Visualization Inspiration

2022 Feb.

Agenda

§1. Introduction

§2. History of Data Visualization

§3. Visualization Design

§4. Data Storytelling

§5. Awesome Charts

§0

Takeaways

Takeaways

01. Visualization has the effect of not only reducing the burden on the brain but also calming the mind

02. Visualization can be effectively used more as a communication tool

03. Keeping in touch with awesome visual sources (e.g. Pinterest) can create new inspiration!

§1

Introduction

Introduction

- What's Visualization?
- Recent Trends on Data Visualization
- Celebrities to refer to for Visualization

What's Visualization?

Definition of "Visualization":

[Dictionary by Merriam-Webster]

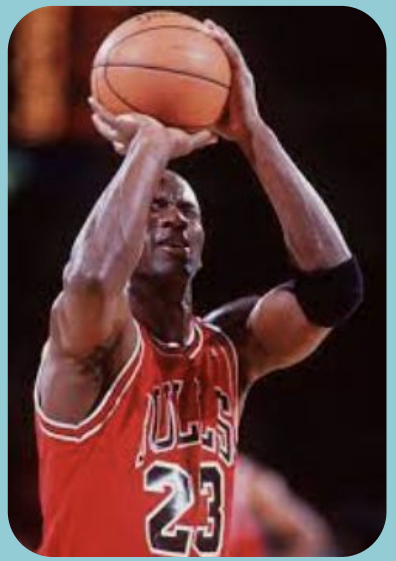
- Formation of mental visual images
- Act or process of interpreting in visual terms or of putting into visible form

What's Visualization in your life?

- ***Visualization is usually paired with meditation and mindfulness***

Ex.) Sports:

- *Many professional athletes use the practice of visualization before games*
- *Studies on basketball found that:*
  - *Improve the percentage of free throws made by simply visualizing making free throws* ***without even practicing shooting the ball***



How Visualization Transforms Your Life?

- *When you practice visualization, you are getting into the routine of calming your mind*

- **Learn what you really want**
  - *Working through visualizations helps you to come up with clear goals and really understand what it is that you want*
- **Reduce stress that you experience**
  - *Visualization allows you to take control of what you are thinking about and how your body is reacting*
- **Overcome anxiety**
  - *You can overcome your anxiety and nervousness with the practice of visualization*

Definition of "Data Visualization": [Gartner]

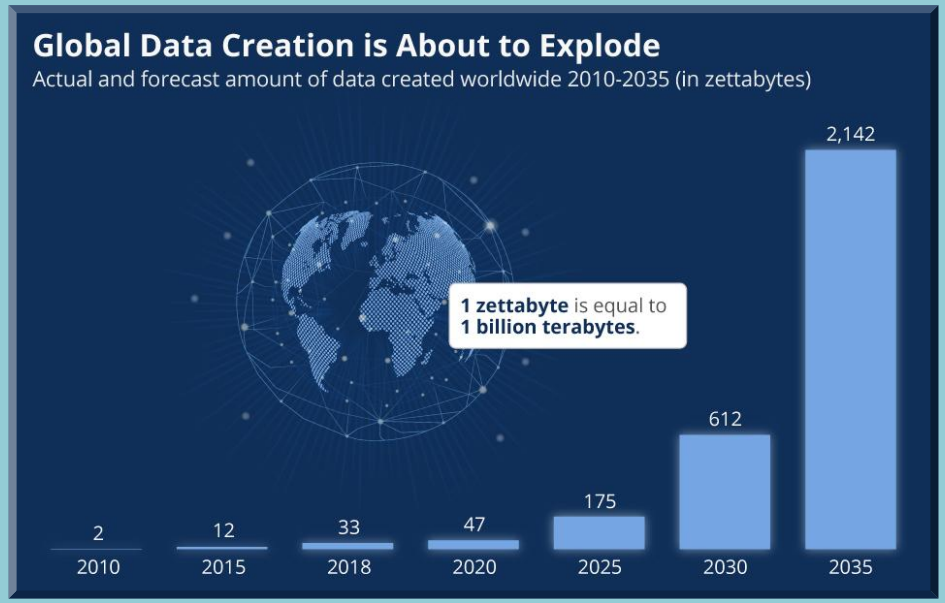
- Data visualization is a way to represent information graphically, highlighting patterns and trends in data and helping the reader to achieve quick insights

- Also known as "interactive visual exploration":
  - It enables the exploration of data via the manipulation of chart images, with the color, brightness, size, shape and motion of visual objects representing aspects of the dataset being analyzed

Recent Trends on Data Visualization

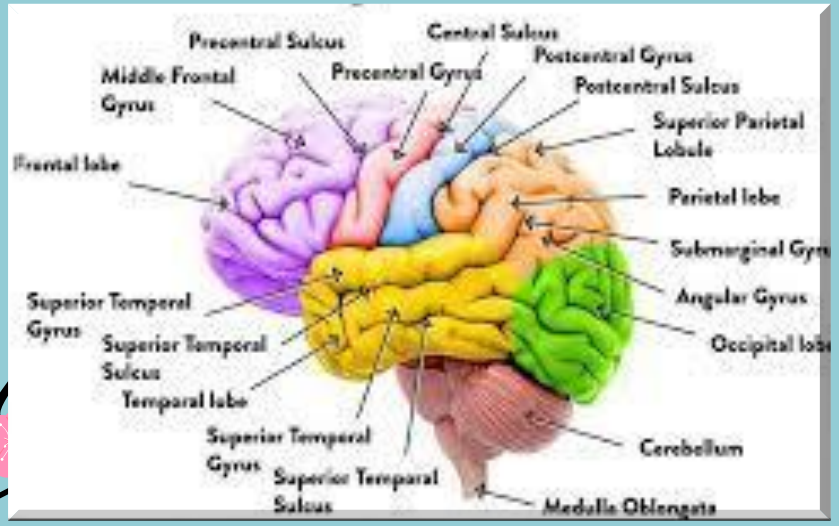
Global Data Creation Forecasts [Source]

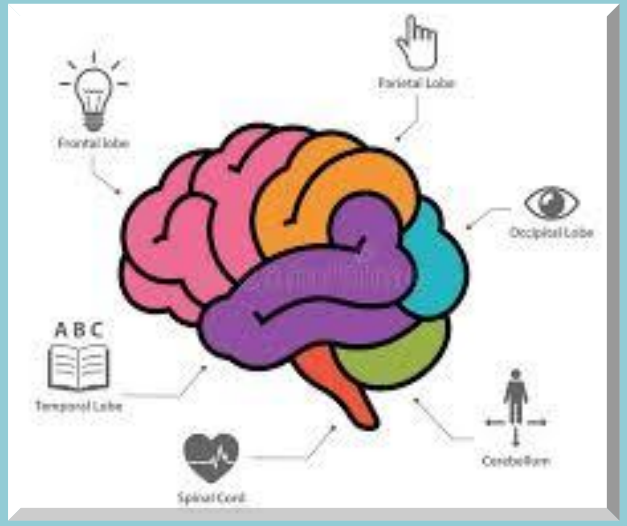
- **By 2025, the sum of business and consumer data will reach 175 zettabytes in size**
  - Human inefficiency to process the data may be a problem



Human brain is optimized for visuals

- Which figure can quickly grasp each function of brain?
- Human brain can process visuals 60,000 times faster than text !?





Recent Trends on Data Visualization [Source]

- With the rapid increase in the amount of data,
  Visuals that do not put a burden on humans are becoming a trend

01. Video Visualization

- 67% of users preferred to learn about a new product or service through a video rather than pictures or text.

02. Data Democratization

- Advanced, no-code data analysis platforms can automatically process

03. Real-time Visualization

- Important to notice when a problem arises at the exact moment it arises

04. Mobile and Social DataVis

- Feb. 2021, 56% of internet access came from mobile devices

05. AI and ML Datavis

- AI and ML are the backbone of all great datavis and will be increasingly key

Celebrities to refer to for Visualization

Celebrities to refer to for Visualization

01. **Steve Jobs (1955~2011y)**
CEO and co-founder of Apple Inc.

02. **Edward Tufte (1942y~)**
Pioneer in the field of data visualization

03. **Stephen Few**
Principal of the consultancy Perceptual Edge

Lessons about data visualization by Steve Jobs: [Source]

- **Steve Jobs was a master of storytelling with minimalistic designs**

  - **Less is More** — Keep your message short and simple
    - ➢ This philosophy can be applied to data visualization
  - **Use Stories** — Present your facts using stories
    - ➢ Steve Jobs was a master of storytelling
  - **Use Visuals** — Use More Visuals, Less text
    - ➢ People can understand the information provided faster if it's easy for them to digest at a glance

Lessons about data visualization by Edward Tufte: [Source]

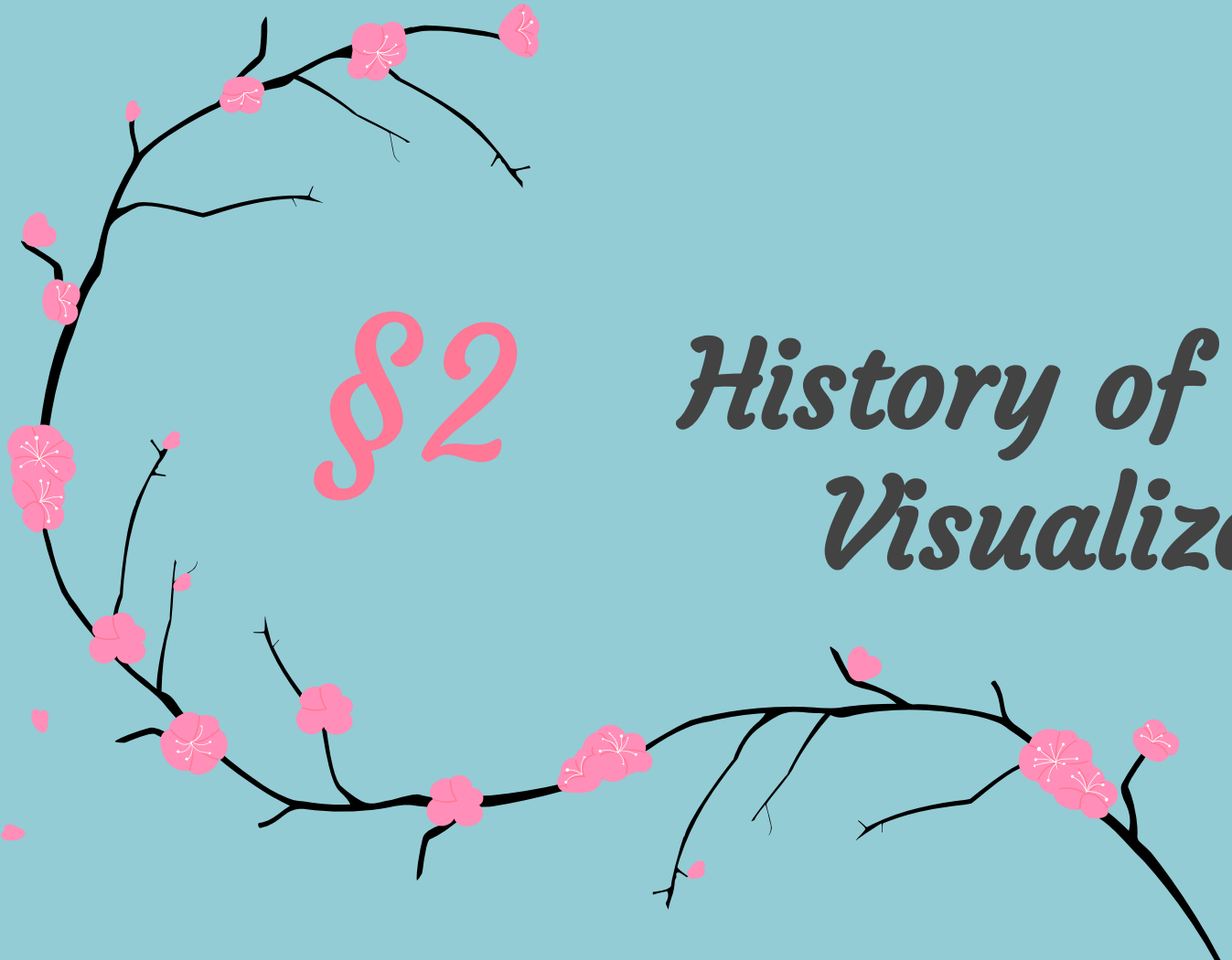
- Tufte's articles are important in such fields as information design and visual literacy

  - **Information Design**
    - He coined the word "chartjunk", "data-ink ratio"
      - Useless, non-informative elements of quantitative displays
  - **Criticism of PowerPoint**
    - Essay: "The Cognitive Style of PowerPoint"
      - He criticized the way Microsoft PowerPoint is typically used
  - **Small Multiple**
    - Sparkline (a very small line chart)

8 Core Principles on Data Visualization Tableau: [Source]

- Good data visualization takes the burden of effort off brain and puts it on the eyes

- **Simplify:** Captures the essence of data
- **Compare:** Can compare side by side
- **Attend:** Pay attention to the relevant/irrelevant details
- **Explore:** Explore data and discover things
- **View Diversely:** Different views provide different insights.
- **Ask why:** Why is it happening?
- **Be skeptical:** Powerful tools give you the luxury to ask more questions
- **Respond:** Leads to global enlightenment



§2 History of Data Visualization

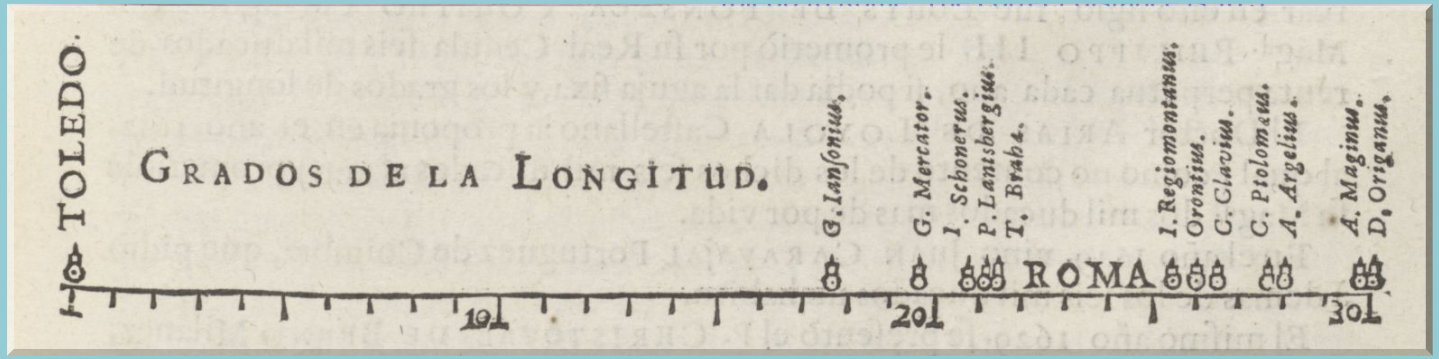
History of Data Visualization

01. The First Graph (1640~)
02. Modern Graphics (~19th Century)
03. Scatterplot (19th Century~)
04. Golden Age of Statistical Graphics(1850~1900)
05. Visualizing Time and Space

[A History of Data Visualization and Graphic Communication(2021y)]
by Michael Friendly, Howard Wainer

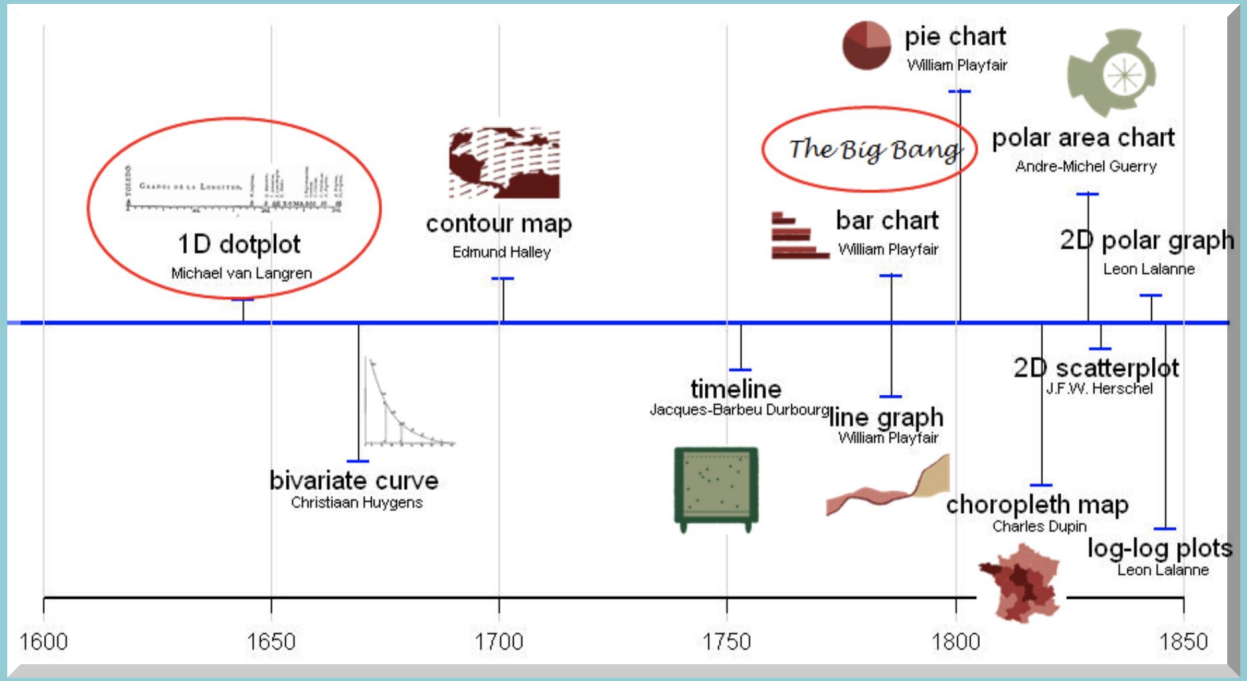
01. The first statistical graph

- *Who invented the idea of graphing data?*



Van Langren's 1644 graph of twelve determinations of the longitude distance from Toledo to Rome: The correct distance is 16.5°.

Graphical Inventions



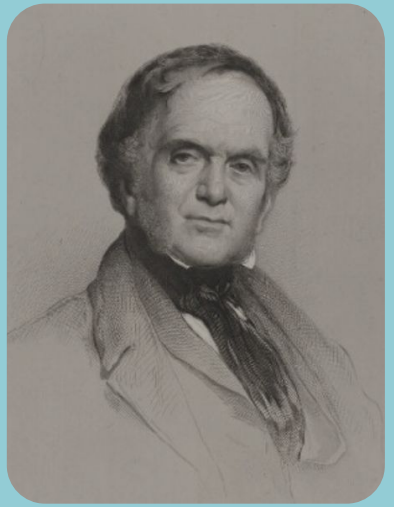
Timeline of the invention of some basic forms for statistical graphs, 1600–1850.

02. Modern Graphics

- William Playfair(1759~1823), the Father of Modern Graphics

At the beginning of the 19th Century, nearly all of the modern forms of data graphics were invented

- Pie chart
- Line graph of a time series
- Bar chart
- ...

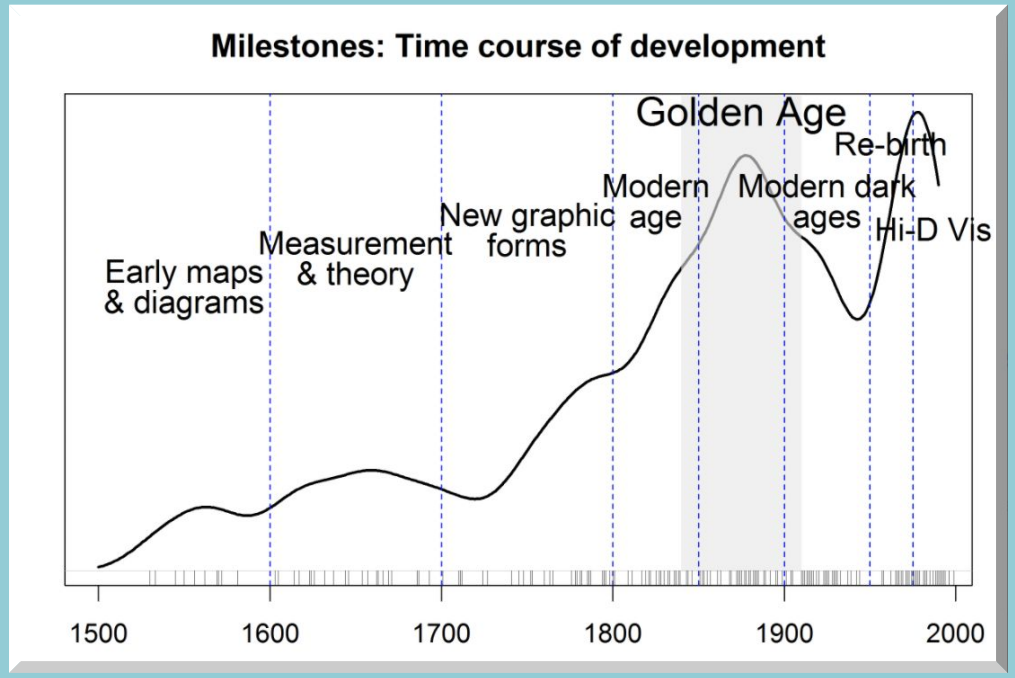


03. Scatterplot

- *Among all the moderns forms of statistical graphics, the scatterplot may be considered the most versatile and generally useful invention*

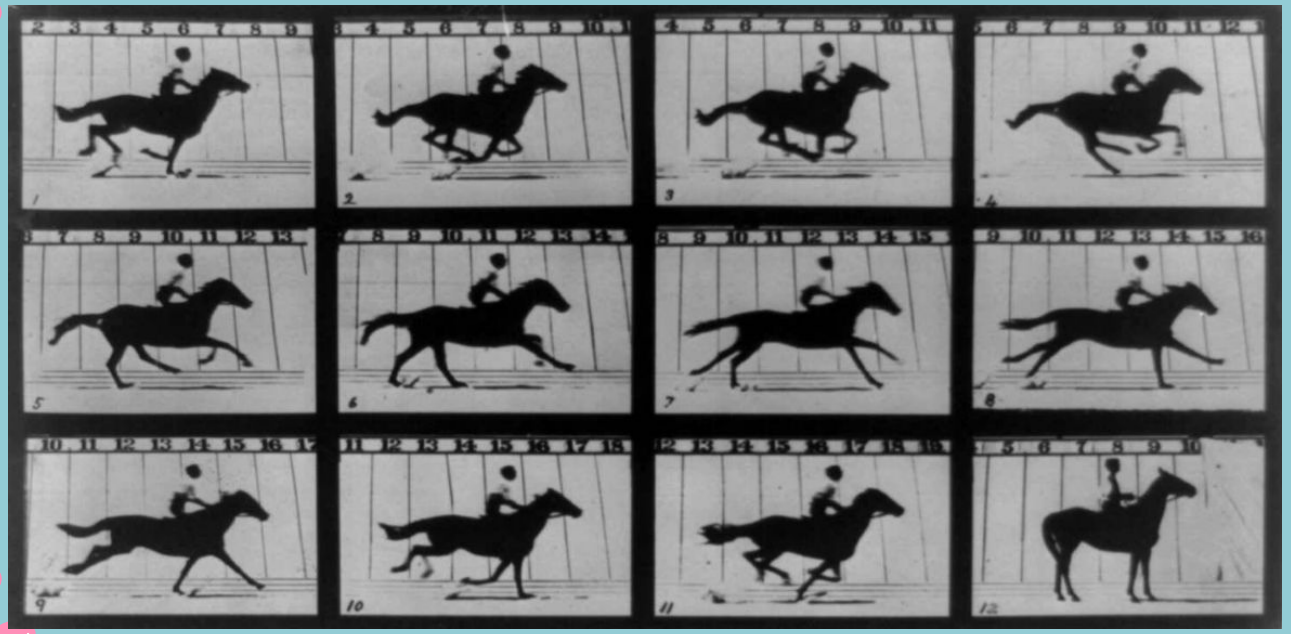
  - ***70~80% of graphs used in scientific publications are scatterplots*** *(By Edward Tufte)*
  - *Graph assuming Cartesian coordinates*
  - *The source of the statistical ideas of correlation and regression*

04. Golden Age of Statistical Graphics

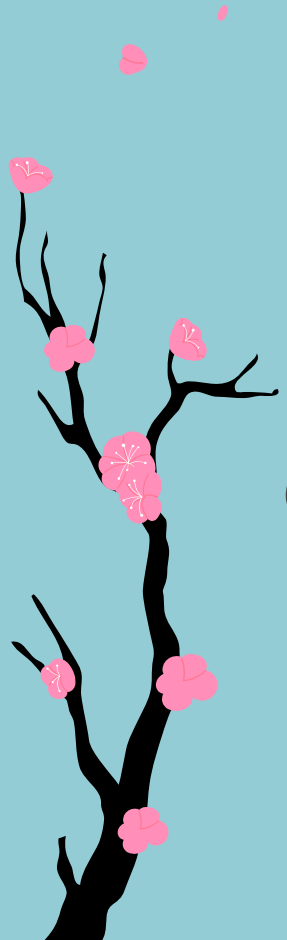


In the latter half of the 19th Century, enthusiasm for graphical methods matured, and a variety of developments in statistics.

05. Visualizing Time and Space

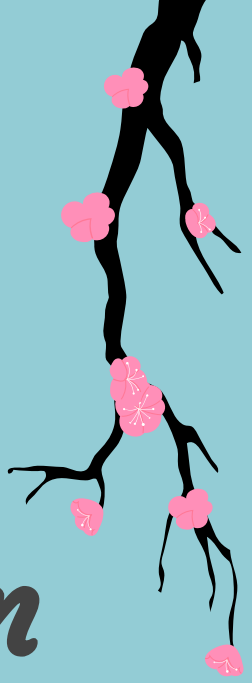


The Horse in Motion:
Photographs of the horse "Sally Gardner" running at a gallop, June 19, 1878.



§3

Visualization Design



Visualization Design

Q1. What is the purpose of visualization?

Q2. What are the key elements of visualization?

Q3. How to learn visualization?

Q1. What is the purpose of visualization?

- **Visualization can be effectively used more as a communication tool**

01. Data Analysis Perspective

- Find awareness before exploratory data analysis (EDA)
  - Make errors more noticeable

02. Thinking Arrangement

- Tool for organizing your thoughts
  - Adjust the level of abstraction depending on the purpose

03. Communication Tool

- Properly share your ideas with others immediately
  - Cartoons help to share ideas with little information

Q2. What are the key elements of visualization?

❑ Clarify the message you want to convey though visuals

01. Clarification of target audience

- ➢ *Make it clear who you will show and explain to*

02. Leaving only essential information

- ➢ *Overviewability of information is important*

03. Design & Appearance

- ➢ *Types, axes, and titles of the graphs*
- ➢ *Check if appropriate for the purpose?*

Q3. How to learn visualization?

- Touch awesome visuals every day
- Just looking at **Pinterest** is inspiring (See: later slide)

01. Organizing and abstracting thinking

- Commonize / abstract user's requests
- Whenever possible, present your ideas in cartoon

02. Trend survey in the design patterns

- imitate awesome design patterns (including color variations)

03. Utilize visualization tools with clear purposes

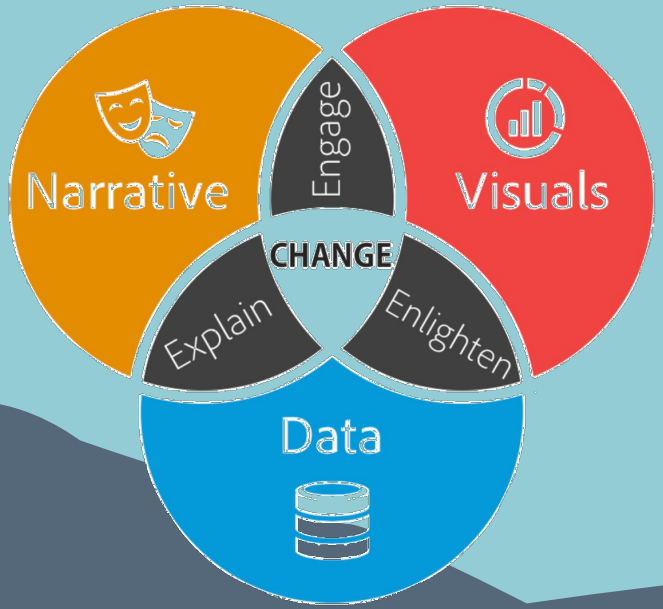
- Use a lot of Plotly (Try different options !!)
- Identify specific use cases

§4

Data Storytelling

Power of Data Storytelling [Source]

Data storytelling is a structured approach for communicating data insights, and it involves a combination of 3 key elements:

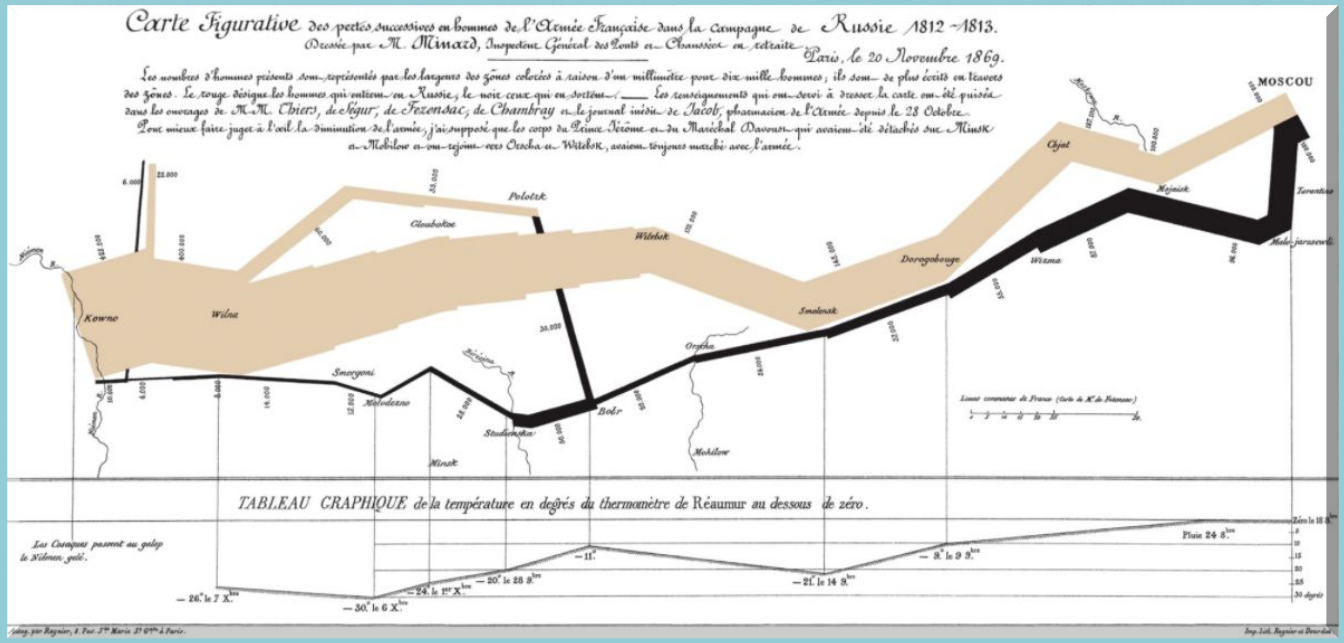


- Data + Narrative → Explain
- Data + Visual → Enlighten
- Visual + Narrative → Engage

Data + Visual + Narrative
→ Change!!

The Minard Narrative Map

[Source]



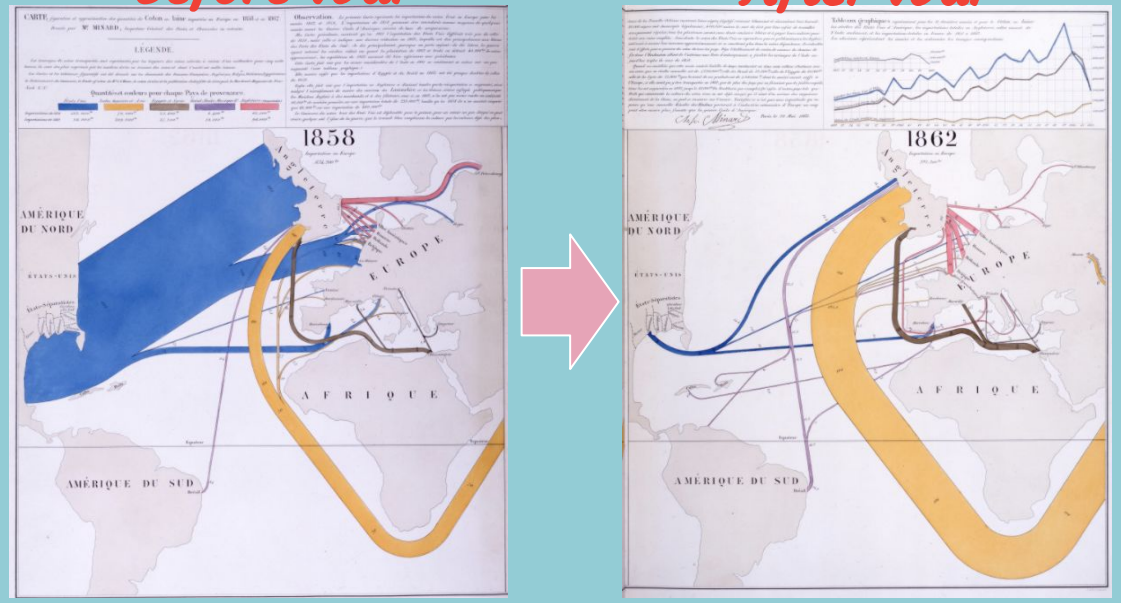
Charles Joseph Minard's narrative map of Napoleon's disastrous 1812 Russian campaign. The width of the gray "river" is proportional to the size of Napoleon's invading army; its black continuation shows the size of the returning army.

Comparative Flow Maps

[Source]

Before War

After War



Effect of the US Civil War on trade in cotton. The import of raw cotton to Europe from various sources to destination is shown by colored flow bands of width proportional to the amount of cotton before (left: 1858) and after (right: 1862) the US Civil War.

200 years that changed the world

[Source]

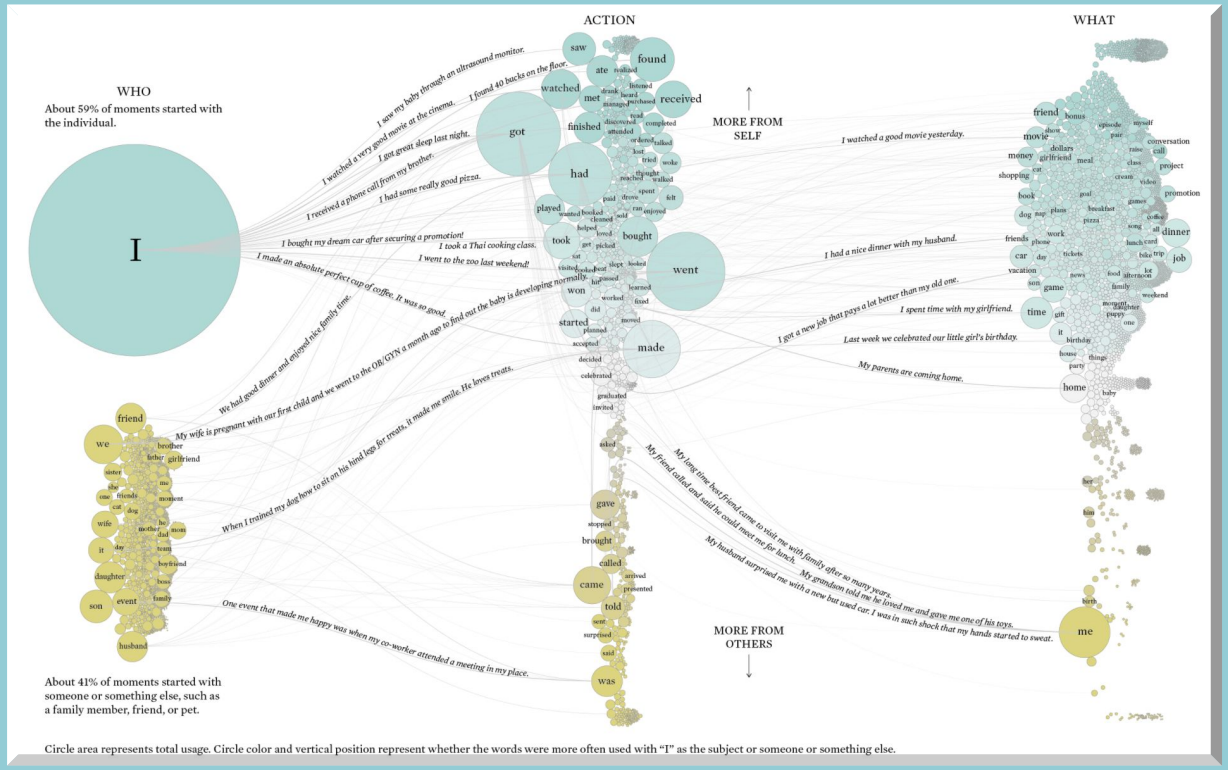
Three frames of an animated sequence, plotting life expectancy against income per person for 142 nations from 1809 to 2015. Income is plotted on a log scale.

Counting Happiness

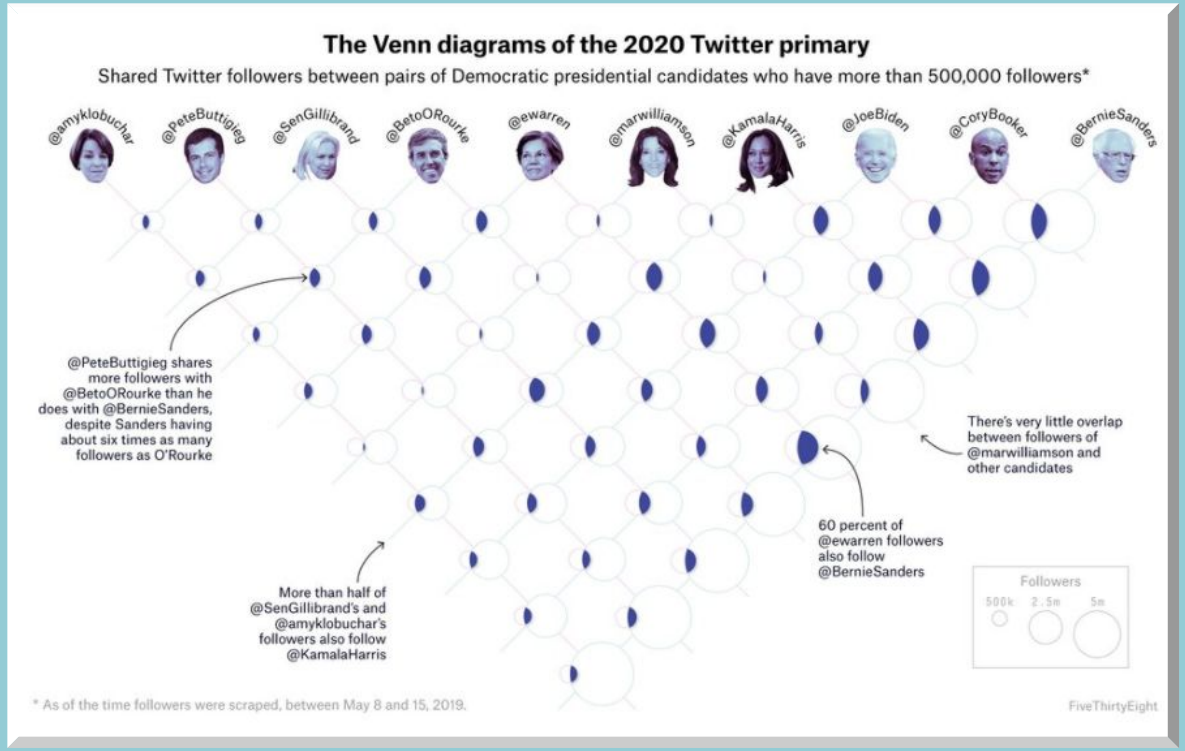
[HappyDB], a collection of 100,000 happy moments

Nathan Yau

1. I / had / dinner
2. I / watched / movie
3. I / got / job
4. I / spent / time
5. I / had / lunch



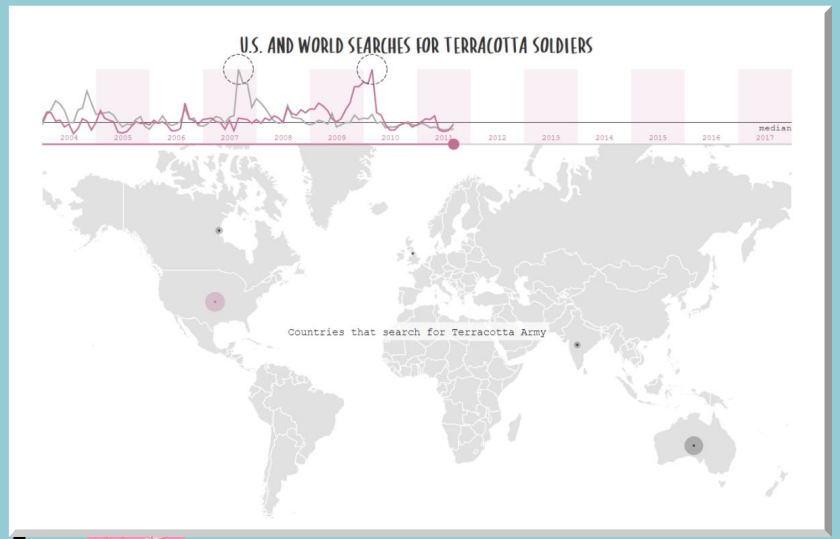
How the Twitter followers of Democratic candidates overlap?

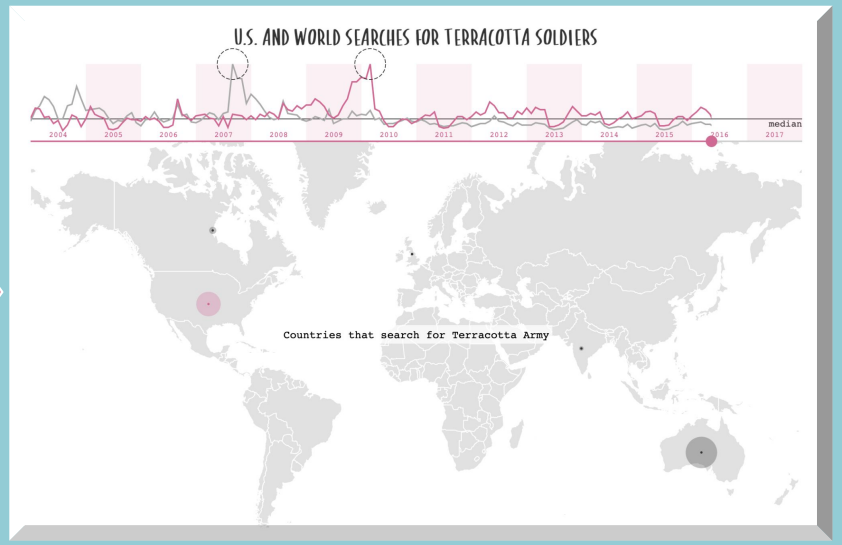


[Source]

Combo Charts as StoryTelling [Source]

- The ideas of "A graph summarizes another graph"





[Shirley Wu on Data Sketches]
[Explore-Adventure]

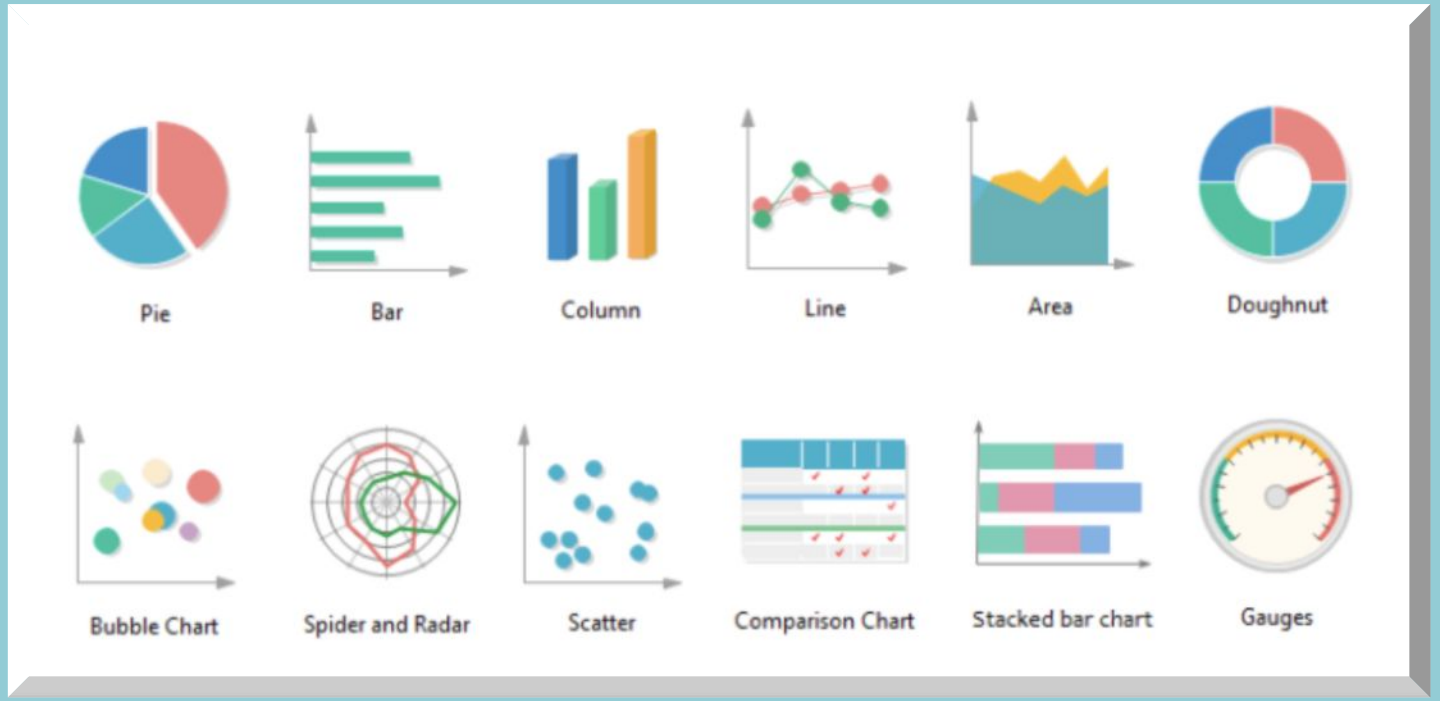
§5
Awesome Charts

Awesome Charts

01. Bubble Chart
02. Animation Plot
03. Sankey Diagram
04. Ridgeline Plot / Joyplot
05. Radial / Circular Bar Chart
06. Chord Diagram

Basic Charts

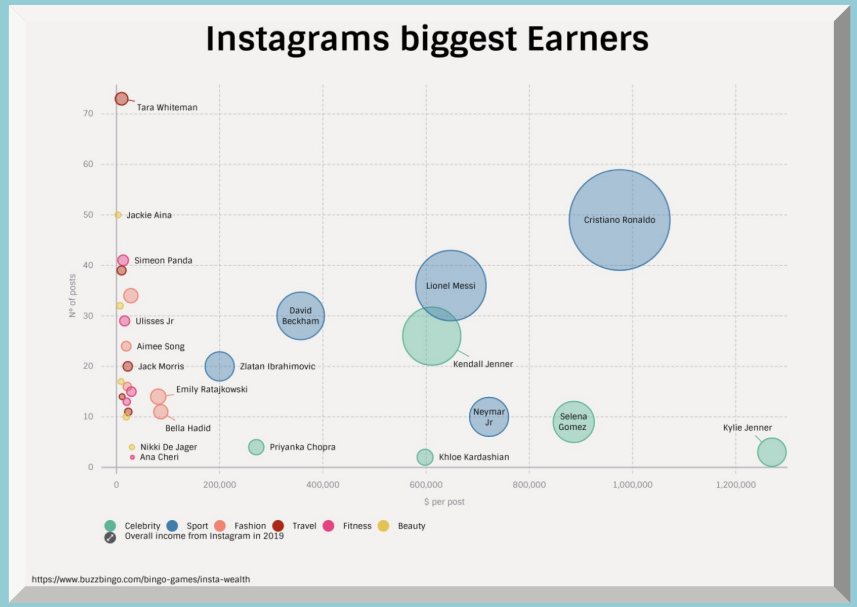
- *It goes without saying that basic charts are important*



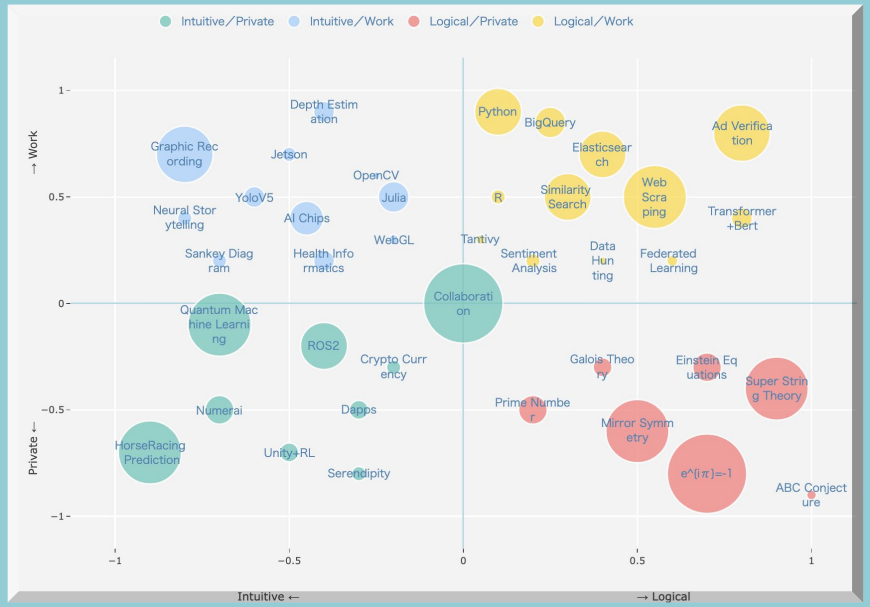
01. Bubble Chart

- Bubble chart expresses 3-dim information in single chart
- Scale information is often represented by bubble size

- Instagrams biggest Earners

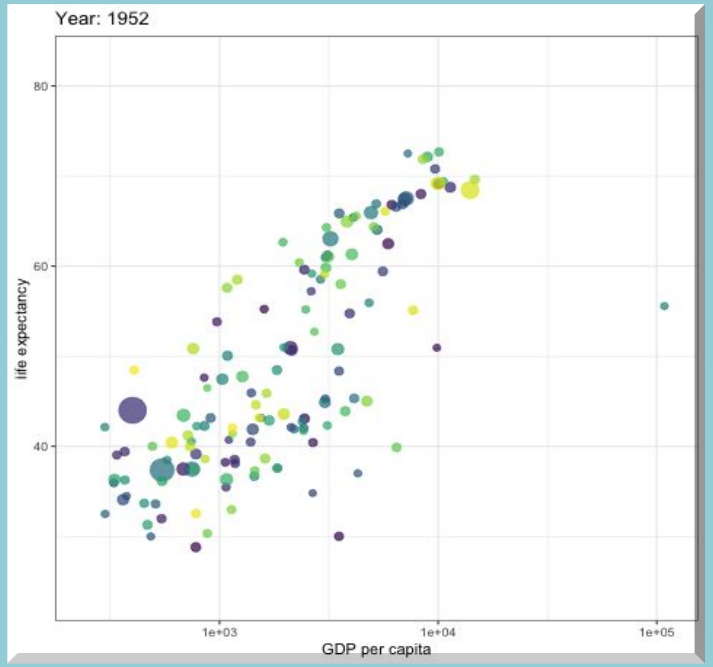


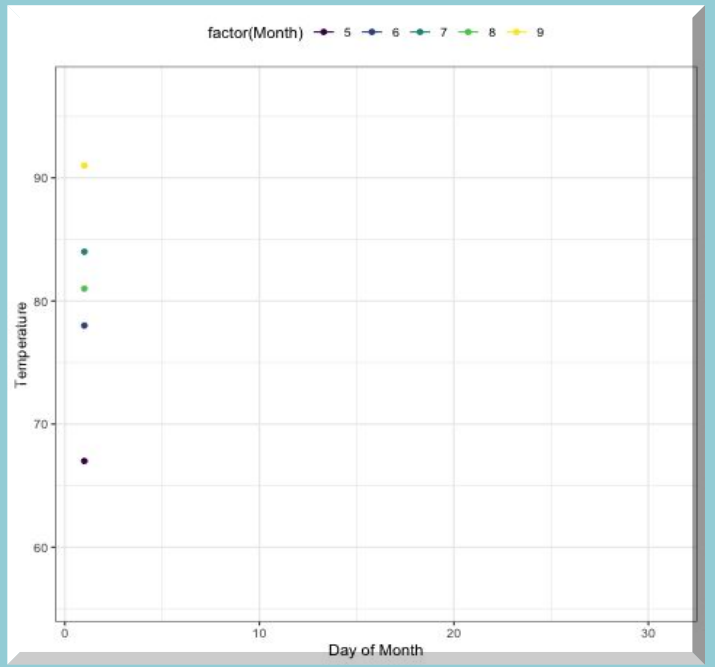
- Interest Map



02. Animation Plot

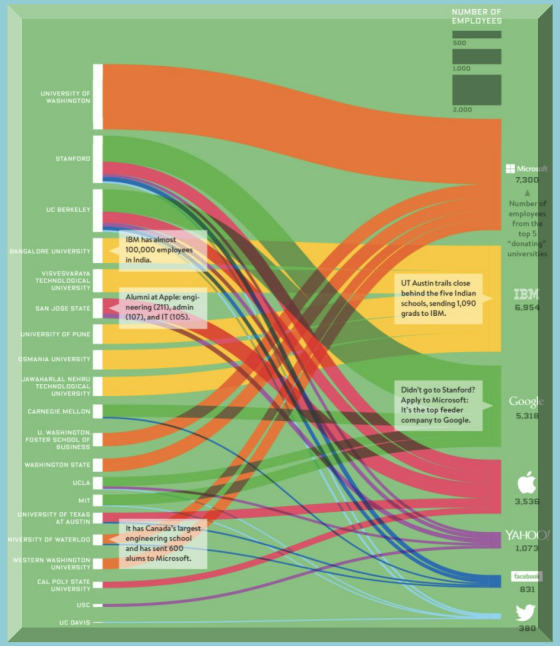
- *Annimation plot has a high affinity with storytelling, and can be used by embedding it in materials*



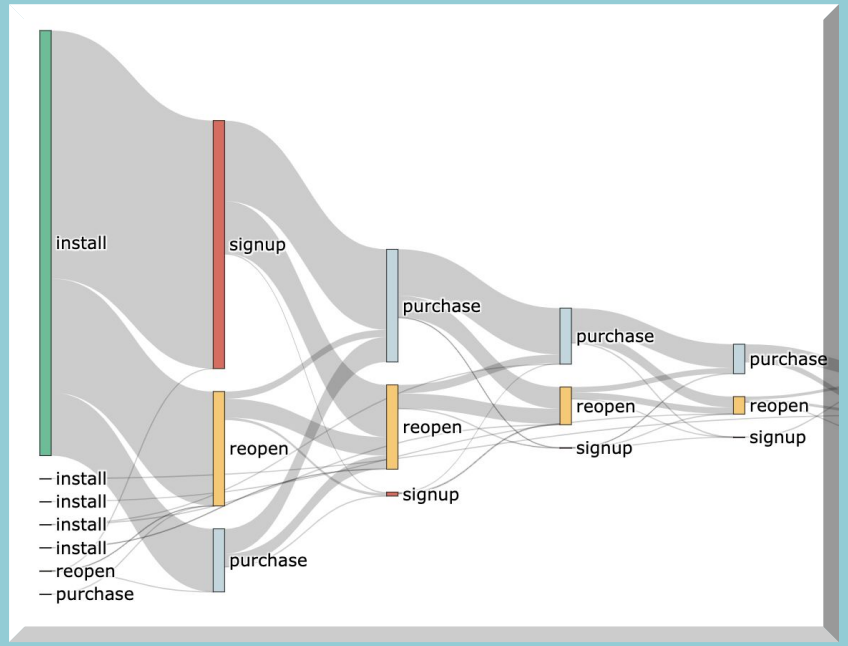


03. Sankey Diagram (1/3)

- Sankey diagrams represent interactions or information flows
  - Which college graduates does Apple, Google, and Facebook employ?



- User Journey in an App



03. Sankey Diagram (2/3)

- Sankey diagrams represent interactions or information flows
  - WorldTour(Road Cycling) Transfers in 2020–2021 Offseason

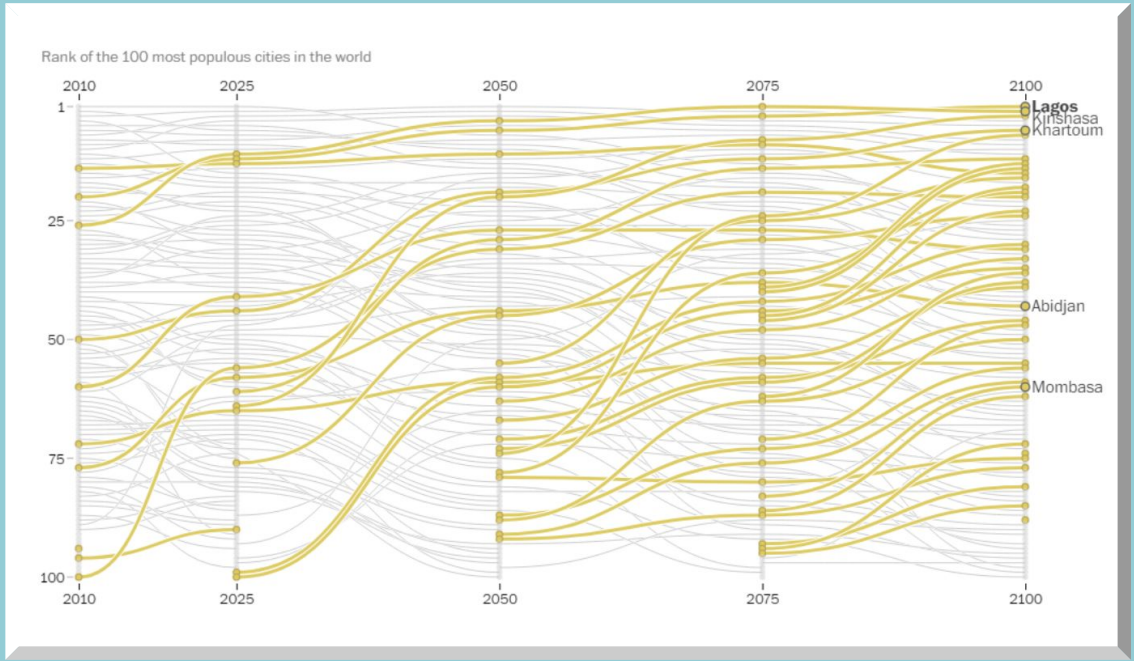
2020 teams

2021 teams

- The teams are ordered according to the # of ProCyclingStats (PCS) points
- Lines between the nodes represent individual riders
- Width of the lines corresponds to the PCS ranking of each rider

03. Sankey Diagram (3/3)

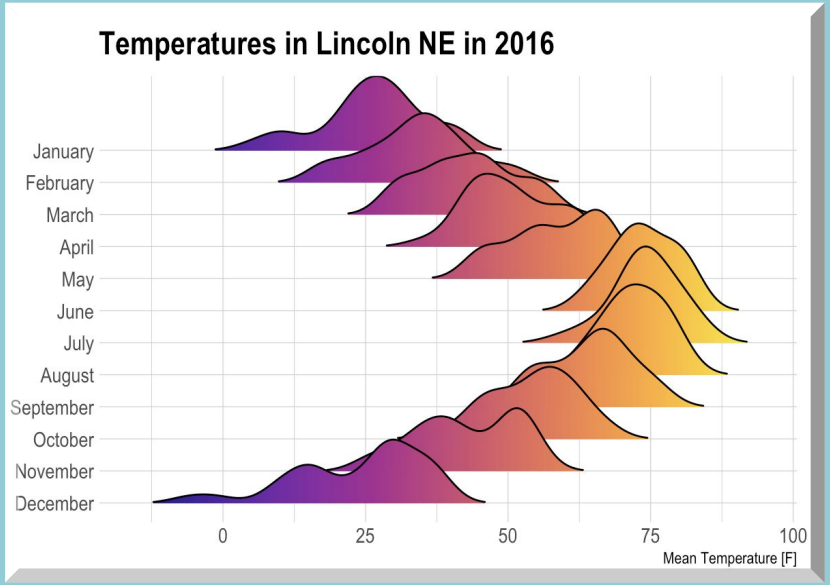
- Sankey diagrams represent interactions or information flows
  - Rapid Urban Growth in Africa; [pdf]

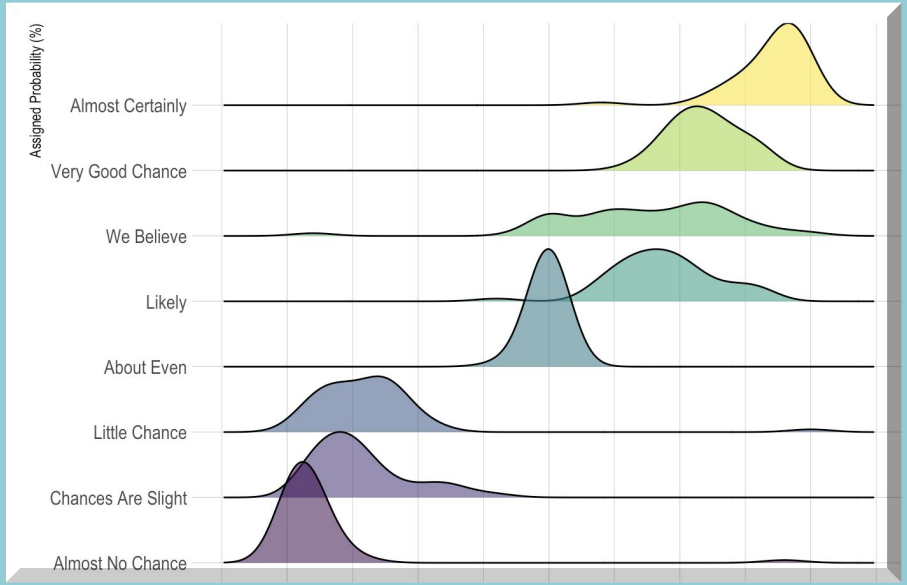


By 2100y, 38 of the world's 100 most populous cities will be in Africa, and more than 1 billion people will live in those 38 cities.

04. Ridgeline Plot / Joyplot (1/2)

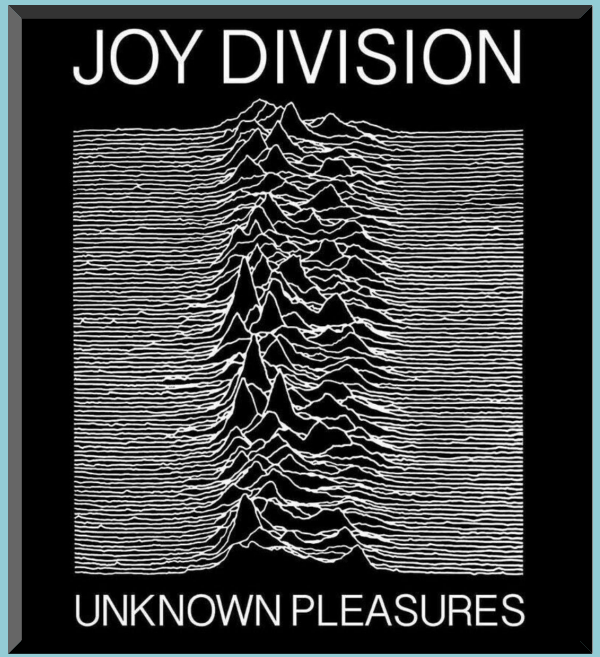
- *Ridgeline plots make it easy to compare the distribution of multiple groups*





04. Ridgeline Plot / Joyplot (2/2)

- The name “joy plot” comes from the rock band “Joy Division”

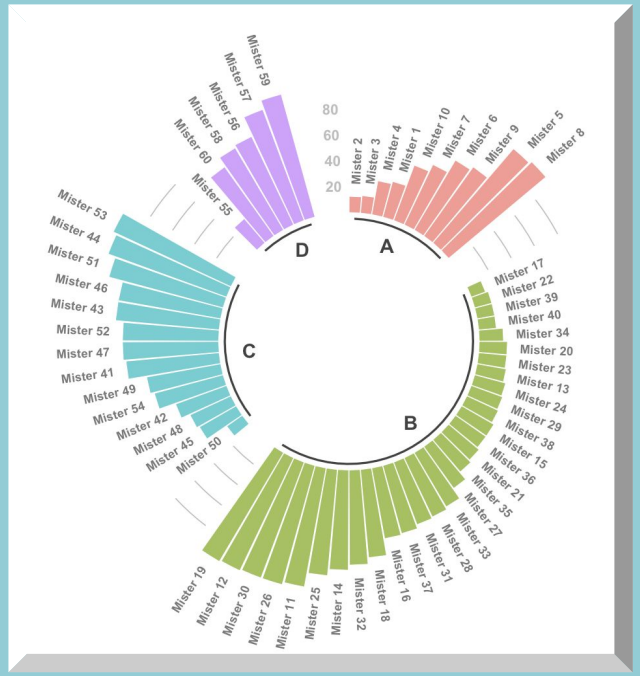


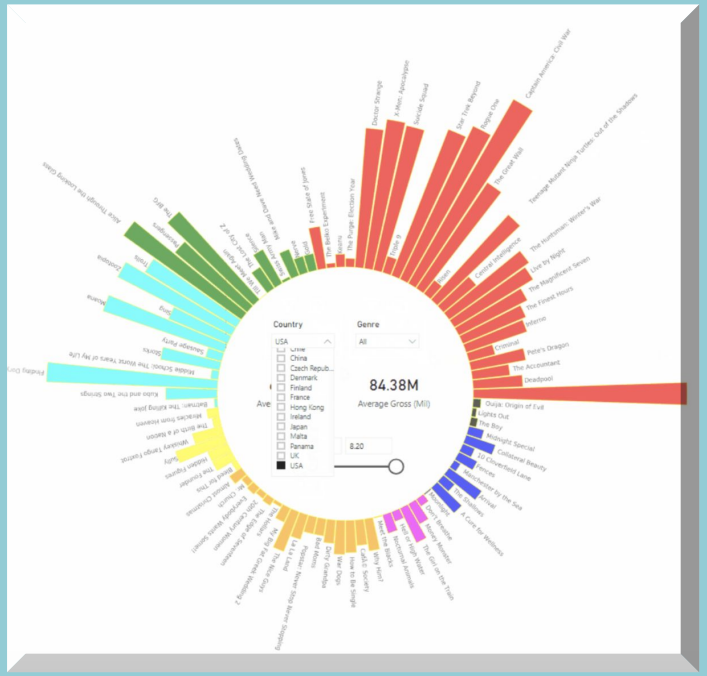
[Source]

[Source]

05. Radial / Circular Bar Chart

- *Radial chart may not be used, but the information grouping is helpful and suggestive*

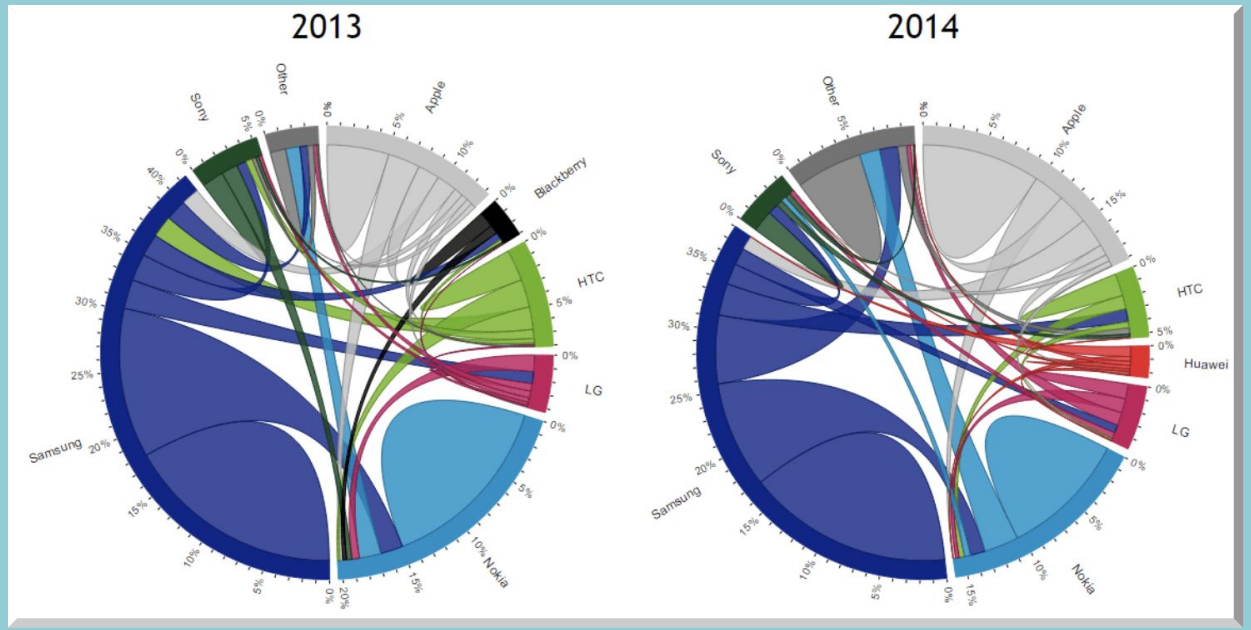




06. Chord Diagram

- A chord diagram allows to visualize weigthed relationships between several entities

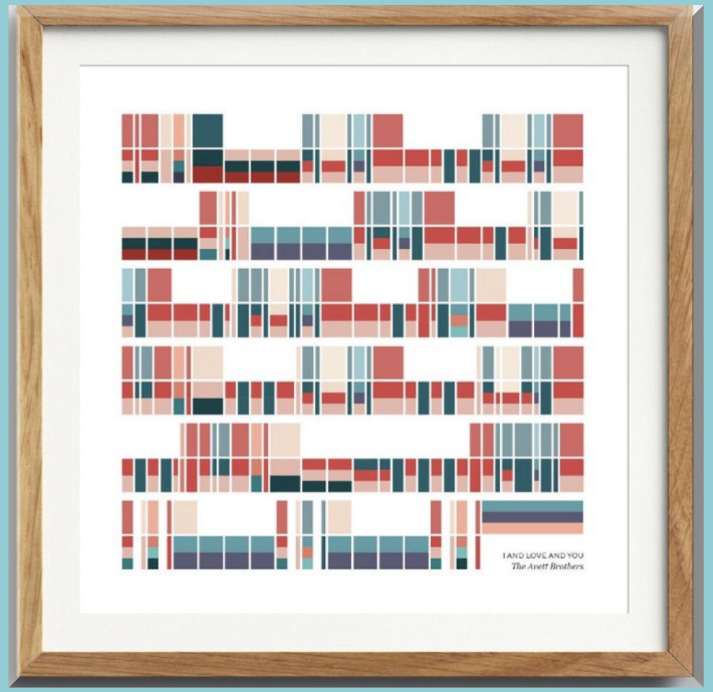
[Source: Switching Behaviour of Phone Brand]



Favorite Songs as Art:

[SoundscapeStudio] ~ Colorful data visualizations of music scores

- Soundscapes are graphic representations of music scores
- Each color represents a different note and the rhythm is shown through the length of the shape

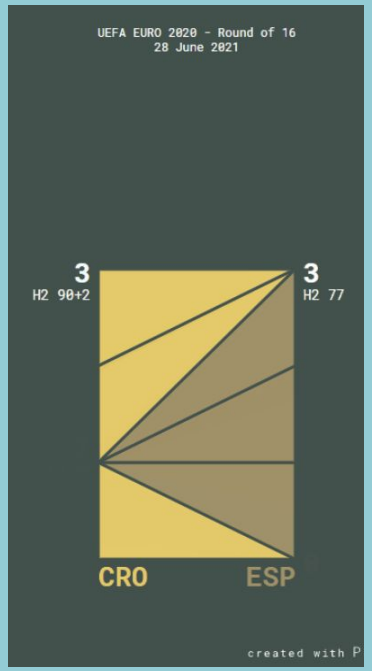


Soccer matches visualized with triangle sets:

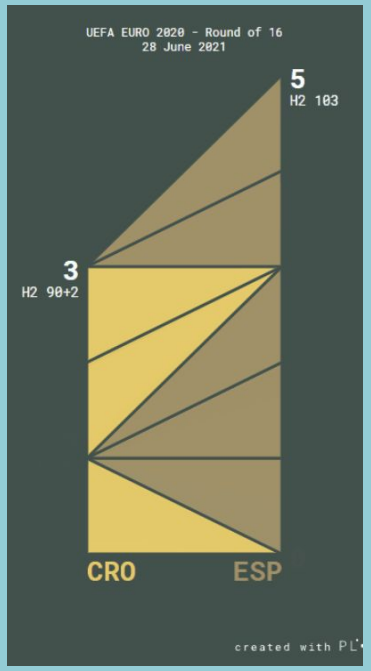
[UEFA Euro 2020]

1-2

3-3



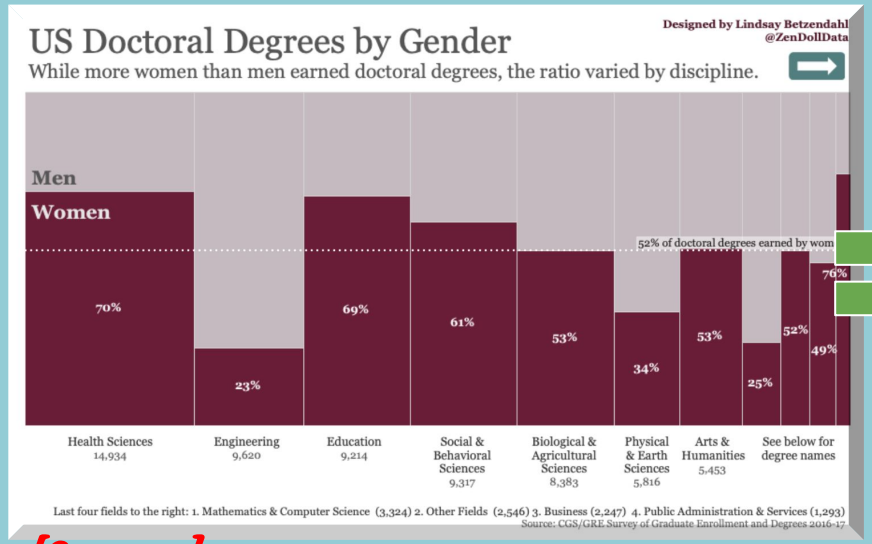
3-5



Marimekko Chart (a.k.a. Mosaic Chart)

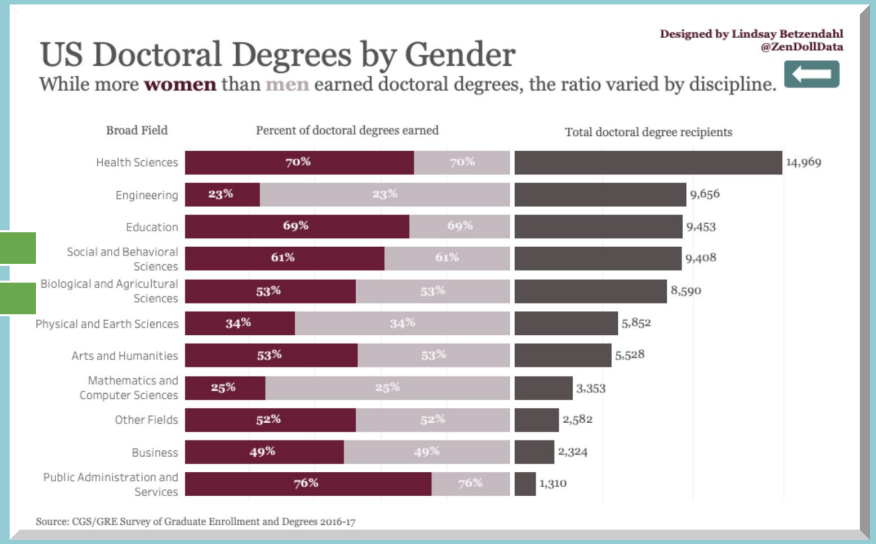
- Some people doesn't know how to read it before learning
- Marimekko chart has other alternative charts

Marimekko Charts



[Source]

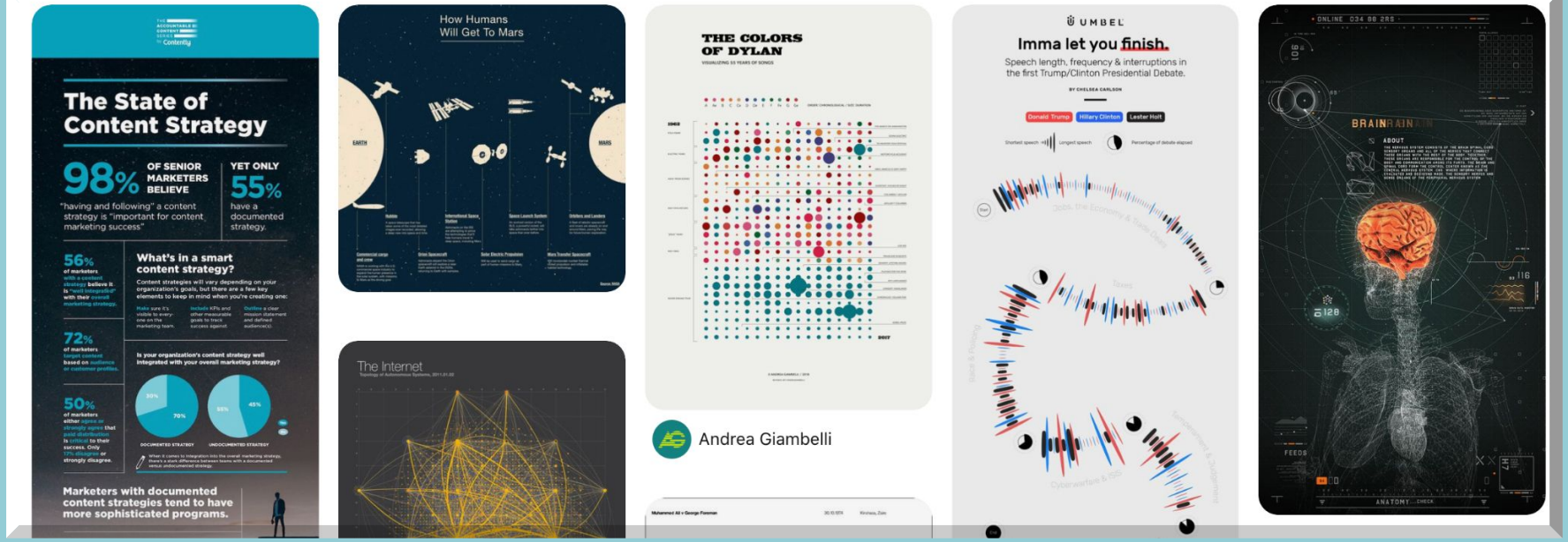
Stacked bar chart with second bar chart



Pinterest: [Data Visualization Inspiration]

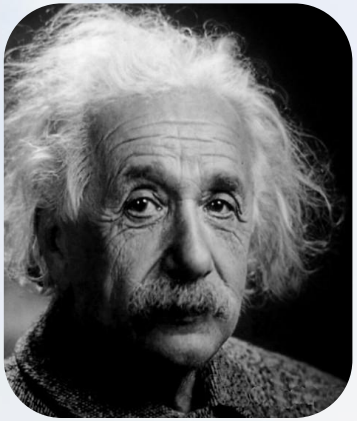
- *We are huge fans of data visualizations. This board is a collection of our favorites. Look through them to get inspired!*

[Source]



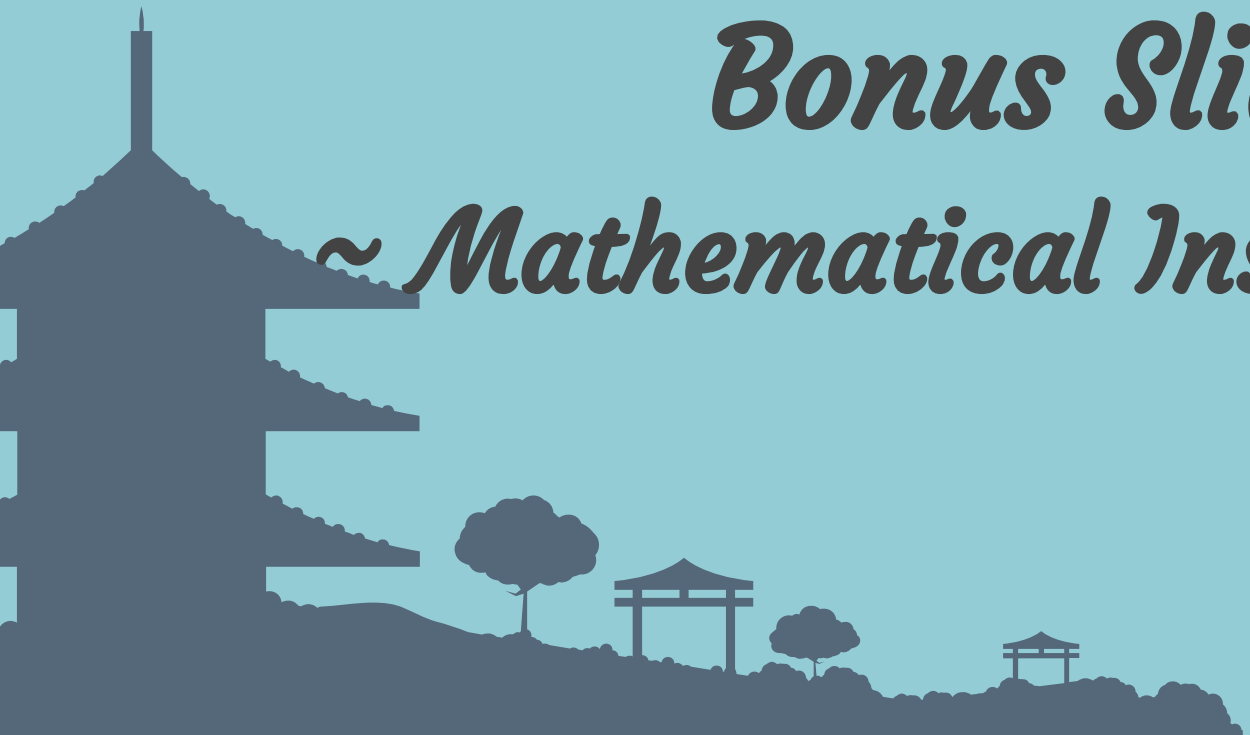
“If I can’t picture it,
I can’t understand it.”

Albert Einstein



“The ability to take data—to be able to understand it, to process it, to extract value from it, to visualize it, to communicate it —that’s going to be a hugely important skill in the next decades”

Google’s Chief Economist
Hal R.Varian



Bonus Slide

~ Mathematical Inspiration ~

Mathematical Inspiration (1/3)

- What's formula?

$$y = \frac{\log_e \left(\frac{x}{m} - sa \right)}{r^2}$$

Mathematical Inspiration (2/3)

- Transform the formula...

$$yr^2 = \log_e\left(\frac{x}{m} - sa\right)$$

$$e^{yr^2} = \frac{x}{m} - sa$$

$$me^{yr^2} = x - msa$$

- Have you noticed yet?

Mathematical Inspiration (3/3)

- It's out of season...

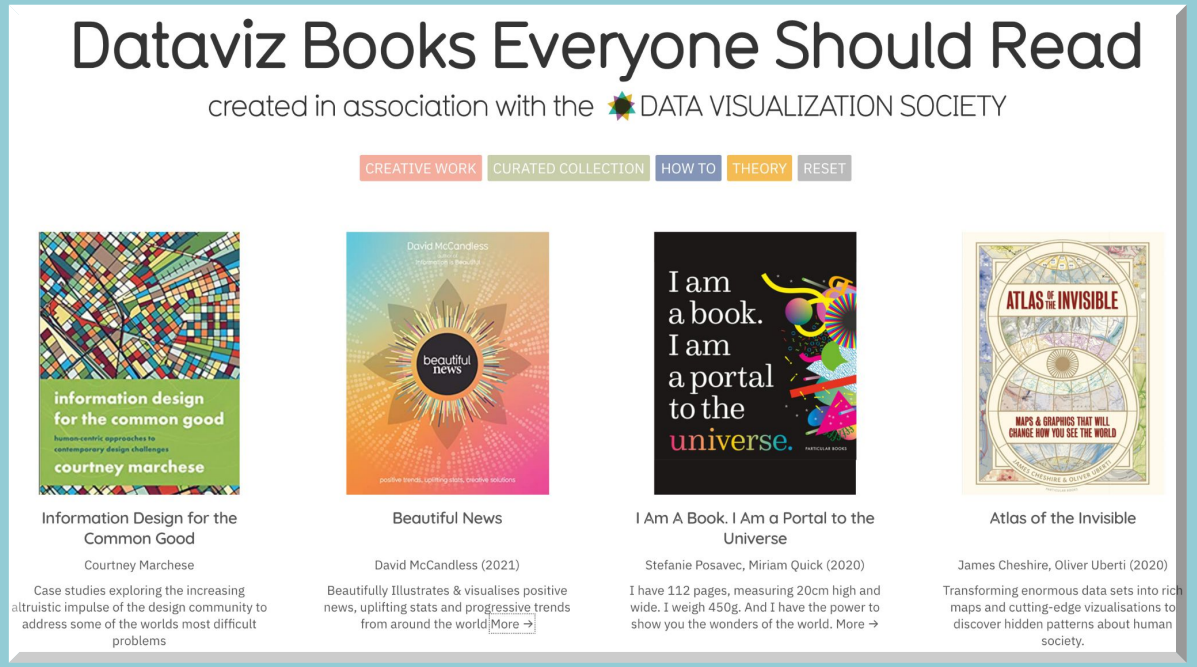
$$me^{rry} = x - mas$$

References

~ DataViz Books~

Dataviz Books Everyone Should Read

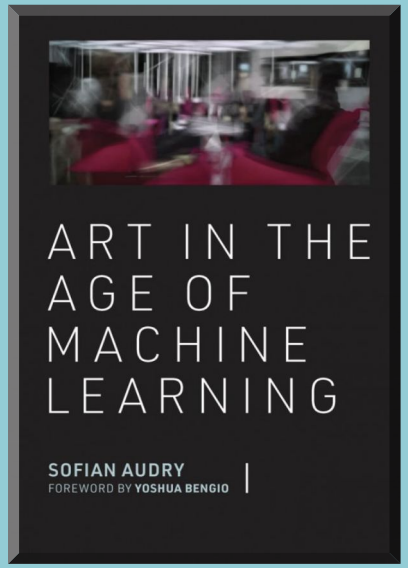
- A variety of Dataviz books are listed on this site: [source]



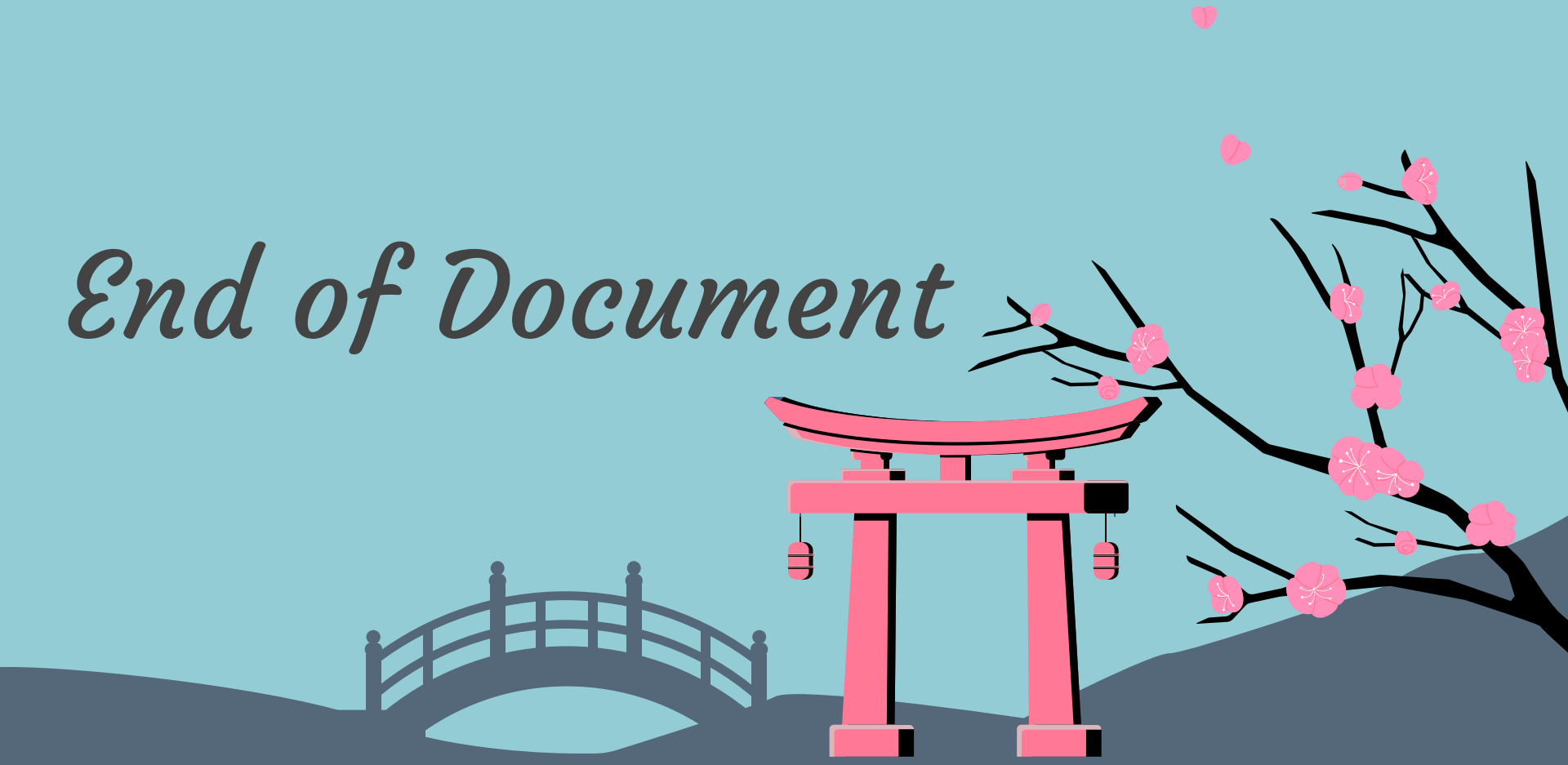
Latest book (Nov.2021)

[Art in the Age of Machine Learning]

- An examination of machine learning art and its practice in new media art and music



"Audry puts machine learning in historical context and provocatively argues for its unique artistic potential.

This book is tremendously useful to scholars and artists alike as a source of theoretical footholds and methodological guidance."

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