

# Deceptive Visualization



Michael Correll  
Tableau Research

# What is a "bad" visualization?



bad visualization



Sign in

Q All

Images

Videos

News

Shopping

More

Settings

Tools

SafeSearch ▼

# What is a "bad" visualization?



bad visualization



Sign in

All

Images

Videos

News

Shopping

More

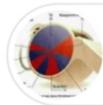
Settings

Tools

SafeSearch



data



pie chart



infographic



good

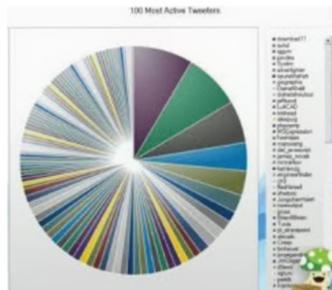
dashboard

4 dimensional data

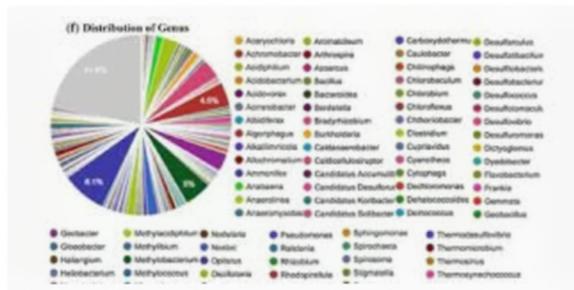
network

education

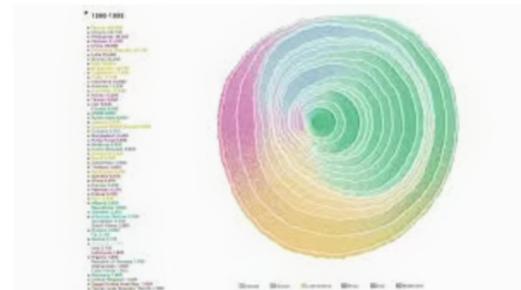
the functi



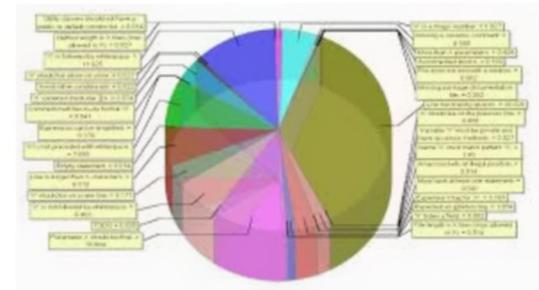
9 Worst Data Visualizations Ev...  
livingqlikview.com



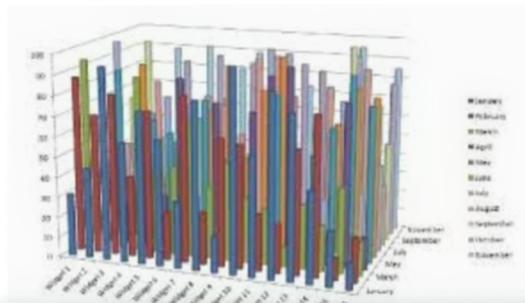
Data Stories: Avoiding Visualization ...  
tdwi.org



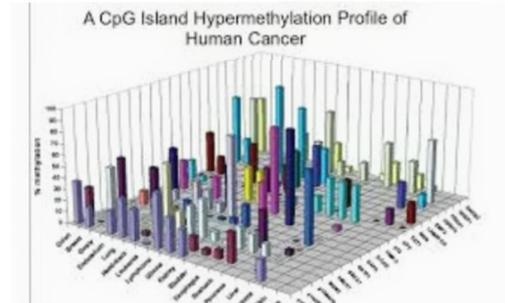
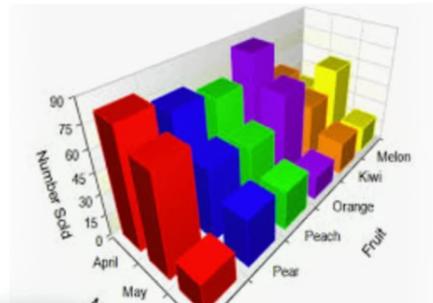
The Best and Worst Data Visualizations ...  
kdnuggets.com



Pin on Chartjunk Data Visualization  
pinterest.com



<https://tdwi.org/articles/2018/02/28/bi-all-visualization-fails.aspx>



“A great introduction to the use of statistics,  
and a great refresher for anyone who’s already  
well versed in it.” —**BILL GATES**

# HOW TO LIE WITH STATISTICS

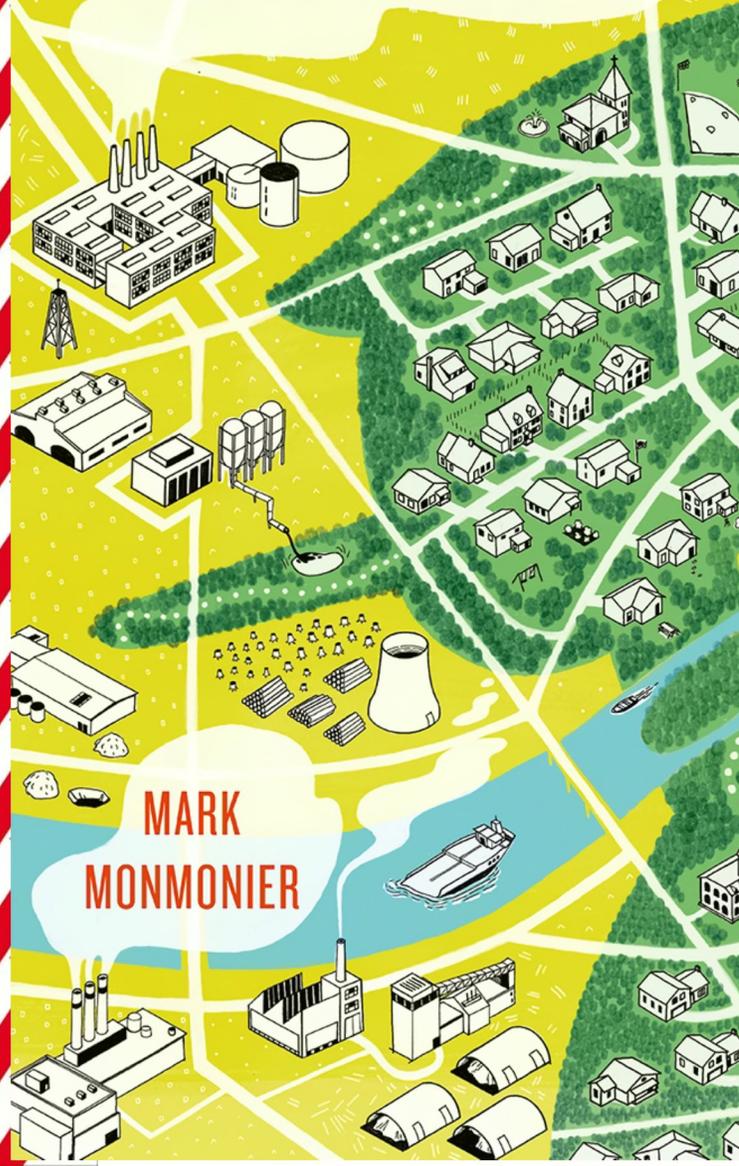


**DARRELL HUFF**

Illustrated by **Irving Geis**

An Honest-to-Goodness Bestseller

# HOW TO LIE WITH MAPS



**MARK  
MONMONIER**

# How Charts Lie



Getting Smarter about  
Visual Information

**Alberto Cairo**

# Takeaway:

Visualizations are a form of communication.

You can lie, stretch the truth, and bullshit with visualizations, just like any form of communication.

The background features a minimalist, abstract pattern of black geometric shapes on a white background. These shapes include thin, hand-drawn style lines of various orientations, solid black circles of different sizes, and bold black 'x' marks. The elements are scattered across the frame, creating a sense of movement and depth. The central text is framed by several thin horizontal lines, some of which are slightly wavy, adding to the hand-drawn aesthetic.

# DARK PATTERNS

*(They're Everywhere)*

# Dark Patterns

The screenshot shows a web browser window with the URL `mac.softpedia.com/get/System-Utilities/OnyX.shtml`. The page features a dark blue navigation bar with the Softpedia logo and menu items for Desktop, Mac, Mobile, Web, and News. A red alert banner for '2016 Holiday Giveaways!' is visible. The main content area is for 'OnyX for Mac', displaying a 'DOWNLOAD' button, 177,446 downloads, and a 5.5/5 star rating. A 'Start Download' section includes a 'DOWNLOAD NOW' button and a three-step process: 1. Click Download, 2. Run the quick scan, 3. Enjoy your clean Mac. The page also includes an 'EDITOR'S REVIEW' section with a description of the software as a free OS X application for optimization and maintenance, and a 'Download Cleaner' advertisement at the bottom right.

**SOFTPEDIA** DESKTOP Mac MOBILE WEB NEWS

Alert 2016 Holiday Giveaways!

## OnyX for Mac

**DOWNLOAD** 177,446 downloads Updated: October 15th, 2016 DONATIONWARE 5.5/5 260

**CURRENT VERSION:**  
OnyX 3.2.1  
SEND US AN UPDATE

**17 SCREENSHOTS**

**IN-DEPTH REVIEW**  
[OnyX in-depth review](#)

**FILE SIZE:**  
54.8 MB

**RUNS ON:**  
macOS 10.12 or later (Intel only)

**CATEGORY:**  
Home | System Utilities

**DEVELOPER:**

**Start Download**  
Follow 3 steps for quick install & scan

1. Click Download
2. Run the quick scan
3. Enjoy your clean Mac

**EDITOR'S REVIEW** DOWNLOAD SPECIFICATIONS CHANGELOG 100% CLEAN REPORT MALWARE

**Free OS X application designed to help you perform a large variety of optimization, maintenance, and customization tasks via a very simple and intuitive interface**

Tweaking applications for macOS come in various shapes and prices, and you are free to pick the one that meets your needs, be it focused on finding and fixing as many system errors and problems as possible or on boosting your Mac's overall performance.

Onyx is a free and very complex macOS application created to cope with both these aspects, while also providing its users with a very simple and intuitive interface.

*It has a version for each specific macOS version, so download the*

**Download Cleaner**

# Dark Patterns

The image shows a screenshot of the Softpedia website for the software 'Onyx for Mac'. The browser address bar shows the URL 'mac.softpedia.com/get/System-Utilities/Onyx.shtml'. The website header includes the Softpedia logo and navigation links for 'DESKTOP', 'Mac', 'MOBILE', 'WEB', and 'NEWS'. A blue navigation bar contains the site name and user icons. Below the header, a breadcrumb trail reads 'Softpedia > Mac > System Utilities > Onyx'. A red 'ALERT' banner for '2016 Holiday Giveaways!' is visible. The main content area features a large orange-bordered box around a 'DOWNLOAD' button with a download icon. To the right of this button, it shows '177,446 downloads', 'Updated: October 15th, 2016', 'DONATIONWARE', and a 5.5/5 star rating. Below this, a 'CURRENT VERSION' section lists 'Onyx 3.2.1' and a 'SEND US AN UPDATE' link. A large blue 'DOWNLOAD NOW' button is prominently displayed, followed by a 'Start Download' section with a three-step process: '1. Click Download', '2. Run the quick scan', and '3. Enjoy your clean Mac'. A sidebar on the left contains '17 SCREENSHOTS', 'IN-DEPTH REVIEW', 'FILE SIZE: 34.8 MB', 'RUNS ON: macOS 10.12 or later (Intel only)', 'CATEGORY: Home | System Utilities', and 'DEVELOPER:'. The main text describes Onyx as a 'Free OS X application designed to help you perform a large variety of optimization, maintenance, and customization tasks via a very simple and intuitive interface'. It also mentions that it is a free and very complex macOS application. At the bottom right, there is a 'Download Cleaner' advertisement featuring an image of a person using a laptop.



Zone Kaiwei Ni factory  
Sponsored

**80% OFF**

**BLACK FRIDAY SALE**



Shop Now



Bad Visualizations

Incorrect Visualizations

Illegible Visualizations

Bullshit Visualizations

Unconventional Visualizations



# Bad Visualizations

## **Incorrect Visualizations**

Illegible Visualizations

Bullshit Visualizations

Unconventional Visualizations



# Incorrect Visualization

## 2010 Georgia Approval Ratings by Region

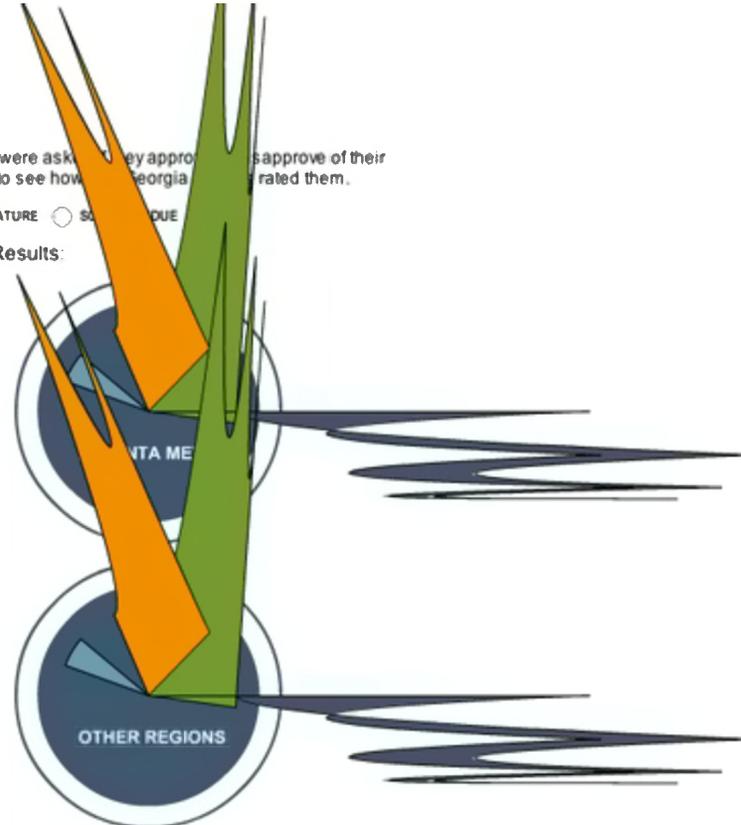
In a Georgia Newspaper Partnership poll, residents were asked if they approve or disapprove of their government. Select a politician or legislative branch to see how Georgia residents rated them.

BARACK OBAMA  U.S. CONGRESS  G.A. STATE LEGISLATURE  SONNY PERDUE

### Statewide Results:

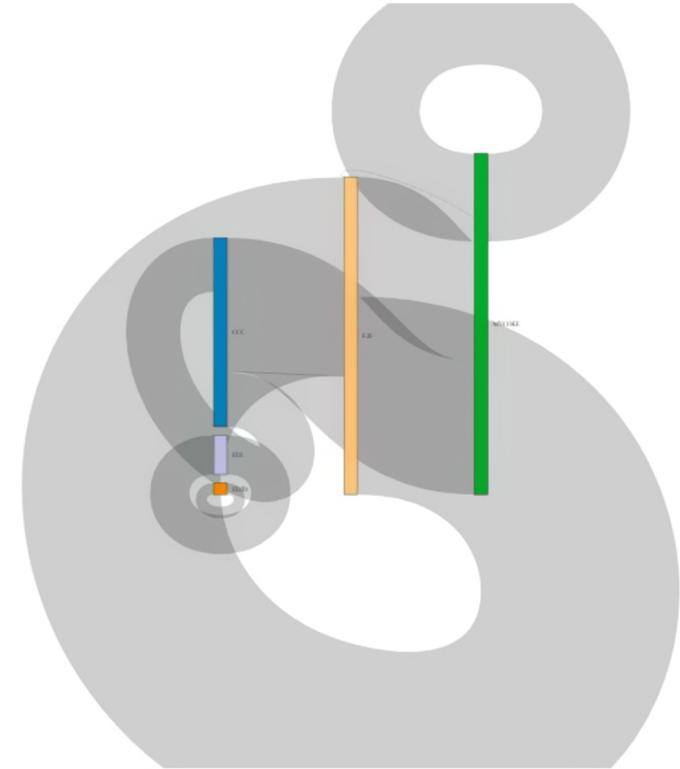


### Regional Results:



Percent of Polled Residents

Approve  Disapprove  Not Sure





AROUND THE WORLD

# GIANT HORNETS KILL 42 PEOPLE IN CHINA

LIVE CNN

RIGHT NOW

CHICAGO  71°

DETROIT  66°

HOUSTON  77°

HEALTH EVALUATION IN MIRIAM CAREY'S HOME AFTER DC (

CNN.com

**RIGHT NOW**

**FOX 10**  
**AccuWeather**

**TEMPERATURES**

Wickenburg  
**2385**

Cave Creek  
**2960**

Surprise  
**1350**

Deer Valley  
**65**

Fountain Hills  
**1665**

Glendale  
**66**

Scottsdale  
**64**

Buckeye  
**66**

Goodyear  
**64**

Sky Harbor  
**64**

Mesa  
**63**

Apache Junction  
**64**

Ahwatukee  
**1270**

Chandler  
**63**

Gateway  
**63**

Queen Creek

Maricopa  
**63**

Florence  
**1625**

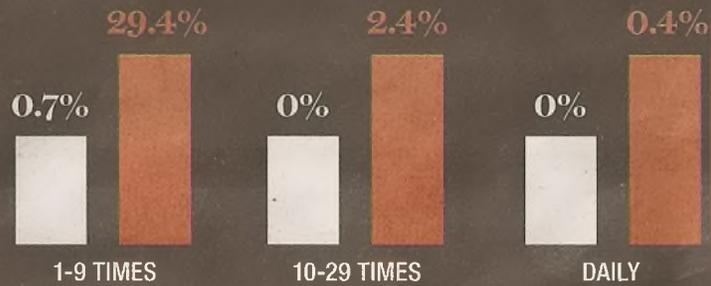
**FOX 10**

12:20 64°

# BY THE NUMBERS

The National Collegiate Health Assessment was taken by 1,000 UCSB students in Spring 2009. Participants were asked how frequently they used substances over the past 30 days. Numbers in white reflect actual student use, while red numbers indicate perceived substance use. The average age of participants was 20 years and approximately 99 percent were full-time students.

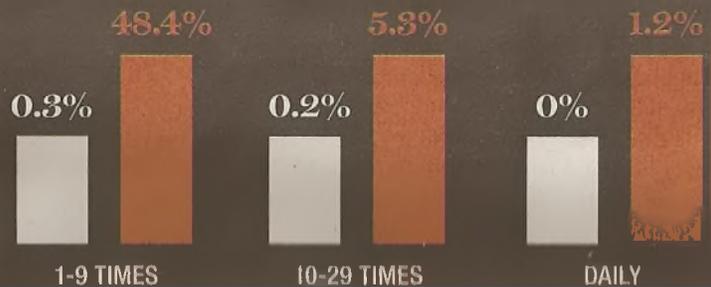
## OPIATES



## ALCOHOL

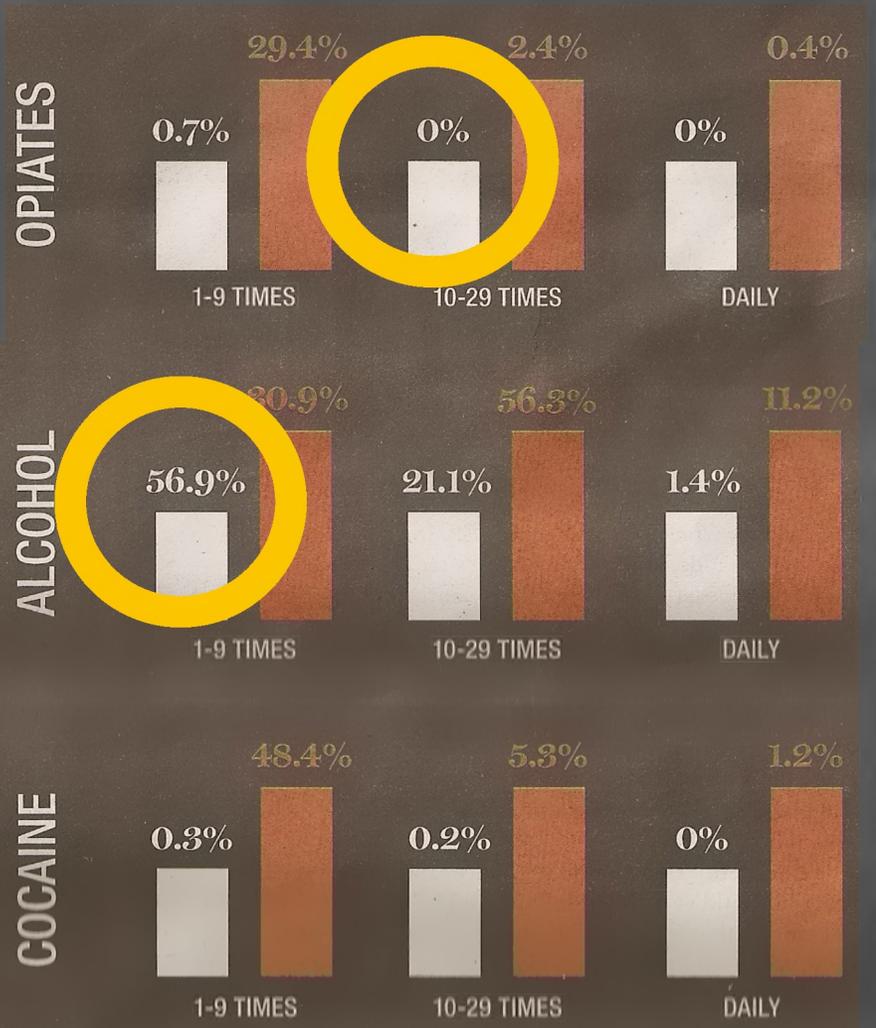


## COCAINE



# BY THE NUMBERS

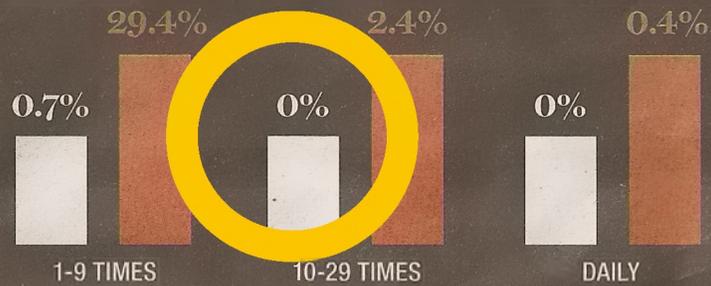
The National Collegiate Health Assessment was taken by 1,000 UCSB students in Spring 2009. Participants were asked how frequently they used substances over the past 30 days. Numbers in white reflect actual student use, while red numbers indicate perceived substance use. The average age of participants was 20 years and approximately 99 percent were full-time students.



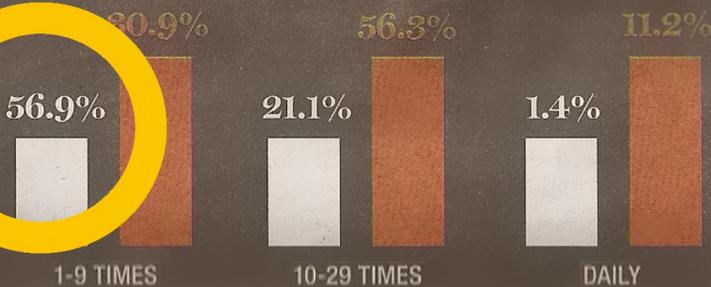
# BY THE NUMBERS

The National Collegiate Health Assessment was taken by 1,000 UCSB students in Spring 2009. Participants were asked how frequently they used substances over the past 30 days. Numbers in white reflect actual student use, while red numbers indicate perceived substance use. The average age of participants was 20 years and approximately 99 percent were full-time students.

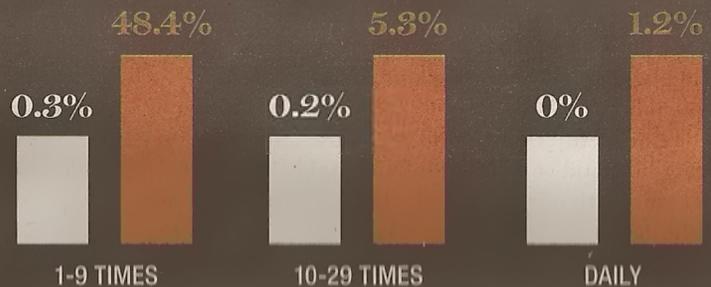
## OPIATES



## ALCOHOL



## COCAINE



## Opiates

## Alcohol

## Cocaine

	1-9 Times		10-29 Times		Daily	
	Actual	Perceived	Actual	Perceived	Actual	Perceived
Opiates	0.7%	29.4%	0.0%	2.4%	0.0%	0.4%
Alcohol	56.9%	30.9%	21.1%	56.3%	1.4%	11.2%
Cocaine	0.3%	48.4%	0.2%	5.3%	0.0%	1.2%

# UNEMPLOYMENT RATE

## UNDER PRESIDENT OBAMA



# UNEMPLOYMENT RATE

## UNDER PRESIDENT OBAMA



# UNEMPLOYMENT RATE

## UNDER PRESIDENT OBAMA



# UNEMPLOYMENT RATE

## UNDER PRESIDENT OBAMA



# UNEMPLOYMENT RATE

## UNDER PRESIDENT OBAMA



# UNEMPLOYMENT RATE

## UNDER PRESIDENT OBAMA



Unemployment

9.8  
9.6  
9.4  
9.2  
9.0  
8.8  
8.6  
8.4  
8.2

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov



# Incorrect Visualizations

People assume that visualizations properly encode their data

...if we violate that assumption, we can do anything we want.

# Bad Visualizations

Incorrect Visualizations

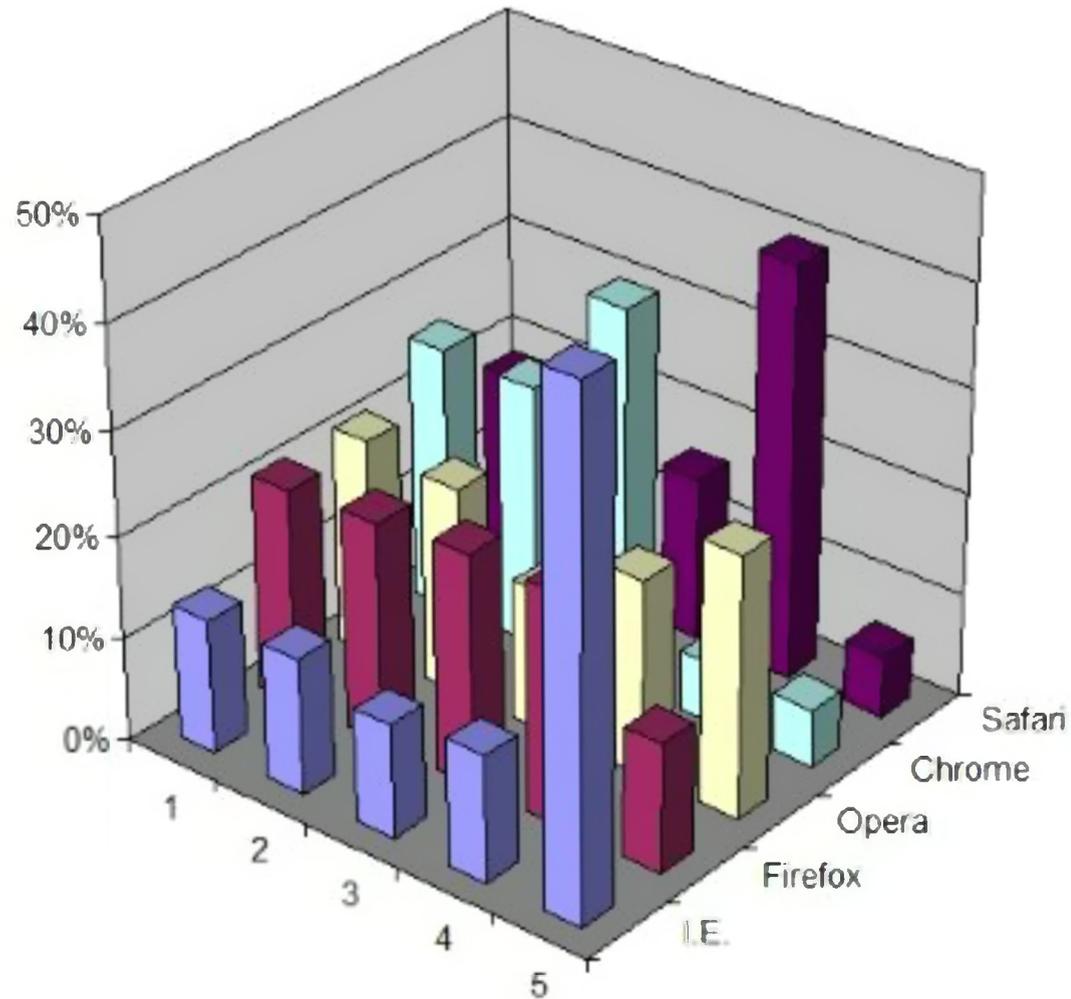
## **Illegible Visualizations**

Bullshit Visualizations

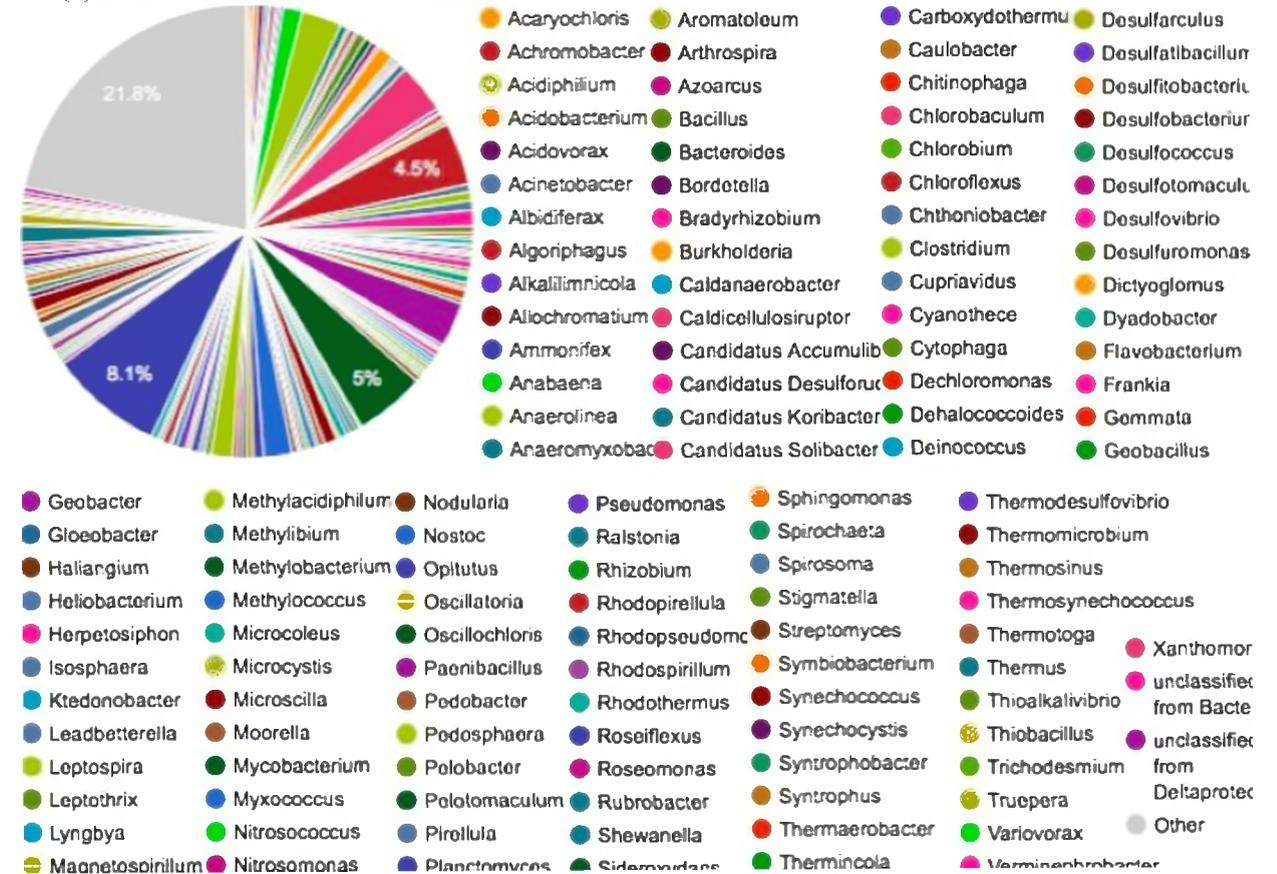
Unconventional Visualizations



# Illegible Visualization



(f) Distribution of Genus





## Interactive Weekly Unemployment Insurance Claims

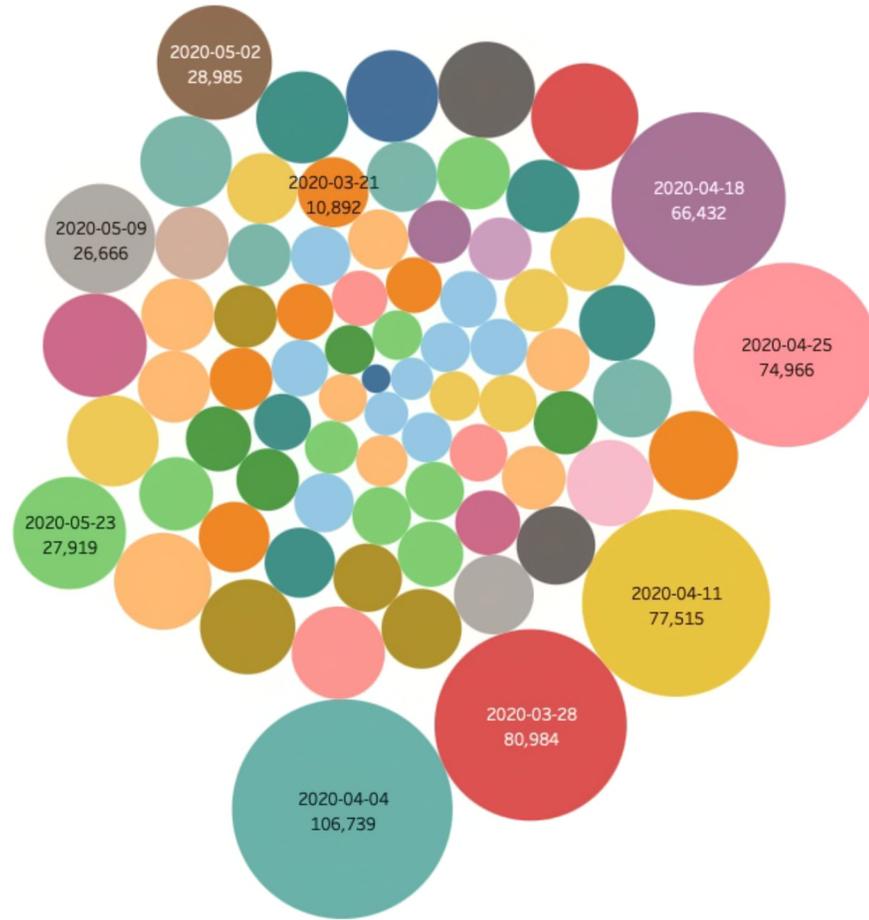
Initial\_Claims\_byCounty | **Historical**

County

Total

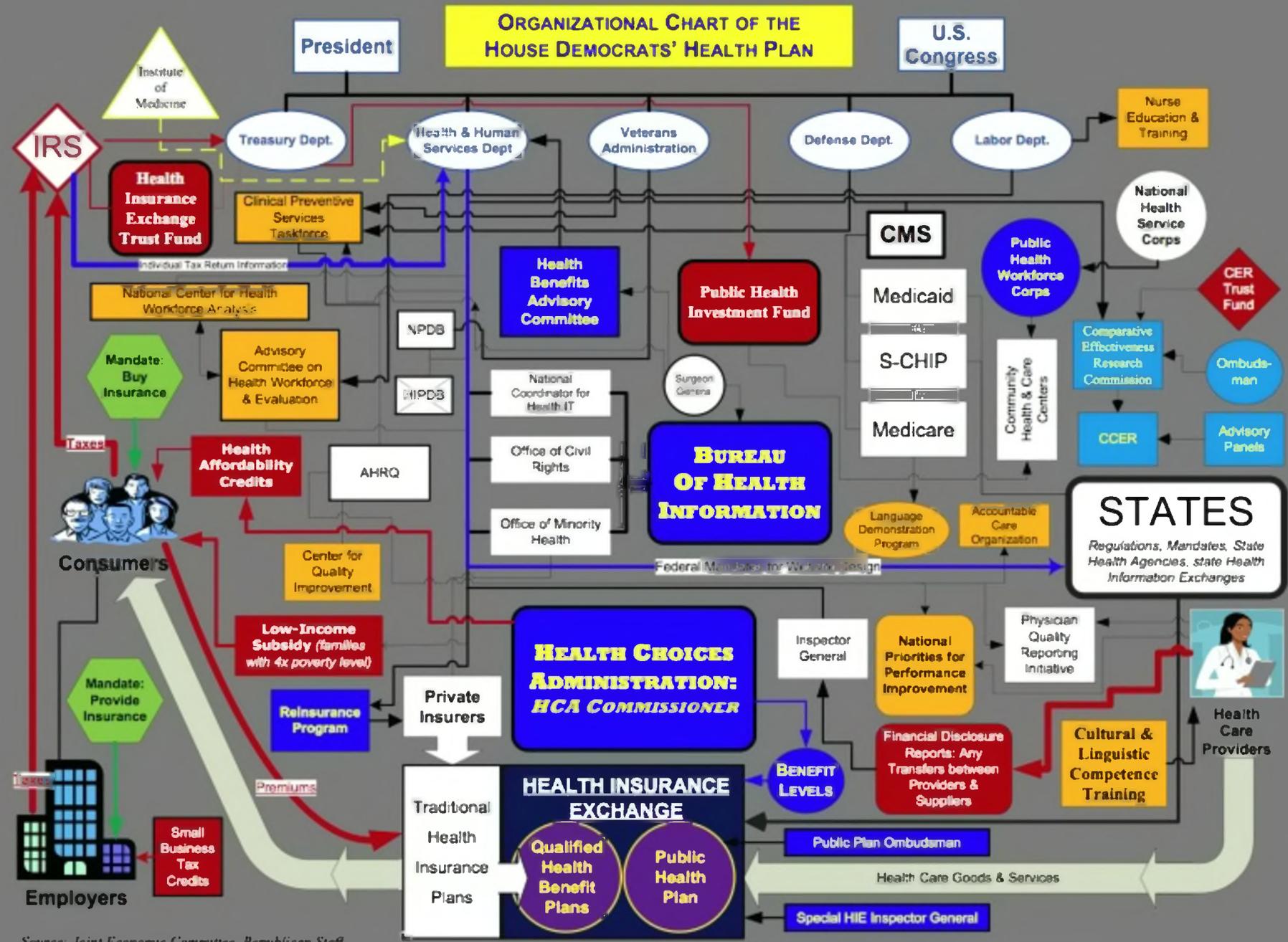
Historical Initial Claims by Week

2020-12-26	5,506
2021-01-02	10,986
2021-01-09	14,084
2021-01-16	11,983
2021-01-23	11,815
2021-01-30	12,664
2021-02-06	13,464
2021-02-13	12,087
2021-02-20	11,395
2021-02-27	11,624
2021-03-06	13,592
2021-03-13	16,506
2021-03-20	13,994
2021-03-27	18,710
2021-04-10	10,909
2021-04-17	8,983
2021-04-24	8,704
2021-05-01	10,325
2021-05-08	10,841
2021-05-15	9,377
2021-05-22	8,698
2021-06-05	7,290
2021-06-12	6,847
2021-06-19	7,108
2021-06-26	5,816
2021-07-03	7,295
2021-07-10	5,435
2021-07-17	4,254
2021-07-24	3,977
2021-07-31	6,793
2021-08-07	6,196
2021-08-14	5,469
2021-08-21	5,407
2021-08-28	5,431
2021-09-04	5,095



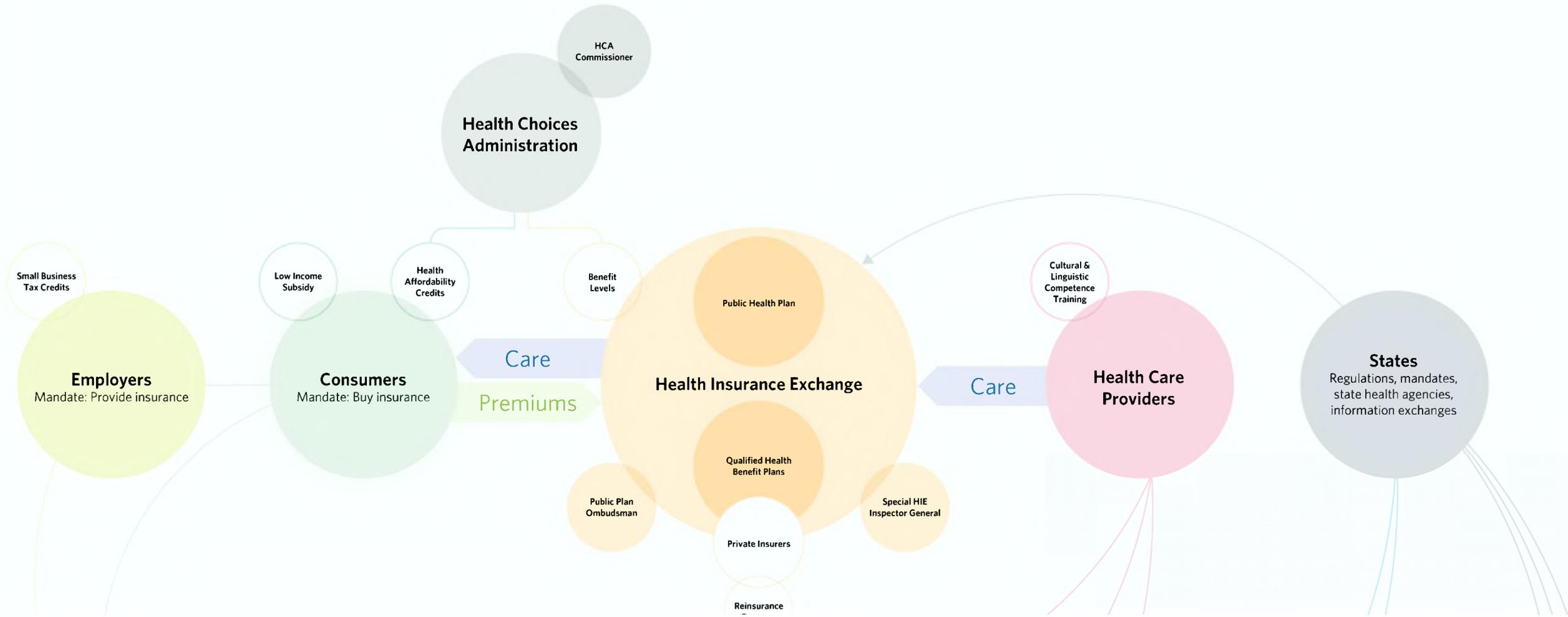
Week Ending date

■ 2020-03-14  
 ■ 2021-07-24  
 ■ 2021-07-17  
 ■ 2021-09-04  
 ■ 2021-08-21  
 ■ 2021-08-14



Source: Joint Economic Committee, Republican Staff  
 Congressman Kevin Brady, Ranking House Republican Member





**“Do not fuck with graphic designers” – Robert Palmer**

# Illegible Visualizations

People will get lost in the details or overwhelmed by complexity

...if we make things intentionally complex people then people will just assume we know what we're talking about or will be too dazed to check too closely.

# Bad Visualizations

Incorrect Visualizations

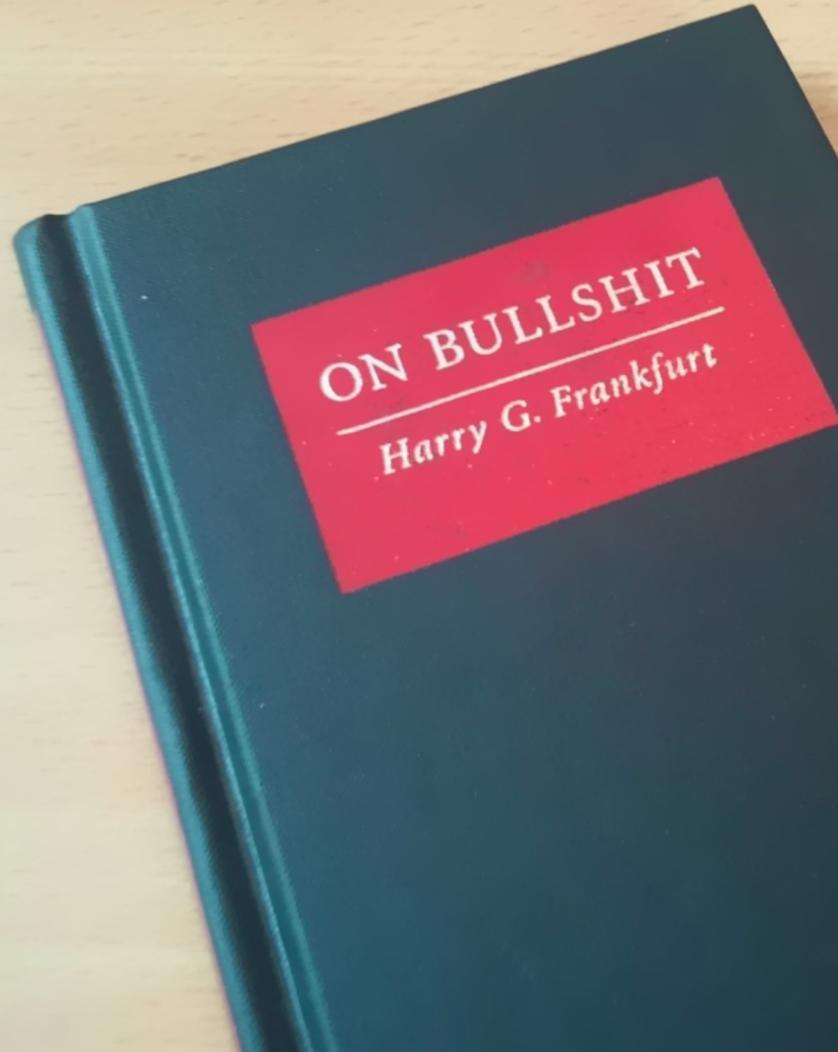
Illegible Visualizations

## **Bullshit Visualizations**

Unconventional Visualizations



# Bullshit Visualization



## Lie:

“No, officer, I wasn’t speeding”

(you know the truth, but intentionally say something you know is untrue)

## Bullshit:

“The party was lame anyways, it’s good I wasn’t invited”

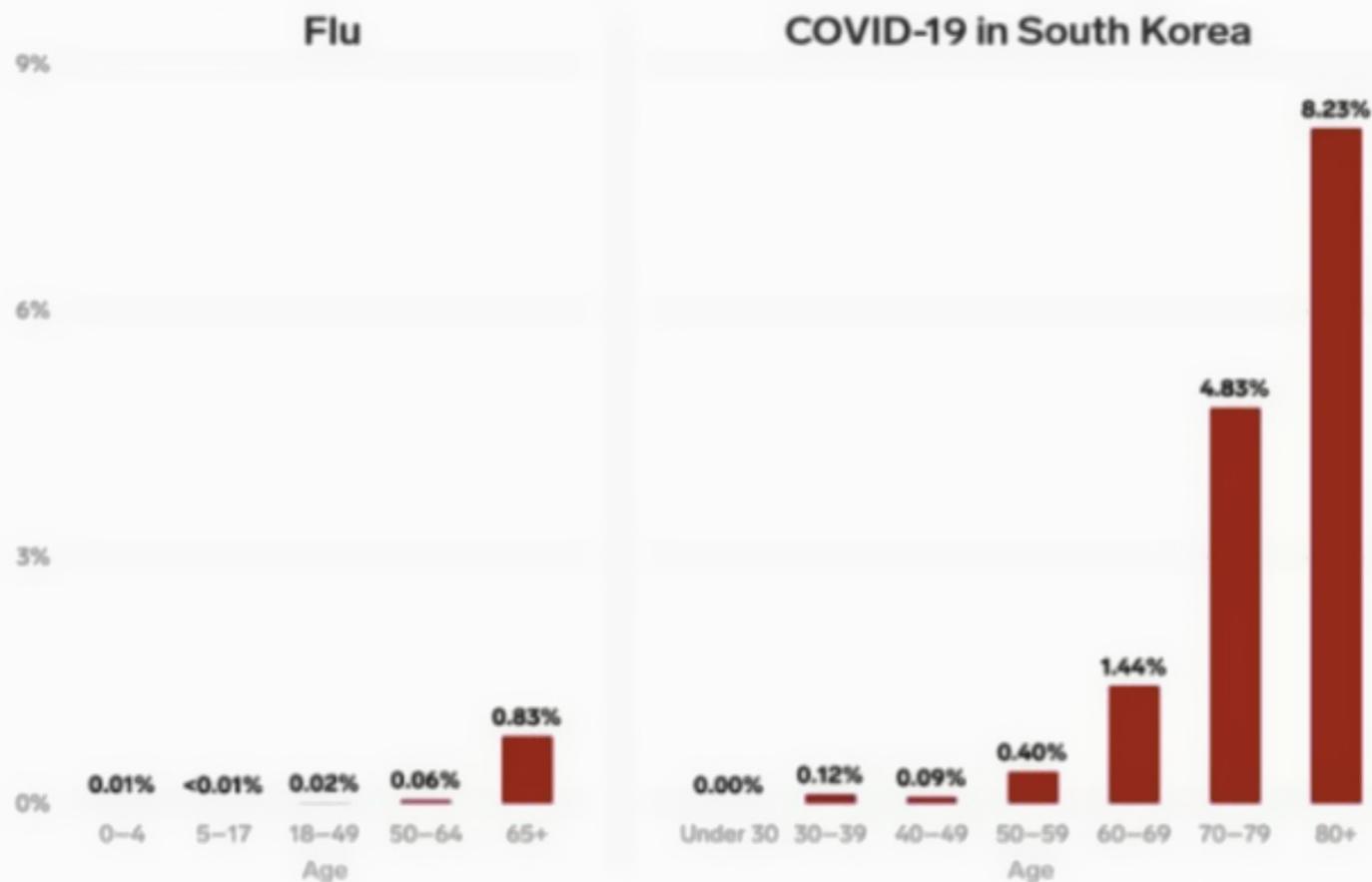
(you don’t know or don’t care about the truth, but intentionally say something you hope is persuasive)

# the **DECLINE** of **ARTISTIC STANDARDS**



For people under 60, coronavirus is LESS dangerous than the seasonal flu:

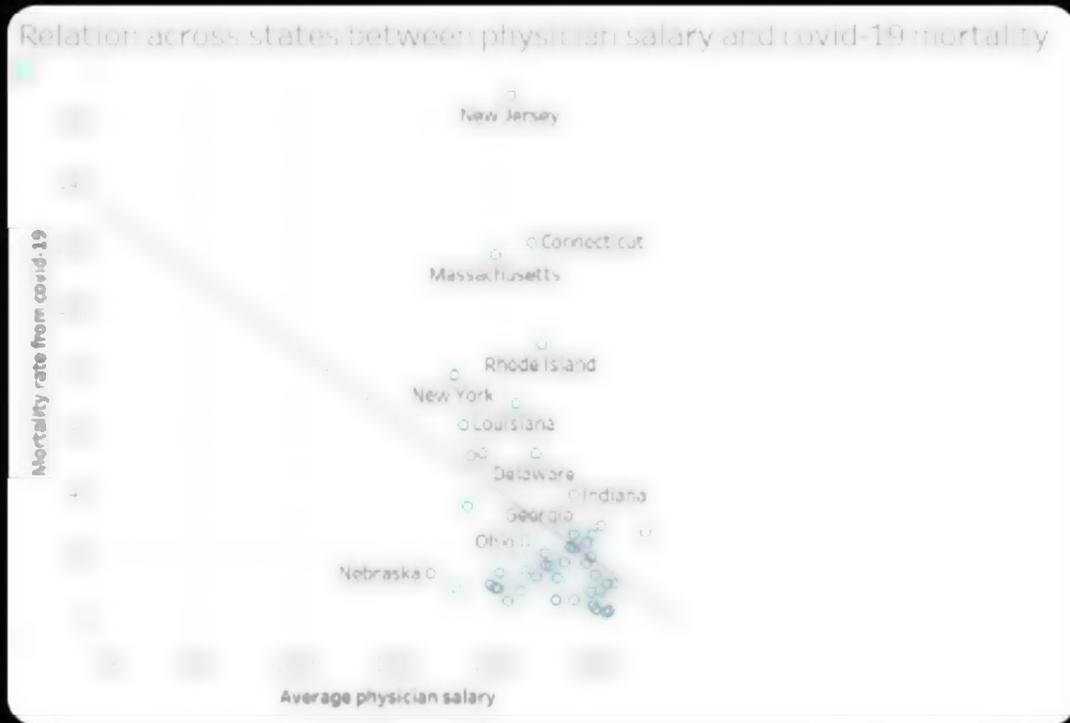
### Flu and COVID-19 death rates by age



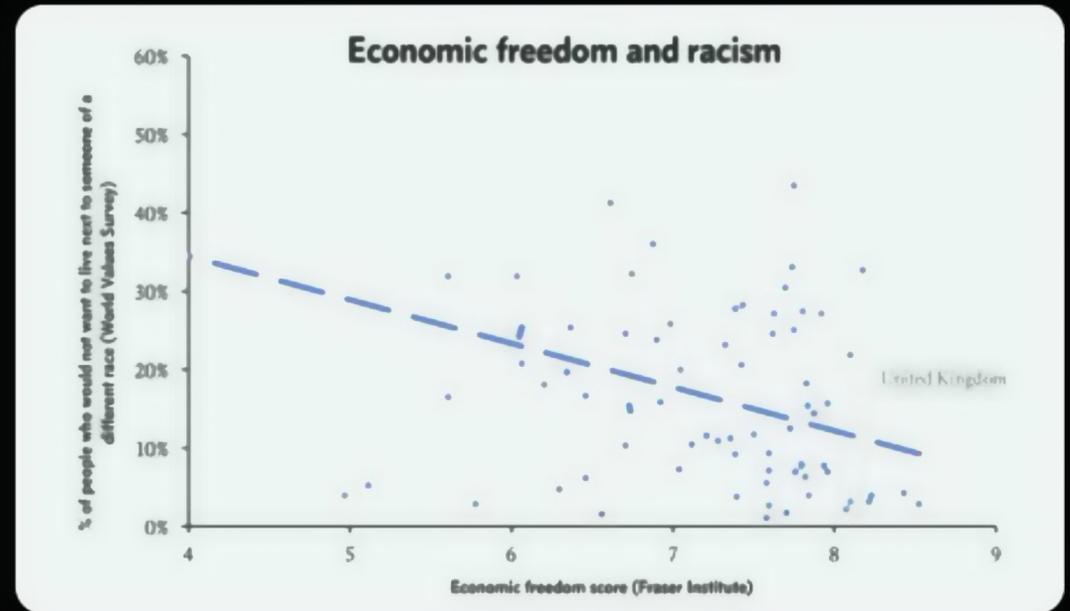
Source: Flu rates from US Centers for Disease Control and Prevention; COVID-19 rates as of March 12, 2020 from Korea Centers for Disease Control and Prevention.

BUSINESS INSIDER

States where physicians are highly paid have lower Covid-19 mortality per capita.

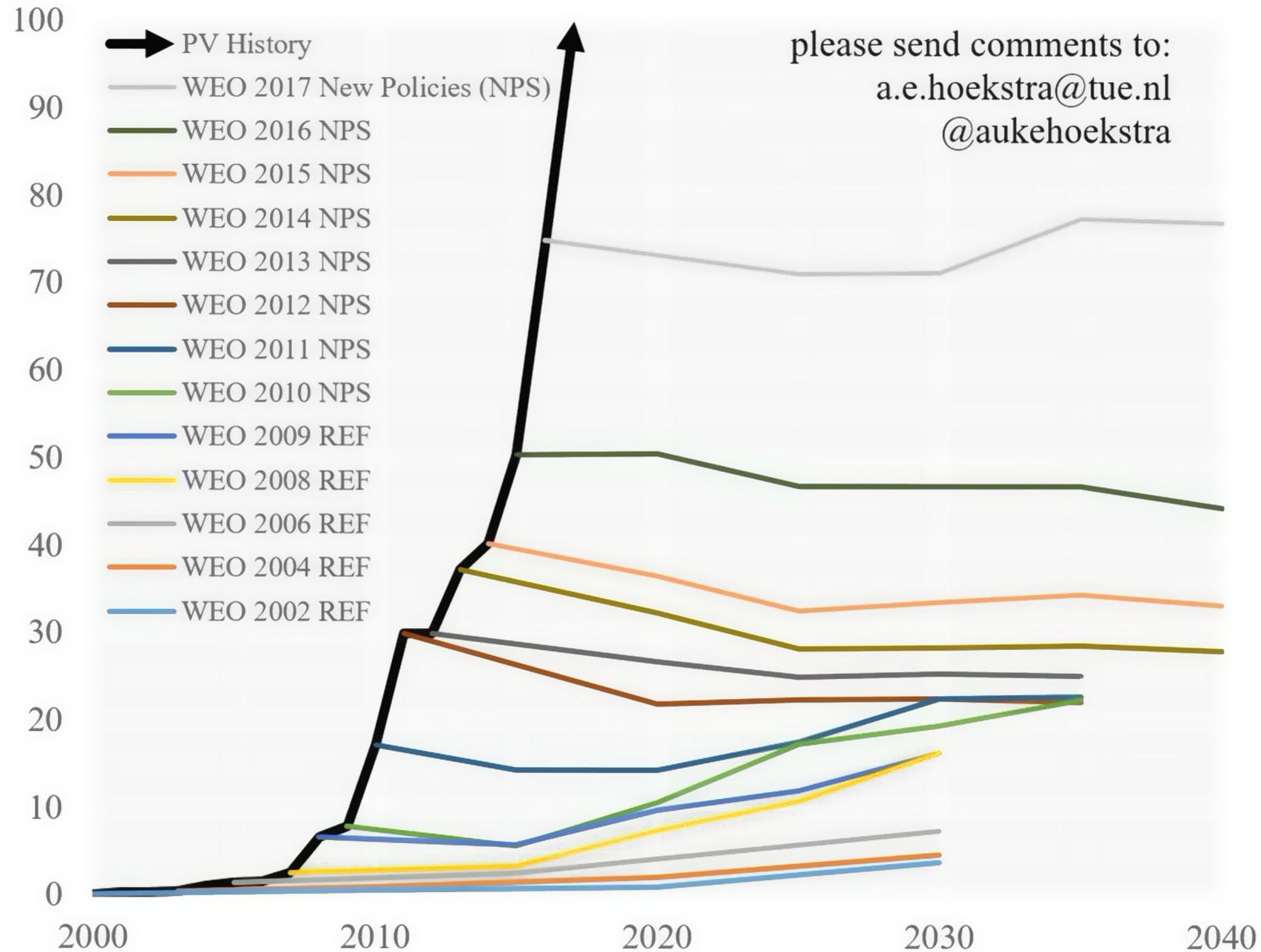


Fact check: Countries with more economic freedom have less racist attitudes, according to the World Values Survey.

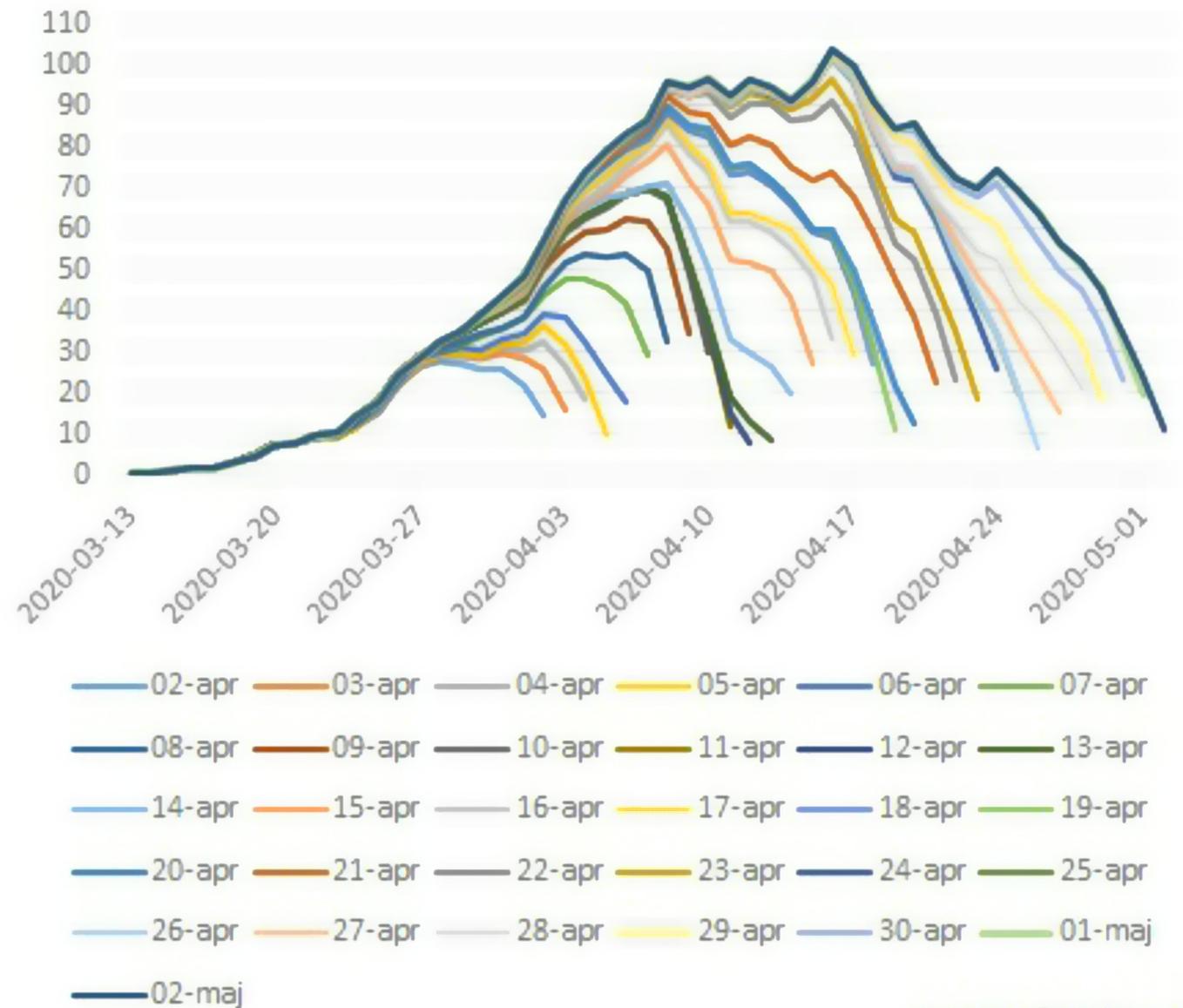


# Annual PV additions: historic data vs IEA WEO predictions

In GW of added capacity per year - source International Energy Agency - World Energy Outlook



Sweden Covid-19 deaths per day  
Rolling 3-day average  
source: Folkhälsomyndigheten, daily spreadsheet



# Bullshit Visualizations

You can just make stuff up with no connection to reality

...show stuff that looks like data but isn't

...assume a conclusion and pretend it's true

...or give people data they can't do anything with

# Bad Visualizations

Incorrect Visualizations

Illegible Visualizations

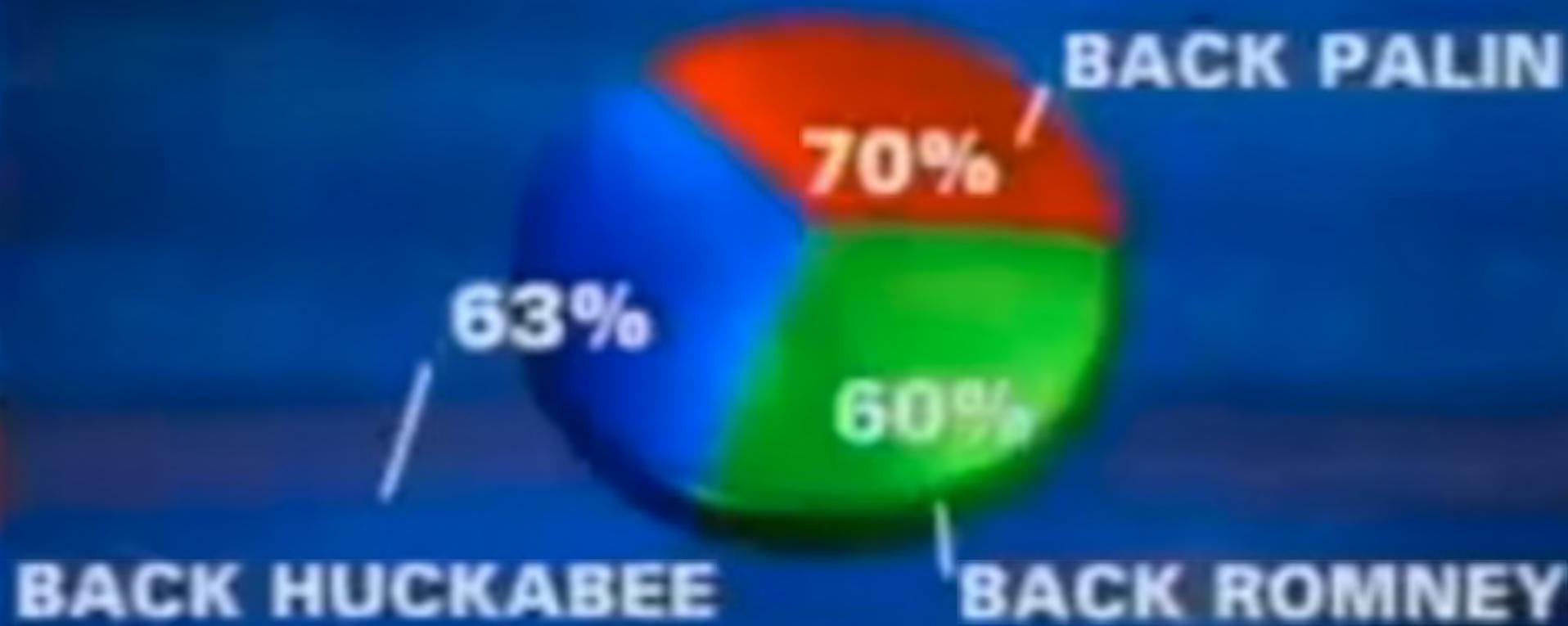
Bullshit Visualizations

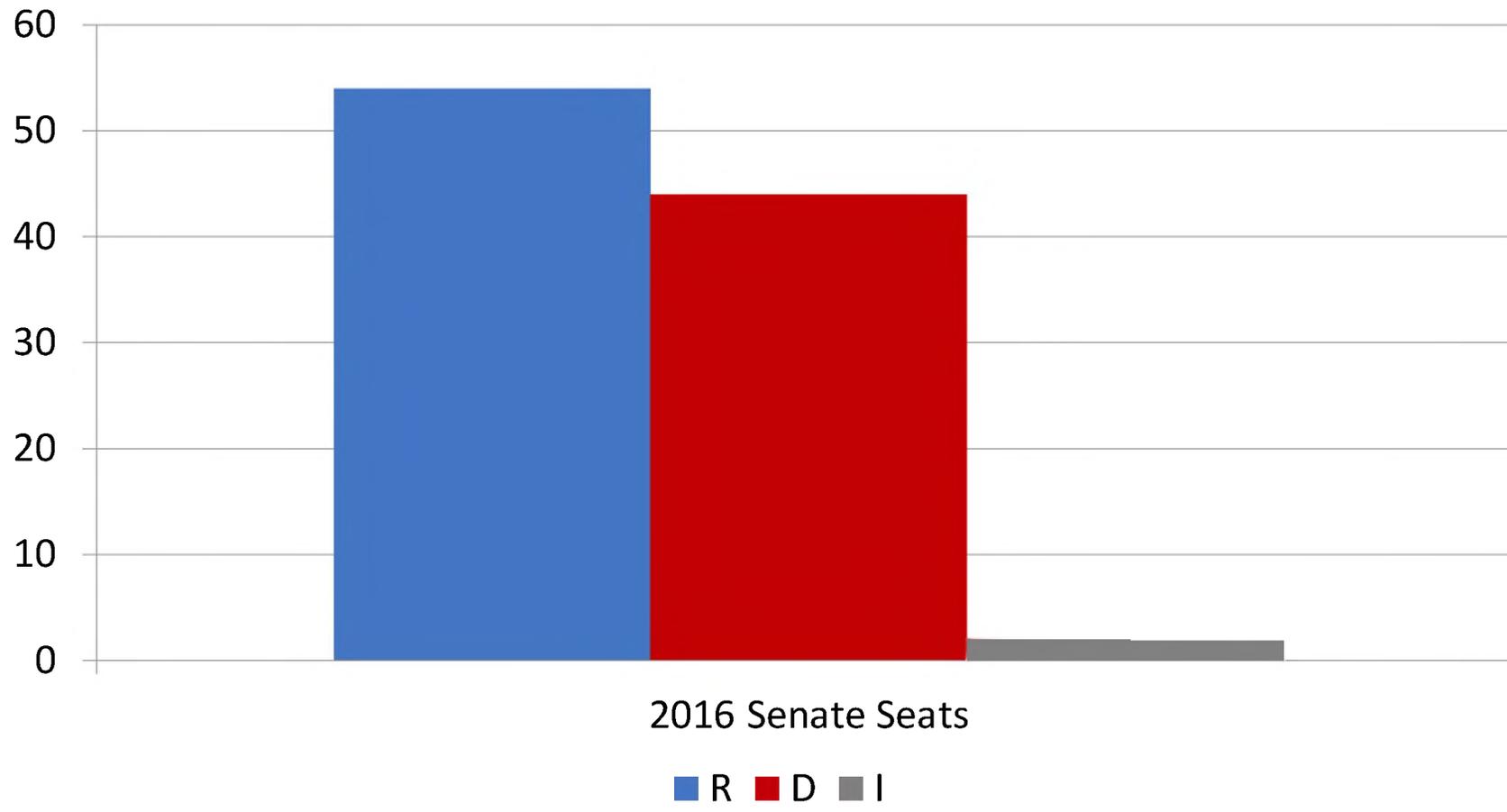
**Unconventional Visualizations**

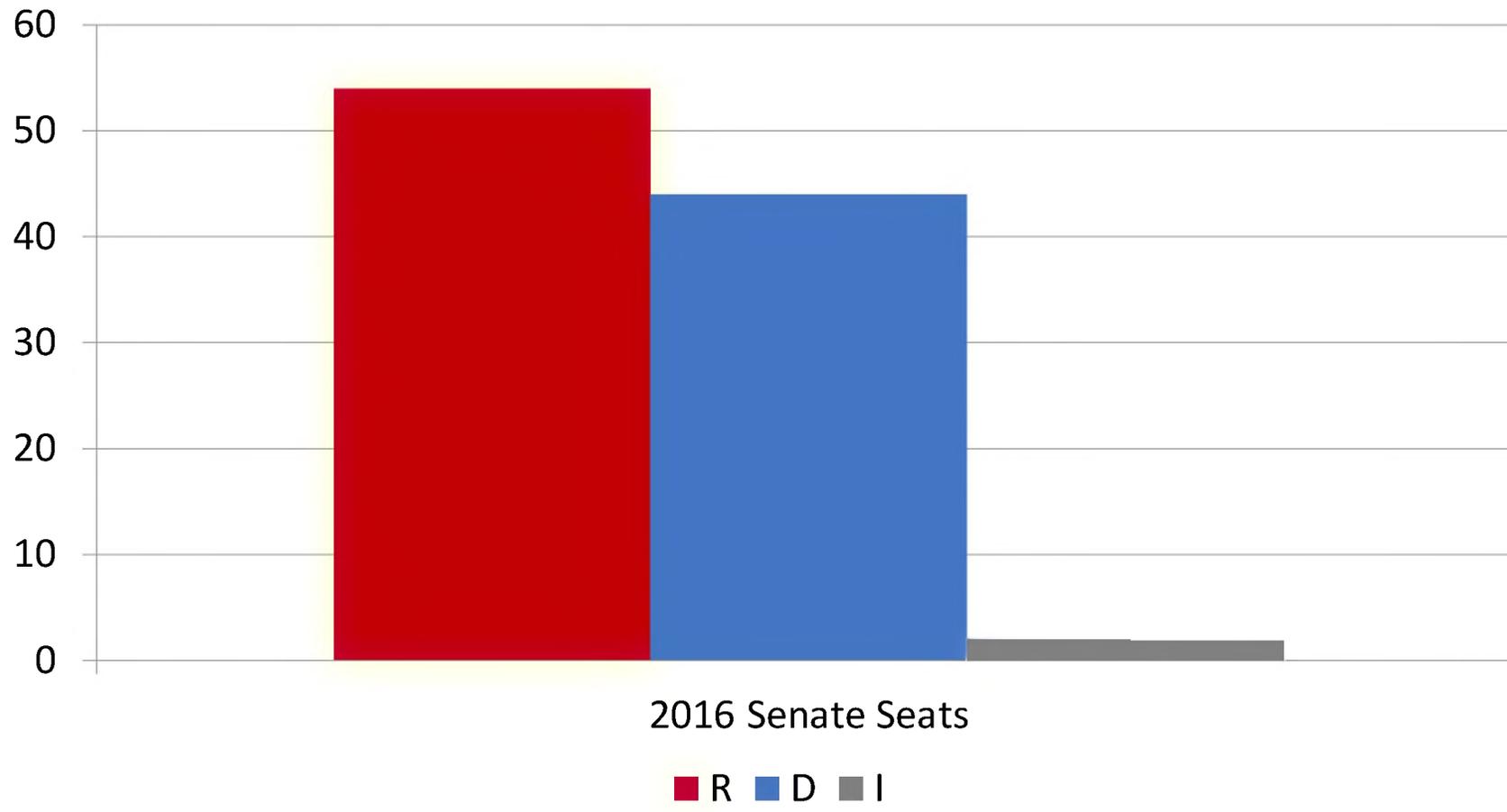


# 2012 PRESIDENTIAL RUN

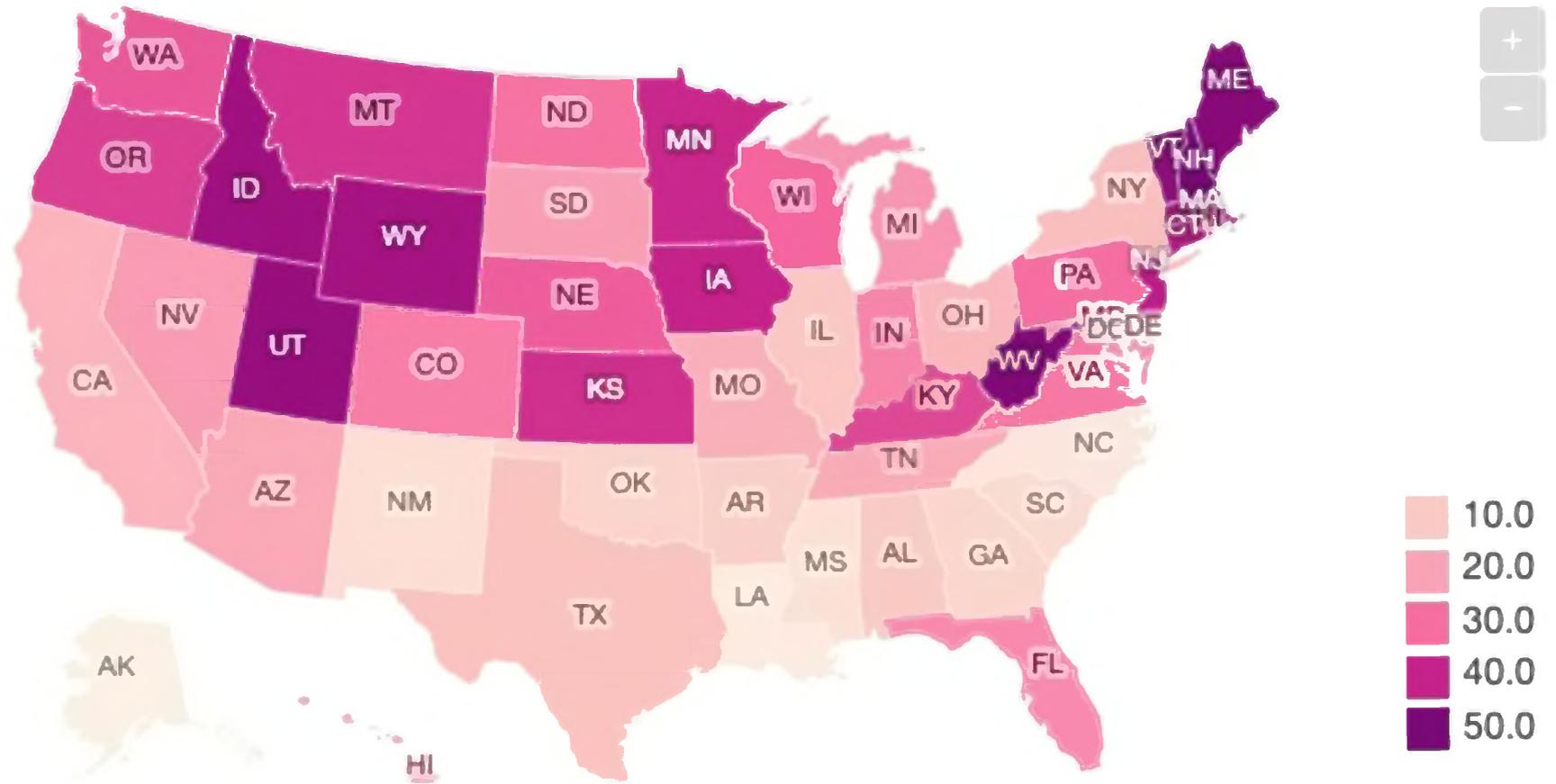
## GOP CANDIDATES



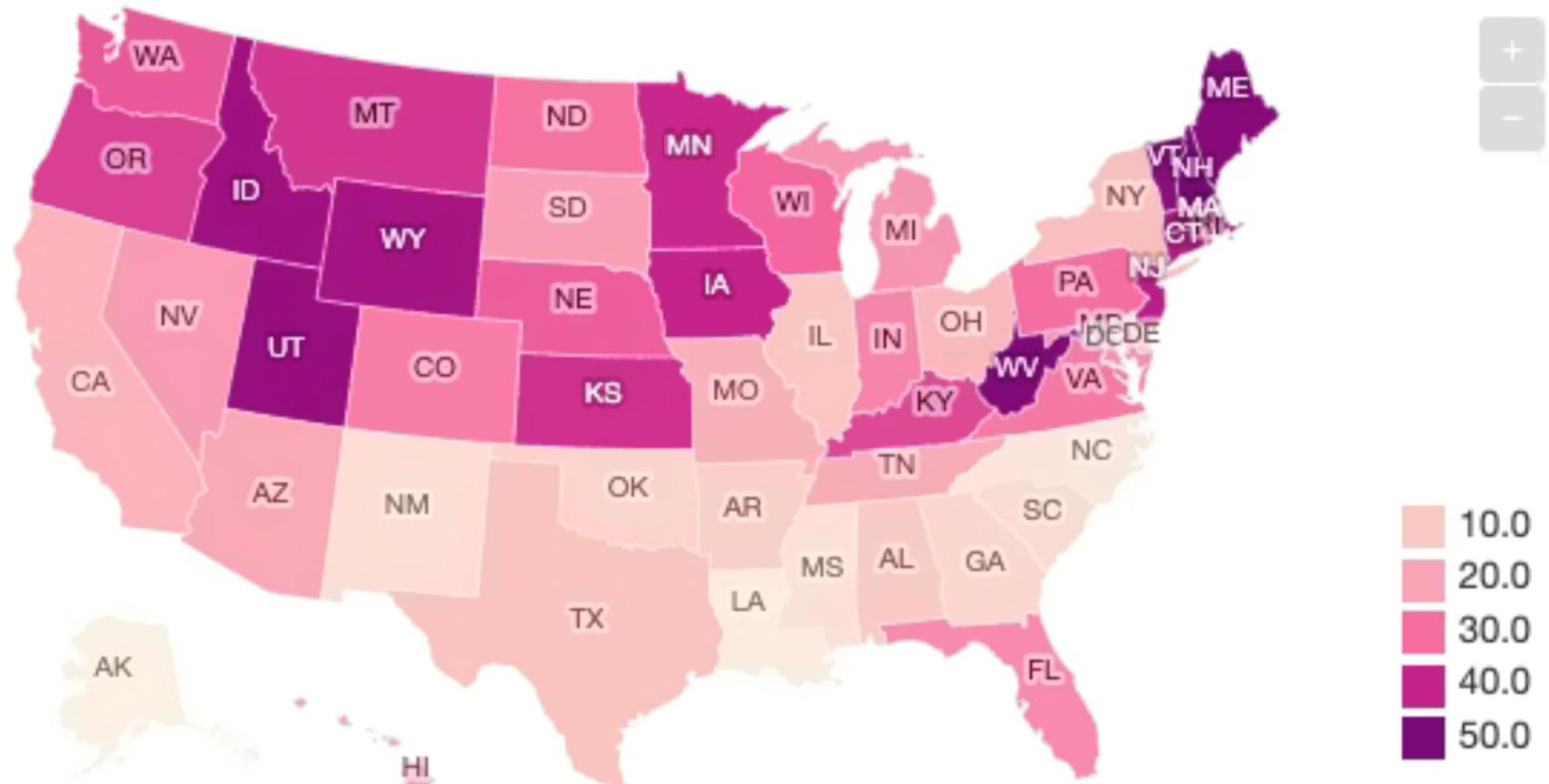




Which states have the most STIs?



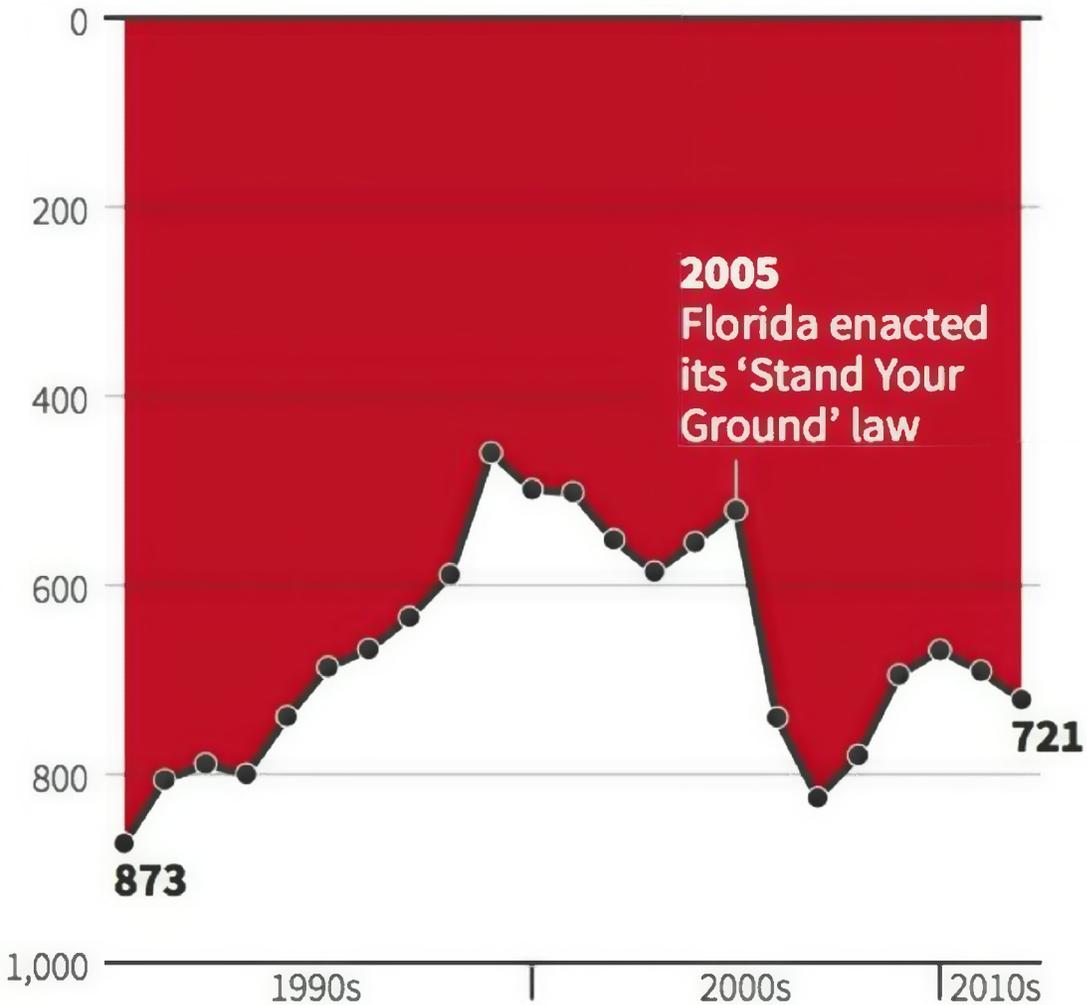
## Which states have the most STIs?



“Each state has been rated from one to 50: the higher the score, the smaller the proportion of STIs. So on the map - the darker the colour, the smaller the rate of STIs.”

# Gun deaths in Florida

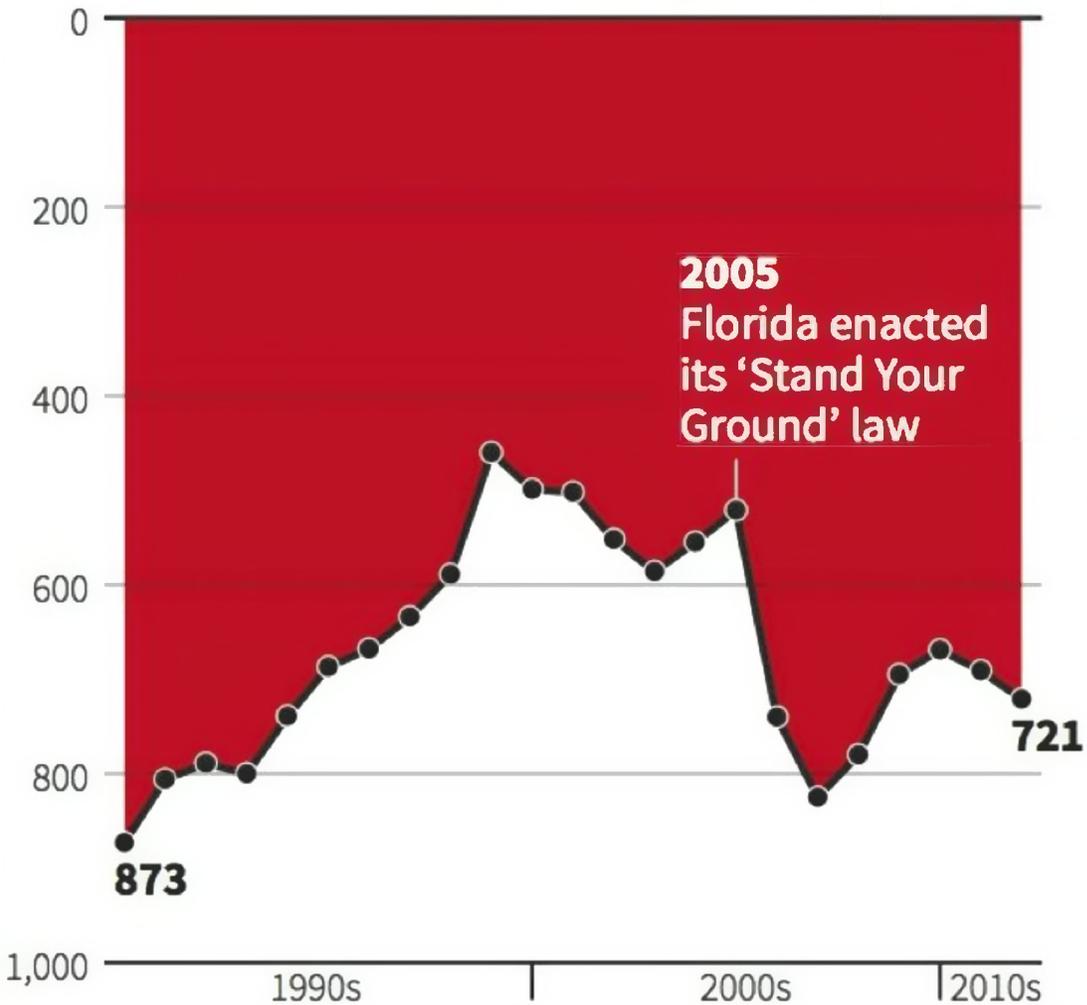
Number of murders committed using firearms



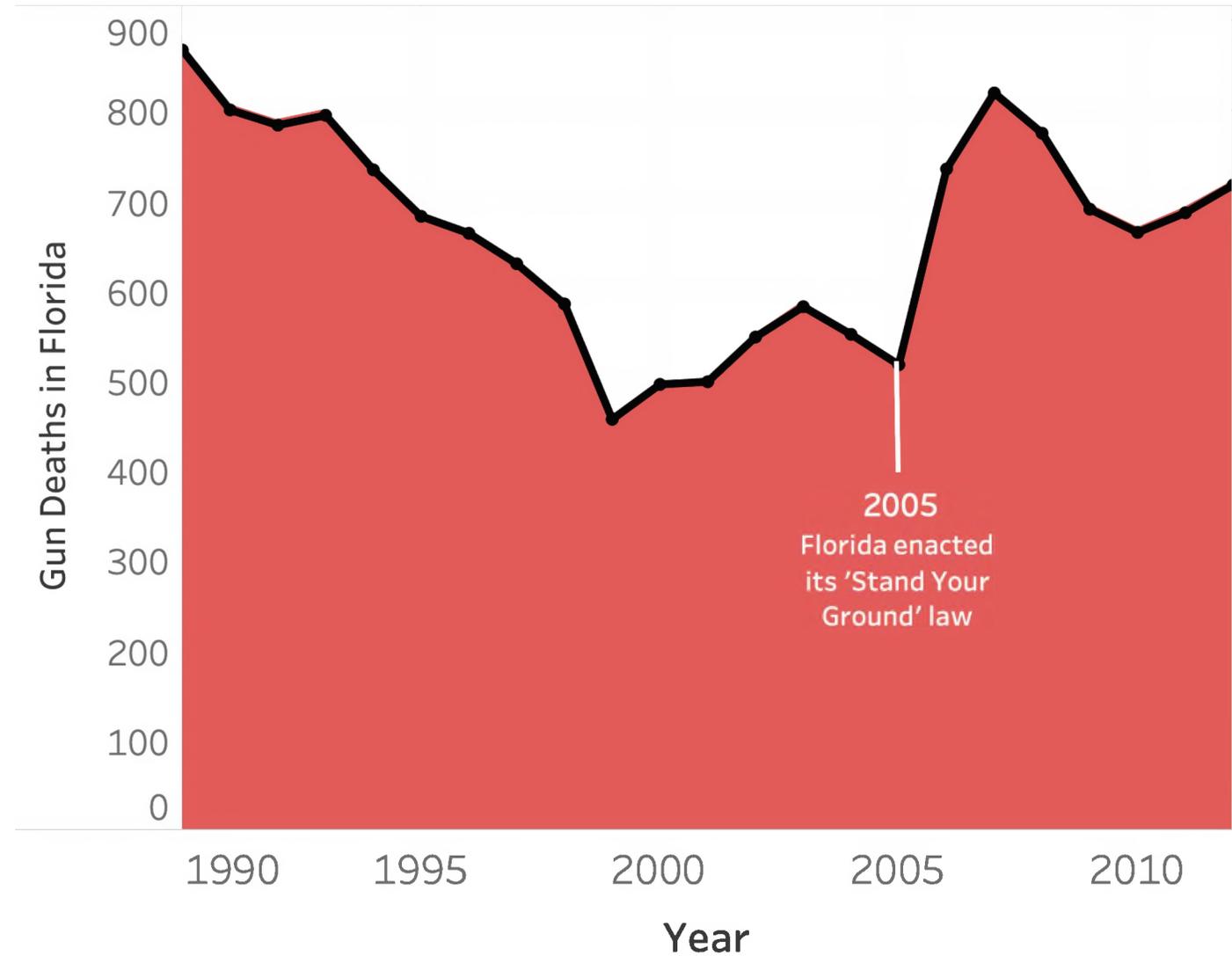
Source: Florida Department of Law Enforcement

# Gun deaths in Florida

Number of murders committed using firearms



Source: Florida Department of Law Enforcement





# ITHACA TIMES

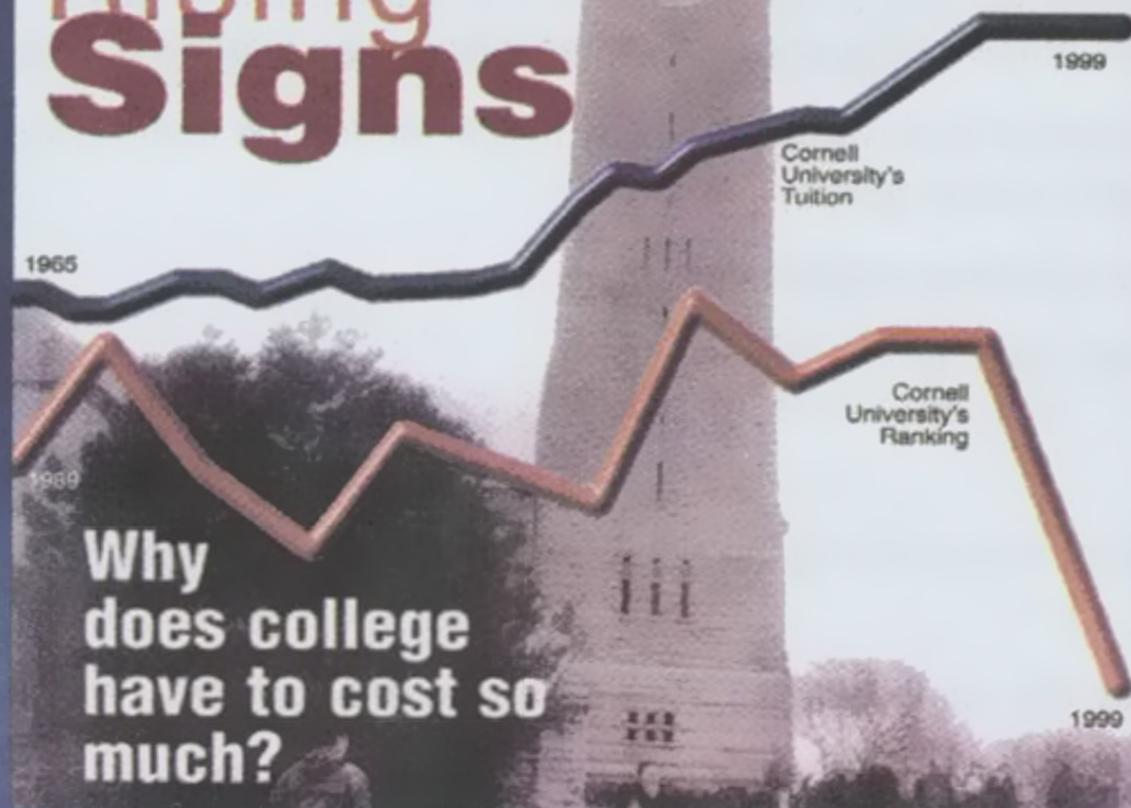
Visit us online at <http://www.ithacatimes.com>

Planning Board approves  
Widewaters development

IC students occupy Job Hall

Cayuga Vocal Ensemble  
ushers in the holidays with  
"Judas Maccabaeus"

## Rising Signs



Why  
does college  
have to cost so  
much?

# ITHACA TIMES

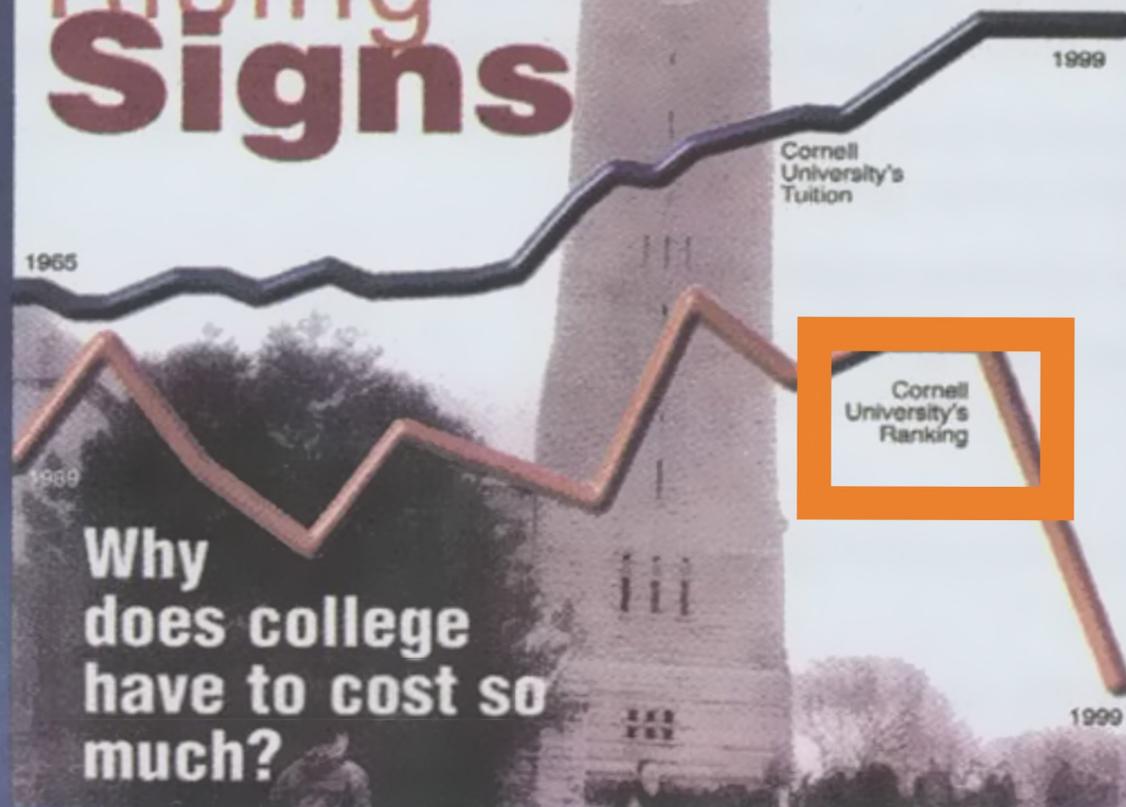
Visit us online at <http://www.ithacatimes.com>

Planning Board approves  
Widewaters development

IC students occupy Job Hall

Cayuga Vocal Ensemble  
ushers in the holidays with  
"Judas Maccabaeus"

## Rising Signs

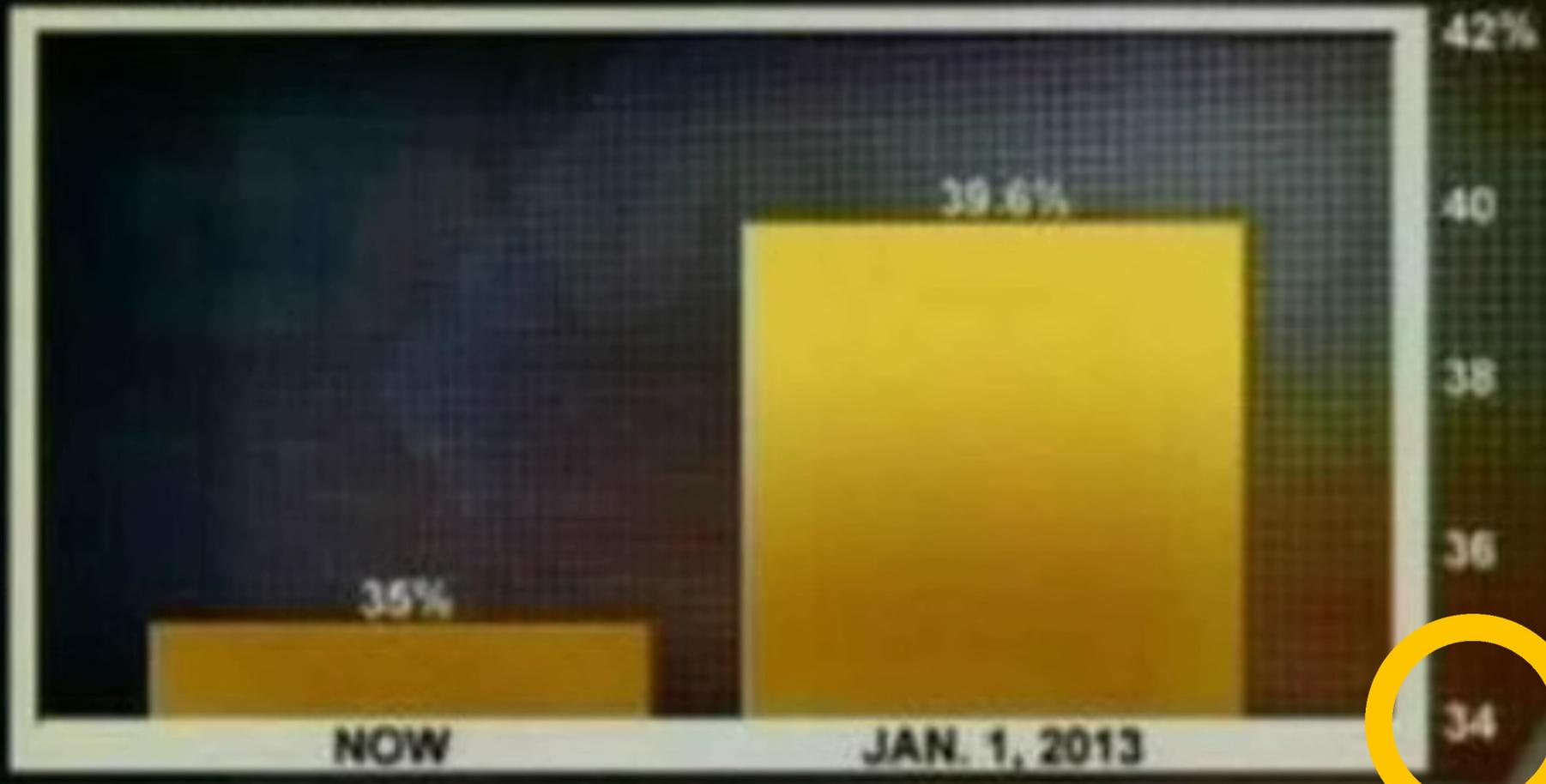


Why  
does college  
have to cost so  
much?



IF BOTH TAX CUTS ENACTED

# TOP TAX RATE



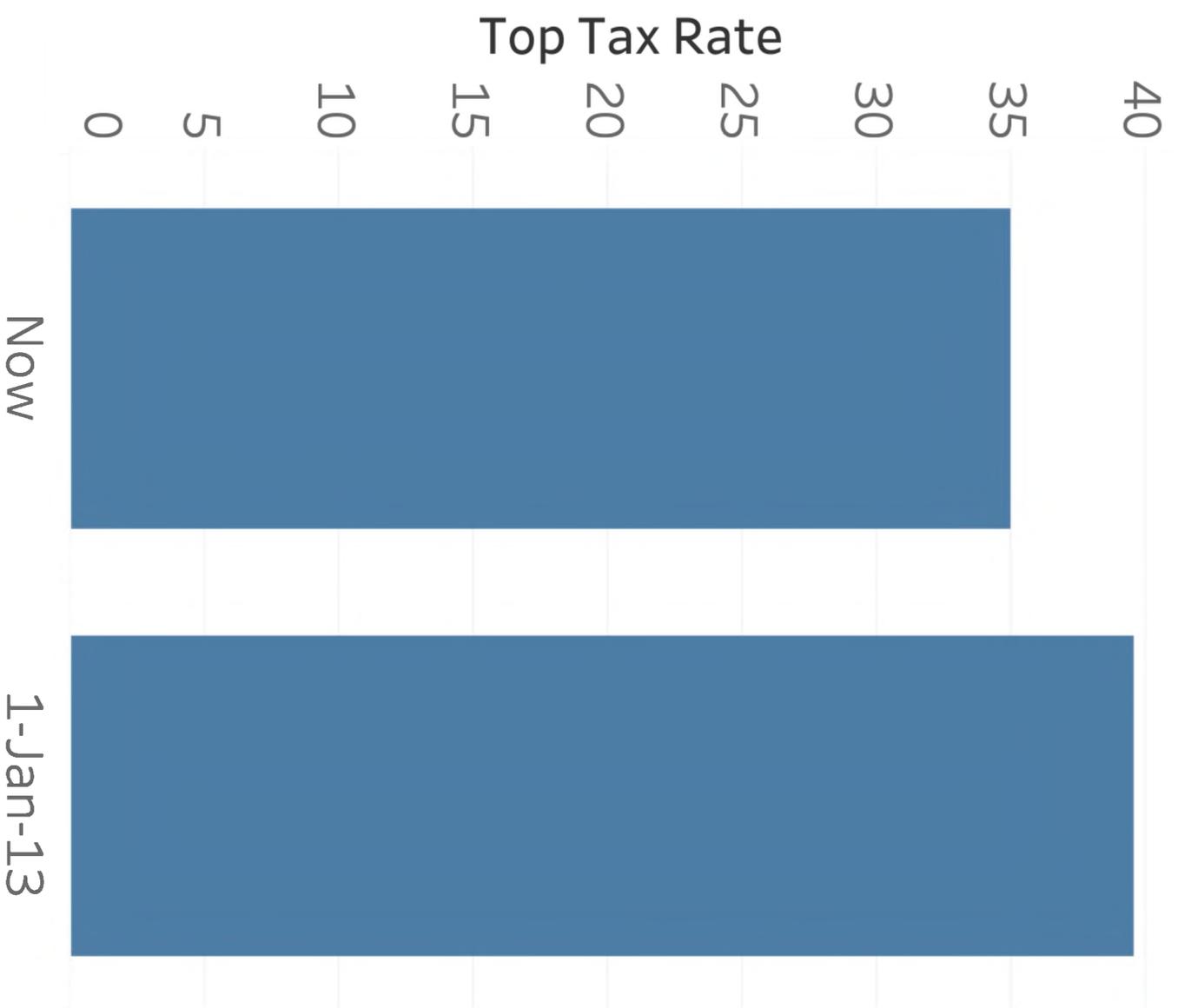
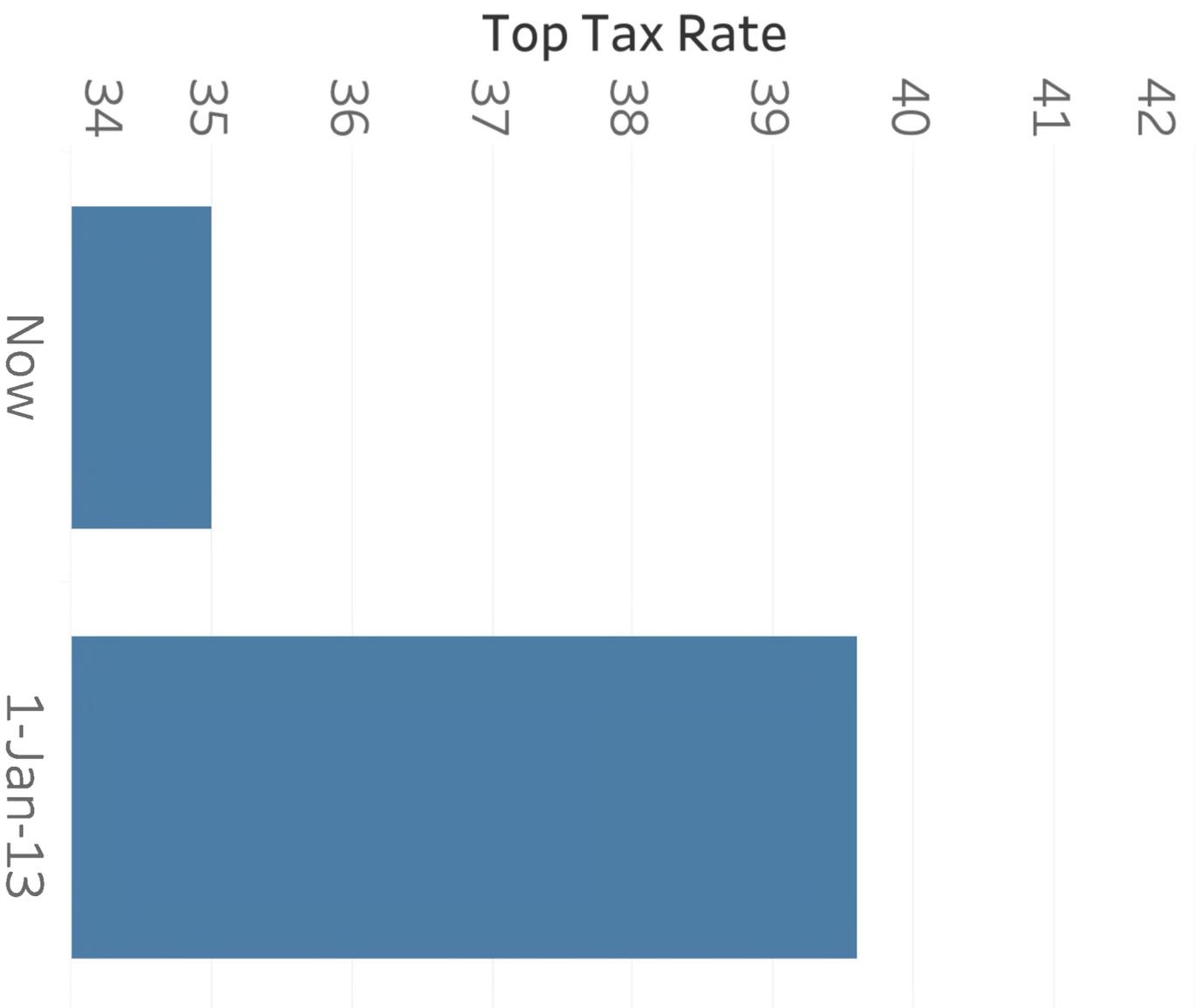
8:01p ET



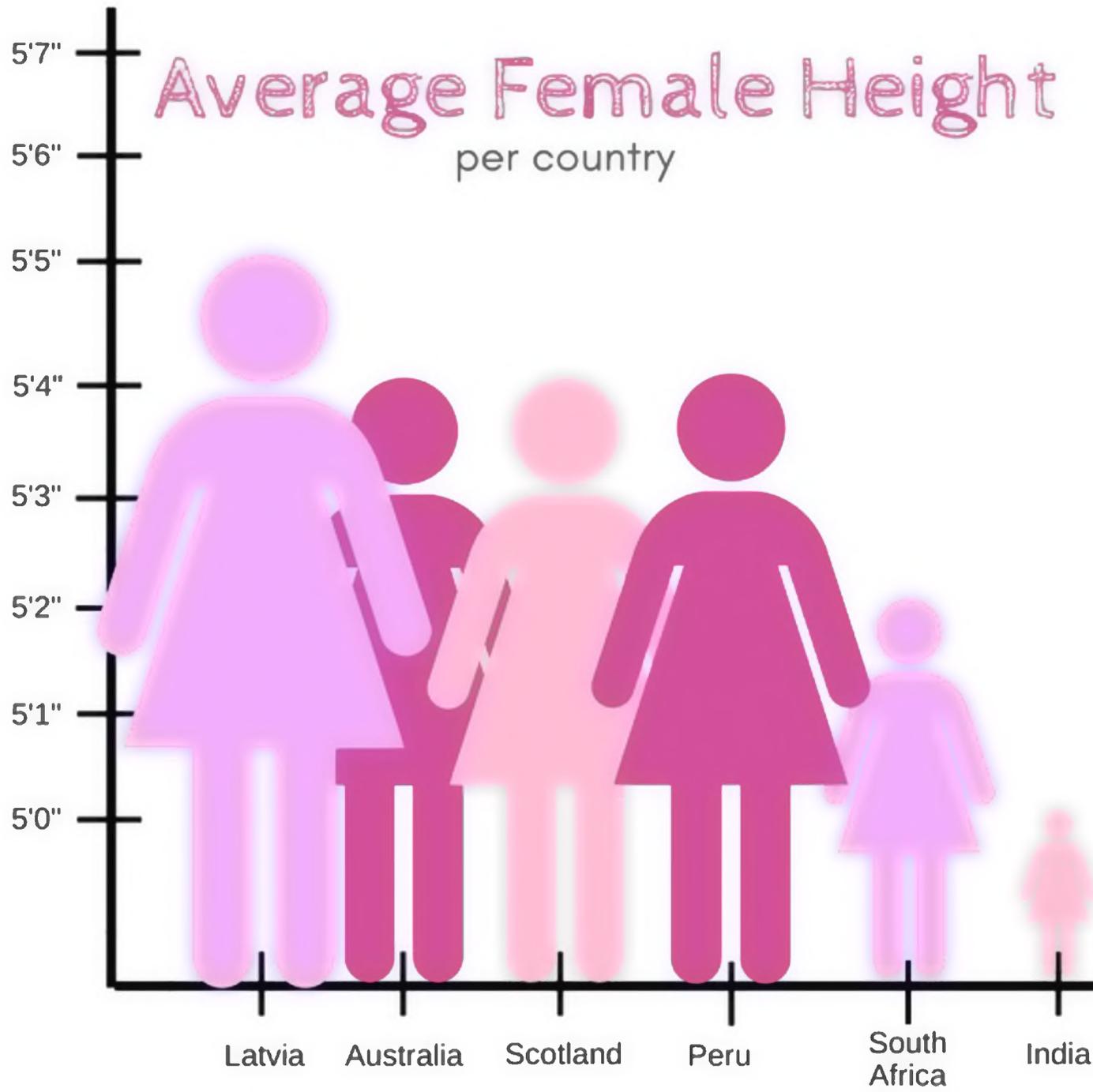
TOP STORIES

TECHNOLOGY

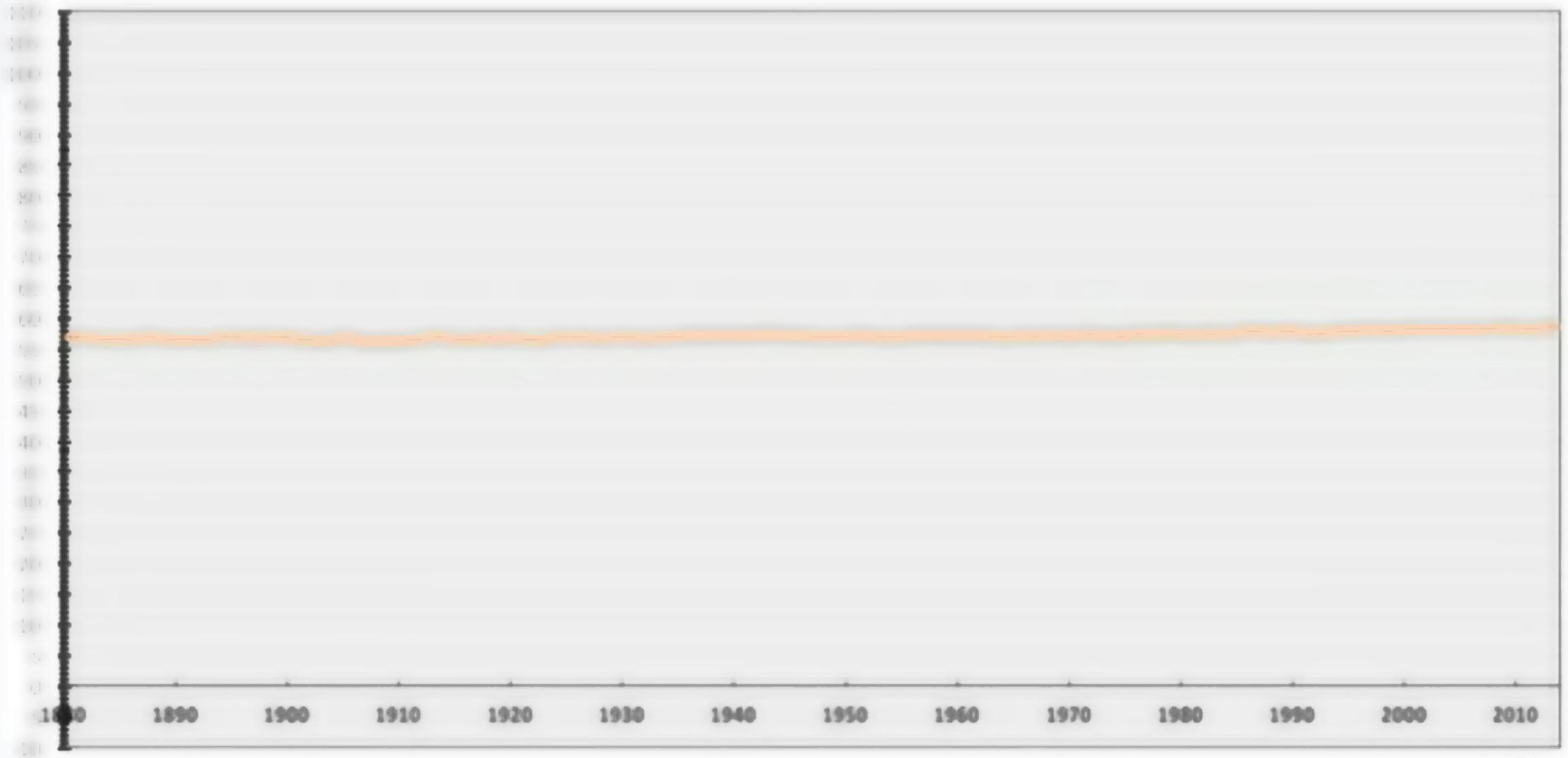
CONSUMER



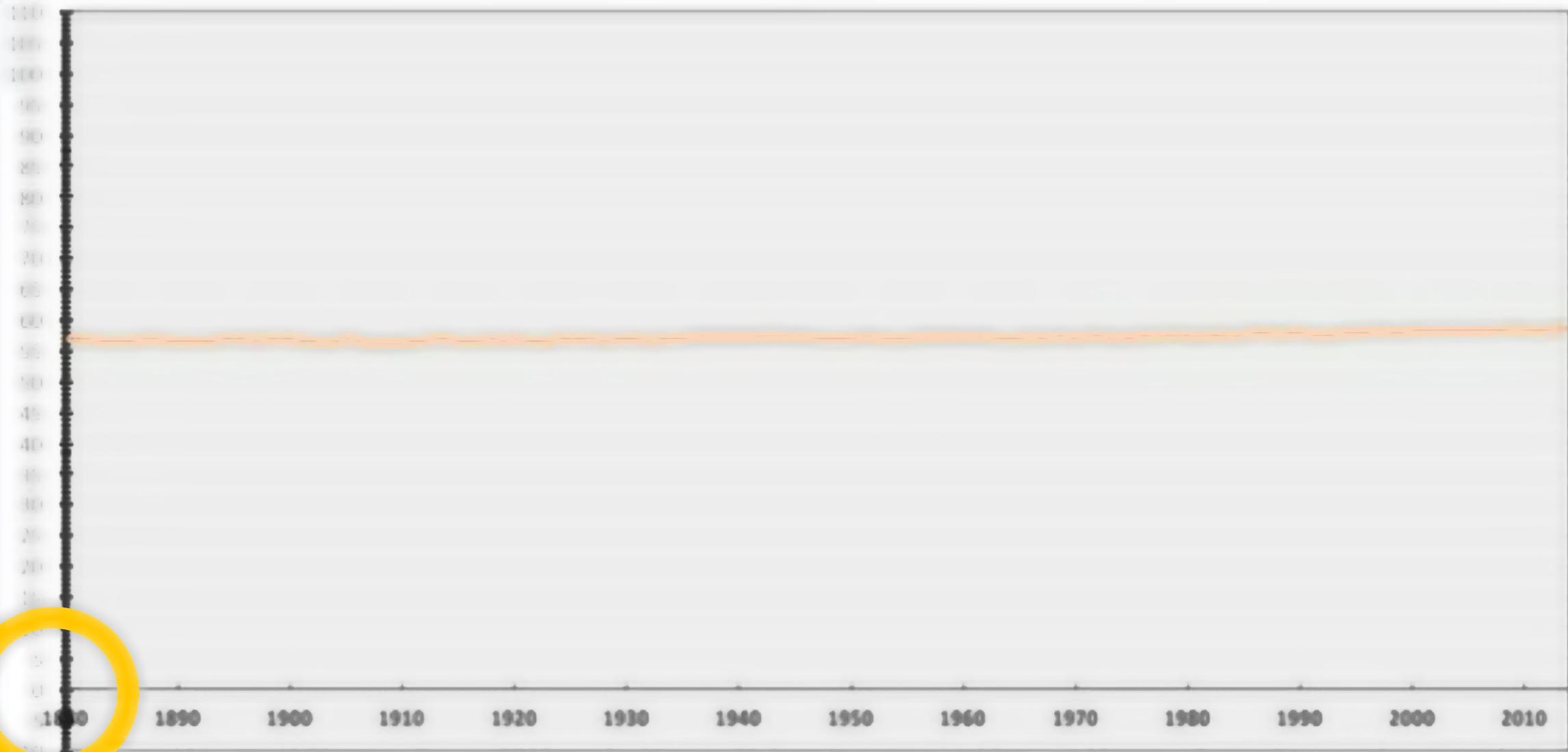
# Average Female Height per country



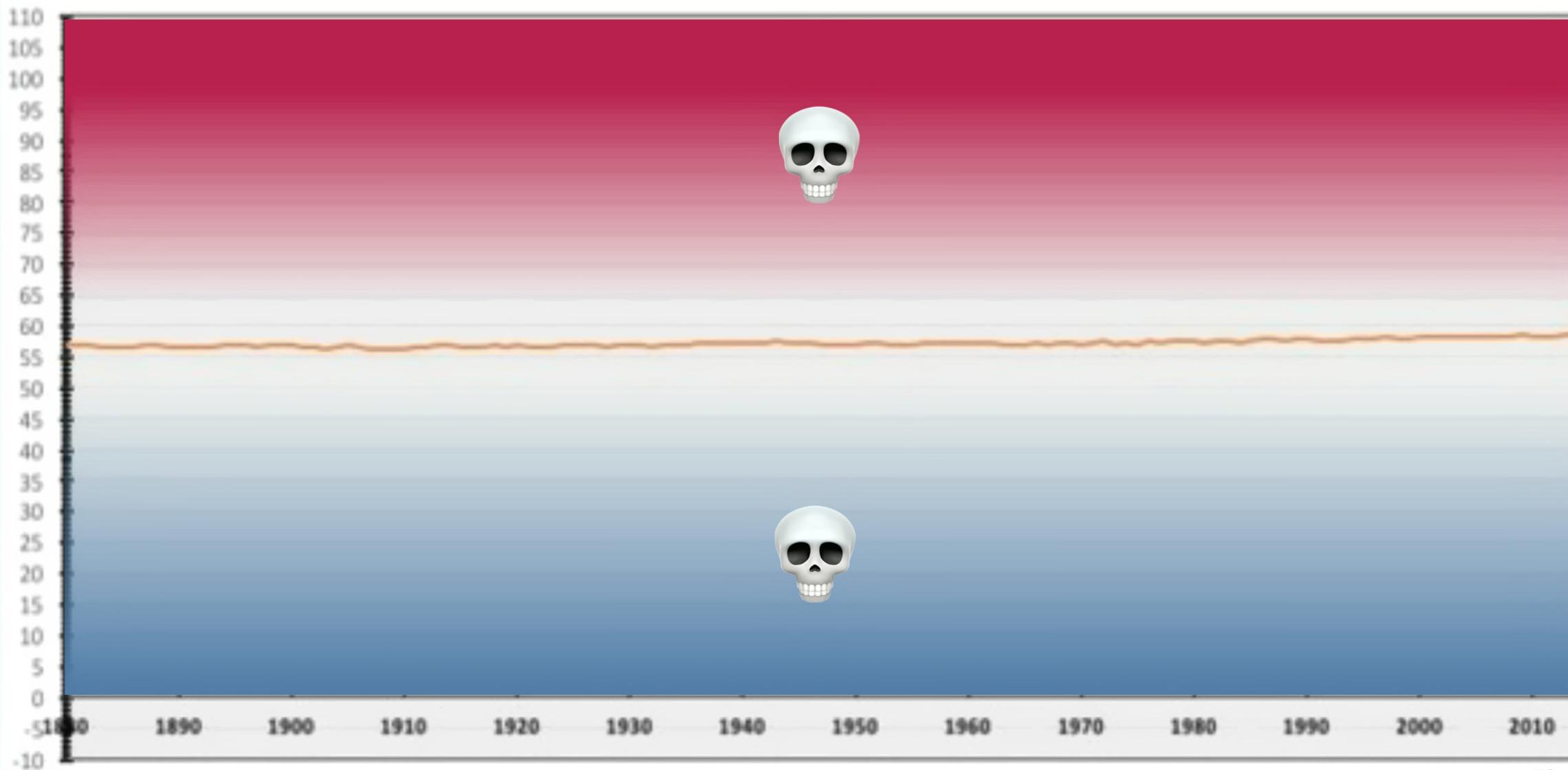
# Average Annual Global Temperature in Fahrenheit 1880-2015



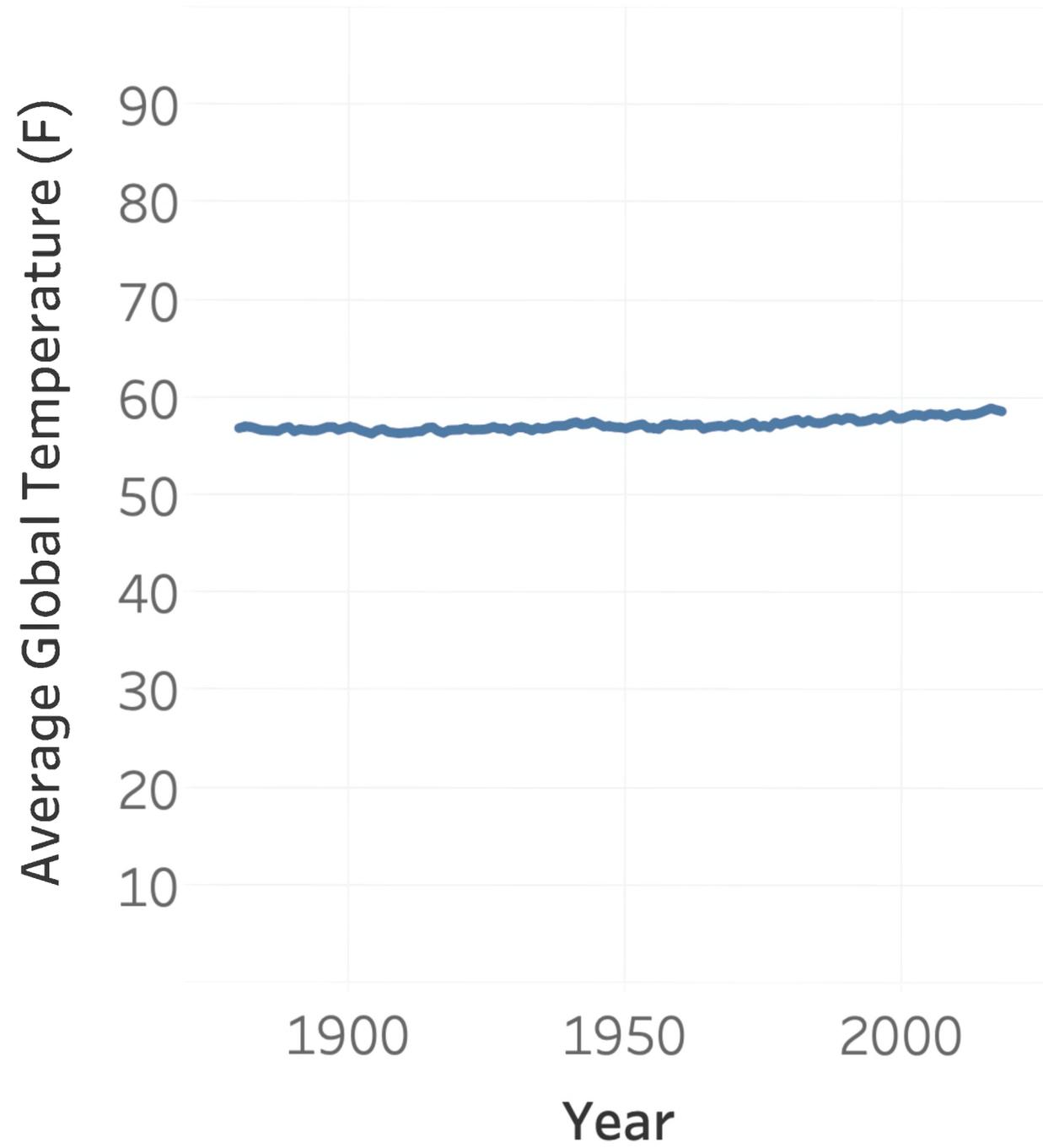
# Average Annual Global Temperature in Fahrenheit 1880-2015



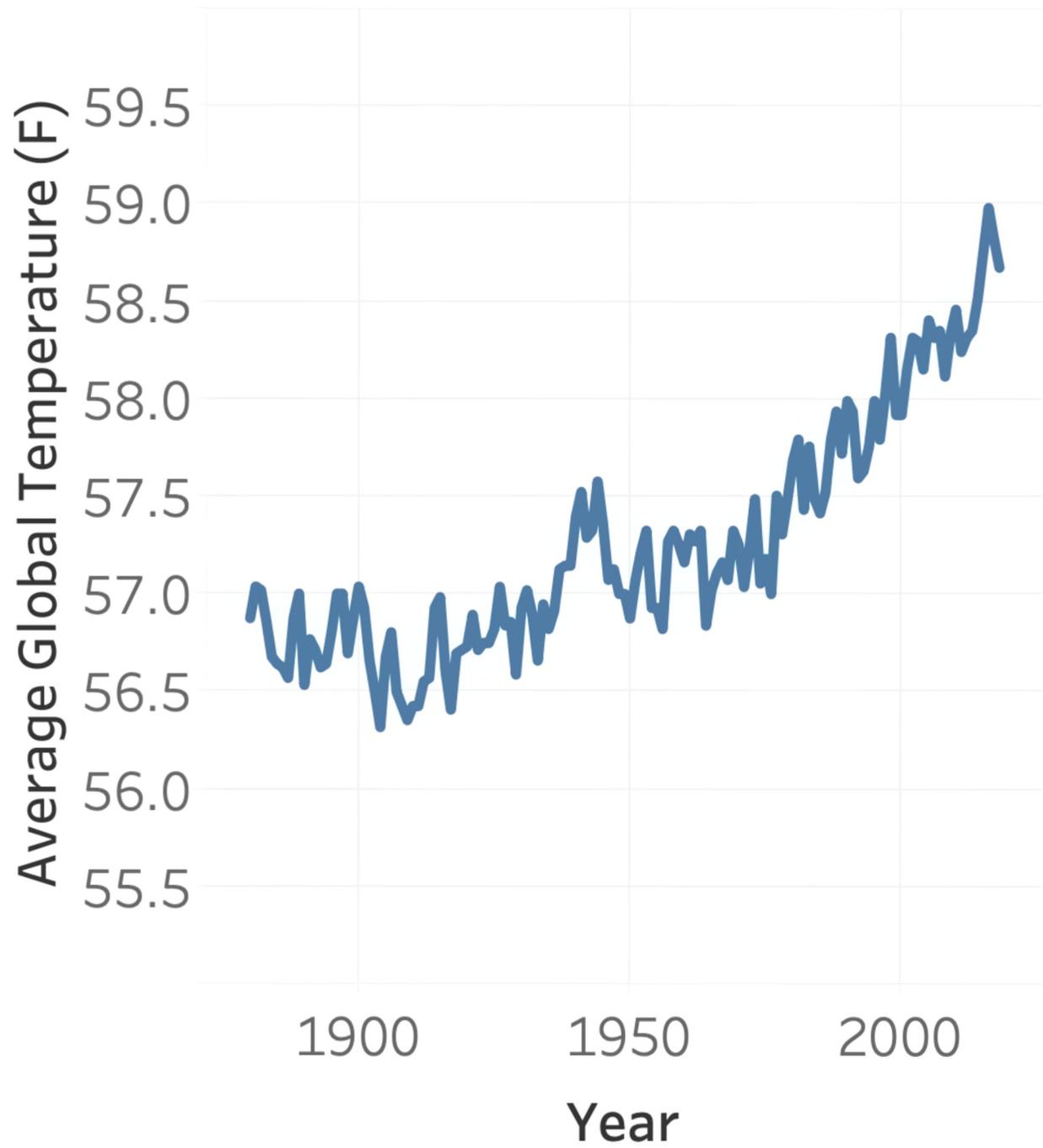
# Average Annual Global Temperature in Fahrenheit 1880-2015



NRO



NRO (Truncated)



# Unconventional Visualizations

People have tacit conventions on how they interpret charts  
(around colors, axes, slopes)

...if you violate those conventions, you can catch people off guard.

Bad Visualizations

Incorrect Visualizations

Illegible Visualizations

Bullshit Visualizations

Unconventional Visualizations

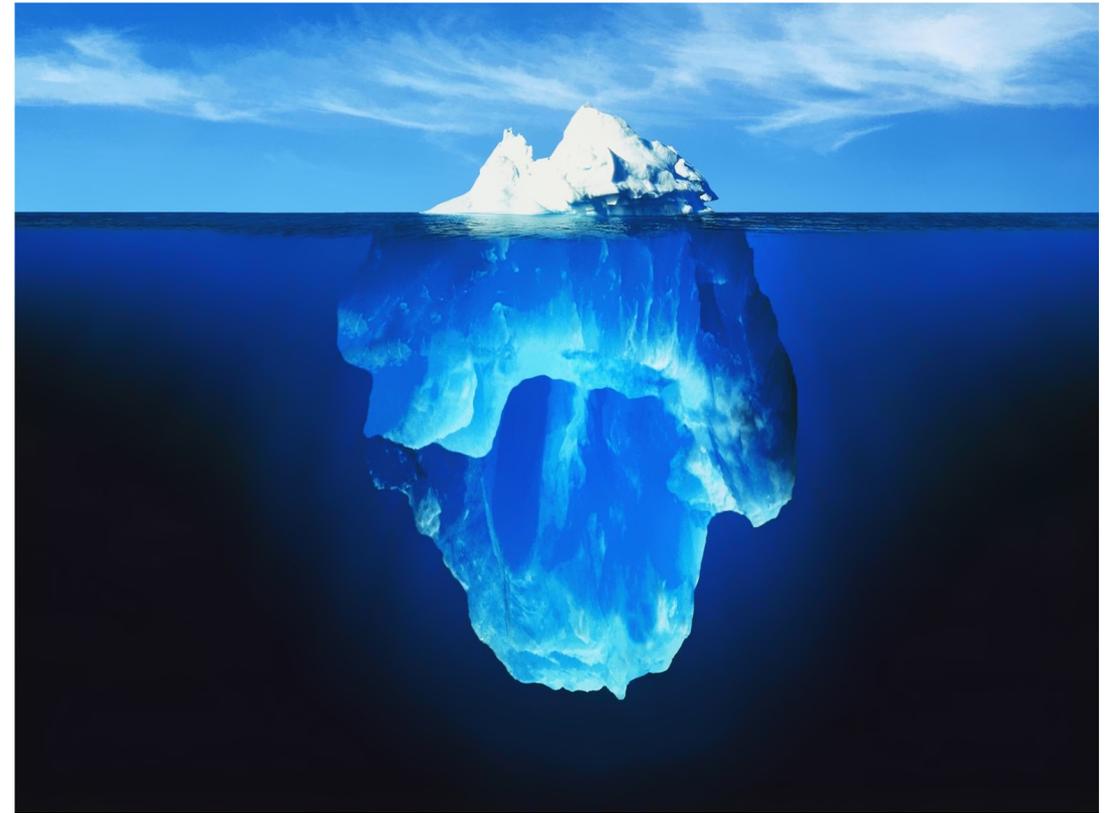


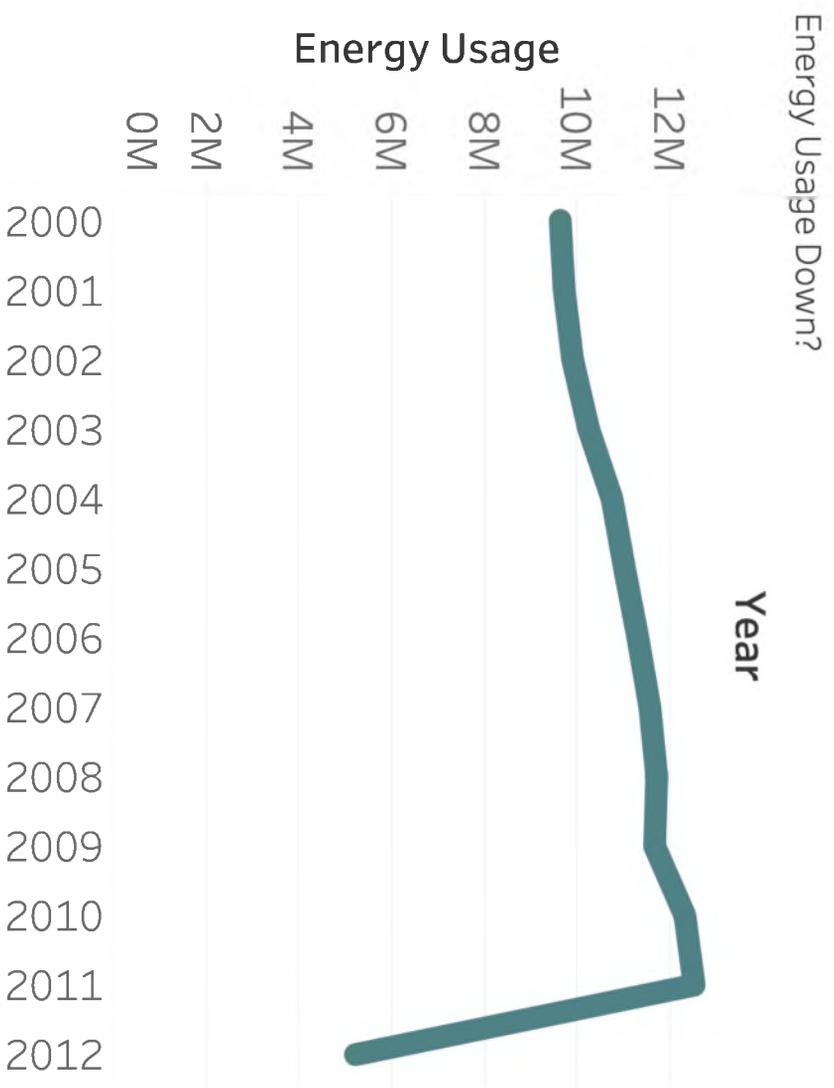
# Other Types of Bad Visualizations

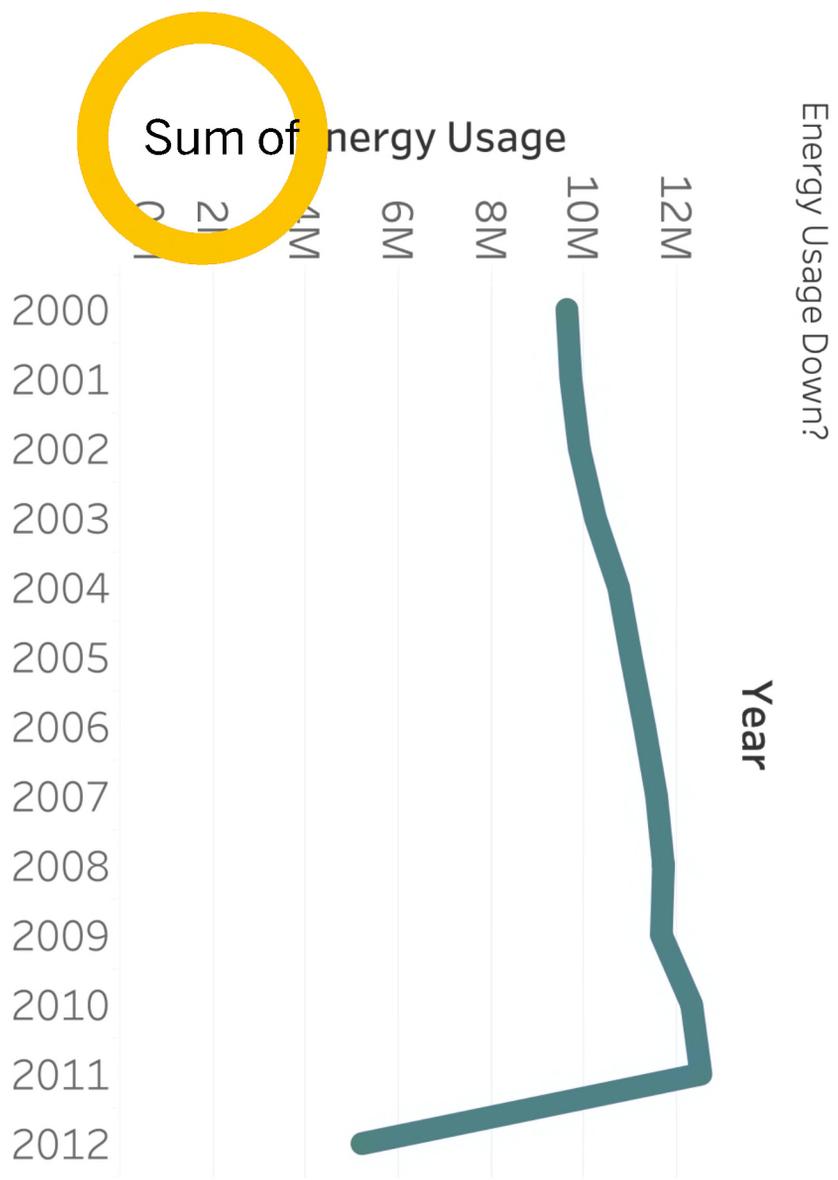
Fragile Visualizations?

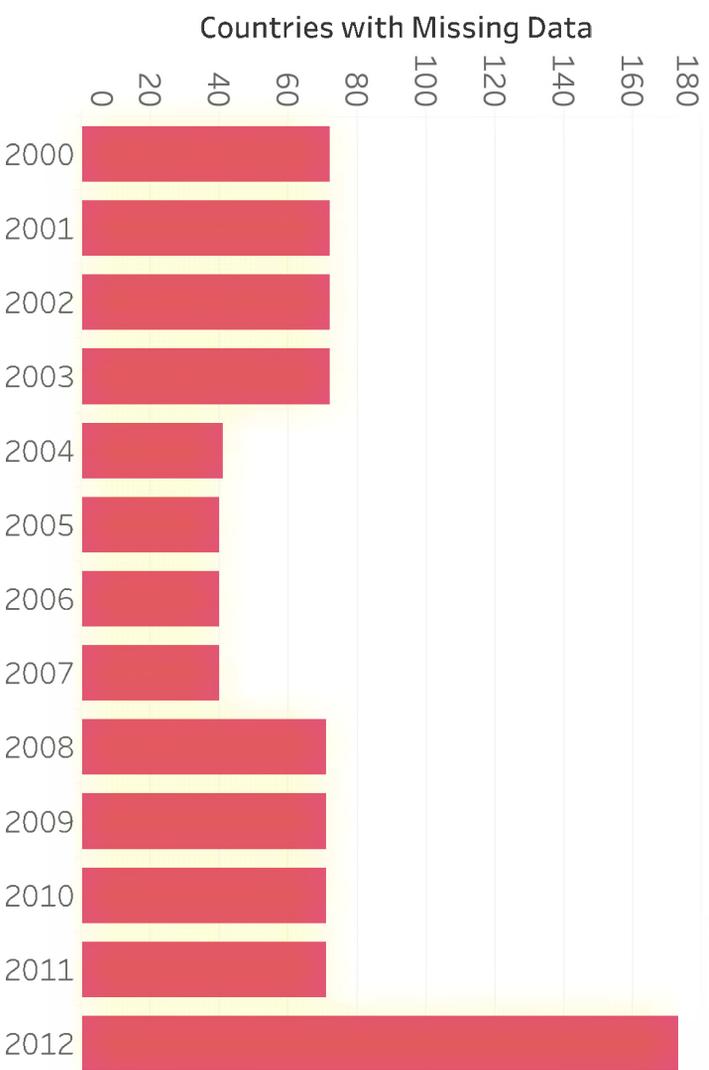
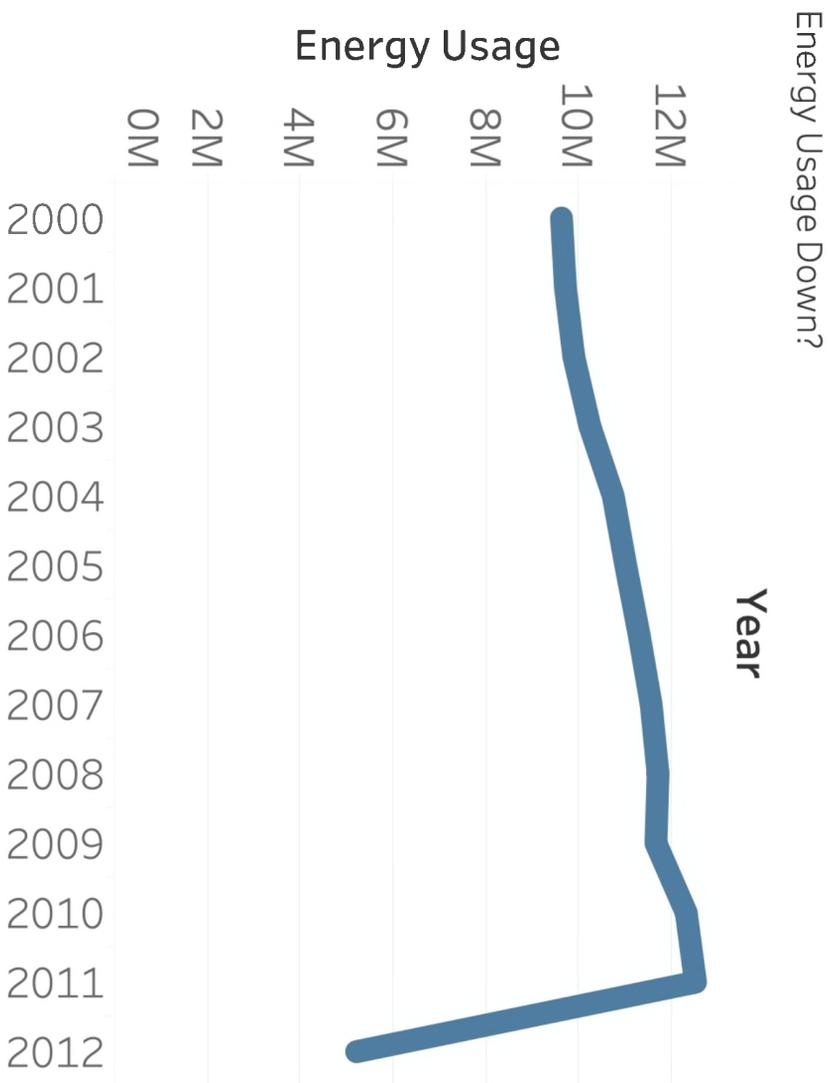
Inhuman Visualizations?

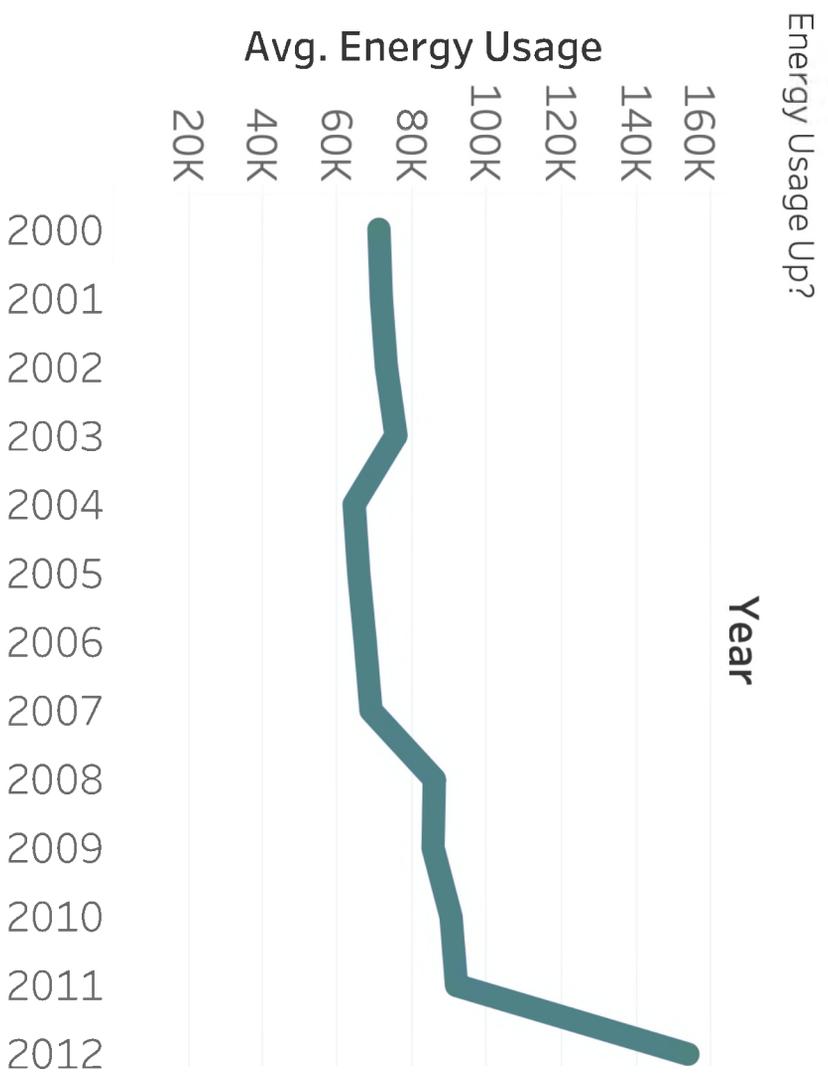
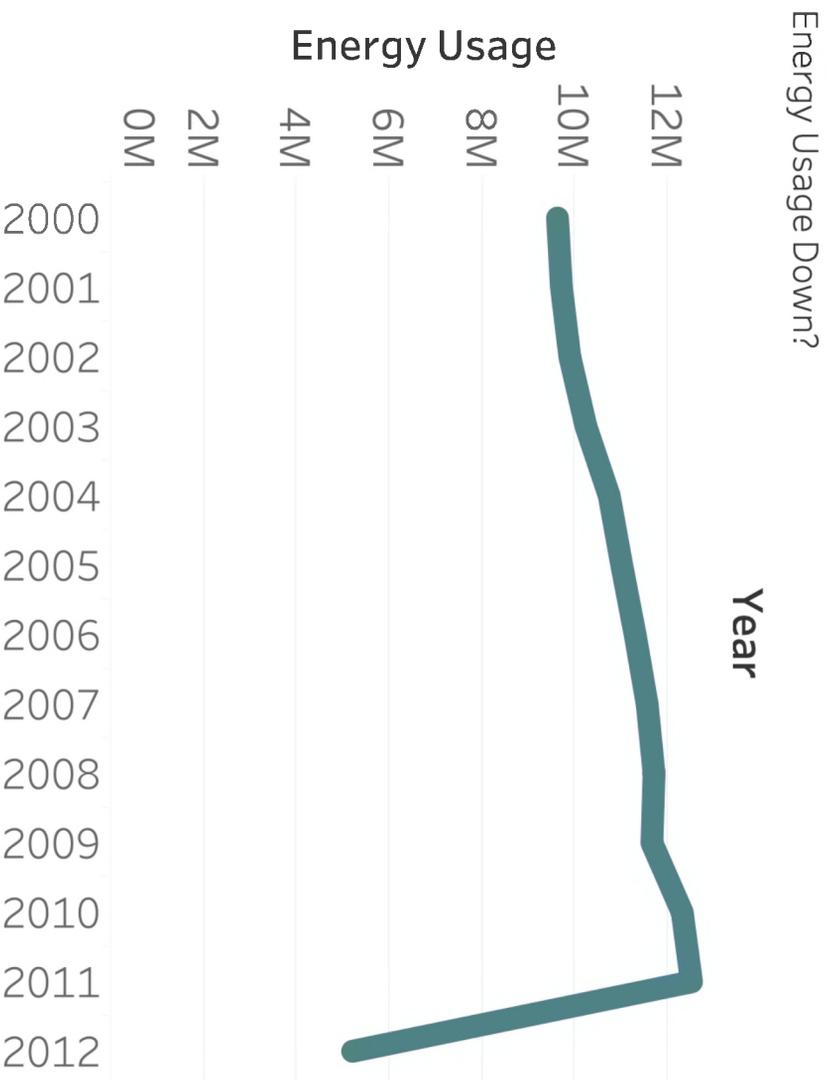
Visualization White Lies?



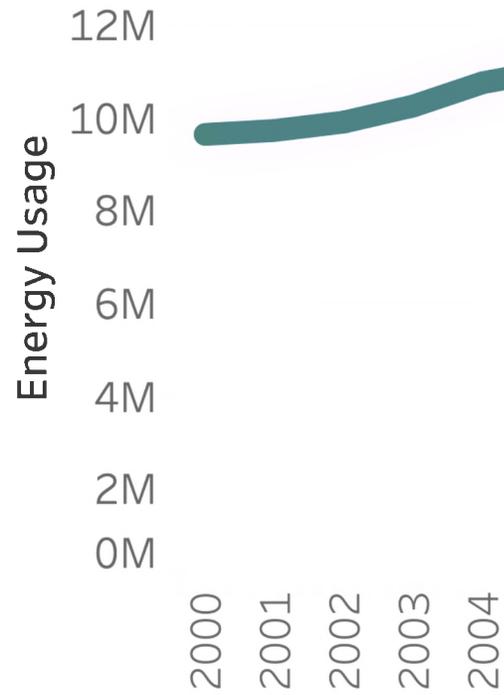




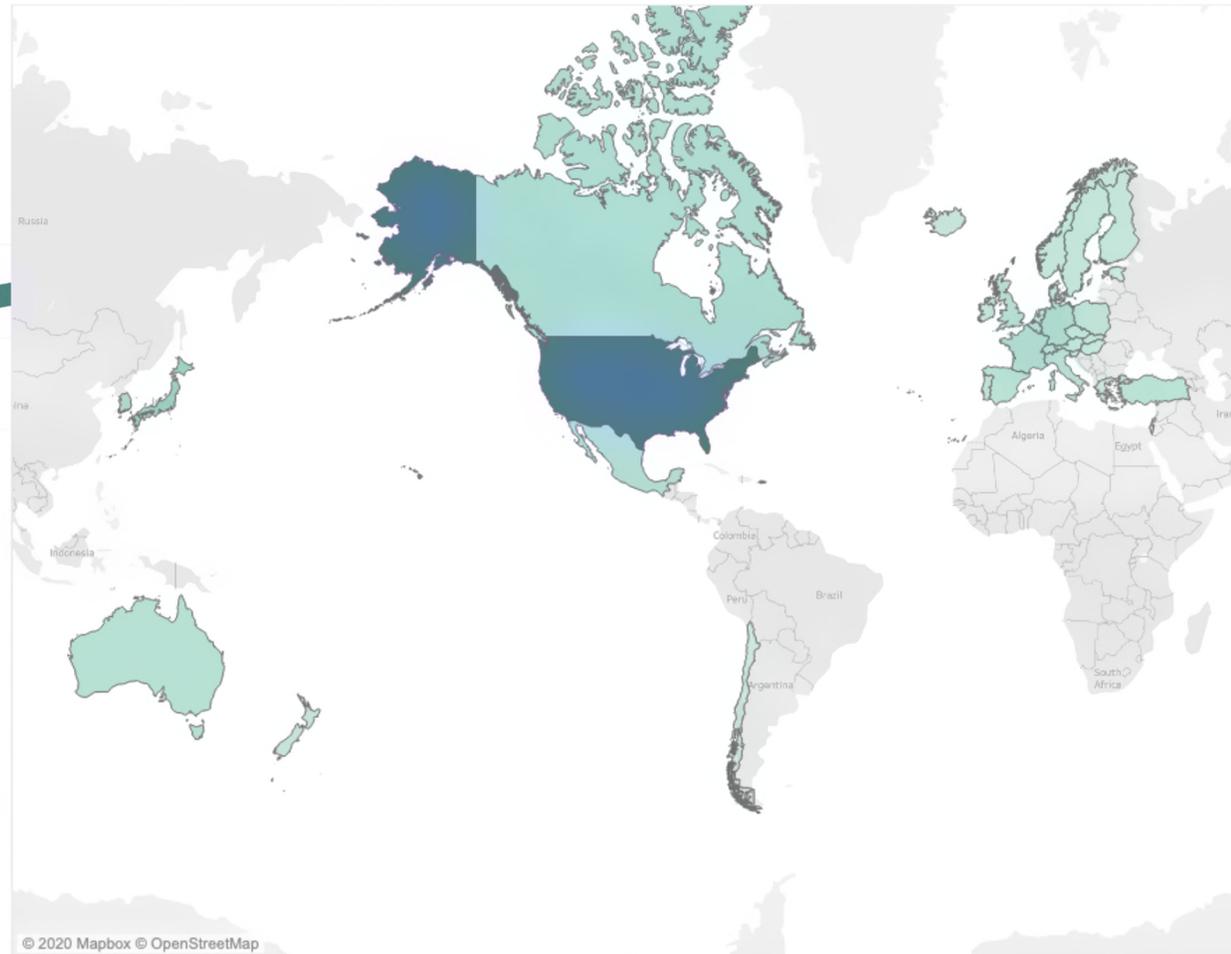


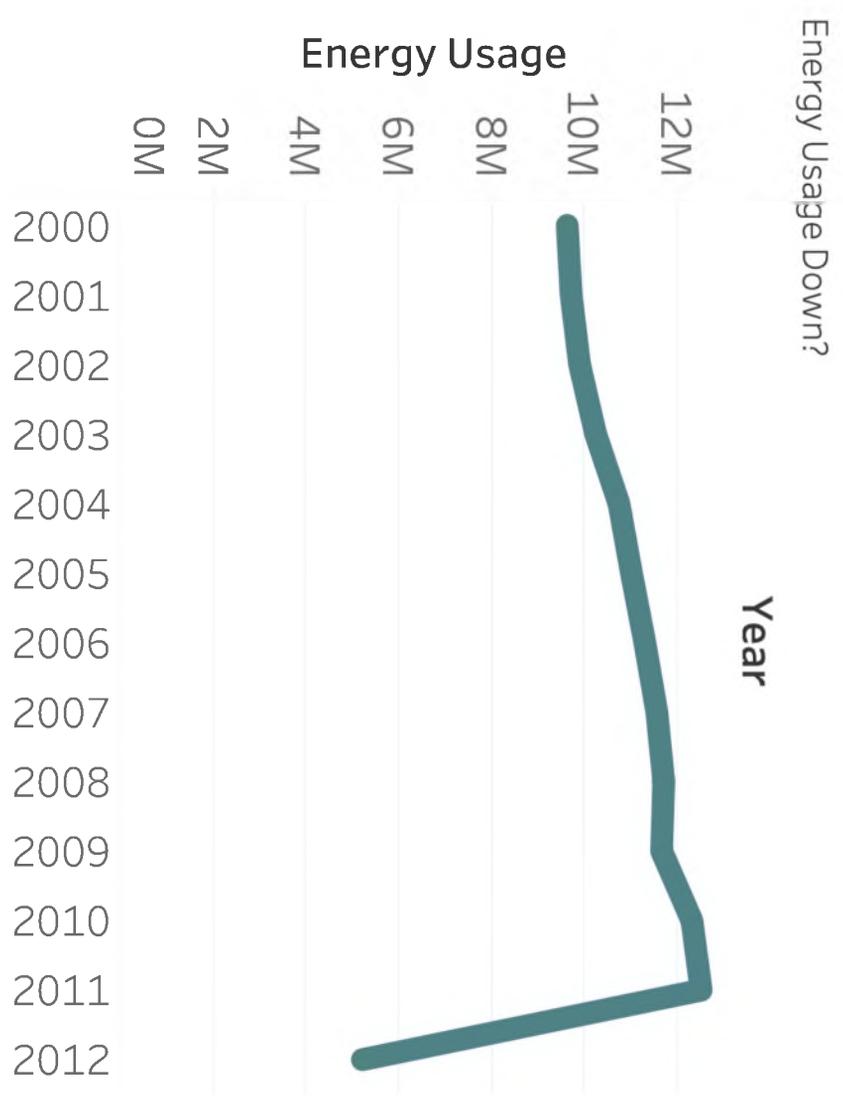


Energy Usage Down?

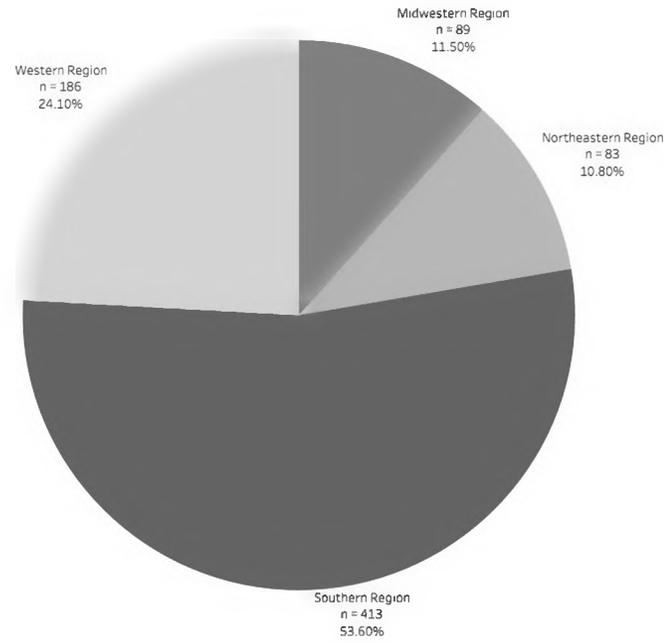


2012 Non-Nulls Are OECD Countries



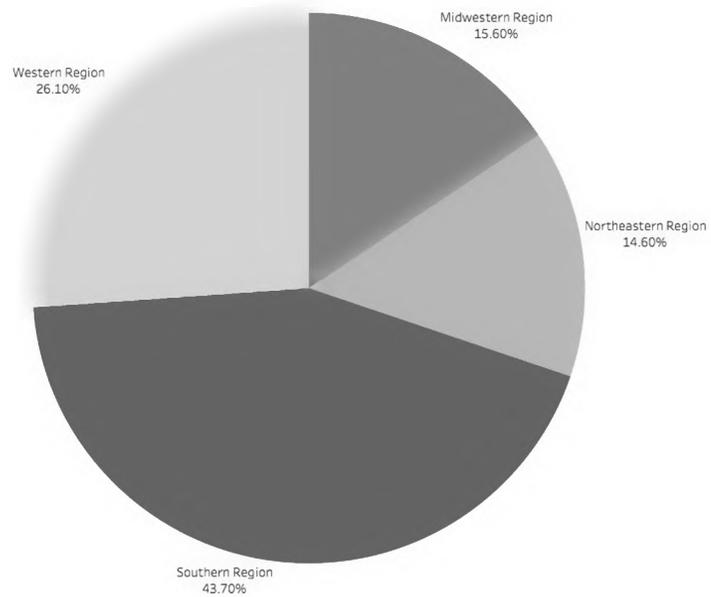


Logging fatalities and percentages by region, 1992-97

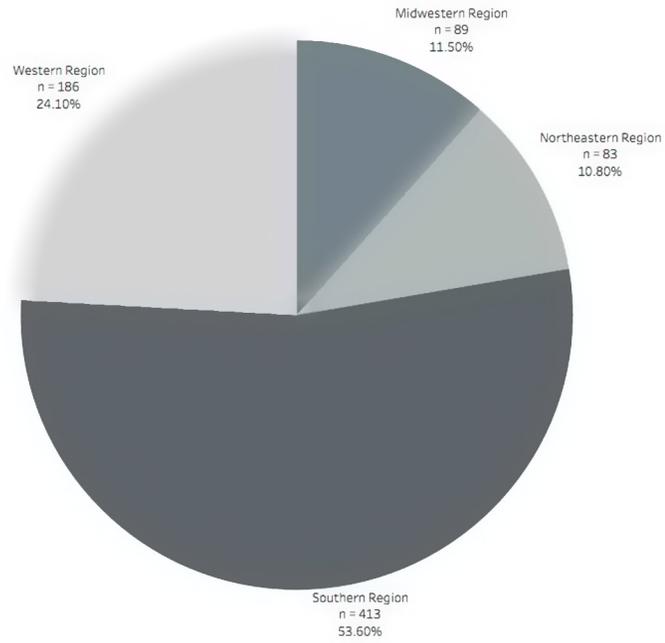


Sam Dragga & Dan Voss “Cruel Pies: The Inhumanity of Technical Illustrations”

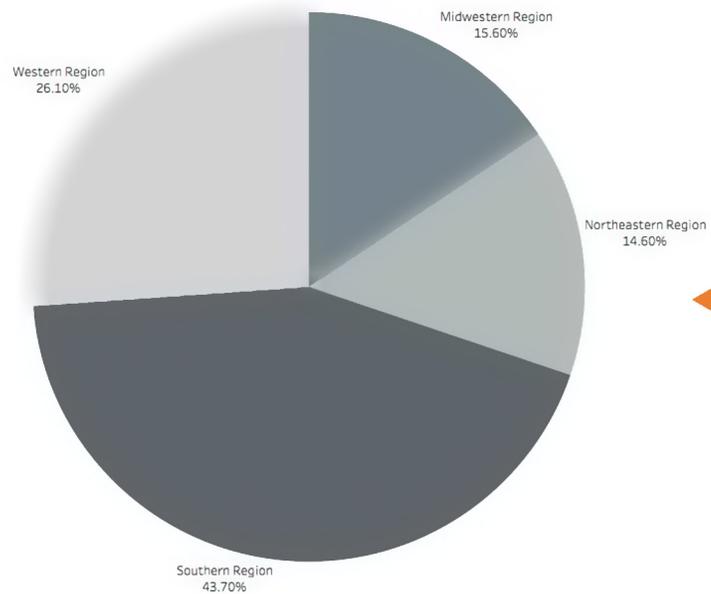
Logging employment percentages by region, 1992-97



Logging fatalities and percentages by region, 1992-97

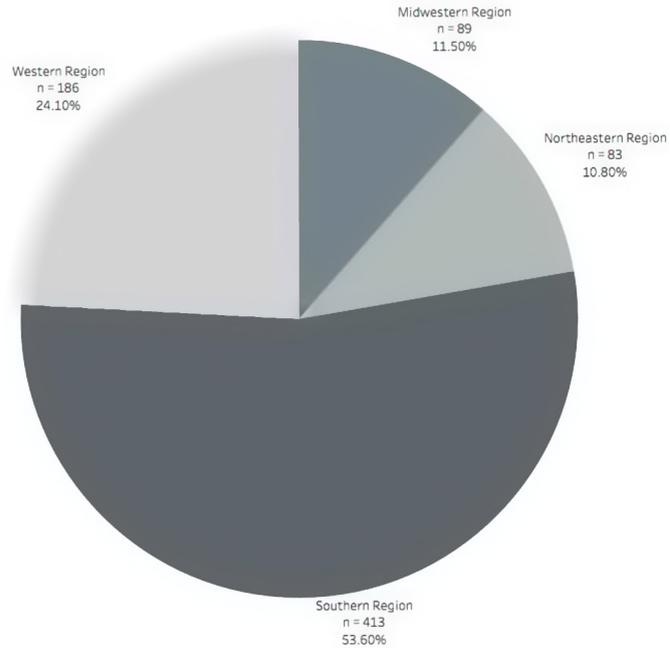


Logging employment percentages by region, 1992-97



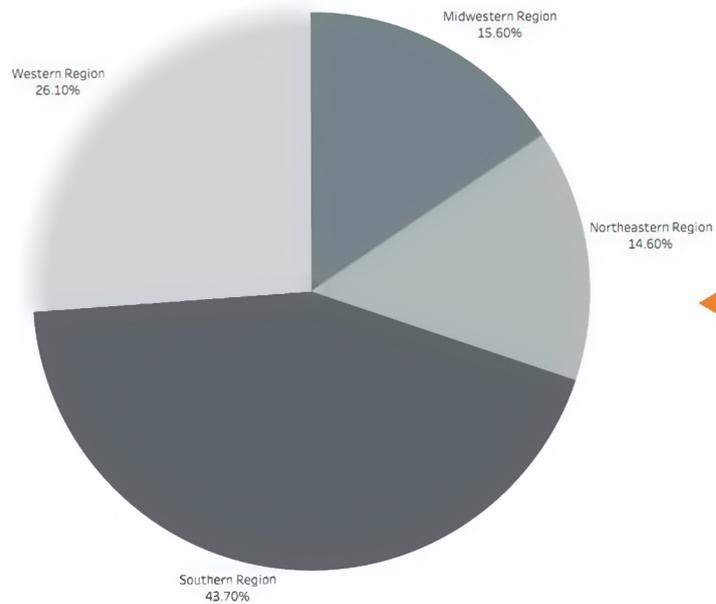
← Where Your Employees Live

## Logging fatalities and percentages by region, 1992-97



← 771 Dead People

## Logging employment percentages by region, 1992-97

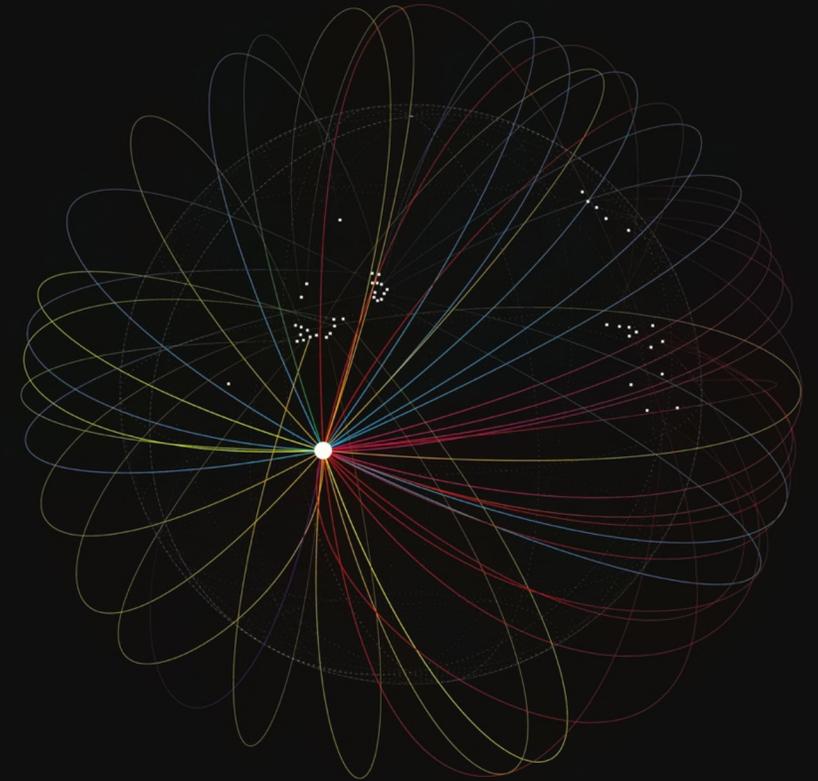


← Where Your Employees Live

# "The UnEmpathic Art"

I am just very skeptical of the idea that data visualization is a medium that can convey (or even care about conveying) or increase "empathy"

-Alberto Cairo



## HIROSHIMA

34° 23' 53" N, 132° 28' 32" E

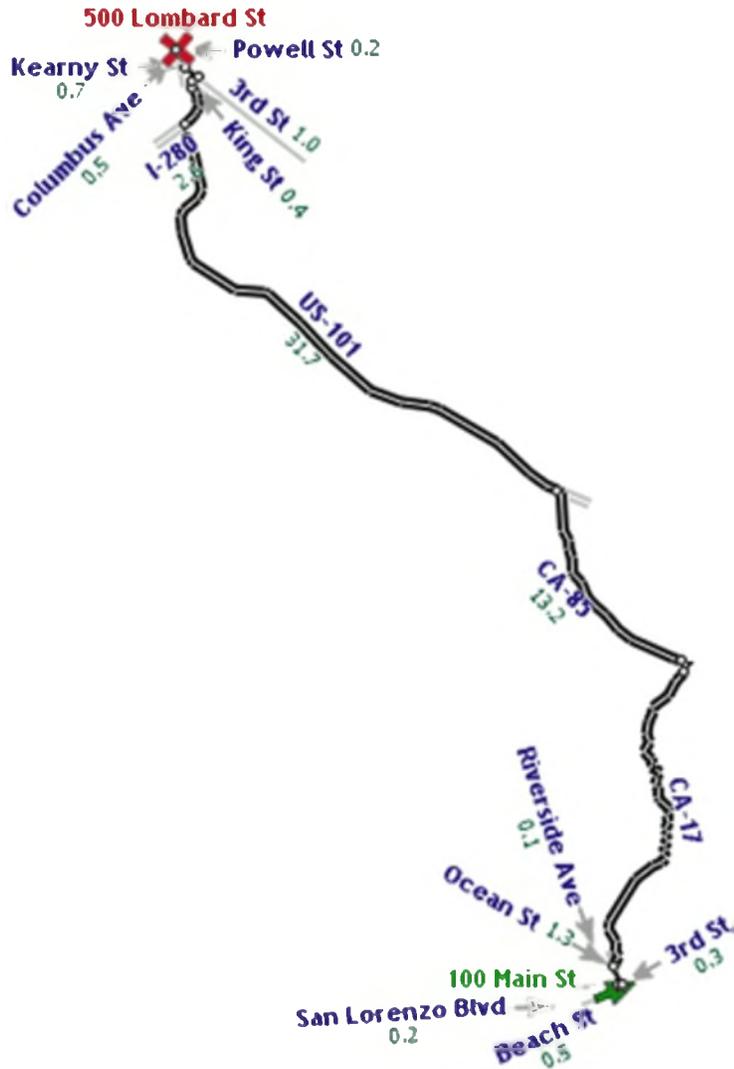
During the final stages of World War II in 1945, the United States conducted two atomic bombings against the cities of Hiroshima and Nagasaki in Japan, the first on August 6, 1945 and the second on August 9, 1945.

This graphic shows all the locations, geographically on the globe, of the events leading up to the dropping of the bomb. Each line is also colored to show its source in different colors. The white large spot near the middle is Hiroshima and where the bomb hit. The smaller square dots are the locations of where the events happened on the Earth.

The shape of the graphic was inspired by the atom of Uranium 235, which was used in the bomb on Hiroshima.

- BRITAIN
- CANADA
- FRANCE
- GERMANY
- ITALY
- NORWAY
- SWITZERLAND
- UNITED STATES

# Visualization "White Lies"



# Wrap Up

Ways to mislead:

Breaking assumptions, expectations, conventions, drowning people in details... or just making stuff up.

Nuance:

Not every chart that breaks a "rule" is misleading

Not every chart that follows the "rules" is truthful