

Data Visualization

EXAMPLES (2)

Good visualization design is

1. Trustworthy

2. Accessible

3. Elegant

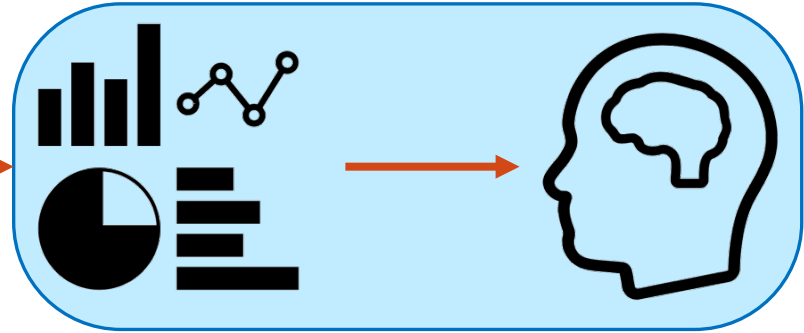
Accessibility

Phenomenon

Data

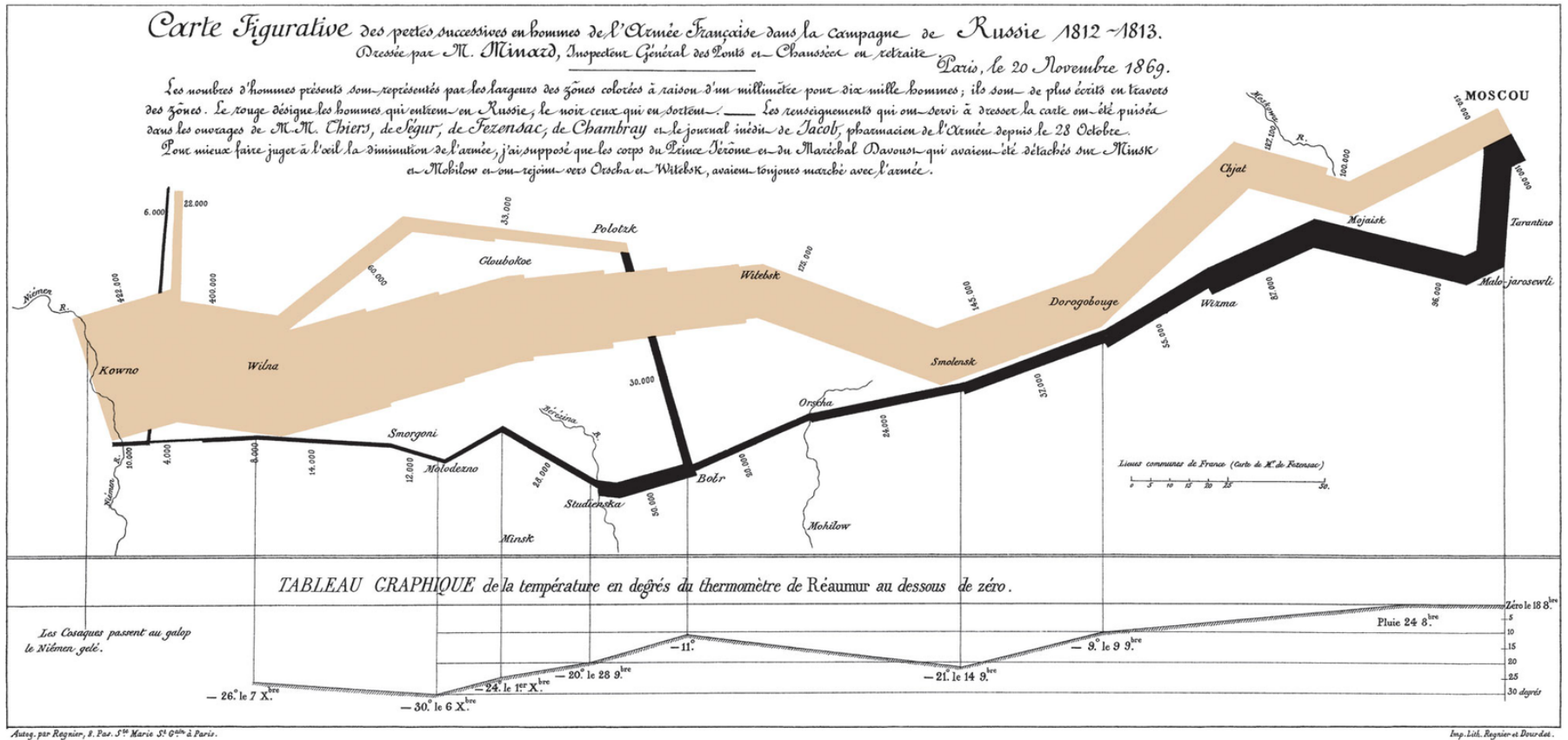
Chart

Person

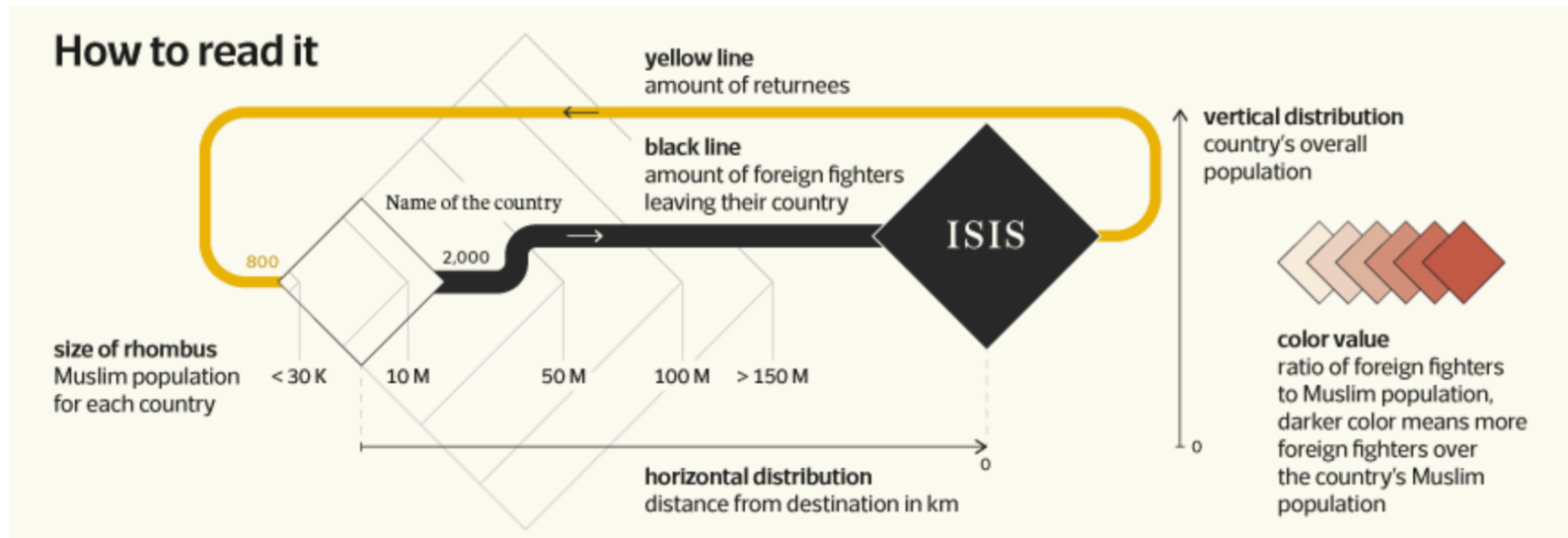


Make design choices that facilitate understanding

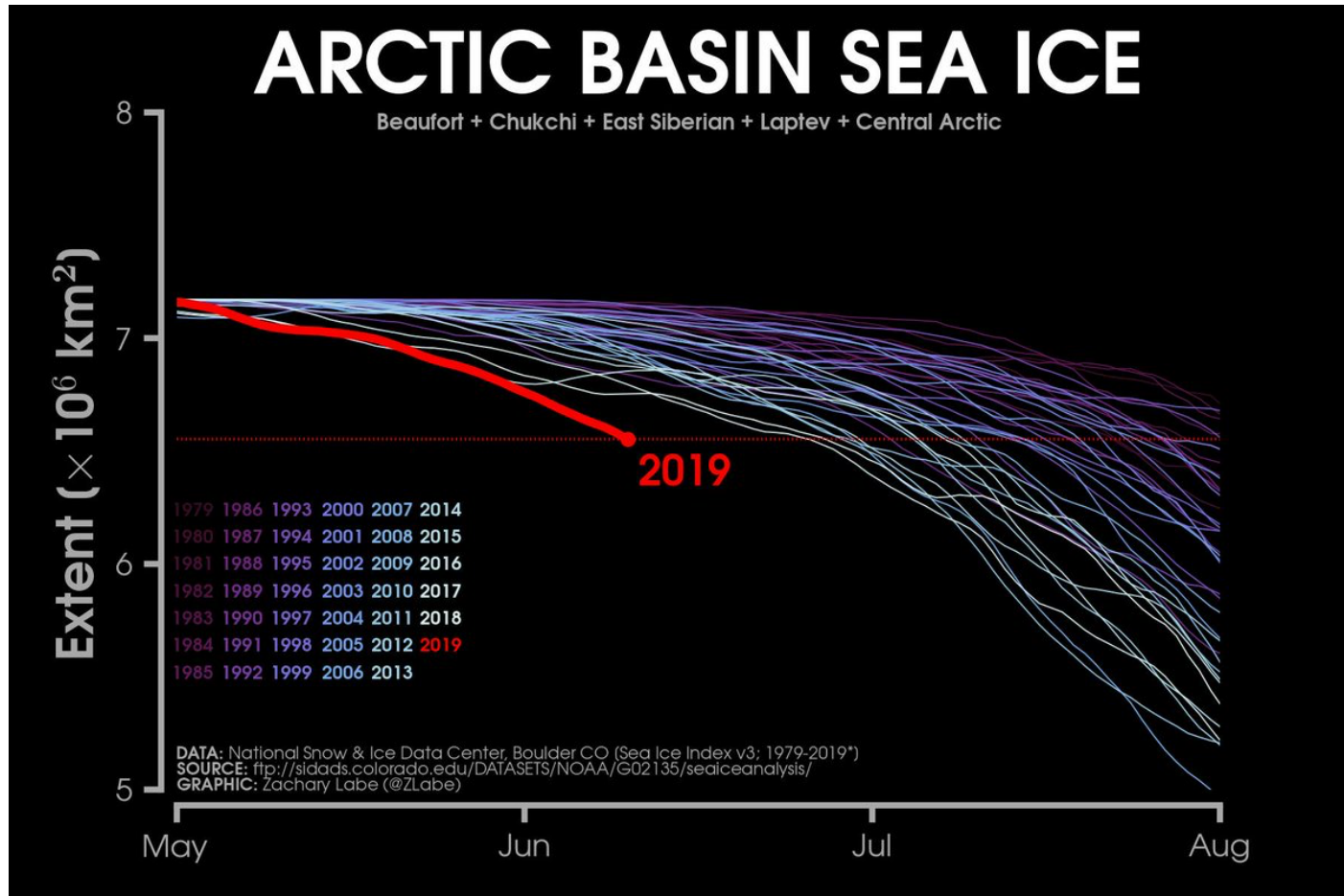
Napoleon's Russian campaign of 1812



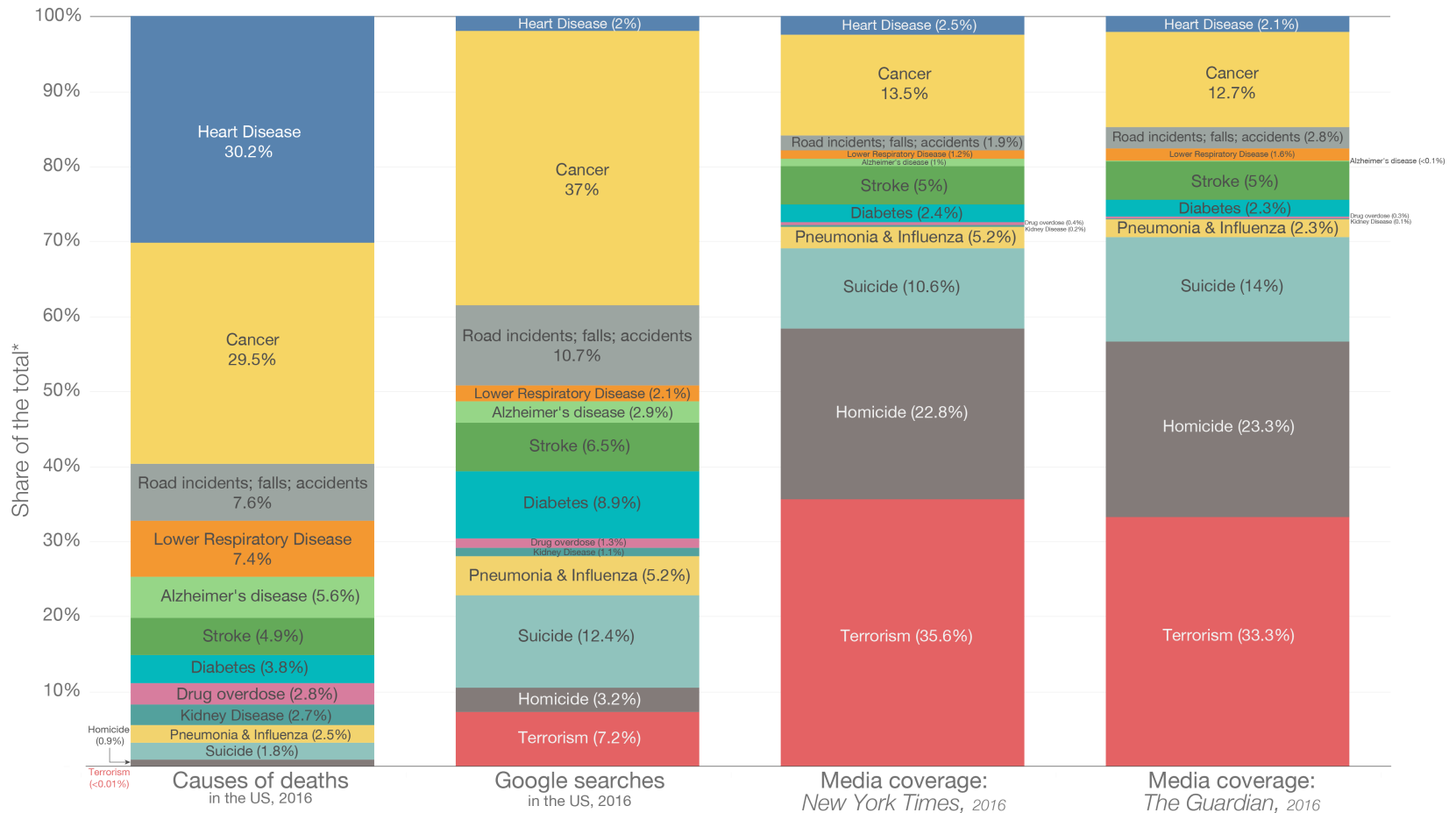
On their way: The journey of foreign fighters



Extent of sea ice in the last 40 years



Causes of death in the US




Here's every total solar eclipse happening in your lifetime

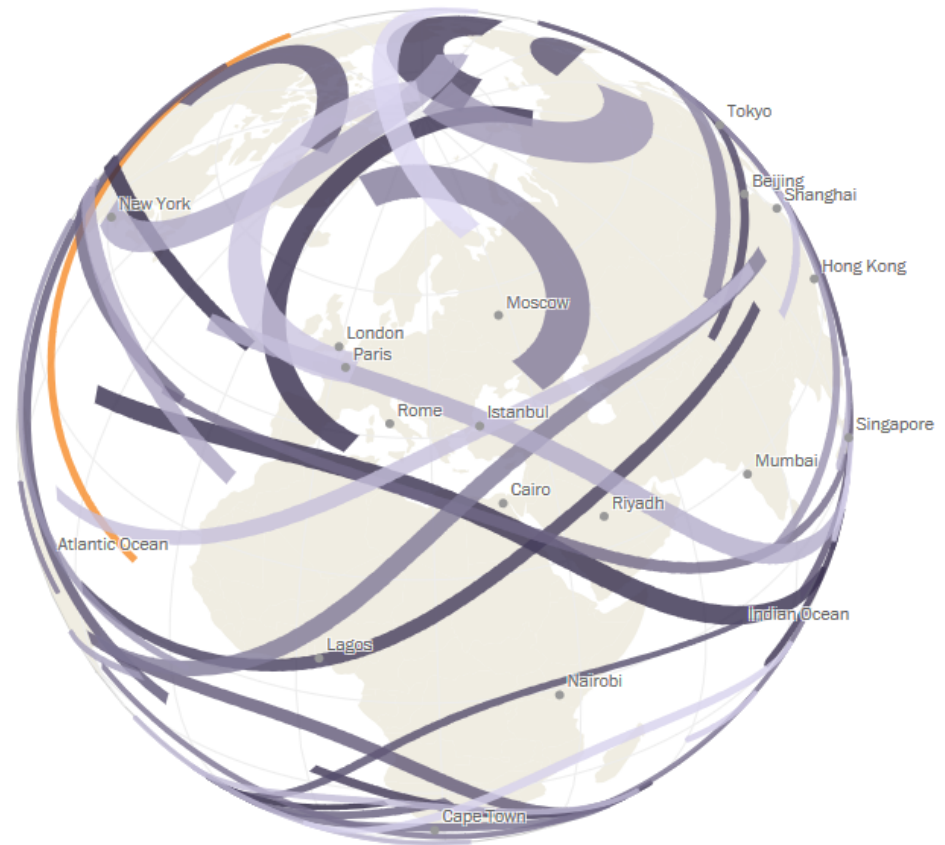
I was born in the year

1997

See eclipses

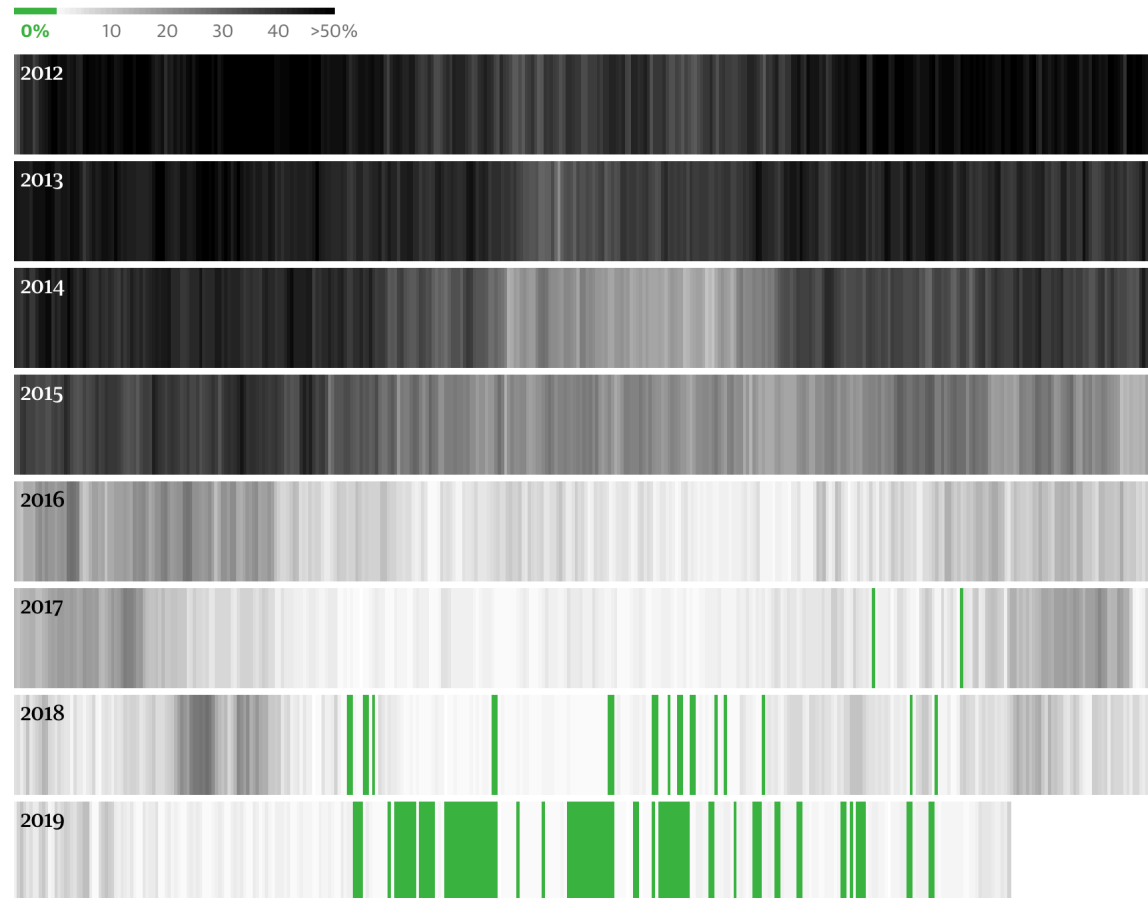
If you were born in **1997**, you are (or will be) **20** this year. If you live to be 100, there will be **56** more total solar eclipses worldwide in your lifetime. Many will be over **Asia**. **Three** will only eclipse over water.

2017 eclipse Sooner  Later



Britain is phasing out coal

Daily share of Britain's power generated by burning coal

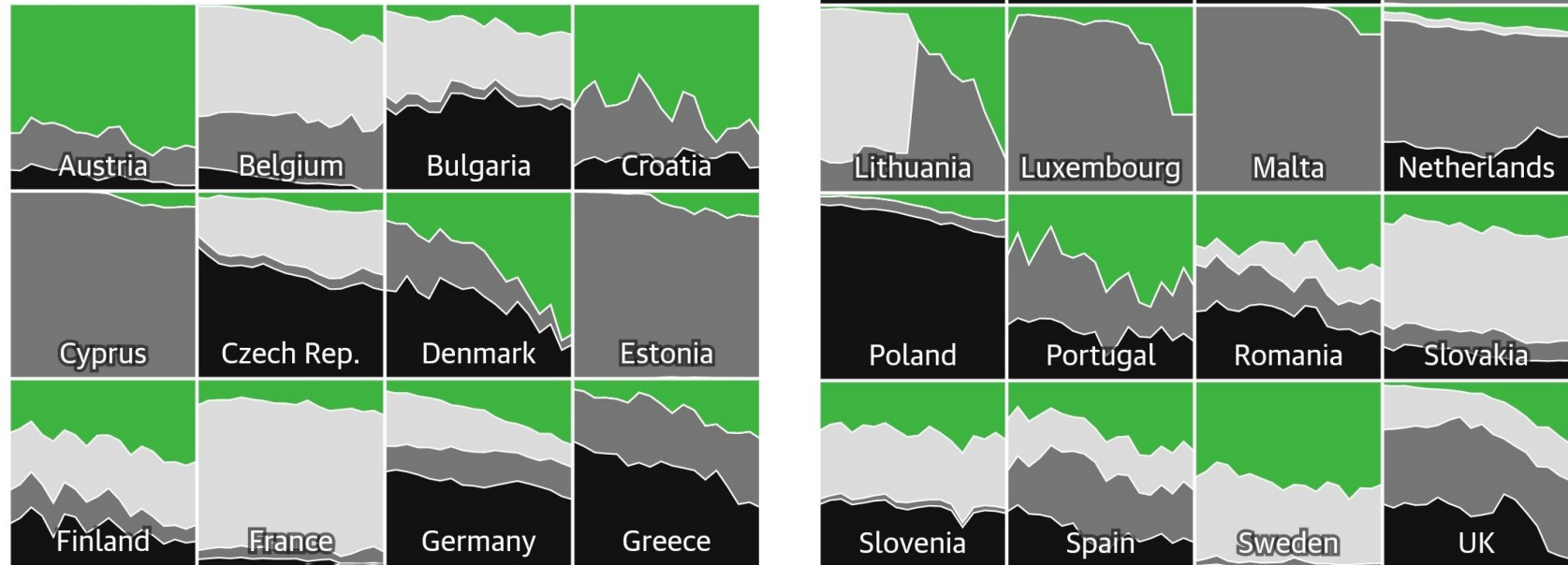


Power generation in EU countries

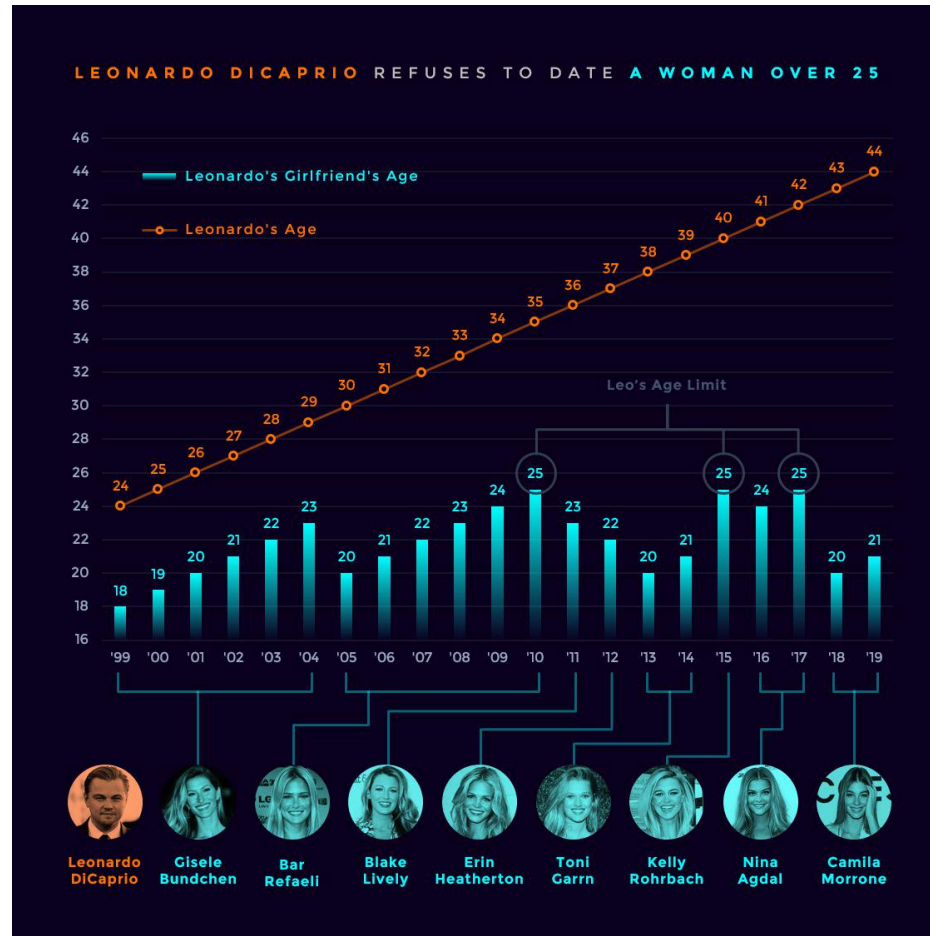
Power generation by source (2000-2018)

coal
 other fossil fuels
 nuclear
 renewables

2000 2018

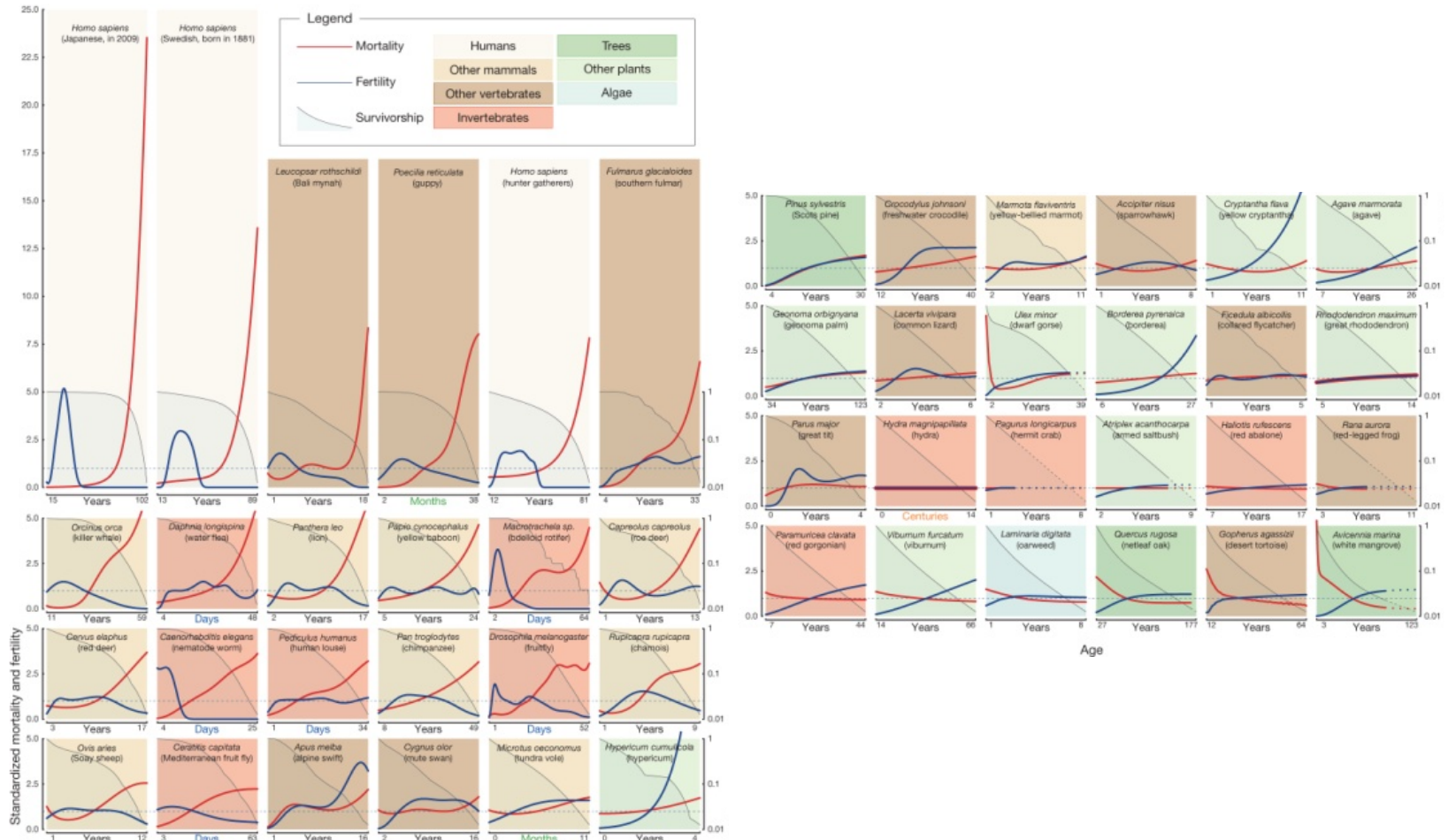


Leonardo DiCaprio's girlfriends



Made in
MS Excel!

Diversity of ageing



Diversity of ageing (redesign)

Surprising variety in Ageing

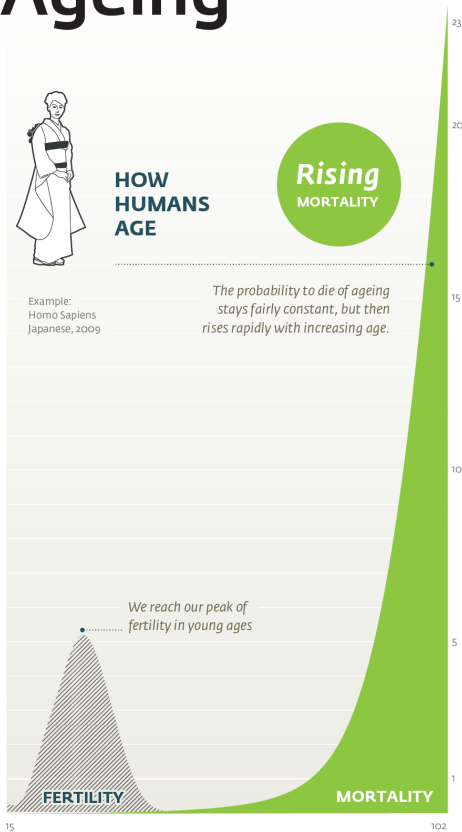


HOW HUMANS AGE

Example: Homo Sapiens Japanese, 2009

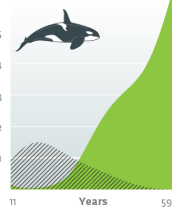
Rising MORTALITY

The probability to die of ageing stays fairly constant, but then rises rapidly with increasing age.



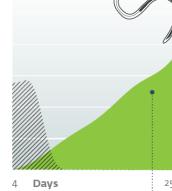
We reach our peak of fertility in young ages

KILLER WHALE



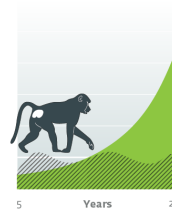
Many animals show an ageing pattern similar to humans.

NEMA-TODE WORM



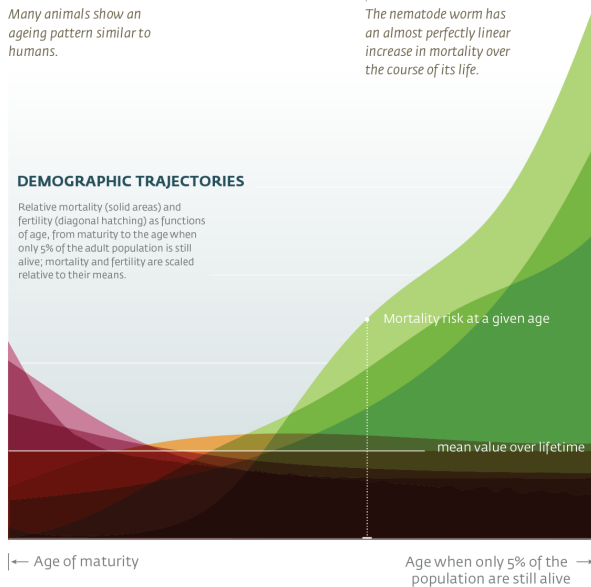
The nematode worm has an almost perfectly linear increase in mortality over the course of its life.

YELLOW BABOON



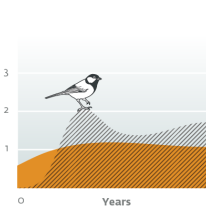
DEMOGRAPHIC TRAJECTORIES

Relative mortality (solid areas) and fertility (diagonal hatching) as functions of age, from maturity to the age when only 5% of the adult population is still alive, mortality and fertility are scaled relative to their means.



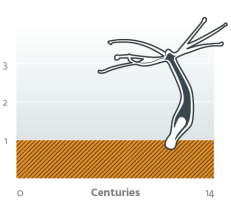
Constant MORTALITY

GREAT TIT



For some animals, however, mortality risk does not change with age.

HYDRA

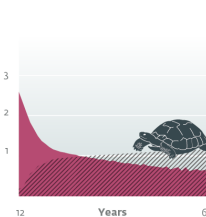


The hydra can live for centuries, fresh (and as fertile) as on day one.

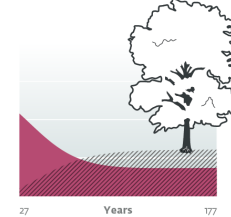
Declining MORTALITY

Some plants and animals are even less likely to die, the older they get!

DESERT TORTOISE



NETLEAF OAK

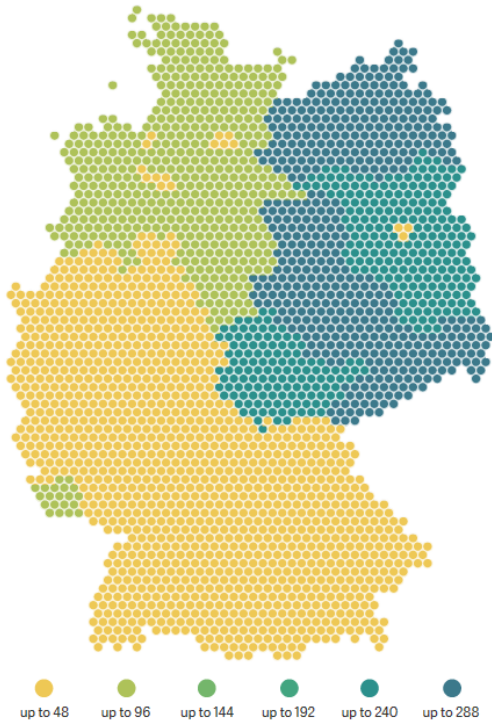


A nation divided



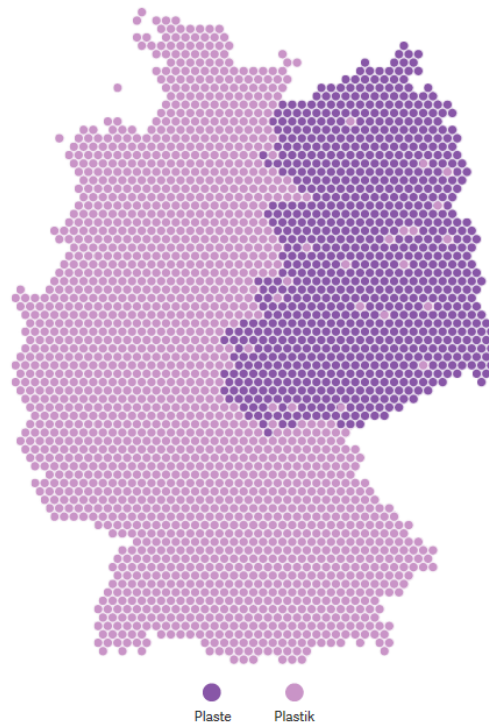
Agriculture

Average farm size in hectares, 2010



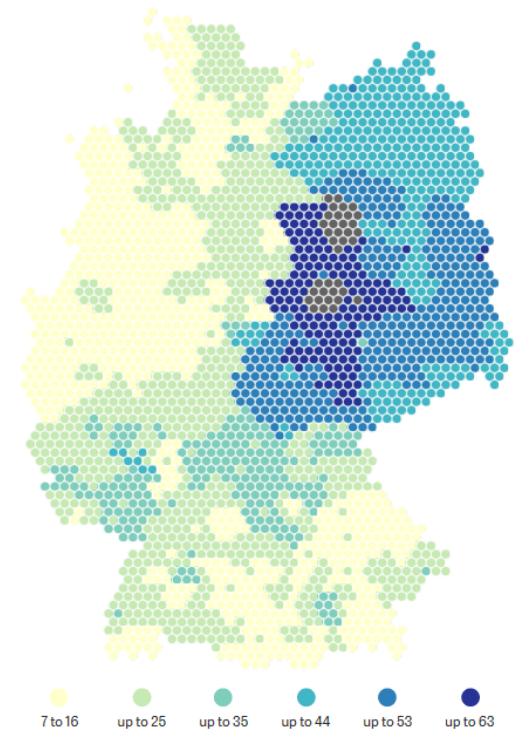
Plastic in German?

Word used regionally

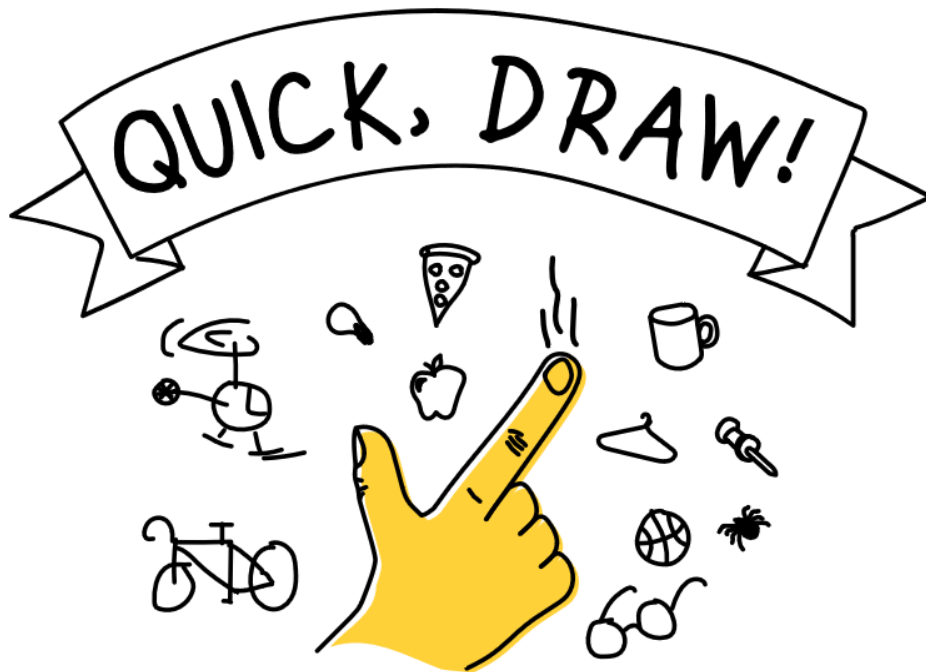


Day Care

Percentage of children under two in day care, 2012 (gray: no data)



Quick, Draw!



The Quick Draw Dataset is a collection of 50 million drawings across 345 categories, contributed by players of the game Quick, Draw!

quickdraw.withgoogle.com/data

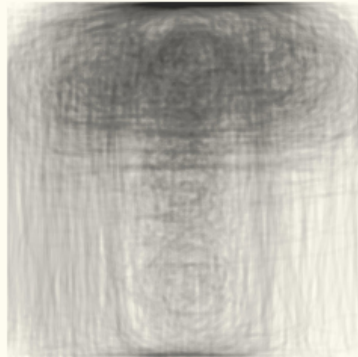
Can a neural network learn to recognize doodling?

Help teach it by adding your drawings to the [world's largest doodling data set](#), shared publicly to help with machine learning research.

Averaging drawings

Another cultural link between Japan and Taiwan, they are the only countries where traffic lights are mostly drawn horizontally:

Traffic light in Japan



Traffic light in Taiwan

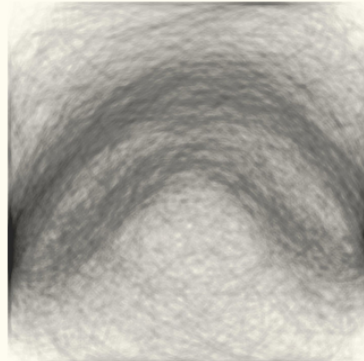


Traffic in the World

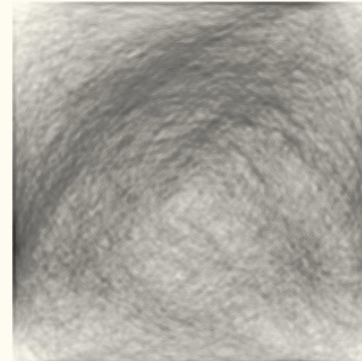


Australians draw boomerangs with the tip upwards:

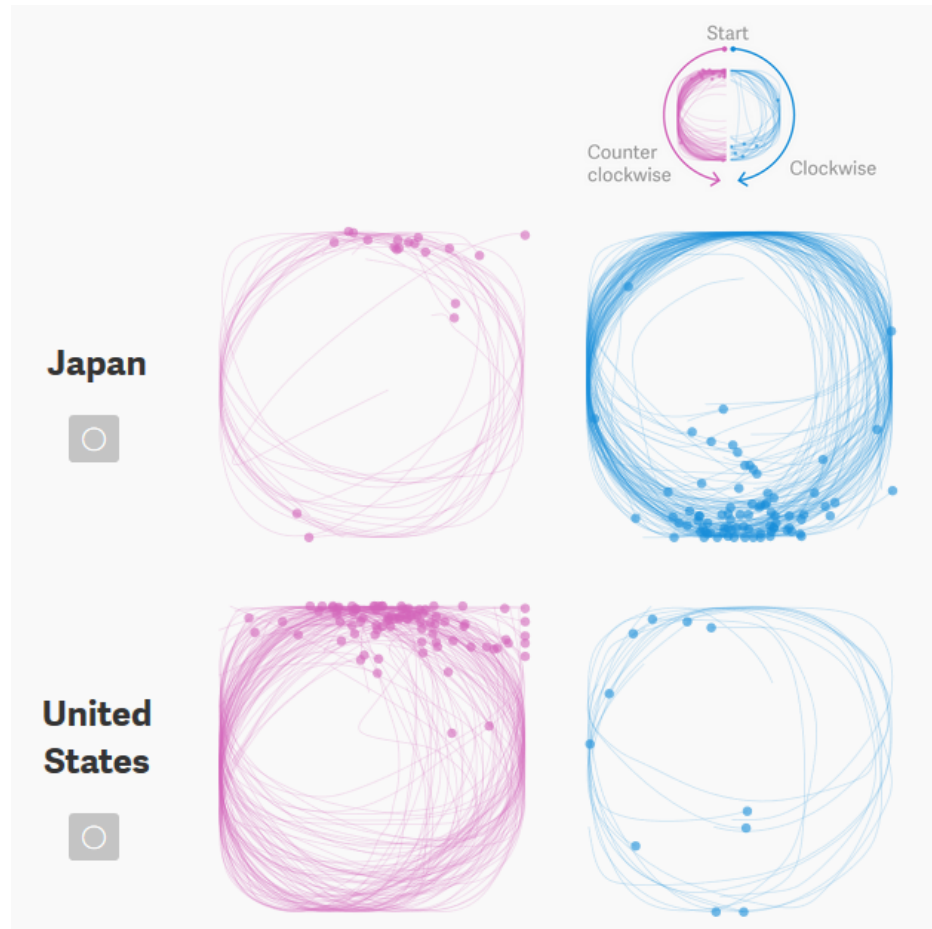
Boomerang in Australia



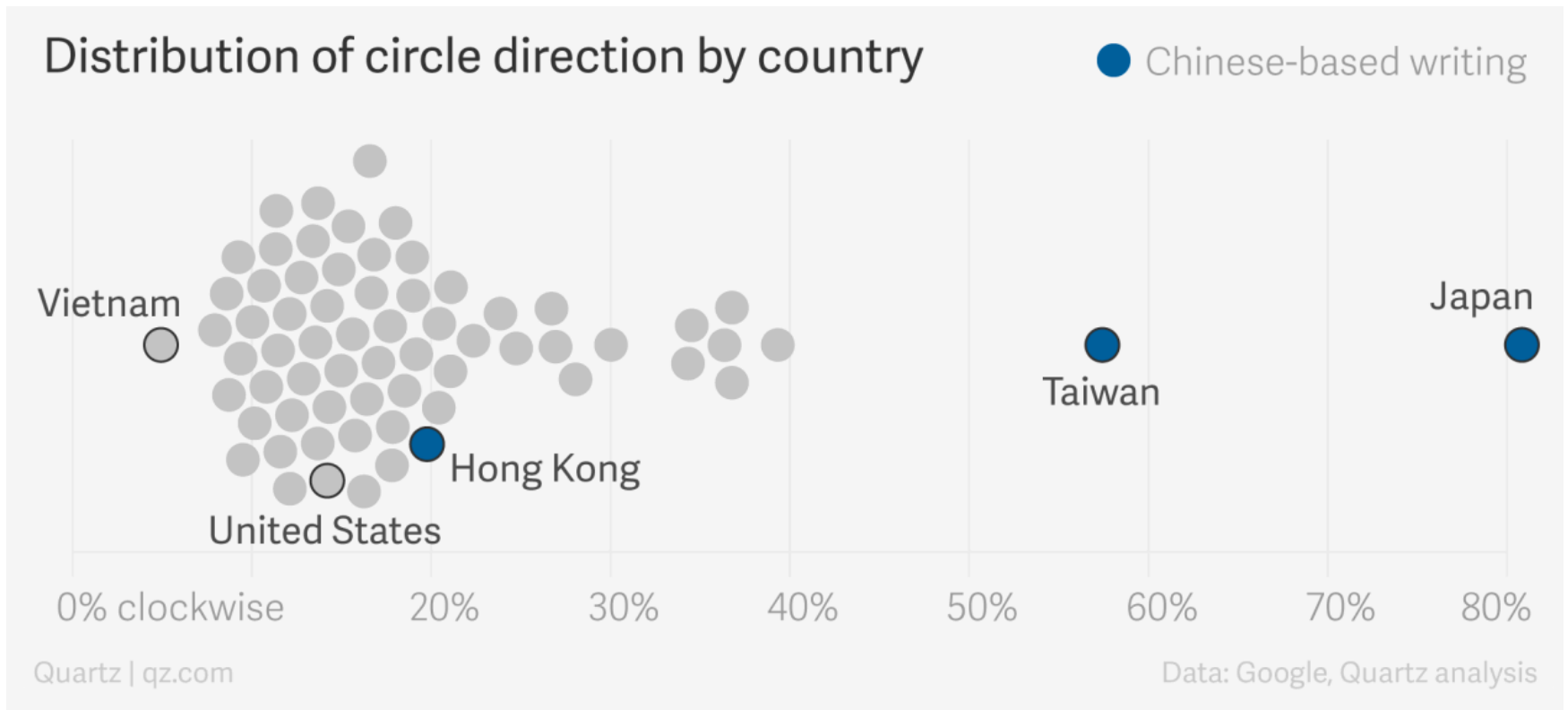
Boomerang in the world



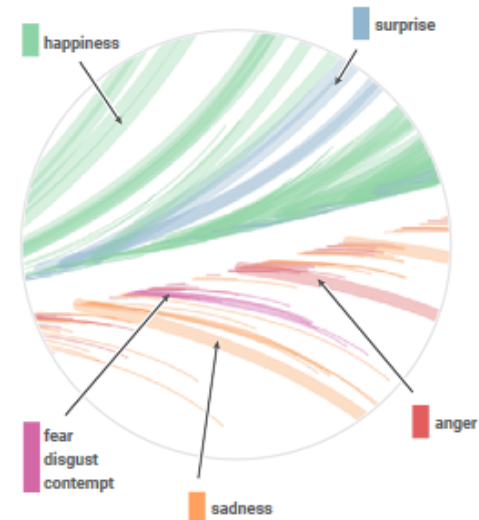
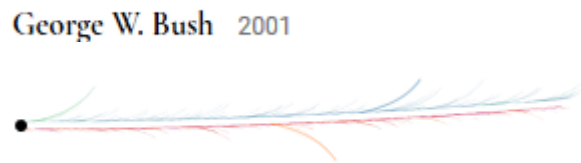
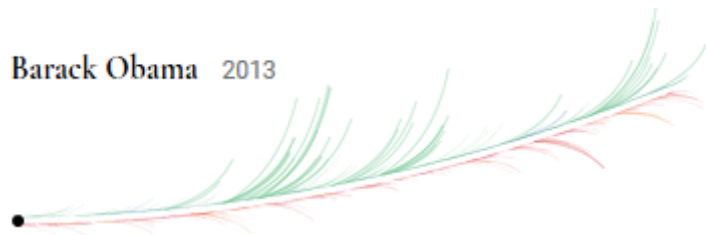
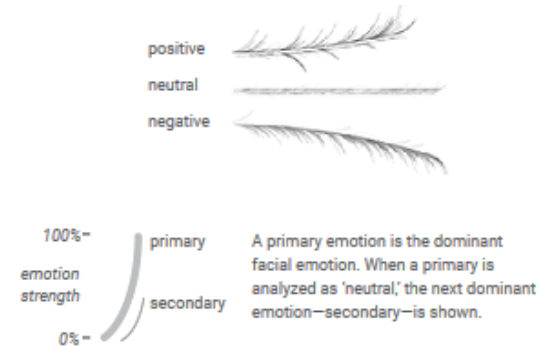
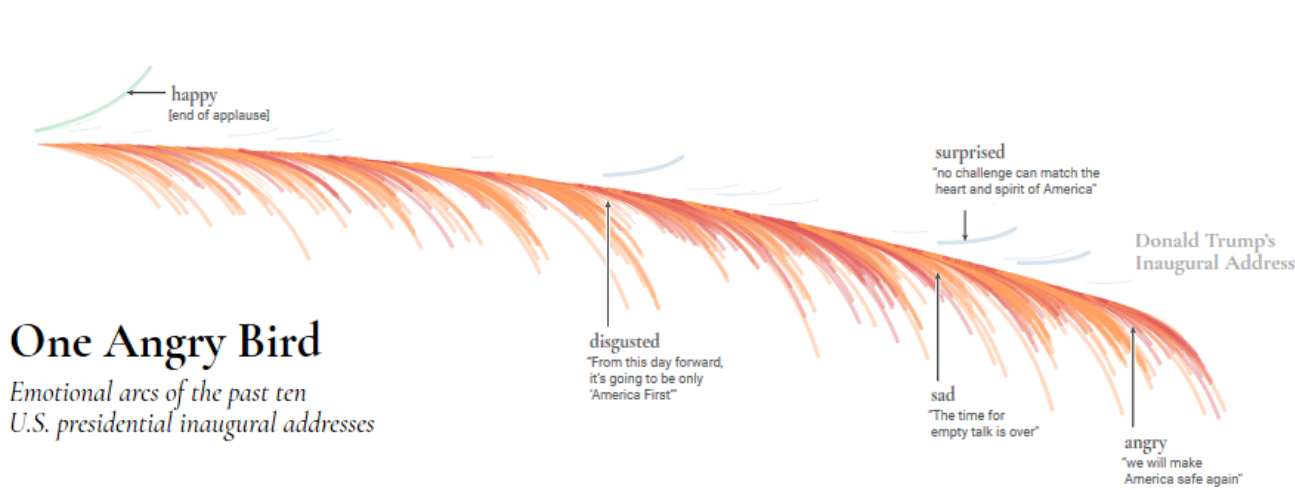
How do you draw a circle?



How do you draw a circle?



Emotions in US presidential inaugural addresses



Shakespeare's tragedies

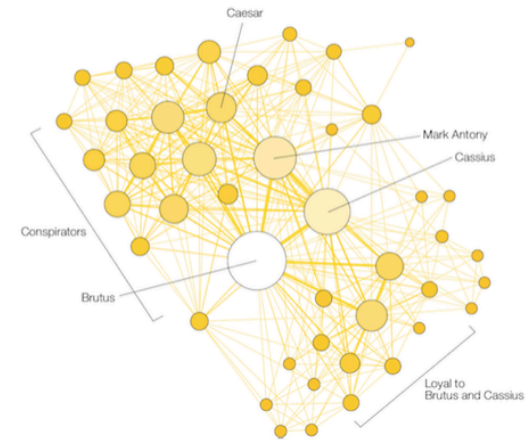
Are Shakespeare's tragedies all structured in the same way?
Are the characters rather isolated, grouped, all connected?



TITUS ANDRONICUS
Number of characters 36 | 50% Network density

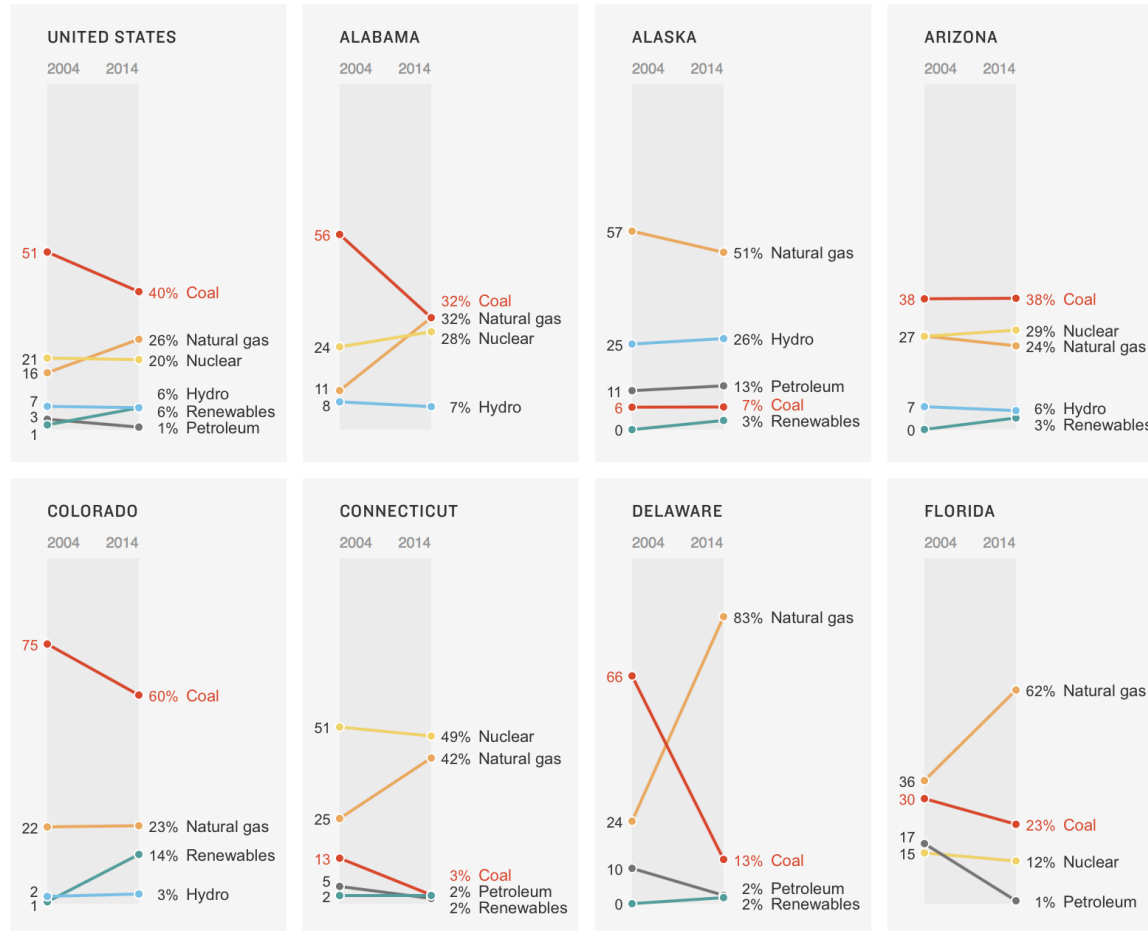


ROMEO AND JULIET
Number of characters 41 | 37% Network density



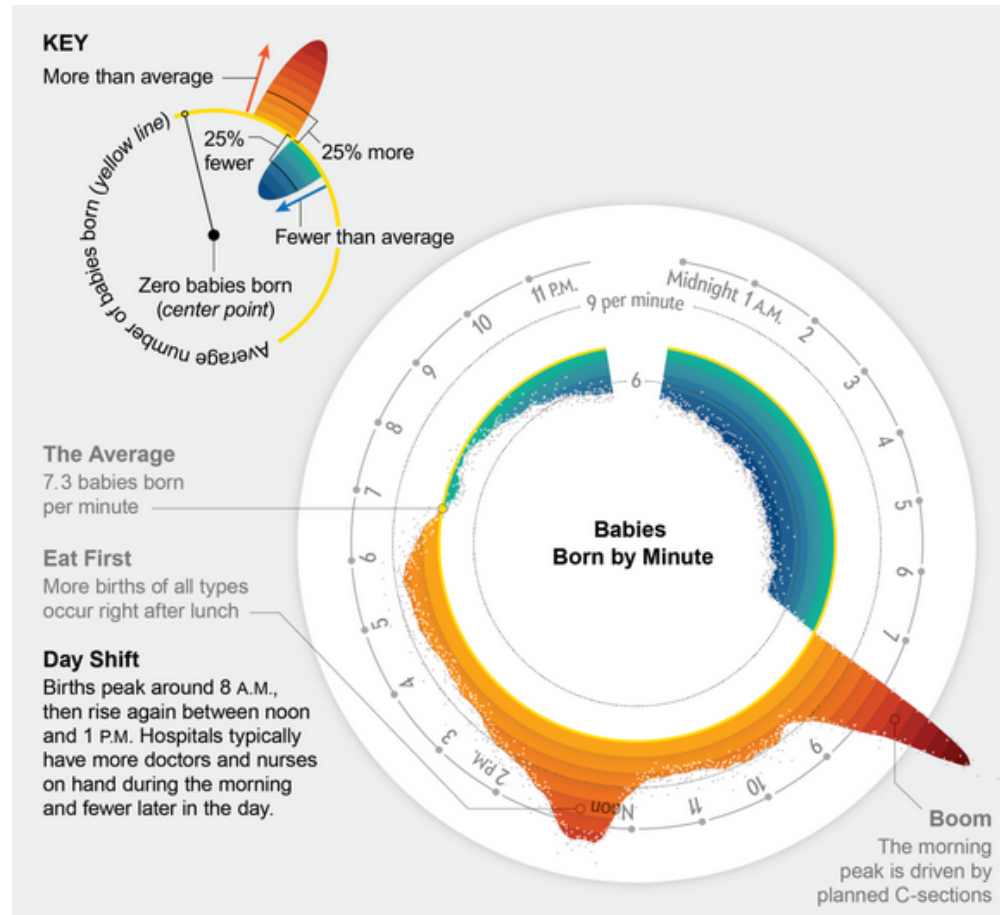
JULIUS CAESAR
Number of characters 46 | 34% Network density

Electric power generation

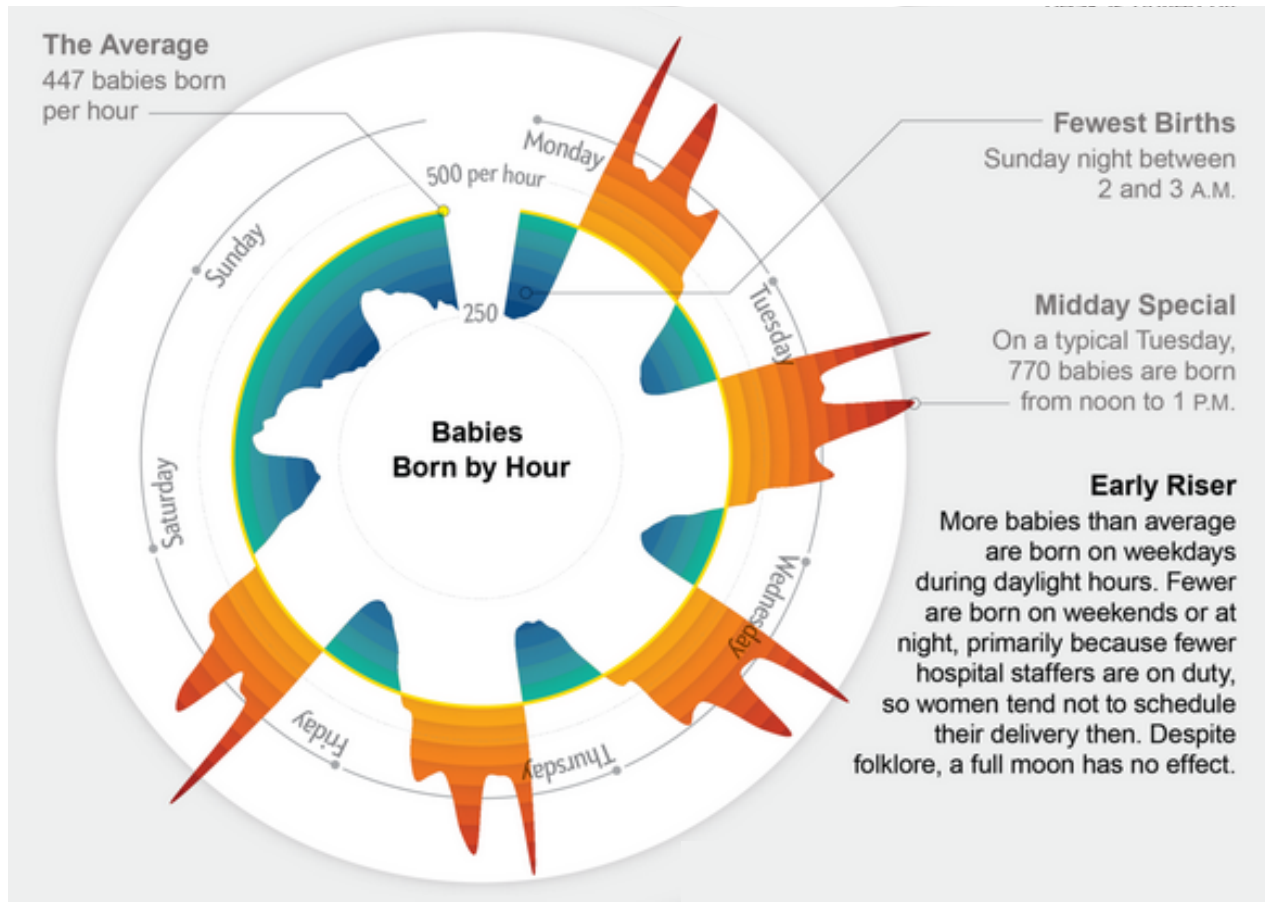


Slope graph

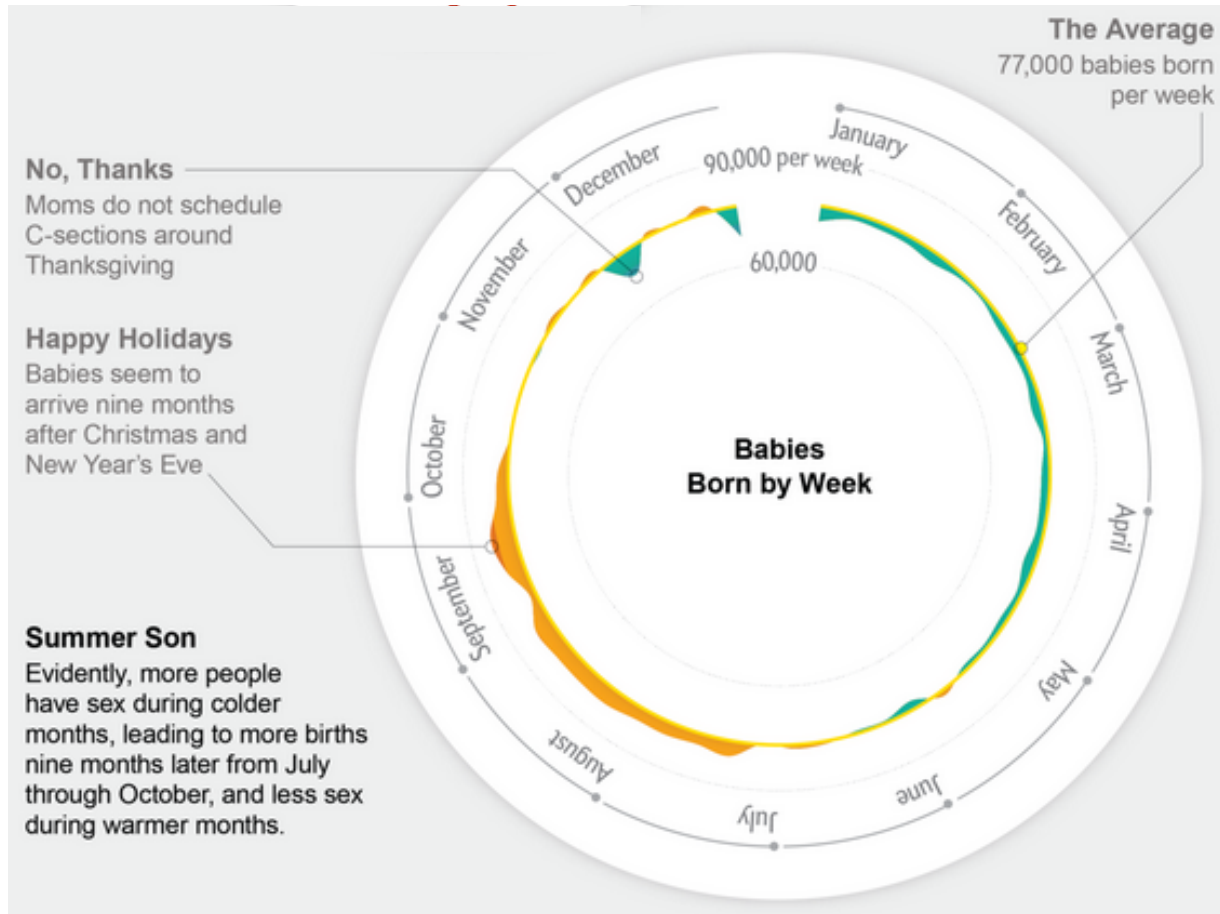
The baby spike



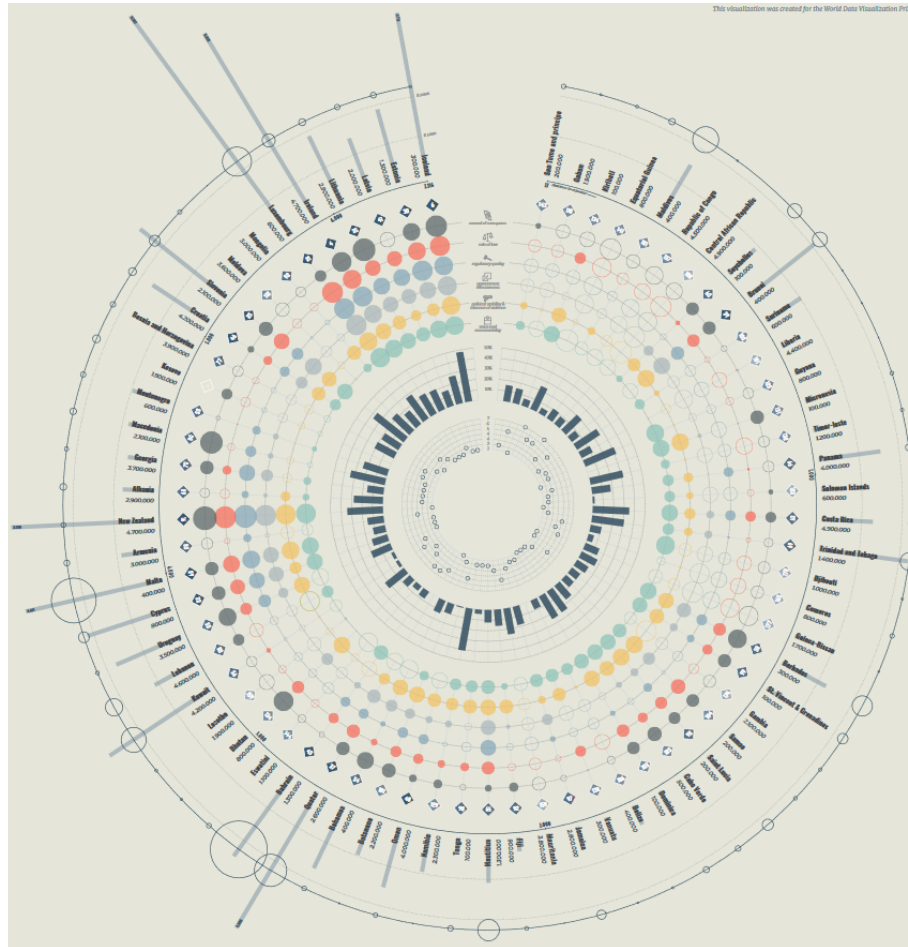
The baby spike



The baby spike



Does size matter?



Of all the people in all the world

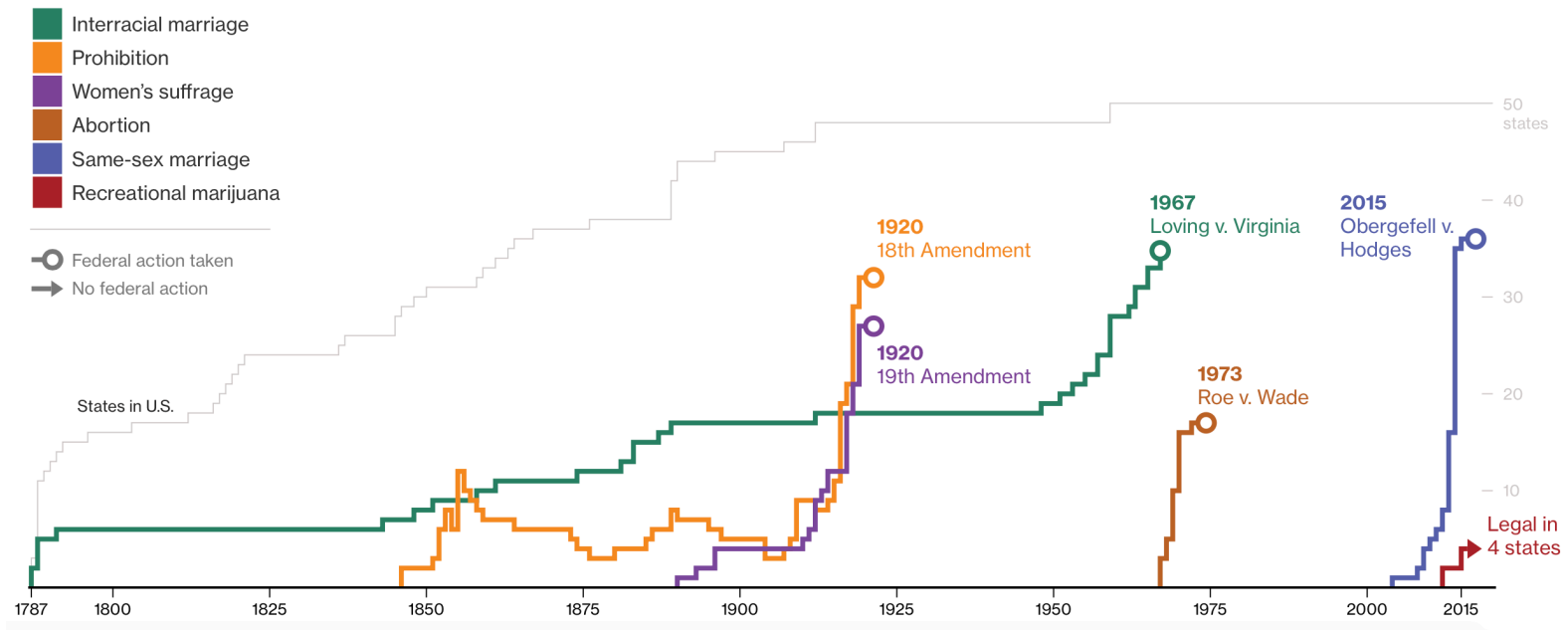


**ASTON VILLA VS BIRMINGHAM CITY
20/04/2008**

Tracking the pace of social change

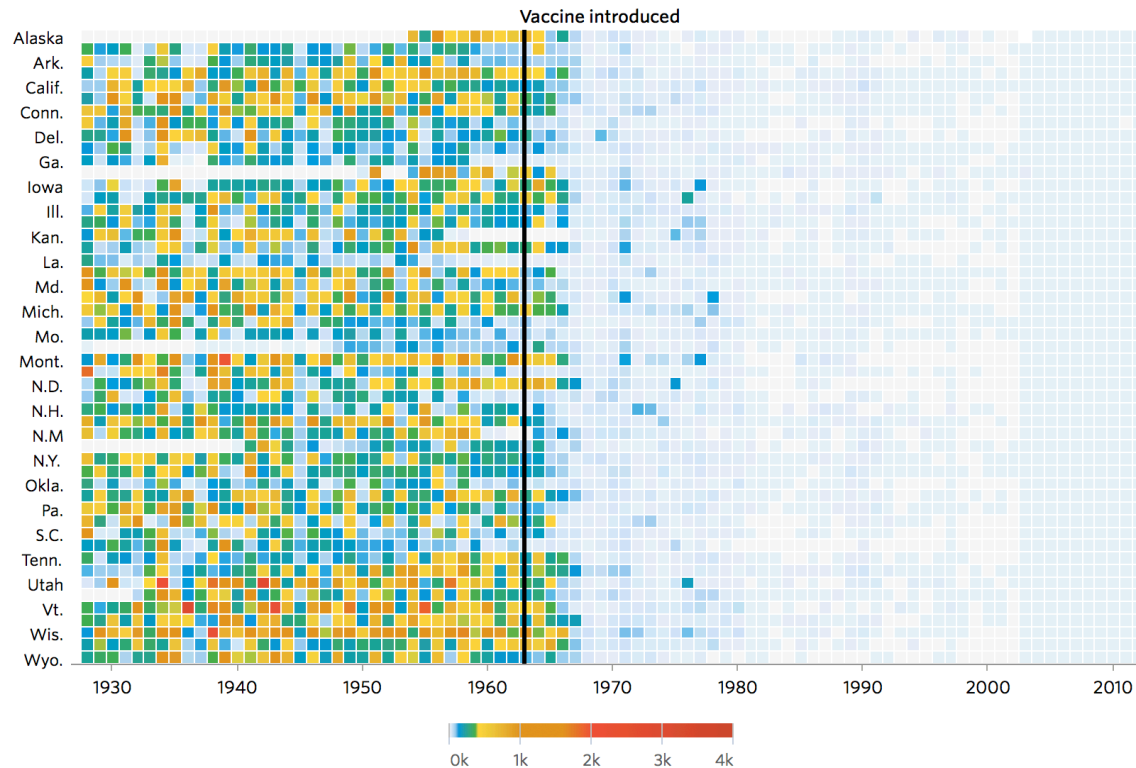
Tracking the Pace of Social Change

Number of states that have removed a ban, by year
(Prohibition shows the number of states that enacted)



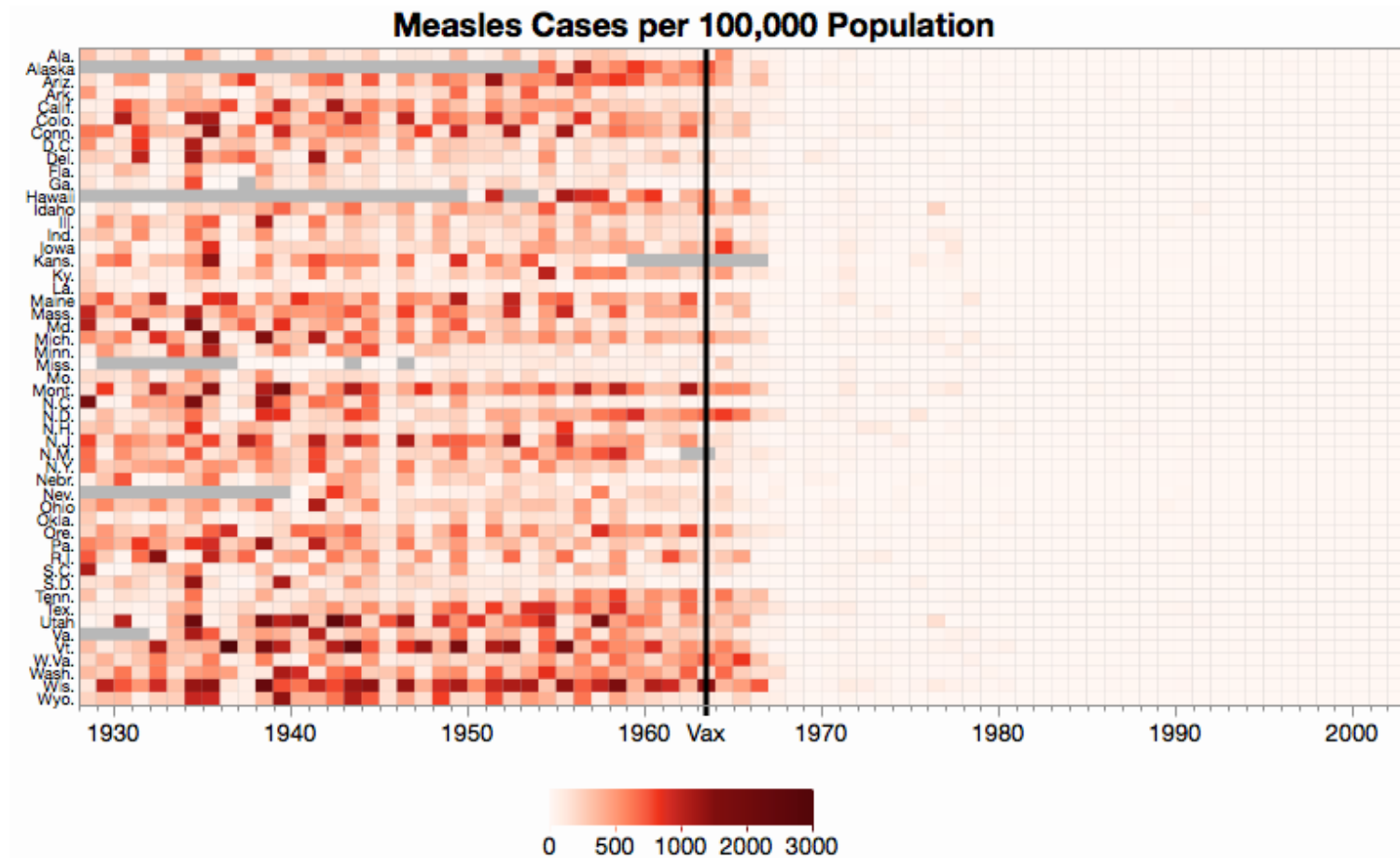
Battling infectious diseases in the 20th century

Measles

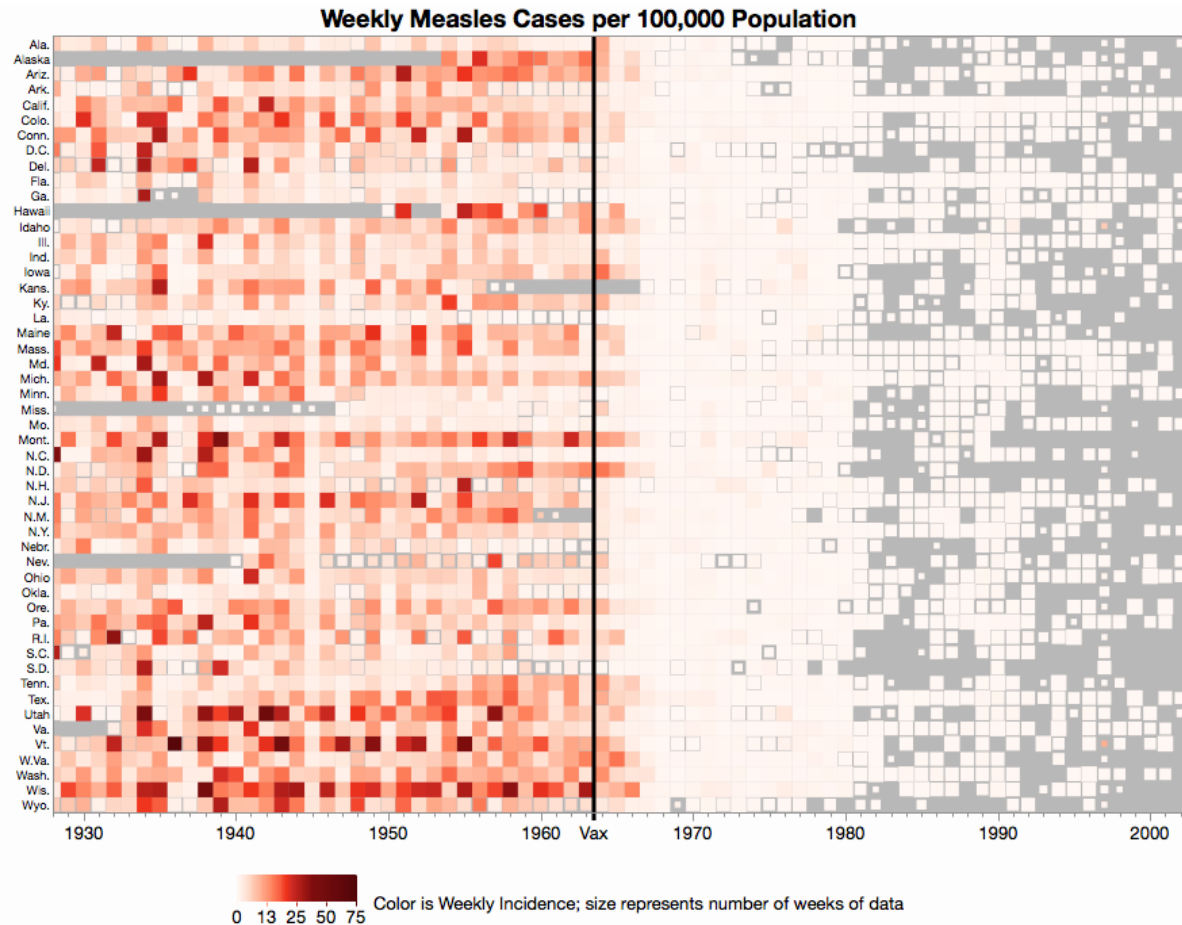


Note: CDC data from 2003-2012 comes from its Summary of Notifiable Diseases, which publishes yearly rather than weekly and counts confirmed cases as opposed to provisional ones.

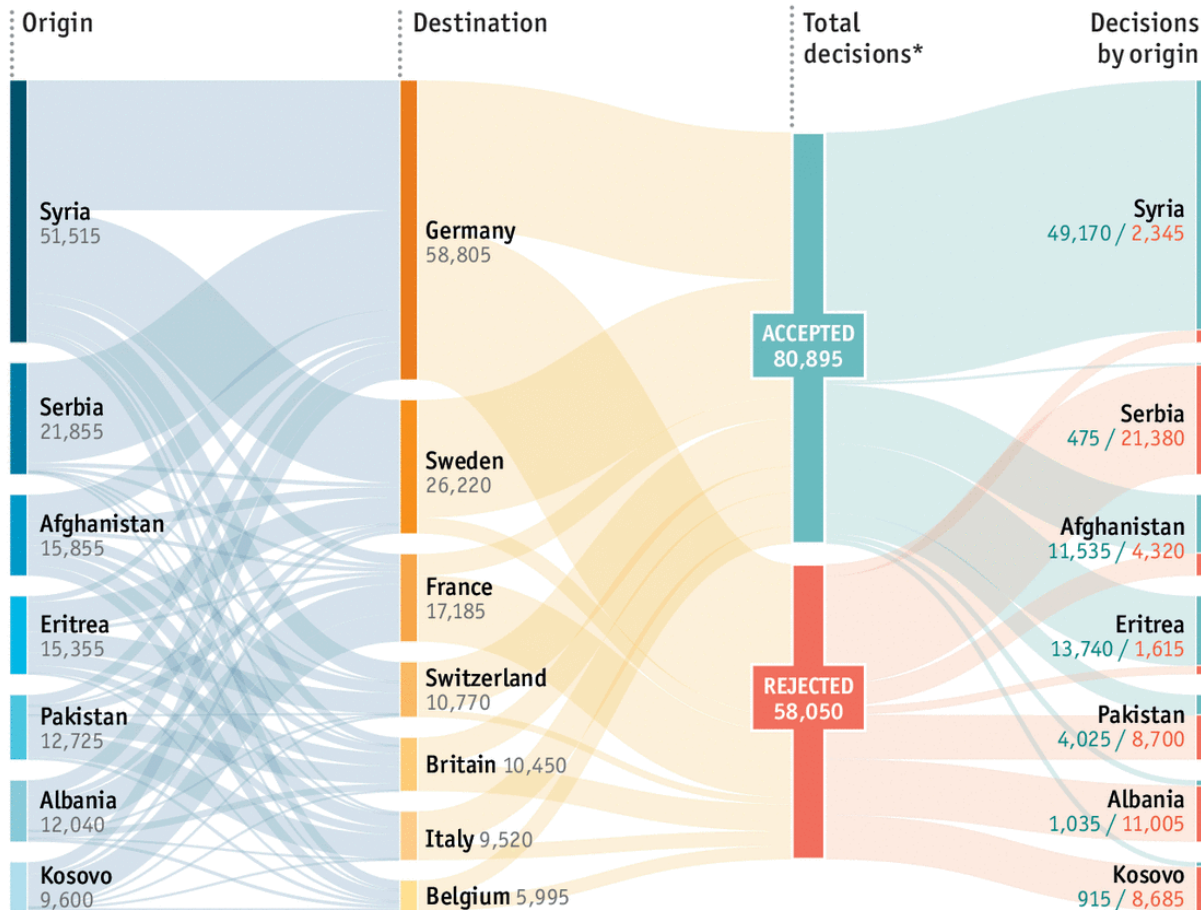
Battling infectious diseases in the 20th century (redesign)



Battling infectious diseases in the 20th century (redesign)



Asylum decisions in Europe

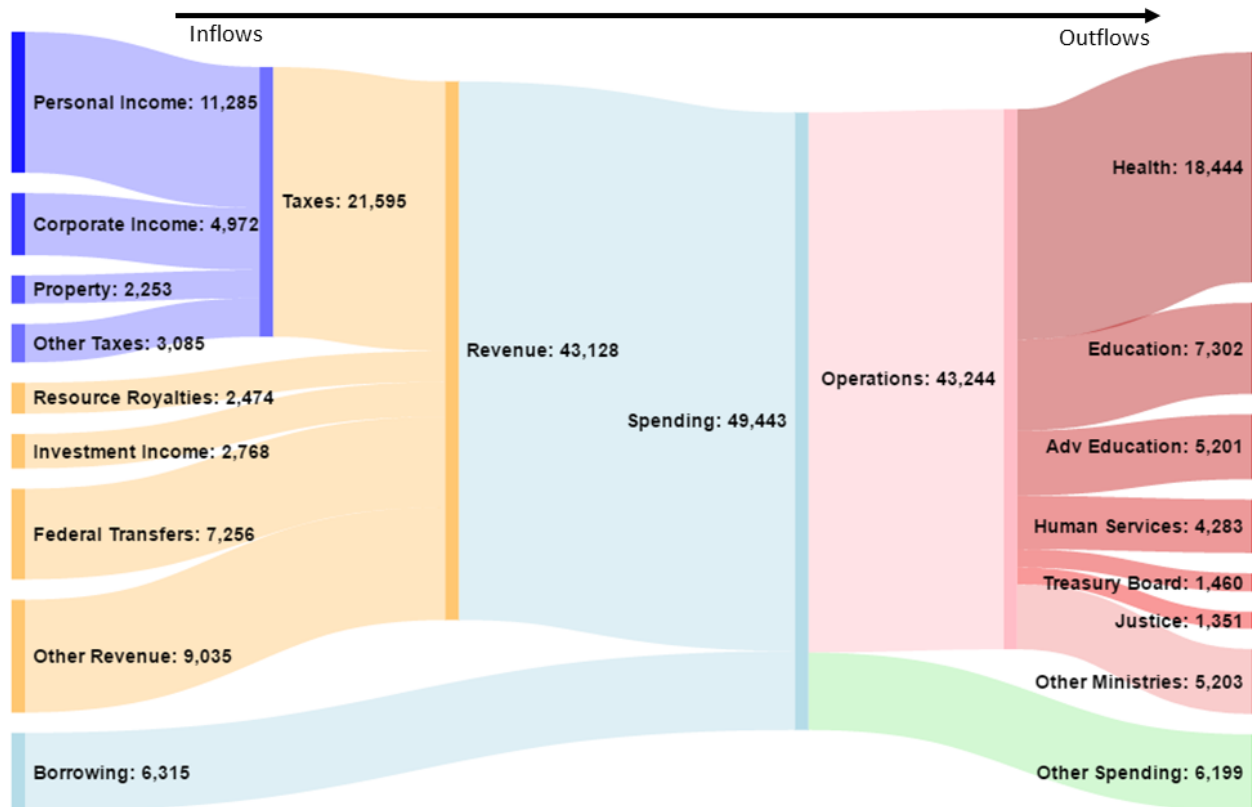


Alluvial diagram

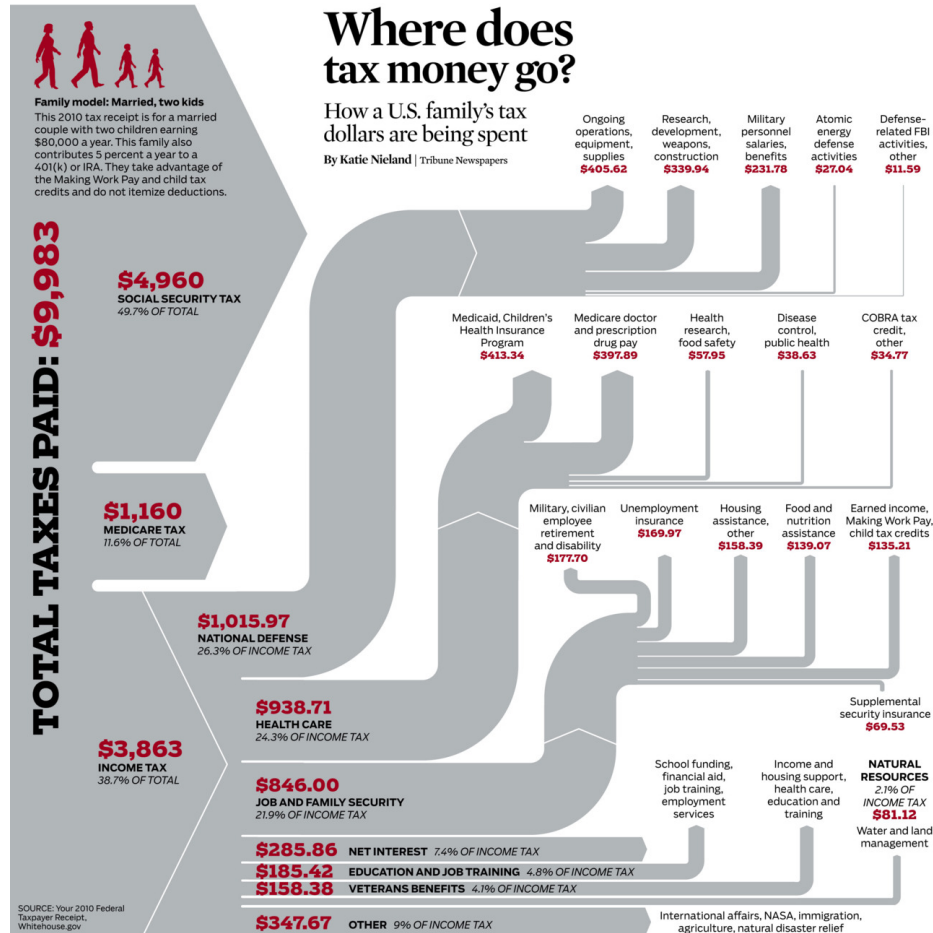
Government Budget in Alberta

Alberta Government Financial Flows, 2015-16

All values are in millions of dollars – From 3rd Quarter Update



Tax money spending in the US



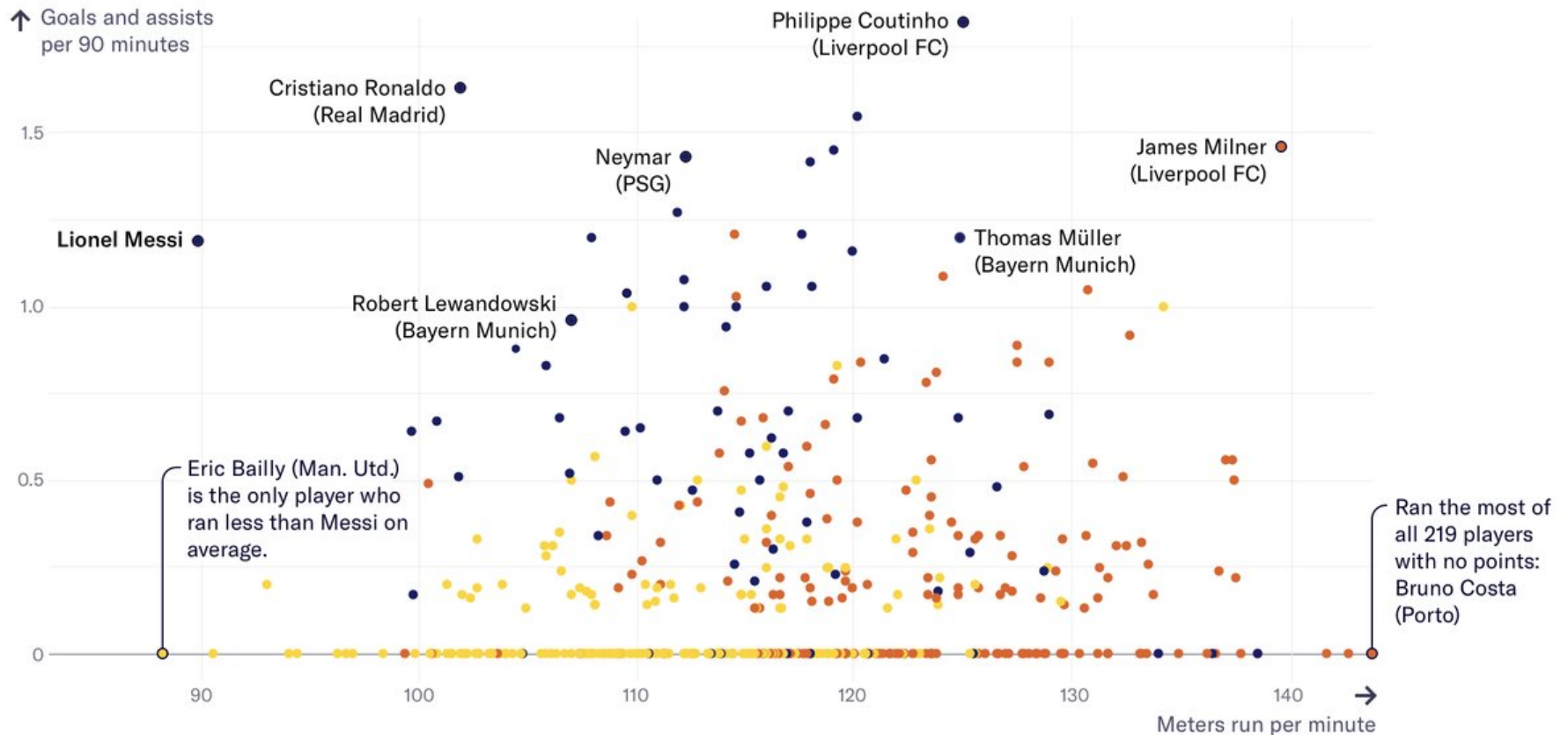
Sankey diagram

How hot it will get for footballers in Qatar?

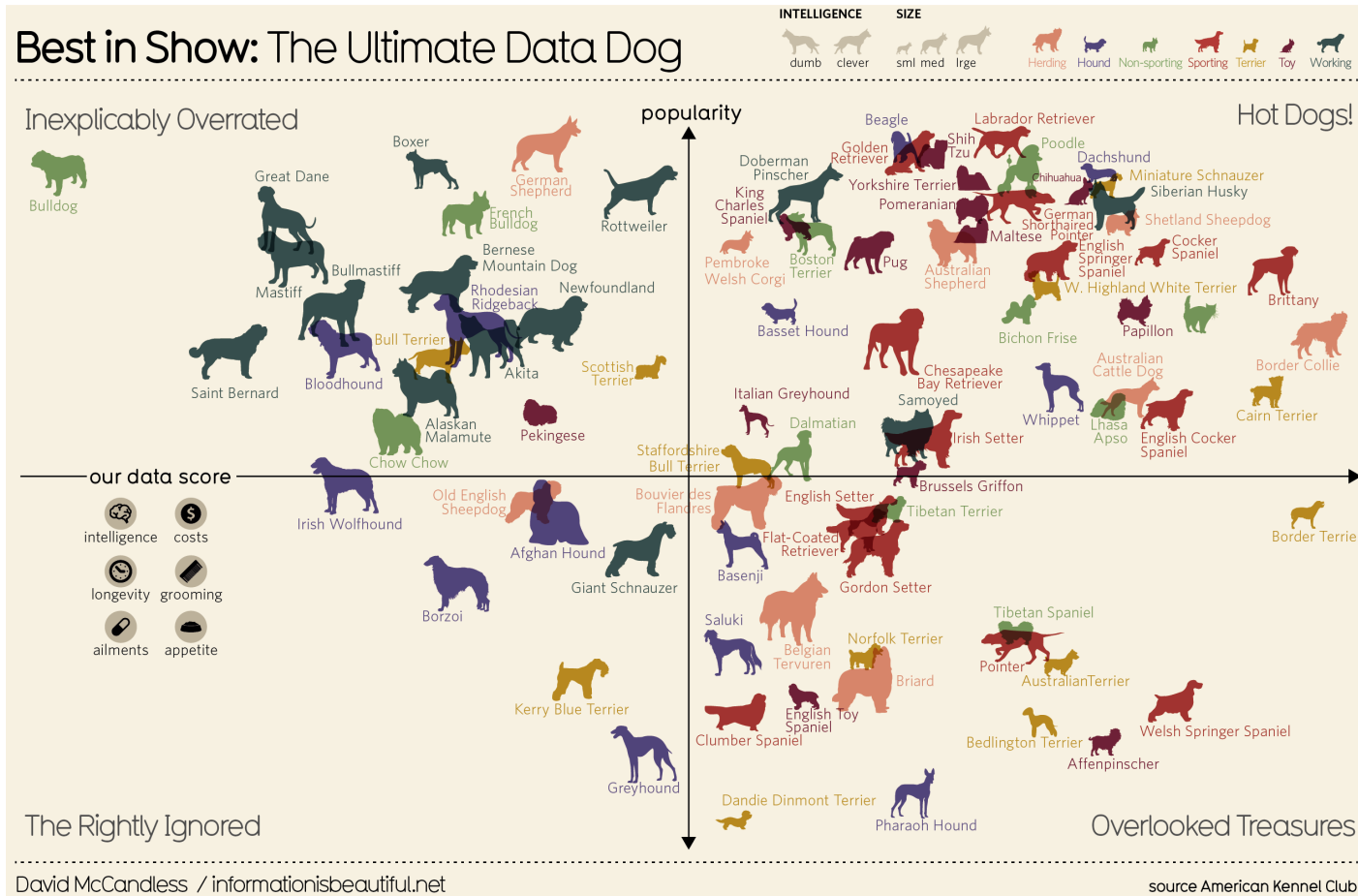


Lionel Messi's efficiency

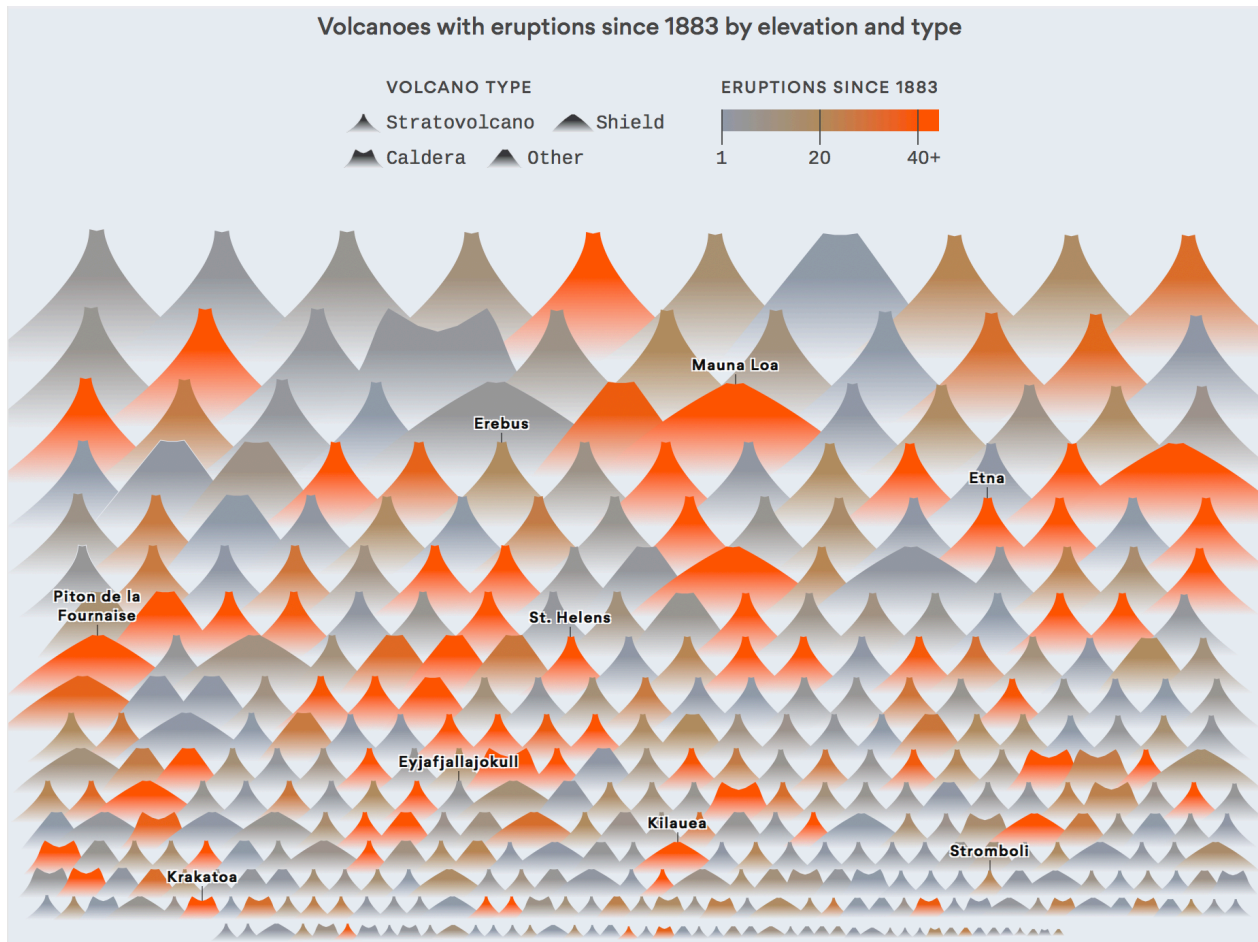
● Forward ● Midfielder ● Defender



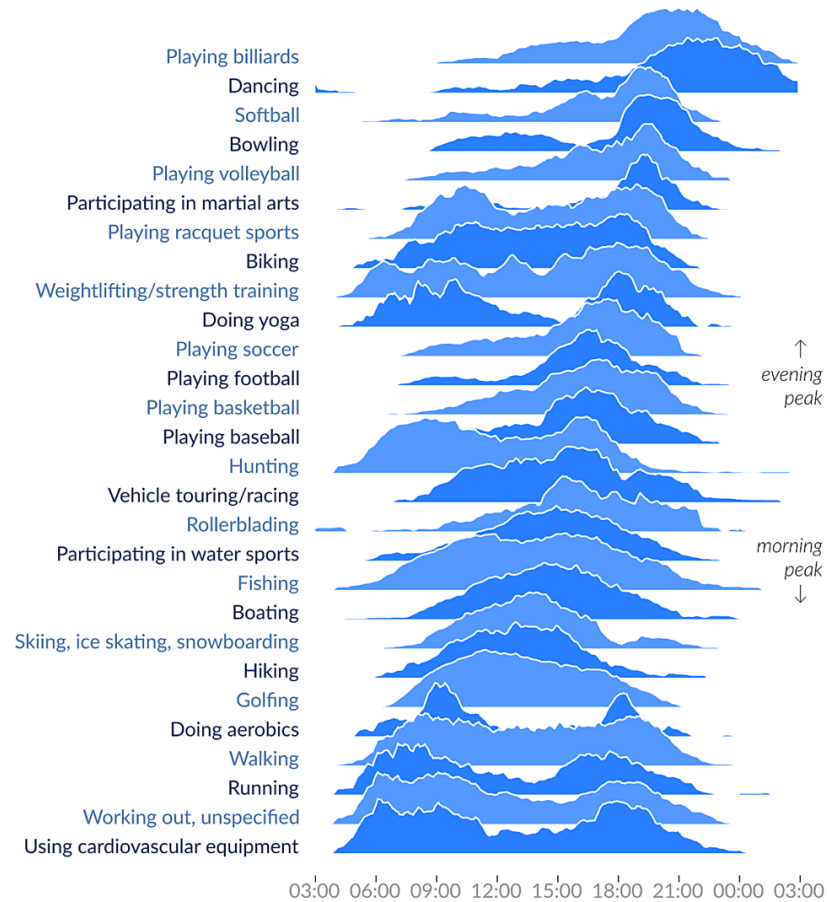
Best in show



Active volcanos



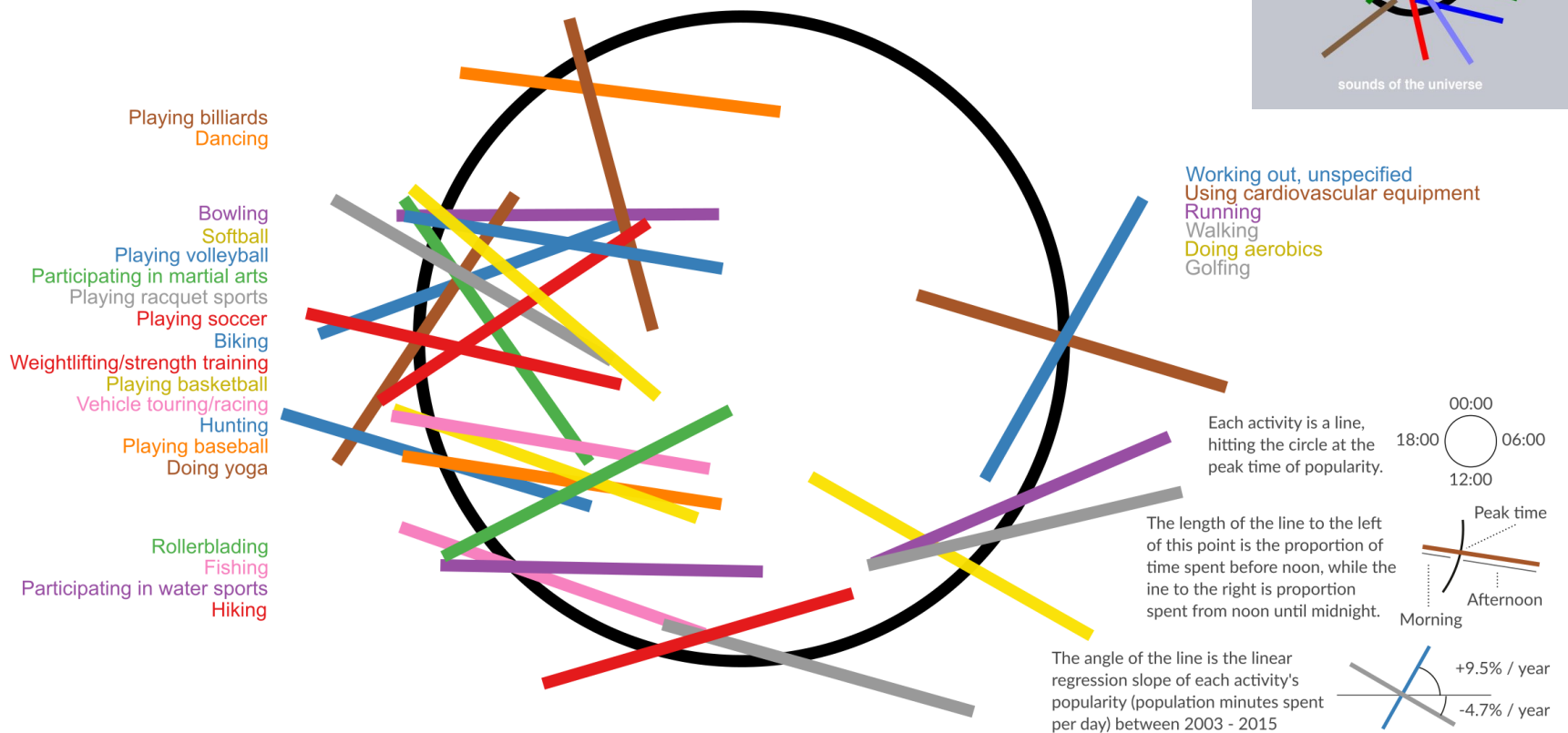
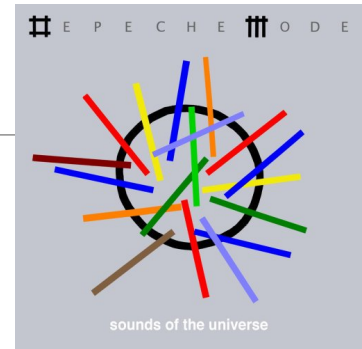
Peak time of day for sports and leisure



@hnrkndbrg | Source: American Time Use Survey

Peak time of day for sports and leisure

@hnrklnbrg | Source: American Time Use Survey



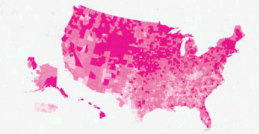
Average pizza size



Are the richest Americans also the best educated?

READING, WRITING, AND EARNING MONEY

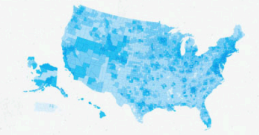
The latest data from the U.S. Census's American Community Survey paints a fascinating picture of the United States at the county level. We've looked at the educational achievement and the median income of the entire nation, to see where people are going to school, where they're earning money, and if there is any correlation.



① HIGH SCHOOL GRADUATES 65% 75% 82% 84%



② COLLEGE GRADUATES 15% 22% 30% 40%

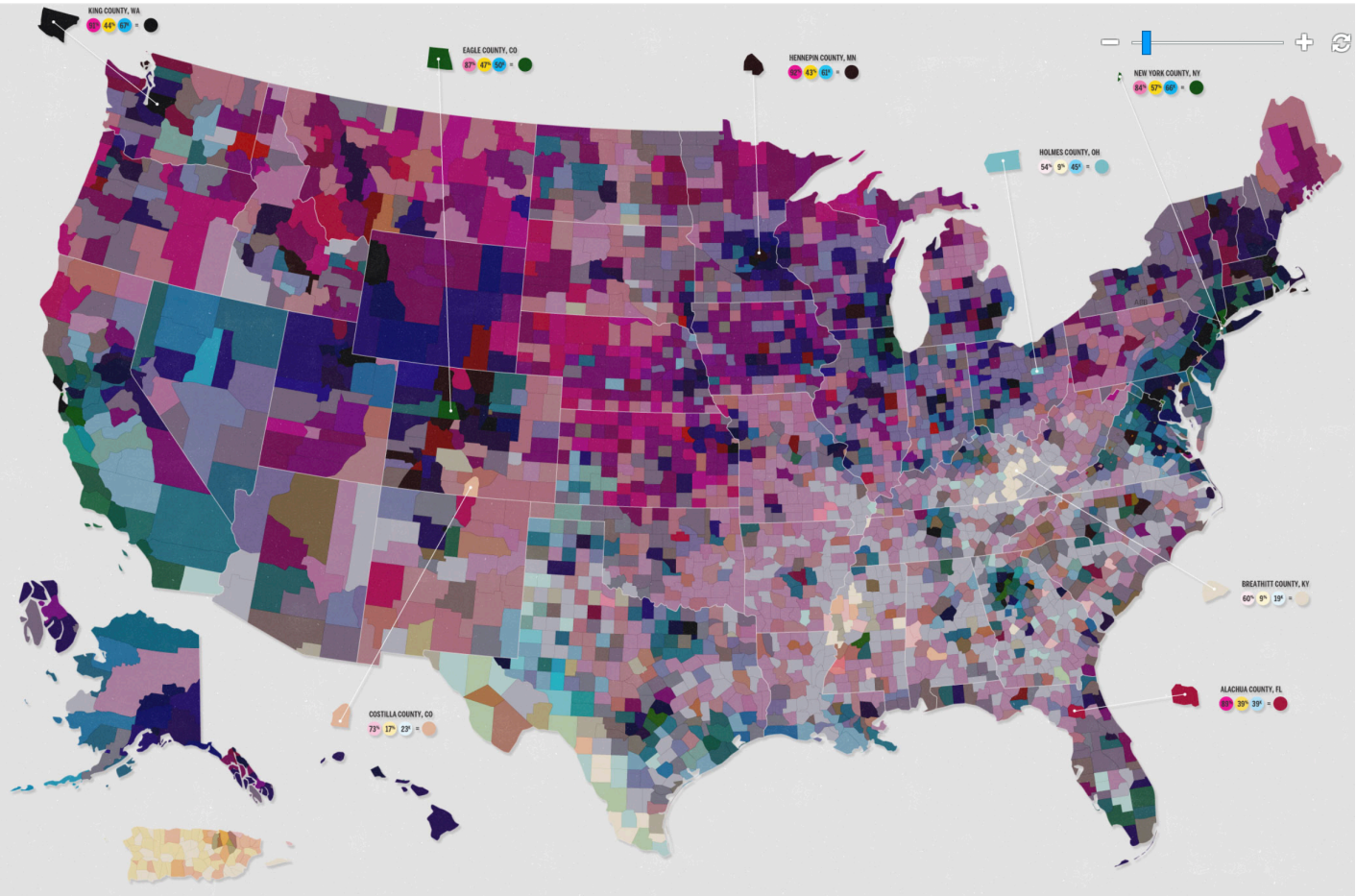


③ MEDIAN HOUSEHOLD INCOME 25% 40% 50% 65%

The map at right is a product of overlaying the three sets of data. The variation in hue and value has been produced from the data shown above. In general, darker counties represent a more educated, better paid population while lighter areas represent communities with fewer graduates and lower incomes.

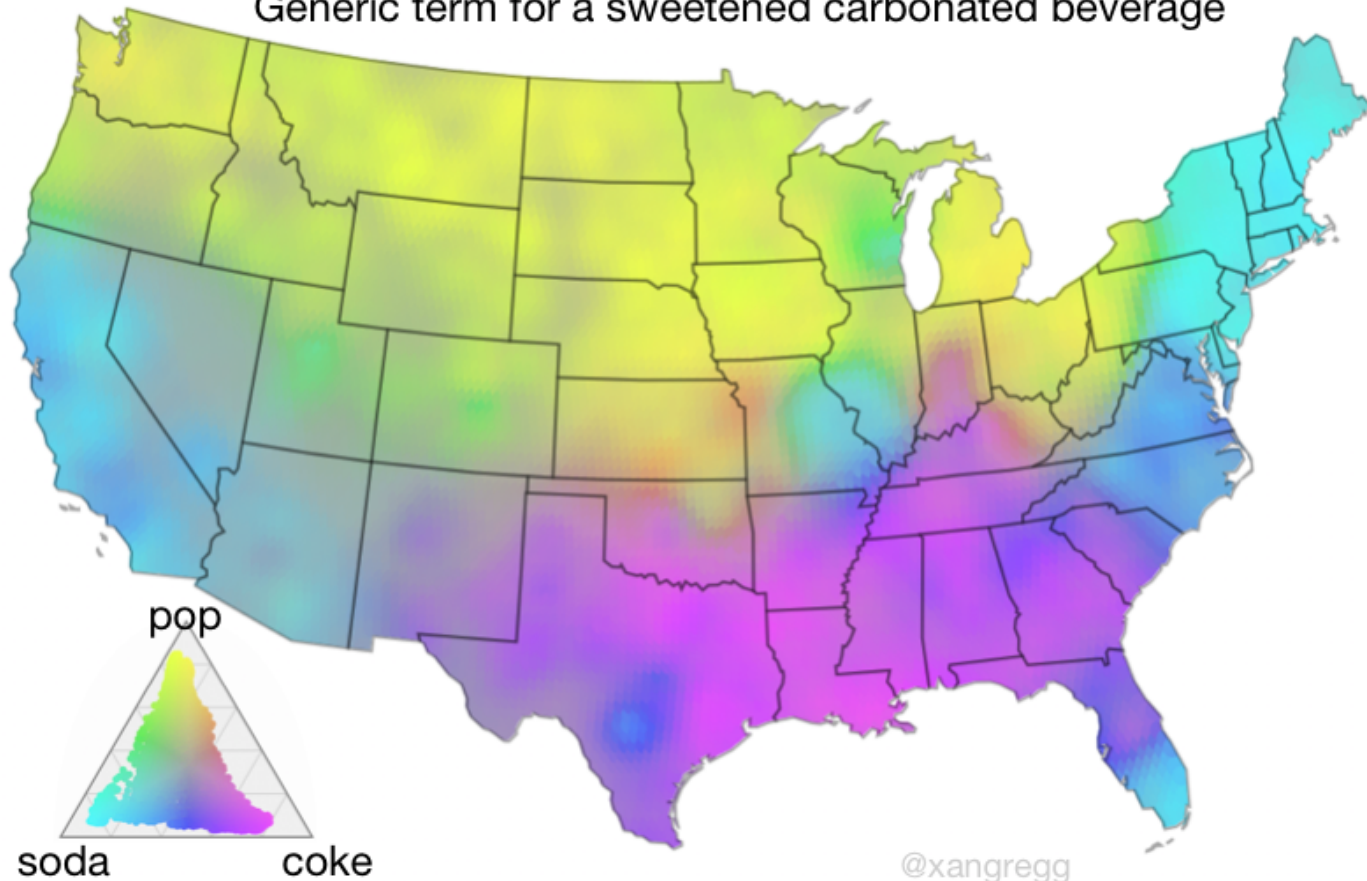


A collaboration between GOOD and Gregory Huback
SOURCE: US Census



Soda/coke/pop map

Generic term for a sweetened carbonated beverage



Profiles of British voters

Build a British voter

randomise

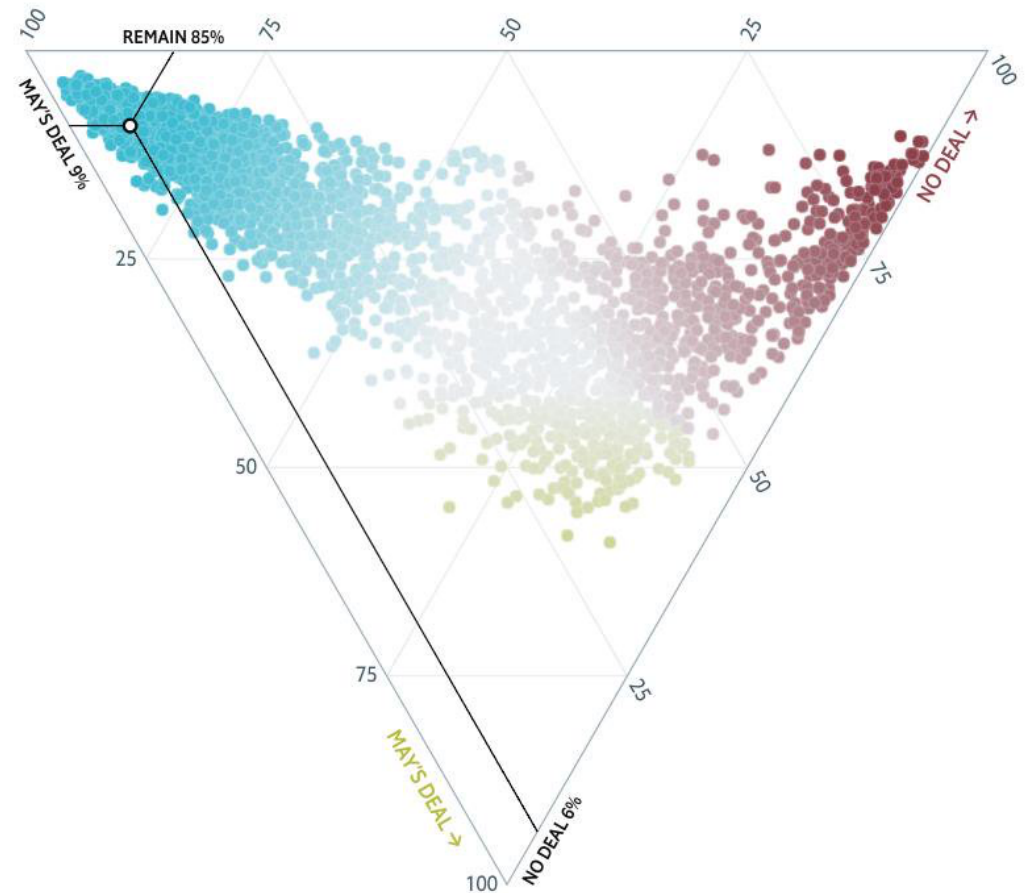
A woman aged between 45 and 59 years old who is straight. She has a household income of £35k to £50k, a post-graduate degree and lives in the Midlands in her mortgaged home. She is moderately engaged in politics, supported Labour in 2015 and Labour again in 2017.

Likelihood of voting

85%
Remain

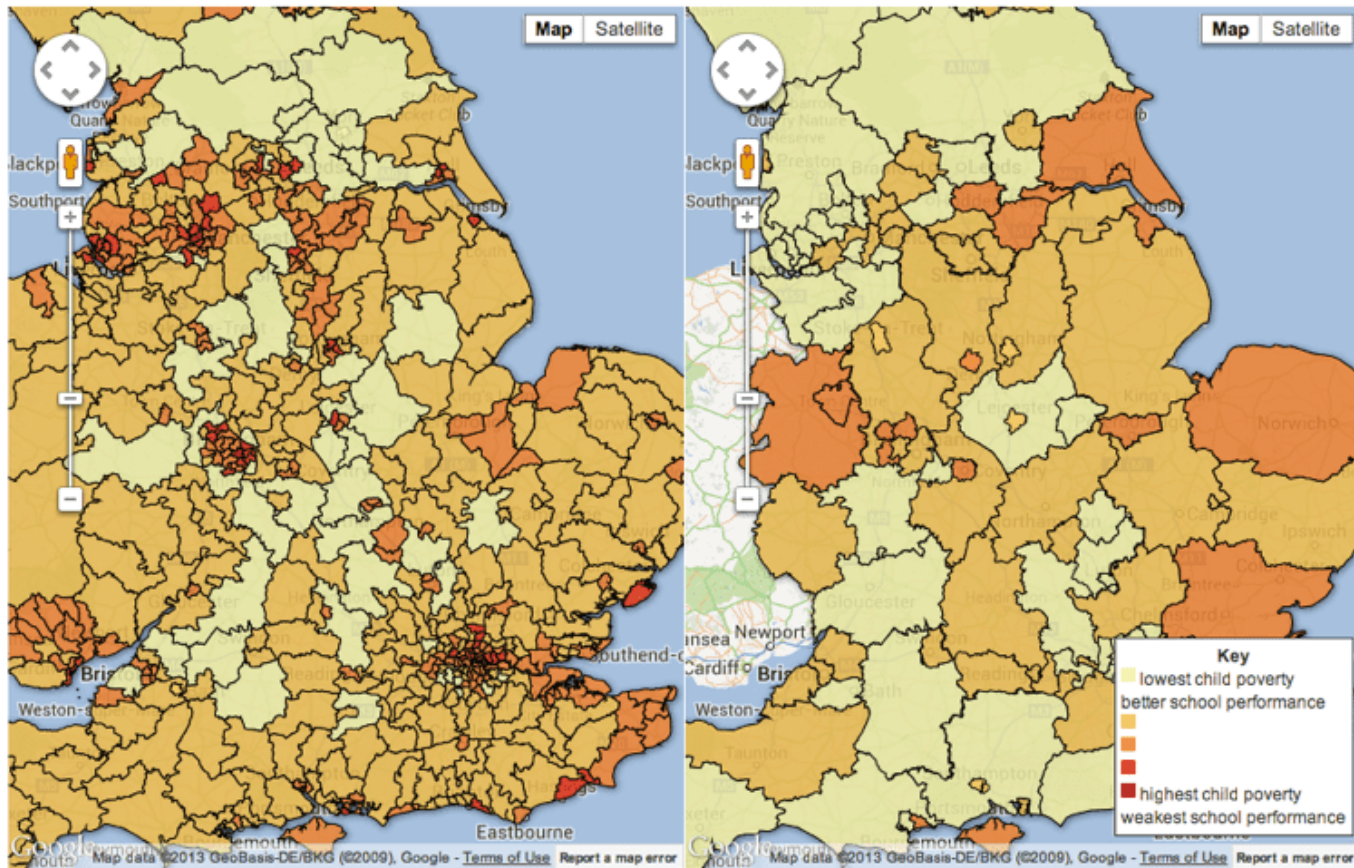
9%
May's deal

6%
No deal

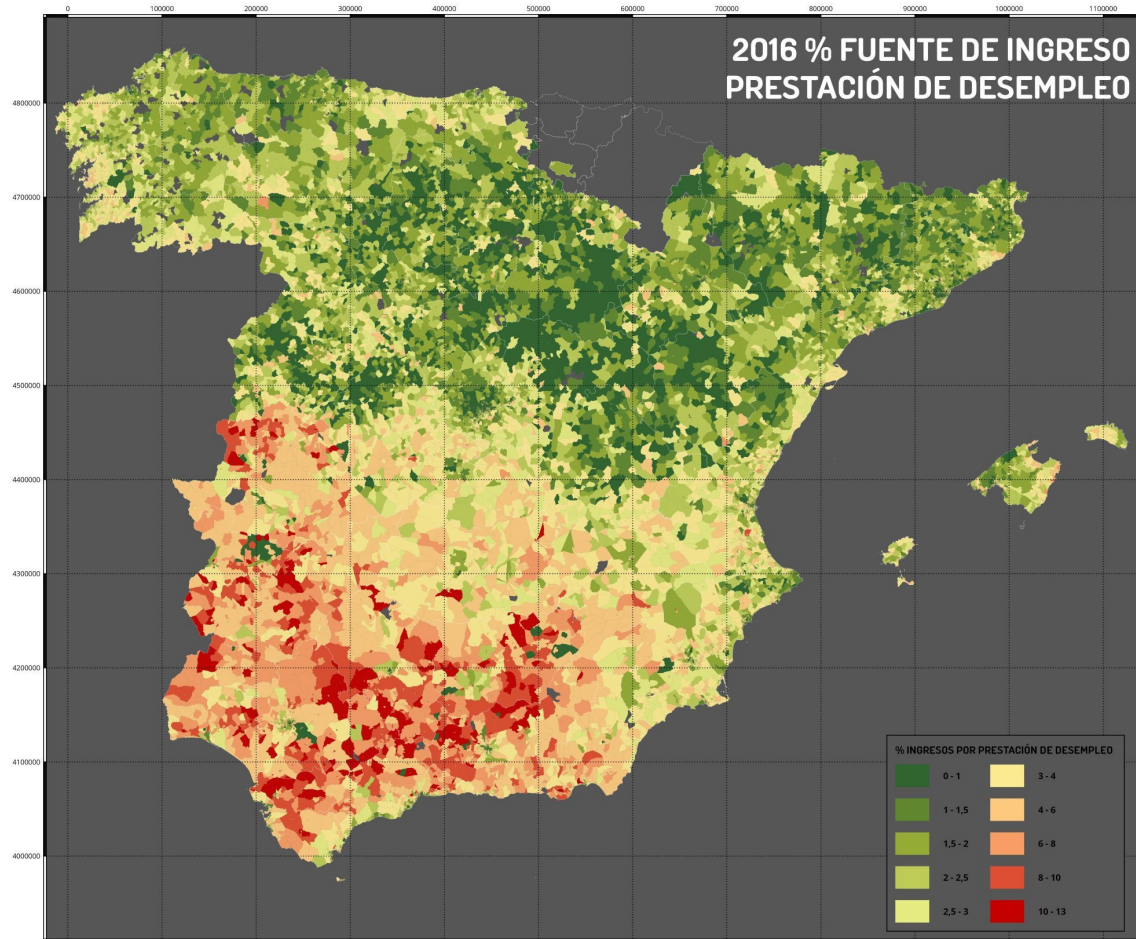


Are the worst schools really in the poorest areas?

LEFT: Child poverty • RIGHT: Schools that 'require improvement' or are 'inadequate' according to Ofsted



Income from unemployment benefits



Android's deadly fragmentation

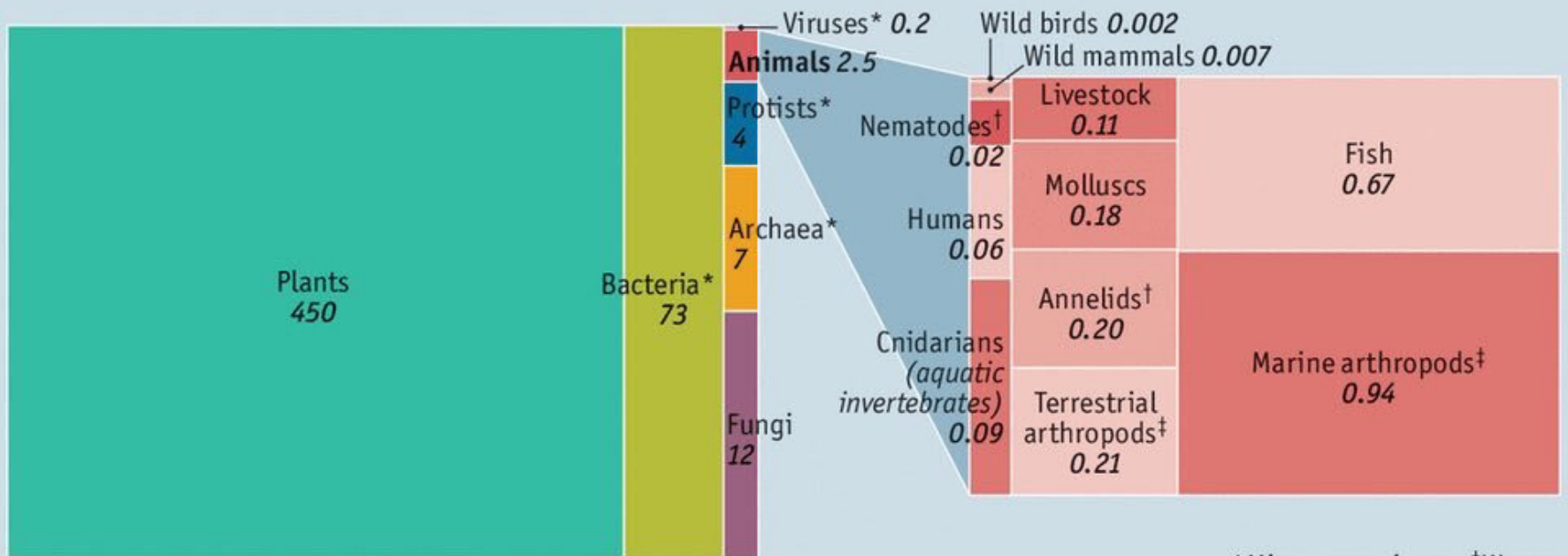


Tree map

The biomass distribution on Earth

Life as we know it

Estimated global biomass of selected taxonomic groups, gigatonnes



Source: "The biomass distribution on Earth" by Bar-On, Phillips & Milo, *PNAS*, 2018

*Micro-organisms †Worms
‡Invertebrates with hard exoskeleton

Severity of regurgitation

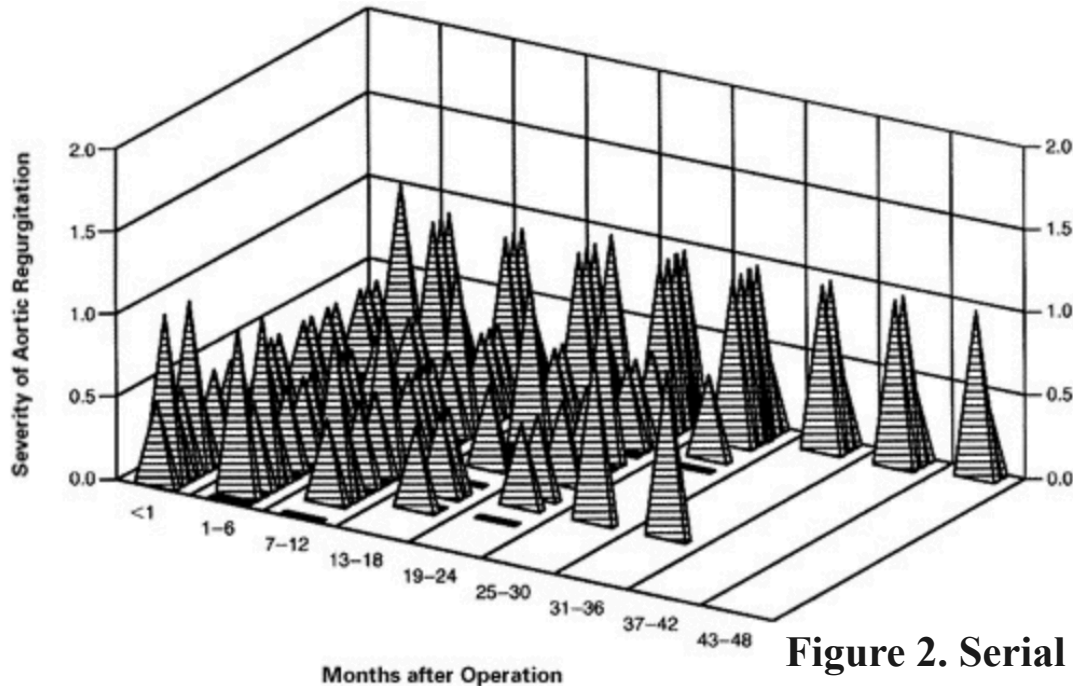
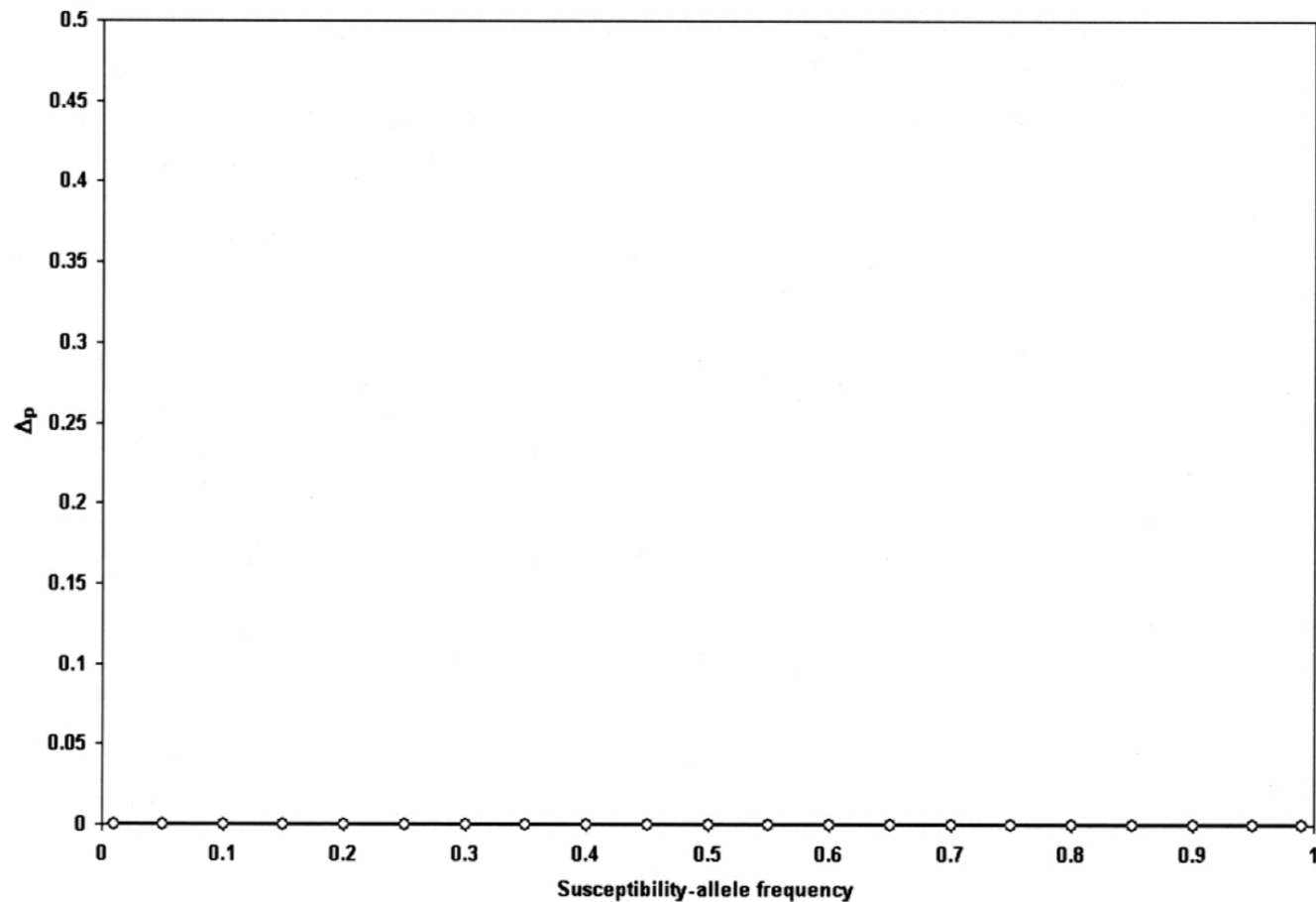


Figure 2. Serial Echocardiographic Assessments of the Severity of Regurgitation in the Pulmonary Autograft in 31 Patients.

The numerical grades were assigned according to the severity of regurgitation, as follows: 0, none; 0.5, trivial; 1.0 to 1.5, mild; 2.0, moderate; and 3.0, severe.

Zero information plot



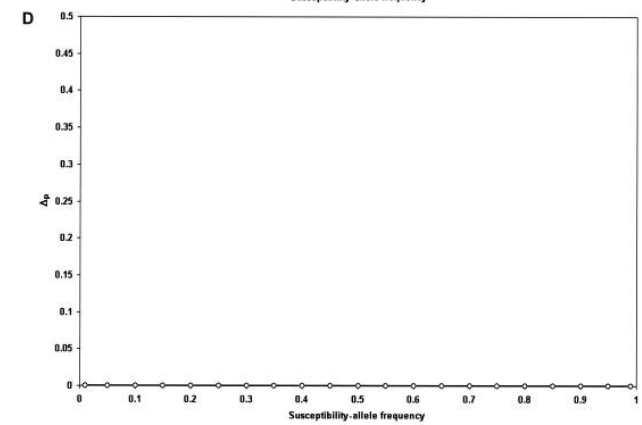
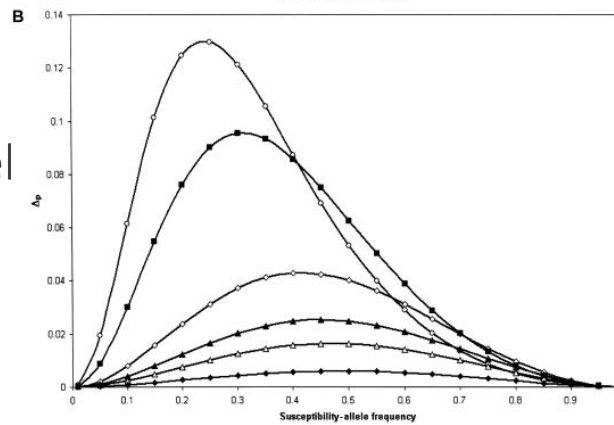
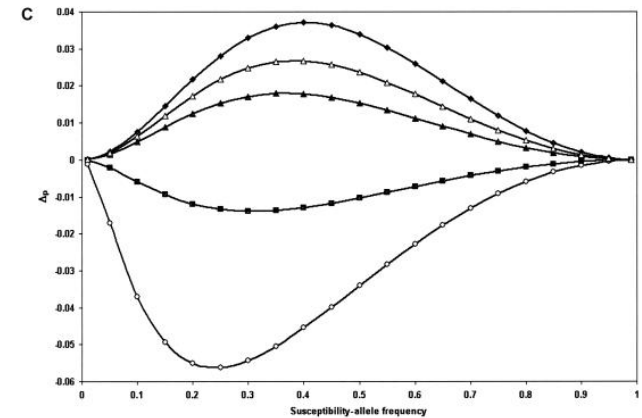
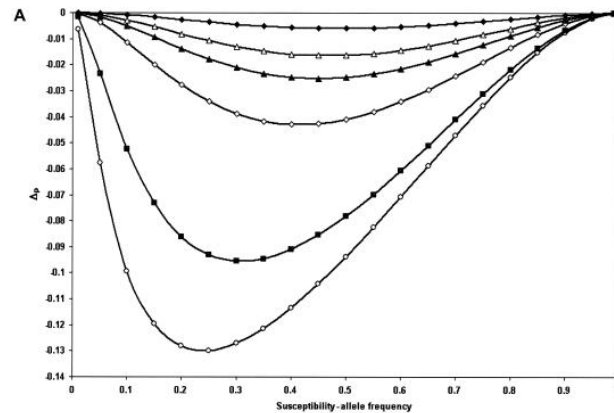
Zero information plot

A = dominate model

B = recessive model

C = additive model

D = multiplicative model



To achieve accessibility

General guidelines

- Keep in mind
 - The audience
 - The presentation format
 - The specifics of the data
 - **The message**
- Strive for clarity, minimize clutter
- Take into account human visual processing abilities
 - Careful choice of colors
 - Use annotation
- Use uncommon charts only if they are “worth it”

To achieve accessibility

Design process guidelines

- Try different visualizations
- Show your visualizations to a friend—are they able to get to the message?