

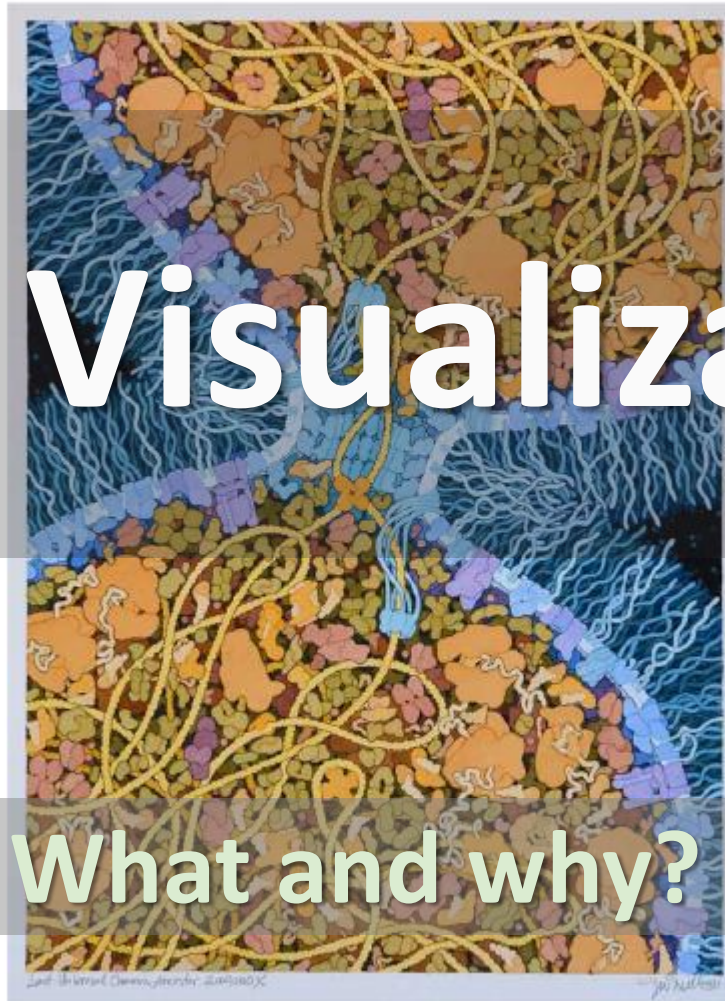
Volume 52 | Number 3 | 2019

LEONARDO

THE MIT PRESS | \$17.00

Data Visualization

What and why?



David S. Goodsell. 2018

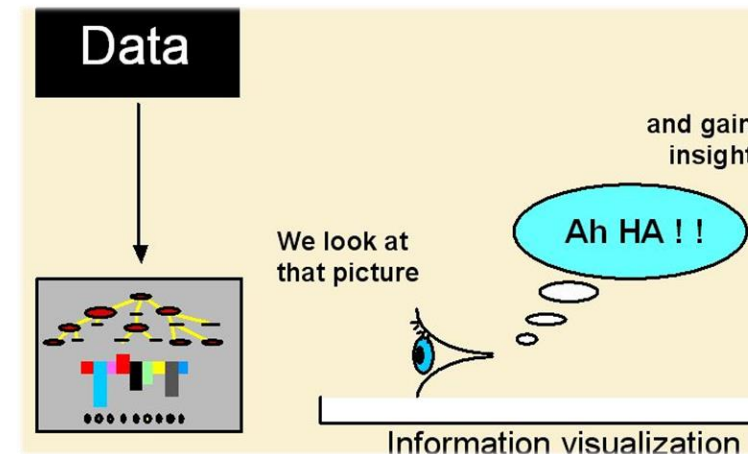
M126 | Maria Roussou

What is Visualization

- The formation of a **mental image** of something
- The formation of **mental visual images**

various dictionaries

- ...a human cognitive activity
insight...
first impression...
a feeling for...
sense...
awareness...
...



Spence (2014)

Difference between Data and Information

- **Data**: facts or details from which information is derived. Individual pieces of data are rarely useful alone.
- **Information**: when data is processed, organized, structured or presented in a given context so as to make it useful

The difference is subtle!*

(*) This why the terms are often used interchangeably

What is Information Visualization

- ...the study of (interactive) visual representations of abstract data to reinforce **human cognition**

Wikipedia

- ...the use of **computer-supported interactive** visual representations of **abstract data** to **amplify cognition**

Card, Mackinlay & Shneiderman (1999)

- Computer-supported
- Interactive
- Visual representations
- Abstract data
- **Amplify cognition**

What is Information Visualization

- The underlying philosophy of information visualization:

...solving a problem simply means representing it so as to make the solution **transparent**

Simon (1996)

What is Data Visualization

- ...the graphic representation of data...
- producing **images** that communicate **relationships** among the represented data to viewers of the images...
- a **systematic mapping** between graphic marks and data values in the creation of the visualization.

Wikipedia

What is Data Visualization

A data visualization presents data visually in a systematic way:

- Mapping variables to visual encodings
- Geometric elements to represent data
- Reference elements



- ...to augment human capabilities

What is Data Visualization

- Data visualization refers to graphics that take a large data set and compresses it into an **understandable** image by virtue of a computer. [[ref](#)]
- Computer-based visualization systems provide visual representations of datasets designed to help people carry out tasks more **effectively**.
- Visualization is suitable when there is a need to **augment human capabilities** rather than replace people with computational decision-making methods.

The principle task of information visualization is to allow for
information to be derived from data

What is Data Visualization

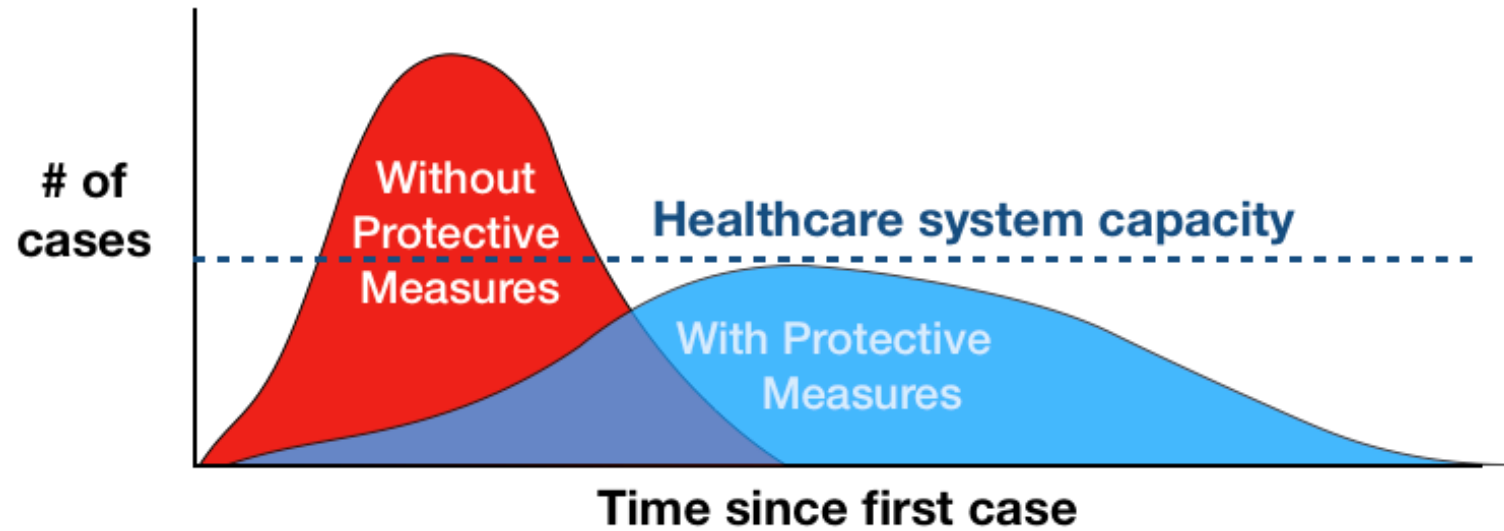
Data visualization is both an **art** and a **science**

- **Psychology** studies data perception, or the impact of some elements on perception, such as colors and shapes.
- **Computer science** and **Statistics** developed several new areas like machine learning and data mining techniques.
- **Graphical and multimedia** designs are critical to building infographic dashboards.

Aparicio & Costa (2015)

A timely (COVID-19 pandemic) example

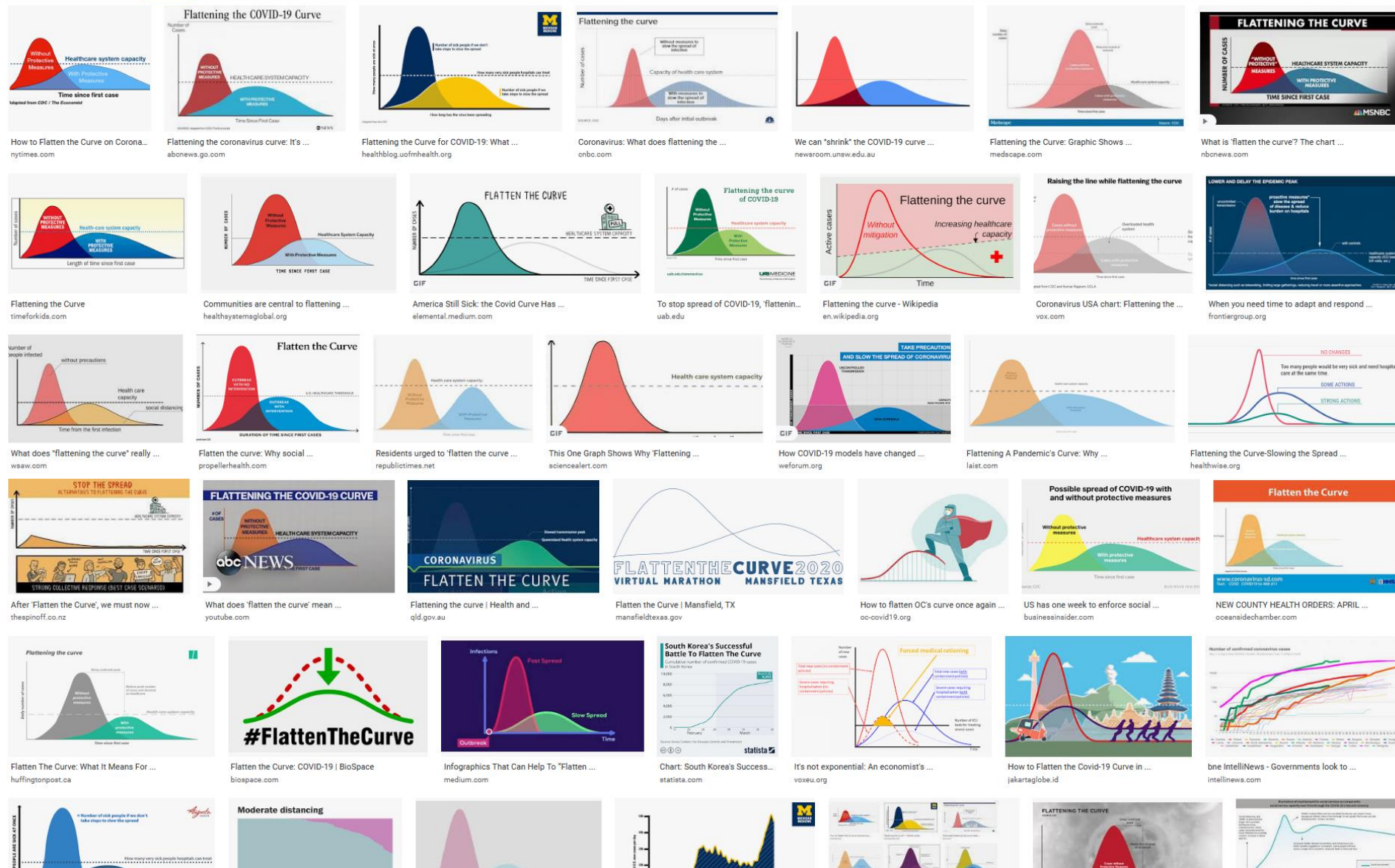
- Flattening the curve



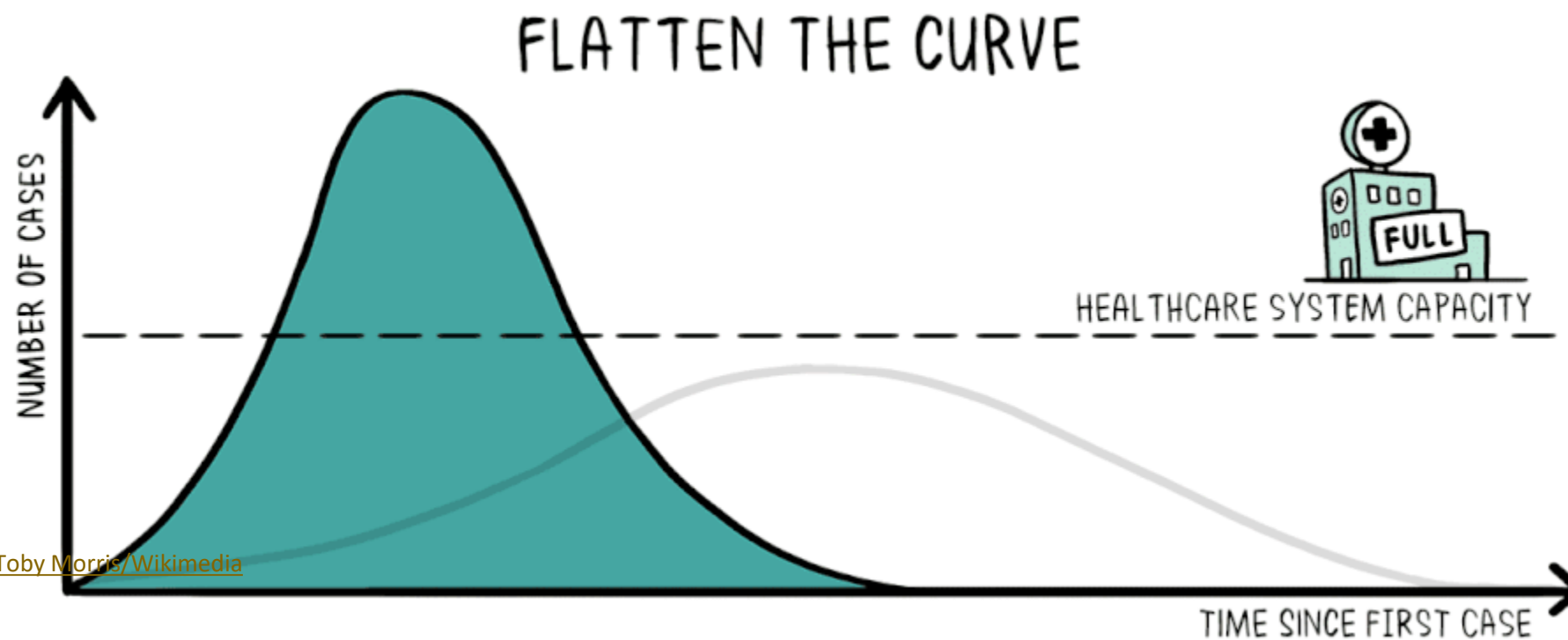
Adapted from CDC / The Economist

Drew Harris, Thomas Jefferson University

...visualized in many creative ways

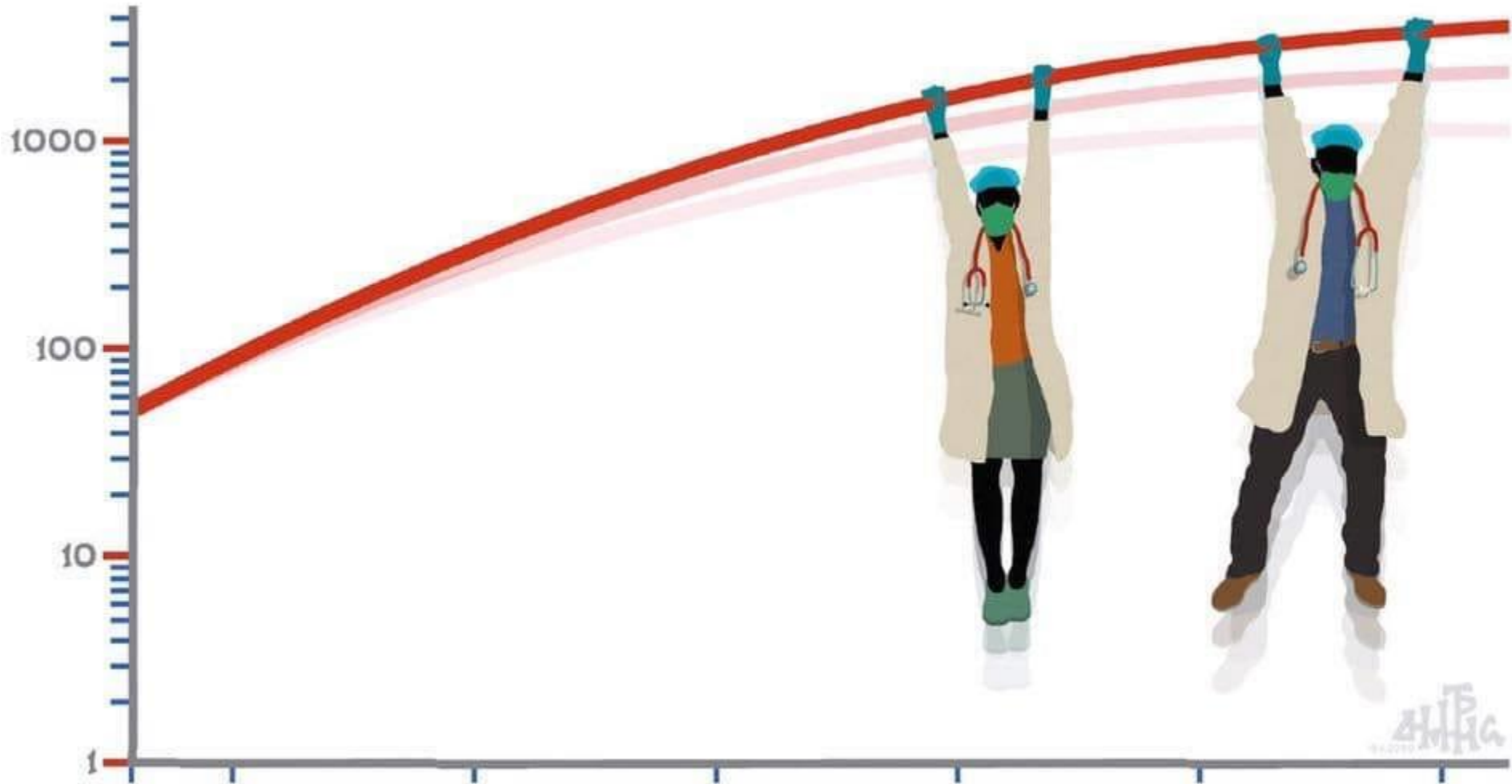


...visualized in many creative ways



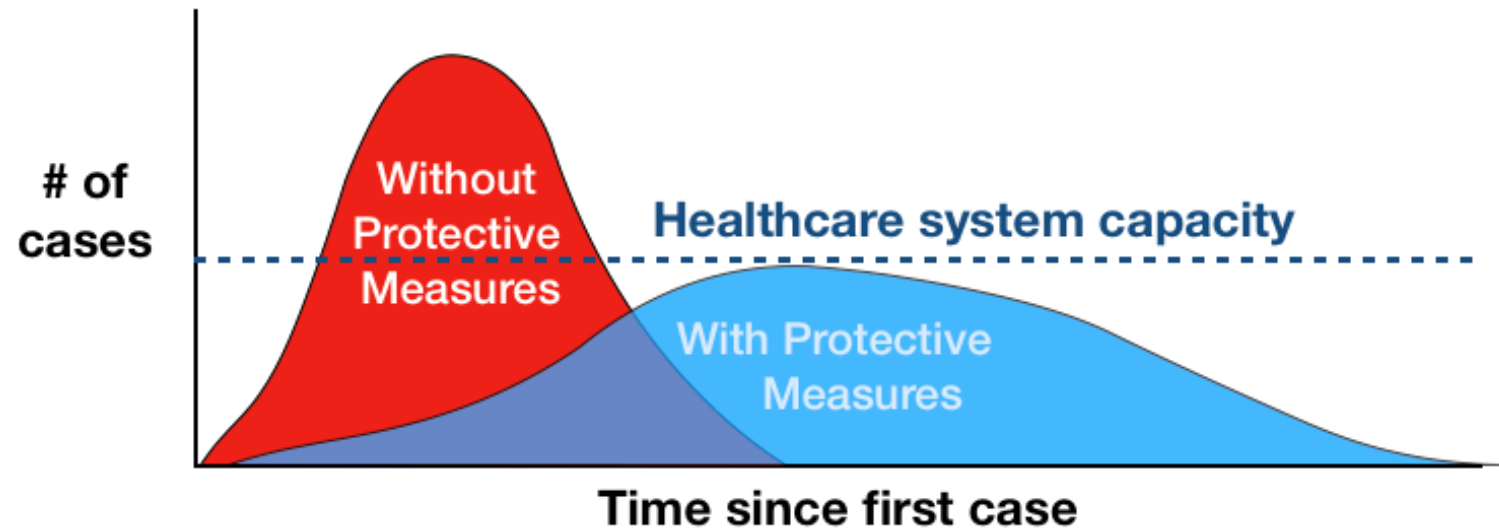
[Siouxie Wiles and Toby Morris/Wikimedia](#)

...visualized in many creative ways



ΣΚΙΤΣΟ ΤΟΥ ΔΗΜΗΤΡΗ ΧΑΝΤΖΟΠΟΥΛΟΥ

why is this viz so effective?

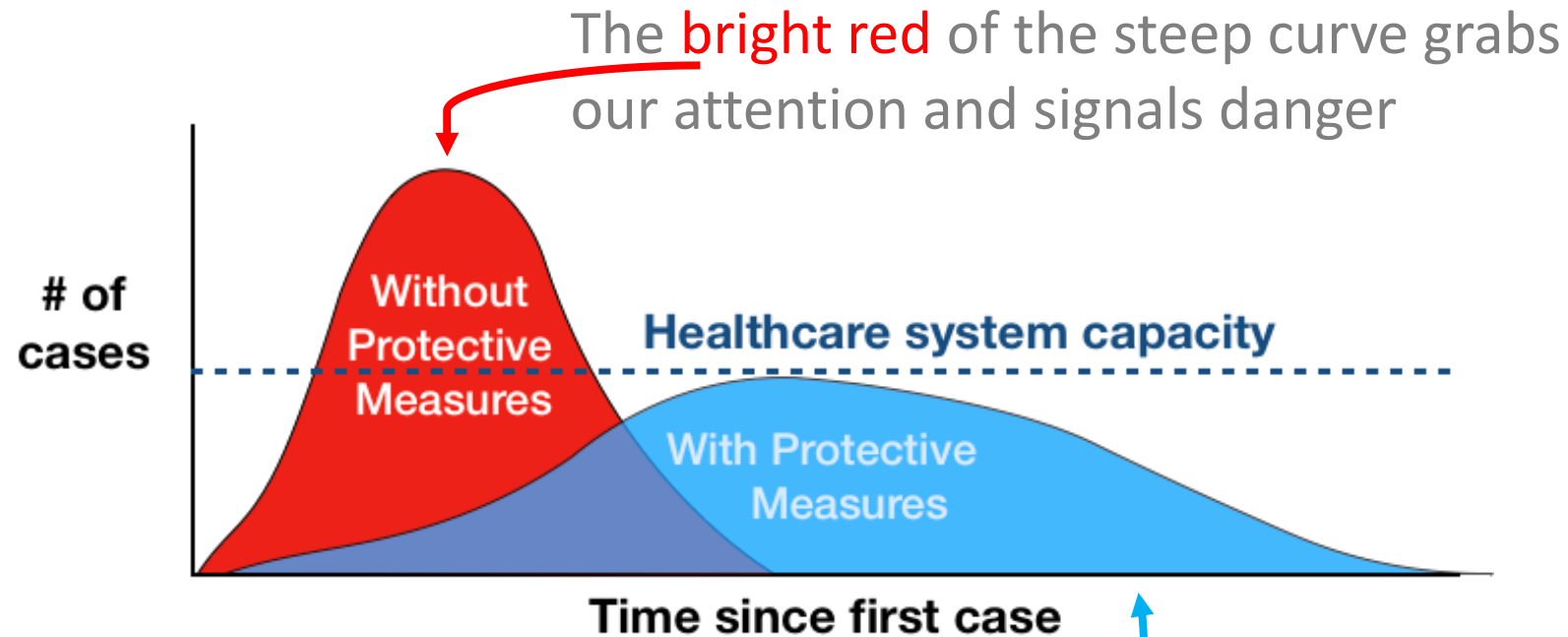


Adapted from CDC / The Economist

Drew Harris, Thomas Jefferson University

why is this viz so effective?

- We're hardwired to understand visual cues:



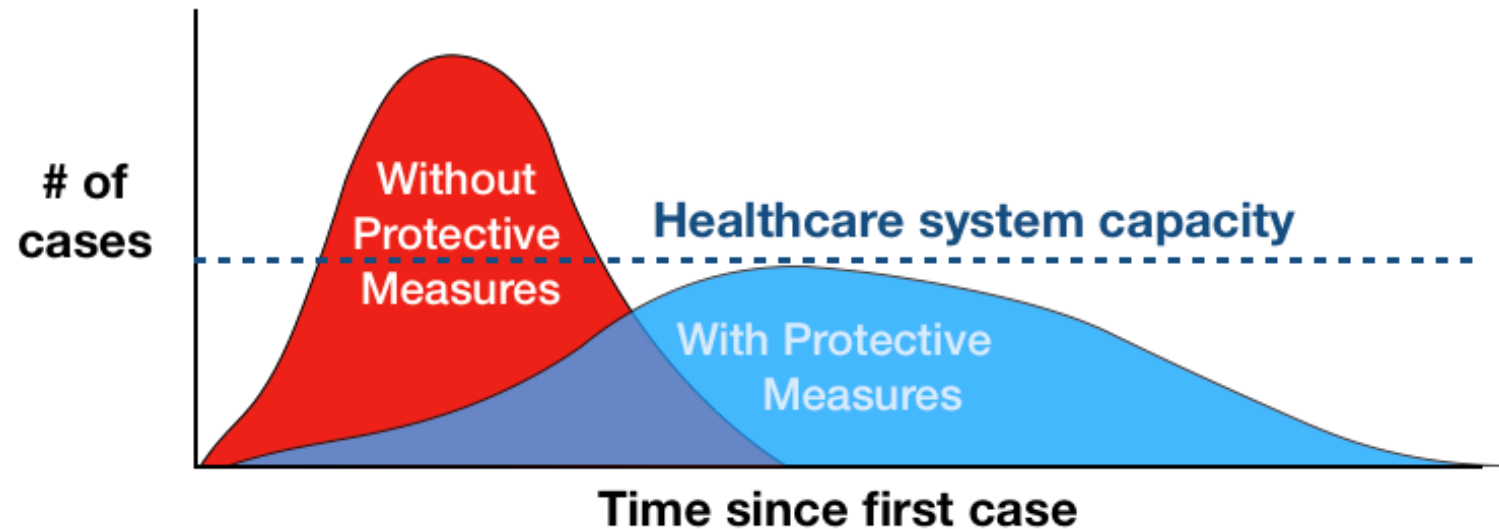
Adapted from CDC / The Economist

Drew Harris, Thomas Jefferson University

The gentle **blue** slope brings calm

why is this viz so effective?

- The message is simple:
 - The **short hill** is better than the **tall hill**!

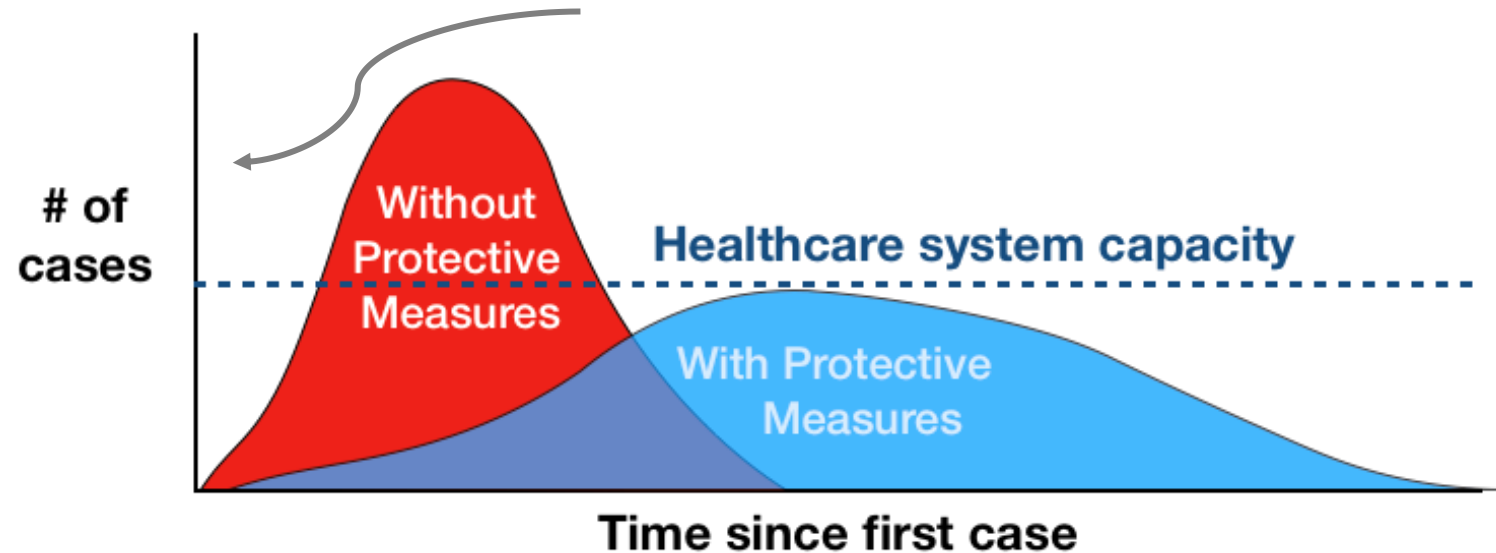


Adapted from CDC / The Economist

Drew Harris, Thomas Jefferson University

why is this viz so effective?

- Our interpretation is straightforward:
 - The axes lend an aura of scientific authority

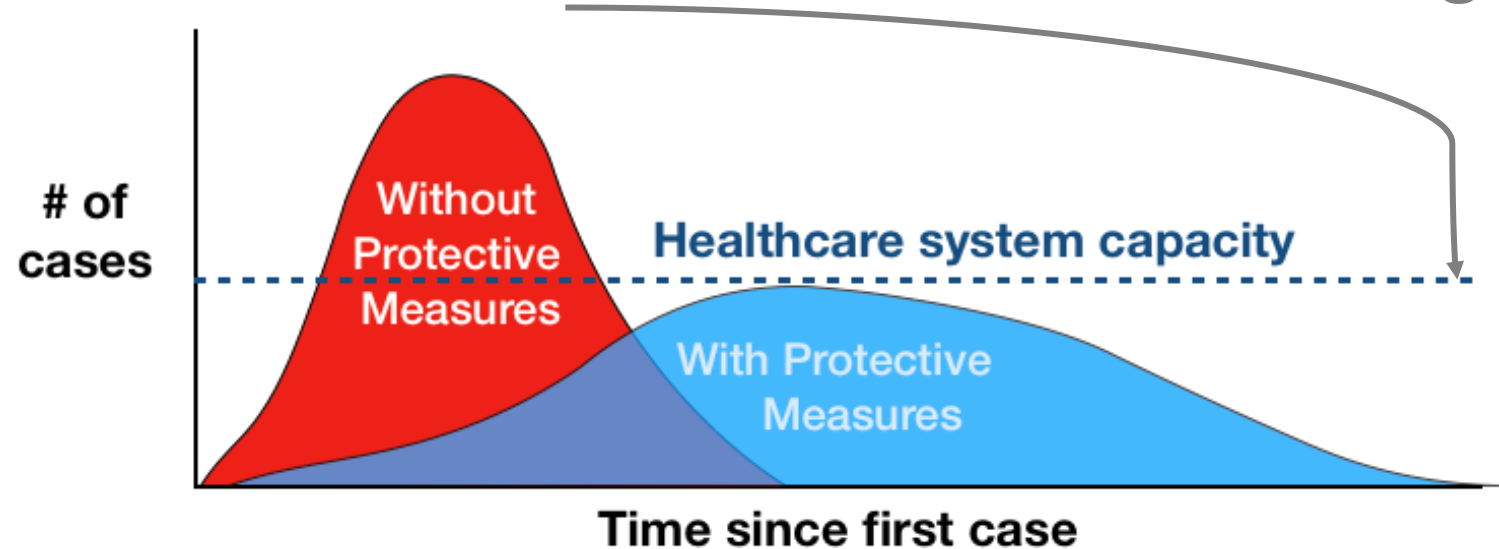


Adapted from CDC / The Economist

Drew Harris, Thomas Jefferson University

why is this viz so effective?

- Our interpretation is straightforward:
 - The line is a threshold: “don’t go beyond it”

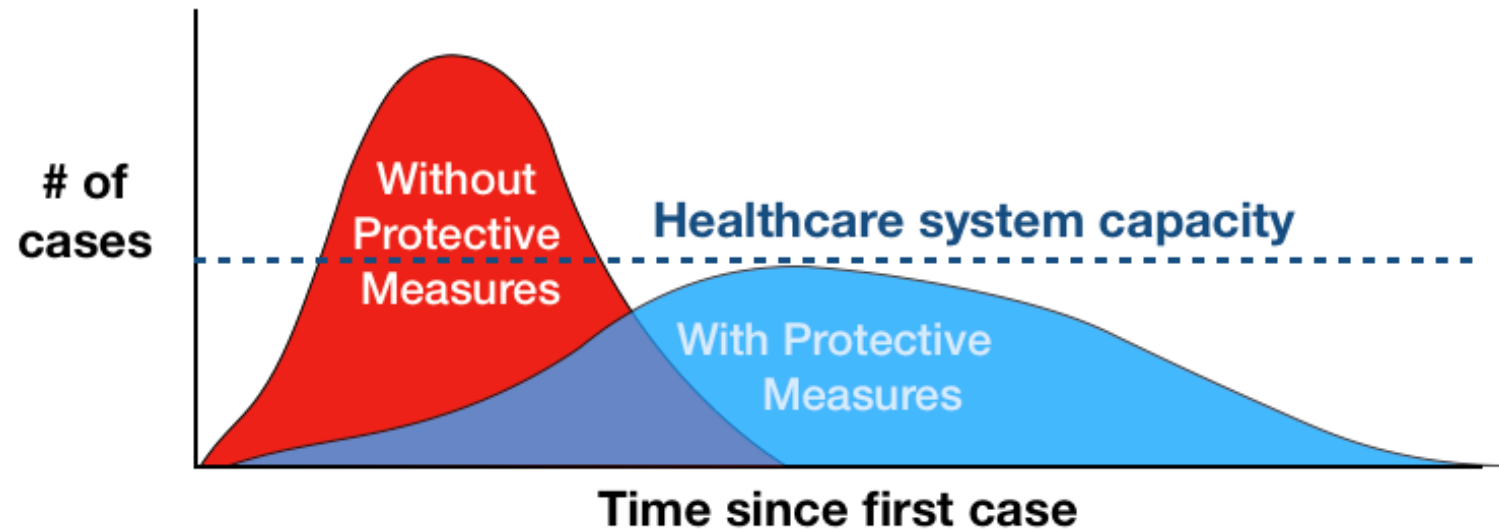


Adapted from CDC / The Economist

Drew Harris, Thomas Jefferson University

why is this viz so effective?

- The genius lies in the chart's implicit promise that our fate is in our own hands



Adapted from CDC / The Economist

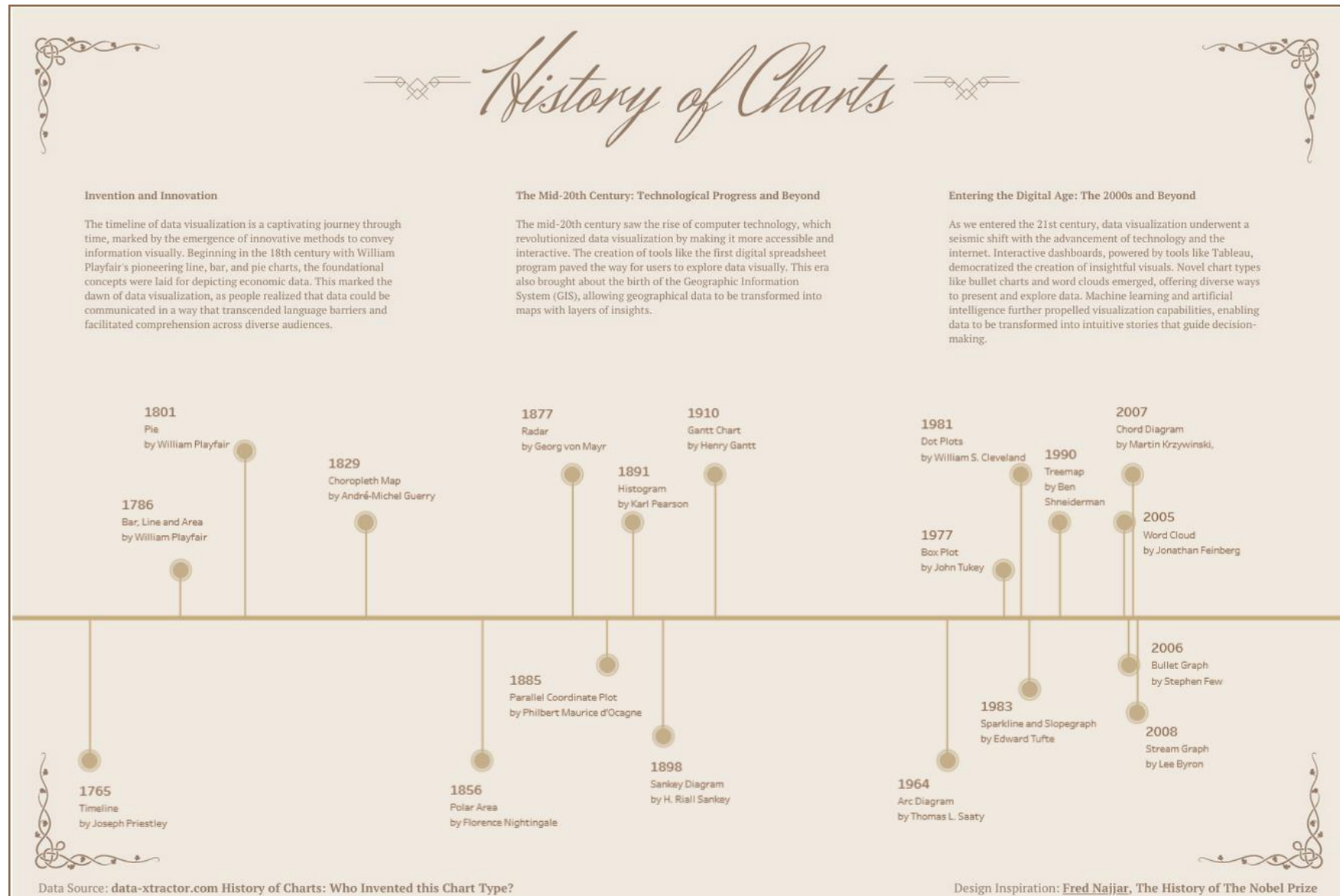
Drew Harris, Thomas Jefferson University

The power of viz is communication

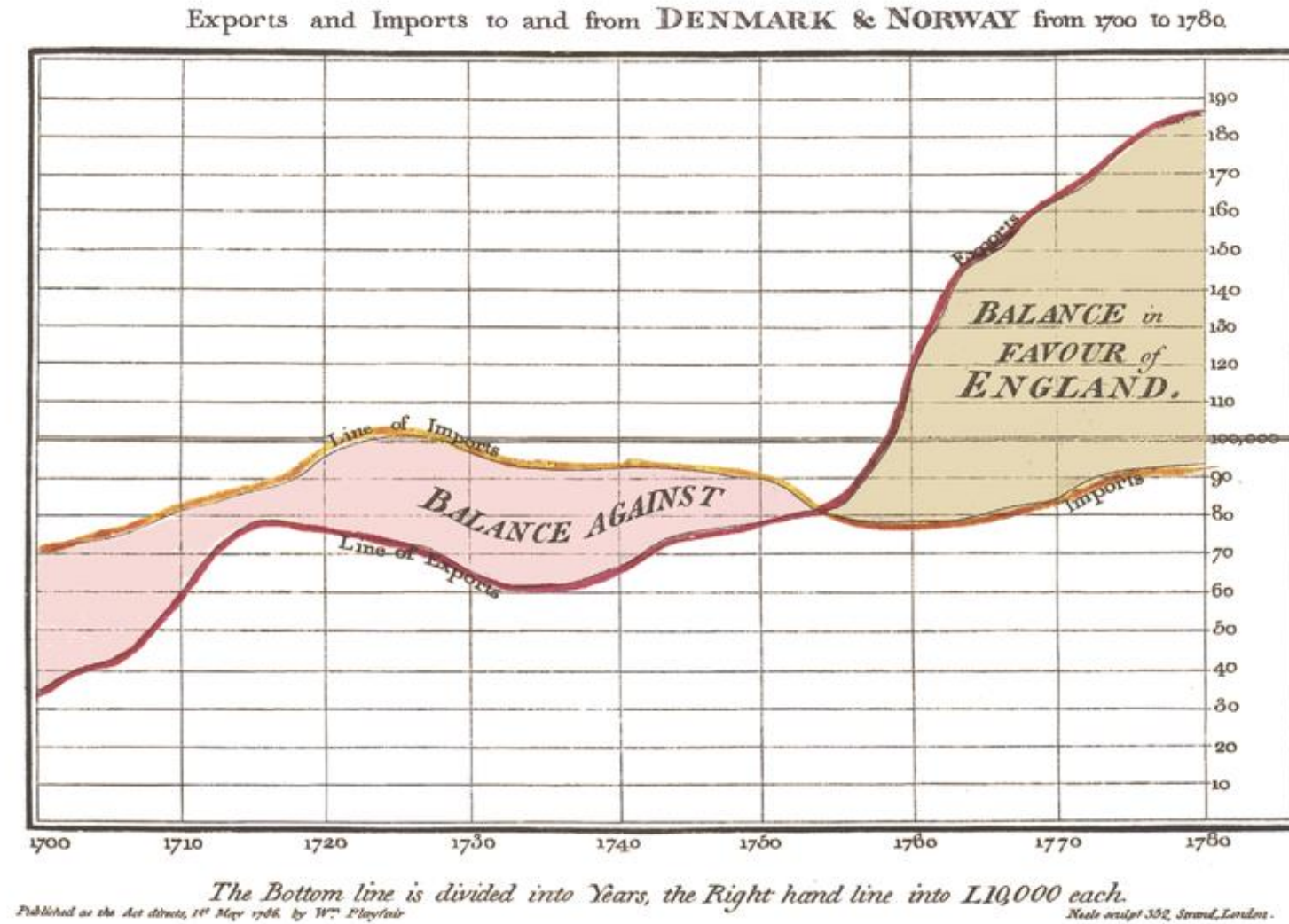
Charts are not illustrations.
Charts are arguments.

Alberto Cairo

What is Data Visualization – history

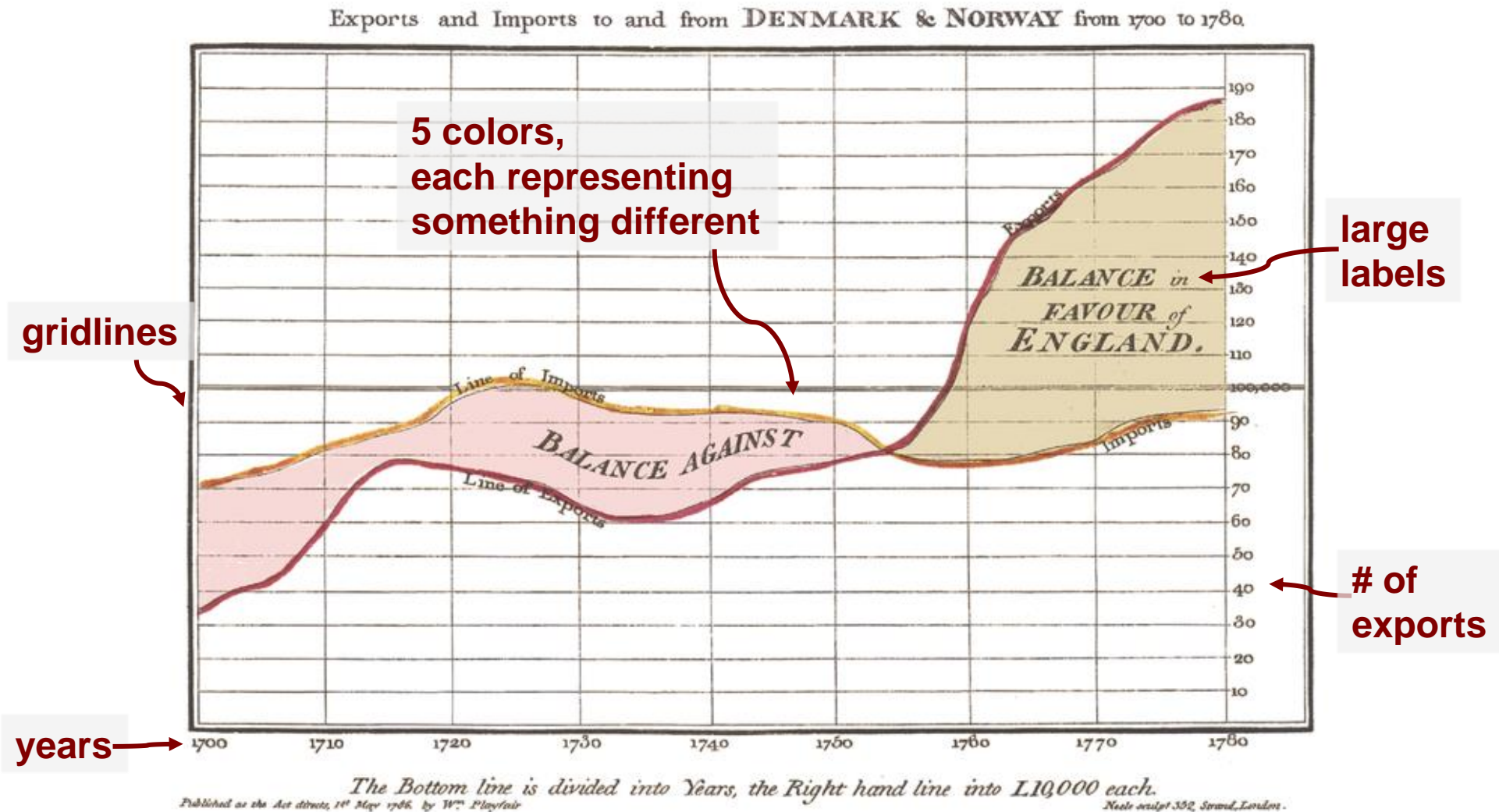


What is Data Visualization – data driven



the inventor of the pie chart, the bar graph, and the line graph ← William Playfair, 1786

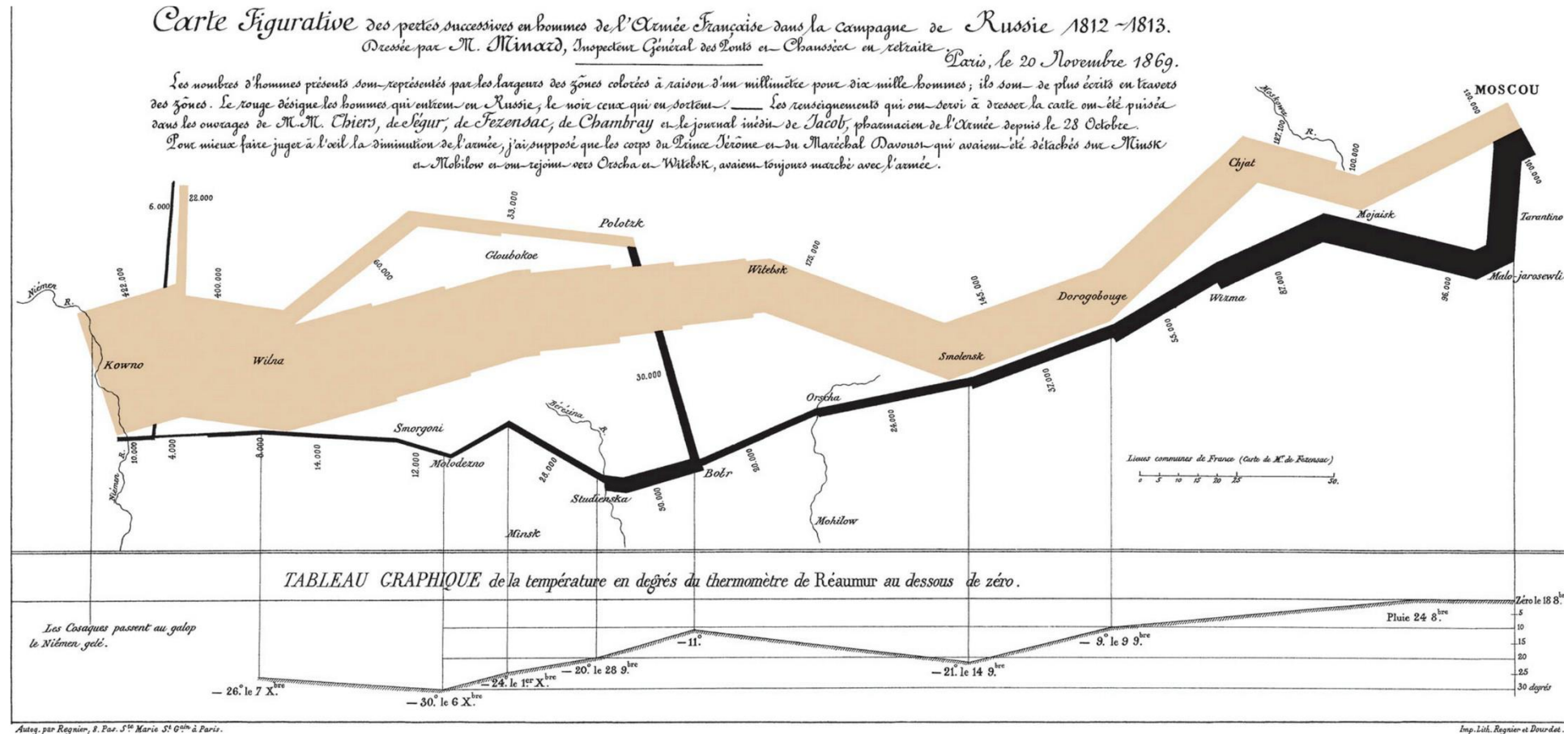
What is Data Visualization – data driven



the inventor of the pie chart, the bar graph, and the line graph ← William Playfair, 1786

What is Data Visualization - storytelling

- Besides the visual representation, data vis “tells” a story...

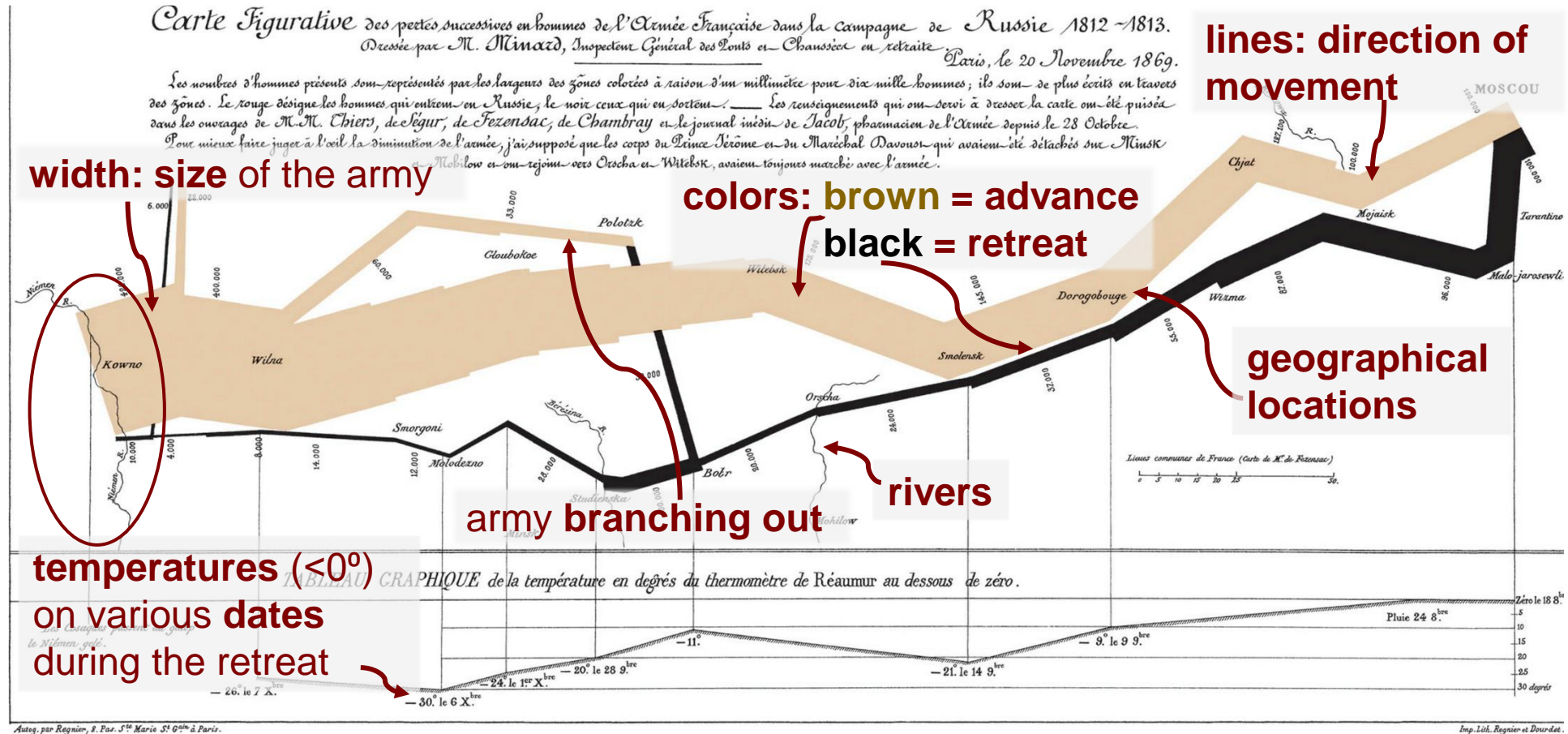


Napoleon's 1812 march east to Moscow, with a massive army of over 400,000, and the retreat west

Charles Joseph Minard (Napoleon's mapmaker), 1869

What is Data Visualization - storytelling

- Known as the best statistical drawing ever created (Tufte). Why?



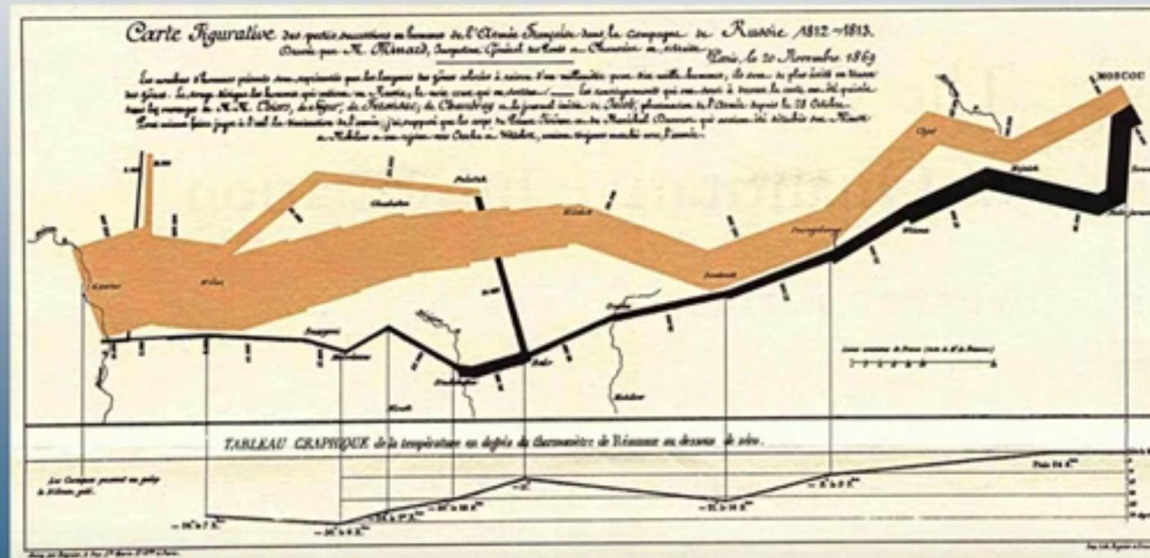
- Analyzing Minard's Visualization Of Napoleon's 1812 March

What is Data Visualization - storytelling

- Many dimensions of data combined in a single graph:
 - loss of life at a time and location
 - temperature
 - direction of movement, historical context
 - geography

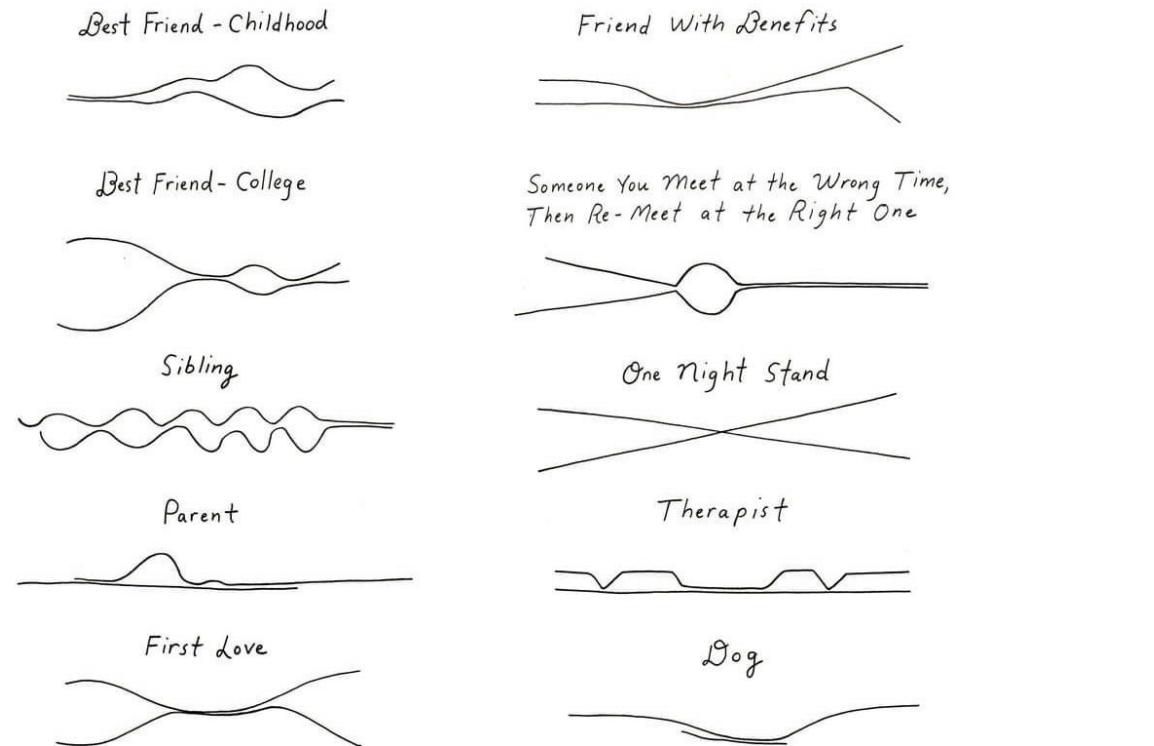
video

Indeed it has 4 types of different information presented simultaneously:



What is Data Visualization - storytelling

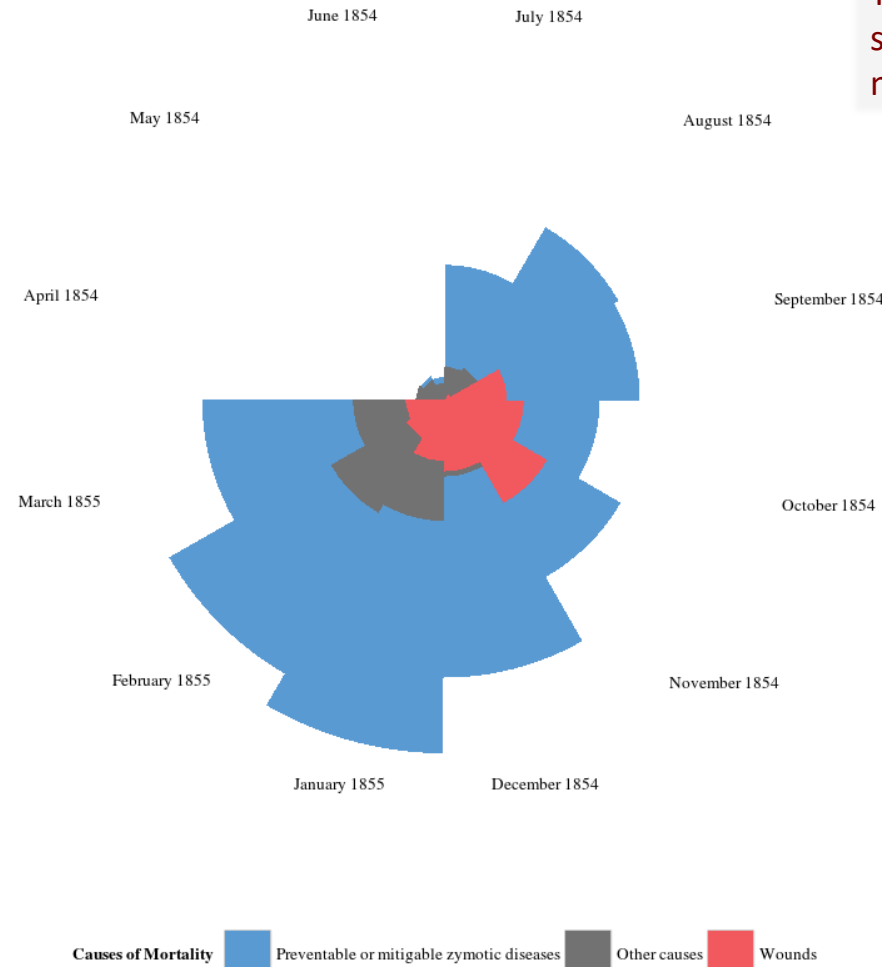
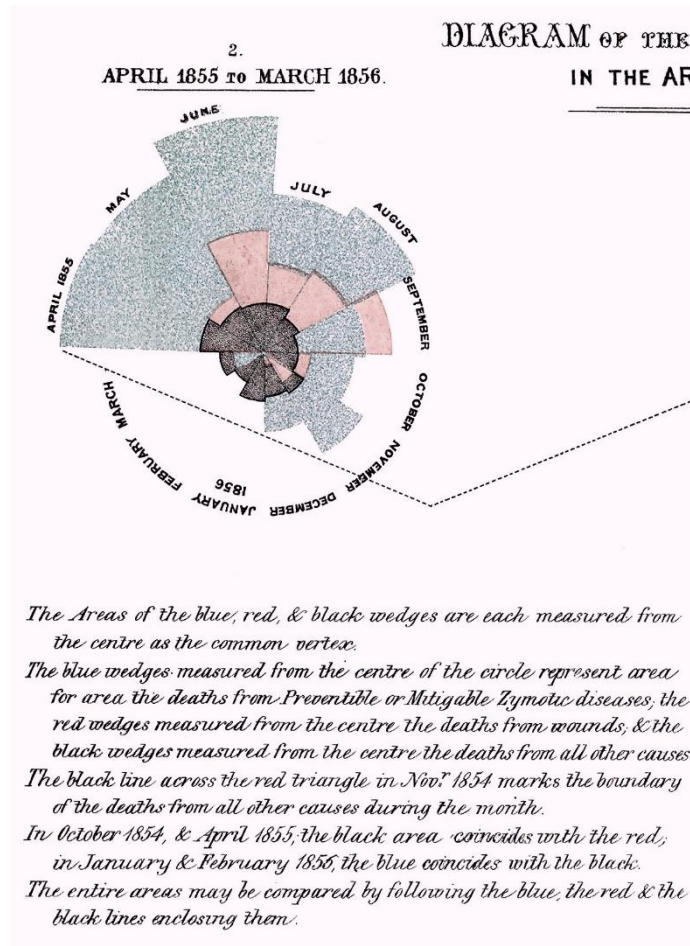
- Even with the simplest of representation elements (plain lines), one can tell a story...



"Closeness Lines Over Time"
de Recat Jan. 2019

What is Data Visualization – data driven

■ Diagram of the Causes of Mortality in the Army of the East



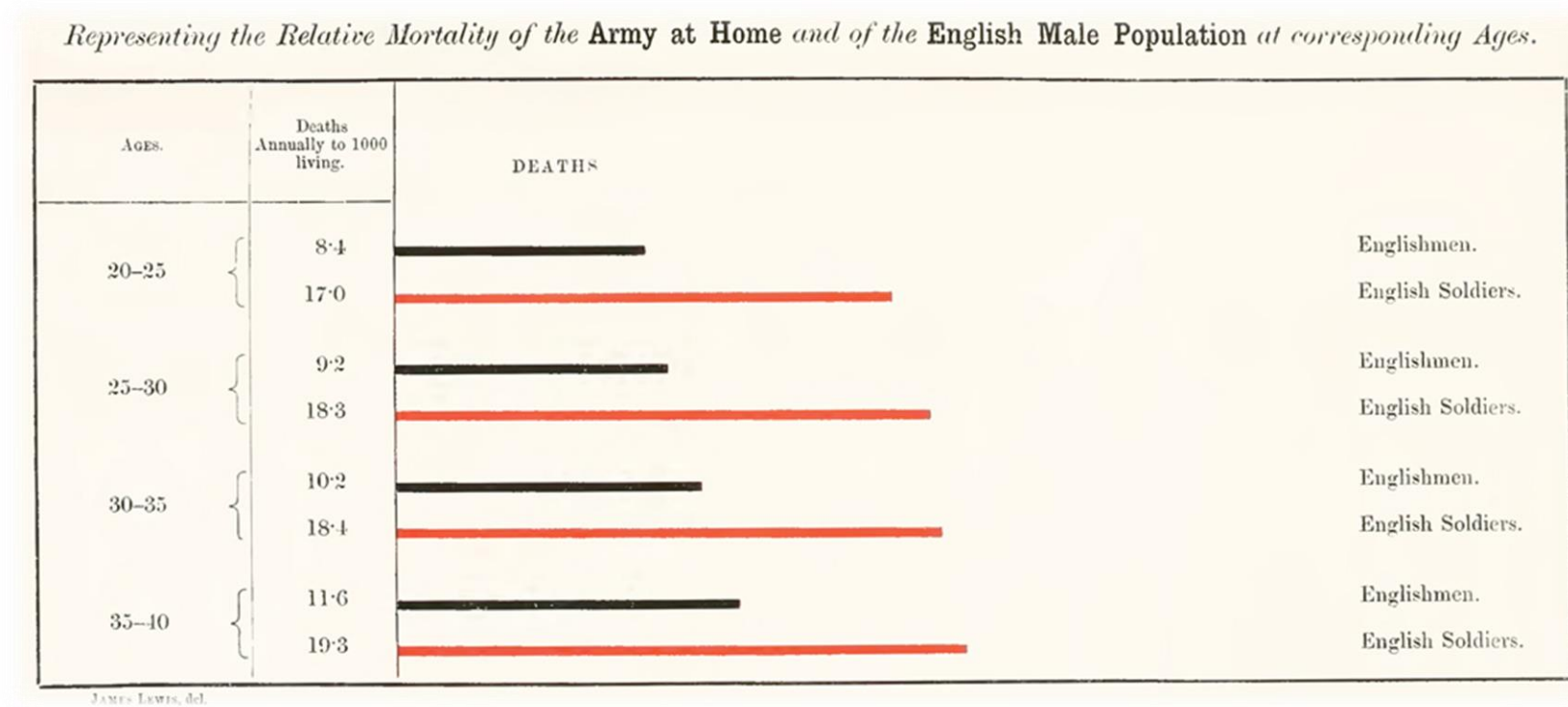
The area of each monthly segment is proportional to the number of hospital deaths



Florence Nightingale
1858

What is Data Visualization – data driven

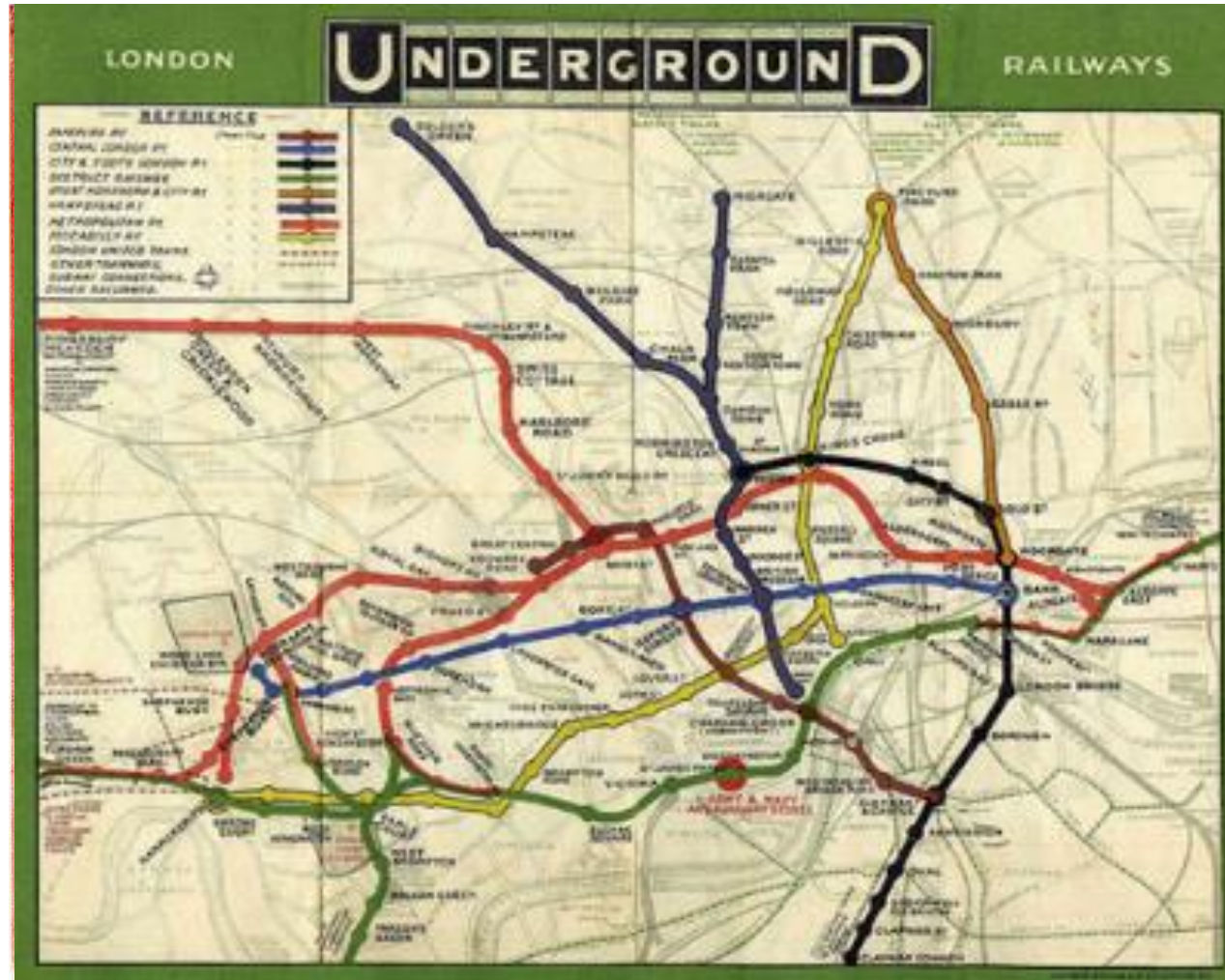
- Mortality of army at home vs. civilians



Florence Nightingale
1858

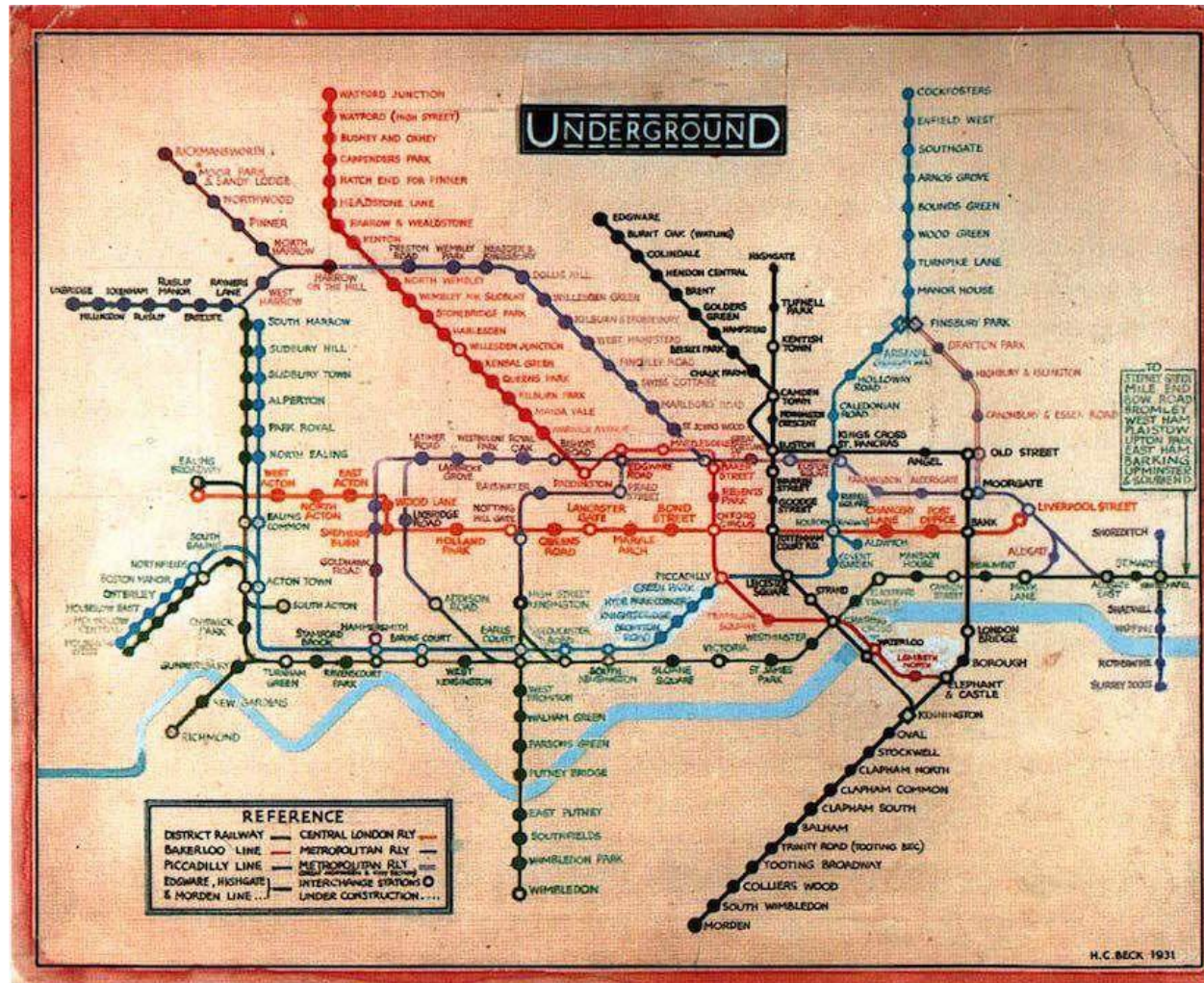
What is Data Visualization – a mental map

- Original London underground map



What is Data Visualization – a mental map

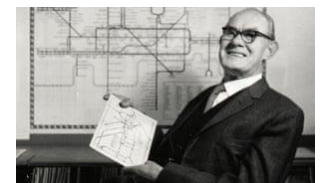
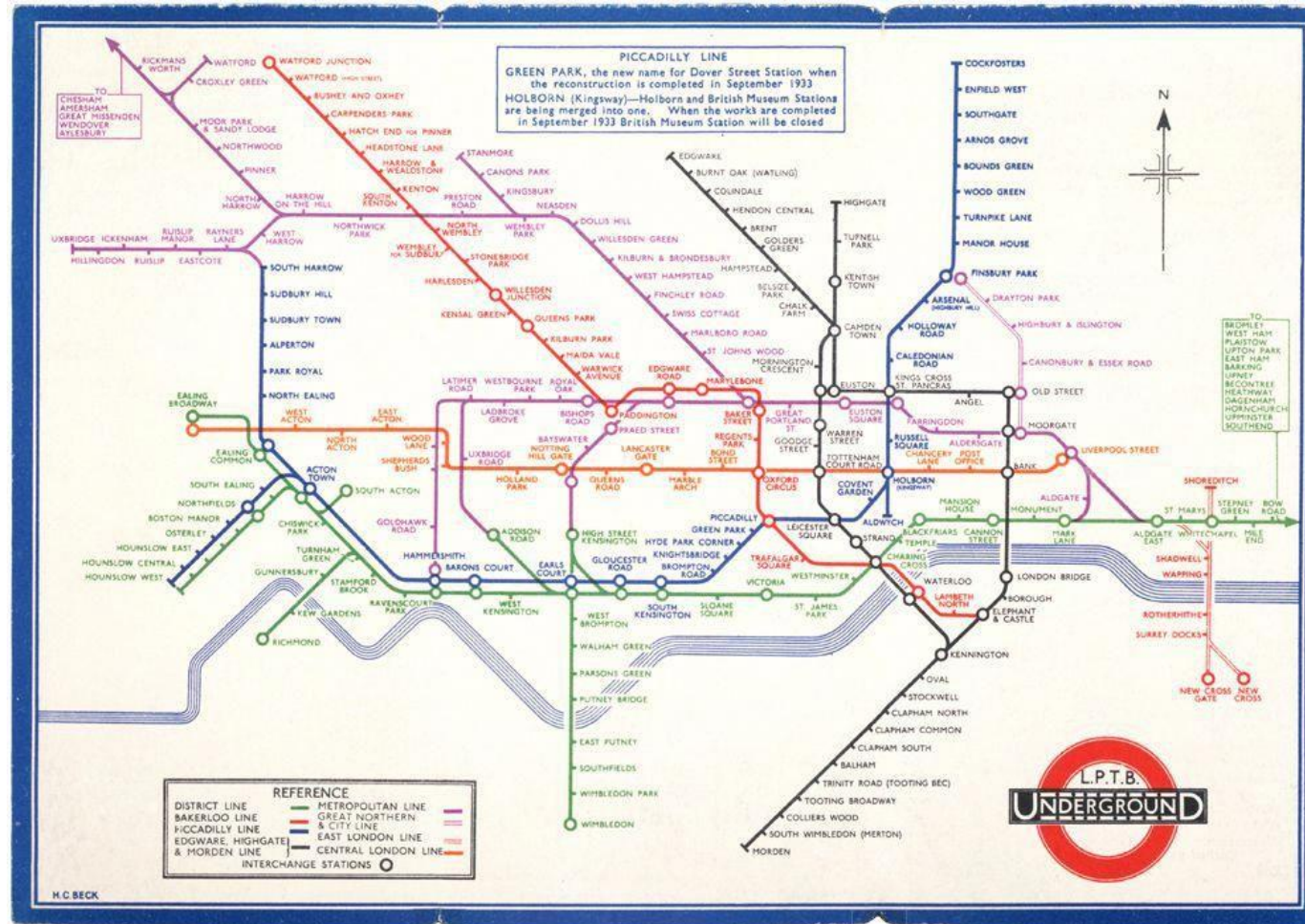
- New London underground map, laid out like an electrical circuit



Harry Beck, 1931

What is Data Visualization – a mental map

- New London underground map, laid out like an electrical circuit



Harry Beck, 1931

What is Data Visualization – a mental map

The full story of the tube map in fun videos

by Jay Foreman

#1



The Tube Map nearly looked very different

#2



What went wrong with the Tube Map?

What is Data Visualization – a mental map

“...do we still need the Tube Map at all? These days you're more likely to plan your journey with an app than a map so why does it matter if the map is a clutter?

It matters because the Tube Map is so much more than just a useful journey planner. It represents London, in every interpretation of that word.

For visitors, it's **the first thing you look at** when you want to **familiarise yourself** with the city.

For Londoners, it's **the way the city looks in our brains**.

It creates **order out of chaos, simplicity out of complexity.**”

Excerpt from [What went wrong with the Tube Map?](#)

What is Data Visualization – a human cognitive activity

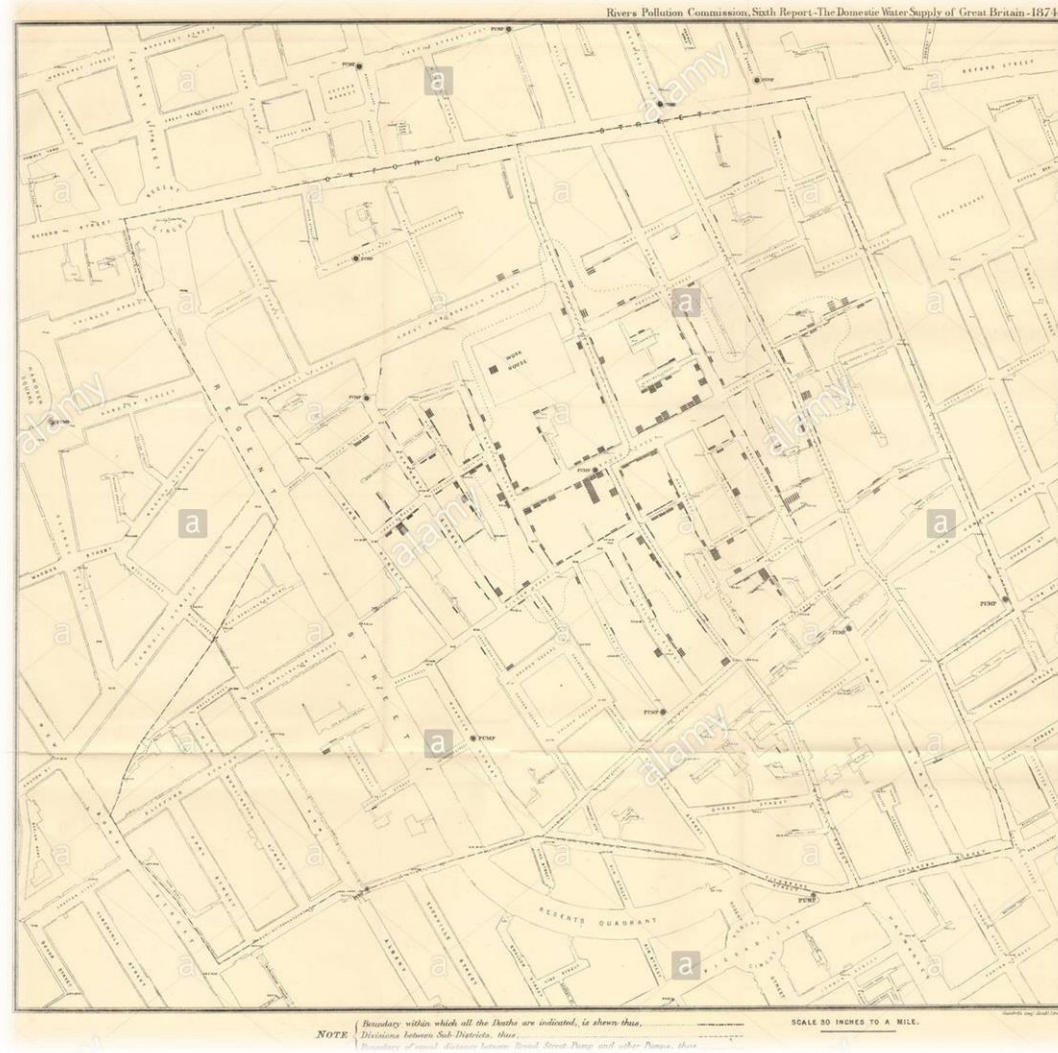
- Without looking back at the previous 3 examples (Minard, Nightingale, Beck), sketch out the essential details of what you remember.

What do they have in common?

They are **well remembered** albeit not in full detail
The viewer departs with an **image in their mind**

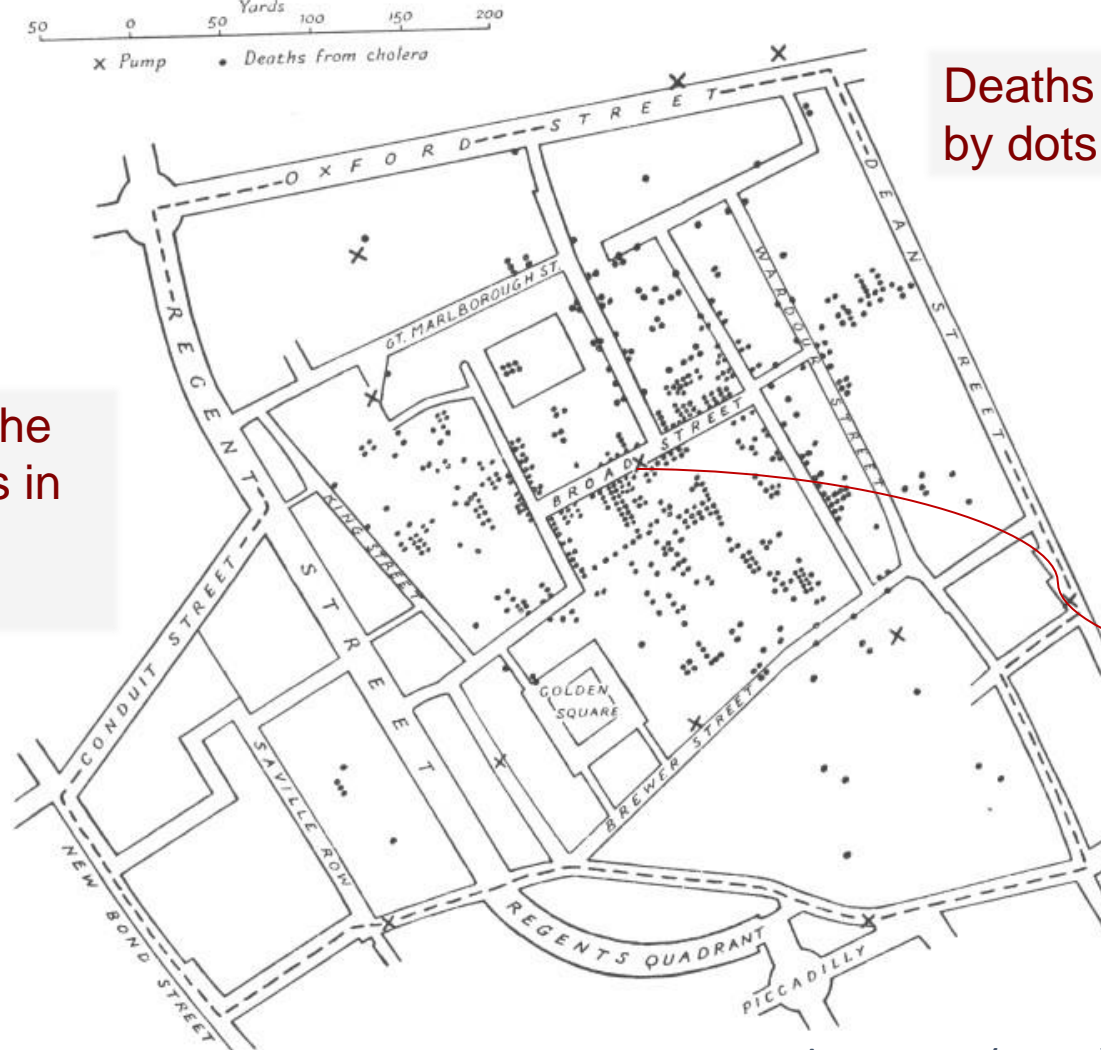
What is Data Visualization – data driven

- Deaths in central London from Cholera



What is Data Visualization – data driven

- Deaths in central London from Cholera



Deaths are marked by dots

the location of the 11 water pumps in the area are marked with Xs



modern reconstruction of the Broad St. Pump | Photo: M. Roussou, 2022

Dr. John Snow (1854)

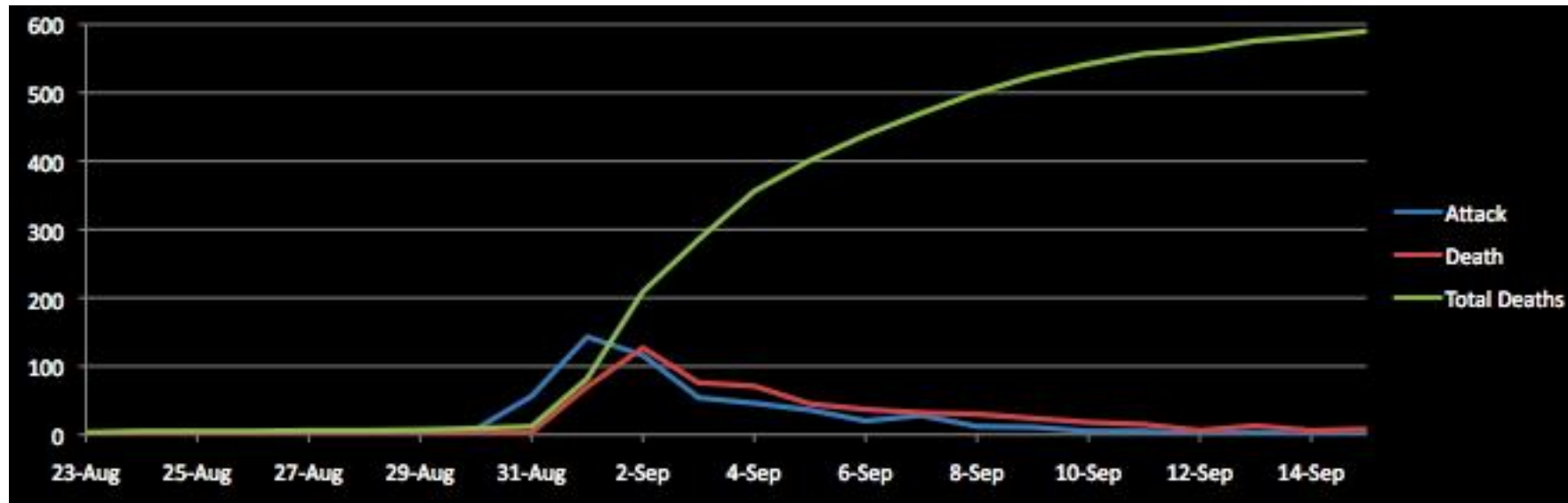
What is Data Visualization - data driven

- Deaths in central London from Cholera – a chart of the data

"Very few of the fifty-six attacks placed in the table to the 31st August occurred till late in the evening of that day. The eruption was extremely sudden, as I learn from the medical men living in the midst of the district, and commenced in the night between the 31st August and 1st September."

"On September the 8th - the day when the handle of the pump was removed - there were twelve attacks;..."

"During the decline of the epidemic the deaths were more numerous than the attacks, owing to the decease of many persons who had lingered for several days in consecutive fever."



What is Data Visualization – data driven

John Snow's visualization has a number of good features that you should strive for:

1. Place data in the appropriate context for assessing cause and effect
2. Allow the viewer to make quantitative comparisons
3. Encourage search for alternative explanations and contrary cases
4. Indicate level of certainty and possible errors in the data

What is Data Visualization – data driven

3. Encourage search for alternative explanations and contrary cases

- There are areas near the Broad Street pump with no/few fatalities and there are a few fatalities far from the pump. Those suggest that maybe our hypothesis is wrong.
- John Snow visited families of the deceased that lived far from the pump. Some preferred the taste of the water at Broad Street as it was usually more clear than the others. Some had children that went to school near the Broad Street Pump.
- What about the areas near the pump with no fatalities. One was a brewery employing 70 men. The other was a work house with over 500 inmates that had only 5 deaths from cholera, and it had its own water pump.
- As a result of John Snow's work this was the last great cholera outbreak in London.

What is Data Visualization – data driven

The full story of John Snow in a fun video series:

England: The Broad Street Pump

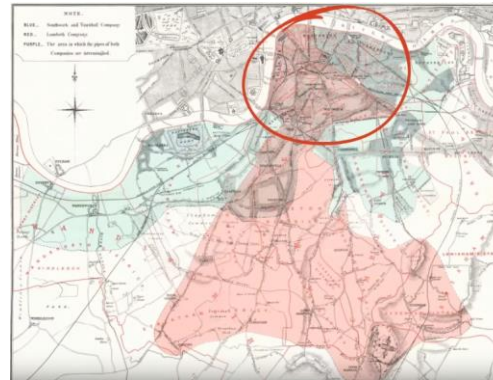
by [Extra Credits](#)

#1



You Know Nothing, John Snow

#2



Epidemiology Begins!

#3



Map of the Blue Death

What is Data Visualization – data driven

...but also in Greek:



:34

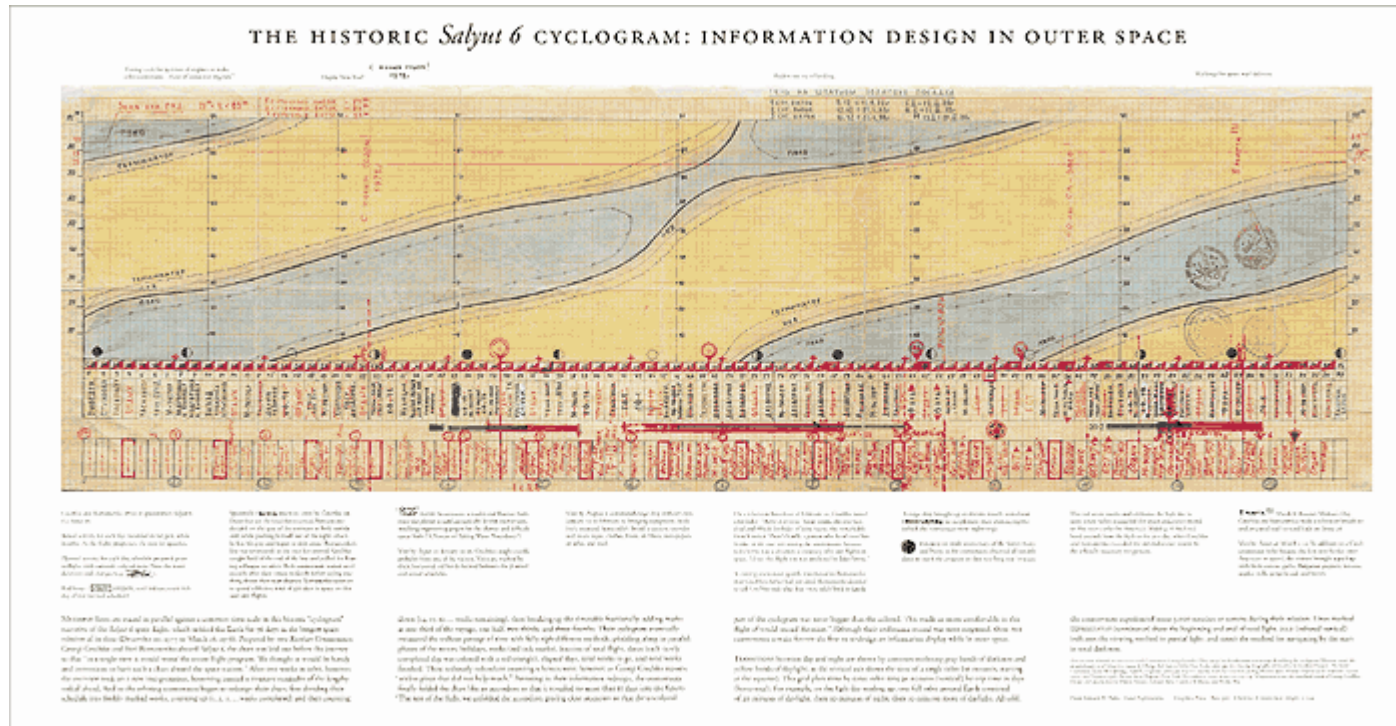


Mikeius

What is Data Visualization - storytelling

- Historic Visual Diary of Spaceflight: Cyclogram

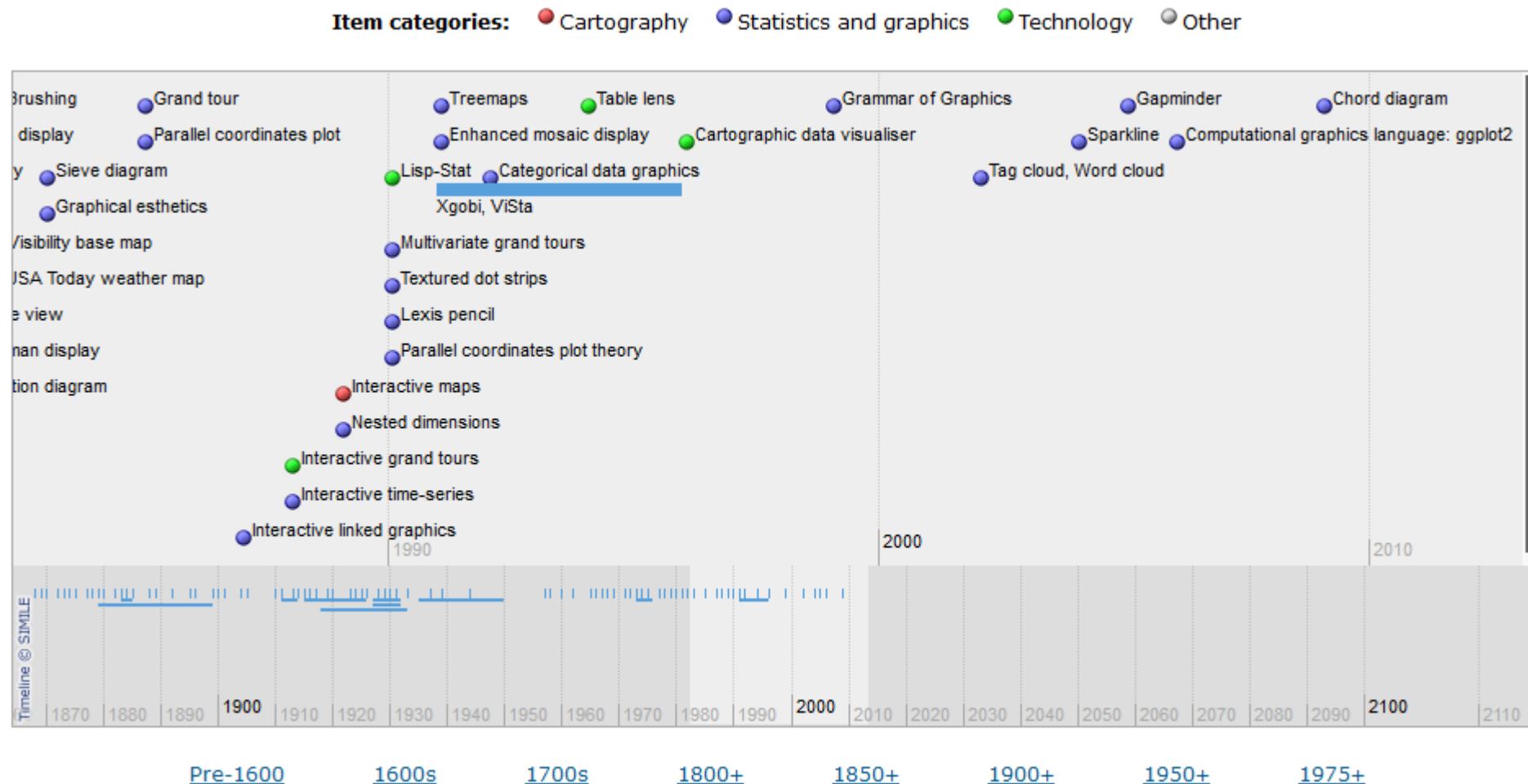
Some 22 parallel time-series show 1500 sunrises and 1500 sunsets during the flight, a schedule for space walks and baths, and visits of resupply ships bringing equipment, fresh fruit, and gingerbread.



Georgi Grechko
Russian cosmonaut of Salyut6

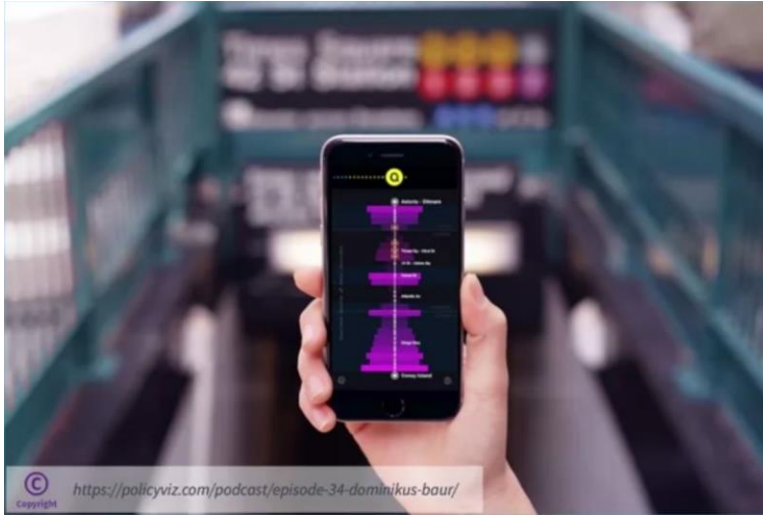
The history of data visualization

- Milestones in the history of thematic cartography, statistical graphics, and data visualization



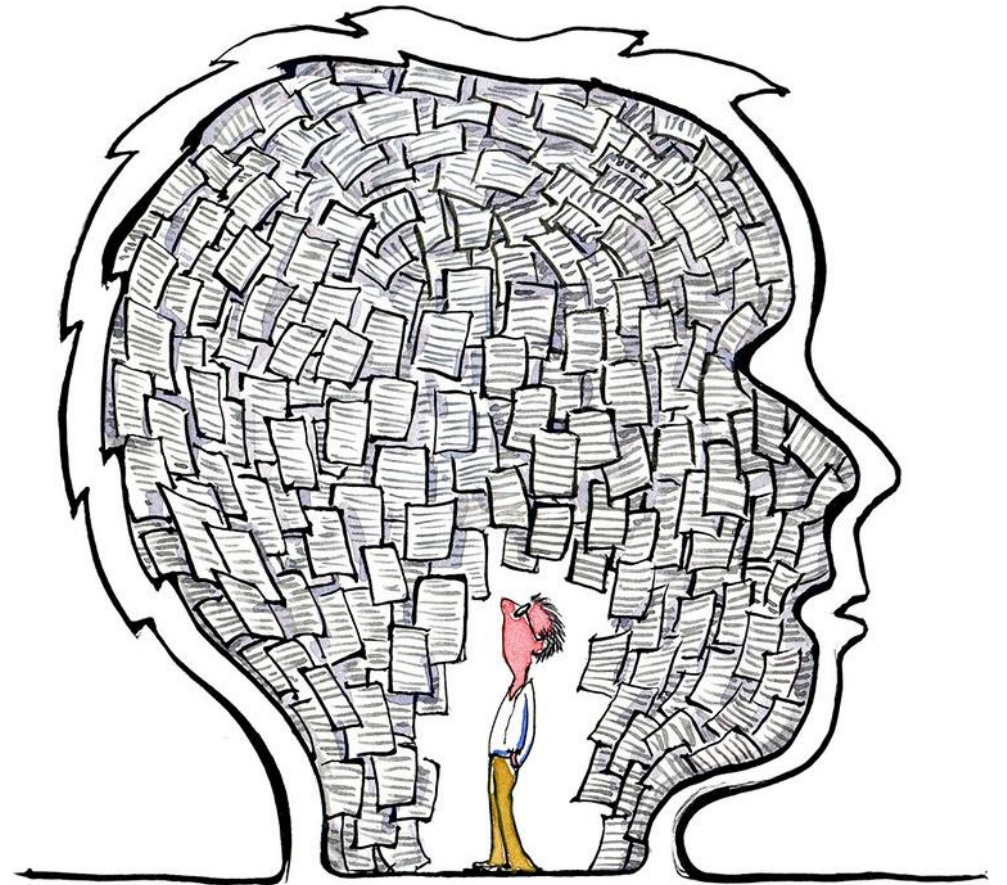
Viewing visualizations...

- ...everywhere



Why visualize?

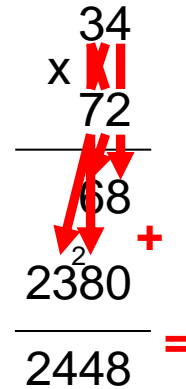
- Humans are visual creatures.
- Peer-reviewed studies have shown that we can consume information more quickly when it is expressed in diagrams than when it is presented as text.
- Visualizing data is not just creating pretty pictures.



A picture says more
than a thousand words

Why visualize?

- E.g., multiplying 2-digit numbers, like 34×72 , can be 5 times slower (!) if done mentally vs. using pen and paper:



A handwritten multiplication problem: 34×72 . The numbers are aligned vertically with a horizontal line below 72. The product 2380 is written below the line, and 2448 is written below that, followed by an equals sign. Red annotations include: a vertical line through the 4 in 34 and the 2 in 72; a red arrow pointing from the 4 to the 8 in 2380; a red arrow pointing from the 3 to the 2 in 2380; a red arrow pointing from the 7 to the 2 in 2380; a red arrow pointing from the 2 in 72 to the 0 in 2380; a red plus sign to the right of the 8 in 2380; and a red equals sign to the right of the 2448.

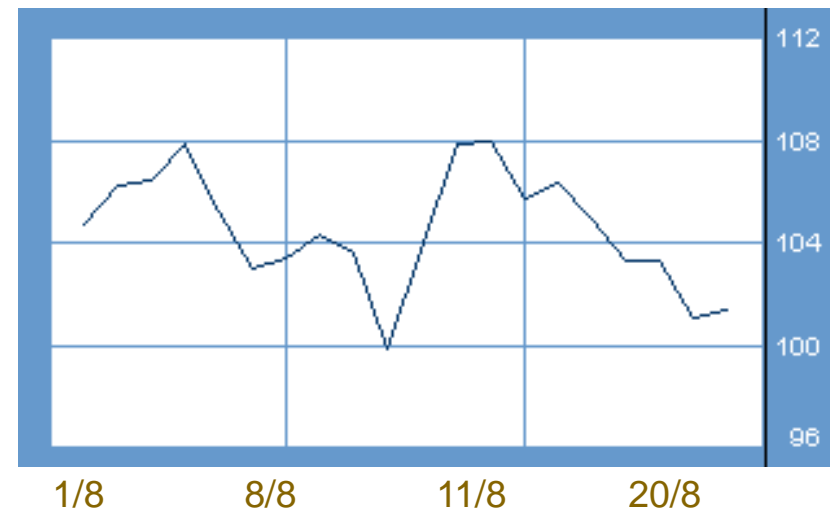
$$\begin{array}{r} 34 \\ \times 72 \\ \hline 68 \\ 2380 \\ \hline 2448 = \end{array}$$

- With 4- or 5-digit numbers this would be impossible using just our brain.

Why visualize?

- E.g.: identifying the deviation of the price of a stock at a specific date range is easier when looking a chart vs. looking at numbers:

1/8	104 3/4
4/8	106 1/4
5/8	106 1/2
6/8	107 7/8
8/8	105 1/4
11/8	103
18/8	104
19/8	107 15/16
20/8	108
21/8	105 3/4
22/8	106 3/8



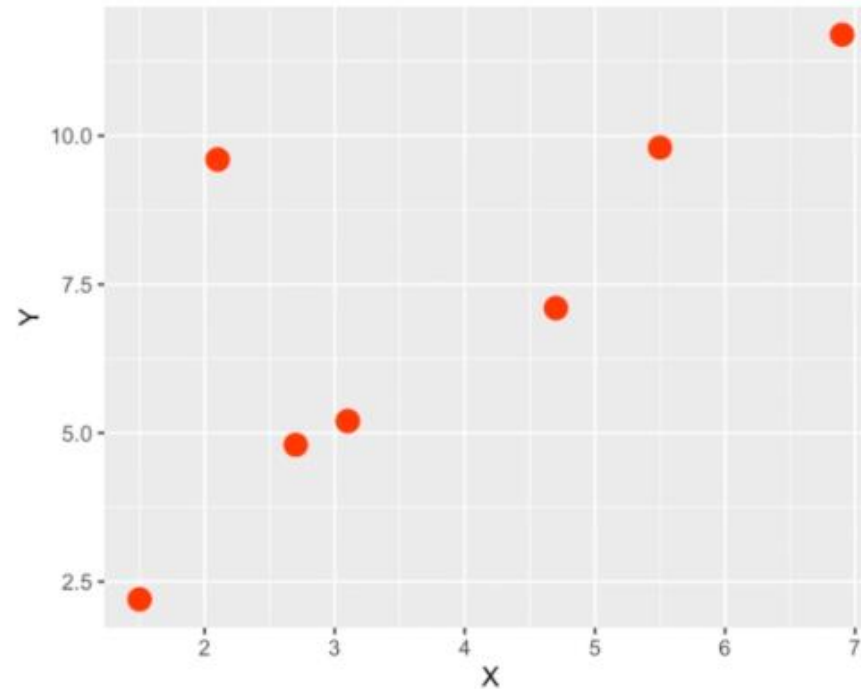
- If the date range is bigger, e.g. a year, it would've been almost impossible to define the price deviation through the number table

Why visualize?

- E.g.: identifying the deviation of the price of a stock at a

SPOT OUTLIERS

X	Y
1.5	2.2
2.1	9.6
5.5	9.8
3.1	5.2
6.9	11.7
4.7	7.1
2.7	4.8



Why visualize?

Because **information spaces** can be:

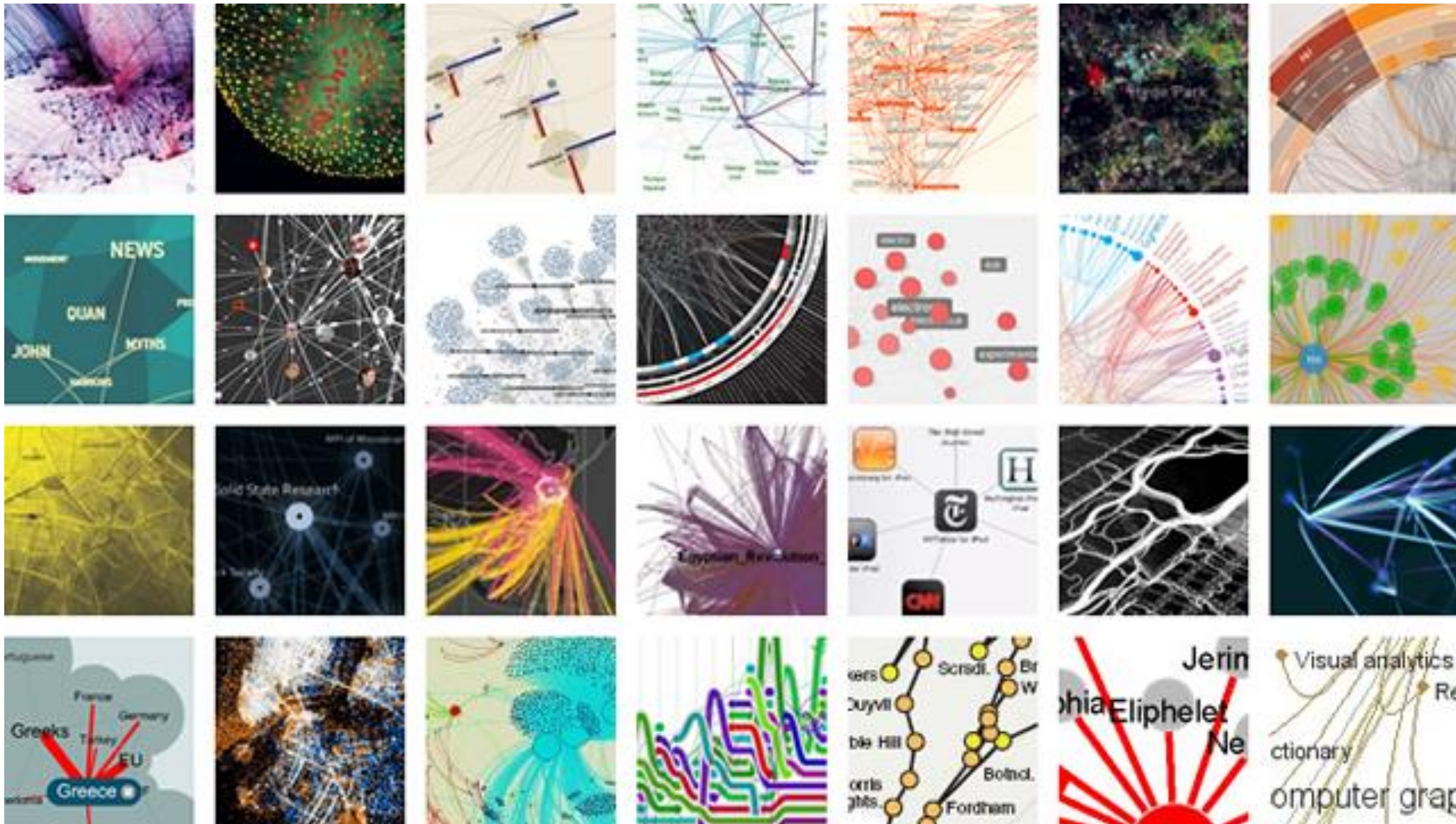
- large
- abstract
- complex
- continuously becoming larger and larger...

Information spaces

- The World Wide Web (WWW)
- Stock exchange
- Scientific data (biology, physics, mathematics, etc.)
- Road traffic data, network data
- Atmospheric data, seismic data, meteorological data, climate change...
- A novel (data can be sentences, words, letters...)
- SETI@home (Search for Extraterrestrial Intelligence): space radio data collected via radio-telescopes

- **...more at** Geisler, G. (2005). Making Information More Accessible : A Survey of Information Visualization Applications and Techniques, 1–25. Retrieved from <http://www.ischool.utexas.edu/~geisler/info/infovis/paper.html>

Information spaces



Why visualize?

People create visualizations as part of

- exploratory data analysis
 - See patterns
 - Inspire new questions

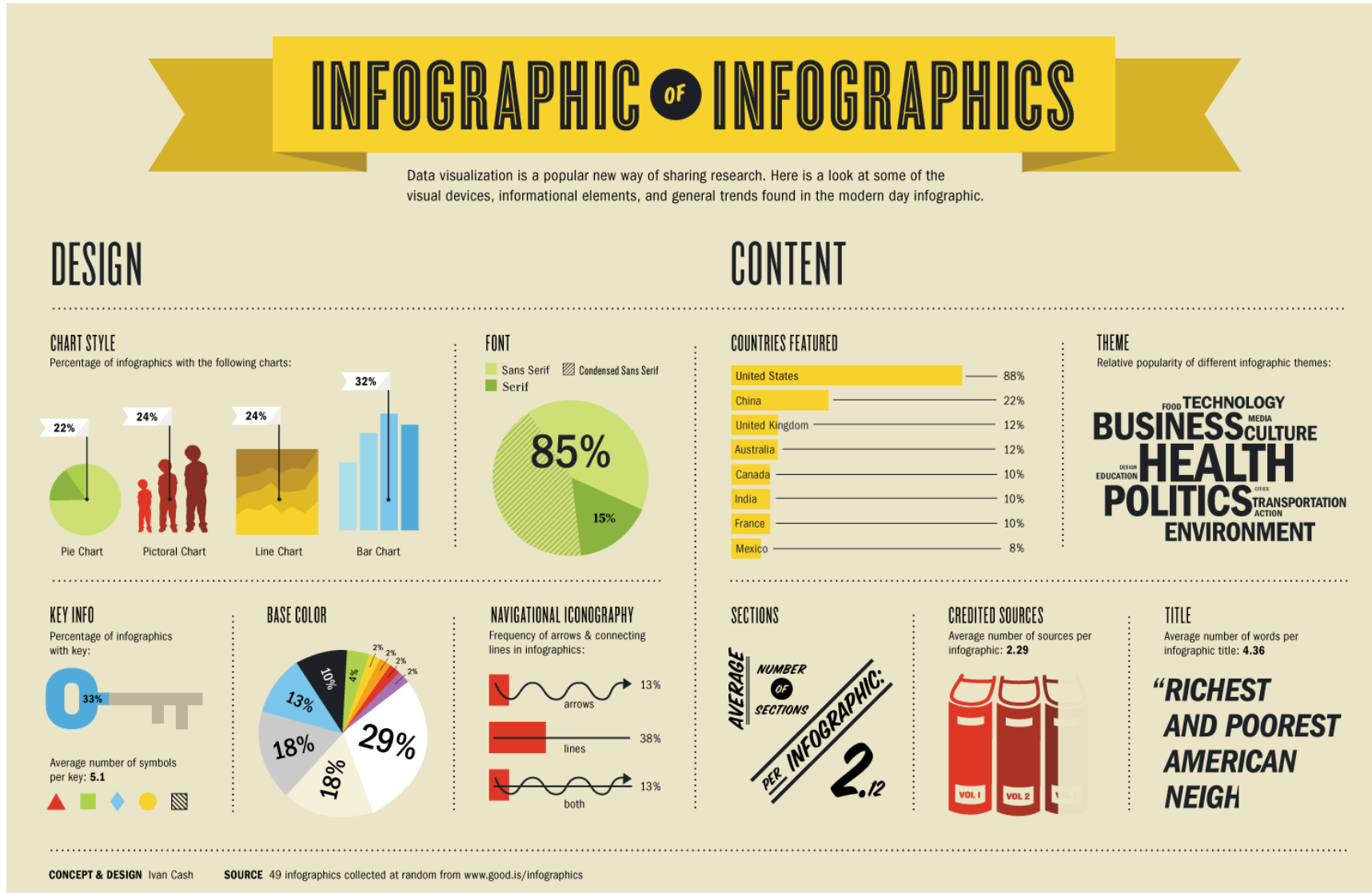
or

- to convey a story about their data to an audience
 - What do you want to convey?
 - Show it clearly

Infographics - examples

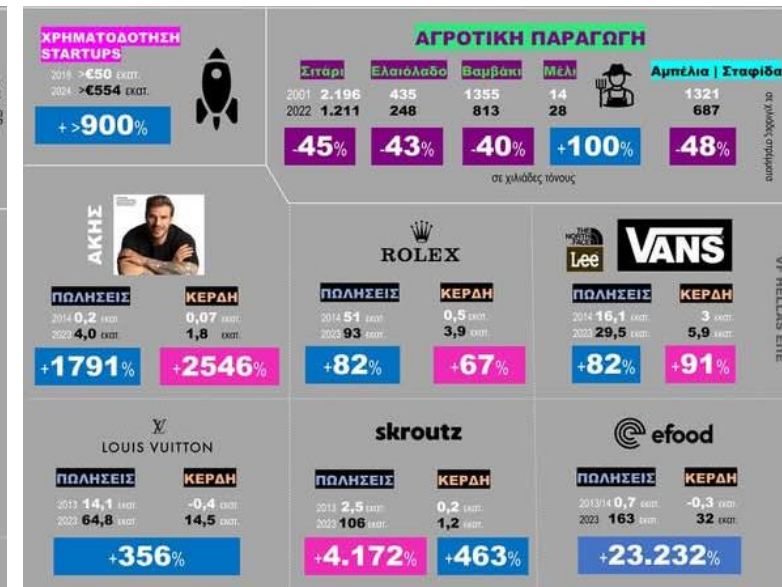
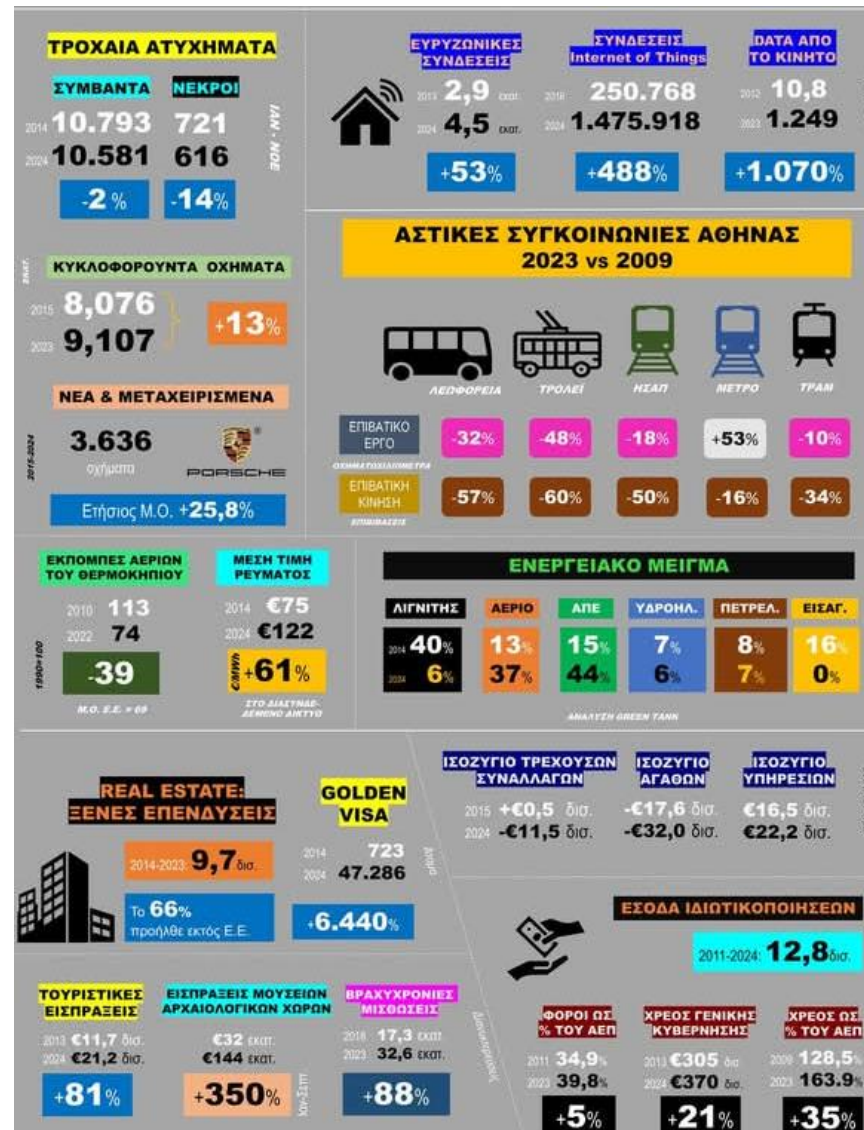
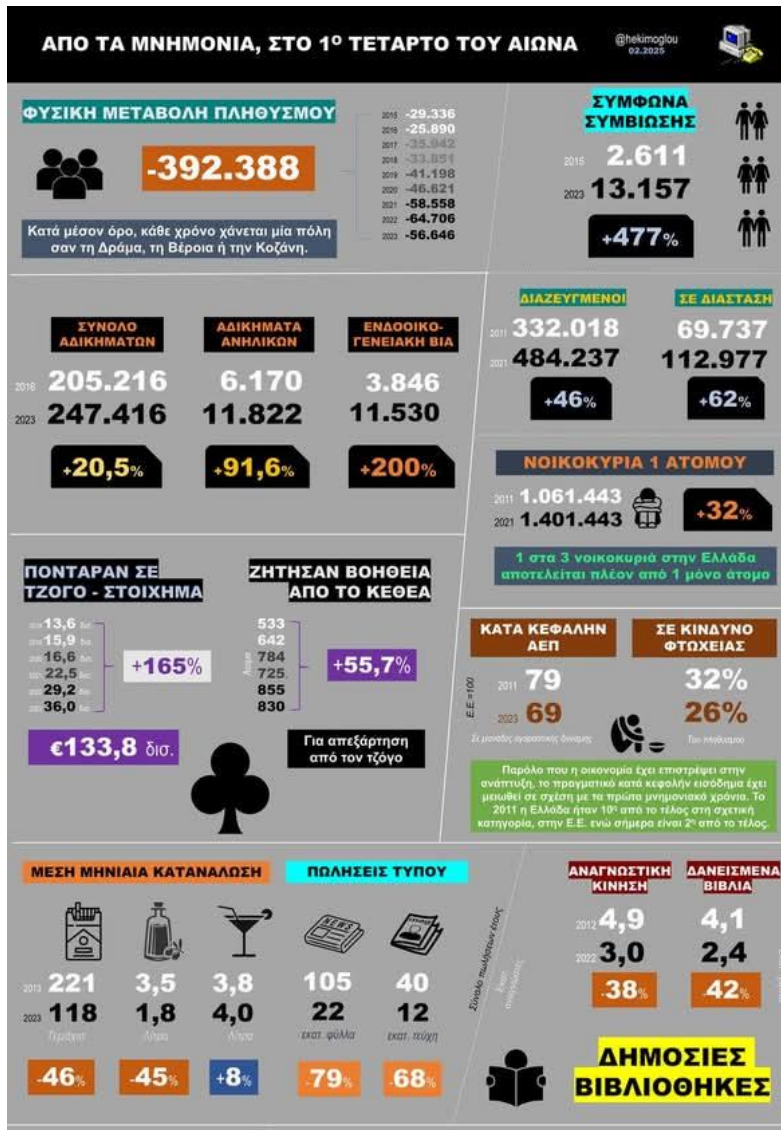
- infographics

Infographics

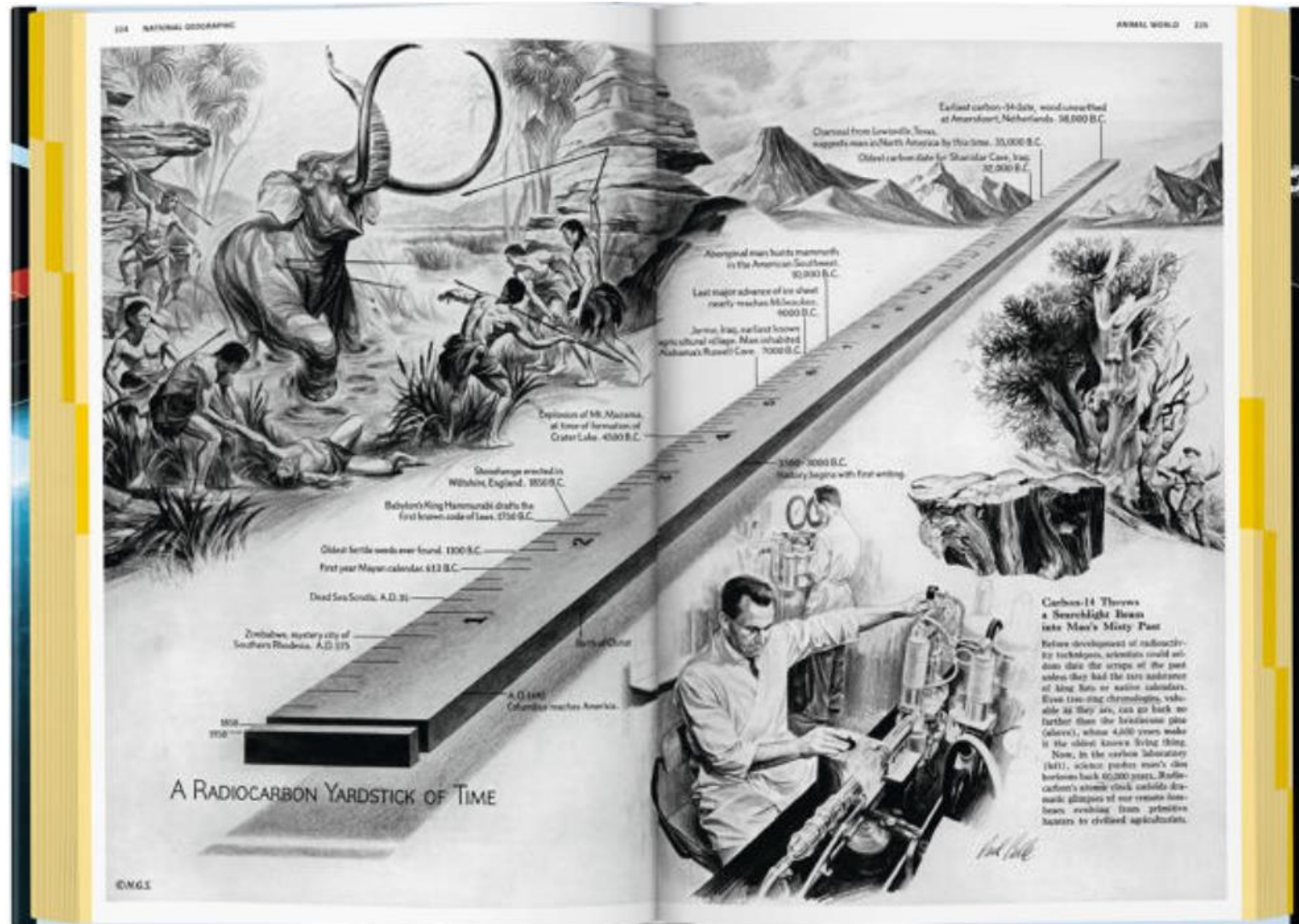


Infographics

Contemporary Greece in one infographic...



Infographics

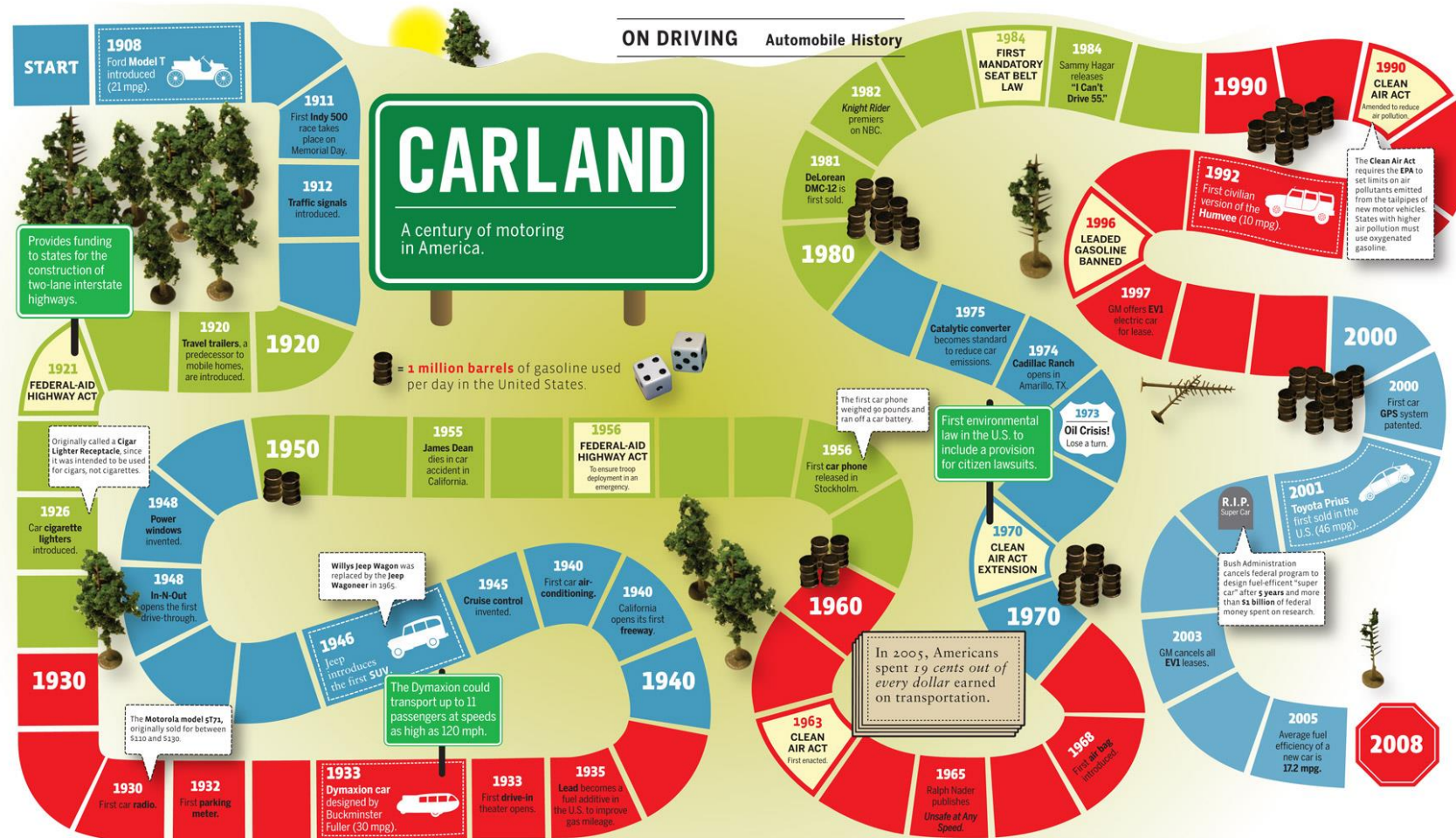


National Geographic Infographics

Infographics

GOOD

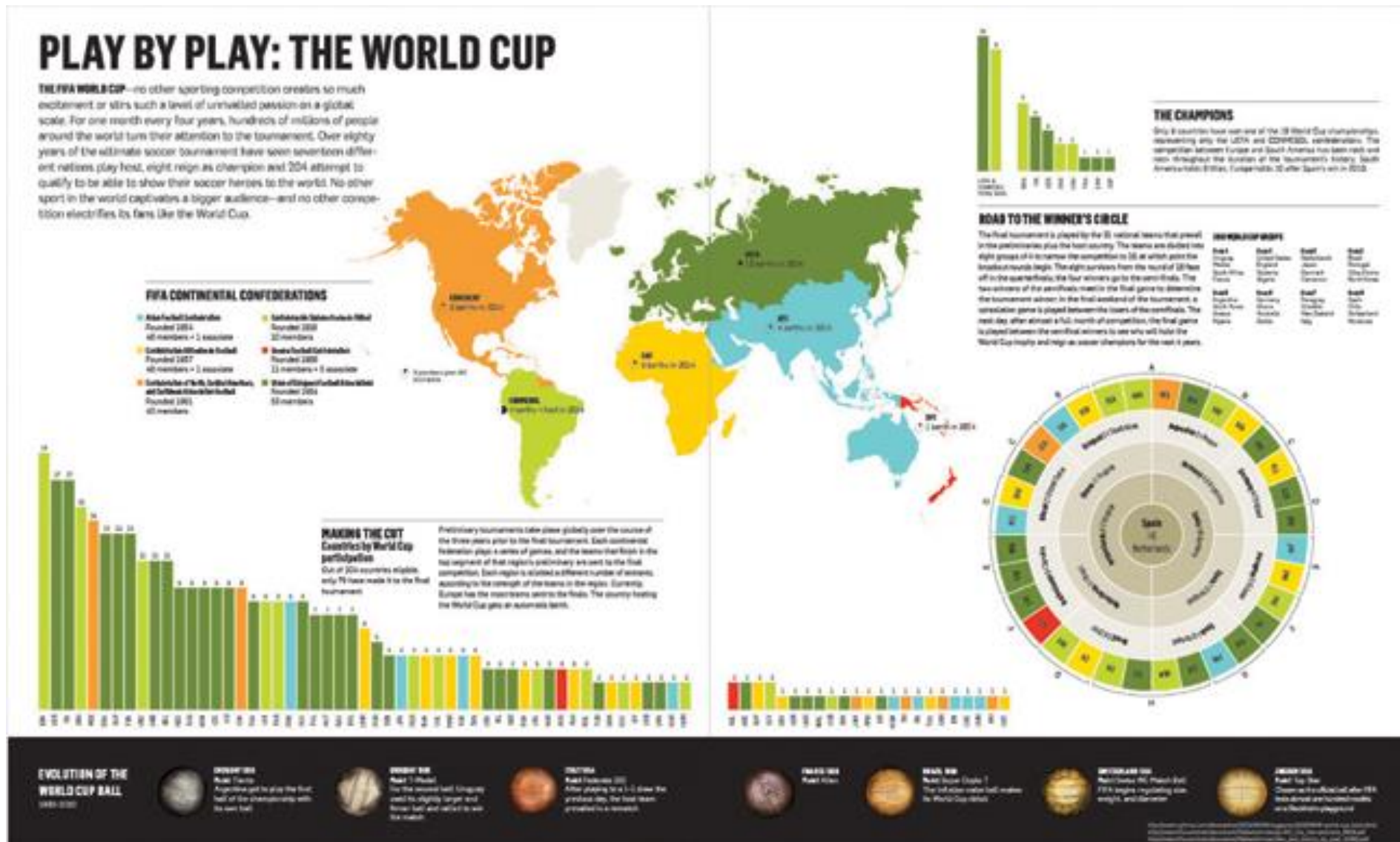
Transparency Issue009 Mar/Apr 08



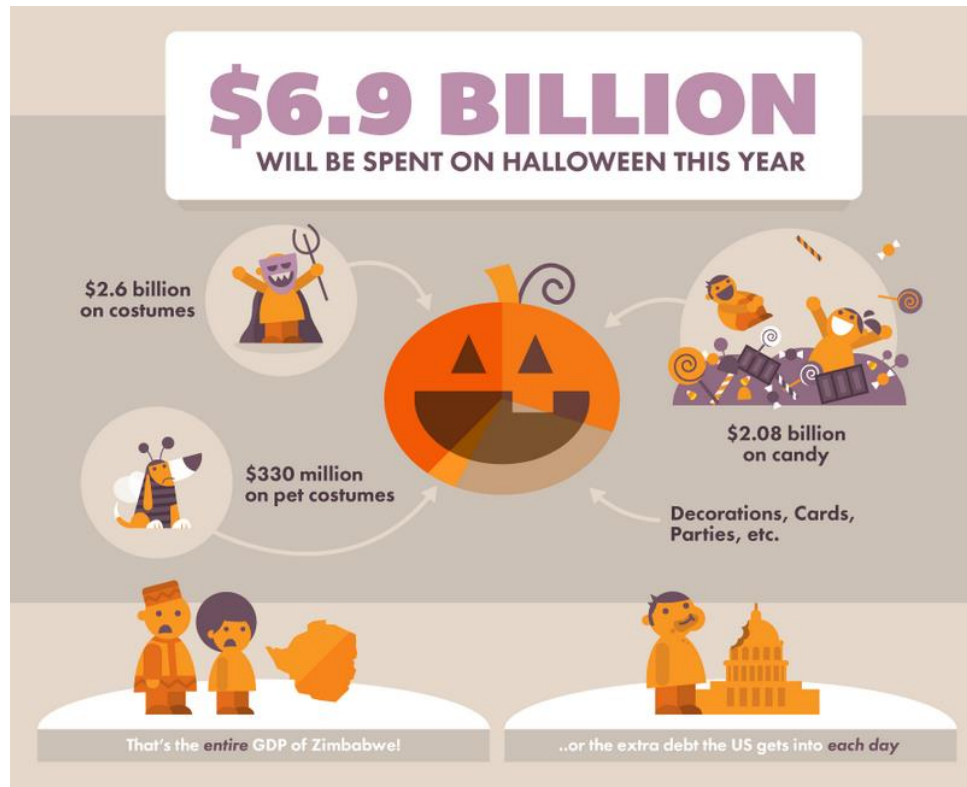
SOURCES Energy Information Administration

CREDITS Coleen Corcoran and Joe Prichard

Infographics



Infographics



WHAT YOUR COFFEE SAYS ABOUT YOU



ESPRESSO

You're friendly and adaptive. You actually like the taste of coffee, a rare, but admirable trait.



DOUBLE ESPRESSO

You're practical and hard-working. You like knowing that one shot just doesn't do it for you anymore.



TRIPLE ESPRESSO

You're enthusiastic but obsessive. You've been awake since the late 90's.



MOCHA

You're fun-loving and creative. You hate the taste of coffee, but you need the pick-me-up, so you improvise.



LATTE

You're reflective, but often indecisive. In a world of unknowns, you like the safe pick.



CAPPUCCINO

You're warm-hearted, but oblivious at times. Your friends have to remind you to wipe the foam off your lip.



MACCHIATO

You're traditional and reserved, but for the most part, you hate foam mustaches.



ICED COFFEE

You're assertive and outspoken. You don't let seasons dictate how you live your life. Also, you like straws.



AMERICANO

You're calm and conscientious. You enjoy the simple things in life, like picnics in the park, birds chirping, and watery coffee.



FRAPPUCCINO

You're happy and energetic. You claim to love coffee, but really, you just love ice cream.



COFFEE TO-GO

You're serious and focused. You believe when the going gets tough, the tough get cardboard sleeves because the cups too hot.



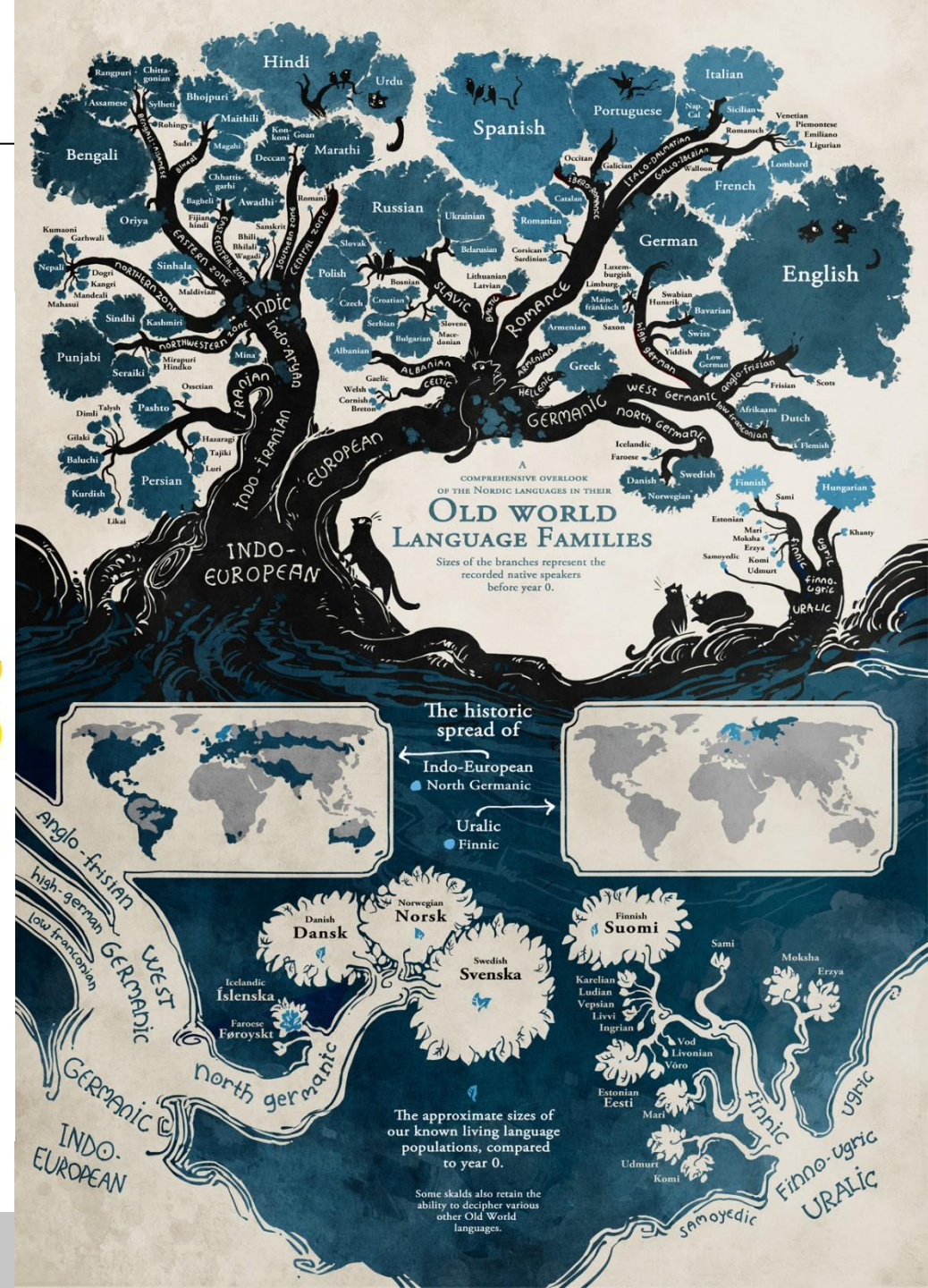
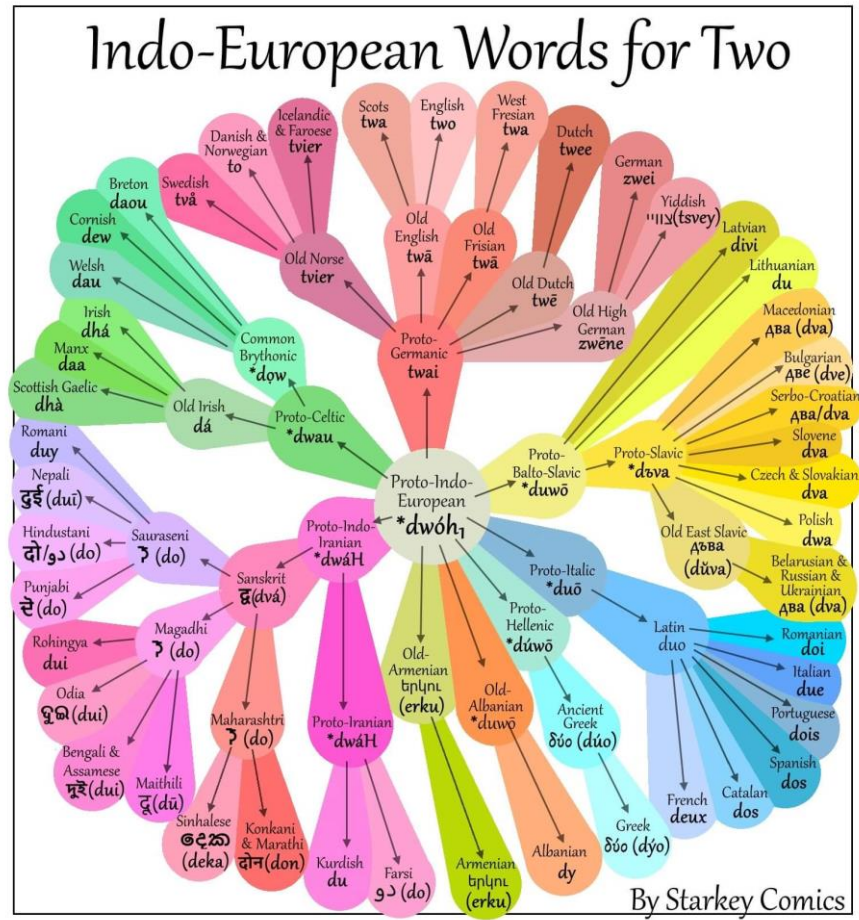
EXPRESSO

You're clever, annoying, or both. You knowingly or unknowingly mispronounce eSpresso. Either way, I hate you.

Infographics

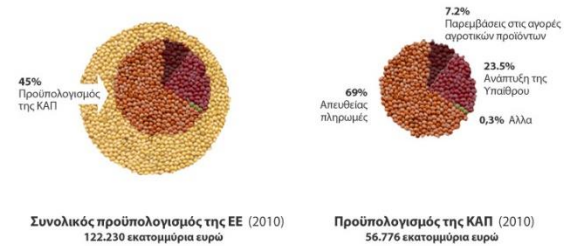


Infographics

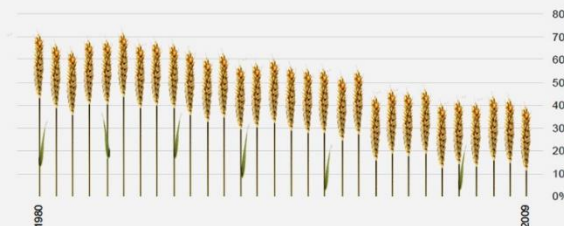


Infographics

Η Κοινή Αγροτική Πολιτική σε αριθμούς



Οι δαπάνες της ΚΑΠ ως % των δαπανών του προϋπολογισμού της ΕΕ



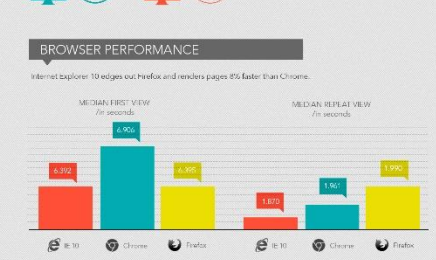
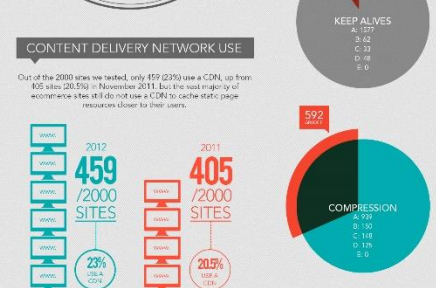
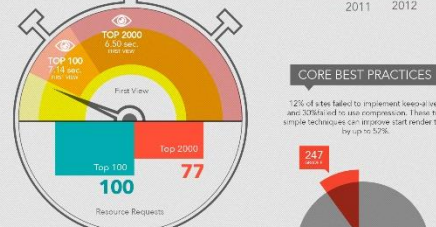
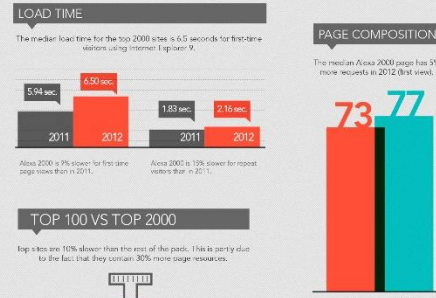
3 κύρια εξαγόμενα αγροτικά προϊόντα (2008-2010)



Source: Eurostat - Comext
Ευρωπαϊκό κοινοτικό
EU expenditure - European Commission, DG Agriculture and Rural Development (Financial Reports);
EU expenditure - European Commission, DG Budget (2009 Financial report);
European Commission, Directorate General for Agriculture and Rural Development.

STATE OF THE UNION Page Speed & Web Performance

We tested the load times of the top 2000 retail websites* and found that the median site takes 6.5 seconds to load, pages are getting bigger, and Internet Explorer 10 renders pages 8% faster than Chrome.

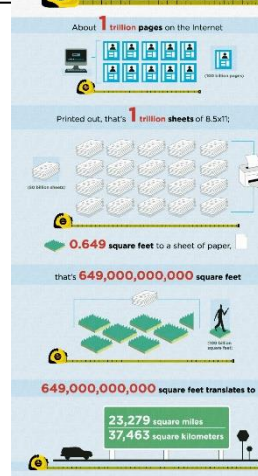


*Based on a study of the top 2000 retail websites as measured by Alexa.com. These pages were tested in Chrome 75, Firefox 15, and Internet Explorer 10 using a 10-second timeout and 10-second timeout.

strangeloop

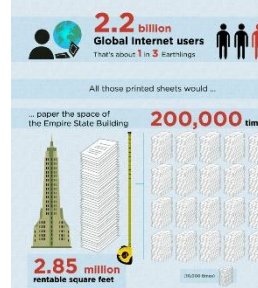
health-information-technology.net

HOW BIG IS THE INTERNET?



So, just how big is the Internet?

With an estimated 1 trillion pages, the World Wide Web is massive and ubiquitous, permeating nearly every aspect of daily life.



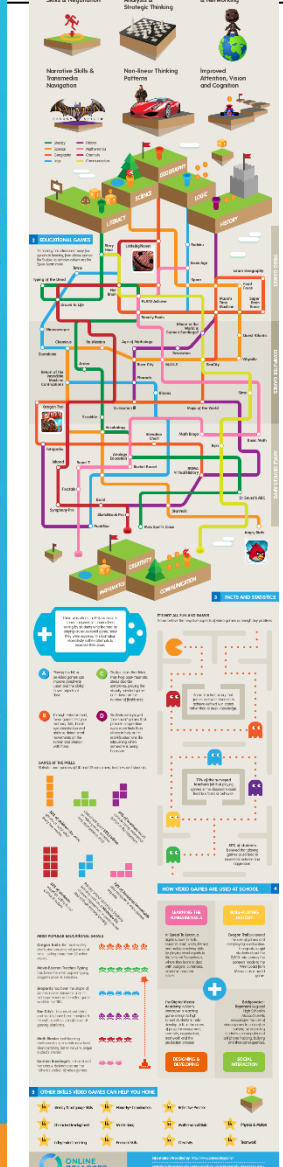
THE STATS ON INTERNET PORNOGRAPHY



SHOPPING AND SHIPPING



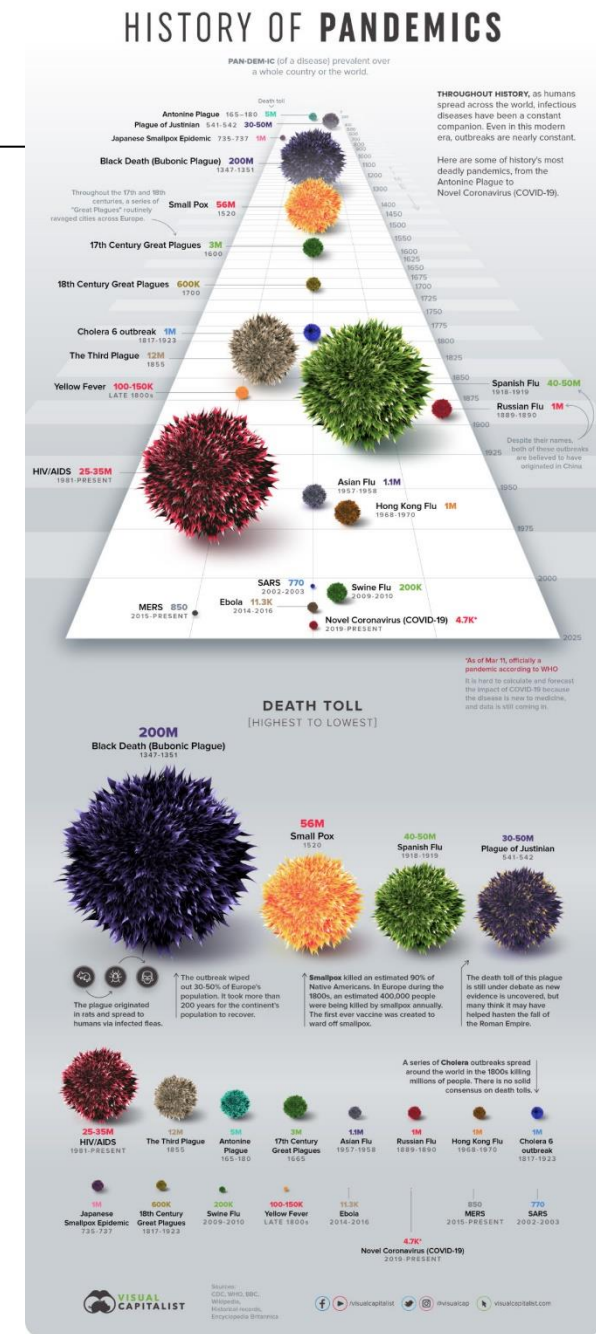
HOW VIDEO GAMES IMPROVE EDUCATION



Infographics

Visualizing the History of Pandemics, March 14, 2020

Name	Time period	Type / Pre-human host	Death toll
Antonine Plague	165-180	Believed to be either smallpox or measles	5M
Japanese smallpox epidemic	735-737	Variola major virus	1M
Plague of Justinian	541-542	Yersinia pestis bacteria / Rats, fleas	30-50M
Black Death	1347-1351	Yersinia pestis bacteria / Rats, fleas	200M
New World Smallpox Outbreak	1520 – onwards	Variola major virus	56M
Great Plague of London	1665	Yersinia pestis bacteria / Rats, fleas	100,000
Italian plague	1629-1631	Yersinia pestis bacteria / Rats, fleas	1M
Cholera Pandemics 1-6	1817-1923	V. cholerae bacteria	1M+
Third Plague	1885	Yersinia pestis bacteria / Rats, fleas	12M (China and India)
Yellow Fever	Late 1800s	Virus / Mosquitoes	100,000-150,000 (U.S.)
Russian Flu	1889-1890	Believed to be H2N2 (avian origin)	1M
Spanish Flu	1918-1919	H1N1 virus / Pigs	40-50M
Asian Flu	1957-1958	H2N2 virus	1.1M
Hong Kong Flu	1968-1970	H3N2 virus	1M
HIV/AIDS	1981-present	Virus / Chimpanzees	25-35M
Swine Flu	2009-2010	H1N1 virus / Pigs	200,000
SARS	2002-2003	Coronavirus / Bats, Civets	770
Ebola	2014-2016	Ebolavirus / Wild animals	11,000
MERS	2015-Present	Coronavirus / Bats, camels	850
COVID-19	2019-	Coronavirus – Unknown (possibly	4,700 (as of Mar 12,



tracking infectiousness

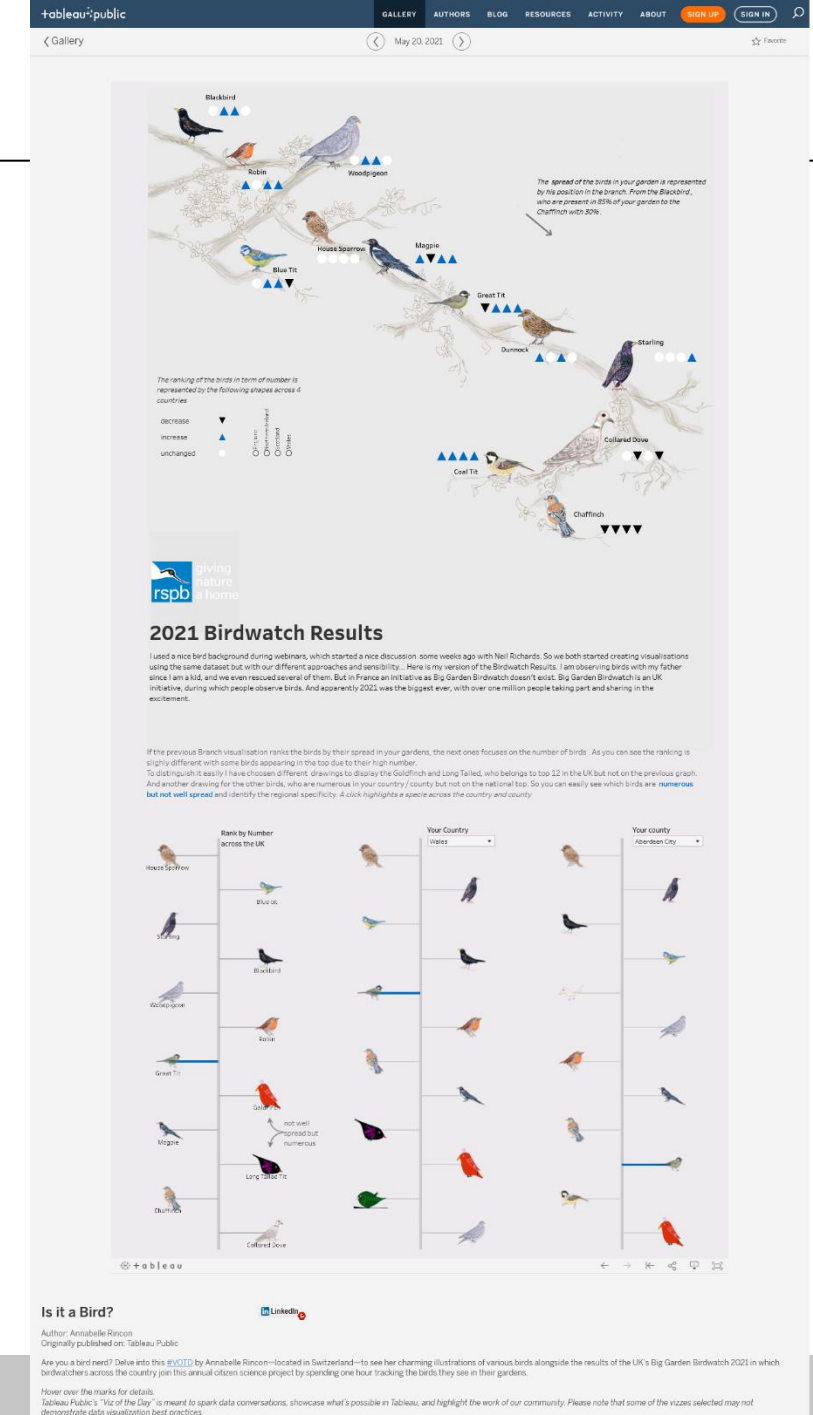
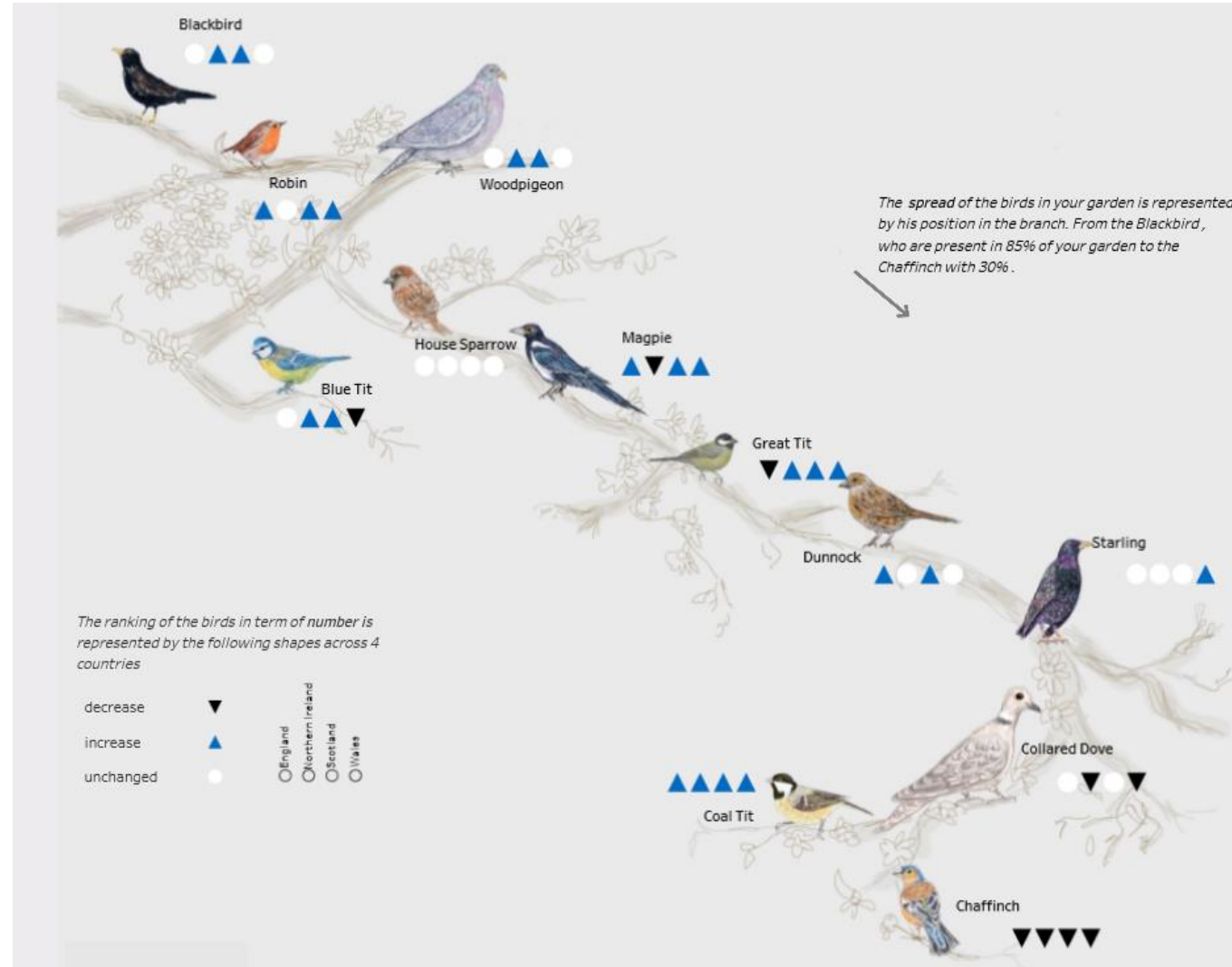
R0 (basic reproduction number) of diseases

A measure of how many people each sick person will infect on average



Infographics

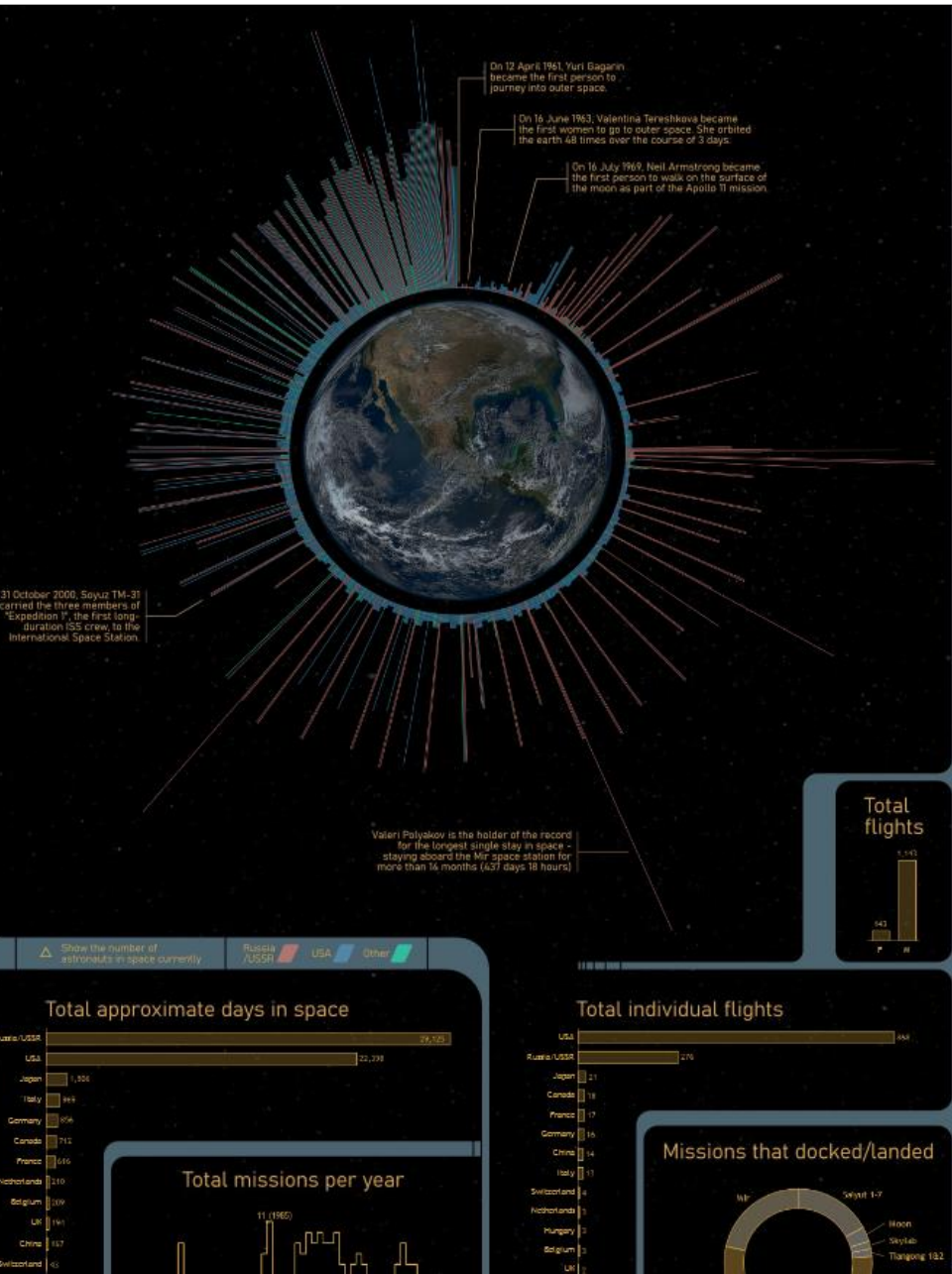
■ Is it a bird?



Infographics... with some interactivity

What does it take
to become an
astronaut?

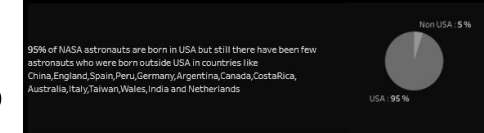
60 Years of
Human Space
Flight



ASTRONAUT

When we are children and the world seems to be filled with infinite and exciting possibilities, we are asked what we wanted to be when we grew up. Different kids had various aspirations such as Doctors, Engineers, Lawyers, Firefighters, Policemen, or The President Of The United States, others wanted to become Astronauts and work for NASA. While becoming an Astronaut is not a cake walk, this viz is to explore those that have become astronauts and to hopefully inspire those that are working to make their space ambitions into a reality. We will look at the Age group, Graduate majors, Military rank, Military branch, Gender, Country, Schools.

Note: The analysis is done on summary data and the sankey charts are built on % share based data. Granular details like astronaut names are not captured and also only top 5 values for certain metrics are considered for charts.



Which Military Rank?

Higher the ranking in military greater is your chance to become an astronaut



Which Military Branch?

US Air Force and US Navy produce the most astronauts of all the military branches



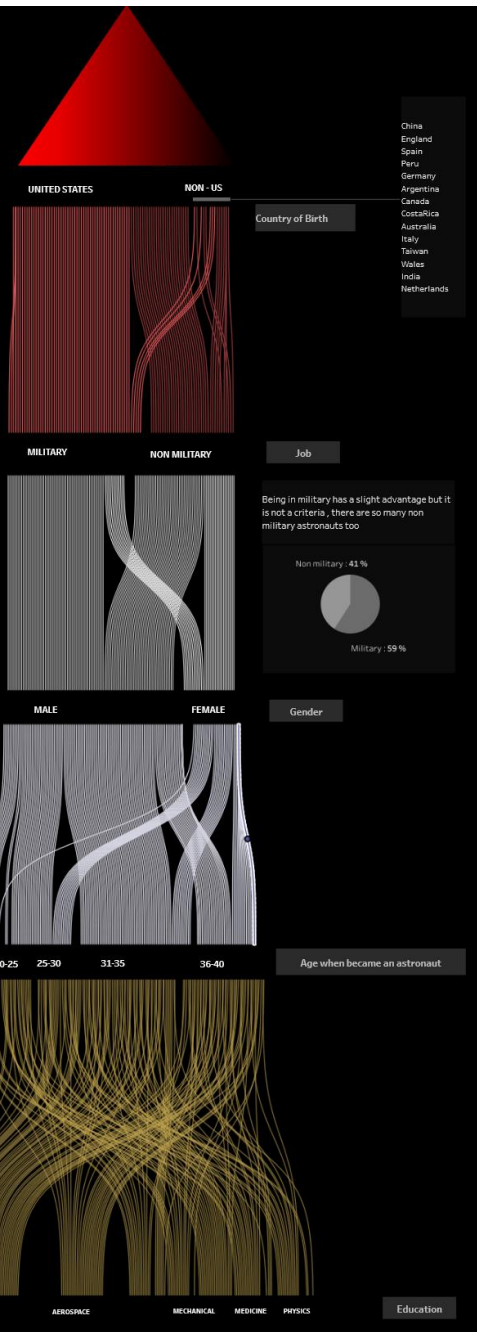
Which Gender?

Most of the NASA astronauts are Male but females do not be discouraged, pursue and close the gap.



Most astronauts come from these schools

As we can see the US Naval Academy & the US Air Force Academy produced the most Astronauts. Purdue University and the Massachusetts Institute of Technology trailing right behind.

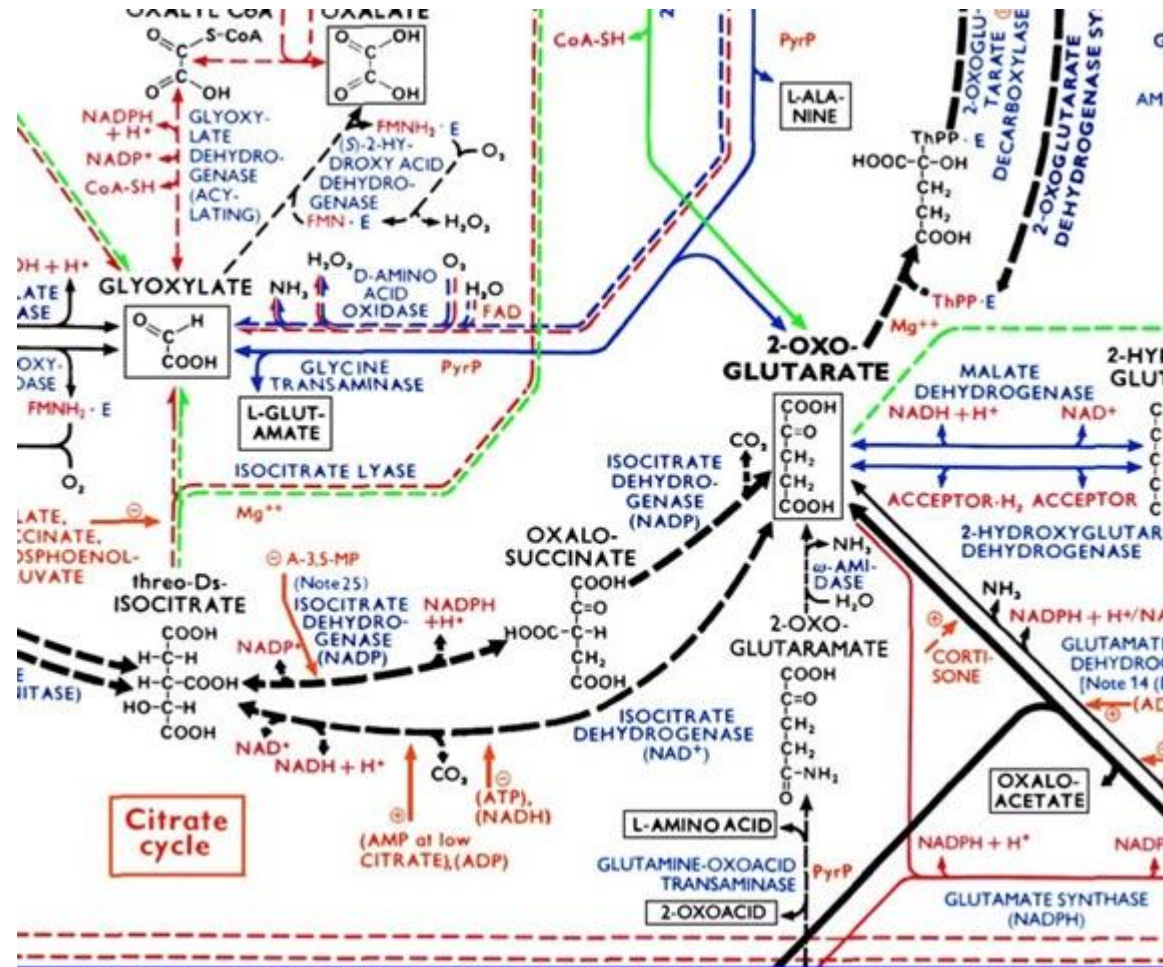


DataVis vs. Infographics

	Data Visualization	Infographic
Method of generation	More numbers used	Original images created
Quantity of data	More data	Less data, more conclusions
Degree of aesthetic treatment	Less artful, more focused on information itself	More artful
Interactive vs. static	Interactive (data changes)	Static (data remains fixed)

DataVis examples

■ Chemistry



DataVis examples

- NSFNET T1 backbone traffic (09/1991)



- purple=0 bytes ... white=100 billion bytes

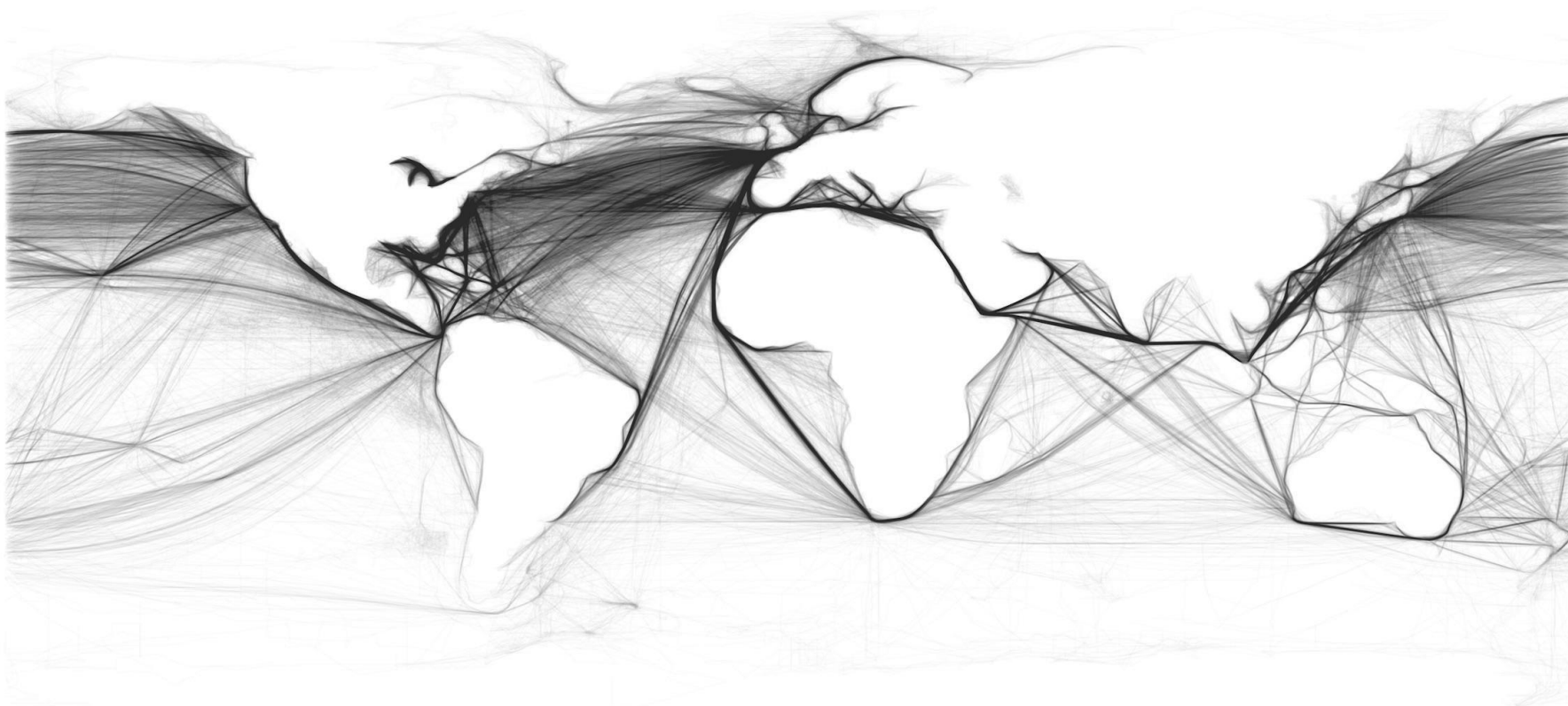
DataVis examples

- Facebook “friendships” visualized (December 2010 – sample of 10m. pairs)



DataVis examples

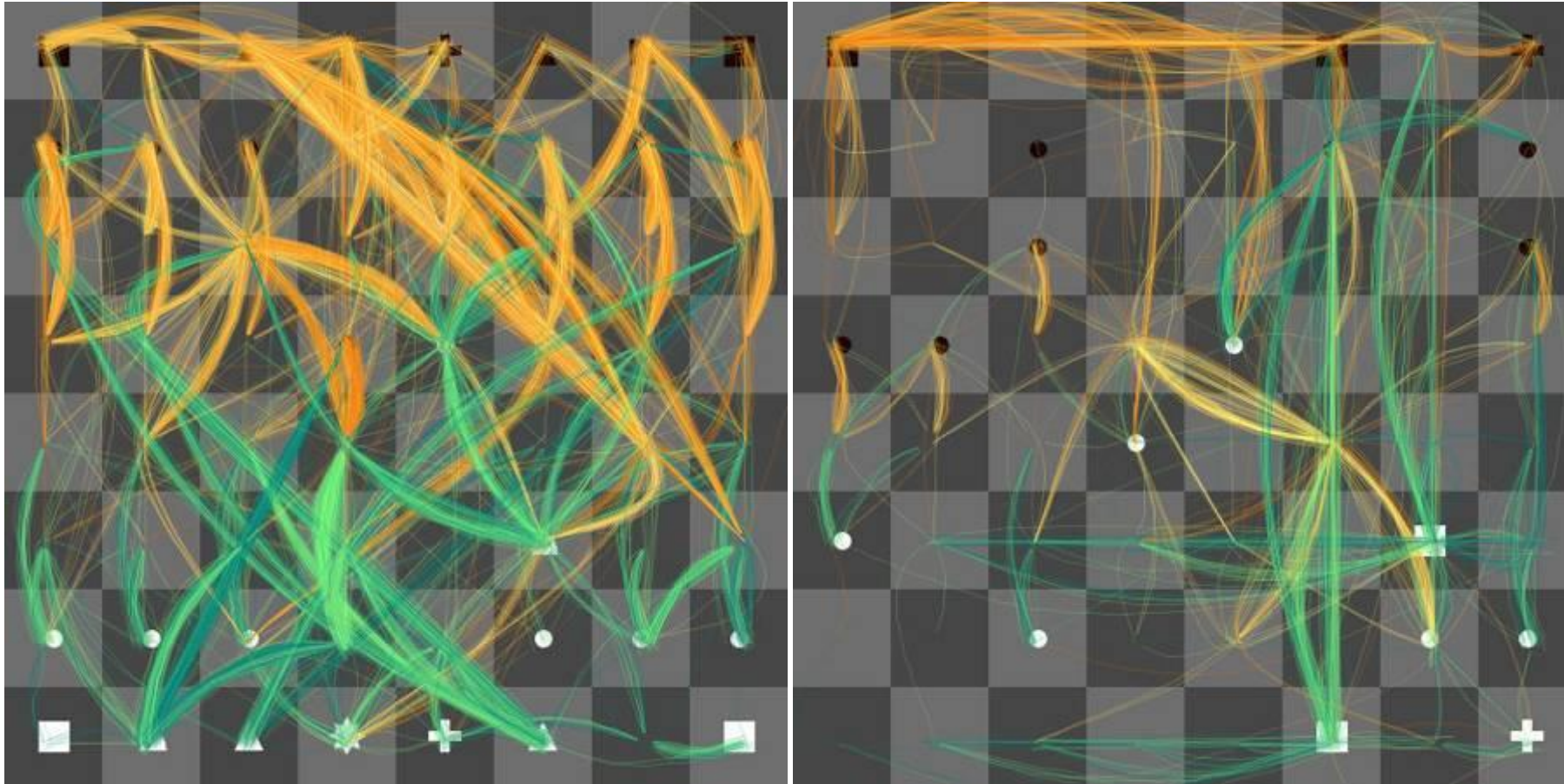
- Οι κινήσεις καραβιών μέσα από τα ημερολόγια (φύλλα πορείας) τους, από το 1945



[https://www.reddit.com/r/MapPorn/comments/dmkkpe/this map is drawn entirely from shipping logs/](https://www.reddit.com/r/MapPorn/comments/dmkkpe/this_map_is_drawn_entirely_from_shipping_logs/)

DataVis examples

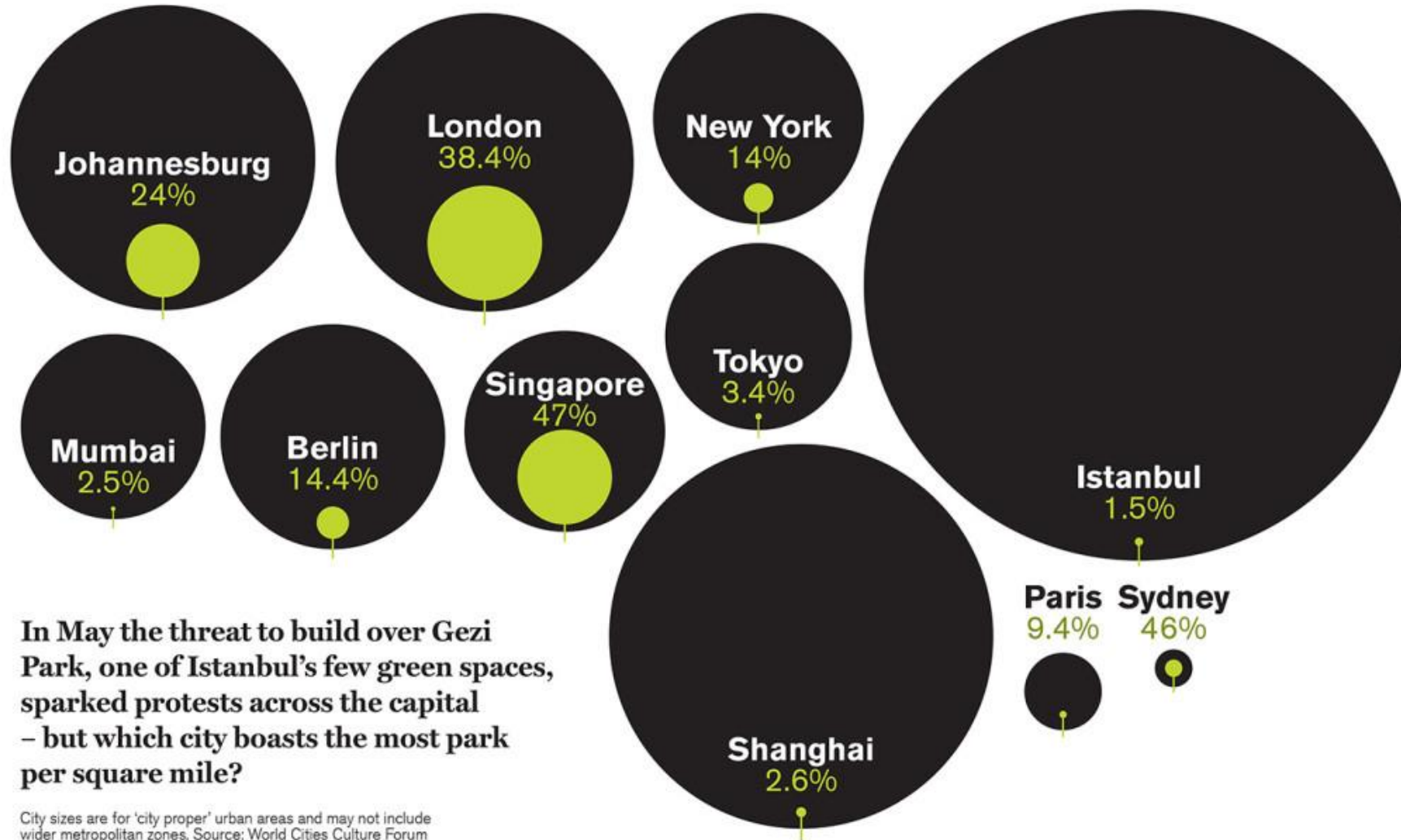
- Possible moves in a game of chess



<http://turbulence.org/spotlight/thinking/method.html>

DataVis examples

Park life



DataVis examples: OneZoom tree of life explorer

What is the tree of life?

The tree of life shows how all life on earth is related. Each leaf represents a different species. The branches show how these many species evolved from common ancestors over billions of years. In our interactive tree of life you can explore the relationships between **2,235,076** species and wonder at **105,378** images on a single zoomable page.

2,235,076
species

105,378
images

[Find out more](#)

Popular places to start exploring...



Frogs and toads

Orchids

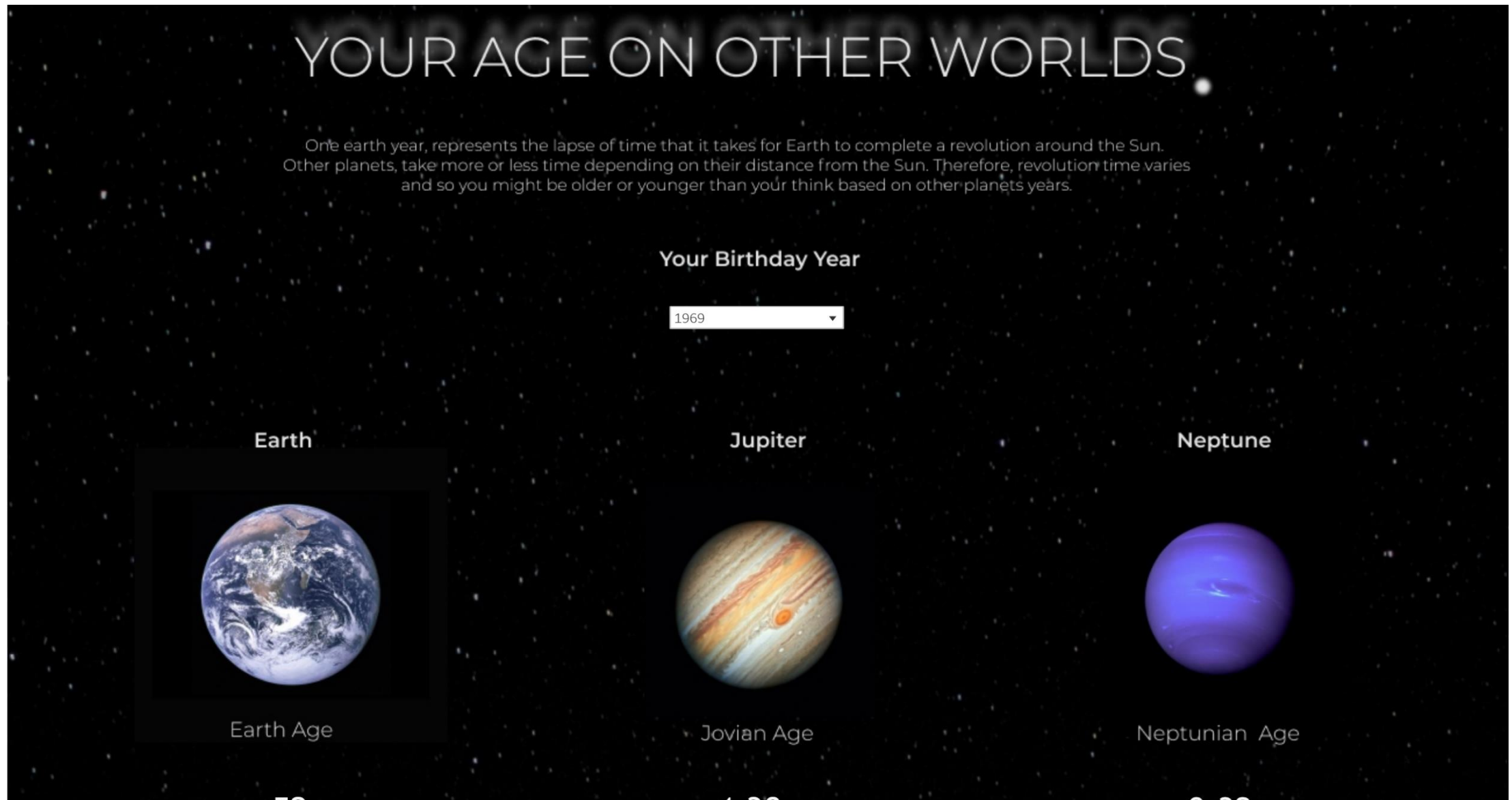
Owls, barn owls

Butterflies and
moths

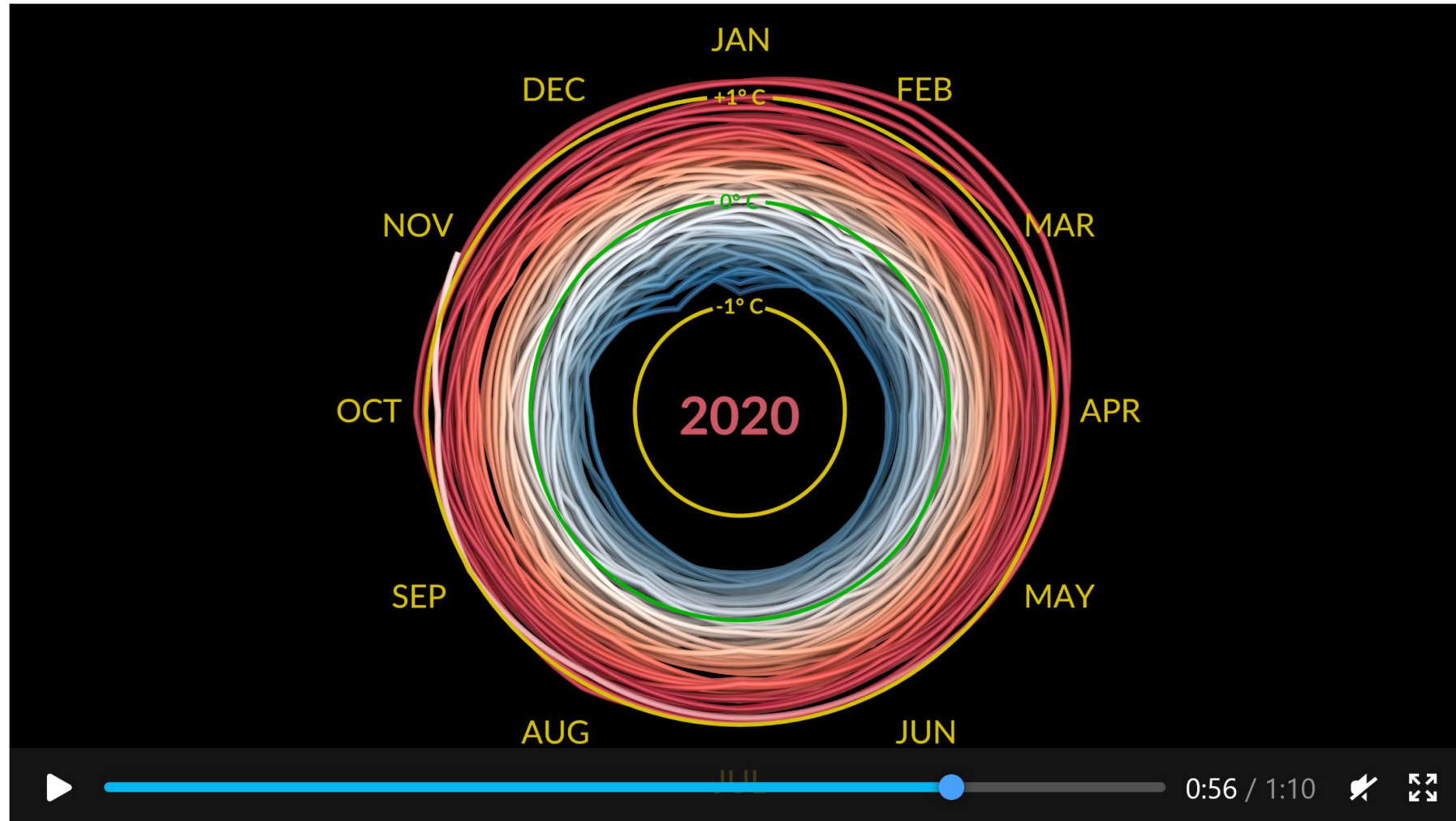
[Start at the origin of life](#)



DataVis examples



Animation –example of powerfully and simply conveying a message



NASA Climate Change, <https://svs.gsfc.nasa.gov/4975>

DataVis examples

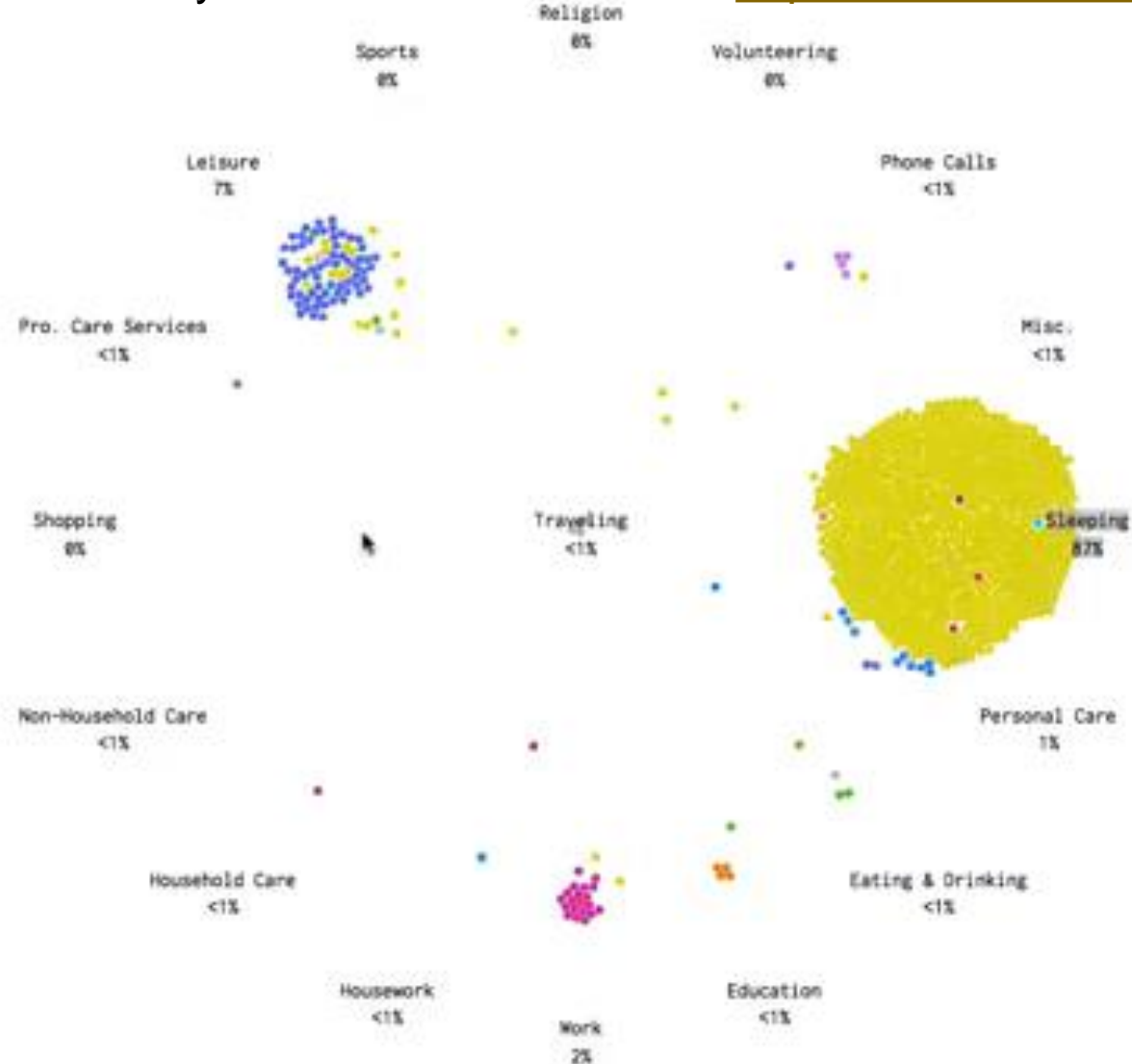
12:33am

SLOW MEDIUM FAST

Goodnight. More than 80% of people are asleep and it peaks at 96% around 3:00am.

This is a simulation of 1,000 people's average day. It's based on 2014 data from the American Time Use Survey, made way more accessible by the ATUS Extract Builder.

A Day in the Life of Americans <https://lnkd.in/dTb5Xhf>



Maps - examples

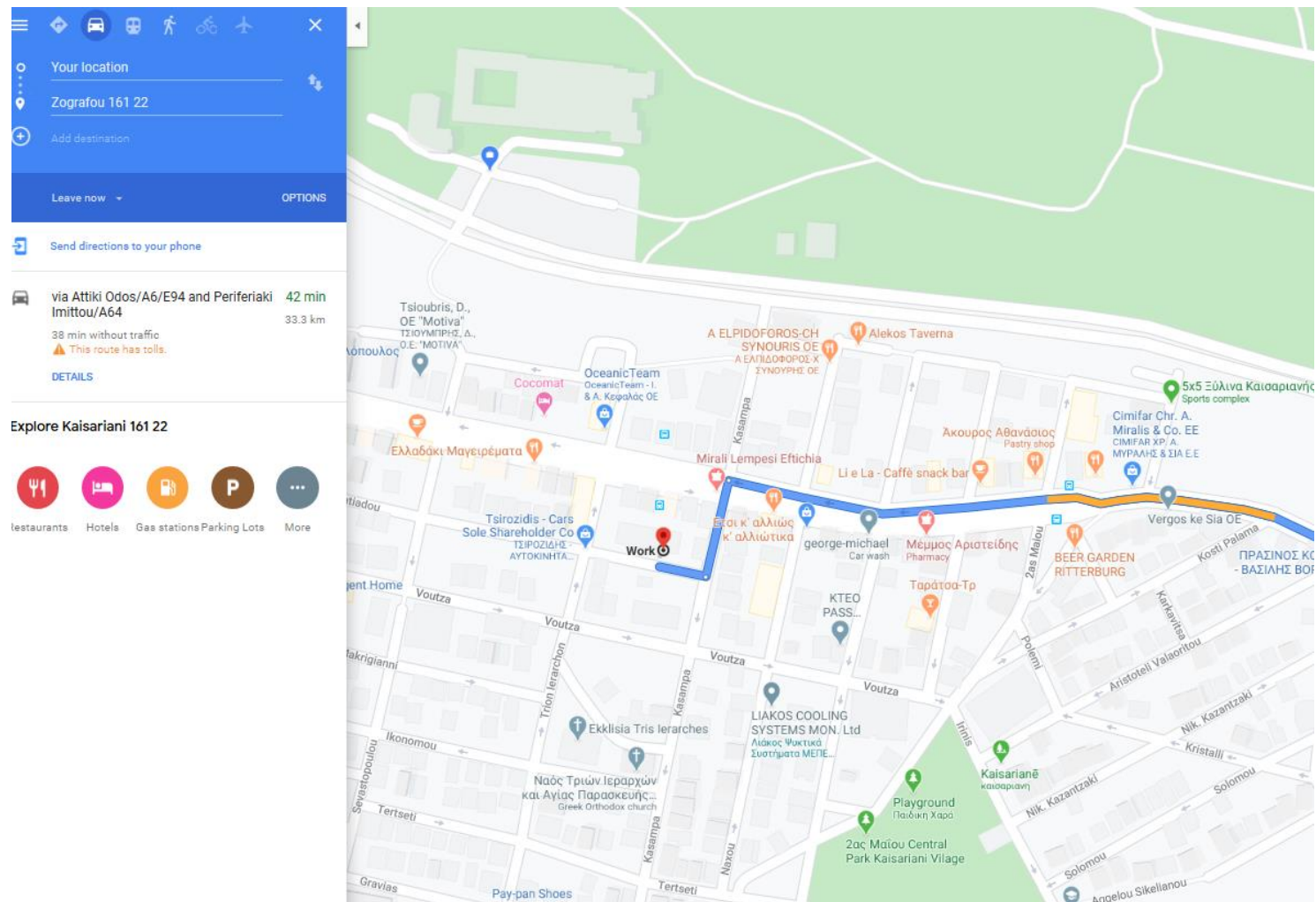
- Geographic maps
- Cartograms

- online map services



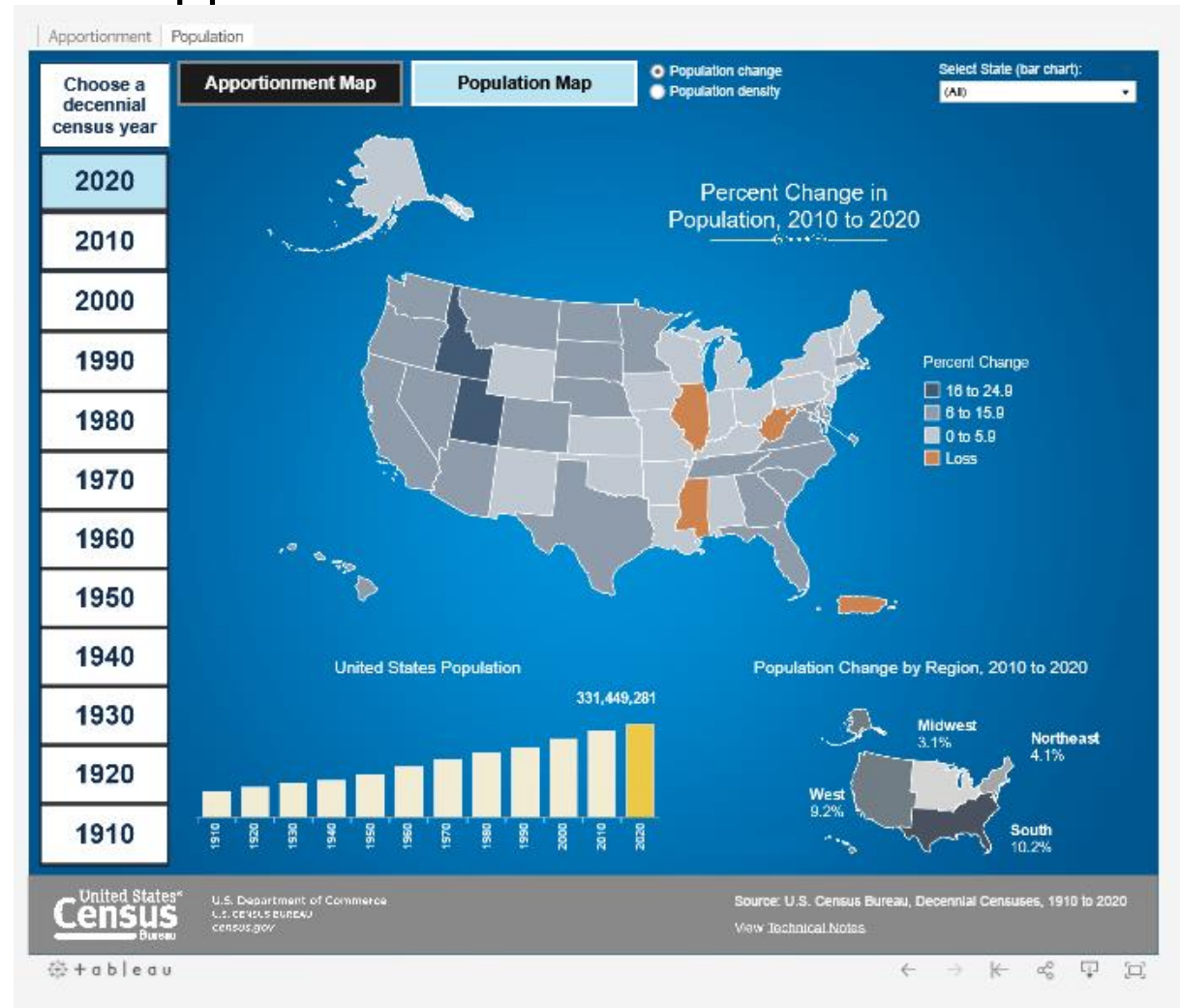
DataVis examples

- Google Maps



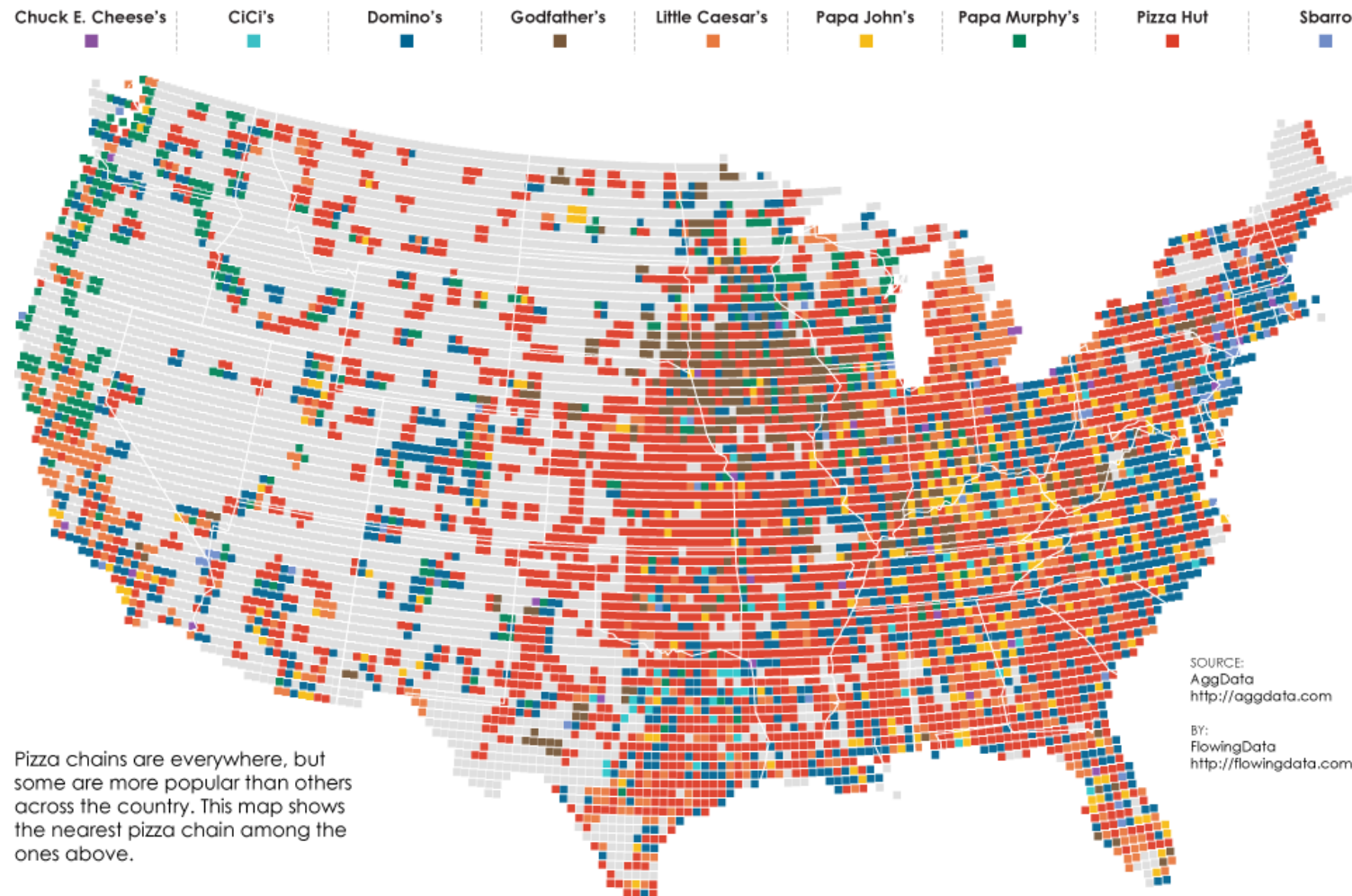
DataVis examples

- Historical population and apportionment in the USA



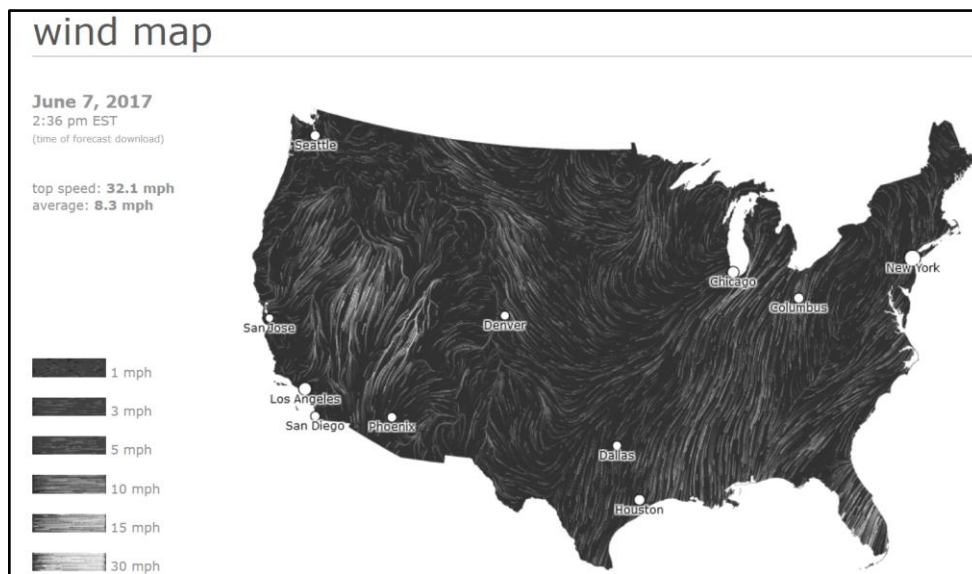
DataVis examples

- Pizza restaurant chains in the USA

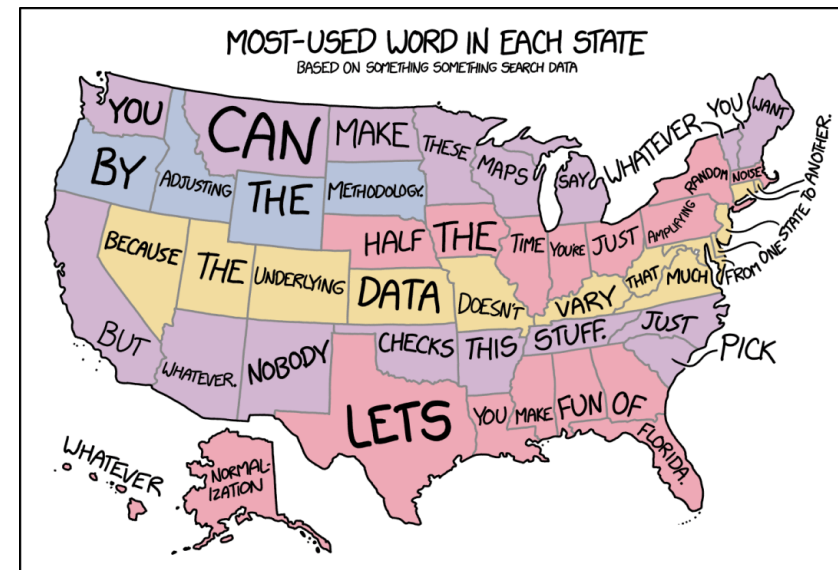


DataVis examples

- Places & Spaces: mapping science



<http://hint.fm/wind/>

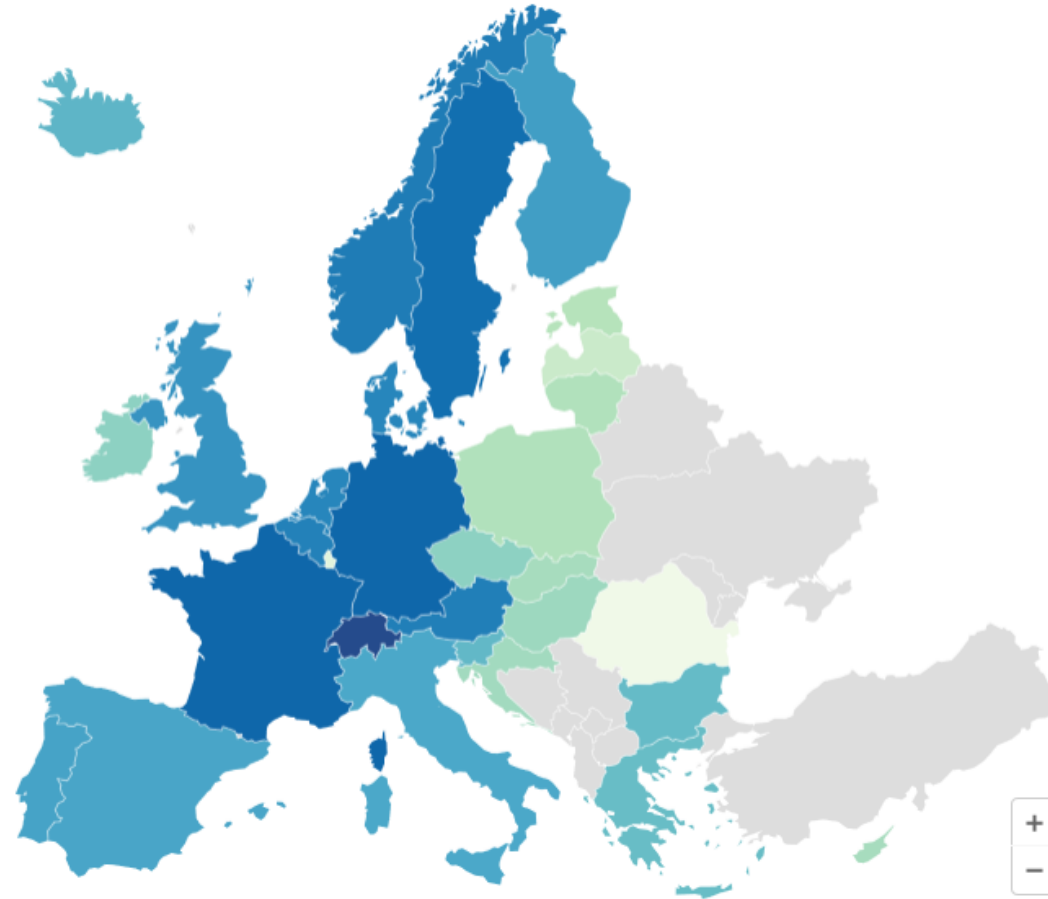


Less is more

- Interactive maps

European healthcare spending by country

Expenditure as a percentage of GDP



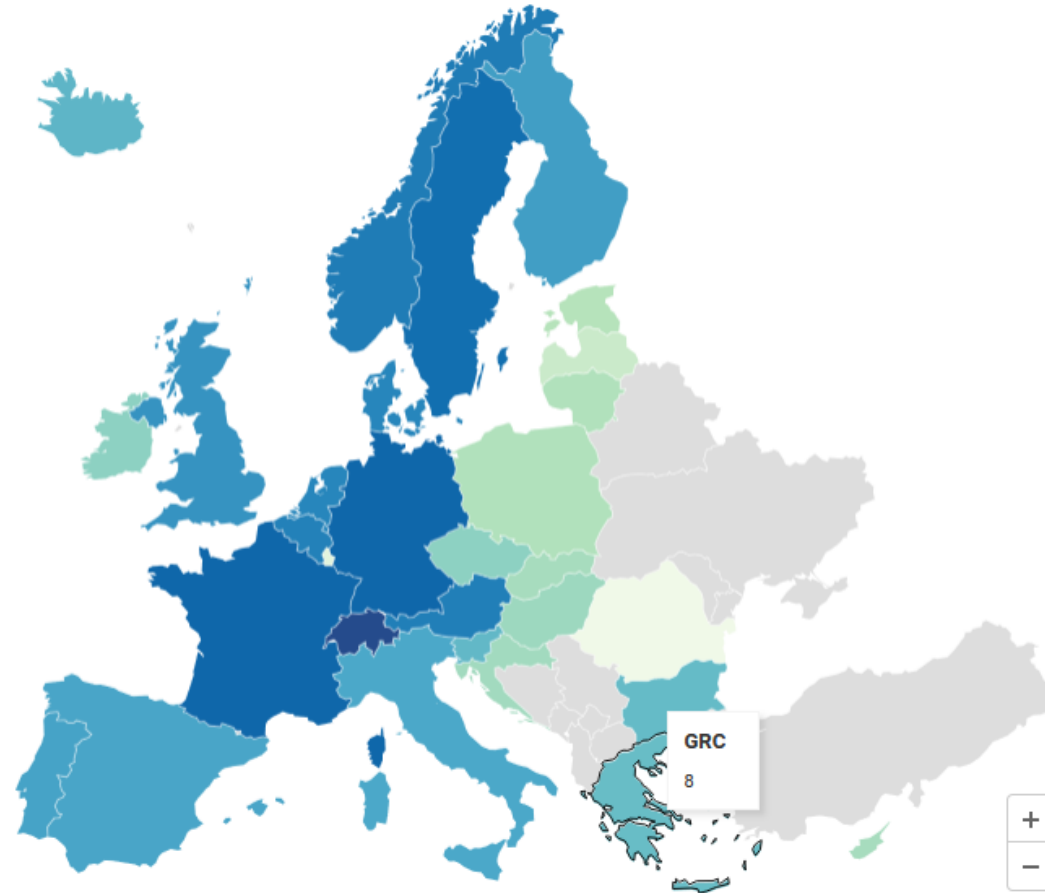
Map: The Local Creative Studio • Source: Eurostat, 2017 figures (published in April 2020) • [Get the data](#) • Created with [Datawrapper](#)

Less is more

- Interactive maps

European healthcare spending by country

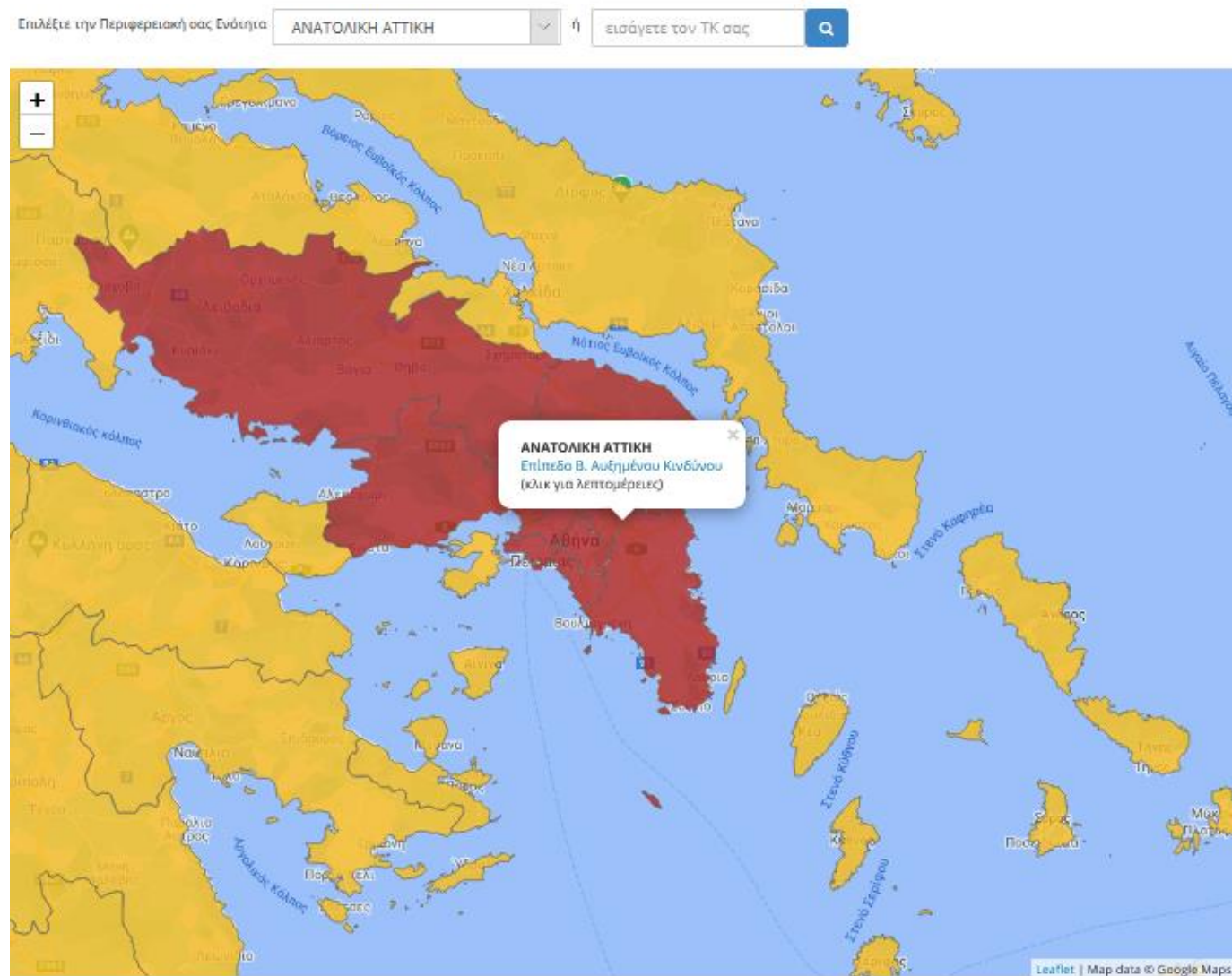
Expenditure as a percentage of GDP



Map: The Local Creative Studio • Source: Eurostat, 2017 figures (published in April 2020) • [Get the data](#) • Created with [Datawrapper](#)

Less is more

- Interactive maps

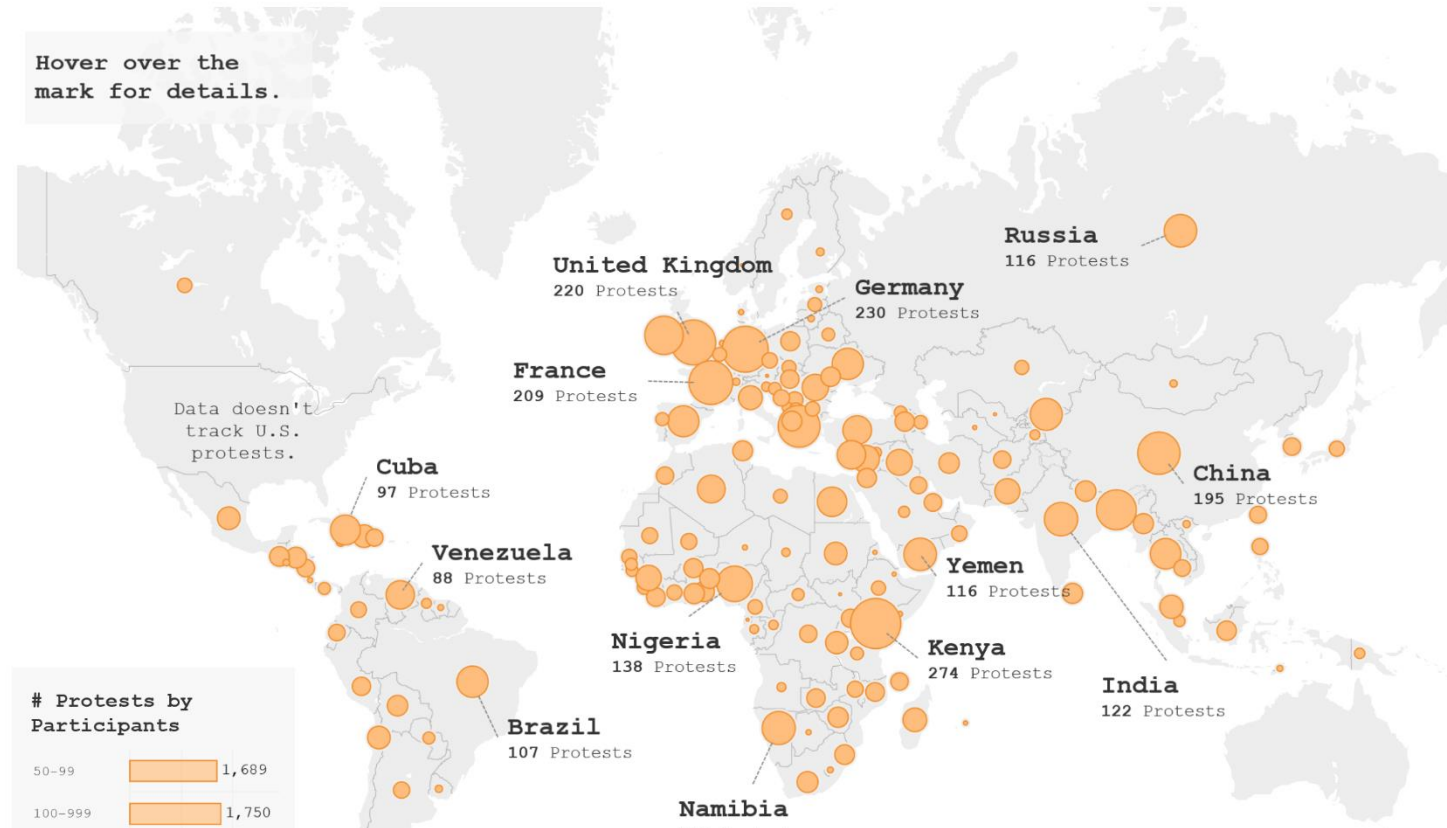


Bubble chart on map

GLOBAL DEMONSTRATIONS & PROTESTS 2010-2020

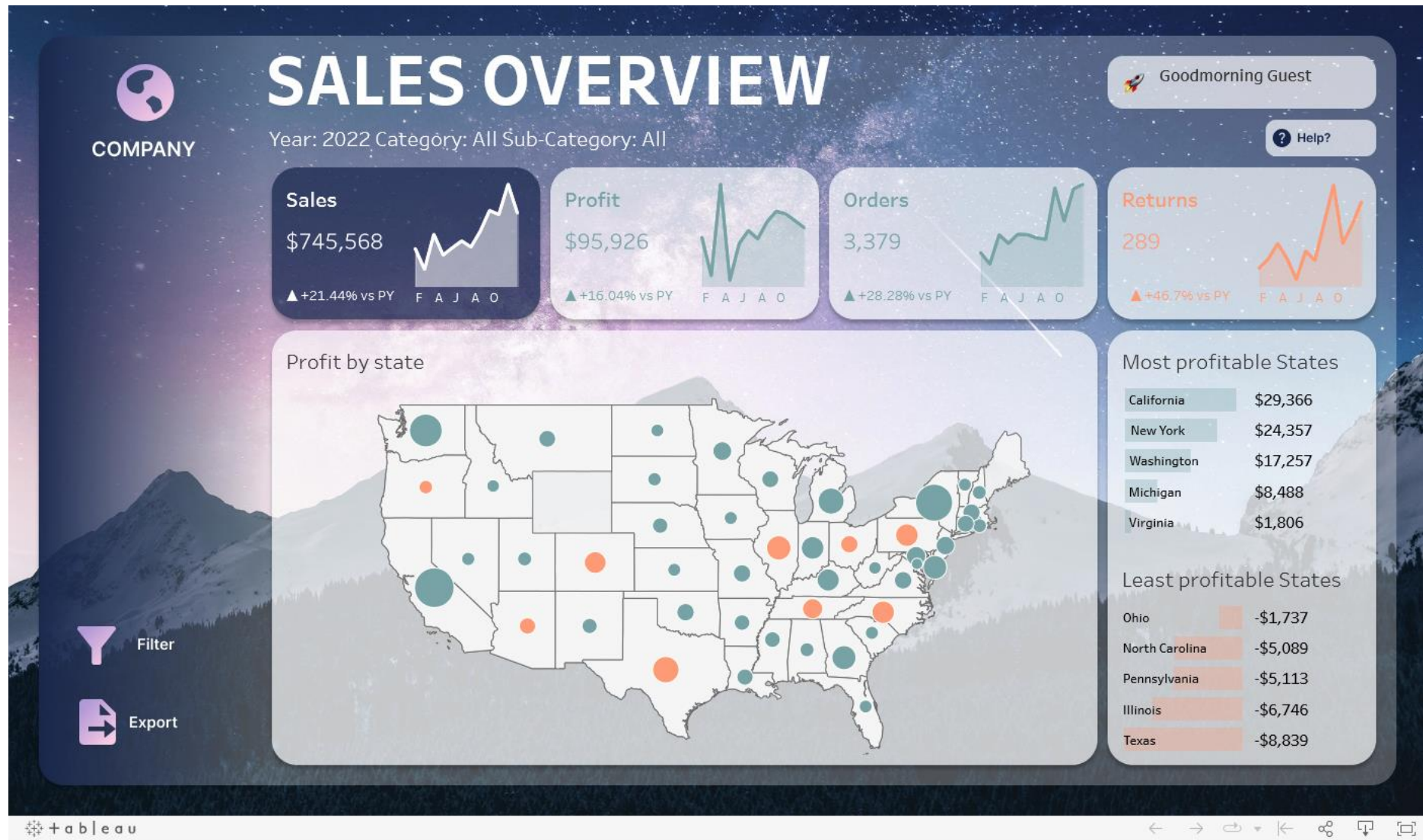
from the government. The data only captures protests targeted at the state or state policies within a single country and excludes those targeting policies of other countries.
Data does not include inter-communal demonstrations and rebel attacks or other types of armed resistance to the state.

Hover over the
mark for details.



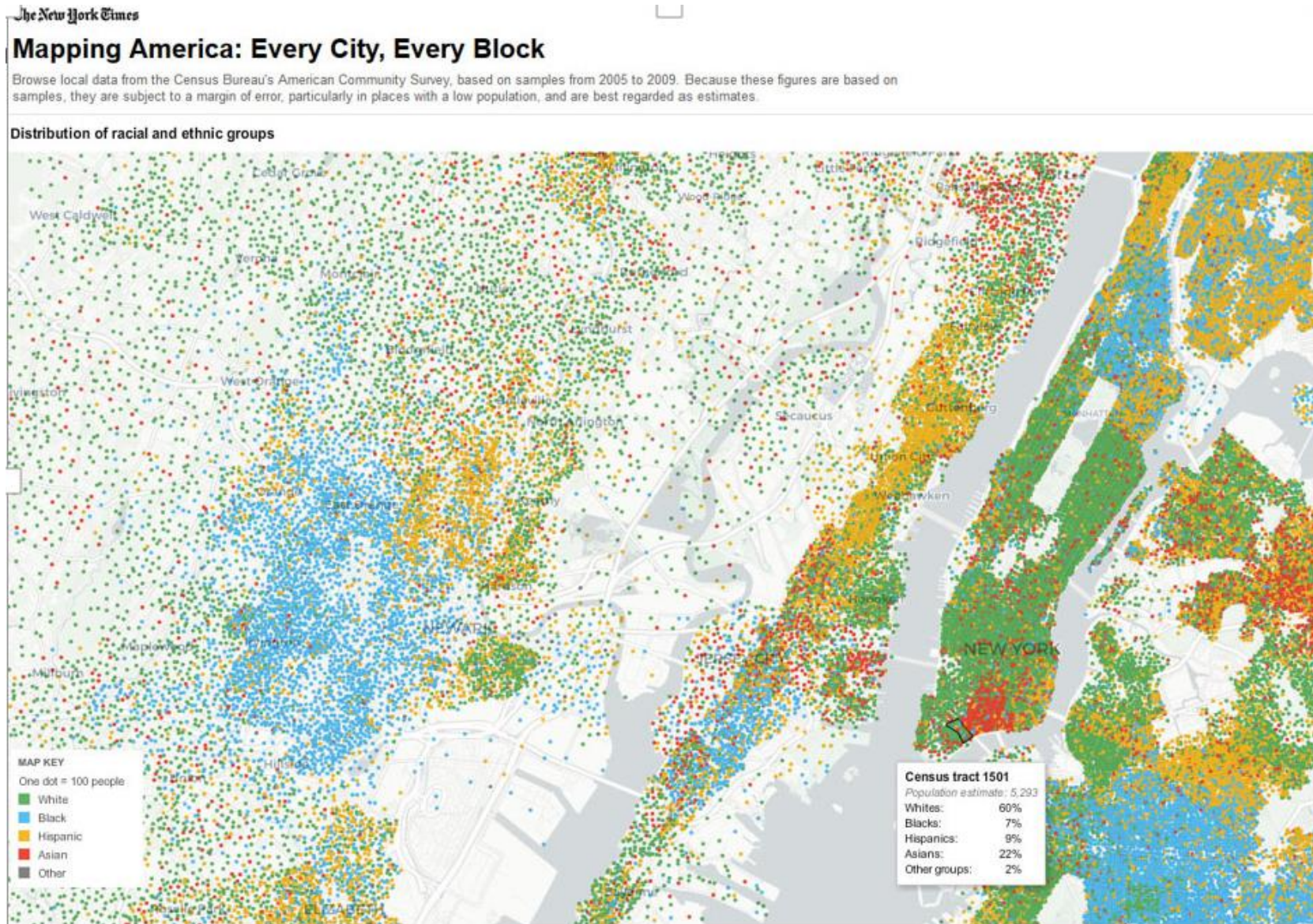
<https://public.tableau.com/app/profile/m.azhar/viz/GlobalDemonstrationsandProtests/Dashboard1>

Bubble chart on map



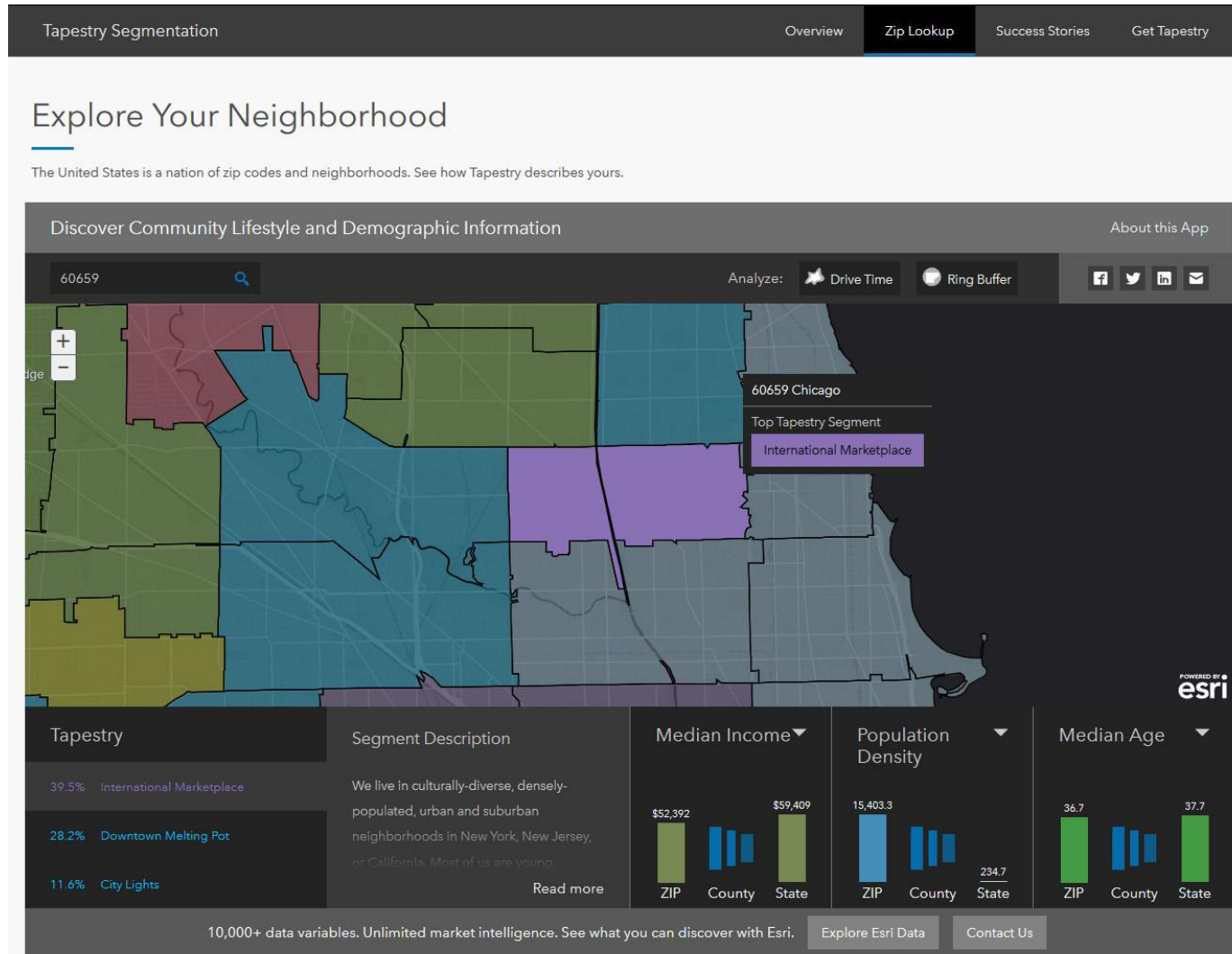
<https://public.tableau.com/app/profile/joris.van.den.berg/viz/SunCycleSalesDashboard/SunCycleSalesDashboard>

DataVis examples



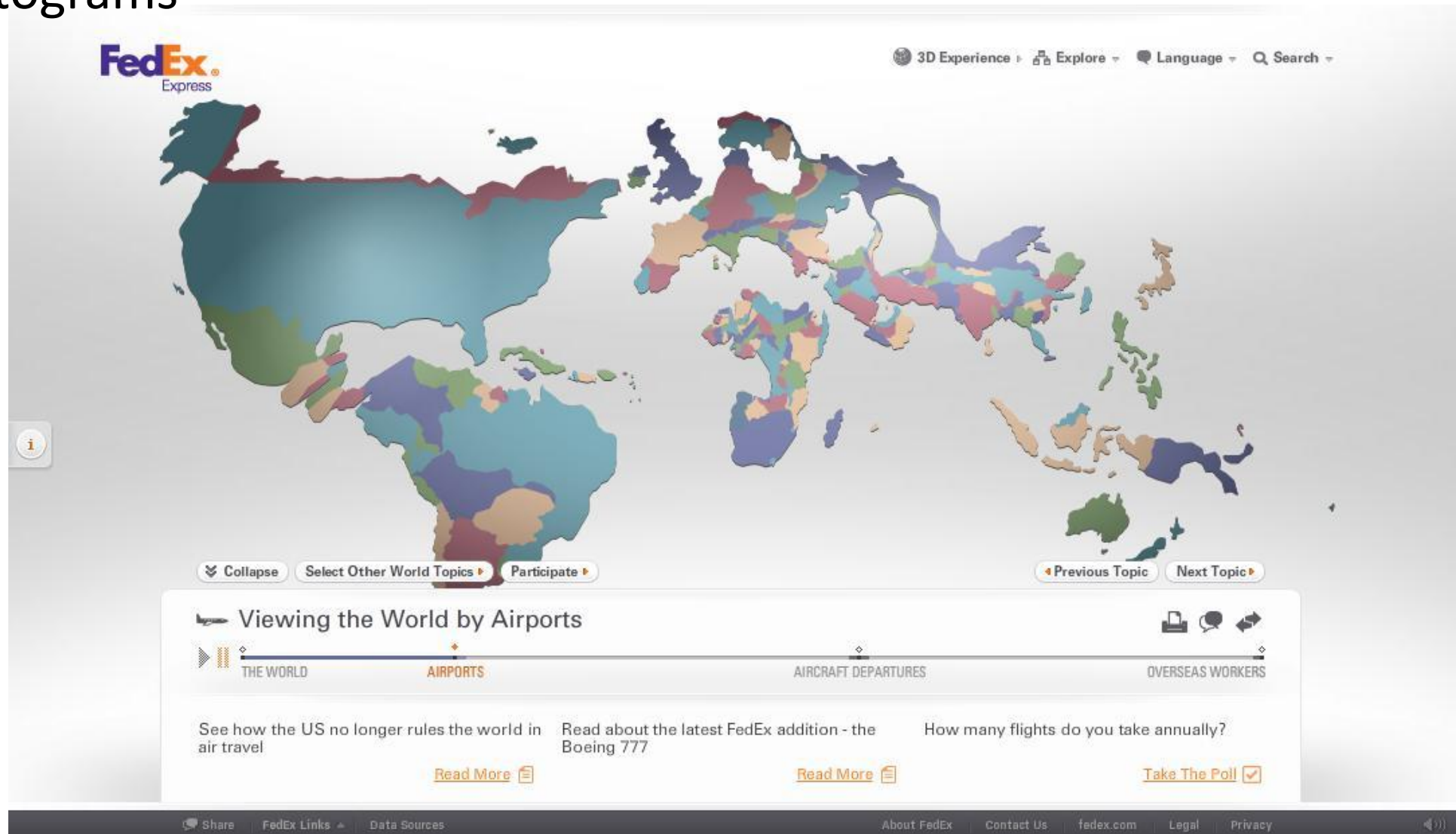
DataVis examples

- Explore Your Neighborhood



DataVis examples

- cartograms



DataVis examples

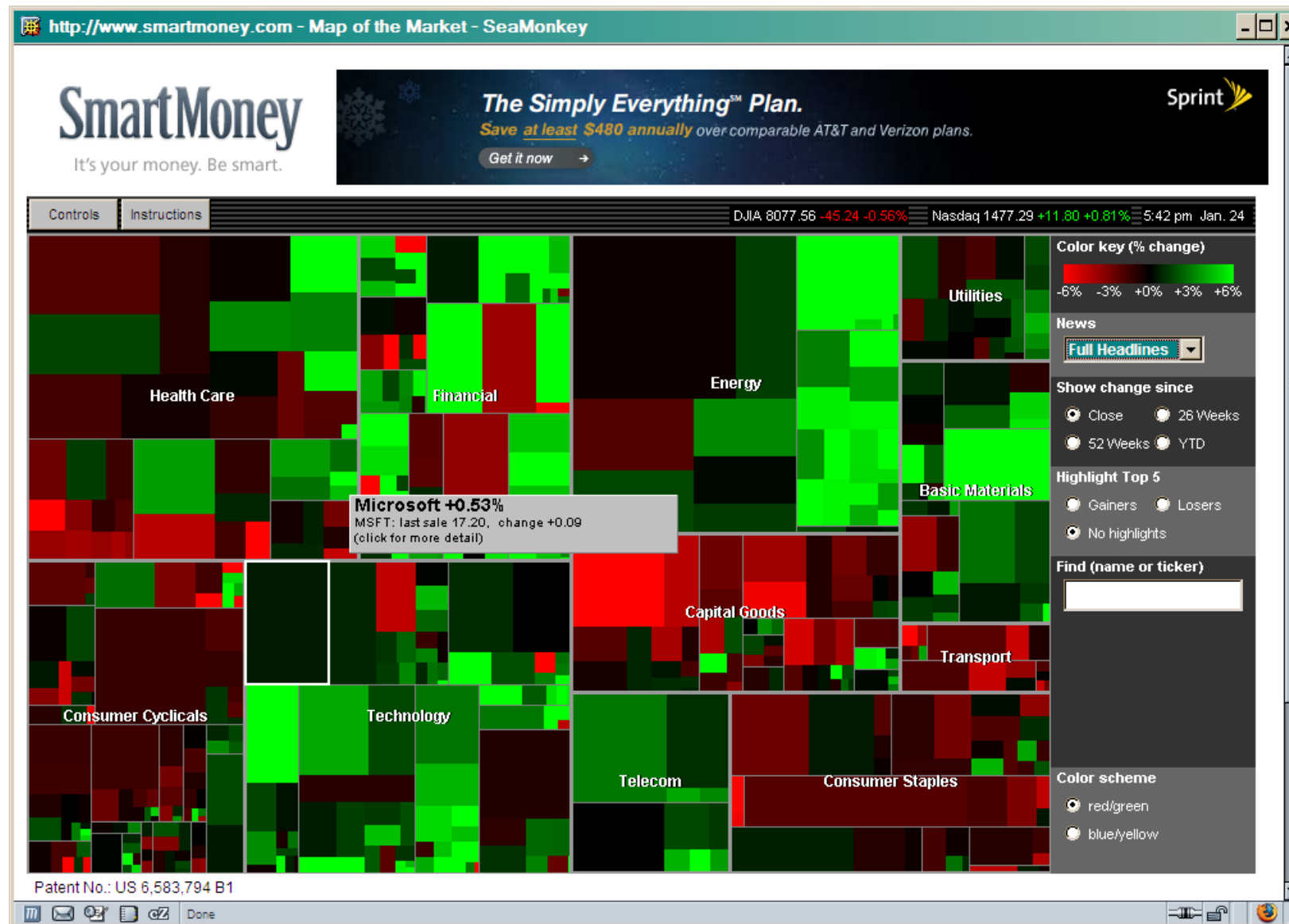
- cartograms



Maps - examples

- treemaps

DataVis examples



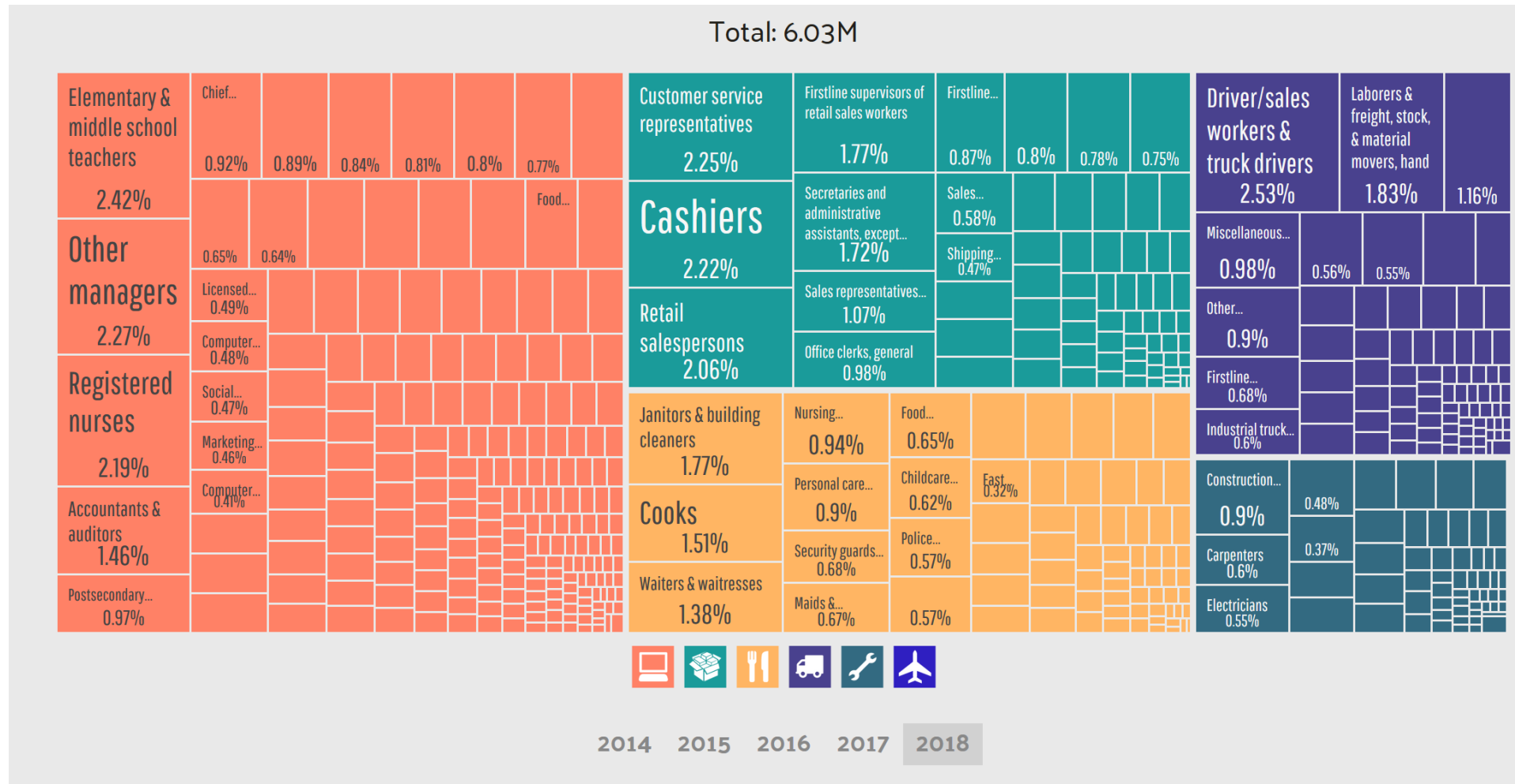
DataVis examples



<http://www.naftemporiki.gr/finance/treeMap?data=turnover&market=ATH&type=market>

DataVis examples

- https://datausa.io/profile/geo/illinois#category_occupations



DataVis examples

- News headlines categorized



<http://newsmap.jp/>

Interactivity - examples

- Charts
 - line charts
 - bar charts
 - pie charts
 - bubble charts
 - scatterplots
 - time series plots, timelines
 - spider/radar charts
 - box and whisker diagrams / charts
- Interactivity
 - Queries, filtering, selection, etc.

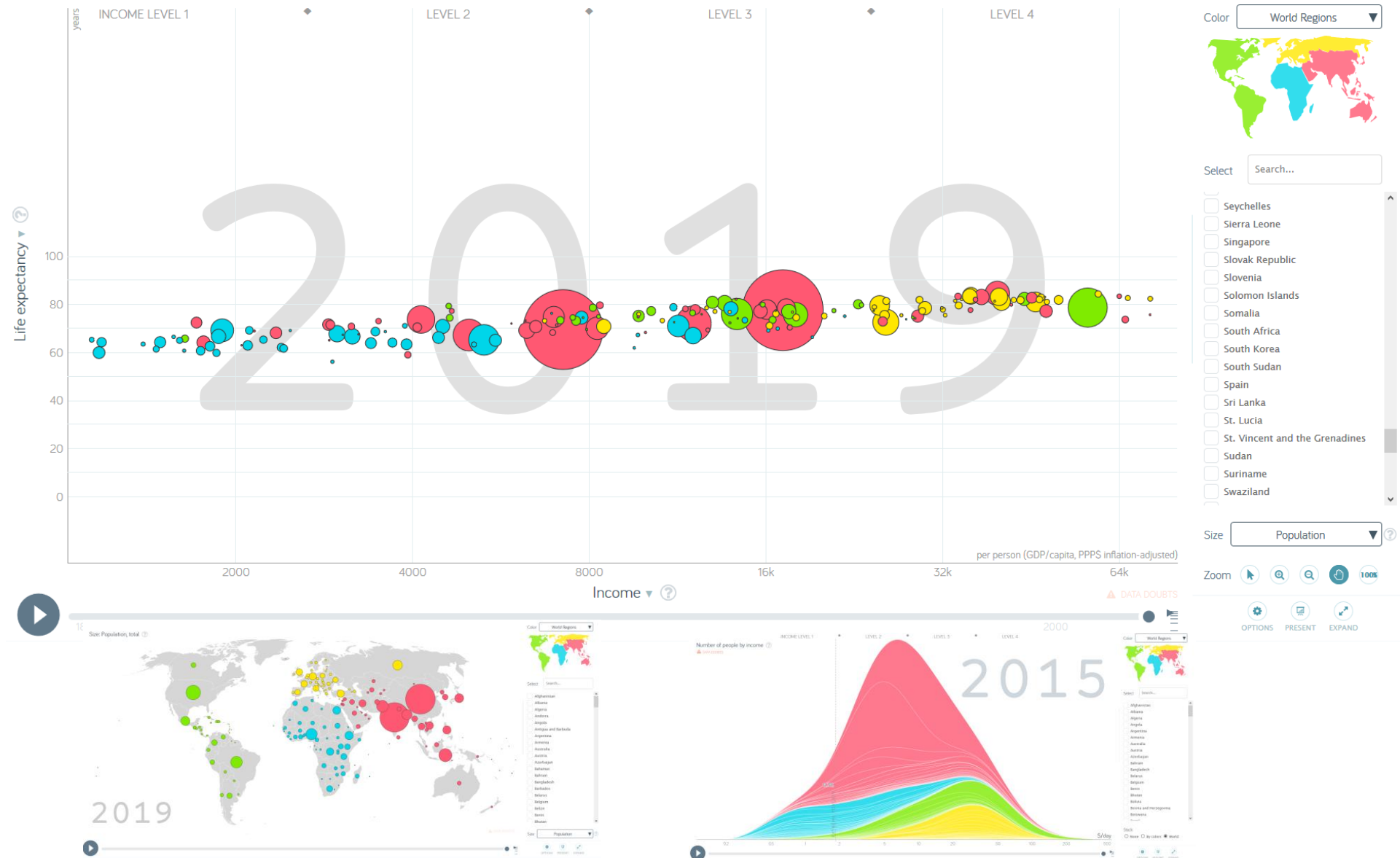
DataVis examples

- Homefinder (DC) real estate
 - The city is within the diamond shape
 - Houses on sale shown as yellow dots



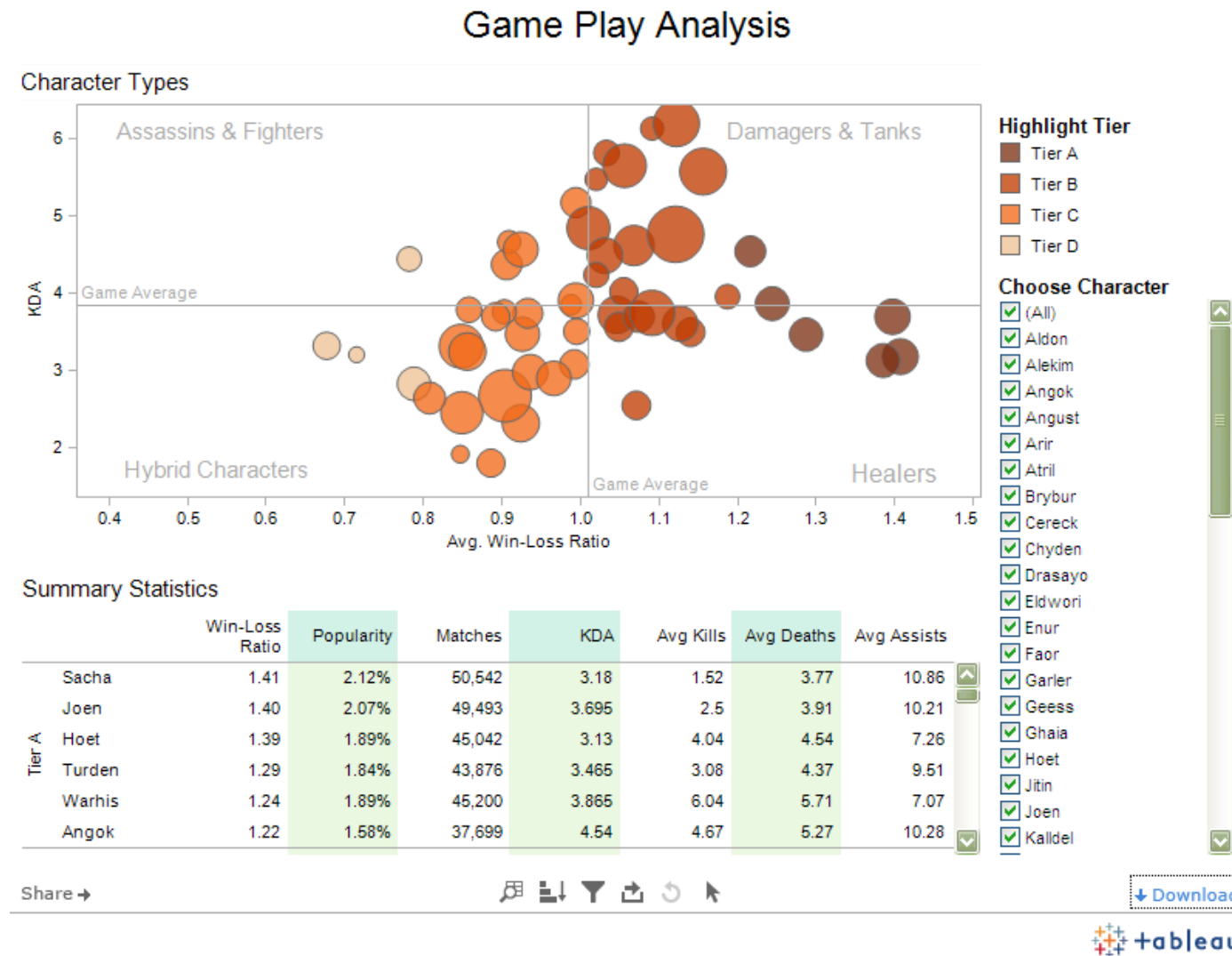
In Card et al. (1999)

DataVis examples – bubble charts



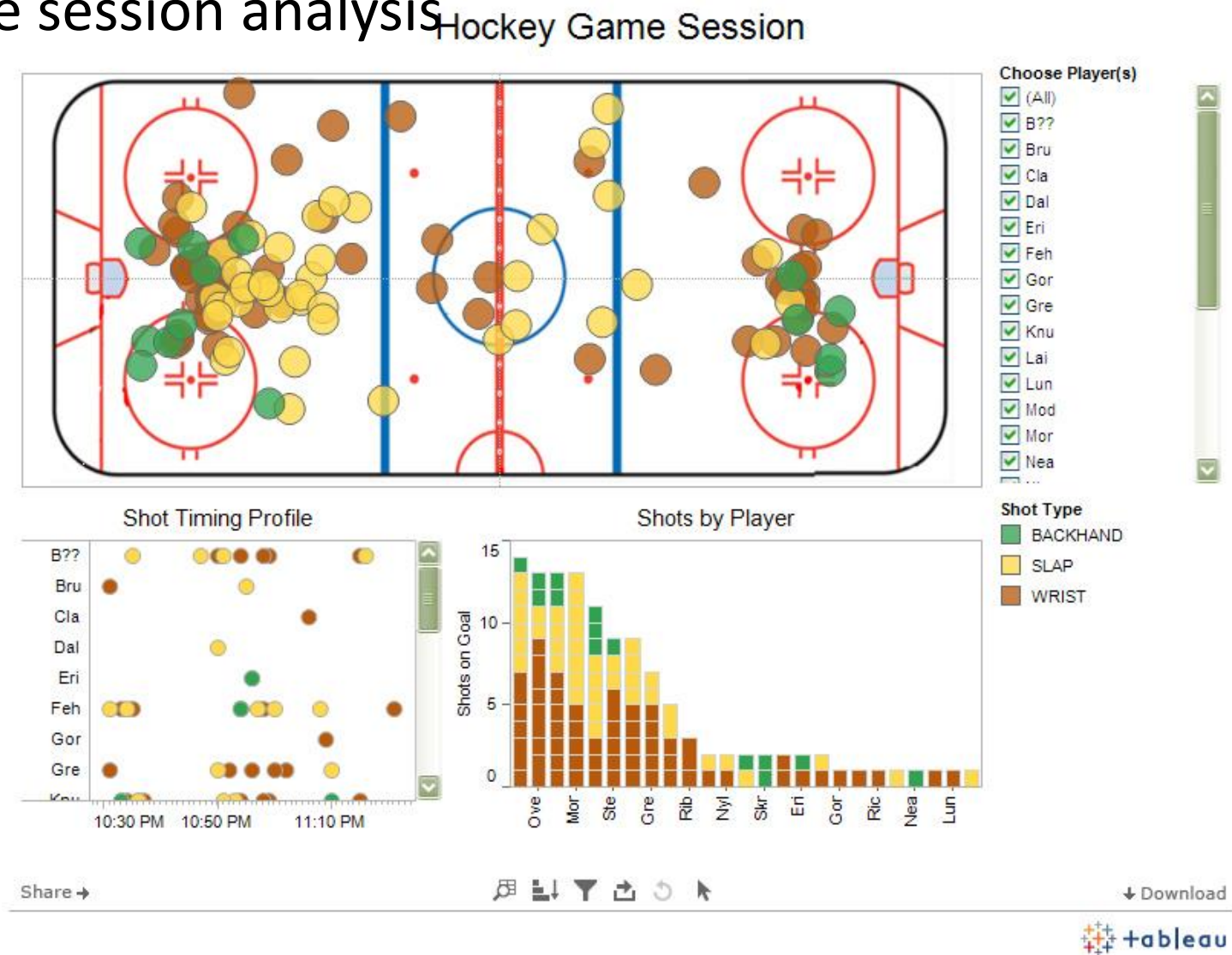
DataVis examples

- Game play analysis between characters of a game



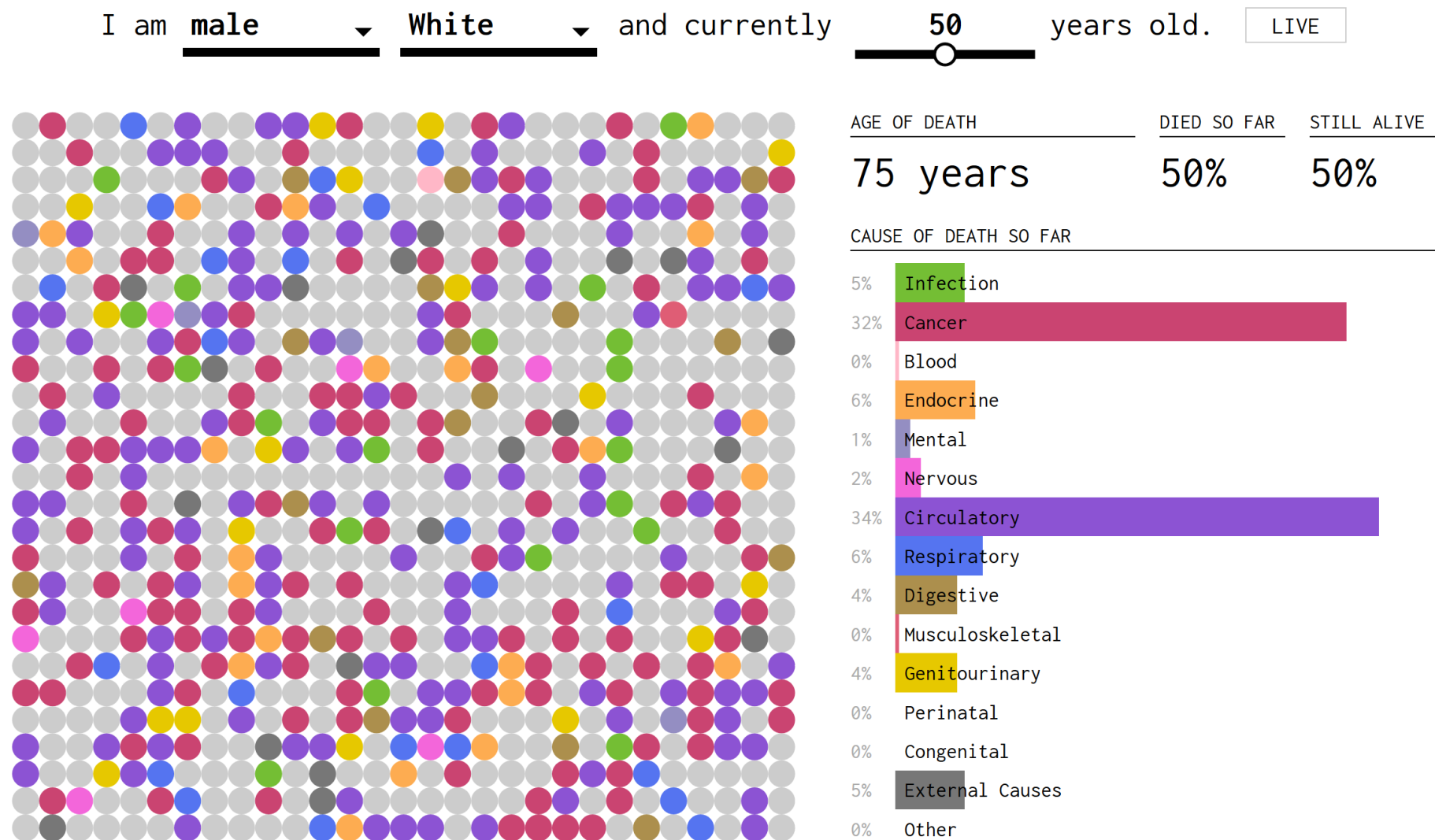
DataVis examples

■ Hockey game session analysis



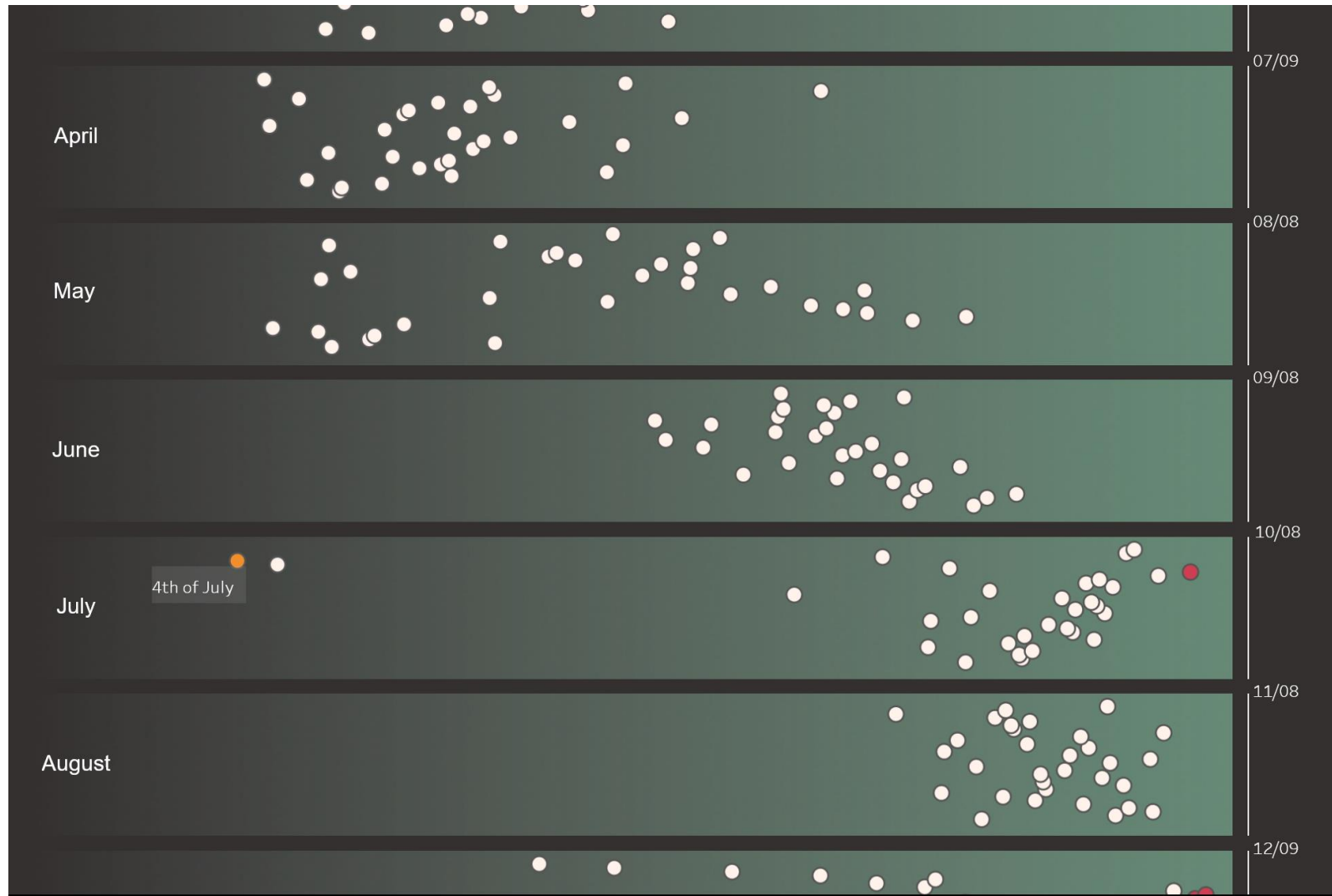
DataVis examples

- How You Will Die: # of people who died in the USA, 1999 - 2014



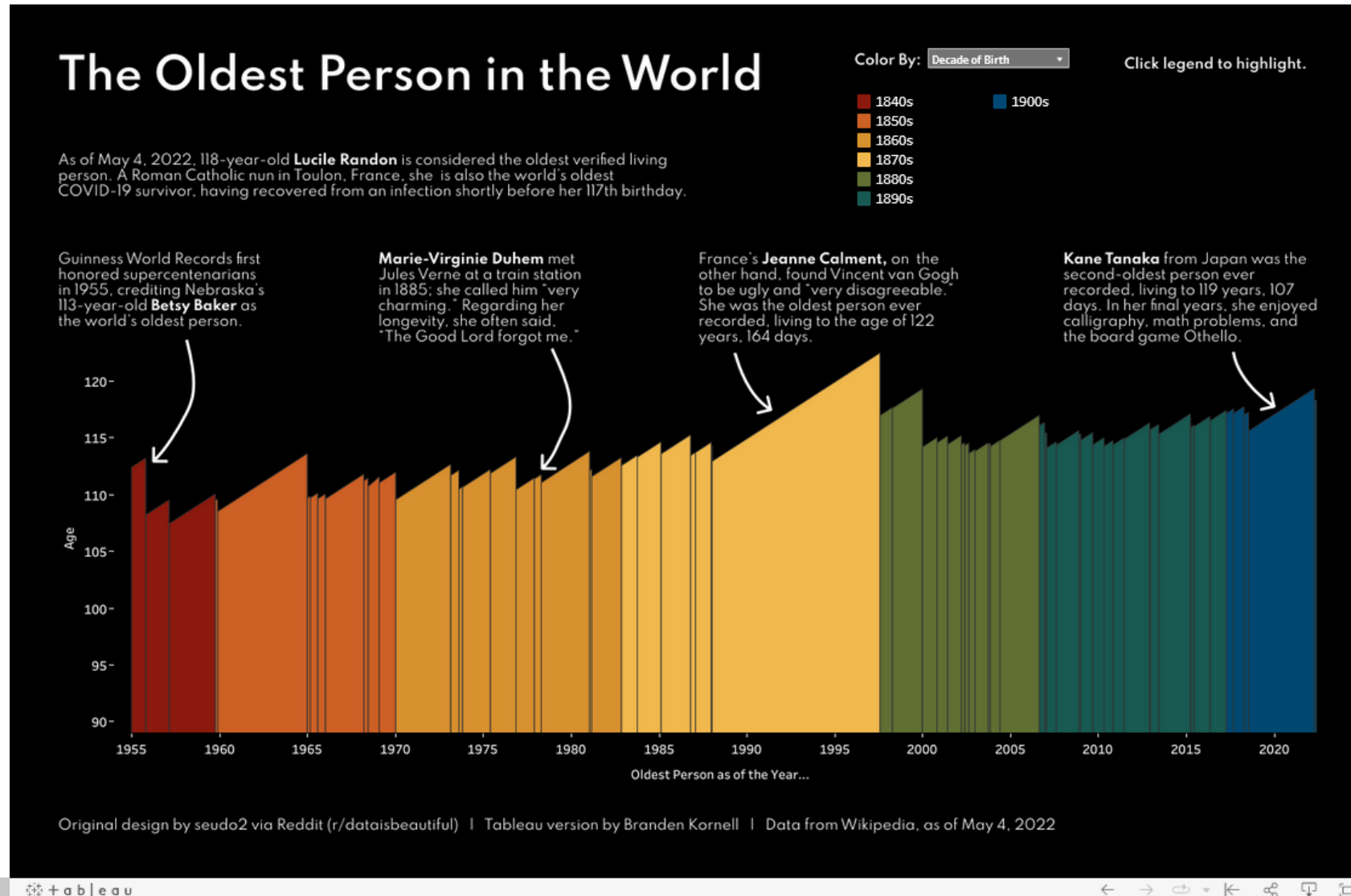
DataVis example

- How common is your birthday?



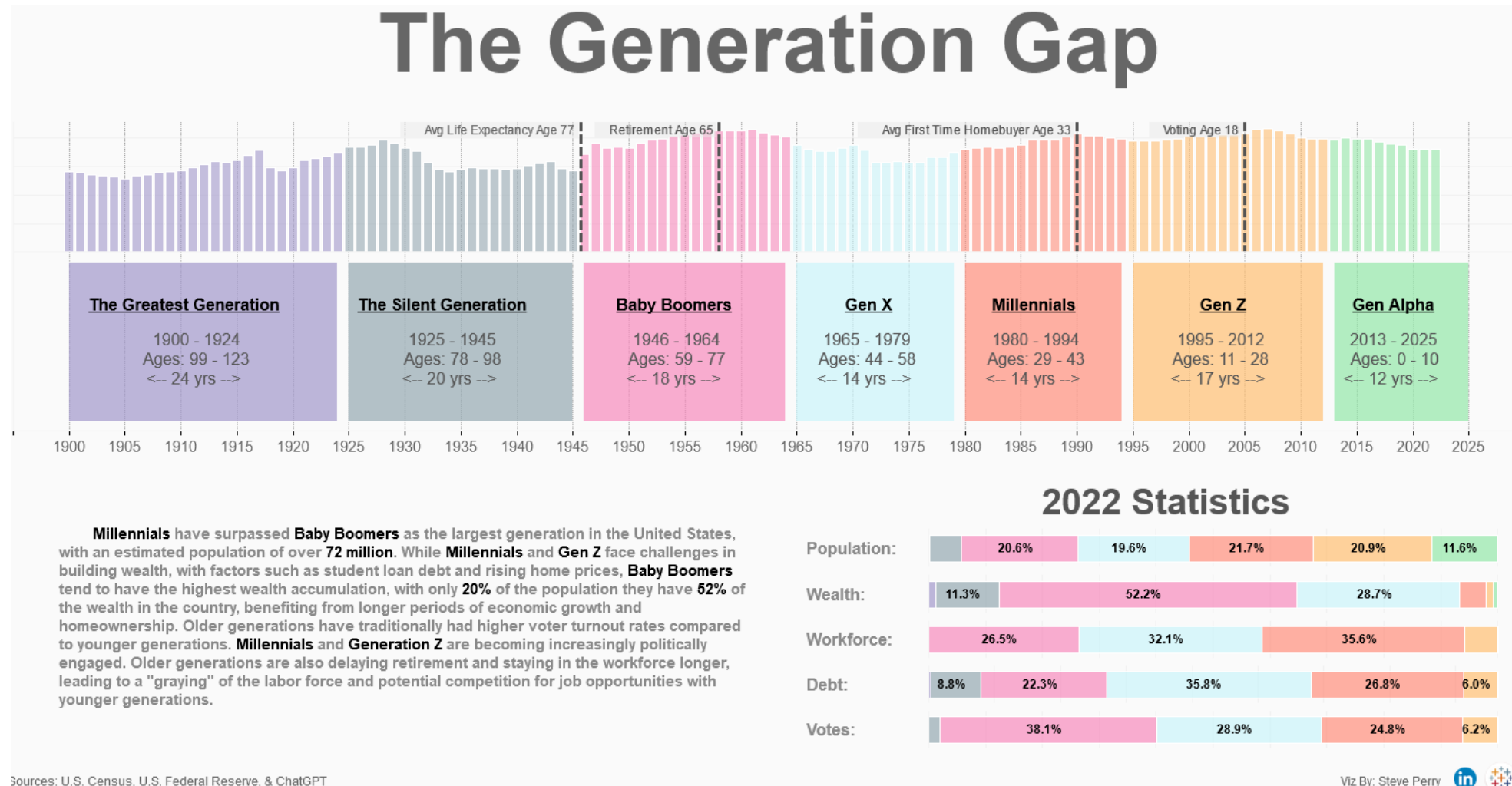
DataVis examples

- The oldest person in the world (1955-2022)



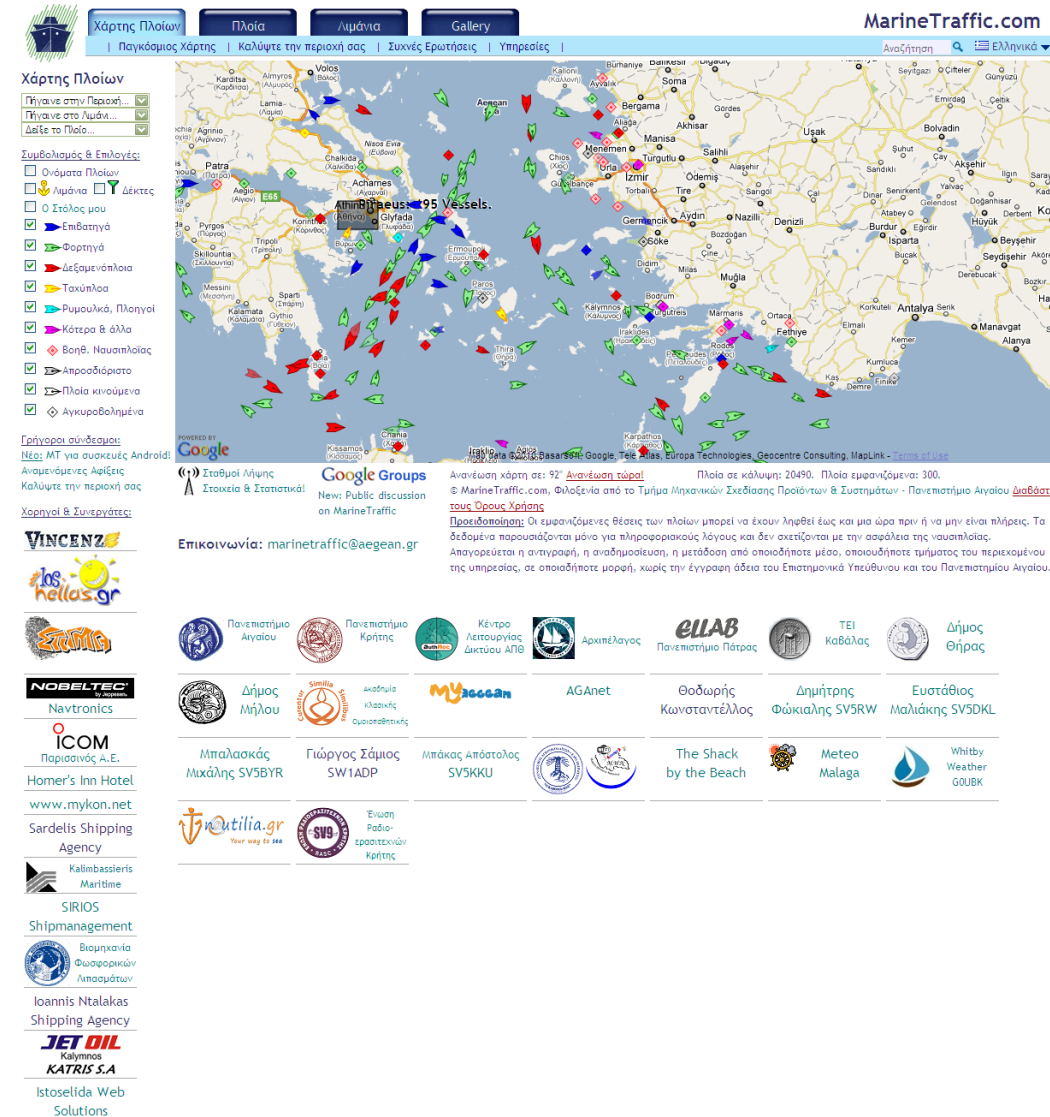
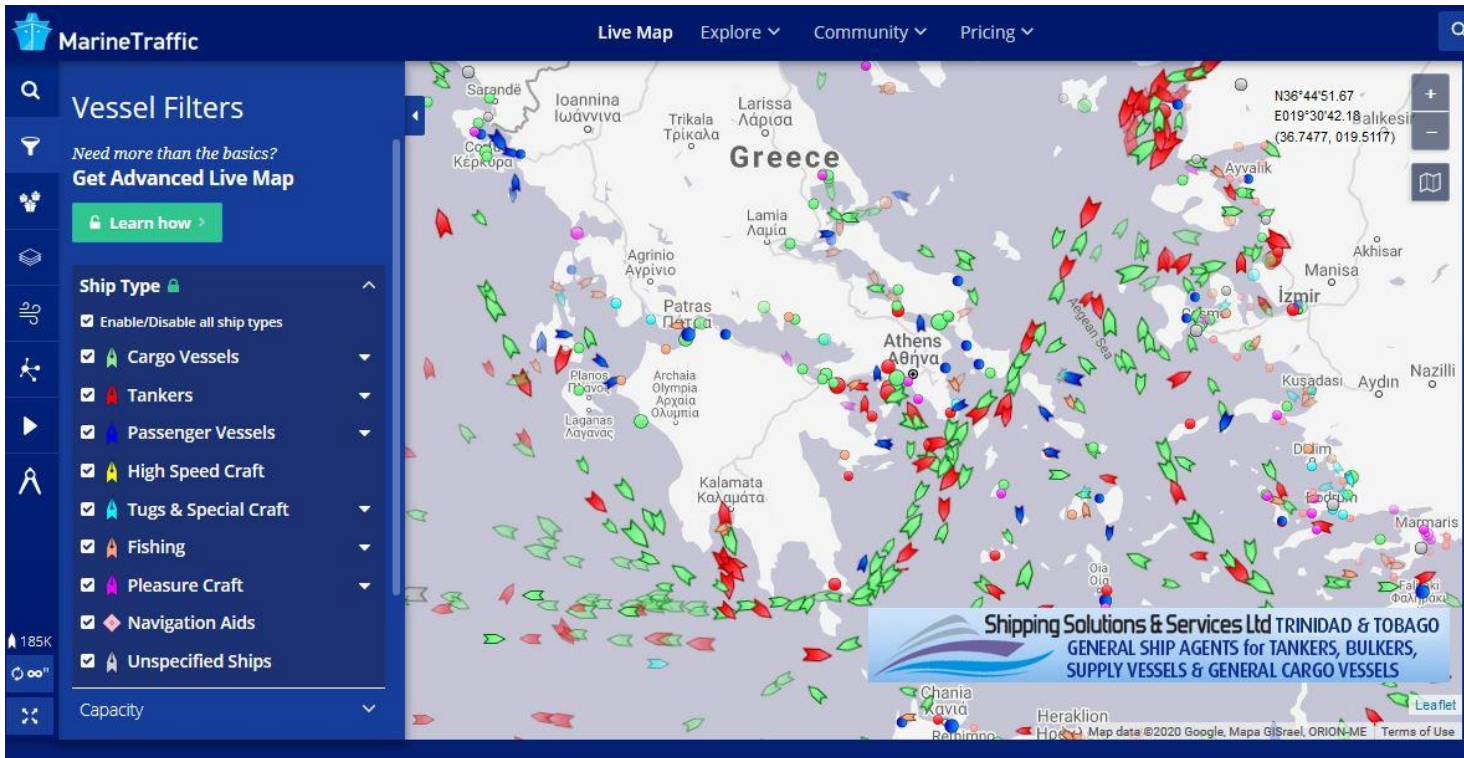
DataVis examples

- Bar charts (in small multiples)



DataVis examples

- Real time positions of marine vessels



DataVis examples

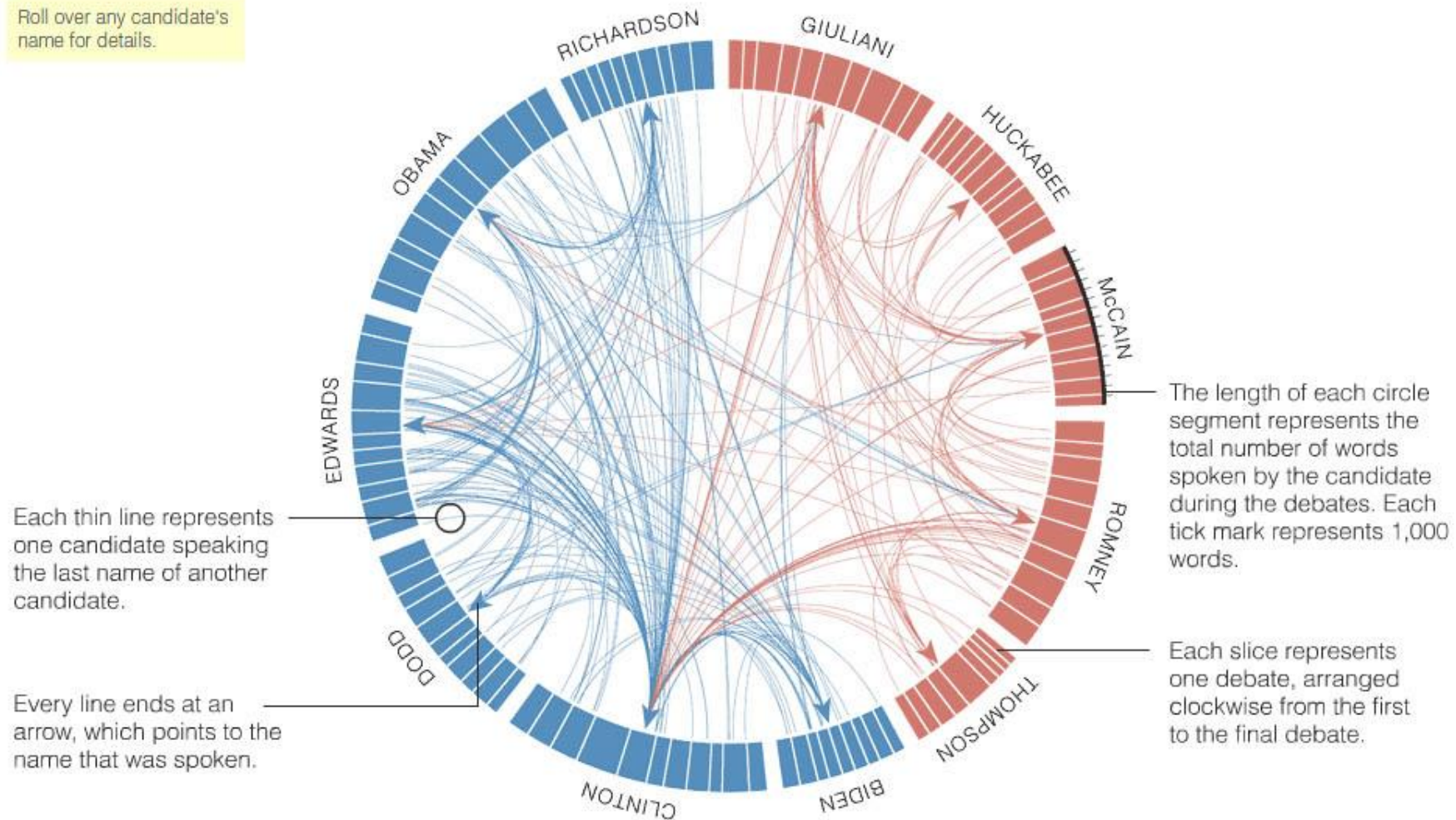
December 15, 2007

[SIGN IN TO E-MAIL OR SAVE THIS](#) | [FEEDBACK](#)

Naming Names

Names used by major presidential candidates in the series of Democratic and Republican debates leading up to the Iowa caucuses.

Roll over any candidate's name for details.



DataVis examples

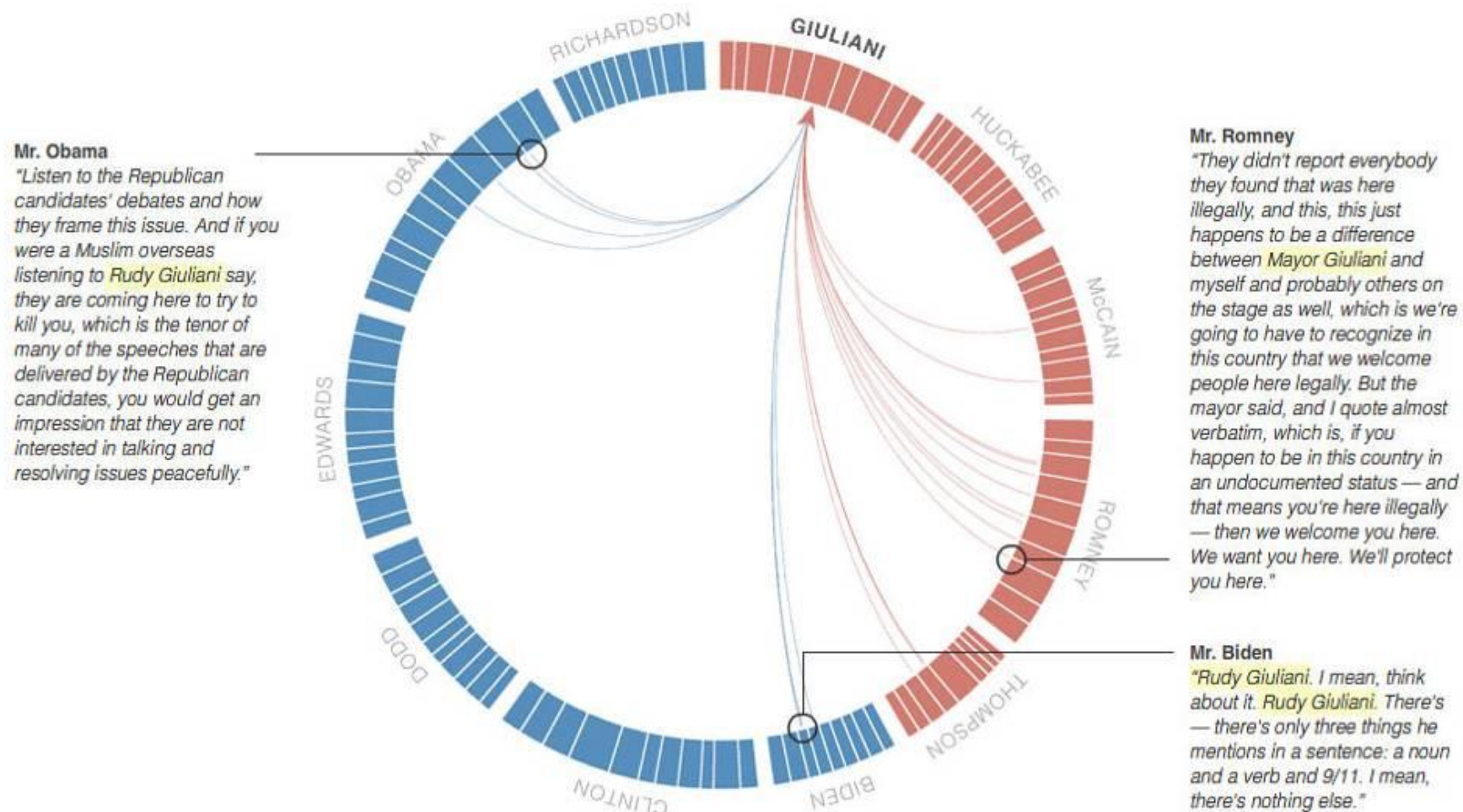
December 15, 2007

☒ SIGN IN TO E-MAIL OR SAVE THIS

[FEEDBACK](#)

Naming Names

Names used by major presidential candidates in the series of Democratic and Republican debates leading up to the Iowa caucuses.



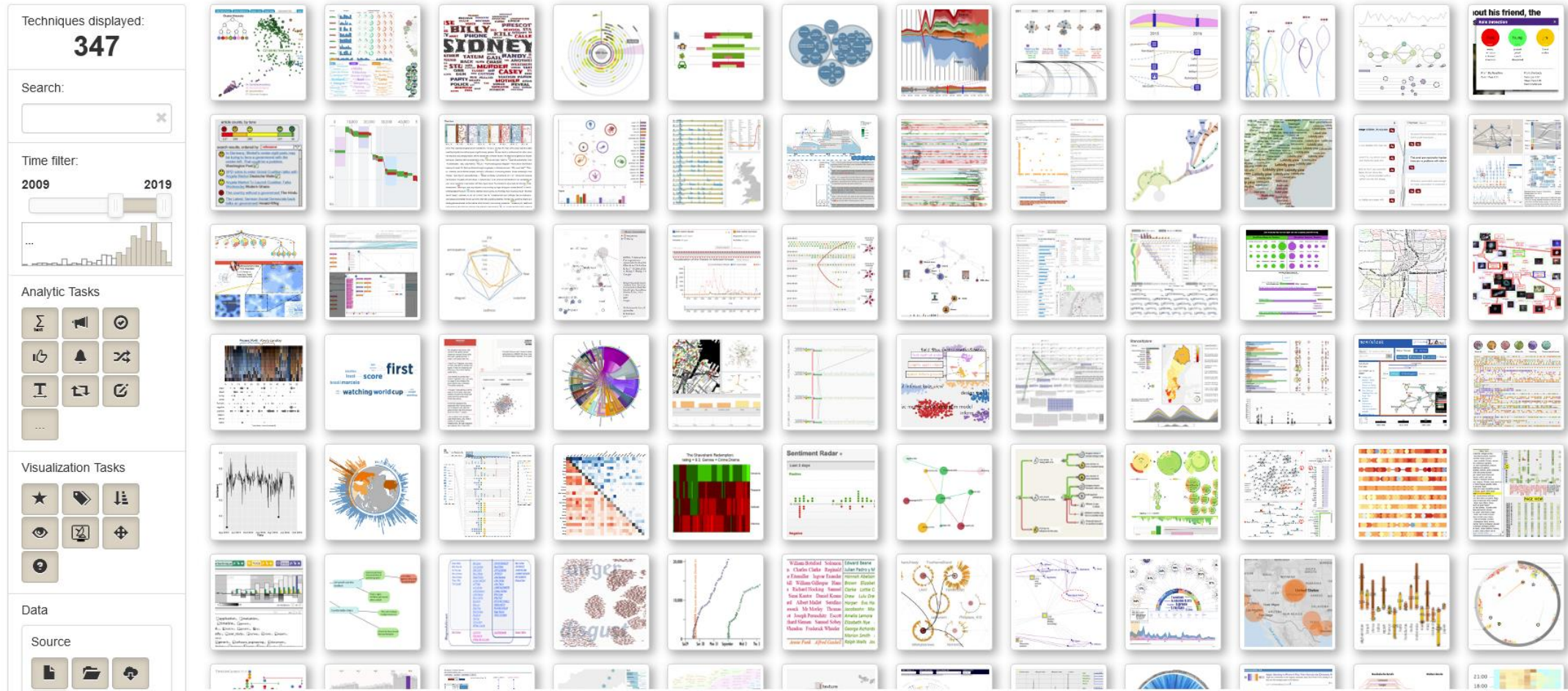
Text Visualization Browser

Text Visualization Browser

A Visual Survey of Text Visualization Techniques ([IEEE PacificVis 2015 short paper](#))

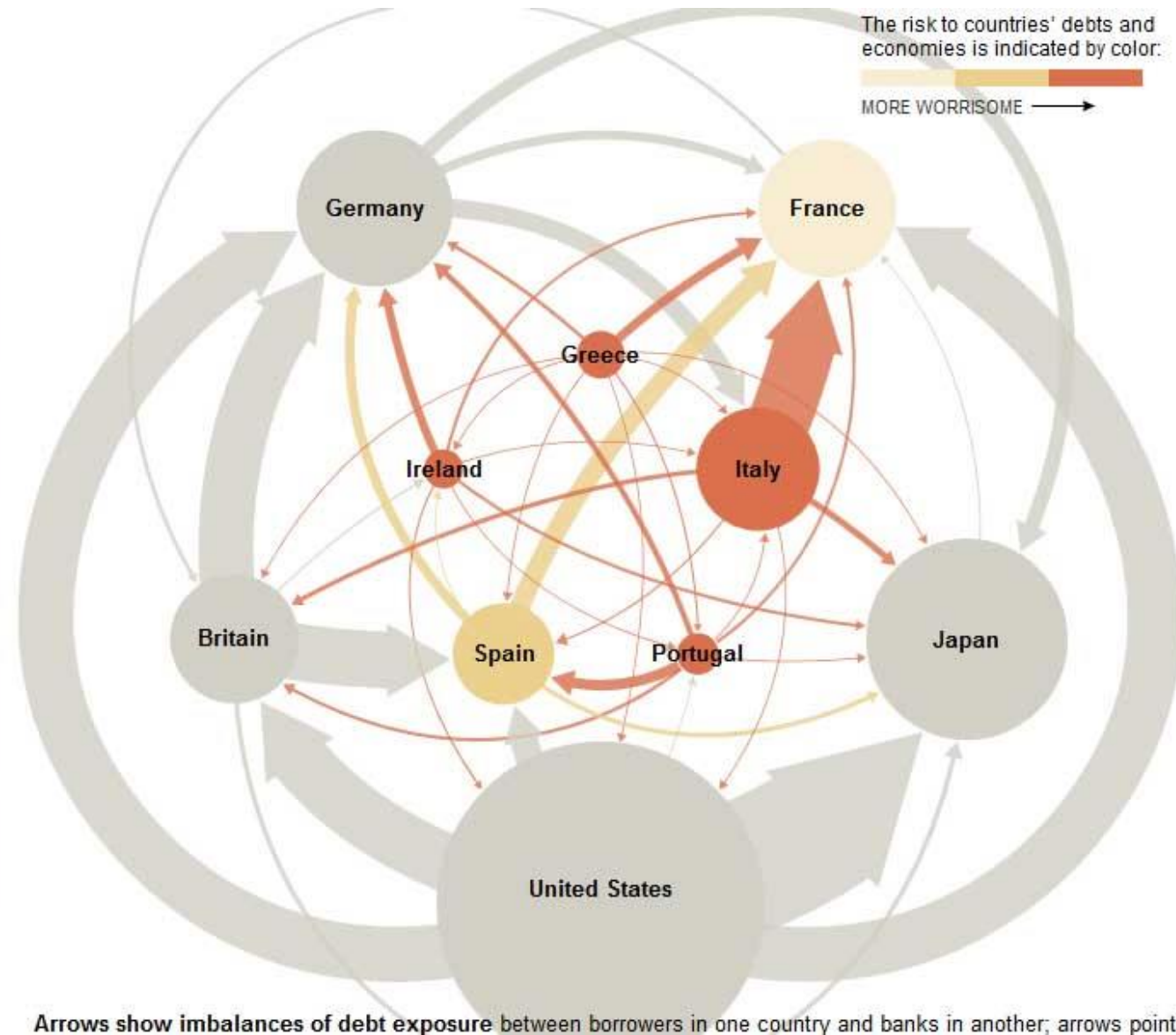
Provided by ISOVIS group

[About](#) [Summary](#) [Add entry](#) [Other surveys ▾](#)



A Visual Survey of Text Visualization Techniques ([IEEE PacificVis 2015 short paper](#))

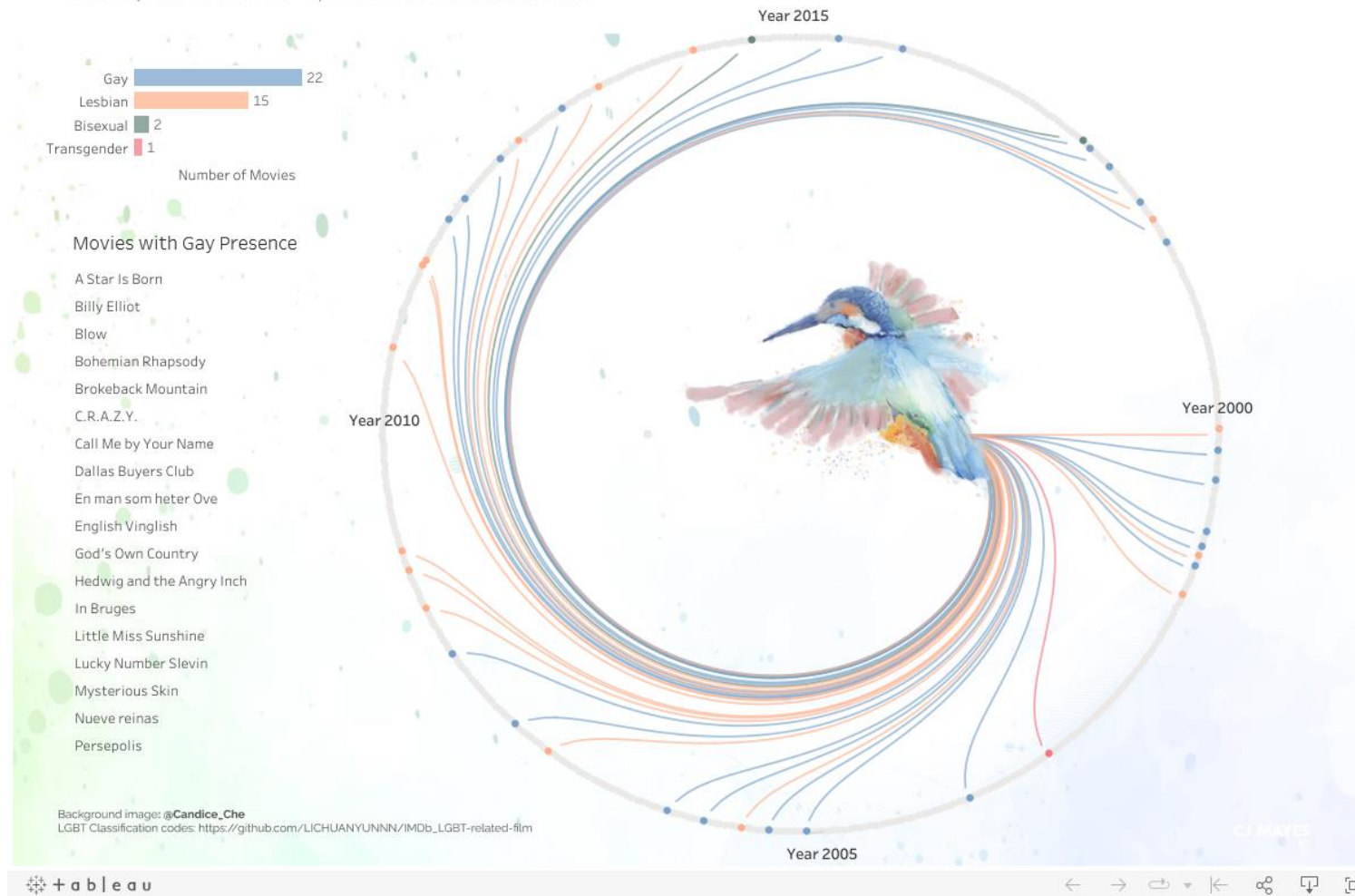
DataVis examples



DataVis examples

Shake the tail feather Movies Soar with LGBT Representation

Since recent years big screen has embraced diversity and authentic voices. In this dashboard we shine a spotlight on the presence of LGBT representation in the Top IMDB 1000 movies since 2000.



DataVis examples

The World's Electricity Tapestry:

Exploring the Electricity profile of each country.

A dive into country specific Electricity mix - unveiling how much is generated per capita, and the generation sources.

1.

Although the terms "electricity" and "energy" are often used interchangeably, it's important to understand that electricity is just one component of total energy consumption.

2.

Comparisons of electricity generation often reflect population size (i.e. generation increases due to population rise). It does not tell us about how much electricity the average person in a given country consumes relative to another.

3.

This is why the per capita electricity generation - i.e., per person, should also be considered. The largest producers - Iceland, Norway, USA and Canada - generate hundreds of times as much electricity as the smallest.

Electricity generation per capita as at 2022:

Each country's generation figures, grouped by region.

On the visualisation to the right, we see the differences in average electricity generation per capita across the world.

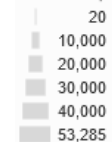
Clearly, there are large inequalities between countries.

In many low-income countries, per capita electricity generation is several magnitudes lower than in the richest countries.

This is magnified at a regional level as well.

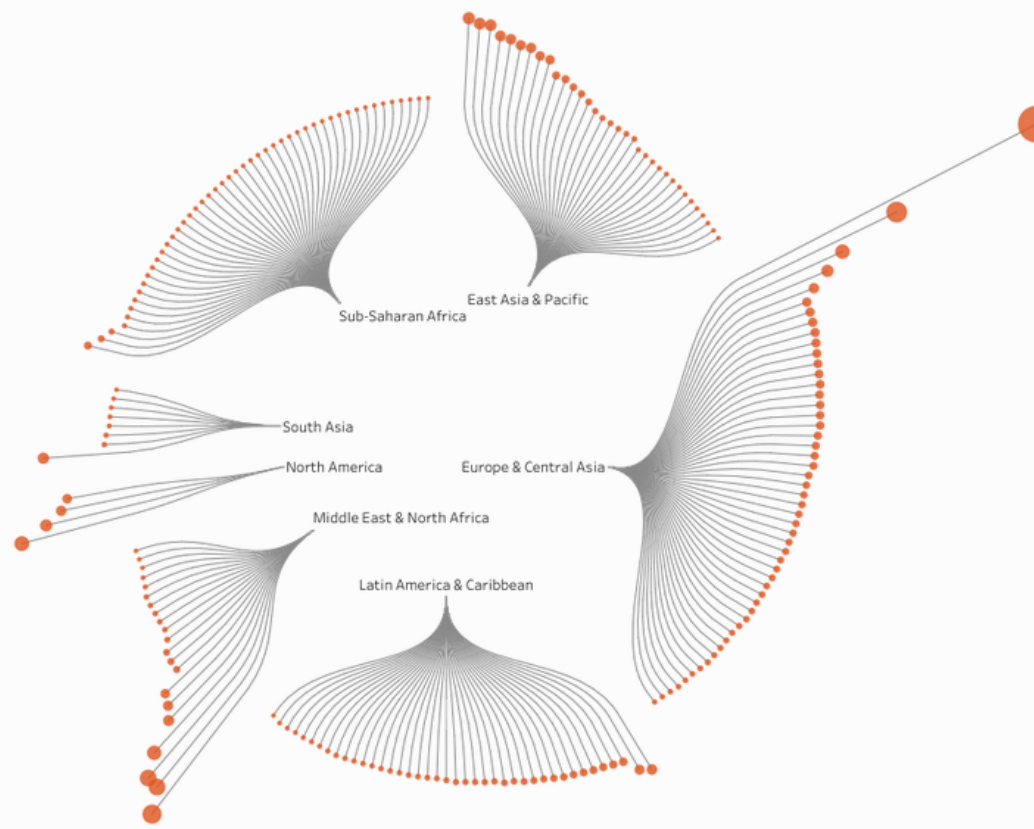
Hover over each country to view historic trends.

Generation per capita:

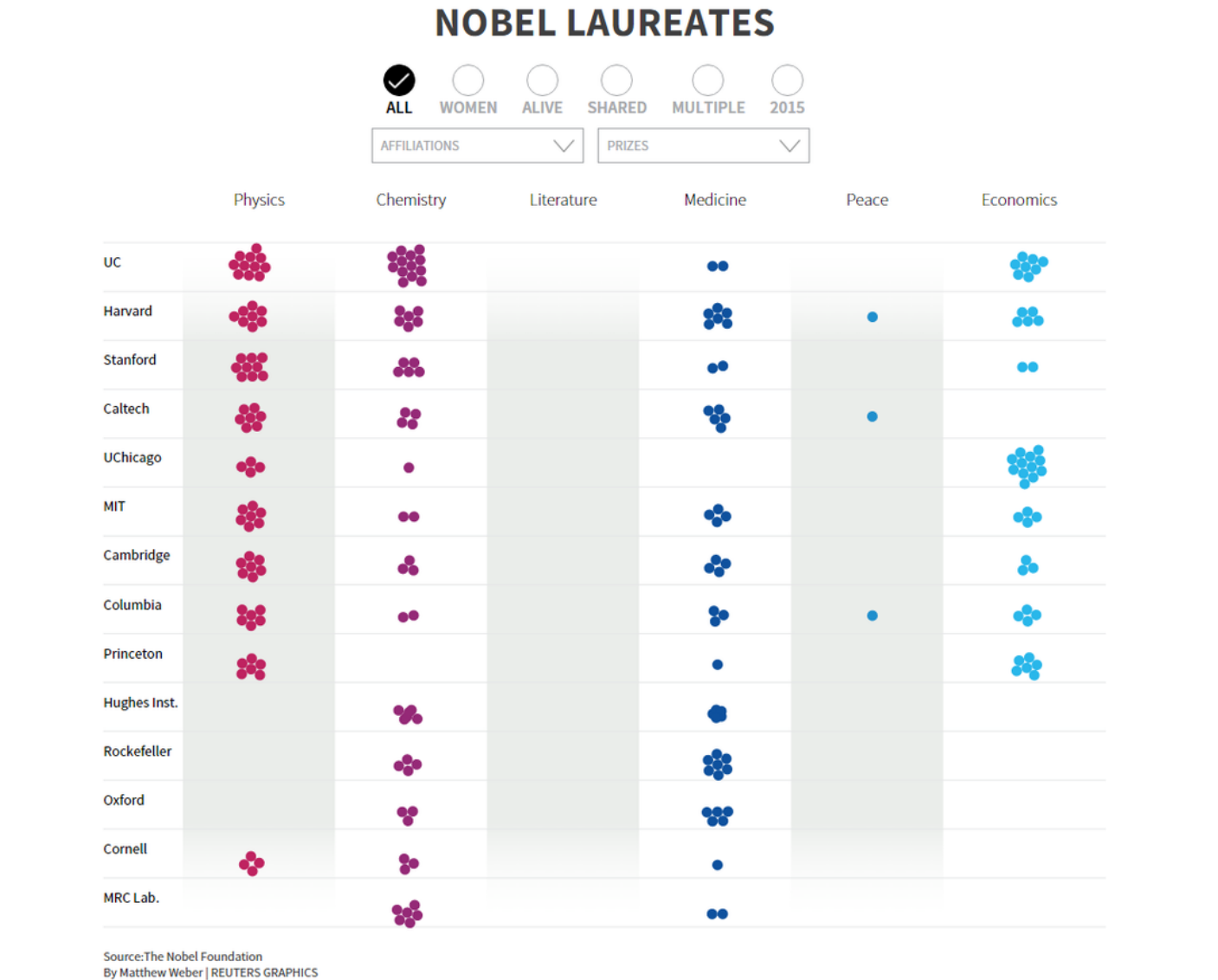


Show chart as:

Tree diagram



DataVis examples



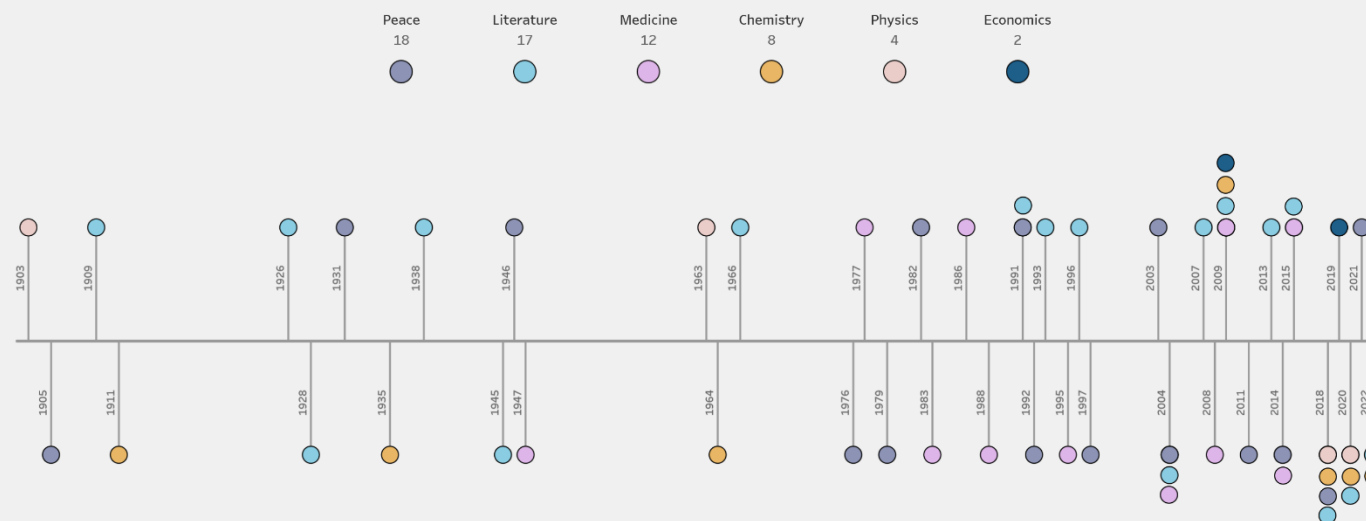
DataVis examples

Female Nobel Prize Laureates

There are 60 women who have been awarded a Nobel Prize out of the more than 900 recipients. One woman - Marie Curie - received the Nobel Prize twice, she is also the first woman to ever win this award (1903).

These women have made outstanding contributions to the worlds of medicine, science, art and peace-keeping.

Each ● represents a Nobel Prize awarded to a woman for their achievement in their respective field.



#B2VB - Visualize Data in Timeline | Data Source: www.nobelprize.com | Created by: Ela Piwowarska

tableau

Navigation icons: back, forward, search, etc.

DataVis examples

■ The Matilda Effect and the forgotten women scientists

THE MATILDA EFFECT

and the forgotten women scientists

What is the Matilda Effect?

The Matilda Effect is used to describe the bias against acknowledging the achievements of women scientists in favour of their male colleagues.

The term was coined in 1993 by science historian Margaret Rossiter after suffragist Matilda Joselyn Gage, whose own work was overlooked.

The Matilda Effect has happened throughout history and is still alive and well today.

Designed by Kimly Scott | @ScottKimly | #WomenInHistoryMonth2022

The Matilda Effect in the Nobel Prize

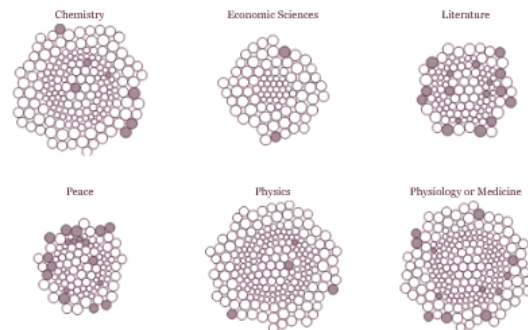
The Nobel Prize needs no introduction. It is the most prestigious international award, awarded by the Nobel Foundation in Stockholm, Sweden and awarded for the 'the greatest benefit of humankind'.

We can see the Matilda Effect at work when looking at the Nobel Prize winners throughout history. Since 1901, the Nobel Prize has been awarded to 943 individuals - only 58 of whom have been women.

When looking at laureates by category, we can see that the disparity between the number of men and women winners is even greater for Economic Sciences and Physics.



Nobel Prize Laureates by Category & Gender



Data Sources: nobelprize.org, wikipedia.com, news.northeastern.edu

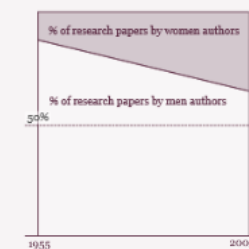
Images: Kimly Scott

The Matilda Effect in Research & Publications

Women historically have published less papers in STEM based research than men. While the number of research papers authored by women in STEM has increased since 1955, they still lag immensely behind.

On average, men and women publish at the same rate, but during the length of their careers, women publish fewer articles. This is because women are leaving their careers earlier than men, therefore having less time to publish.

On average both women and men publish 1.3 papers per year. However, the average length of a man's career in STEM fields is 11 years compared to 9.3 years for women.



Certain STEM fields have a higher discrepancy than others.



Why are we losing women earlier in their careers? Is it due to having children, lack of recognition, or all of those things? This much is not 100% clear.

What we do know is that, it's not enough to attract women to these roles, we need to support them throughout their careers - recognise them and credit them.

The Forgotten Women Scientists

Women are at the heart of every scientific discovery and innovation but history has forgotten many brilliant women.

Below are ten accomplished women scientists who did not get the recognition they deserved during their lifetime. Click on a diamond icon to learn more about each remarkable scientist.

Esther Lederberg

(1922-2006)

American | Microbiologist

Esther Lederberg was a major pioneer of bacterial genetics. She discovered the lambda phage, a bacterial virus which is widely used as a tool to study gene regulation and genetic recombination. Esther was the wife of Nobel laureate Joshua Lederberg and during her career, struggled for professional recognition.

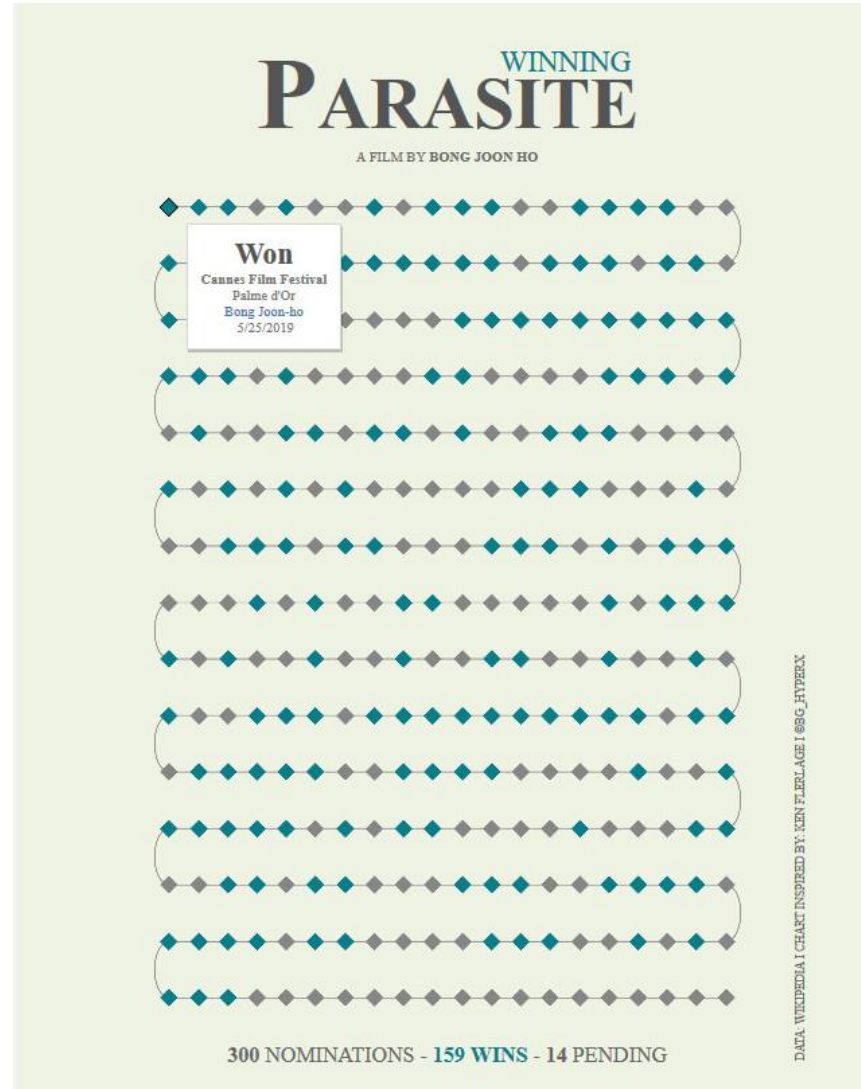
Despite her foundational discoveries in the field of microbiology, she was never offered a tenure position at a university. Textbooks often ignore her work and attributed her accomplishments to her husband.

https://en.wikipedia.org/wiki/Esther_Lederberg



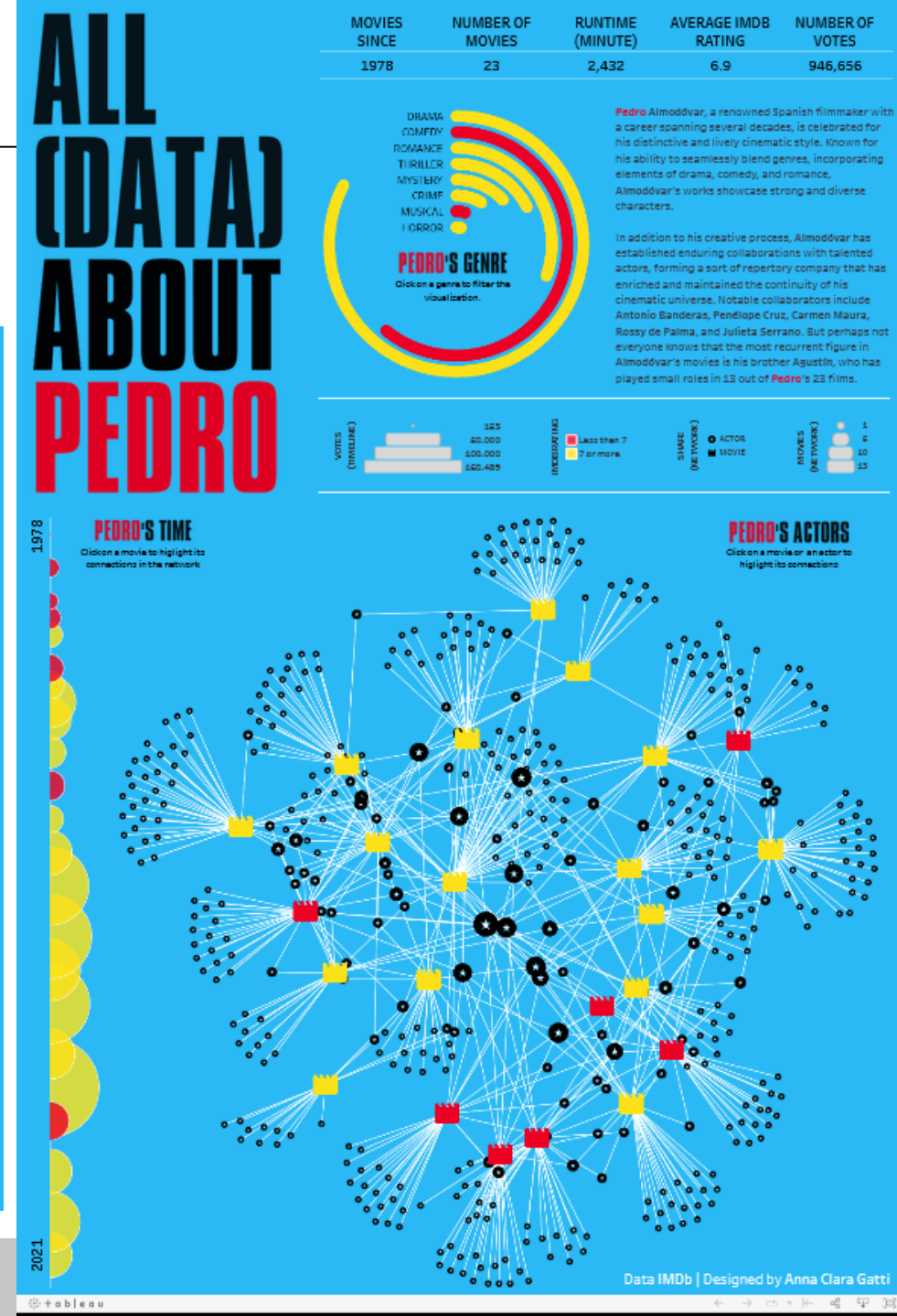
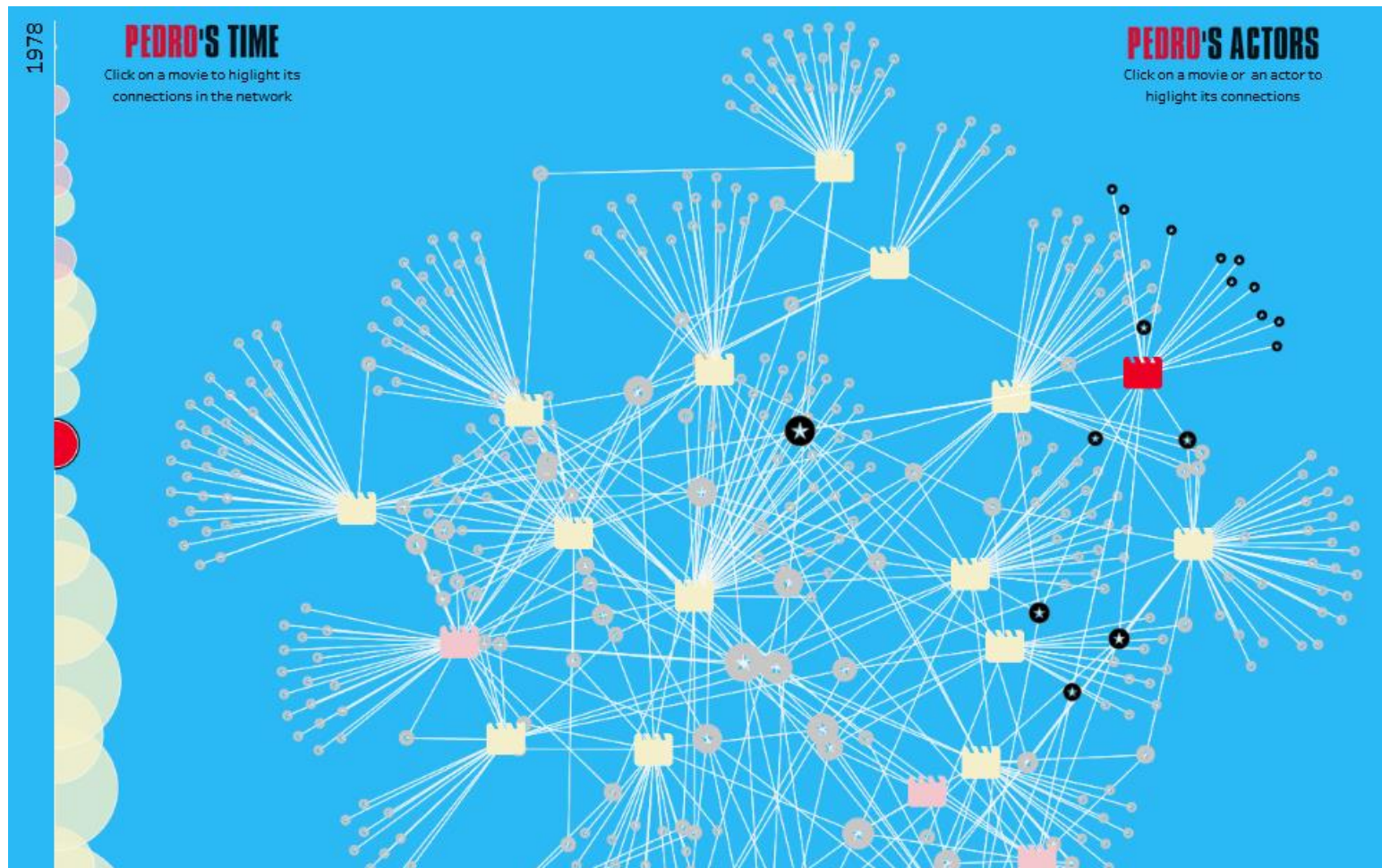
DataVis examples

- Parasite: A film by Bong Joon Ho – award nominations & wins

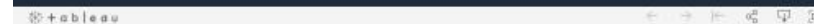


DataVis examples

■ P. Almodovar's films & actors

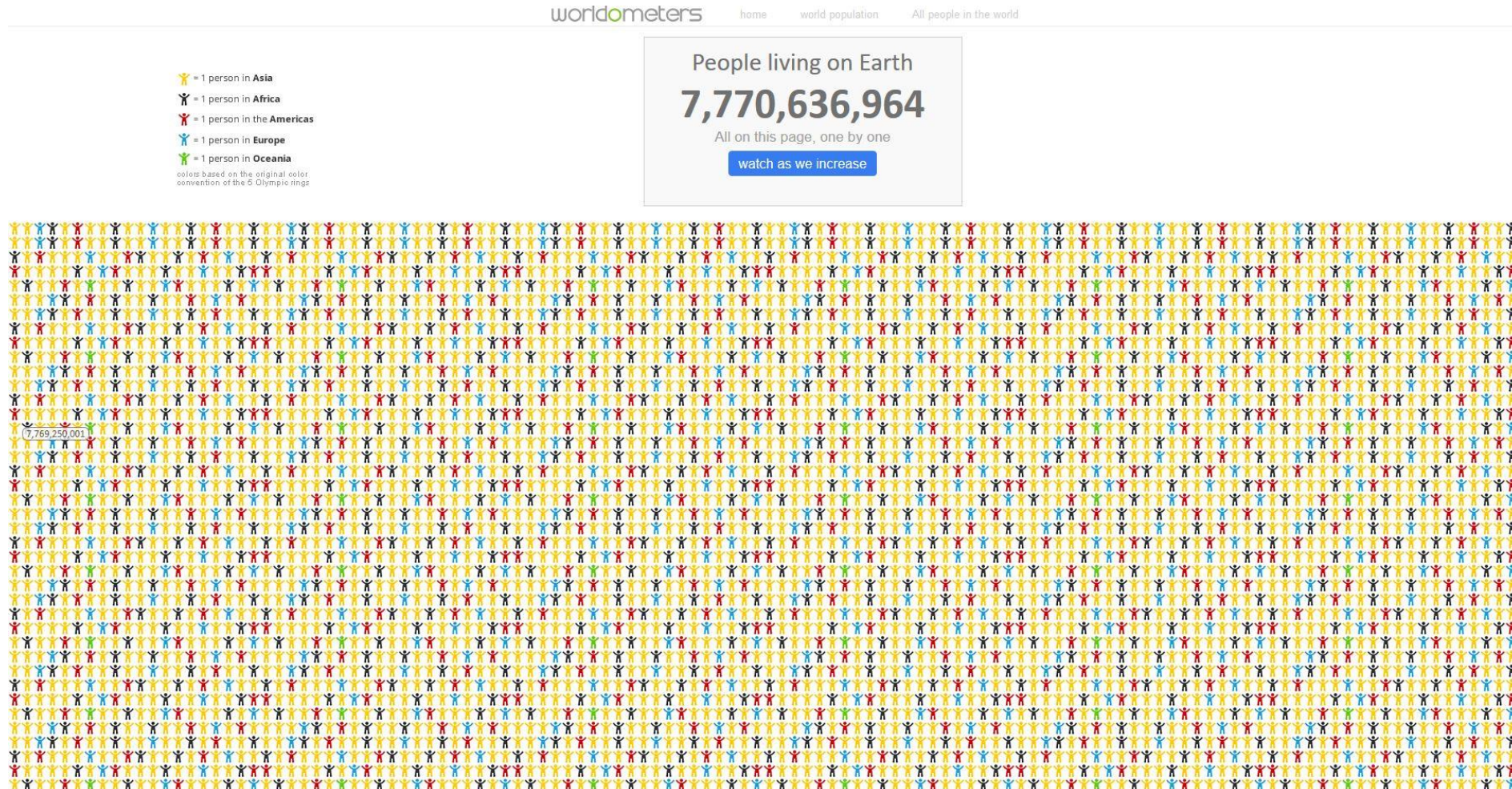


- 50-great-jazz-trumpeters



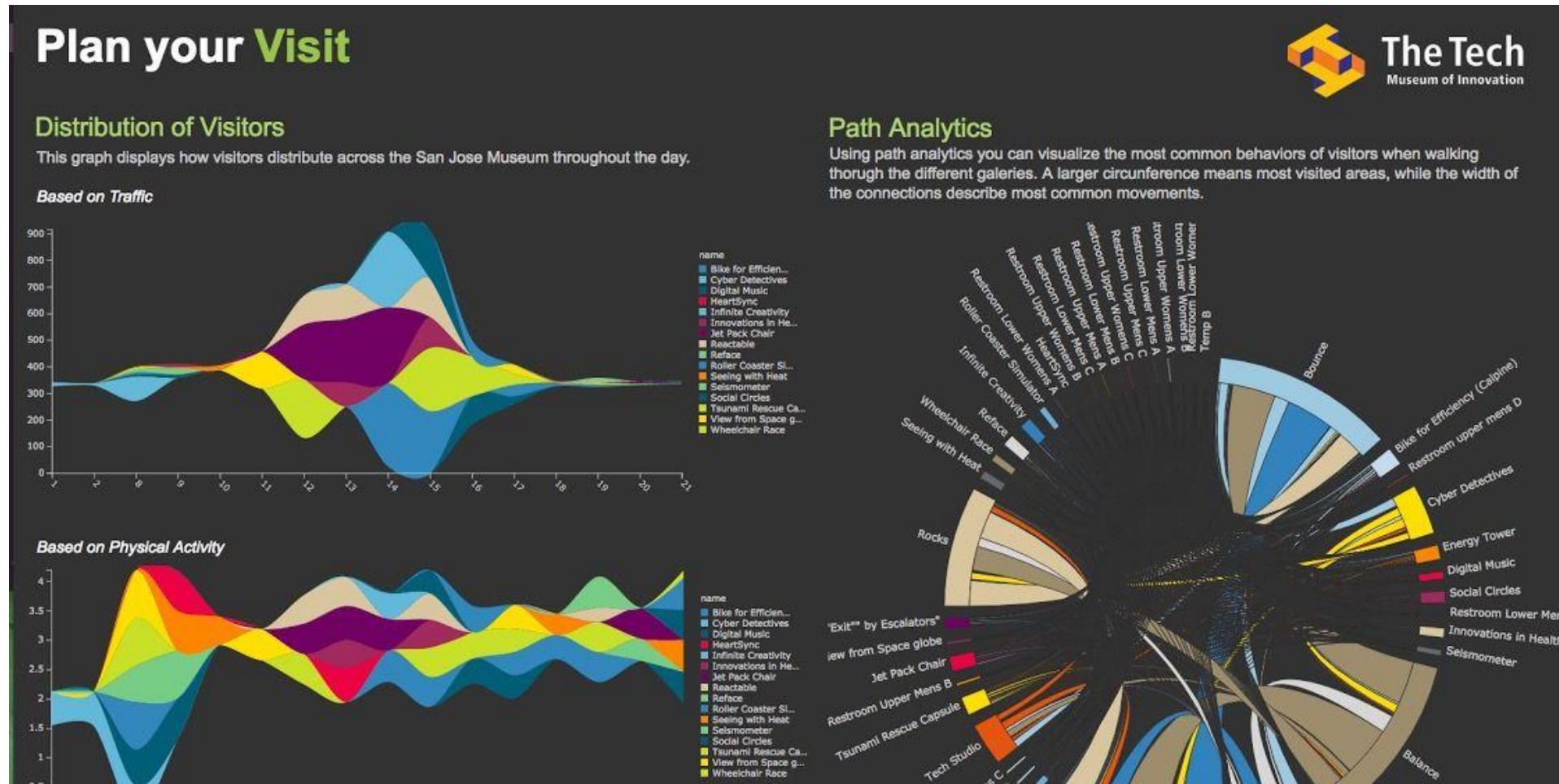
DataVis examples

■ Current World Population - worldometer



DataVis examples

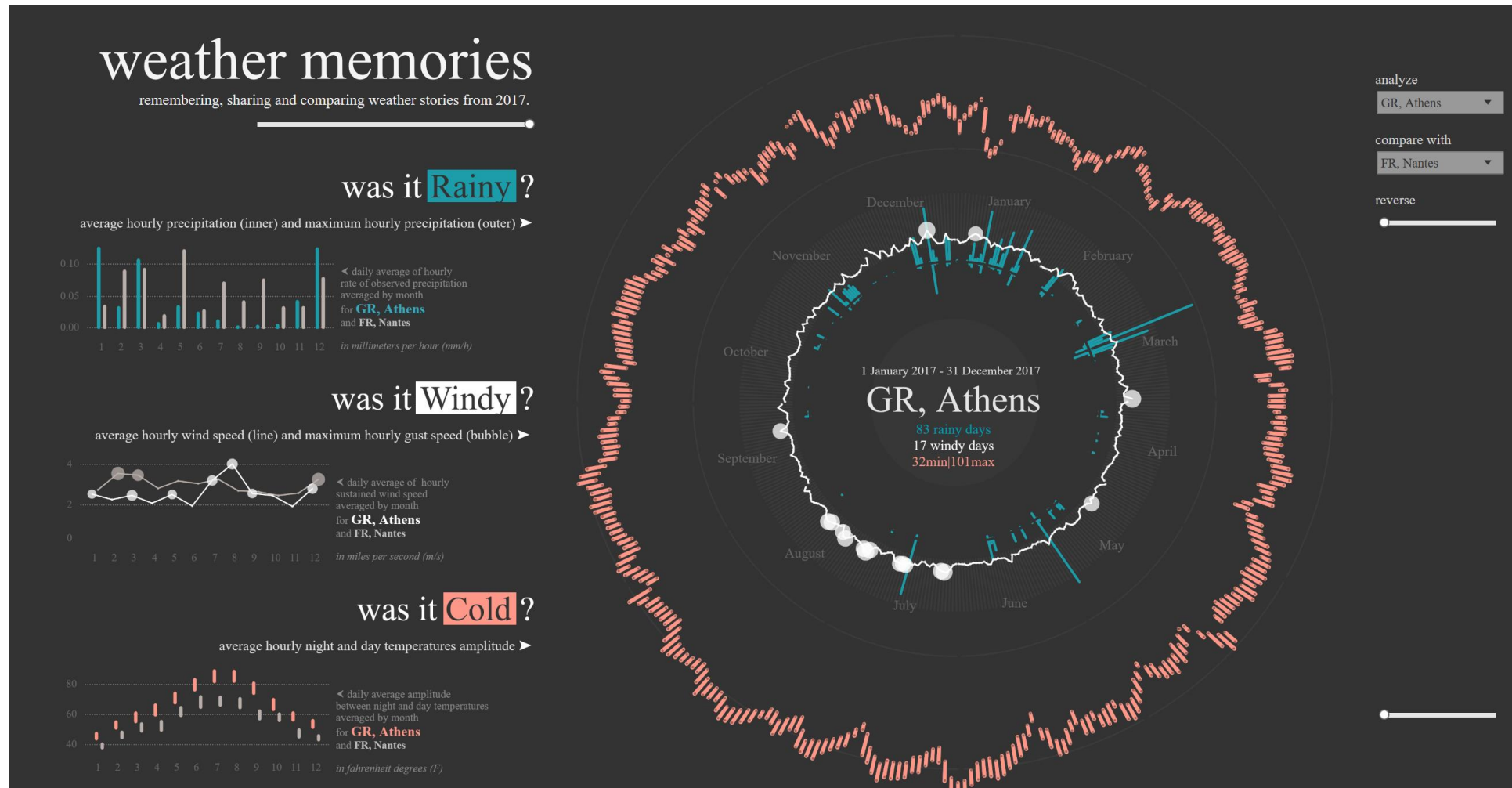
- Analysis of visitor paths in the museum



The Tech Museum of Innovation

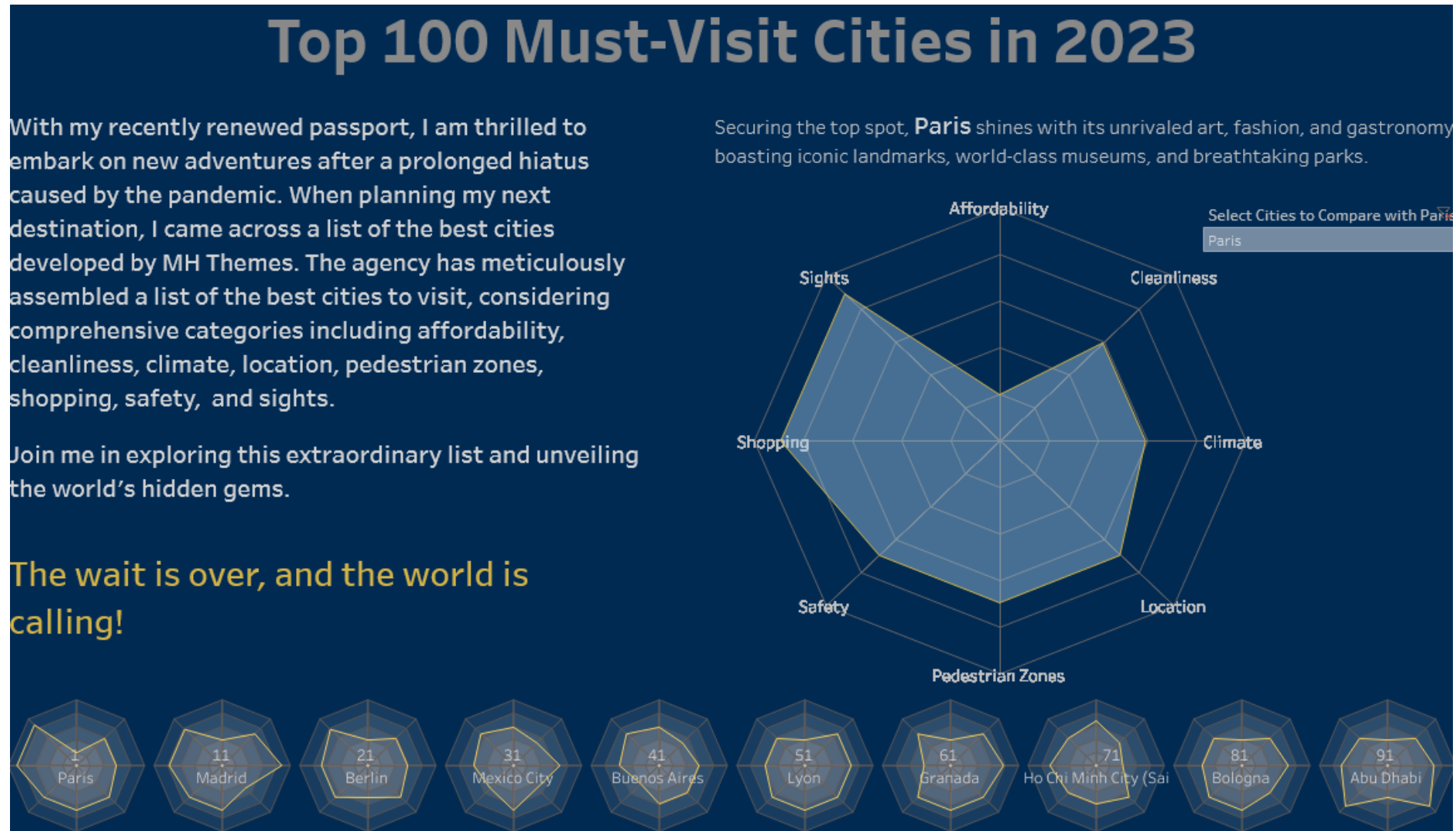
DataVis examples

- The weather per location, in a year



DataVis examples

- Spider charts



DataVis examples

The Jobless Rate for People Like You

Not all groups have felt the recession equally.

All races
White
Black
Hispanic
All other races

Men and Women
Men
Women

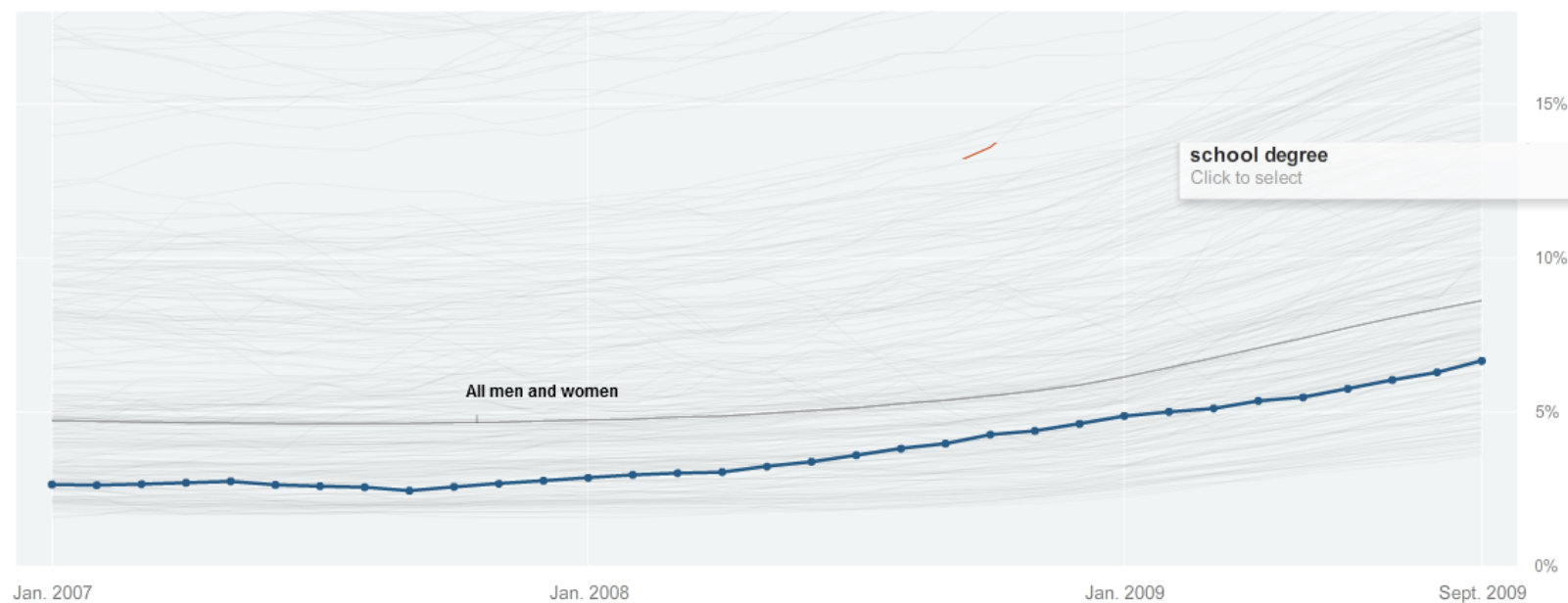
All ages
Ages 15 to 24
Ages 25 to 44
Age 45 and older

All education levels
Not a high school graduate
High school graduate
College graduate

UNEMPLOYMENT RATE,
12 MONTH AVG. ENDING SEPT. '09

6.7%

For black men and women age 45
and older with a college degree



Note: 12-month rates are shown because monthly estimates for small groups are not reliable.

By SHAN CARTER, AMANDA COX and KEVIN QUEALY/The New York Times | [Send Feedback](#)

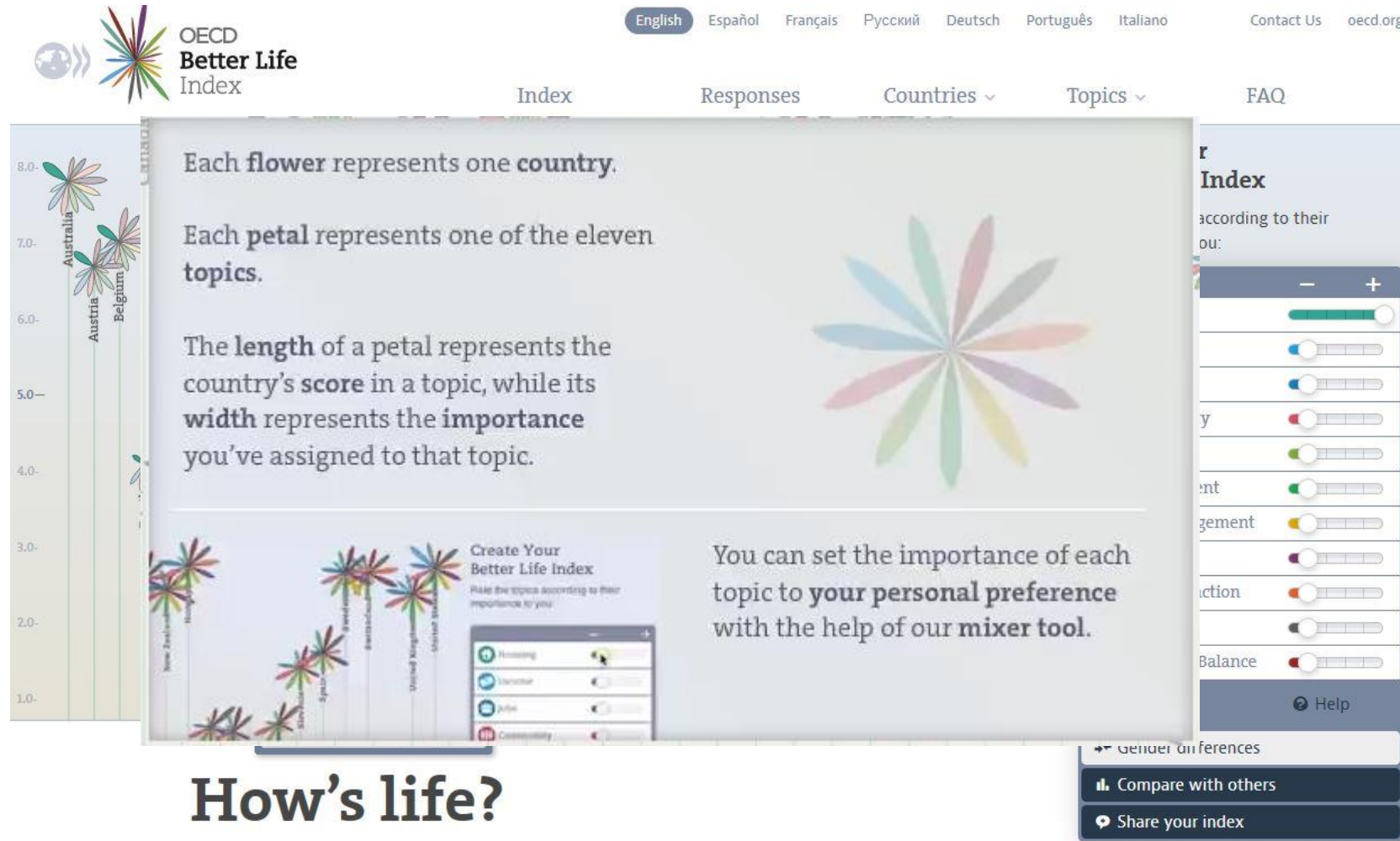
Source: Bureau of Labor Statistics

[TWITTER](#) [LINKEDIN](#) [SHARE](#)

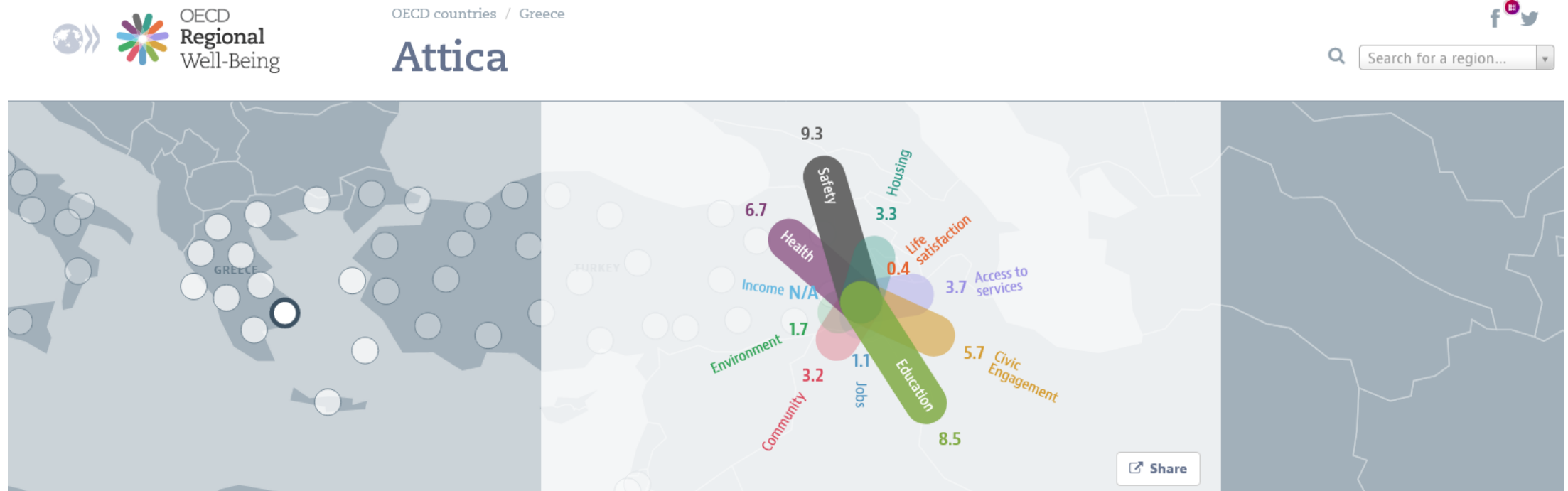
DataVis examples



DataVis examples



DataVis examples



Explore the map to find out how life is across OECD regions and discover regions with similar well-being.

Each region is measured in eleven topics important for well-being. The values of the indicators are expressed as a score between 0 and 10. A high score indicates better performance relative to the other regions.

Help

Regions with similar well-being in other countries



Italy
Molise



Turkey
Ankara

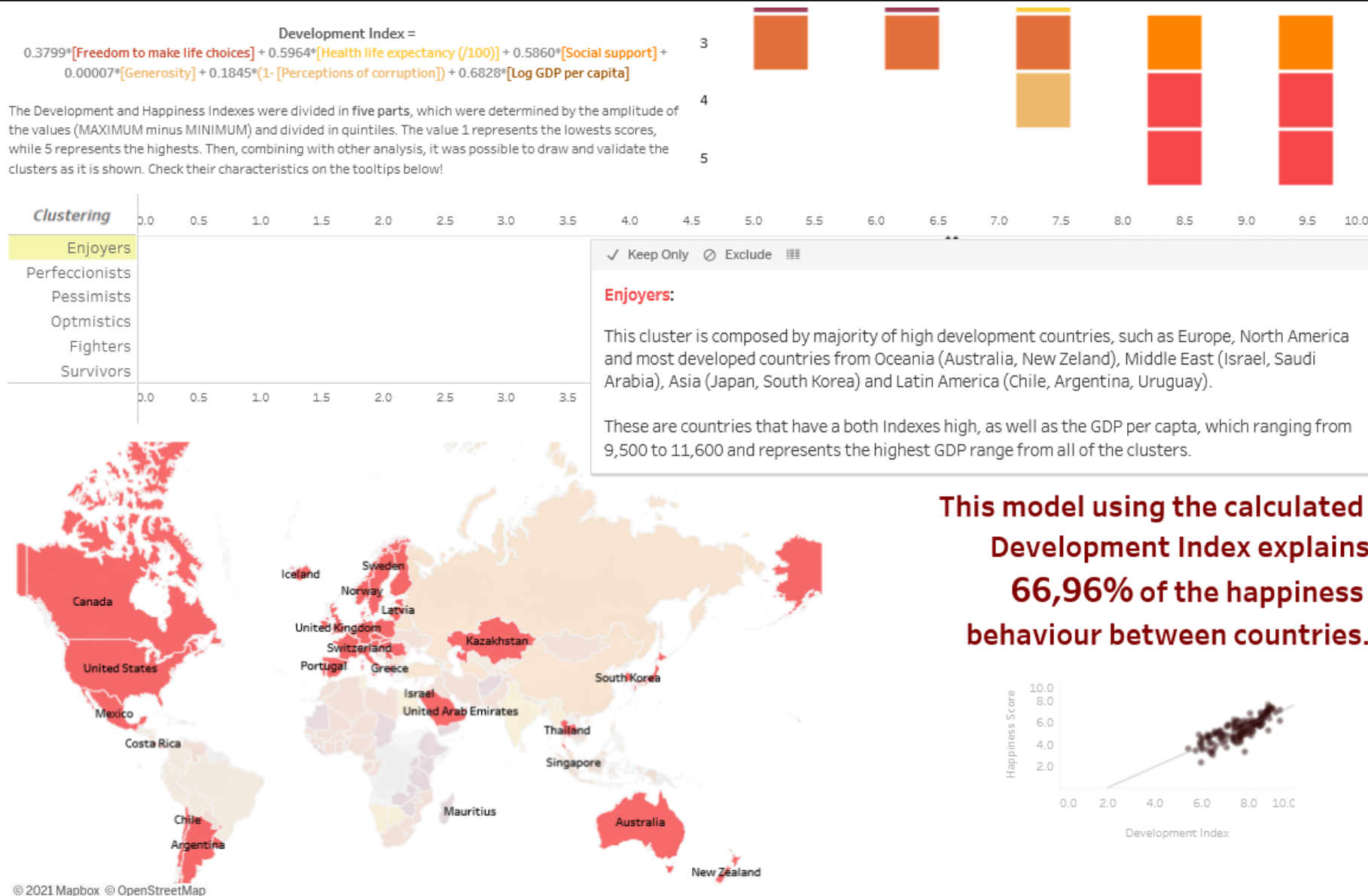


France
Hauts-de-France



Israel
North

DataVis examples

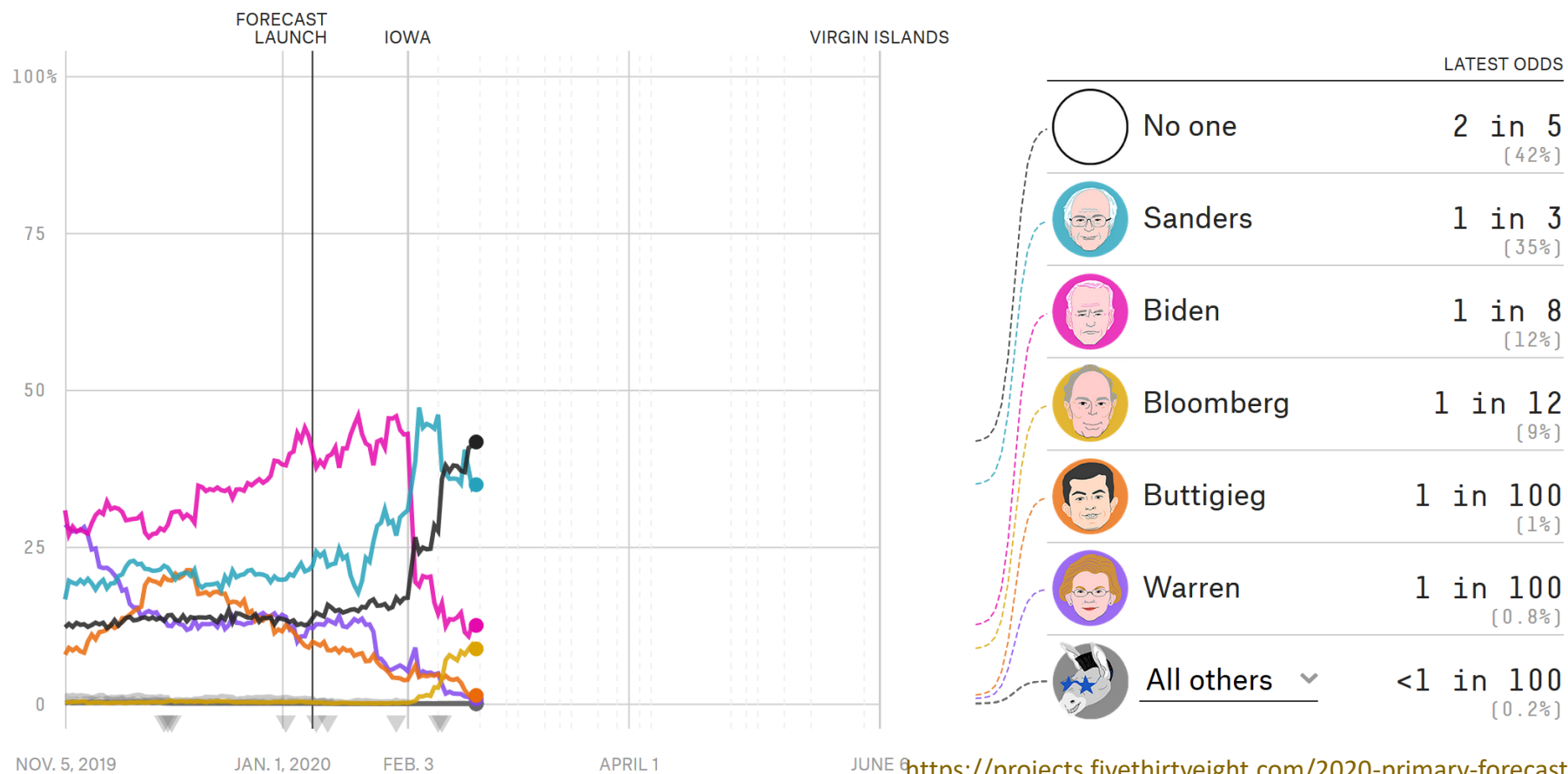


DataVis examples

UPDATED FEB. 21, 2020, AT 12:46 AM

Who Will Win The 2020 Democratic Primary?

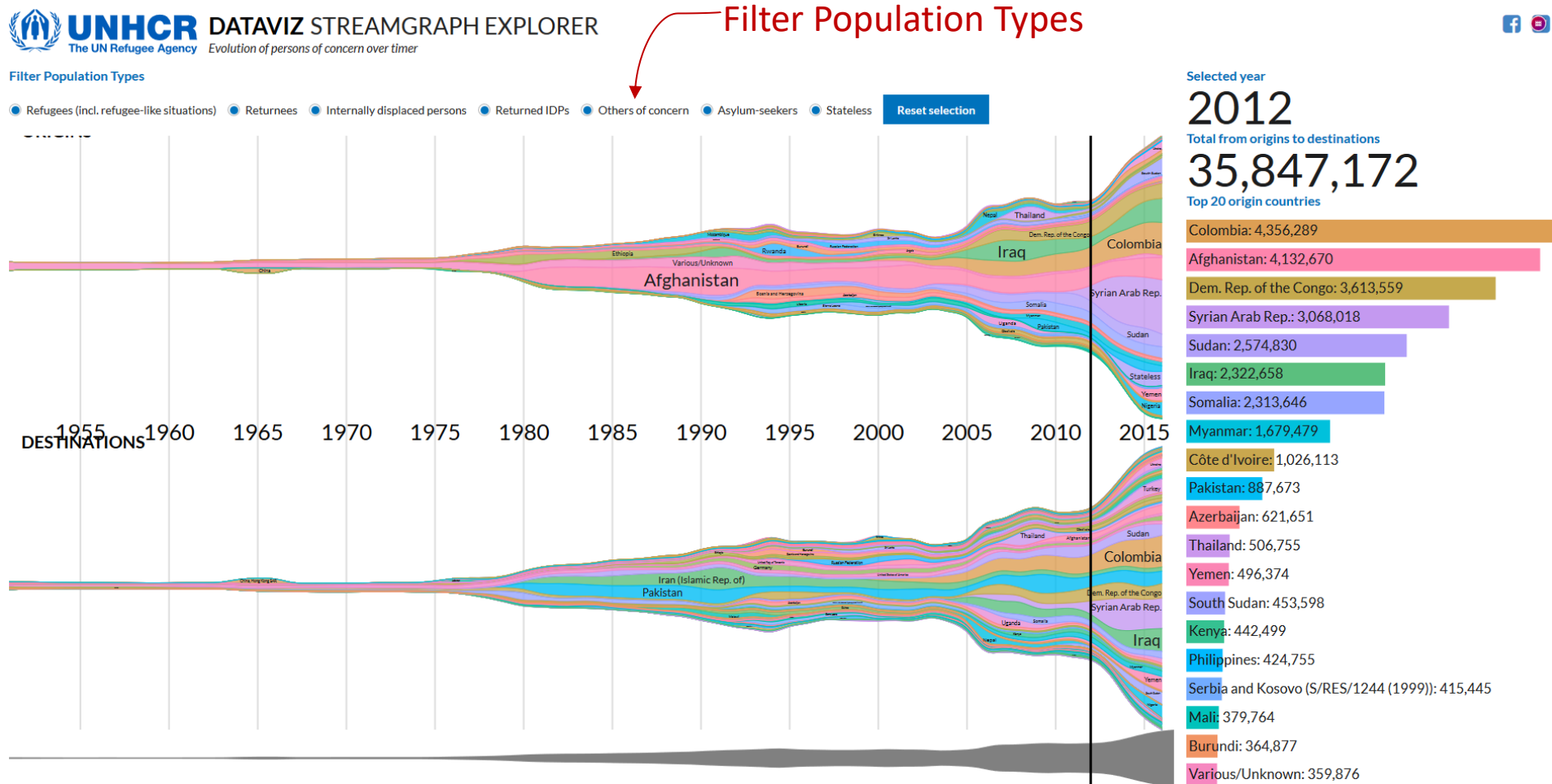
How each candidate's chances of winning more than half of pledged delegates have changed over time



<https://projects.fivethirtyeight.com/2020-primary-forecast/>

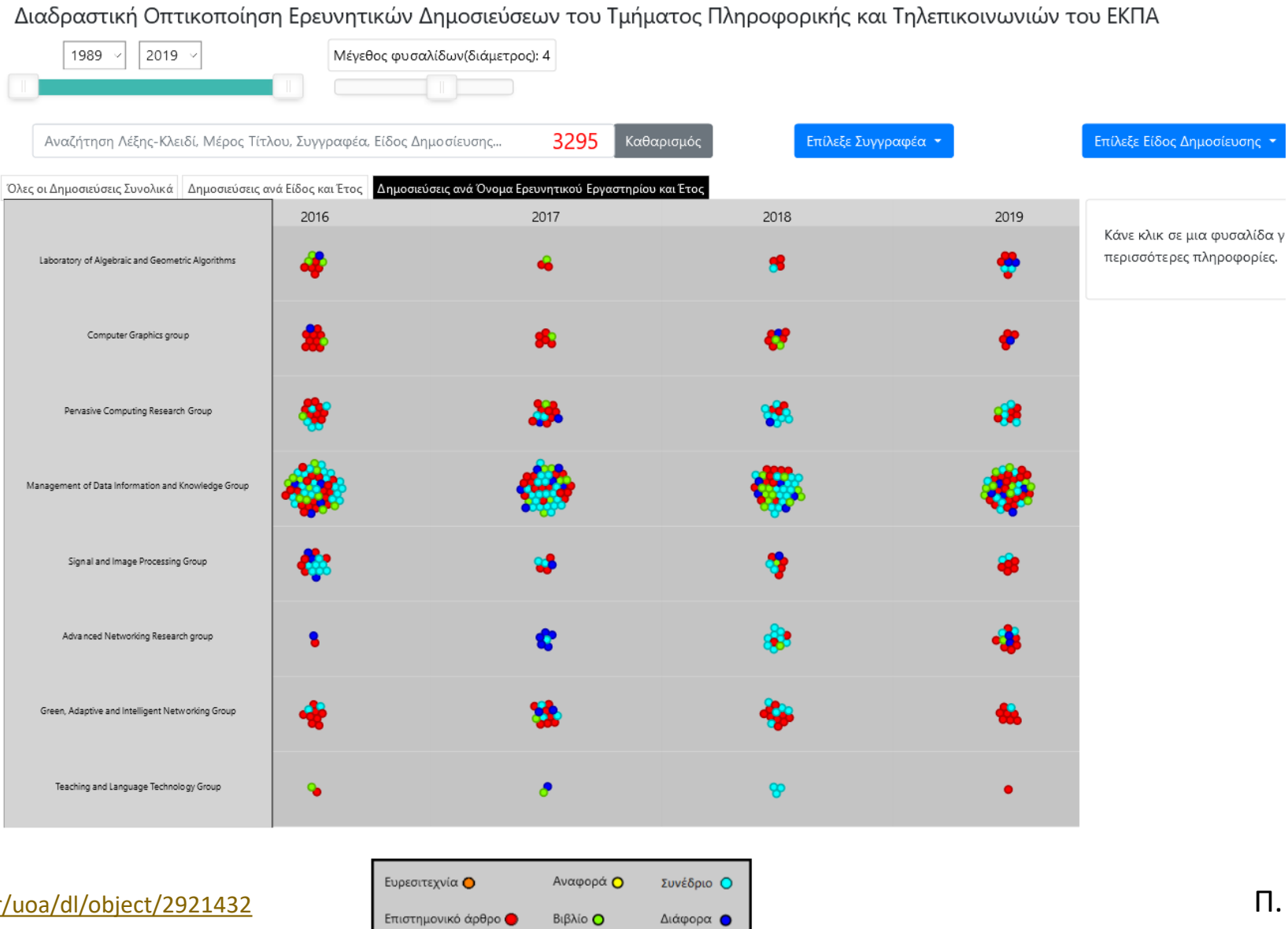
DataVis examples

■ UNHCR Evolution of persons of concern over timer



<https://datavis.tech/projects/unhcr-streamgraph-explorer/> & <https://unhcr.github.io/dataviz-streamgraph-explorer/#types=1-2-3-4-5-6-7>

DataVis examples



<https://pergamos.lib.uoa.gr/uoa/dl/object/2921432>

Π. Ξένος, 2020

-
- Combinations of visualizations on dashboards

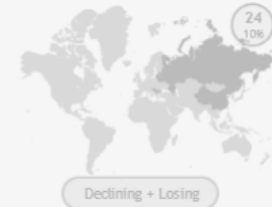
DataVis examples

Growth and Movement: Unveiling the Patterns of Population and Migration

Explore global demographic shifts, revealing the interplay between migration patterns and population trends.

How to use

Glossary



Growing + Losing

Growth Amidst Outflow

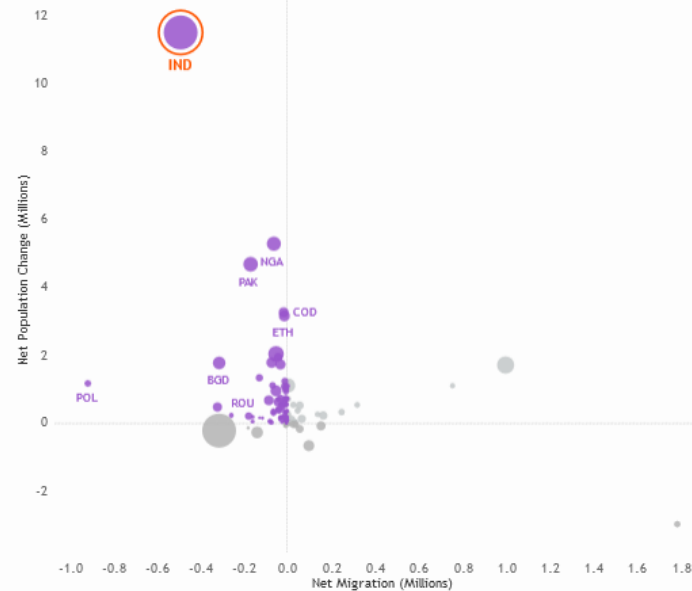
Regions in this category show a population increase despite a net outflow of residents. This growth, often from natural increases, is juxtaposed with challenges in retaining the populace, driven by factors like limited employment opportunities or the search for better living conditions. This scenario underscores the complex dynamics of population movements.

Overview

Countries in the 'Growing + Losing' category, primarily developing nations like India, Indonesia, and Mexico, are navigating demographic transitions, evident in declining fertility rates despite overall growth. This indicates significant future shifts in demographic profiles. Similarly, developed countries such as Poland and Romania face growth alongside a net outflow, with challenges like higher median ages and below-replacement fertility rates, hinting at a potential move towards a declining-losing dynamic.

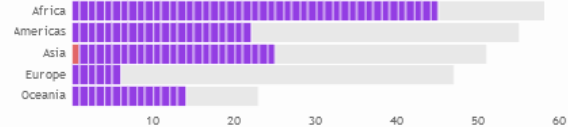
Migration vs. Population Change by Country Size

● Population size | ◐ Selected country



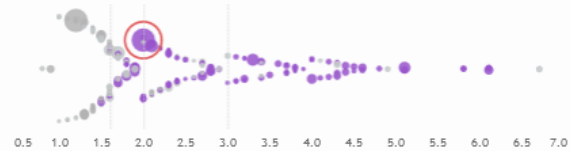
Country Distribution by Continent

■ Selected country



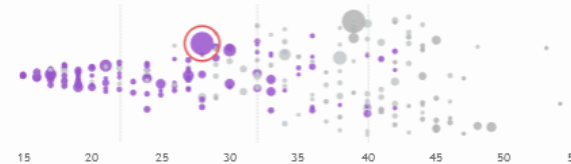
Worldwide Distribution of Fertility Rates by Country

● Population size | ◐ Selected country | Quantiles



Global Distribution of Median Age by Country

● Population size | ◐ Selected country | Quantiles



#makeovermonday | 2024 | week 6

Data: Populometer

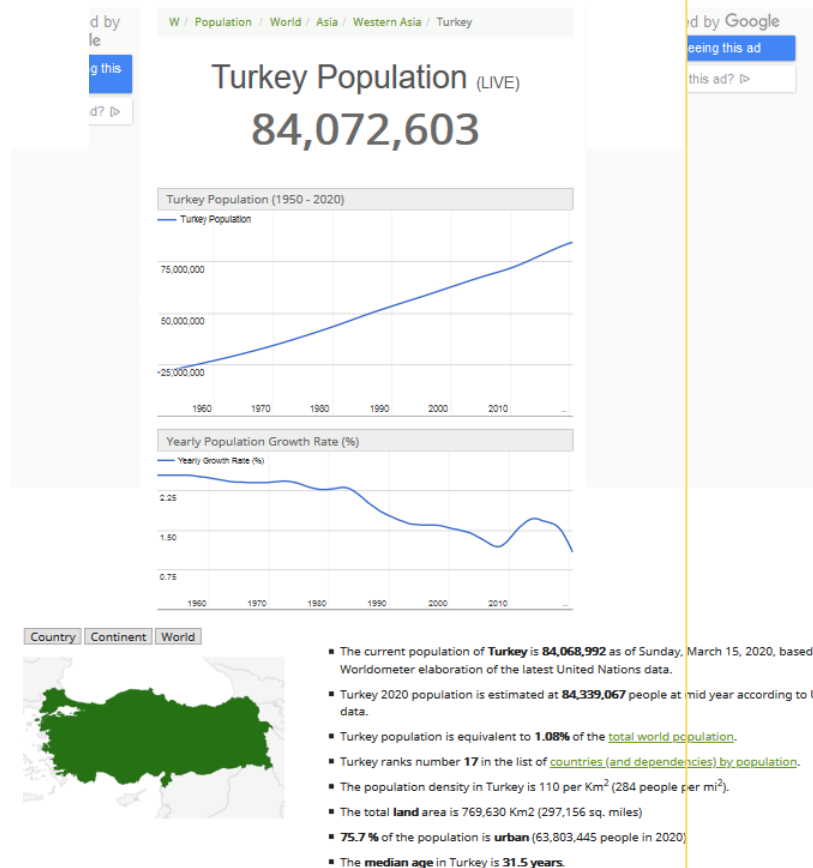
Viz: Felipe Sebben | @SebbenF

[View on Tableau Public](#)

[Share](#)

DataVis examples

■ Current World Population - worldometer



Population of Turkey (2020 and historical)

Year	Population	Yearly % Change	Yearly Change	Migrants (net)	Median Age	Fertility Rate	Density (P/Km ²)	Urban Pop %	Urban Population	Country's Share of World Pop	World Population	Turkey Global Rank
2020	84,339,067	1.09 %	909,452	283,922	31.5	2.08	110	75.7	63,803,445	1.08 %	7,794,798,739	17

World Population by Region

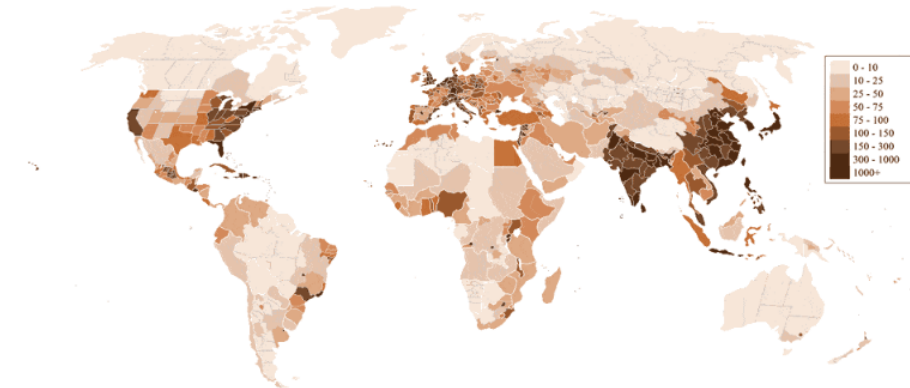
[back to top ↑](#)

#	Region	Population (2020)	Yearly Change	Net Change	Density (P/Km ²)	Land Area (Km ²)	Migrants (net)	Fert. Rate	Med. Age	Urban Pop %	World Share
1	Asia	4,641,054,775	0.86 %	39,683,577	150	31,033,131	-1,729,112	2.2	32	0 %	59.5 %
2	Africa	1,340,598,147	2.49 %	32,533,952	45	29,648,481	-463,024	4.4	20	0 %	17.2 %
3	Europe	747,636,026	0.06 %	453,275	34	22,134,900	1,361,011	1.6	43	0 %	9.6 %
4	Latin America and the Caribbean	653,962,331	0.9 %	5,841,374	32	20,139,378	-521,499	2	31	0 %	8.4 %
5	Northern America	368,869,647	0.62 %	2,268,683	20	18,651,660	1,196,400	1.8	39	0 %	4.7 %
6	Oceania	42,677,813	1.31 %	549,778	5	8,486,460	156,226	2.4	33	0 %	0.5 %

World Population Density (people/km²)

[back to top ↑](#)

Population density map of the world showing not only countries but also many subdivisions (regions, states, provinces). See also: [World Map](#)



Courtesy of [Junuxx](#) at [en.wikipedia](#) [CC-BY-SA-3.0 or GFDL], via [Wikimedia Commons](#)

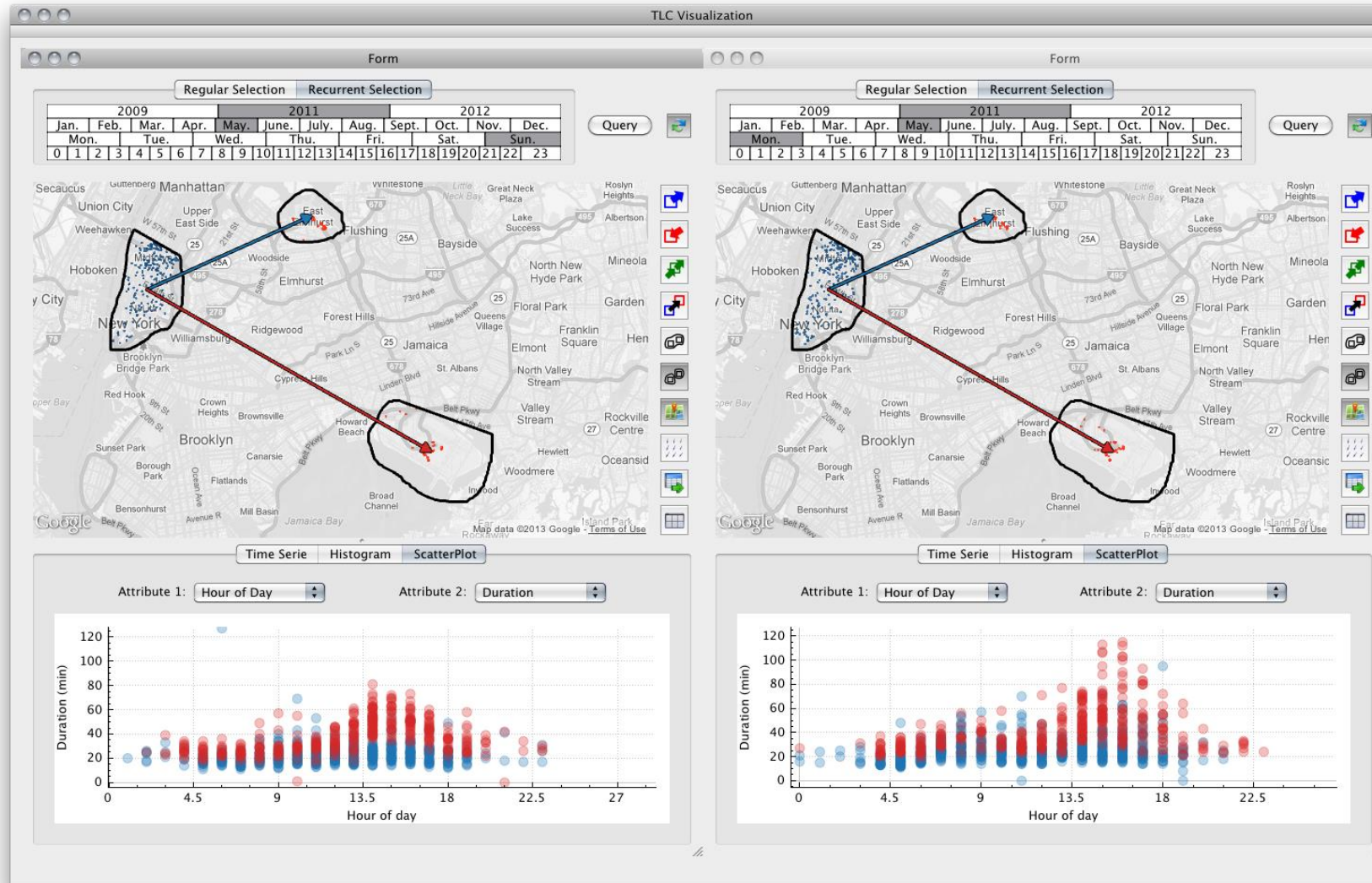
World Population by Religion

[back to top ↑](#)

According to a recent study (based on the 2010 world population of 6.9 billion) by [The Pew Forum](#), there are:

- **2,173,180,000 Christians (31% of world population)**, of which 50% are Catholic, 37% Protestant, 12% Orthodox, and 1% other.
- **1,598,510,000 Muslims (23%)**, of which 87-90% are Sunnis, 10-13% Shia.

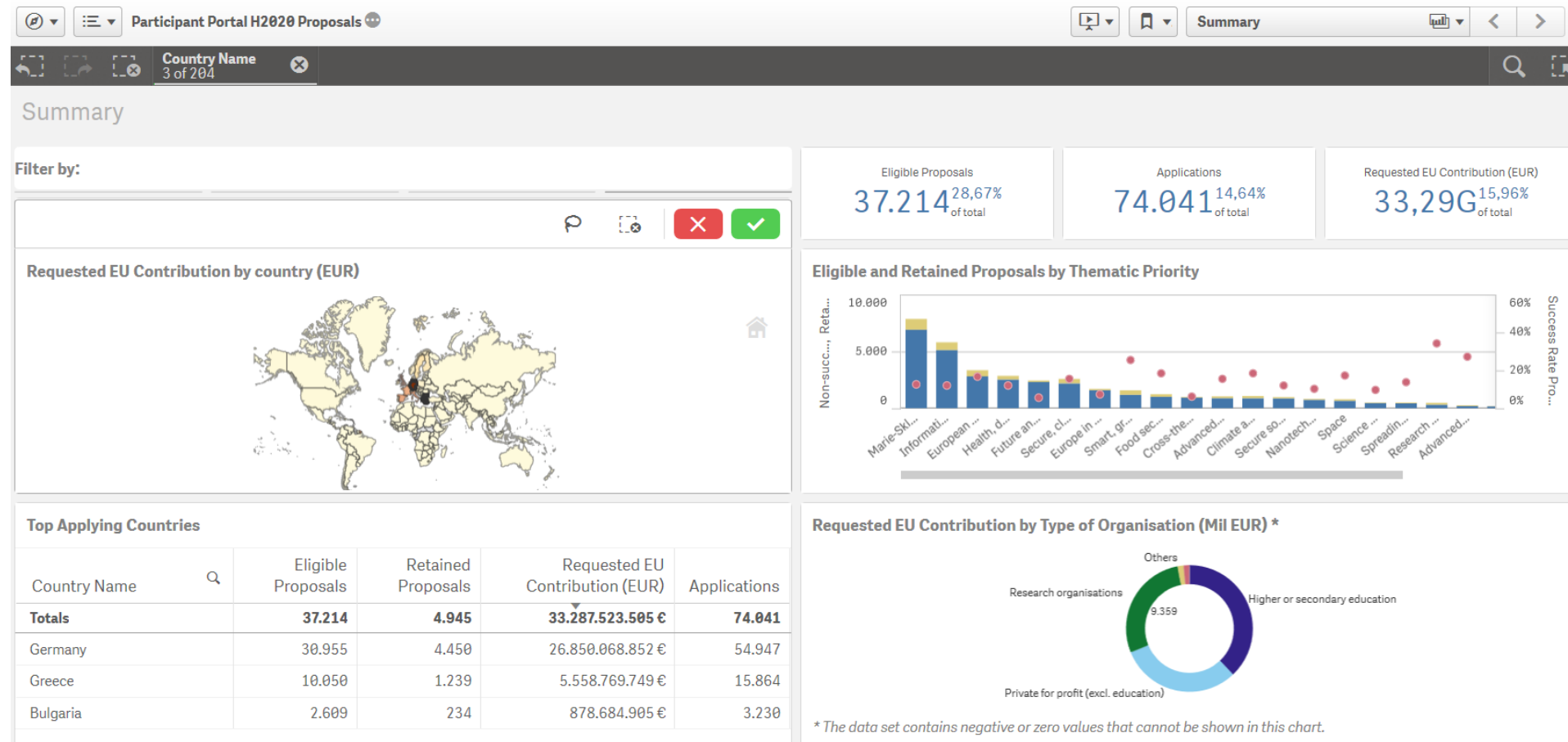
DataVis dashboards



New York City Taxi Trips <http://vgc.poly.edu/projects/taxivis/>

DataVis dashboards

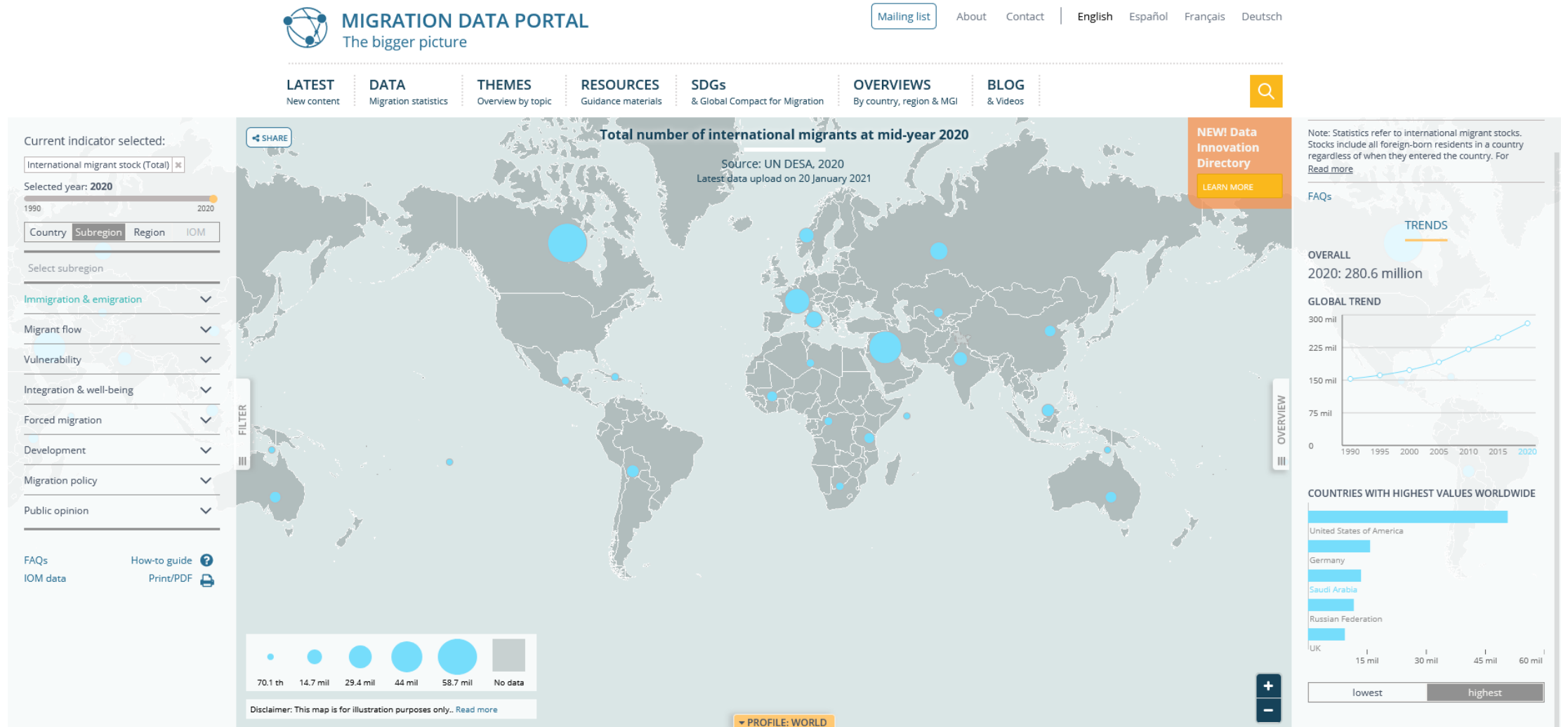
■ European Commission funding, 2017



European Commission, 2017

DataVis dashboards

■ Migration Data Portal



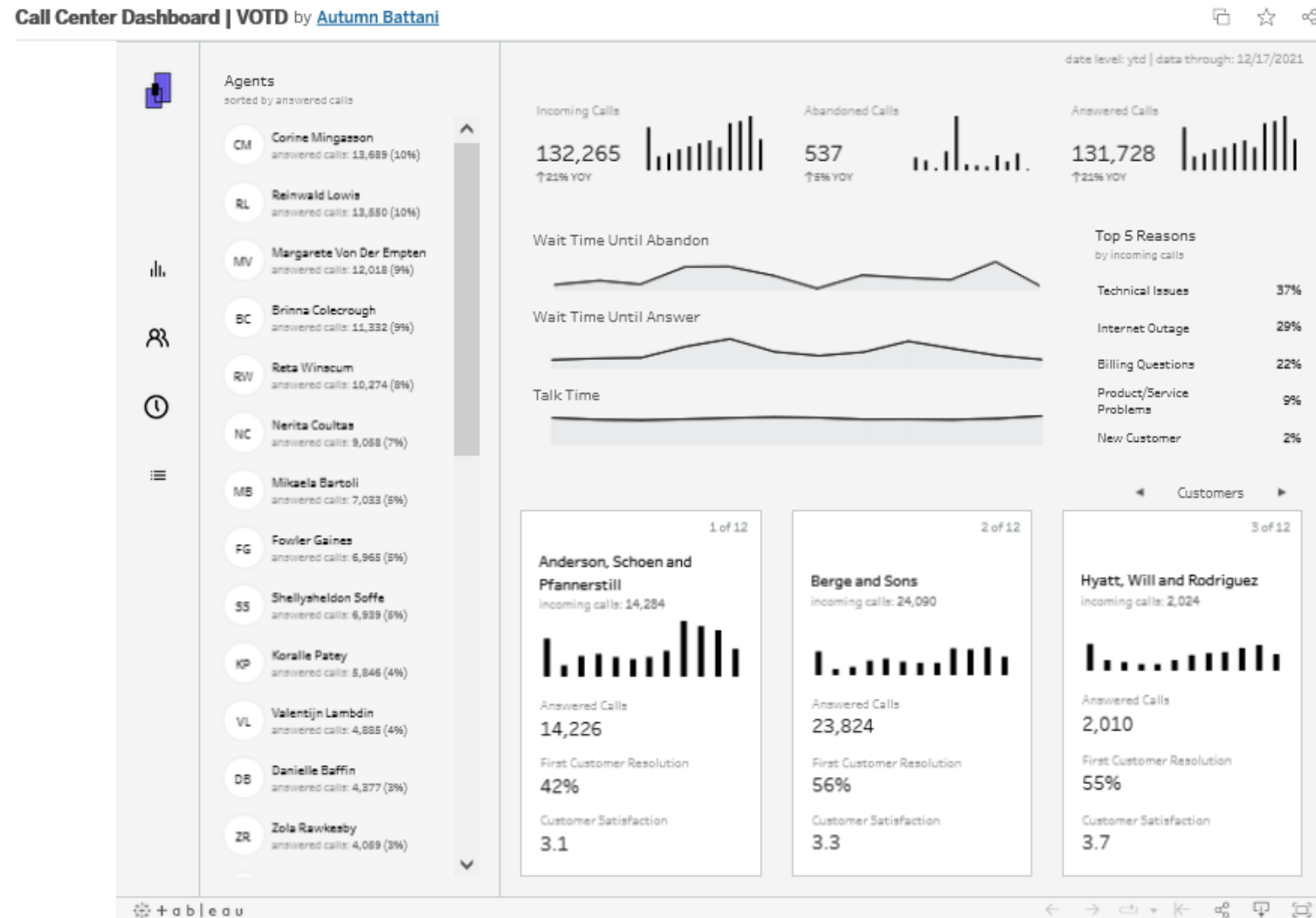
DataVis dashboards

■ IMF DataMapper



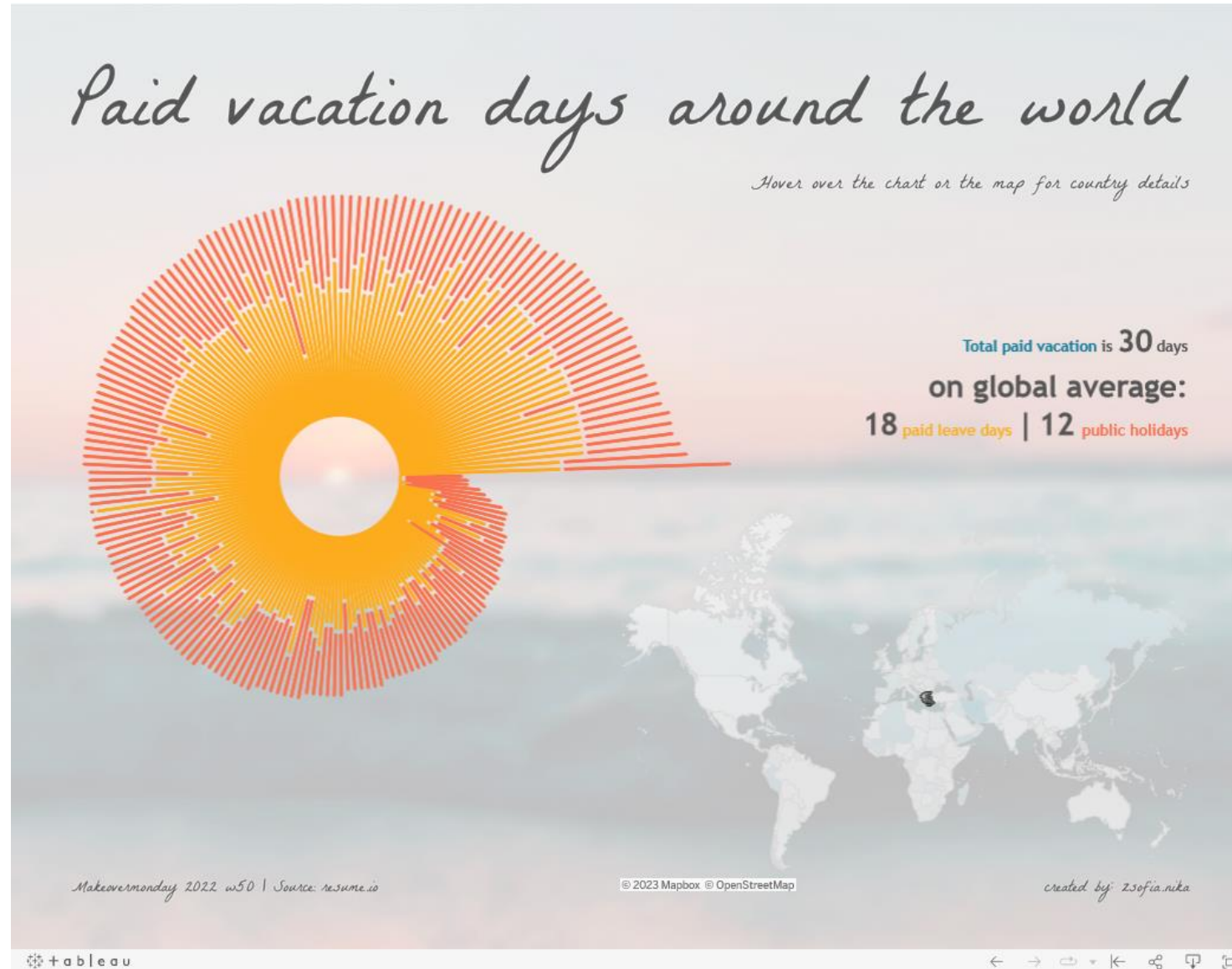
DataVis dashboards

■ CallCenter Dashboard



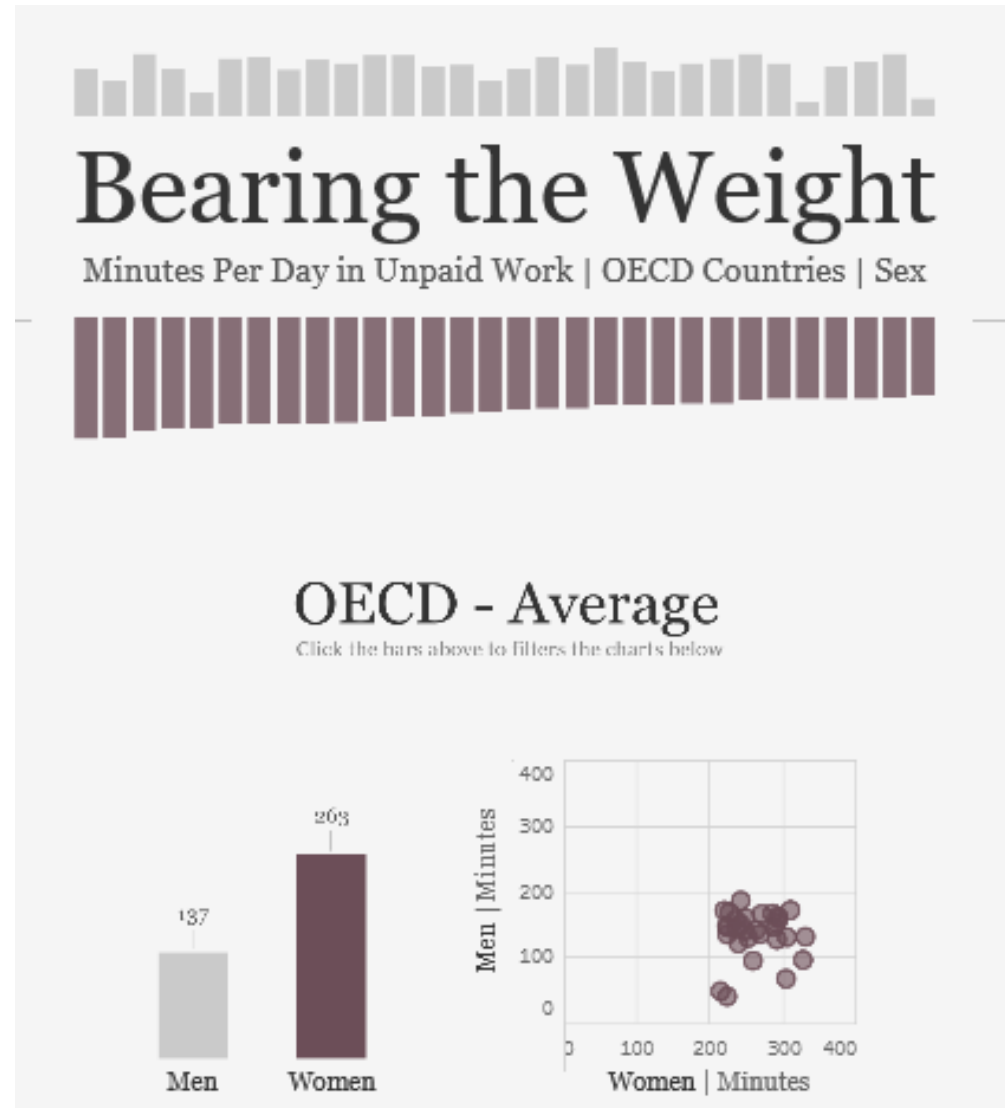
DataVis dashboards

- radial
&
- map



DataVis dashboards

- Bars
- Scatter plot



DataVis dashboards

Back to the 80s

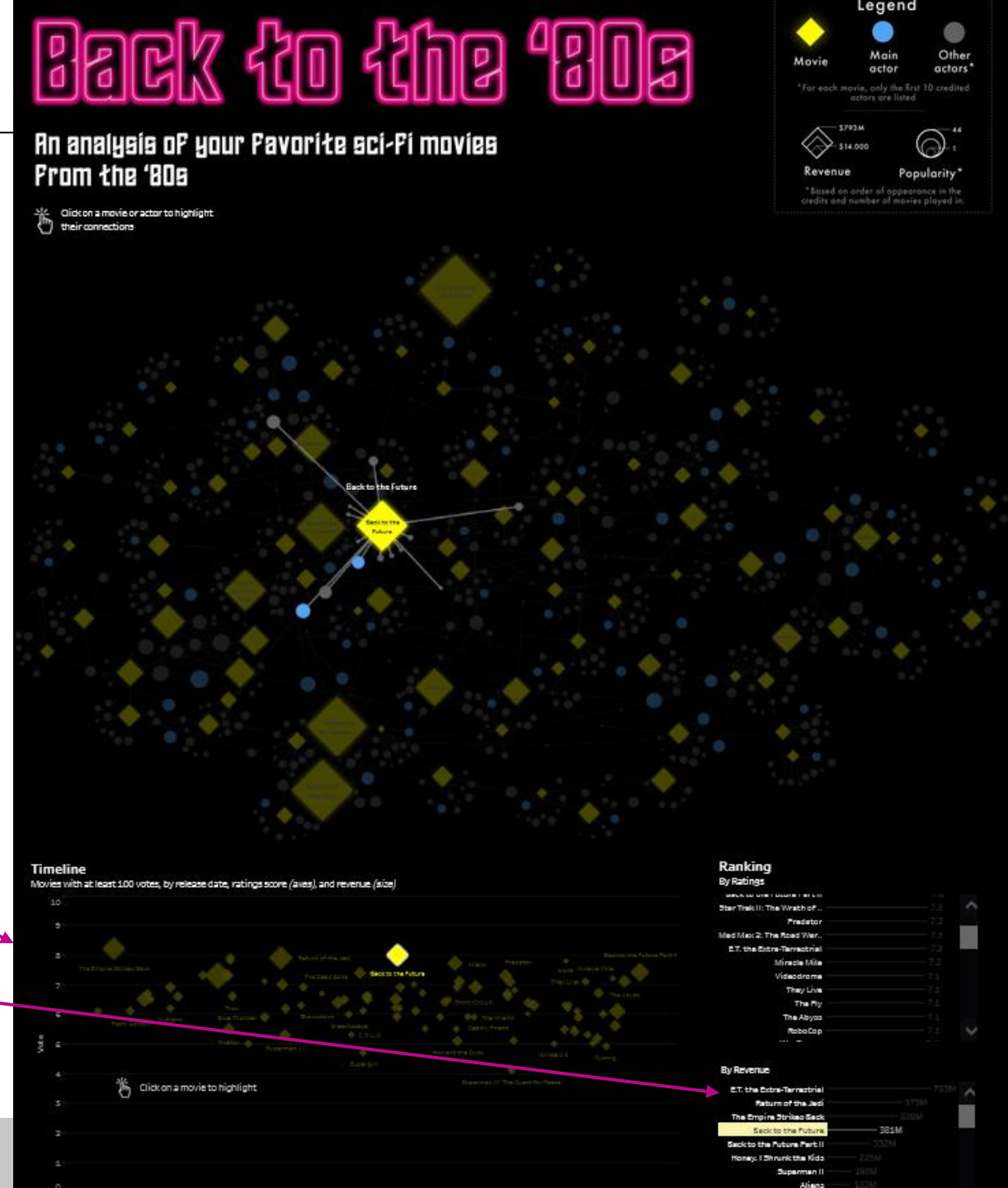
An analysis of your favorite movies from the 80s

Data from Kaggle

A choice on the top viz

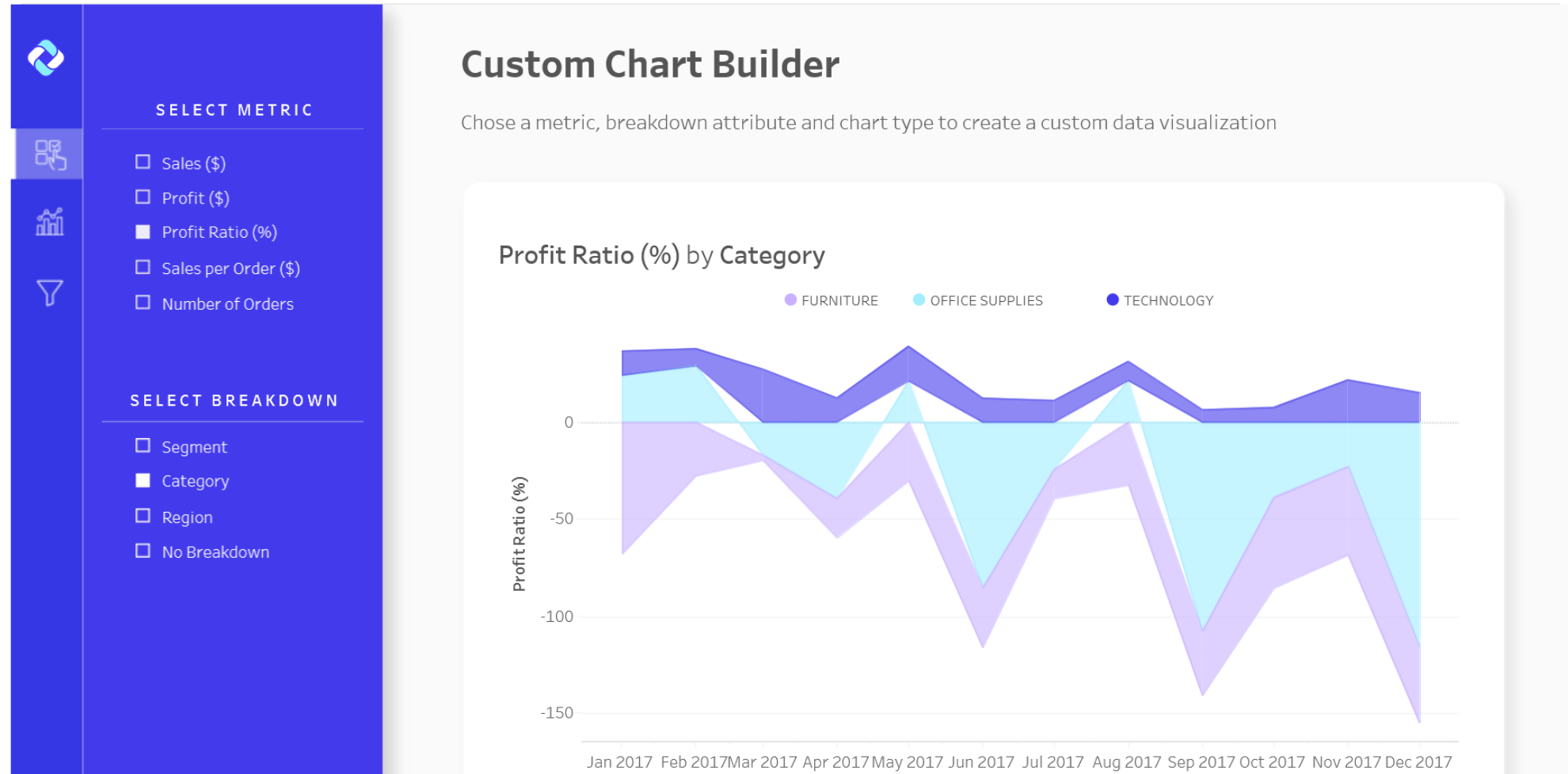
“filters” the same movie on a timeline viz

and on the list



Viz Builder

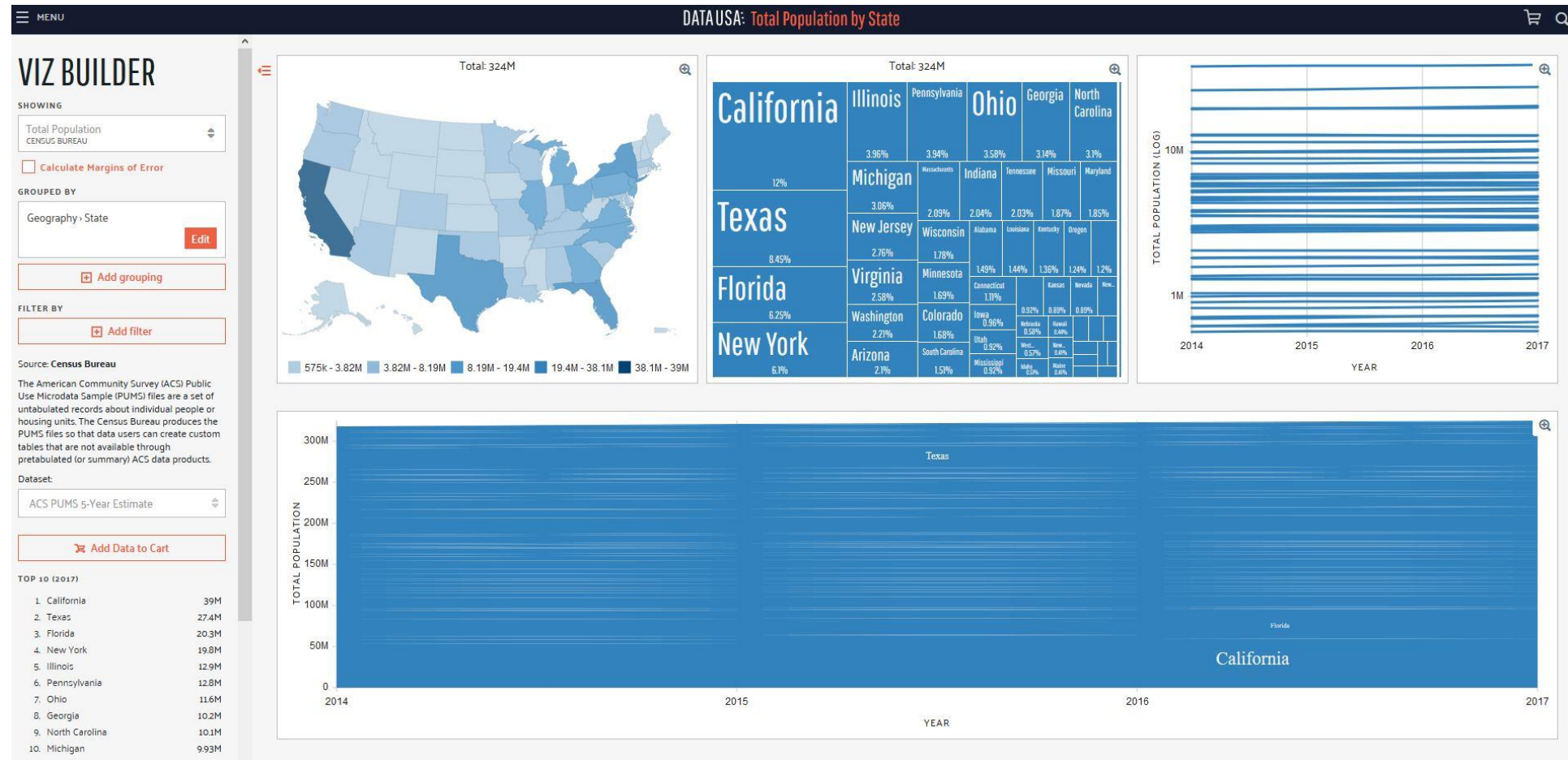
- “Building” simple charts



<https://public.tableau.com/app/profile/kasia.gasiewska.holc/viz/CustomChartBuilder/CustomChartBuilder>

Viz Builder

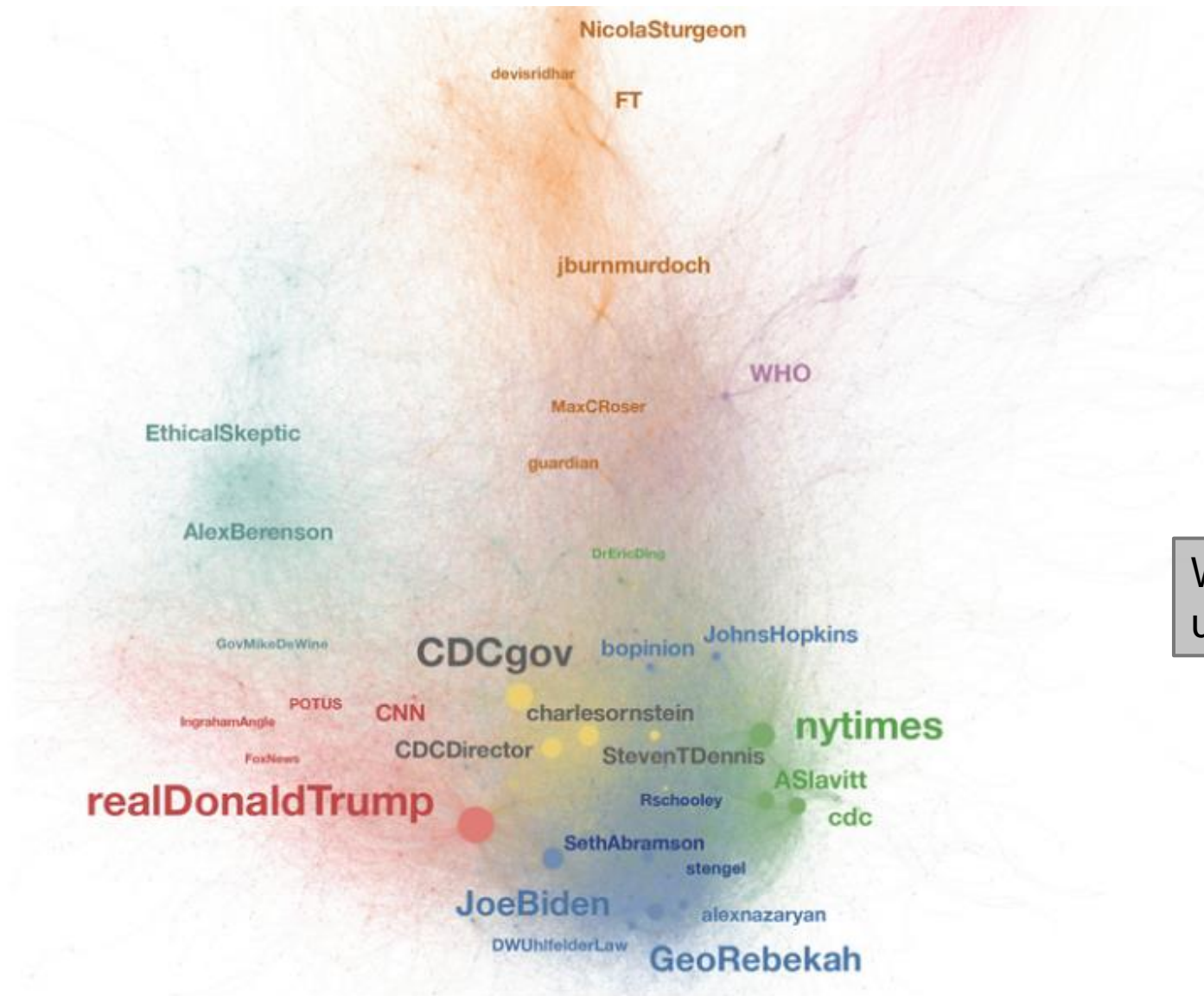
- “Building” visualizations of USA data with a filters-based interface



Video demo: <https://vimeo.com/343322385>

- Shneiderman, B. (2020, April). **Data Visualization's Breakthrough Moment in the COVID-19 Crisis.** *Nightingale: The Journal of the Data Visualization Society*. Retrieved from <https://medium.com/nightingale/data-visualizations-breakthrough-moment-in-the-covid-19-crisis-ce46627c7db5>
- Ackerman, D. (2021, March). When more Covid-19 data doesn't equal more understanding. *MIT News*. Retrieved from <https://news.mit.edu/2021/when-more-covid-data-doesnt-equal-more-understanding-0304>

COVID 19 data visualization



This figure shows a network visualization of Twitter users appearing in the research. Color encodes community and nodes are sized by their degree of connectedness.

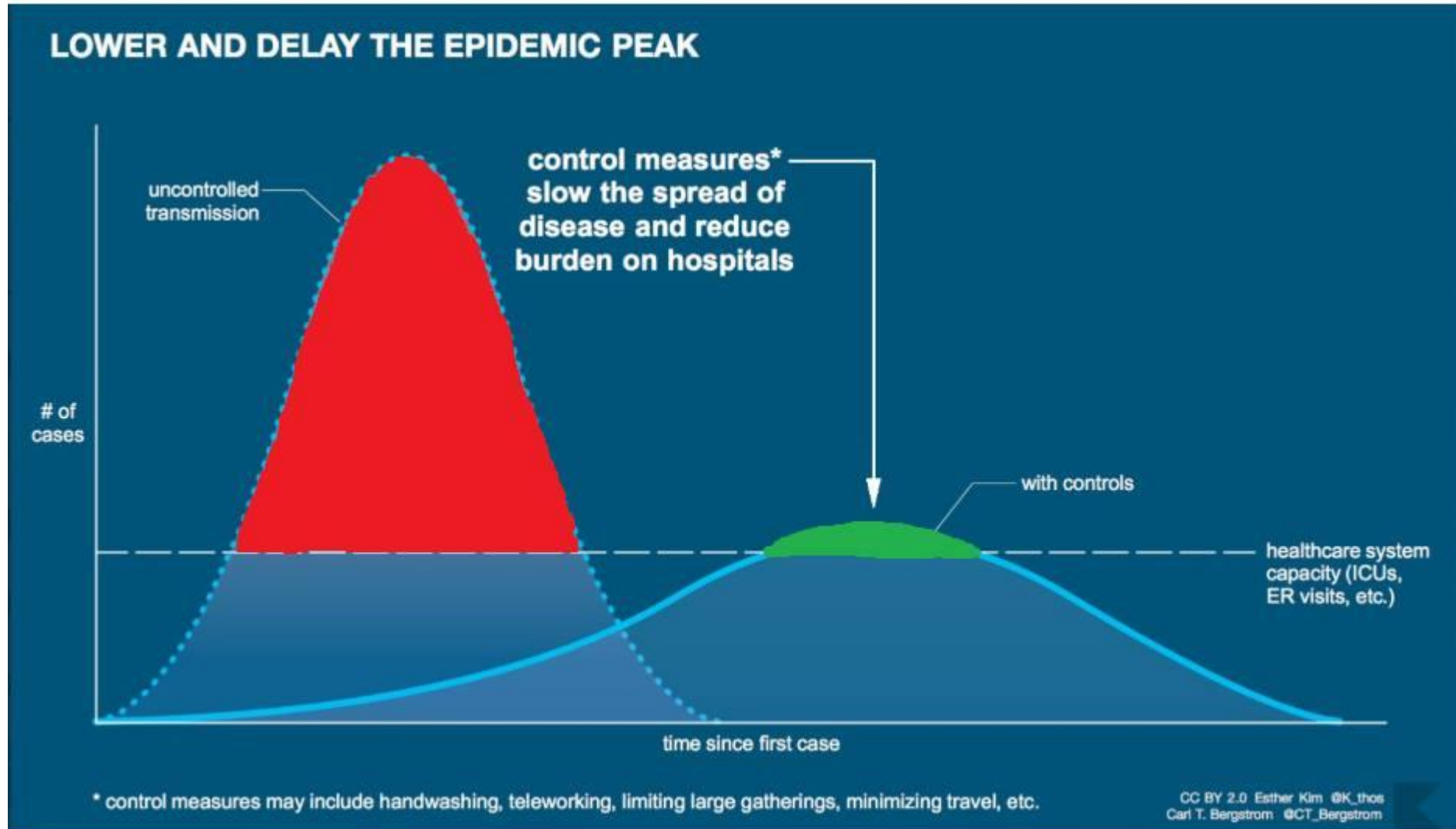
Courtesy of the researchers

When more Covid-19 data doesn't equal more understanding. *MIT News*.



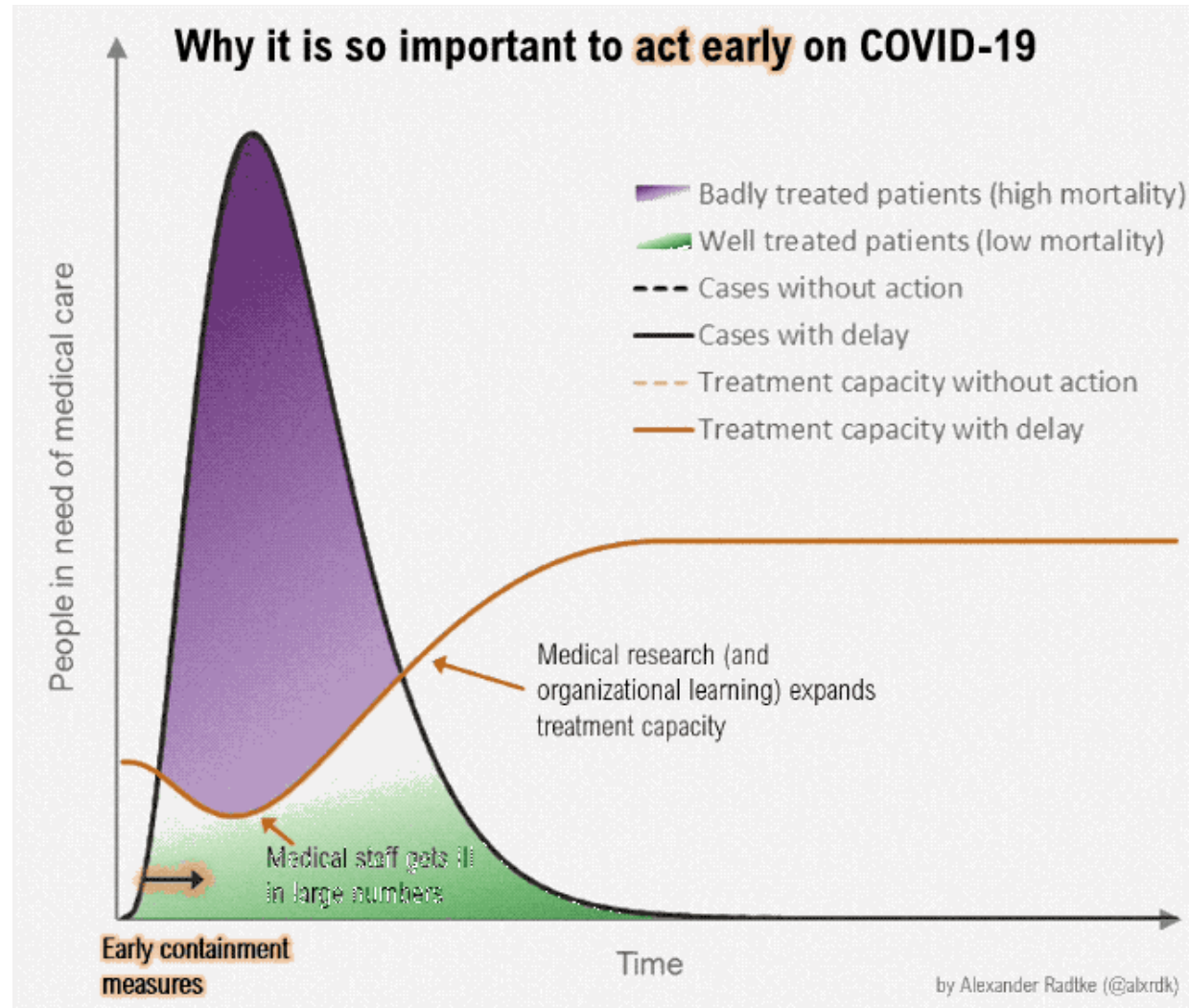
COVID 19 data visualization

- COVID-19 epidemic: Flatten the curve



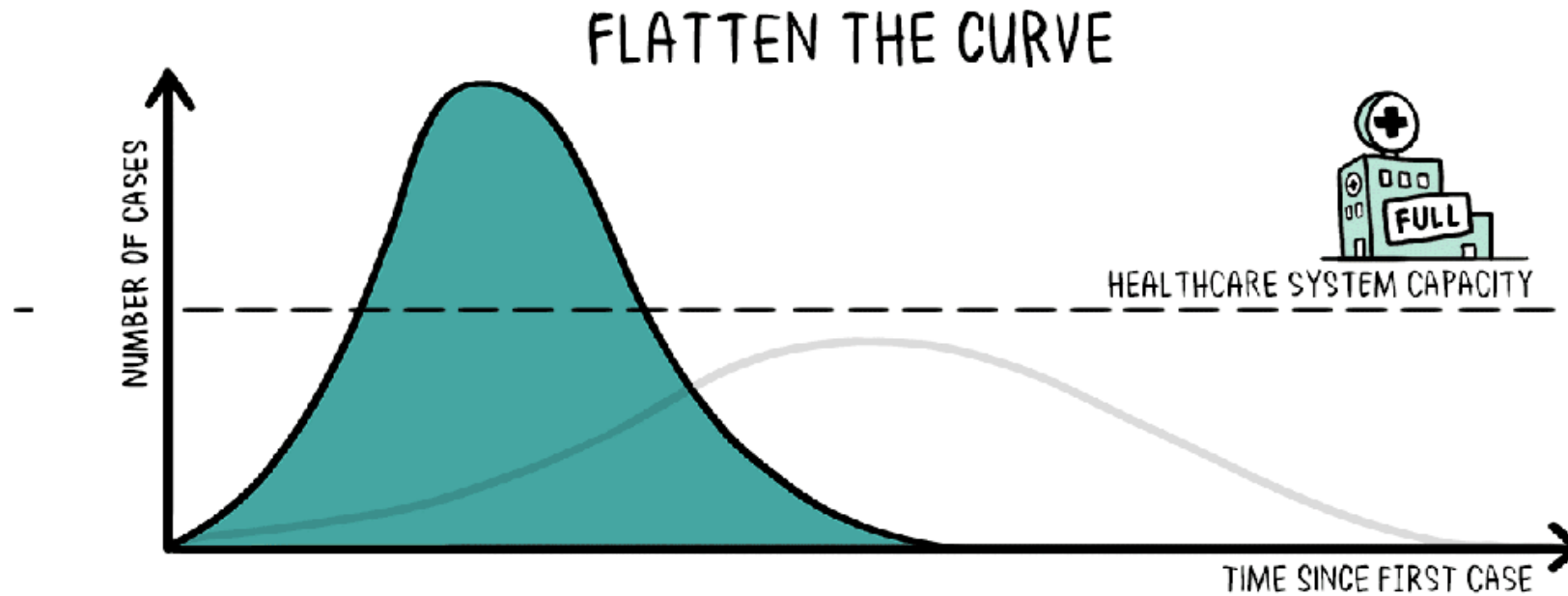
COVID 19 data visualization

■ COVID-19 epidemic: Flatten the curve



COVID 19 data visualization

- COVID-19 epidemic: Flatten the curve

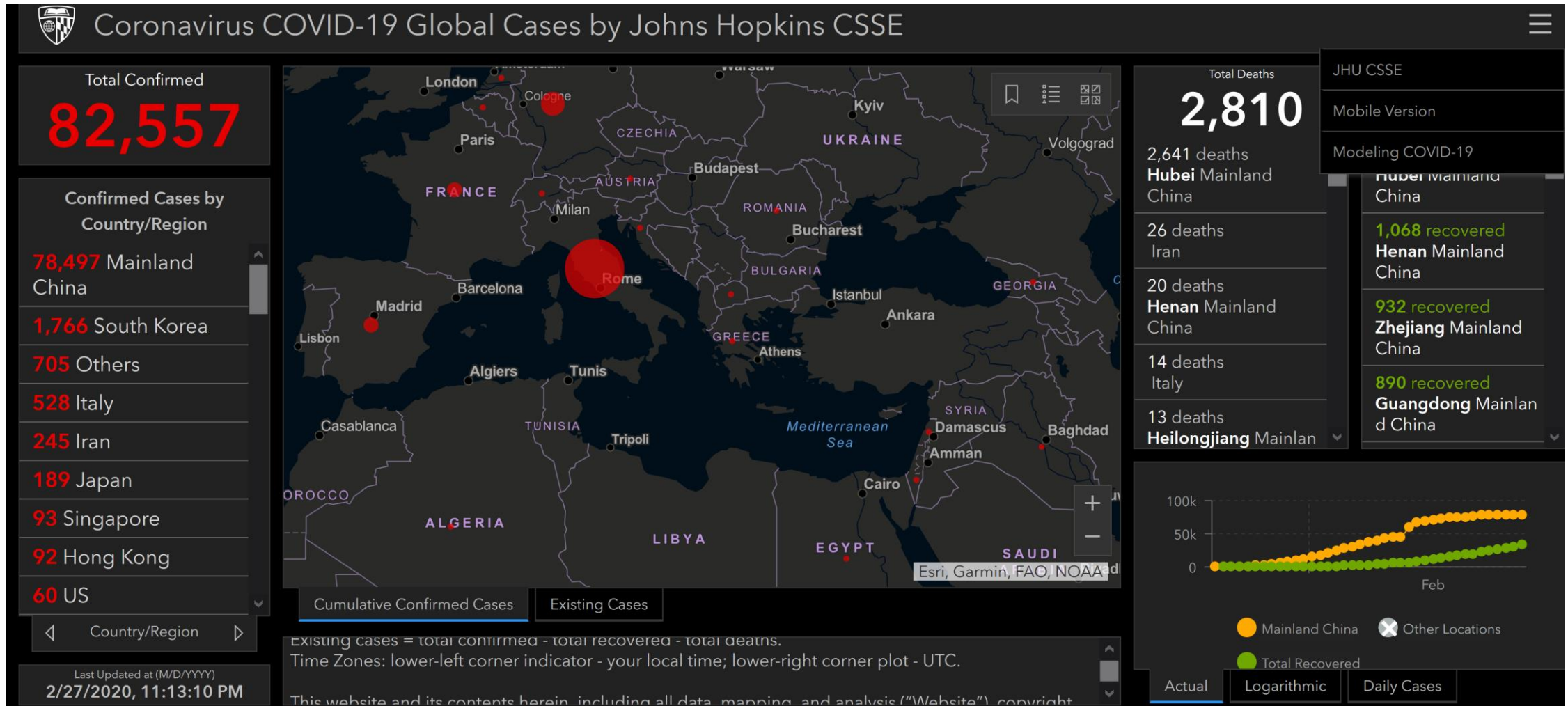


@SIOUXSIEW @XTOTL @THESPINOFFTV

'ADAPTED FROM @DREWAHARRIS, THOMAS SPLETTSTÖBER (@SPLETTE) AND THE CDC'
CC-BY-SA

COVID 19 data visualization

COVID-19 epidemic: Real-time outbreak

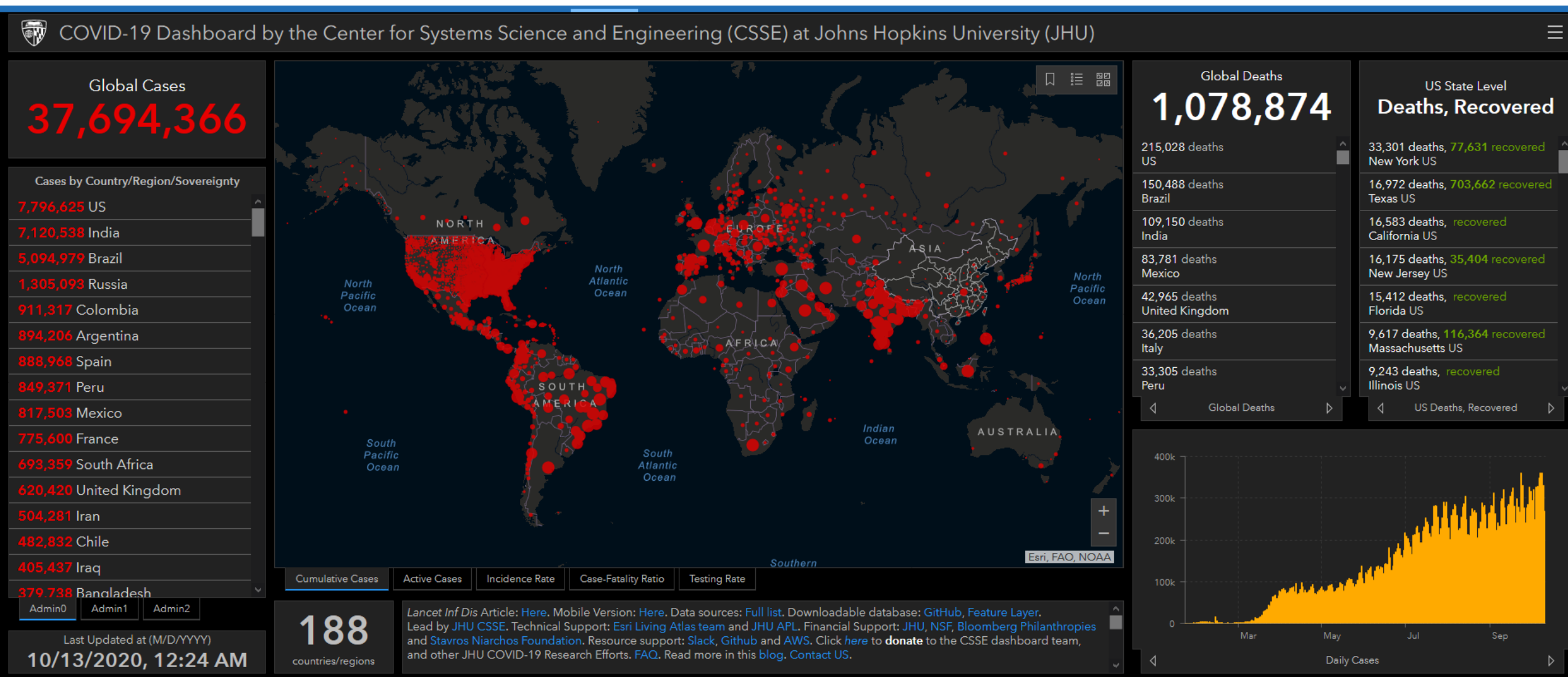


COVID 19 data visualization

■ COVID-19 epidemic: Real-time outbreak



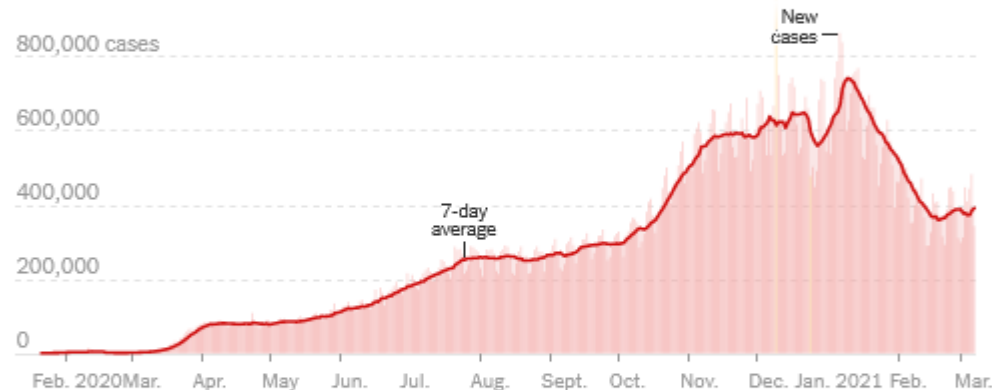
COVID 19 data visualization



Johns Hopkins University COVID-19 dashboard

Coronavirus World Map: Tracking the Global Outbreak

Updated March 8, 2021, 12:04 A.M. E.T.



	TOTAL REPORTED	ON MARCH 7	14-DAY CHANGE
Cases	116.8 million+	342,103	+7% →
Deaths	2.5 million+	5,260	-8% →

■ Day with reporting anomaly. 14-day change trends use 7-day averages.

Jump to:

Map

Country table

New cases

Tips

COVID 19 data visualization



[Home](#) [Data](#) [Community](#) [About](#)

[GitHub](#)

COVID-19 Forecasts

Week Ahead

[? Help](#)

[Time Chart](#)

The **ensemble** forecast is a multi-model ensemble developed and published weekly in real-time that combines models with varied approaches, data sources, and assumptions.

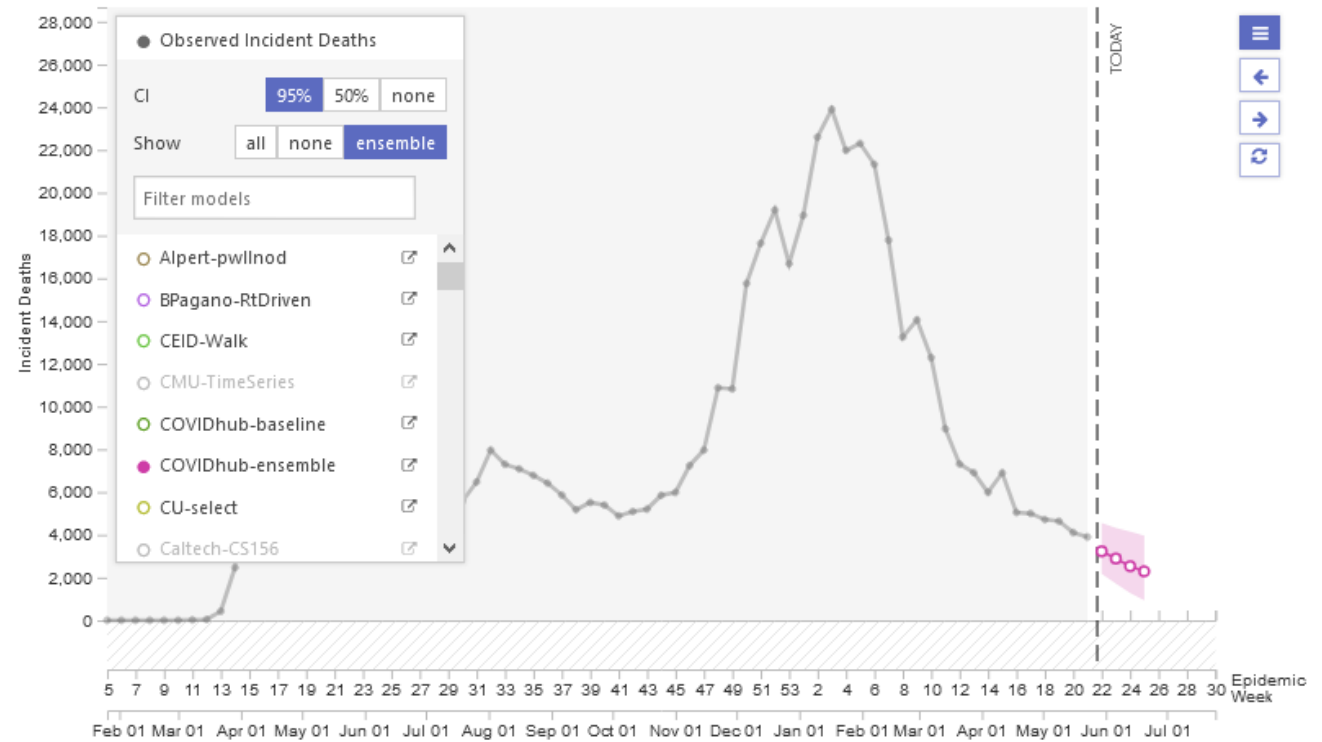
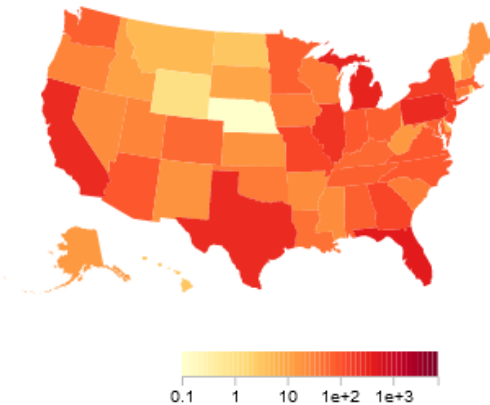
WEEK 21 (2021)

TARGET

US National

Incident Deaths

Incident Deaths (Observed)

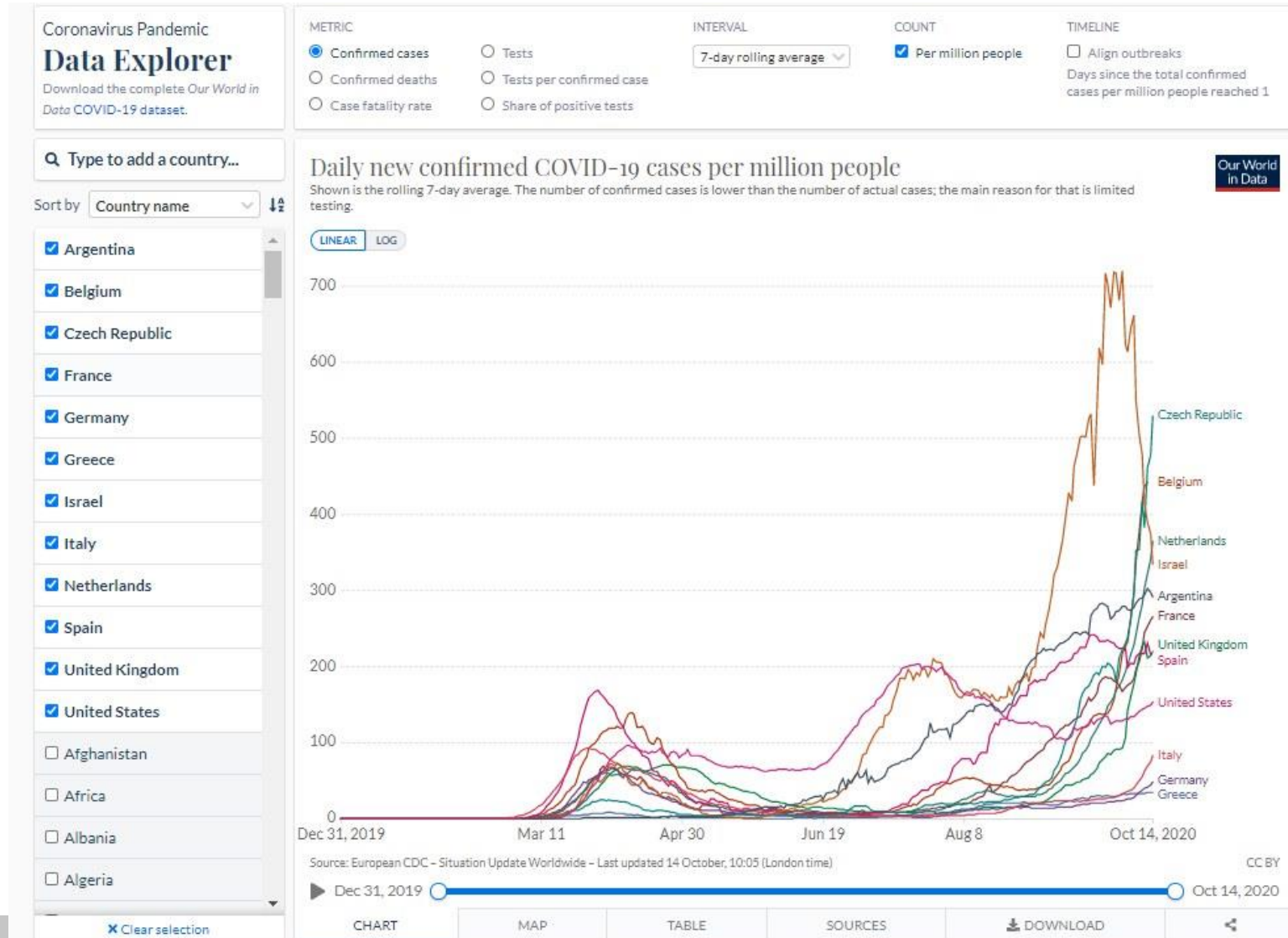


Data last updated on **Tue, 25 May 2021 13:48:21 GMT**.

Visualizations use D3, see the supported browsers here. The source is licensed MIT.

Linear & logarithmic daily cases

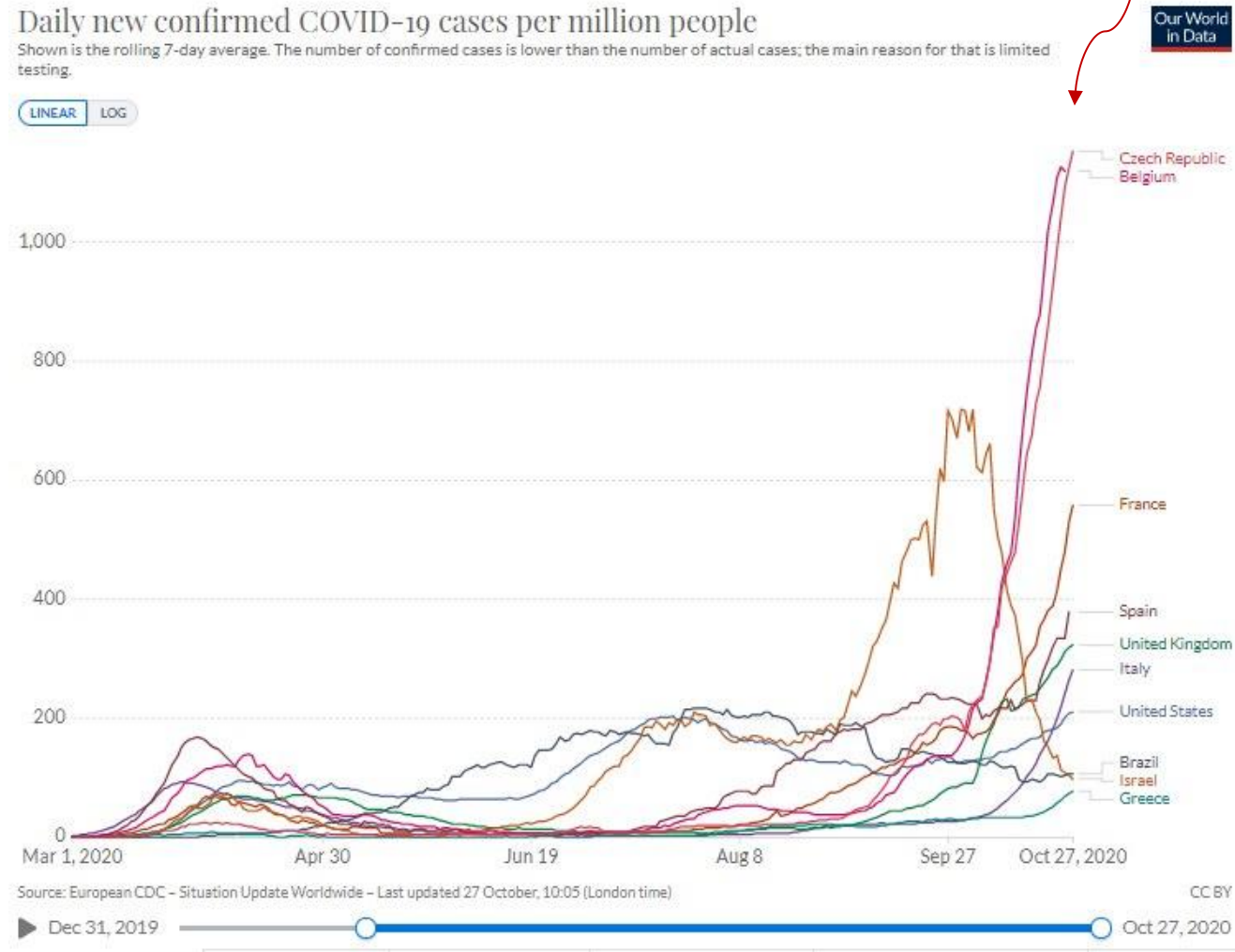
- Our World in Data – ECDC data



Linear & logarithmic daily cases

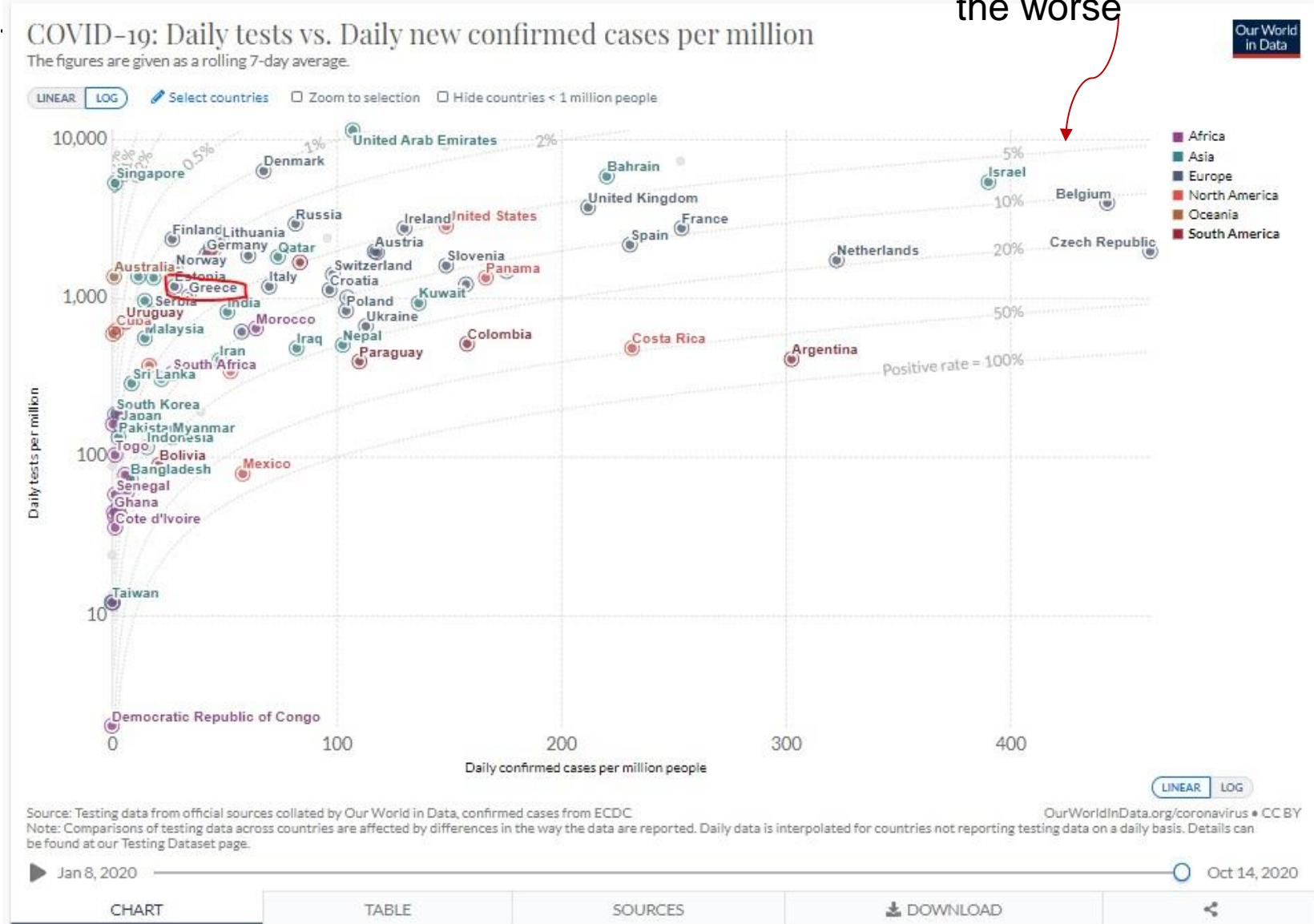
- Our World in Data

the more up here
the worse



Linear & logarithmic daily tests vs. cases

- Our World in Data



the more up here
the worse

- Compare state outbreaks - daily growth or decline

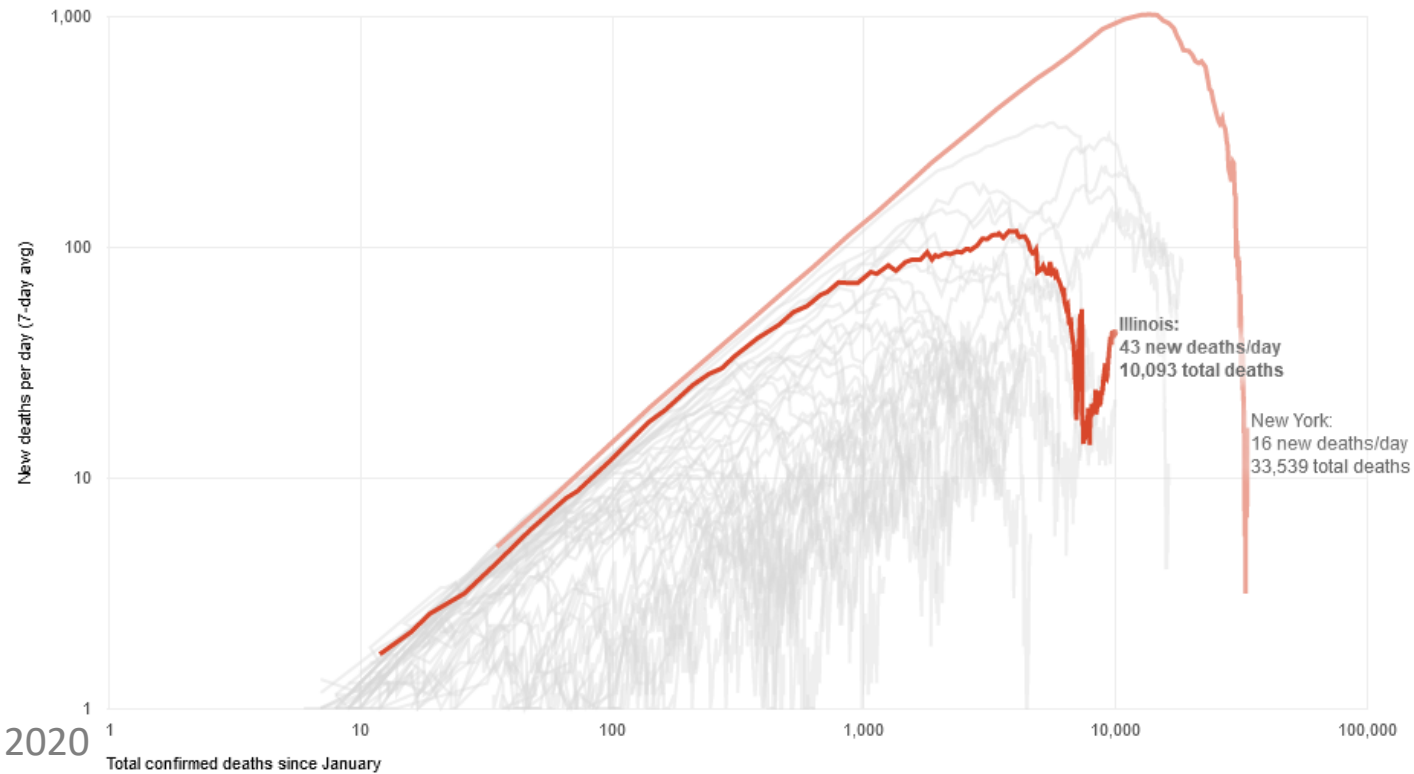
Are New Cases And Deaths Still Growing In Your State?

Data as of November 2

NEW DAILY CASES

NEW DAILY DEATHS

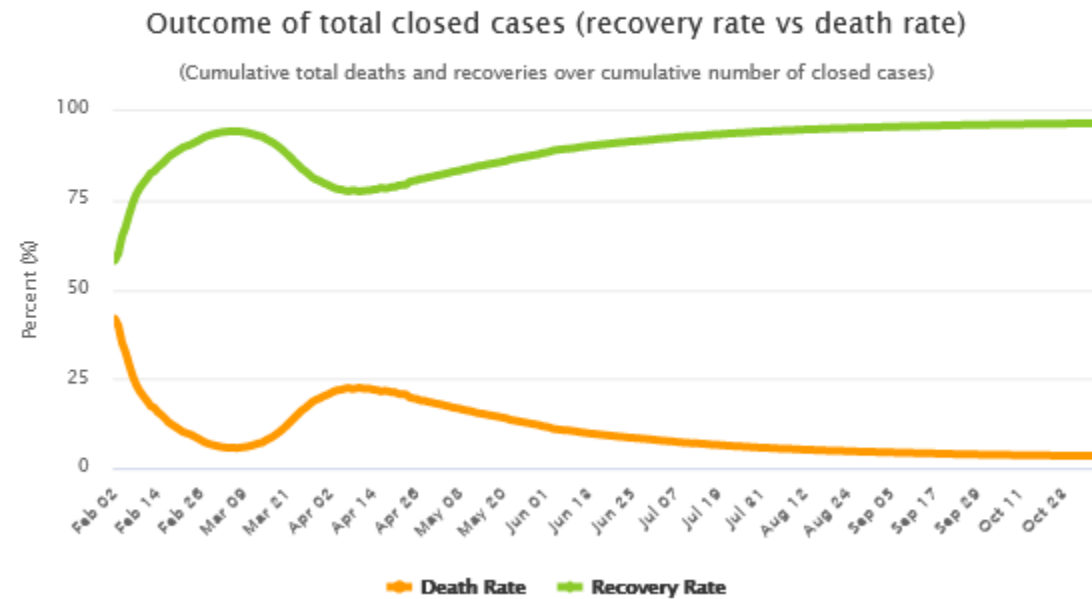
Illinois

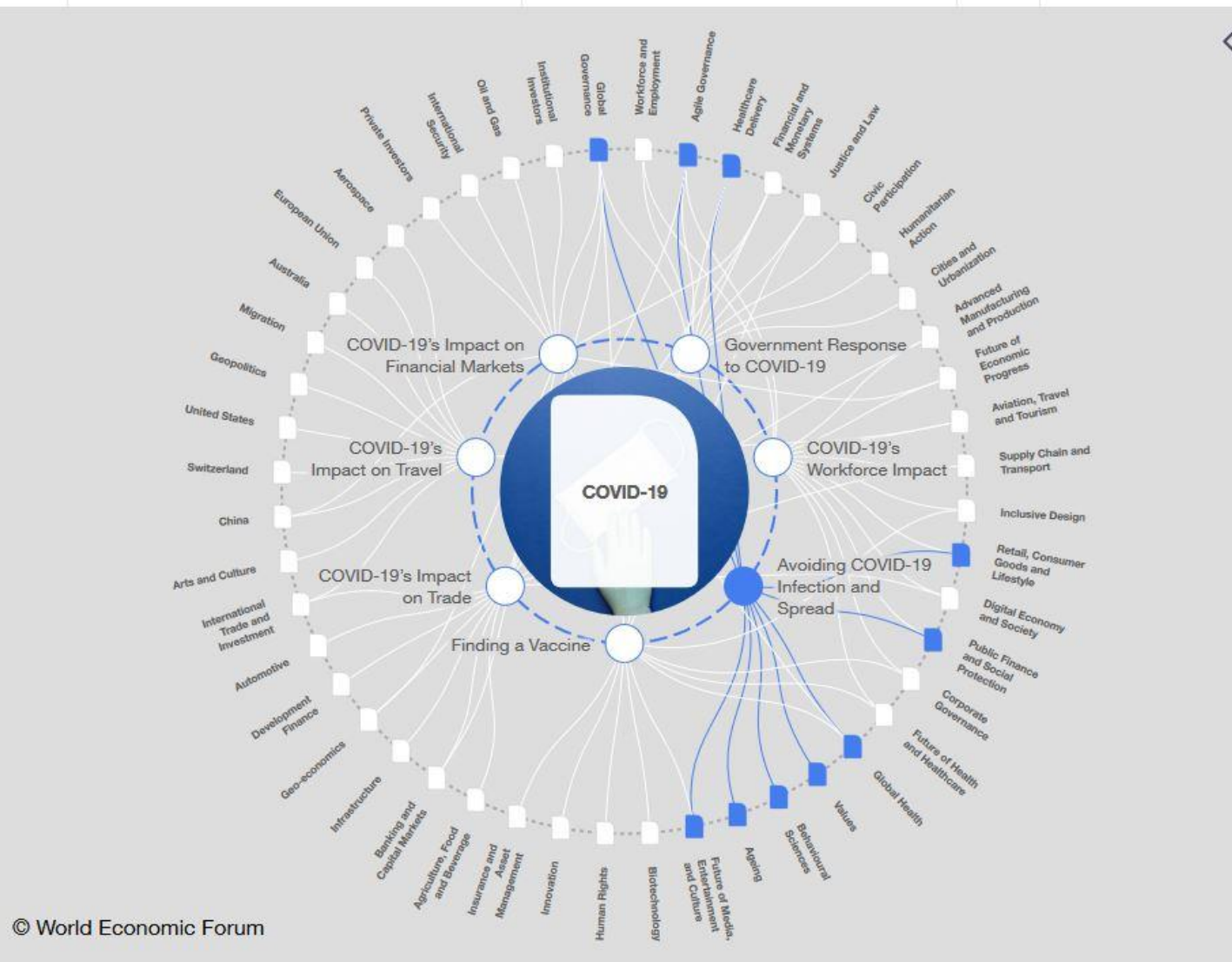


New York Times Interactive, 2020

■ Worldometer

Outcome of Cases (Recovery or Death)



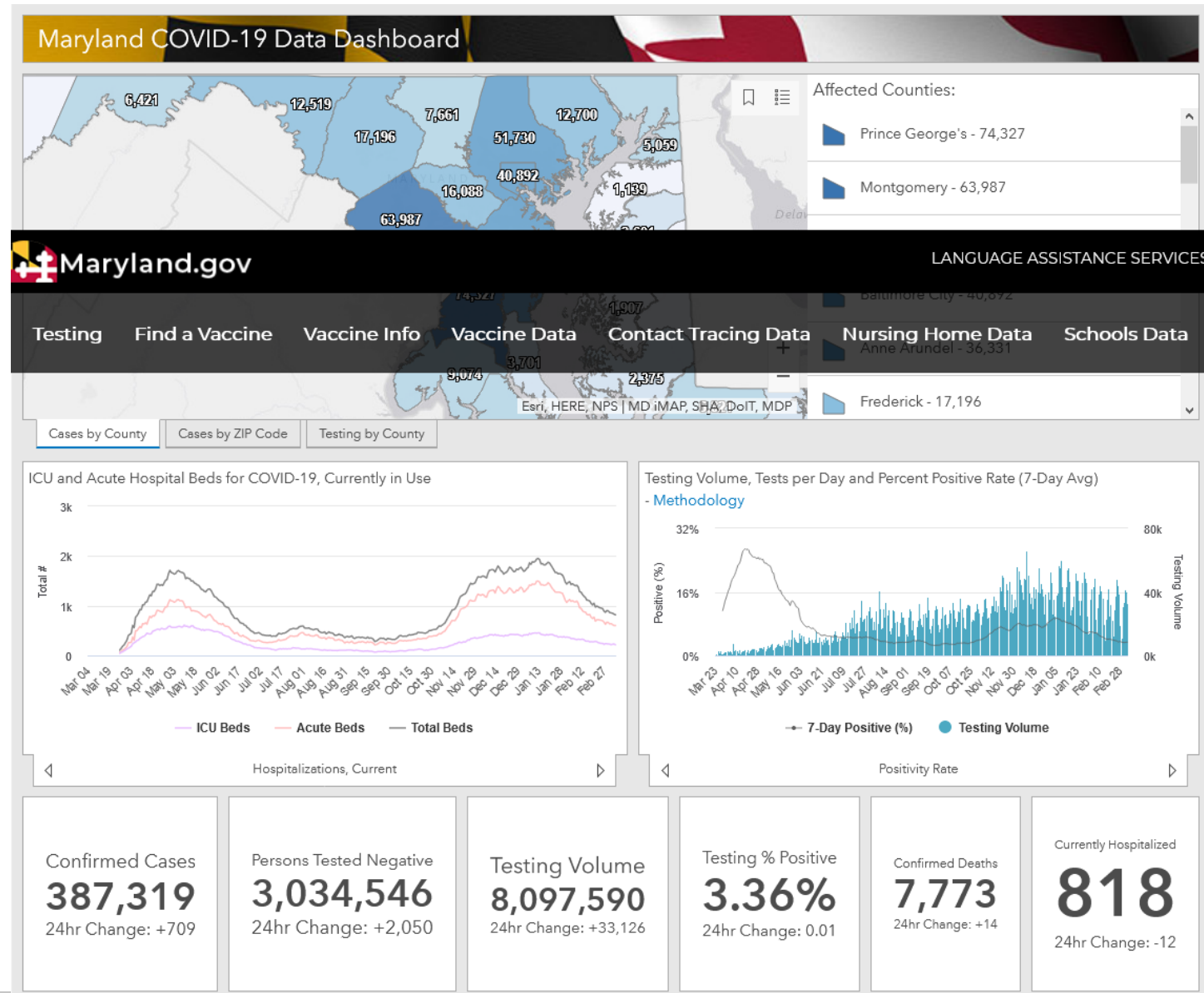


COVID 19 data visualization



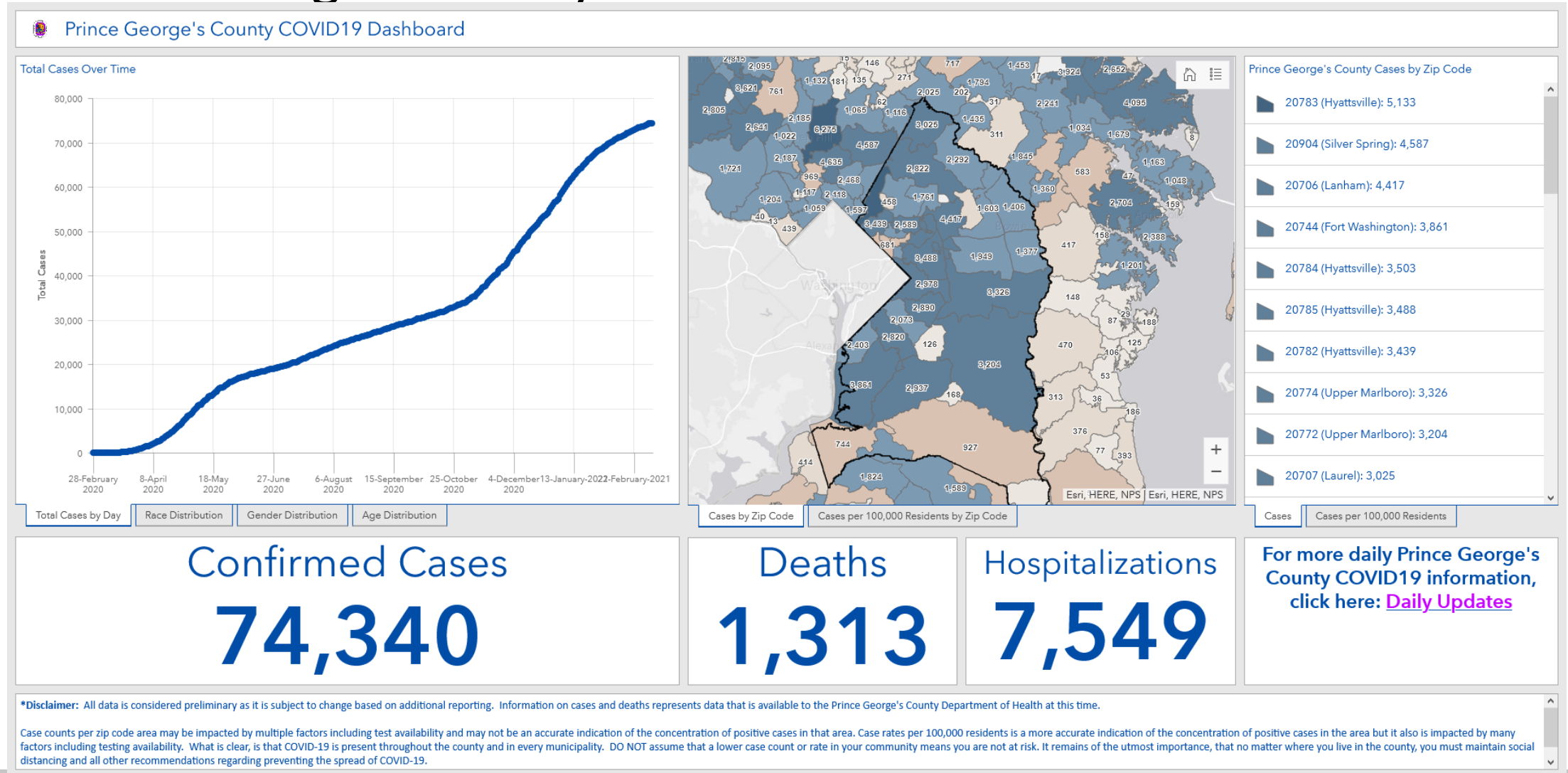
COVID 19 data visualization

- dashboards



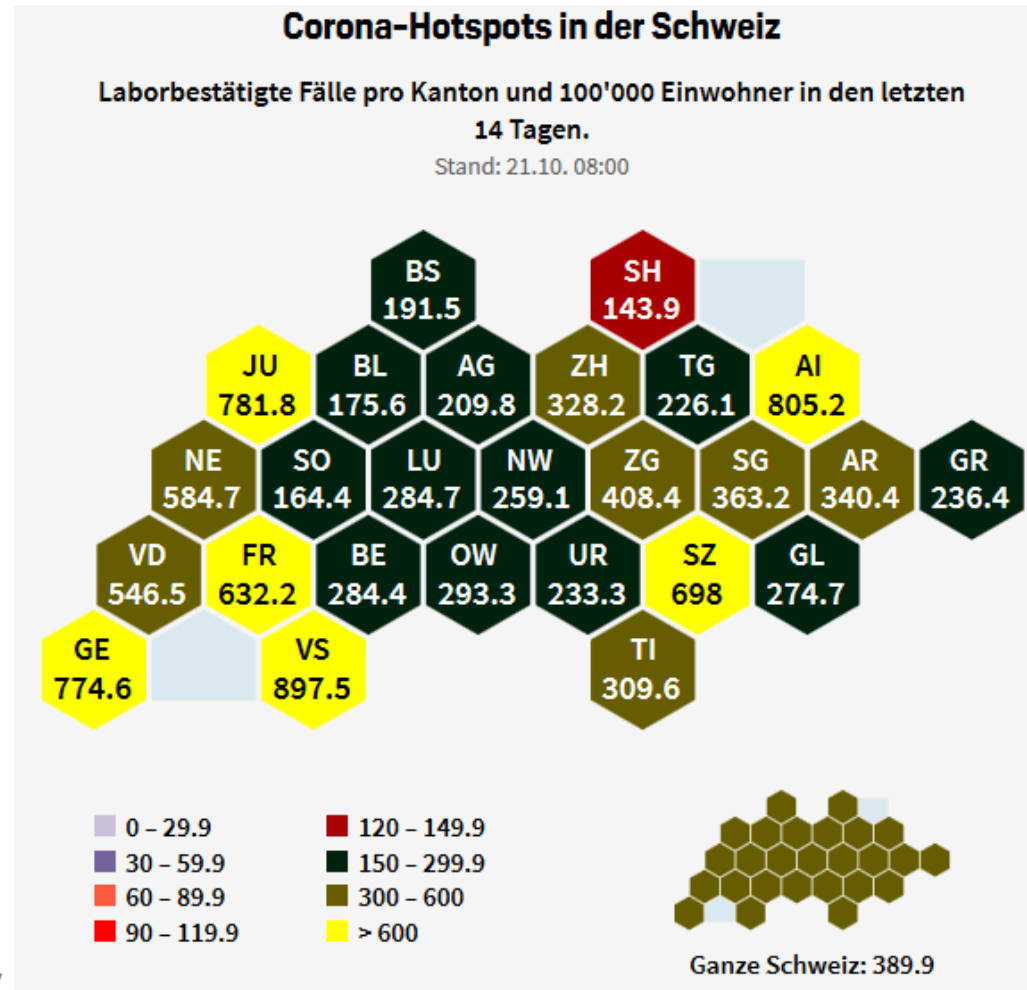
COVID 19 data visualization

■ Prince George's County COVID19 Dashboard



Misleading use of color scale

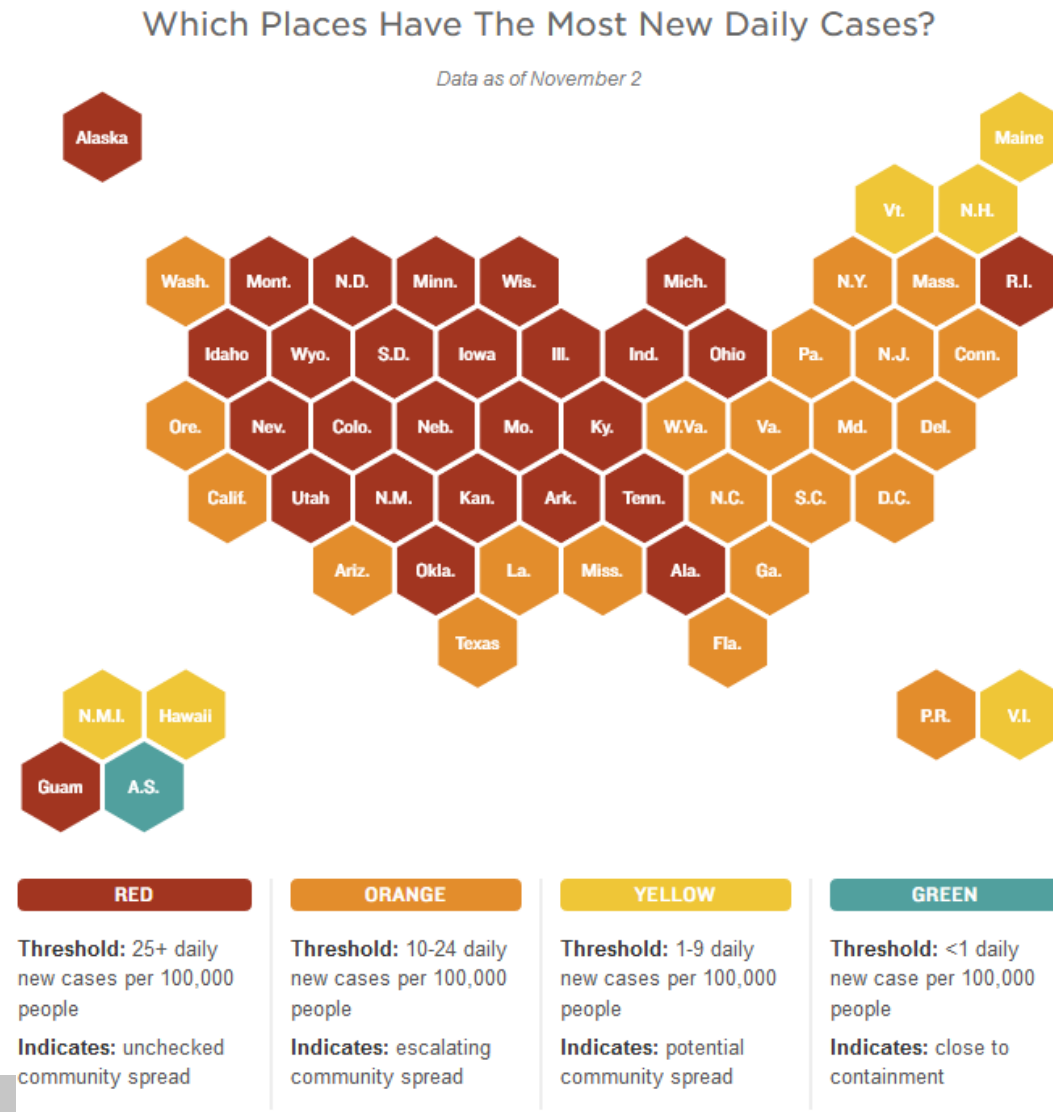
- New COVID-19 cases in Switzerland, by canton



<https://www.reddit.com/r/dataisugly>

More rational use of color scale

- New COVID-19 cases in the USA, by state

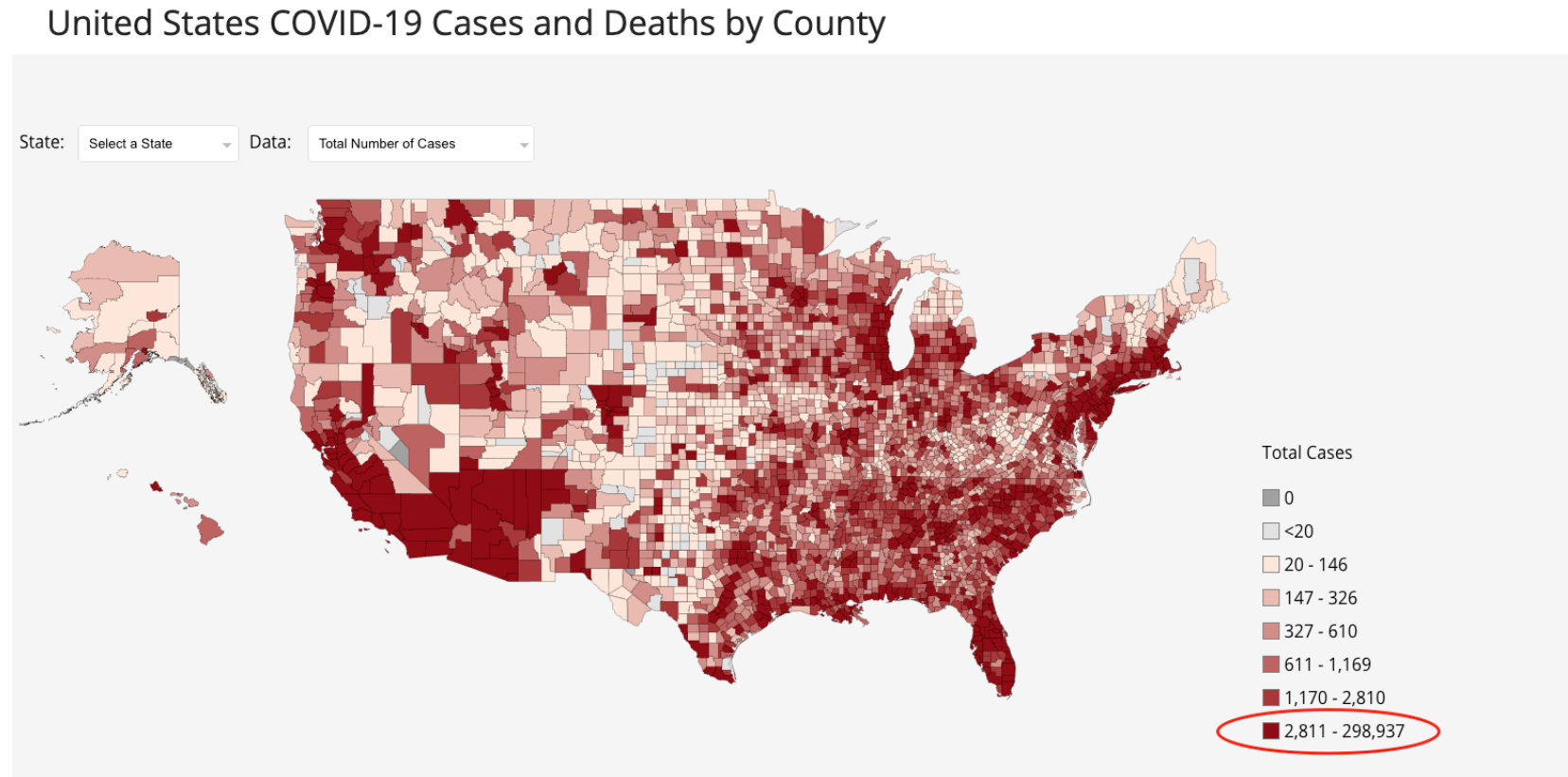


<https://www.reddit.com/r/dataisugly>

NPR site

Misleading use of color scale

- ~3000 or ~300000?



<https://www.reddit.com/r/dataisugly>

-
- **List of Visualizations related to the Coronavirus Covid-19 Pandemic**
https://docs.google.com/document/d/1g_t_v_2JsYtO5CePwCkcD1m-rRfUuaSupumWbWiF0cs/edit

Data-driven storytelling

- Scrollytelling
- (interactive) video – documentaries

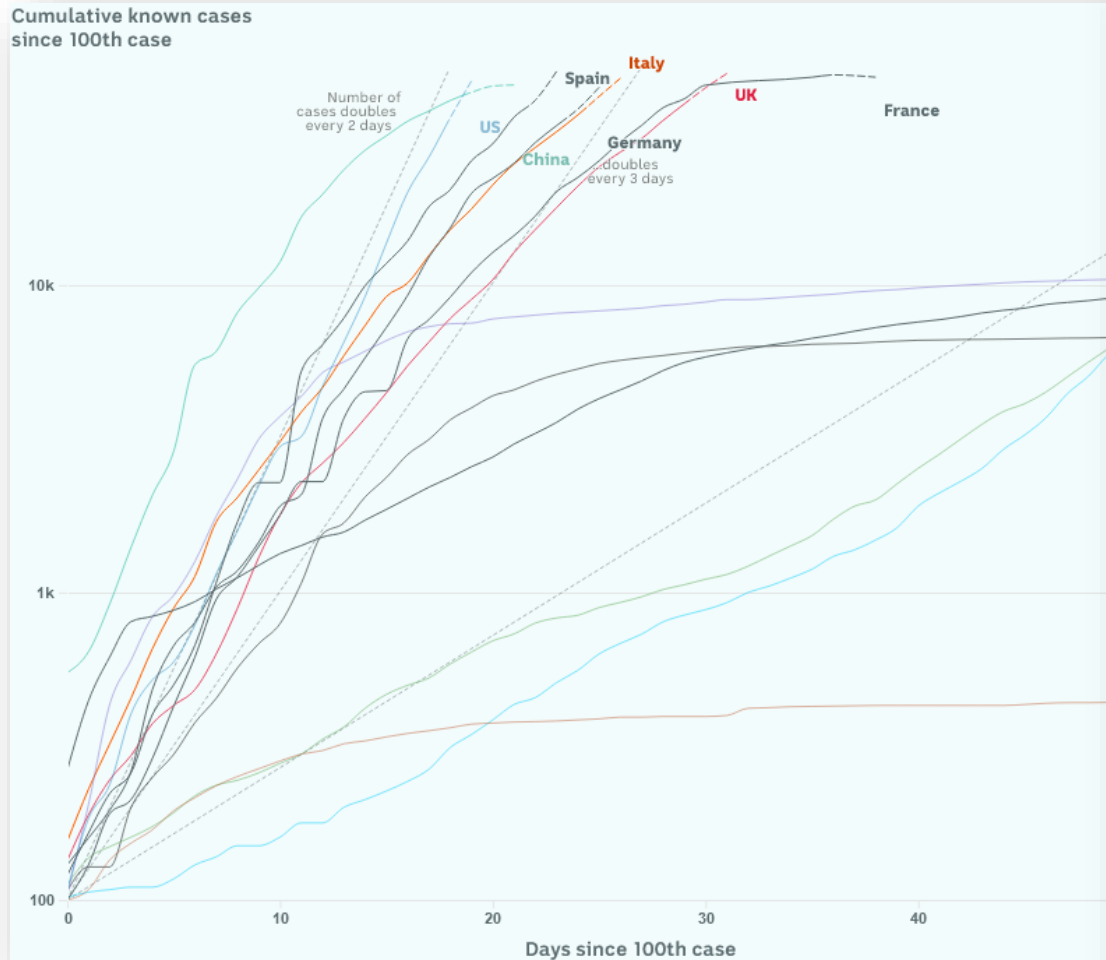
Scrollytelling

- How the virus got out



Scrollytelling

- What we can learn from the countries winning the coronavirus fight

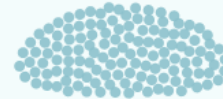


Week 3

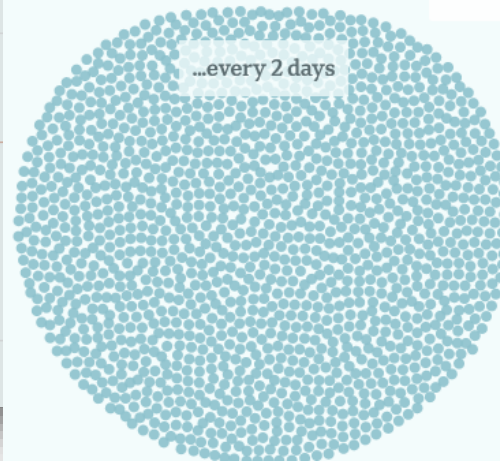
Cases double every week



...every 3 days



...every 2 days

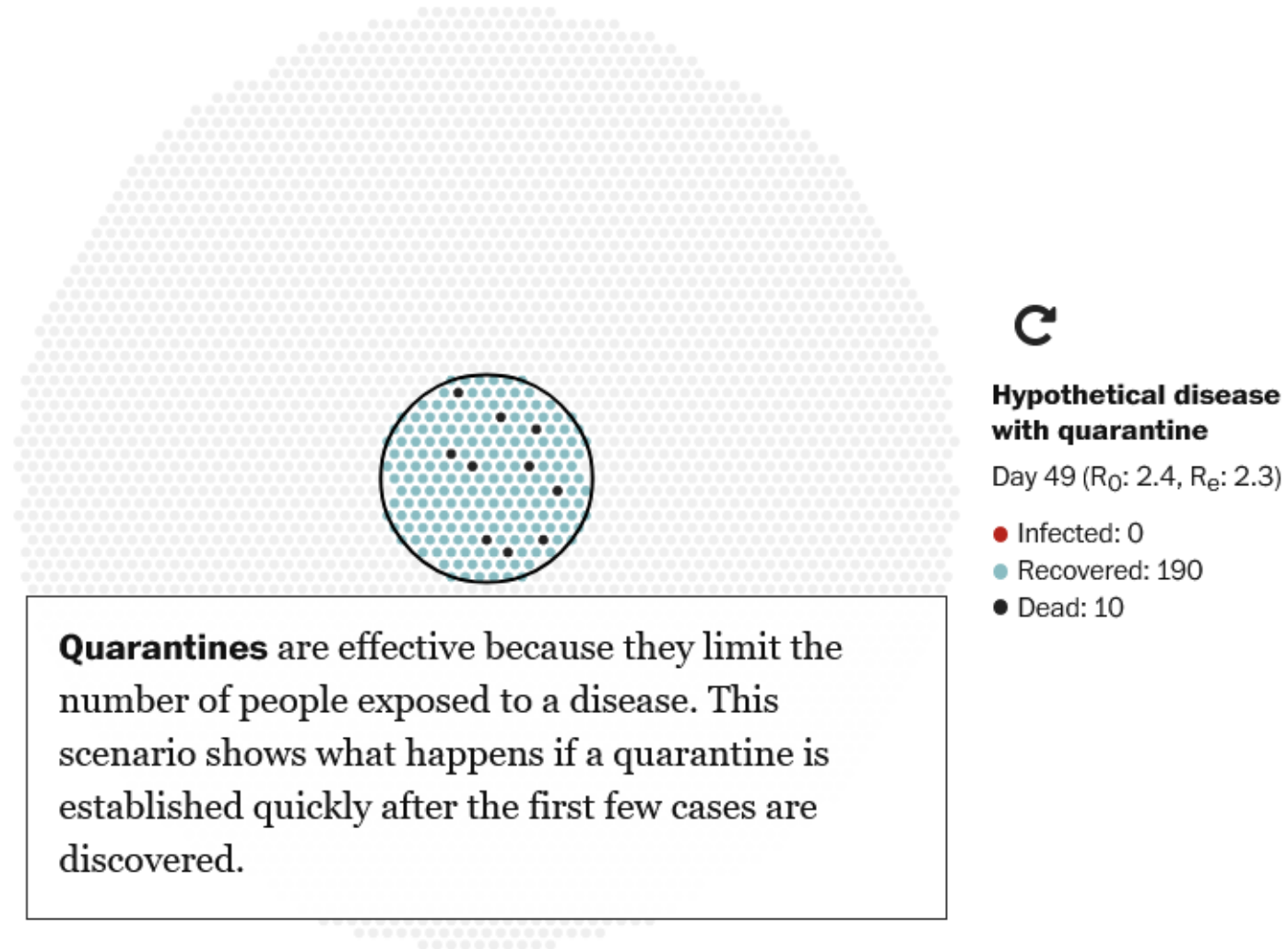


It's for this reason that early intervention can have a huge impact. One single infection in the early days of the outbreak can easily scale into hundreds, perhaps even thousands over time.

The flipside, of course, is that every infection avoided early in the outbreak can have a huge positive impact.

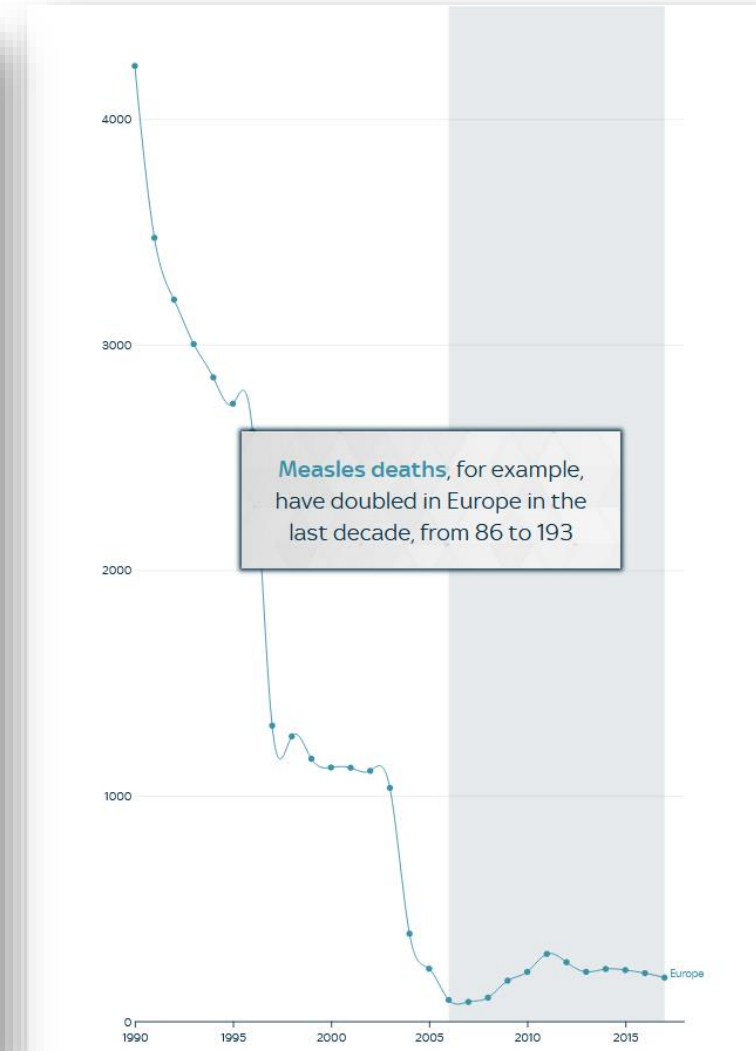
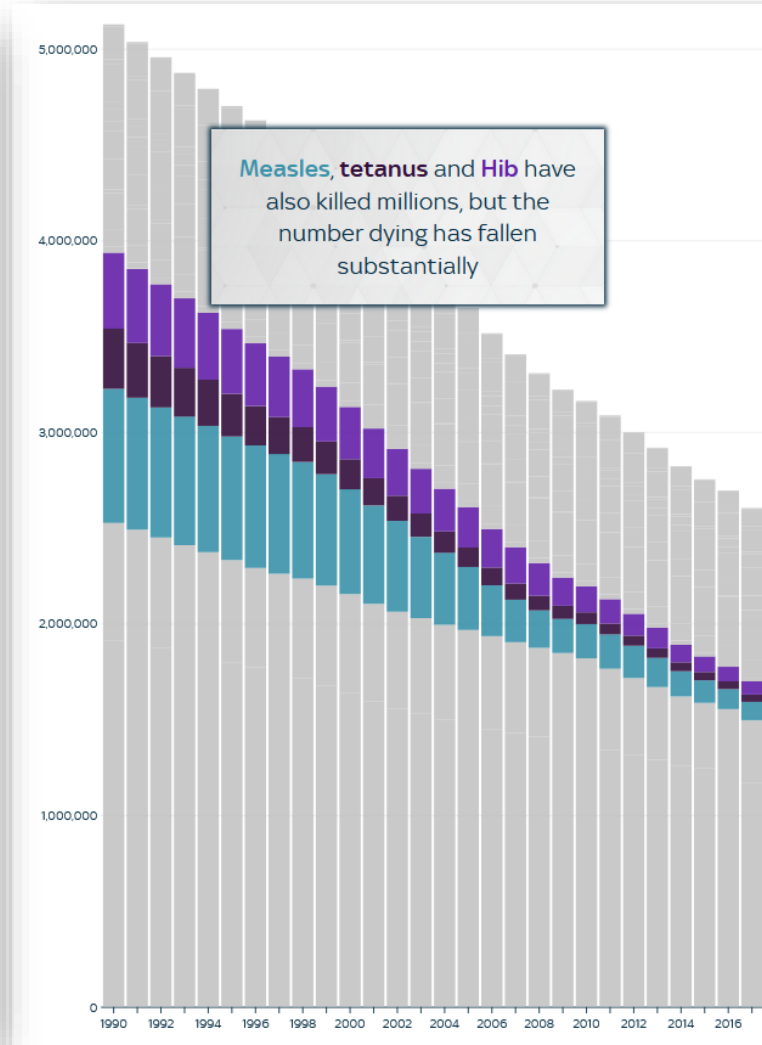
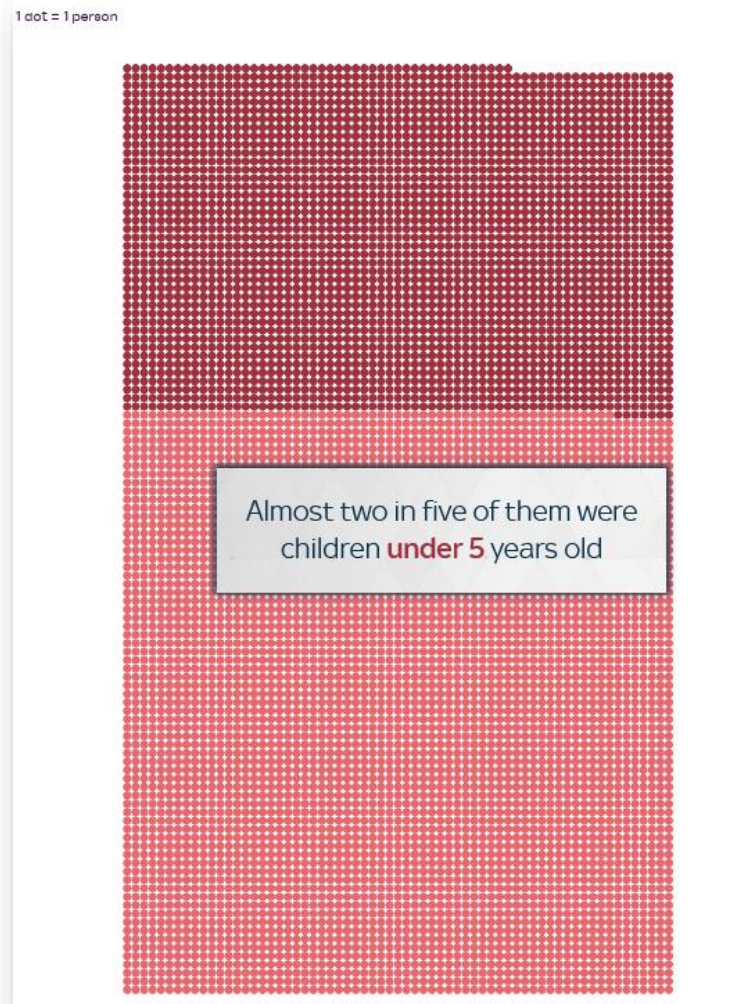
Scrollytelling

- How epidemics like covid-19 end (and how to end them faster)



Scrollytelling

■ The state of vaccination



Scrolllytelling

- An Incalculable Loss



Scrollytelling

■ Scientific Proof that Americans are Completely Addicted to Trucks

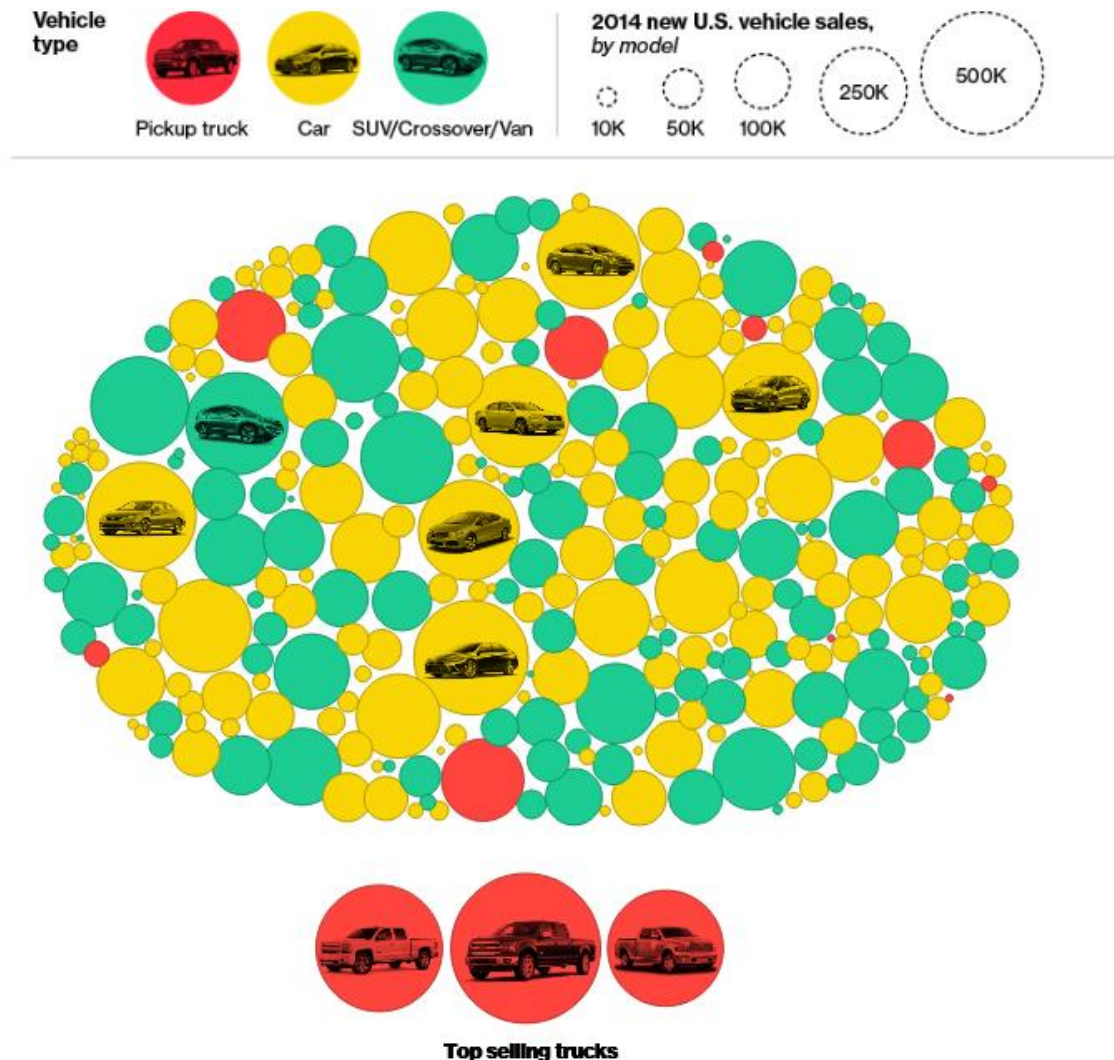
The #2 and #3 top sellers are also pickups.

Chevy's Silverado came in distant second, followed by Fiat Chrysler's Ram truck. The top three trucks combined for 1.7 million sales, or one in every ten new vehicles sold in 2014.

Big vehicles are booming and cars aren't keeping up.

Sales of light trucks grew five times faster than cars last year, increasing 10 percent compared to 1.8 percent for cars.

Since the end of the recession, sales of cars and trucks had been neck and neck: Americans bought about 39,000 more trucks than cars in 2013. But in 2014, light trucks dramatically pulled away, outselling cars by 685,000 vehicles. Sales of midsize cars,



Scrollytelling

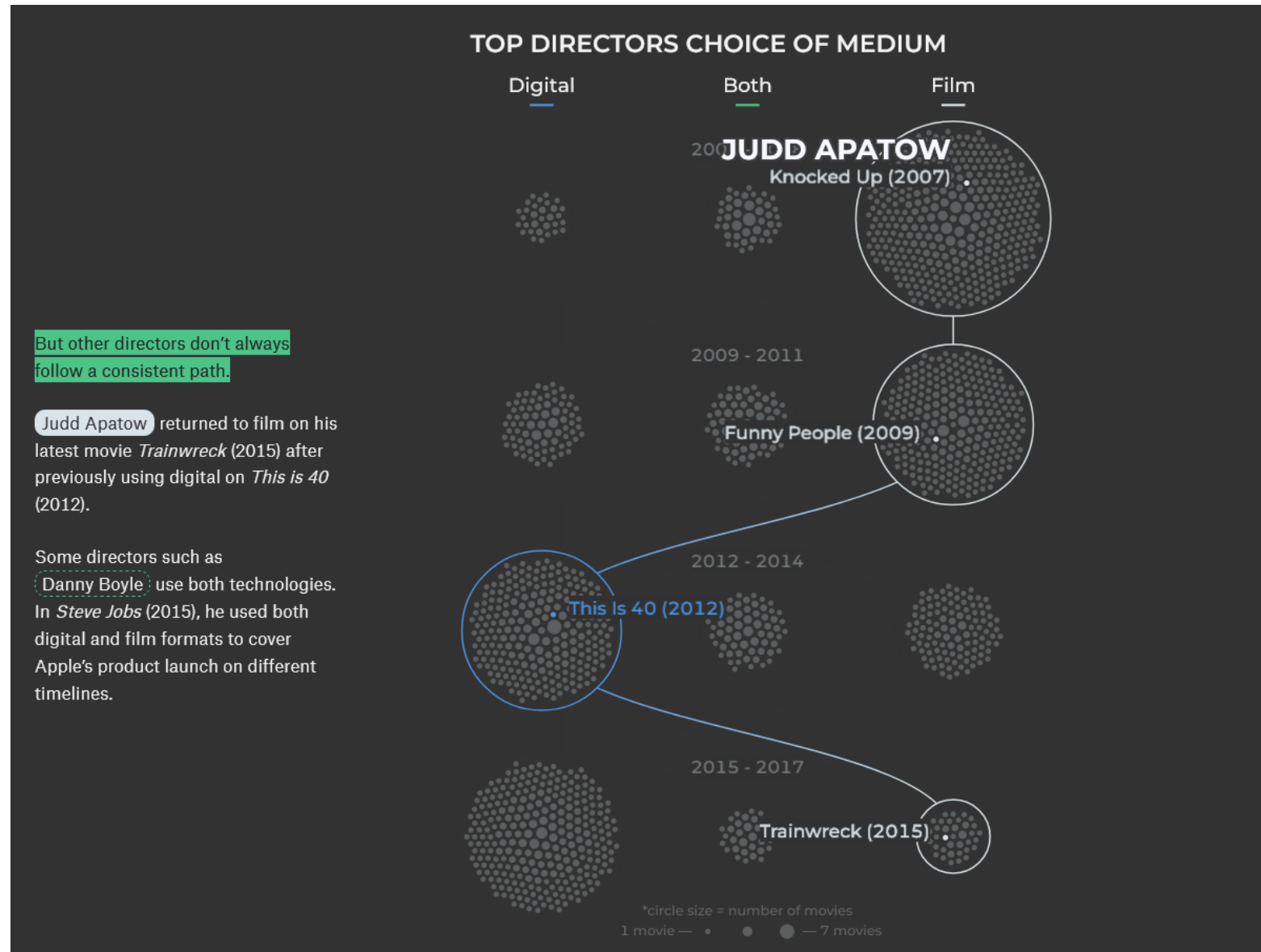
■ Film or Digital?

Breaking Down Hollywood's
Choice of Shooting Medium

But other directors don't always
follow a consistent path.

Judd Apatow returned to film on his
latest movie *Trainwreck* (2015) after
previously using digital on *This Is 40*
(2012).

Some directors such as
Danny Boyle use both technologies.
In *Steve Jobs* (2015), he used both
digital and film formats to cover
Apple's product launch on different
timelines.



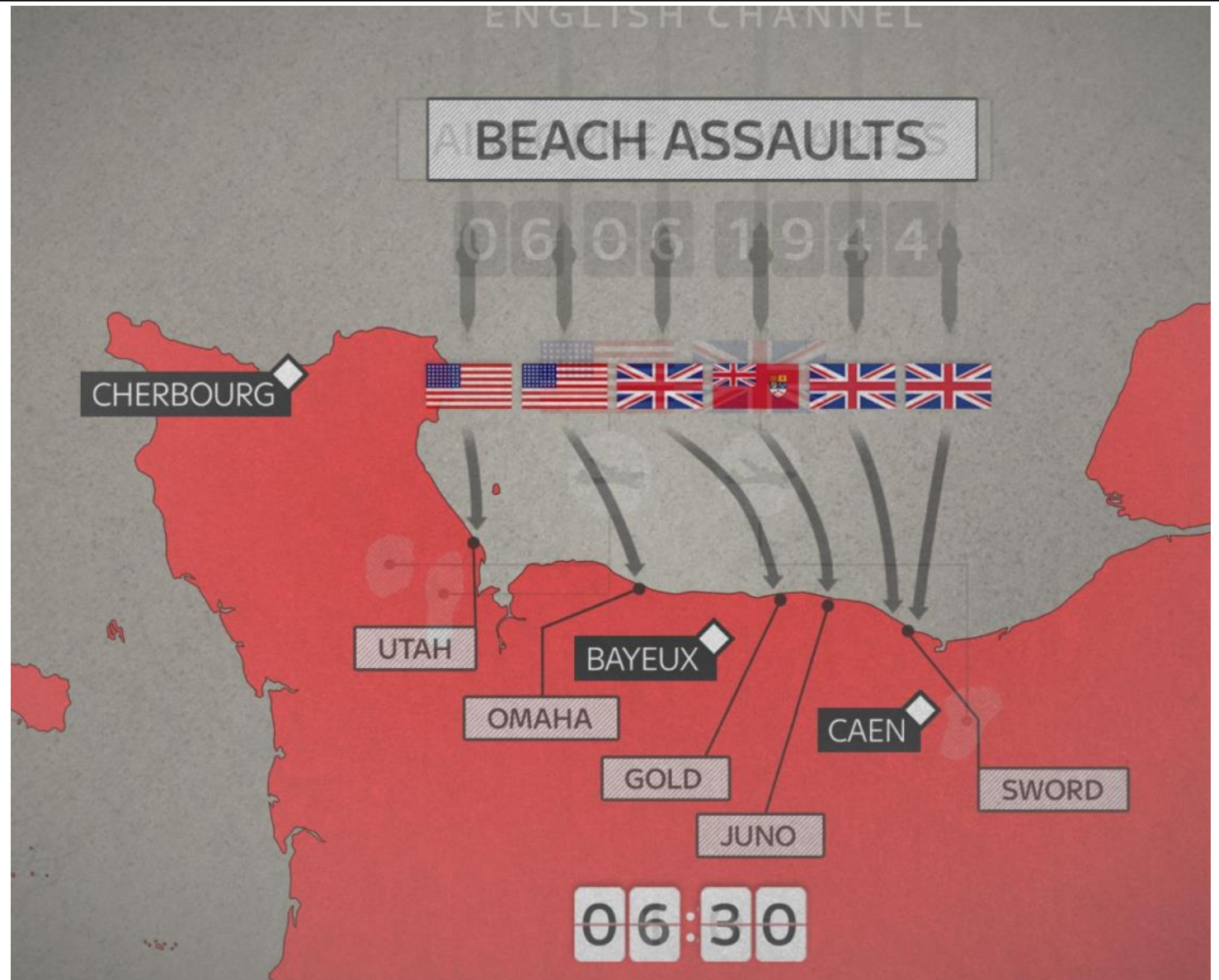
Scrollytelling

- One nation, tracked An investigation into the smartphone tracking industry



Scrollytelling

- Day of reckoning
The story of 24 hours that changed the world



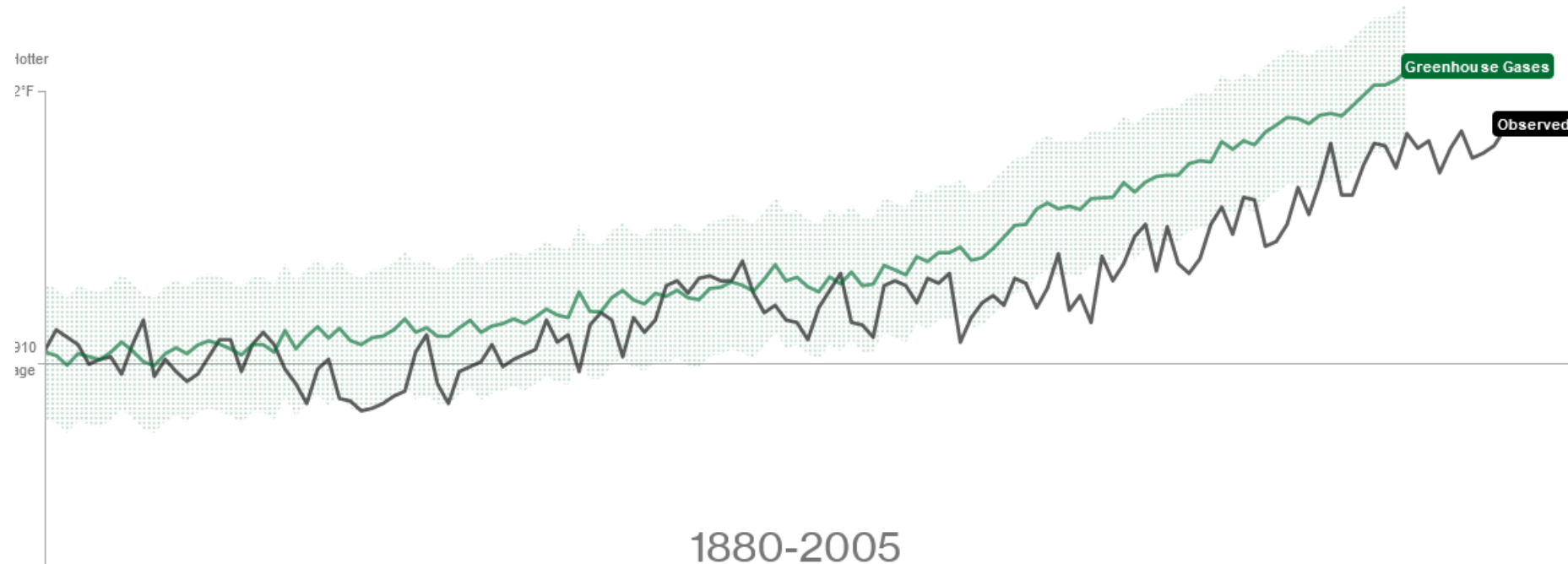
Scrollytelling

■ What's Really Warming the World?

Climate deniers blame natural factors; NASA data proves otherwise

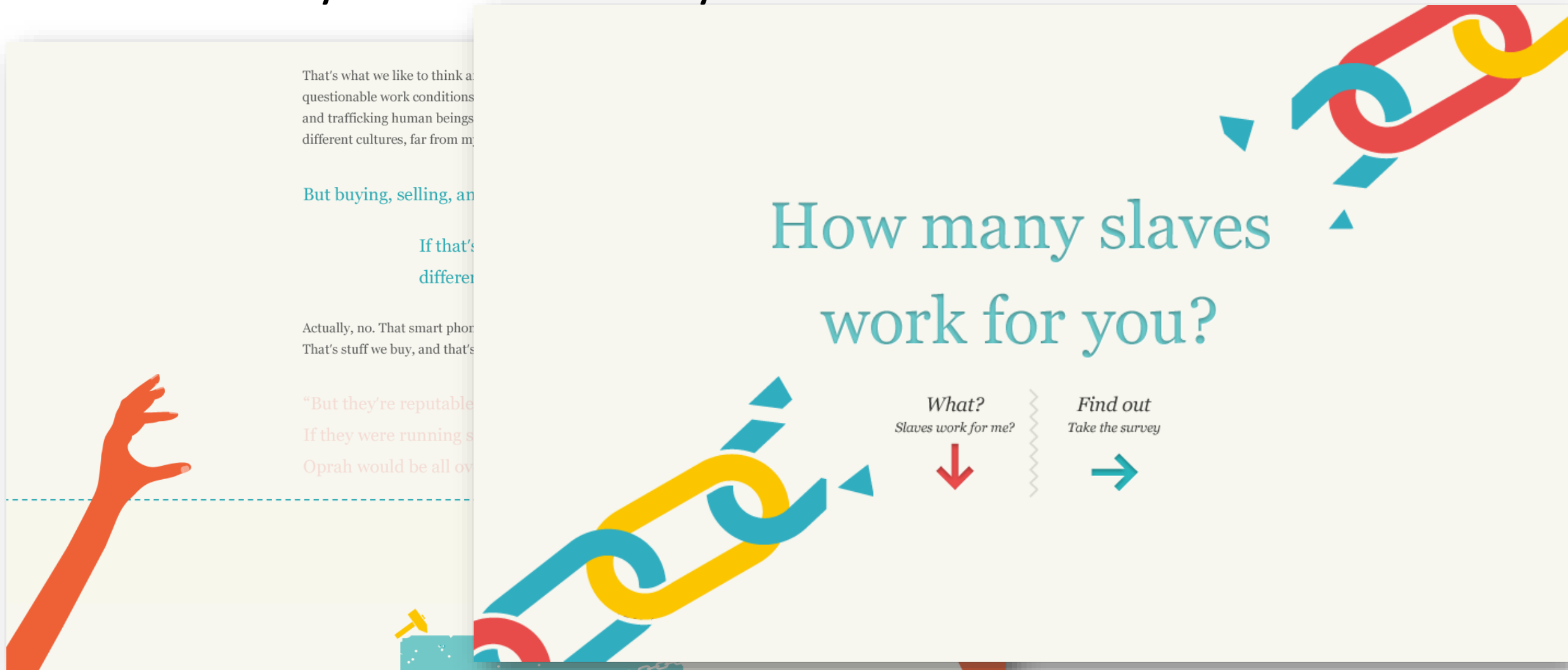
No, It Really Is Greenhouse Gases.

Atmospheric CO₂ levels are 40 percent higher than they were in 1750. The green line shows the influence of greenhouse gas emissions. It's no contest.



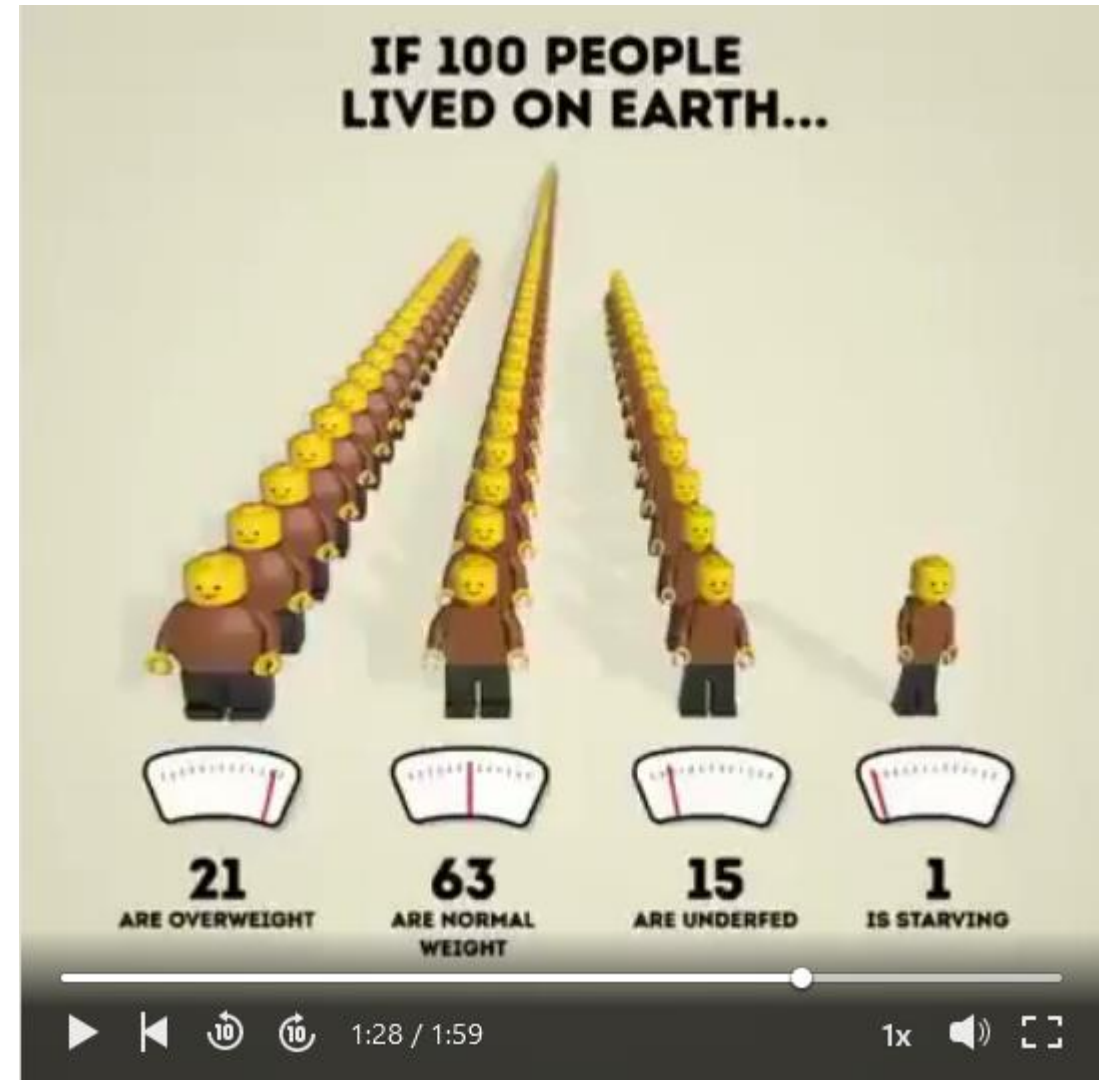
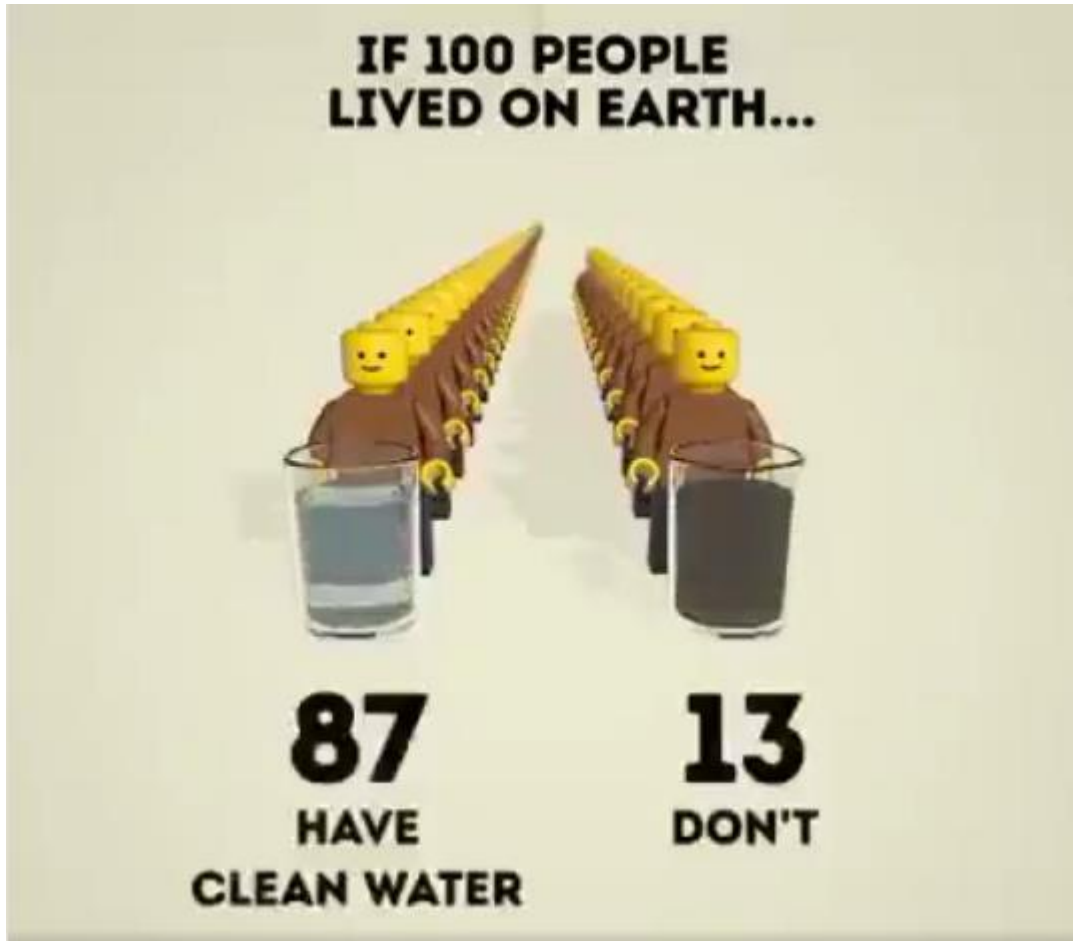
Scrollytelling

- How many slaves work for you?



Scrollytelling

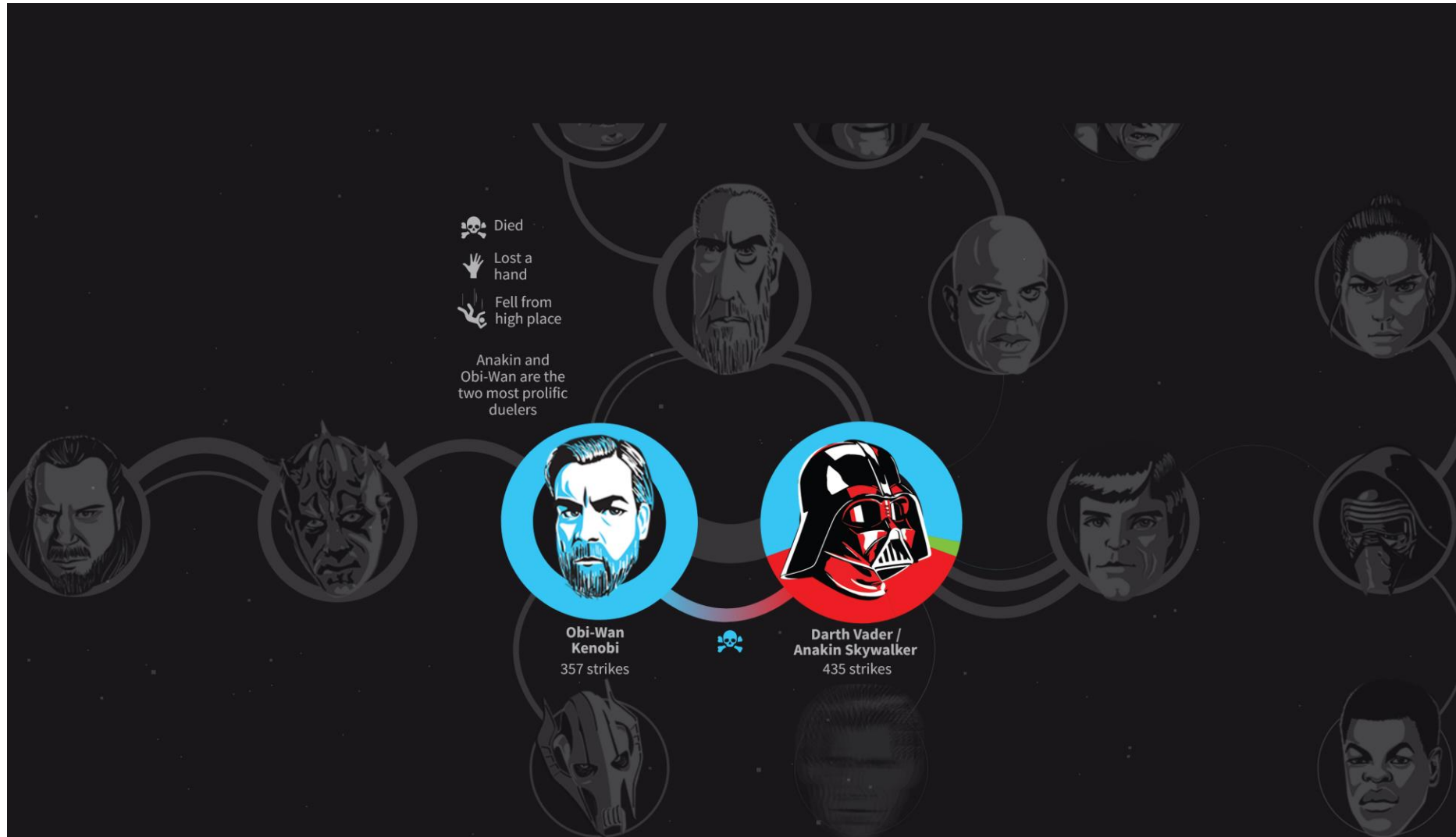
- If 100 people lived on earth...



https://www.linkedin.com/posts/stevenouri_datastorytelling-datavisualization-datascience-activity-6903685674508070912-RHW6/

Scrollytelling

■ Lightsaber Duels in Star Wars, Reuters Graphics



Scrollytelling

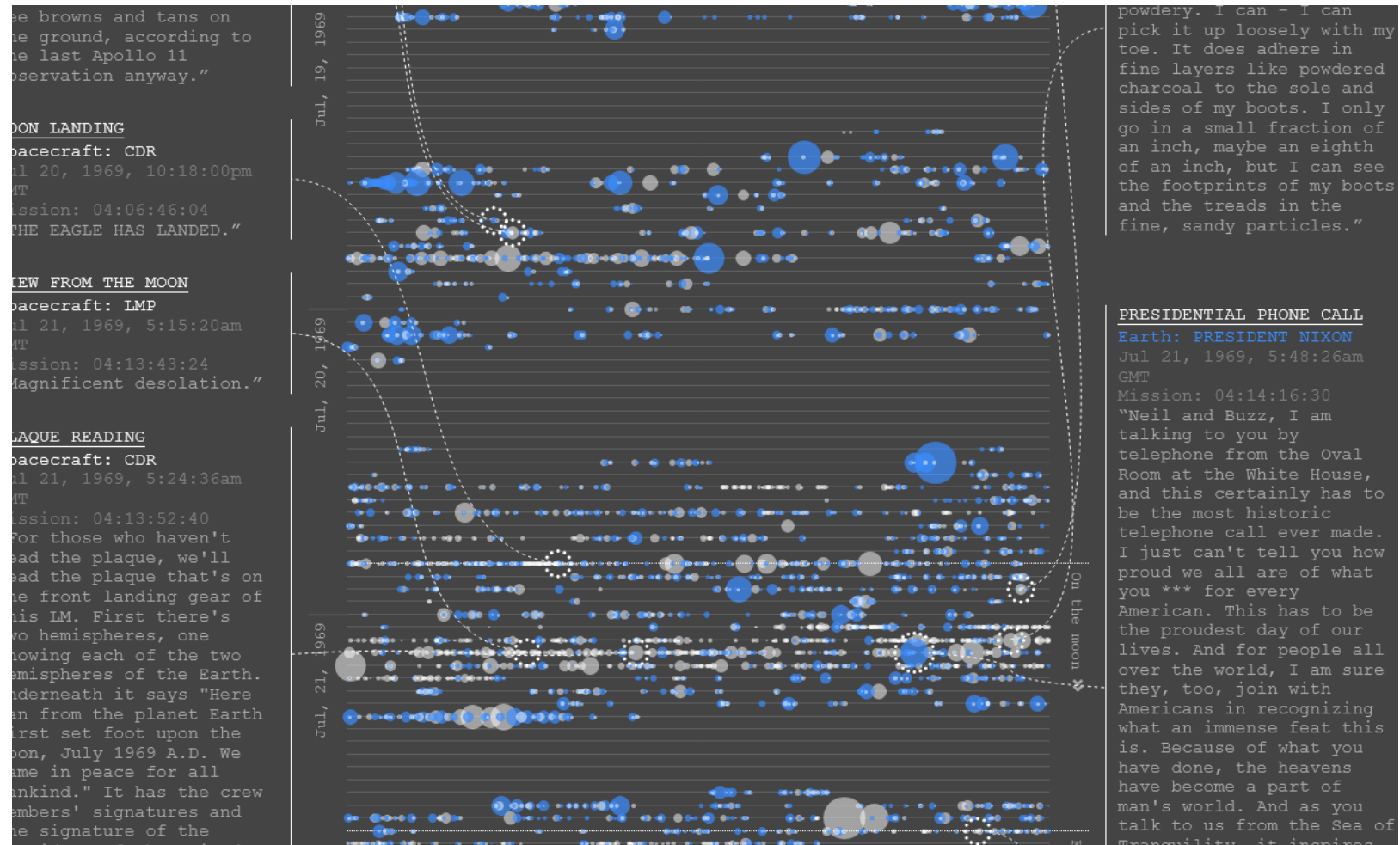
- **No Epicentro** What if all Covid-19 deaths in Brazil happened in your neighborhood?



Data-driven storytelling

■ Lunar Conversations

A timeline of the conversations between Earth and the spacecraft of the Apollo 11 mission from liftoff to splashdown



<https://www.c82.net/work/?id=368>

Scrollytelling

- The Deep Sea










Scrollytelling



■ Byrne's Euclid








III IV V VI About Posters Puzzles Intro Symbols English [Jump to ↗](#)





PROPOSITION V. THEOREM.





IN any ifosceles triangle  if the equal sides be produced, the external angles at the base are equal, and the internal angles at the base are also equal.





Produce , and , (pof. 2.), take  = , (pr. 3.); draw  and .





Then in  and  we have,





 =  (conf.),  common to both, and  =  (hyp.) \therefore  = ,

 =  and  =  (pr. 4.).

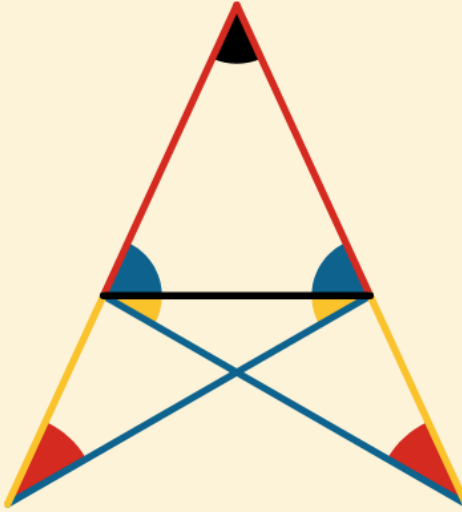
Again in  and  we have  = ,

 =  and  = ,

\therefore  =  and  =  (pr. 4.) but

 = , \therefore  =  (ax. 3.)

Q. E. D.

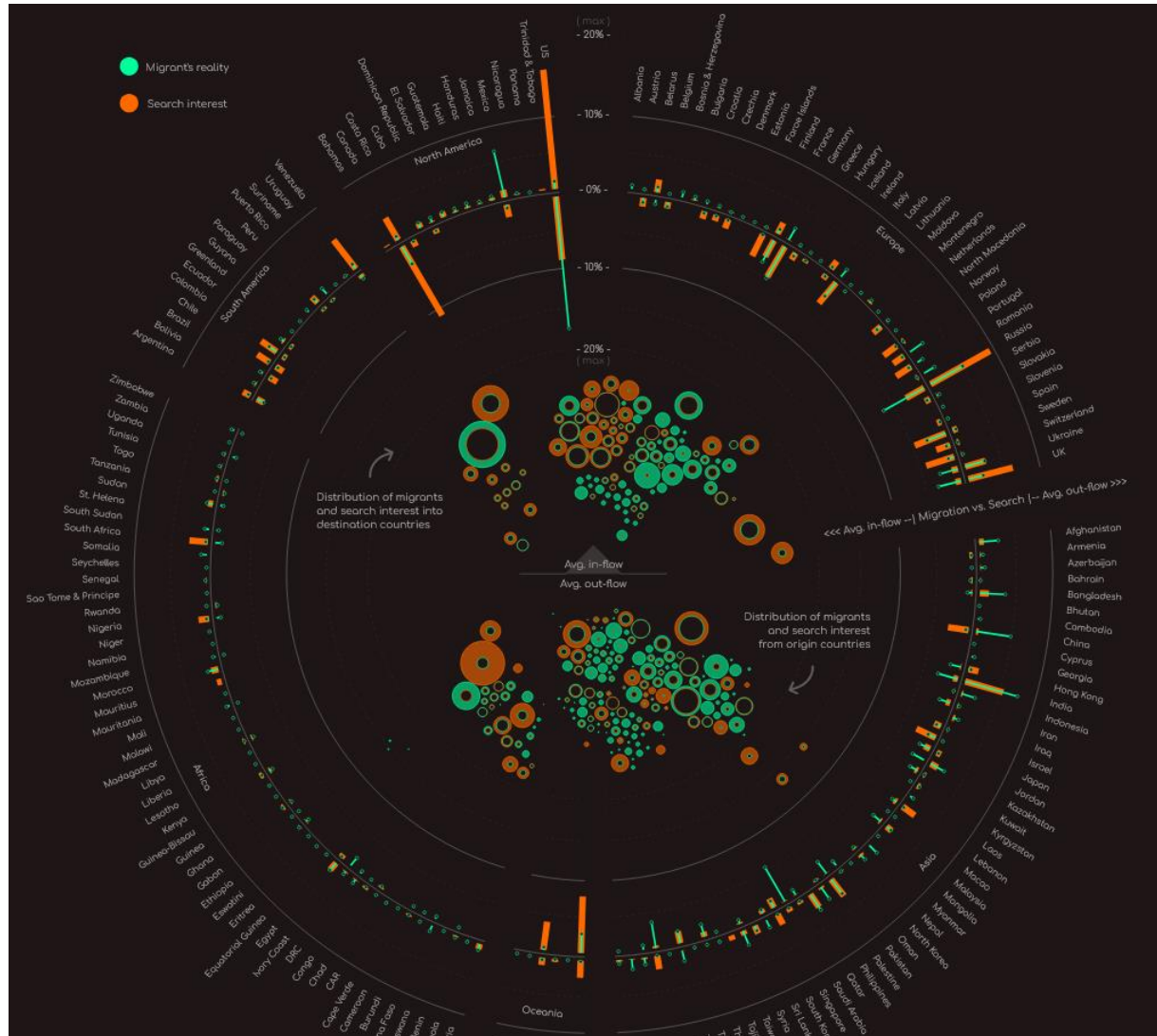


Scrollytelling

- The Data that Lies Beneath
an interactive infographic that takes
a look at the murky origins - and
potential of dark data.



Scrollytelling



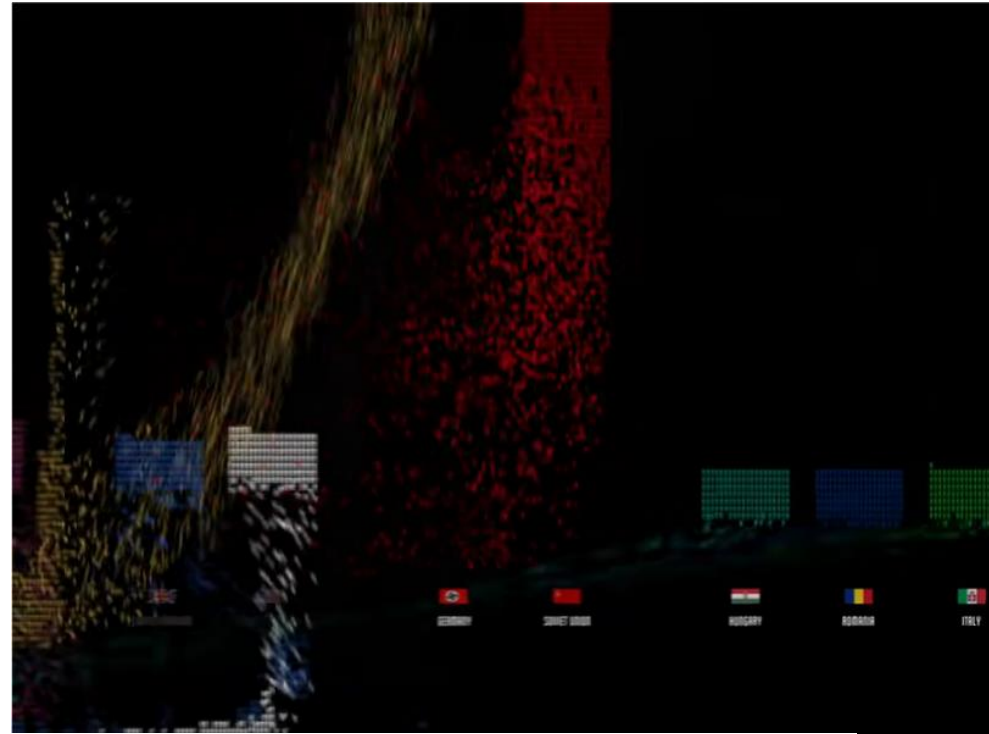
Migration between SEARCH & REALITY



A visual exploration of the gap between the reality of the world's migrants and search interest.

Data-driven storytelling

- The Fallen of World War II animated data-driven video documentary

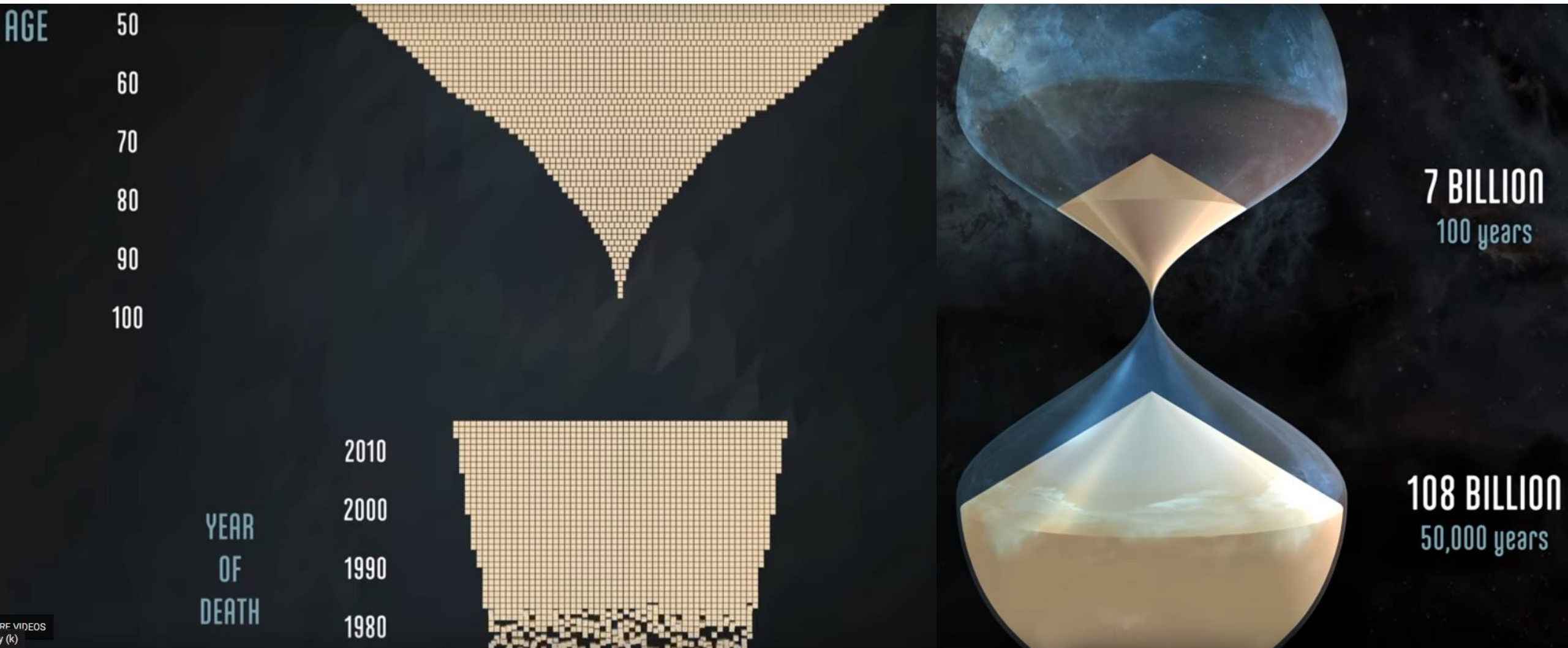


<https://youtu.be/DwKPFT-RioU>

<http://www.fallen.io/ww2/>

Data-driven storytelling

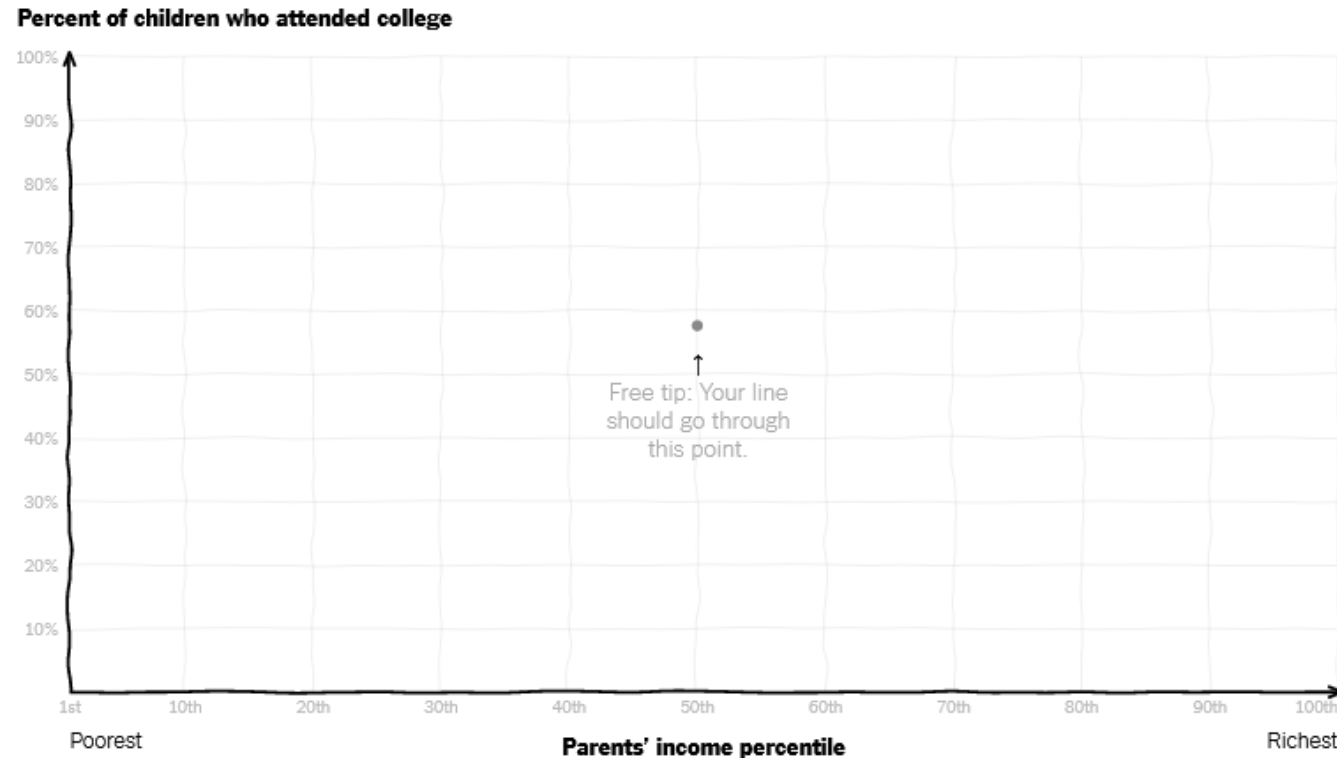
- The Shadow Peace sequel data-driven video documentary



Data-driven storytelling

■ You Draw It: How Family Income Predicts Children's College Chances

Draw your line on the chart below

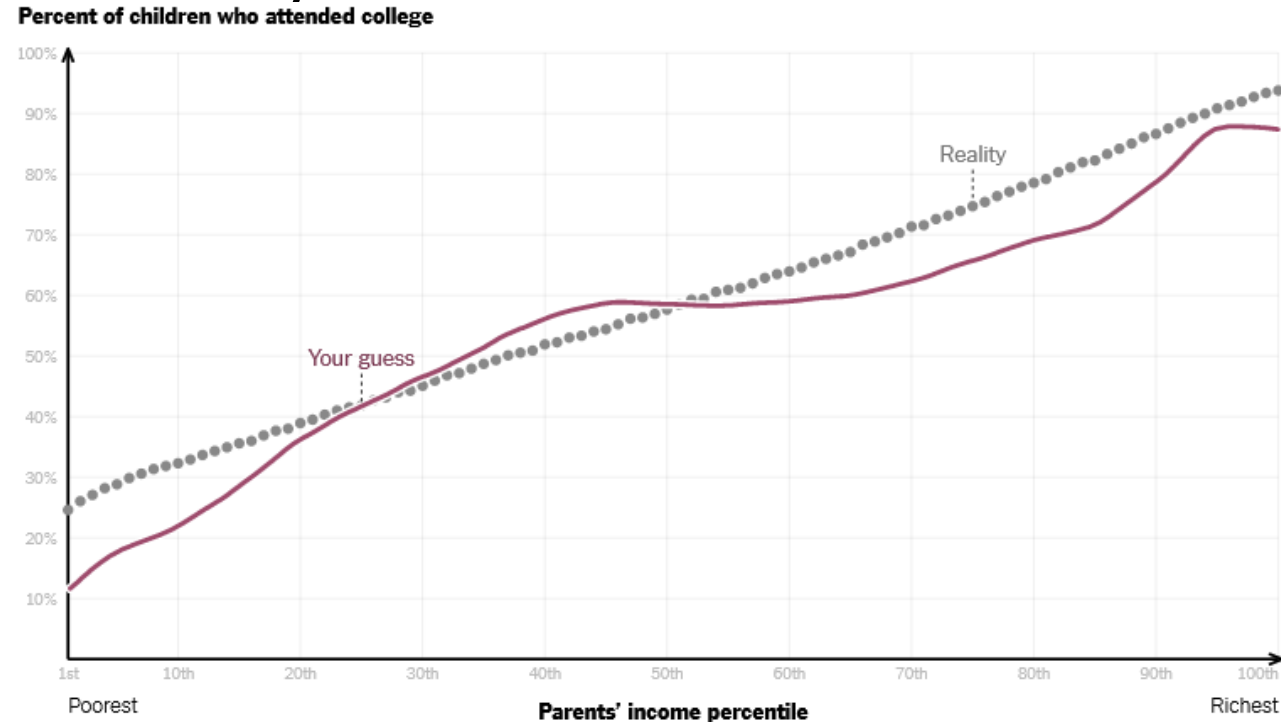


I'm done

Start over

Data-driven storytelling

■ You Draw It: How Family Income Predicts Children's College Chances



Thanks for drawing. Here's how you did:

- You drew a more accurate picture of reality than about 89 percent of people who have tried so far.
- You underestimated the chances of college enrollment for the very poorest children. In reality, about one in four children in America's poorest families go to college. (You guessed around 12 percent.)
- You correctly guessed the exceptionally high rates of college enrollment for children from the very richest families – about 94 percent.

Data-driven storytelling

■ Violence against women, Data Viz course, 2022

How are homicides scattered across the world?

Between 1990 and 2020, Brazil and India noted the highest counts of homicides. While the majority of the victims in Brazil were men, most victims in India were women.

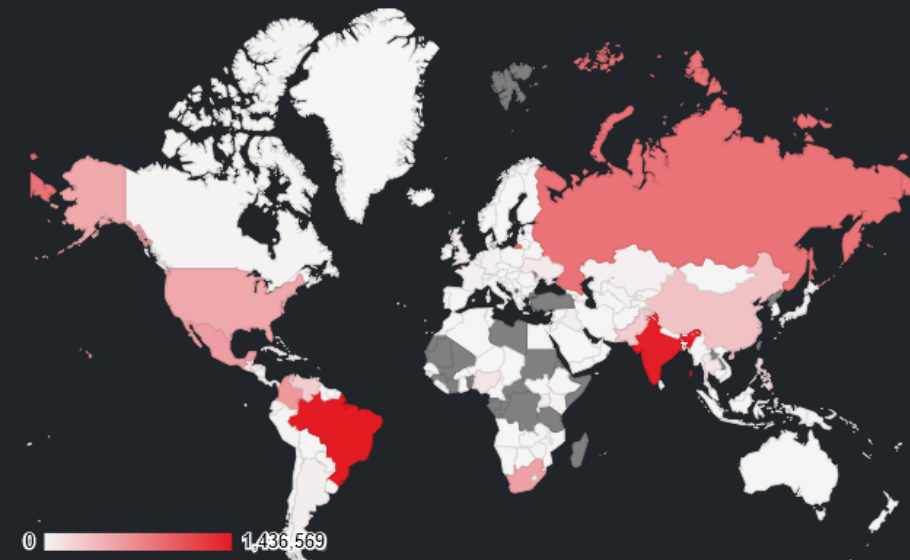
Shifting our focus to homicide counts relative to total population, El Salvador and Colombia have the highest counts. Considering male victims, Colombia is at the top, but female victims per total population are highest in Russia.

The last few years seem to follow these same trends.

Drug trafficking and gang activity is to blame for Brazil's high count of male victims. In contrast, the high femicide count in India is the result of multiple manifestations, including [female infanticide](#), forced abortions, [honor killings](#) and [dowry murders](#). These are a few of the various forms of femicide covering a very large percentage of murders committed by an intimate person, mainly a partner. Other notable cases include killing of women and girls during war, and killing of women due to sexual preference, decision to divorce, adultery or refusal to marry.

The high homicide rate with male victims in Colombia and El Salvador is again due to the extent of drug trafficking, gang activity and gang violence. On the other hand, Russia's high count of femicides is a complex issue and linked to high rates of domestic violence, which was [decriminalized in Russia in 2017](#).

Recorded intentional homicides by country, year range, and gender



0 1,436,569

Start year



1990

End year



2020

Victim gender

Total

Male

Female

Unknown

Measure

Count

Per 100,000 inhabitants

Scrollytelling

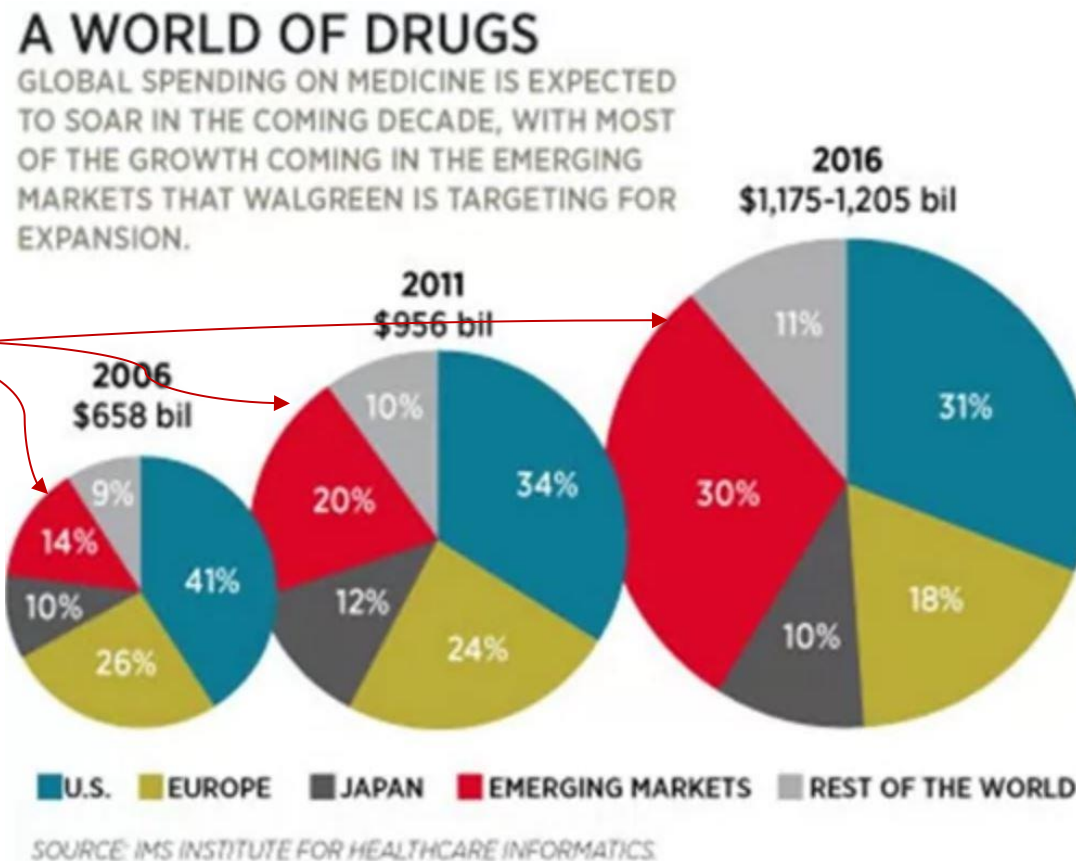
- More in e-class forum and resources slide deck

Assessing the quality of a data visualization

- How do you assess the quality of a visualization?
- How do you know that one visualization is better than another?

Assessing the quality of a data visualization - example

- 3 pie charts showing how the proportion of different markets in a global spending in drugs changes over time (2006, 2011, 2016)...



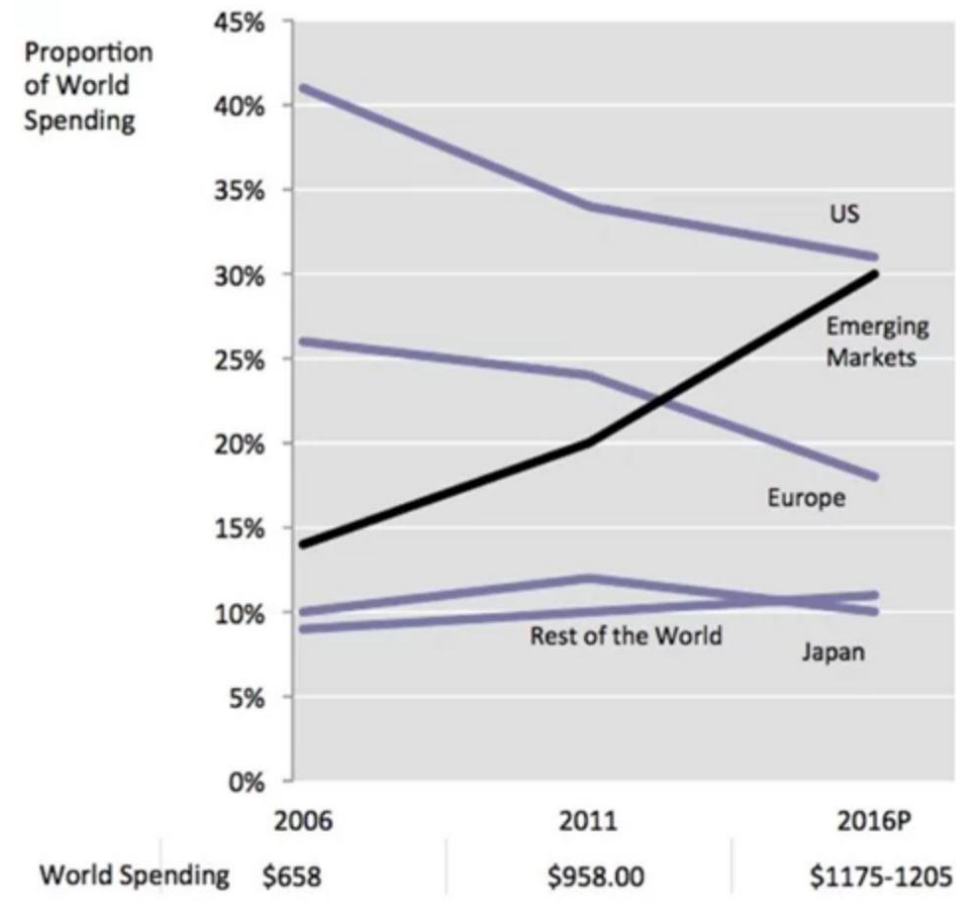
To see how proportions change over time, we have to mentally link these areas across the segments. But they are not aligned, making these comparison even harder.

Quantity is represented with the angle of the pies, not the area of the segments.

The angle and the size interfere.

Assessing the quality of a data visualization - example

- The same dataset represented with a line chart, observing trend over time and how they relate to each other



Designing effective visualizations requires

- Knowing the design space (to create a certain number of alternatives)
- Being able to compare the solutions

...in turn, comparing the solutions requires understanding how human perception works.

To be effective, the graphical display of data should:

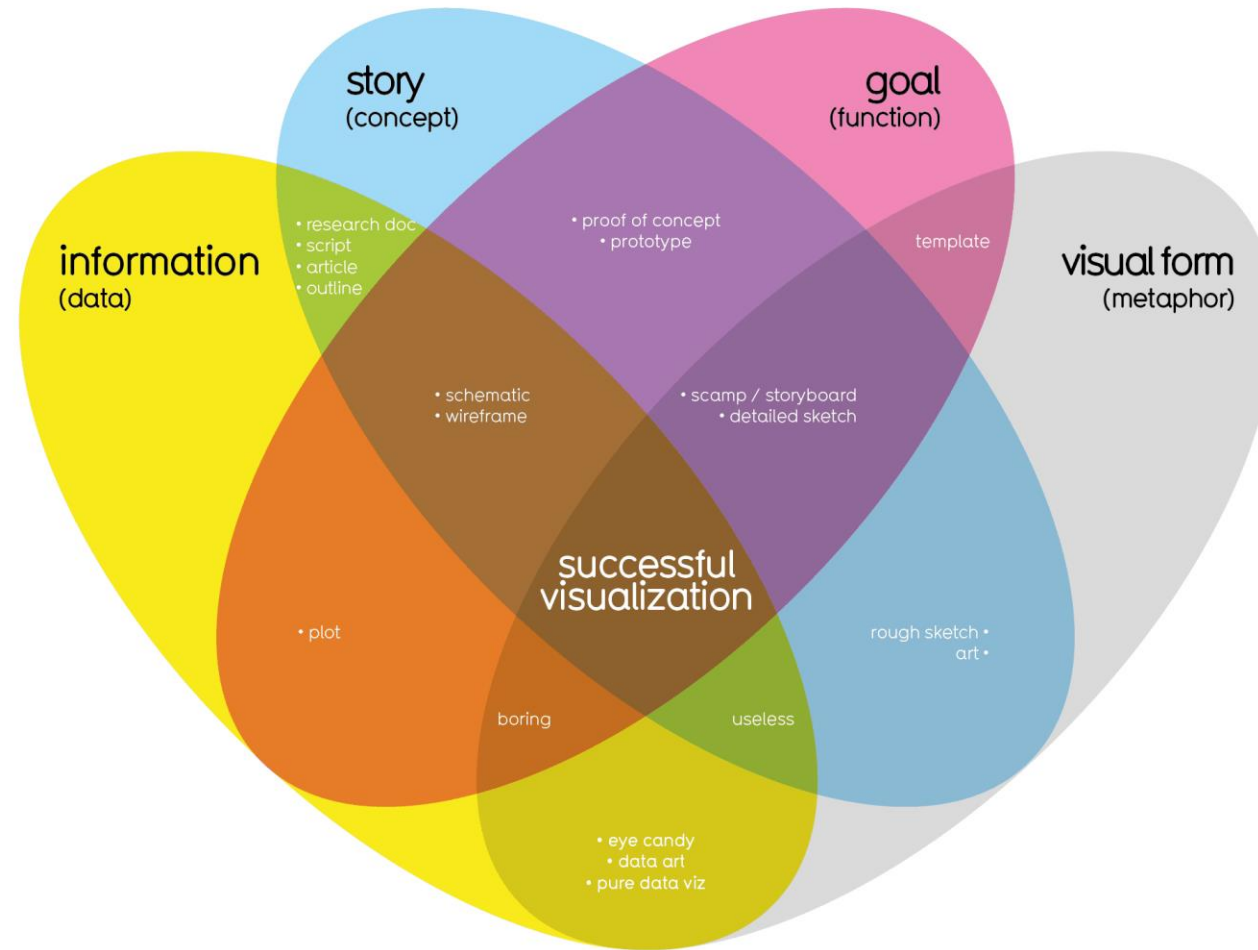
- Show the data;
- Induce the viewer to **think about the substance** rather than about methodology, graphic design, the technology of graphic production, or something else;
- **Avoid distorting** what the data have to say;
- Make large data sets **coherent**;
- Encourage the eye to **compare** different pieces of data;
- Reveal the data at **several levels of detail**, from a broad overview to the fine structure;
- Serve a reasonably **clear purpose**: description, exploration, tabulation, or decoration;
- Be closely integrated with the **statistical and verbal descriptions** of a data set.

Assessing the quality of a data visualization

rollover for more detail

What Makes a Good Visualization?

explicit (implicit)



David McCandless
InformationIsBeautiful.net

taken from new book
Knowledge is Beautiful

find out more
bit.ly/KIB_Books

Overview first, zoom and filter, and then details-on- demand

Shneiderman (2003)

- **Overview**: Gain an overview of the entire collection.
- **Zoom**: Zoom in on items of interest
- **Filter**: filter out uninteresting items.
- **Details-on-demand**: Select an item or group and get details when needed.
- **Relate**: View relationships among items.
- **History**: Keep a history of actions to support undo, replay, and progressive refinement.
- **Extract**: Allow extraction of sub-collections and of the query parameters

Search, show context,
expand on demand

Van Ham & Perer (2009)

To read

- Franconeri, S. L., Padilla, L. M., Shah, P., Zacks, J. M., & Hullman, J. (2021). The Science of Visual Data Communication: What Works. *Psychological Science in the Public Interest*, 22(3), 110–161. <https://doi.org/10.1177/15291006211051956>

Thank you!

mrroussou@di.uoa.gr

<http://eclass.uoa.gr/courses/DI411/>