions in case there are any issues with an upload, but the latest submission will be the one that is graded.
- Answer submissions should be in a format easily read by the me. The following formats are acceptable .docx, .doc, .rtf, .txt, .pdf with pdf being the preferred format
- You may include images and diagrams in your answer if you wish. Be careful when uploading these that they don’t become detached from the document. Consider saving your final submission as a pdf and submitting that. You can take pictures with your phone and include in the document

Open Book Exam Questions

- Not a copy/paste of notes/text books – **in your own words. No plagiarism.**
- **Read the question carefully** and make sure to answer the question you are asked
- Questions will ask you to **apply the theory/knowledge** you have learned to **new scenarios**
- You might also be asked to **reflect** on your own data visualisations and any improvements that could be made
- Questions in sample paper are to **guide you on the language used and overall structure** of the exam paper, they are not an indication of the questions you will be asked or the topics that will be covered

Sample Exam Paper

Available for 4 hours at a set time on a set date. Exam should take about 90 minutes to complete.