



EFFECTIVE COMMUNICATION OF SCIENTIFIC DATA

MARK JONES

EXECUTIVE EXTERNAL STRATEGY AND COMMUNICATIONS FELLOW

THE DOW CHEMICAL COMPANY

12 January 2020



The top 10 Payment Card Processors account for 57% of the total number of Merchant Outlets in 2010.



curated bad graphics



COMMUNICATION HIERARCHY

Tools
Tactics
Strategy
Audience
Goal



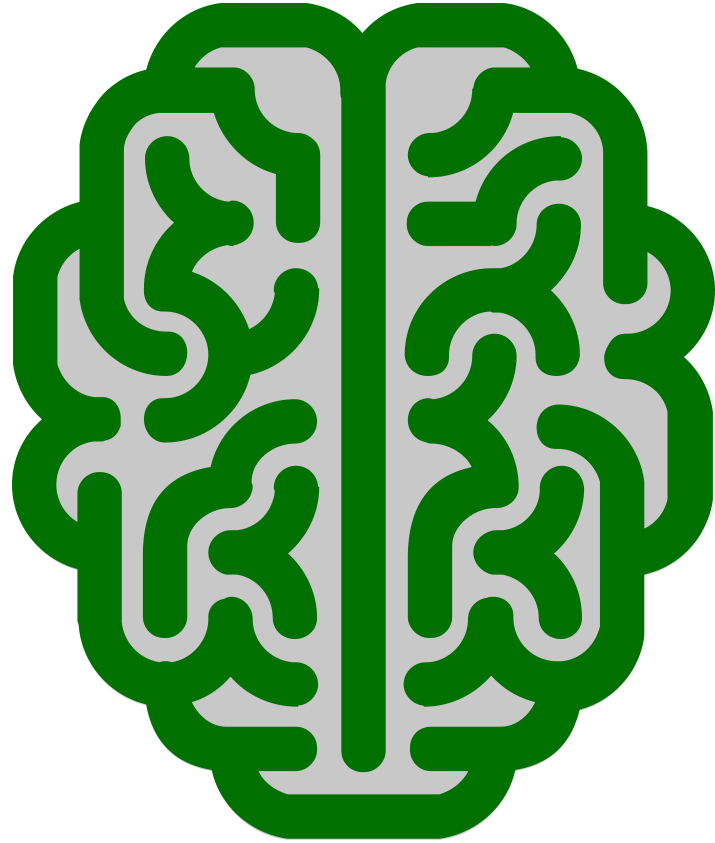


any communication
Designing a presentation
without an audience in mind
is like writing a love letter
and addressing it 'to whom
it may concern'.



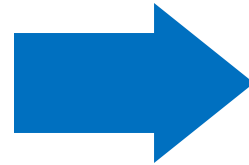
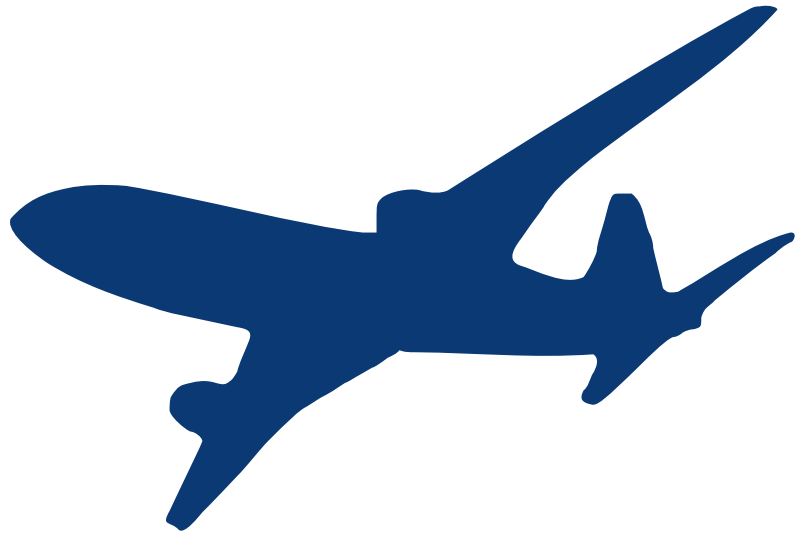
Ken Haemer
Presentation Research Manager,
AT&T





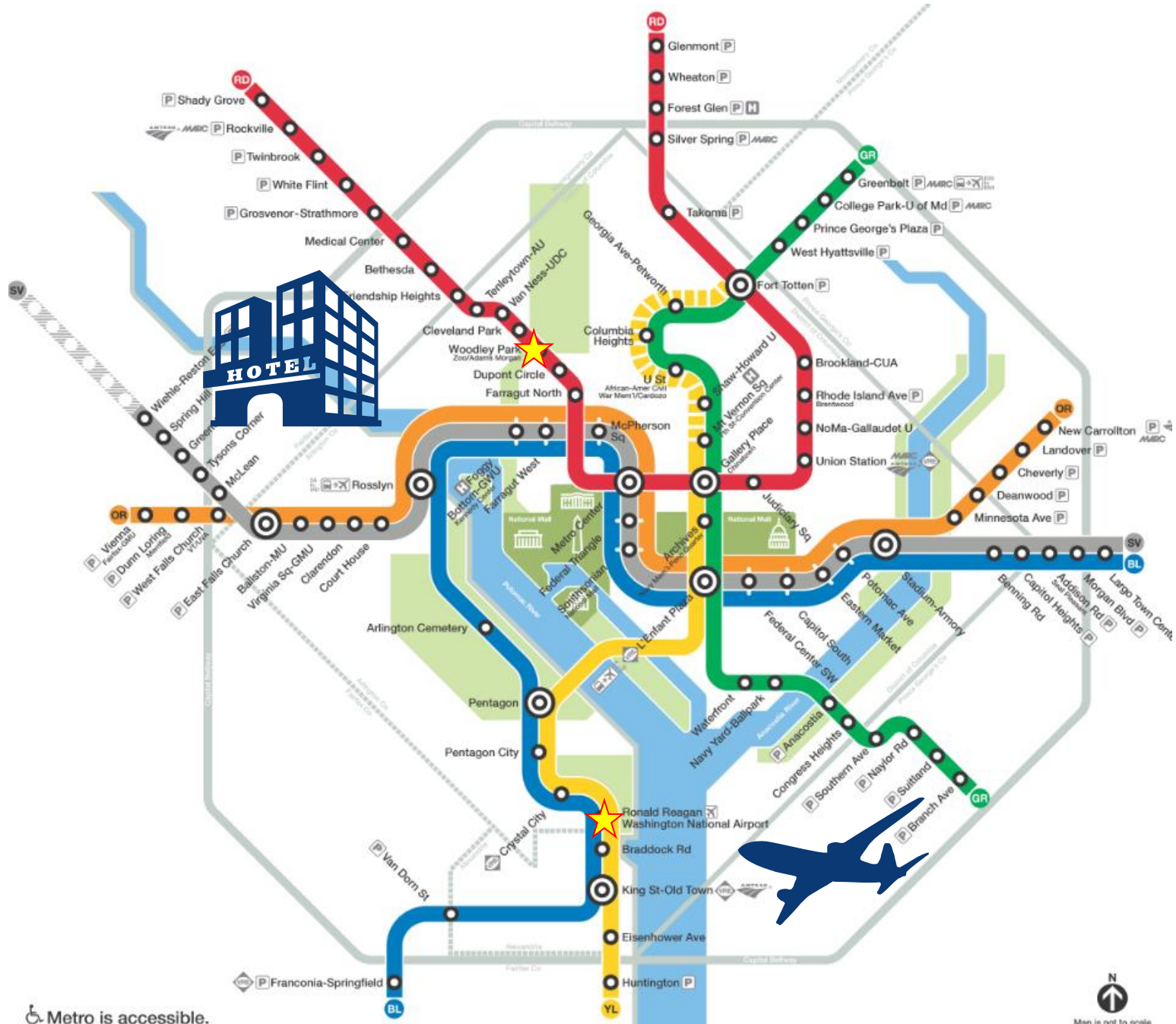
ready

Washington, D.C.



Reagan National Airport

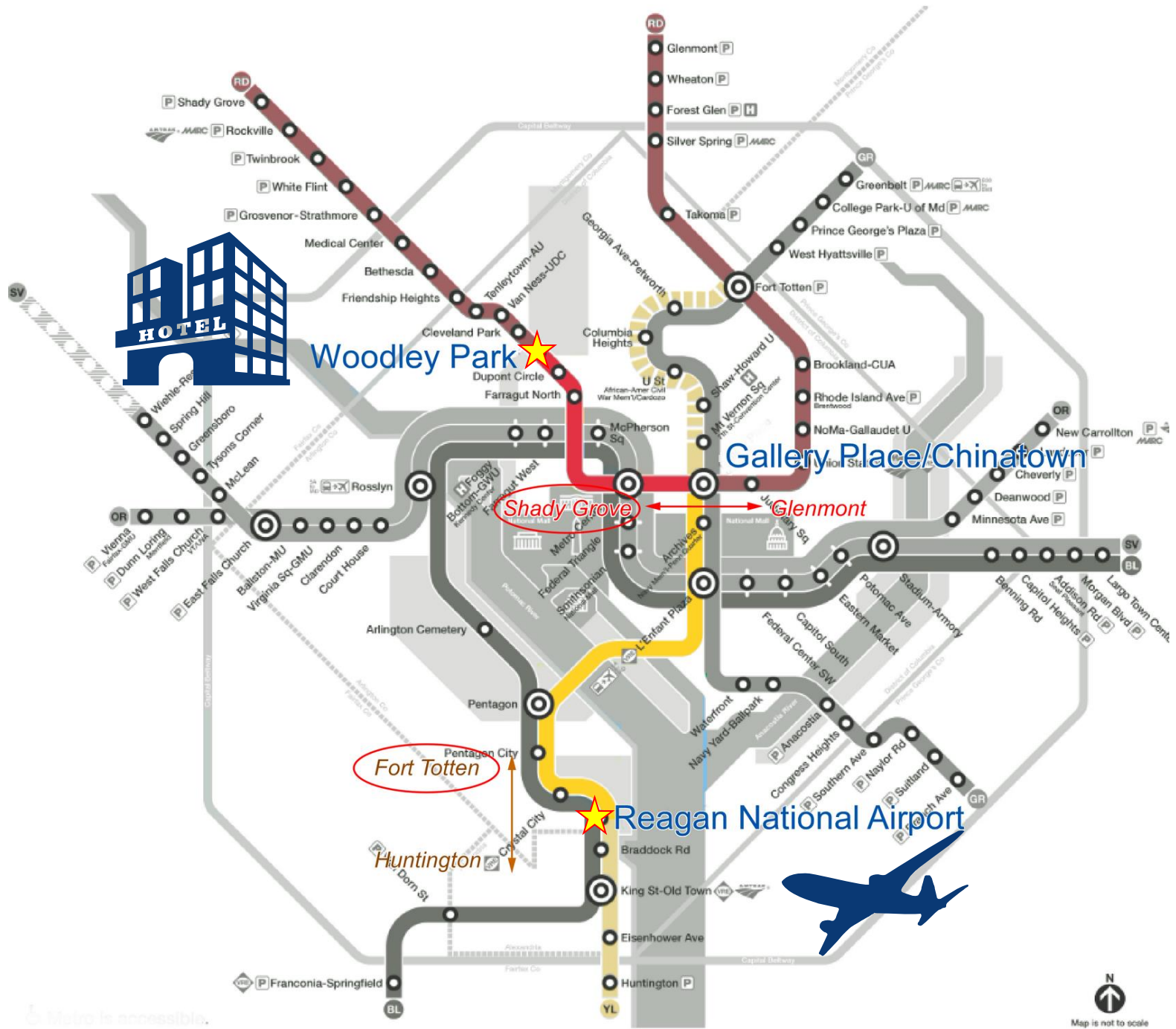
Marriott Woodley Park



Metro is accessible.

N

 Map is not to scale



Woodley Park

Gallery Place/Chinatown

Shady Grove ← → Glenmont

Fort Totten

Reagan National Airport





Woodley Park ★

Gallery Place/Chinatown

Shady Grove

Glenmont

Fort Totten

★ Reagan National Airport

Huntington

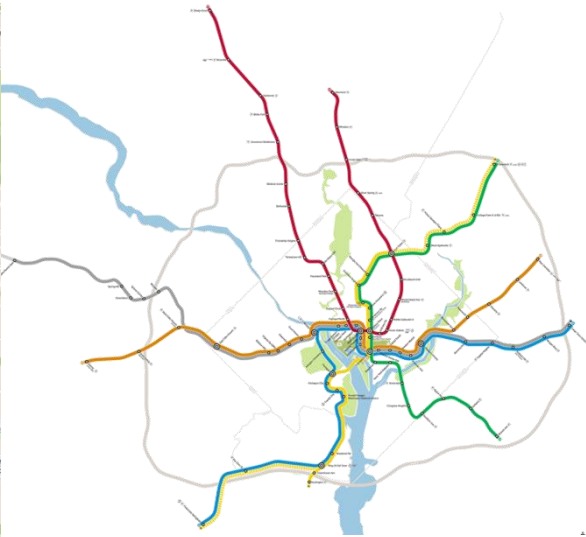




Everything should be
made as simple as
possible, but not simpler.

Albert Einstein





FIVE PRINCIPLES OF DATA PRESENTATION



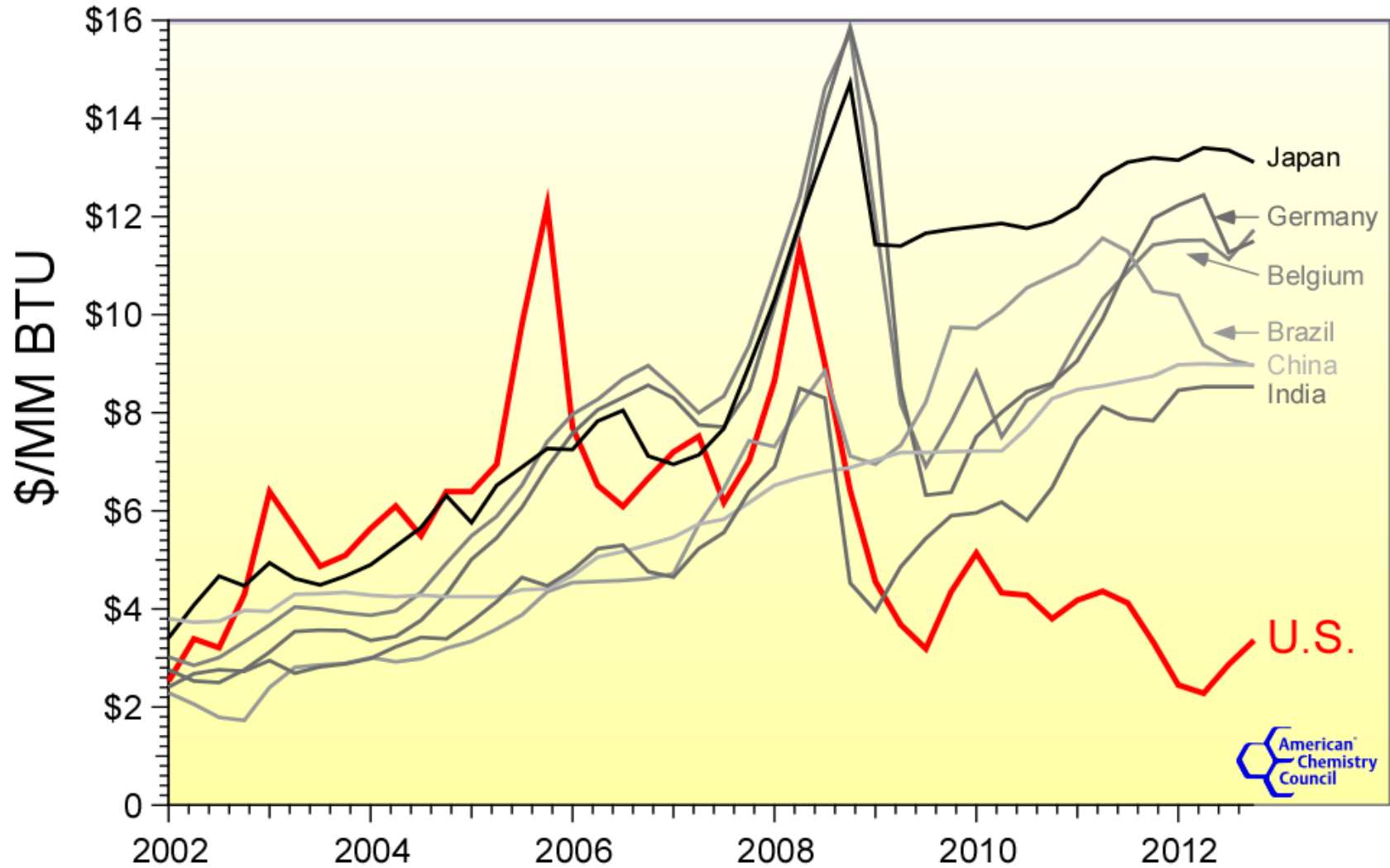
- *Tell the truth*
- *Get to the point*
- *Pick the right tool*
- *Highlight what is important*
- *Keep it ~~simple~~ **appropriate***

Everything should be made as simple as possible, but not simpler.



Nancy Duarte in Slideology

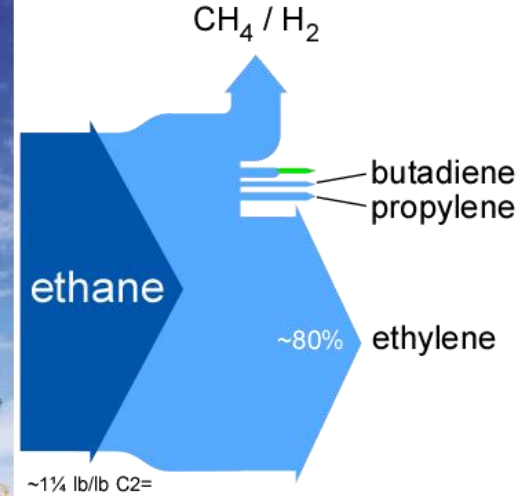
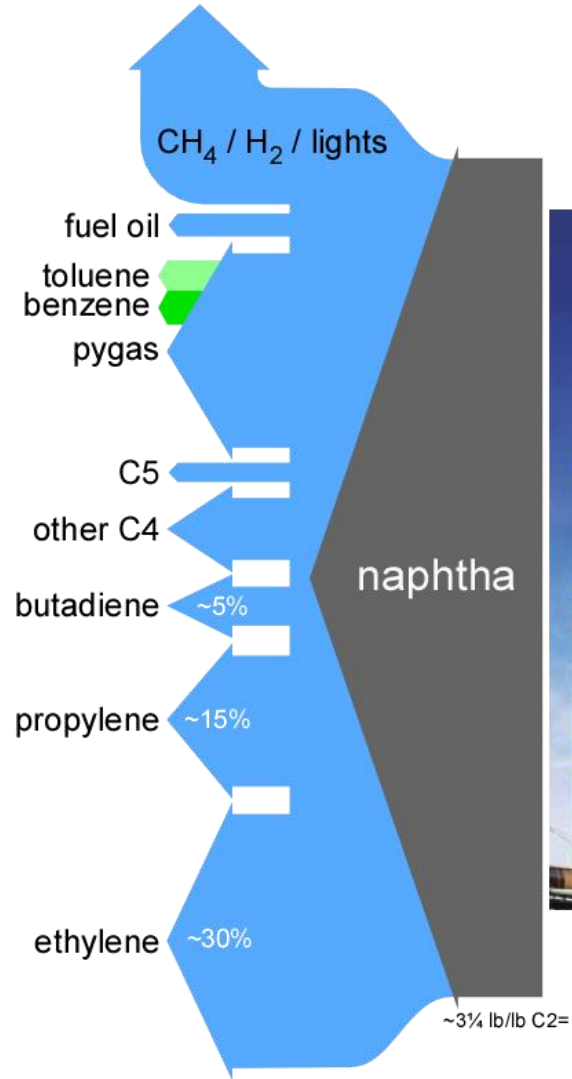
WORLD NATURAL GAS PRICES



American
Chemistry
Council



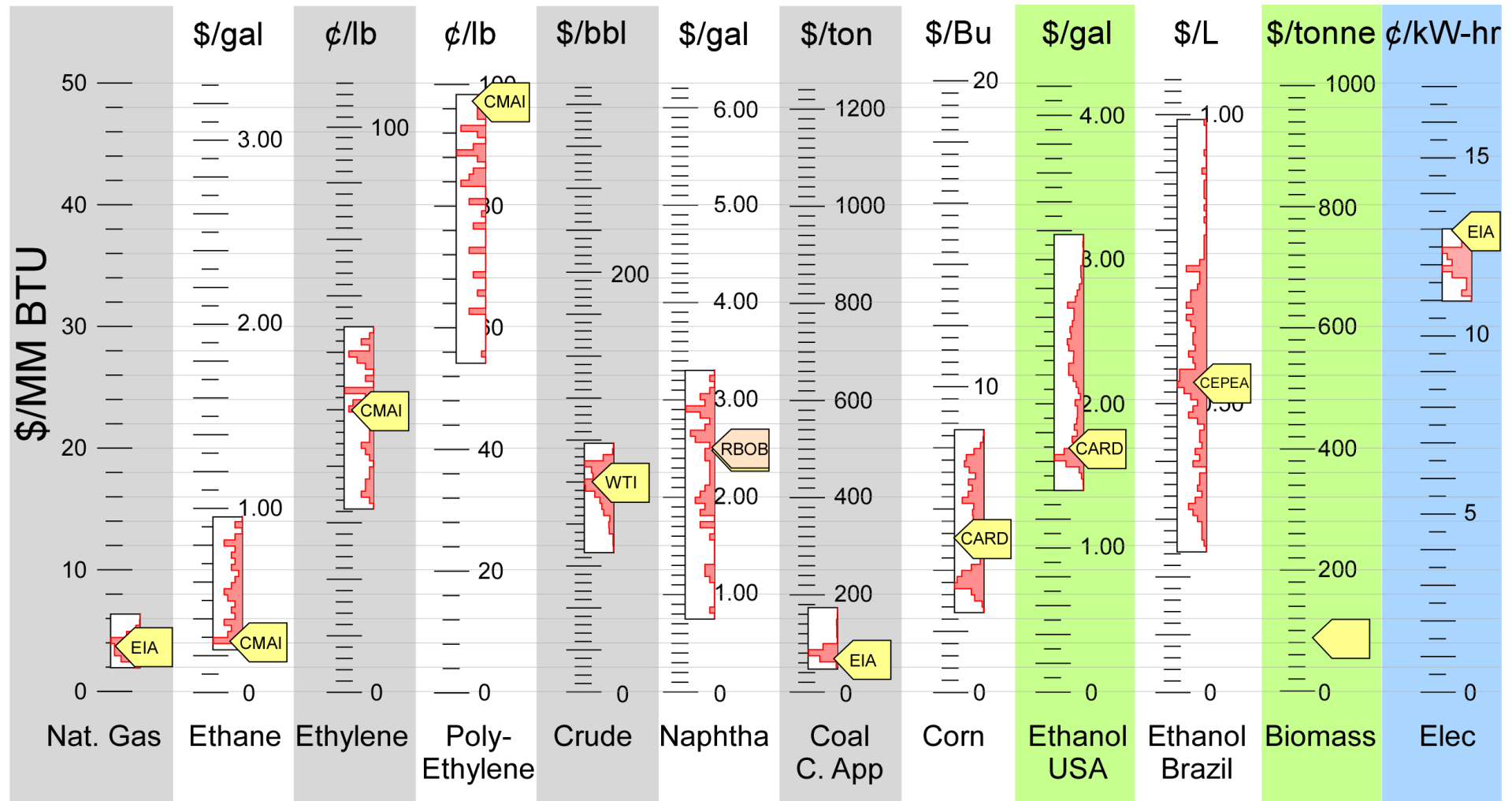
NAPHTHA VS ETHANE CRACKING COMPARISON



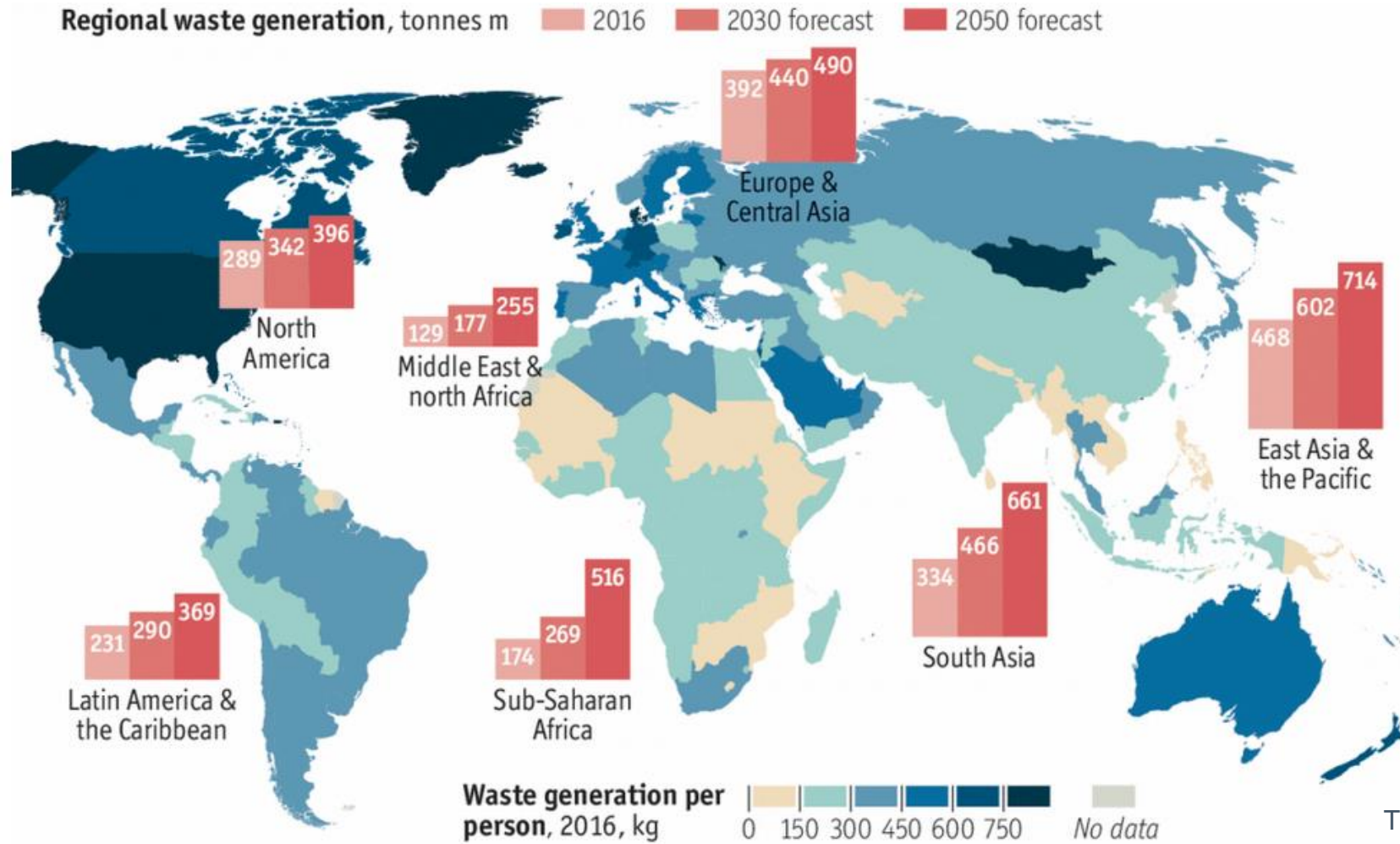
same amount of ethylene



DATA RICH SLIDE



LOTS OF INFORMATION – THROWAWAY WORLD



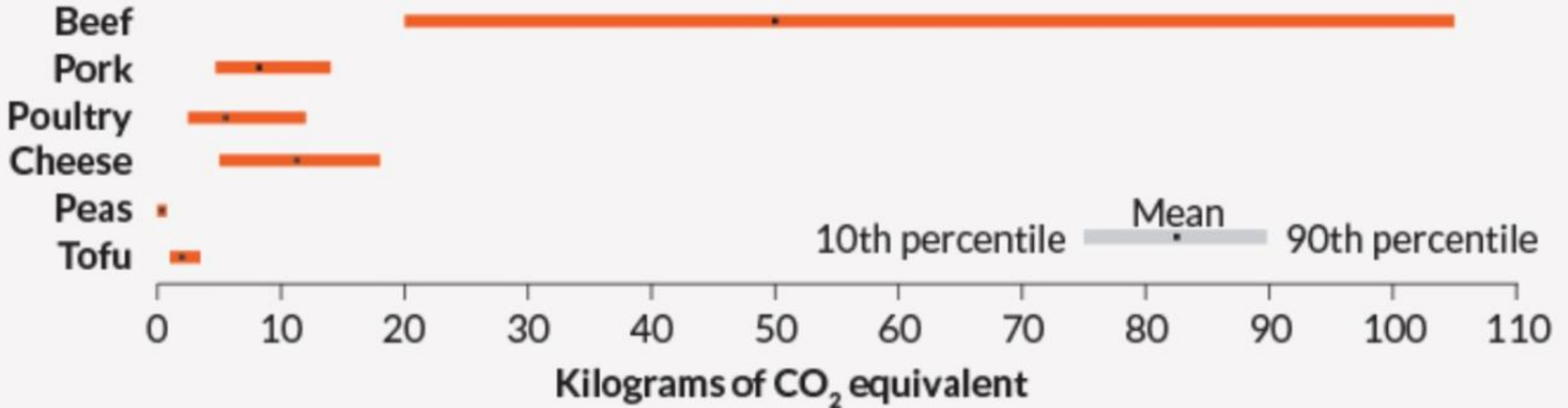
Source: World Bank

The Economist; 2 Oct 2018



FARM TO TABLE

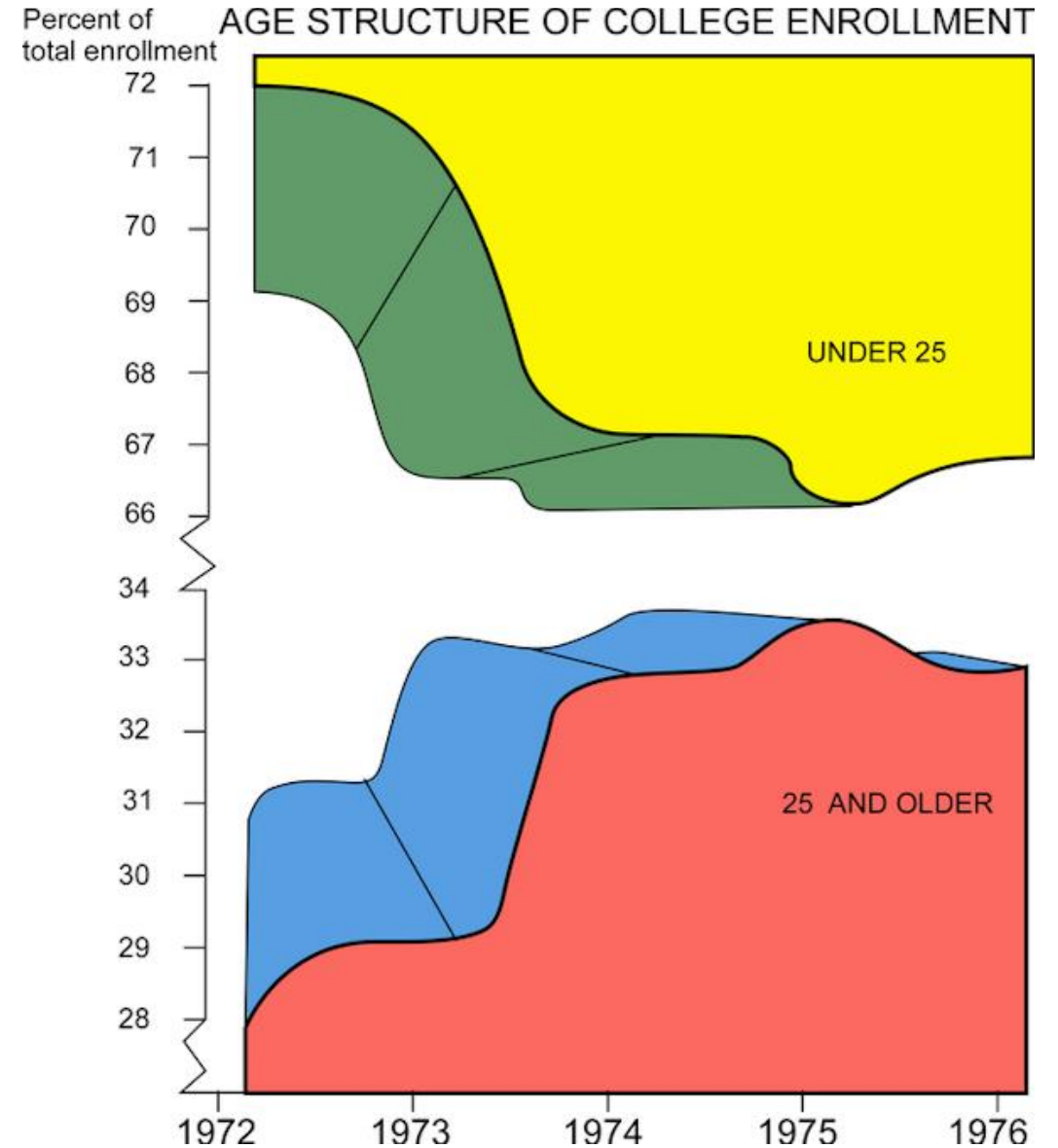
Greenhouse gas emissions from protein-rich foods (per 100 grams)



graphic by C. Chang in Milius, Susan; "Can science build a better burger?", *Science News*, September 20, 2018 downloaded from [sciencenews.org/article/can-science-build-better-burger](https://www.sciencenews.org/article/can-science-build-better-burger) on 2 November 2018.

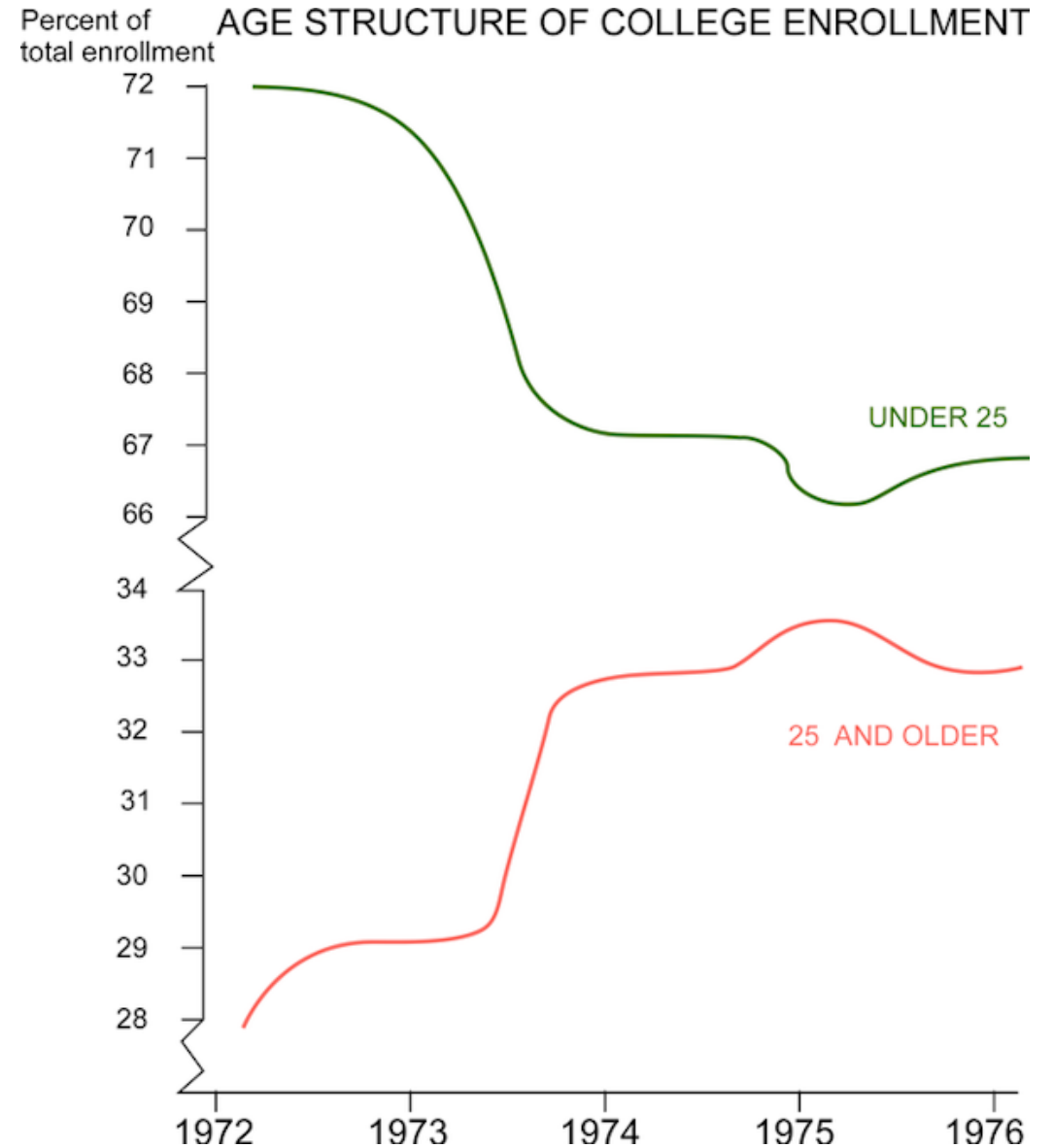
EDWARD TUFTE'S FIVE PRINCIPLES OF DATA PRESENTATION

1. Above all else show the data
2. Maximize the data-ink ratio
3. Erase non-data ink
4. Erase redundant data
5. Revise and Edit.



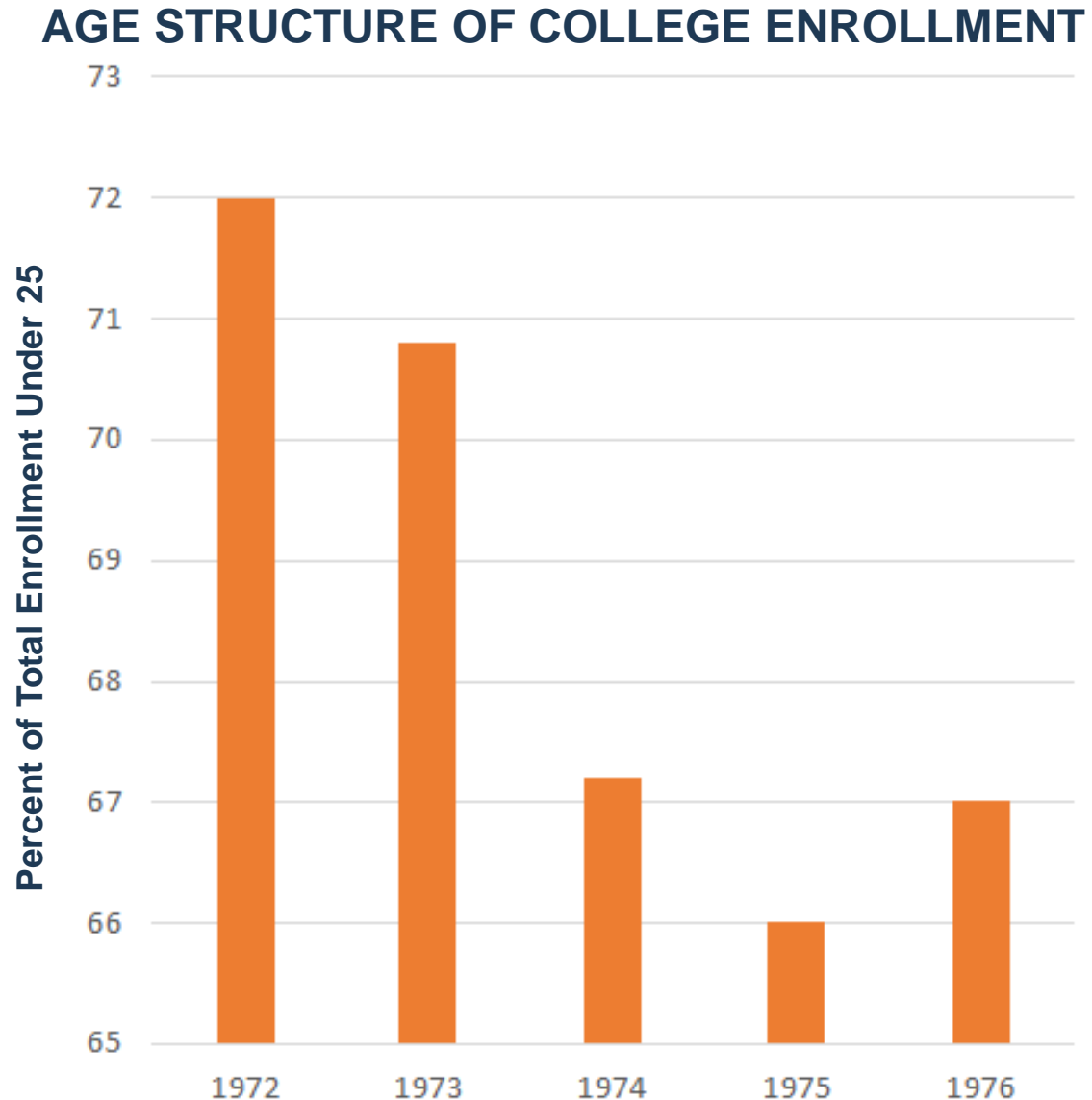
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EDWARD TUFTE'S FIVE PRINCIPLES OF DATA PRESENTATION

Pick the right tool
1. Above all else show the data
Tell the truth

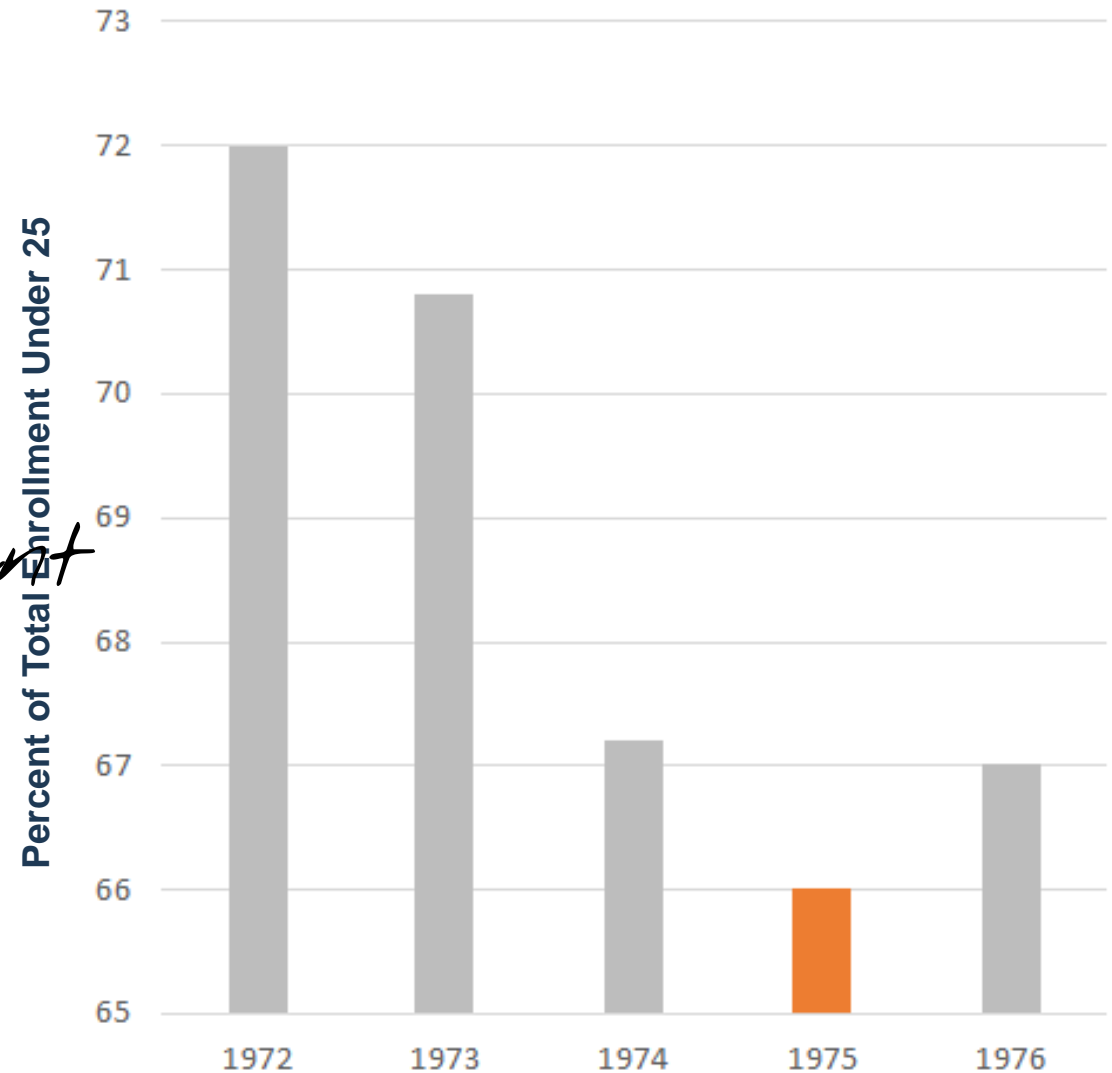
2. Maximize the data-ink ratio
Get to the point

3. Erase non-data ink

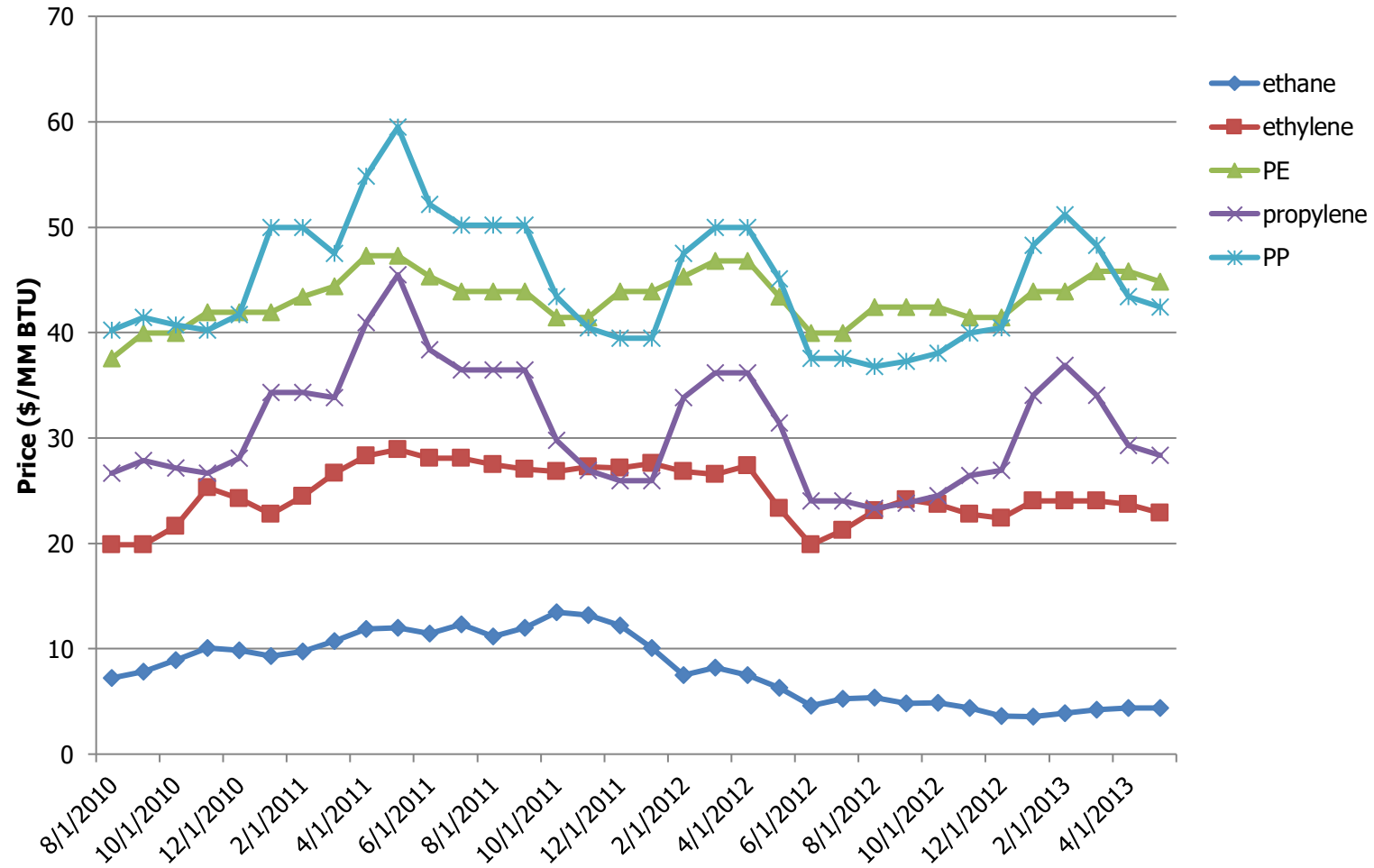
Highlight what is important
4. Erase redundant data
Get to the point

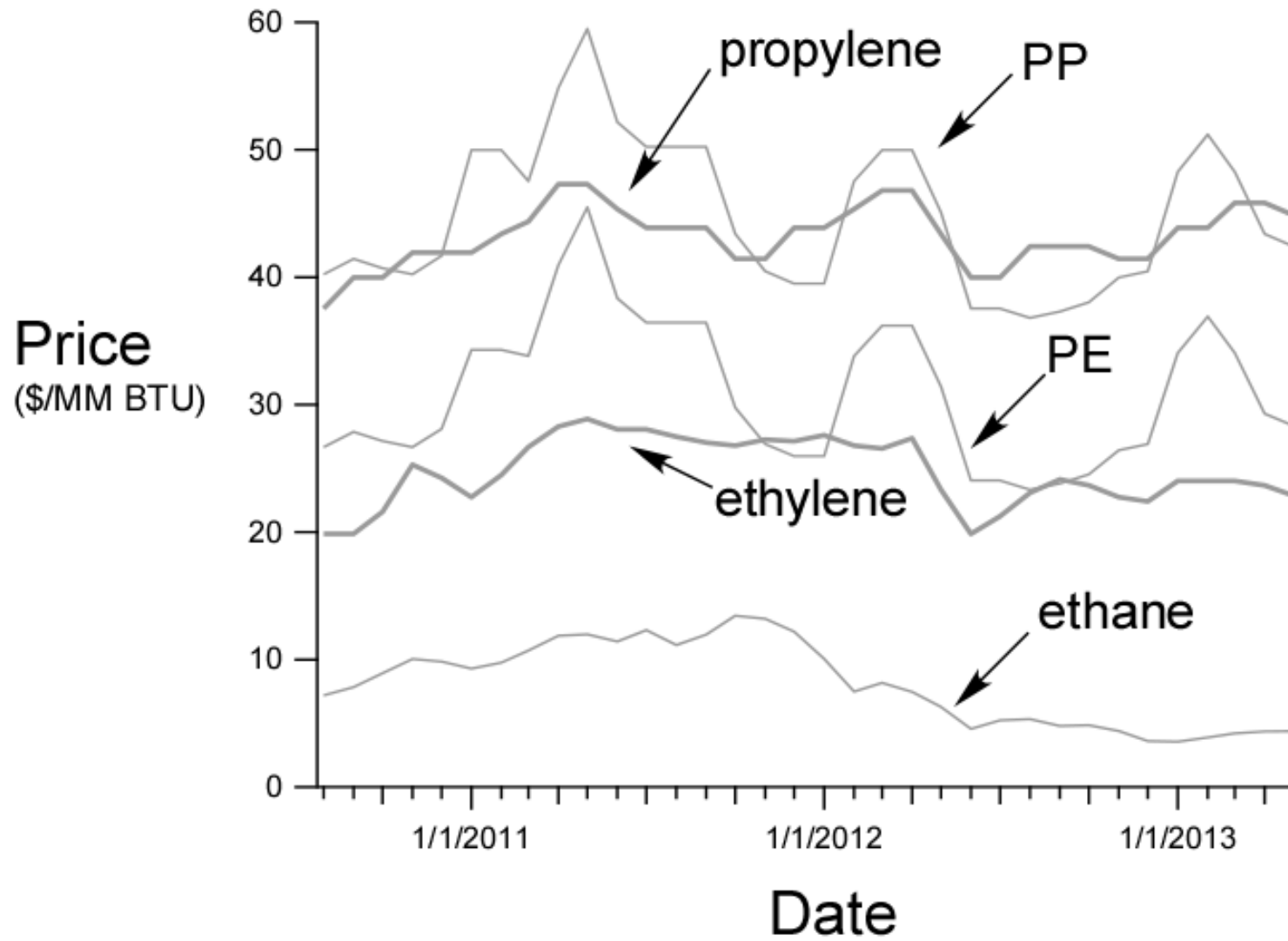
5. Revise and Edit.
Keep it appropriate

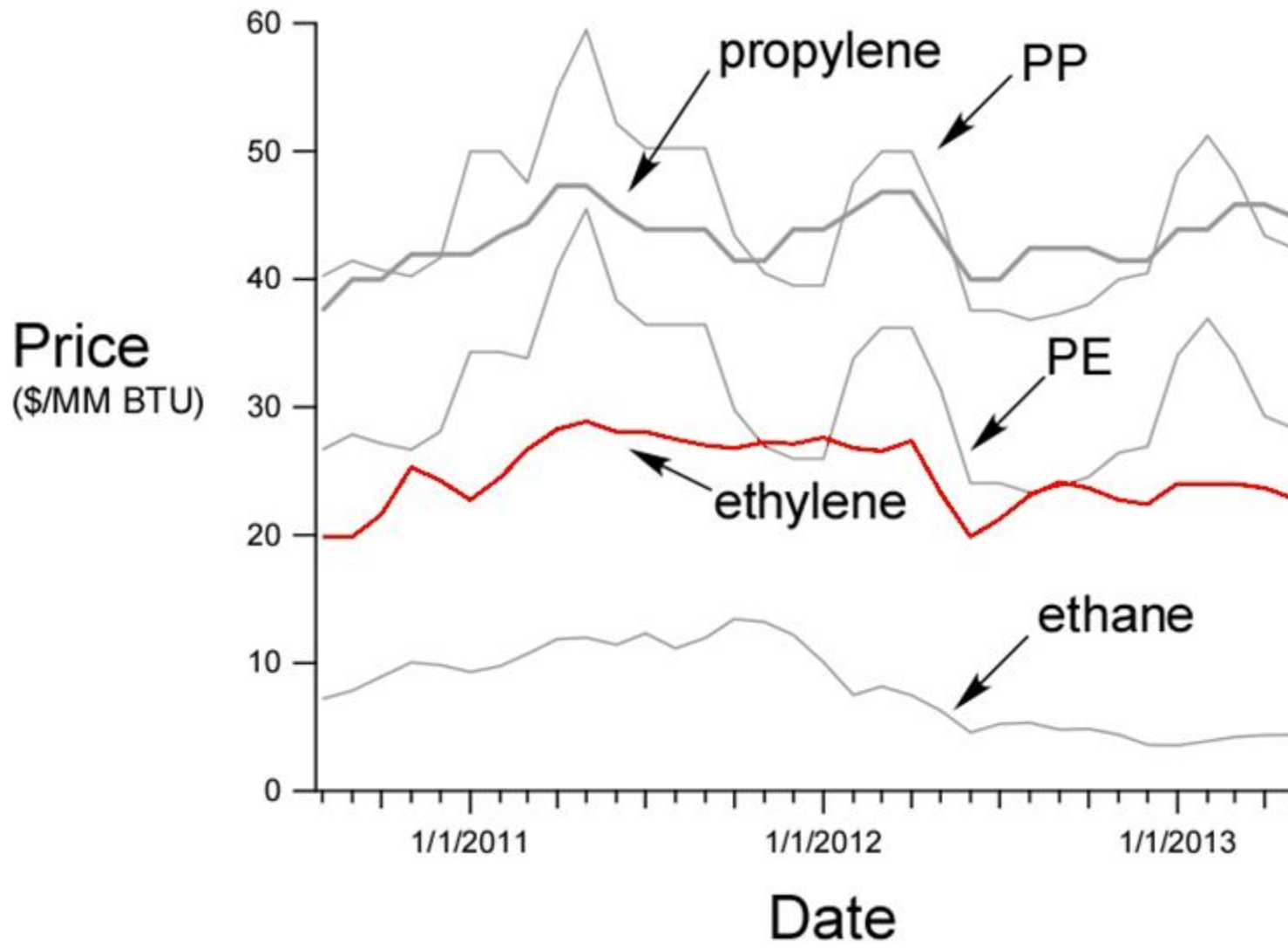
AGE STRUCTURE OF COLLEGE ENROLLMENT



STANDARD EXCEL PLOT

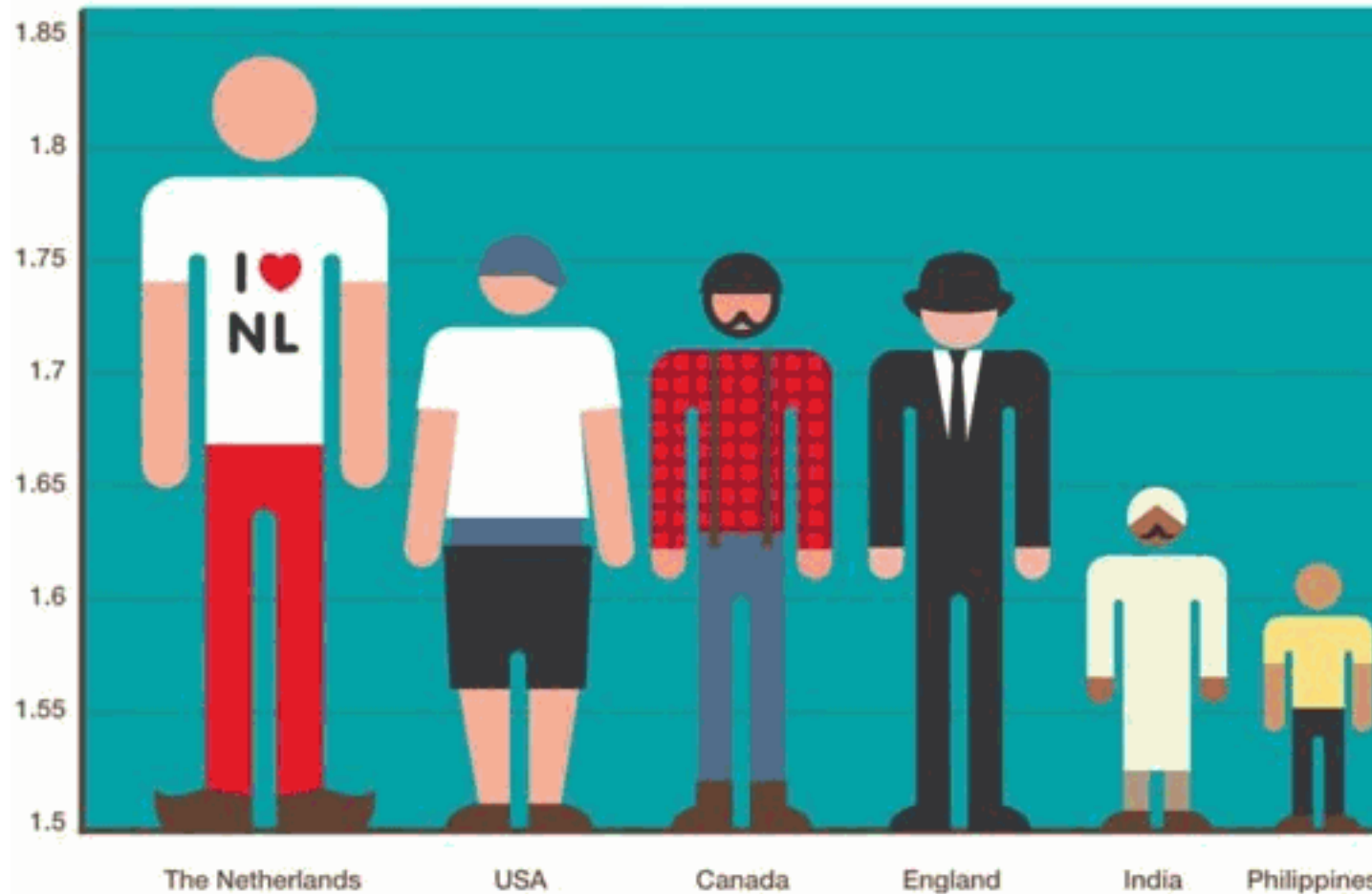






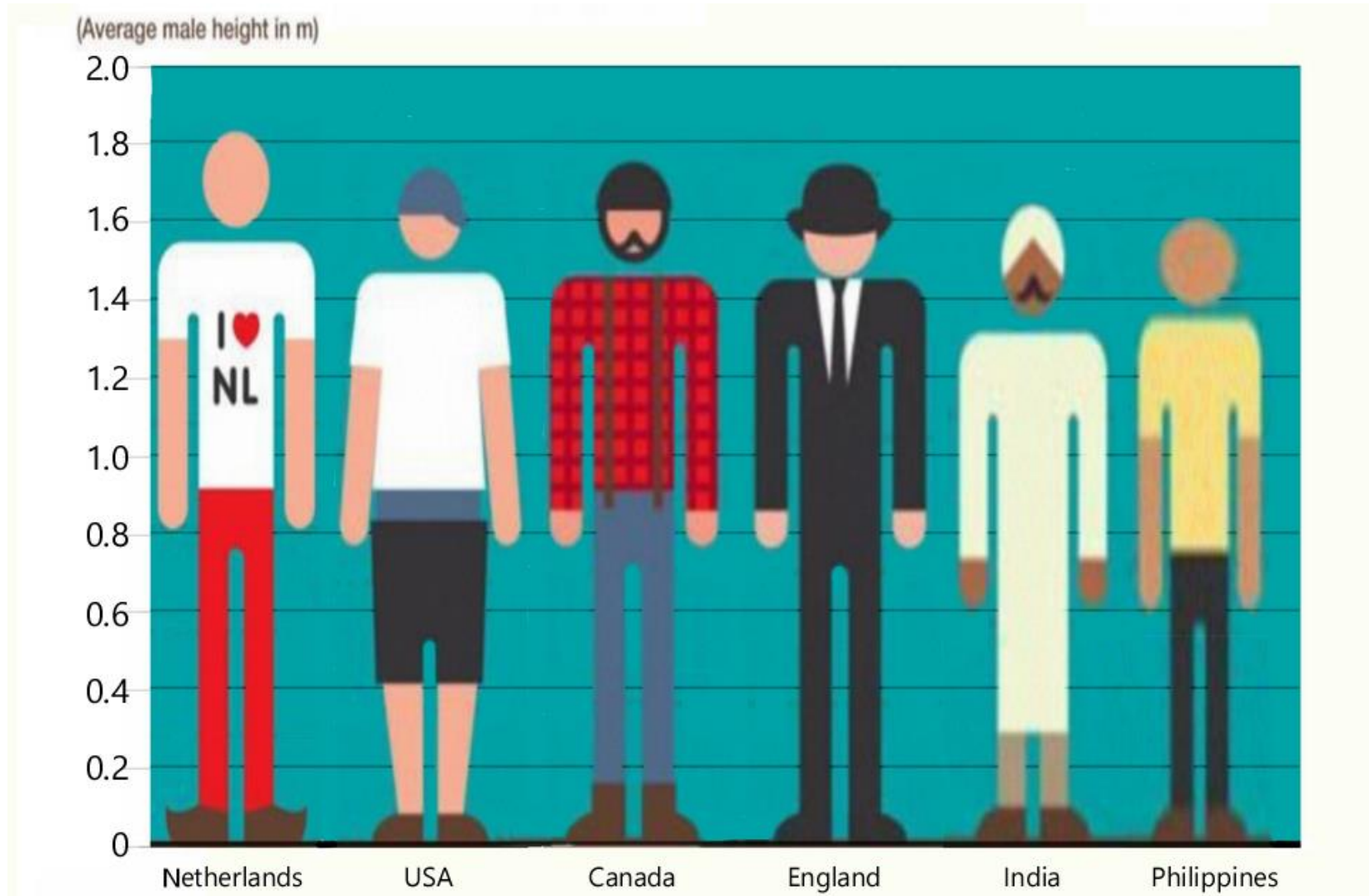
BAD GRAPHS – LOOKING DOWN ON THE REST OF THE WORLD

(Average male height in m)

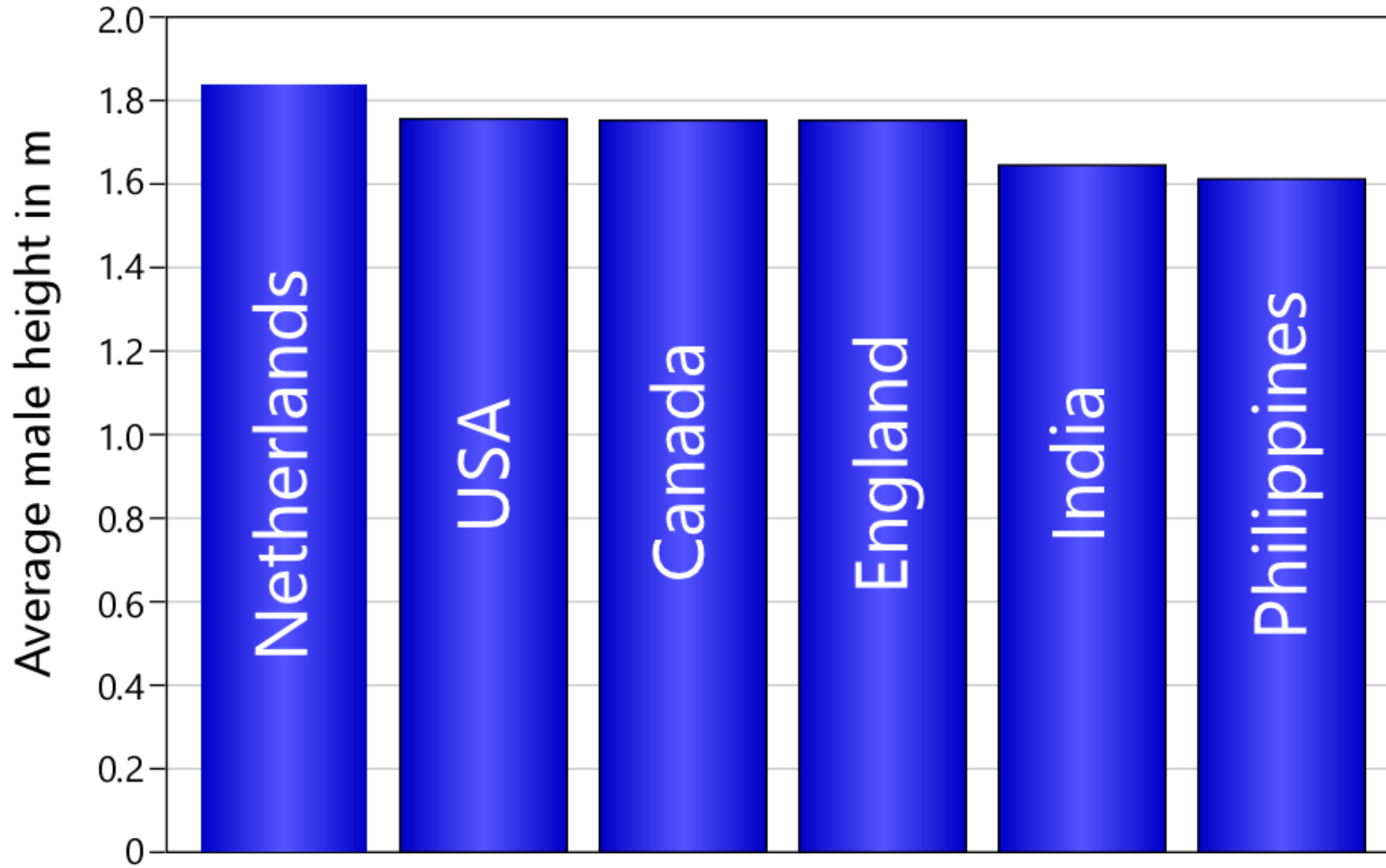


ticktockmaths.co.uk/bad-graphs/

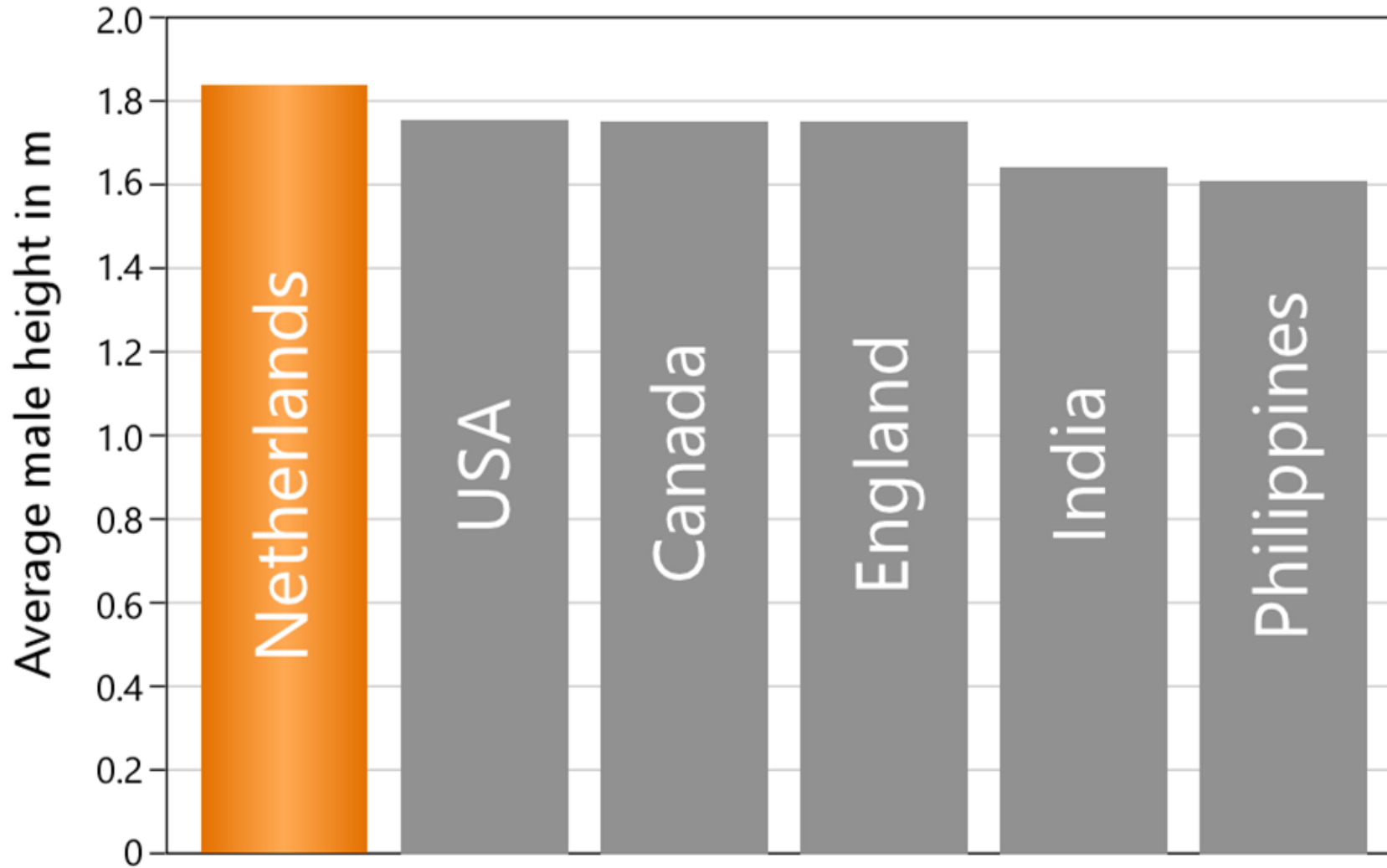
BETTER – BUT NOT GOOD ENOUGH



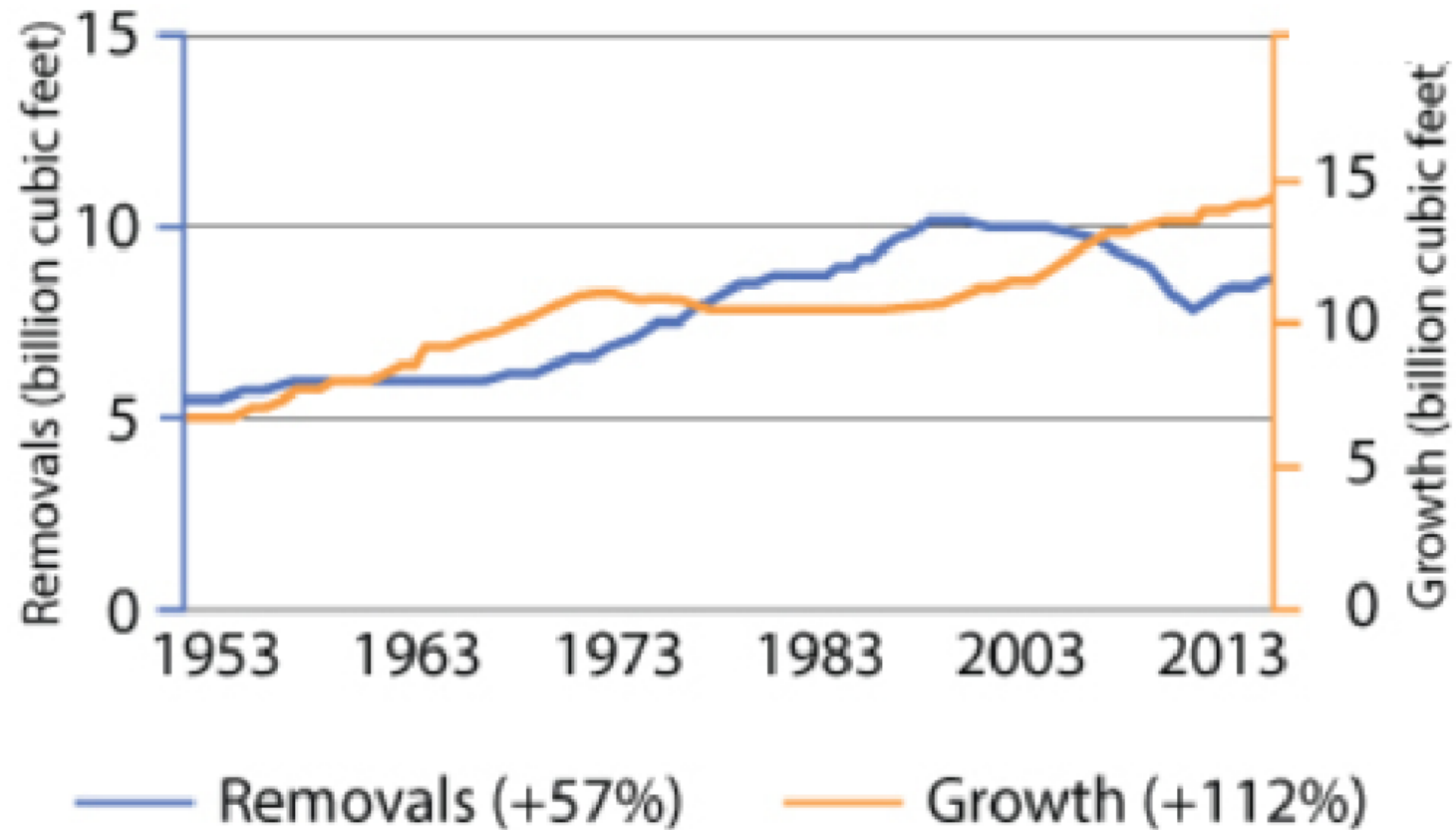
BETTER GRAPH



MAKING THE POINT

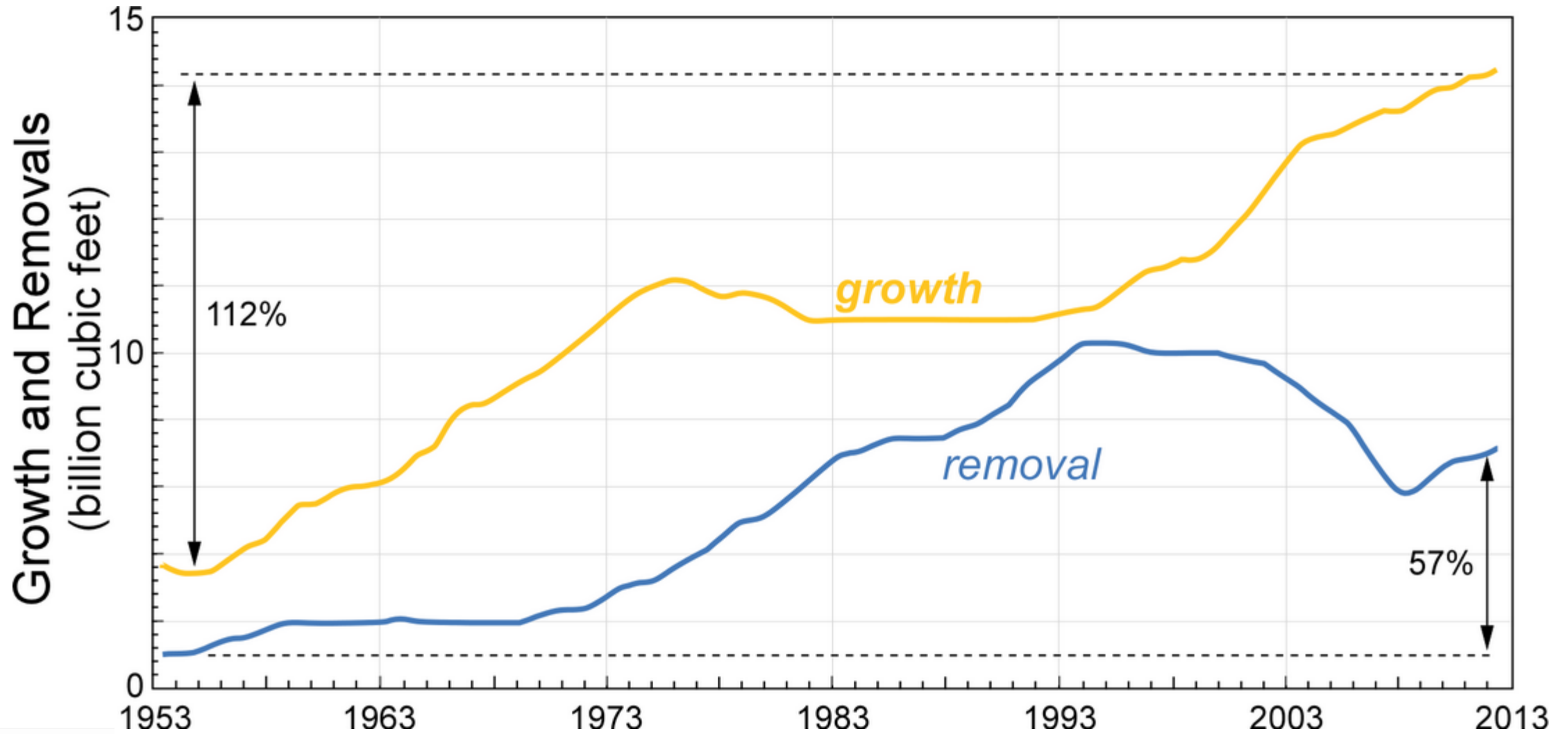


Southern Timber Removals and Growth

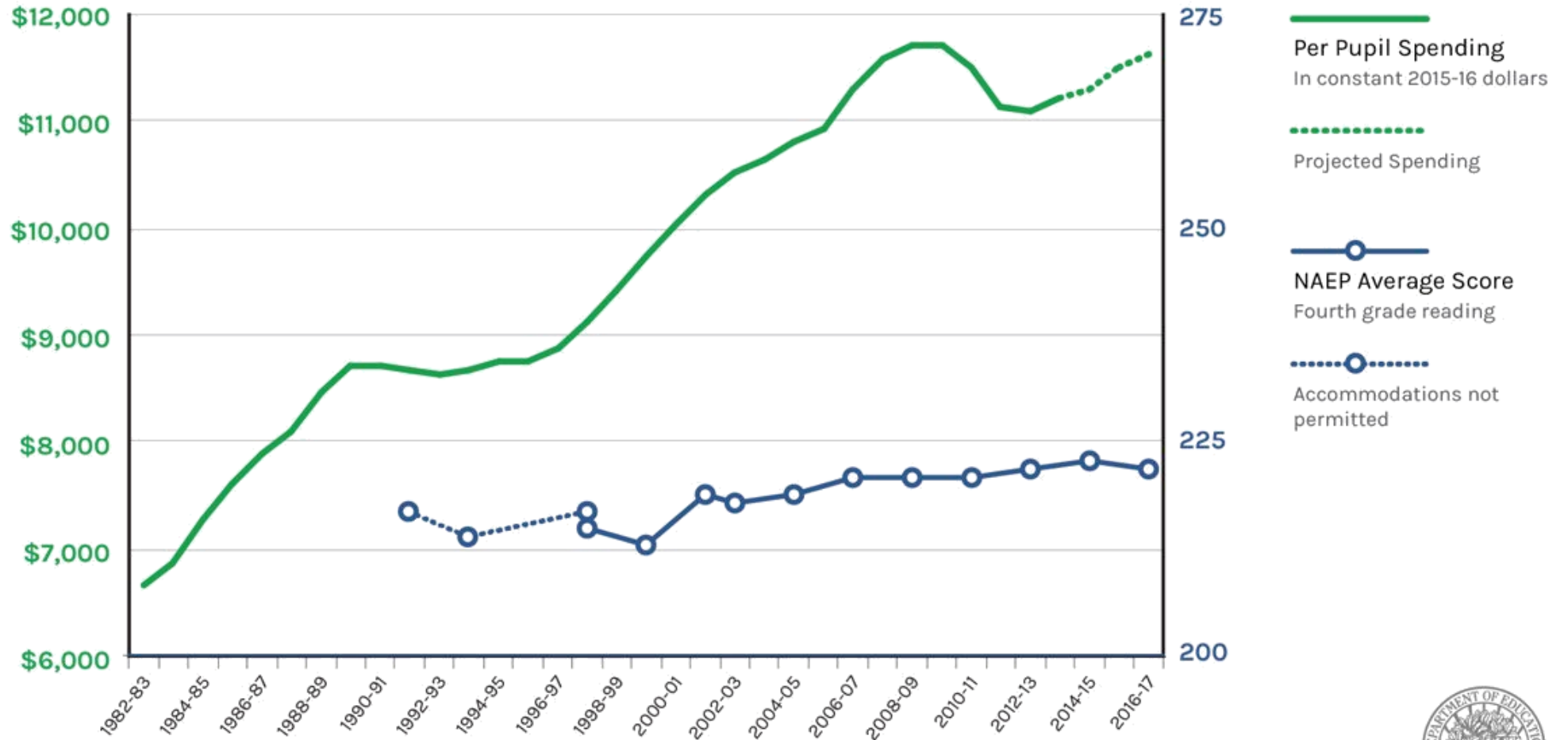


biomassmagazine.com/articles/15210/healthy-demand-for-southern-timber-ensures-forested-lands-remain-forested

SOUTHERN TIMBER



GAMES WITH 2 AXES



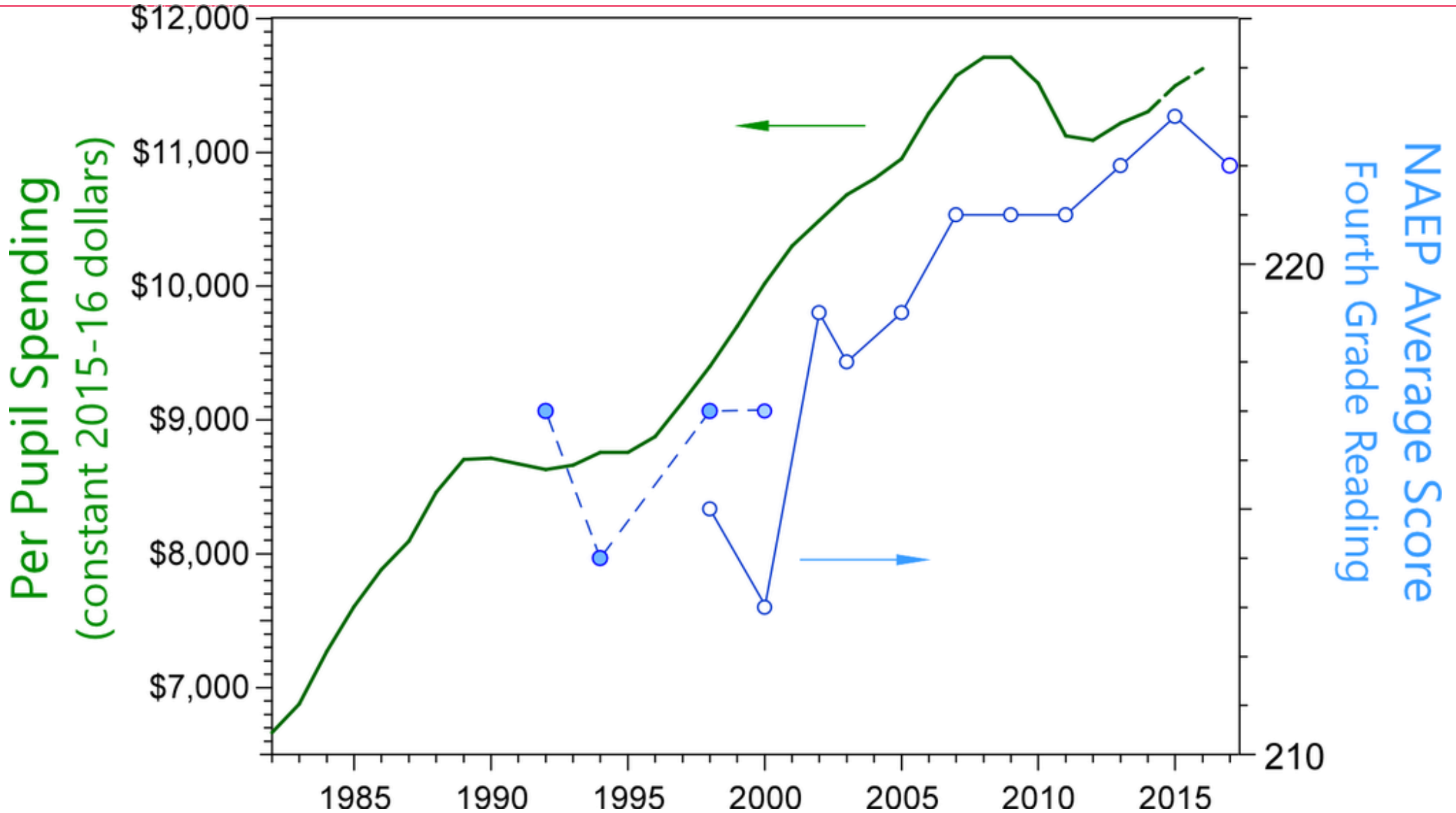
Source: U.S. Department of Education, National Center for Education Statistics, Revenues and Expenditures for Public Elementary and Secondary Education, 1970–71 through 1986–87; Common Core of Data (CCD), "National Public Education Financial Survey," 1987–88 through 2013–14; National Elementary and Secondary Enrollment Projection Model, 1972 through 2026; Public Elementary and Secondary Education Current Expenditure Projection Model, 1973–74 through 2026–27; and National Assessment of Educational Progress, Reading Report Card, 2017



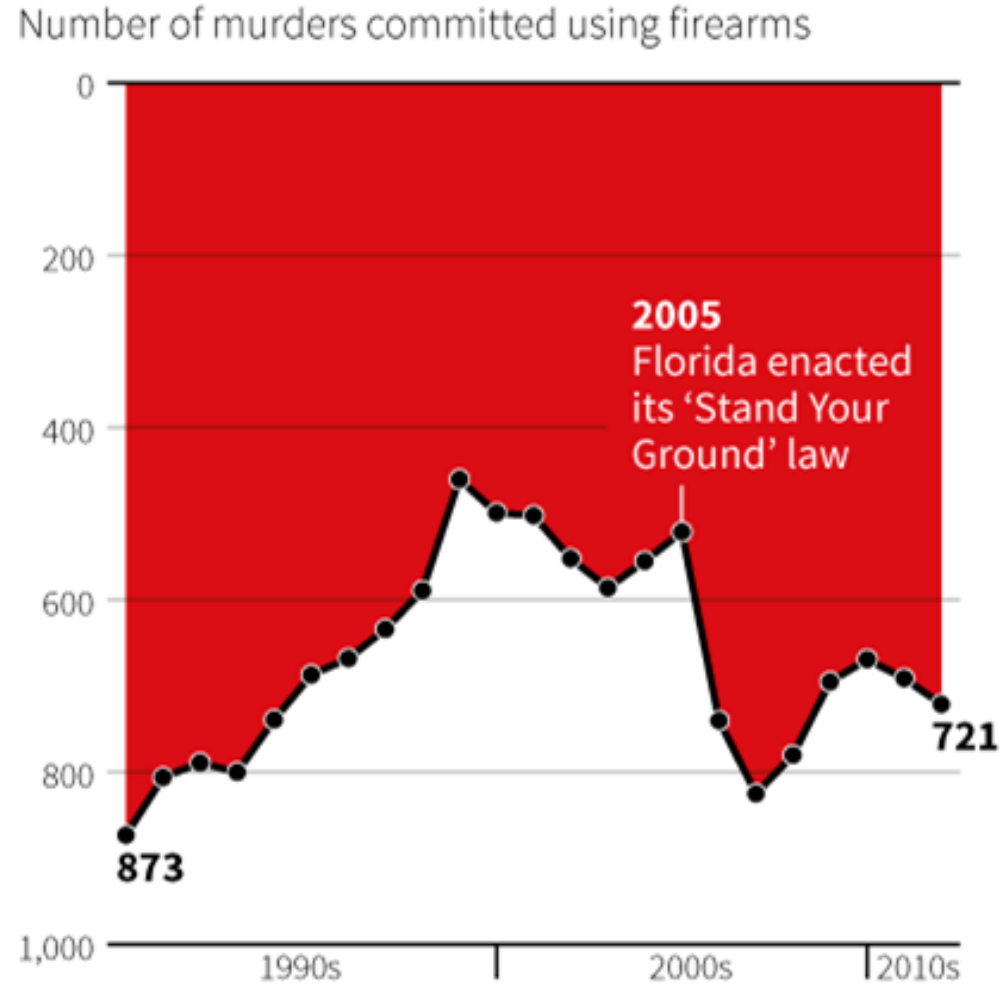
<http://www.shankerinstitute.org/blog/we-cant-graph-our-way-out-research-education-spending>



MORE HONEST AXES



AXIS GAMES - GUN DEATHS IN FLORIDA



Source: Florida Department of Law Enforcement

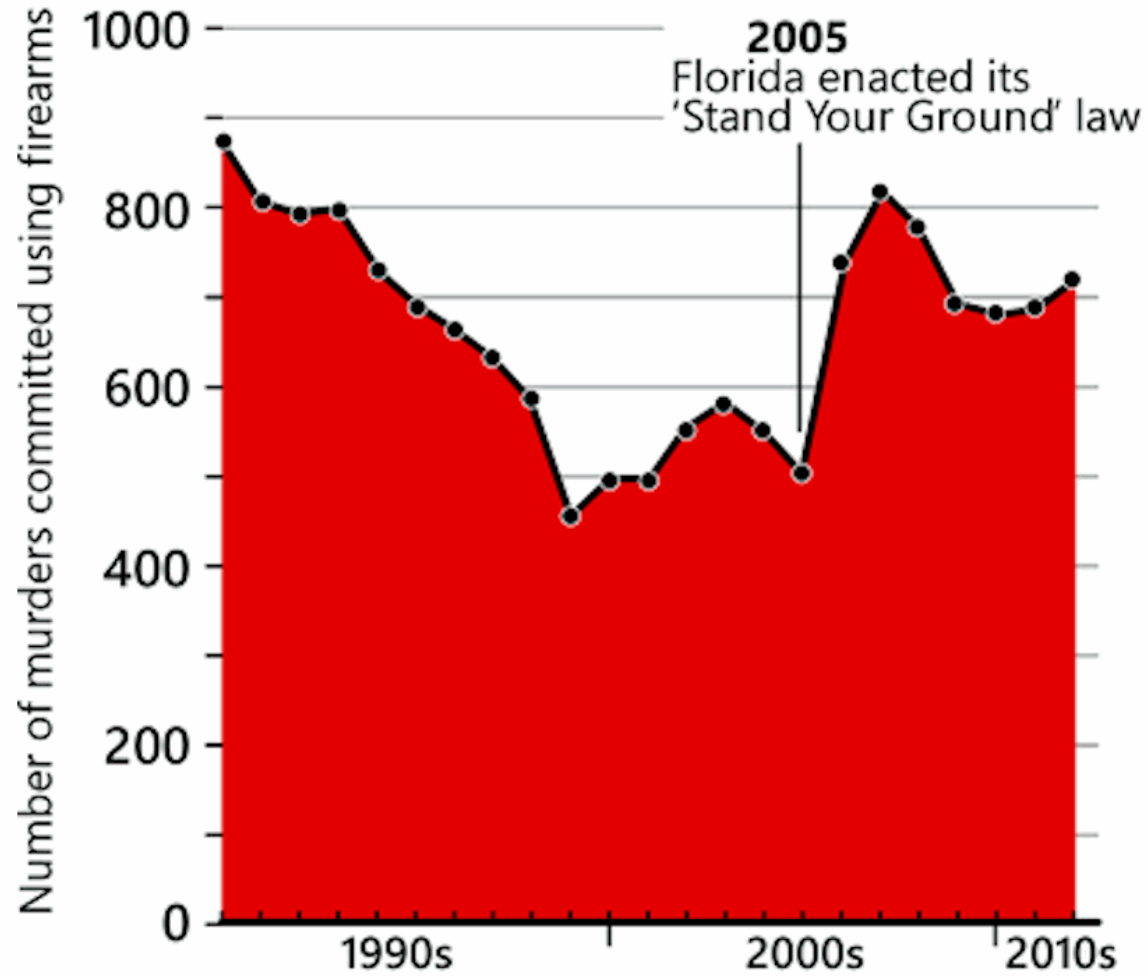
C. Chan 16/02/2014

REUTERS

methodsavvy.com/good-data-bad-graphs/



GUN DEATHS IN FLORIDA

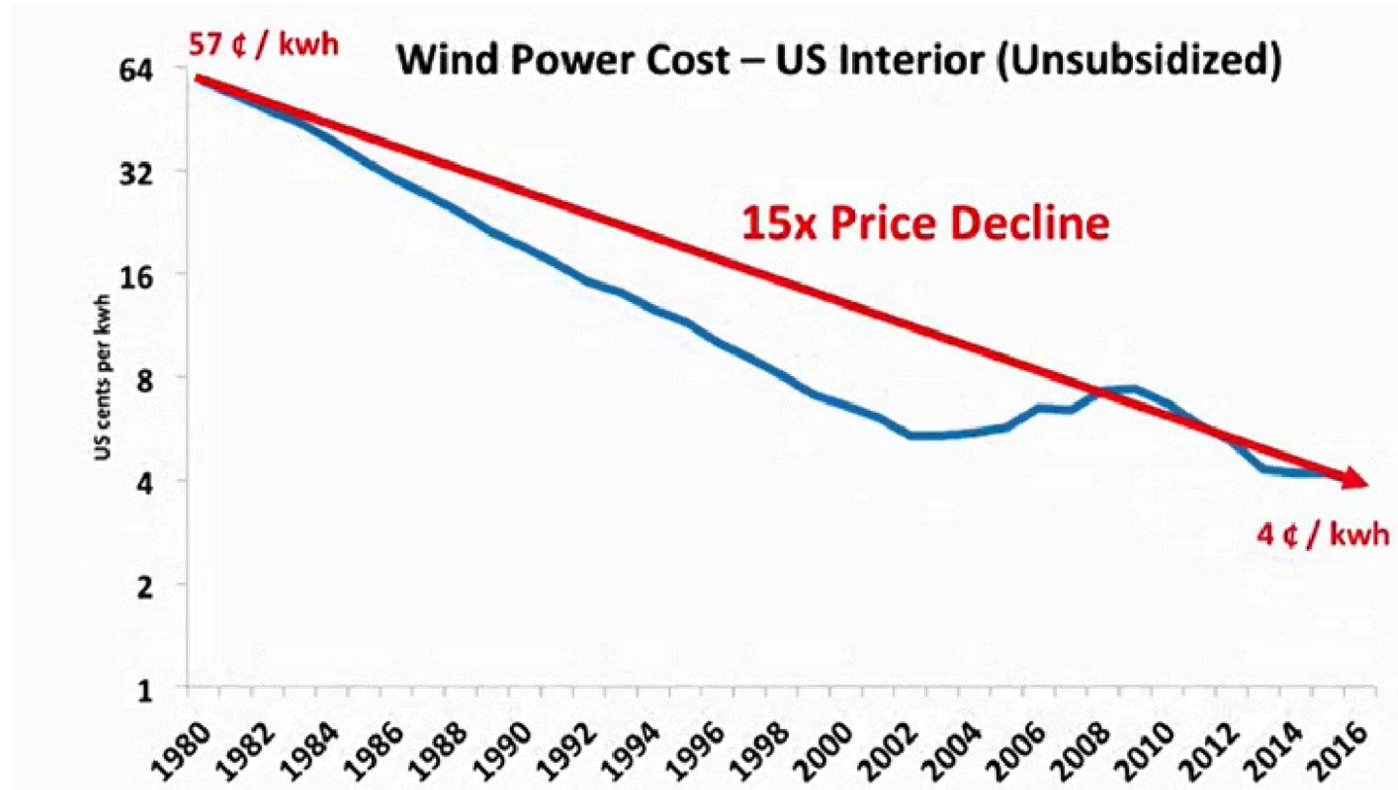


Source: Florida Dept of Law Enforcement



AXIS GAMES – HIDDEN LOG AXIS

The Clean Energy Revolution – and the Disruption of the Energy Industry



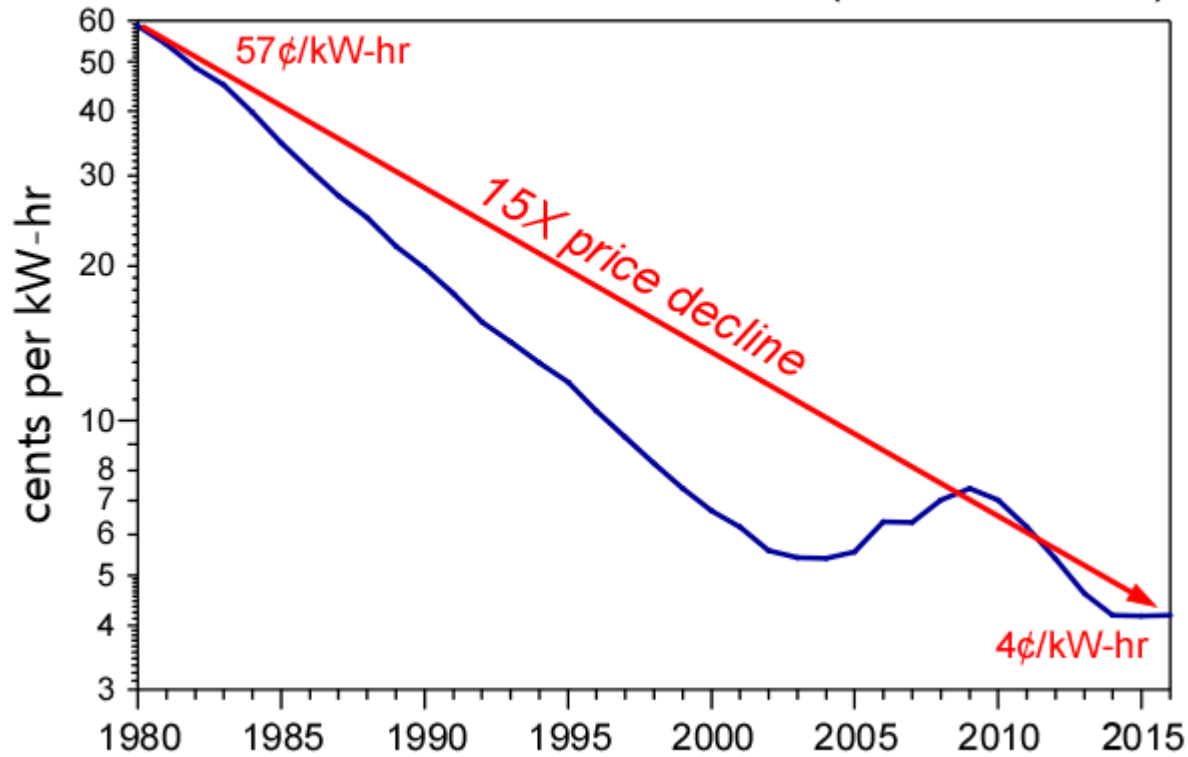
rameznaam.com/ video "The Clean Energy Revolution – and the Disruption of the Energy Industry",

youtu.be/fwSkQa1tNmE

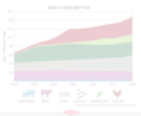
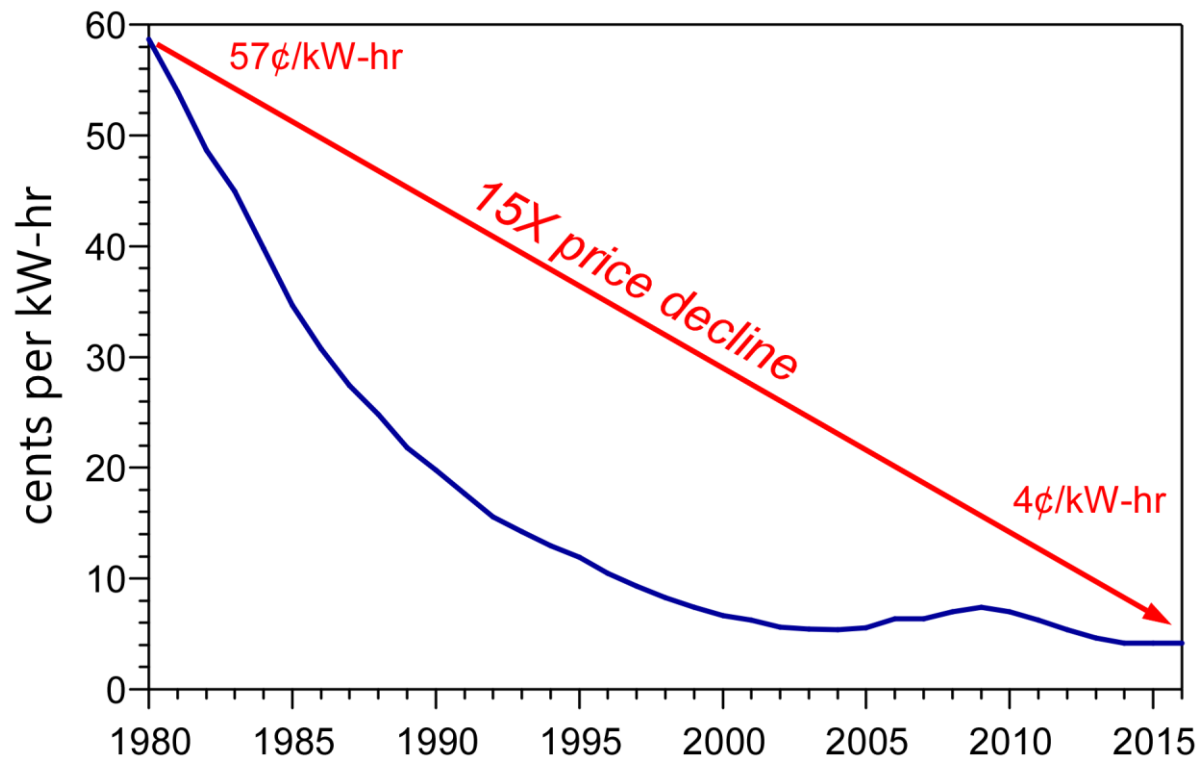


CLEAN ENERGY

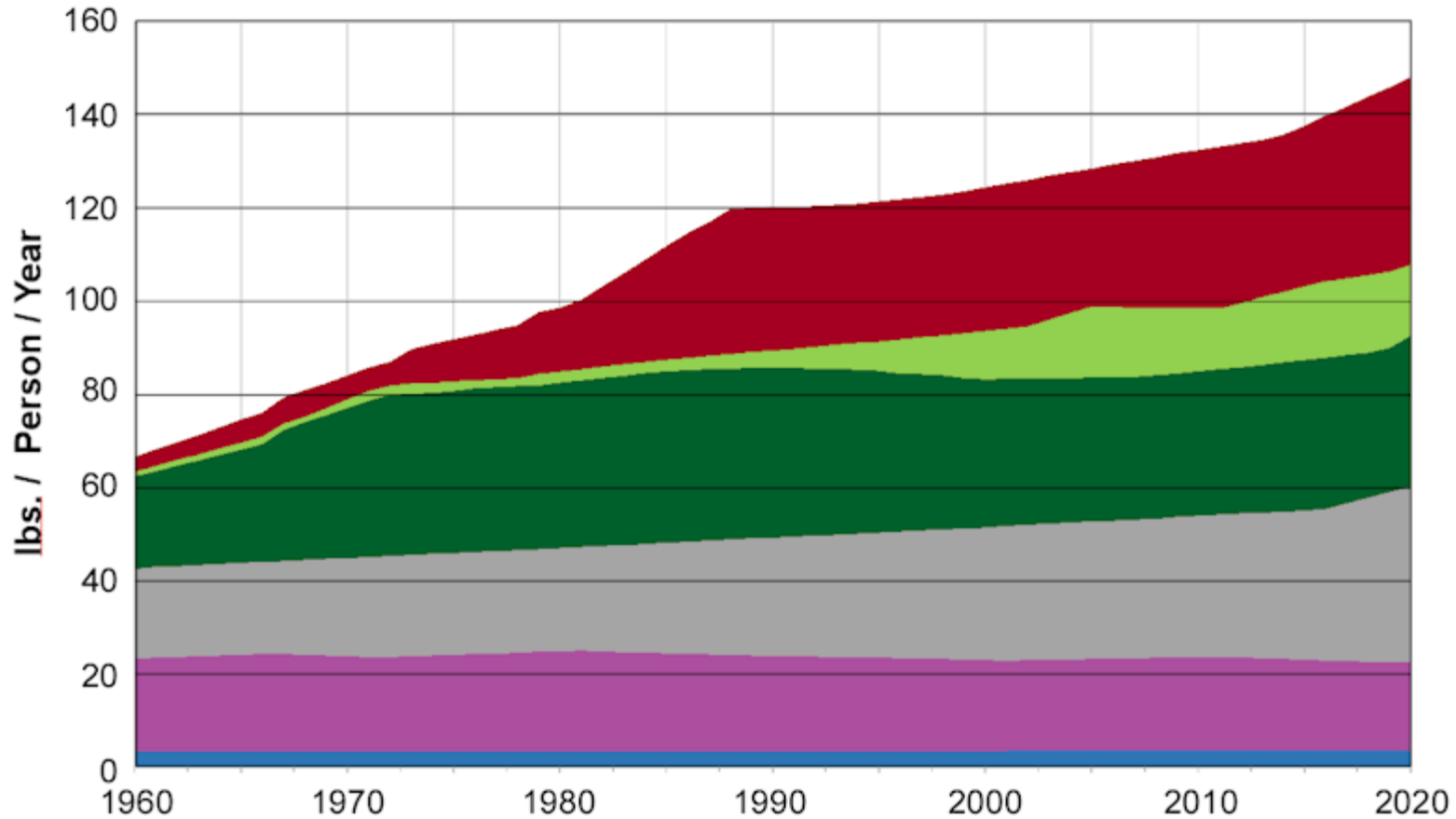
Wind Power Cost - US Interior (unsubsidized)



Wind Power Cost - US Interior (unsubsidized)



MEAT CONSUMPTION



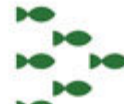
SHEEP/GOAT



BEEF



PORK



WILD FISH



FARMED FISH

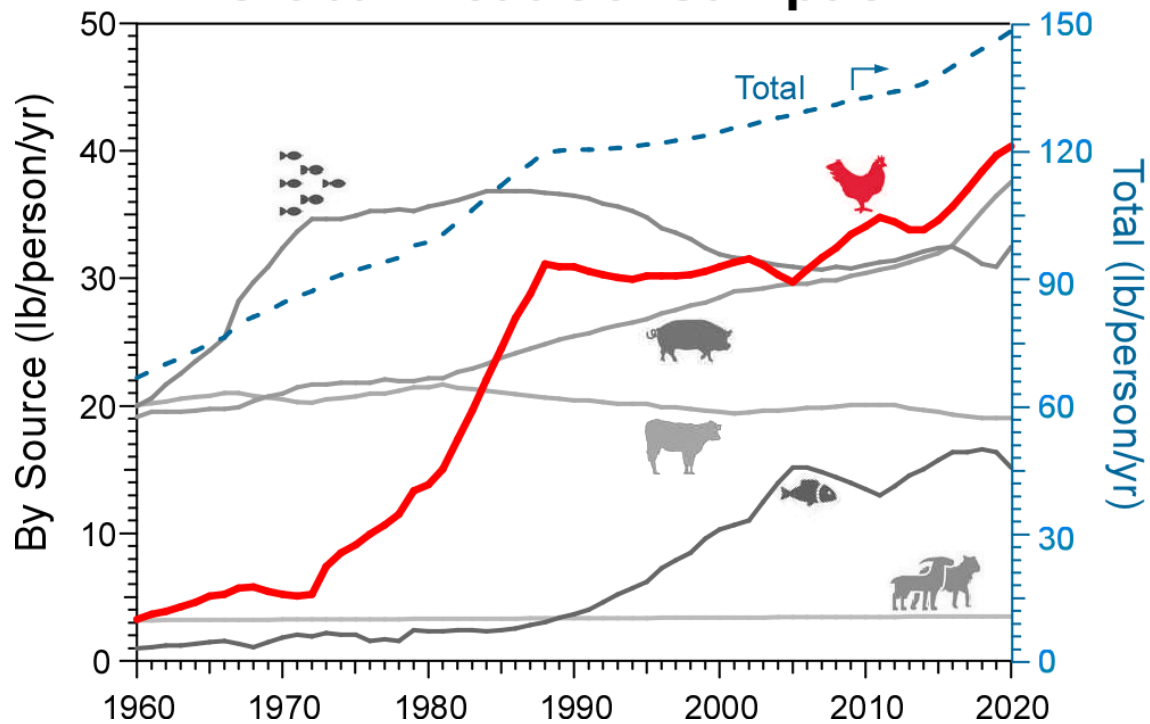


POULTRY

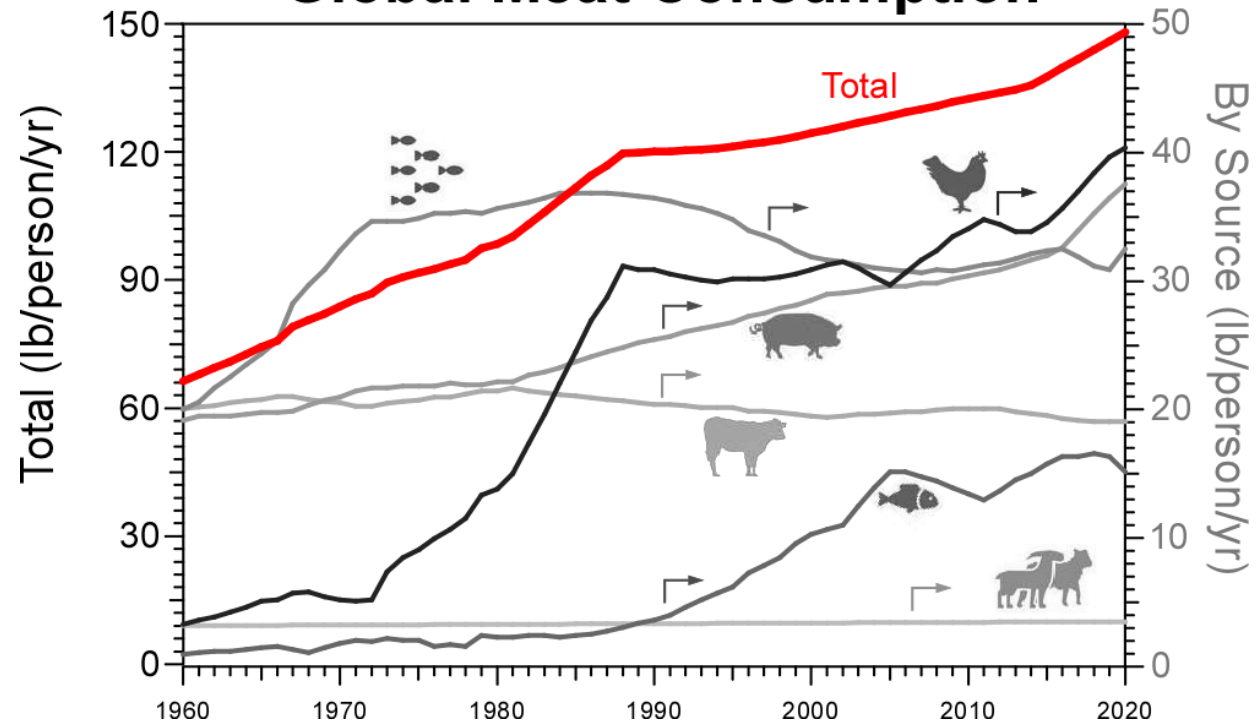
www.ethanolproducer.com/articles/16179/opportunities-in-high-protein-feed



Global Meat Consumption

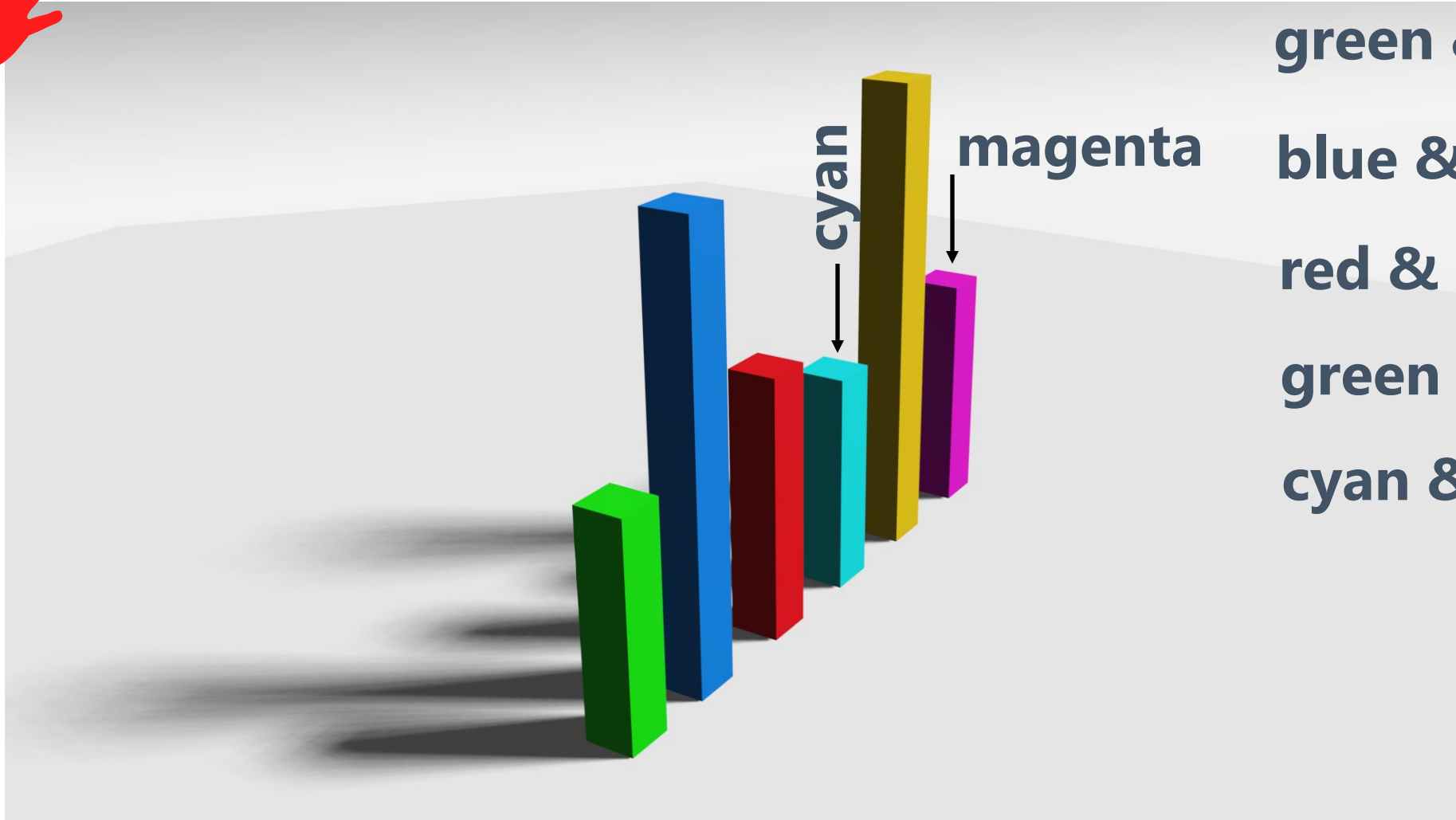


Global Meat Consumption





WHICH BARS ARE THE SAME HEIGHT?



green & red

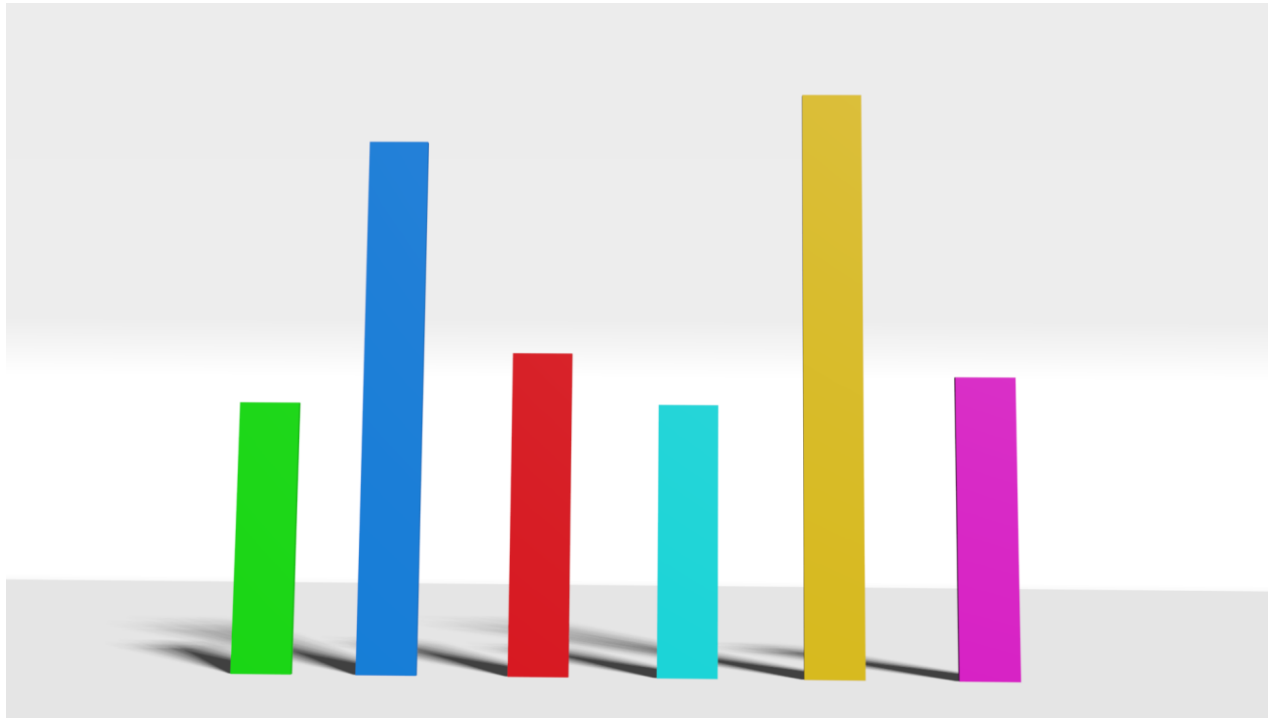
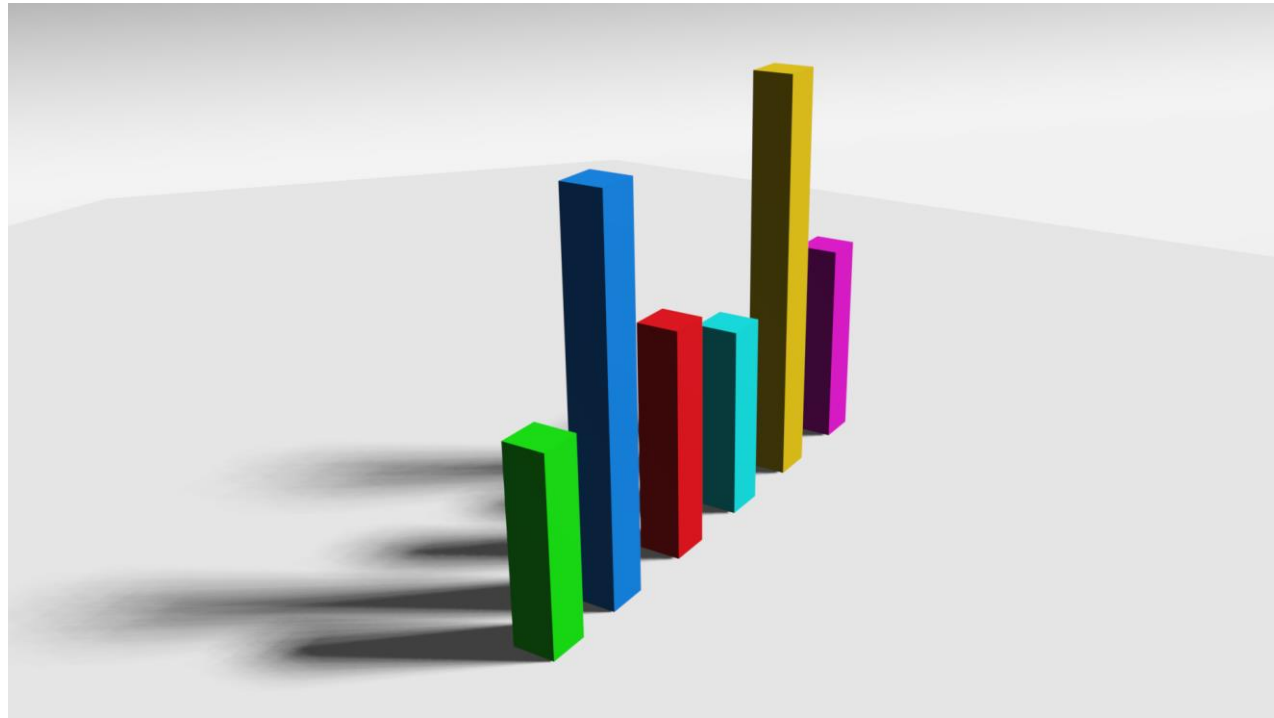
blue & yellow

red & magenta

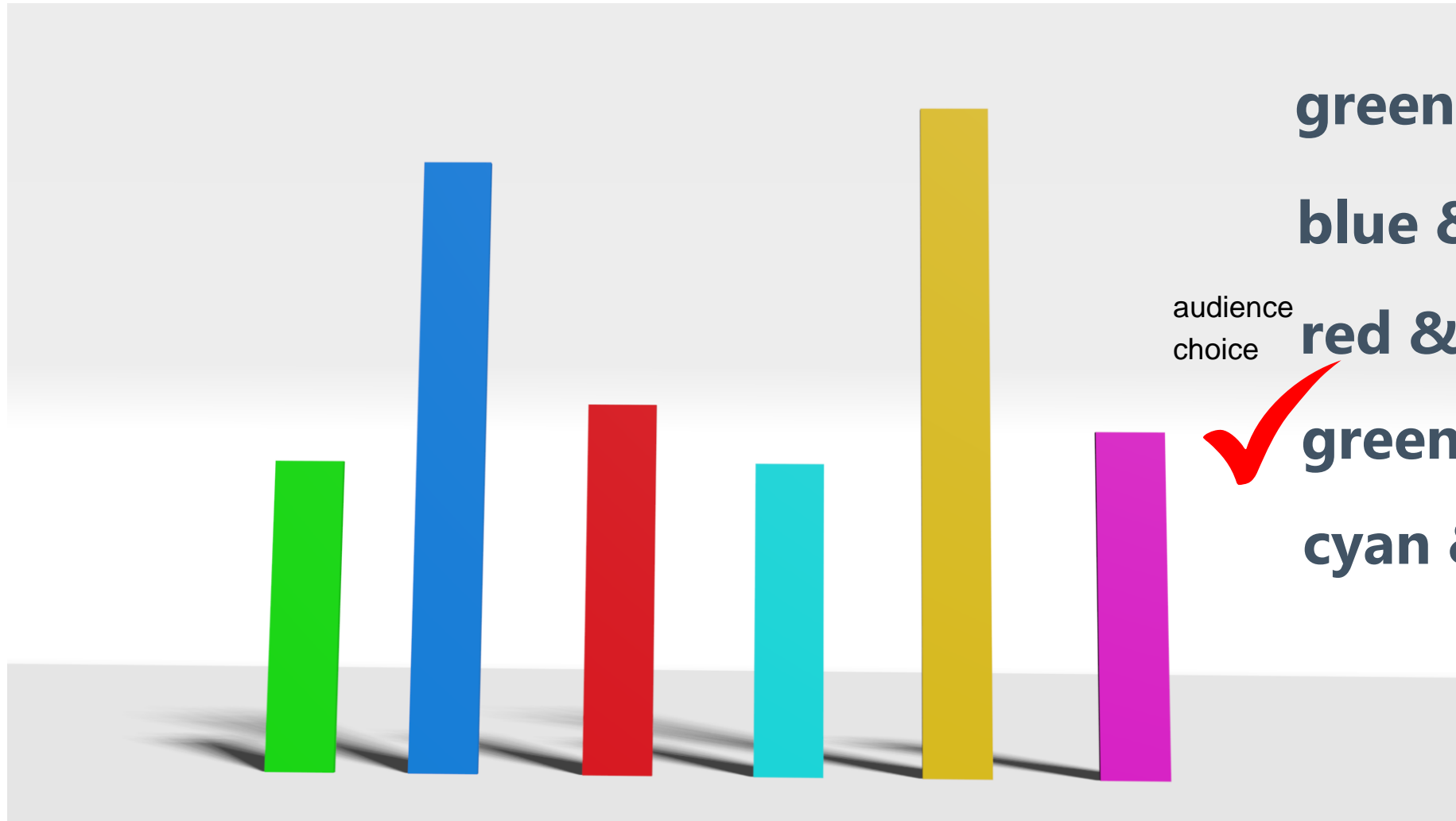
green & cyan

cyan & magenta

WHICH BARS ARE THE SAME HEIGHT?



WHICH BARS ARE THE SAME HEIGHT?



green & red

blue & yellow

audience
choice

red & magenta

green & cyan

cyan & magenta



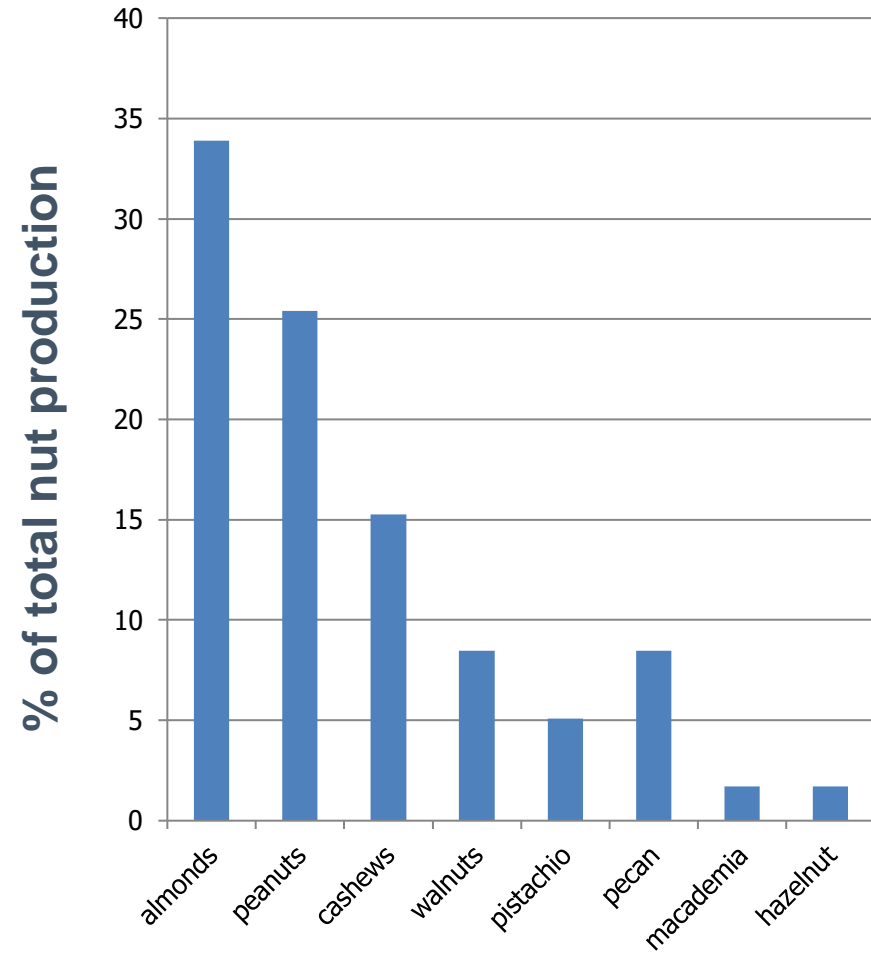
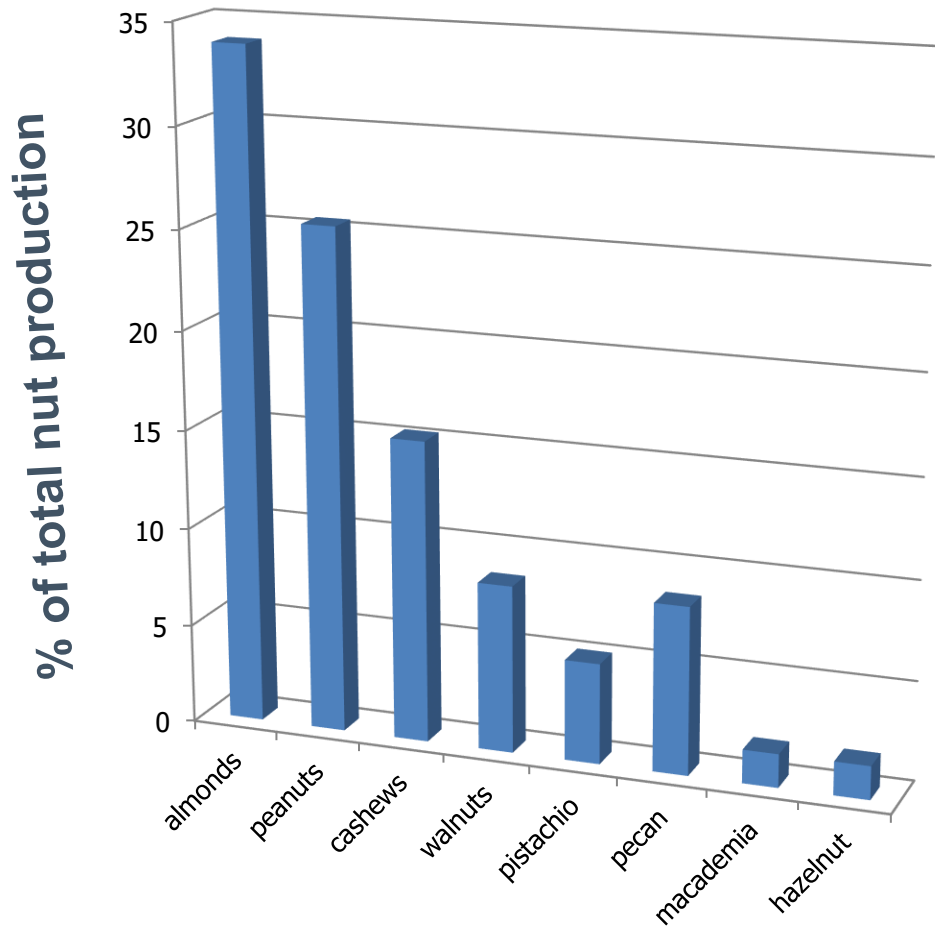


CHART JUNK

Median student debt of households headed by people 55-64 and owing student loans (all figures in 2016 dollars).

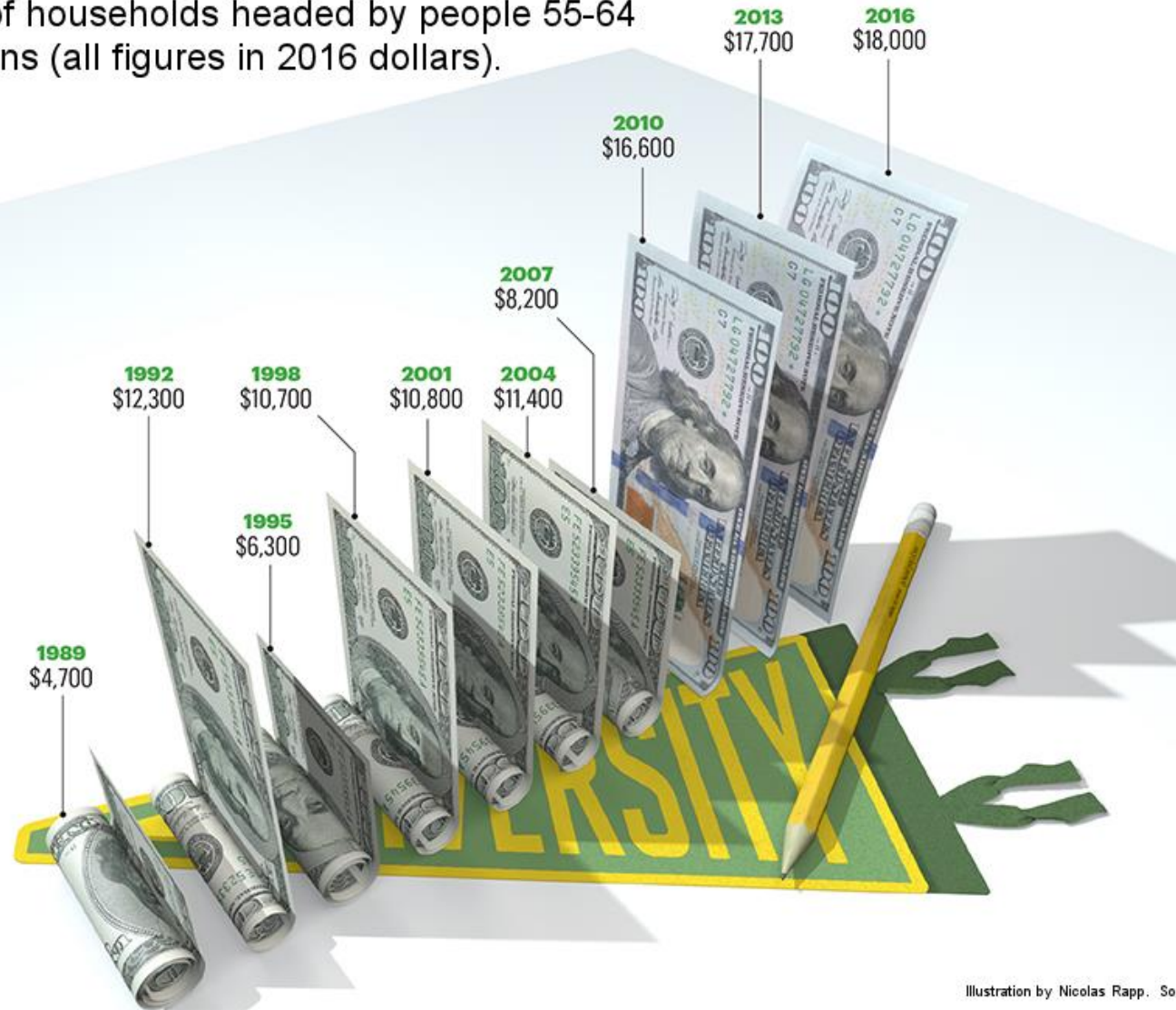
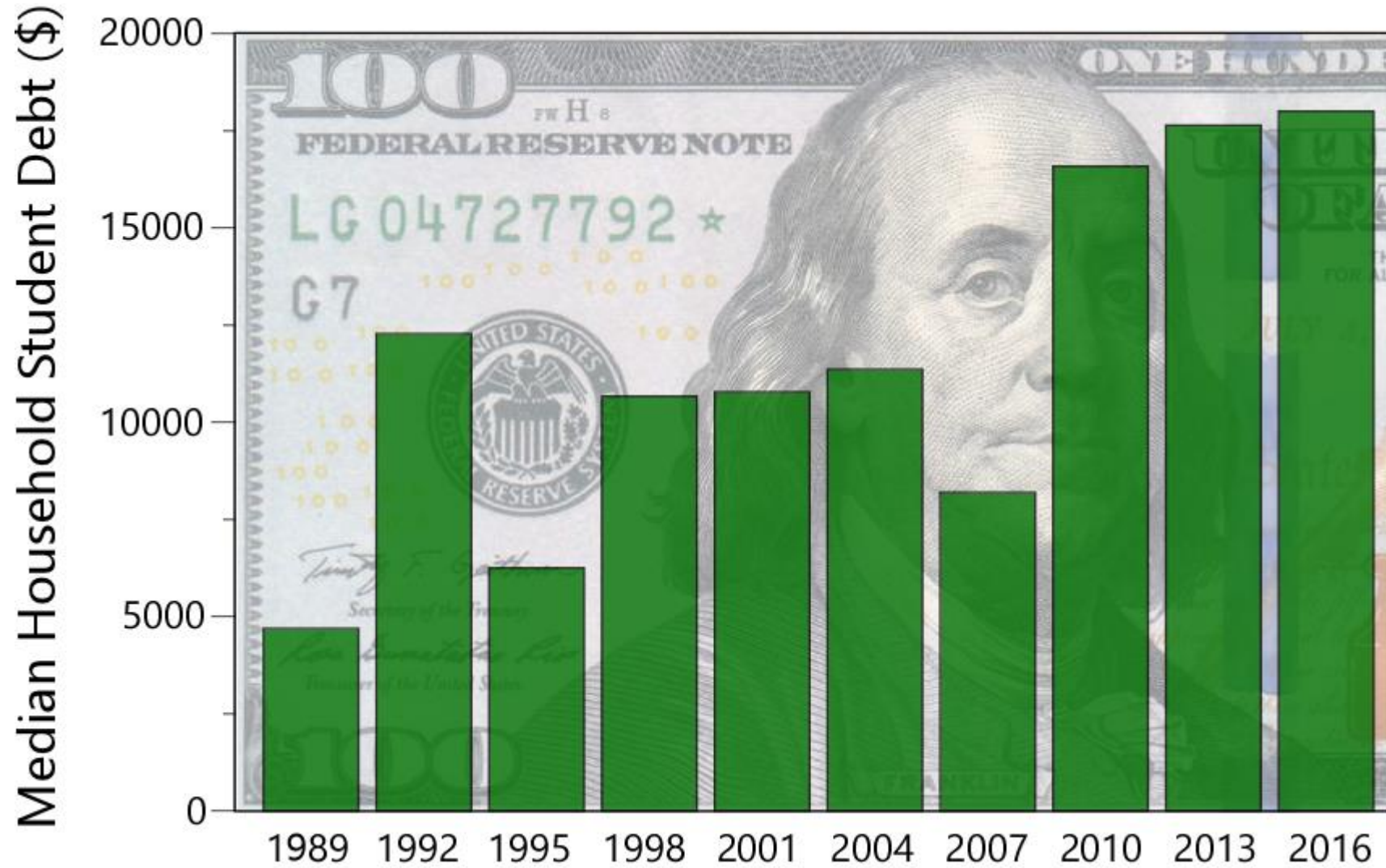
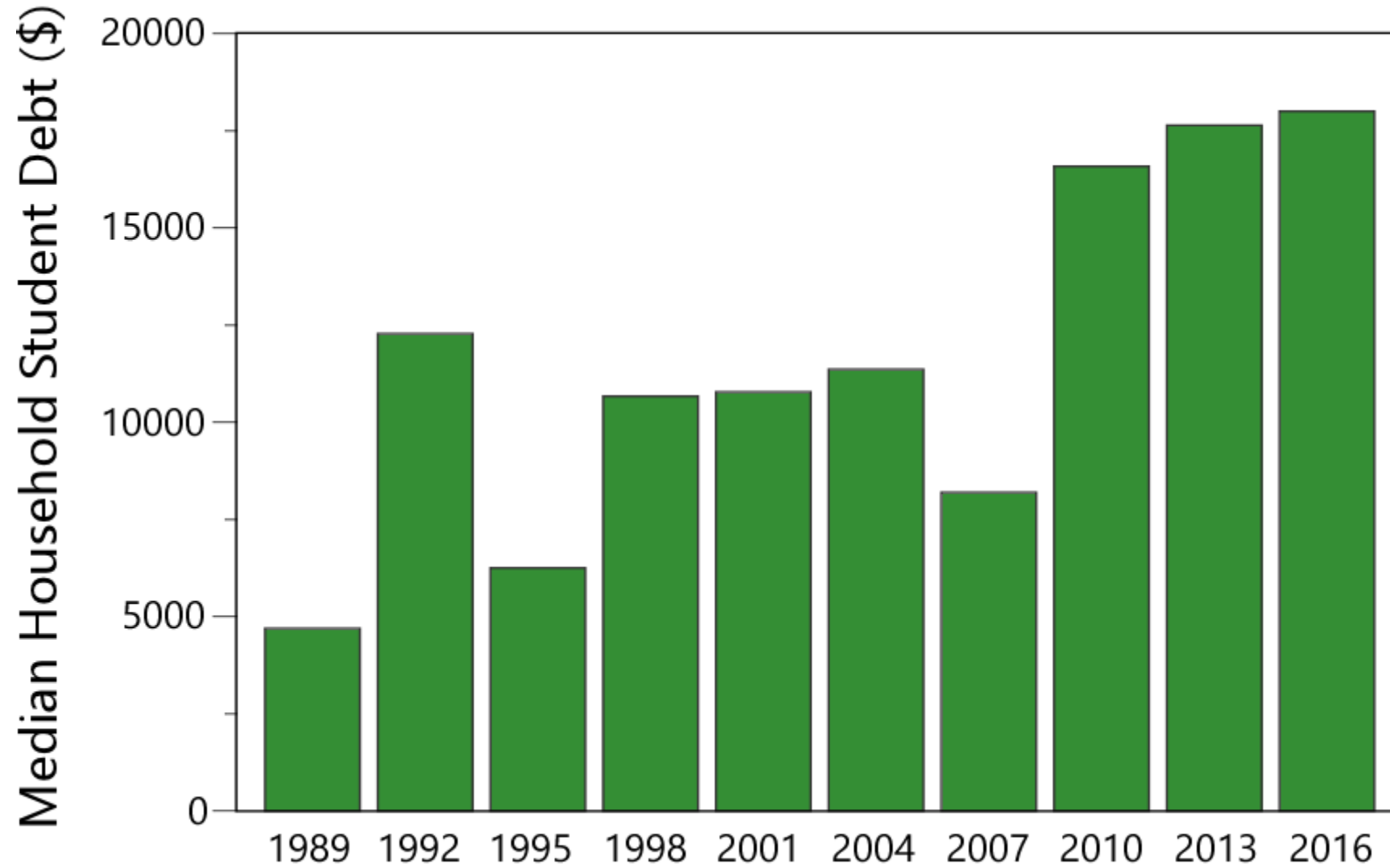


Illustration by Nicolas Rapp. Source: Federal Reserve Board

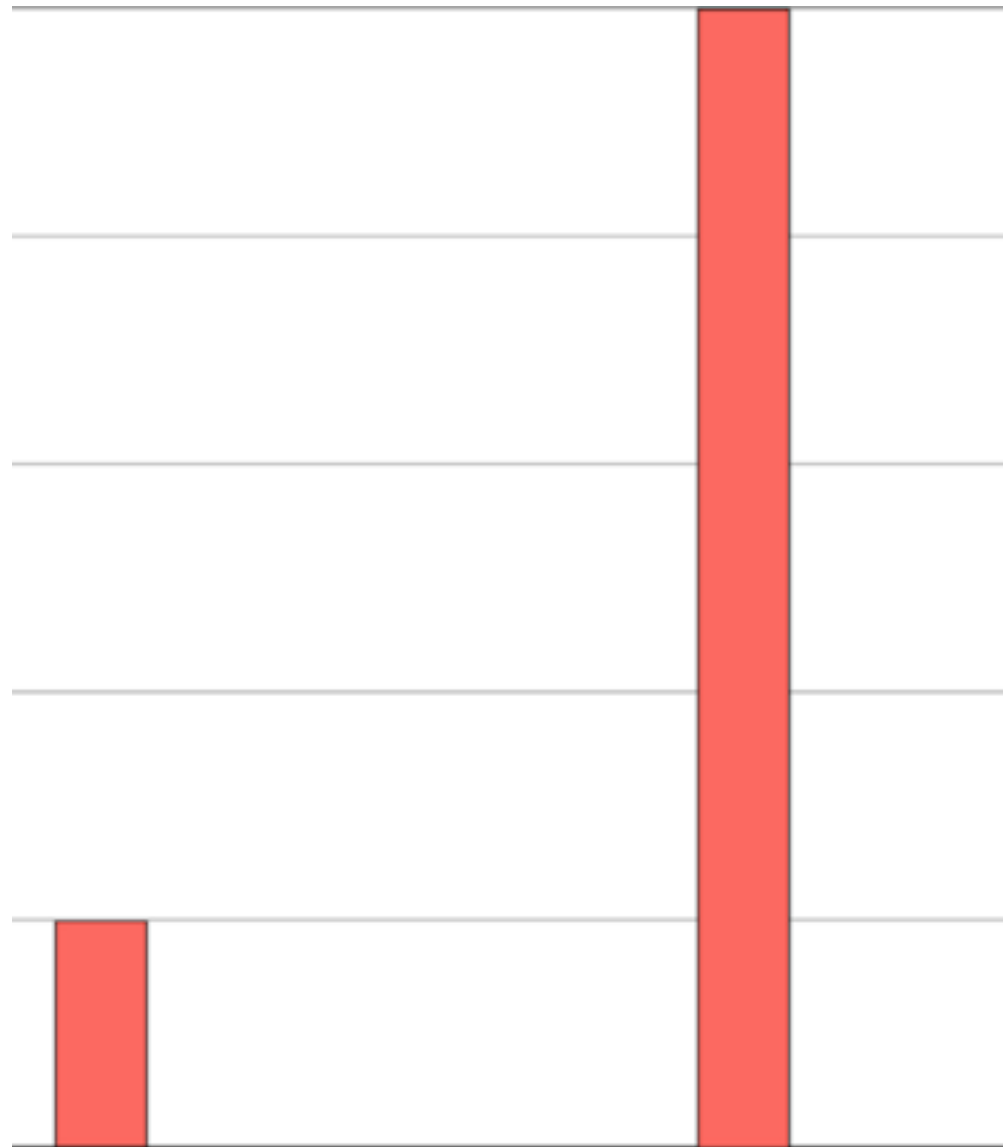
REMOVE THE JUNK



REMOVE THE JUNK



HOW MANY TIMES BIGGER?



4x 22 votes

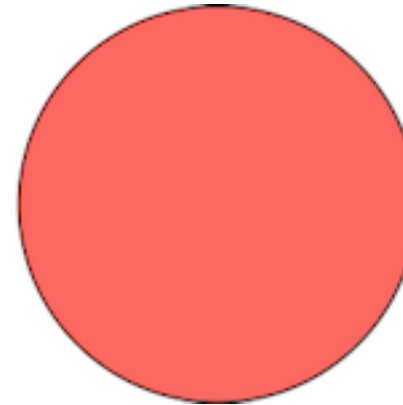
5x 56 votes

6x

7x



HOW MANY TIMES BIGGER?



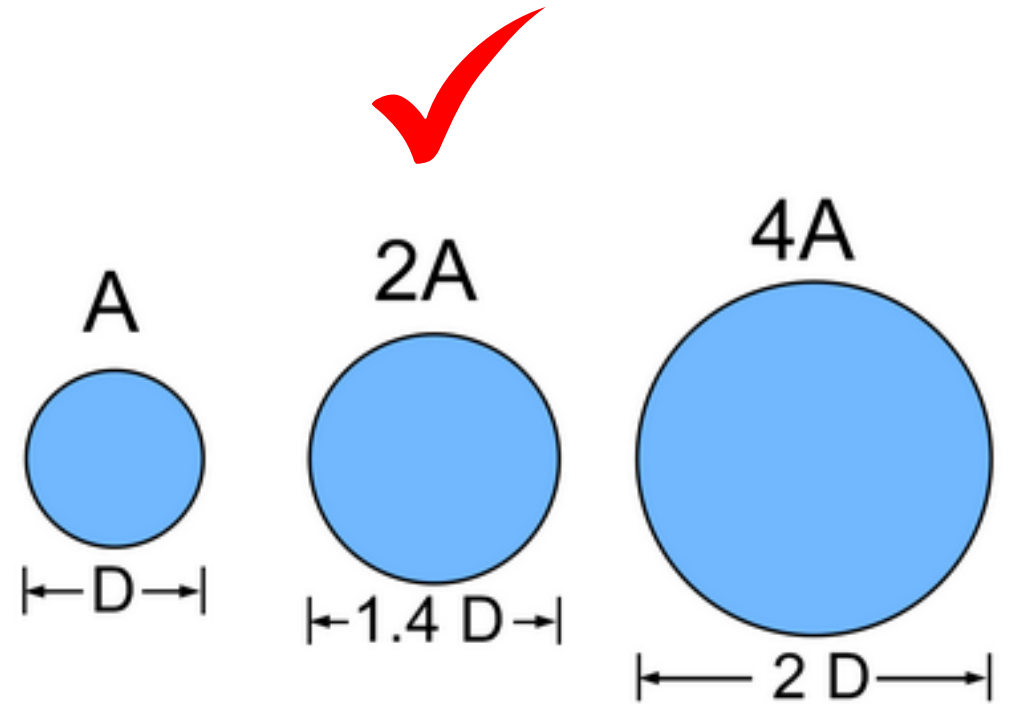
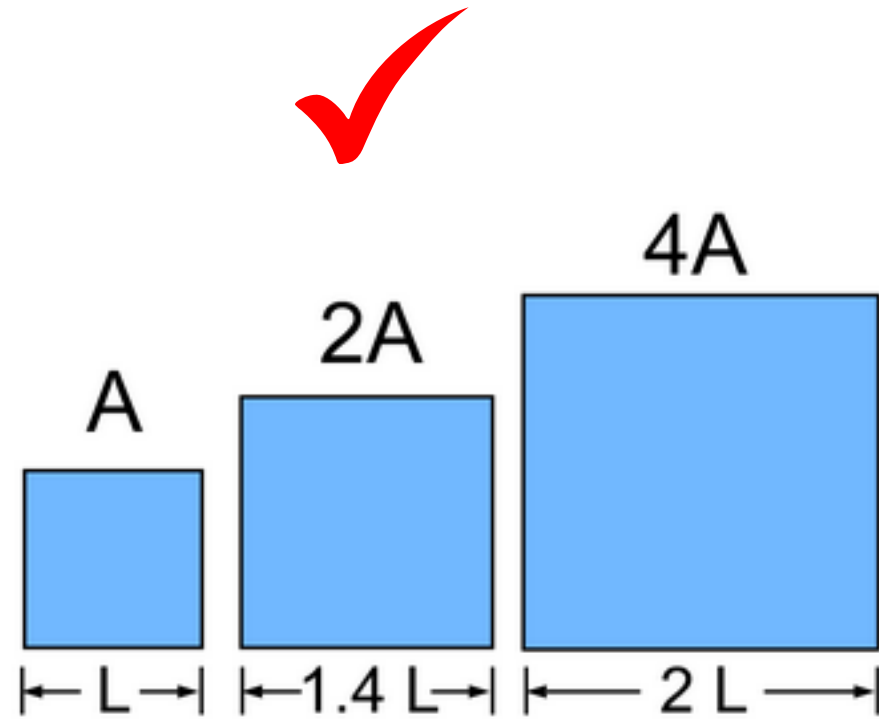
3x 22 votes

4x 26 votes

5x 15 votes

6x 24 votes

AREA CONFUSION



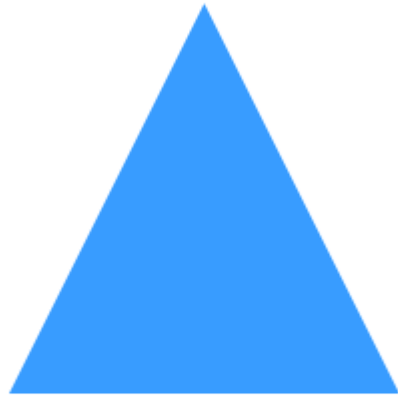
WHICH IS LARGEST?



left
rectangle



triangle



square



circle



right
rectangle

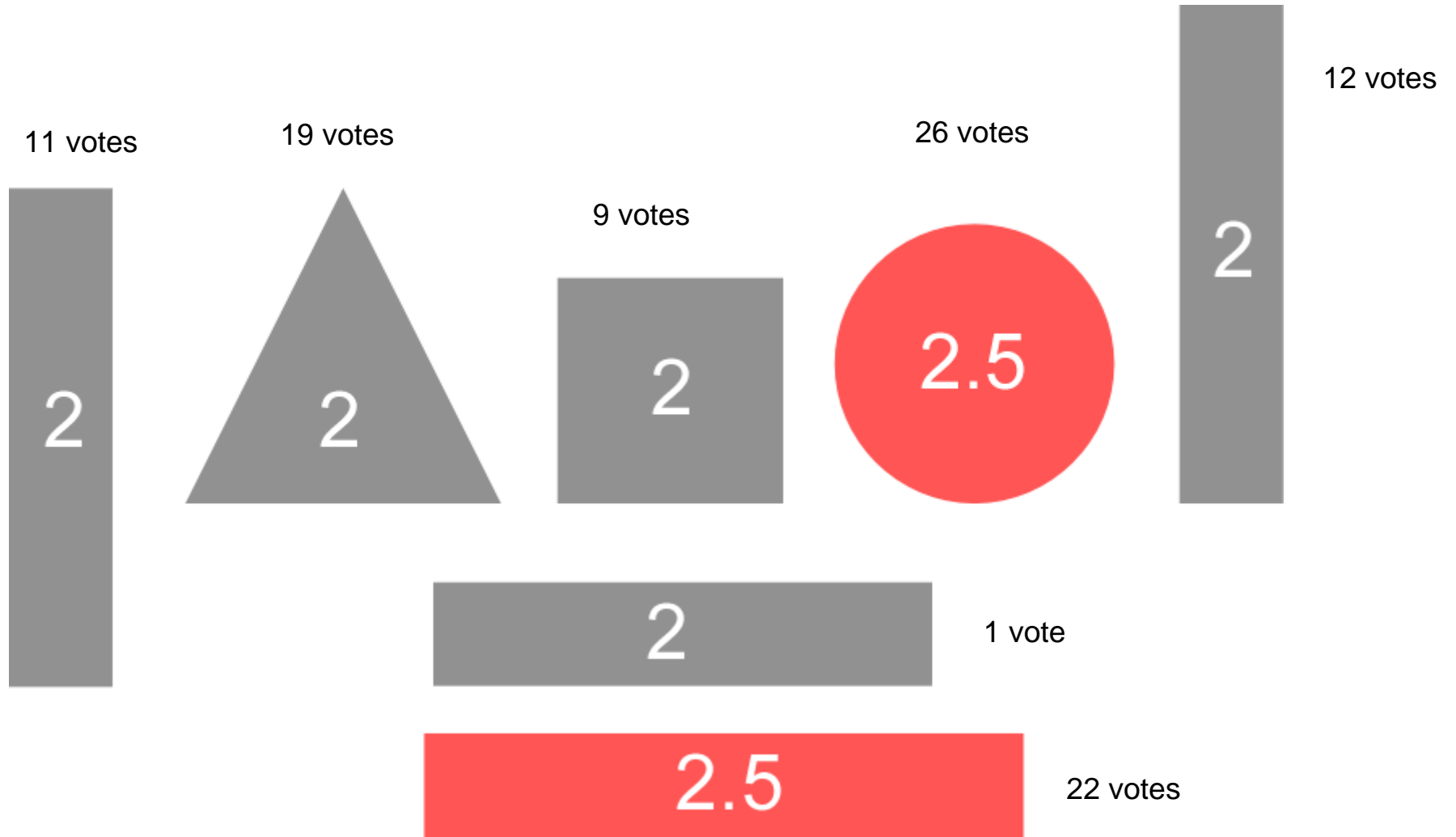


top
bar

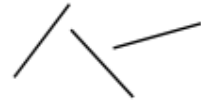
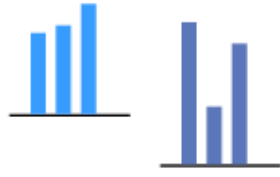


bottom
bar





HUMAN PERCEPTION



slope



volume



position
(aligned)



position
(unaligned)



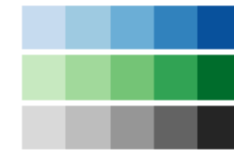
length



angle



area



color intensity



color hue

more
accurate

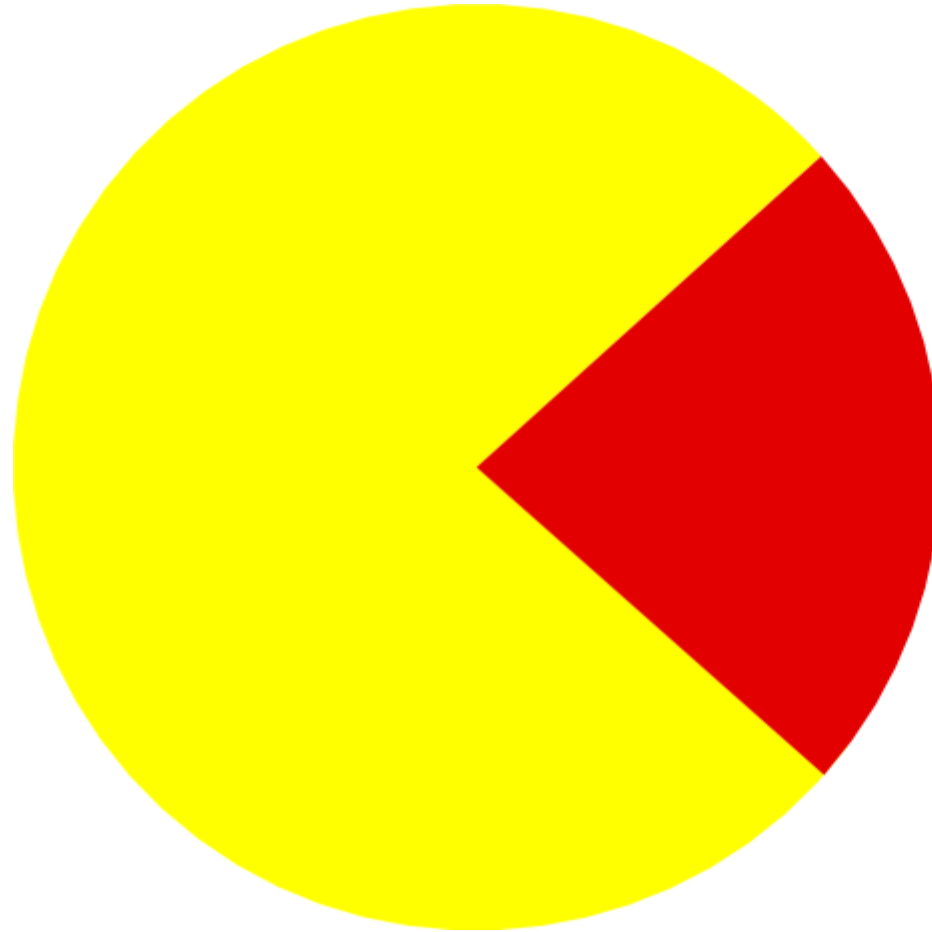
human perception

less
accurate

Cleveland, W.S. and McGill, R., 1984. Graphical perception: Theory, experimentation, and application to the development of graphical methods. *Journal of the American statistical association*, 79(387), pp.531-554.



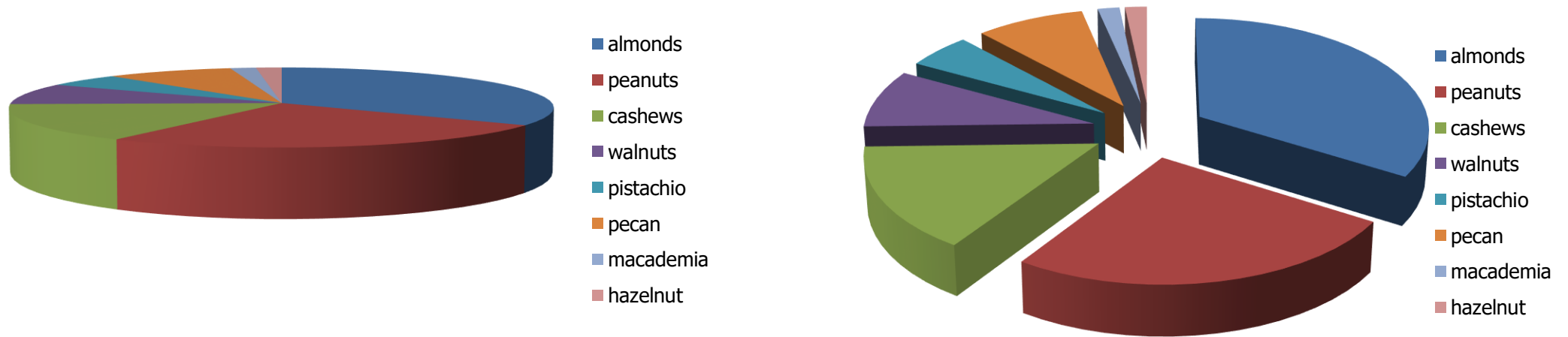
PIE CHARTS



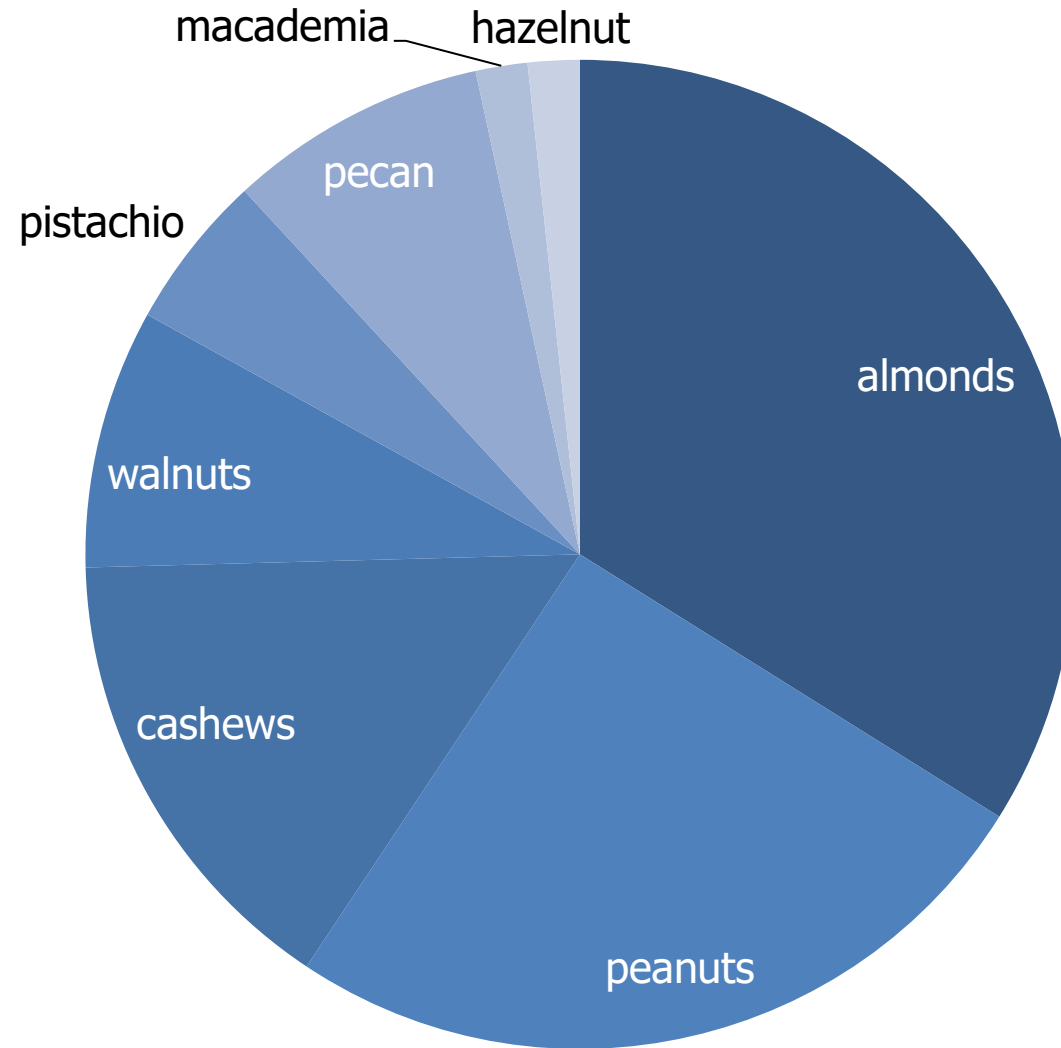
 doesn't look like Pacman

 looks like Pacman

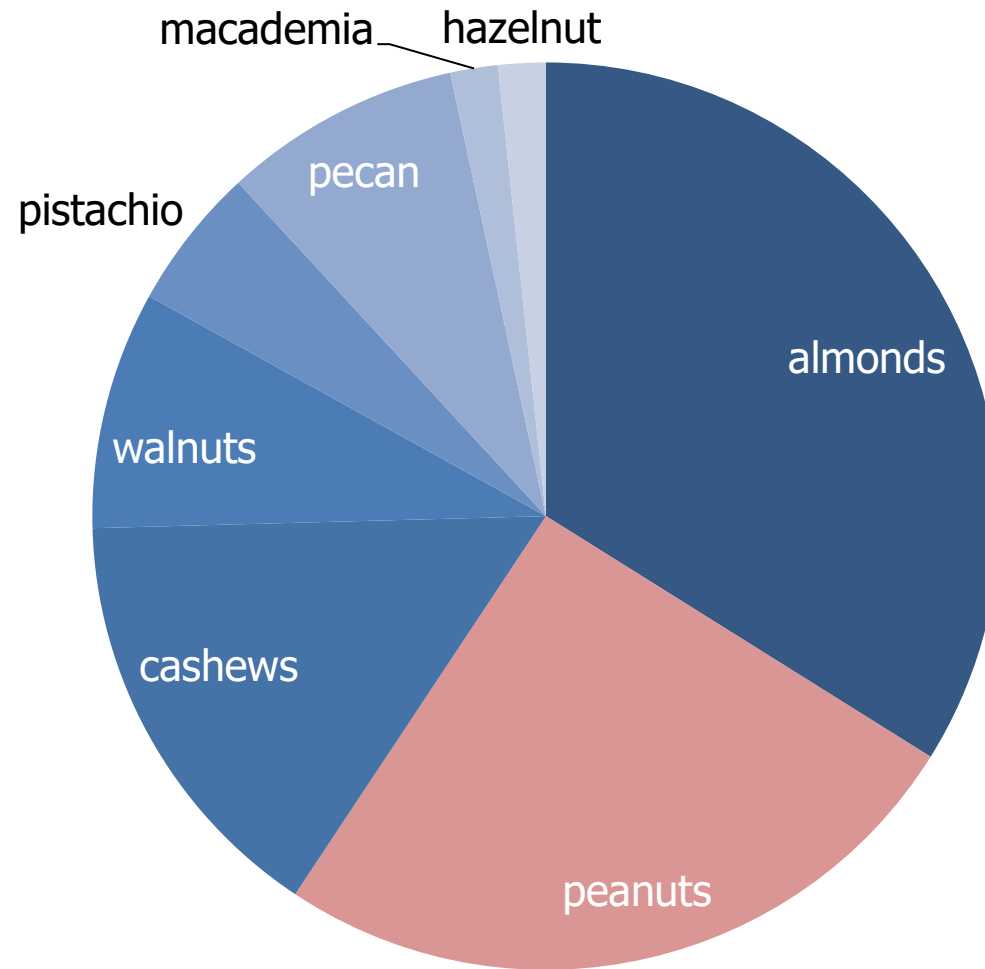
U.S. NUT PRODUCTION



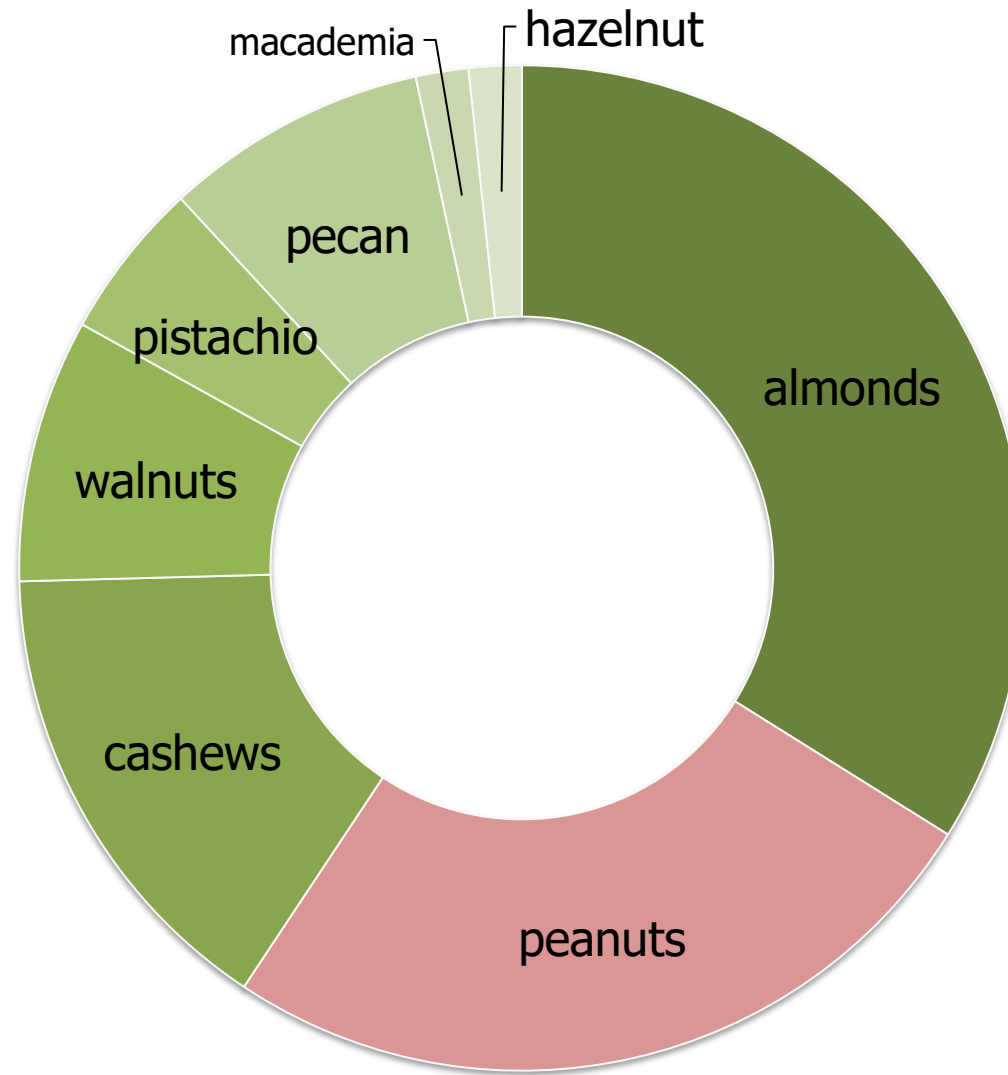
U.S. NUT PRODUCTION



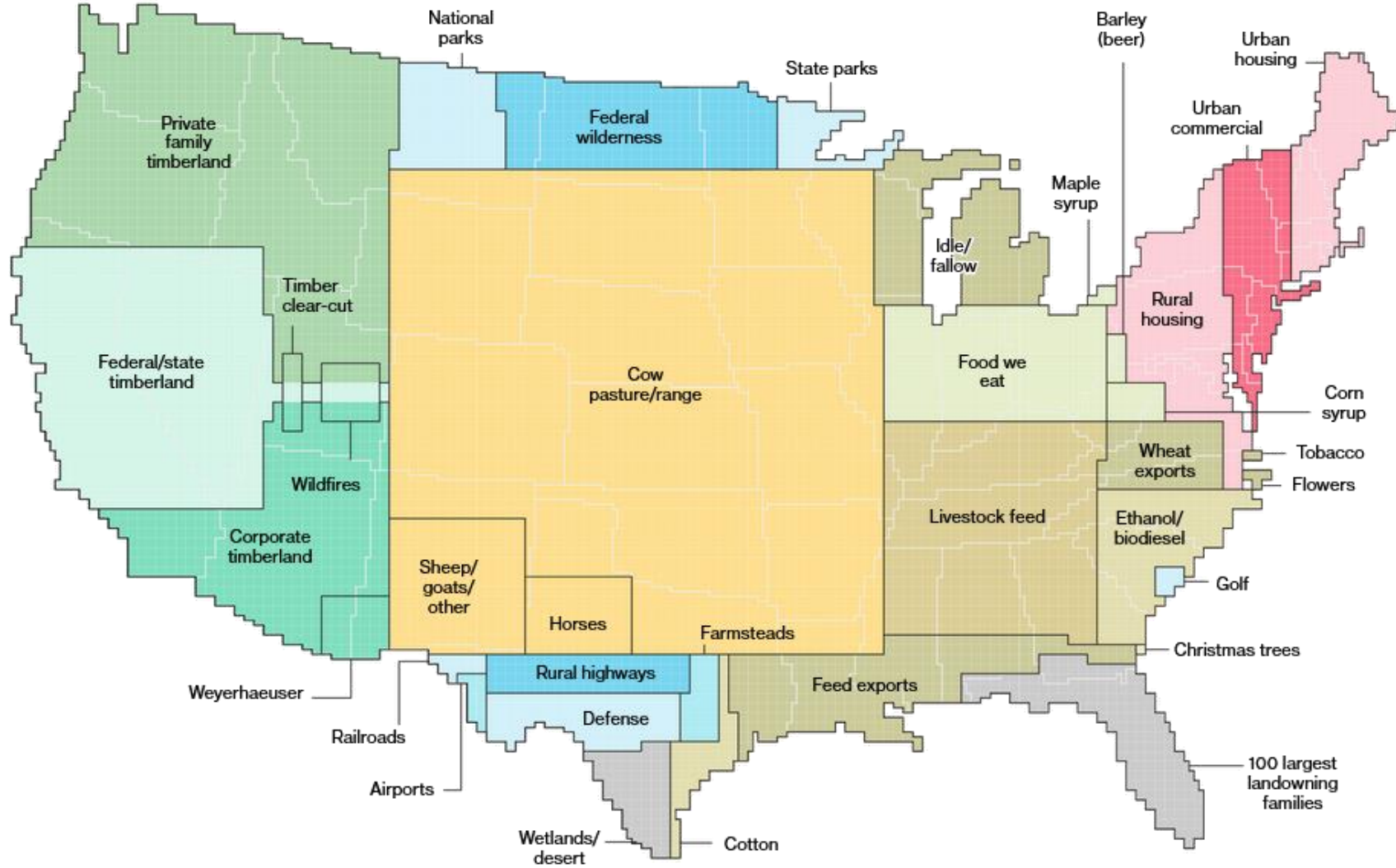
U.S. NUT PRODUCTION



U.S. NUT PRODUCTION

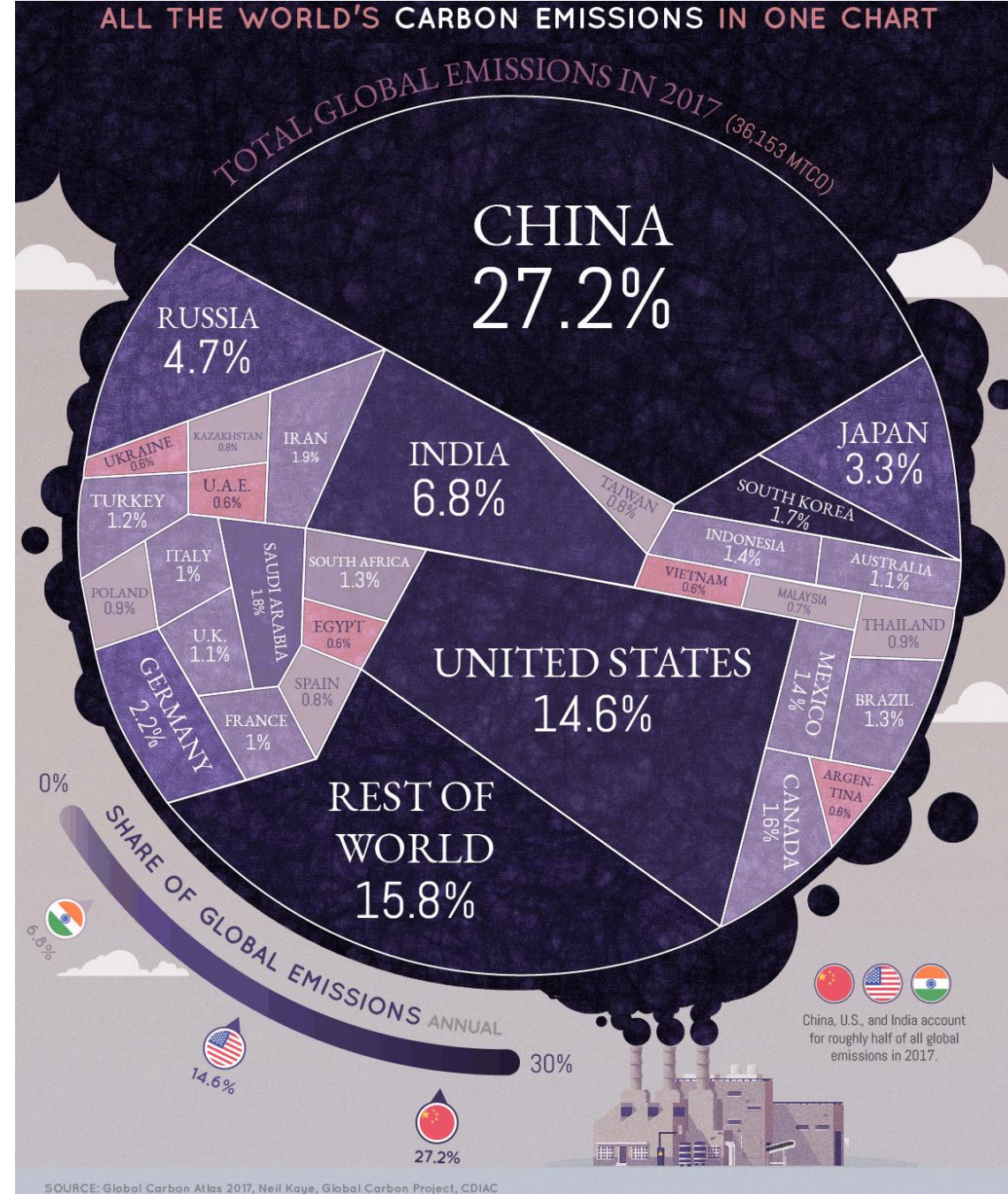


U.S. LAND USE



www.bloomberg.com/graphics/2018-us-land-use/

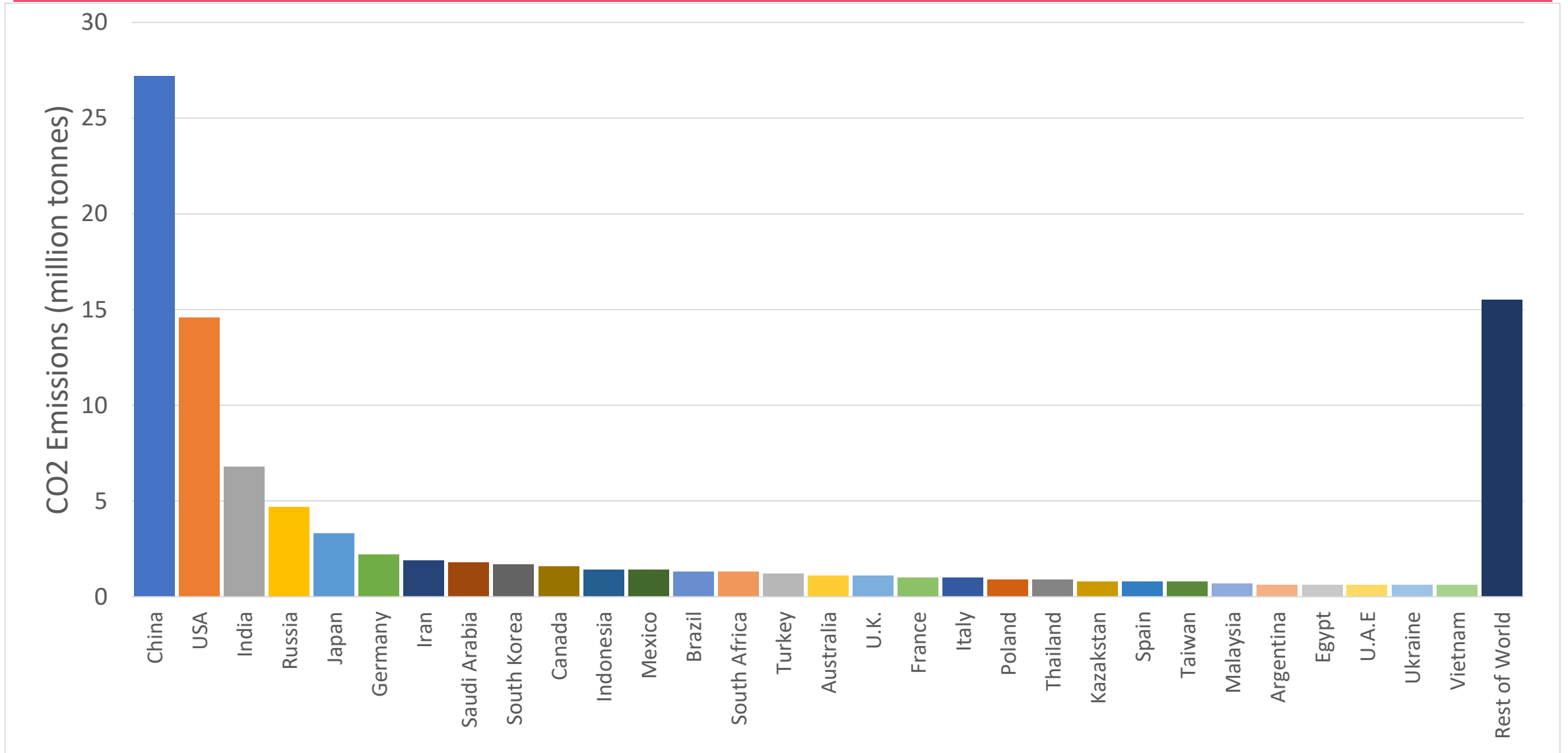




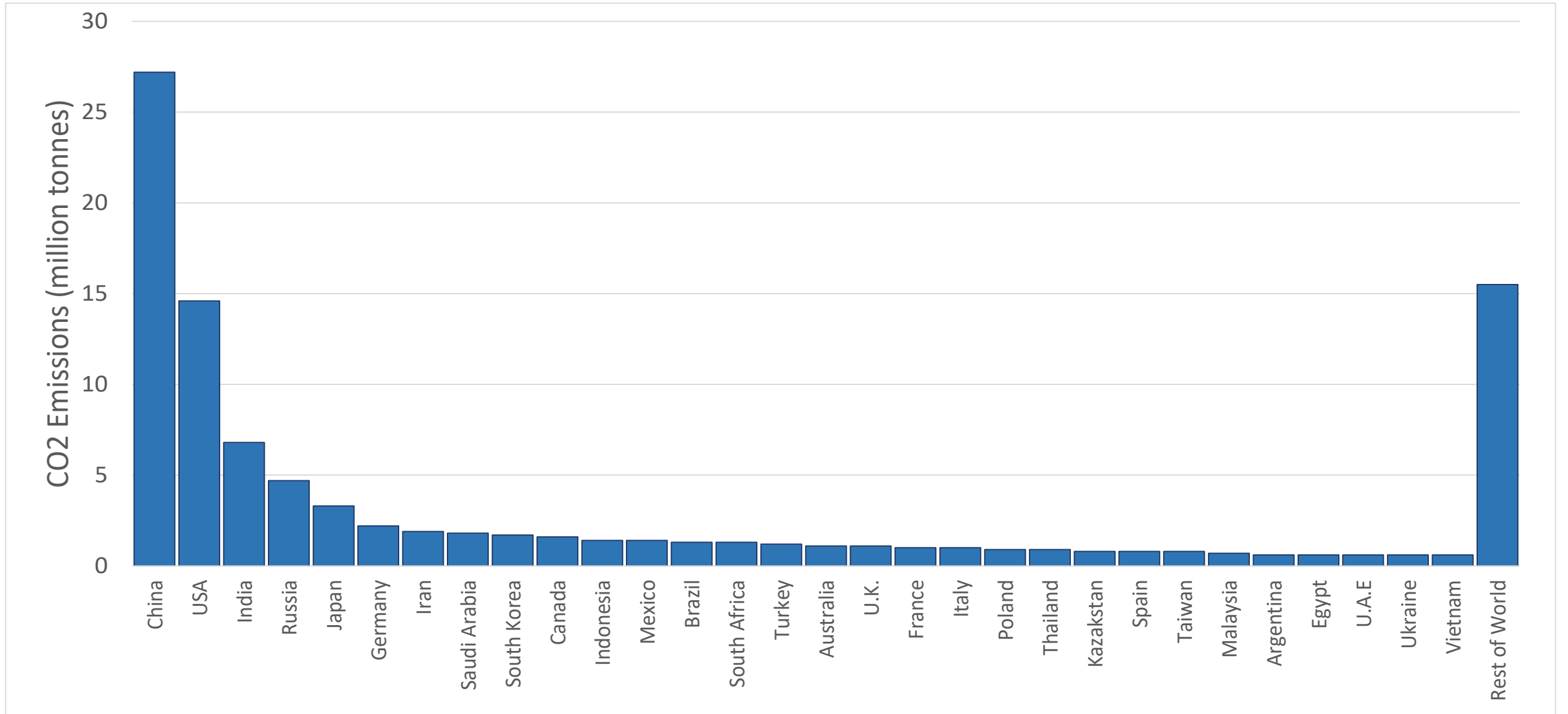
Voronoi Treemap in an irregular shaped container



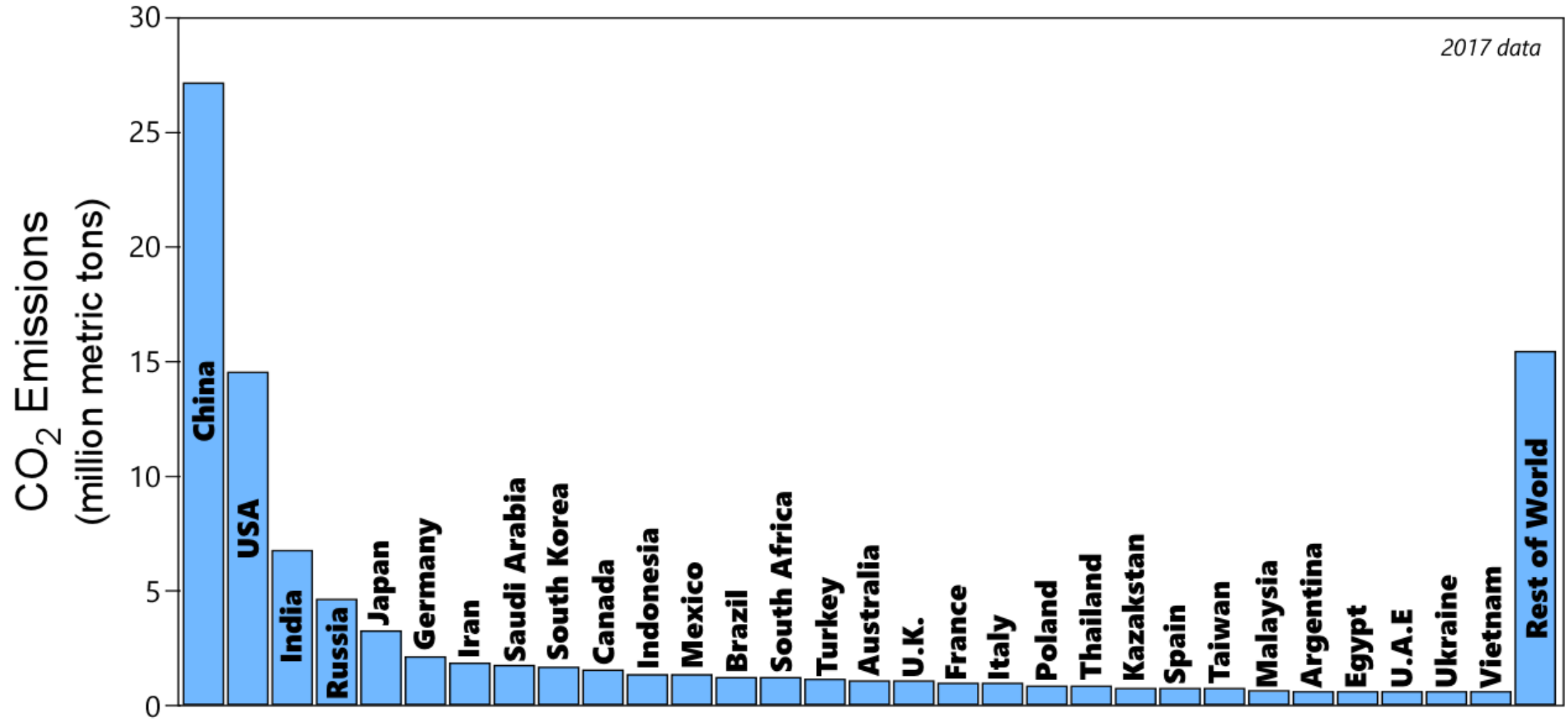
CARBON EMISSIONS



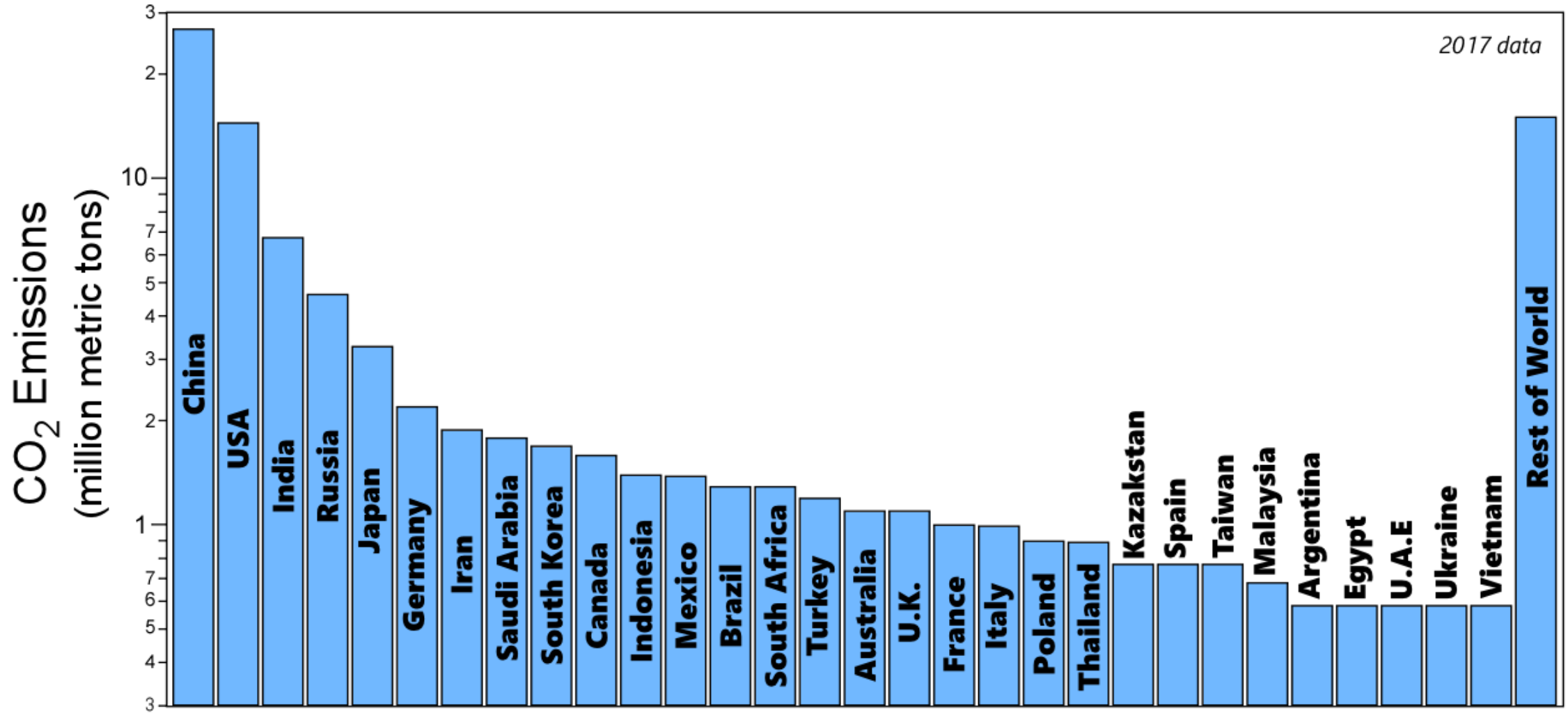
CARBON EMISSIONS



CARBON EMISSIONS

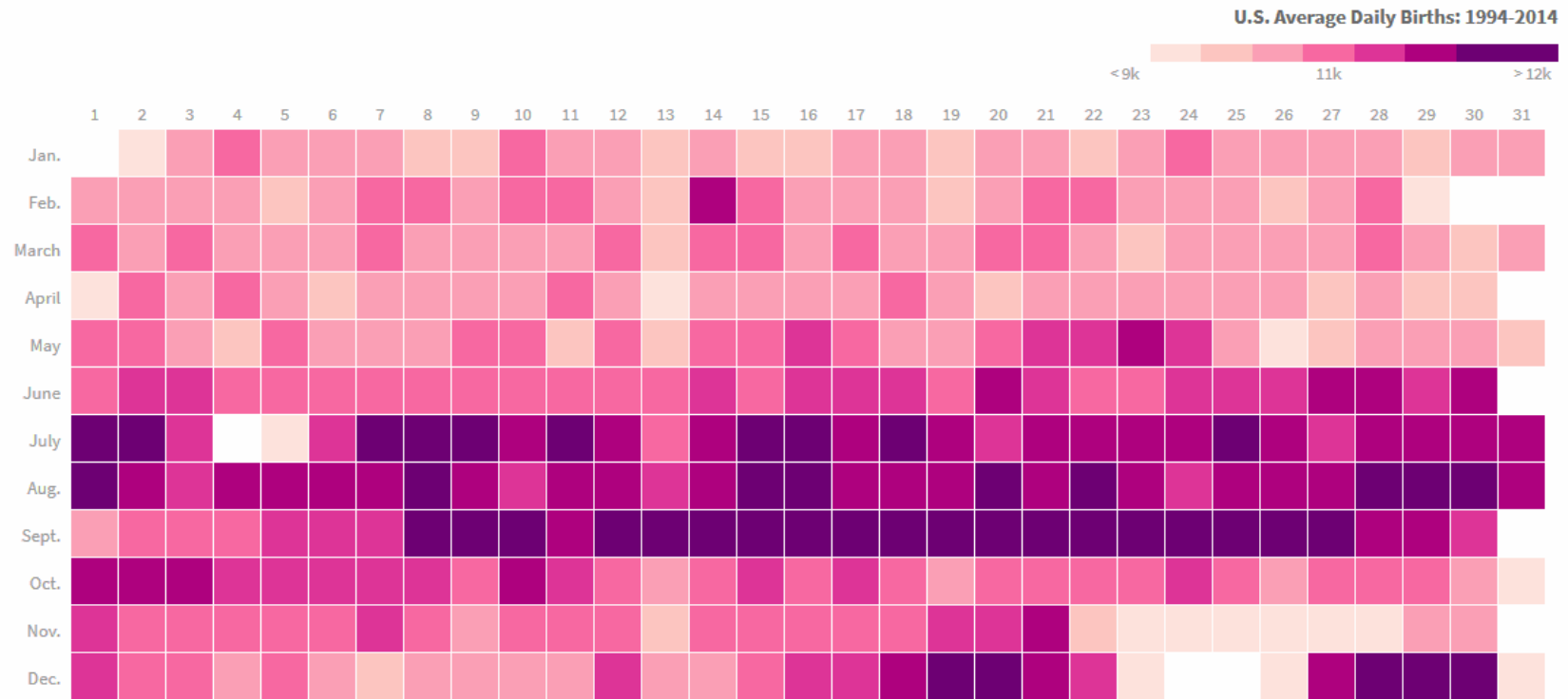


CARBON EMISSIONS



HOW POPULAR IS YOUR BIRTHDAY?

Two decades of American birthdays, averaged by month and day.



Notes: The conception date, purely for illustration, is 266 days prior to birth. It represents a hypothetical "moment of conception" based on the normal gestation period for humans, 280 days, minus the average time for ovulation, two weeks.

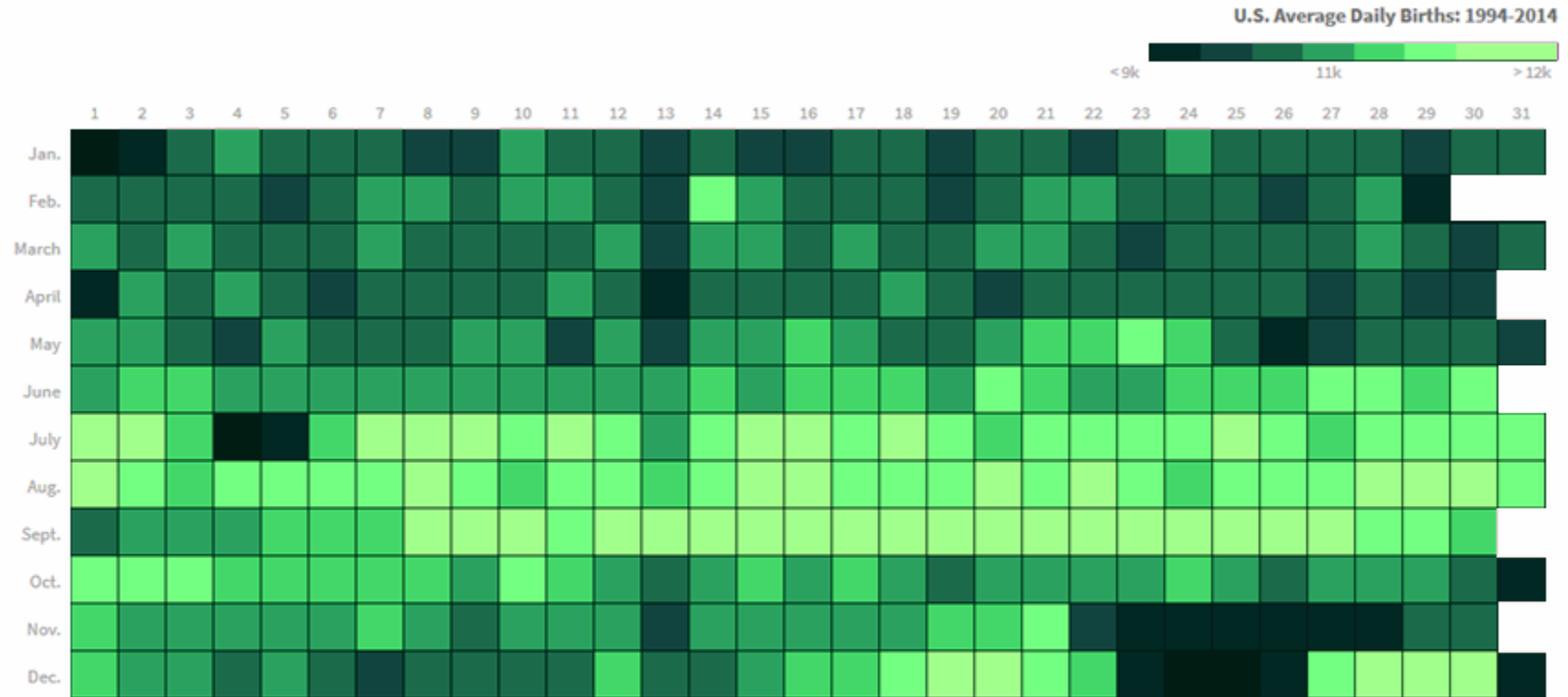
Data: U.S. National Center for Health Statistics (1994-2003); U.S. Social Security Administration (2004-2014) — via FiveThirtyEight

Credit: Matt Stiles/The Daily Viz



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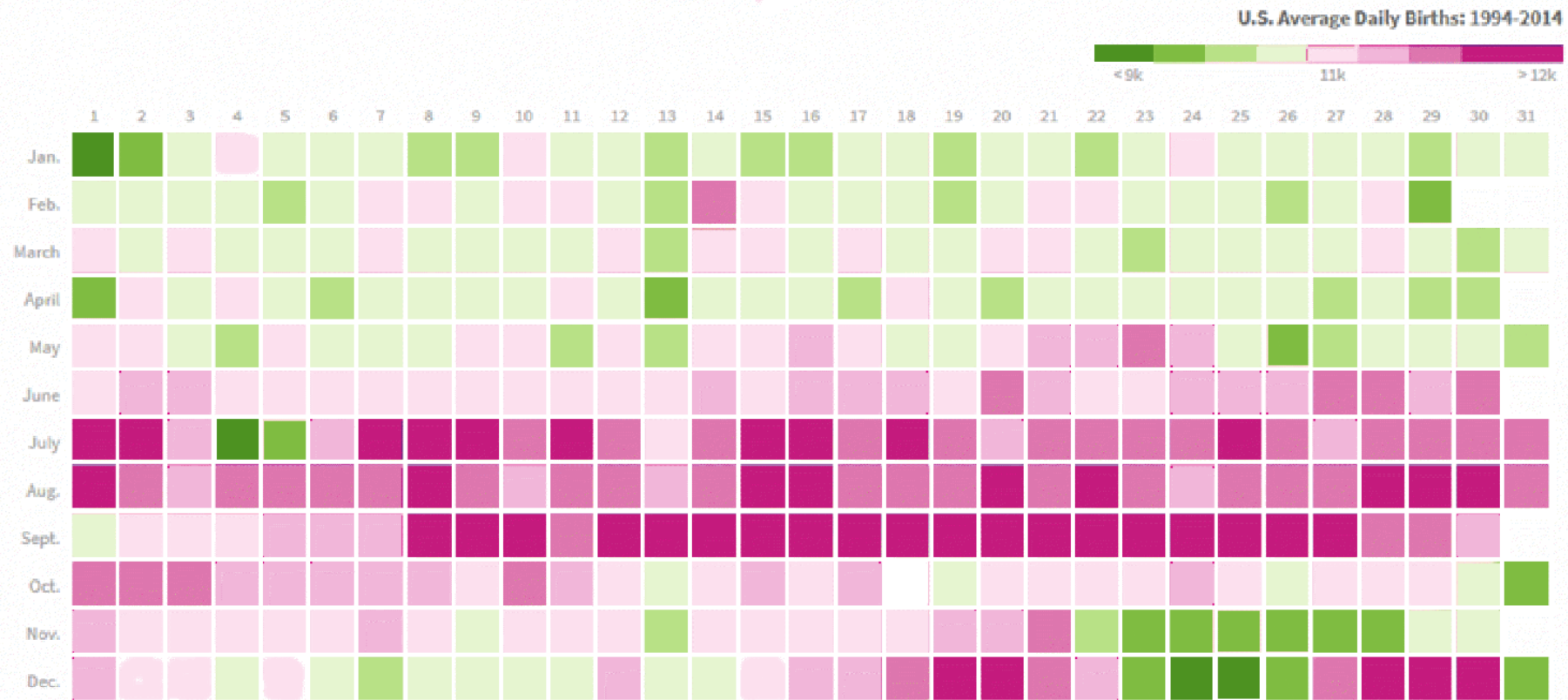
Data: U.S. National Center for Health Statistics (1994-2003); U.S. Social Security Administration (2004-2014) — via [FiveThirtyEight](#)

Credit: [Matt Stiles/The Daily Viz](#)



HOW POPULAR IS YOUR BIRTHDAY?

Two decades of American birthdays, averaged by month and day.



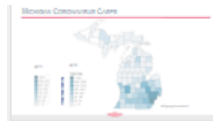
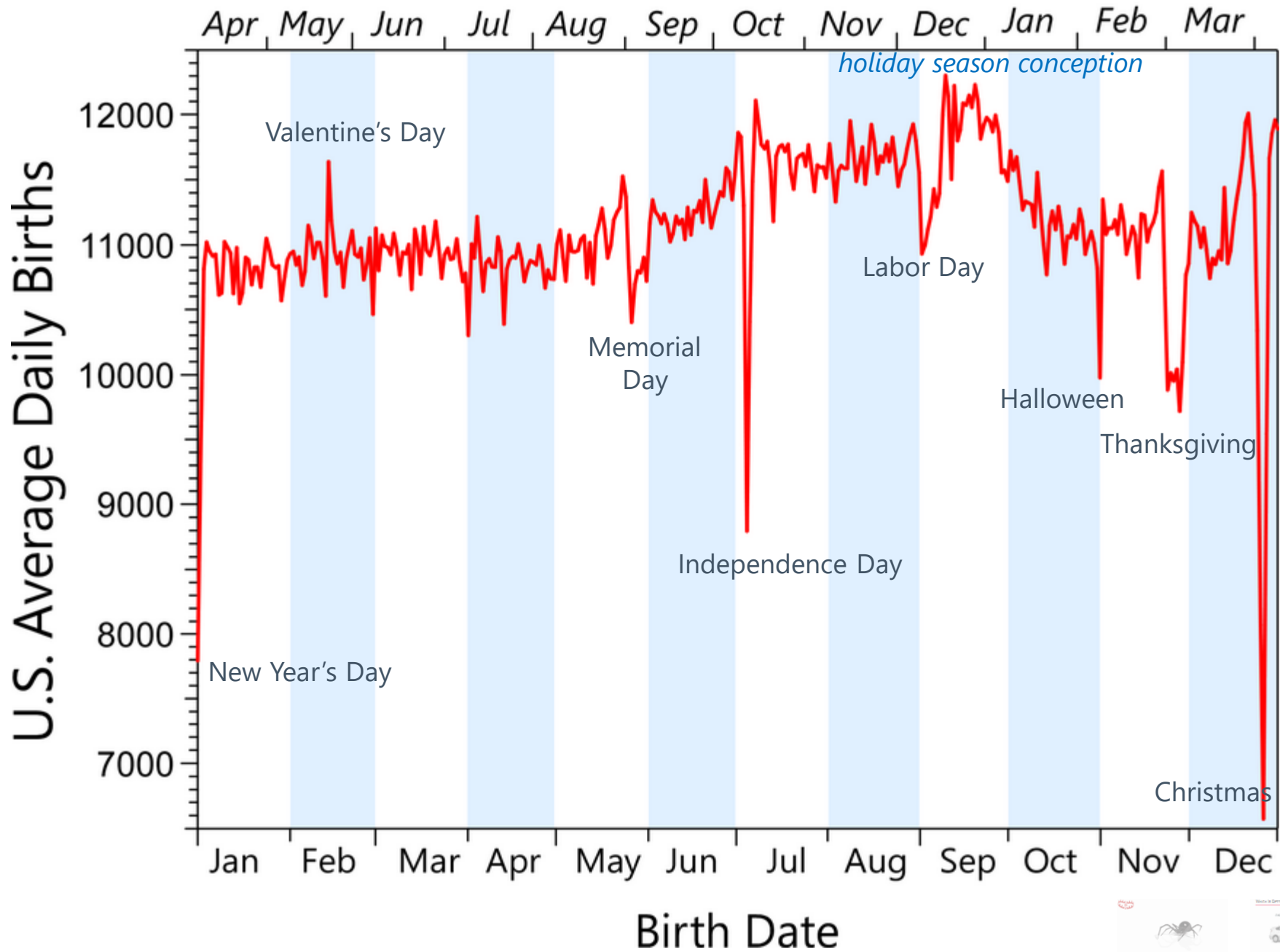
Notes: The conception date, purely for illustration, is 266 days prior to birth. It represents a hypothetical "moment of conception" based on the normal gestation period for humans, 280 days, minus the average time for ovulation, two weeks.

Data: U.S. National Center for Health Statistics (1994-2003); U.S. Social Security Administration (2004-2014) — via [FiveThirtyEight](#)

Credit: [Matt Stiles/The Daily Viz](#)

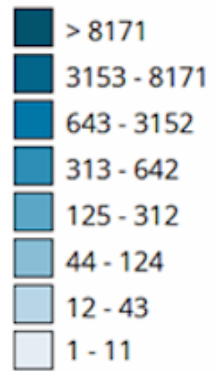


Approximate Conception Date



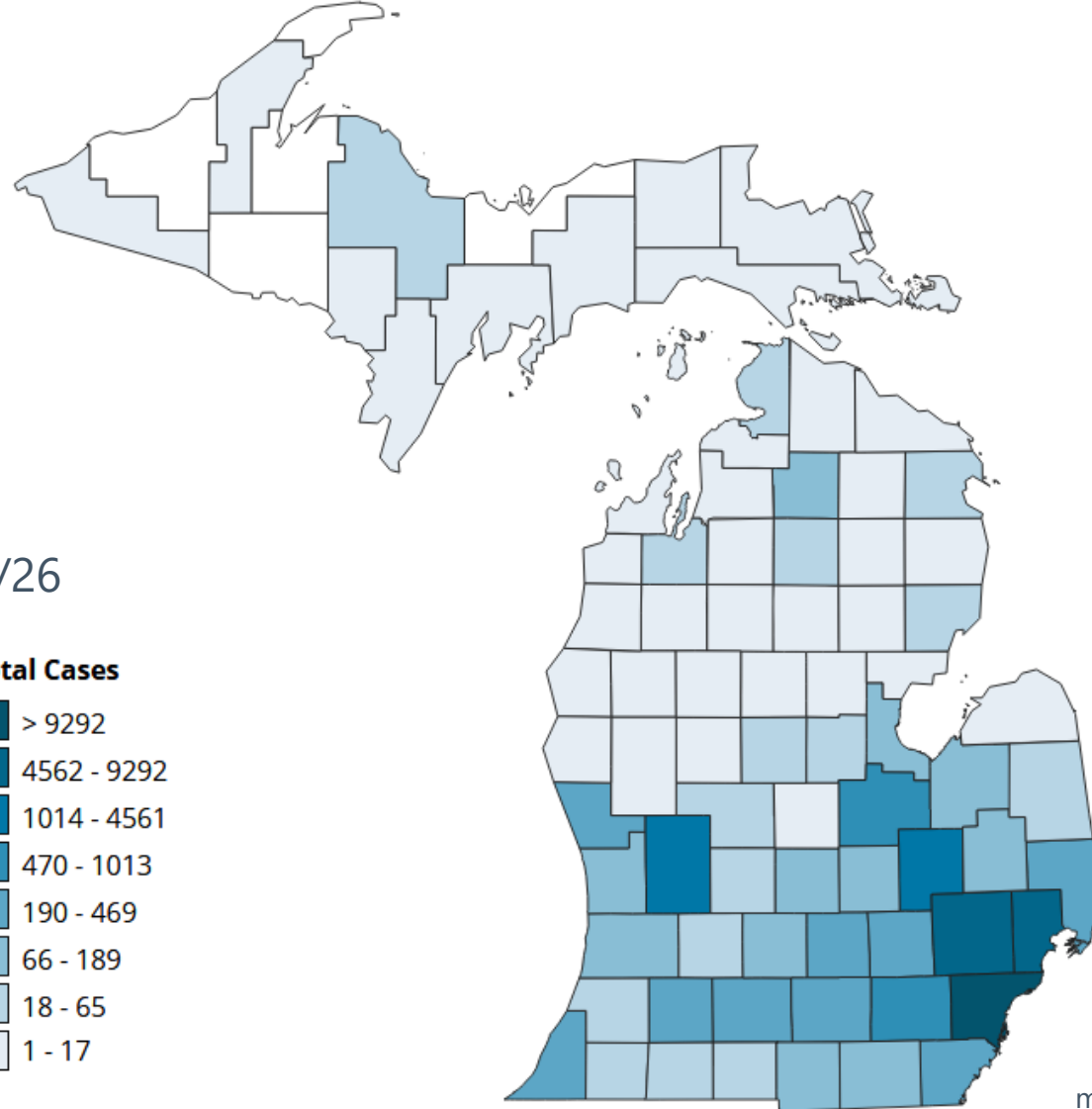
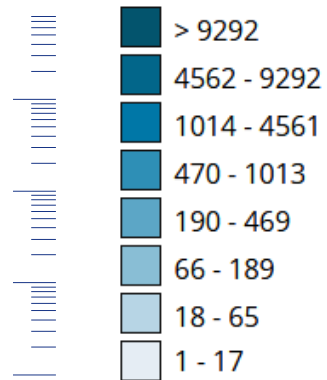
MICHIGAN CORONAVIRUS CASES

4/23



4/26

Total Cases



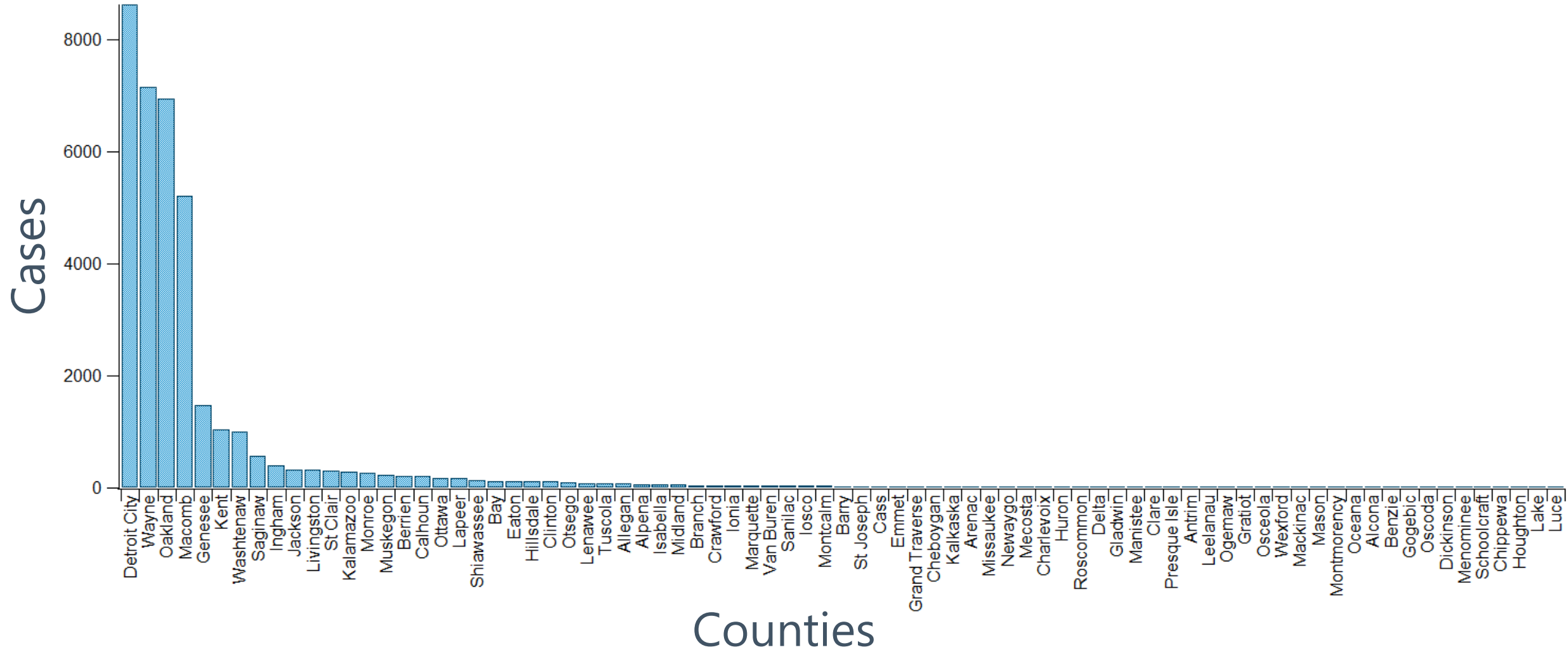
michigan.gov/coronavirus/



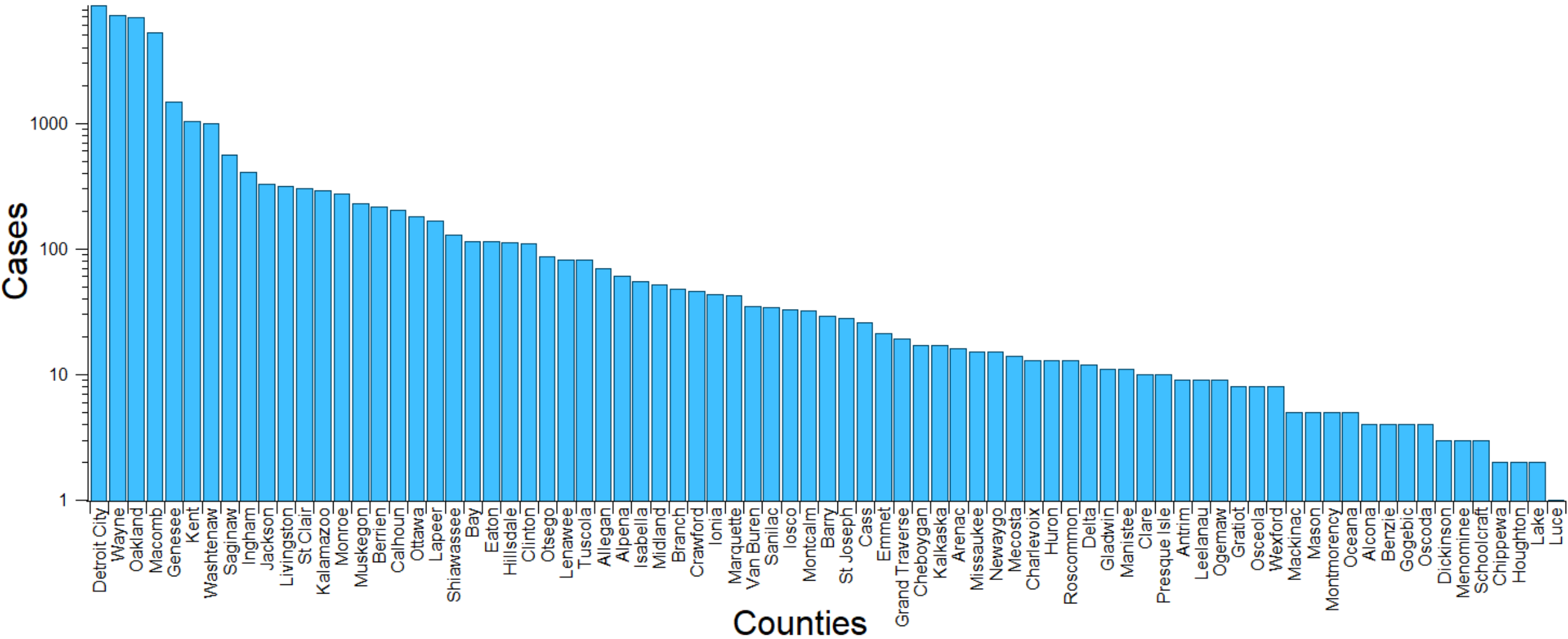
MICHIGAN CORONAVIRUS CASES



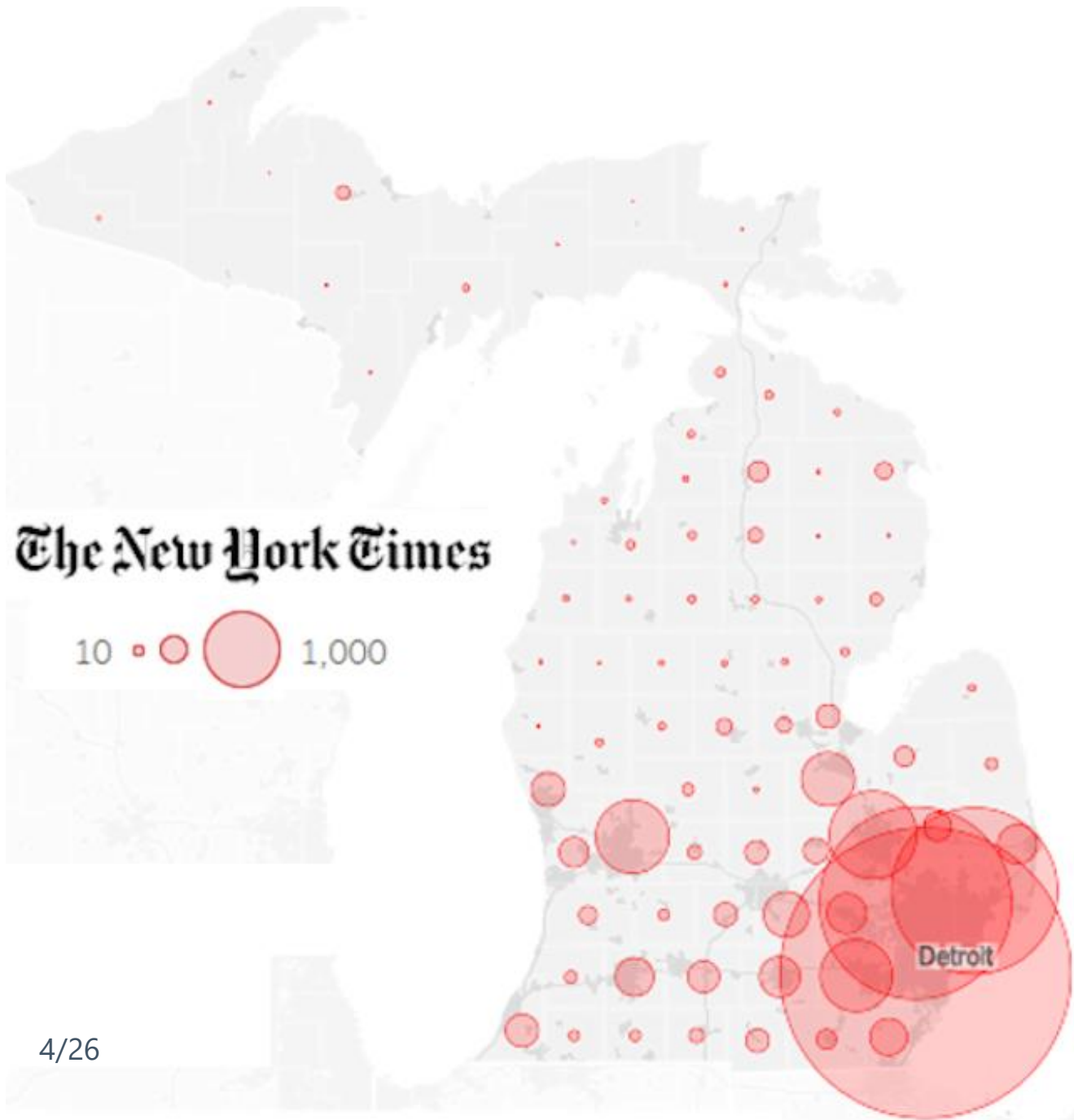
MICHIGAN CORONAVIRUS CASES



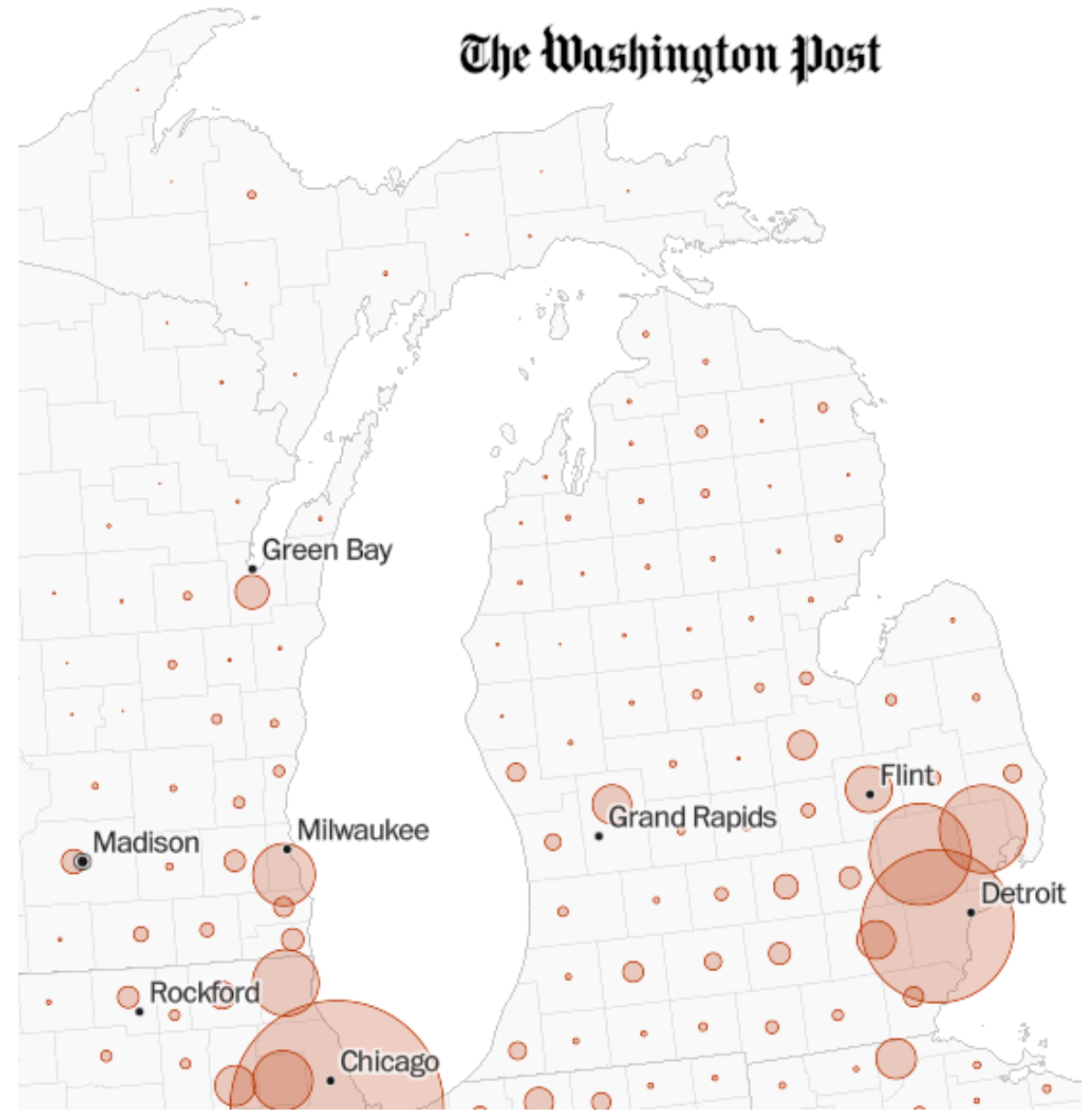
MICHIGAN CORONAVIRUS CASES



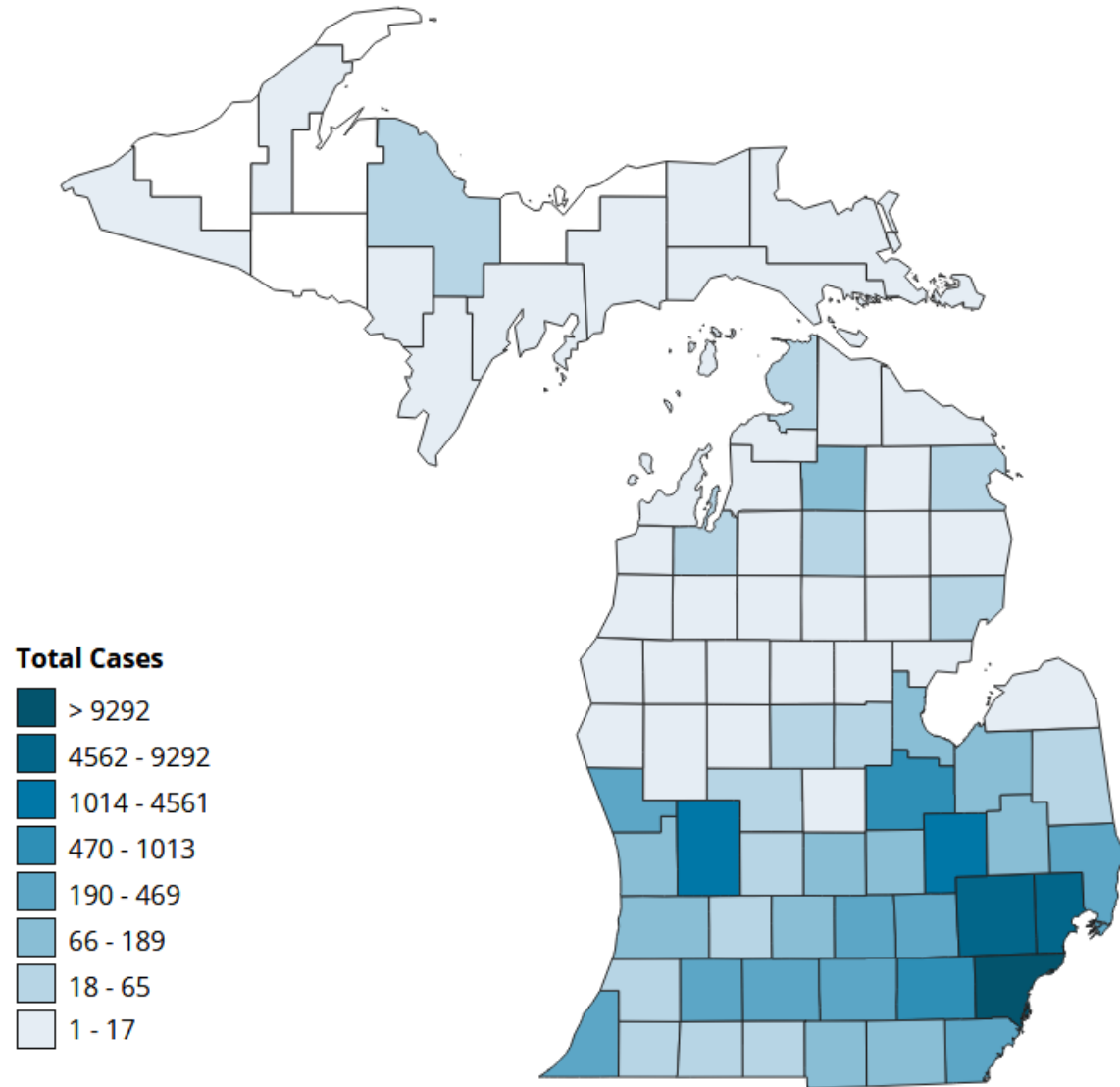
The New York Times



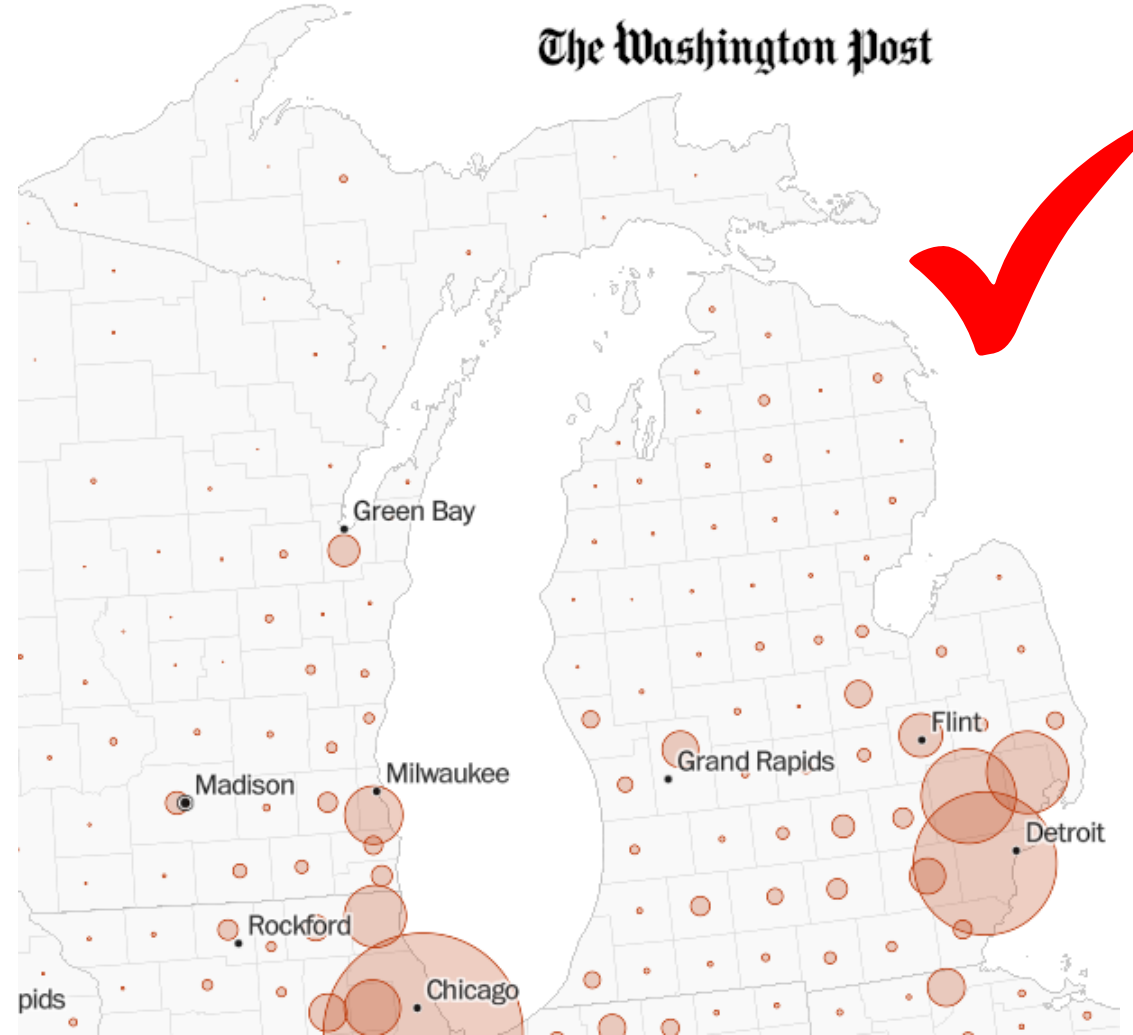
The Washington Post



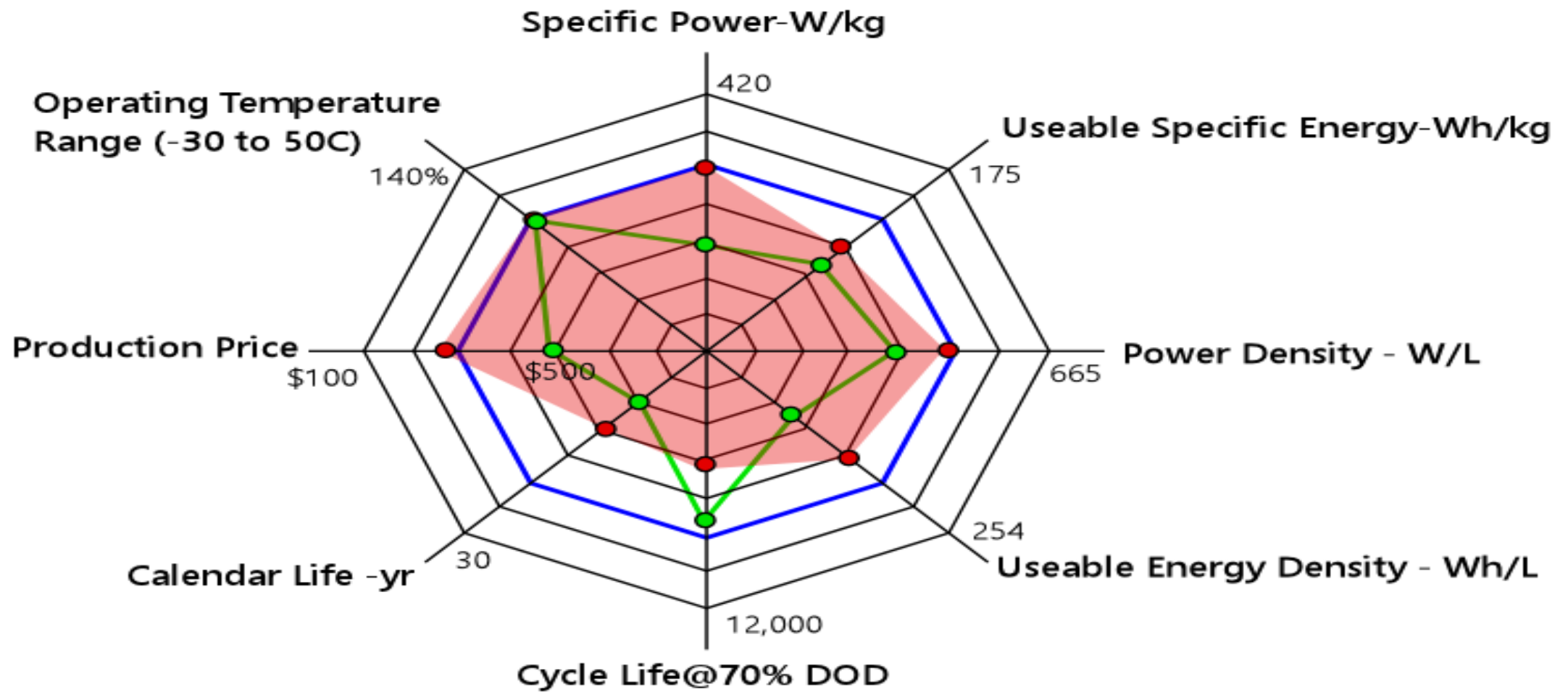
MICHIGAN CORONAVIRUS CASES



michigan.gov/coronavirus/







Battery A **Battery B**



TIPS

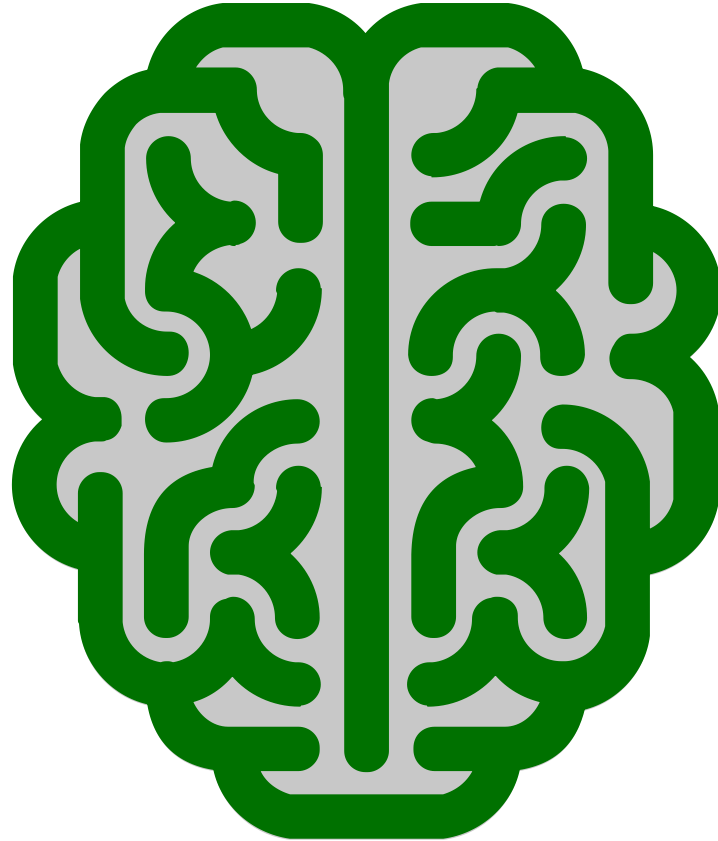
graphs used to gain understanding
are unlikely to be good for explaining



PREPARE PLOT FOR YOUR AUDIENCE

- Know your audience and craft the presentation for them
- focus on your key message(s)





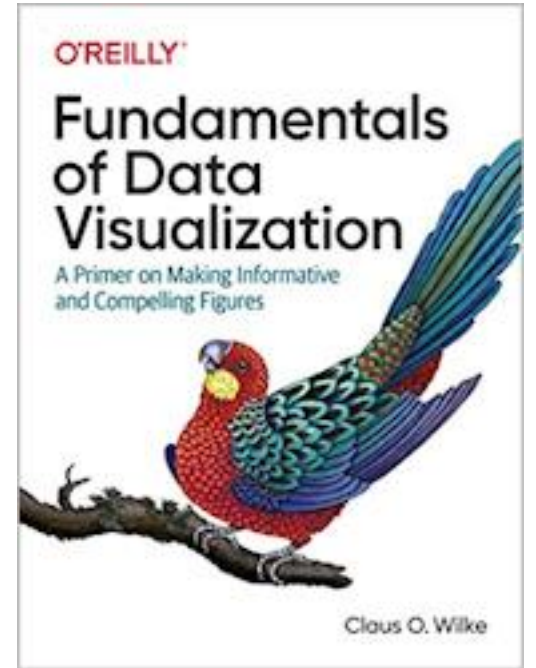
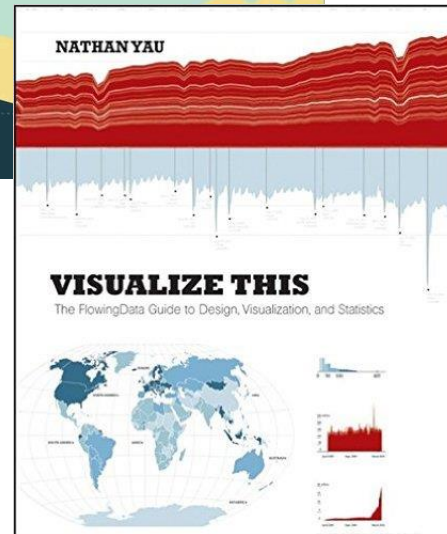
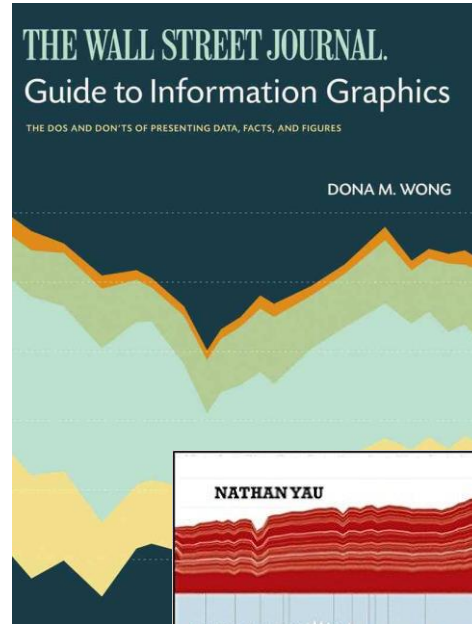
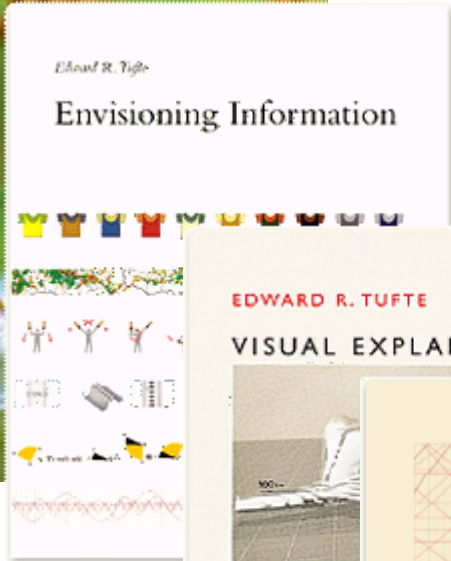
ready

- memorable is better than forgettable (pics memorable)
- make graphics *mind ready*
- info density right for material and audience



• don't let tools get in the way

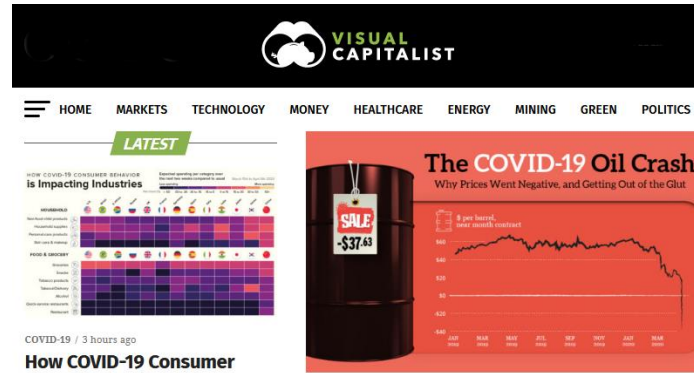
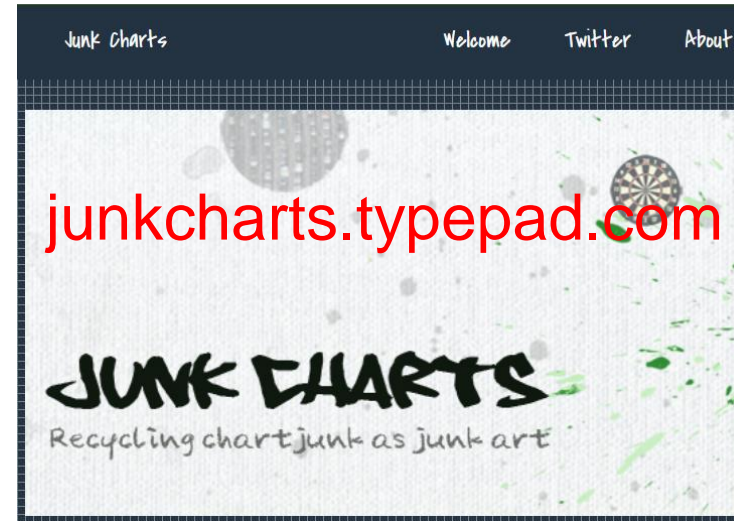
FAVORITE REFERENCES – DISPLAY OF INFORMATION



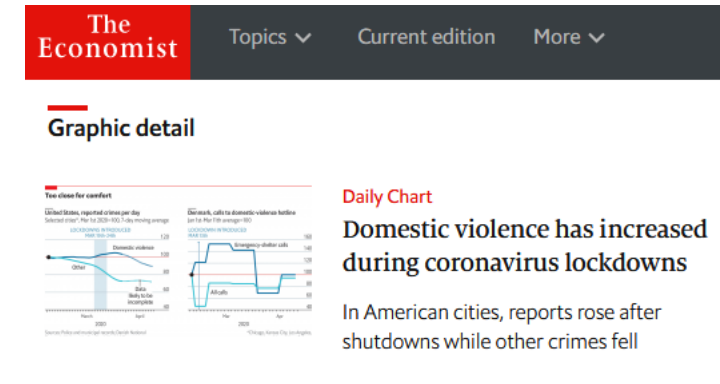
FAVORITE DATA VISUALIZATION WEBSITES - SAMPLES



howmuch.net



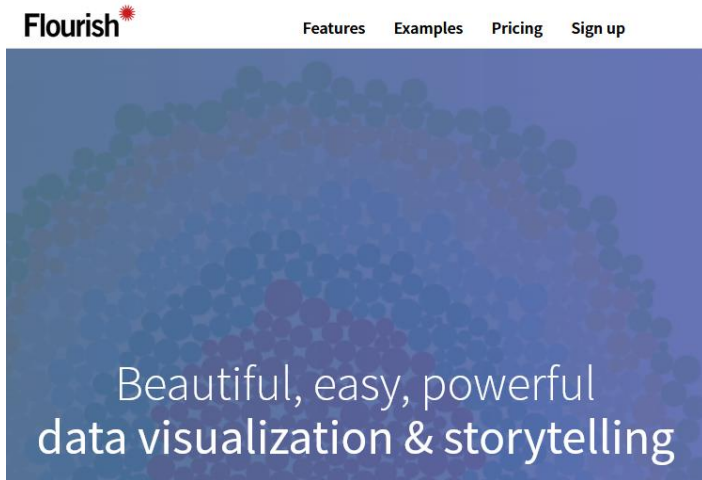
visualcapitalist.com



economist.com/graphic-detail/



FAVORITE DATA VISUALIZATION WEBSITES - TOOLS

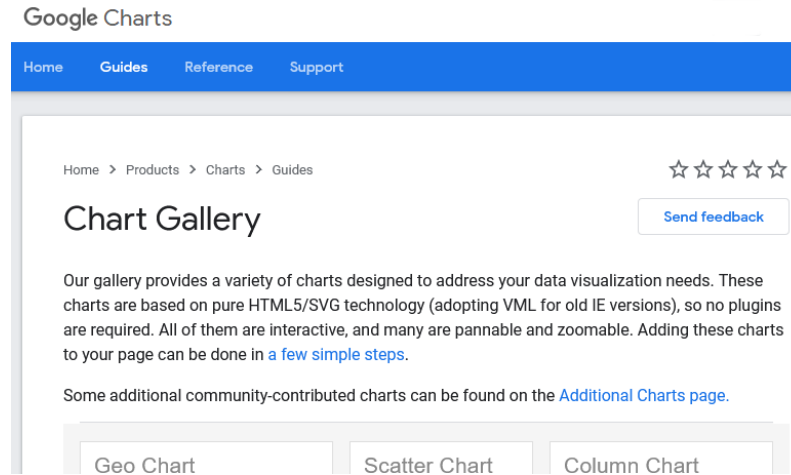


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Beautiful, easy, powerful data visualization & storytelling

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Google Charts

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Send feedback

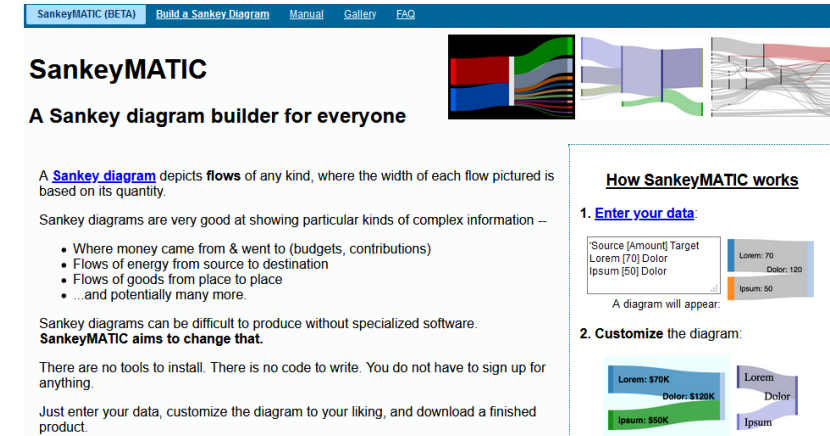
Chart Gallery

Our gallery provides a variety of charts designed to address your data visualization needs. These charts are based on pure HTML5/SVG technology (adopting VML for old IE versions), so no plugins are required. All of them are interactive, and many are pannable and zoomable. Adding these charts to your page can be done in [a few simple steps](#).

Some additional community-contributed charts can be found on the [Additional Charts page](#).

Geo Chart Scatter Chart Column Chart

developers.google.com/chart/
interactive/docs/gallery



SankeyMATIC (BETA) Build a Sankey Diagram Manual Gallery FAQ

SankeyMATIC

A Sankey diagram builder for everyone

A [Sankey diagram](#) depicts **flows** of any kind, where the width of each flow pictured is based on its quantity.

Sankey diagrams are very good at showing particular kinds of complex information --

- Where money came from & went to (budgets, contributions)
- Flows of energy from source to destination
- Flows of goods from place to place
- ...and potentially many more.

Sankey diagrams can be difficult to produce without specialized software. **SankeyMATIC aims to change that.**

There are no tools to install. There is no code to write. You do not have to sign up for anything.

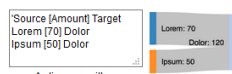
Just enter your data, customize the diagram to your liking, and download a finished product.

How SankeyMATIC works


1. **Enter your data:**

Source	Amount	Target
Lorem	70	Dolor
Ipsum	50	Dolor

A diagram will appear:



2. **Customize the diagram:**



sankeymatic.com

