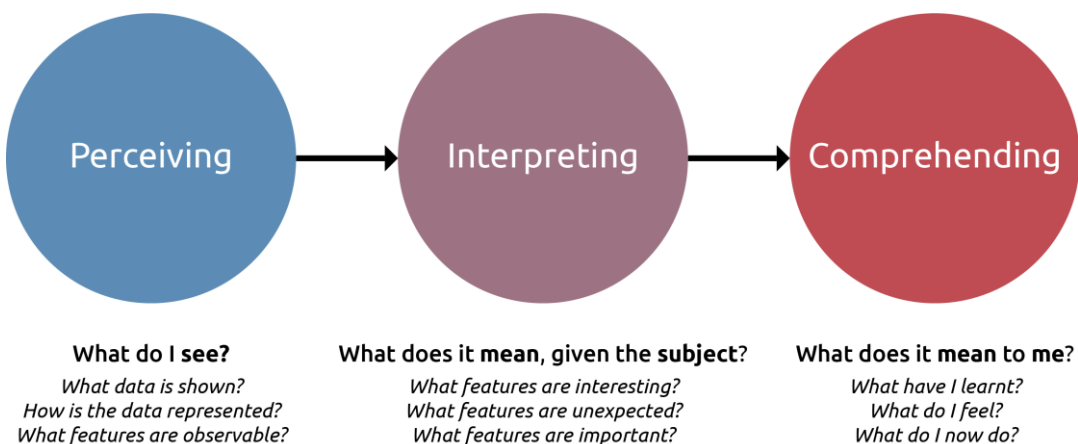


Information Visualization

Part 2

Deepak Kumar

Understanding: Three Phases

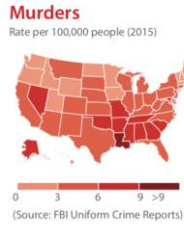


VISUALISER CONTROL

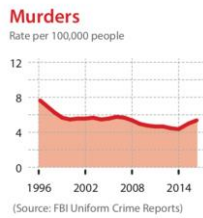
VIEWER CONTROL

Anatomy of a Chart

Complete chart



Complete chart



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3

Anatomy of a Chart

• Scaffolding

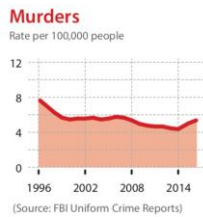
Complete chart



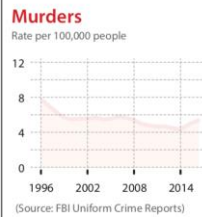
Scaffolding



Complete chart



Scaffolding



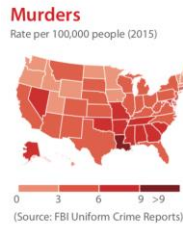
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4

Anatomy of a Chart

- Scaffolding
- Content

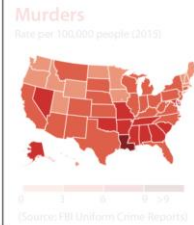
Complete chart



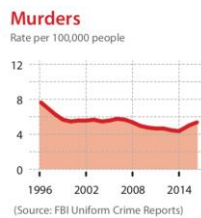
Scaffolding



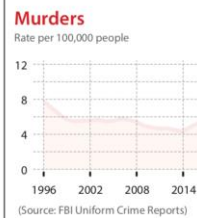
Content



Complete chart



Scaffolding



Content



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5

Visual Encoding

- **Marks**
Visual placeholders representing data *items* (point, line, shape)
- **Attributes**
Variations in visual appearance of marks to represent values associated with each item (position, size, angle, color, etc.)



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How to read a chart

1. Read the Title, introduction (or caption), and source.
2. Look at the measurements, units, scales, legends.
3. Identify the methods of visual encoding: Color, position, shape, size, etc.
4. Read annotations.
5. Take a bird's-eye-view to spot patterns, trends, and relationships.

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A chart is a *visual argument*.

-: Alberto Cairo

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Chart Types (CHRTS)

- **Categorical**
Comparing categories and distributions of quantitative values
- **Hierarchical**
Revealing part-whole relationships and hierarchies
- **Relational**
Exploring correlations and connections
- **Temporal**
Plotting trends and intervals over time
- **Spatial**
Mapping spatial patterns through overlays and distortions

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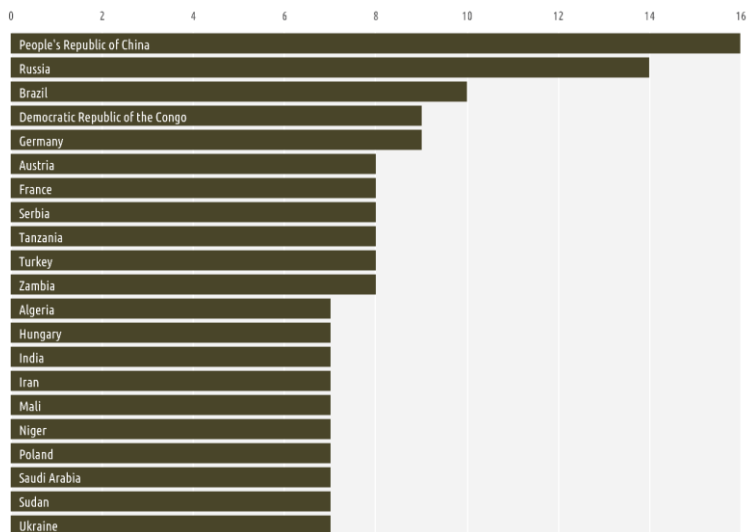
COMPARISONS

Bar Chart

Comparing the number of unique land neighbors for countries with at least seven.

By Andy Kirk

THE COUNTRIES WITH THE MOST LAND NEIGHBOURS



Source: https://en.wikipedia.org/wiki/List_of_countries_and_territories_by_land_borders (as at December 2018).
Notes: Minimum 7 neighbouring countries. France's figure does not include French overseas departments, collectivities, and territories.

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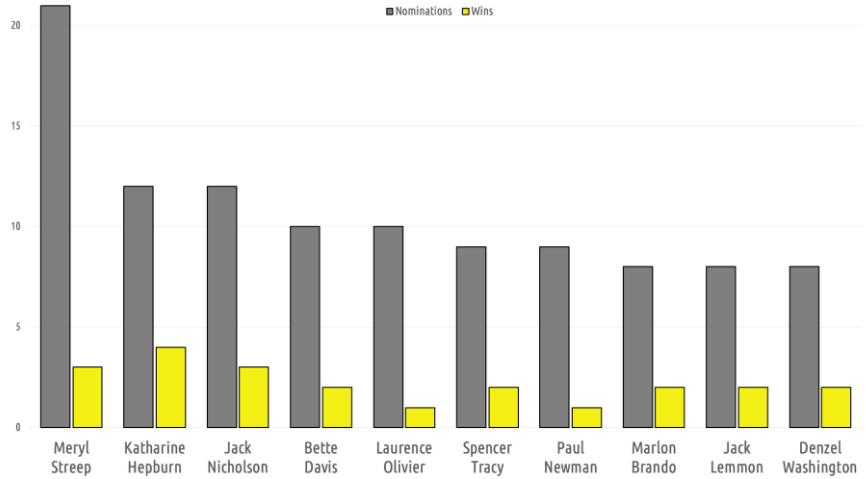
COMPARISONS

Clustered Bar Chart

The 10 actors who have received the most Oscar nominations for acting

Comparing the number of Oscar nominations with the number of Oscar awards won for the ten actors who have received the most nominations for acting.

By Andy Kirk



Source: www.filmsite.org (as at December 2018)
 Notes: Al Pacino and Geraldine Page each have 8 nominations, 1 win. Peter O'Toole has 8 nominations but no win.

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COMPARISONS

Radar Chart aka Spider Chart

United Kingdom

8th /137

Global Competitiveness Index 2017-2018 edition

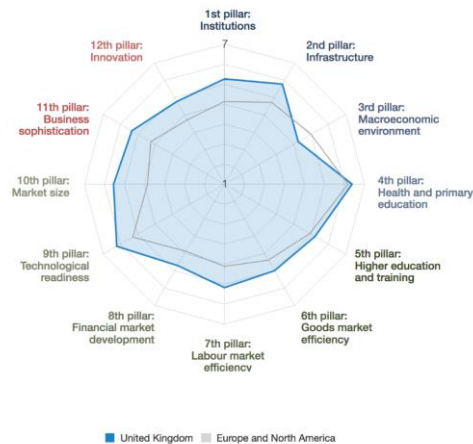
Key indicators, 2016

Source: International Monetary Fund; World Economic Outlook Database (April 2017)

Population millions	66.1	GDP per capita US\$	39,734.6
GDP US\$ billions	2,624.5	GDP (PPP) % world GDP	2.29

Comparing the global competitiveness scores across 12 "pillars" of performance for the UK versus Europe and North America.

Global Competitiveness Report 2017-18
 By the World Economic Forum



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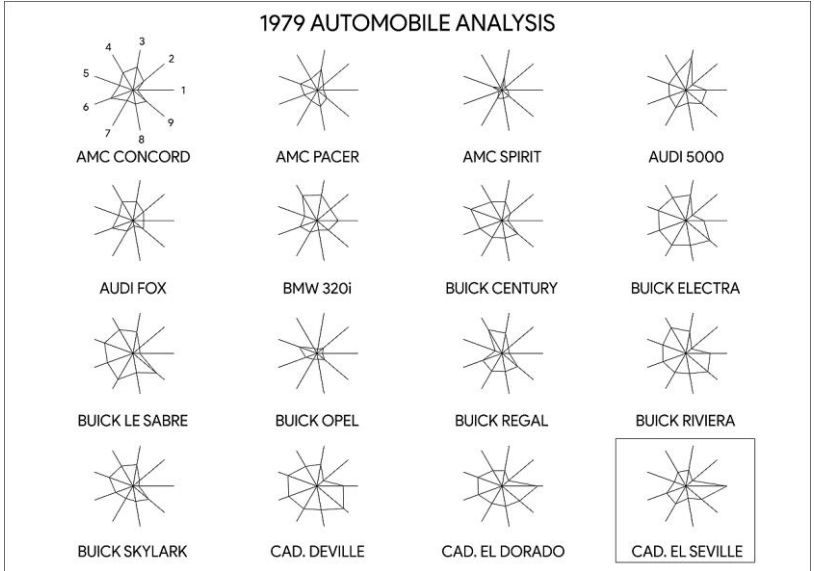
12

COMPARISONS

Radar Chart aka Spider Chart

1. Price
2. Mileage (MPG)
3. 1978 Repair Record
4. 1977 Repair Record
5. Headroom
6. Rear Seat Room
7. Trunk Space
8. Weight
9. Length

From:
https://en.wikipedia.org/wiki/Radar_chart



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COMPARISONS

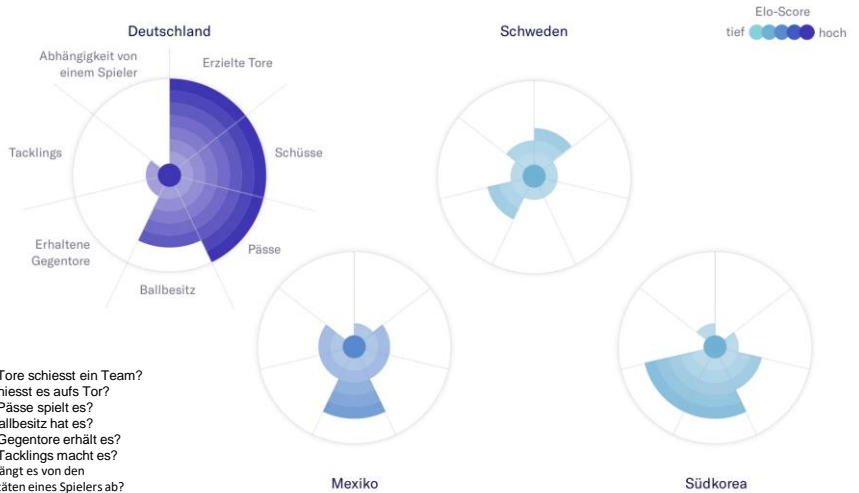
Polar Chart

Gruppe F: Breit abgestützte Offensiven

Comparing the capabilities of the four teams competing in Group F of the 2018 World Cup across seven attributes.

How Do National Teams Play?
By NZZ Visuals

- Wie viele Tore schießt ein Team?
- Wie oft schießt es aufs Tor?
- Wie viele Pässe spielt es?
- Wie viel Ballbesitz hat es?
- Wie viele Gegentore erhält es?
- Wie viele Tacklings macht es?
- Wie sehr hängt es von den Skorerqualitäten eines Spielers ab?



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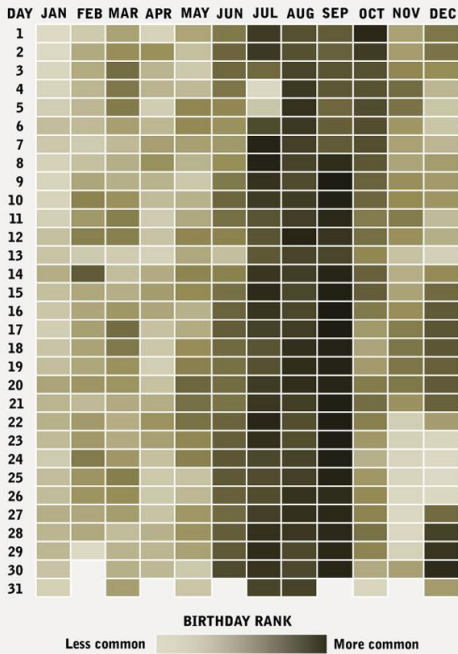
COMPARISONS

Heat Map

US Births by day from 1994-2014

How Common is Your Birthday?
By Matt Stiles

Which Birth Dates Are Most Common?



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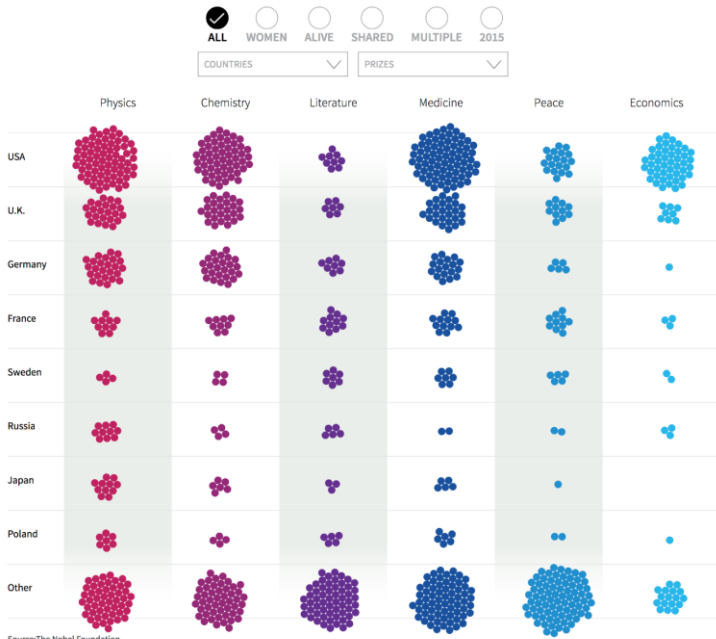
COMPARISONS

Matrix Chart

Comparing the number of Nobel Laureates by award category and country of birth.

Nobel Laureates,
by Matthew Weber
(Reuters Graphics)

NOBEL LAUREATES



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Source: The Nobel Foundation
By Matthew Weber | REUTERS GRAPHICS

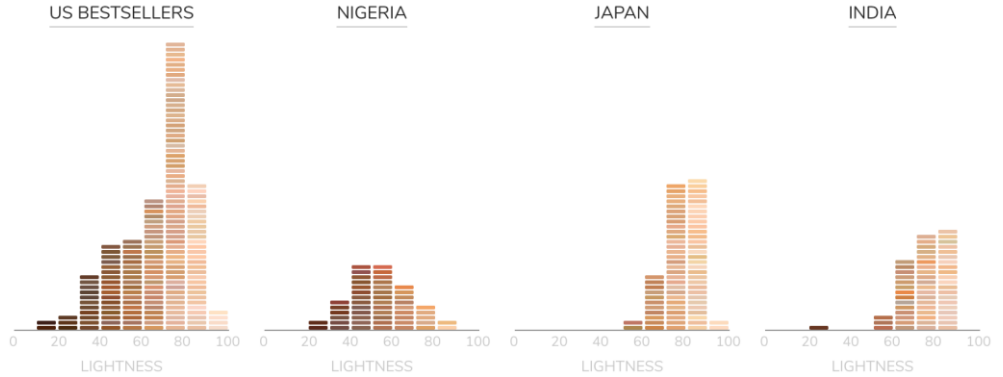
18

DISTRIBUTIONS

Histogram

Comparing the distribution of lightness range among Common foundation Products sold in four Regions.

Foundation Lightness Around the World



Beauty Brawl: How Inclusive are Beauty Brands Across the world?
By Amber Thomas, Jason Li, Divya Manian for 'The Pudding'.

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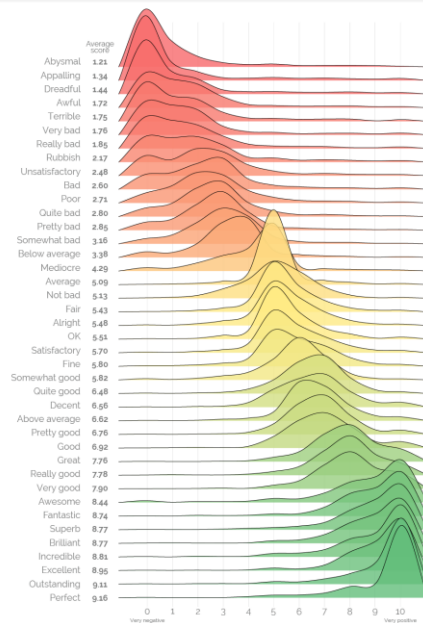
DISTRIBUTIONS

Density Plot

Comparing the distribution of scores allocated to a selection of words or phrases indicating the perceived level of positivity or negativity.

How Good is 'Good'?
by Matthew Smith

How good is "good"? Now with even more words!
On a scale of 0 to 10, where 0 is 'very negative' and 10 is 'very positive', in general, how positive or negative would the following word/phrase be to someone when you used it to describe something?



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YouTube | @jessgins.com

October 3-8, 2018

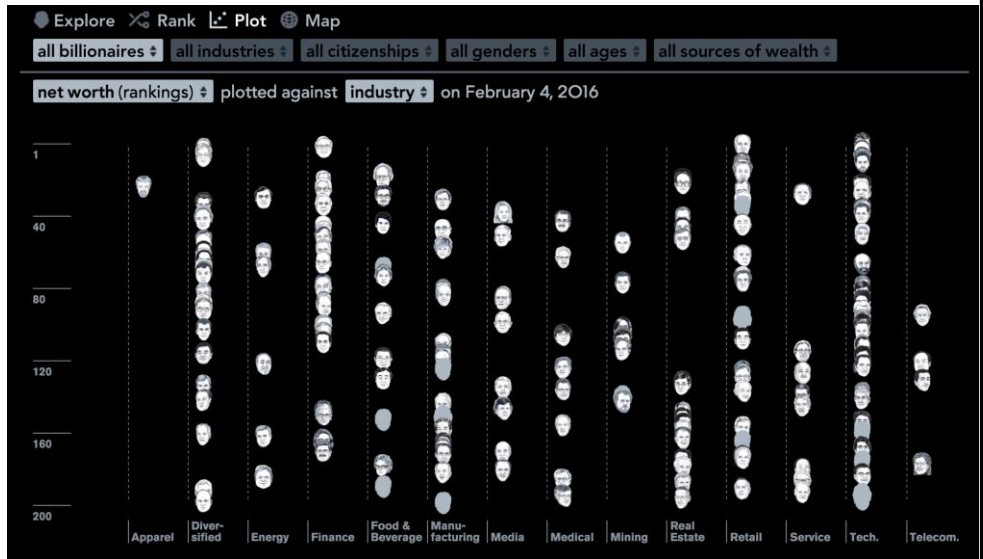
20

DISTRIBUTIONS

Dot Plot

Comparing the ranking distribution of the top 200 billionaires by industry.

Bloomberg Billionaires By Bloomberg Visual Data – Lina Chen and Anita Rundles.



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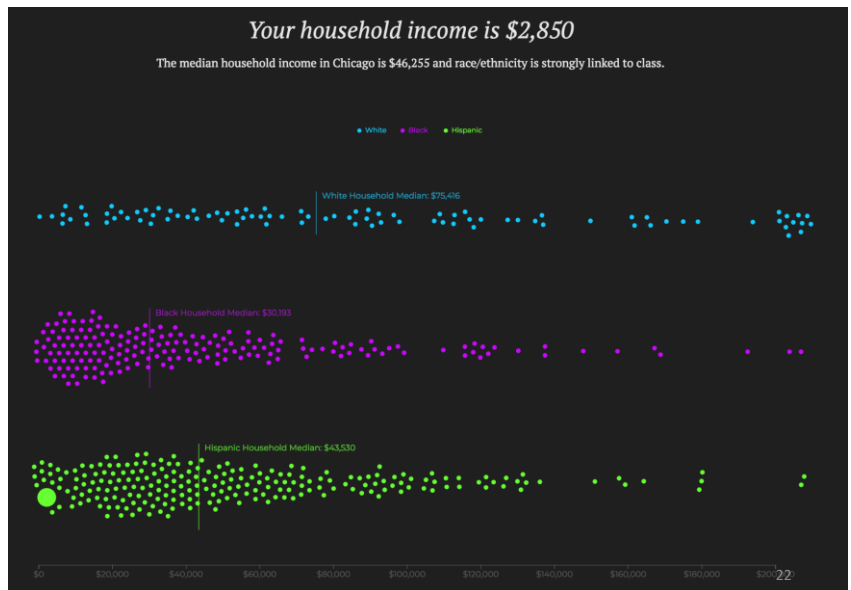
21

DISTRIBUTIONS

Beeswarm Plot

Comparing the distribution of household incomes for a simulated population of Chicago residents broken down by ethnic group.

Is Your Child Ready for School? by Gabrielle Lamar LeMee



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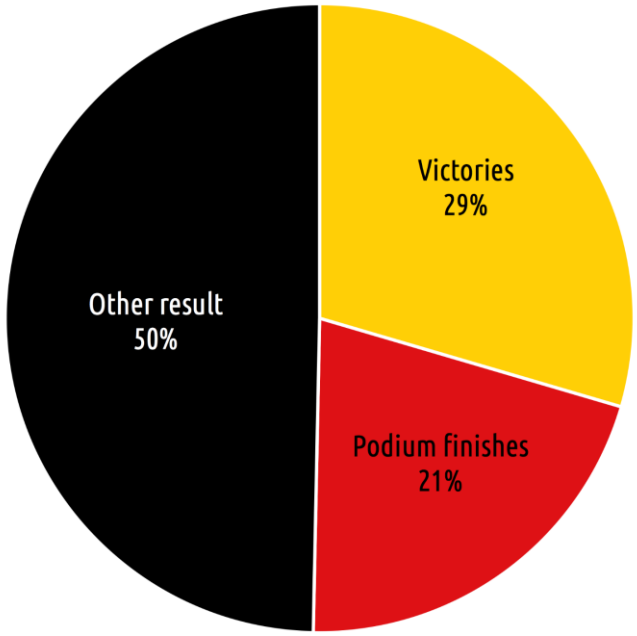
PART-TO-WHOLE

Breakdown of Michael Schumacher's F1 Career Over 308 Races

Pie Chart

Comparing the proportion of Michael Schumacher's F1 races by result group.

By Andy Kirk



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PART-TO-WHOLE

3-D Pie Chart – NO!!!



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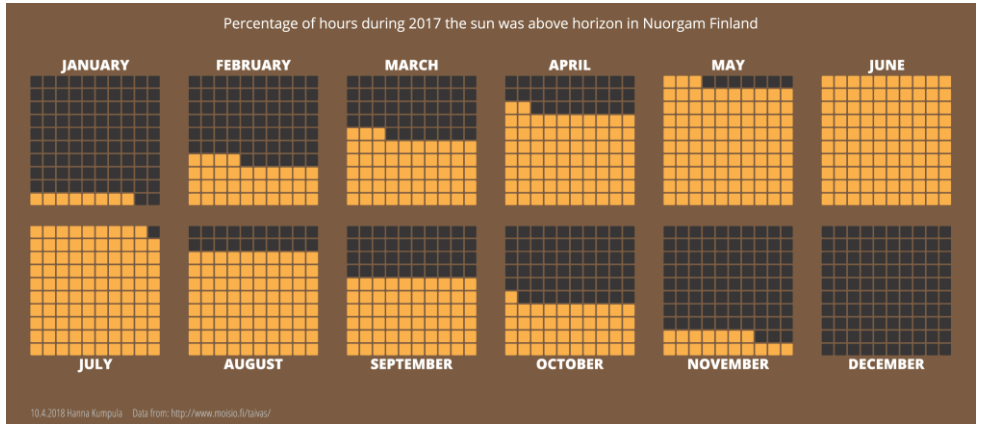
24

PART-TO-WHOLE

Waffle Chart

Comparing the percentage of hours of sun by month during 2017 in Nuorgam, Finland.

By Hanna Kumpula



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PART-TO-WHOLE

Stacked Bar Chart

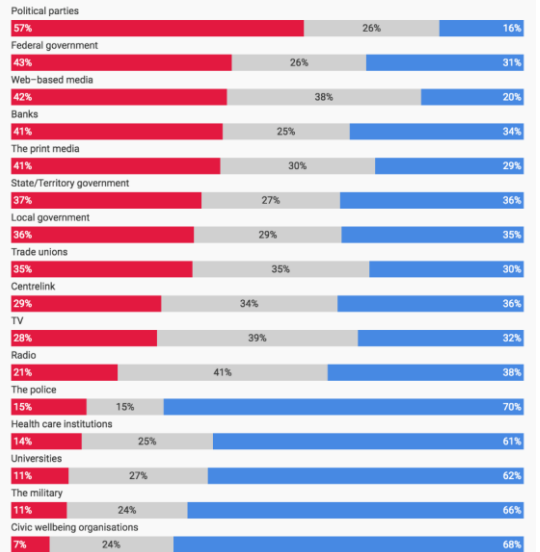
Comparing the degree of trust held by Australians for different Institutions.

In a Nation of Cynics,
We're Flocking to the Fringe
by ABC

Only 16 per cent of Australians trust political parties, compared to 30 per cent for trade unions and 70 per cent for police.

How much do you trust ...?

■ Distrust ■ Neither ■ Trust



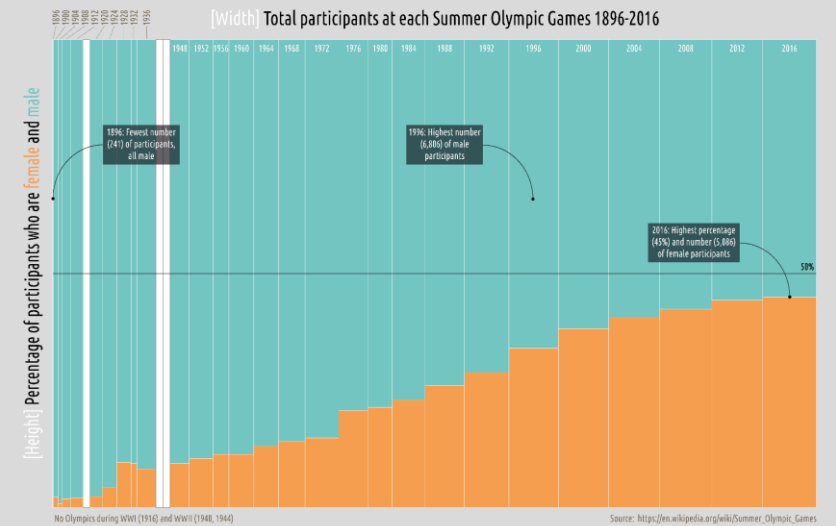
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PART-TO-WHOLE

Marimekko Chart

THE GROWTH IN PARTICIPANTS AND FEMALE PARTICIPATION AT THE SUMMER OLYMPICS



Comparing the proportion and number of competitors by gender across all Summer Olympic Games.

By Andy Kirk.

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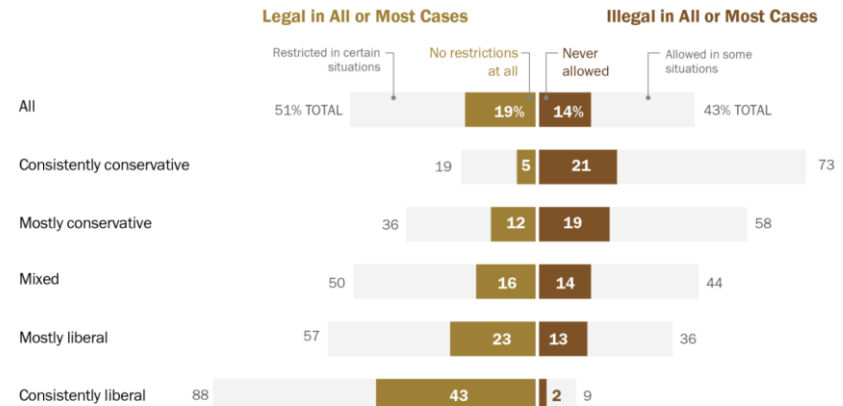
27

PART-TO-WHOLE

Diverging Bar Chart

Liberals Most Likely to Favor No Restrictions on Abortion

Abortion should be ...



Comparing the responses to a survey question asking for opinions about the legality of abortion across different demographic categories.

By Pew Research Center

11/20/2019

Source: 2014 Political Polarization in the American Public
 Notes: "Don't know" responses not shown. Ideological consistency based on a scale of 10 political values questions (see Appendix A)
 PEW RESEARCH CENTER

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HIERARCHIES

Tree Map

Comparing the relative value and daily changes of market capital for stocks across the S&P 500 index grouped by sectors and industries.

Standard & Poors 500 Index Stocks By FinViz.



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HIERARCHIES

Sunburst Chart

Showing a breakdown of the types of companies responsible for extracting different volumes of carbon-based fuels through various activities.

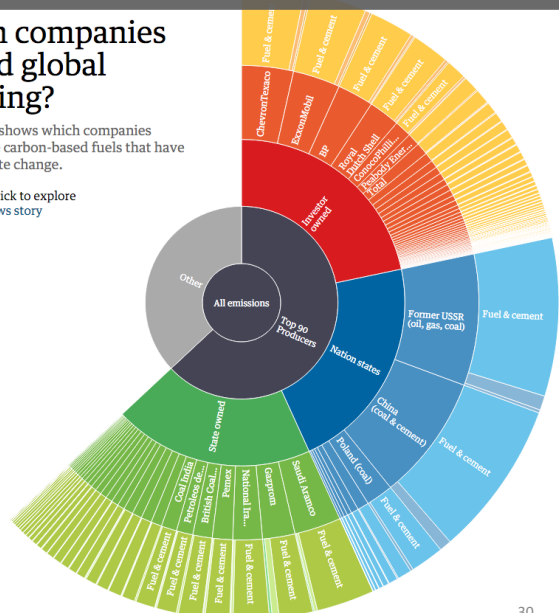
Which fossil fuel companies are most responsible for climate change?
By Duncan Clark & Robin Houston (kiln). In *The Guardian*.

Top 90 Producers
914.26 Gt CO₂e (63.04% of total since 1750)

Which companies caused global warming?

A new paper shows which companies extracted the carbon-based fuels that have caused climate change.

- 👁 Hover and click to explore
- 📖 Read the news story



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HIERARCHIES

Venn Diagram

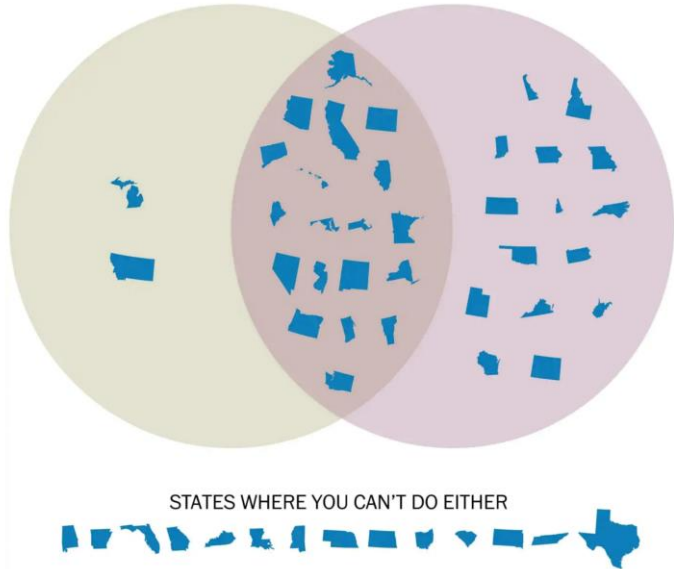
Comparing sets of permutations for legalities around marijuana usage and same-sex marriage across states of the USA as of 2014.

This Venn Diagram Shows Where You Can Both Smoke Weed and Get a Same-sex Marriage.
By Phillip Bump (*Washington Post*).

The Venn diagram of cultural politics

STATES WHERE YOU CAN LEGALLY USE MARIJUANA

STATES WHERE SAME-SEX COUPLES CAN GET MARRIED



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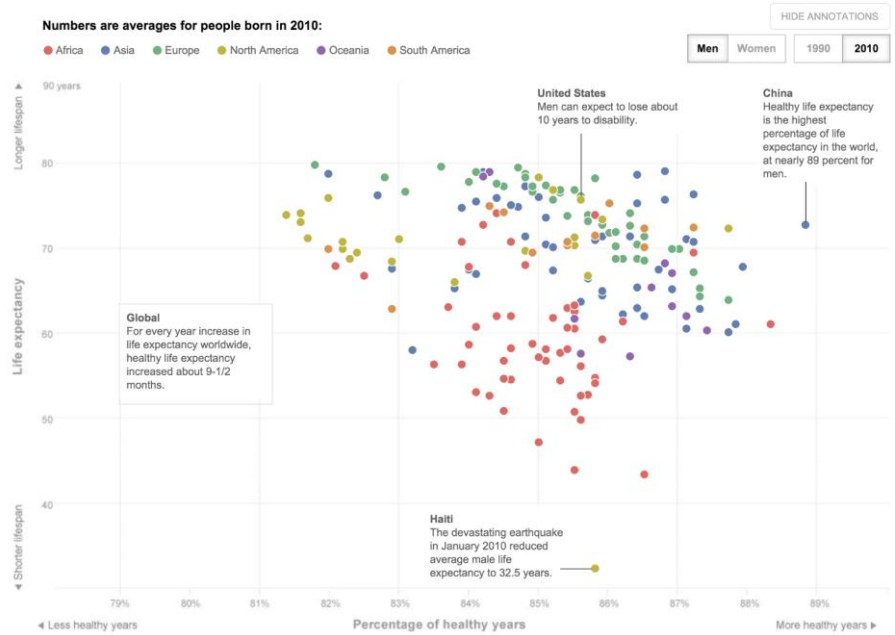
33

CORRELATIONS

Scatter Plot

Exploring the relationship between life expectancy and the percentage of healthy years across all countries.

How Long Will We Live – And How Well?
By Bonnie Berkowitz, Emily Chow, and Todd Lindeman (*Washington Post*).



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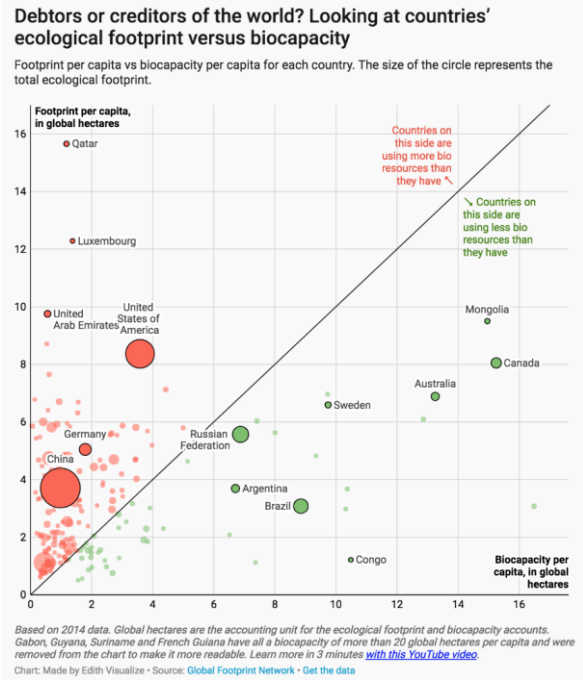
34

CORRELATIONS

Bubble Plot

Exploring the relationship between ecological footprint and biocapacity by country.

Debtors of Creditors of the World? Looking at Countries' Ecological Footprint Versus Biocapacity.
By Lisa Rost and Edith Maulandi.



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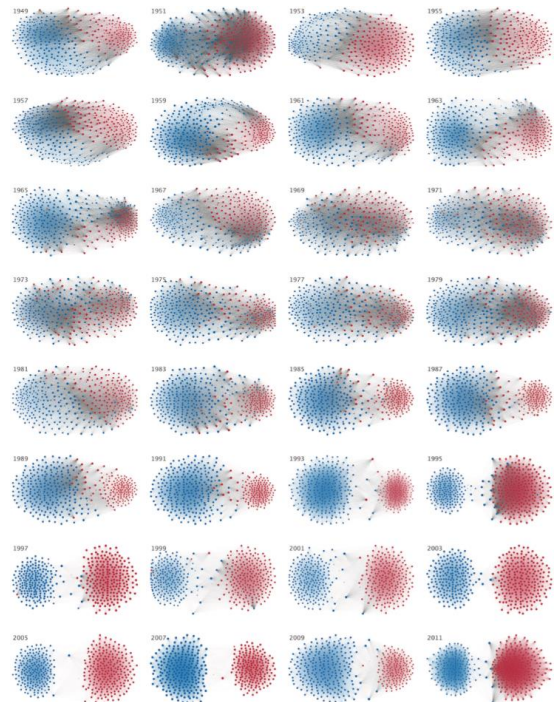
35

CONNECTIONS

Network Diagram

Exploring the connections of voting patterns for Democrats and Republicans across all members of the US House of Representatives from 1949 to 2012.

The Rise of Partisanship and Super-Cooperators in the US House of Representatives.
By Mouro Martino *et al.*



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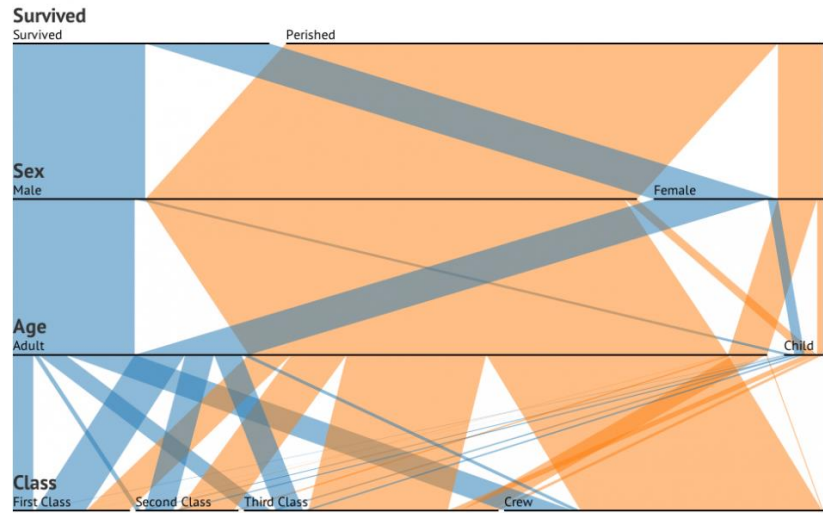
36

CONNECTIONS

Sankey/Uvial Diagram

The Titanic
Survived & Perished

By Jason Davies
(<https://www.jasondavies.com/parallel-sets/>)



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CONNECTIONS

Chord Diagram

aka Radial Sankey Diagram

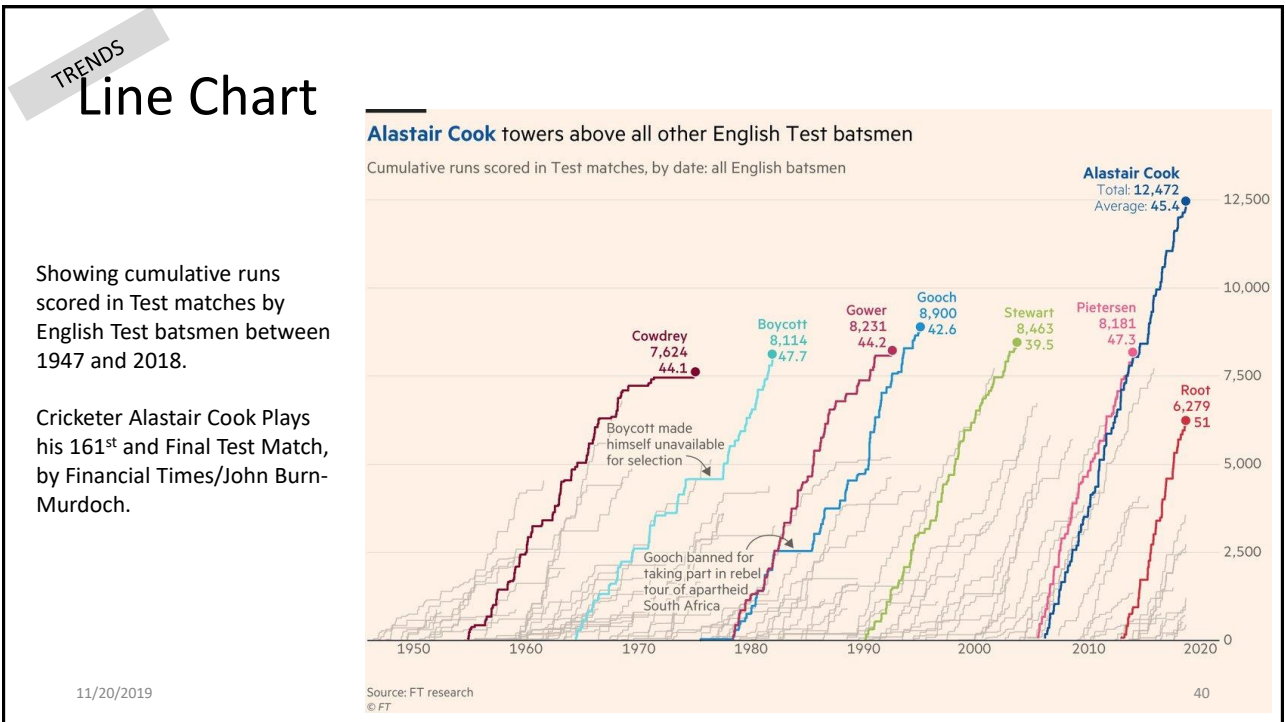
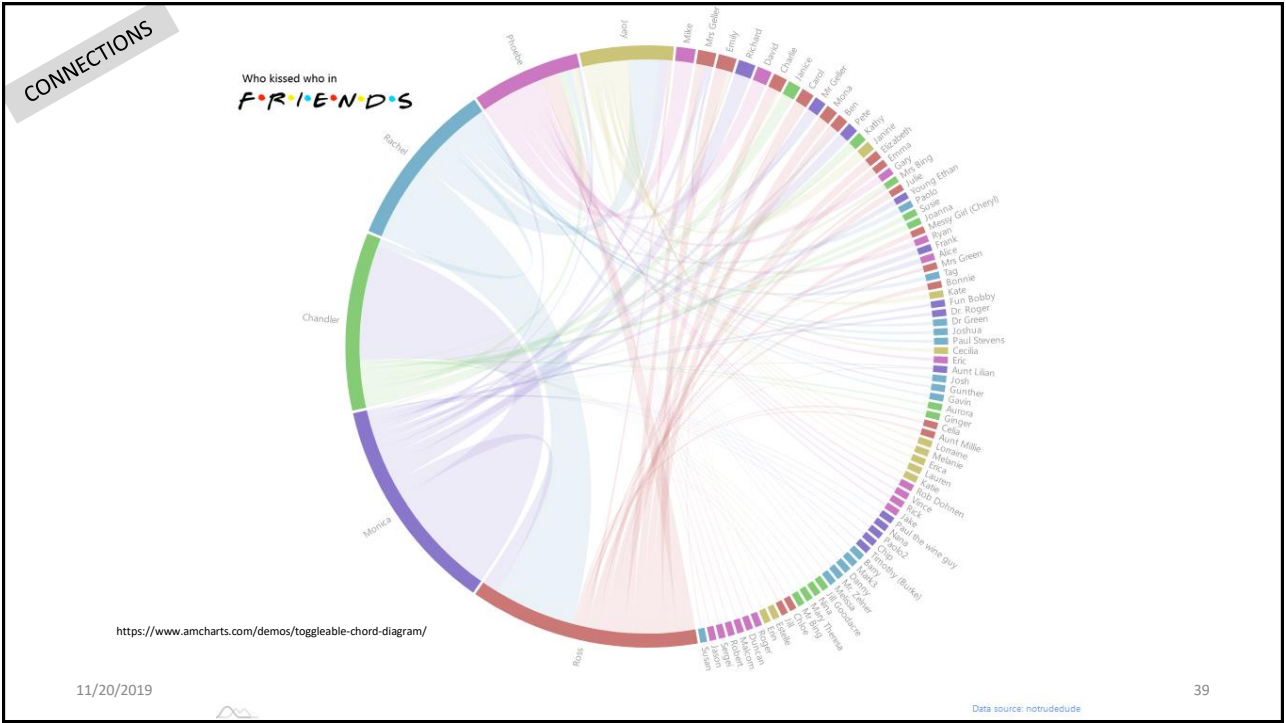
Exploring the connections of migration between and within ten world regions based on estimates across five-year intervals between 1990 and 2010.

The Global Flow of People
By Nicola Sander, Guy J. Abel and Ramon Bauer



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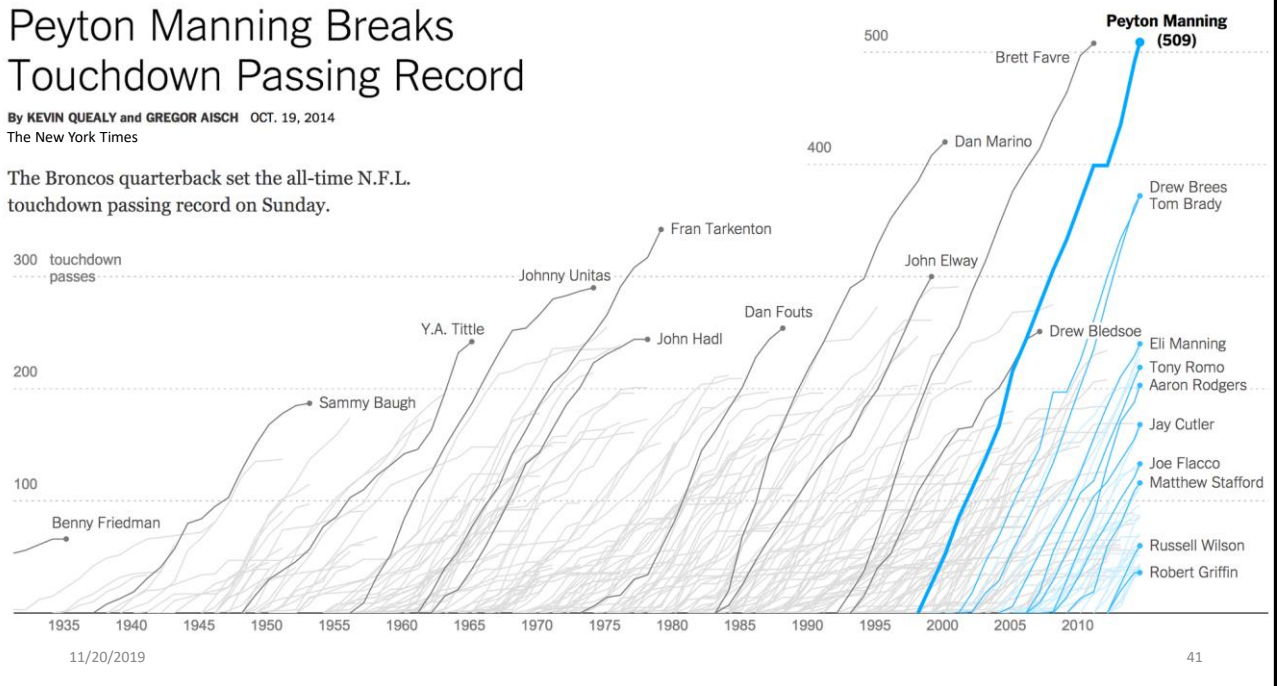
38



Peyton Manning Breaks Touchdown Passing Record

By KEVIN QUEALY and GREGOR AISCH OCT. 19, 2014
The New York Times

The Broncos quarterback set the all-time N.F.L. touchdown passing record on Sunday.



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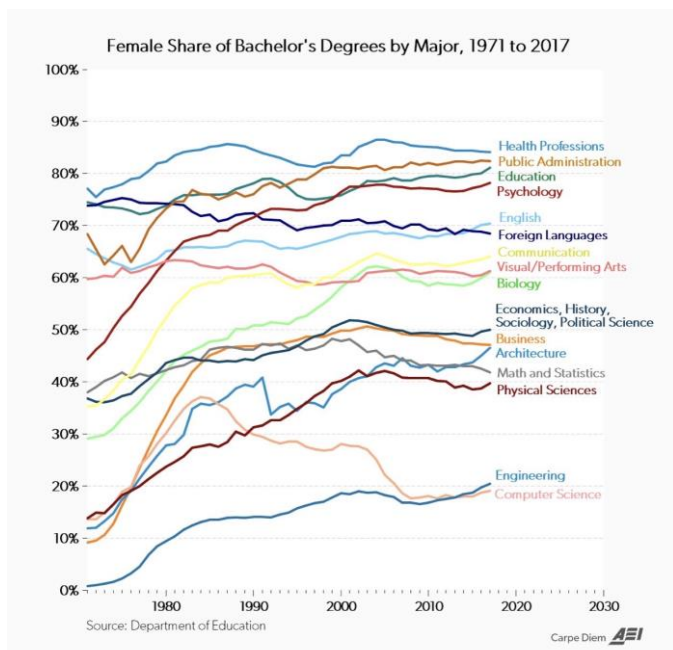
41

Line Chart

Showing percentage of women granted Bachelors degrees in the US by discipline.

By Randall Olson

<http://www.randalolson.com/2014/06/14/percentage-of-bachelors-degrees-conferred-to-women-by-major-1970-2017/>



Source: Department of Education

Carpe Diem A&E

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TRENDS

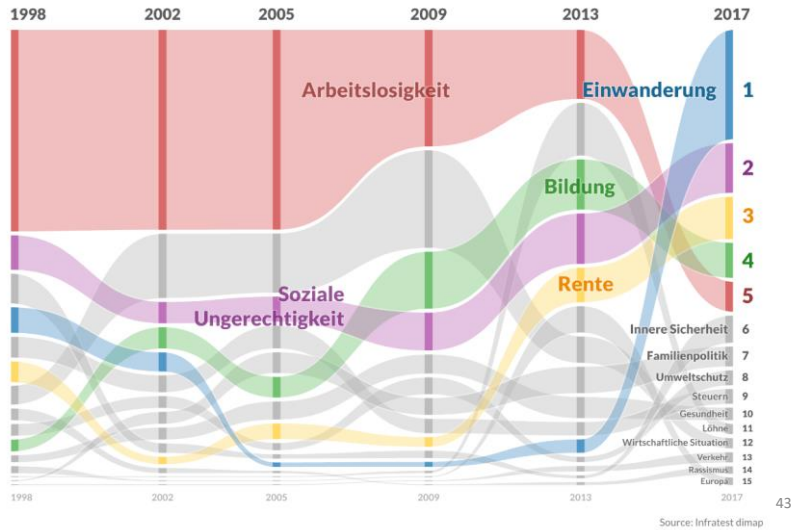
Bump Chart

These are the 15 most important political problems in Germany

The chart shows which topics Germans are the most active in this general election and what significance they had in previous elections.

Showing changes in rank of the most politically important topics for Germans between 1998 and 2017.

By Berliner Morgenpost



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Source: Infratest dimap

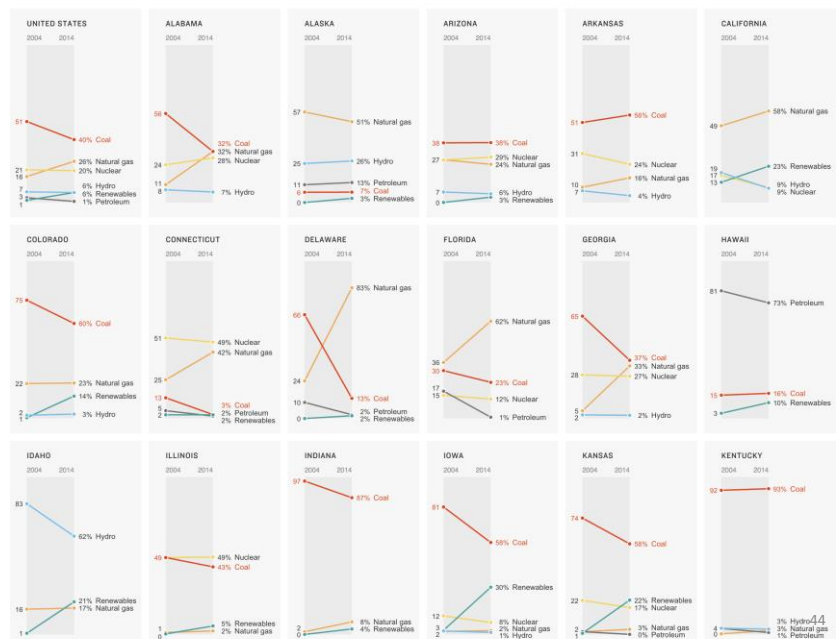
TRENDS

Slope Graph

How Each State Generates Electric Power (2004-2014)

Showing changes in share of power sources across all US states between 2004 and 2014.

Coal, Gas, Nuclear, Hydro? How Your State Generates Power. By Christopher Groskopf, Alyson Hurt and Avie Schneider (NPR)



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TRENDS

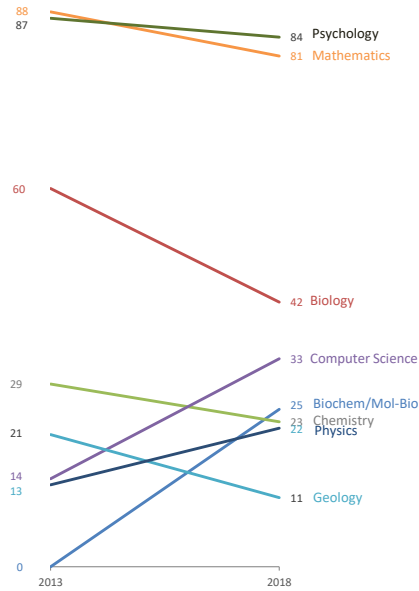
Slope Graph

Comparing the changes in the number of declared majors in STEM disciplines at Bryn Mawr College.

By: Deepak Kumar

Undergraduate Majors 2013 - 2018

Source: 2013-2018 Bryn Mawr Factbook



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TRENDS

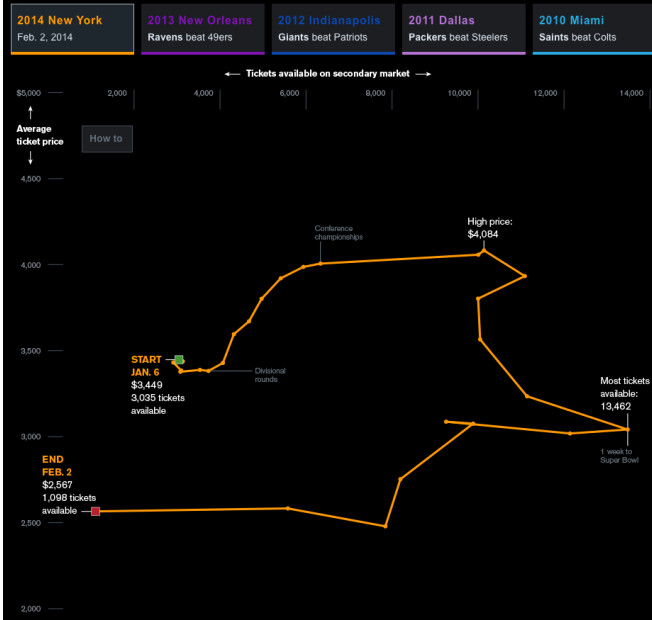
Connected Scatter Plot

Showing changes in daily price and availability of Super Bowl tickets on the secondary market four weeks prior to the event across five Super Bowls.

Holdouts Find Cheapest Super Bowl Tickets Late in the Game
By Alex Tribou, David Ingold and Jeremy Diamond (Bloomberg Visual Data).

Tracking Super Bowl Tickets: Daily Price, Supply on Secondary Market

Daily data starts four weeks prior to Super Bowl and ends on the day of the game.



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Sources: TiqIQ, National Football League, Pro-football-reference.com
GRAPHIC: ALEX TRIBOU, DAVID INGOLD & JEREMY DIAMOND / BLOOMBERG VISUAL DATA

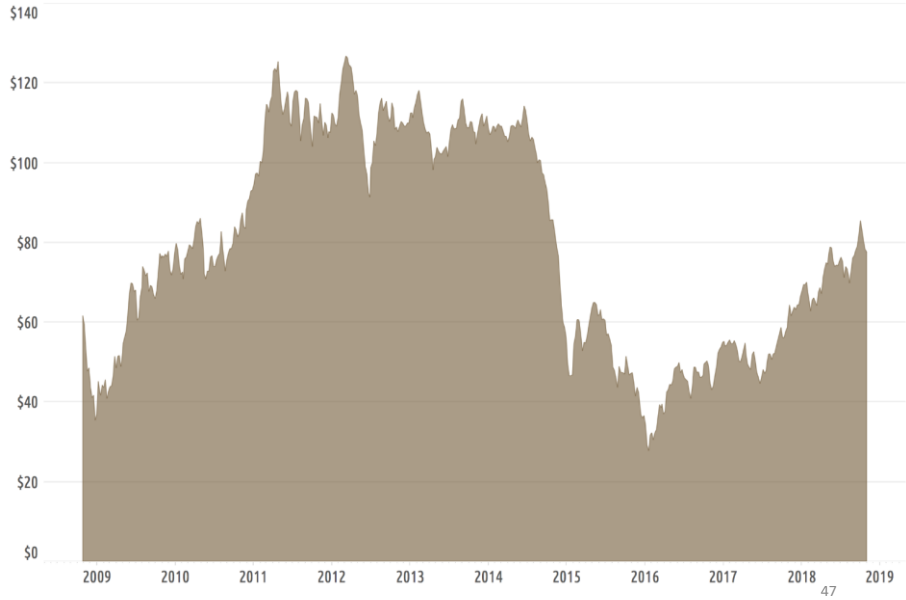
TRENDS

Area Chart

Average Weekly Brent Crude Oil Prices (\$ per barrel), 2008 - 2018

Showing changes in the average weekly price (\$ per barrel) of Brent crude oil between 2008 and 2018.

By Andy Kirk



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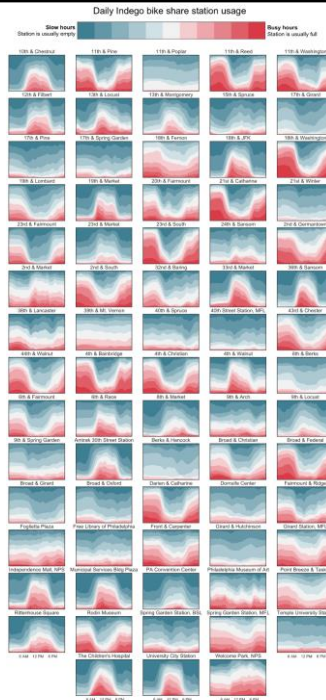
47

TRENDS

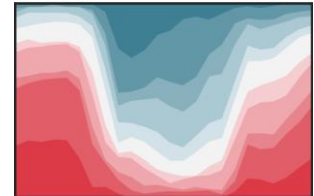
Stacked Area Chart

Showing the average trends of bike share usage across the bike share stations of Philadelphia.

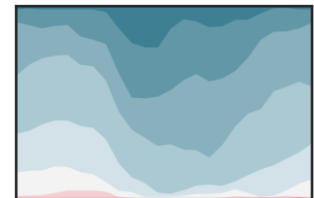
By Randy Olson



21st & Catharine

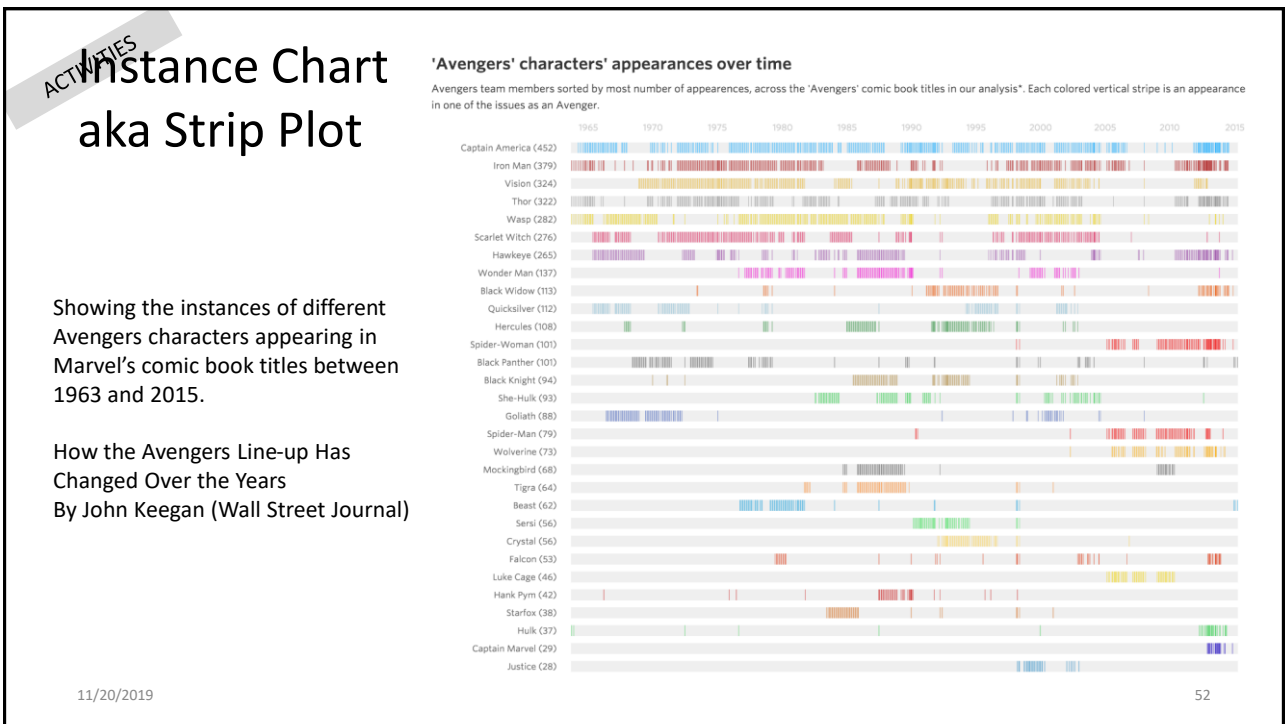
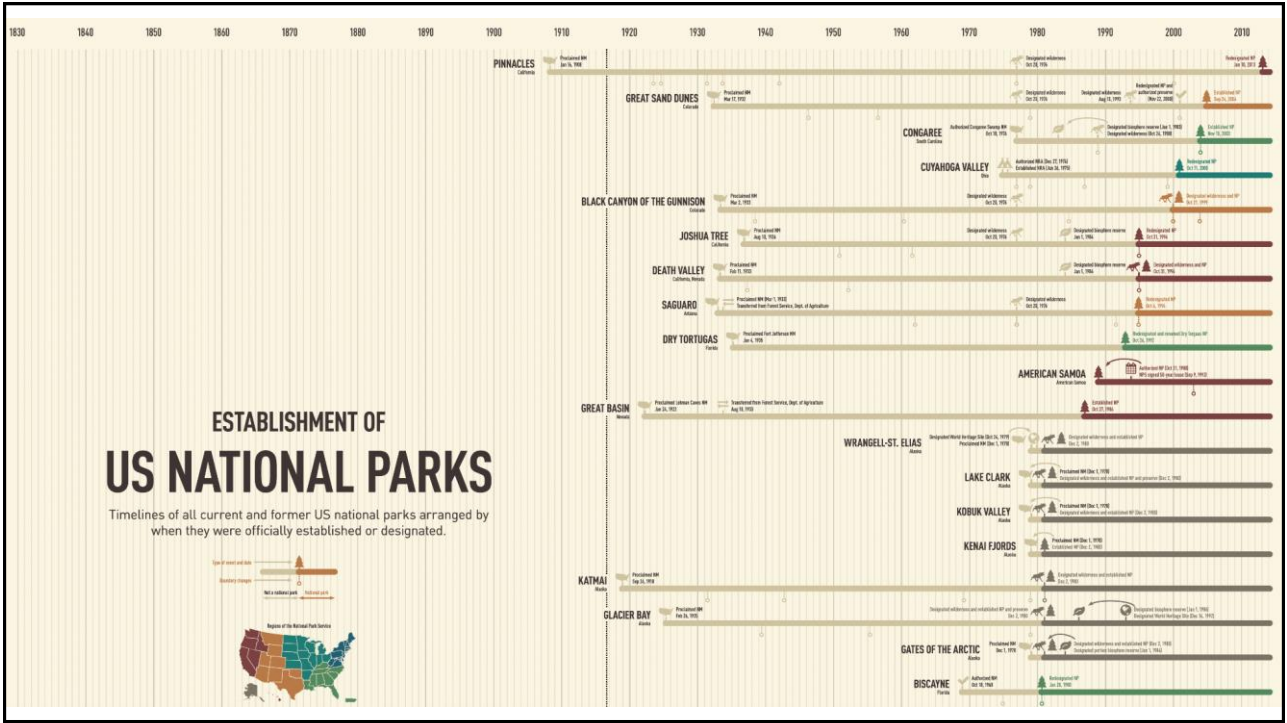


17th & Girard



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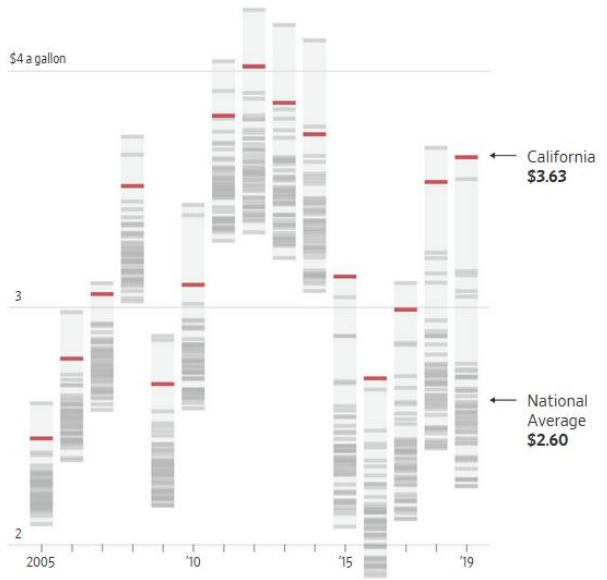
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ACTIVITIES

Another Strip Plot

Average gasoline price, by state with California highlighted



Note: 2019 data are through Oct. 15
 Source: GasBuddy
 James Benedict/THE WALL STREET JOURNAL

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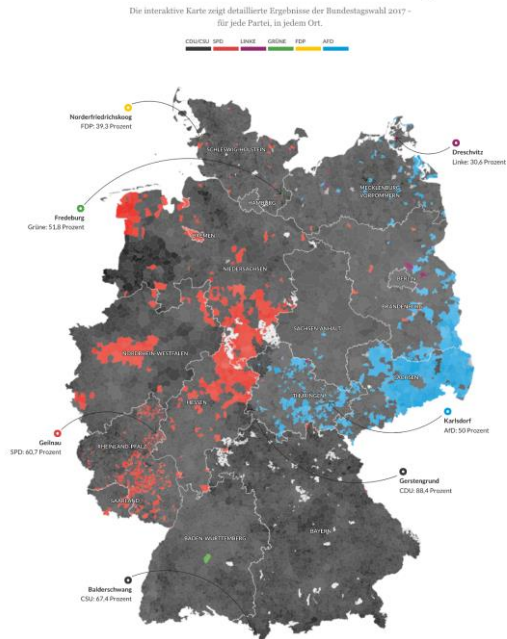
OVERLAYS

Choropleth Map aka Heat Map

Mapping the results of the 2017 German general election showing the winning party for each electoral location.

How Voters in the 11,000 Municipalities Voted
 By Berliner Morgenpost

So haben die Wähler in den 11.000 Gemeinden gestimmt



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OVERLAYS

Isarithmic Map aka Contour Map

How Y'all, Youse and You Guys Talk

By JOSH KATZ and WILSON ANDREWS DEC. 21, 2013
The New York Times

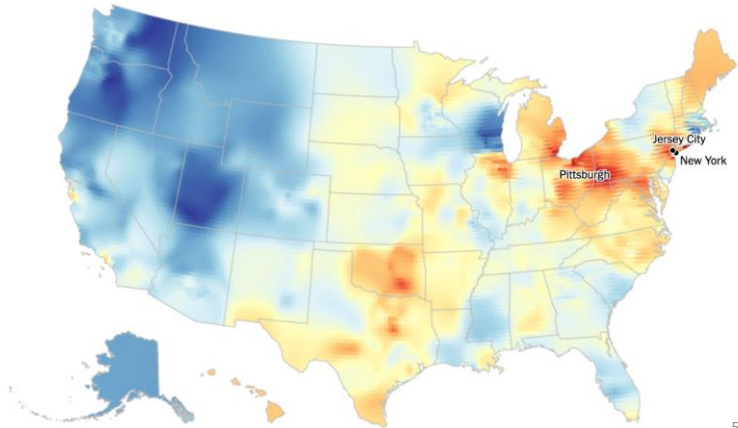
What does the way you speak say about where you're from? Answer all the questions below to see your personal dialect map.

Your Map

See the pattern of your dialect in the map below. Three of the most similar cities are shown.

Least similar Most similar Show least similar SHARE YOUR MAP:   

Mapping the degree of dialect similarity across the USA.



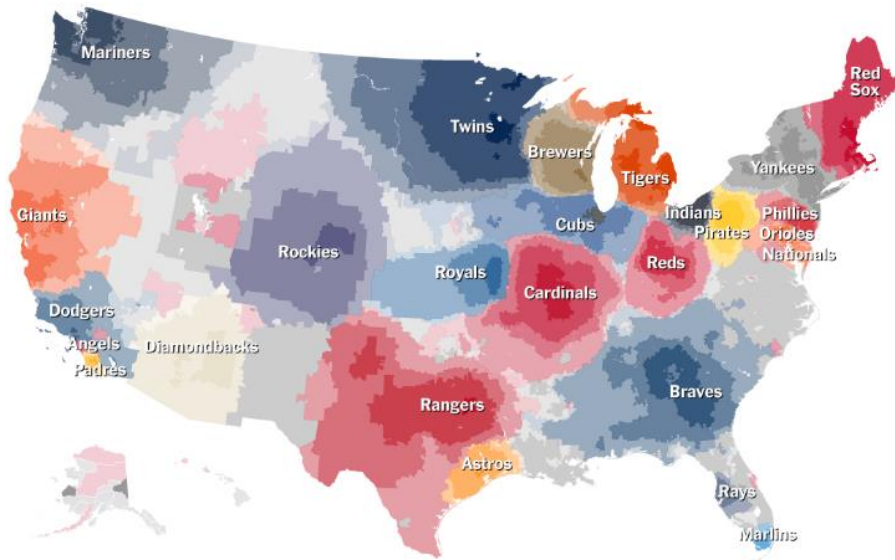
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OVERLAYS

Up Close on Baseball's Borders

By TOM GIRATIKANON, JOSH KATZ, DAVID LEONHARDT and KEVIN QUEALY APRIL 24, 2014



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OVERLAYS

New York Mets vs. New York Yankees

The We'd-Draw-a-Line-If-We-Could Line



There's no other way to put it: The Yankees are the preferred team everywhere in New York City, and nearly everywhere in the U.S. over the Mets (in more than 98 percent of ZIP codes nationwide). One small Mets bright spot, if you want to call it that, is that in the area in Queens surrounding Citi Field, where the Mets play, Facebook users had the courtesy to prefer what some call the Evil Empire at a slightly reduced rate relative to its advantage elsewhere in New York.

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OVERLAYS

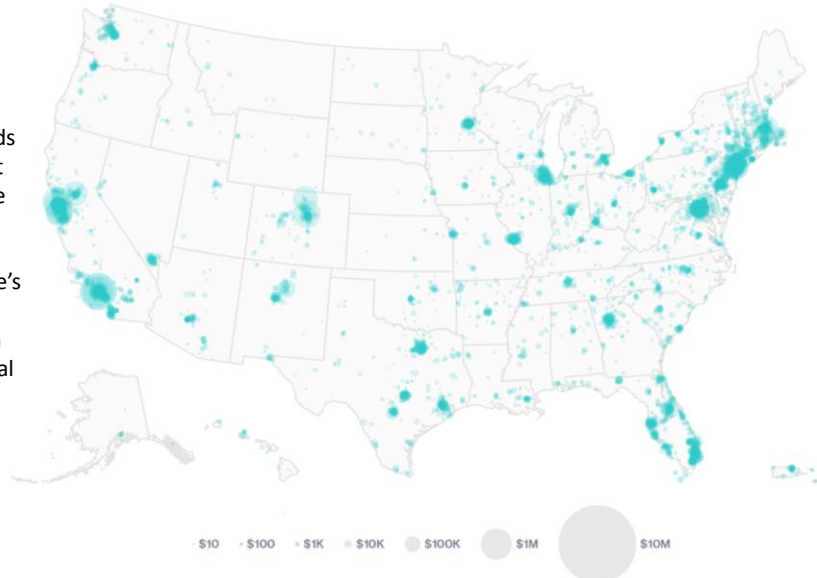
Proportional Symbol Map

Hillary Clinton

Hillary Clinton's contributors skew more toward the coasts than the leading Republicans', and didn't write any checks larger than about \$1 million.

Mapping the origin and size of funds raised across the USA for Democrat candidate Hillary Clinton during the first half of 2015.

Here's Exactly Where the Candidate's Cash Came From
By Zach Miller, Christopher Cannon and Adam Pearce (Bloomberg Visual Data)



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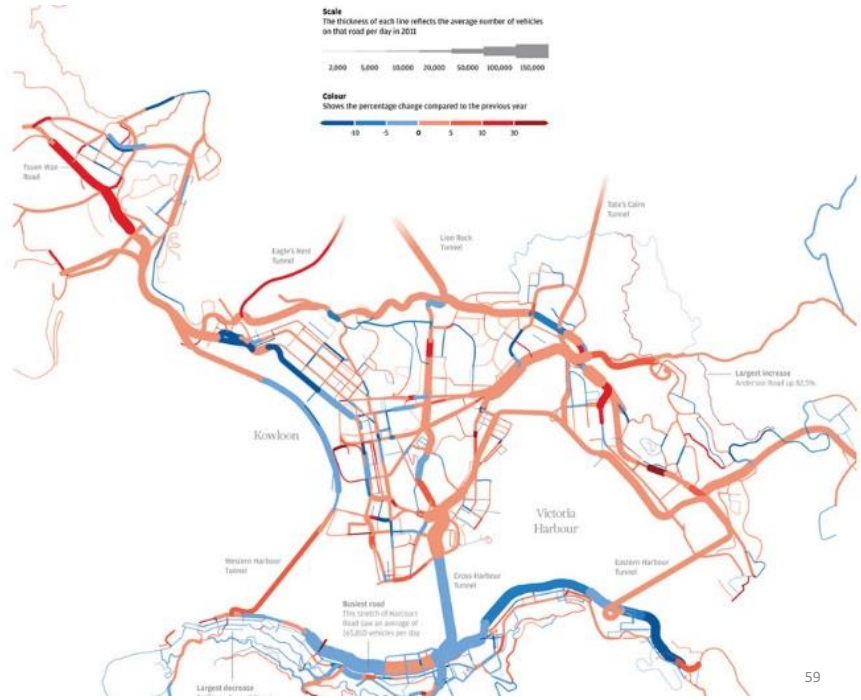
58

OVERLAYS

Flow Map

Mapping average number of vehicles using Hong Kong's main network of roads during 2011.

Arteries of the City
By Simon Scarr (South China Morning Post)



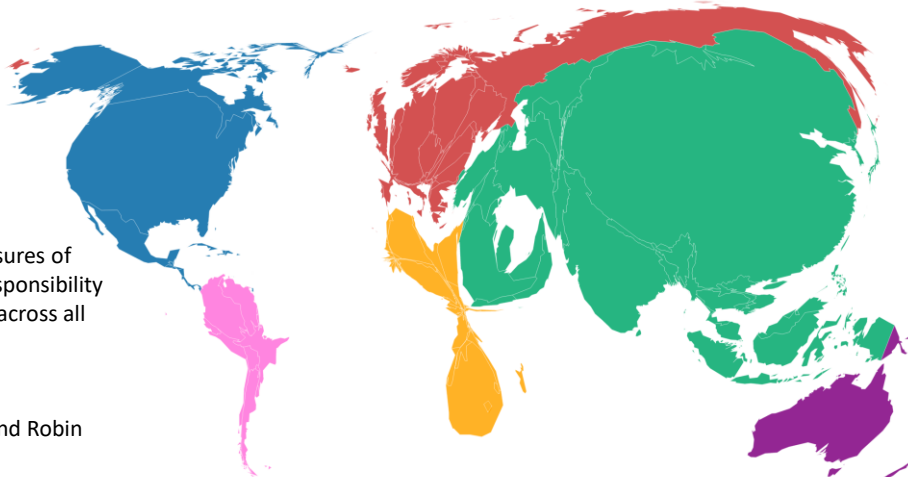
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DISTORTIONS

Area Cartogram

BACKGROUND: Area Population Wealth
RESPONSIBILITY: Extraction Emissions Consumption Historical Reserves
VULNERABILITY: People at risk Sea level Poverty



Mapping the measures of climate change responsibility with vulnerability across all countries.

The Carbon Map
By Duncan Clark and Robin Houston (Kiln)

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Shade by

Continents

- Europe
- Africa
- Asia
- North America
- South America
- Oceania

This map

Country sizes show the eventual CO₂ emissions from oil, coal and gas extracted (2013) each year. Many of these fuels are exported rather than used domestically, but arguably the countries extracting and selling fossil fuels bear a degree of responsibility for the resulting emissions.

ABOUT THIS TOOL DATA SOURCES

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CHRTS

- **Categorical**
 - **Comparisons:** Bar Chart, Stacked Bar Chart, Radar Chart, Polar Chart, Proportional Symbol Chart, Word Cloud, Heat Map, Matrix Chart
 - **Distributions:** Histogram, Density Plot, Dot Plot, Beeswarm Plot
- **Hierarchical**
 - **Part-to-whole:** Pie Chart, Stacked Bar Chart, Marimekko Chart, Diverging Bar Chart
 - **Hierarchy:** Tree Map, Sunburst Chart, Dendrogram, Venn Diagram
- **Relational**
 - **Correlations:** Scatter Plot, Bubble Plot
 - **Connections:** Network Diagram, Sankey Diagram, Chord Diagram
- **Temporal**
 - **Trends:** Line Chart, Bump Chart, Slope Graph, Connected Scatter Plot, Area Chart, Stacked Area Chart, Stream Graph
 - **Intervals:** Gantt Chart
 - **Activities:** Instance/Strip Chart
- **Spatial**
 - **Overlays:** Choropleth Map, Isarithmic/Contour Map, Proportional Symbol Map, Flow Map
 - **Distortions:** Area Cartogram

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How Can I Make These Charts???

- Visit the [Chartmaker Directory](#)

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