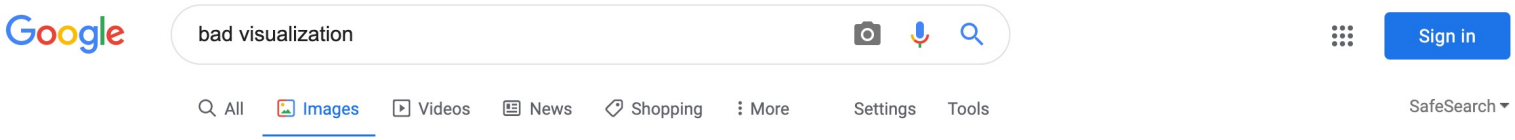
Deceptive Visualization

Michael Correll
Tableau Research

What is a "bad" visualization?



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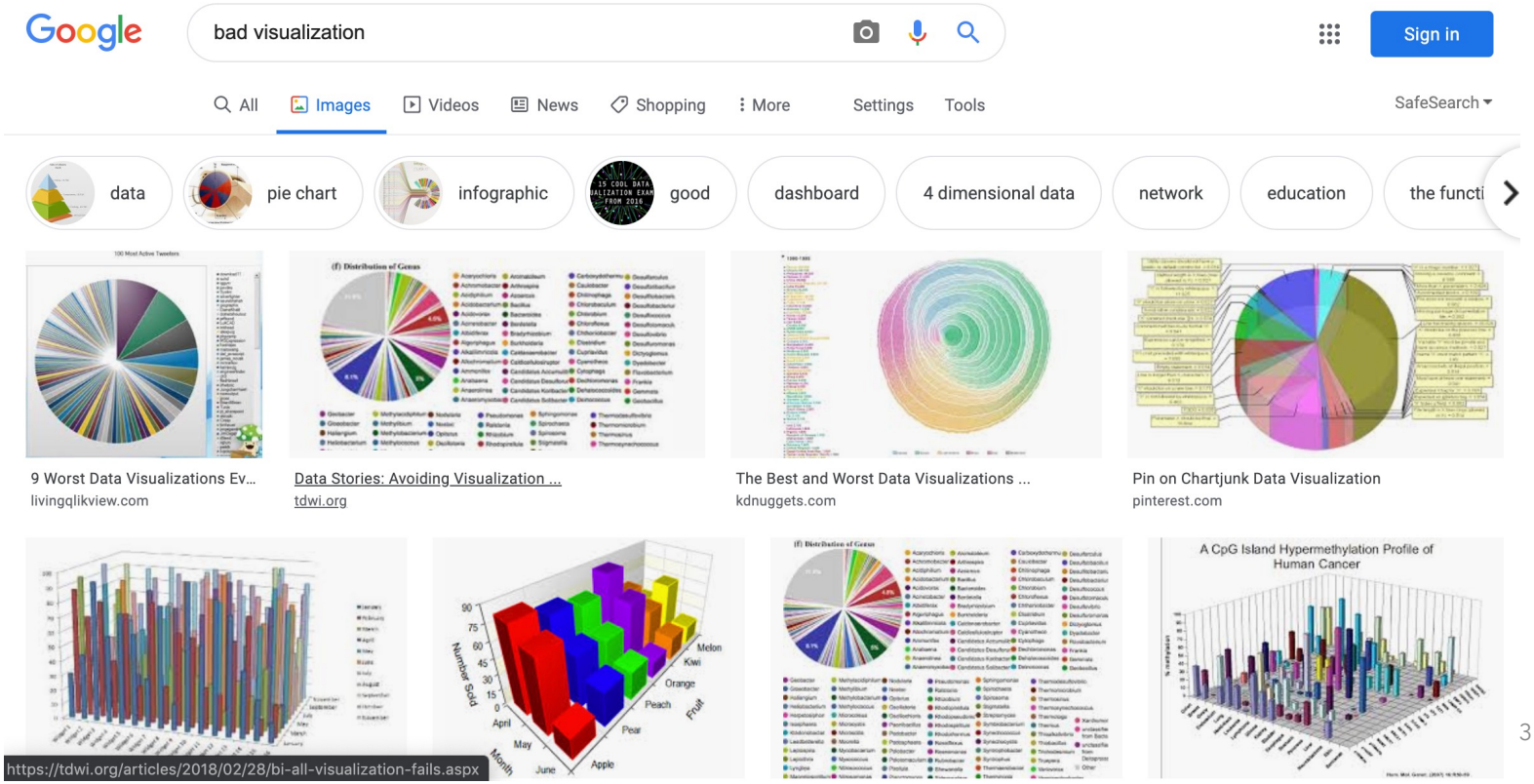
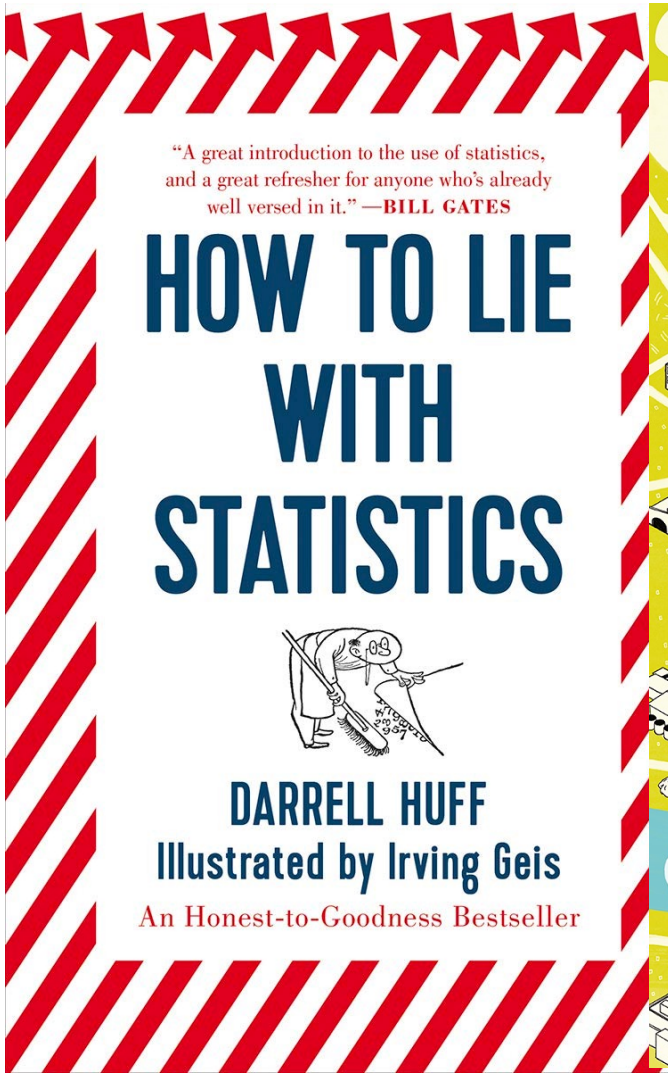
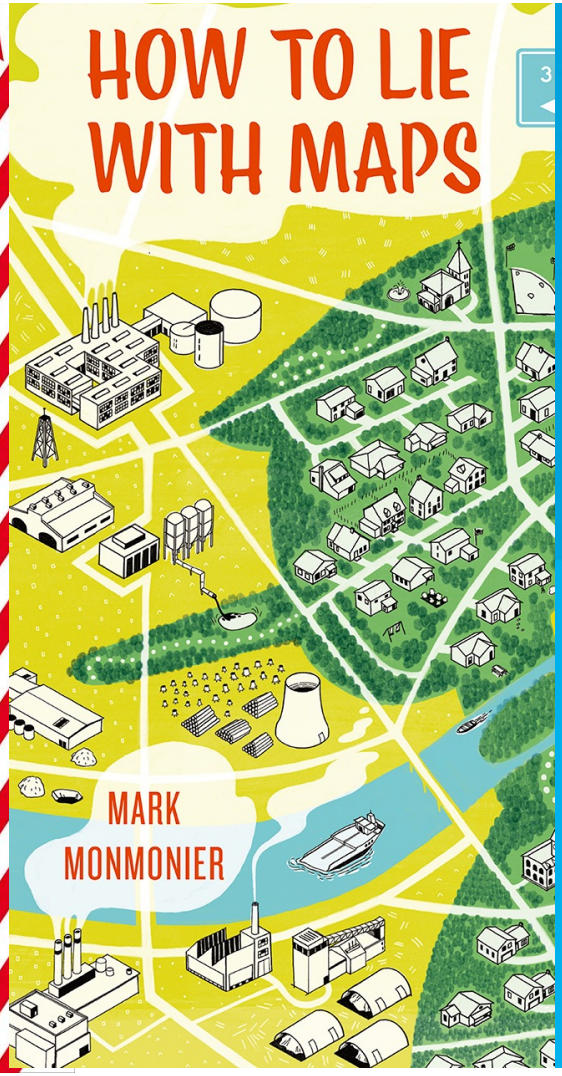
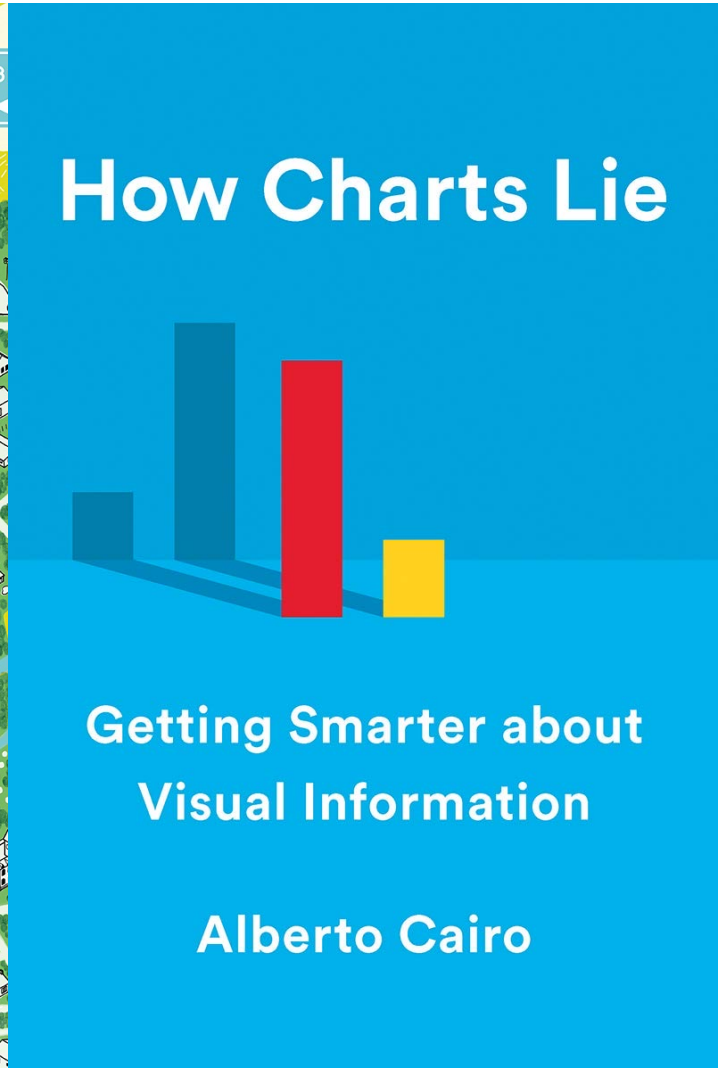



"A great introduction to the use of statistics, and a great refresher for anyone who's already well versed in it." —BILL GATES
HOW TO LIE WITH STATISTICS
DARRELL HUFF
Illustrated by Irving Geis
An Honest-to-Goodness Bestseller


HOW TO LIE WITH MAPS
MARK MONMONIER


How Charts Lie
Getting Smarter about Visual Information
Alberto Cairo

Takeaway:

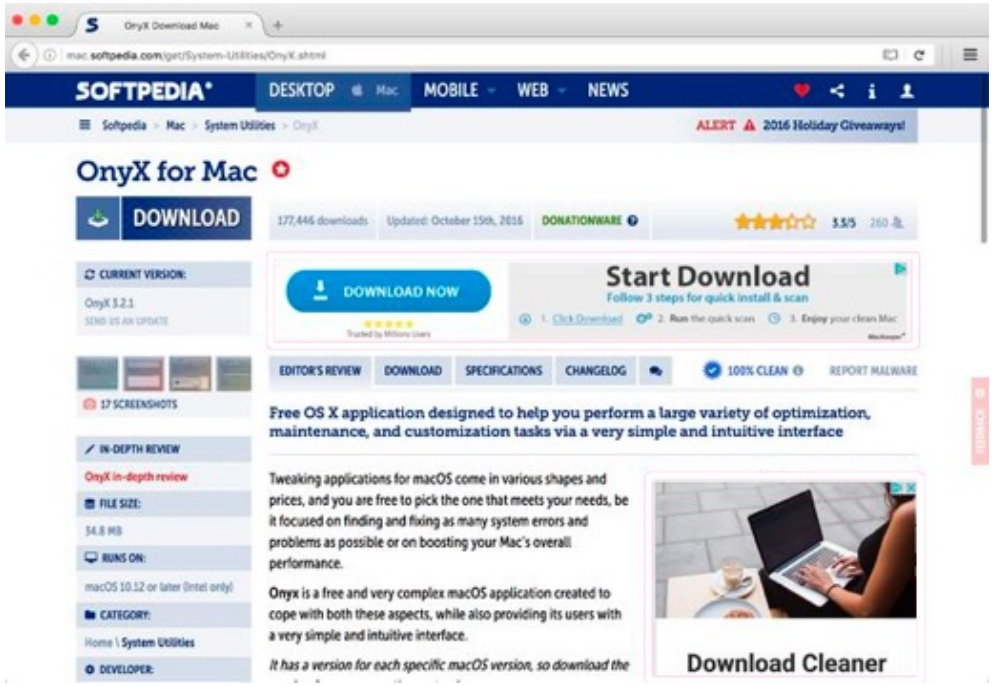
Visualizations are a form of communication.

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

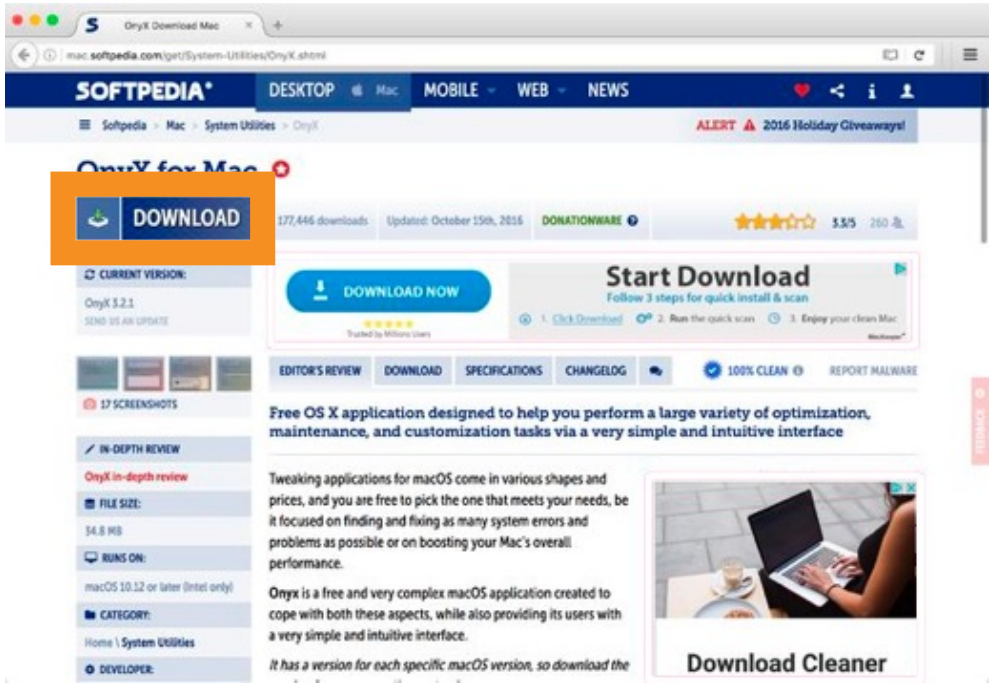
DARK PATTERNS

(They're Everywhere)

Dark Patterns



Dark Patterns



Zone Kaiwei Ni factory
Sponsored
80% OFF
BLACK FRIDAY SALE
Shop Now

Bad Visualizations

Incorrect Visualizations

Illegible Visualizations

Bullshit Visualizations

Unconventional Visualizations

Bad Visualizations

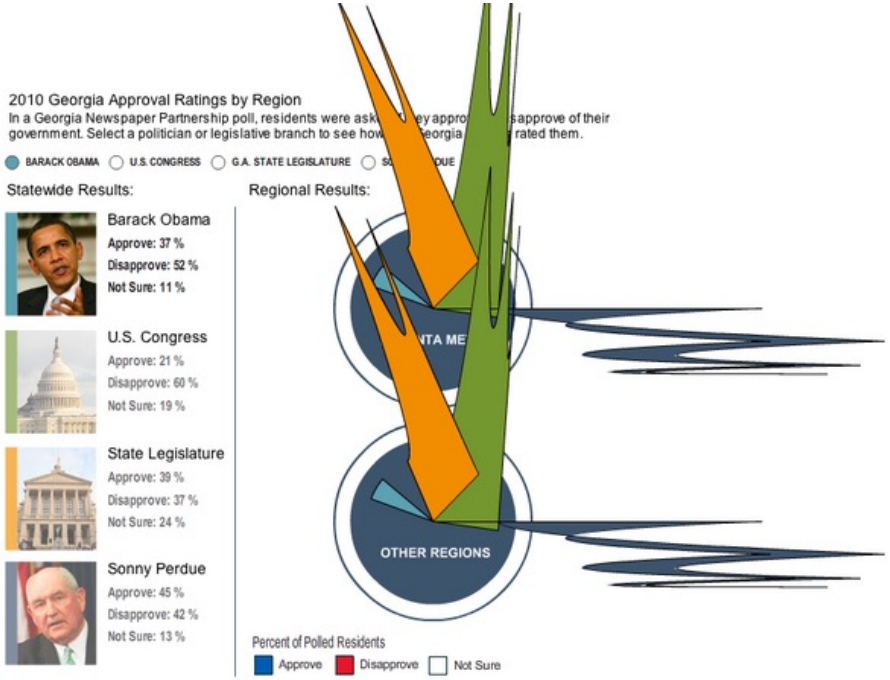
Incorrect Visualizations

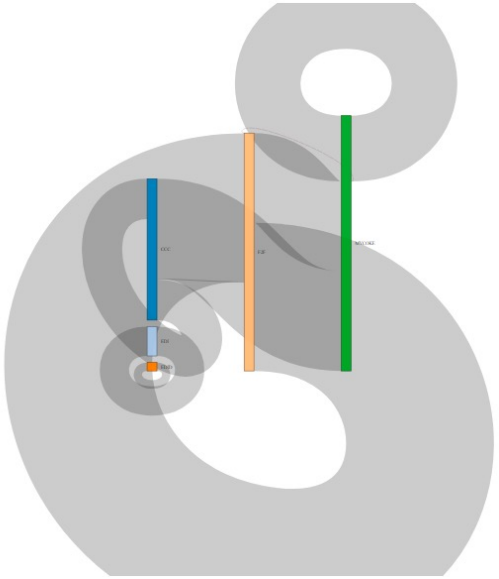
Illegible Visualizations

Bullshit Visualizations

Unconventional Visualizations

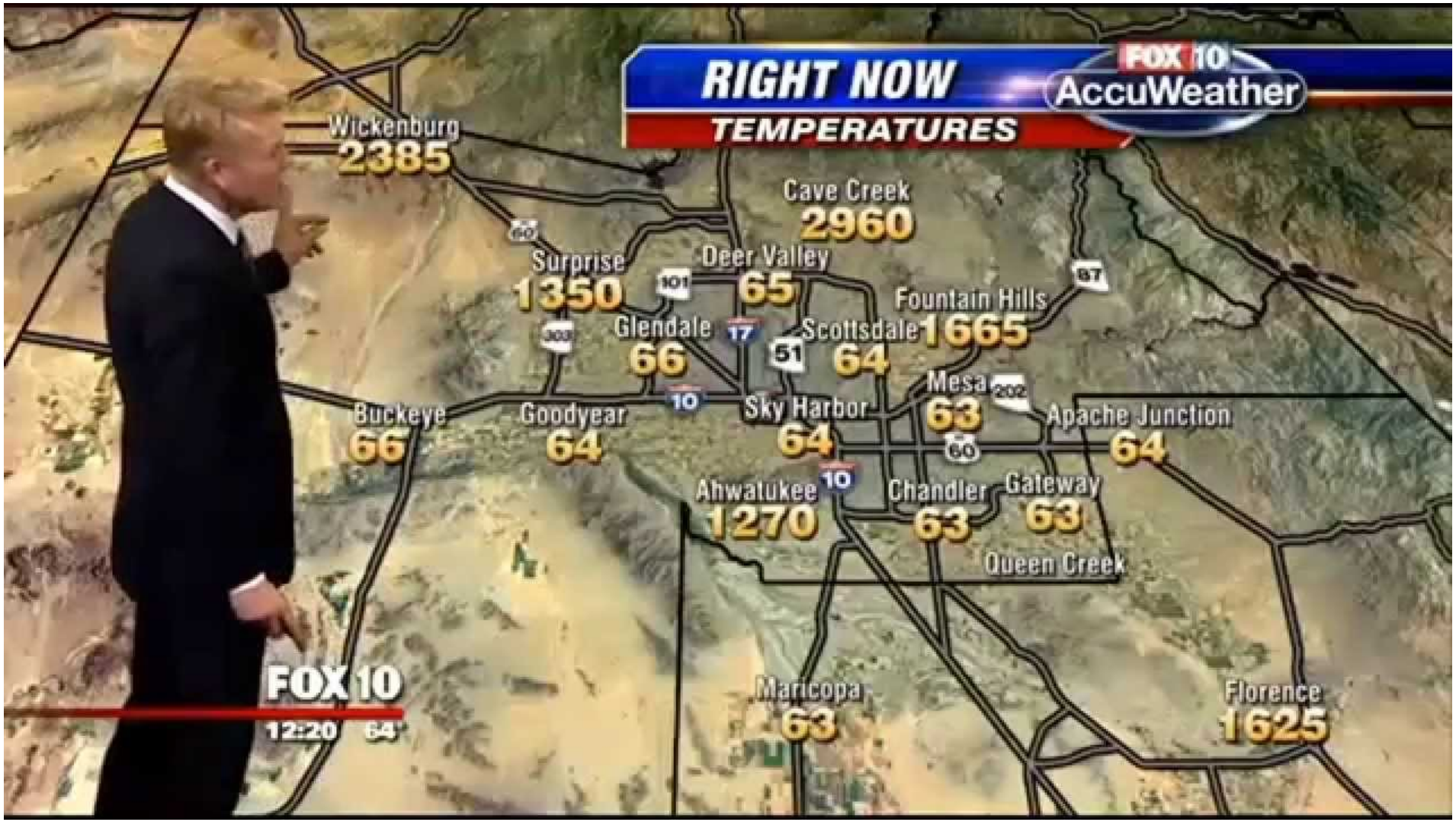
Incorrect Visualization





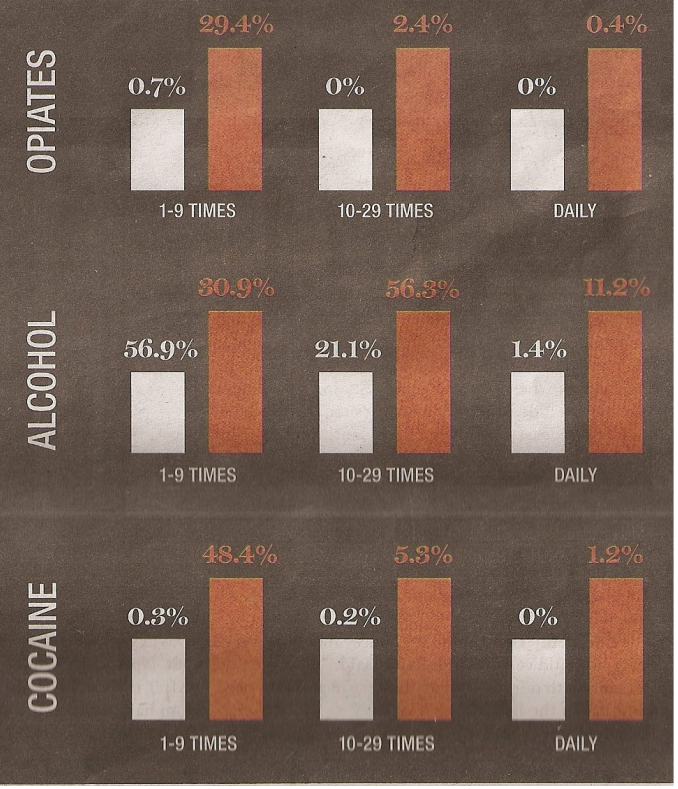
https://accidental-art.tumblr.com/

HONG KONG
AROUND THE WORLD
GIANT HORNETS KILL 42 PEOPLE IN CHINA
LIVE CNN
IGHT NOW
CHICAGO 71°
DETROIT 66°
HOUSTON 77°
EALTH EVALUATION IN MIRIAM CAREY'S HOME AFTER DC (
CNN.com


RIGHT NOW
TEMPERATURES
FOX 10
AccuWeather
Wickenburg
2385
Cave Creek
2960
Surprise
1350
Deer Valley
65
Fountain Hills
1665
Glendale
66
Scottsdale
64
Mesa
63
Buckeye
66
Goodyear
64
Sky Harbor
64
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.



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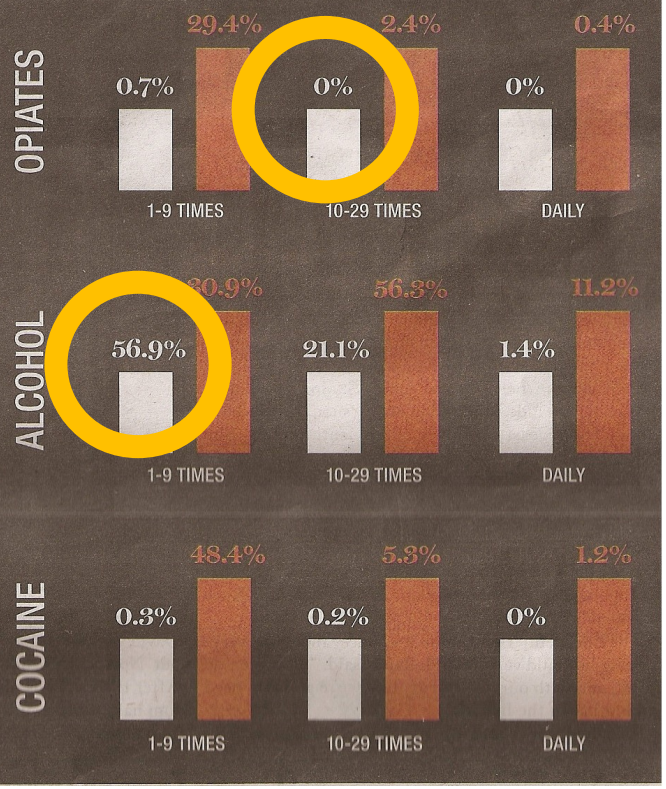

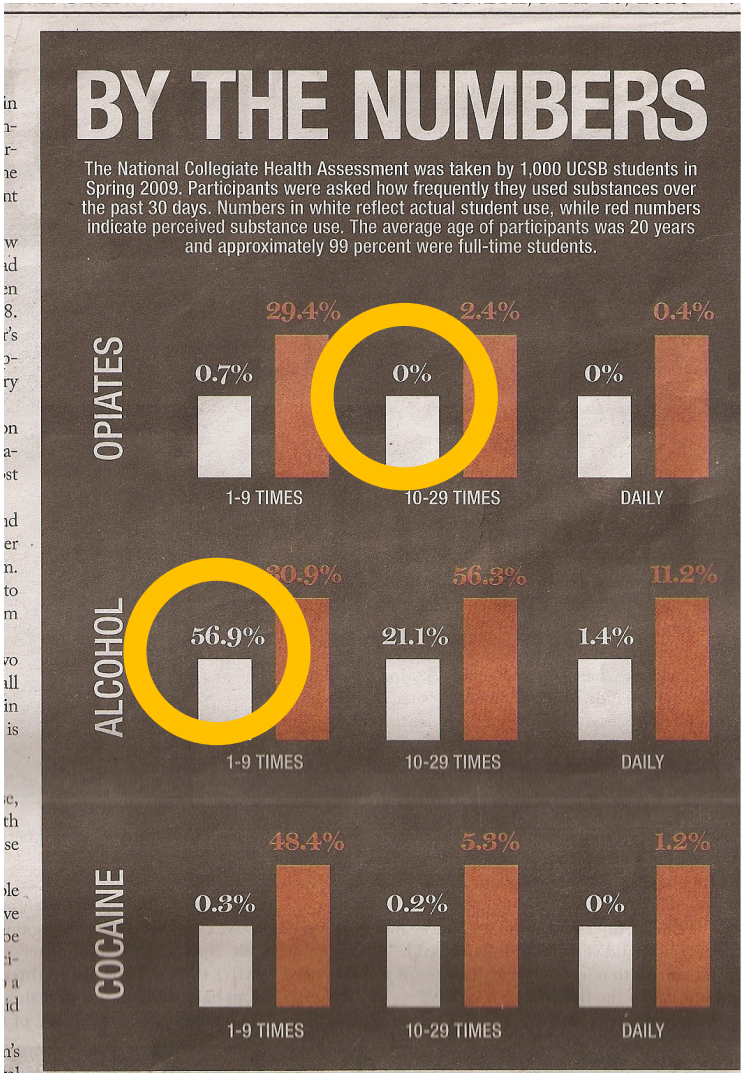
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OPIATES
0.7%
29.4%
0%
2.4%
0%
0.4%
1-9 TIMES
10-29 TIMES
DAILY
ALCOHOL
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30.9%
21.1%
56.3%
1.4%
11.2%
1-9 TIMES
10-29 TIMES
DAILY
COCAINE
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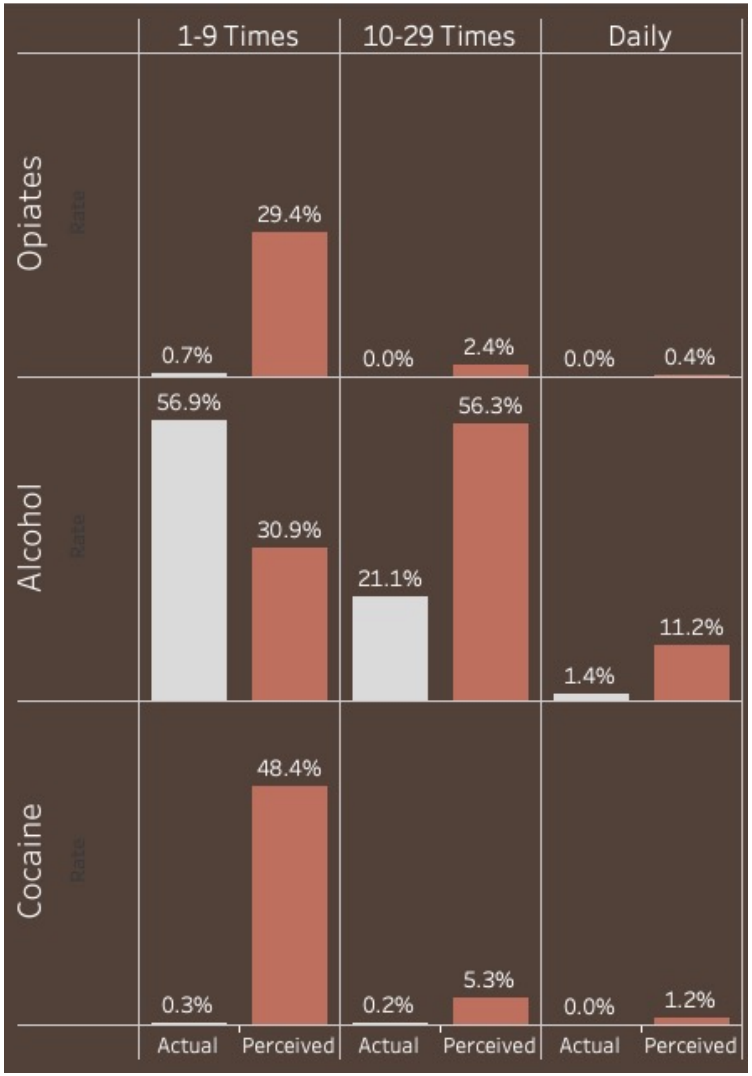
1.2%
1-9 TIMES
10-29 TIMES
DAILY


1-9 Times
10-29 Times
Daily
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%
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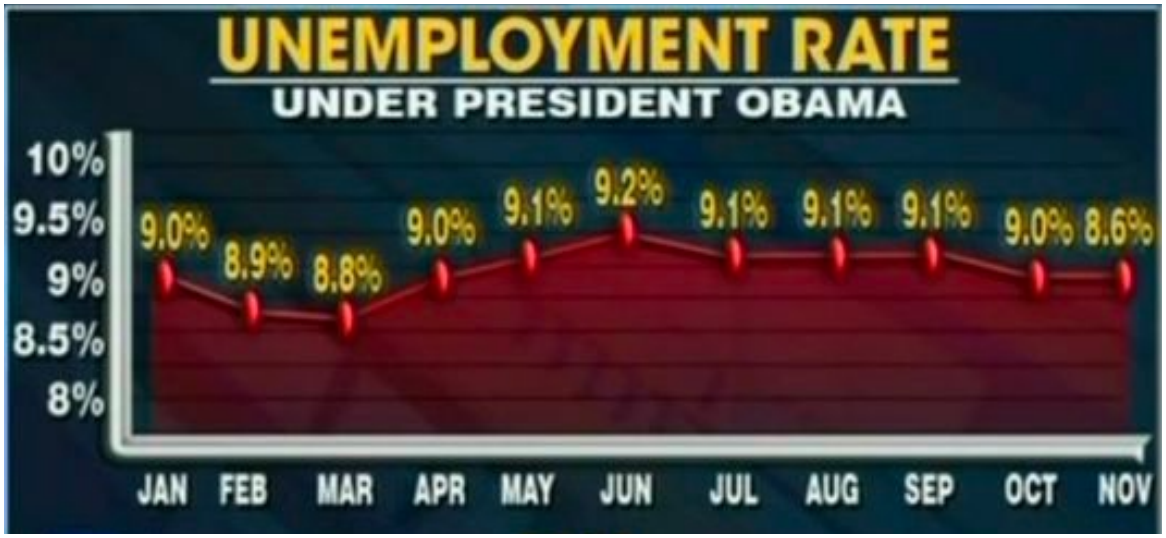
UNEMPLOYMENT RATE
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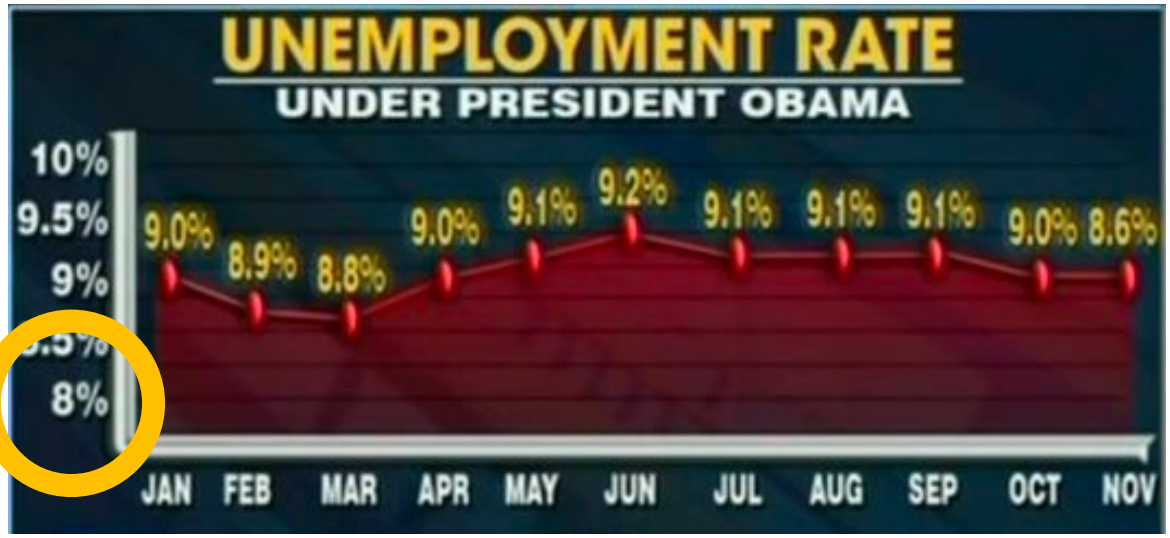
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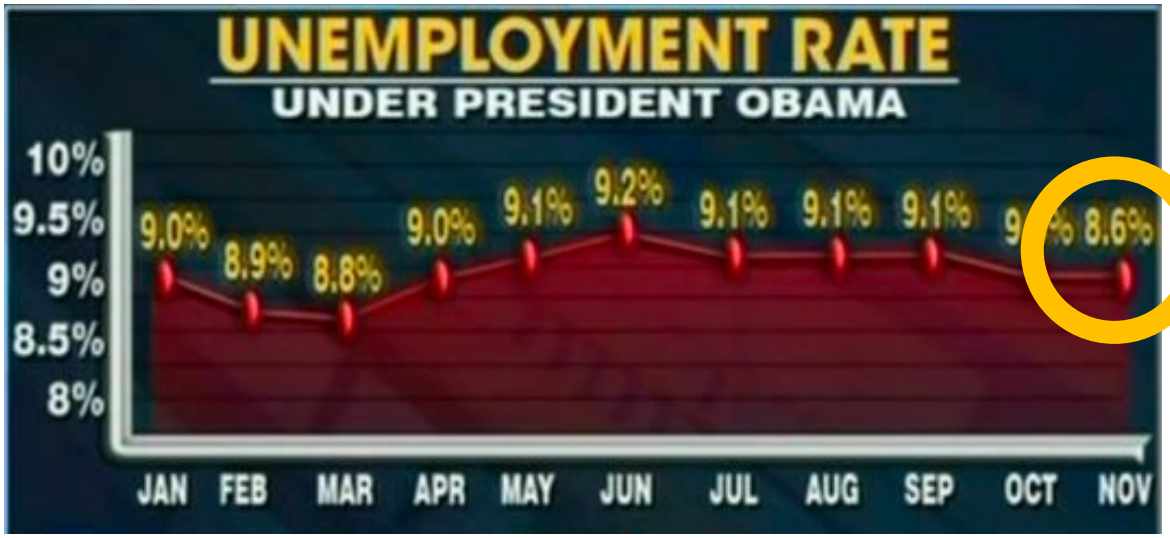
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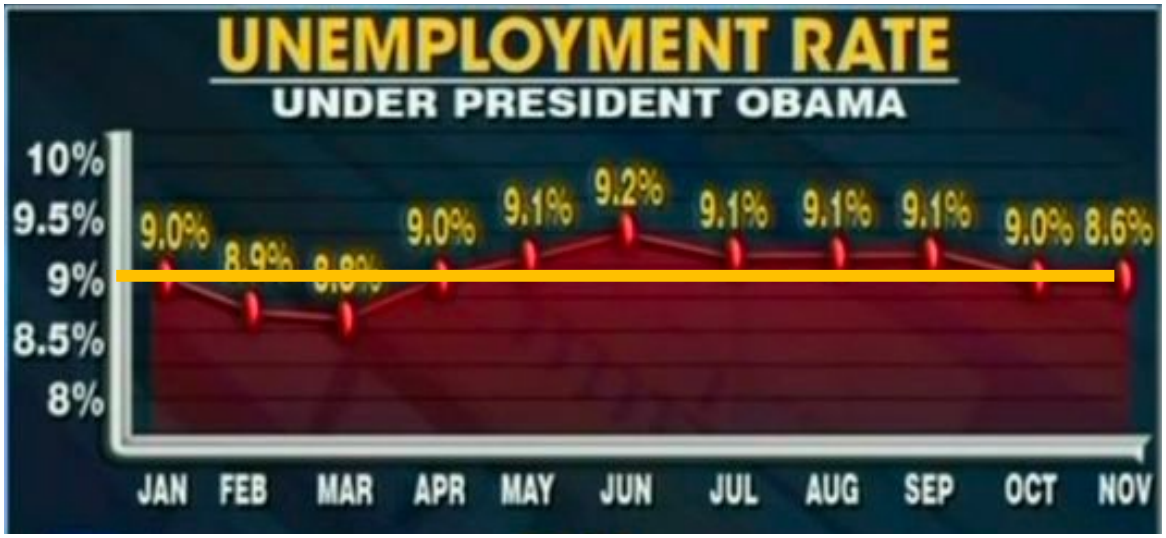
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UNEMPLOYMENT RATE
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AUG
SEP
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NOV

Unemployment
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9.6
9.4
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8.8
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Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov
UNEMPLOYMENT RATE
UNDER PRESIDENT OBAMA
10%
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8%
9.0% 8.9% 8.8% 9.0% 9.1% 9.2% 9.1% 9.1% 9.1% 9.0% 8.6%
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

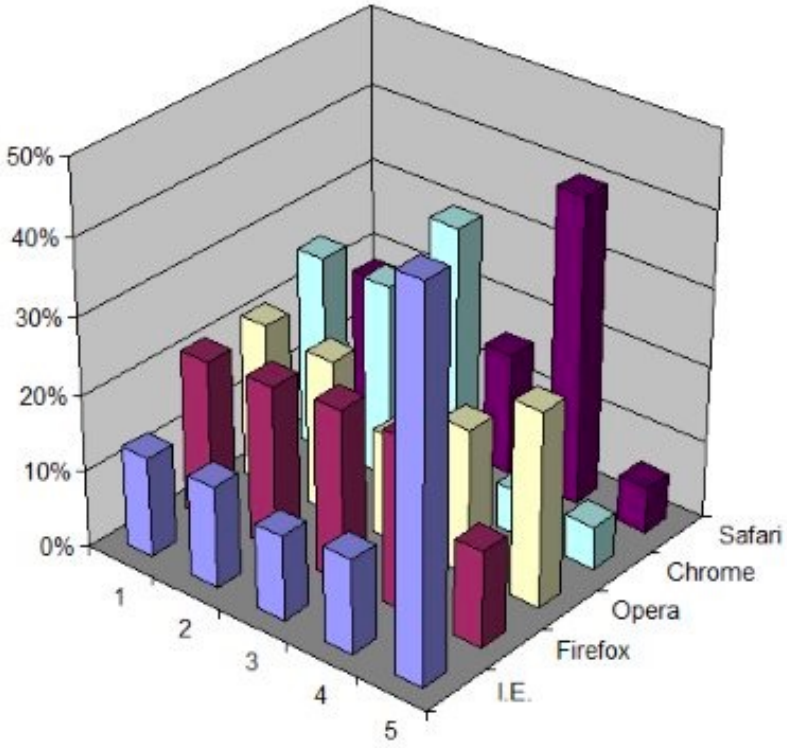
Incorrect Visualizations

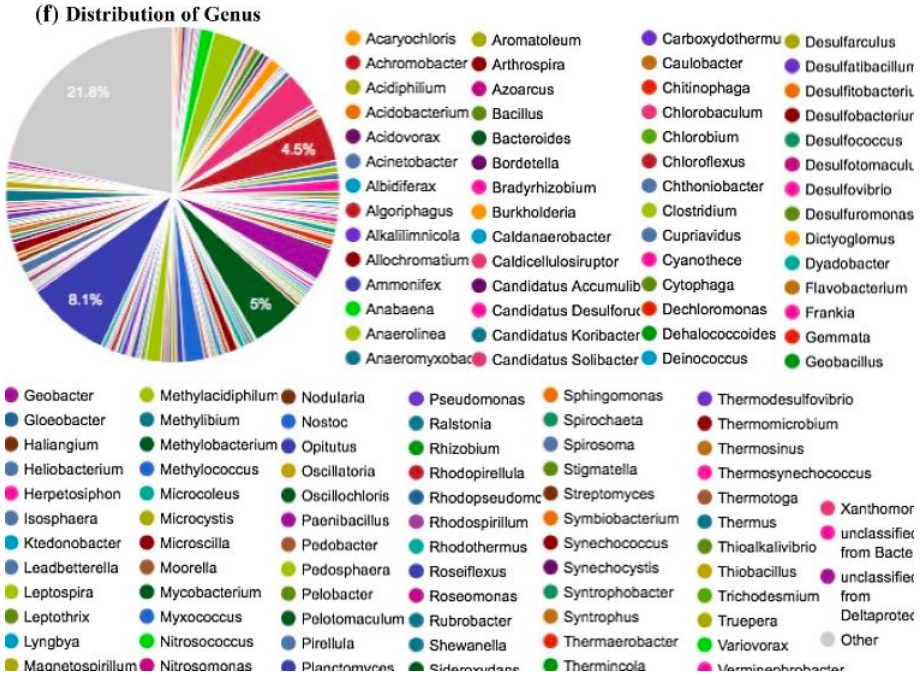
Illegible Visualizations

Bullshit Visualizations

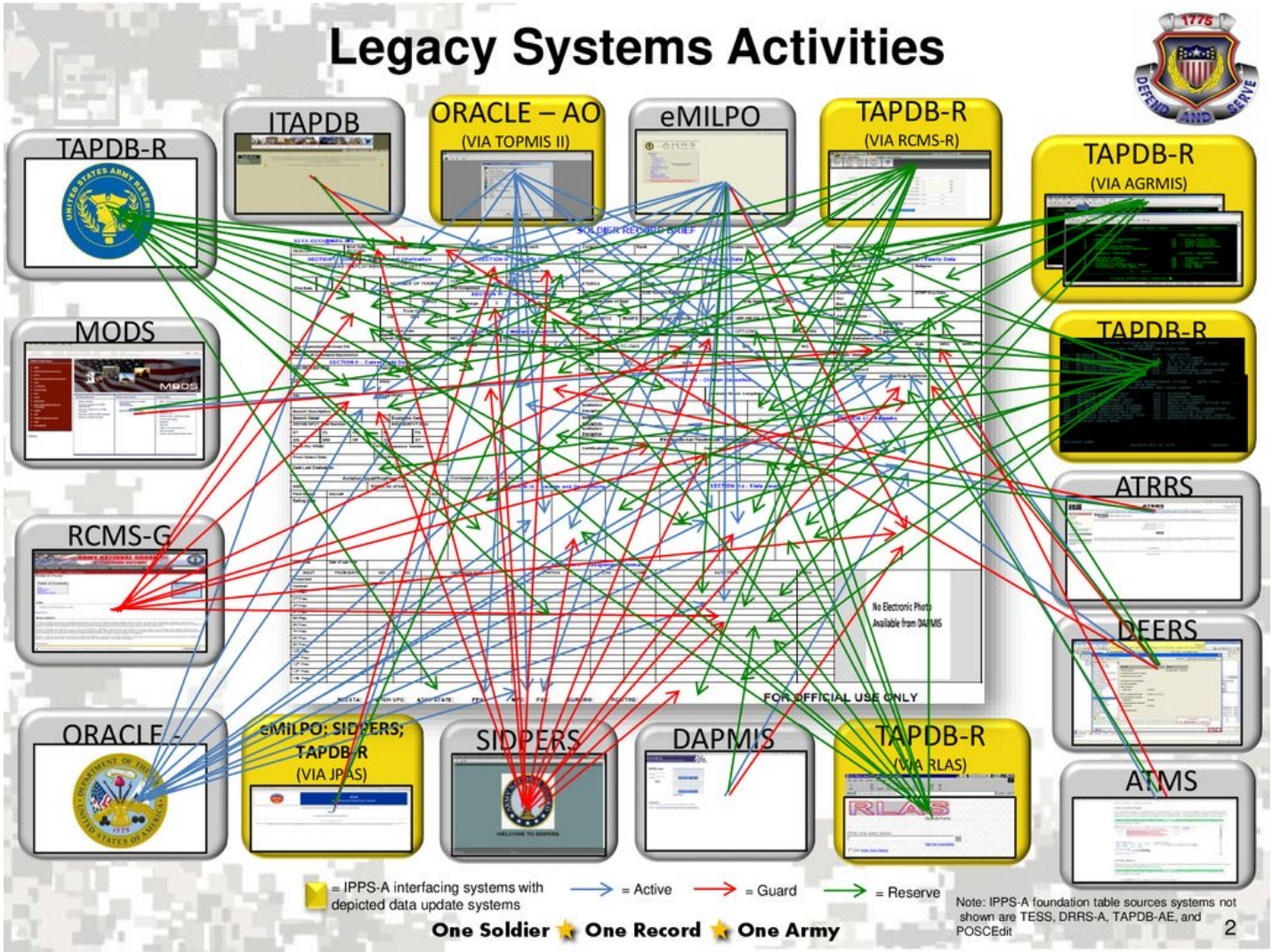
Unconventional Visualizations

Illegible Visualization





Legacy Systems Activities



Note: IPPS-A foundation table sources systems not shown are TESS, DRRS-A, TAPDB-AE, and POSCEdit

ALABAMA DEPARTMENT OF LABOR
LABOR MARKET INFORMATION DIVISION

LMI Home | CES | OES | QCEW | LAUS | Workforce Development | OSHS

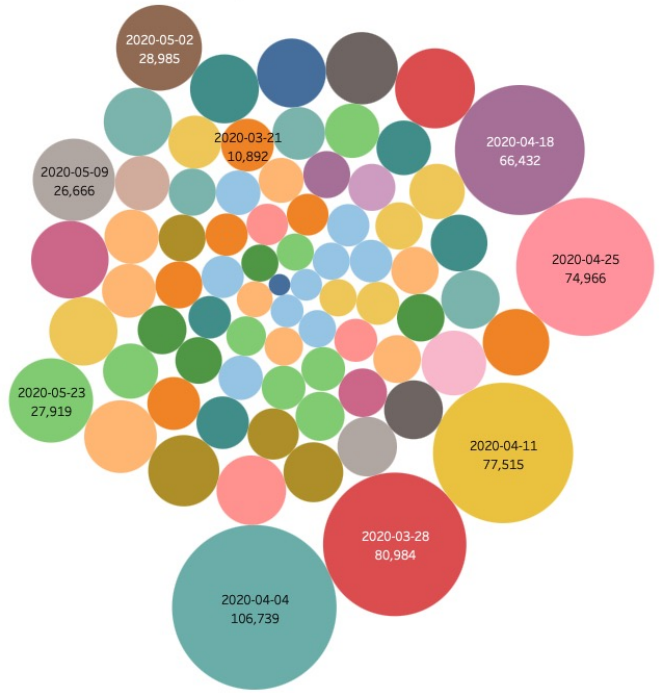
Interactive Weekly Unemployment Insurance Claims

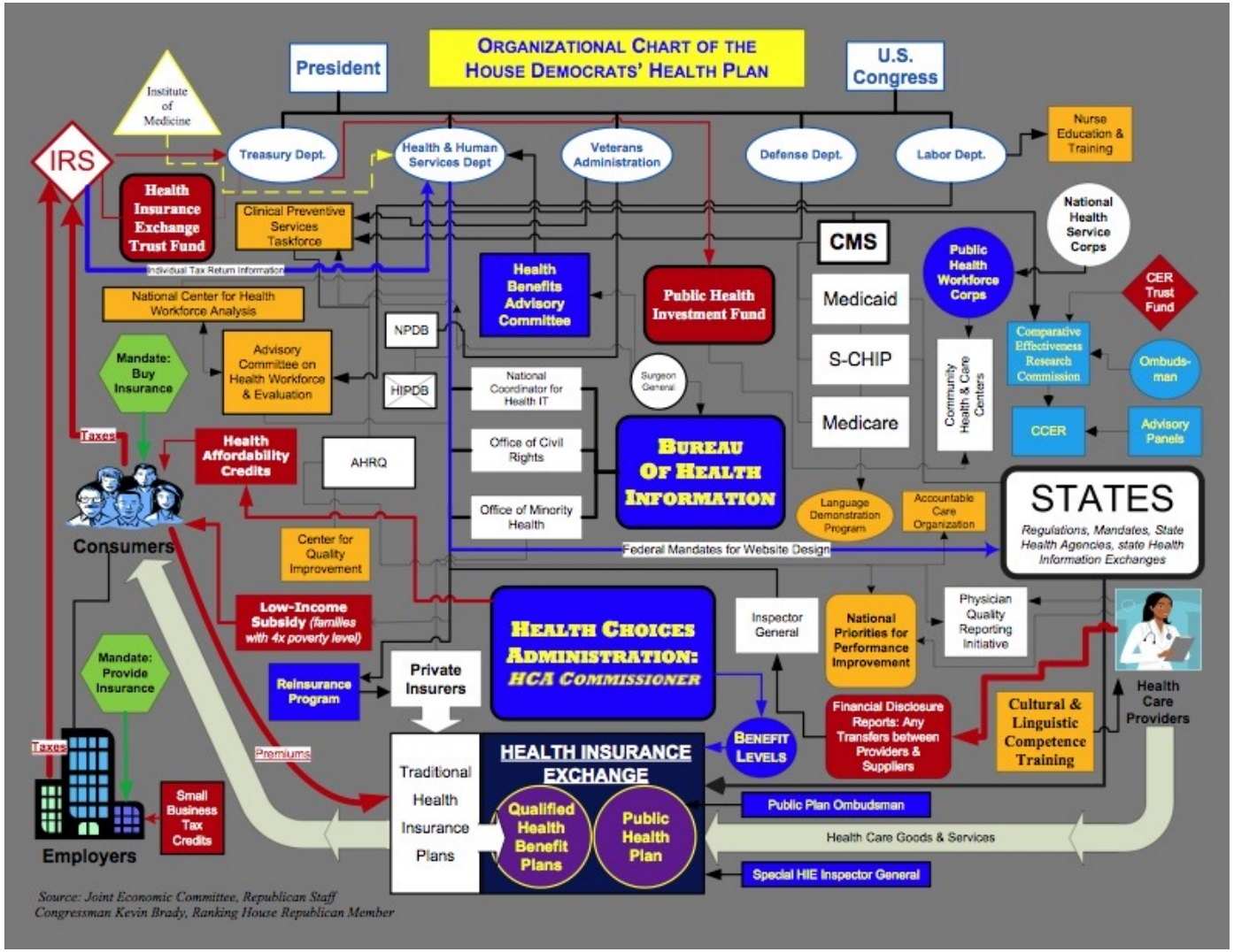
Initial_Claims_byCounty | Historical

County
Total

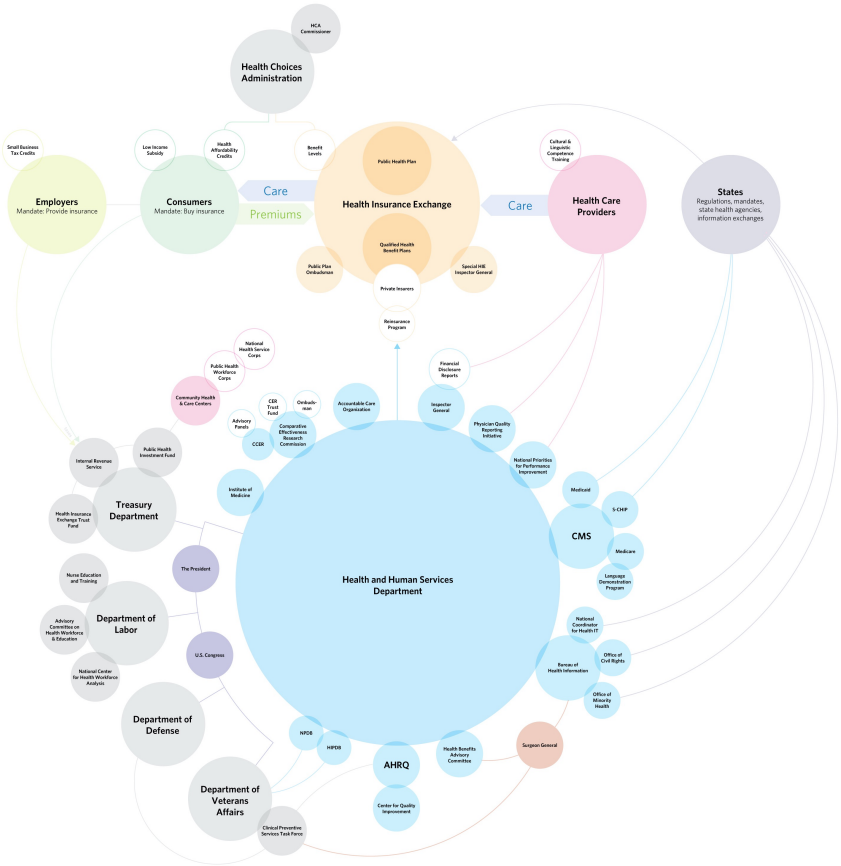
2020-12-26	5,506
2021-01-02	10,986
2021-01-09	14,084
2021-01-16	11,983
2021-01-23	11,615
2021-01-30	12,664
2021-02-06	13,464
2021-02-13	12,087
2021-02-20	11,395
2021-02-27	11,624
2021-03-06	13,592
2021-03-13	16,506
2021-03-20	13,994
2021-03-27	18,710
2021-04-10	10,909
2021-04-17	8,983
2021-04-24	8,704
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

Historical Initial Claims by Week



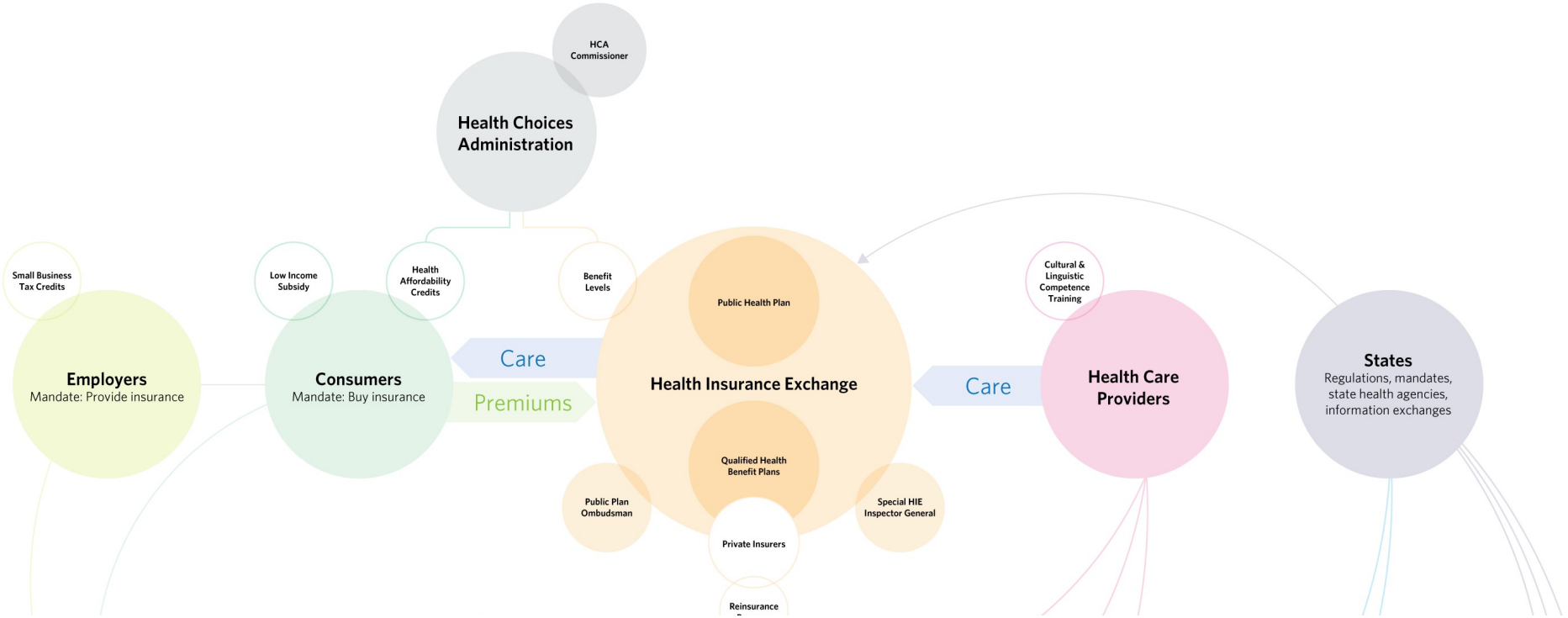

ORGANIZATIONAL CHART OF THE HOUSE DEMOCRATS' HEALTH PLAN
President
U.S. Congress
Institute of Medicine
IRS
Treasury Dept.
Health & Human Services Dept
Veterans Administration
Defense Dept.
Labor Dept.
Nurse Education & Training
Health Insurance Exchange Trust Fund
Clinical Preventive Services Taskforce
Individual Tax Return Information
National Health Service Corps
CMS
Medicaid
S-CHIP
Medicare
Public Health Workforce Corps
CER Trust Fund
Health Benefits Advisory Committee
Public Health Investment Fund
National Center for Health Workforce Analysis
NPDB
HIPDB
Advisory Committee on Health Workforce & Evaluation
Mandate: Buy Insurance
Taxes
Health Affordability Credits
AHRQ
National Coordinator for Health IT
Office of Civil Rights
Office of Minority Health
Surgeon General
BUREAU OF HEALTH INFORMATION
Community Health & Care Centers
Comparative Effectiveness Research Commission
Ombuds-man
CCER
Advisory Panels
Language Demonstration Program
Accountable Care Organization
STATES
Regulations, Mandates, State Health Agencies, state Health Information Exchanges
Consumers
Federal Mandates for Website Design
Center for Quality Improvement
Low-Income Subsidy (families with 4x poverty level)
HEALTH CHOICES ADMINISTRATION: HCA COMMISSIONER
Inspector General
National Priorities for Performance Improvement
Physician Quality Reporting Initiative
Mandate: Provide Insurance
Reinsurance Program
Private Insurers
Financial Disclosure Reports: Any Transfers between Providers & Suppliers
Cultural & Linguistic Competence Training
Health Care Providers
Taxes
Premiums
Traditional Health Insurance Plans
HEALTH INSURANCE EXCHANGE
BENEFIT LEVELS
Qualified Health Benefit Plans
Public Health Plan
Public Plan Ombudsman
Health Care Goods & Services
Special HIE Inspector General
Small Business Tax Credits
Employers
Source: Joint Economic Committee, Republican Staff
Congressman Kevin Brady, Ranking House Republican Member

Organizational Chart of the House Democrats' Health Plan



"Do not fuck with graphic designers" – Robert Palmer

Revised design by Robert Palmer
Find more information at rp-network.com



“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

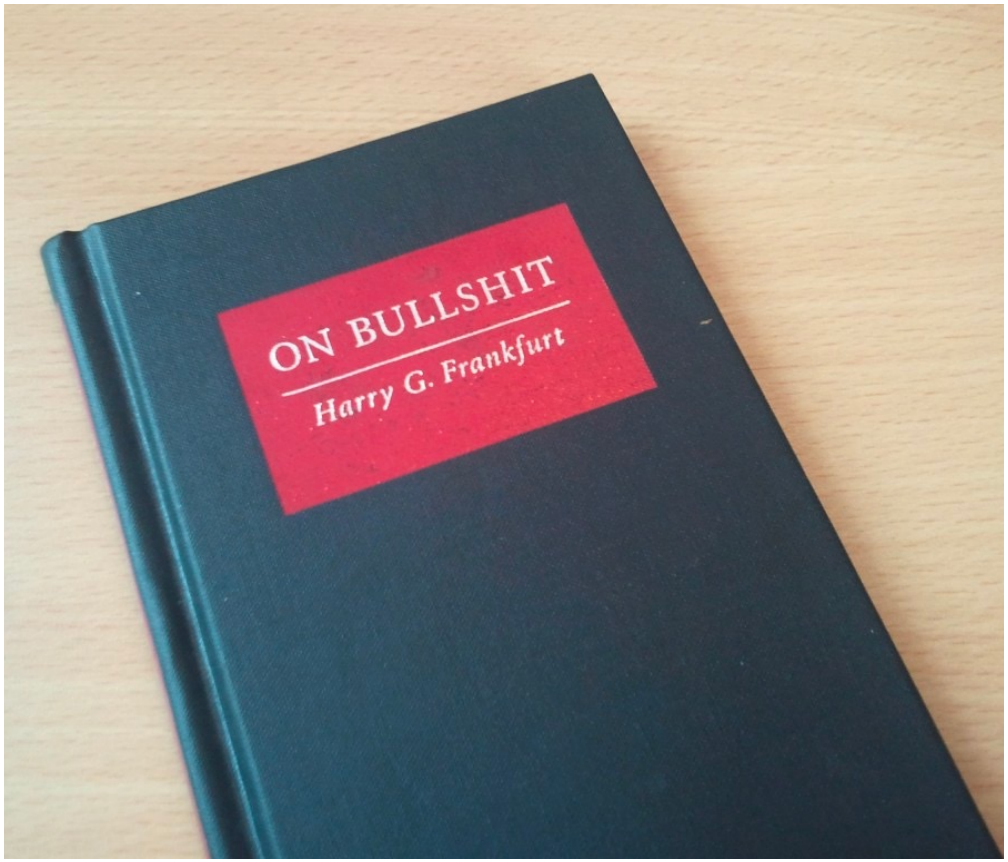
Incorrect Visualizations

Illegible Visualizations

Bullshit Visualizations

Unconventional Visualizations

Bullshit Visualization



Lie:

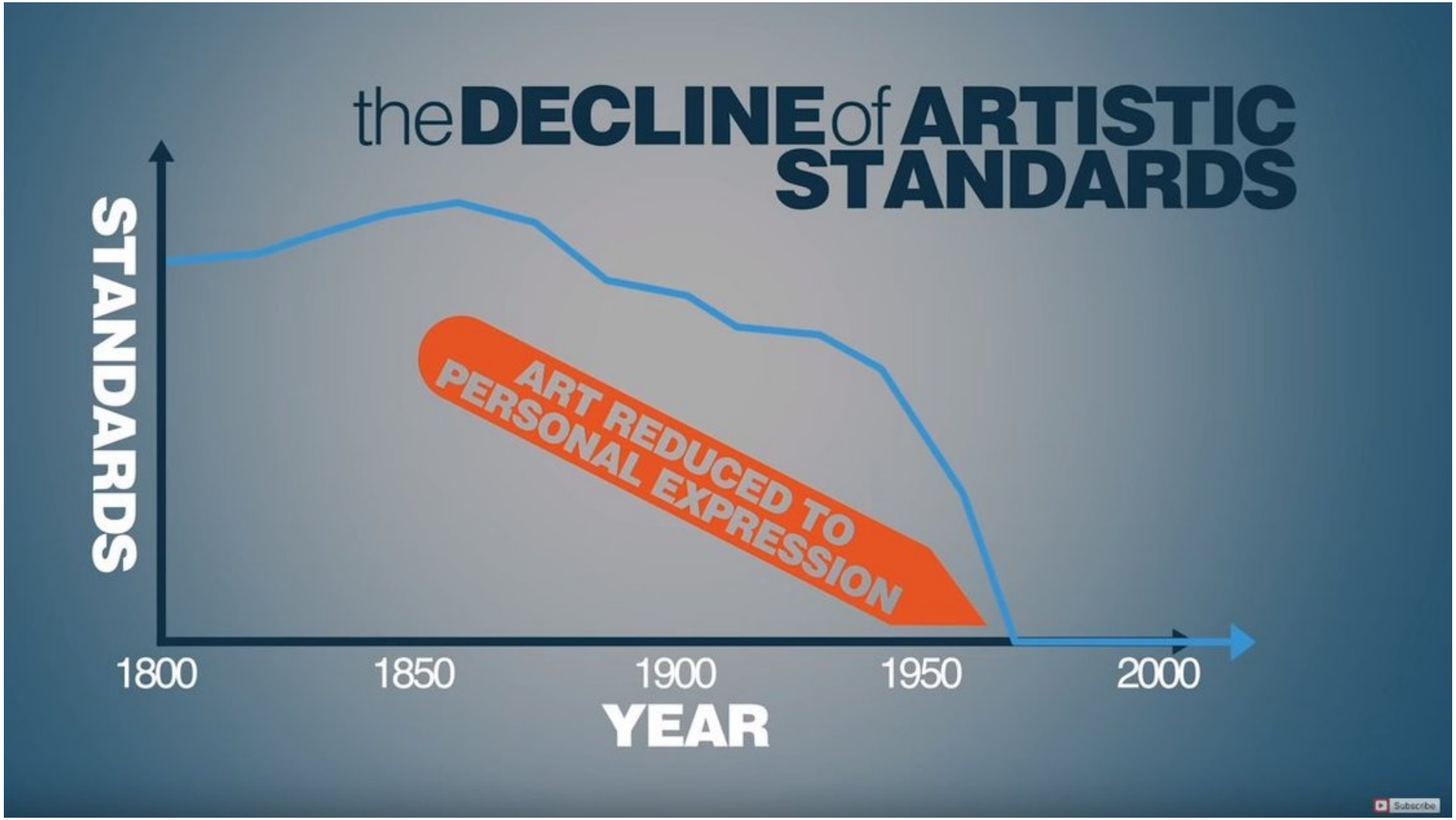
“No, officer, I wasn’t speeding”

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

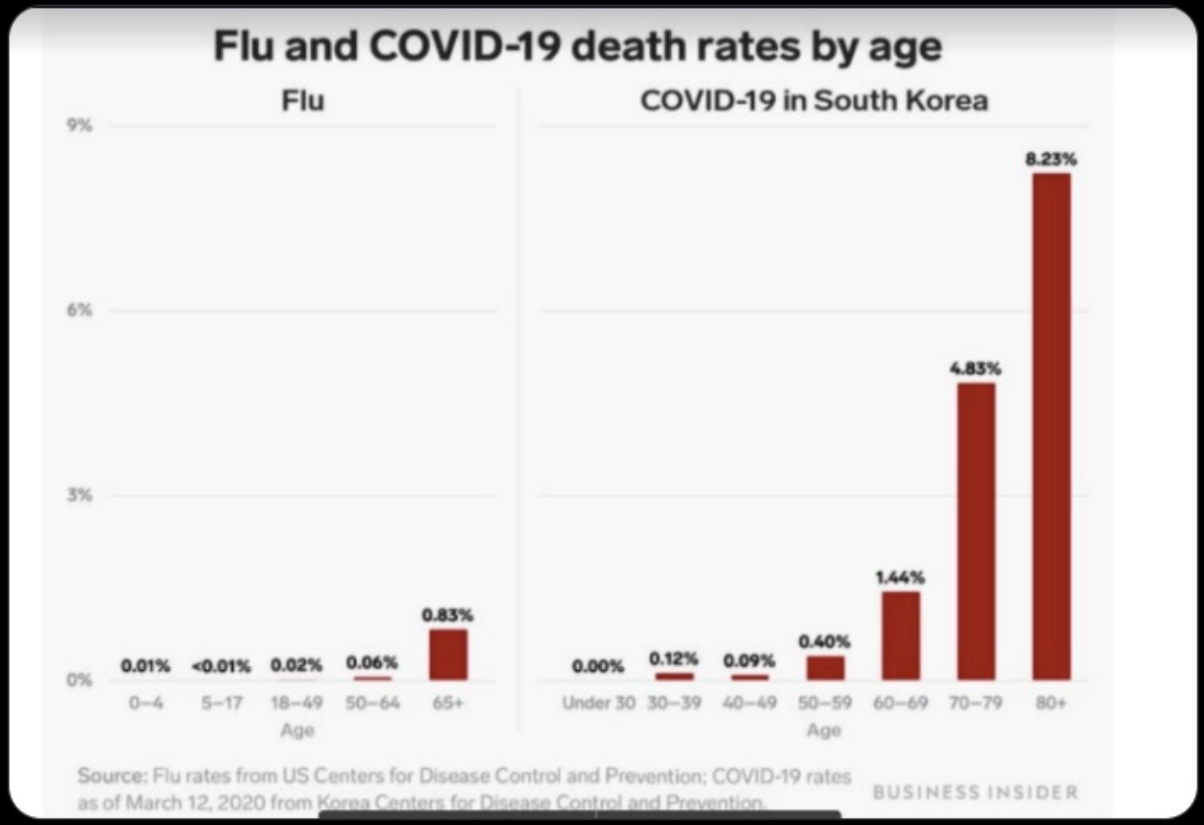
Bullshit:

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

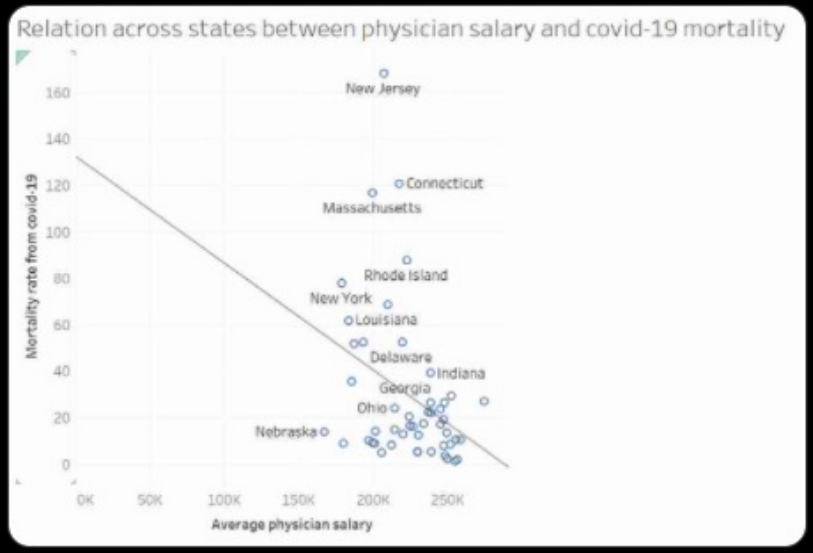
(you don’t know or don’t care about the truth, but intentionally say something you hope is persuasive)


the DECLINE of ARTISTIC STANDARDS
STANDARDS
ART REDUCED TO PERSONAL EXPRESSION
1800
1850
1900
1950
2000
YEAR
Subscribe

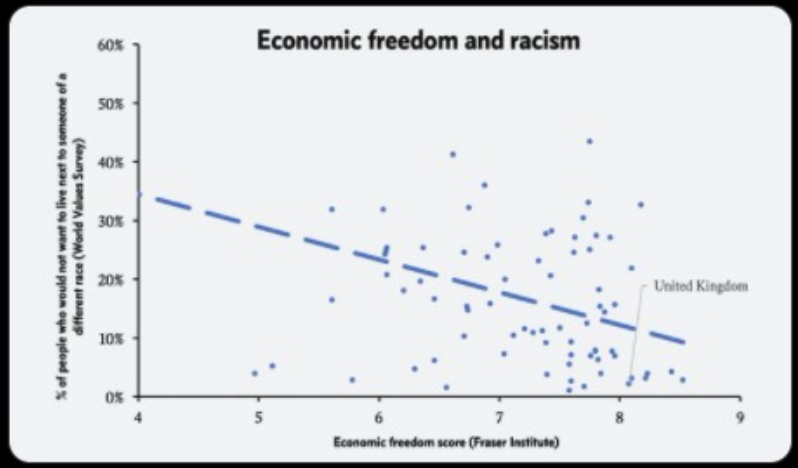
For people under 60, coronavirus is LESS dangerous than the seasonal flu:



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

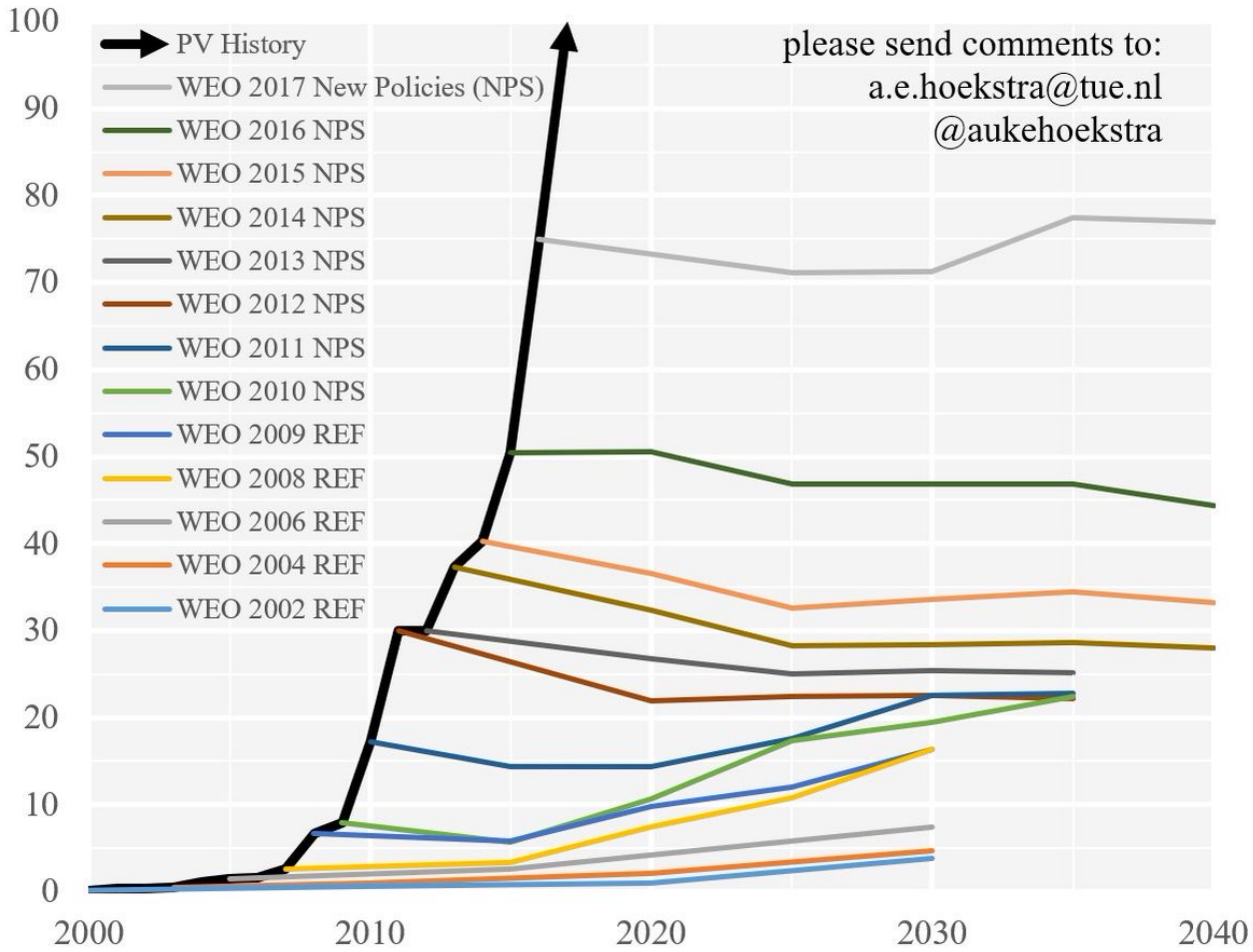


Fact check: Countries with more economic freedom have less racist attitudes, according to the World Values Survey.



Annual PV additions: historic data vs IEA WEO predictions

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



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

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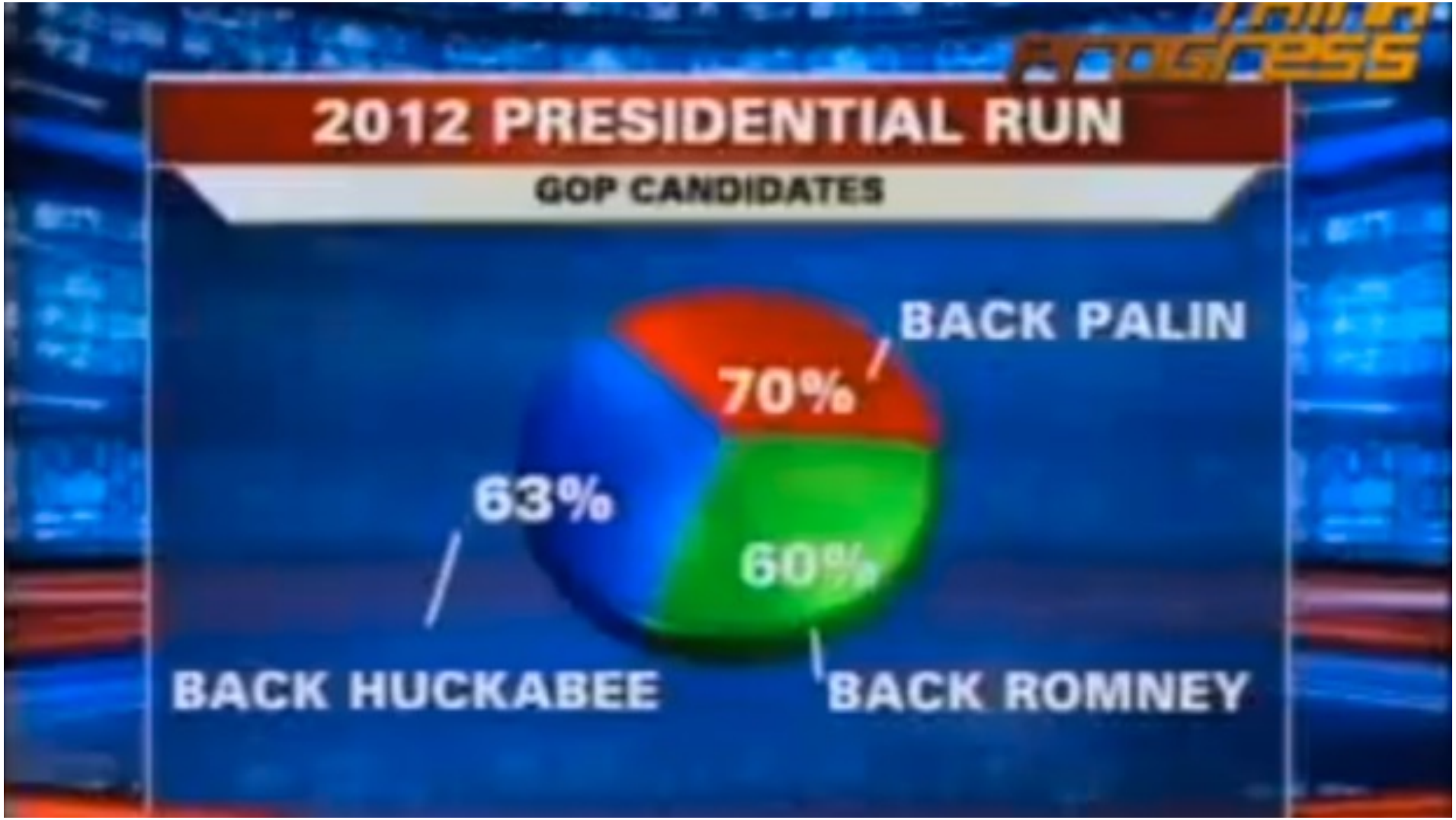
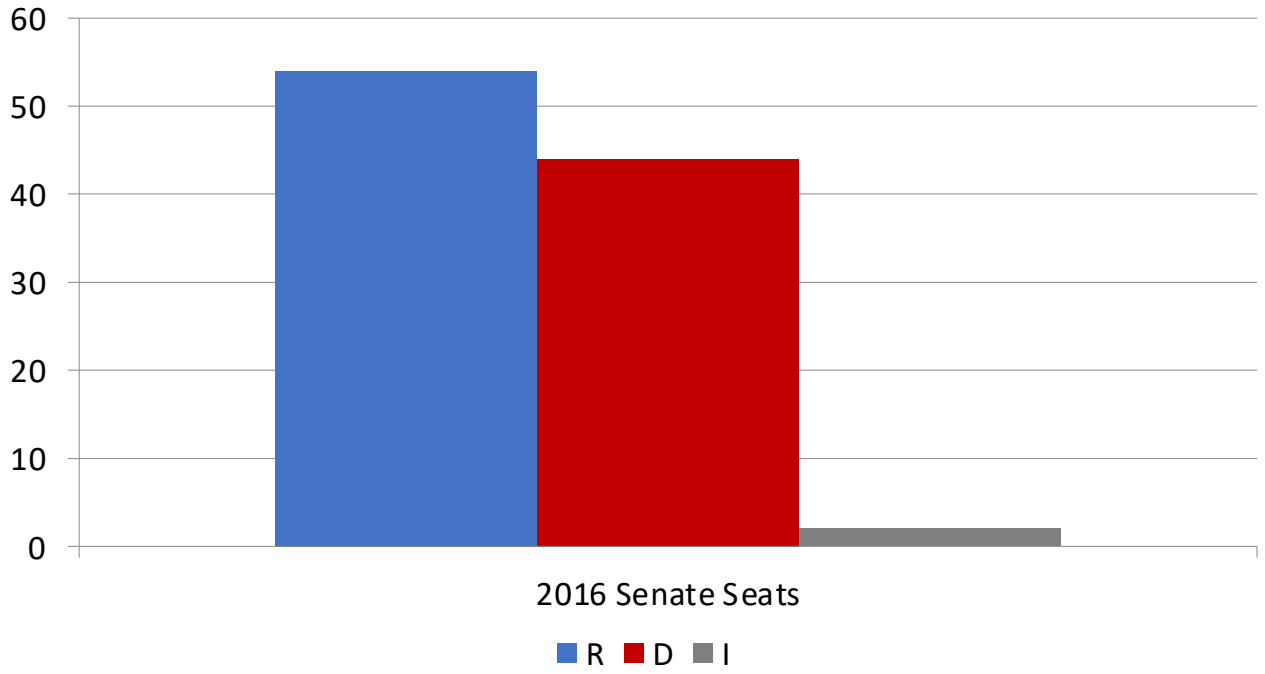
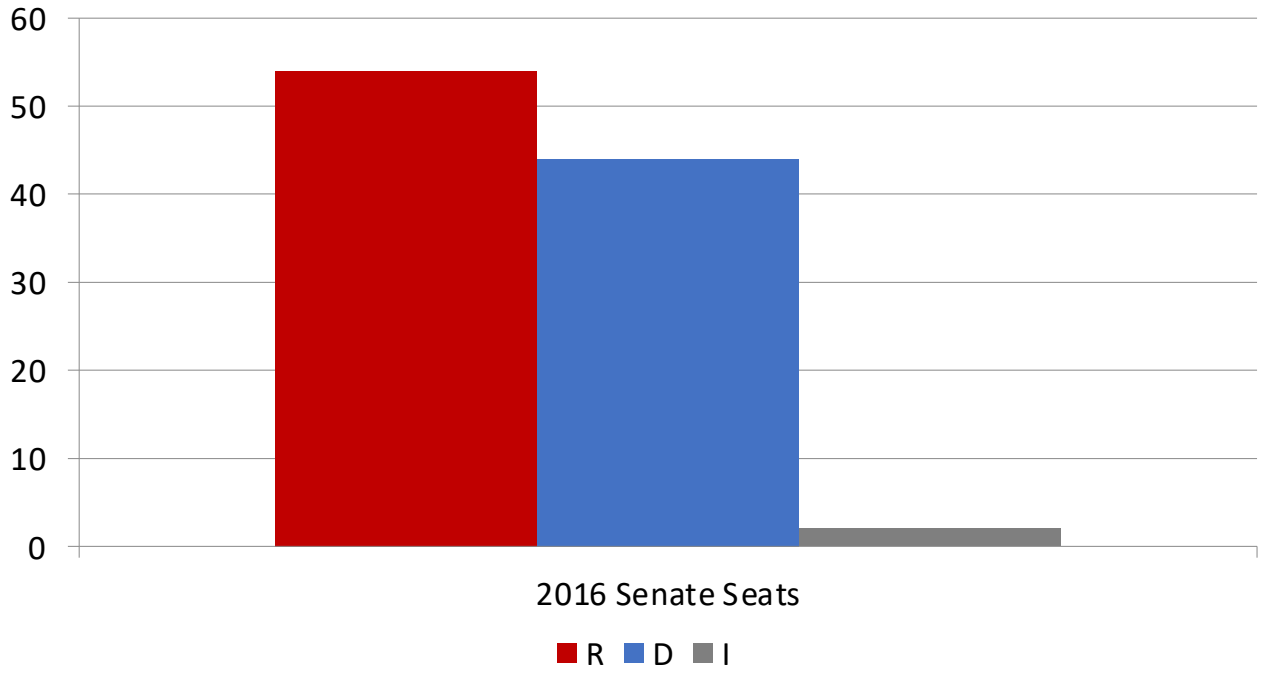
Bullshit Visualizations

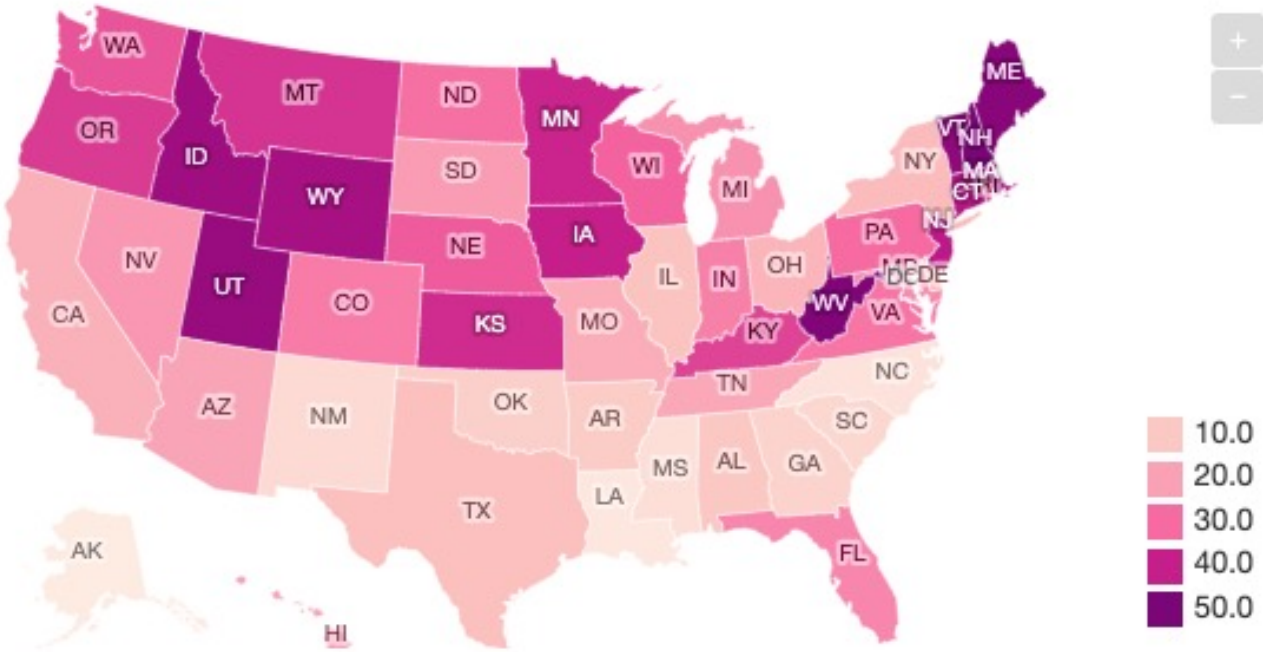
Unconventional Visualizations

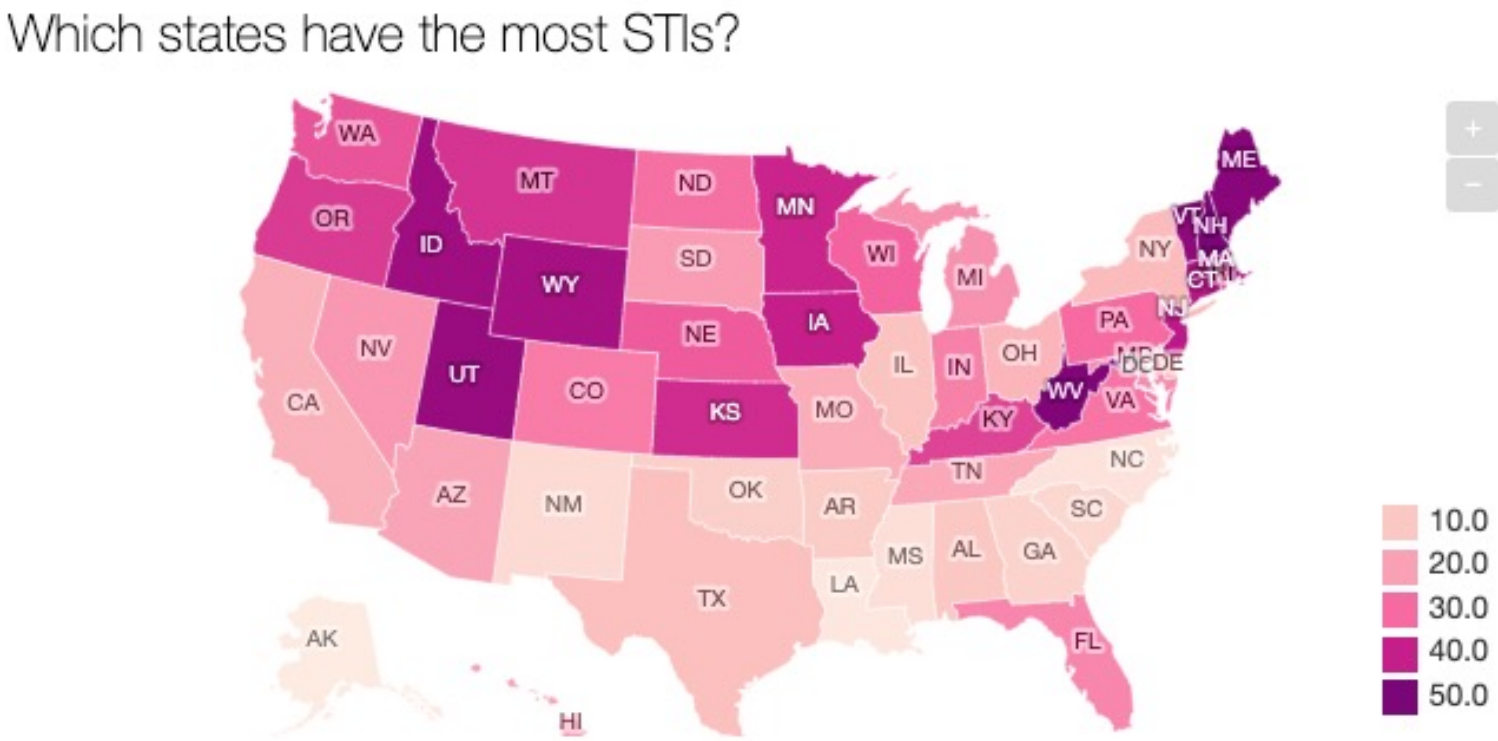

2012 PRESIDENTIAL RUN
GOP CANDIDATES
BACK PALIN
70%
63%
60%
BACK HUCKABEE
BACK ROMNEY


60
50
40
30
20
10
0
2016 Senate Seats
R
D
I


60
50
40
30
20
10
0
2016 Senate Seats
R
D
I

Which states have the most STIs?

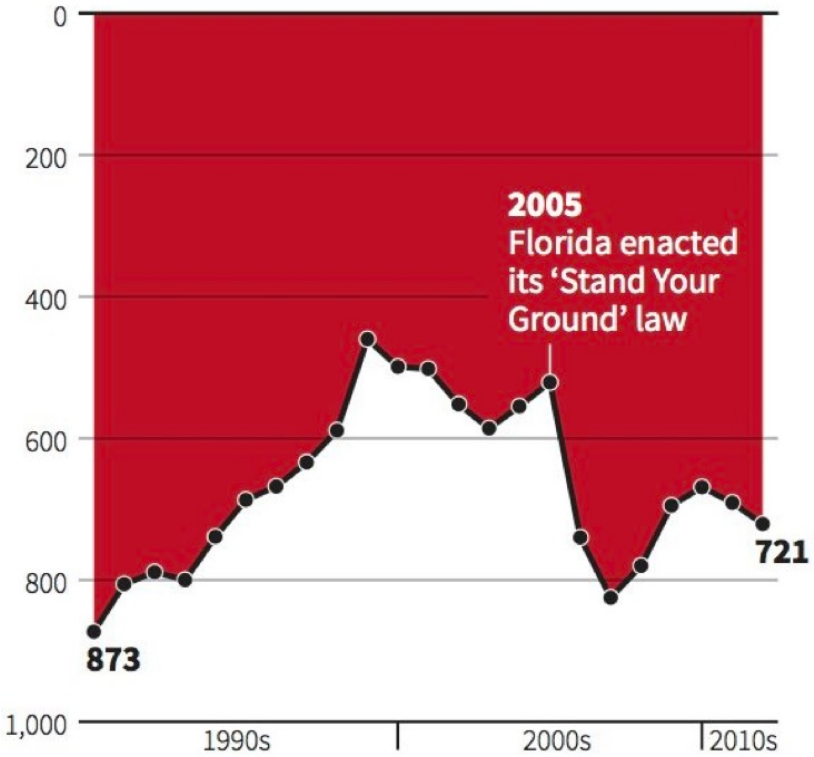




"Each state has been rated from one to 50: the higher the score, the smaller the proportion of STIs. So on the map - the darker the colour, the smaller the rate of STIs."

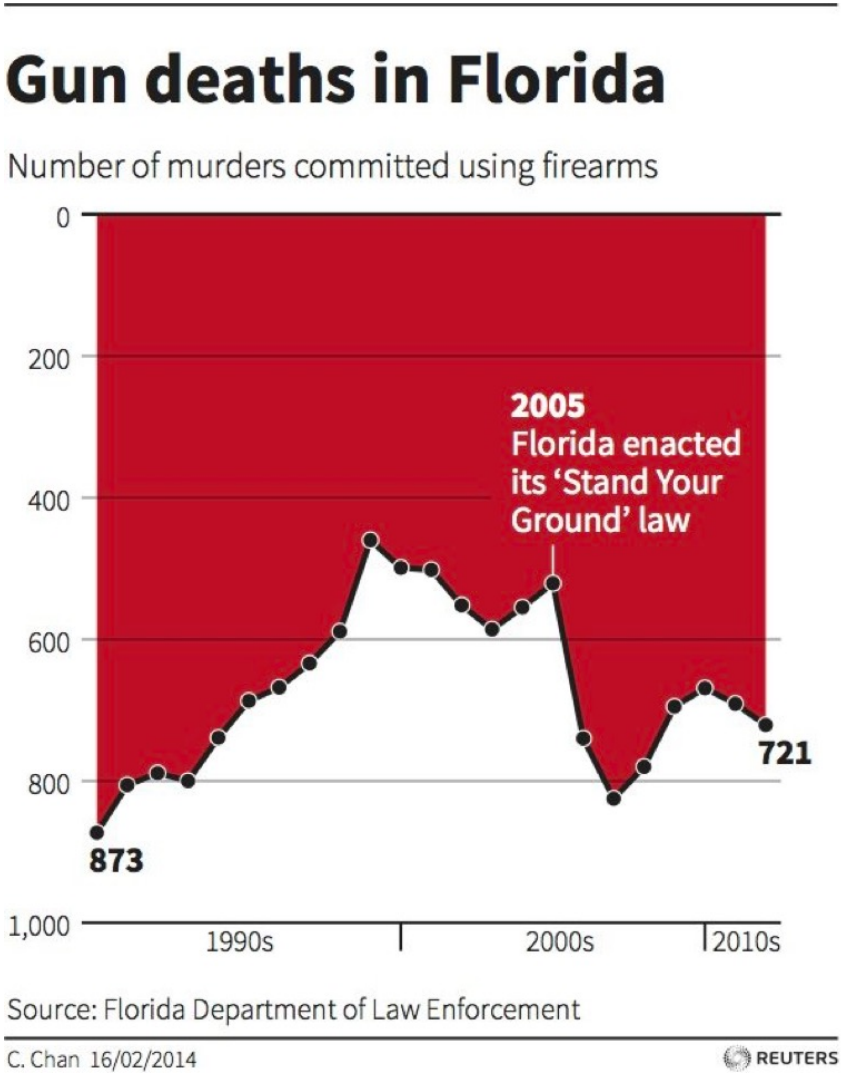
Gun deaths in Florida

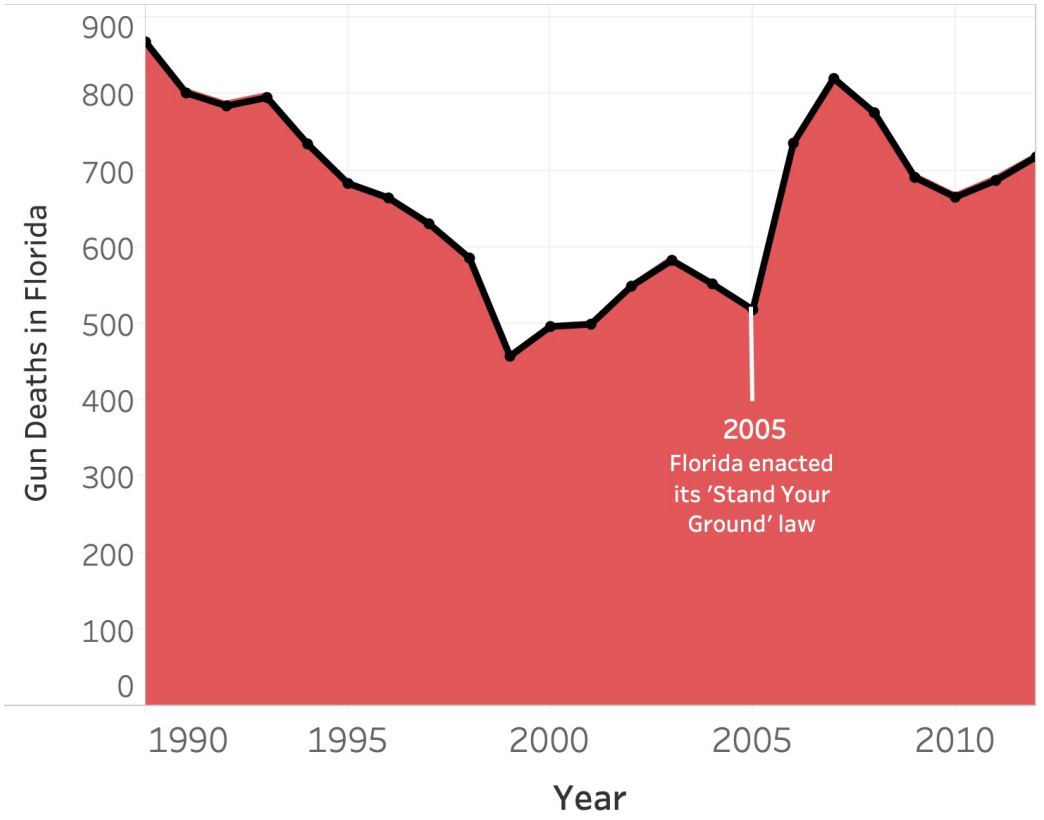
Number of murders committed using firearms



Source: Florida Department of Law Enforcement

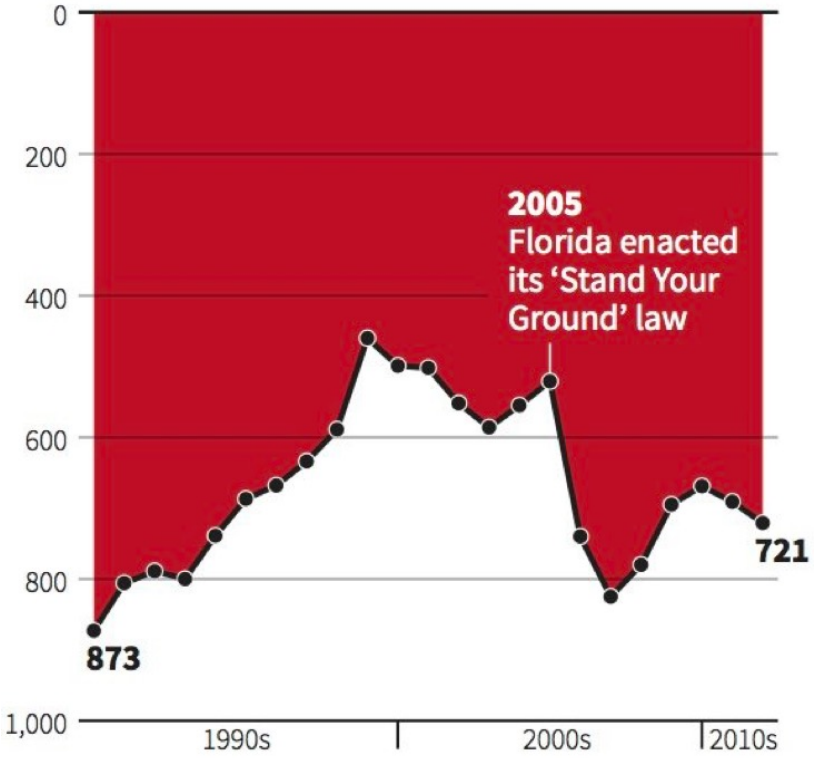
C. Chan 16/02/2014 REUTERS


Gun deaths in Florida
Number of murders committed using firearms
0
200
400
600
800
1,000
2005
Florida enacted its 'Stand Your Ground' law
873
721
1990s
2000s
2010s
Source: Florida Department of Law Enforcement
C. Chan 16/02/2014
REUTERS


Gun Deaths in Florida
900
800
700
600
500
400
300
200
100
0
2005
Florida enacted its 'Stand Your Ground' law
1990
1995
2000
2005
2010
Year

Gun deaths in Florida

Number of murders committed using firearms

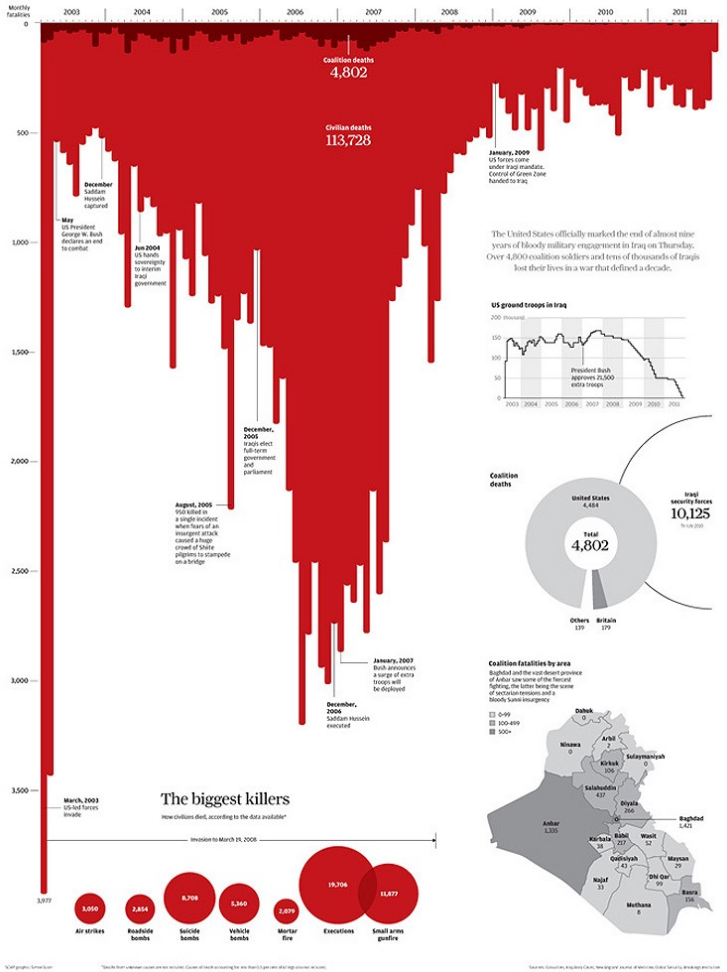


Source: Florida Department of Law Enforcement

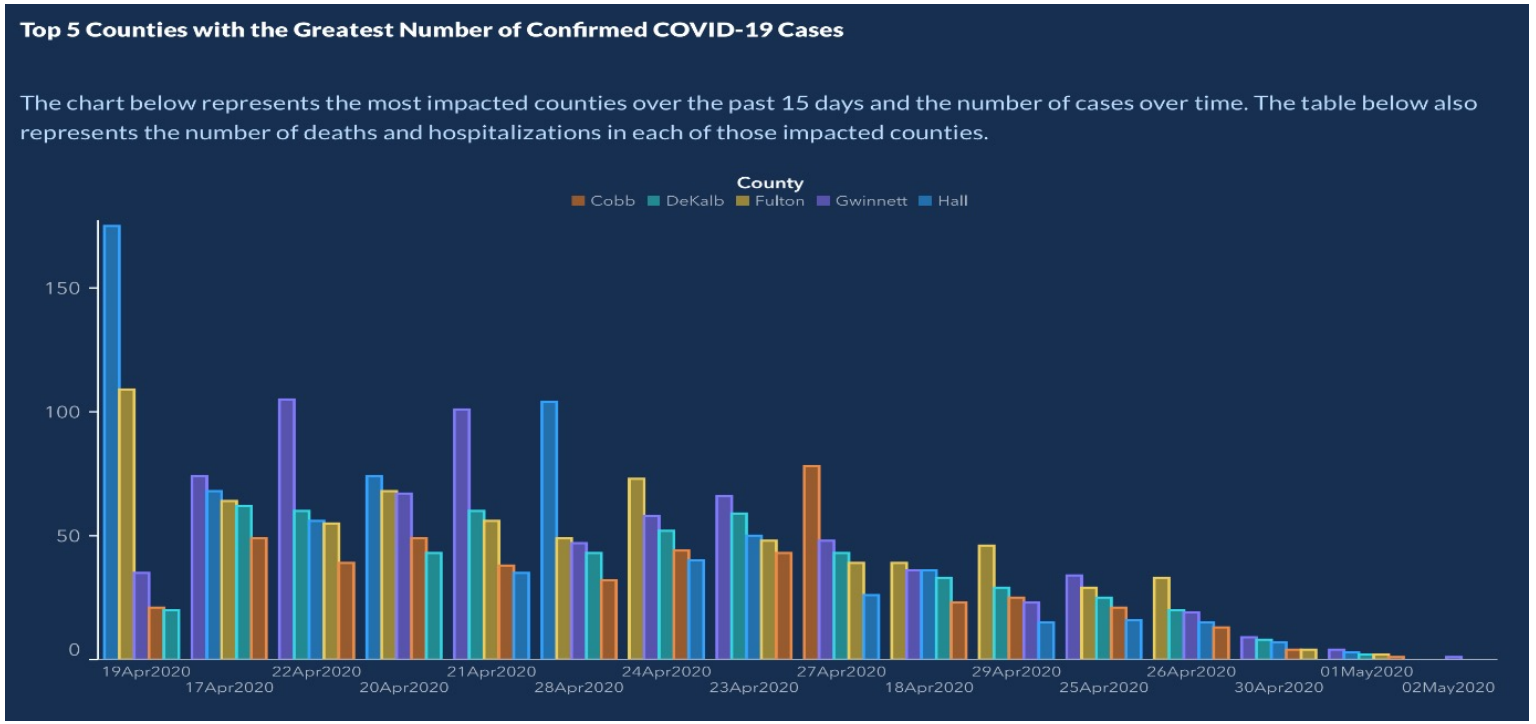
C. Chan 16/02/2014

REUTERS

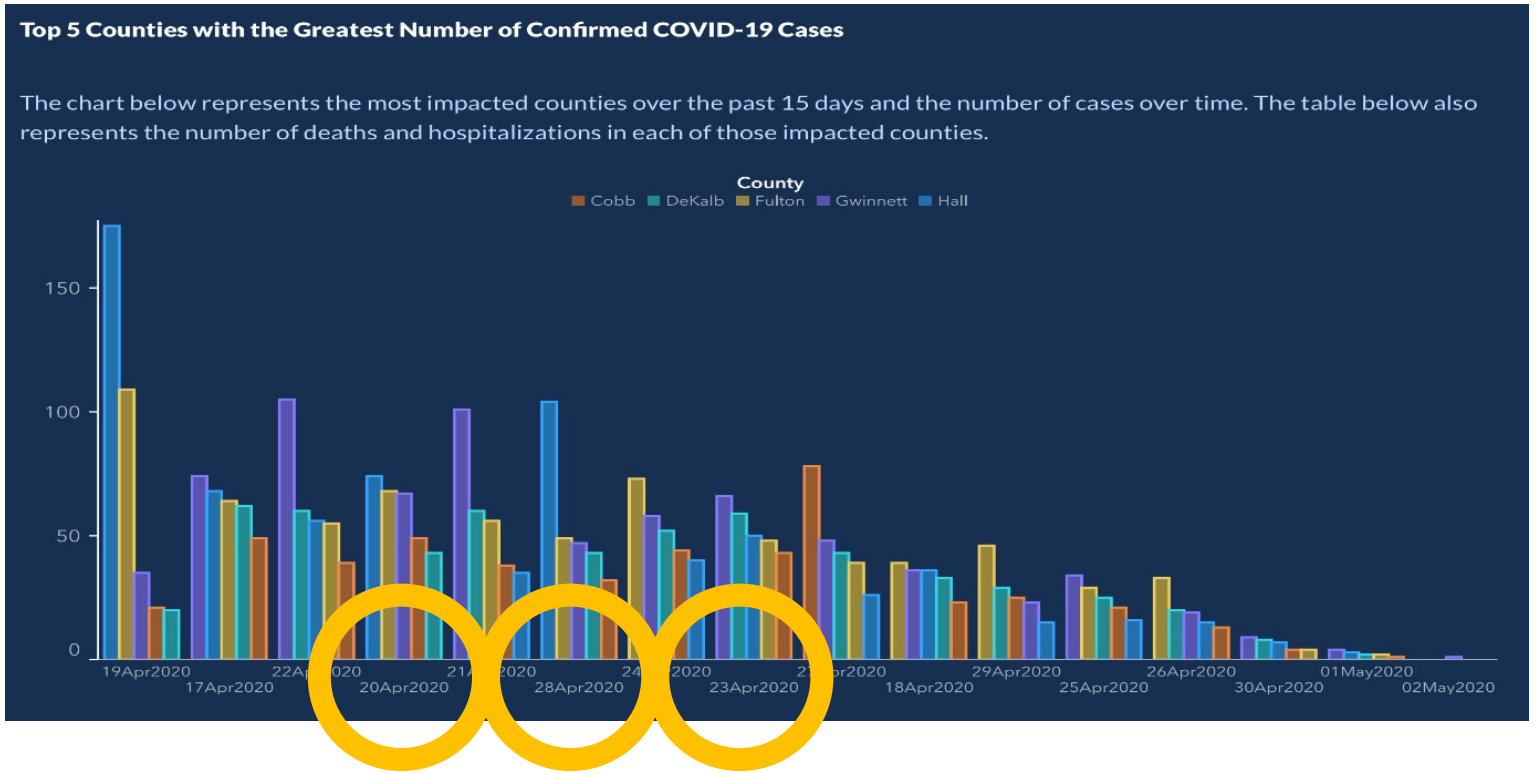
Iraq's bloody toll



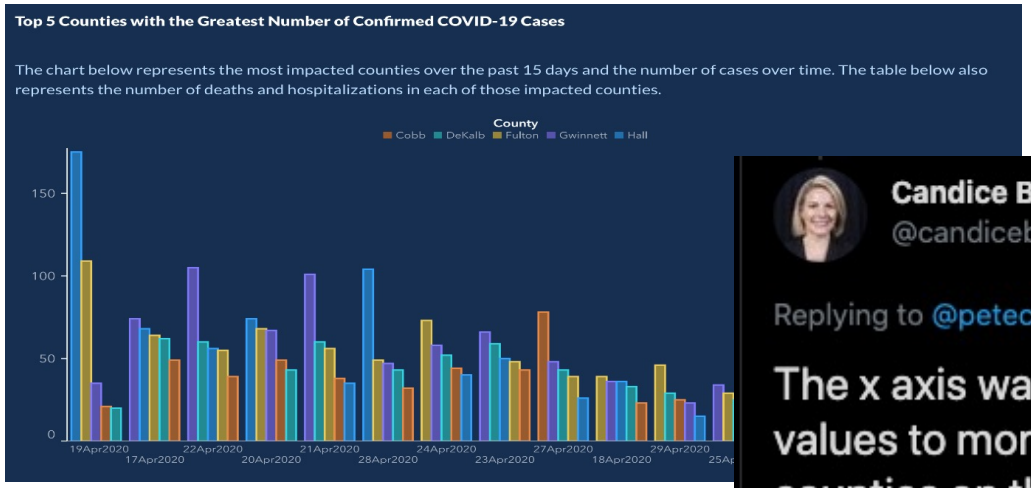
Convention Manipulation



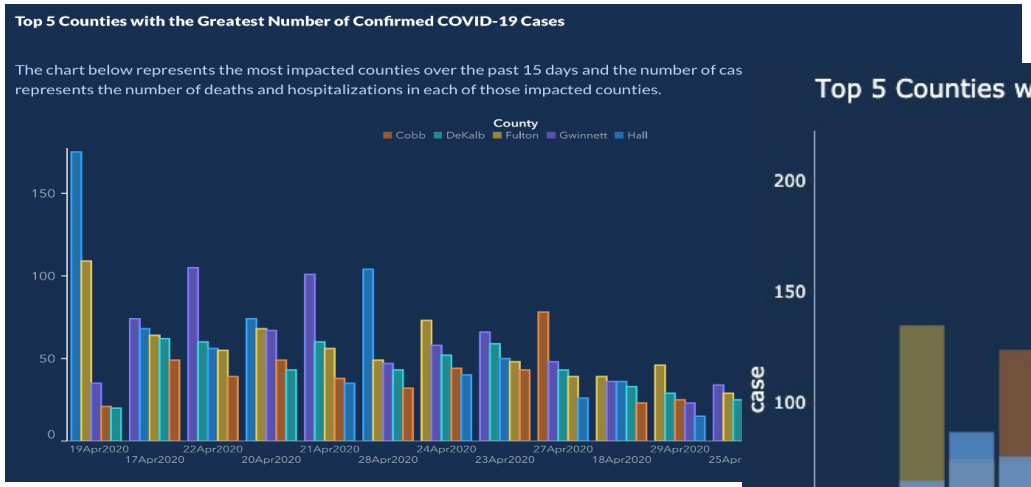
Convention Manipulation

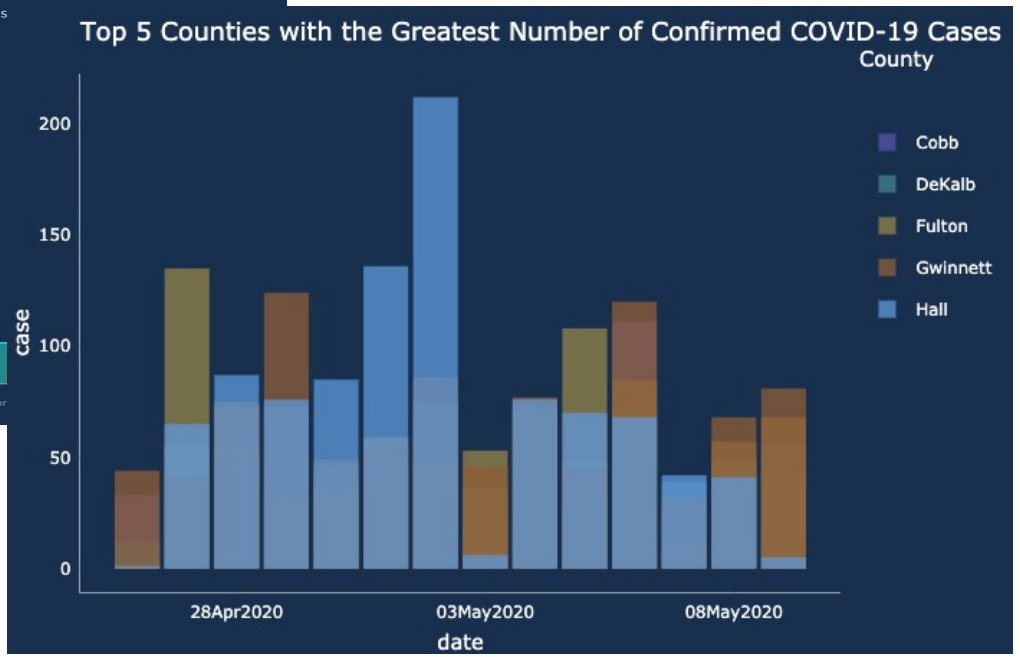


Convention Manipulation

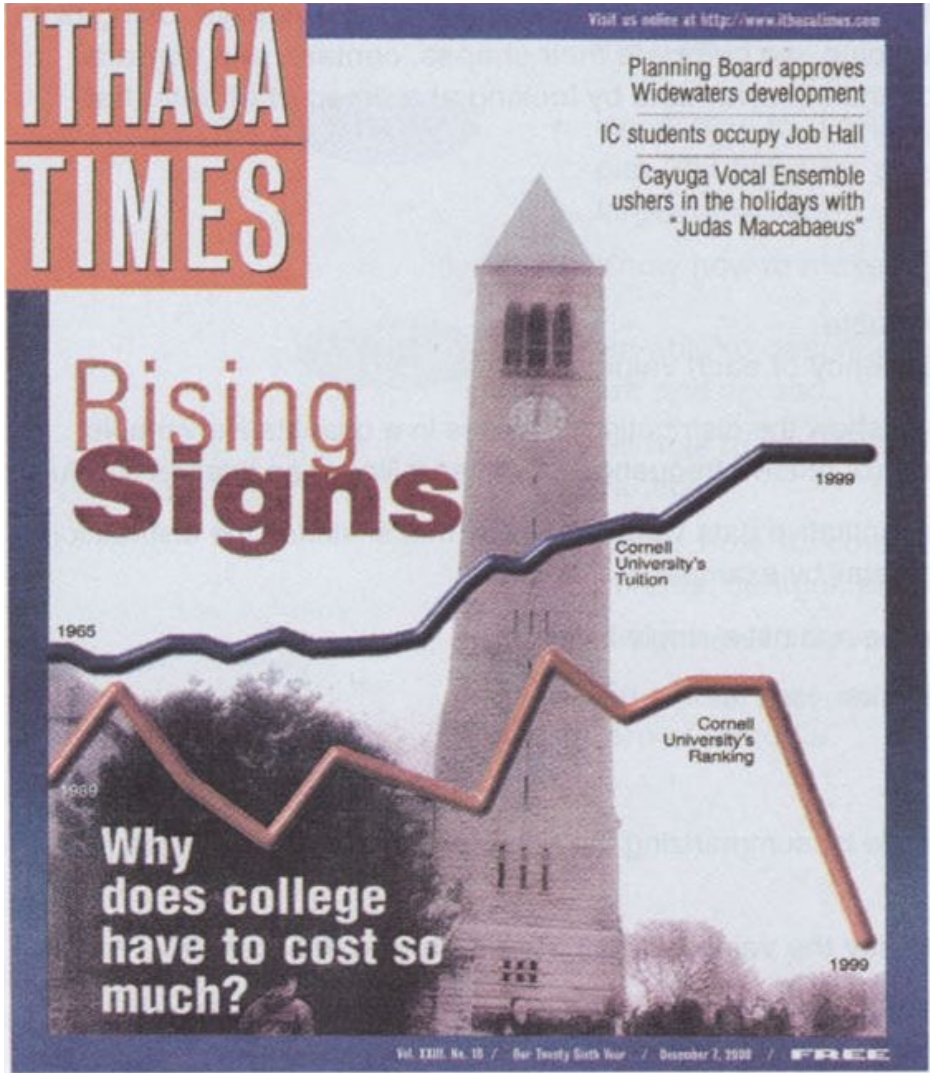


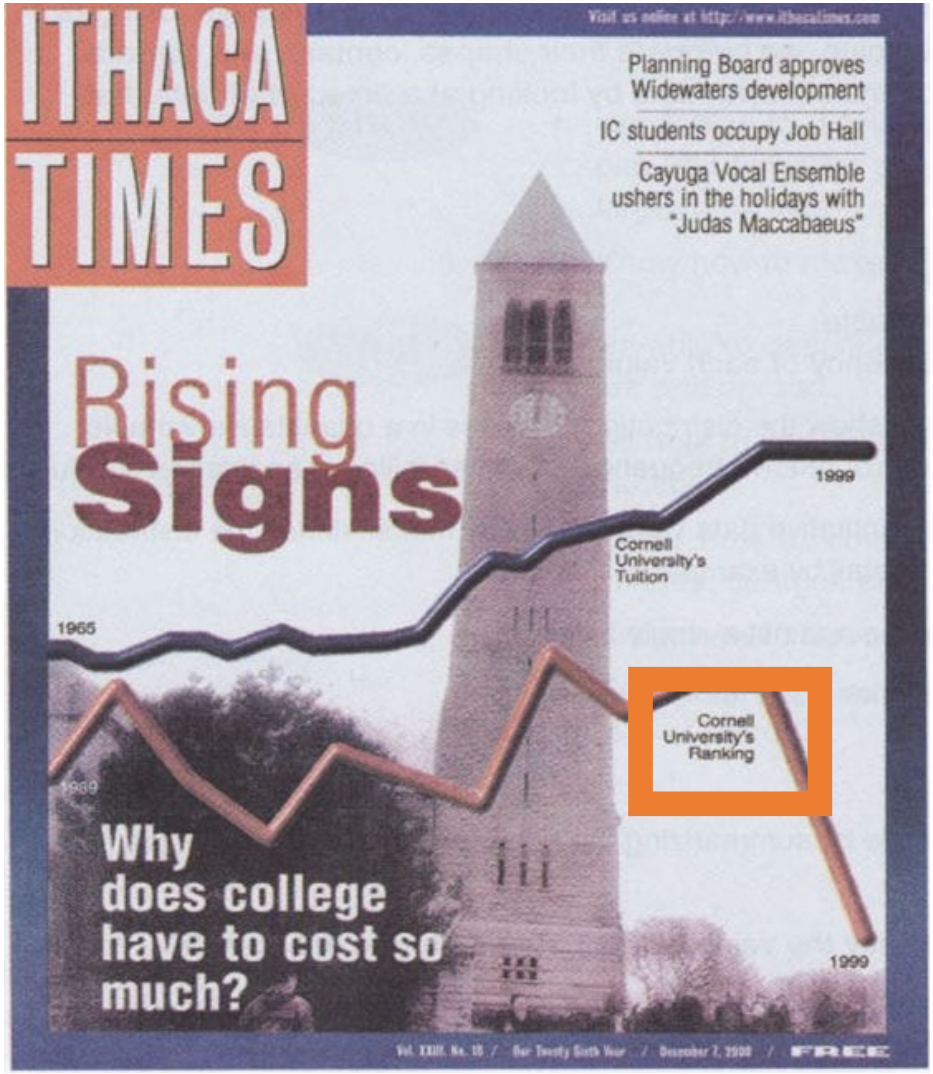
Convention Manipulation





Redesign from Lucy D'Agostino McGowan
https://livefreeordichotomize.com/2020/05/17/graph-detective/


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
1999
Cornell University's Tuition
1965
Cornell University's Ranking
1999
1999
Why does college have to cost so much?
Vol. XXIII, No. 18 / Our Twenty Sixth Year / December 7, 2000 / FREE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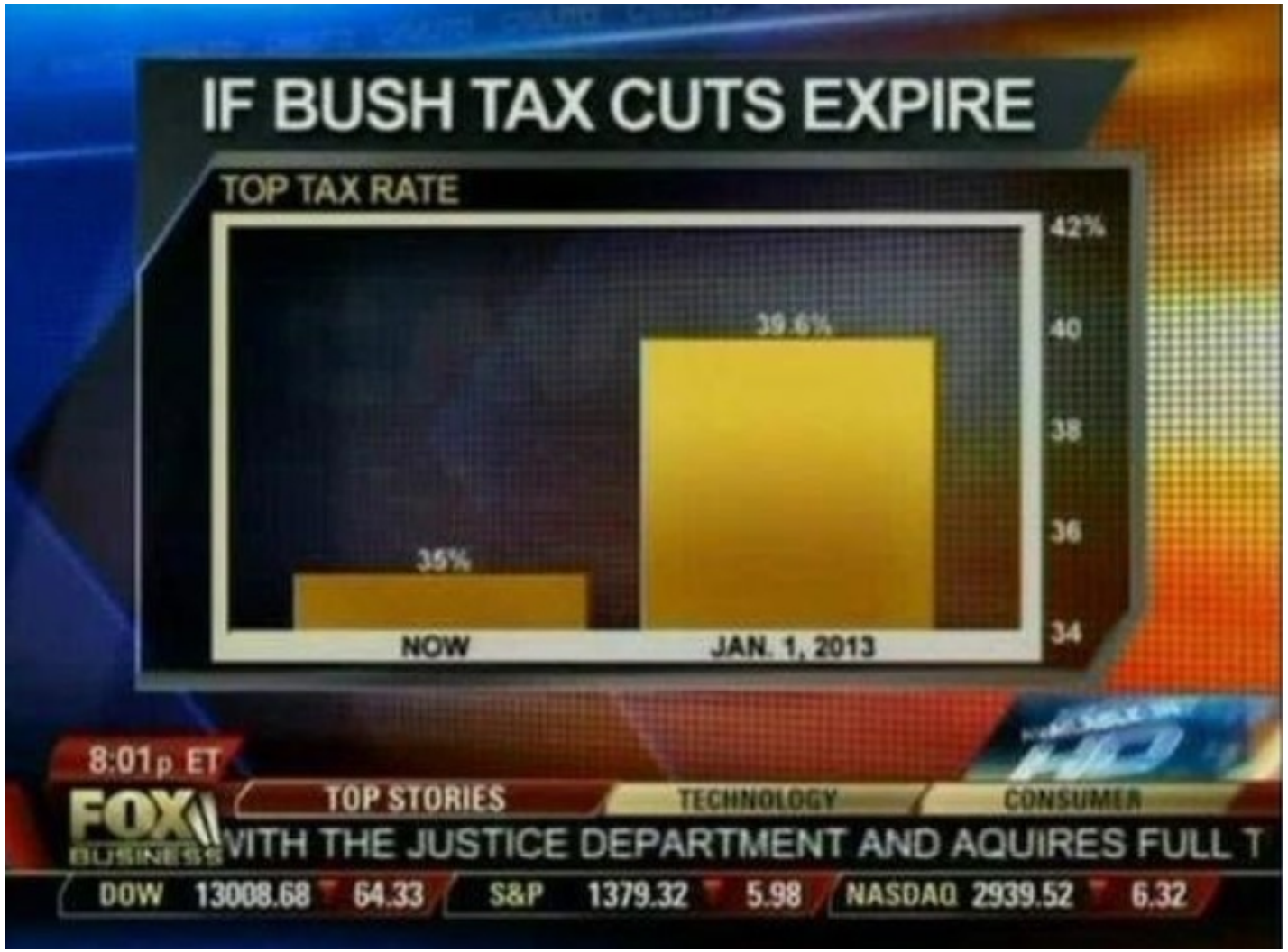
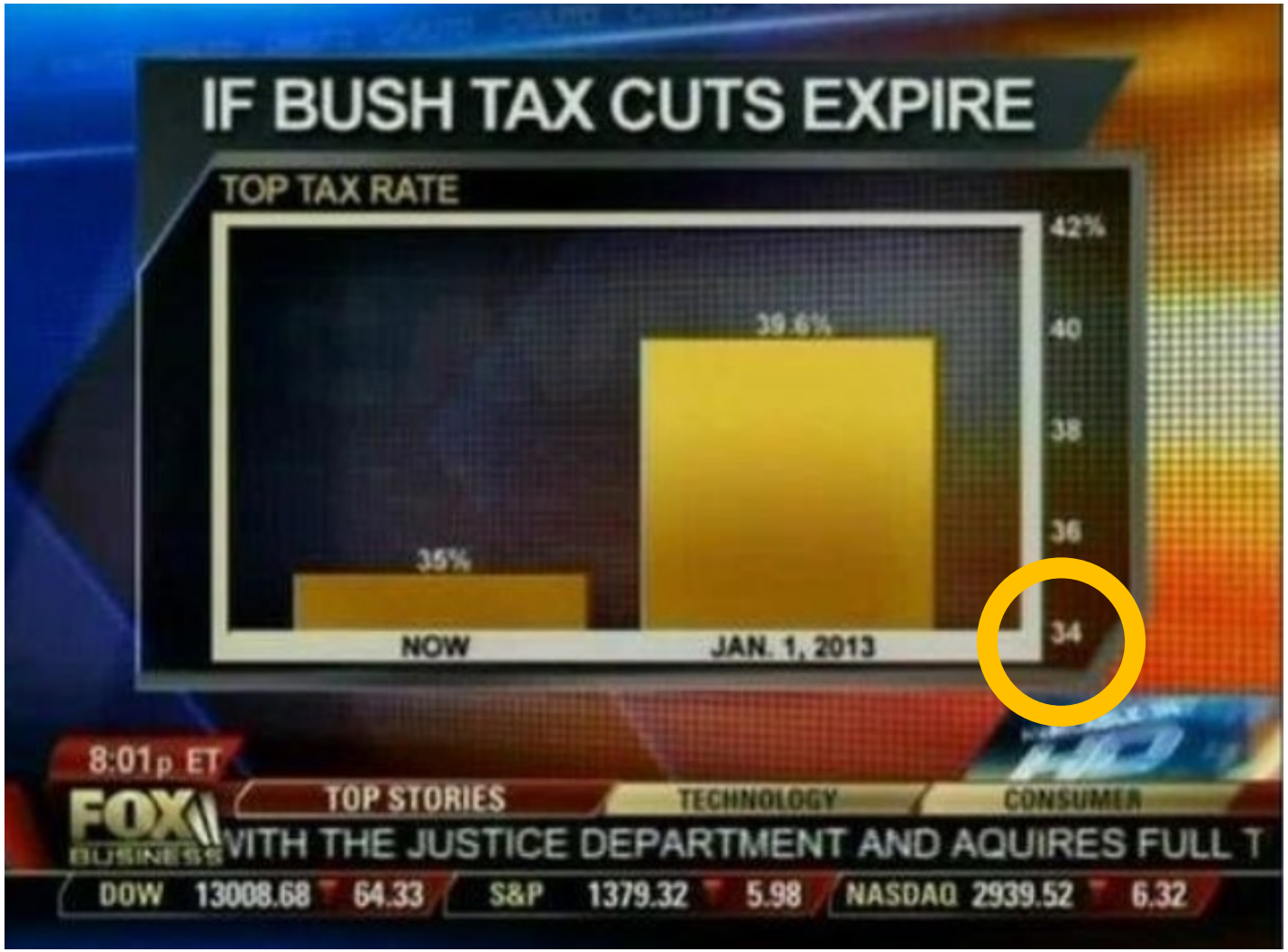

IF BUSH TAX CUTS EXPIRE
TOP TAX RATE
42%
40
38
36
34
39.6%
35%
NOW
JAN. 1, 2013
8:01p ET
FOX BUSINESS
TOP STORIES
TECHNOLOGY
CONSUMER
VITH THE JUSTICE DEPARTMENT AND AQUIRES FULL T
DOW 13008.68 64.33
S&P 1379.32 5.98
NASDAQ 2939.52 6.32


IF BUSH TAX CUTS EXPIRE
TOP TAX RATE
42%
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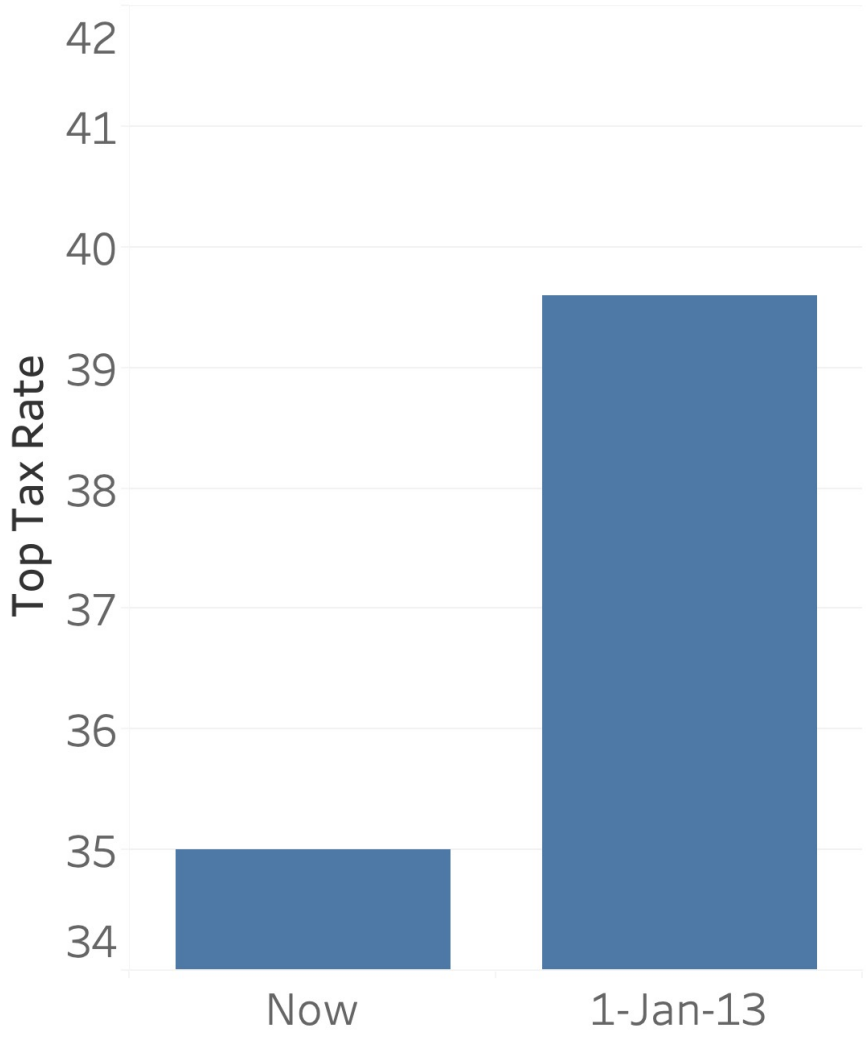
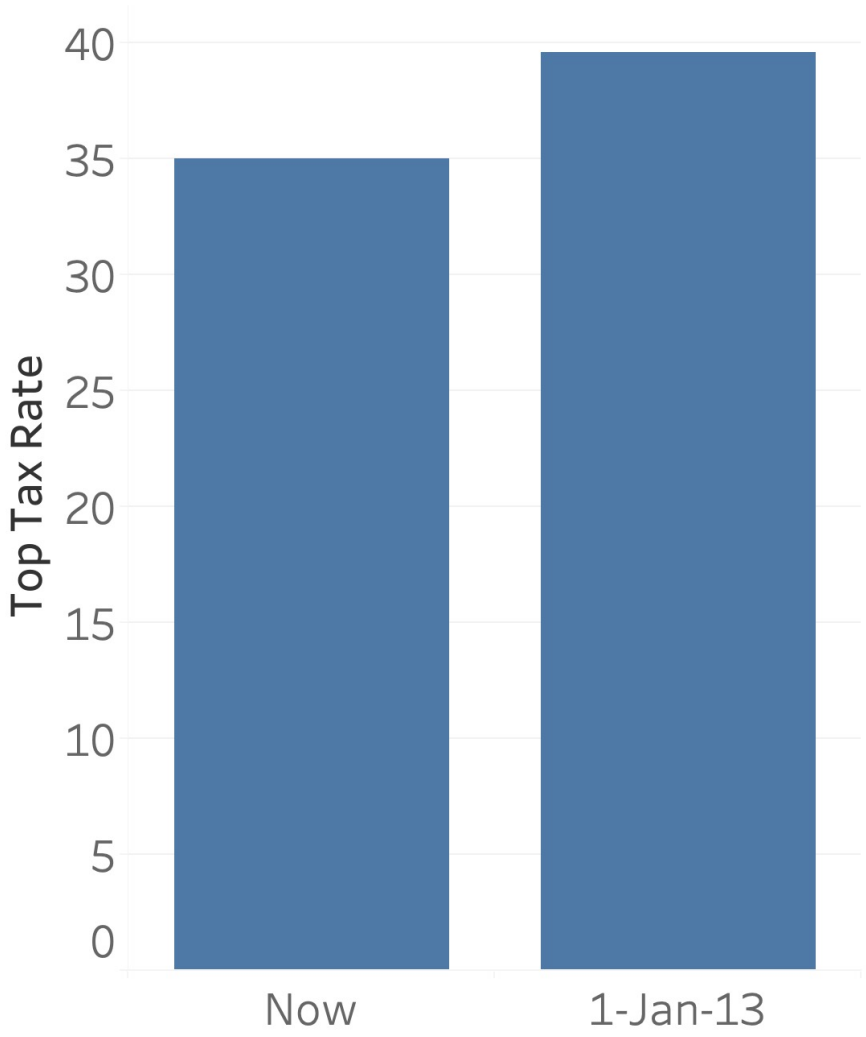
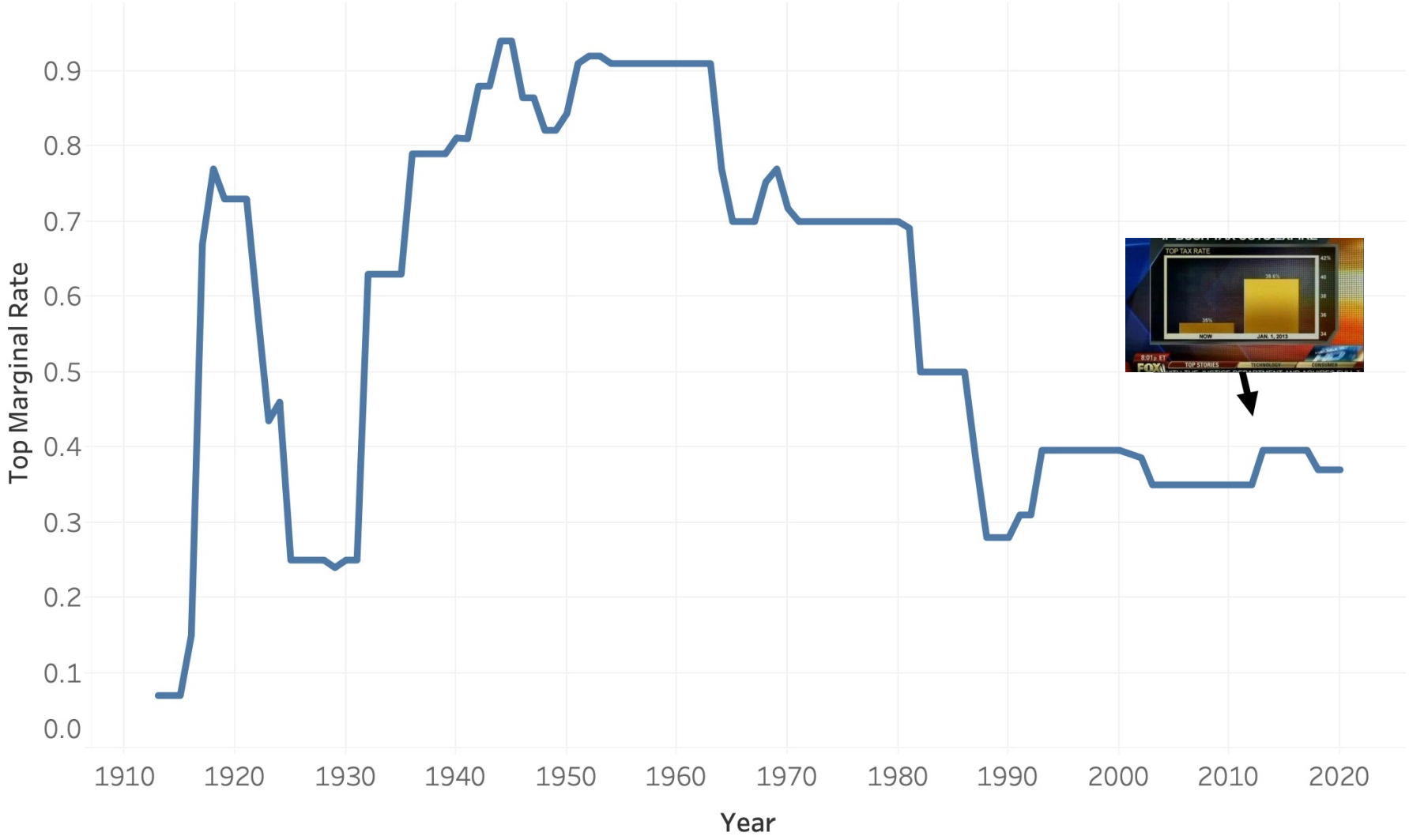
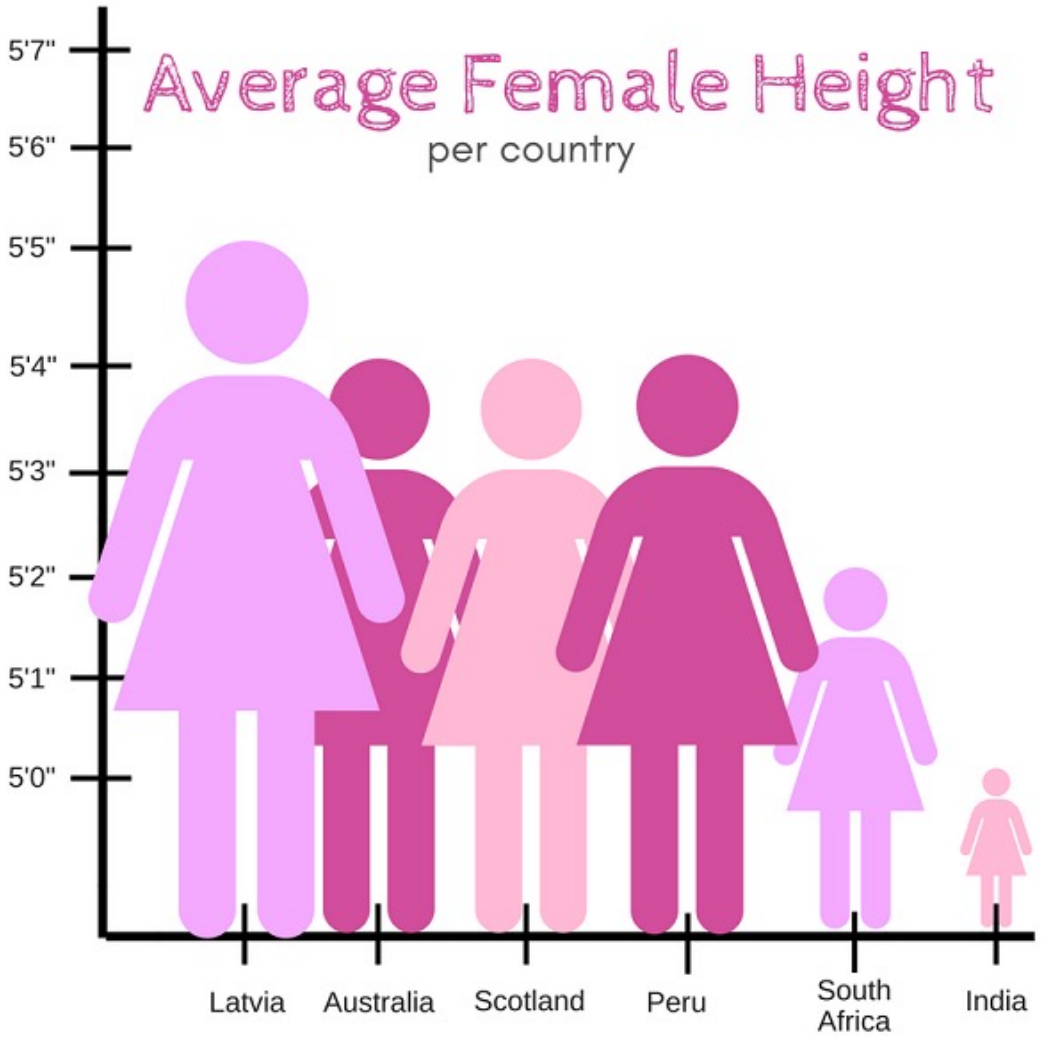
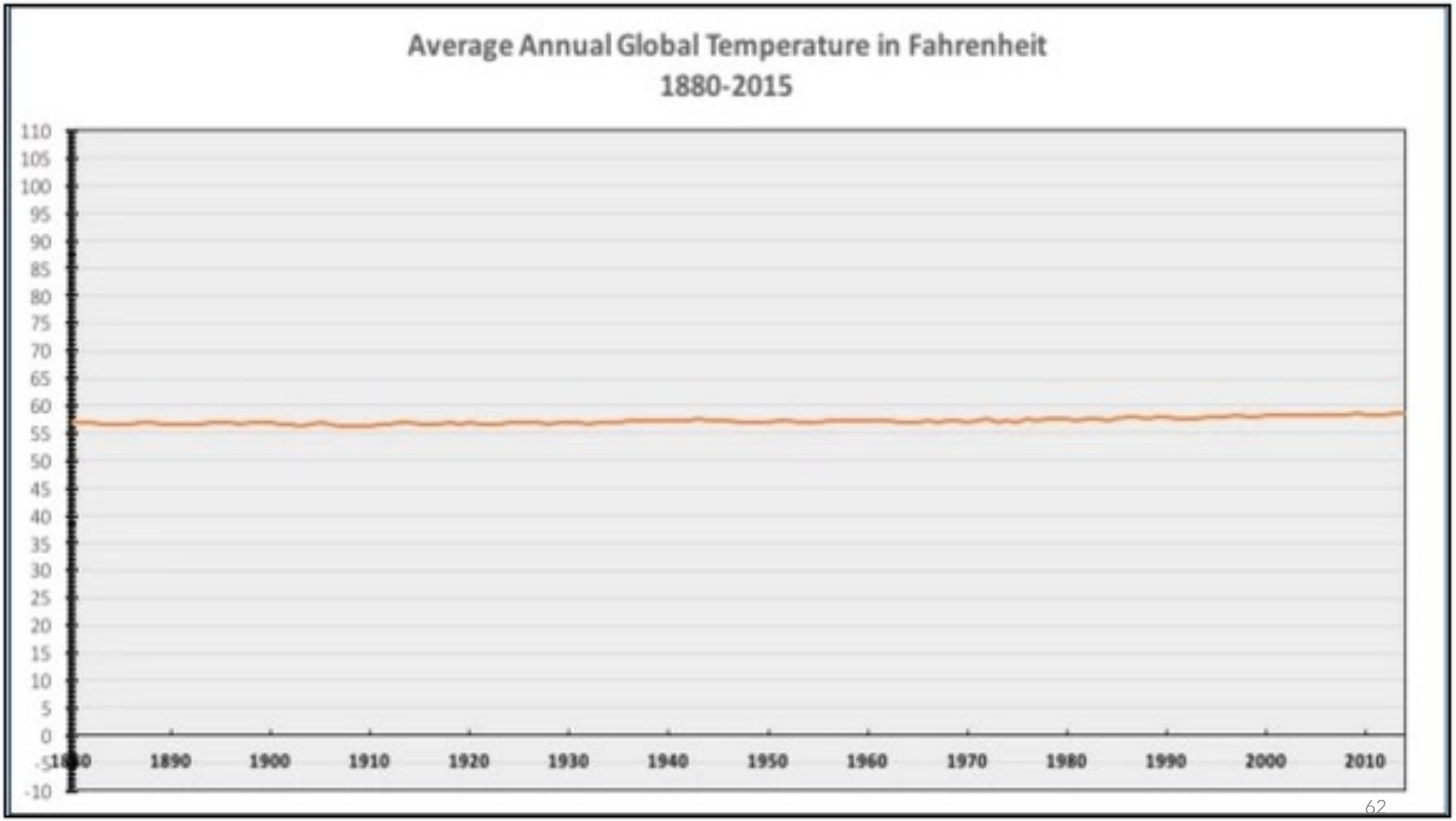
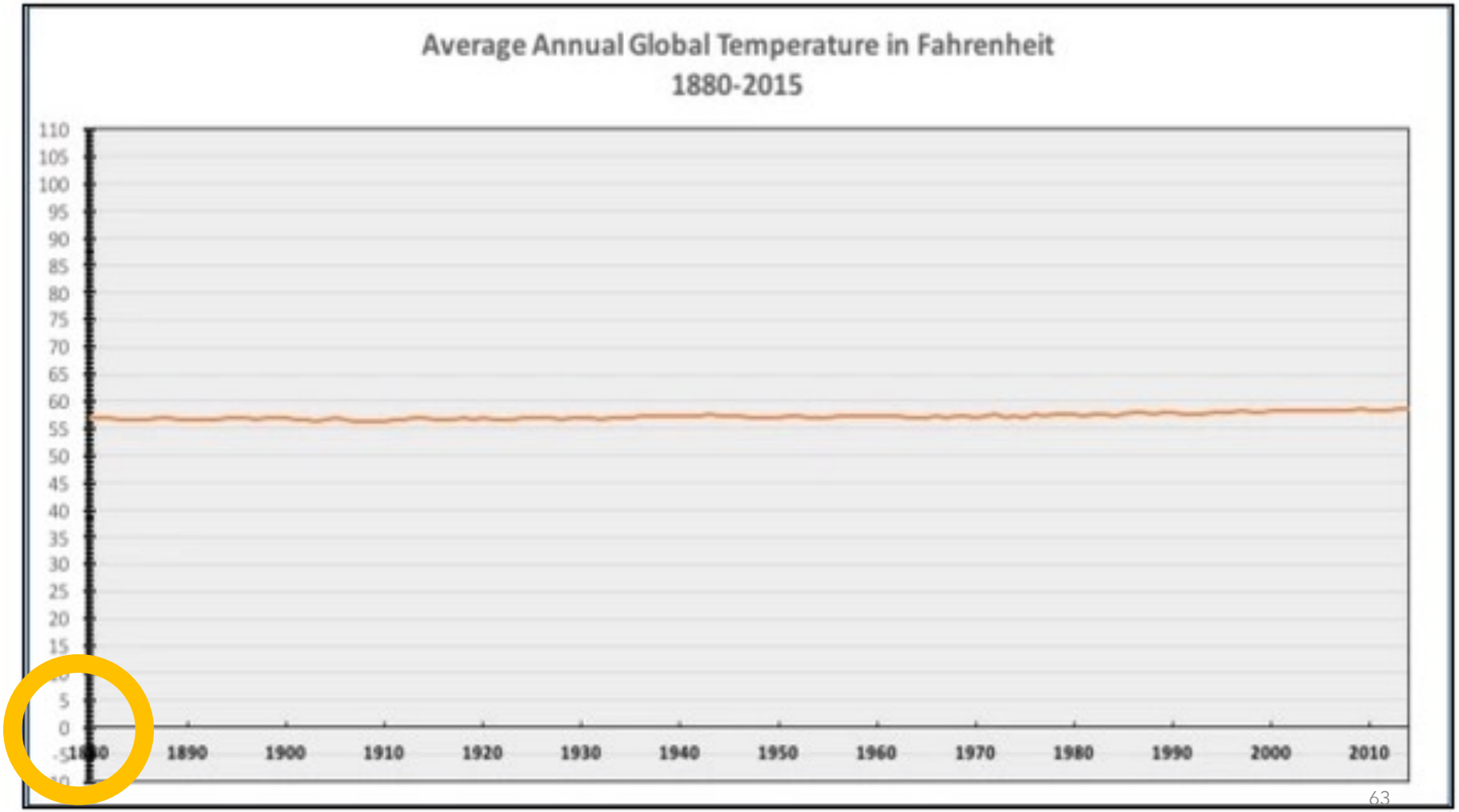

Top Tax Rate
42
41
40
39
38
37
36
35
34
Now
1-Jan-13

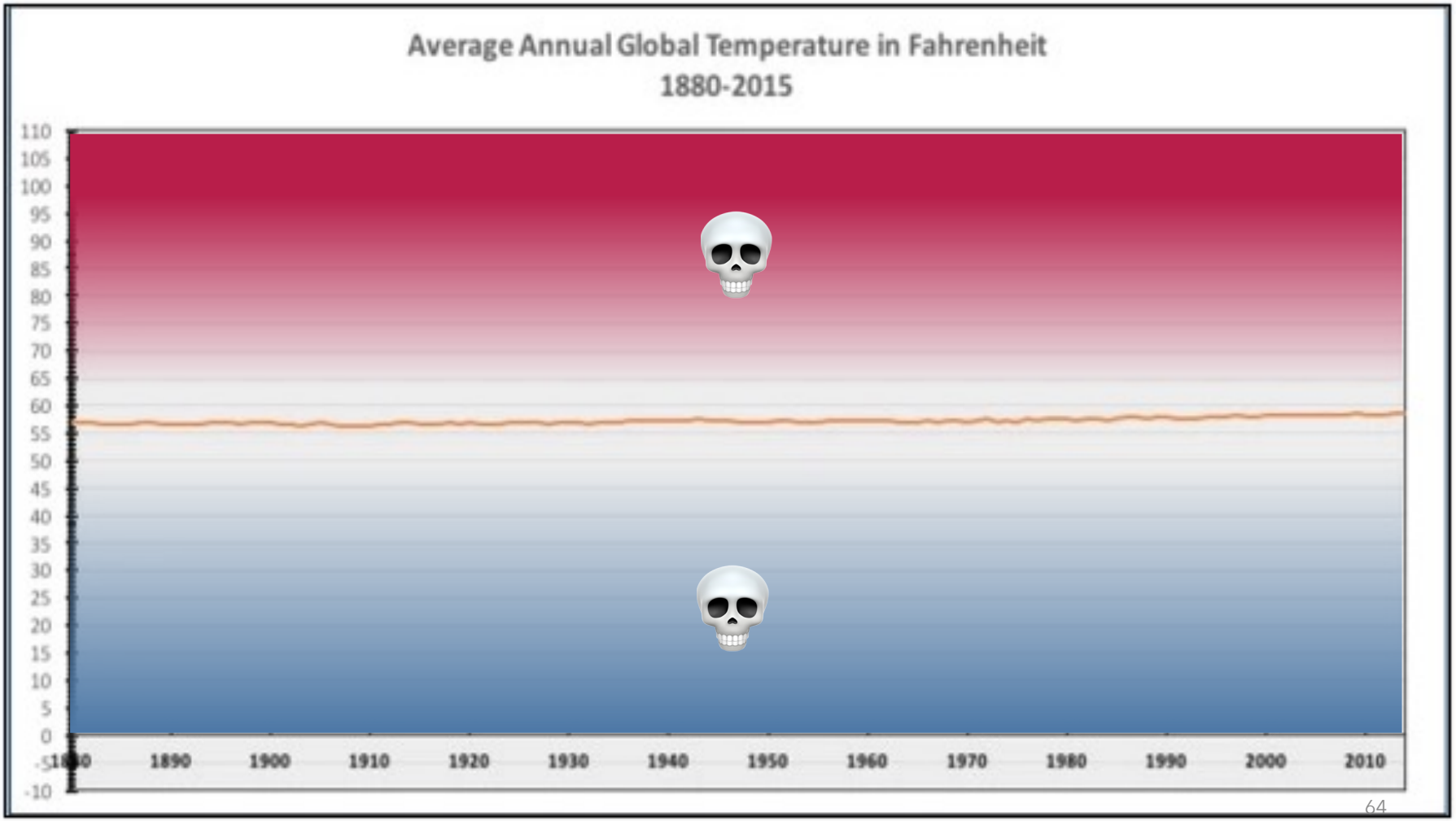

Top Tax Rate
40
35
30
25
20
15
10
5
0
Now
1-Jan-13


Top Marginal Rate
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020
Year
TOP TAX RATE
NOW
JAN. 1, 2013
TOP STORIES

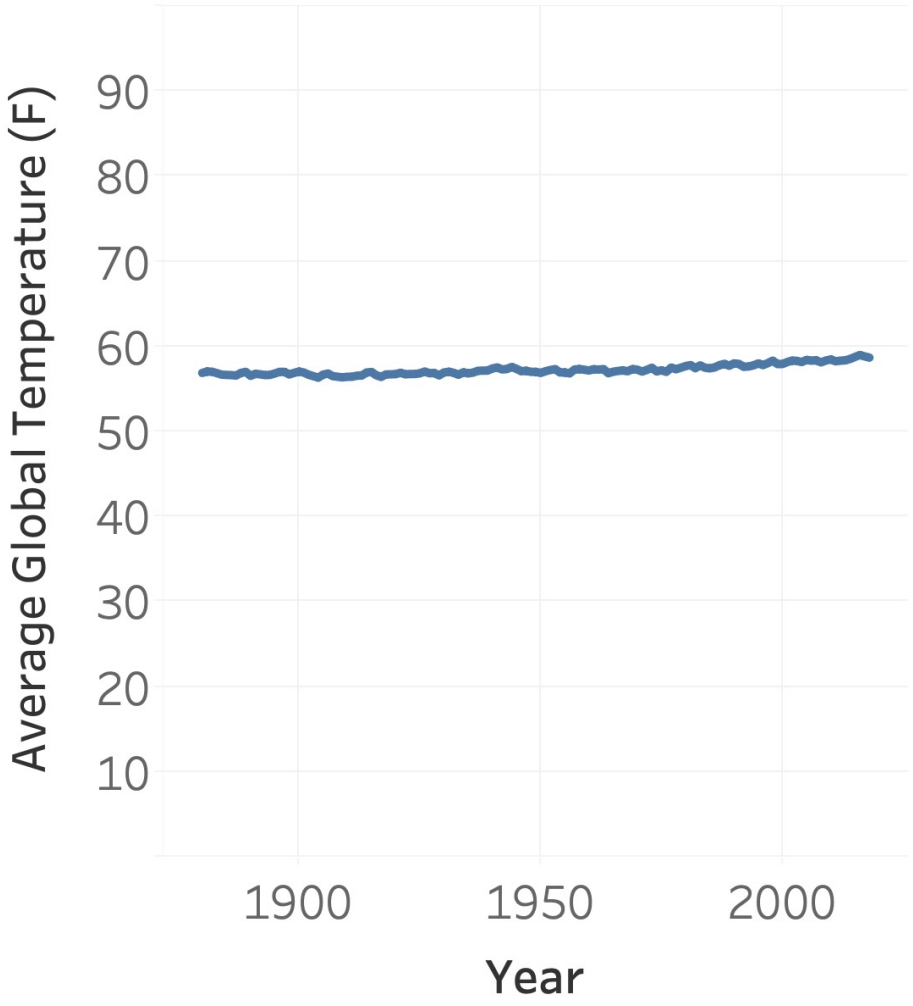

Average Female Height
per country
5'7"
5'6"
5'5"
5'4"
5'3"
5'2"
5'1"
5'0"
Latvia
Australia
Scotland
Peru
South Africa
India


Average Annual Global Temperature in Fahrenheit
1880-2015
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010

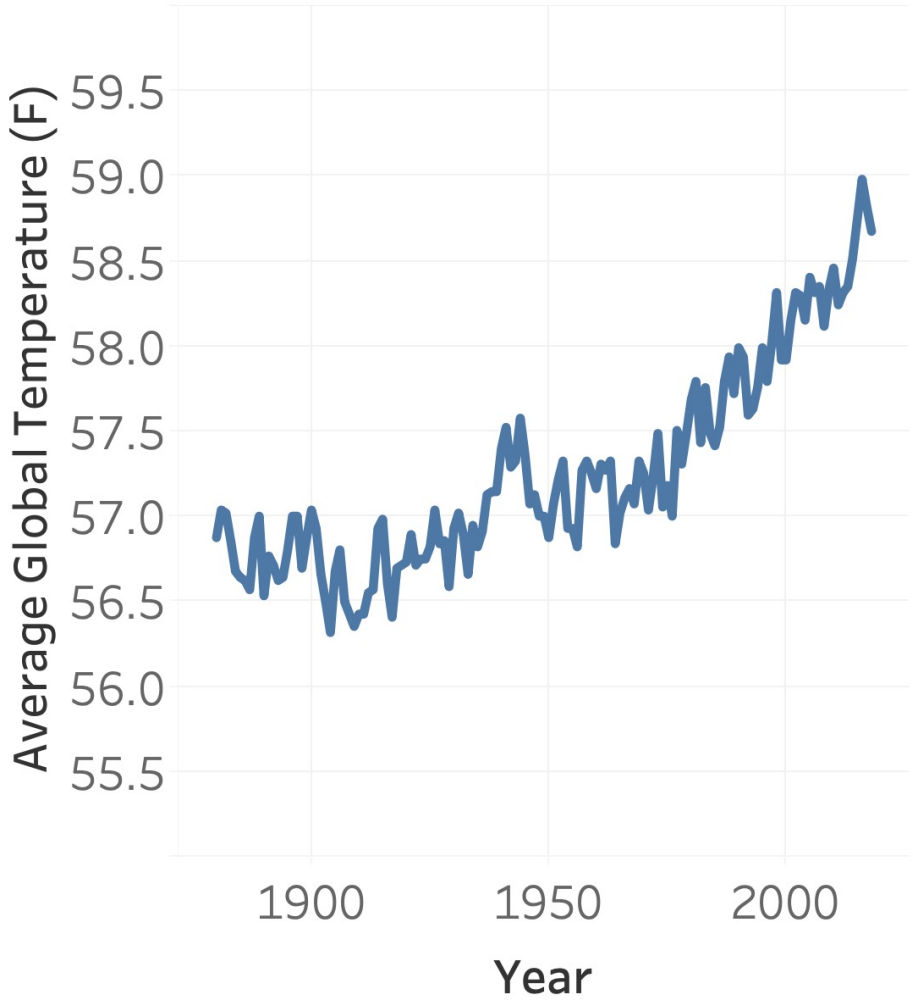

Average Annual Global Temperature in Fahrenheit
1880-2015
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
5
0
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010


Average Annual Global Temperature in Fahrenheit
1880-2015
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010

NRO

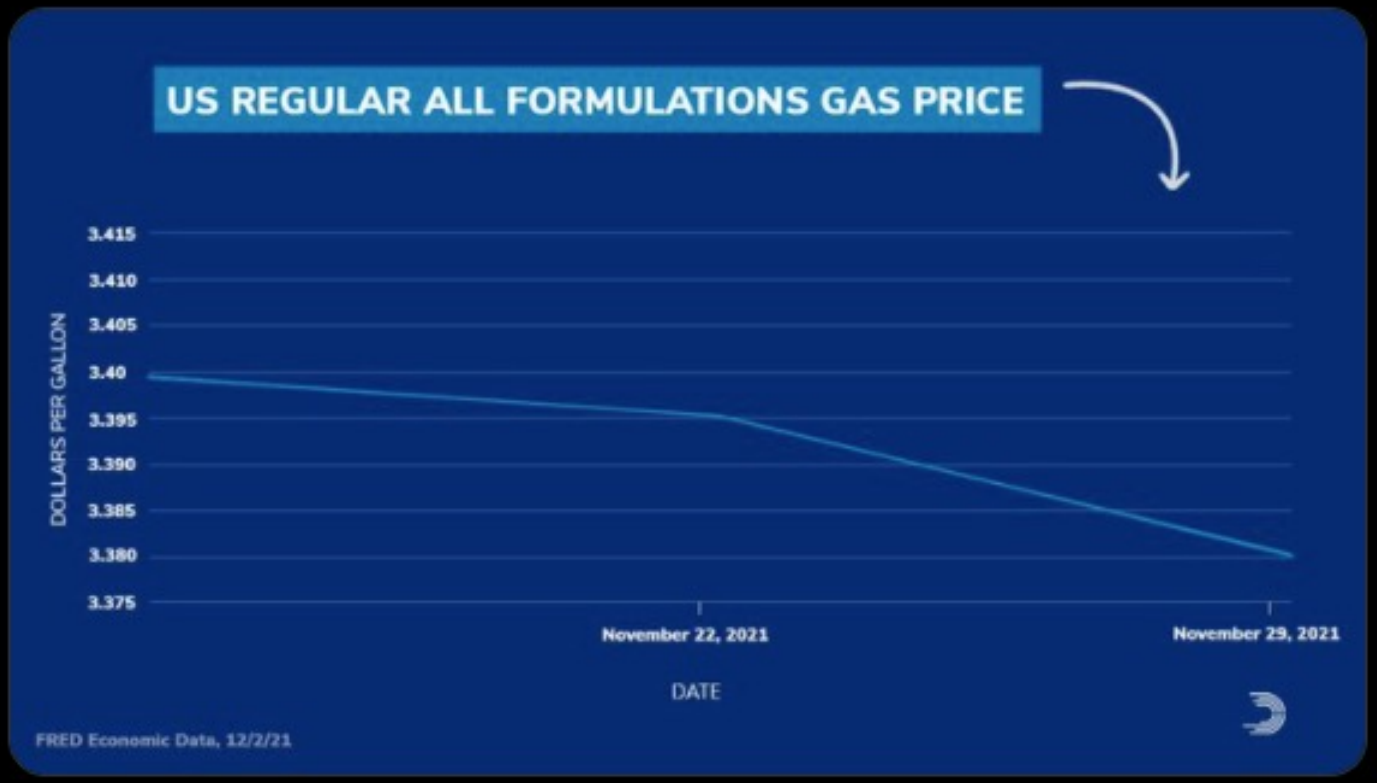


NRO (Truncated)



DCCC
@dccc

Thanks, @JoeBiden.



DCCC
@dccc

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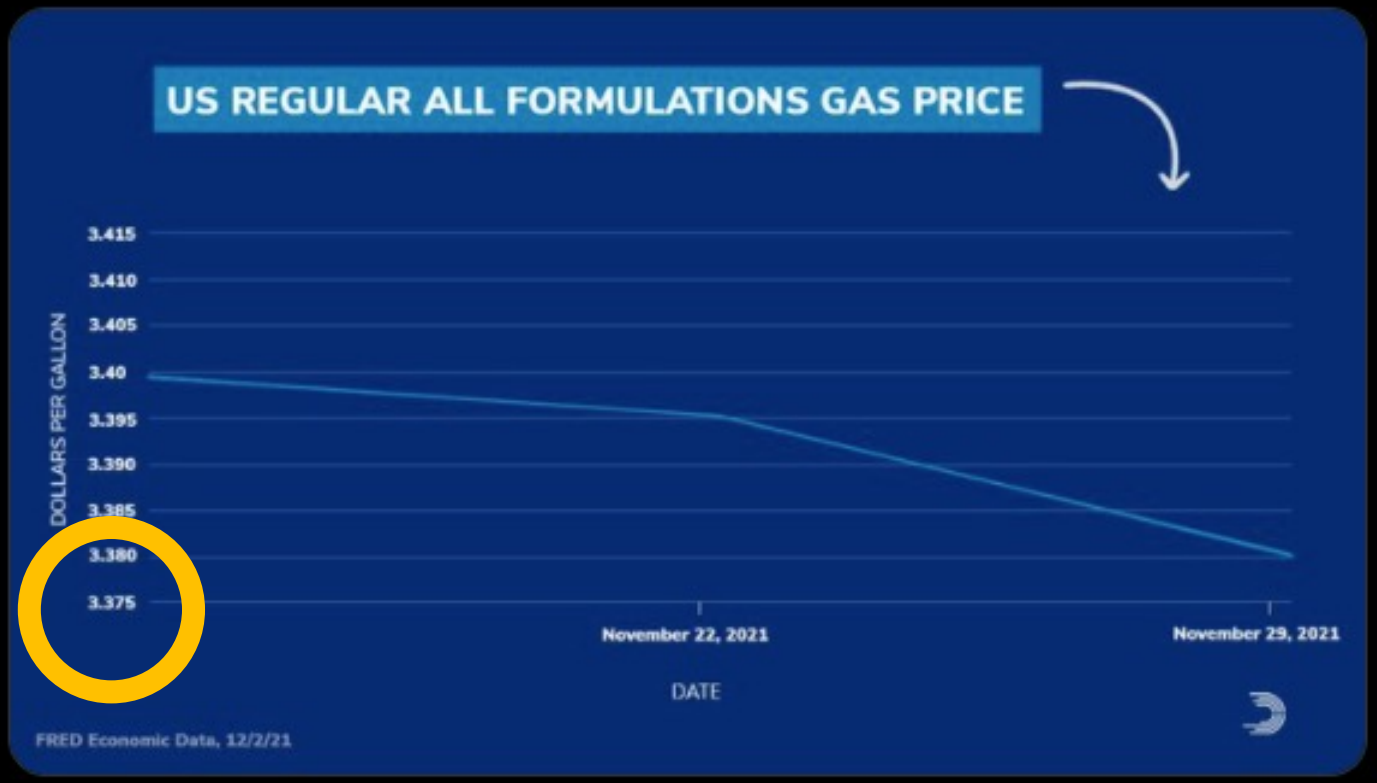

DCCC
@dccc

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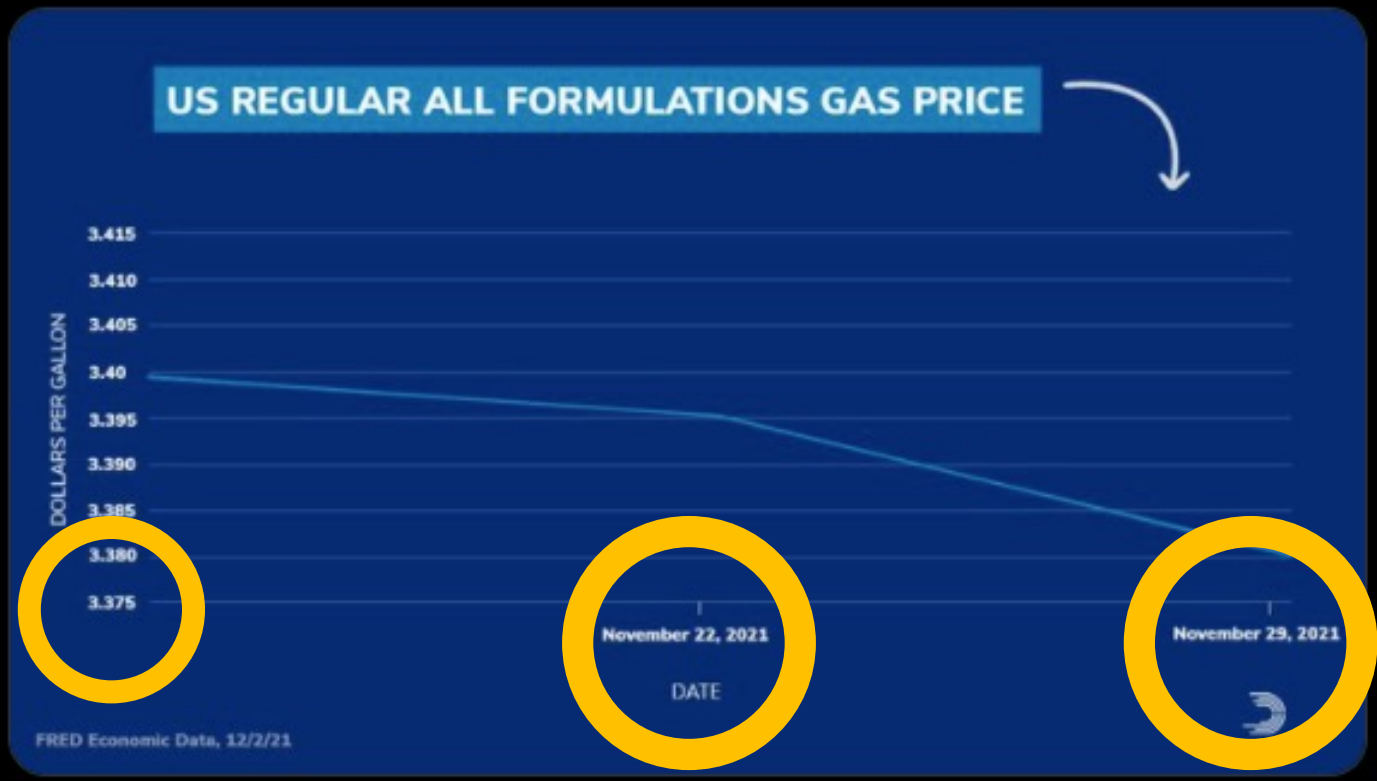
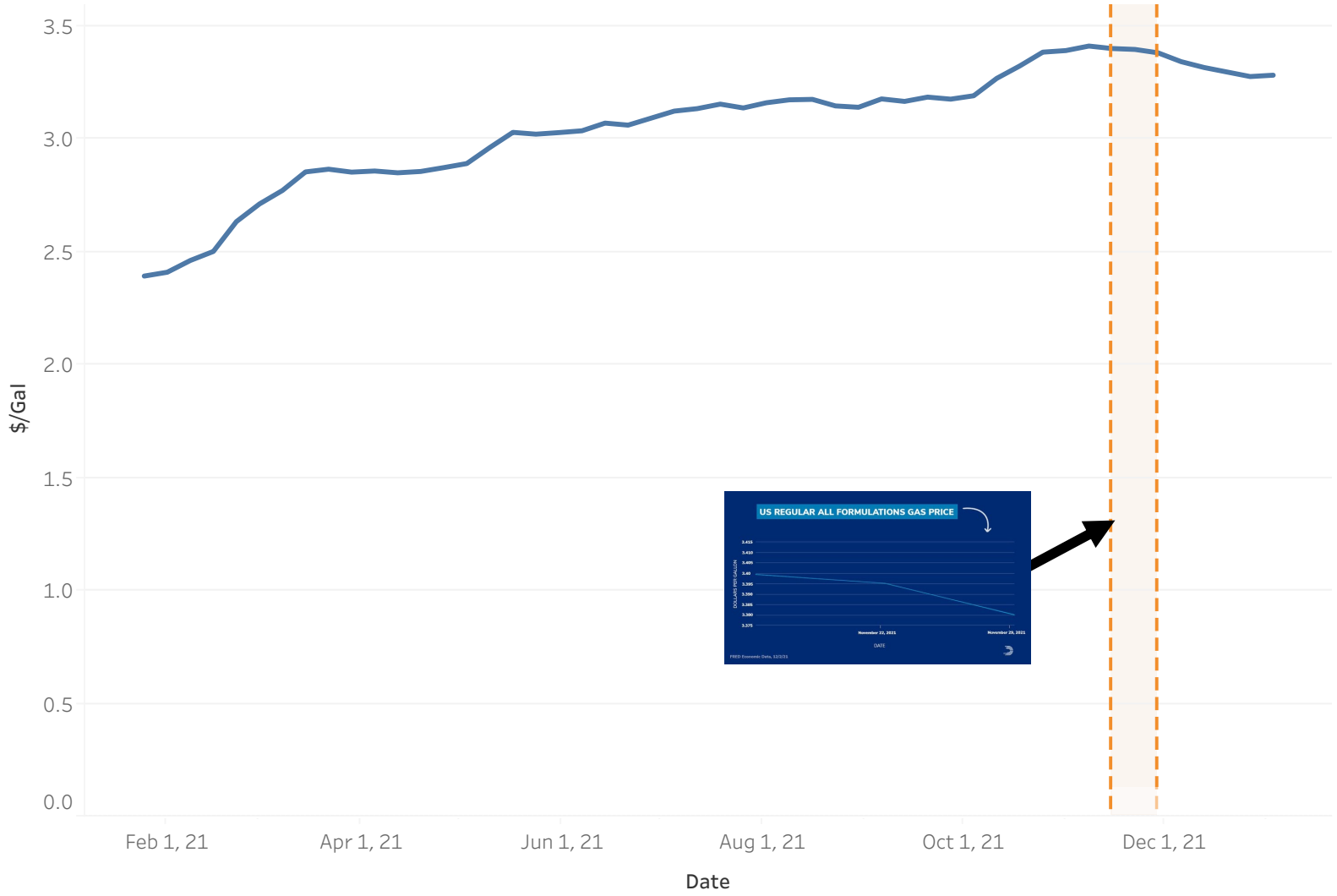


4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
$/Gal
1993
1998
2003
2008
2013
2018
2023
Date
US REGULAR ALL FORMULATIONS GAS PRICE


3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
$/Gal
Feb 1, 21
Apr 1, 21
Jun 1, 21
Aug 1, 21
Oct 1, 21
Dec 1, 21
Date
US REGULAR ALL FORMULATIONS GAS PRICE

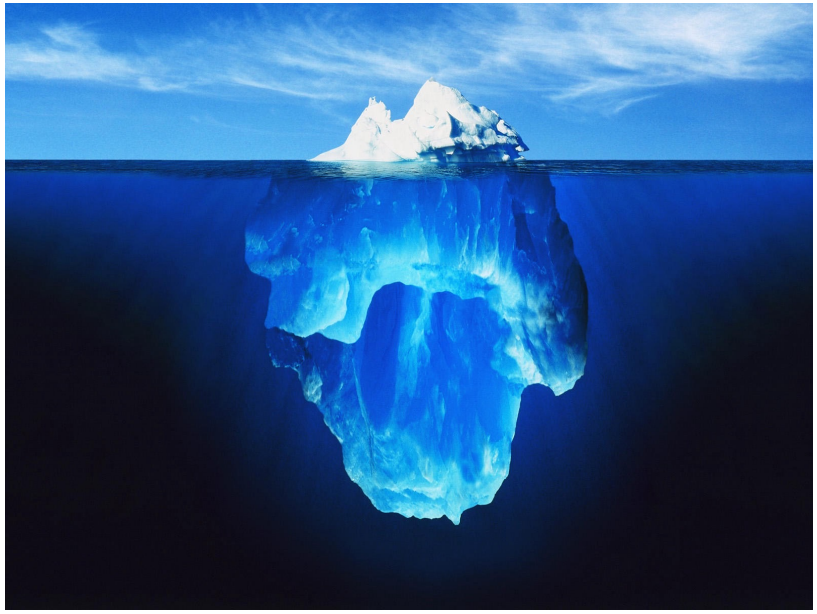
Unconventional Visualizations

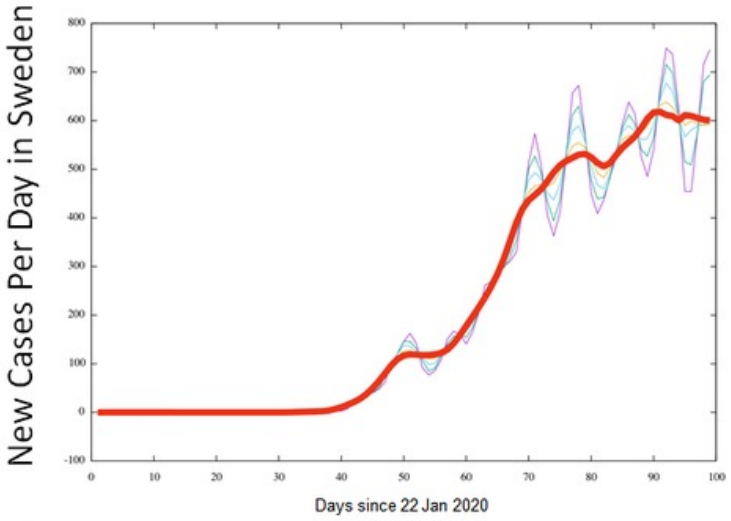
People have tacit conventions on how they interpret charts (around colors, axes, slopes)

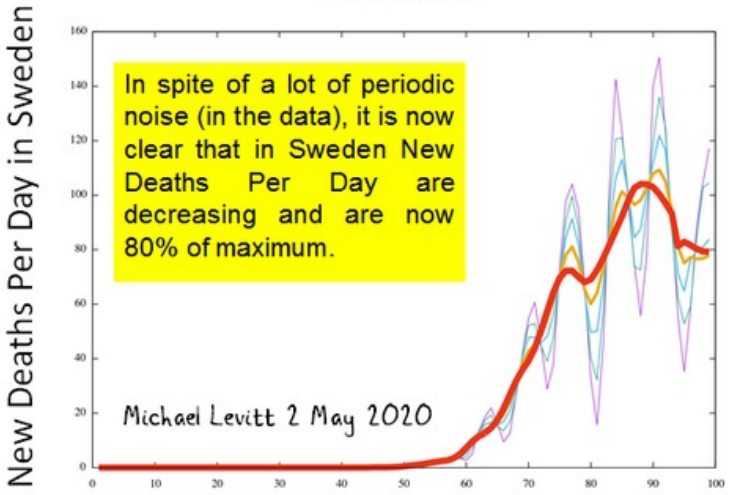
…if you violate those conventions, you can catch people off guard.

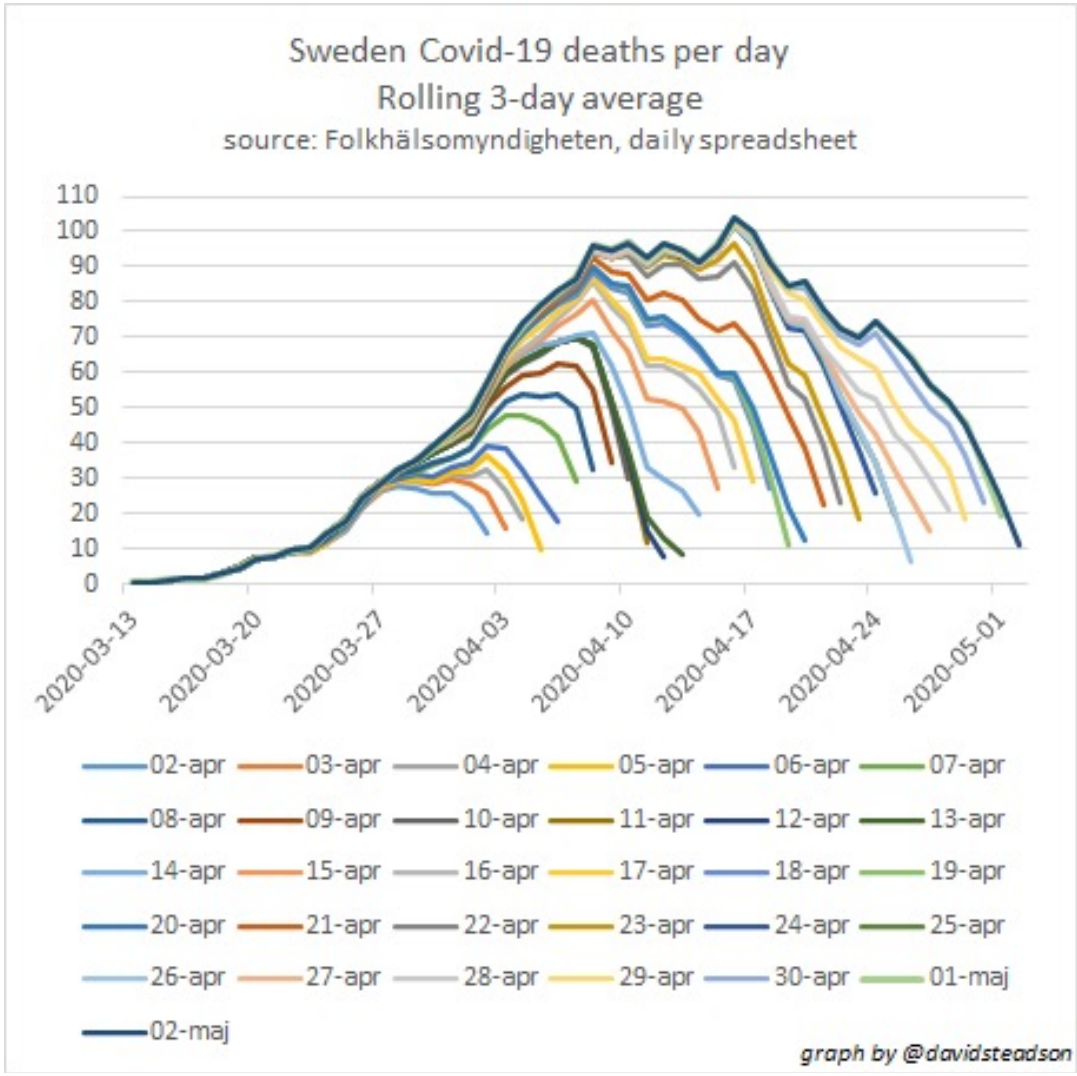
Other Types of Bad Visualizations

Fragile Visualizations?
Visualization White Lies?
Inhuman Visualizations?

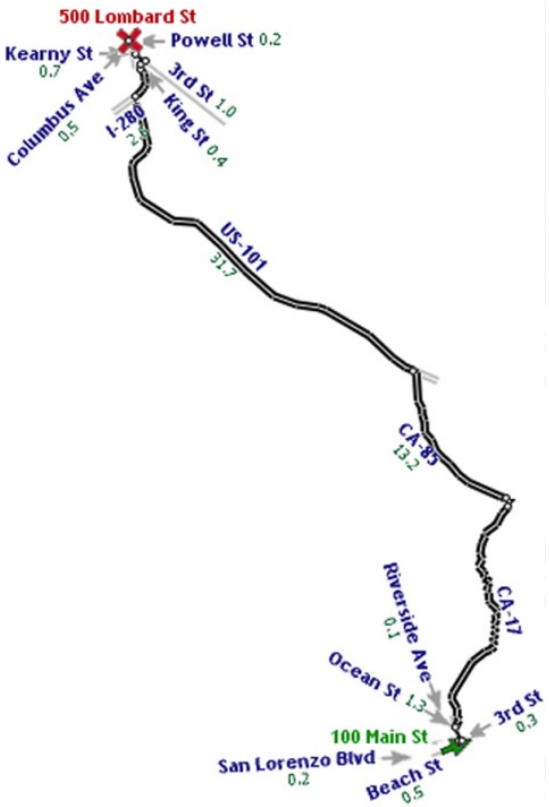



New Cases Per Day in Sweden
Days since 22 Jan 2020

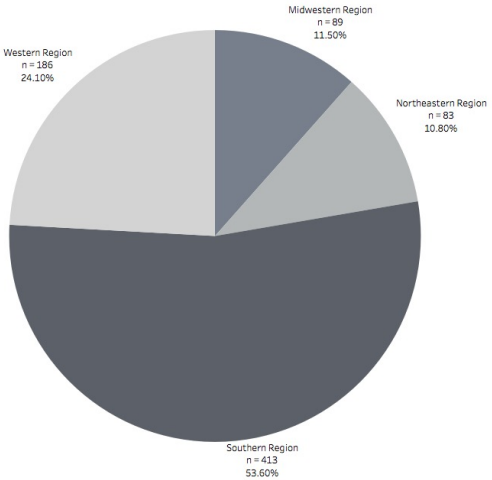

New Deaths Per Day in Sweden
In spite of a lot of periodic noise (in the data), it is now clear that in Sweden New Deaths Per Day are decreasing and are now 80% of maximum.
Michael Levitt 2 May 2020


Sweden Covid-19 deaths per day
Rolling 3-day average
source: Folkhälsomyndigheten, daily spreadsheet
110
100
90
80
70
60
50
40
30
20
10
0
2020-03-13
2020-03-20
2020-03-27
2020-04-03
2020-04-10
2020-04-17
2020-04-24
2020-05-01
02-apr
03-apr
04-apr
05-apr
06-apr
07-apr
08-apr
09-apr
10-apr
11-apr
12-apr
13-apr
14-apr
15-apr
16-apr
17-apr
18-apr
19-apr
20-apr
21-apr
22-apr
23-apr
24-apr
25-apr
26-apr
27-apr
28-apr
29-apr
30-apr
01-maj
02-maj
graph by @davidsteadson

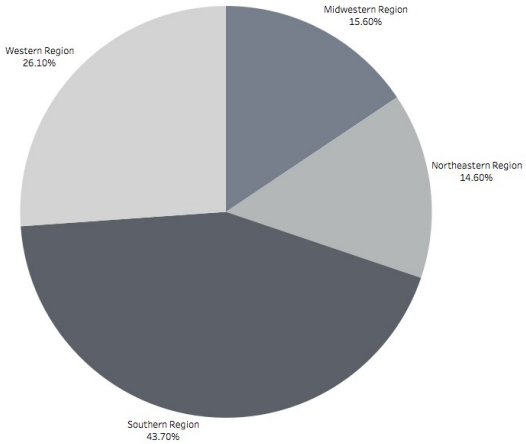
Visualization "White Lies"



Logging fatalities and percentages by region, 1992-97

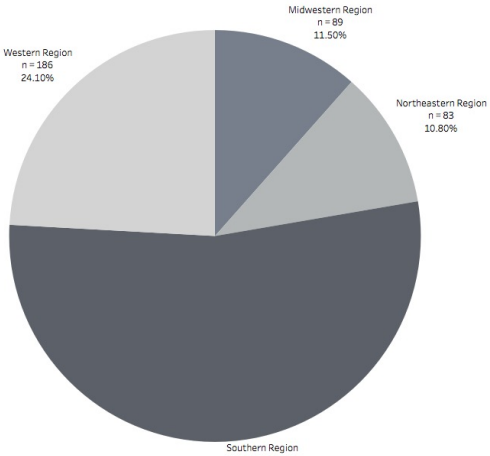


Logging employment percentages by region, 1992-97

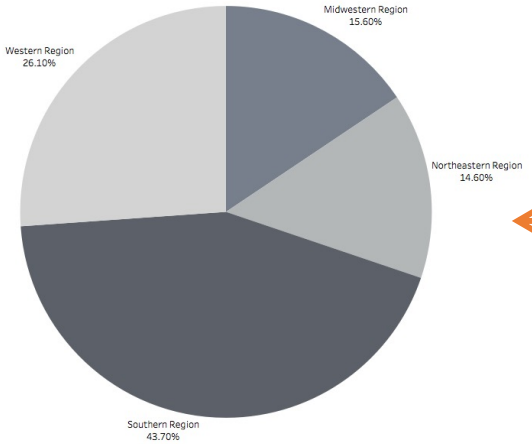


Sam Dragga & Dan Voss “Cruel Pies: The Inhumanity of Technical Illustrations”

Logging fatalities and percentages by region, 1992-97

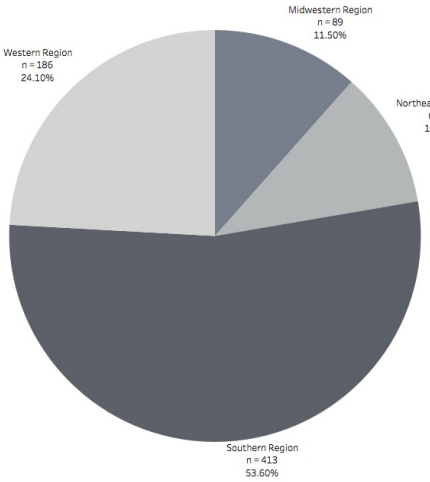


Logging employment percentages by region, 1992-97



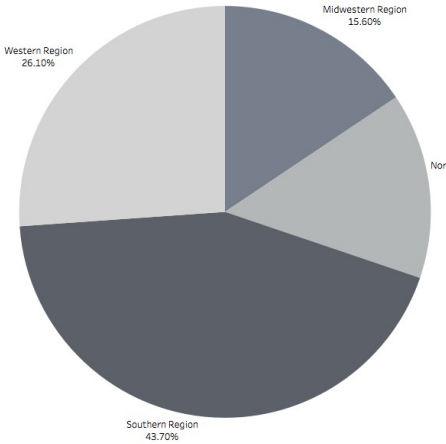
Where Your Employees Live

Logging fatalities and percentages by region, 1992-97



771 Dead People

Logging employment percentages by region, 1992-97

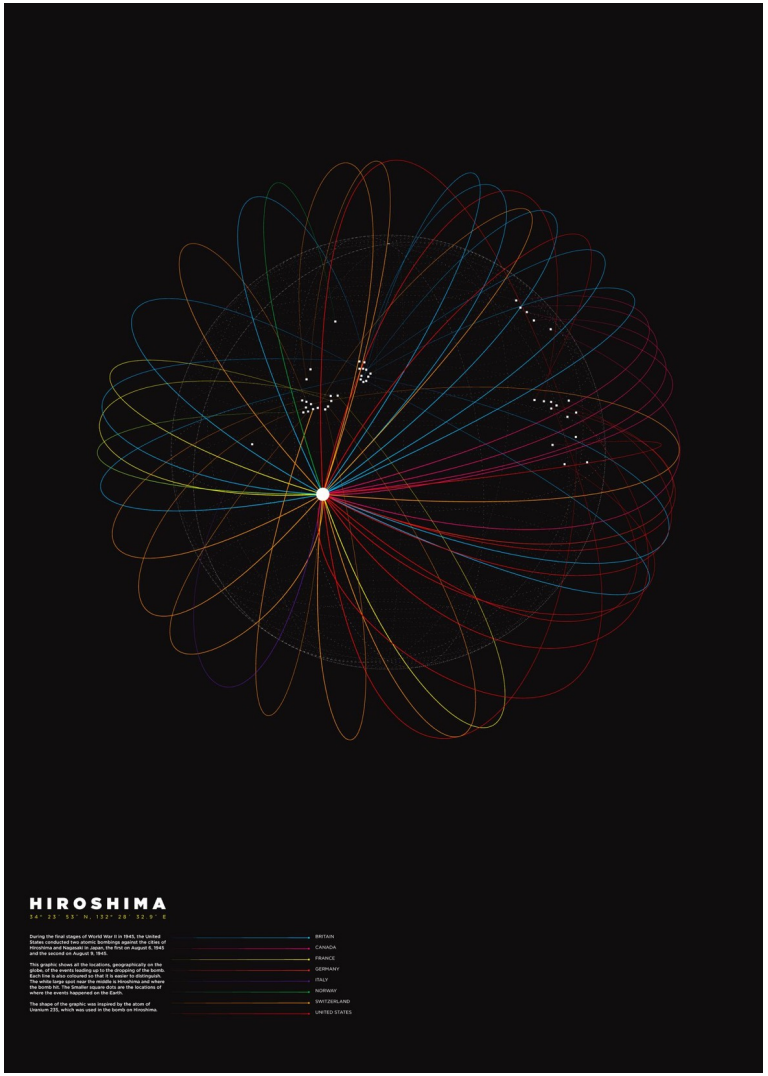


Where Your Employees Live

"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



Wrap Up

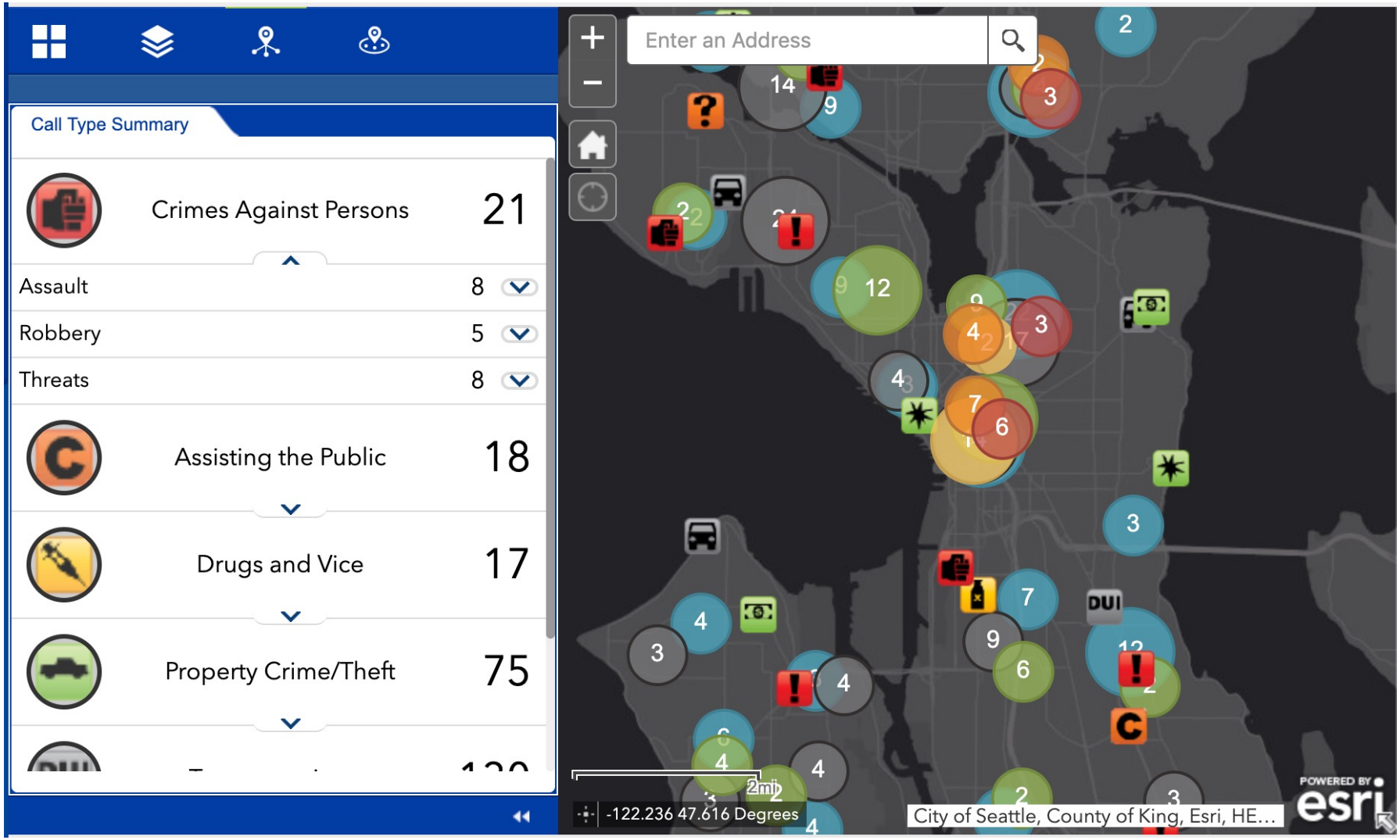
Ways to mislead:

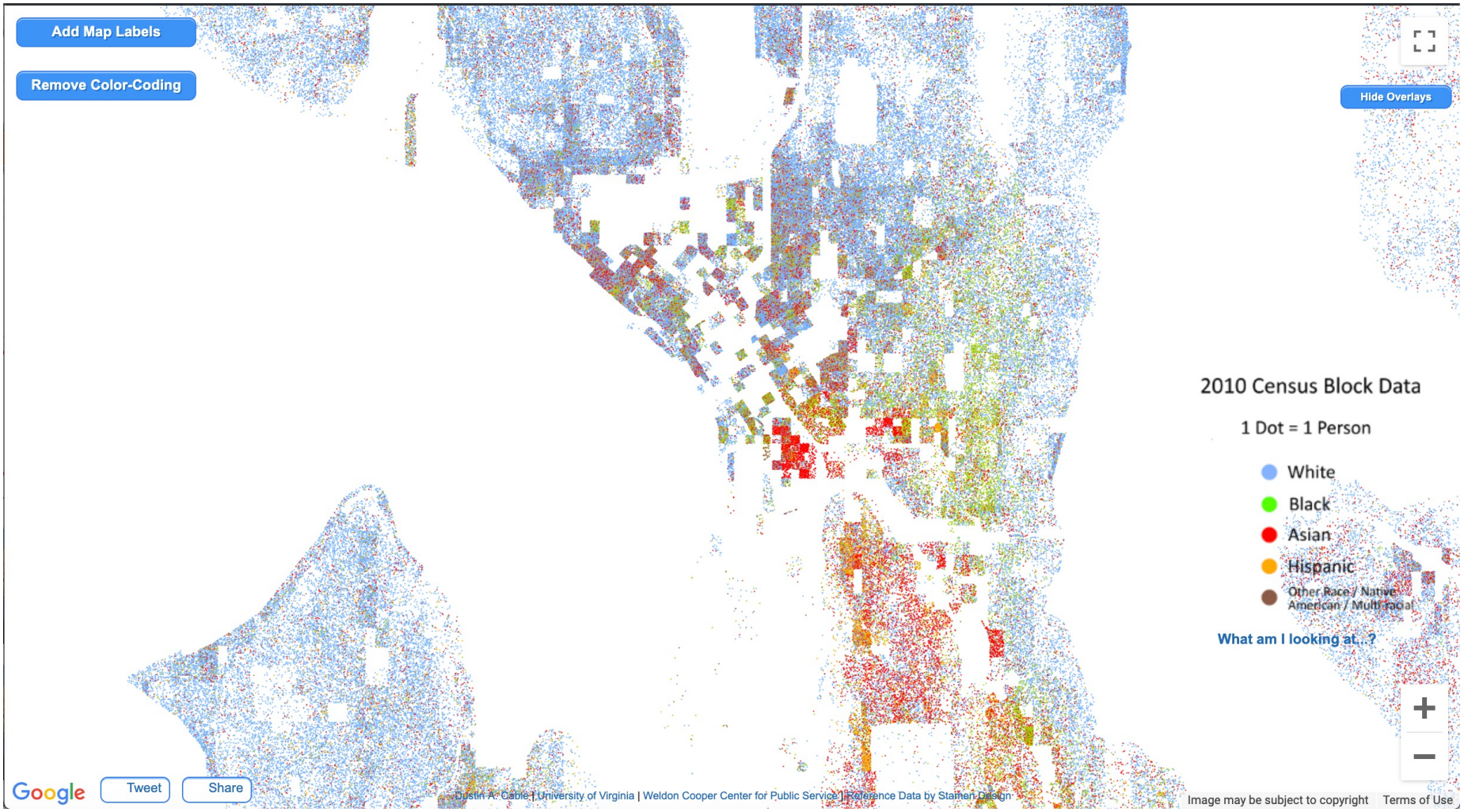
Breaking assumptions, expectations, conventions, drowning people in details… or just making stuff up.

Nuance:

Not every chart that breaks a “rule” is misleading

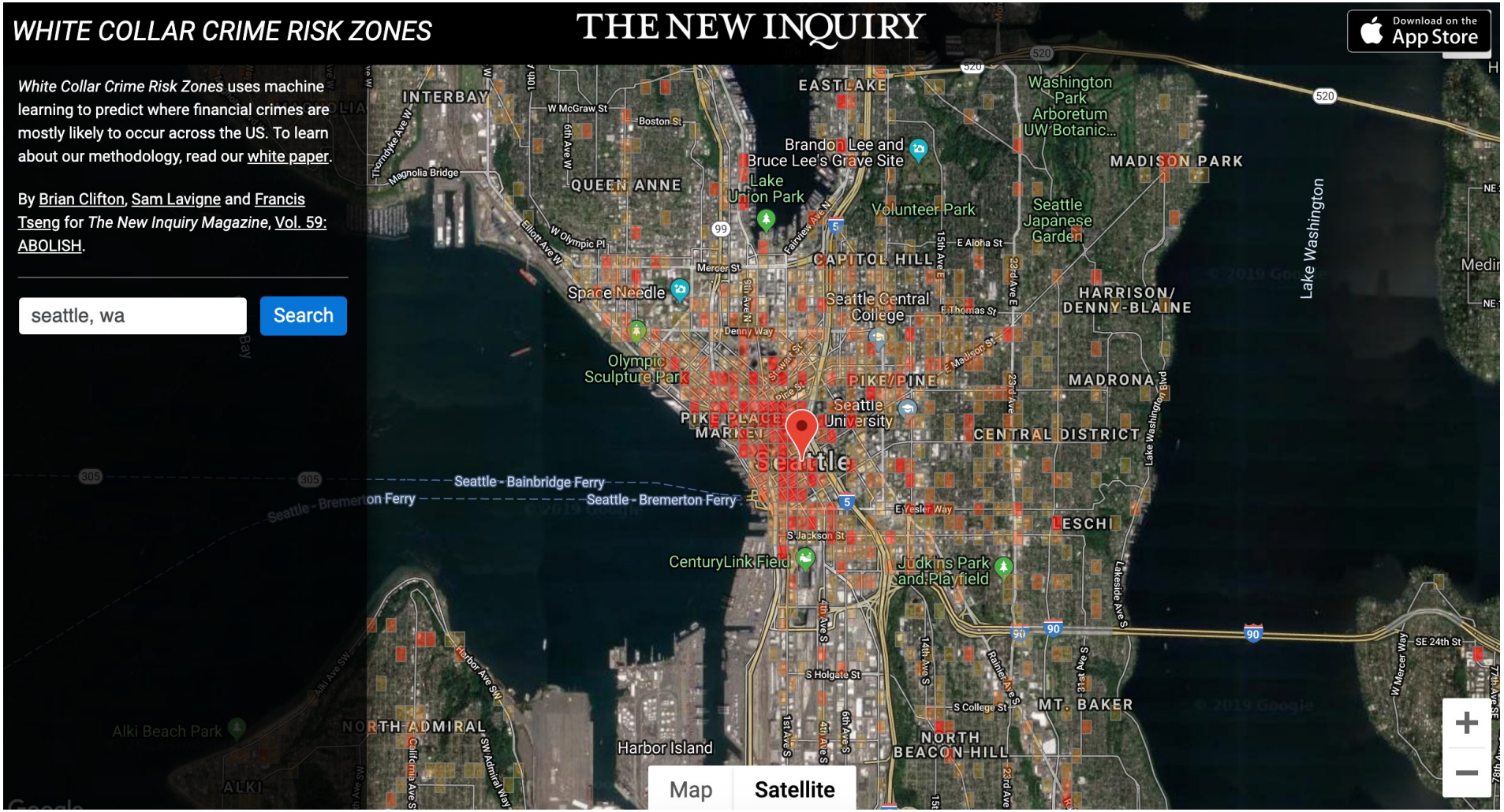
Not ever chart that follows the “rules” is truthful


Call Type Summary
Crimes Against Persons
21
Assault
8
Robbery
5
Threats
8
Assisting the Public
18
Drugs and Vice
17
Property Crime/Theft
75
Enter an Address
DUI
2mi
-122.236 47.616 Degrees
City of Seattle, County of King, Esri, HE...
POWERED BY esri


Add Map Labels
Remove Color-Coding
Hide Overlays
2010 Census Block Data
1 Dot = 1 Person
White
Black
Asian
Hispanic
Other Race / Native American / Multi-racial
What am I looking at...?
Google
Tweet
Share
Dustin A. Cable | University of Virginia | Weldon Cooper Center for Public Service | Reference Data by Stamen Design
Image may be subject to copyright
Terms of Use

WHITE COLLAR CRIME RISK ZONES

THE NEW INQUIRY



100 years of world cuisine
38,000,000 deaths
25 conflicts
1915 - present
100yearsofworldcuisine.com
Breakdown by continent
Africa 24%
Europe 36%
Asia 40%
Breakdown by decade
Total 20th century death toll
Visualized
38m
Not visualized
162m
Armenian genocide
1915-16
1,500,000 †
Korea war
1950-53
3,500,000 †
Congo wars
1998-2003
3,900,000 †
Biafran war
1967-70
1,000,000 †
Sudanese civil war
1983-2005
2,200,000 †
Gulag system
1929-53
1,600,000 †
Wars in Indochina
1945-75
6,000,000 †
Holodomor
1932-33
3,000,000 †
North Korean famine
1990-ongoing
2,000,000 †
Iraq
2003-2010
100,000 †
Stalingrad
1942-43
1,520,000 †
Khmer genocide
1975-79
3,000,000 †
Holocaust
1941-45
5,000,000 †
Romas
1941-45
200,000 †
Expulsion of Germans after WW2
1944-45
500,000 †
Immigration to Europe
1988-ongoing
15,000 †
Afghanistan
2001-ongoing
40,000 †
Mexican drug war
2006-ongoing
30,000 †
Arab-Israeli conflict
1950-ongoing
51,000 †
Chechen wars
1999-ongoing
160,000 †
Yugoslav wars
1991-95
130,000 †
Algeria war
1954-62
960,000 †
9/11 attacks
2001
2,997 †
Rwandan genocide
1994
1,000,000 †
Iran-Iraq war
1980-88
500,000 †
Partition of India
1947
500,000 †