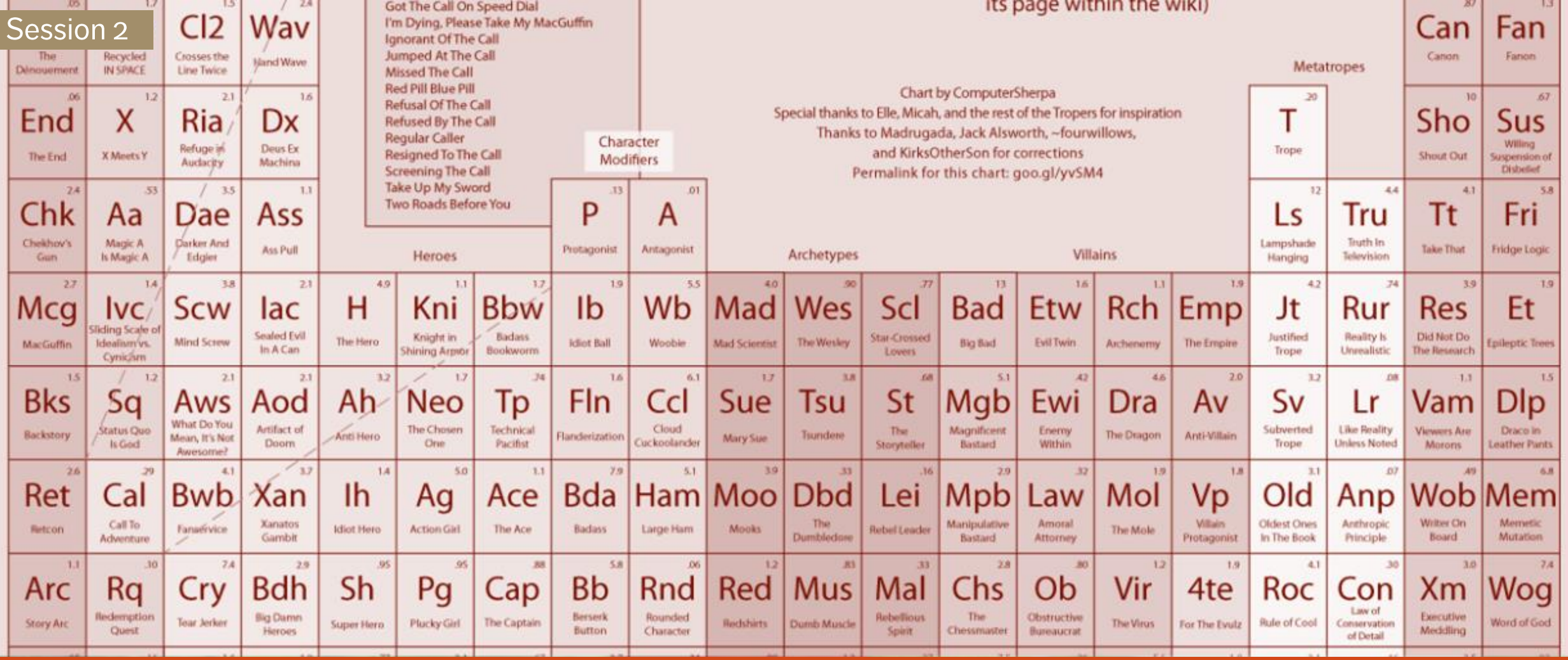
Storytelling with Data

DATA VISUALIZATION AND DASHBOARDS



6. Elements of Storytelling

Practical Definition of a Story

To paraphrase U.S. judge Potter Stewart: “I may not be able to define what a story is, but I know one when I see one”.

We could say that a **story** consists of:

- context,
- series of events, and
- outcome, result, consequence, or resolution.

Storytelling Goals

Cultural Stories

- entertain, inform, teach, explore, shock

Data (Scientific) Stories

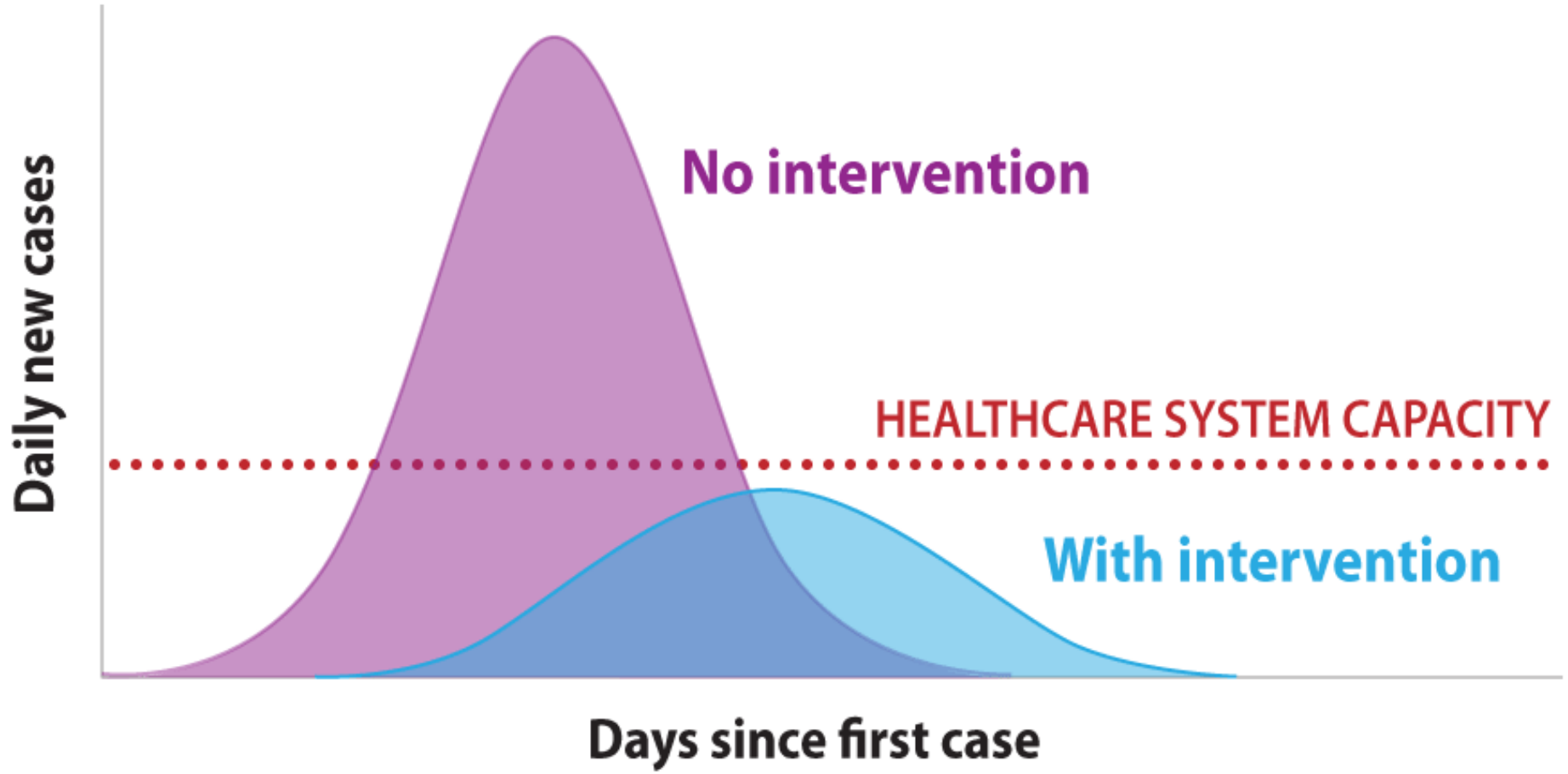
- describe, diagnose, predict, prescribe, persuade

Any overlap?

Anything missing?

FLATTENING THE CURVE

A look at the importance of slowing the spread of a virus, so that the rate of infection doesn't outpace the resources to fight against it.



SOURCE: CDC

THE CANADIAN PRESS

Storytelling Audiences

Storytelling requires a **teller** and a **story**, but also an **audience.**

The **teller**'s job is to convince the audience to accept:

1. the premise ("I'm about to tell you a really interesting story, so listen up!")
2. the contents ("All these things happened, honest!")
3. the conclusion ("And that's why you should never put peanut butter in your laundry.")

The **story**'s must first and foremost not come in the way of the teller's job.

Storytelling Audiences

The **audience** is a more nebulous entity.

In many cases, the teller never interacts directly with the audience. For all they know, the audience could be a single child, or the entire nation of Finland.

This **ambiguity** typically leads to storytellers imagining the largest possible audience. A story for the ages, which will be all things to all people.

This is a common mistake: **less is more**. It pays to know the audience (we will discuss this further at a later stage).

Storytelling Audiences

What is required of a storytelling audience?

What is expected of a storytelling audience?

What kind of audiences exist for stories?

For storytelling with data? (we will discuss this again at a later stage)

Storytelling Context

A given action may be seen as positive or as negative by audiences with different pre-existing feelings/knowledge concerning the agent/situation.

- Would you be able to recognize nobility in a political enemy's actions?
- Could a fan of the Maple Leafs/Habs ever have something worthy to say about hockey?

Similarly, a story may have different **outcomes/impacts** in different contexts.

Trevor Greenway · Feb 9 · 5 min read

[https://www.lowdownonline.com/post/wakefield-nurse-fires-up-freedom-convoy]

Wakefield nurse fires up Freedom Convoy

Wakefield's Bethan Nodwell is known in the Gatineau Hills for many things: being the hospital's former head nurse, singing onstage at the Black Sheep Inn, and more recently, disseminating debatable facts and anti-vax sentiments on social media. Now she's running the main stage at the Freedom Convoy in downtown Ottawa, firing up the crowd as seen here Feb. 4. Trevor Greenway photo

Bethan Nodwell had thousands of demonstrators in Ottawa hanging onto her every word.

What might lead one to view the **subject** of this article in a positive light?

A negative light? A neutral light?

What might lead one to view the **author** of this article in a positive light?

A negative light? A neutral light?

Session 2

[Illustrations: V. Jaskina]

Storytelling Universality

There once was a shepherd boy who was bored as he sat on the hillside watching the village sheep. To amuse himself he took a great breath and sang out, "Wolf! Wolf! The Wolf is chasing the sheep!"

The villagers came running up the hill to help the boy drive the wolf away. But when they arrived at the top of the hill, they found no wolf. The boy laughed at the sight of their angry faces. "Don't cry 'wolf', shepherd boy," said the villagers, "when there's no wolf!" They went grumbling back down the hill.

Later, the boy sang out again, "Wolf! Wolf! The wolf is chasing the sheep!" To his naughty delight, he watched the villagers run up the hill to help him drive the wolf away.

When the villagers saw no wolf they sternly said, "Save your frightened song for when there is really something wrong! Don't cry 'wolf' when there is NO wolf!"

[Illustrations: V. Jaskina]

Storytelling Universality

But the boy just grinned and watched them go grumbling down the hill once more.

Later, he saw a REAL wolf prowling about his flock. Alarmed, he leaped to his feet and sang out as loudly as he could, "Wolf! Wolf!" But the villagers thought he was trying to fool them again, and so they didn't come.

At sunset, everyone wondered why the shepherd boy hadn't returned to the village with their sheep. They went up the hill to find the boy. They found him weeping.

"There really was a wolf here! The flock has scattered! I cried out, "Wolf!" Why didn't you come?"

An old man tried to comfort the boy as they walked back to the village. "We'll help you look for the lost sheep in the morning," he said, putting his arm around the youth, "Nobody believes a liar ... **even when they are telling the truth**/**so don't get caught telling the same lie twice**."

[online.hbs.edu/blog/post/data-storytelling, C. Cote]

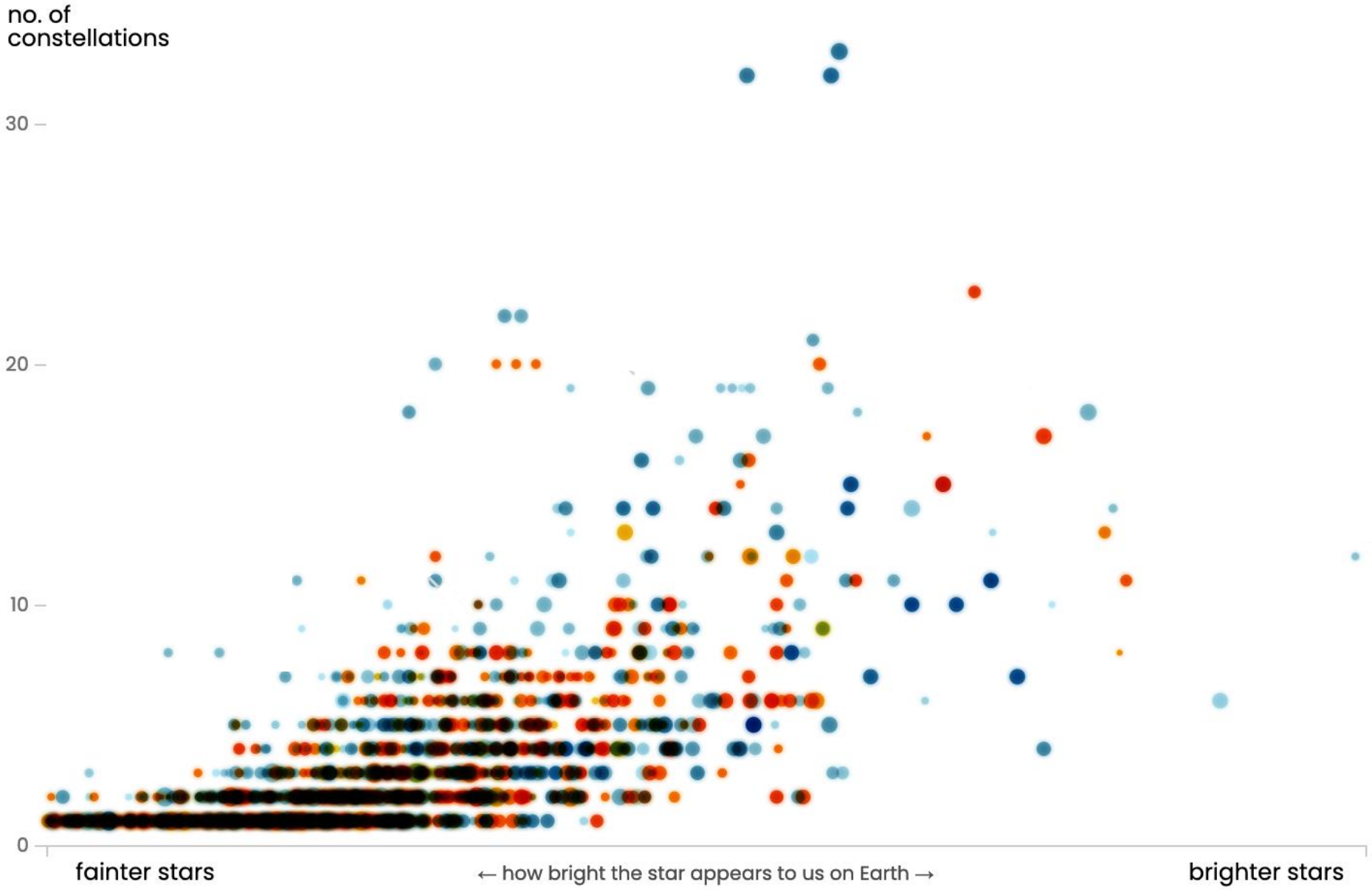
Data Stories

Data storytelling is the ability to effectively communicate insights from a dataset using narratives and visualizations. It can be used to put data insights into context for and inspire action from the audience.

There are 3 key components:

1. **data:** foundation of data story (descriptive, diagnostic, predictive, prescriptive analysis)
2. **narrative:** storyline used to communicate the insights gleaned from data and context, and recommended actions
3. **visuals:** representations of data, analysis results, and narratives, which are used to communicate stories clearly and memorably (charts, graphs, diagrams, pictures, or videos)

[figuresinthesky.visualcinnamon.com]



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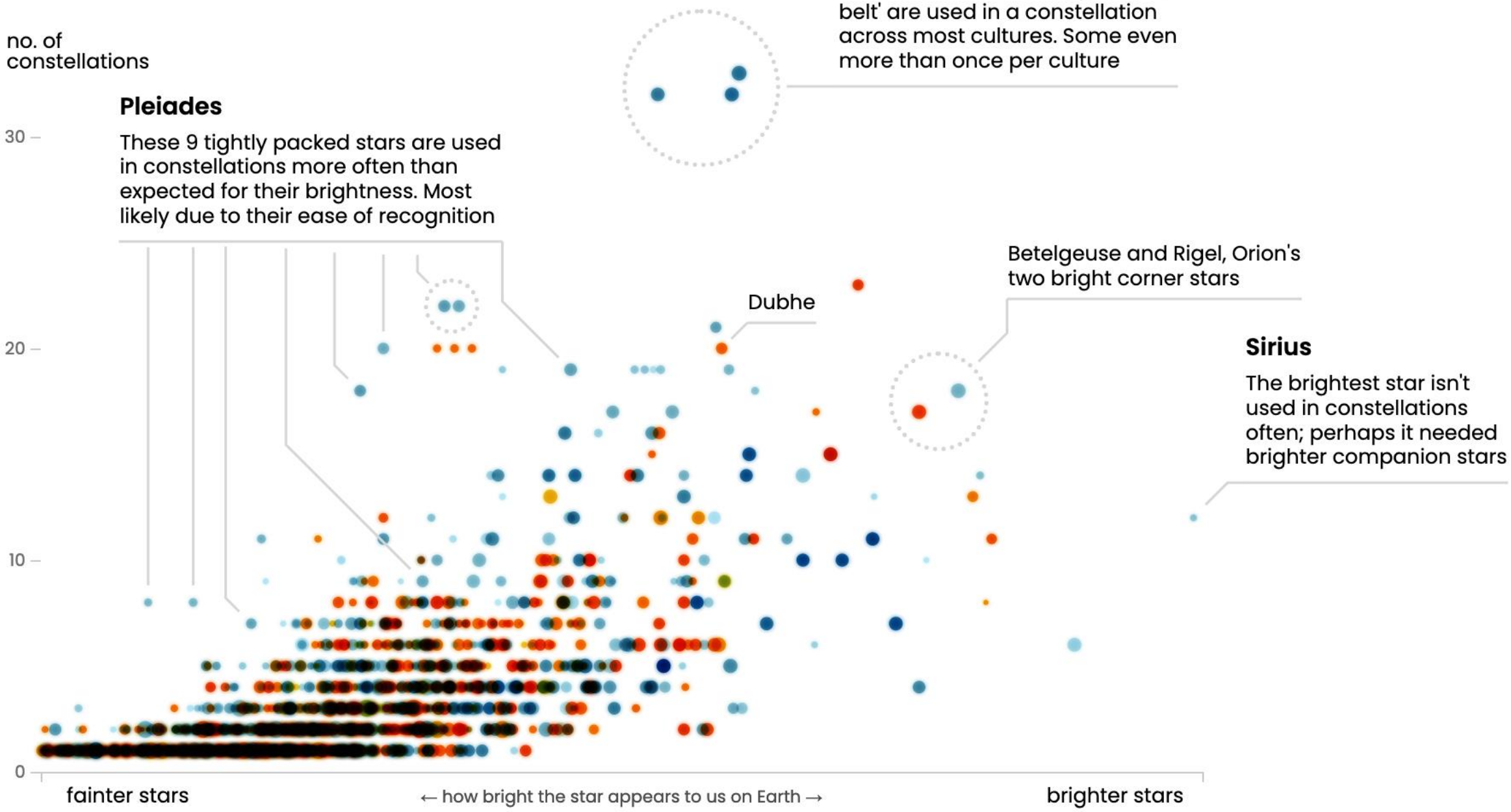


Storytelling Risks

A good story can help shed insights on a situation, but storytelling requires **choices**; the outcome is affected by what is **included** and what is **omitted**.

It is easy to mislead by **accident**; it is also easy to mislead by **design**.

With data stories, there is an additional complication: we usually only have access to the **available data**. The data that was not collected is, by definition, not available. Some of the data that was collected may also be unavailable for a variety of reasons.

This implicit bias can lead to compelling (yet **flawed**) data stories.

During WWII, mathematician **A. Wald** undertook a study to help protect Allied bombers flying over enemy territory.

Data included: the **number** and **location** of **bullet holes** on returning aircraft, and the goal was to use this information to determine where to add armor to best protect the plane's structure.

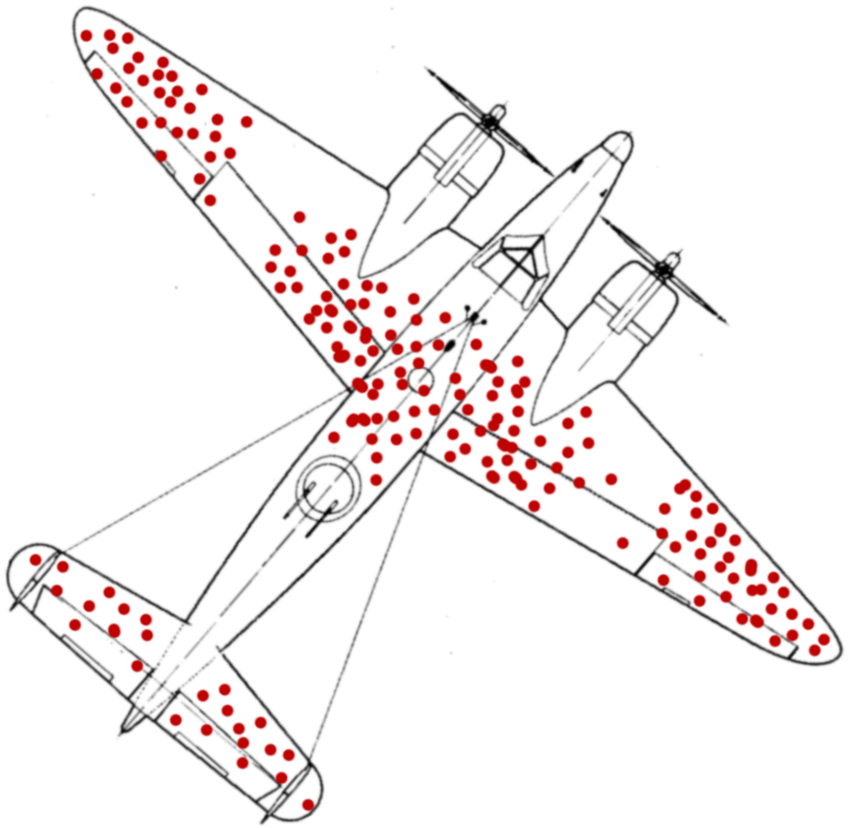
A chart was created to show where the maximum number of bullet holes were located on **returning aircraft**. This chart showed greatest damage on the **aircraft extremities**, not on the main wing and tail spars, engines, and core fuselage areas.

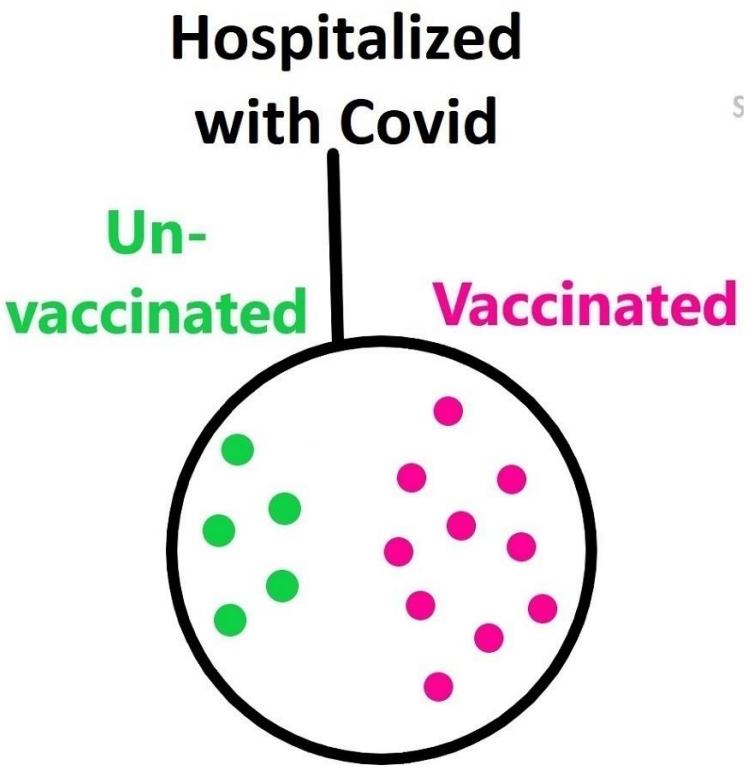
Storytelling Risks

As such, the Air Ministry wanted to add armor to the **extremities**. Wald suggested they were **dead wrong**.

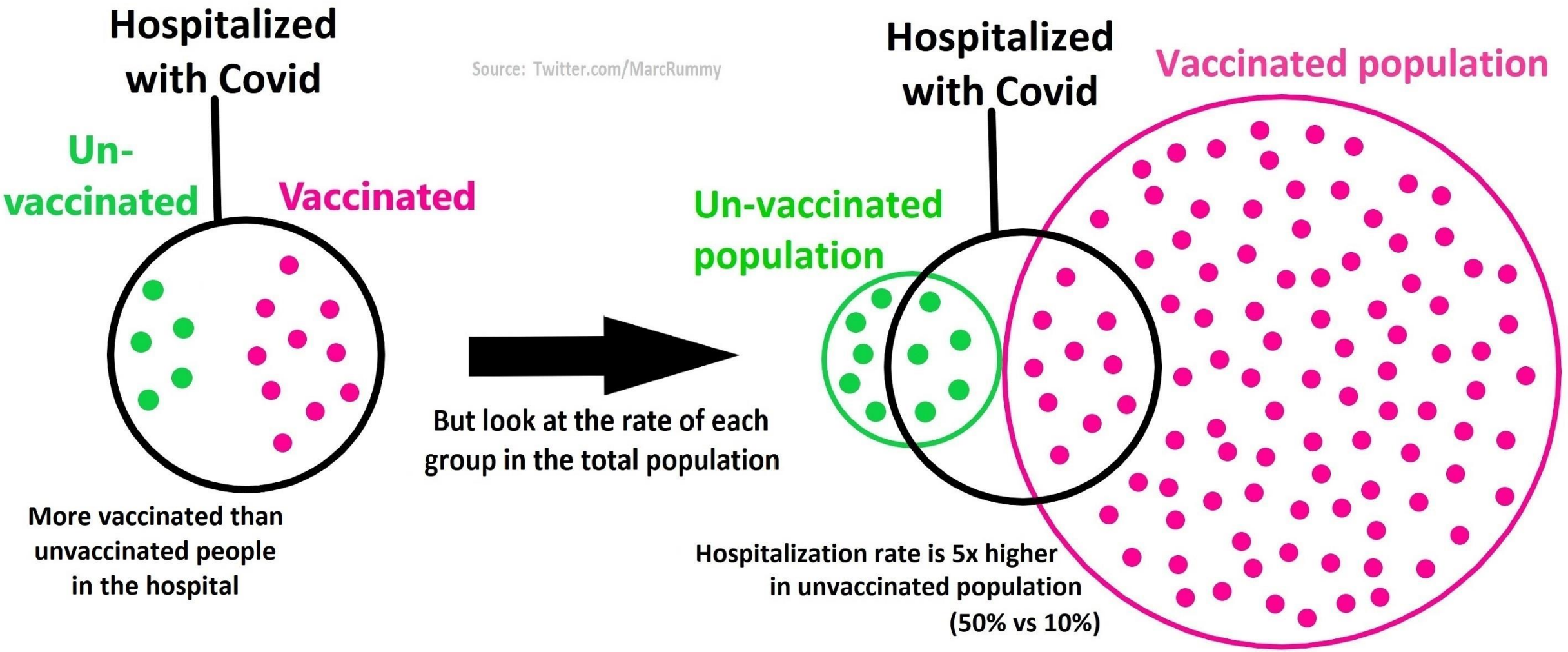
To avoid **"survivorship bias",** armor should be added to the areas with the **fewest holes**: if no returning planes had holes in their wing spars and engines, then even a few holes in those locations were **deadly**.

Take-Away: the data that is missing may be as important to story than the data that is there. Storytelling is not always an obvious endeavour.





More vaccinated than unvaccinated people in the hospital



Note: The ratios presented are made to illustrate the concept of the base rate fallacy when the vaccination rate is high

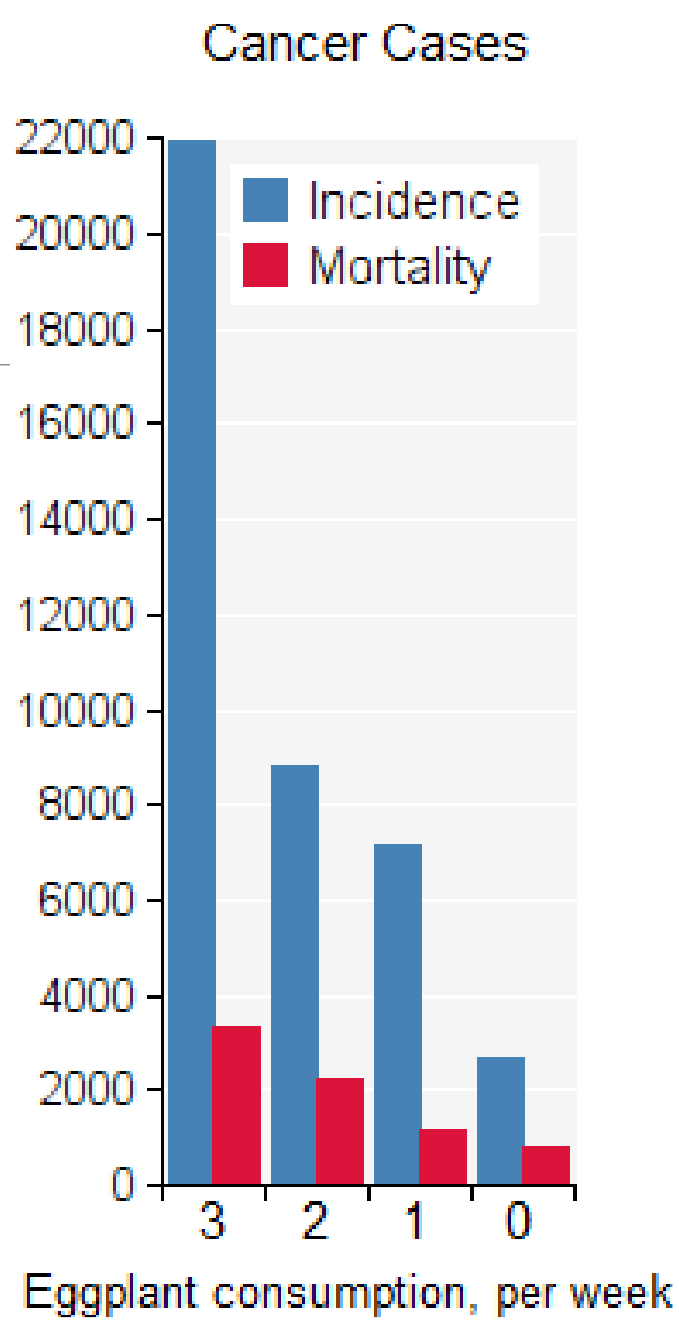
Data Story Universality

Ambiguity can also occur in data stories.

What is the **take-away** here?

Is increased eggplant consumption linked to:

- increased cancer incidence, or
- diminishing mortality rates?



Suggested Reading

Elements of Storytelling

The Practice of Data Visualization
Part III: Visualization and Storytelling

7. Stories and Storytelling

Exercises

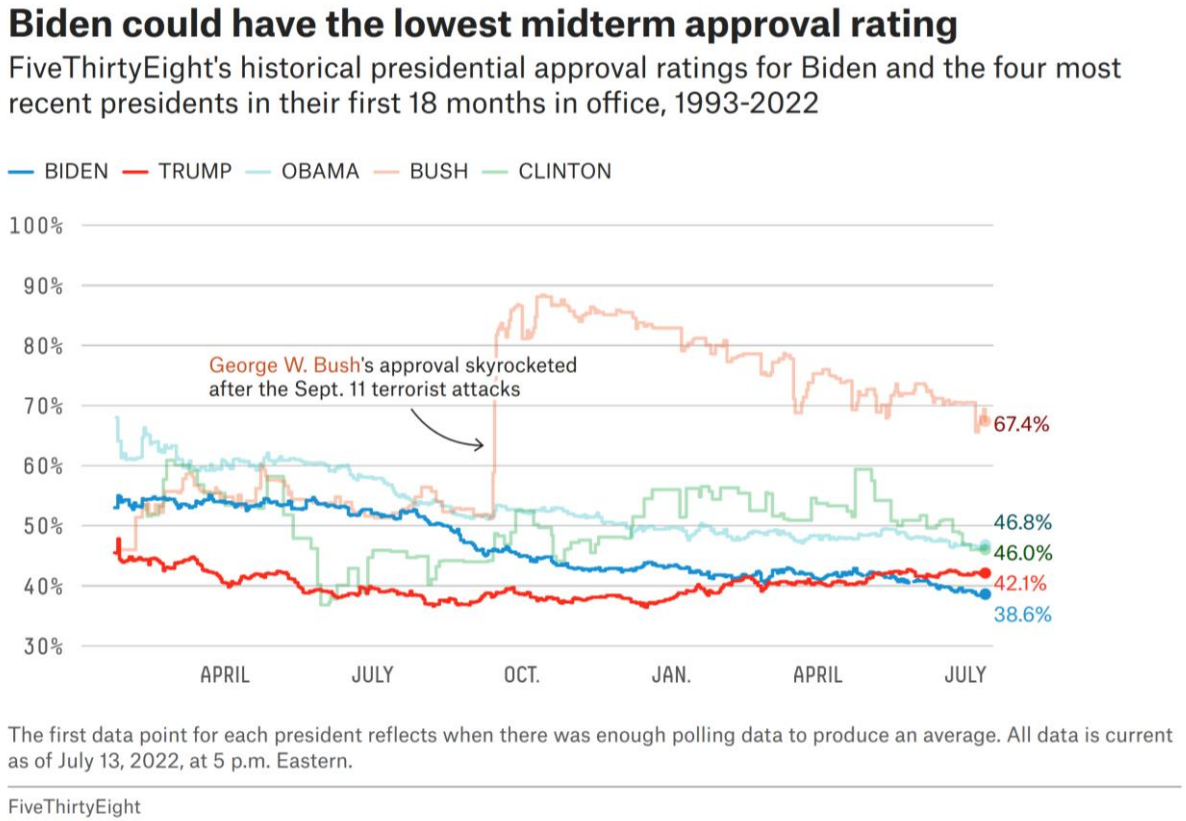
Elements of Storytelling

1. Are the following stories?
   a. Two identical infants lay in a cradle. “One you bore, the other is a Changeling. Choose wisely,” the Fae’s voice echoed from the shadow. “I’m taking both my children,” the mother said defiantly.
   b. Solomon was required to decide which of two women was the mother of a baby, when each of them claimed parenthood. Both had recently given birth, but one child had died. Solomon announced that the child should be cut in two, so that each mother should have half. The real mother, unable to bear her son being killed, immediately offered it to the other woman, to save the child's life, whereas the other agreed to the proposal. The false mother was thus exposed, and Solomon returned the living child to its real mother.

Exercises

Elements of Storytelling

1. Are the following stories?
   c. For sale: baby shoes. Never worn.
   d. Spiritualist medium claims cure for cancer.
   e. Sens rally and beat Leafs to gain on Habs.
   f. Macbeth and his wife
      Want to become the royals
      So they kill 'em all.
   g.



Exercises

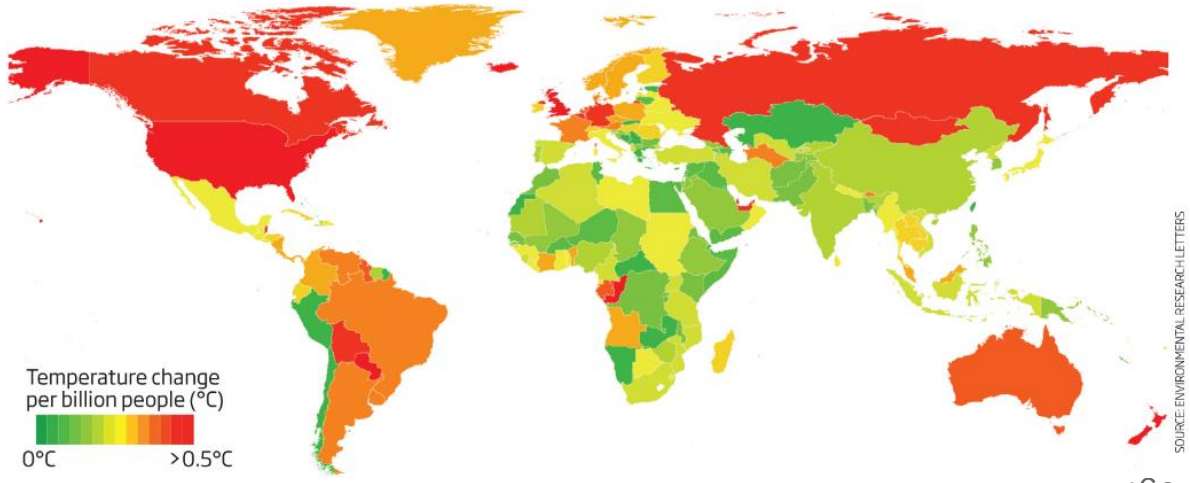
Elements of Storytelling

2. In your organization, who makes up the audience? Is there only one audience? What are the storytelling goals? Is the storytelling context clear? Constant? Universal?

3. In the following charts, who is the intended audience? What are the goals? Are the outcomes universal?

   a. Global warming culprits, judged by population

Countries that have caused more global warming per billion people are coloured red and low-emitters are dark green

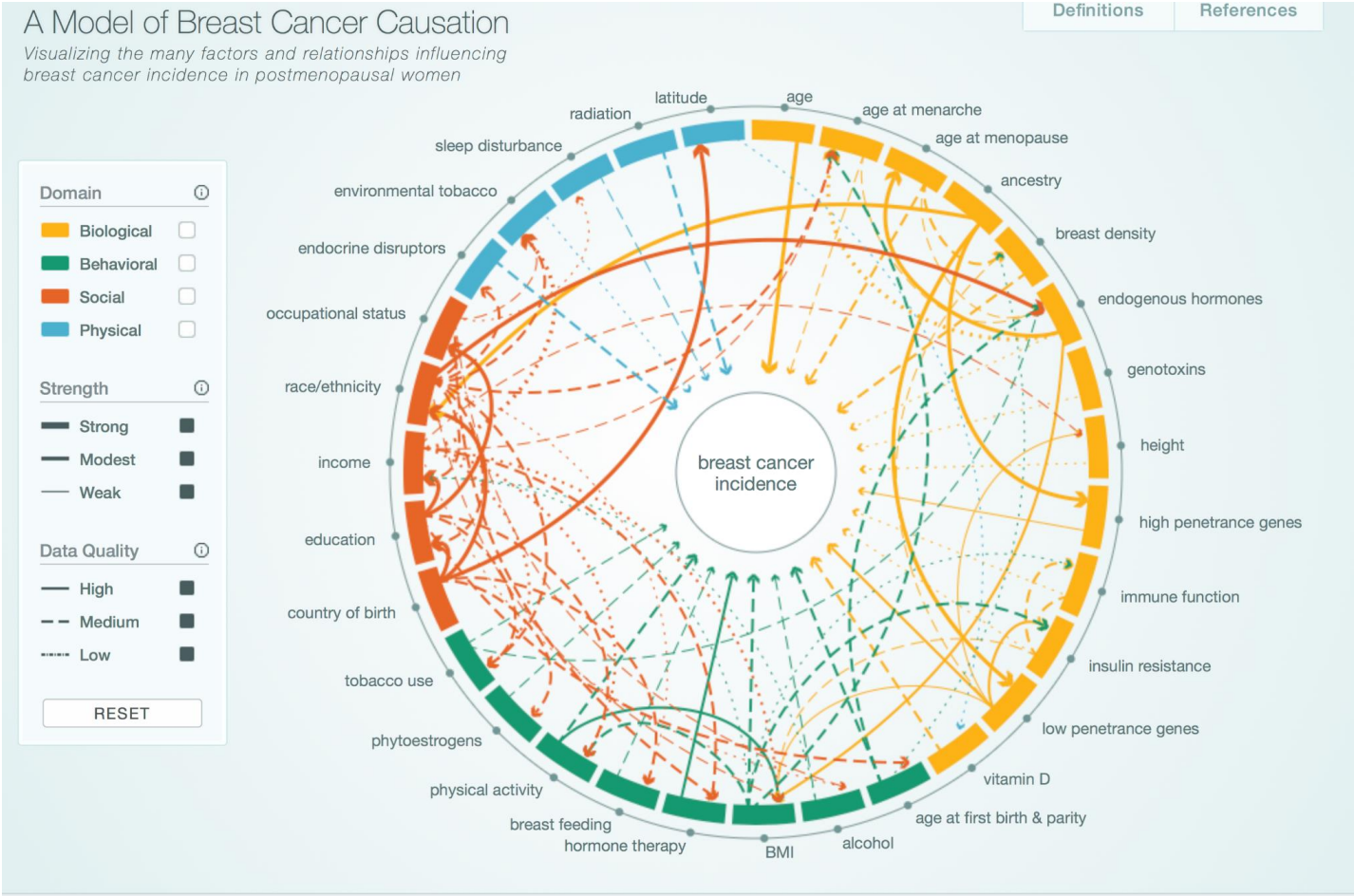


Exercises

Elements of Storytelling

3. In the following charts, who is the intended audience? What are the goals? Are the outcomes universal?

b.

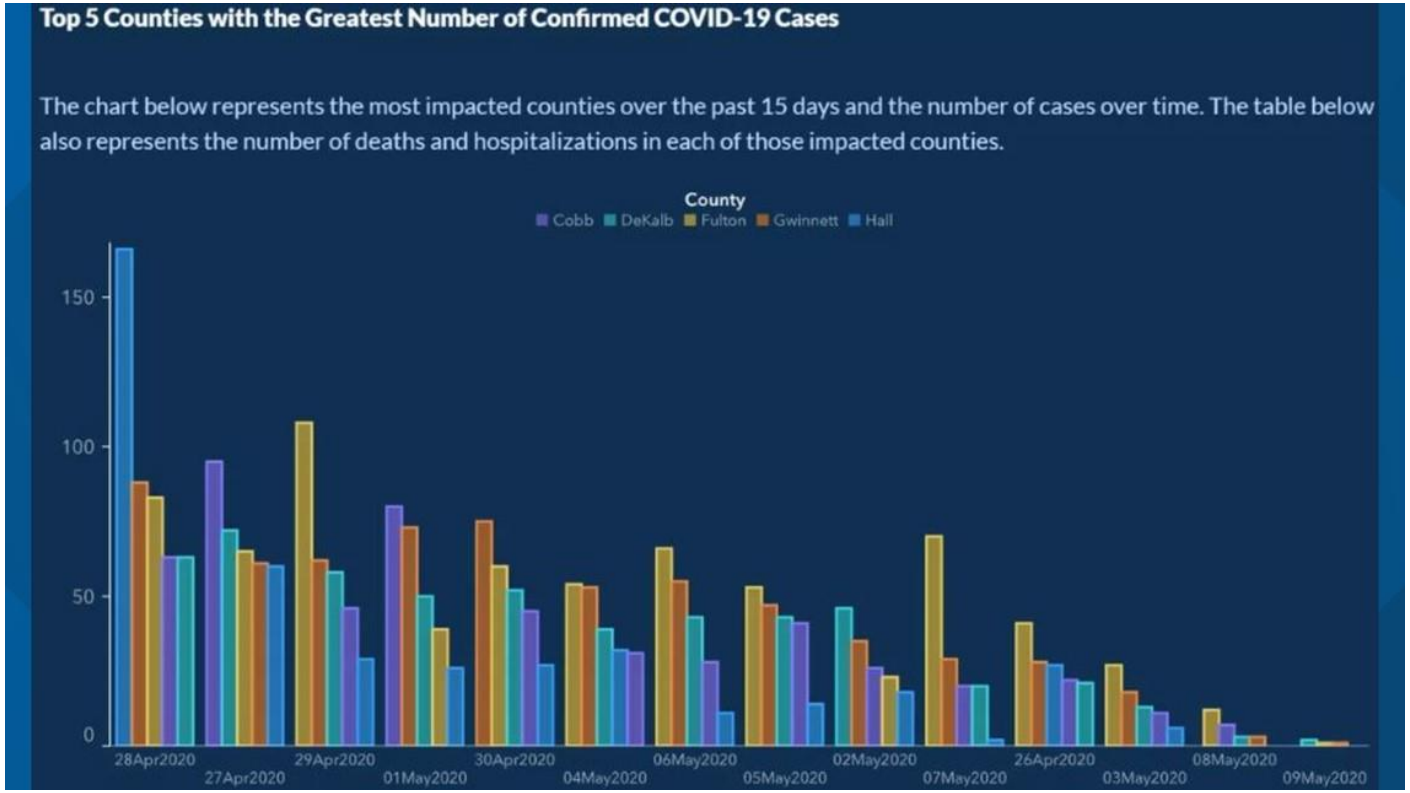


Exercises

Elements of Storytelling

3. In the following charts, who is the intended audience? What are the goals? Are the outcomes universal?

c.



7. Stories and Illustrations

[based on an idea from S. McCloud, *Making Comics*]

Words and Images

A picture is worth a thousand words (vs. a picture is worth 1000 words).

Words bring an unparalleled level of **specificity**. There is no image so vague that words cannot lock it into a **desired meaning**.

Some concepts and names can only be clearly expressed **through words**.

[S. McCloud, *Making Comics*]

"Look, it's Kelly Donovan, twin brother of the Xander actor on *Buffy the Vampire Slayer*, plus Humphrey Bogart wearing a Freddy Mercury mask, and a robot duplicate of former U.N. Secretary General Boutros Boutros-Ghali!"

[based on an idea from S. McCloud, *Making Comics*]

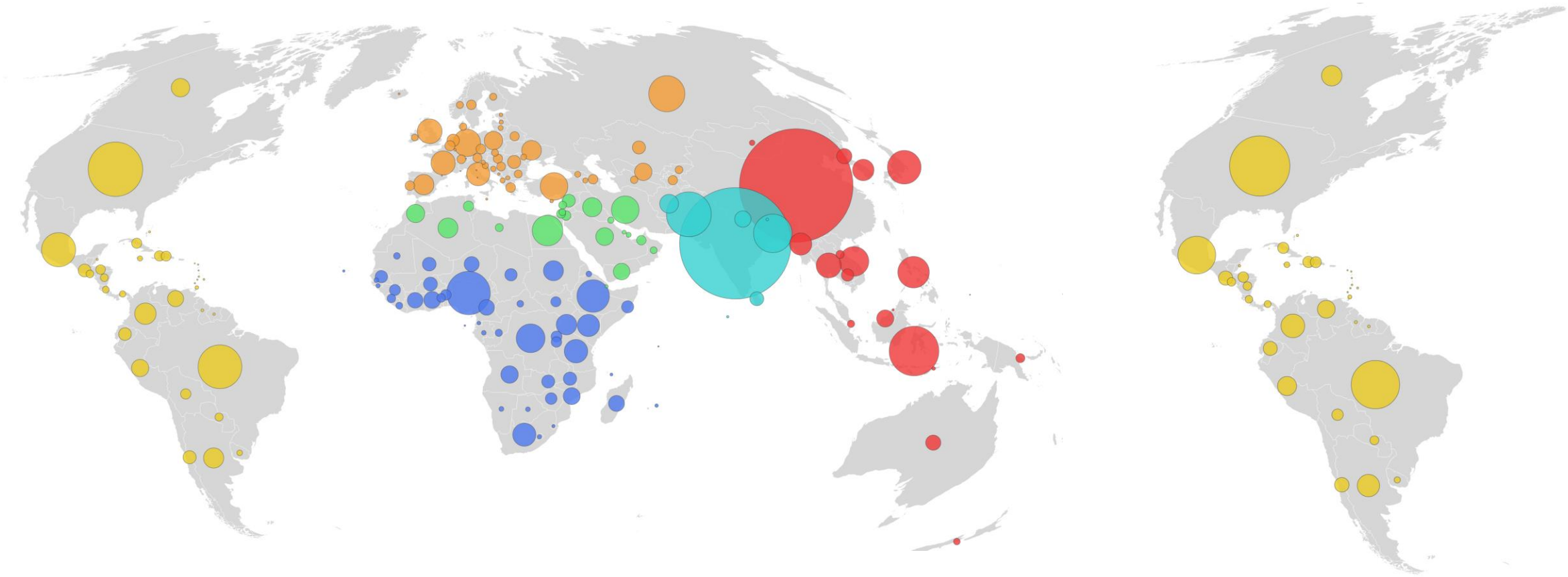
Visual Storytelling Choices

Communicating with **clarity** means that audience comprehension remains the **ultimate goal:**

- choice of **moment** is 'connecting the dots', showing only what matters to the story;
- choice of **frame** is creating and directing the audience's focus;
- choice of **image** is selecting the right charts for the story, with emphasis on simplicity and ability to convey the message;
- choice of **word** is clearly and persuasively communicating ideas in seamless combination with the charts;
- choice of **flow** is guiding the audience from one chart to the next, from one page to the next, and creating a transparent and intuitive 'reading' experience, by arranging pages in a dashboard, charts on a page, and elements within charts intelligently.

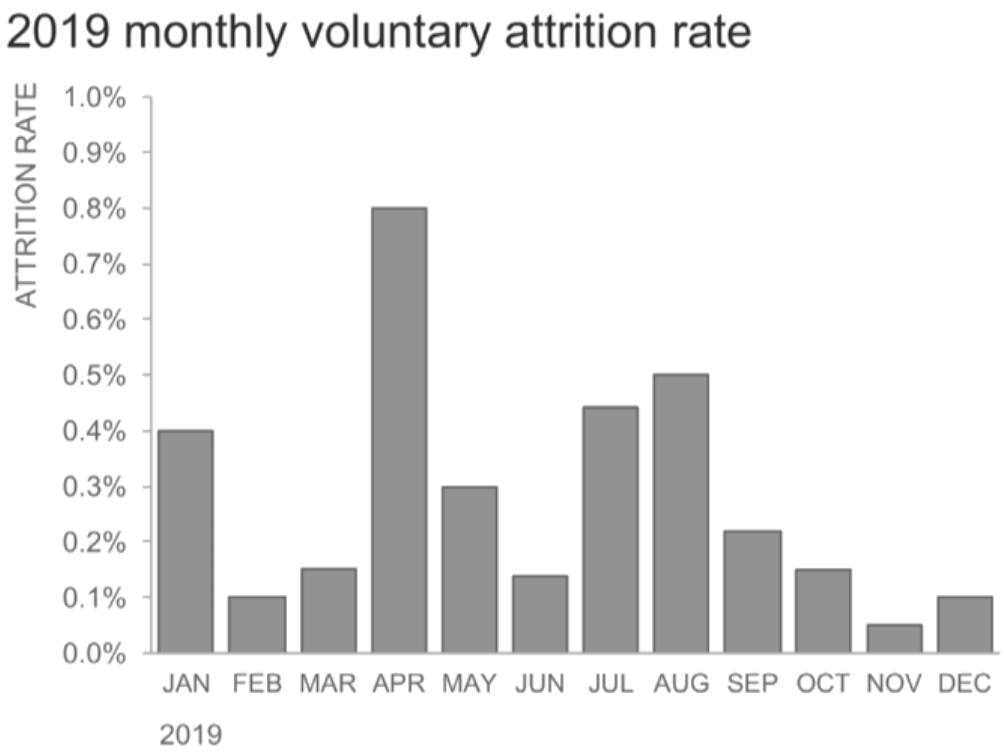
[Gapminder Tools]

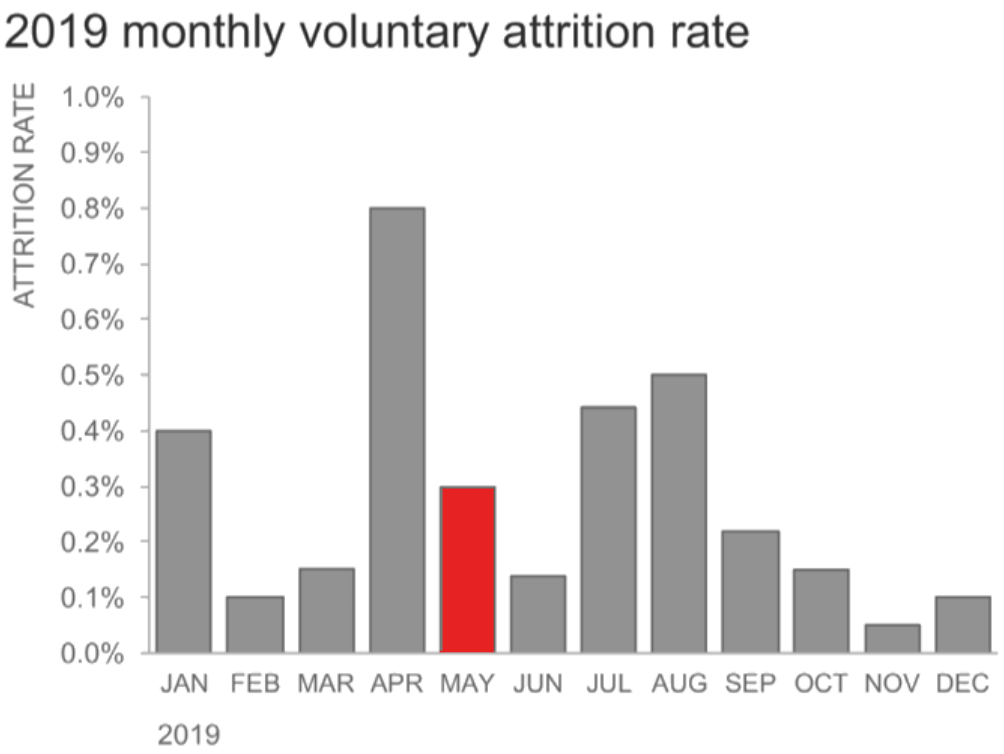
Choice of Moment



[C. Nussbaumer Knaflic, *Storytelling With Data*]

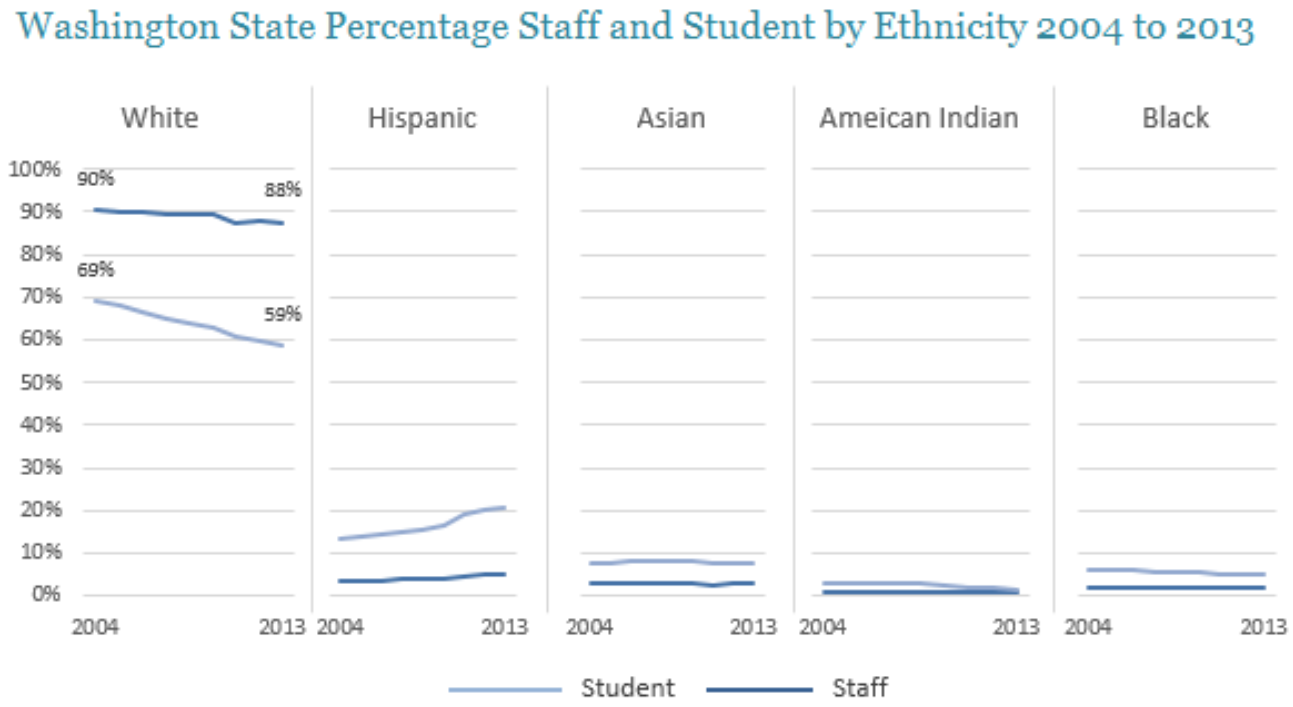
Choice of Frame

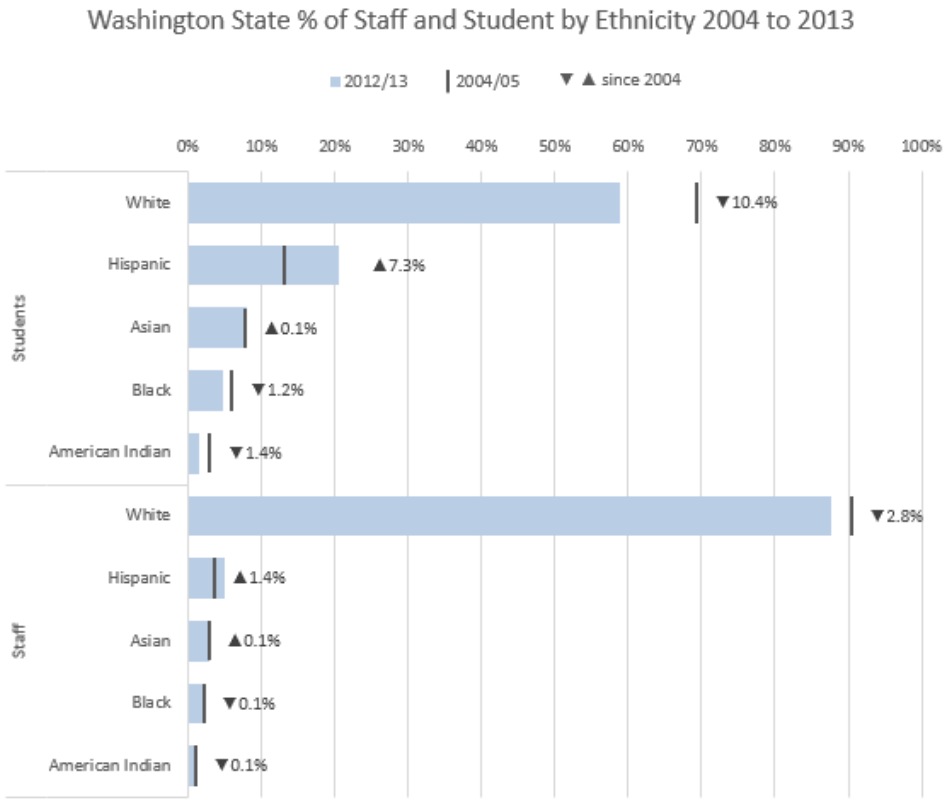




[Author unknown]

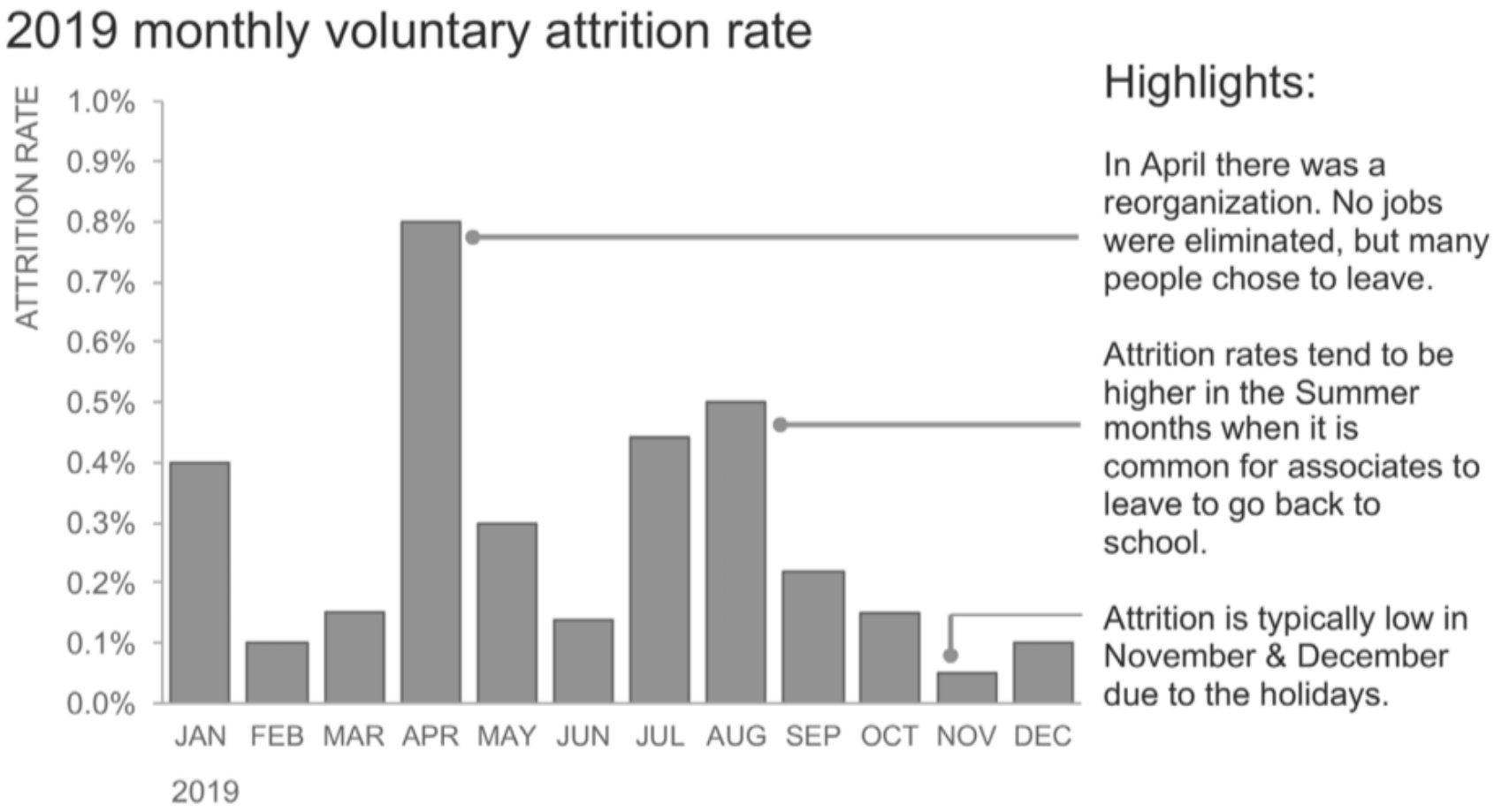
Choice of Image





[C. Nussbaumer Knaflic, *Storytelling With Data*]

Choice of Word



[based on an idea from S. McCloud, *Making Comics*]

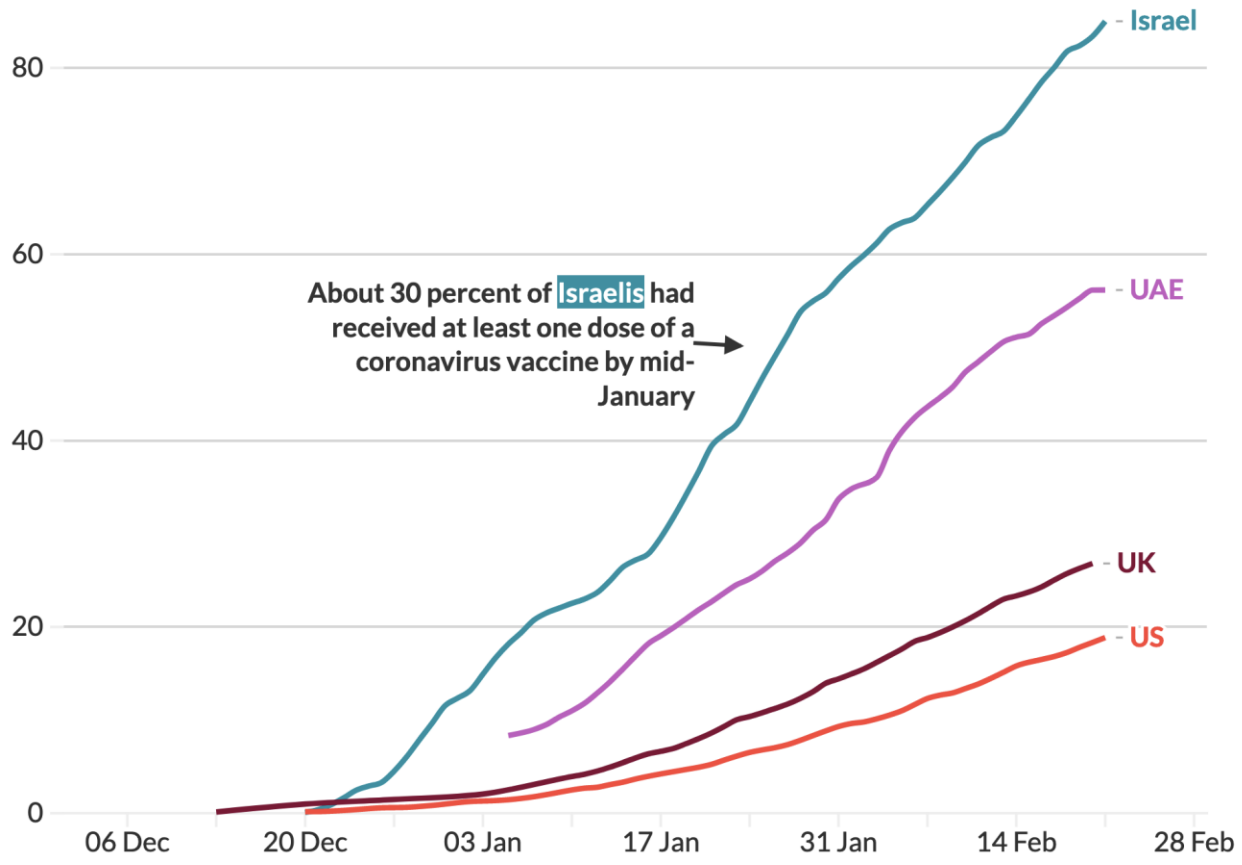
Visual Storytelling Combinations

- **text-specific**, where text provides all that is needed to know and the charts illustrate some aspects of the story that is described
- **chart-specific**, where the charts provide all that is needed to know and the text accentuates some aspects of the story that is shown
- **duo-specific**, where text and charts are both telling roughly the same story
- **intersecting**, where text and charts work together in some respects but also contribute to the story independently
- **interdependent**, where text and charts combine to convey an aspect of the story that neither could convey alone
- **parallel**, where words and charts follow seemingly different storylines, without intersecting

[https://flourish.studio/blog/accessible-chart-design]

Cumulative vaccination doses administered in Israel, UAE, UK and US

Cumulative doses administered per 100 residents • Data last updated 24 Feb



Source: ECDC/OWID • Graphic: Flourish • Embed this

Session 3

[P. Tickell, The Story of the Impossible Train]

I have a story I'd like to tell you. It's about a train, and a group of people who live on that train and know of nothing else.

This train has been moving since anyone can remember. The people on the train can't imagine a time when the train wasn't moving, and when they were not on the train. Everyone works to keep the train moving. The train never stops.

It never stops. It cannot stop.

People on the train live in constant churn. The work to keep the train moving is hard, and inhumane. On the train, people are treated with cruelty and oppression. Some are treated worse than others. But nobody is truly living.

Sometimes they get breaks, but it is hard.

One day, a fire breaks out in one of the carriages of the train.

There is panic. The fire spreads throughout the whole train… Without getting off the train everyone is going to die.

Then the impossible happens.

The brakes no-one believed existed start to work. In the emergency, no-one notices how extraordinary it is that the train is stopping. They're too focused on the fire. The old rules go out the window.

For years on the train, the "worker class" of people have been dying from the awful conditions of the work they have to do on the train. They sleep in the aisles and sometimes have nowhere to sleep at all.

Suddenly, there are orders to house them and treat their ailments.

The train stops, and people begin to get off. Apart from the sound of the fire, suddenly there is a great silence.

Session 3

A HISTORY OF THE ATOM: THEORIES AND MODELS

How have our ideas about atoms changed over the years? This graphic looks at atomic models and how they developed.

SOLID SPHERE MODEL

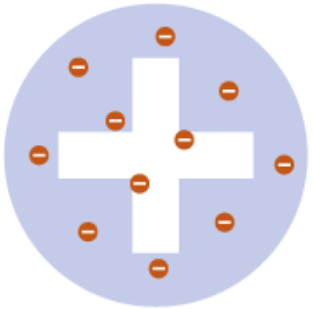
JOHN DALTON

1803

Dalton drew upon the Ancient Greek idea of atoms (the word 'atom' comes from the Greek '*atomos*' meaning indivisible). His theory stated that atoms are indivisible, those of a given element are identical, and compounds are combinations of different types of atoms.

- \+ RECOGNISED ATOMS OF A PARTICULAR ELEMENT DIFFER FROM OTHER ELEMENTS
- − ATOMS AREN'T INDIVISIBLE - THEY'RE COMPOSED FROM SUBATOMIC PARTICLES

PLUM PUDDING MODEL



J.J. THOMSON

1904

Thomson discovered electrons (which he called 'corpuscles') in atoms in 1897, for which he won a Nobel Prize. He subsequently produced the 'plum pudding' model of the atom. It shows the atom as composed of electrons scattered throughout a spherical cloud of positive charge.

- \+ RECOGNISED ELECTRONS AS COMPONENTS OF ATOMS
- − NO NUCLEUS; DIDN'T EXPLAIN LATER EXPERIMENTAL OBSERVATIONS

NUCLEAR MODEL

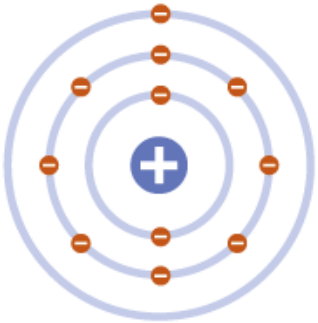
ERNEST RUTHERFORD

1911

Rutherford fired positively charged alpha particles at a thin sheet of gold foil. Most passed through with little deflection, but some deflected at large angles. This was only possible if the atom was mostly empty space, with the positive charge concentrated in the centre: the nucleus.

- \+ REALISED POSITIVE CHARGE WAS LOCALISED IN THE NUCLEUS OF AN ATOM
- − DID NOT EXPLAIN WHY ELECTRONS REMAIN IN ORBIT AROUND THE NUCLEUS

PLANETARY MODEL



NIELS BOHR

1913

Bohr modified Rutherford's model of the atom by stating that electrons moved around the nucleus in orbits of fixed sizes and energies. Electron energy in this model was quantised; electrons could not occupy values of energy between the fixed energy levels.

- \+ PROPOSED STABLE ELECTRON ORBITS; EXPLAINED THE EMISSION SPECTRA OF SOME ELEMENTS
- − MOVING ELECTRONS SHOULD EMIT ENERGY AND COLLAPSE INTO THE NUCLEUS; MODEL DID NOT WORK WELL FOR HEAVIER ATOMS

QUANTUM MODEL

ERWIN SCHRÖDINGER

1926

Schrödinger stated that electrons do not move in set paths around the nucleus, but in waves. It is impossible to know the exact location of the electrons; instead, we have 'clouds of probability' called orbitals, in which we are more likely to find an electron.

- \+ SHOWS ELECTRONS DON'T MOVE AROUND THE NUCLEUS IN ORBITS, BUT IN CLOUDS WHERE THEIR POSITION IS UNCERTAIN
- \+ STILL WIDELY ACCEPTED AS THE MOST ACCURATE MODEL OF THE ATOM

[http://dataphys.org/list/]

A Word About Accessibility

A table can be translated to Braille, but that's not always possible for charts.

Describing the features and emerging structures in a visualization is a possible solution... **if they can be spotted**.

Analysts must produce clear and meaningful visualizations, but they must also describe their features in a fashion that allows all to "see" the insights.

But this requires them to have "seen" all the insights, which is not always necessarily the case (if at all possible).

A Word About Accessibility

Data Perception:

- texture-based representations
- text-to-speech
- sound/music
- odor-based or taste-based representations (?!?)

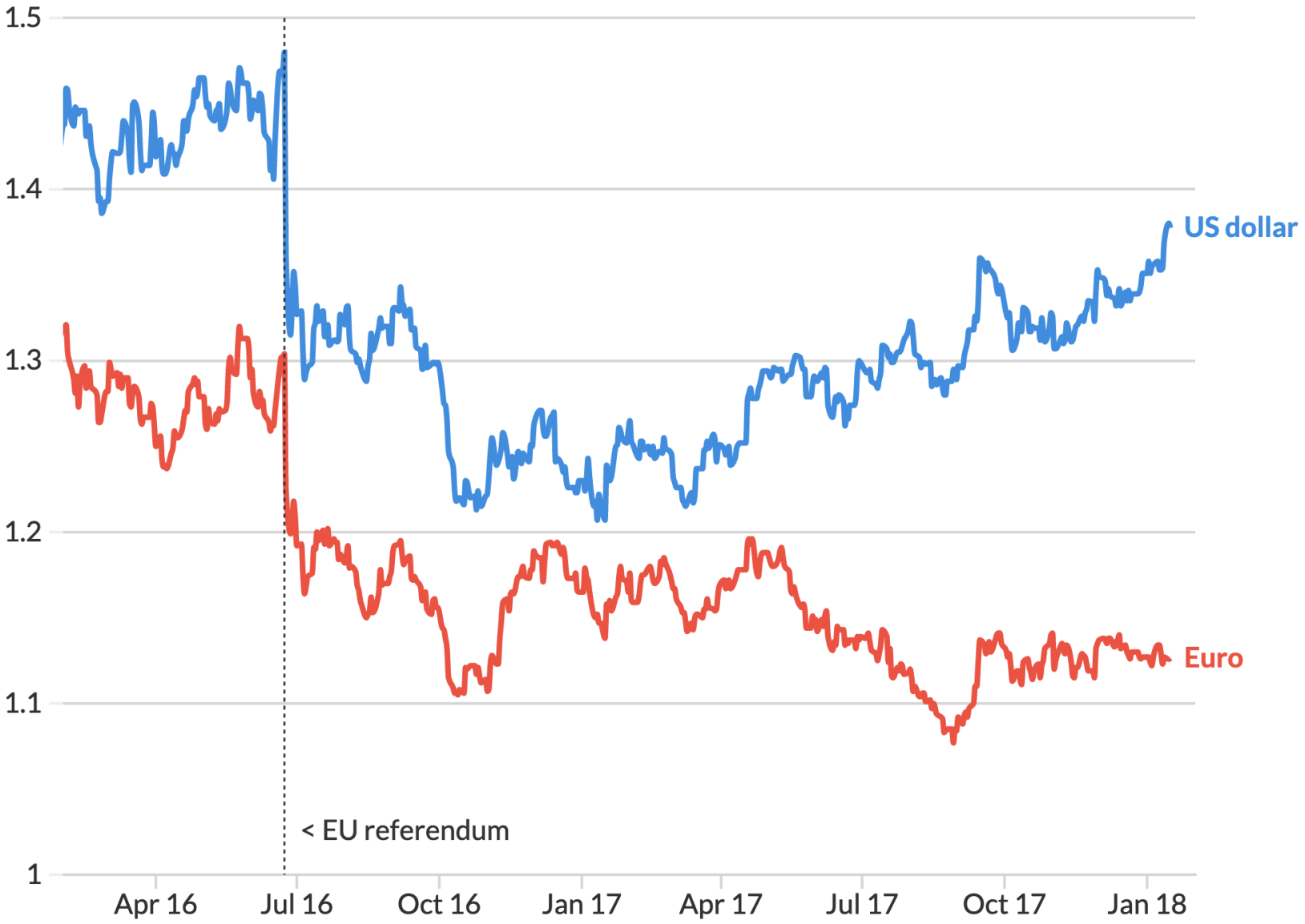
Sonifications:

- TRAPPIST Sounds : TRAPPIST-1 Planetary System Translated Directly Into Music
- Listening to data from the Large Hadron Collider, L. Asquith

[https://flourish.studio/blog/accessible-chart-design]

The value of the pound has fallen, particularly since the EU referendum

Euros and US $ per £



A line chart showing the value of the pound in relation to euros and US dollars. A large drop is visible after the EU referendum in June 2016. Just before the referendum you could get 1.48 US dollars and 1.3 euros for each pound. After the referendum it fell to 1.29 US dollars and 1.16 euros – a fall of around 12%.

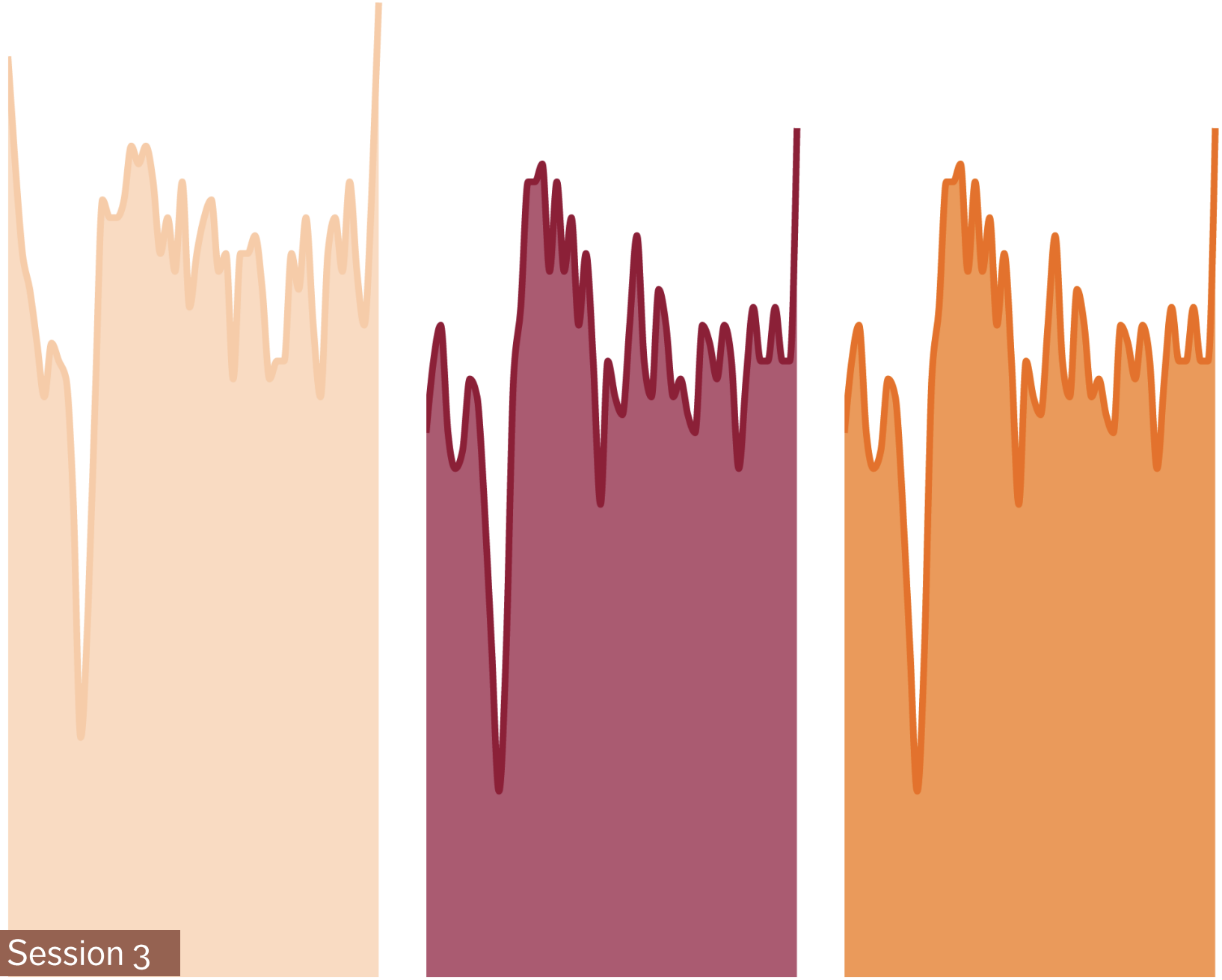
Source: Bank of England

Fail (1.46:1)

Pass (8.52:1)

Partial pass (3.02:1)

[https://flourish.studio/blog/accessible-chart-design]



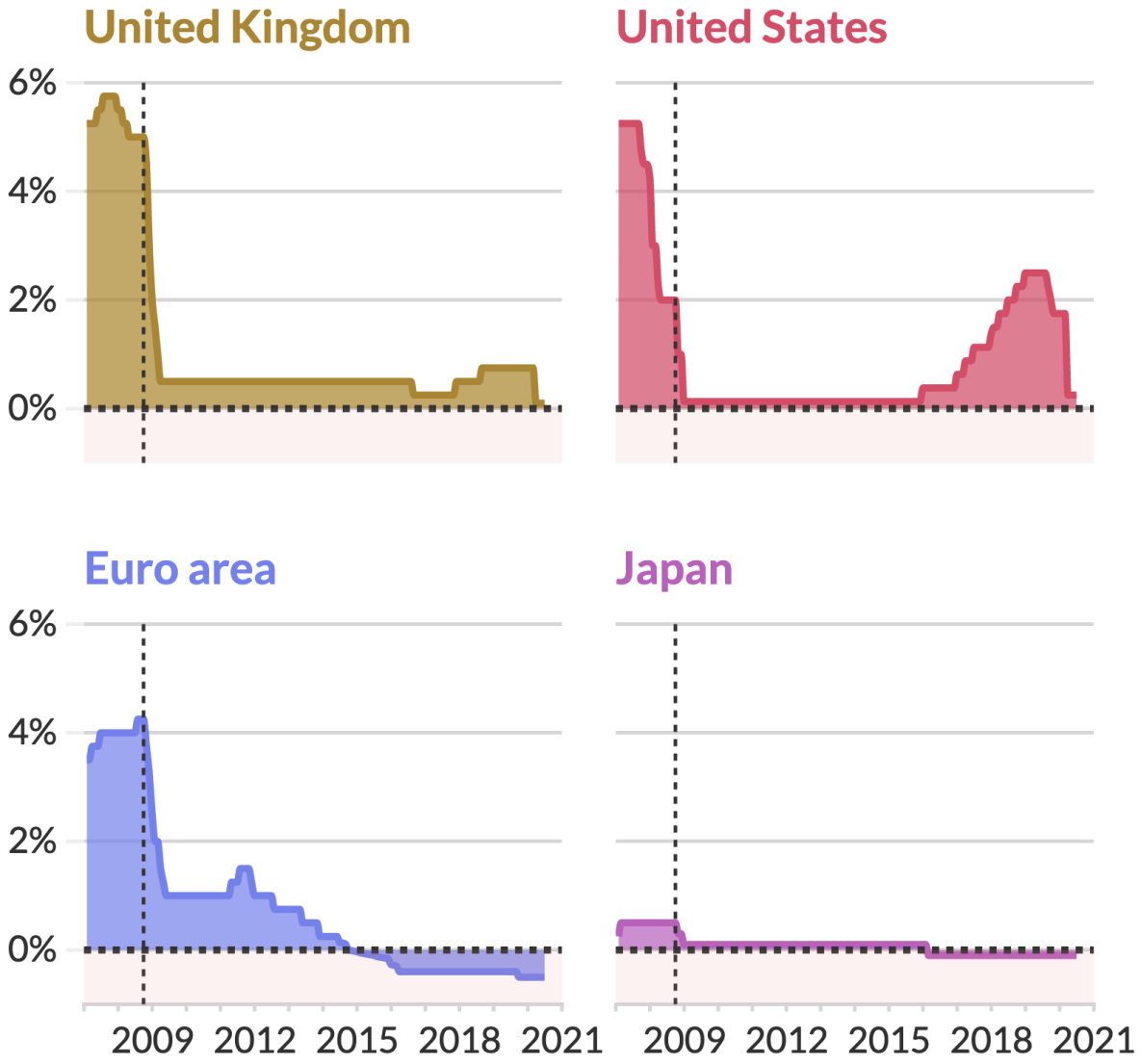
Use colors that are bold and clear enough for people to see both text and graphical elements.

Web Content Accessibility Guidelines (WCAG) suggest meeting the WCAG AA requirements.

To check if your color (and font size) choices are AA accessible you can use a contrast checker website.

For colours to be AA accessible they need to have a contrast ratio of at least **3:1** for **graphical elements**, and **4.5:1** for **normal text**.

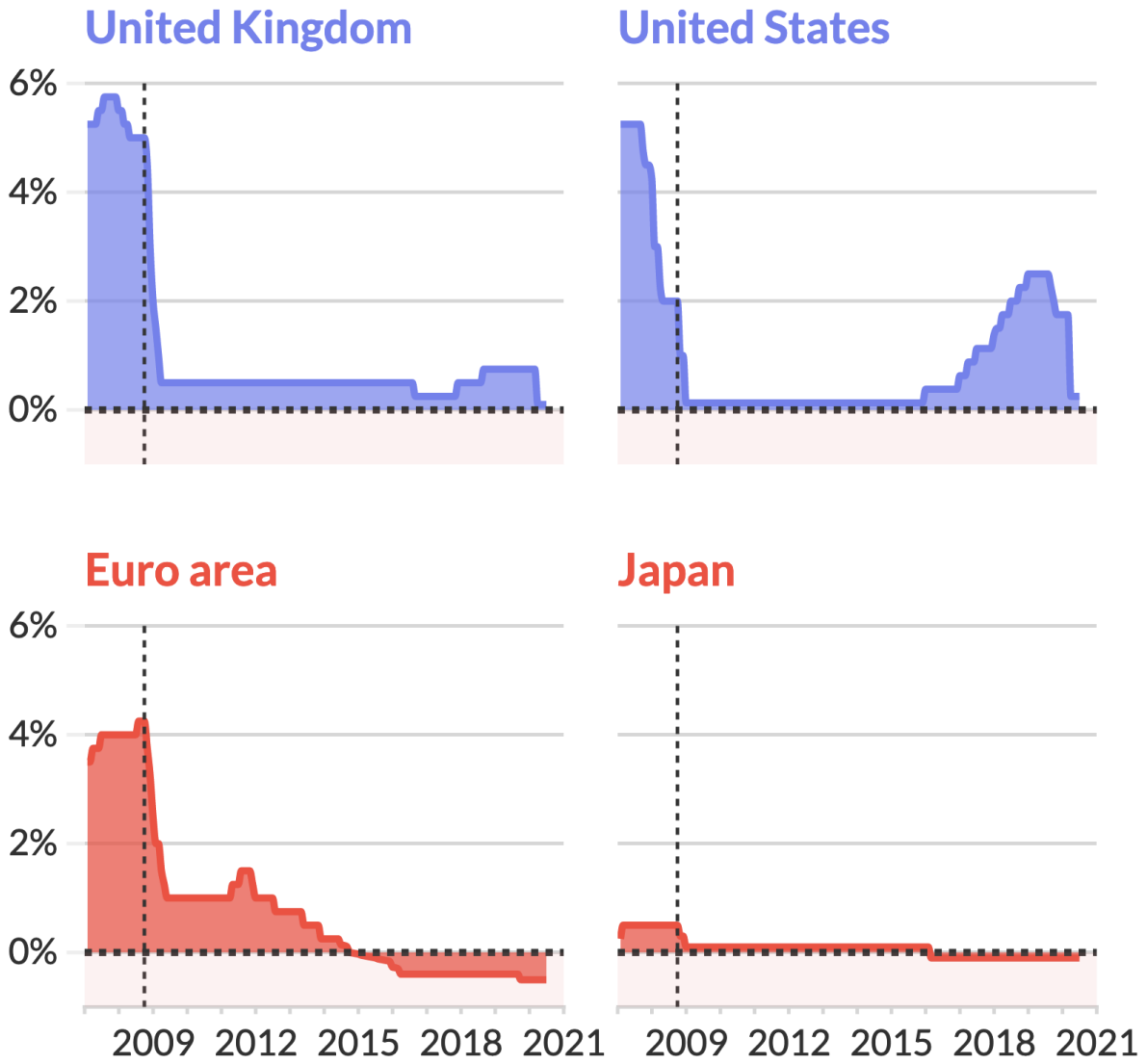
Interest rates have been falling since the financial crisis, and have even gone negative in some countries



Source: ONS

Session 3

Interest rates have been falling since the financial crisis, and have even gone negative in some countries

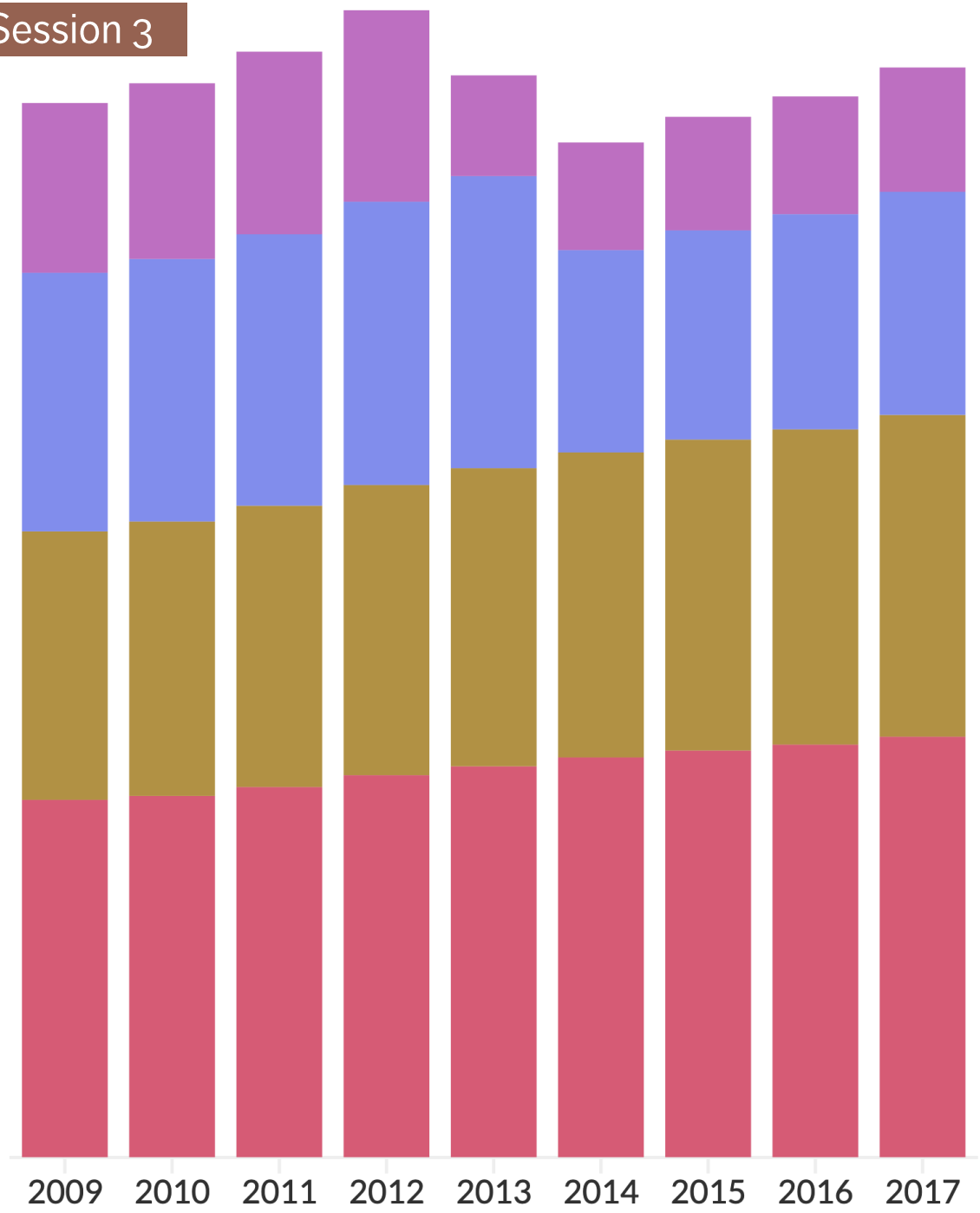


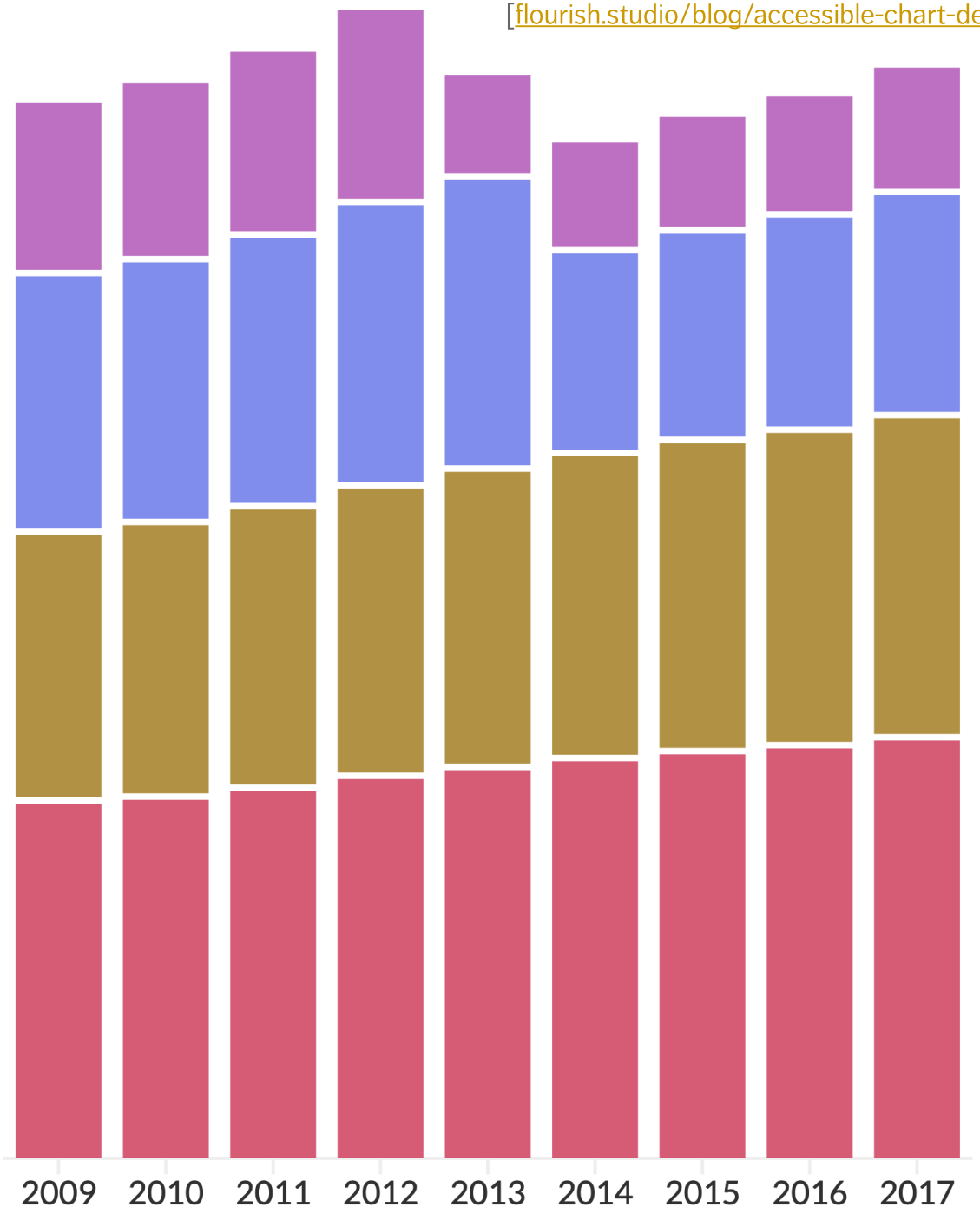
Source: ONS

[https://flourish.studio/blog/accessible-chart-design]

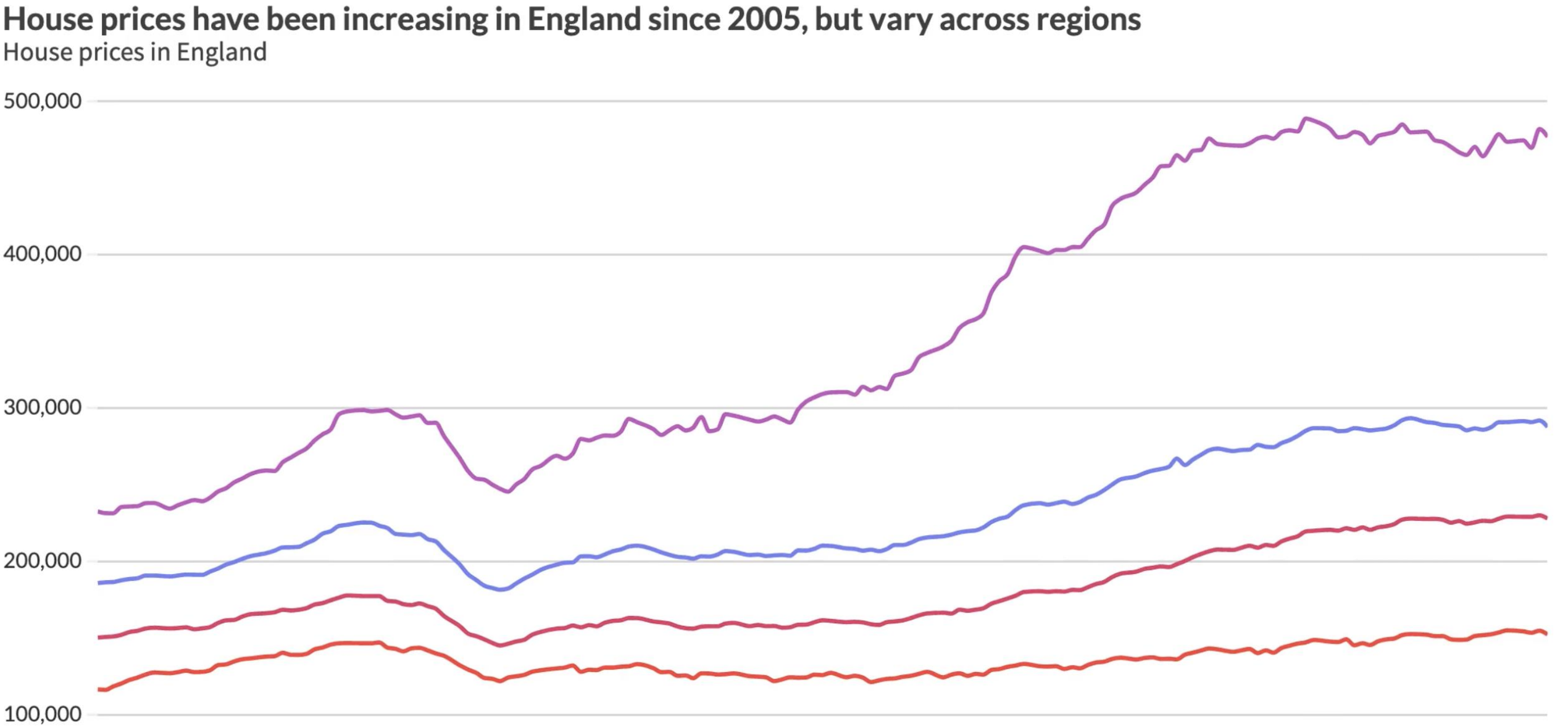
Session 3

[flourish.studio/blog/accessible-chart-design]



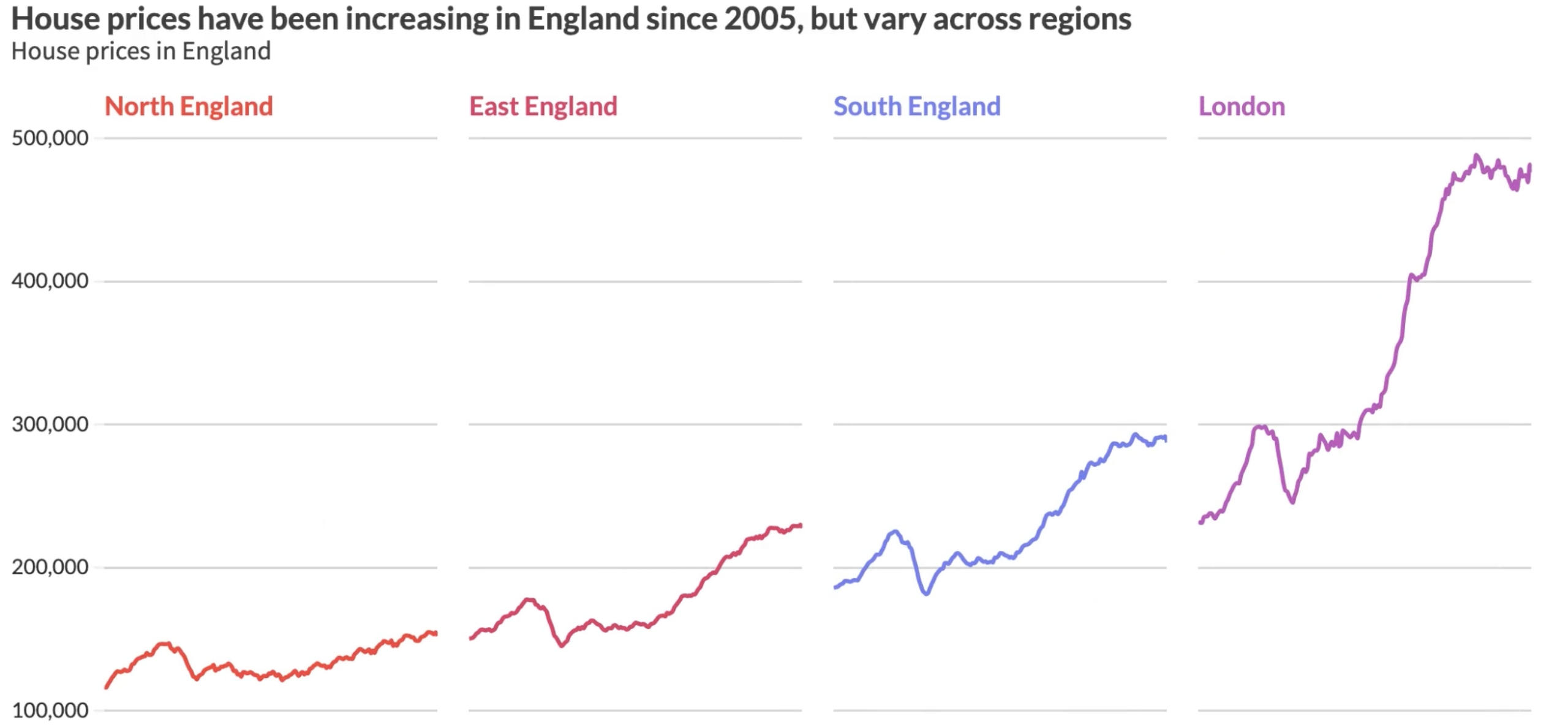


[https://flourish.studio/blog/accessible-chart-design]



Session 3

[https://flourish.studio/blog/accessible-chart-design]



Suggested Reading

Stories and Illustrations

S. McCloud, *Making Comics: Storytelling Secrets of Comics, Manga and Graphic Novels*. Harper, 2006.

The Practice of Data Visualization
Part III: Visualization and Storytelling

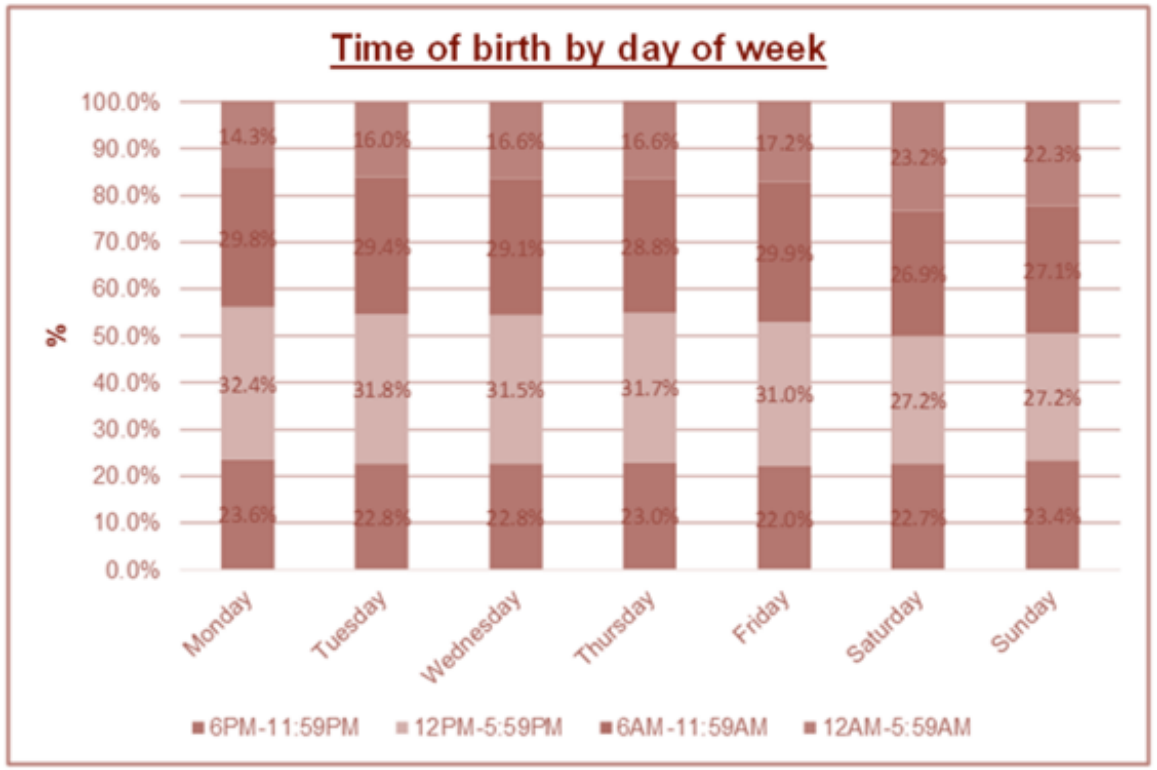
8. Effective Storytelling Visuals
    8.1 Stories and Illustrations

Exercises

Stories and Illustrations

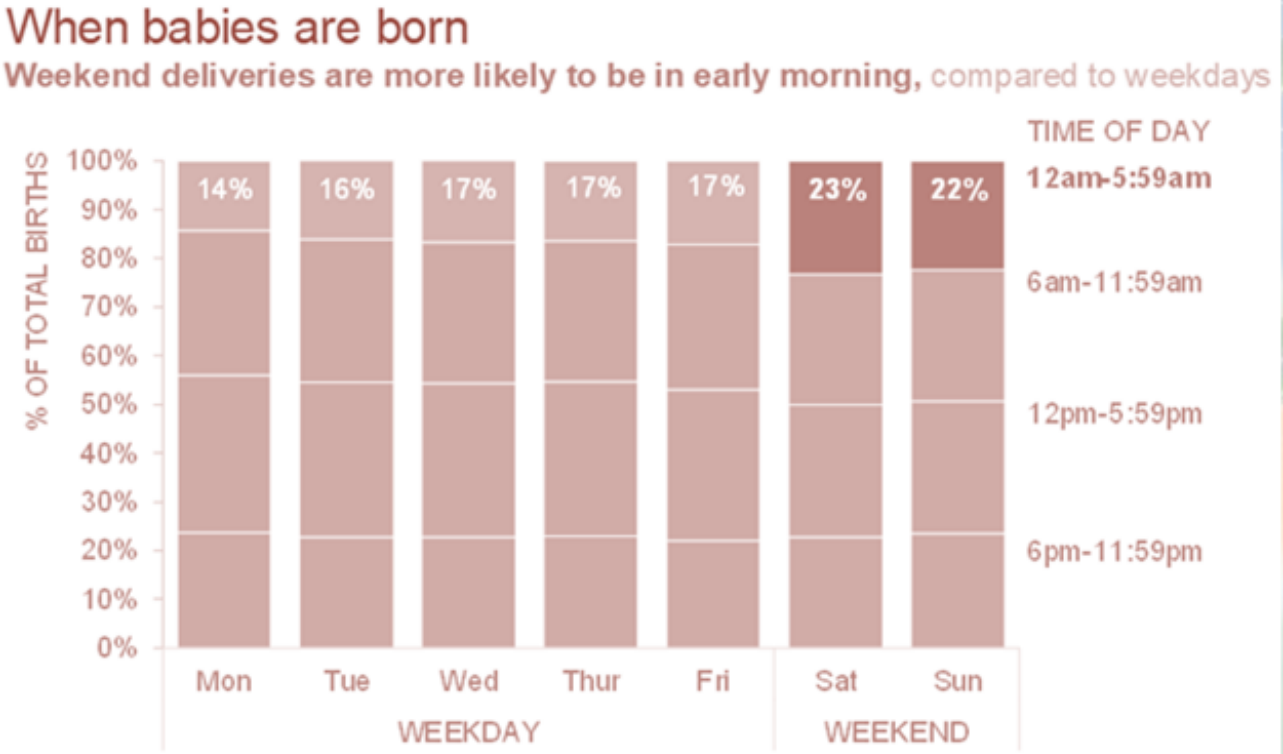
1. Think of a work-related story.
   a. Create a sketch that could illustrate this work story.
   b. What visual storytelling choices and combinations would you consider using?
   c. Would accessibility considerations change the way in which the story is presented to the audience?
2. Re-cast the stories presented in this course (or any other stories, as you wish) using different visual storytelling choices and combinations.
3. Re-cast the data stories in this course (or any other stories, as you wish) using different visual storytelling choices and combinations.

BEFORE



Data source: CDC (National Vital Statistics Reports, Vol. 67, No. 1, January 31, 2018)

AFTER

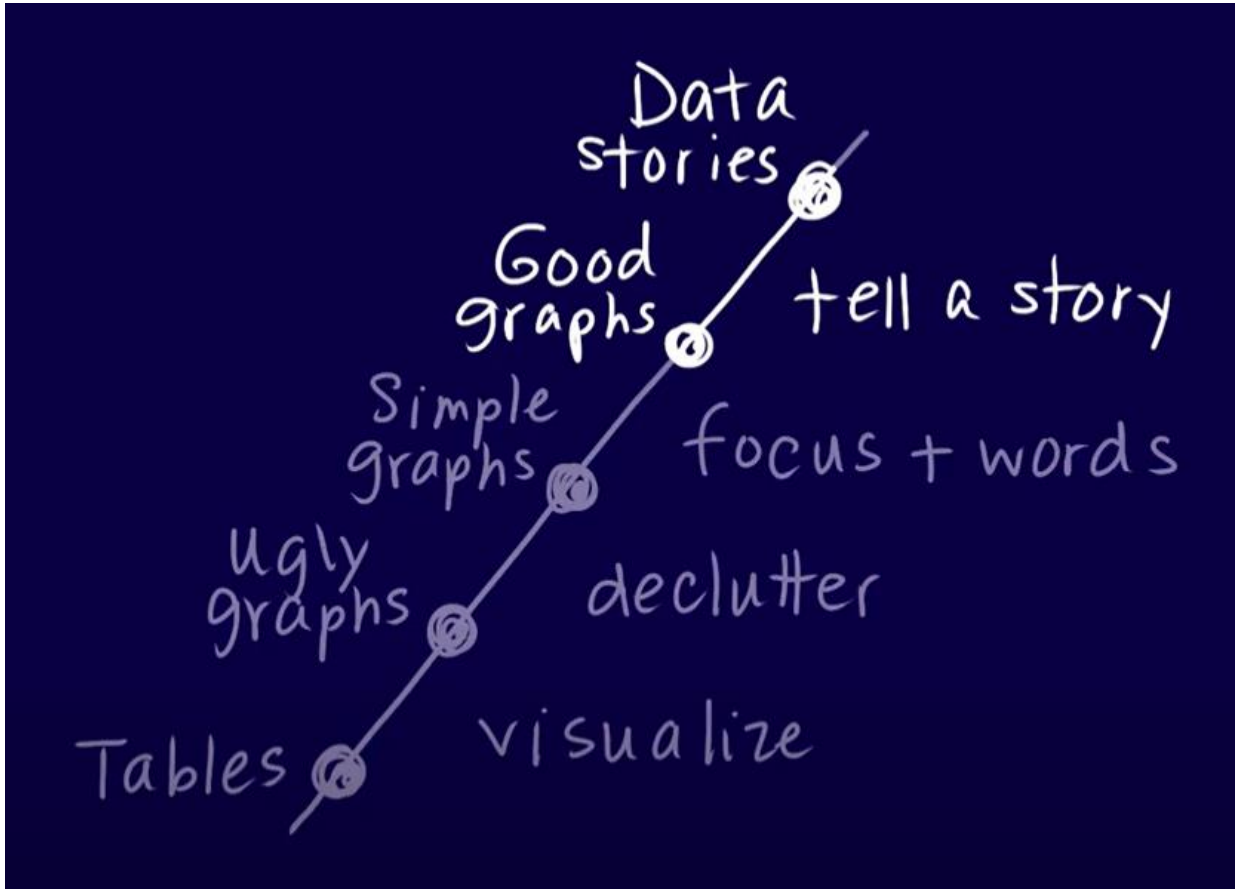


Data source: CDC (National Vital Statistics Reports, Vol. 67, No. 1, January 31, 2018)

8. Evolving a Storytelling Chart

[C. Nussbaumer Knaflic, *Storytelling with Data*]

Evolving a Visualization



[C. Nussbaumer Knaflic, *Storytelling with Data*]

Evolving a Visualization – Table

Meals served over time

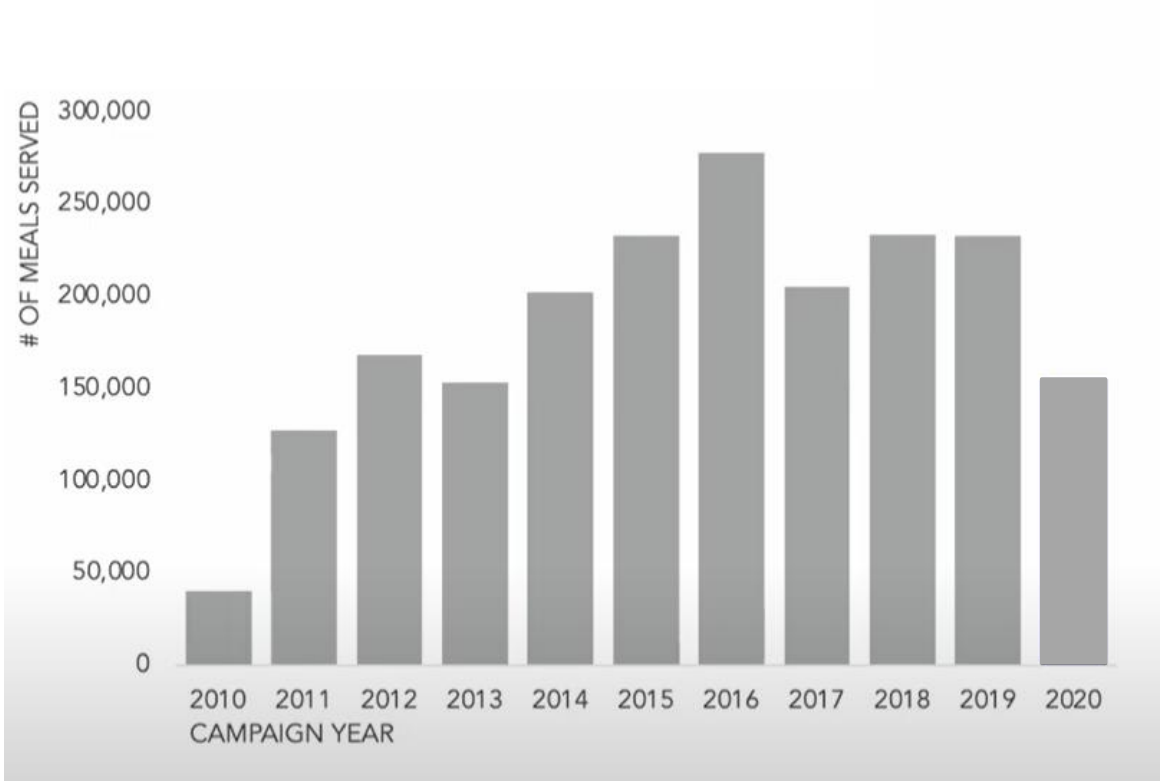
Campaign Year	Meals Served
2010	40,139
2011	127,020
2012	168,193
2013	153,115
2014	202,102
2015	232,897
2016	277,912
2017	205,350
2018	233,389
2019	232,797
2020	154,830

[C. Nussbaumer Knaflic, *Storytelling with Data*]

Evolving a Visualization – Ugly Graph

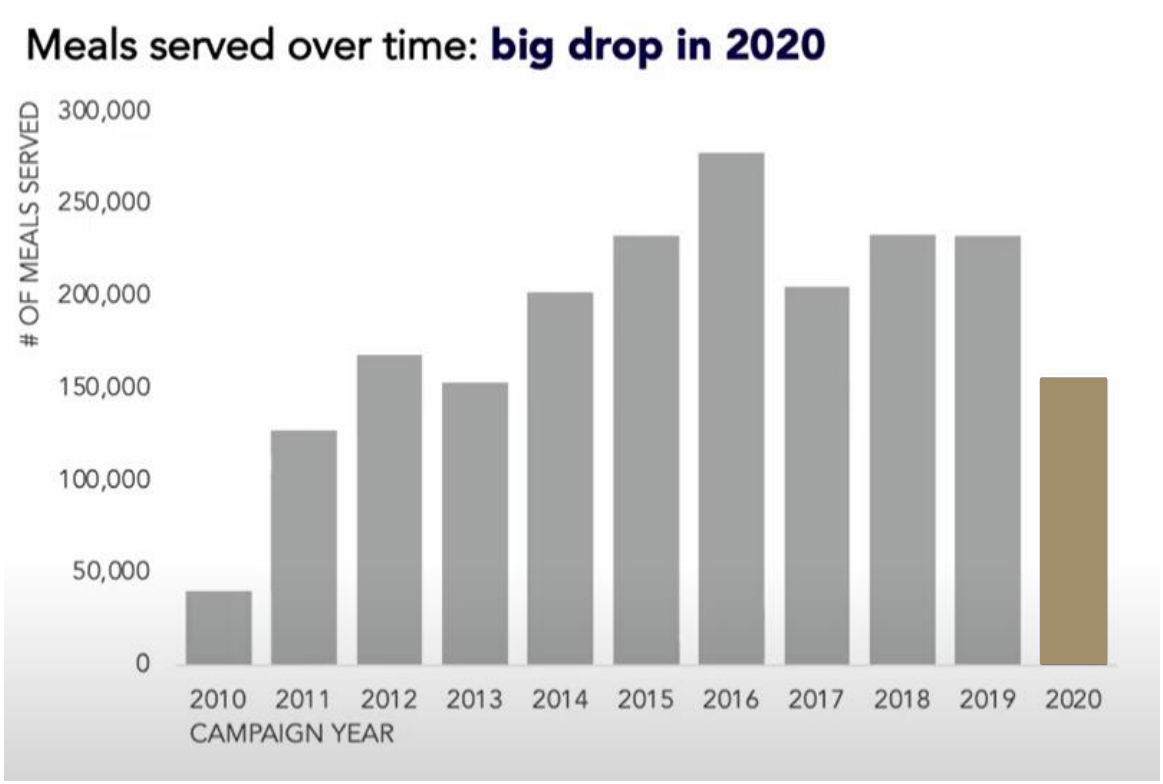
[Based on C. Nussbaumer Knaflic, *Storytelling with Data*]

Evolving a Visualization – Simple Graph



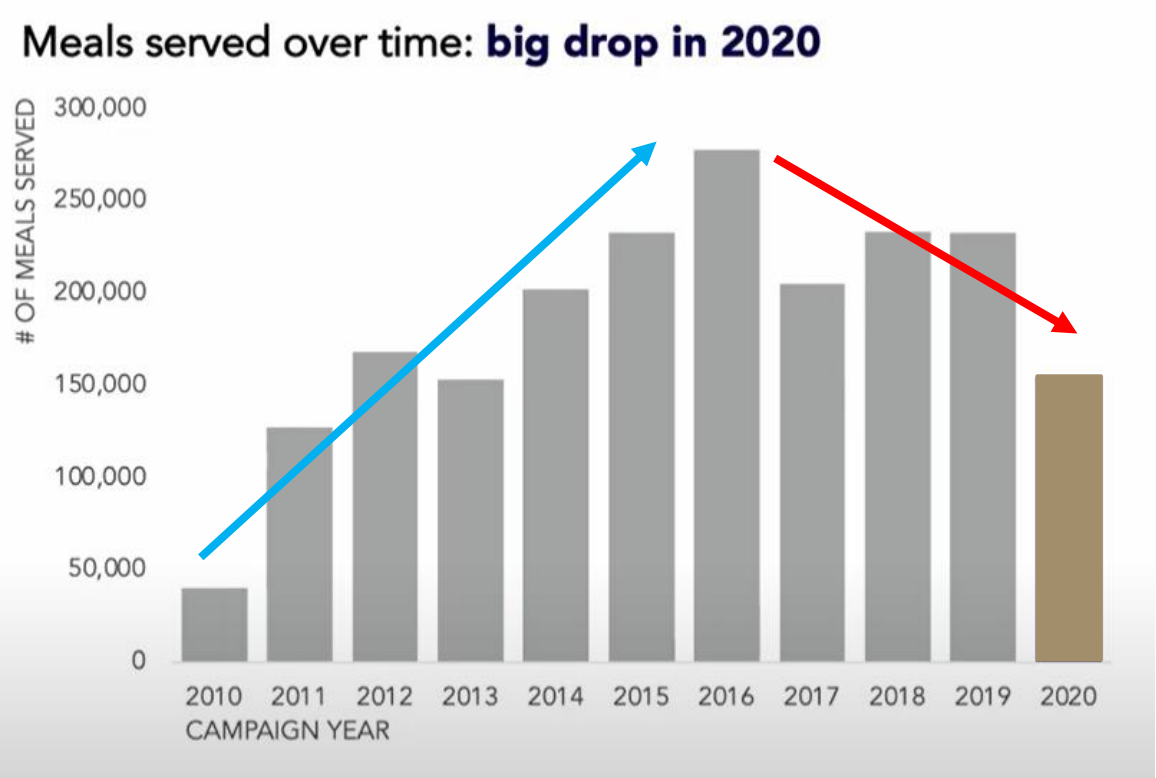
[Based on C. Nussbaumer Knaflic, *Storytelling with Data*]

Evolving a Visualization – Good Graph



[Based on C. Nussbaumer Knaflic, *Storytelling with Data*]

Evolving a Visualization – Data Story



Even though it might seem obvious that there would be a **big drop in meals served in 2020** due to the pandemic, note that the **2017-2019 numbers** were already going against the **2010-2016 trend** – we should not be planning for a return to 2016 levels without first understanding what happened in 2017-2019.

Data Storytelling Tropes

Some data visualizations patterns are so familiar they have become **tropes:**

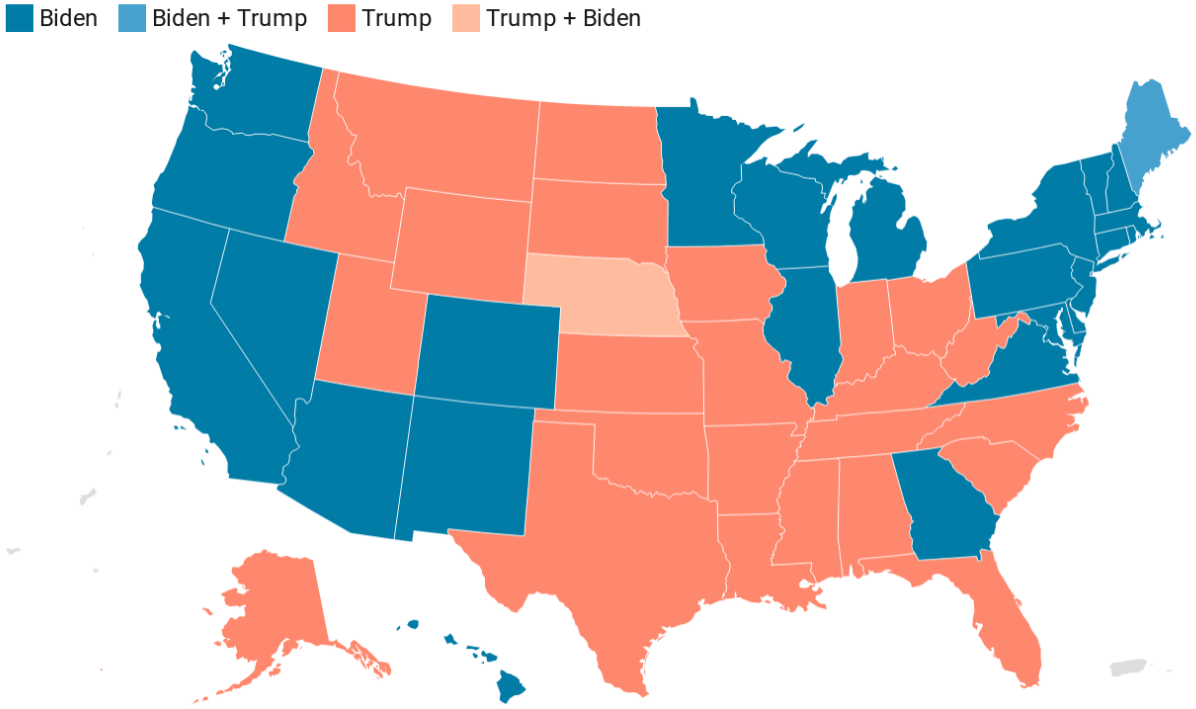
- a scatterplot with a trend line going straight up or straight down
- a cluster bar chart with two categories where one is always lower than the other
- a line chart with the two lines crossing in one place
- pie charts being used all over the place (to avoid)
- red for republican, blue for democrat (US); red for left-leaning, blue for right-leaning (ROW)
- using broken axes to exaggerate effects (can be justified… sometimes)
- etc.

[https://handsondataviz.org/spatial-bias.html]

Data Storytelling Tropes – Examples

Conventional Map of 2020 US Presidential Election Results

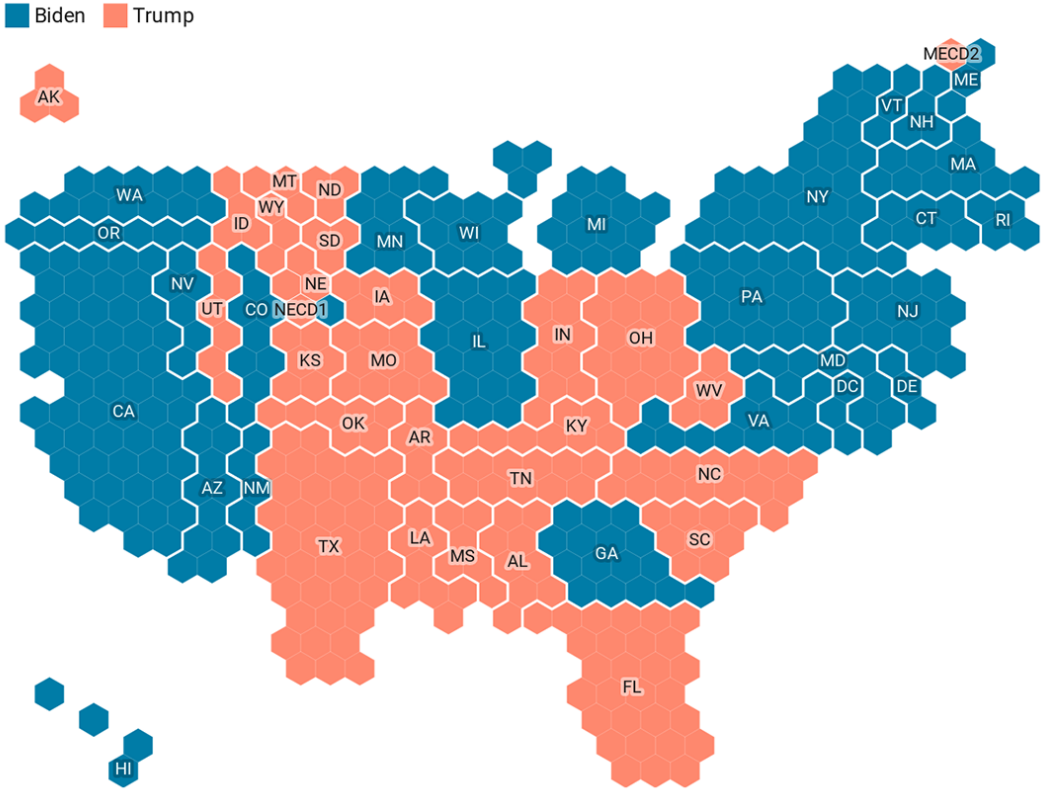
Maine and Nebraska allow some electoral votes to be split by district



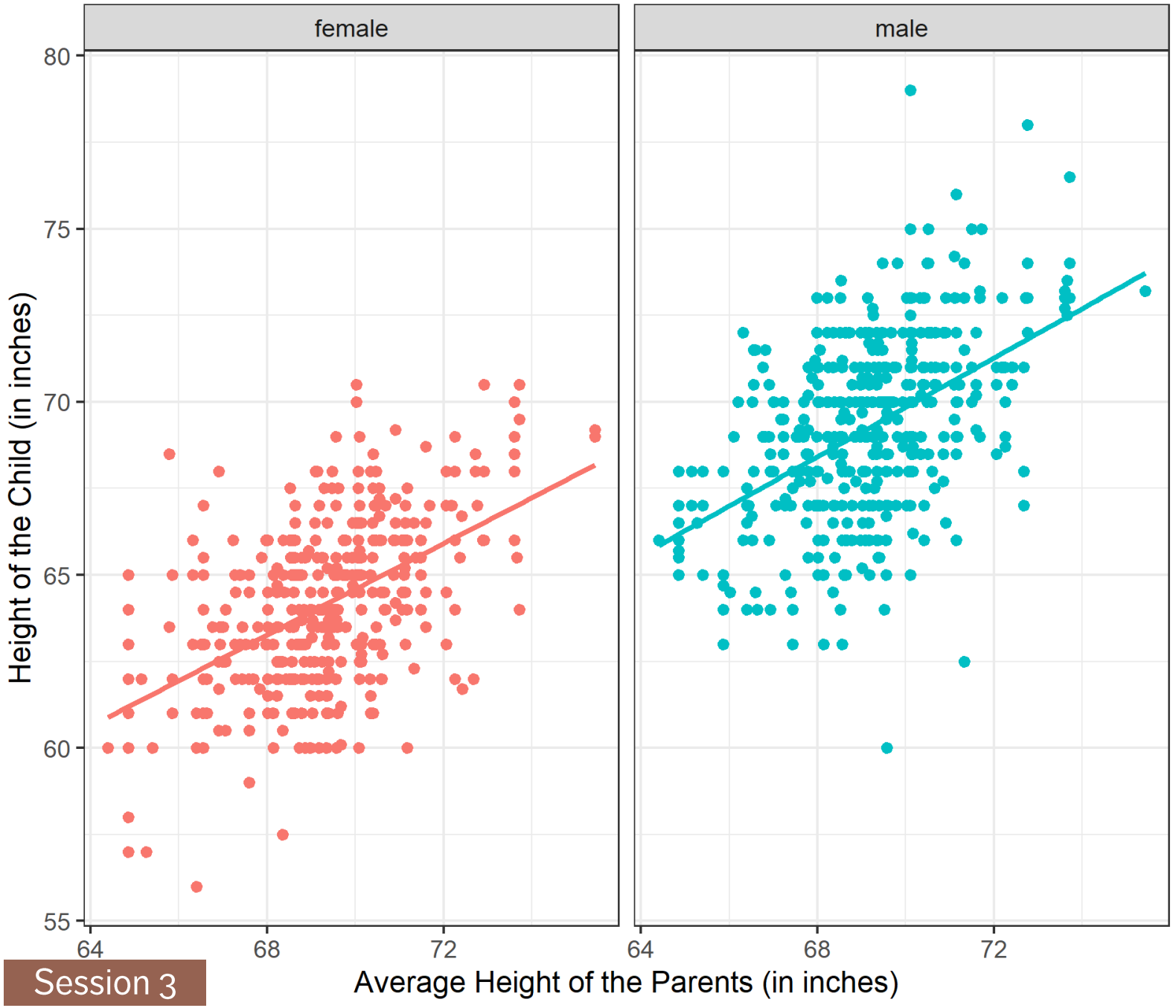
Created with Datawrapper

Cartogram of 2020 US Presidential Election Results

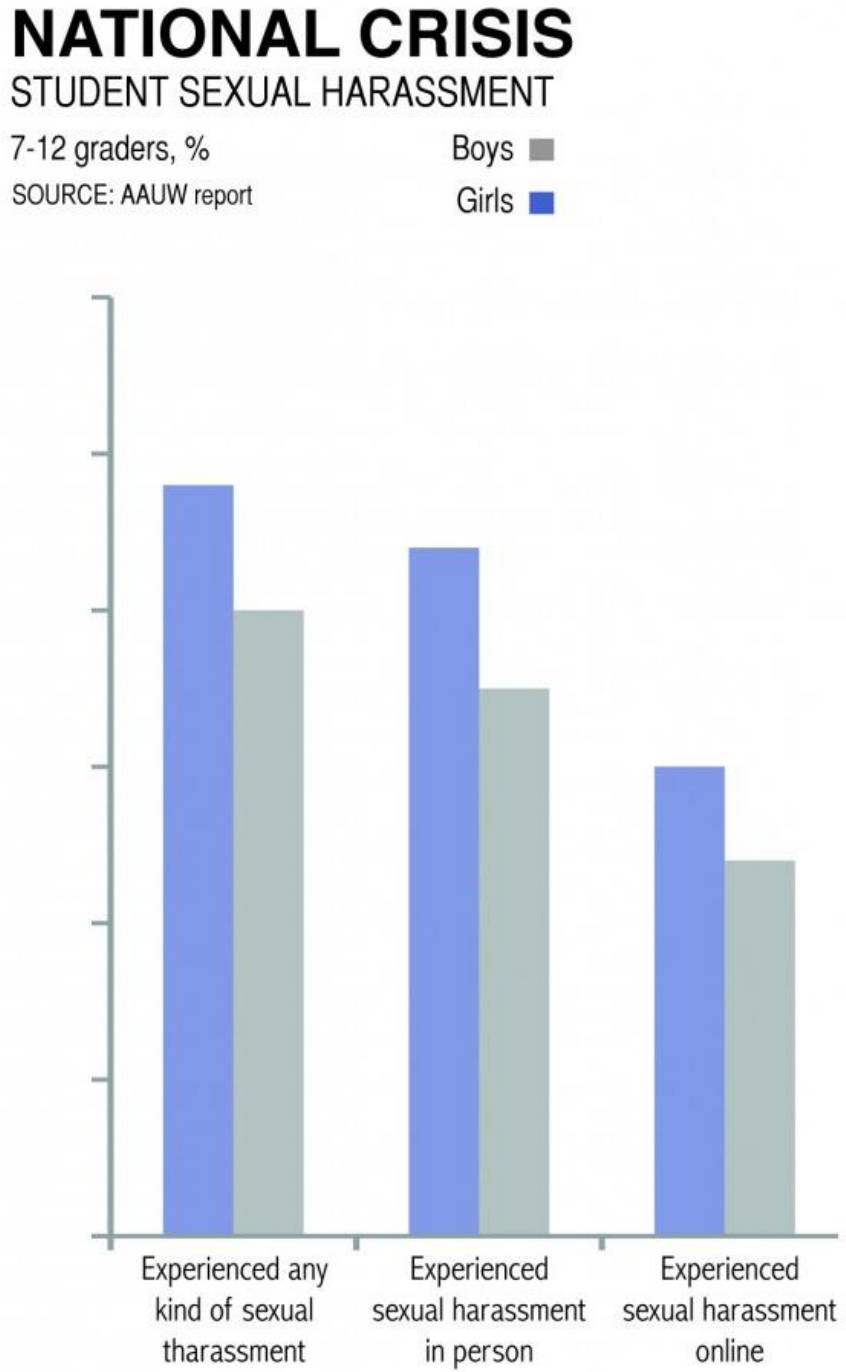
Each hexagon represents one electoral college vote



Scatterplot matrix of Galton Family Data by Gender of the Child

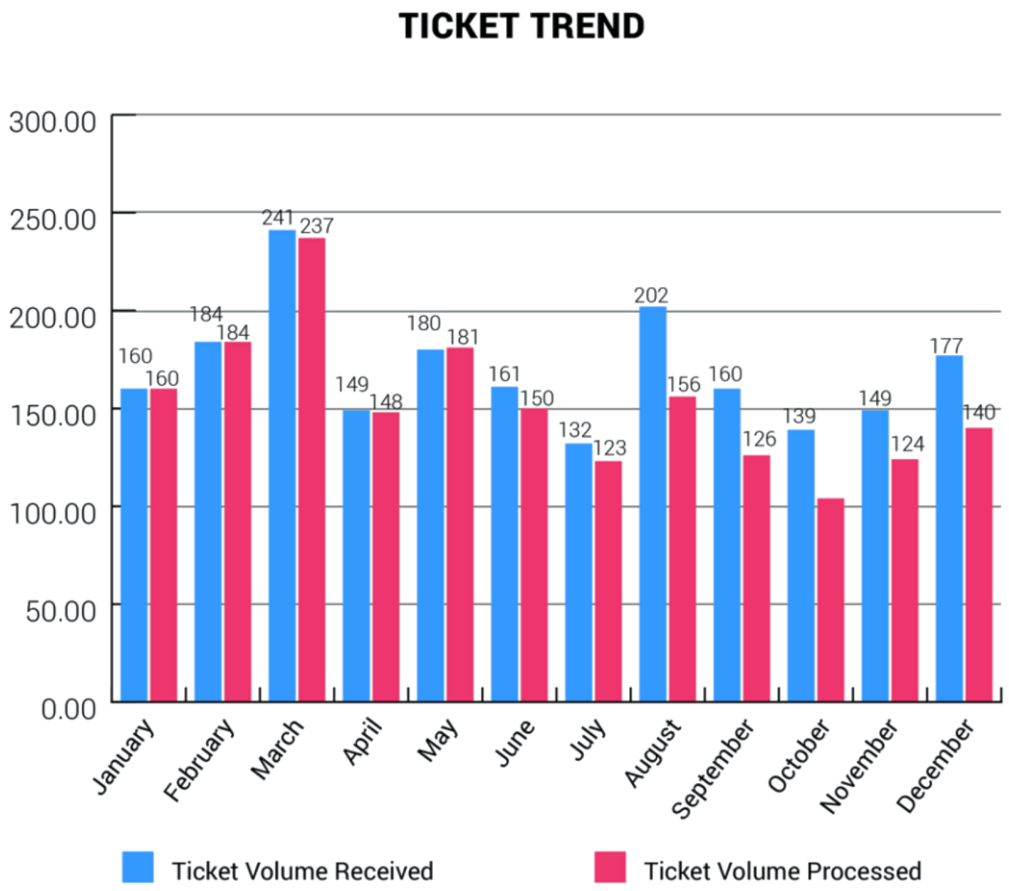


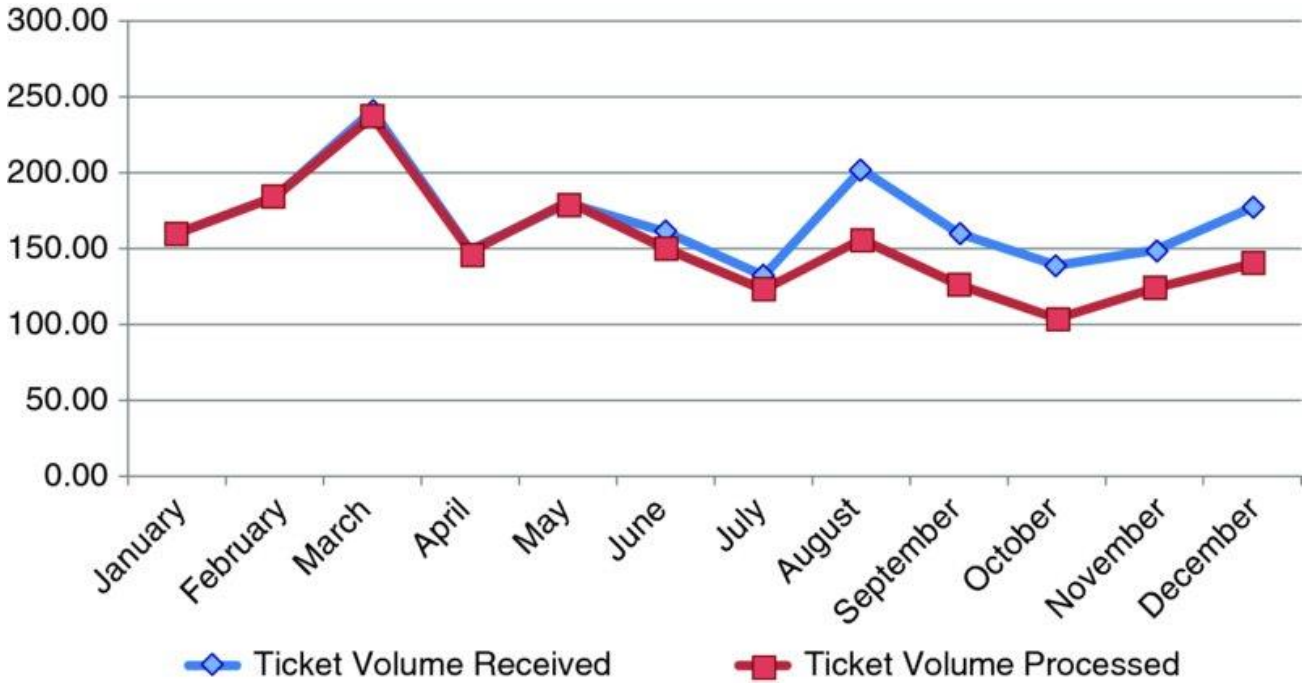
[https://www.chsglobe.com/13376/cover-stories/sexualharassment]



[C. Nussbaumer Knaflic, *Storytelling with Data*]

Examples

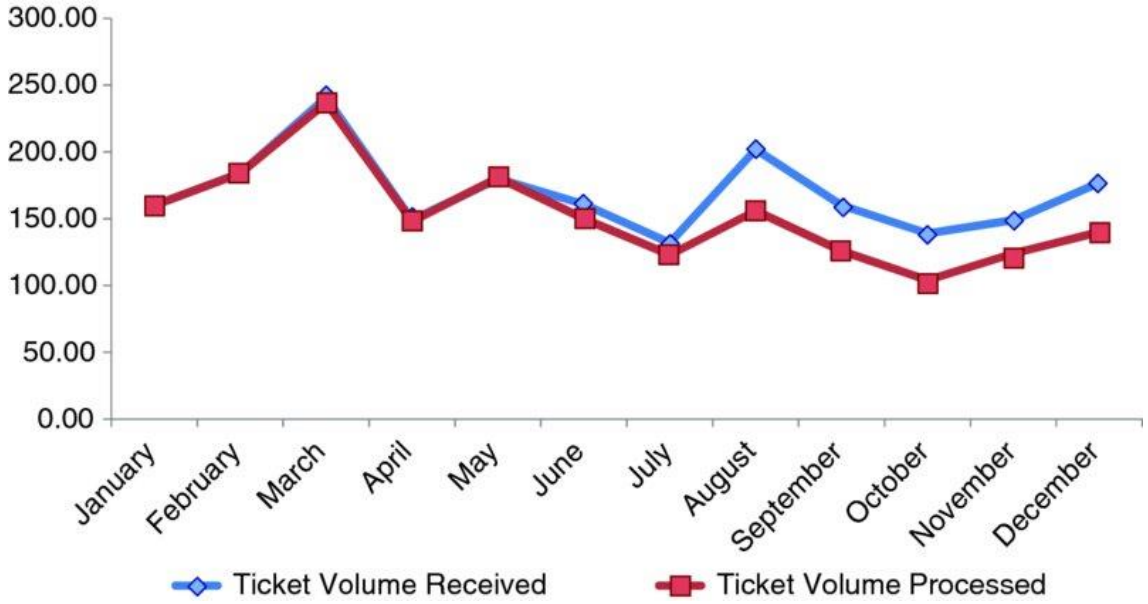




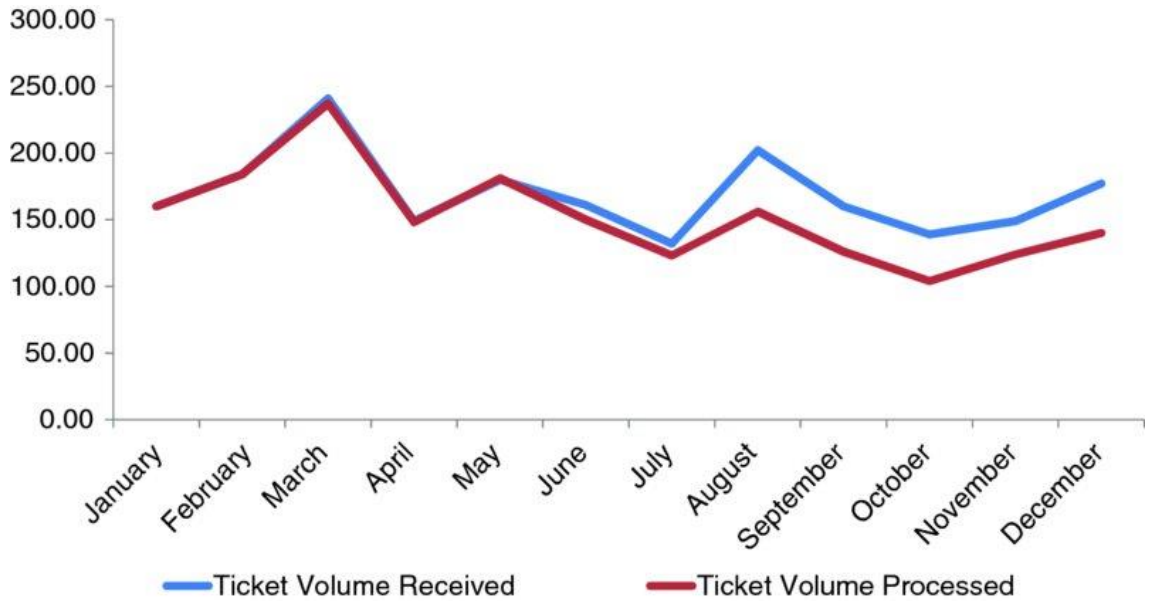
1. Change graph type (trope)

[Based on C. Nussbaumer Knaflic, *Storytelling with Data*]

Examples



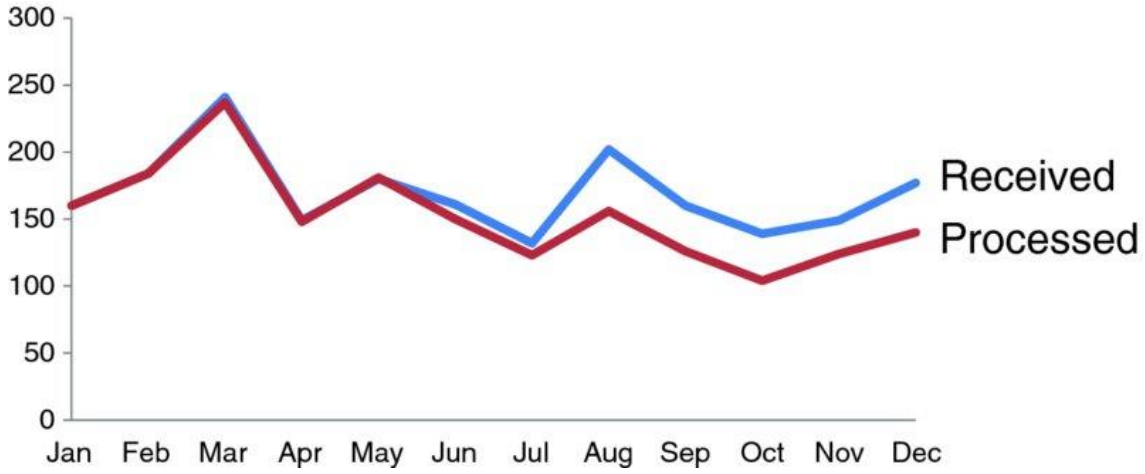
2. Remove border and gridlines



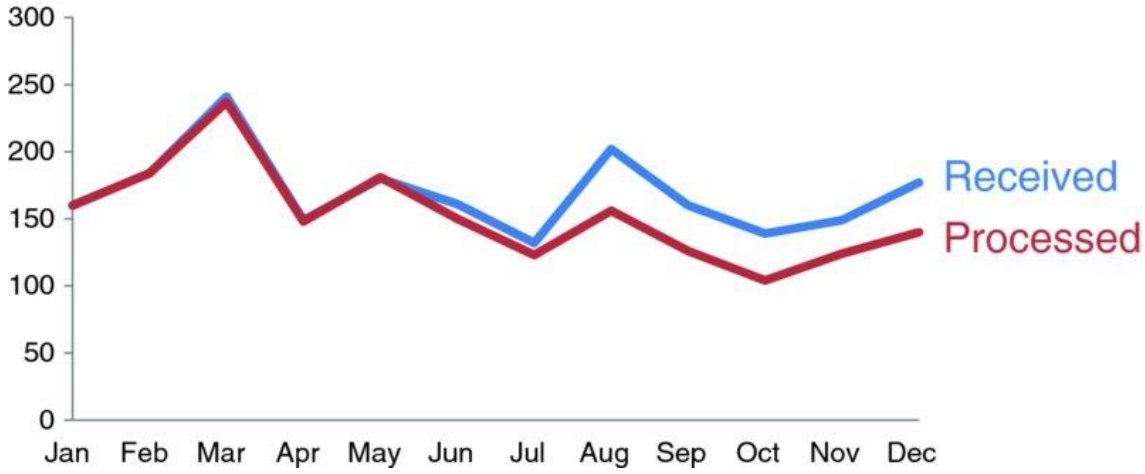
3. Remove markers

[Based on C. Nussbaumer Knaflic, *Storytelling with Data*]

Examples



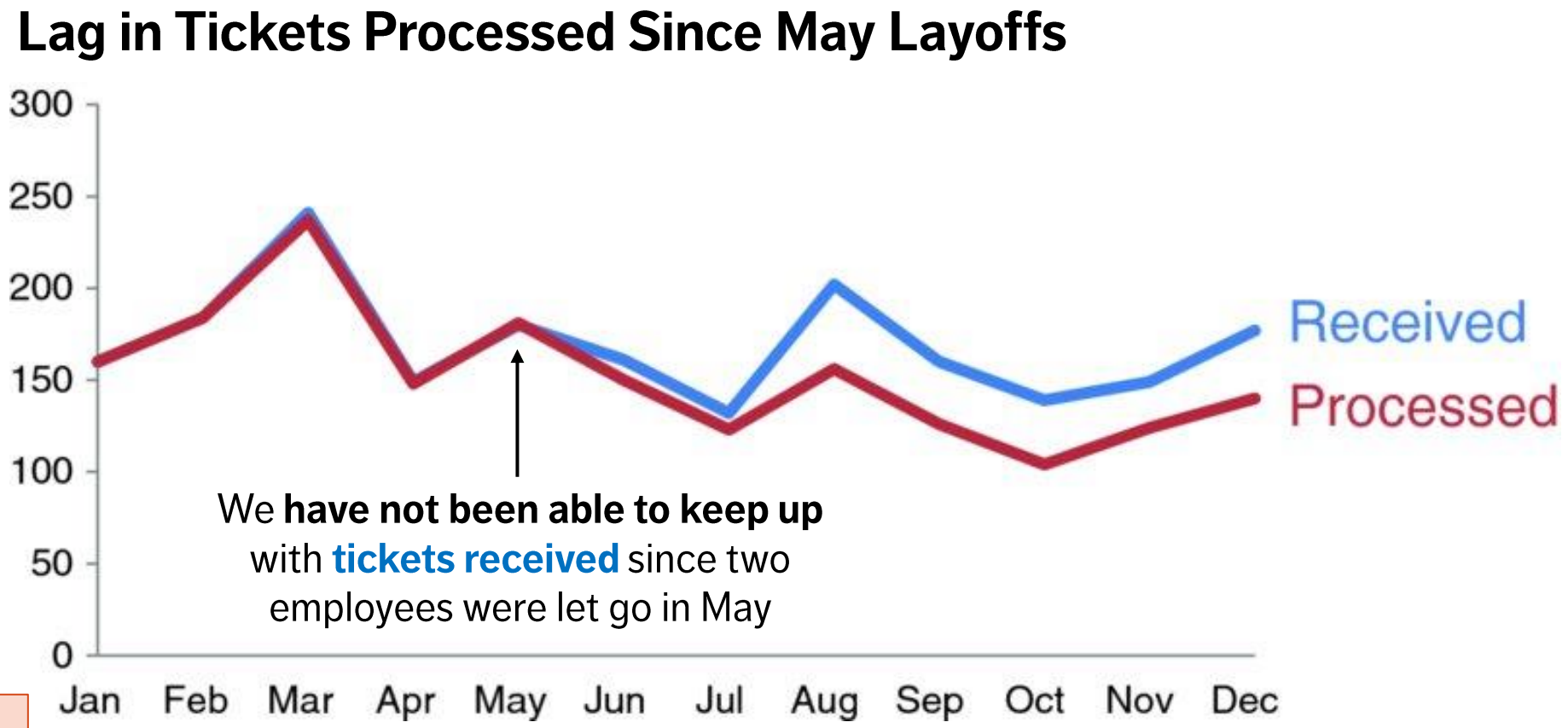
4. Clean-up axis labels and legend



5. Colour code the lines

[Based on C. Nussbaumer Knaflic, *Storytelling with Data*]

Examples

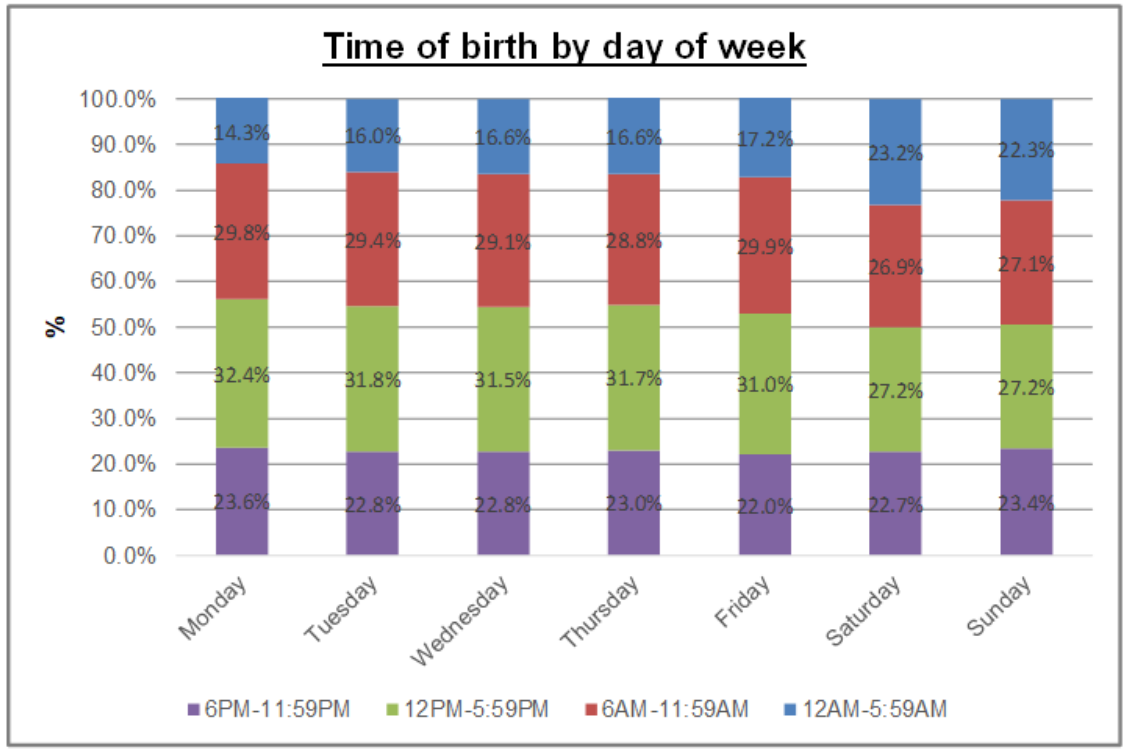


6. Tell the story

[E. Ricks, https://www.storytellingwithdata.com/blog/2019/5/13/declutter-and-question-defaults]

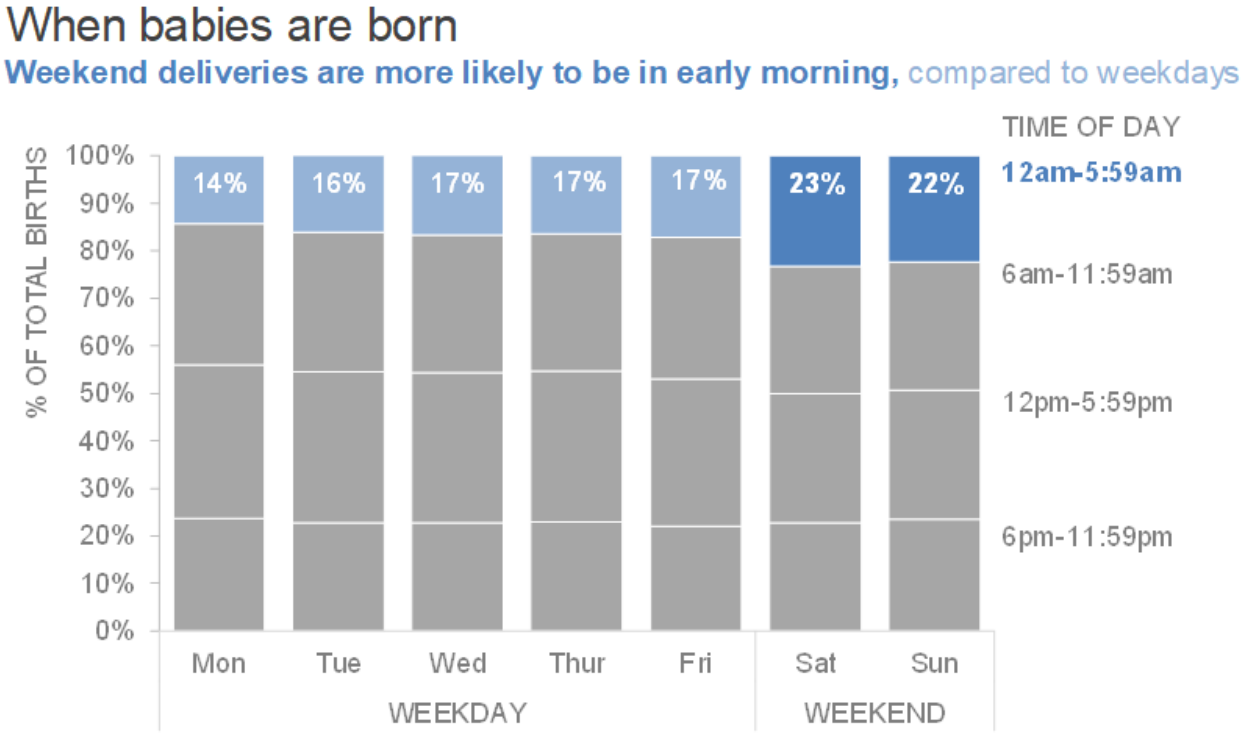
Examples

BEFORE



Data source: CDC (National Vital Statistics Reports, Vol. 67, No. 1, January 31, 2018)

AFTER

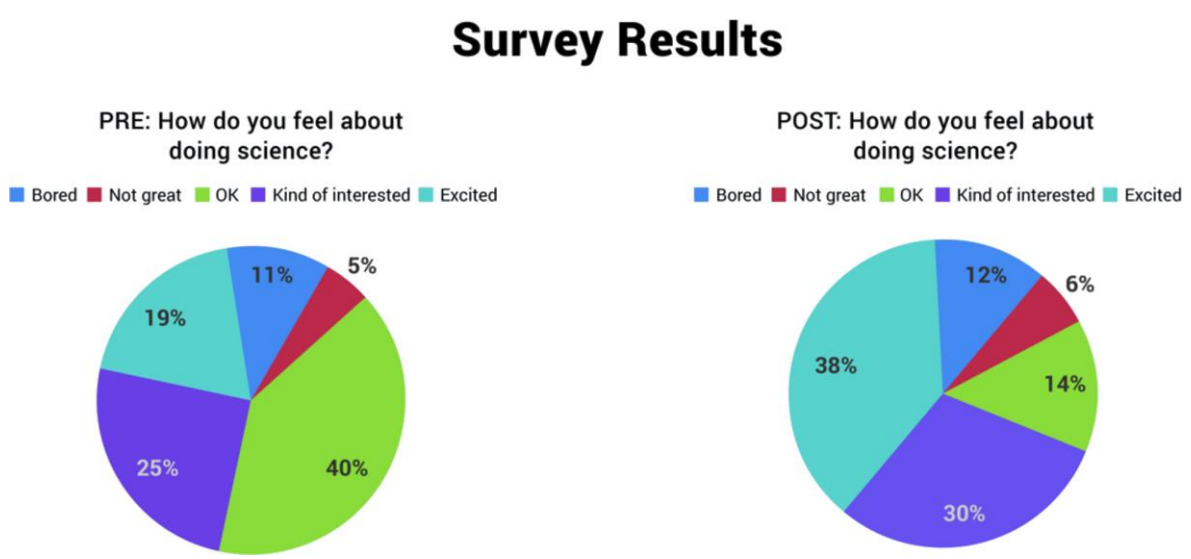


Data source: CDC (National Vital Statistics Reports, Vol. 67, No. 1, January 31, 2018)

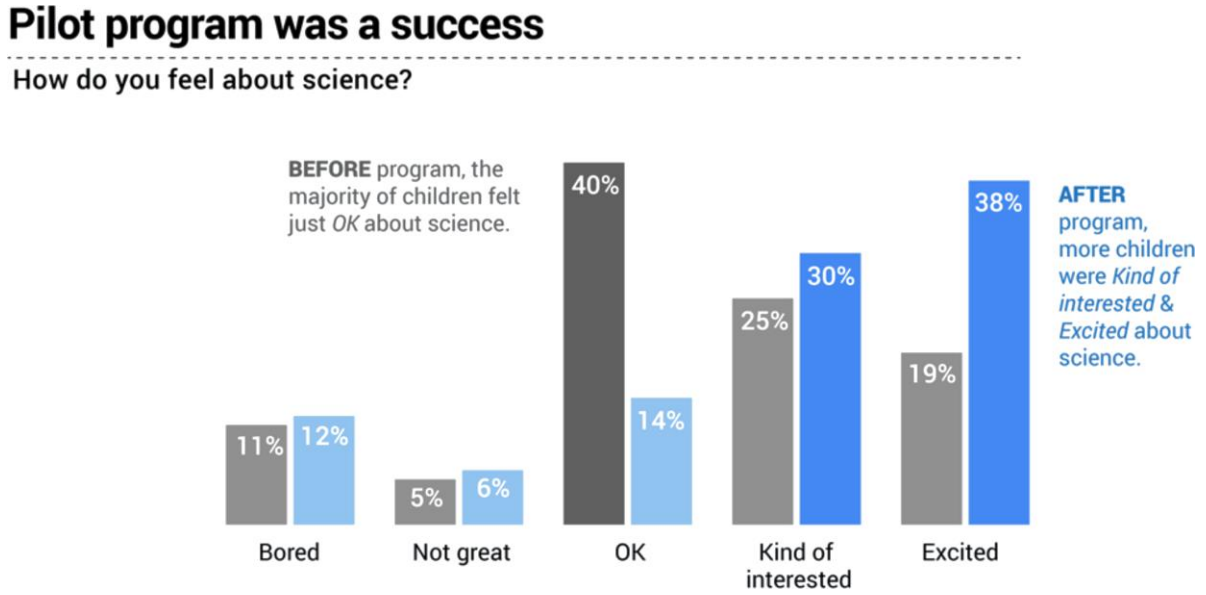
[C. Nussbaumer Knaflic, *Storytelling with Data*]

Examples

BEFORE



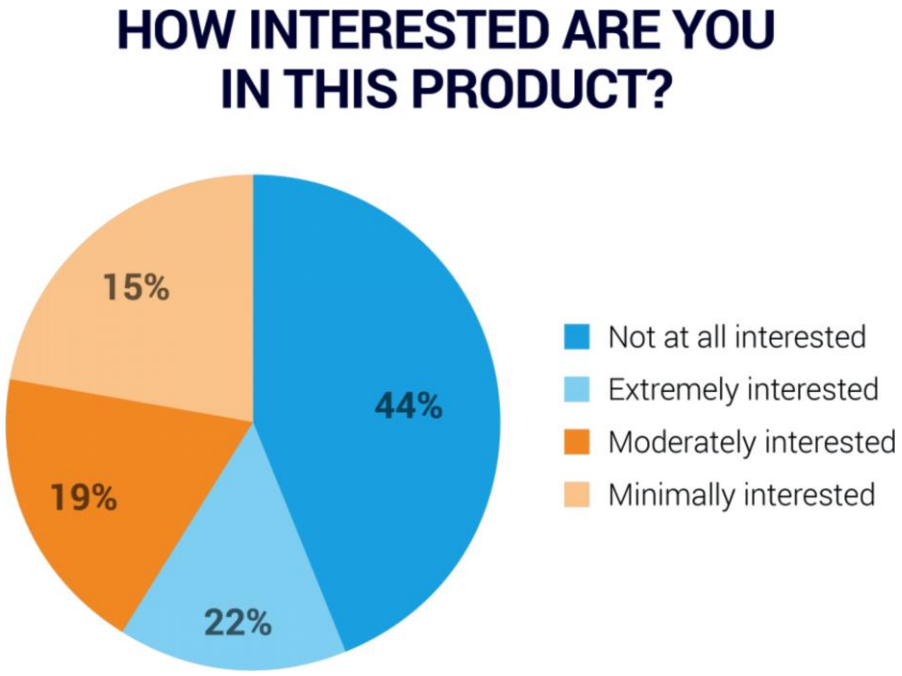
AFTER



[Author unknown]

Examples

BEFORE



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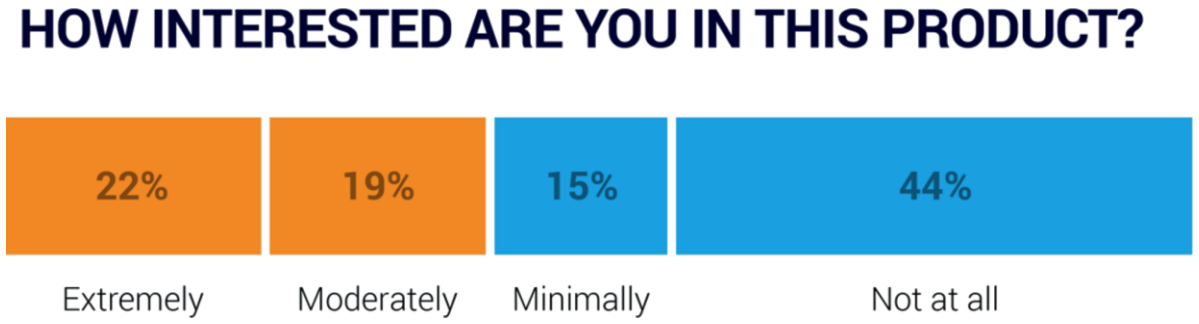


Is this sufficient?

Suggested Reading

Evolving a Storytelling Chart

The Practice of Data Visualization

Part III: Visualization and Storytelling

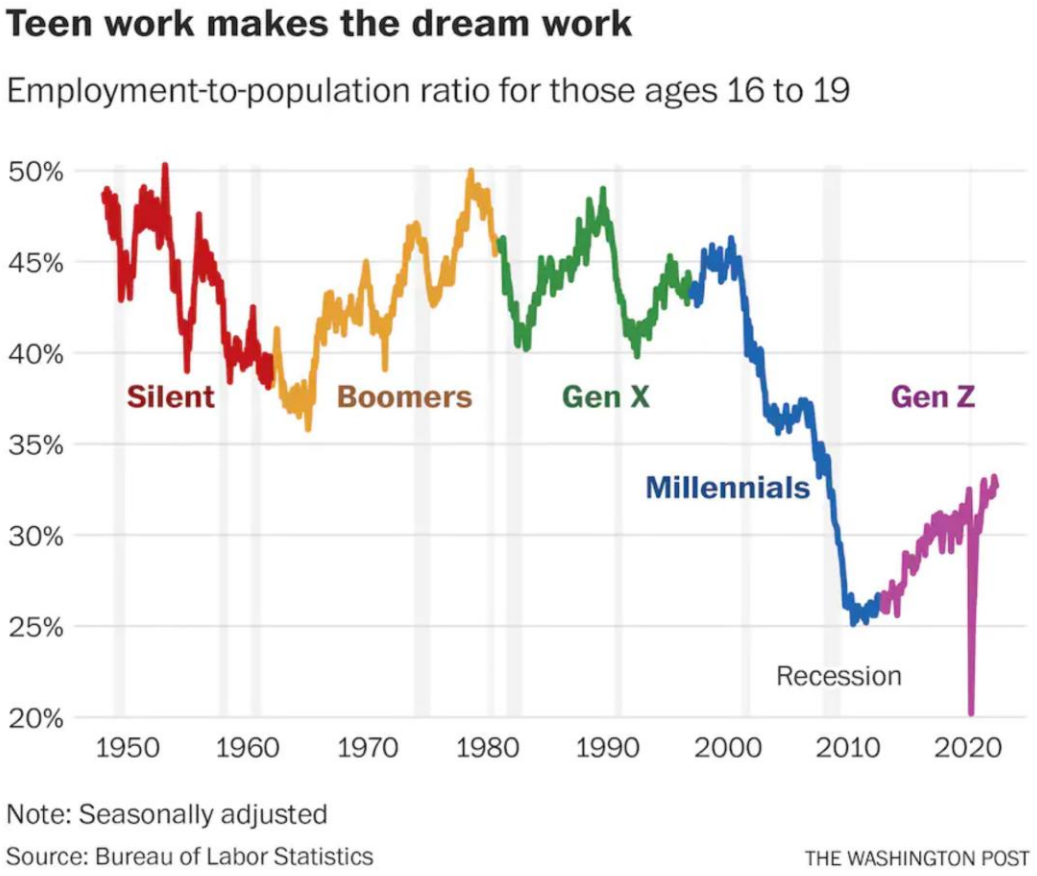
8. Effective Storytelling Visuals

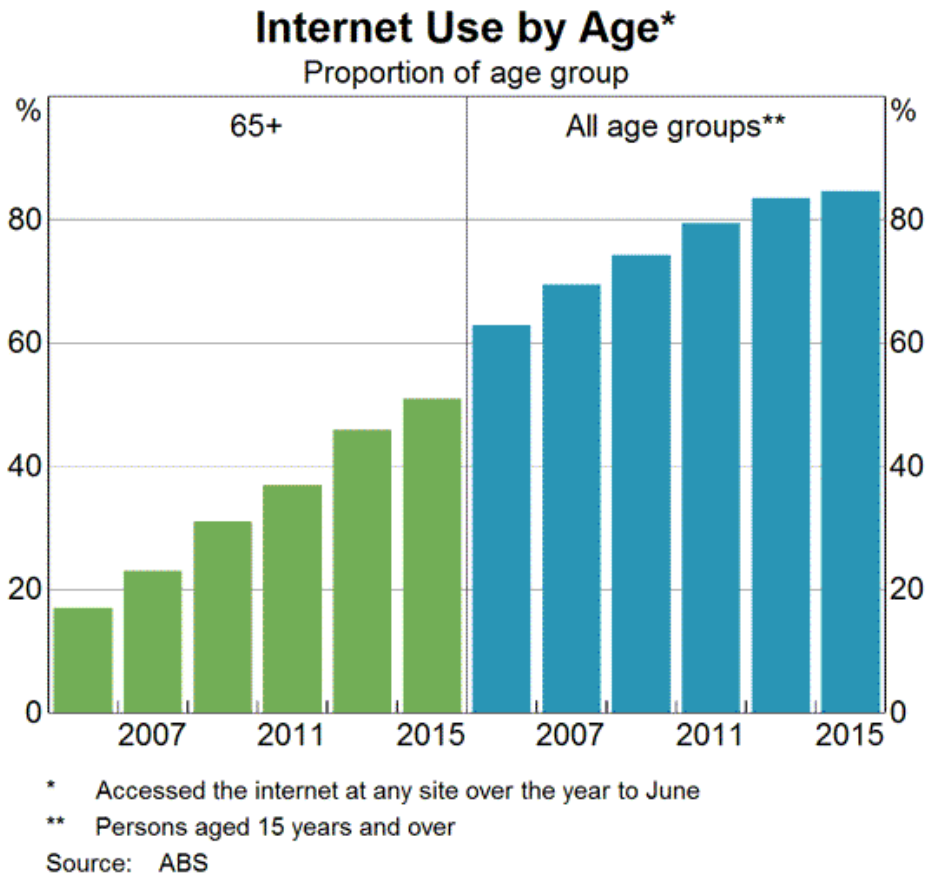
8.3 Evolving a Storytelling Chart

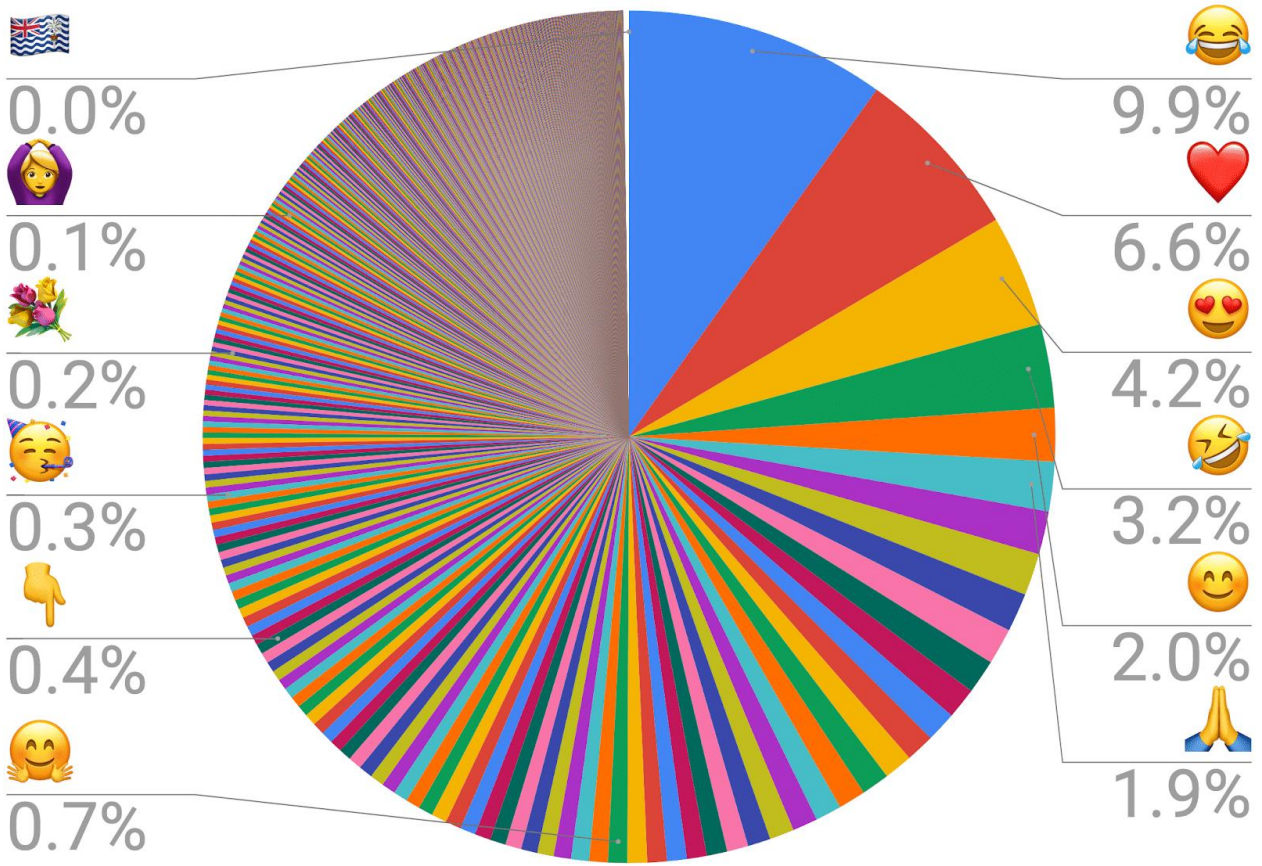
Exercises

Evolving a Storytelling Chart

Evolve the following charts into data stories. Focus on the message and how to avoid misleading the audience. Use data storytelling tropes as needed.

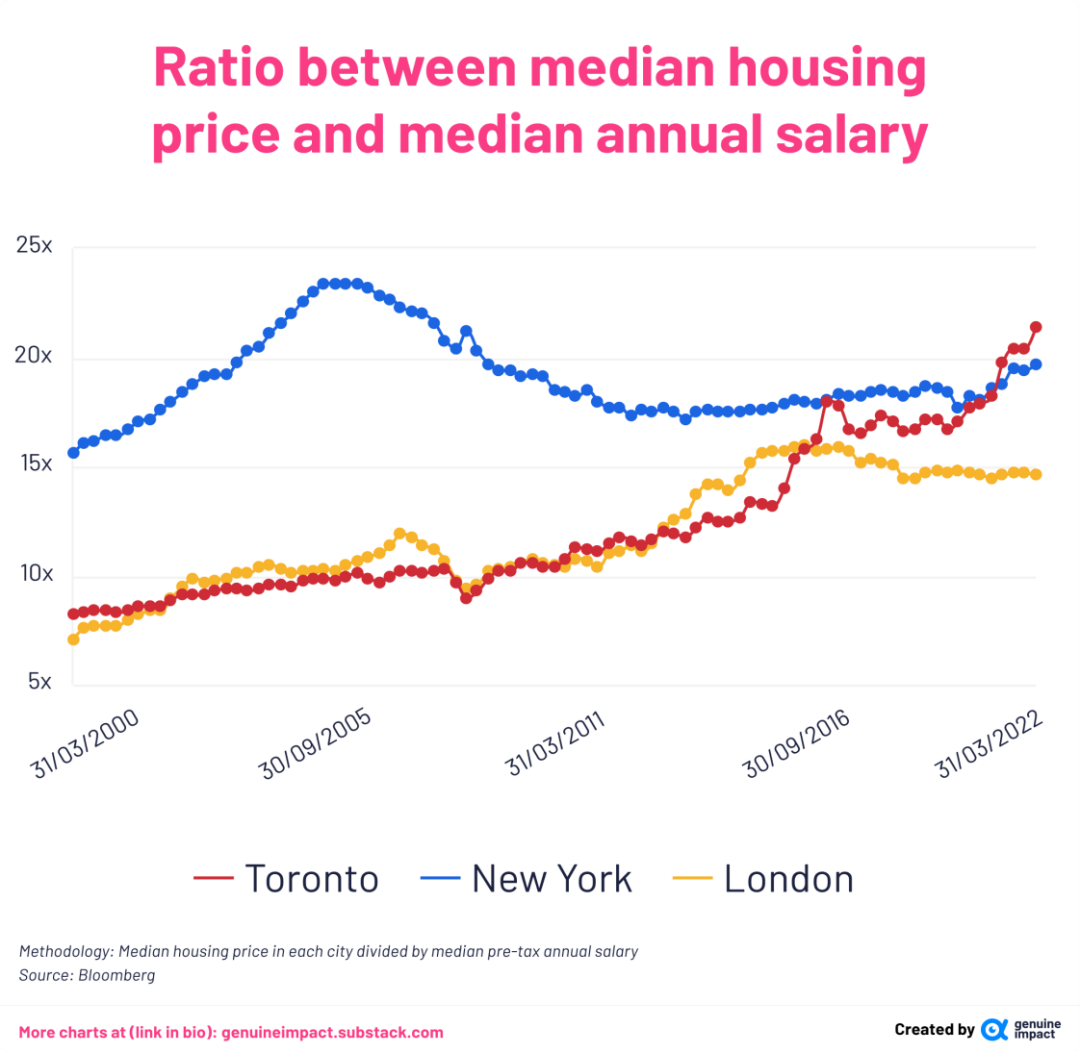


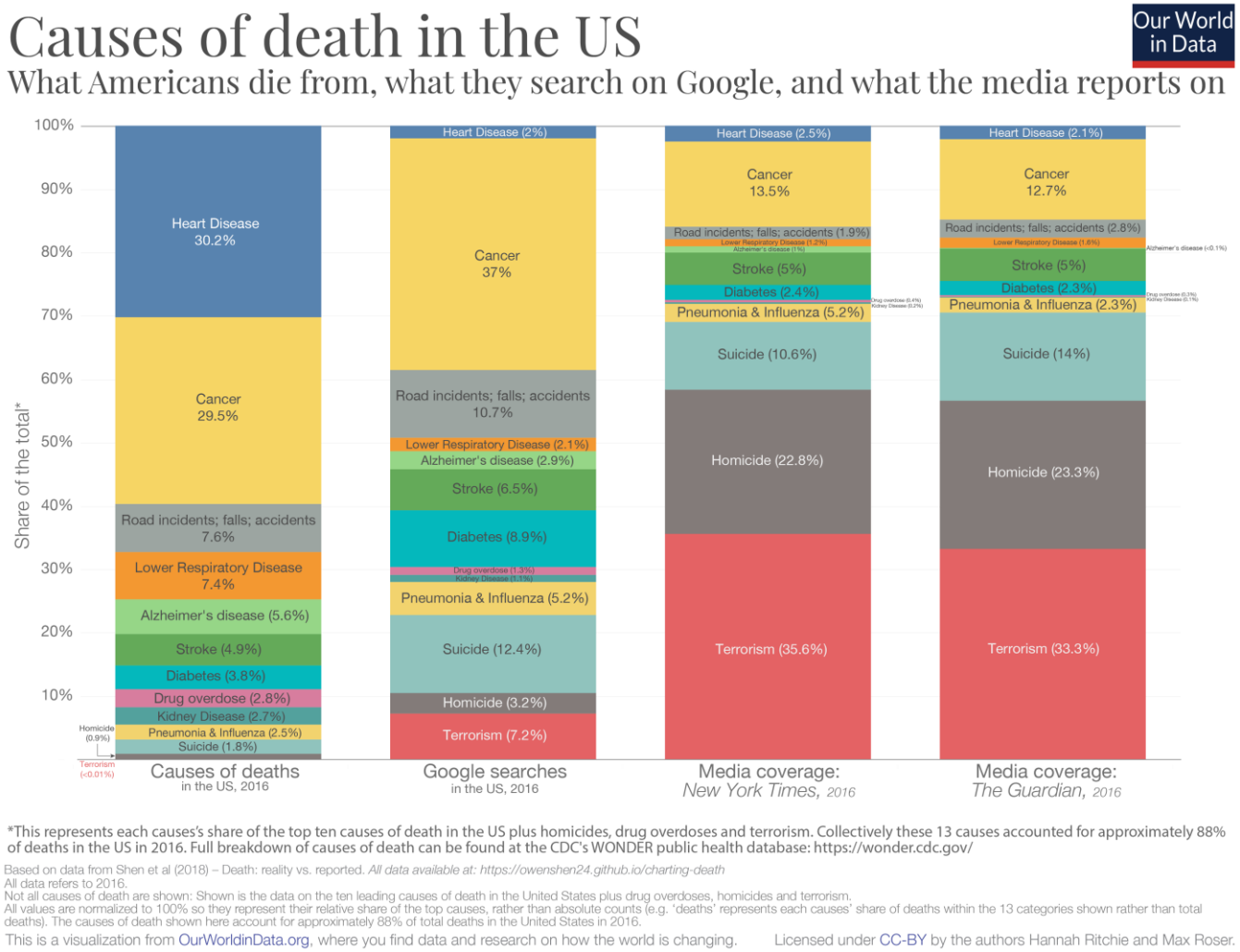

Internet Use by Age*
Proportion of age group
65+
All age groups**
%
80
60
40
20
0
2007
2011
2015
* Accessed the internet at any site over the year to June
** Persons aged 15 years and over
Source: ABS


0.0%
0.1%
0.2%
0.3%
0.4%
0.7%
9.9%
6.6%
4.2%
3.2%
2.0%
1.9%

Session 3

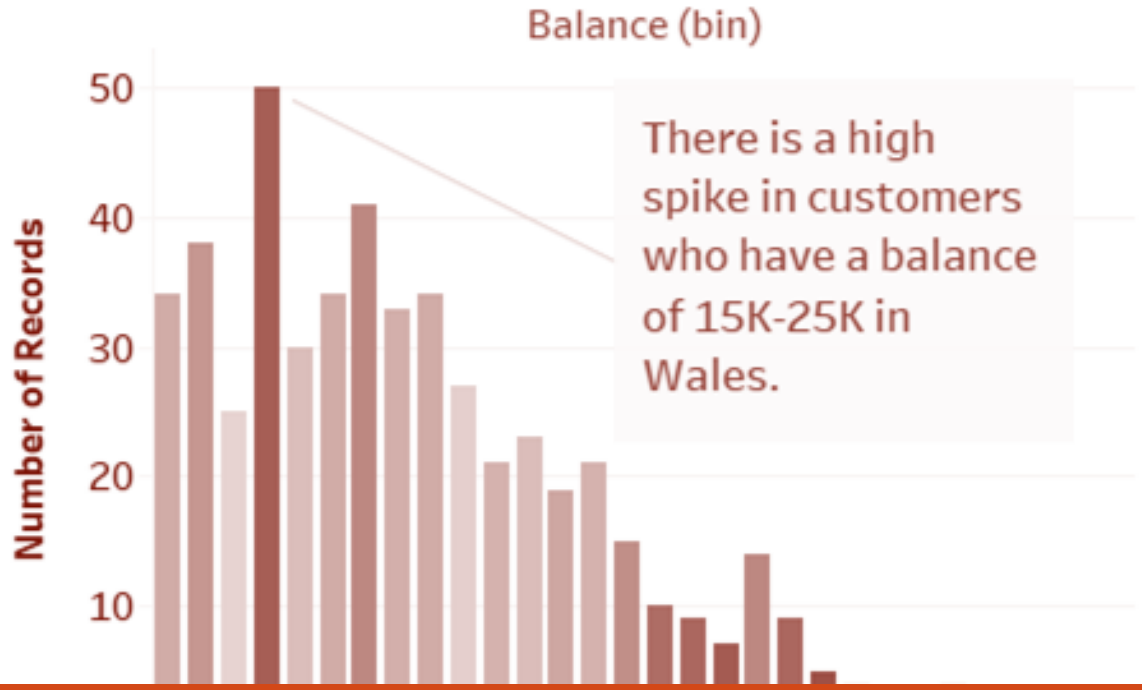
[https://www.dailywire.com/news/chart-heres-what-americans-actually-die-compared-ashe-schow]





The balance of accounts situated in Wales are unevenly distributed.

Balance Classification



9. Anatomy of Storytelling Dashboards

Who is the Audience?

Knowing the audience will help you identify the storytelling dashboard's **presentation requirements**.

Avoid general audiences: address **lines of business** instead (finance, HR, etc.)

Identify **decision-makers** and the various audience **roles**.

Ask the following questions:

- what relationship do you have with them?
- how do they perceive you?
- how do you establish trust and credibility?

Audience Data Storytelling Needs

We need to know how the results will be used **(actions):**

- what decisions are people going to make from the analysis?
- how often are they going to be looking at the data?
- how often do they expect the data to be refreshed?

What does the audience **need to know**?

Additional Questions

What does the audience need to know about data **availability**?

- is the data clean?
- can it be accessed?
- is it being “massaged”, used to paint a rosy picture?

How much will the audience need/want to **interact** with the charts?

- are they passive?
- can they run limited filtering?
- what data can they download (if any)

Creating a Narrative

There are a number of ways of constructing a **narrative**, including:

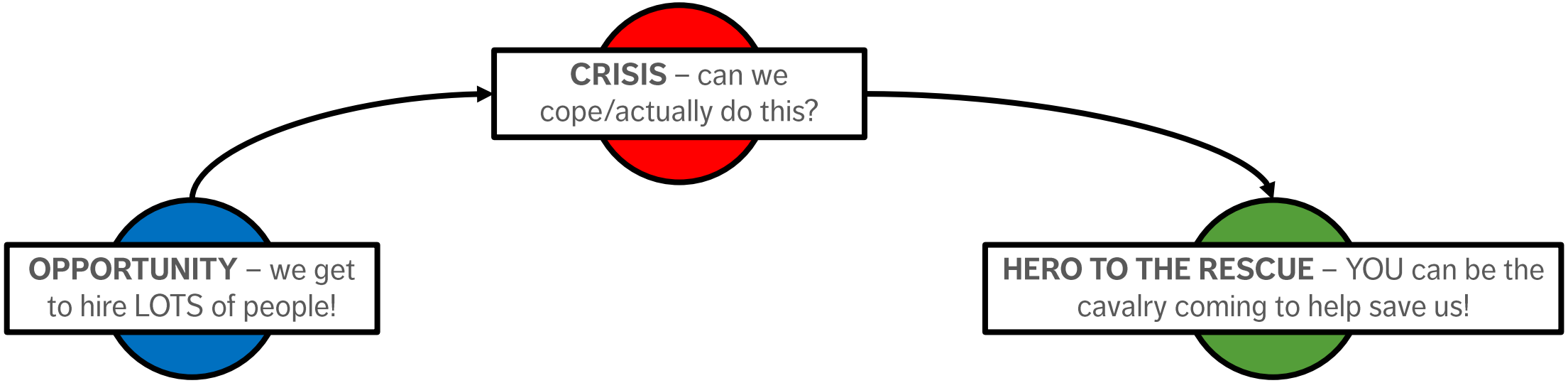
- chronological
- most important first, or least important first
- begin with the end
- success first, bad news last, or bad new first, success last

Advice: tell the story of the data in a number of different ways

Some dashboards are temporary but some will be a constant reference: this has an impact on how the data should be presented.

Example of a Narrative

A department has an aggressive hiring goal for the year, imposed by new legislative requirements. Funding for the hiring has been approved but it will severely impact not just hiring managers but also various corporate service groups (IMIT, HR, Real Property etc.).



Storyboarding

Storyboarding is a crucial exercise: it is a way to summarize the flow of information into a **coherent whole**.

It helps us determine how many **pages/elements per page** we might need.

This is **NOT** the same as designing the **layout** of a dashboard.

Storyboarding is used to **define** the dashboard's **story** and eventual **content**.

Storyboarding Example

1. State intended hiring goal for the year

2. Describe what is driving the hiring (Fed Gov't Init)

3. Show how close/far the goal is as of today

4. Show which branches have the highest requirements

5. Demonstrate which corporate service groups are impacted the most

6. Ask/tell the audience how they can help

Maintaining a Clear Narrative

Horizontal logic:

- if your visualizations span many pages then the title of each page should tell you the story
- reinforce with an executive summary dashboard or report at the beginning

Vertical logic:

- whether one page or many, the content should reinforce the title and vice versa (self-reinforcement)
- there should be a logical link between all the elements, tags and visual aids on the page

Engaging Memory

There are different types of memories, we need to understand how they are engaged when we tell stories:

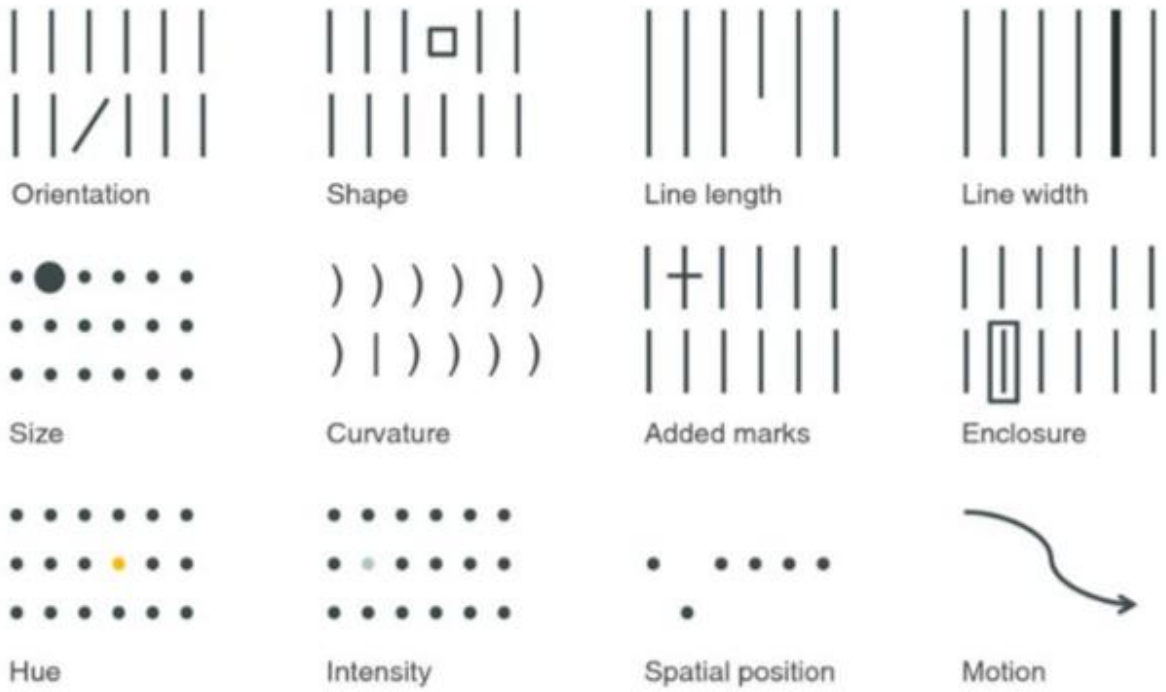
1. **iconic memory** – directs the eye
2. **short-term memory** – limits how many charts are found in dashboards
3. **long-term memory** – helps the audience remember what they saw

Engaging Memory

Iconic memory is the visual sensory memory (SM) register relating to the visual domain and a fast-decaying, high-capacity store of **visual info**.

Iconic memory is **brief** and provides a **coherent representation** for the entire visual perception.

It is tuned to **pre-attentive attributes**.



Engaging Memory

Short term memory can hold ~4 chunks of visual information at a given time.

When presented with more chunks (such as data points on a graph), chunks need to be processed **in and out of memory**.

Generally, we try to form **bigger**, **focused chunk hierarchies** (Gestalt).

Engaging Memory

Long-term memory is built up over a lifetime and is the basis for pattern recognition and general cognitive processing.

It is an aggregate of **visual** memory and **verbal** memory.

Images help us recall long-term memory, making the story "**stick**".

Context-providing text helps:

You have currently selected 28,711 ATIP requests totaling 6,597,612 pages of information

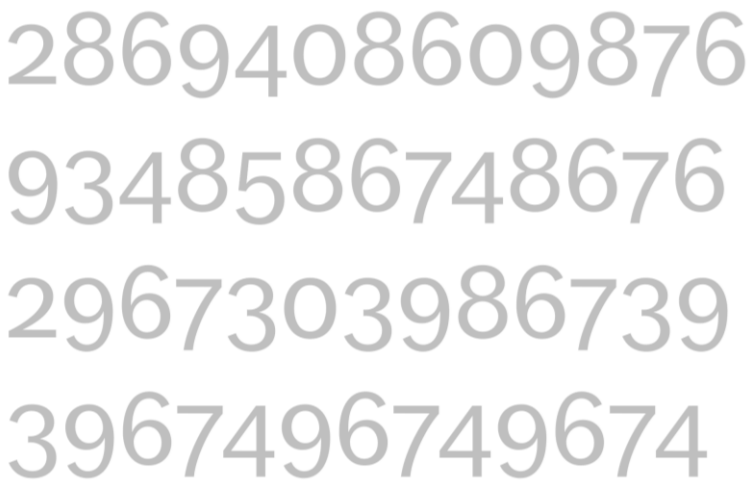
VS

ATIP Requests

30K	6.6M	230
requests	pages	pages/request

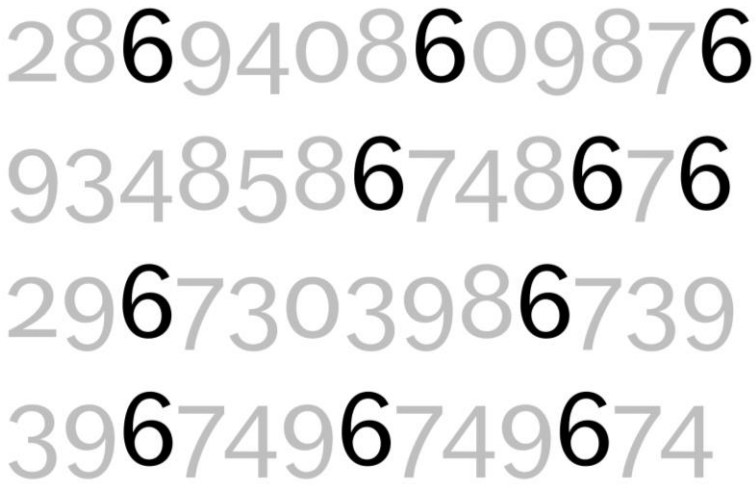
[Based on a idea by C. Nussbaumer Knaflic, *Storytelling With Data*]

WEEKLY number of boats sold (20X6) – Store #16



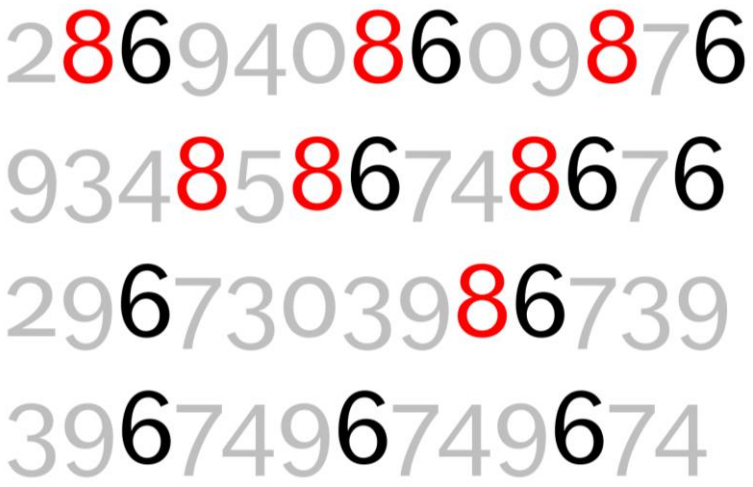
Yearly goal: **290**
20X6 total: **307**

Do these numbers look **reasonable?**



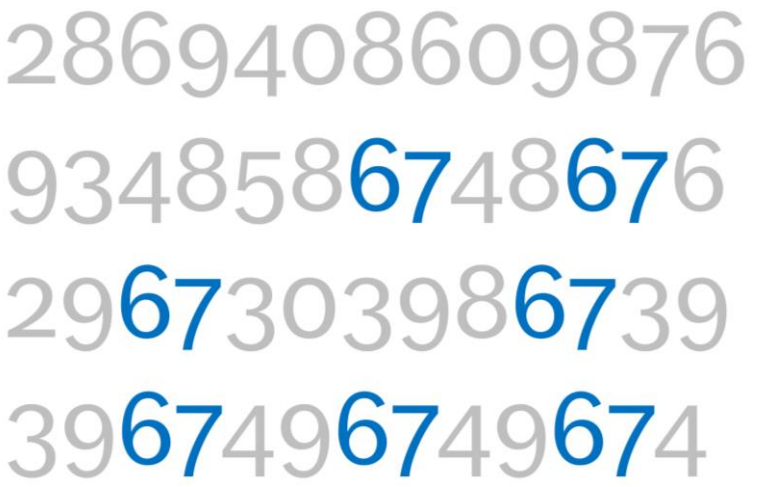
Most frequent weekly number of boats sold: **6 (11 times)**

Occurred: **randomly** (as expected)



Another frequent weekly number of boats sold: **8**

Occurred: **5 times immediately before a 6 (out of 7)** (surprising)



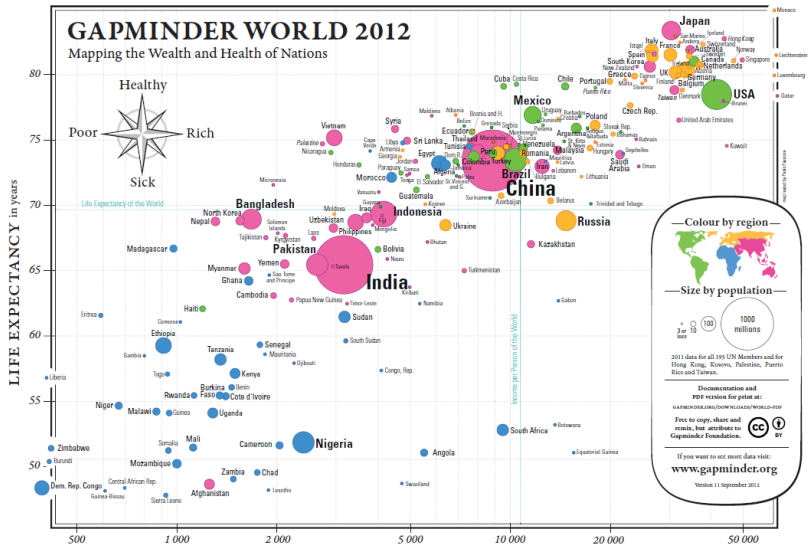
Another frequent weekly number of boats sold: **7**

Occurred: **7 times immediately before a 6 (out of 8)** (surprising)

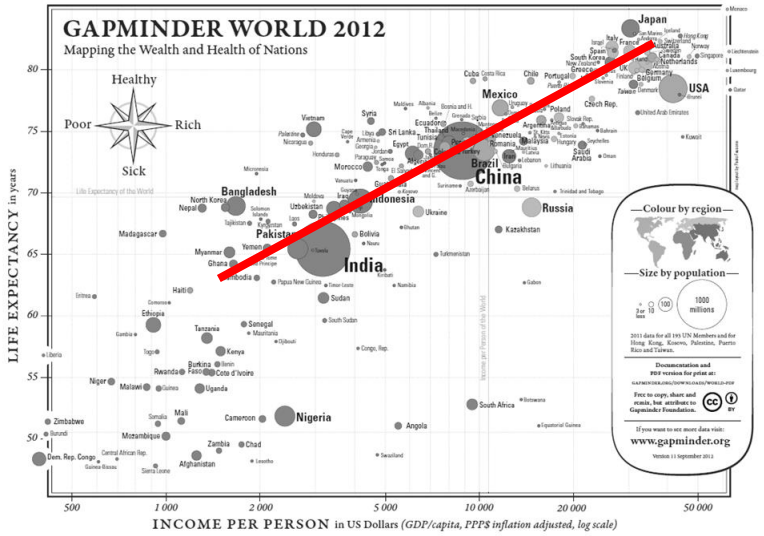
VERDICT: The two last charts suggest that the weekly sale numbers **are not random**, and that they may have been falsified. We recommend **performing an audit** of sales for store #16.

[Based on a chart by the Gapminder Foundation]

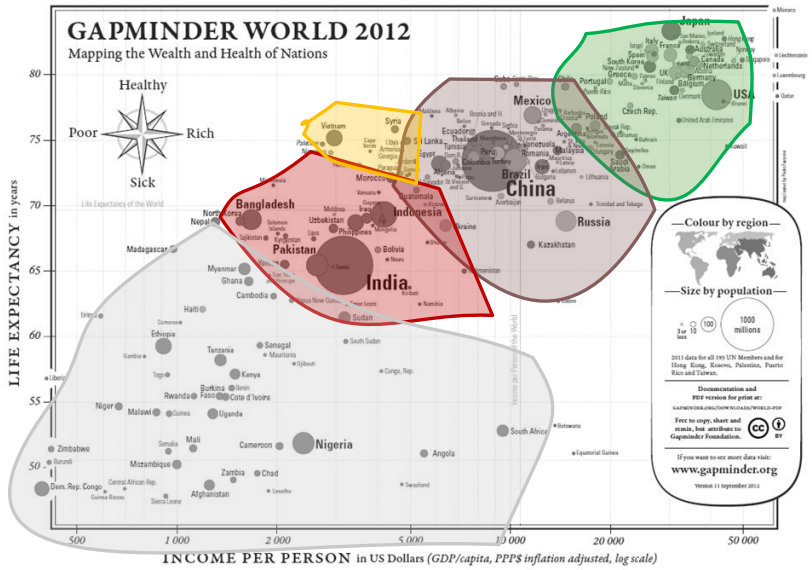
The Health and Wealth of Nations (2012) – Gapminder



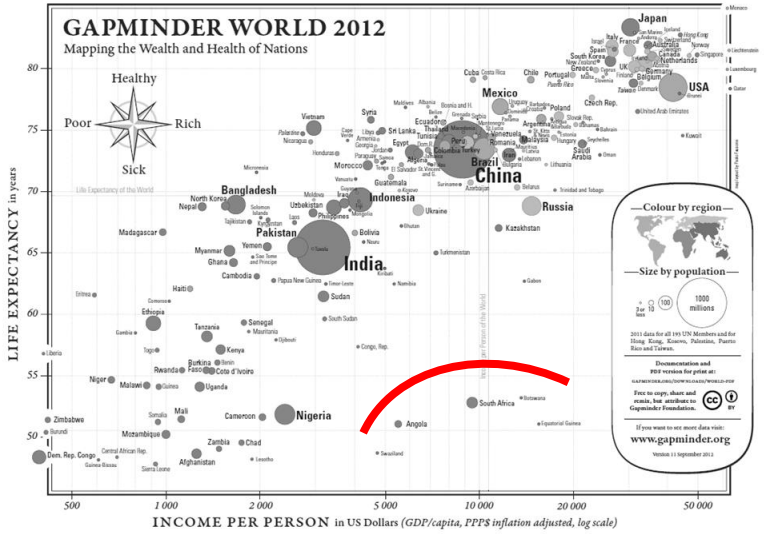
2012 **life expectancy** of nations (health, vert.) against the **log of the GDP per capita** (wealth, hor.); colour represents **world regions**, size is **population**.



The relationship between **health** and **wealth** is **roughly linear**, at least when they are both high enough – is it a **causal relationship**?



We see roughly 5 nations groups (**clusters**), when we only focus on health and wealth. Would these groups be stable when using **other variables**?



There are **outliers** in the bottom right quadrant (**wealthy, but not healthy**); 4 of them are in southern Africa – a manifestation of **apartheid**?

NOTES: The relation between health, wealth, and region can clearly be seen in the charts, but the big surprise might be that life expectancy is as high as it is across the board. Can we get more insight from other variables?

Visual Processing

Perception is fragmented – eyes are **ever scanning**.

Visual thinking seeks **patterns**

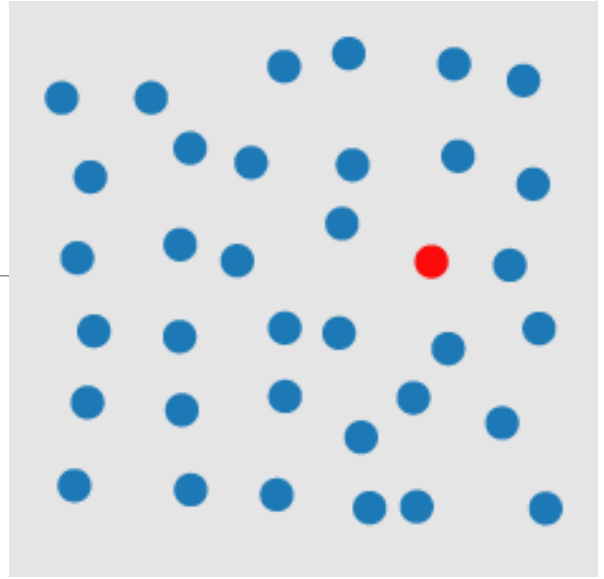
- **pre-attentive processes:** fast, instinctive, efficient, multitasking gather information and build patterns:

  features → patterns → objects

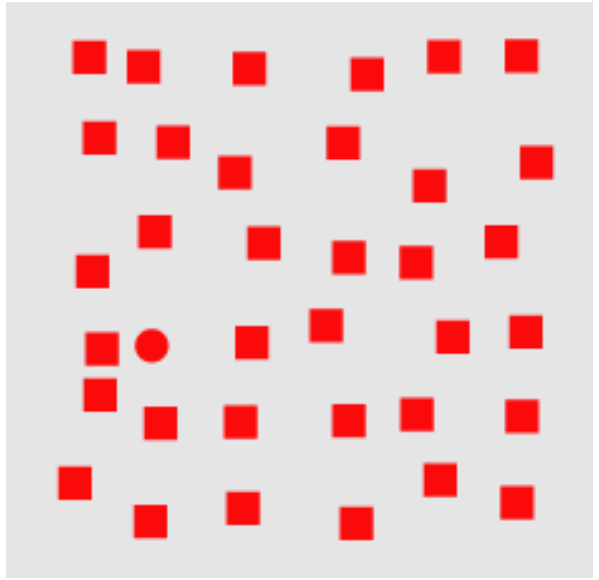
- **attentive process:** slow, deliberate, focused discover features in the patterns:

  objects → patterns → features

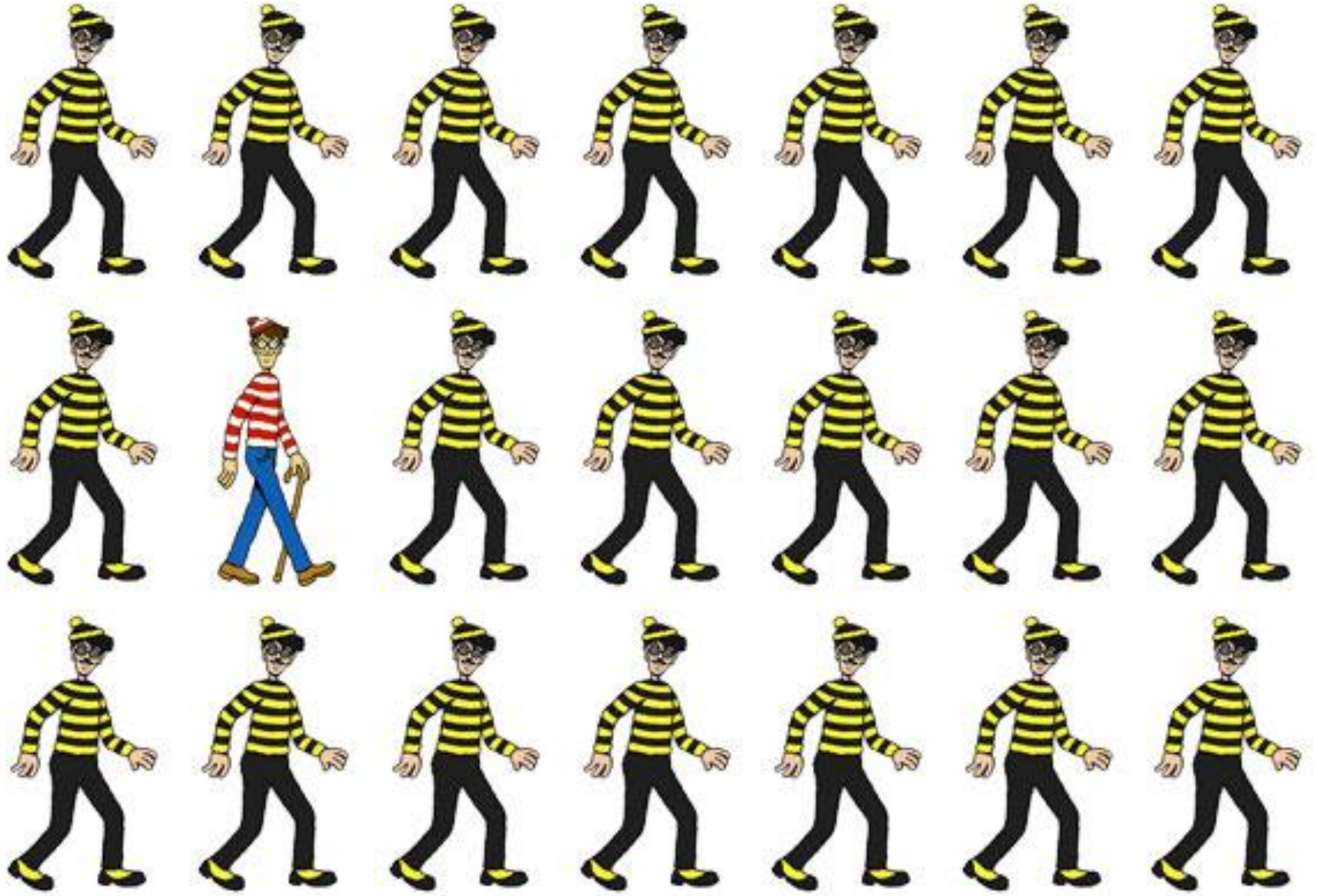
pre-attentive



attentive



[L. Groeger, A Big Article About Wee Things, ProPublica.com]



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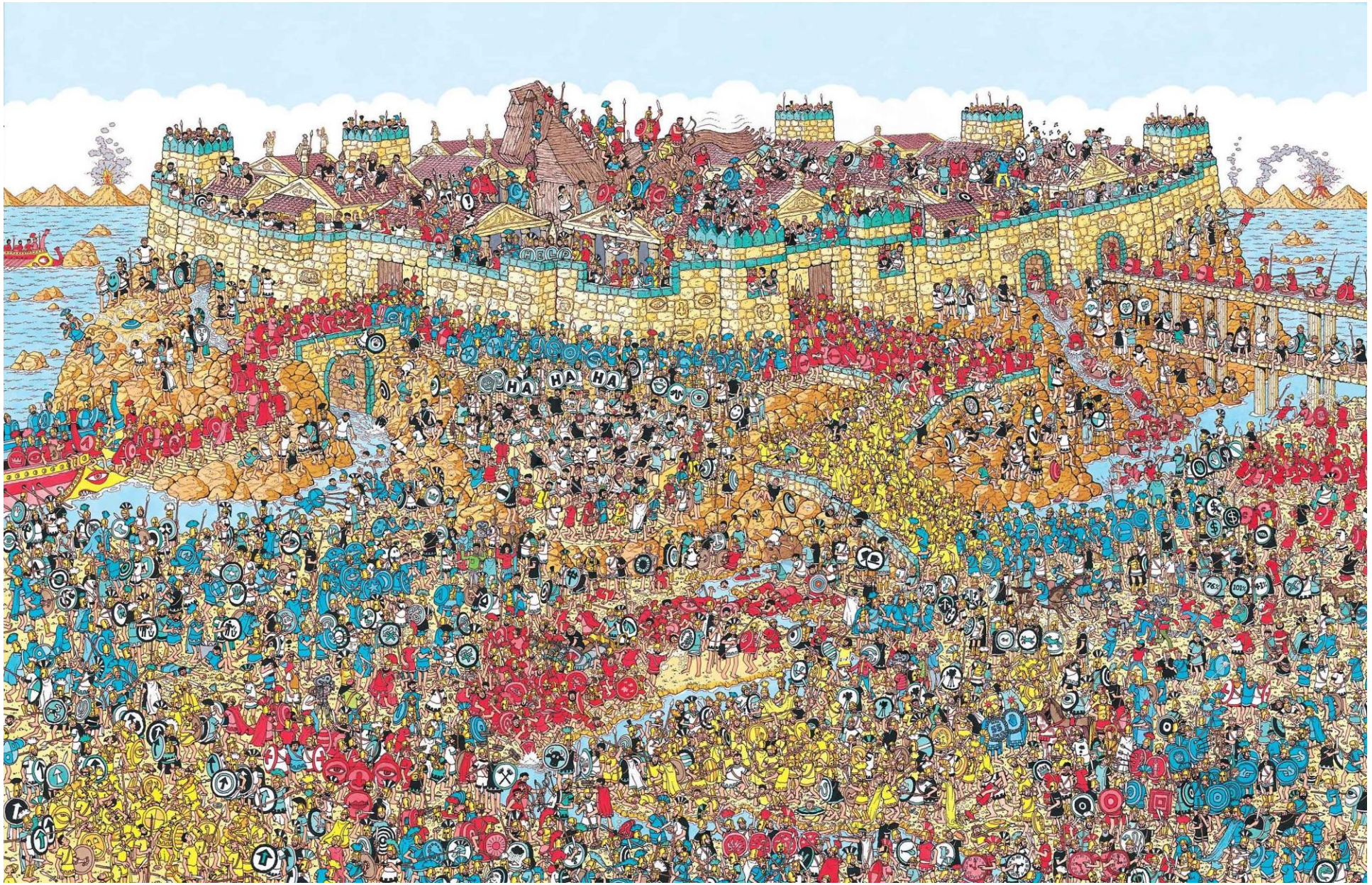

Suggested Reading

Anatomy of Storytelling Dashboards

The Practice of Data Visualization

Part III: Visualization and Storytelling

8. Effective Storytelling Visuals

8.4 Anatomy of a Storytelling Dashboard

Exercises

Anatomy of Storytelling Dashboards

1. Consider a data question of interest to you. Identify the target audience and the goals for your storytelling dashboard.
2. Identify the presentation requirements for your dashboard.
3. Create a storyboard for your dashboard.
4. What type of narrative and logic do you think would best serve your needs?