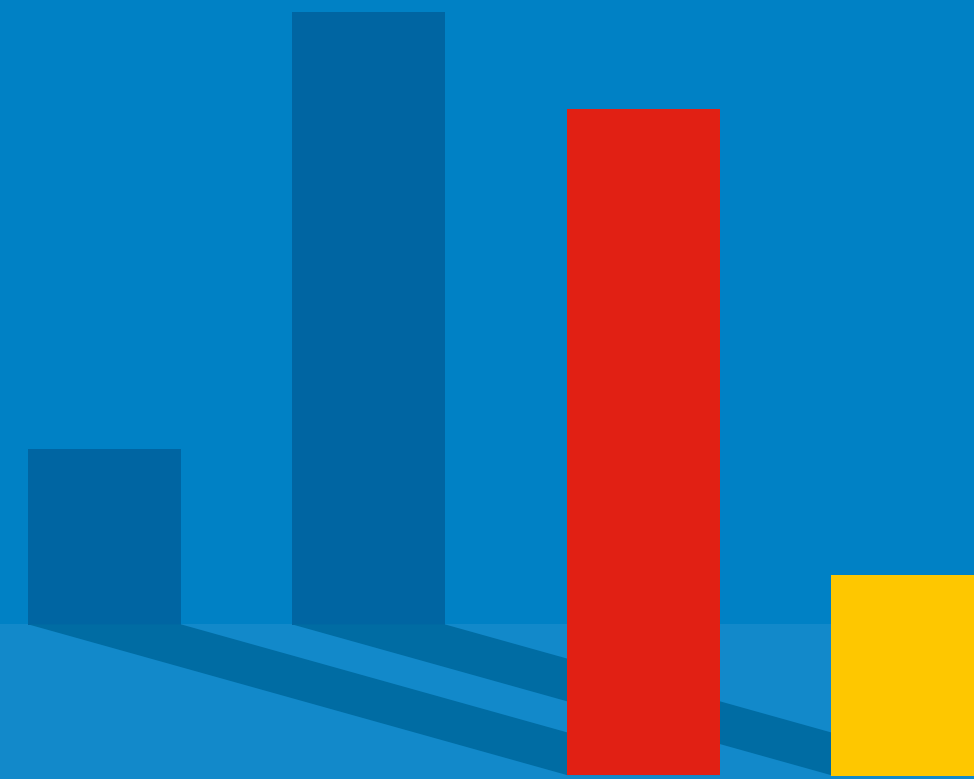


# How Charts Lie



Getting Smarter about  
Visual Information

**Alberto Cairo**

Twitter: @albertocairo

Website: <http://www.thefunctionalart.com>

## How Charts Lie



Getting Smarter about  
Visual Information

Alberto Cairo

“What can I say? I'm a sucker for statistics explained in funny, engaging, and mathematically correct ways, especially when every now and then a line like "charts lie to us because we are prone to lying to ourselves" is thrown in with good humor. A must read for anyone who wants to stay informed.”

**Cathy O'Neil, author of *Weapons of Math Destruction***

“Alberto Cairo has written a wise, witty and utterly beautiful book. You couldn't hope for a better teacher to improve your graphical literacy.”

**Tim Harford, author of *The Undercover Economist* and presenter of *More or Less* in the BBC**

**New book to be published on October 2019**

**Read more about it:**

<http://www.thefunctionalart.com/2019/02/new-book-and-new-public-lecture.html>

**To pre-order:**

<https://www.amazon.com/How-Charts-Lie-Getting-Information/dp/1324001569/>

<https://www.indiebound.org/book/9781324001560>

<https://books.wwnorton.com/books/detail.aspx?ID=4294998829>

I've devoted my career to doing all kinds of charts for media publications

This block contains 12 infographic panels in Spanish, each with a title and a main image or diagram. The panels are:
 

- Mars Exploration Rover: Misión a Marte** - Shows the rover and its components.
- Egrioma** - Illustrates a squid-like creature.
- El calamar gigante** - Shows a giant squid.
- Cassini-Huygens: cita con Saturno** - Shows the Cassini-Huygens spacecraft.
- Los portaaviones clase "Nimitz"** - Shows an aircraft carrier.
- Masacre en Madrid** - Shows a street scene in Madrid.
- La presa de las Tres Gargantas** - Shows a large dam.
- Tiro con arco** - Shows an archer.
- Tiroteo en Ciudad Lineal** - Shows a street scene in Ciudad Lineal.

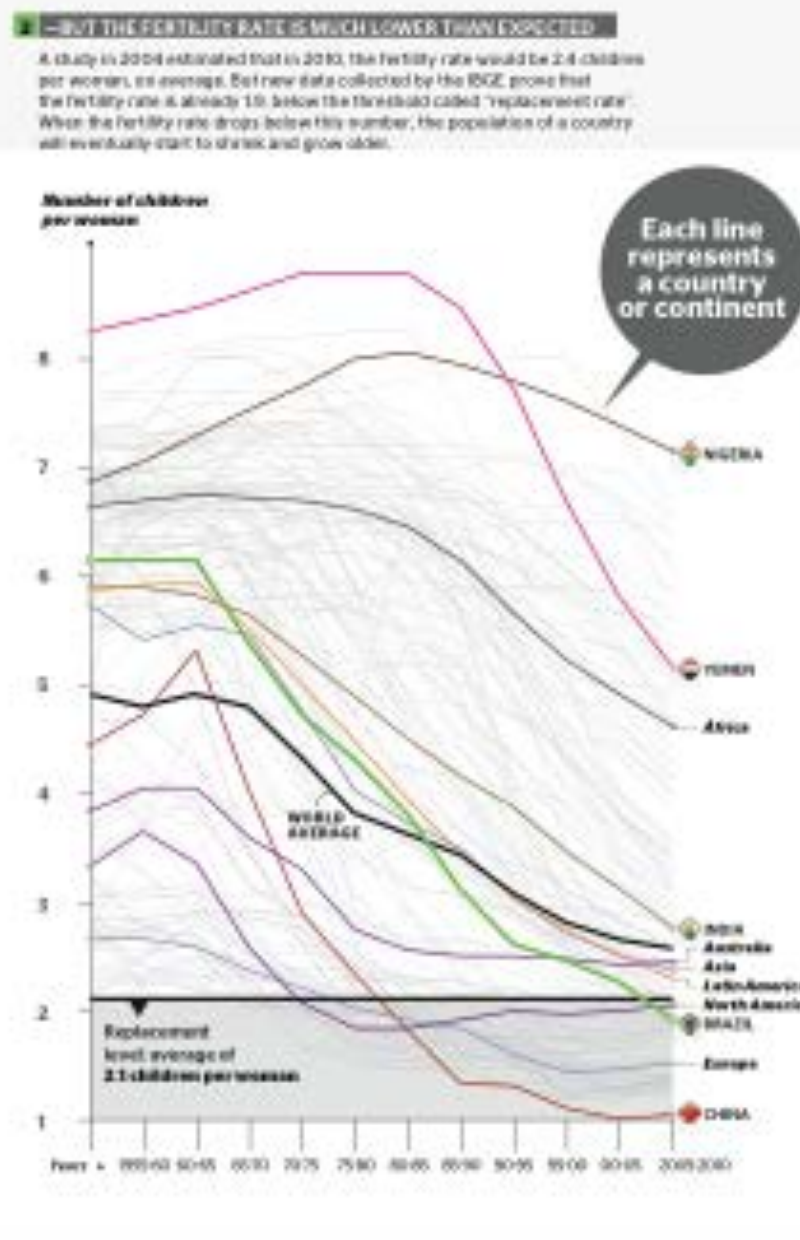
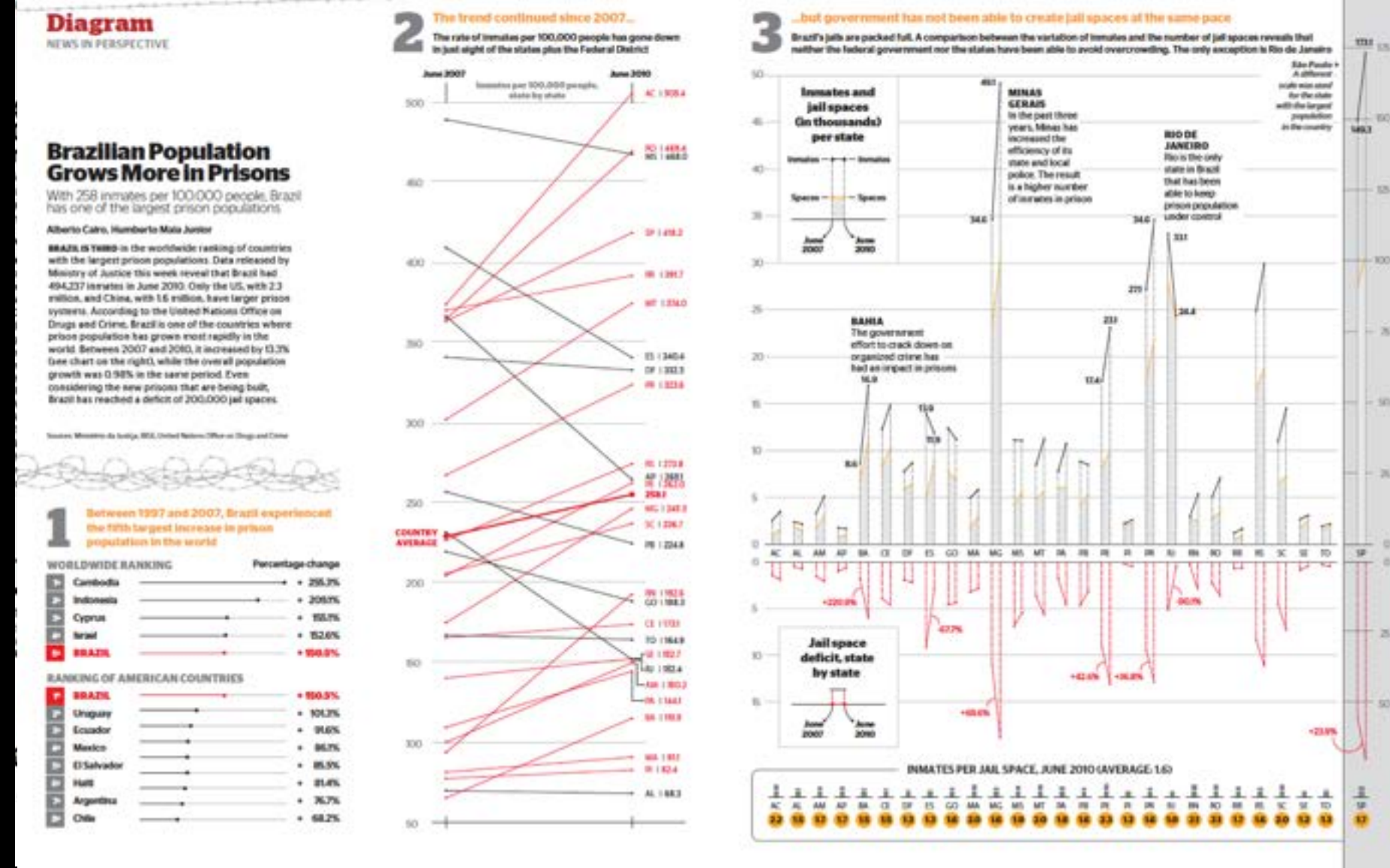
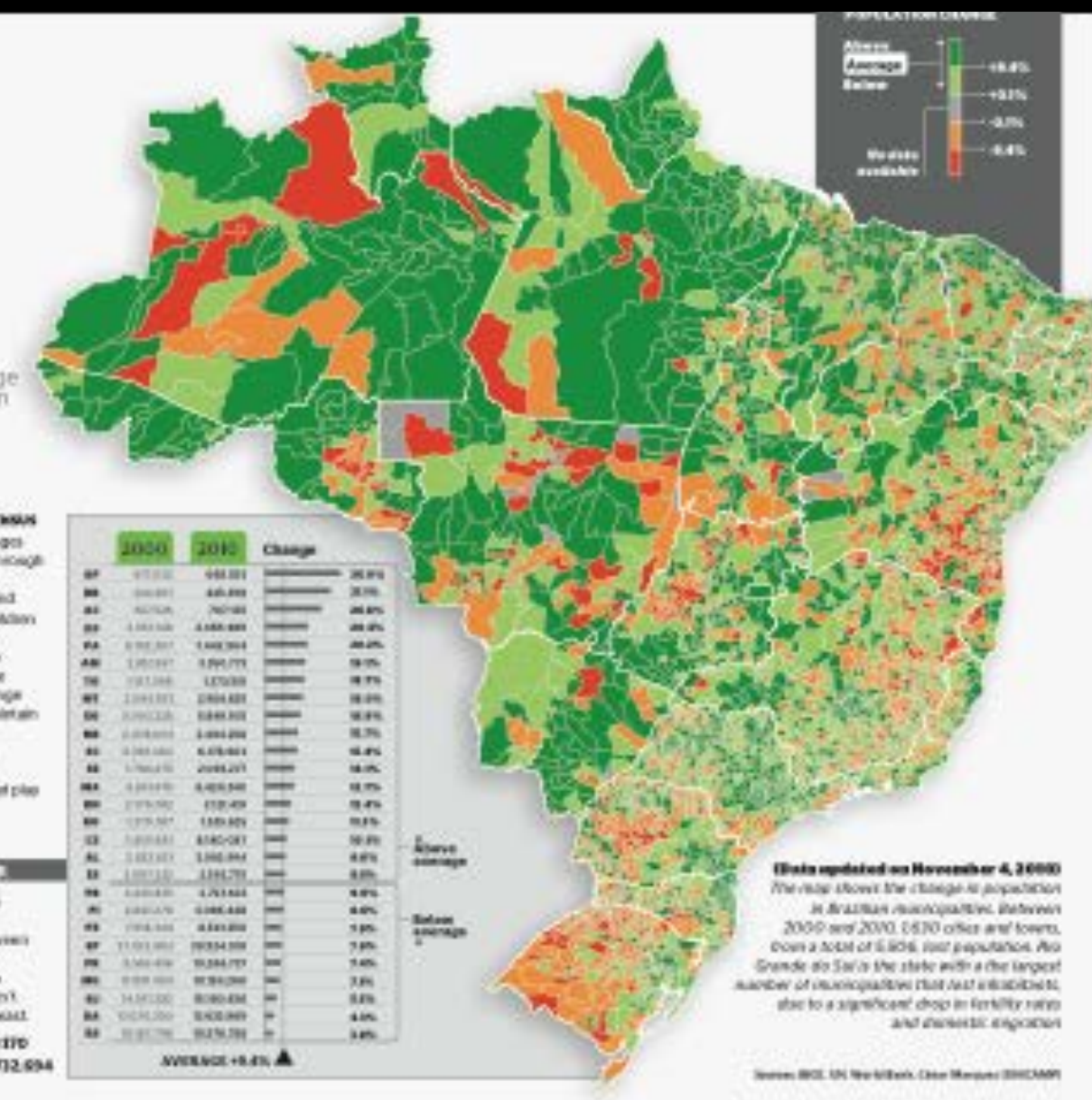
**DIAGRAM**  
NEWS IN PERSPECTIVE

**Brazil's Demographic Opportunity**

How Brazil can take advantage of a future with fewer children per couple

Alberto Cairo, Francine Lima, Marco Vargasi

**PRELIMINARY DATA FROM THE 2010 CENSUS** create an interesting picture of the changes that the Brazilian population has gone through in the past ten years. Brazil's population grew, on average, 10% between 2000 and 2010, but the fertility rate is below 2.1 children per woman, the minimum to keep a population from shrinking. According to César Monteiro, a demographer from the University of Campinas, the main challenge Brazil will face in the future is how to maintain a healthy Social Security system if the number of older and retired people will likely surpass that of the young.



# A Golden Age of visualization in the news and elsewhere

## The New York Times

Friday, January 23, 2018

World U.S. Politics N.Y. Business Opinion Tech Science Health Sports Arts Style Food Travel Magazine T Magazine Real Estate All

### Trump Says He Is Willing to Speak Under Oath to Mueller

President Trump said he was "looking forward" to speaking with Robert S. Mueller III, the special counsel for the Russia inquiry.

Mr. Trump said his lawyers told him it would take "about two to three weeks" to arrange it, but added that any interview would be "subject to my lawyers, and all of that."

### More than 160 women say Larry Nassar sexually abused them. Here are his accusers in their own words.

By CARLA CORREA and MEGHAN KULLY

### Gymnast's Doctor Sentenced to Up to 175 Years for Sexual Abuse

By JUSTICE MCKENNA and VICKY WATSON

### Michigan State President Resigns Over School's Connections to Nassar

By MICHAEL HANAUER and MARK YEAGER

### Low Anna

By Simon Singh

### A Presidential 'Pardon' for the Dreamers? Maybe

By KIAN GOSWAMI

### Seeing Through the Fog in the Mueller Russia Probe

By KEAN GOSWAMI

### American Can No Longer Hide From Its Deep Poverty Problem

By AMOL SHUKLA

### Republicans' Tariffs Could Hurt U.S. Economy

By AMOL SHUKLA

### China Reaches Into the Heart of Europe

By AMOL SHUKLA

### What Homeless Veterans Can Teach Us About Modern Russia

By AMOL SHUKLA

### Follow us on Twitter

## The Washington Post

Democracy Dies in Darkness

Monday, Jan 22, 2018

World U.S. Politics Tech Science Health Sports Arts Style Food Travel Magazine T Magazine Real Estate All

### Surprises, alarms offering Mueller

By KIAN GOSWAMI

### Manhattan District Attorney Says He'll No Longer Accept Contributions From Lawyers With Cases Before Him

By Jesse Eisinger

### Chicago Cop Under Investigation Again Over Social Media Posts

By Jeff B. Guttman

### How an undercover female reporter exposed sexual misconduct at a London charity bash

By Sarah Lyall

### How popular is Donald Trump?

55.9% Disapprove, 39.2% Approve

### 7 Ways to Redistrict the Entire Freakin' Country — From Fair To Heavily Gerrymandered

By Jason Richelf, Etia Krava, David Wasserman and Julia Lurie

## PROPUBLICA

TOPICS SERIES NEWS AFFS GET INVOLVED IMPACT ABOUT

### The Red Cross Forced Out an Executive Over Sexual Harassment — Then Helped Him Land a Job at Save the Children

By Justin Elliott and Ariana Tobin

### Manhattan District Attorney Says He'll No Longer Accept Contributions From Lawyers With Cases Before Him

By Jesse Eisinger

### Chicago Cop Under Investigation Again Over Social Media Posts

By Jeff B. Guttman

### Baltimore Judge Tosses Alford Plea, Rehiring Prosecutor

By Megan Rose

### THE TAKING

Federal land seizures and the border fence

## Standard

LOBBY TODAY MAGAZINE WRITERS PODCASTS BOOKS & ARTS NEWSLETTERS EVENTS STORE

### LABASH: Drone-Assisted Fishing Is Real, and It's Pathetic

By Matt Kasper

### White House Watch: The

By Michael Hastings

### KIA

## AXIOS

SECTIONS SPECIAL FEATURES MORE

### The insane news cycle of Trump's presidency in 1 chart

By Stef W. Kight

It is like the Trump presidency has been hit by non-stop scandals and crises from day one, it is probably because it has been. The Google News Lab looked at the search trends for stories about 40 of the biggest news events of Trump's presidency from Jan. 20 until Sept. 1. You can see how we've all jumped from one four-hour news live to another.

## FiveThirtyEight

Politics Sports Science & Health Economics Culture

### 7 Ways to Redistrict the Entire Freakin' Country — From Fair To Heavily Gerrymandered

By Jason Richelf, Etia Krava, David Wasserman and Julia Lurie

### How Popular is Donald Trump?

55.9% Disapprove, 39.2% Approve

### NFL Predictions

UPDATE: JAN. 21, 2018

New England	58%
Philadelphia	42%

## Vox

EXPLAINERS POLITICS & POLICY WORLD CULTURE SCIENCE & HEALTH IDENTITIES MORE

### Activists got Democrats to shut down the government. Can they do it again?

By Emily Oberman

### 3 potential problems for an obstruction of justice case against Trump

By Andrew Prohsky

### 20 years ago, Dawson's Creek introduced a love triangle that changed teen soaps forever

By Constance Grady

### Trump State of the Union speech 2018: how to watch online and what to expect

By Emily Oberman

## THE WALL STREET JOURNAL

Home World U.S. Politics Markets Business Tech Markets Opinion Lifestyle

### Trump Says He Is Willing to Testify Under Oath

By Michael Hastings

### As Three Companies Demand Arbitration, Targets Promote Rules

By Michael Hastings

### Activists got Democrats to shut down the government. Can they do it again?

By Emily Oberman

## FINANCIAL TIMES

WORLD BUSINESS NEWSPAPER

### Downfall How the high-flying boss of China's Anbang fell foul of the ruling party

By [Author Name]

### Dozens die on Gaza border as US and Israel mark embassy opening

By [Author Name]

## Berliner Morgenpost

Home Berlin Bezirke Interaktiv Politik Wirtschaft Sport Panorama Kultur Wissen Reise Lifestyle

### Zehnjährige in Brandenburg von Laster überrollt

SCHWERER UNFALL

### Meistgelesene Artikel

- SCHWERER UNFALL 25.01.2018: Zehnjährige in Brandenburg von Laster überrollt
- VERÖFFENTLICHUNG 25.01.2018: Bundestag nennt AfD-Politiker Björn Höcke „Bemf“
- DRUCKFRIER RAHMEN 25.01.2018: Zwei neue Bahnstationen für den Berliner Süden
- LANGJAHRIGE DEBATE 25.01.2018: Pflanzkartoffeln am Donnerstag

## ТЕКСТИ.ORG.UA

Динаміка балансу довіри-недовіри

### Діло йде до хунти. Цивільні органи влади втрачають довіру, військові нарощують (ІНФОГРАФІКА)

Волонтери і Збройні сили України вже традиційно отримують найвищу довіру українського суспільства. ЧИТАТИ ДОБРОЧЕСТВО

## ZEITUNG ONLINE

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### A question of credibility

By Lisa C...

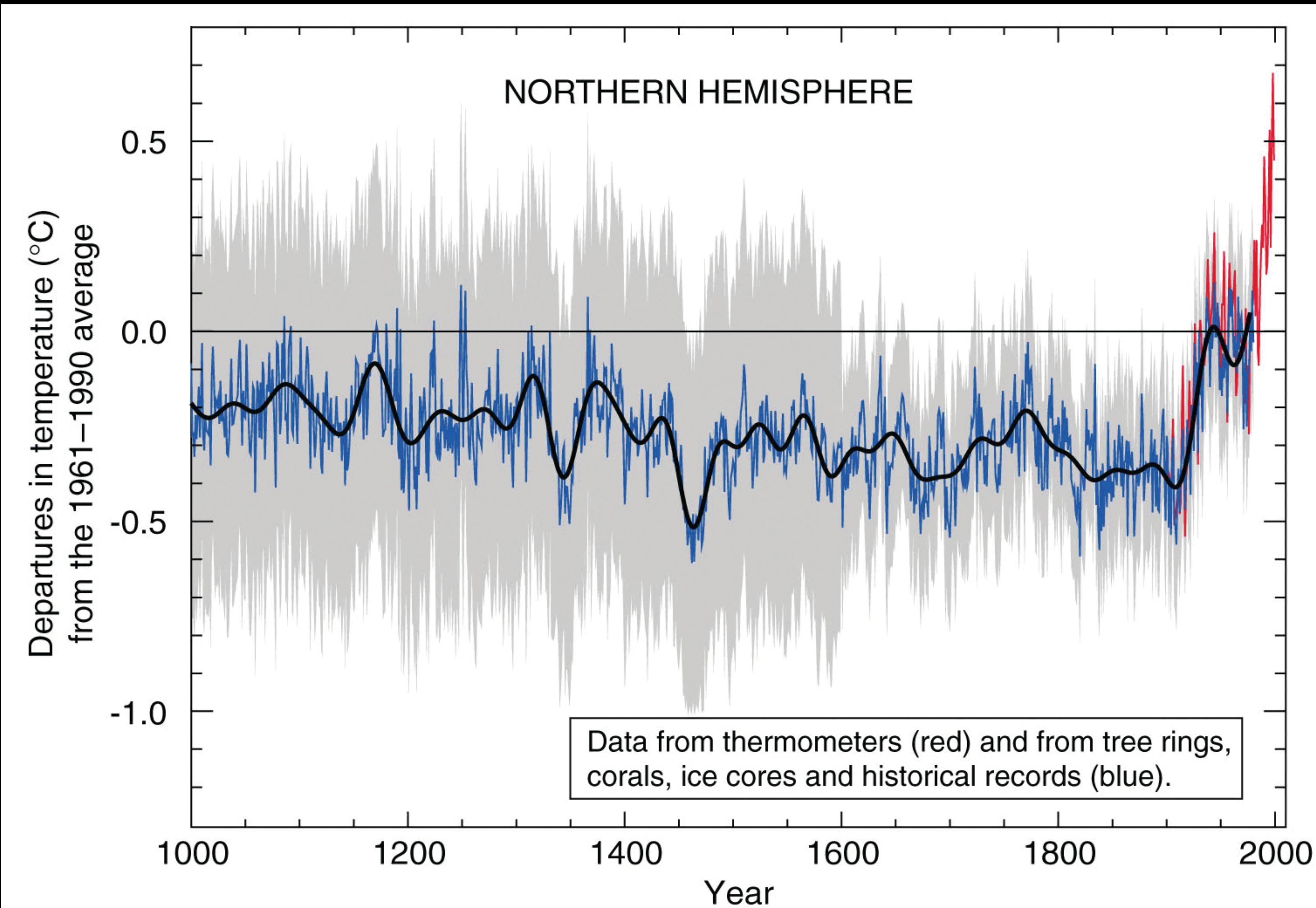
### Martin Schulz loses recognition in the SPD. He has excluded entry to the cabinet Merkel. Can he still become vice-chancellor?

By Lisa C...

# Visualization is becoming popular because it's useful

	A	B	C	D	E	F	G		A	B	C	D	E	F	G	H
1	YEAR	TEMP	YEAR	1 SIGMA	2 SIGMA			878	1876	-0.1891	1876	0.113228	0.226456	8.25297E-02	7.75207E-02	
2	1000	0.0659	1000	0.240346	0.480693	0.206137	0.123588	879	1877	-0.0140	1877	0.113228	0.226457	8.25299E-02	7.75209E-02	
3	1001	-0.1241	1001	0.240347	0.480694	0.206137	0.123589	880	1878	-0.0873	1878	0.113228	0.226457	8.25298E-02	7.75209E-02	
4	1002	-0.1208	1002	0.240346	0.480692	0.206136	0.123588	881	1879	-0.2959	1879	0.113229	0.226458	8.25302E-02	7.75212E-02	
5	1003	-0.1801	1003	0.240347	0.480694	0.206137	0.123589	882	1880	-0.2368	1880	0.113229	0.226457	8.25300E-02	7.75210E-02	
6	1004	-0.0711	1004	0.240347	0.480693	0.206137	0.123588	883	1881	-0.1977	1881	0.113229	0.226458	8.25302E-02	7.75212E-02	
7	1005	-0.1334	1005	0.240346	0.480692	0.206136	0.123588	884	1882	-0.2036	1882	0.113229	0.226457	8.25300E-02	7.75210E-02	
8	1006	-0.0644	1006	0.240346	0.480693	0.206137	0.123588	885	1883	-0.2489	1883	0.113228	0.226455	8.25293E-02	7.75204E-02	
9	1007	0.0042	1007	0.240347	0.480693	0.206137	0.123588	886	1884	-0.2125	1884	0.113229	0.226457	8.25301E-02	7.75211E-02	
10	1008	-0.1288	1008	0.240347	0.480693	0.206137	0.123588	887	1885	-0.1896	1885	0.113228	0.226457	8.25299E-02	7.75210E-02	
11	1009	-0.0296	1009	0.240347	0.480693	0.206137	0.123588	888	1886	-0.1084	1886	0.113228	0.226456	8.25298E-02	7.75208E-02	
12	1010	0.1187	1010	0.240347	0.480694	0.206137	0.123589	889	1887	-0.3265	1887	0.113228	0.226456	8.25296E-02	7.75206E-02	
13	1011	-0.1252	1011	0.240346	0.480692	0.206136	0.123588	890	1888	-0.1694	1888	0.113228	0.226457	8.25298E-02	7.75209E-02	
14	1012	-0.1634	1012	0.240347	0.480694	0.206137	0.123588	891	1889	-0.1339	1889	0.113228	0.226456	8.25298E-02	7.75208E-02	
15	1013	-0.0791	1013	0.240347	0.480693	0.206137	0.123588	892	1890	-0.3107	1890	0.113229	0.226457	8.25301E-02	7.75211E-02	
16	1014	-0.1120	1014	0.240347	0.480693	0.206137	0.123588	893	1891	-0.1754	1891	0.113229	0.226457	8.25300E-02	7.75210E-02	
17	1015	-0.1146	1015	0.240346	0.480692	0.206136	0.123588	894	1892	-0.3186	1892	0.113228	0.226456	8.25295E-02	7.75205E-02	
18	1016	-0.1206	1016	0.240346	0.480692	0.206136	0.123588	895	1893	-0.3236	1893	0.113228	0.226456	8.25297E-02	7.75207E-02	
19	1017	-0.0815	1017	0.240347	0.480693	0.206137	0.123588	896	1894	-0.1970	1894	0.113228	0.226456	8.25295E-02	7.75205E-02	
20	1018	-0.2031	1018	0.240346	0.480693	0.206137	0.123588	897	1895	-0.1578	1895	0.113228	0.226456	8.25297E-02	7.75207E-02	
21	1019	0.0305	1019	0.240347	0.480693	0.206137	0.123588	898	1896	-0.0804	1896	0.113228	0.226456	8.25298E-02	7.75208E-02	
22	1020	0.1098	1020	0.240347	0.480694	0.206137	0.123589	899	1897	-0.0537	1897	0.113228	0.226456	8.25298E-02	7.75208E-02	
23	1021	0.0244	1021	0.240347	0.480693	0.206137	0.123588	900	1898	-0.2195	1898	0.113229	0.226457	8.25301E-02	7.75211E-02	
24	1022	-0.0743	1022	0.240347	0.480693	0.206137	0.123588	901	1899	-0.3486	1899	0.113228	0.226456	8.25297E-02	7.75207E-02	
25	1023	-0.0323	1023	0.240347	0.480693	0.206137	0.123588	902	1900	-0.1253	1900	0.113229	0.226457	8.25300E-02	7.75210E-02	
26	1024	-0.0434	1024	0.240346	0.480693	0.206137	0.123588	903	1901	-0.1575	1901	0.113228	0.226456	8.25296E-02	7.75206E-02	

Visualization is becoming **popular** because it's **useful**



**Michael E. Mann, Raymond S. Bradley, and Malcolm K. Hughes**

Intergovernmental Panel on Climate Change (IPCC), Third Report, 2001

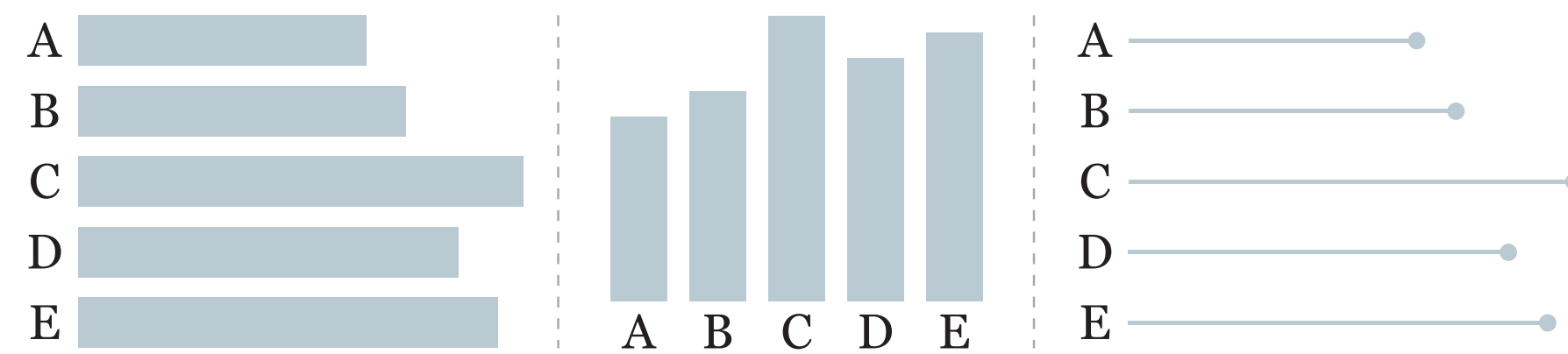
TO LEARN MORE ABOUT  
THE HOCKEY STICK CHART:

***The Hockey Stick  
and the Climate Wars (2012)***

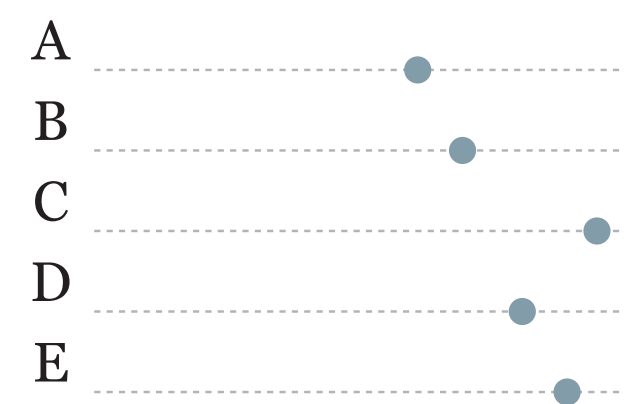
Michael E. Mann

# Visualization is becoming **popular** because it's **useful**

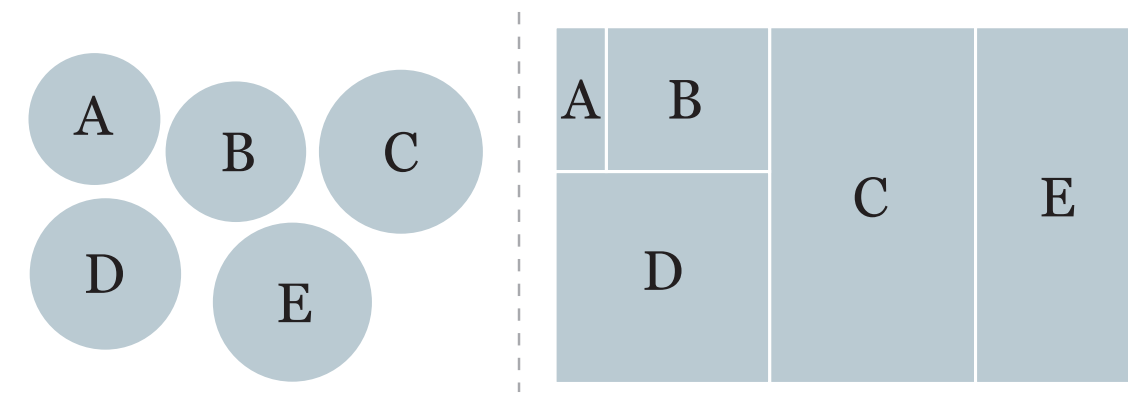
## *Length or height*



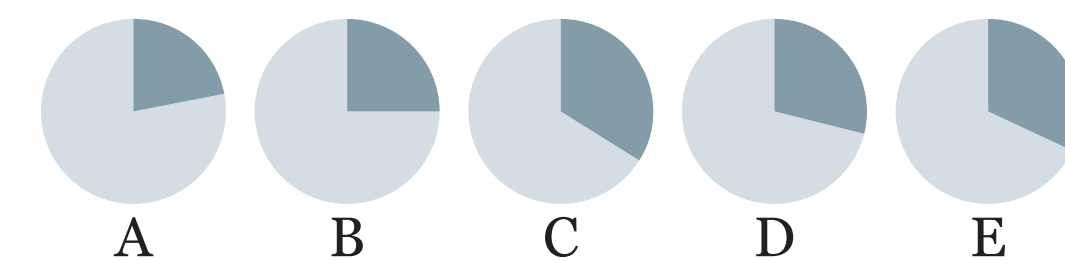
## *Position*



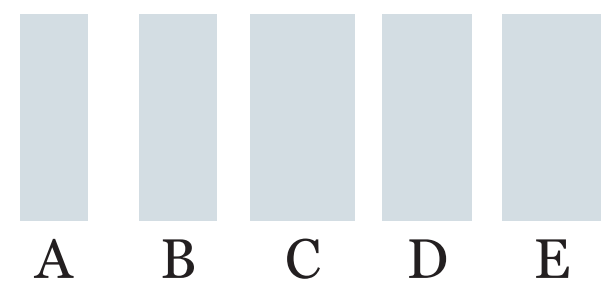
## *Area*



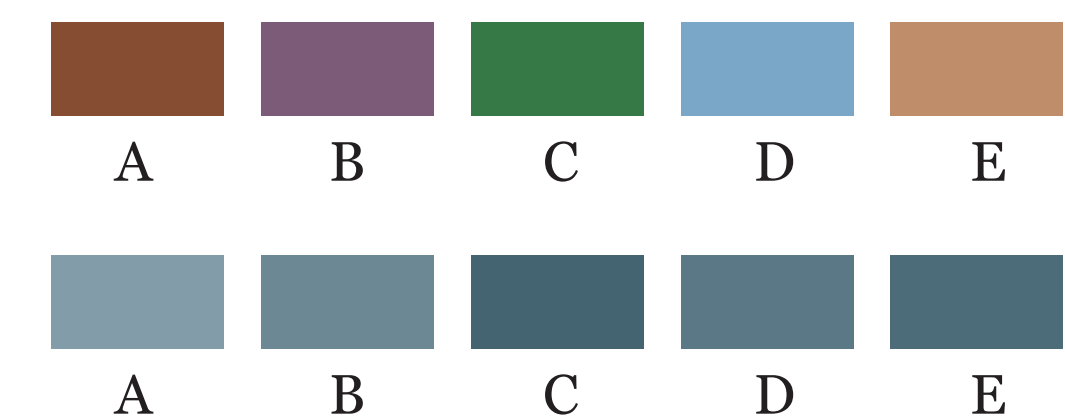
## *Angle/area*



## *Line weight*



## *Hue and shade*



Charts (or “visualization”) are based on the idea of **visual encoding**.

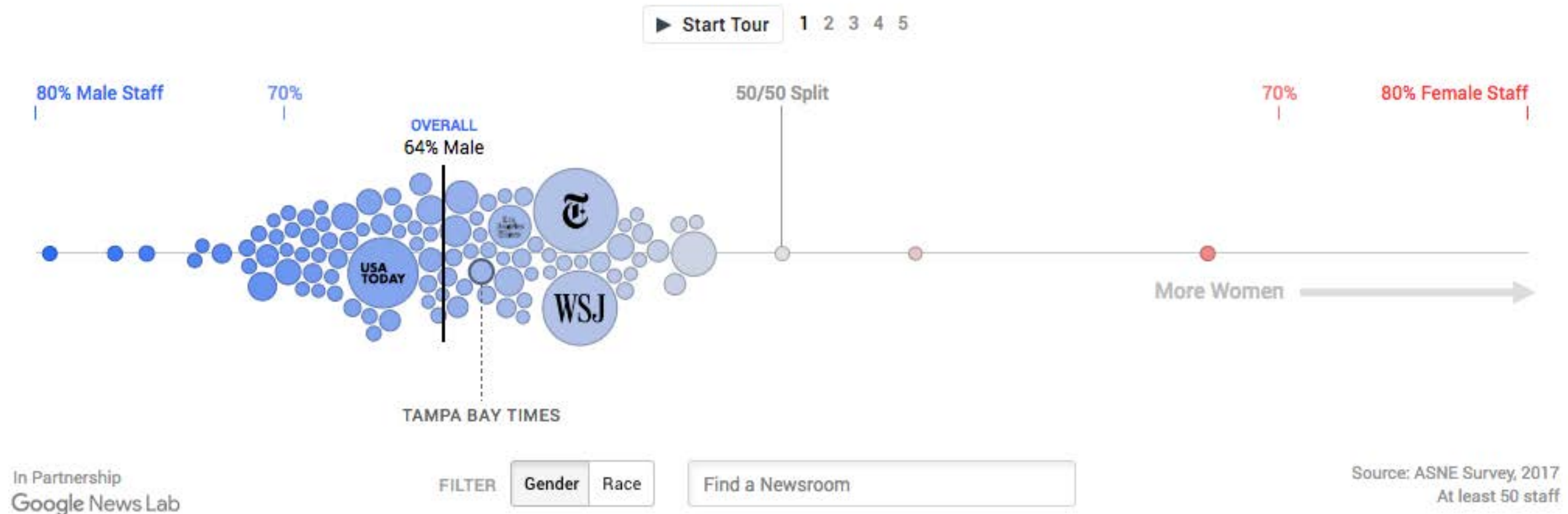
Figures represented in all these graphics: 22%, 25%, 34%, 29%, 32%

# What methods of encoding can you spot here?

AMERICAN SOCIETY of NEWS EDITORS

## The Diversity of US Newsrooms

The Newsroom Employment Diversity Survey measures the percentage of women and minorities working in newsrooms nationwide.



<https://polygraph-cool.github.io/asne/dev/>



Flourish<sup>\*</sup>



*Data Illustrator*



Charticulator

**RAW**Graphs

QGIS

Datawrapper



Power BI

inZight



tableau<sup>®</sup>  
S O F T W A R E



**Free tutorials:** <http://www.thefunctionalart.com/p/instructors-guide.html>

We need to talk less about how to **MAKE** visualizations,  
and more about how **REASON** about them

Good charts that are **correctly** read  
**enable** conversations

Bad charts —or charts that are **misinterpreted**—  
**hinder** those conversations

## Common misconceptions

1. “A picture is worth a thousand words”
2. “Visualization is intuitive”
3. “The data should speak for itself”
4. “Show, don’t tell!”

## Common misconceptions

1. **“A picture is worth a thousand words”**
2. “Visualization is intuitive”
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4. “Show, don’t tell!”

IF YOU  
KNOW  
HOW TO  
READ IT

April 27, 2017



Stephen J. Adler, Steve Holland and Jeff Mason

<https://www.reuters.com/article/us-usa-trump-100days/exclusive-trump-says-he-thought-being-president-would-be-easier-than-his-old-life-idUSKBN17U0CA>



Stephen J. Adler, Steve Holland and Jeff Mason

<https://www.cnn.com/videos/politics/2017/04/28/trump-electoral-maps-reuters-interview-newday.cnn>

Alberto Cairo • University of Miami • [www.thefunctionalart.com](http://www.thefunctionalart.com) • Twitter: @albertocairo



**Gideon Resnick**  @GideonResnick · 32m

here's a pic from reuters of Trump with the electoral maps he showed to reporters yesterday



Stephen J. Adler, Steve Holland and Jeff Mason

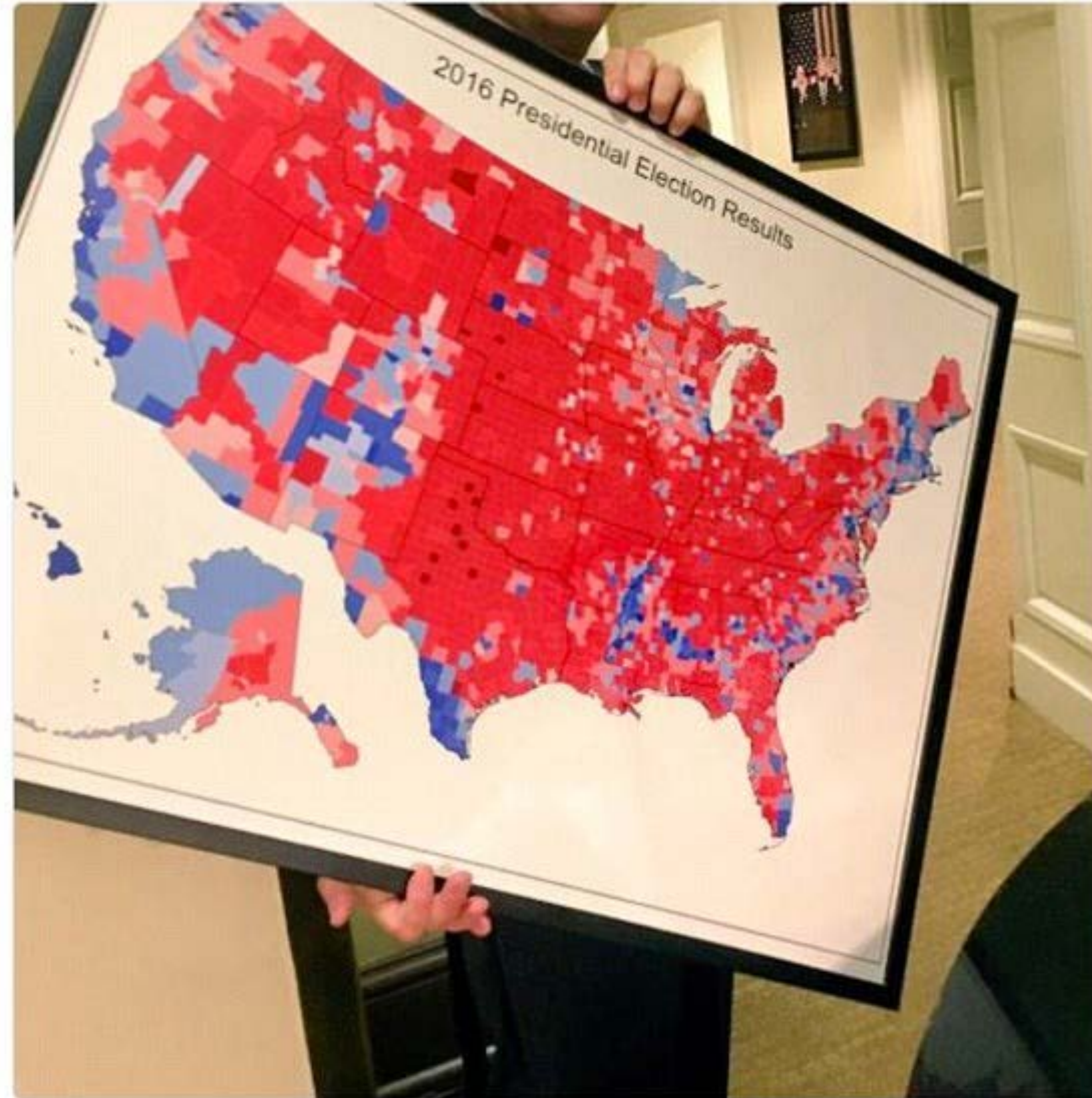
<https://www.reuters.com/article/us-usa-trump-100days/exclusive-trump-says-he-thought-being-president-would-be-easier-than-his-old-life-idUSKBN17U0CA>





Trey Yingst [@TreyYingst](#) · May 11

Spotted: A map to be hung somewhere in the West Wing



[https://twitter.com/TreyYingst?ref\\_src=twsrc%5Egoogle%7Ctwcamp%5Eserp%7Ctwgr%5Eauthor](https://twitter.com/TreyYingst?ref_src=twsrc%5Egoogle%7Ctwcamp%5Eserp%7Ctwgr%5Eauthor)



**Donald J. Trump**  @realDonaldTrump · Feb 27

I want to encourage all of my many Texas friends to vote in the primary for Governor Greg Abbott, Senator Ted Cruz, Lt. Gov. Dan Patrick, and Attorney General Ken Paxton. They are helping me to Make America Great Again! Vote early or on March 6th.

 20K  27K  99K



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 **20K**  **27K**  **99K**



**Trevor** @trevorHartje · Feb 27

You have no friends

 **553**  **223**  **4.9K**



**Donald J. Trump** [@realDonaldTrump](#) · Feb 27

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20K 27K 99K



**Trevor** [@trevorHartje](#) · Feb 27

You have no friends

553 223 4.9K



**Nancy Steffan**

[@steffan\\_nancy](#)

Follow

Replying to [@trevorHartje](#) [@realDonaldTrump](#)

Really?





**Donald J. Trump**  @realDonaldTrump · Feb 27

Such a beautiful map, thank you!



**Nancy Steffan** @steffan\_nancy

Replying to @trevorHartje @realDonaldTrump

Really?

 13K

 16K

 65K



# CITIZENS<sup>FOR</sup> TRUMP



THE INSIDE STORY  
OF THE PEOPLE'S MOVEMENT  
TO TAKE BACK AMERICA



JACK POSOBIEC

# WRONG

**CITIZENS<sup>FOR</sup>  
TRUMP**



THE INSIDE STORY  
OF THE PEOPLE'S MOVEMENT  
TO TAKE BACK AMERICA



**JACK POSOBIEC**

# RIGHT

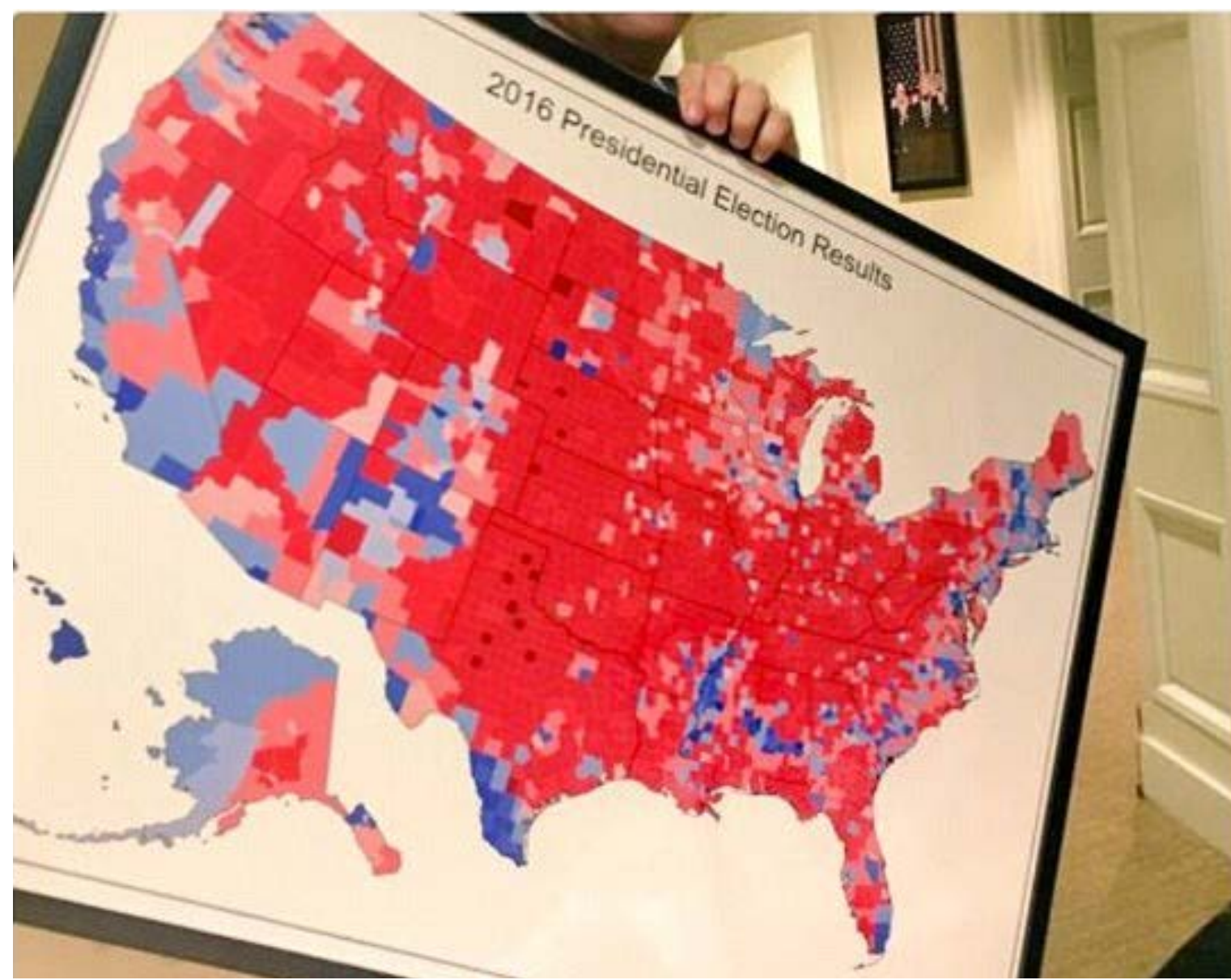
**COUNTIES<sup>FOR</sup>  
TRUMP**



THE INSIDE STORY  
OF 46% OF VOTERS' MOVEMENT  
TO TAKE BACK AMERICA



**JACK POSOBIEC**



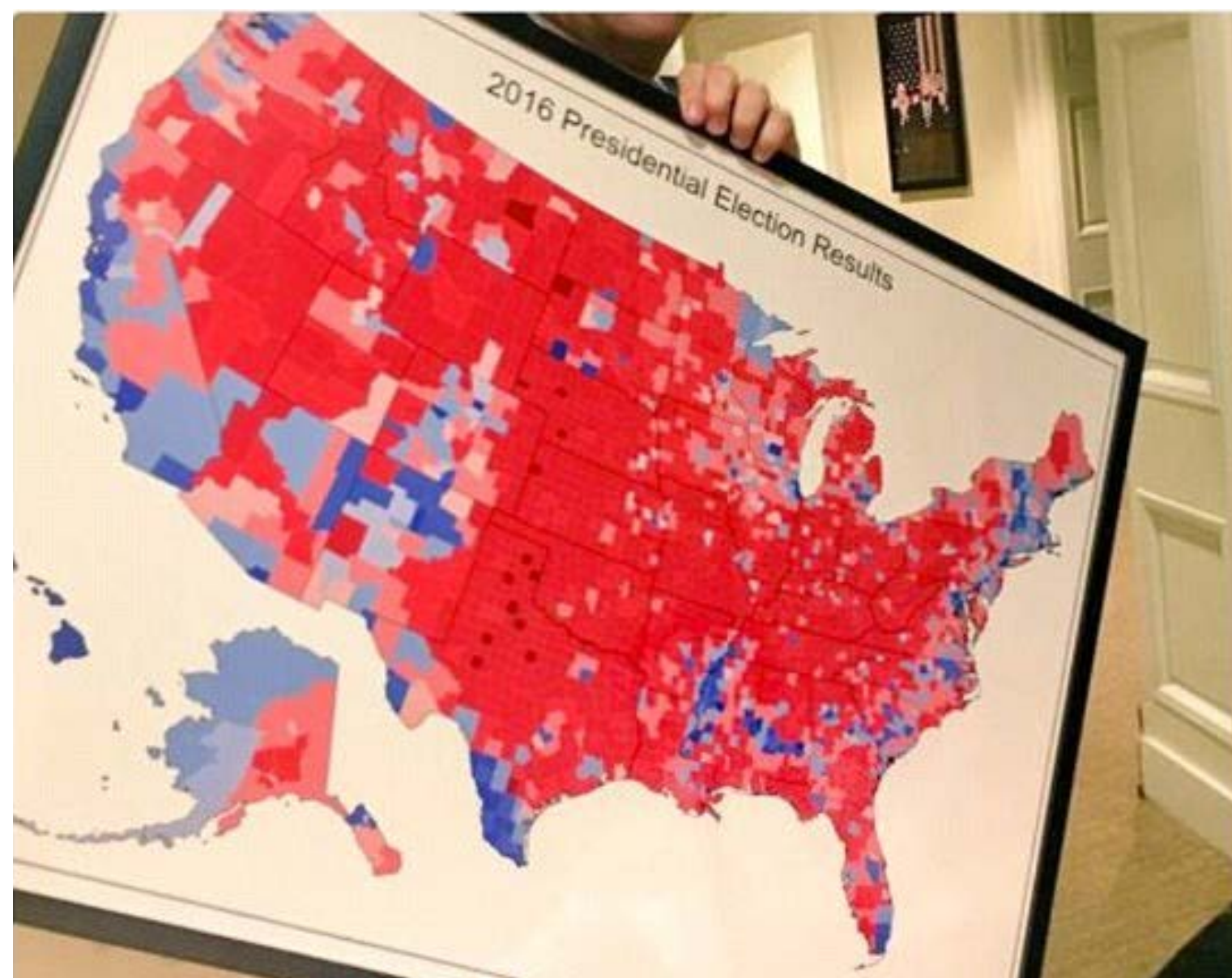
Surface on the  
county-level map:

**Red: 80%**

**Blue: 20%**

**VICTORY BY A LANDSLIDE!!!!!!**



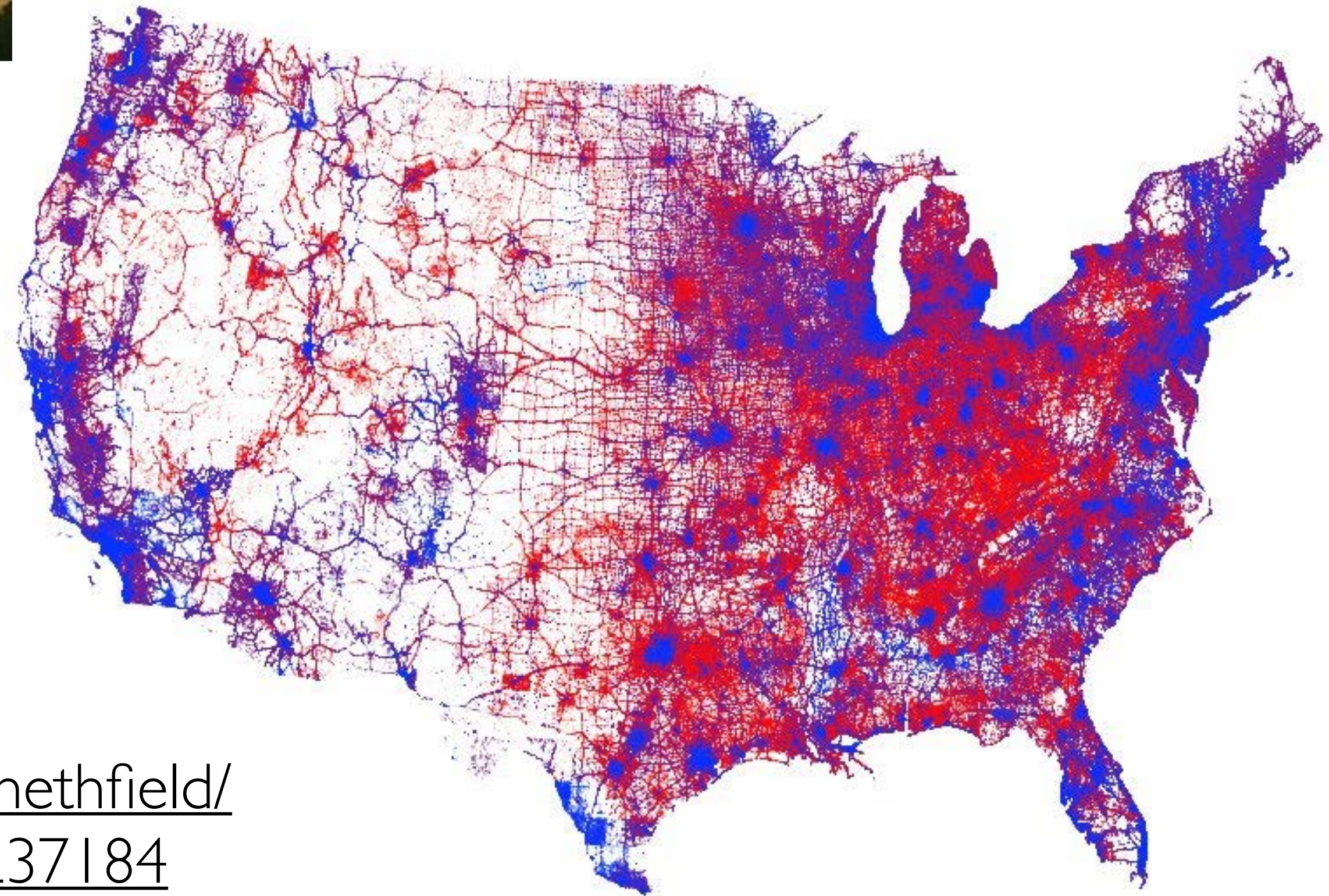


Surface on the  
county-level map:

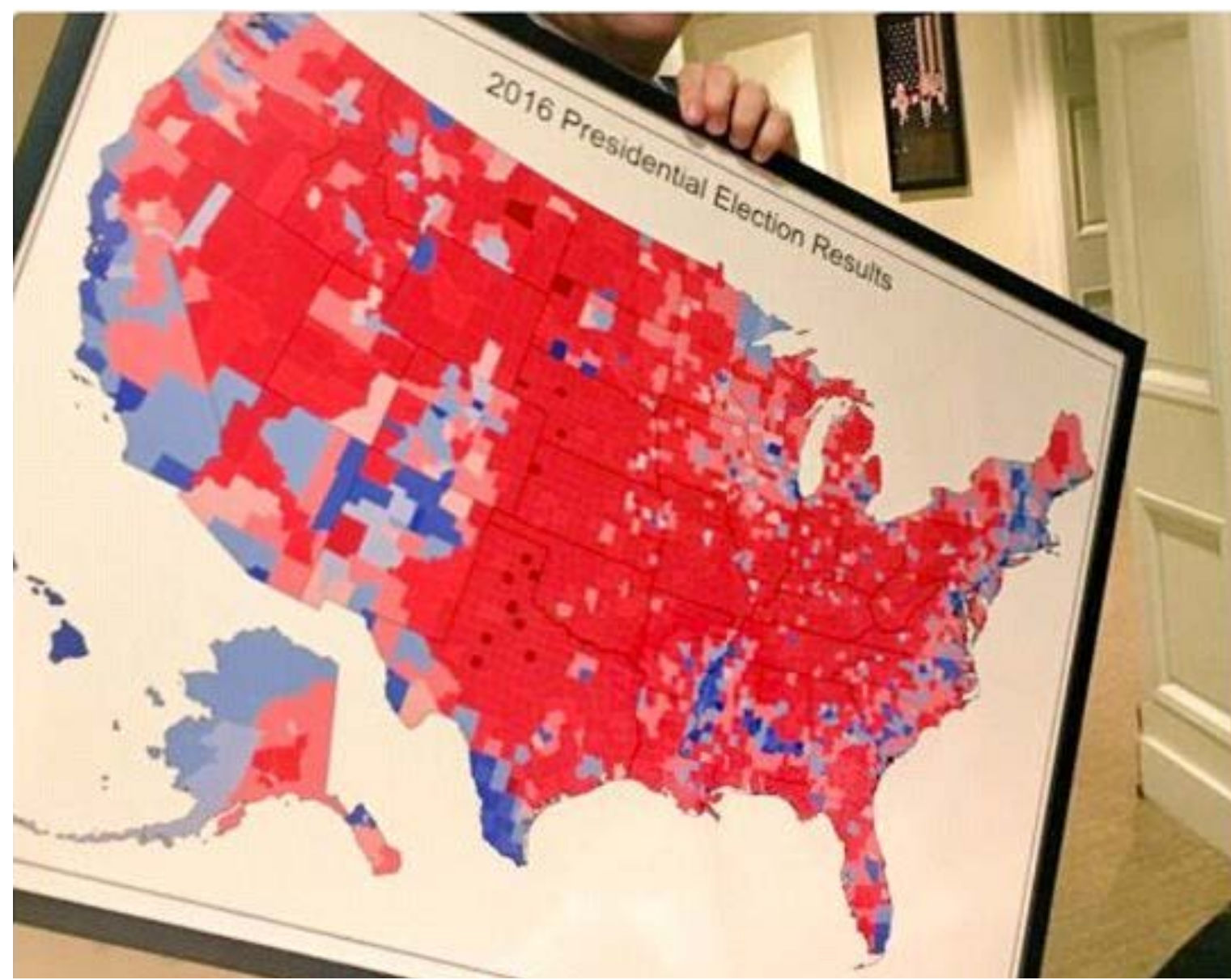
**Red: 80%**

**Blue: 20%**

**VICTORY BY A LANDSLIDE???**



Map by Kenneth Field  
[https://twitter.com/kennethfield/  
status/970827334038237184](https://twitter.com/kennethfield/status/970827334038237184)



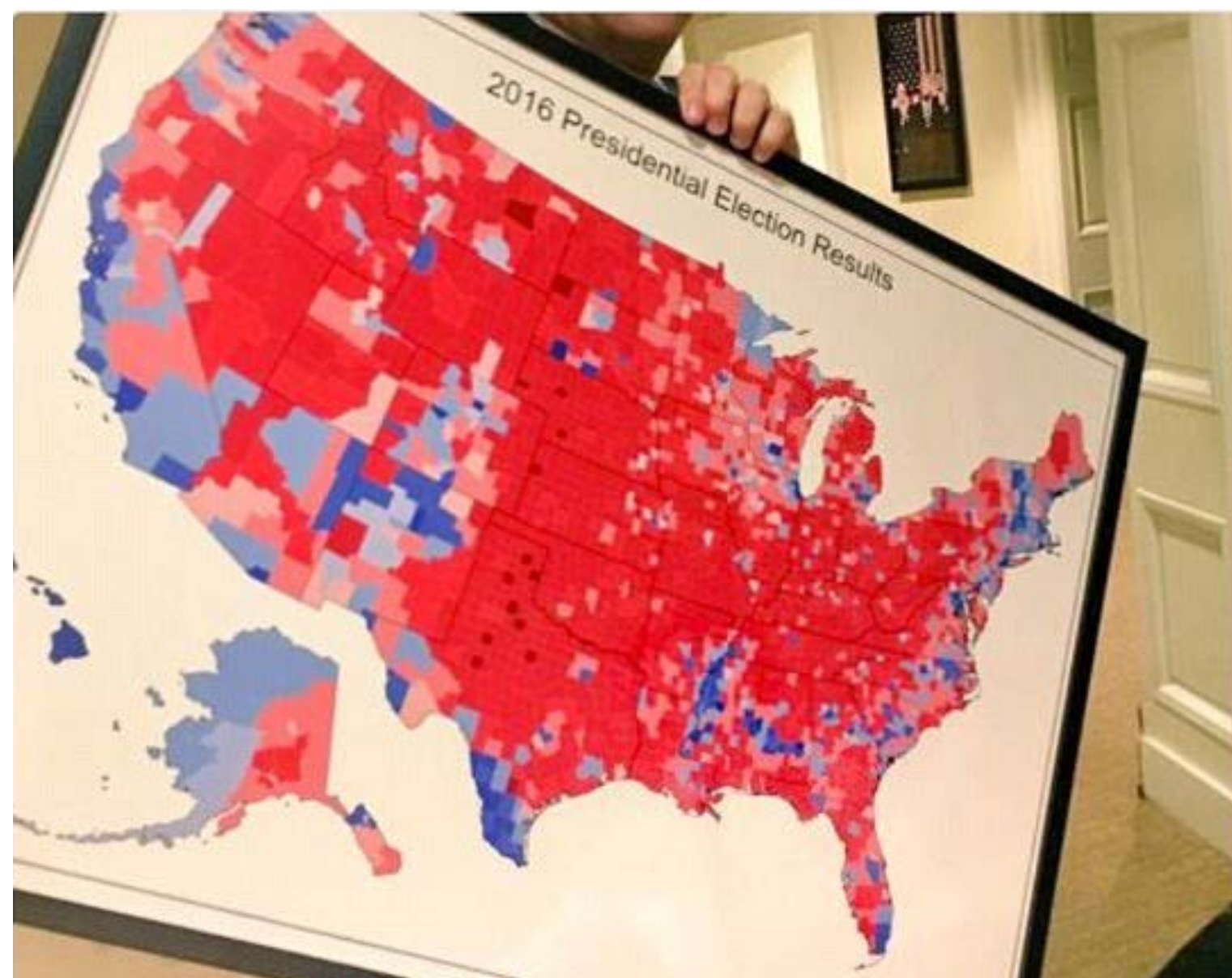
Surface on the  
county-level map:

**Red: 80%**

**Blue: 20%**

## SHARE OF THE POPULAR VOTE IN THE 2016 PRESIDENTIAL ELECTION





Surface on the county-level map:

**Red: 80%**

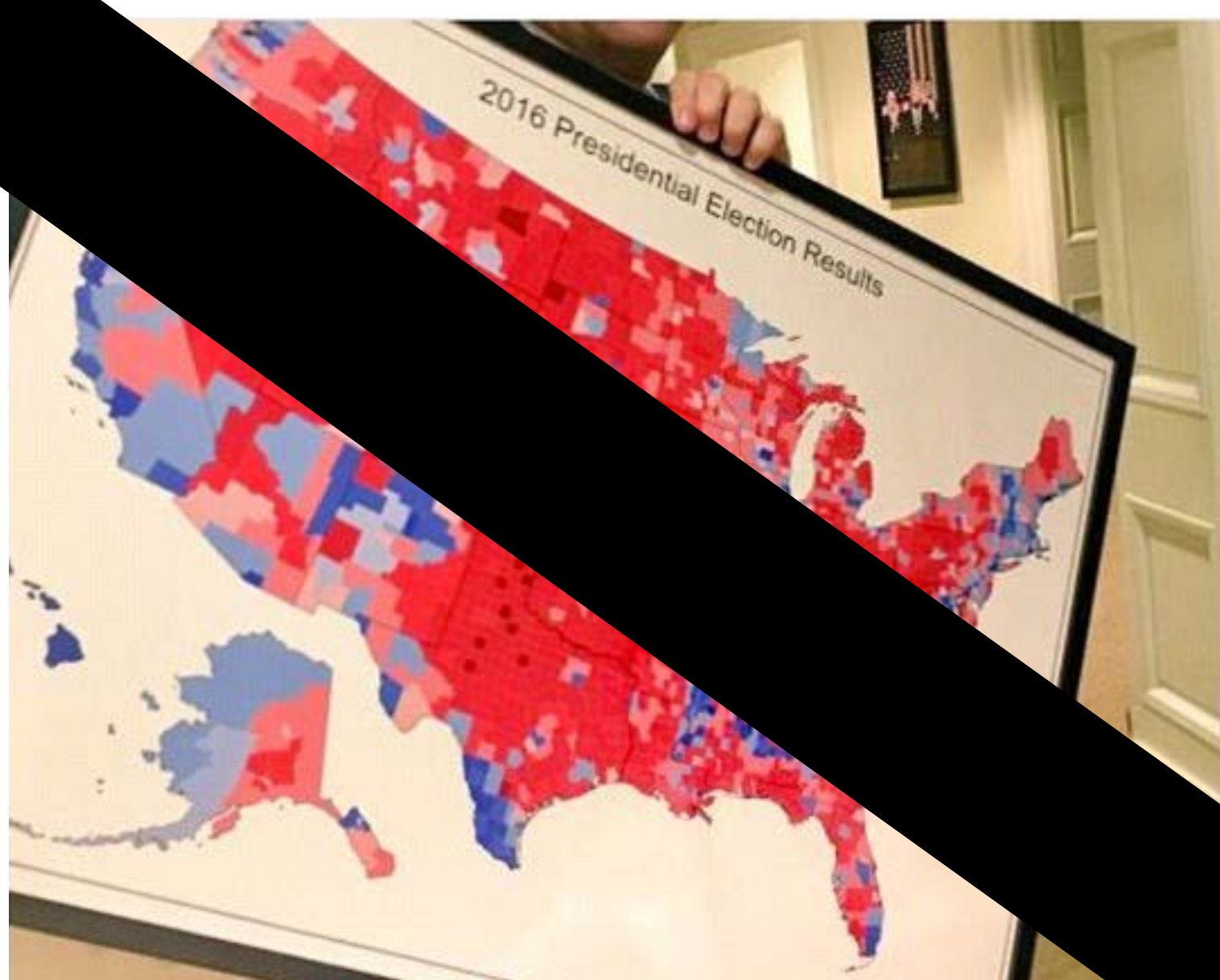
**Blue: 20%**

### SHARE OF THE POPULAR VOTE IN THE 2016 PRESIDENTIAL ELECTION



### PERCENTAGE OF ELIGIBLE VOTERS



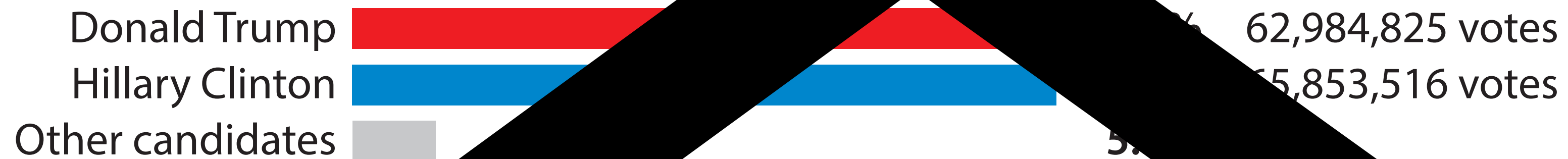


Surface on the county-level map:

**Red: 80%**

**Blue: 20%**

## SHARE OF THE POPULAR VOTE IN THE 2016 PRESIDENTIAL ELECTION



## PERCENTAGE OF ELIGIBLE VOTERS



These are the numbers that truly matter in a U.S. Presidential Election

**ELECTORAL  
VOTES**

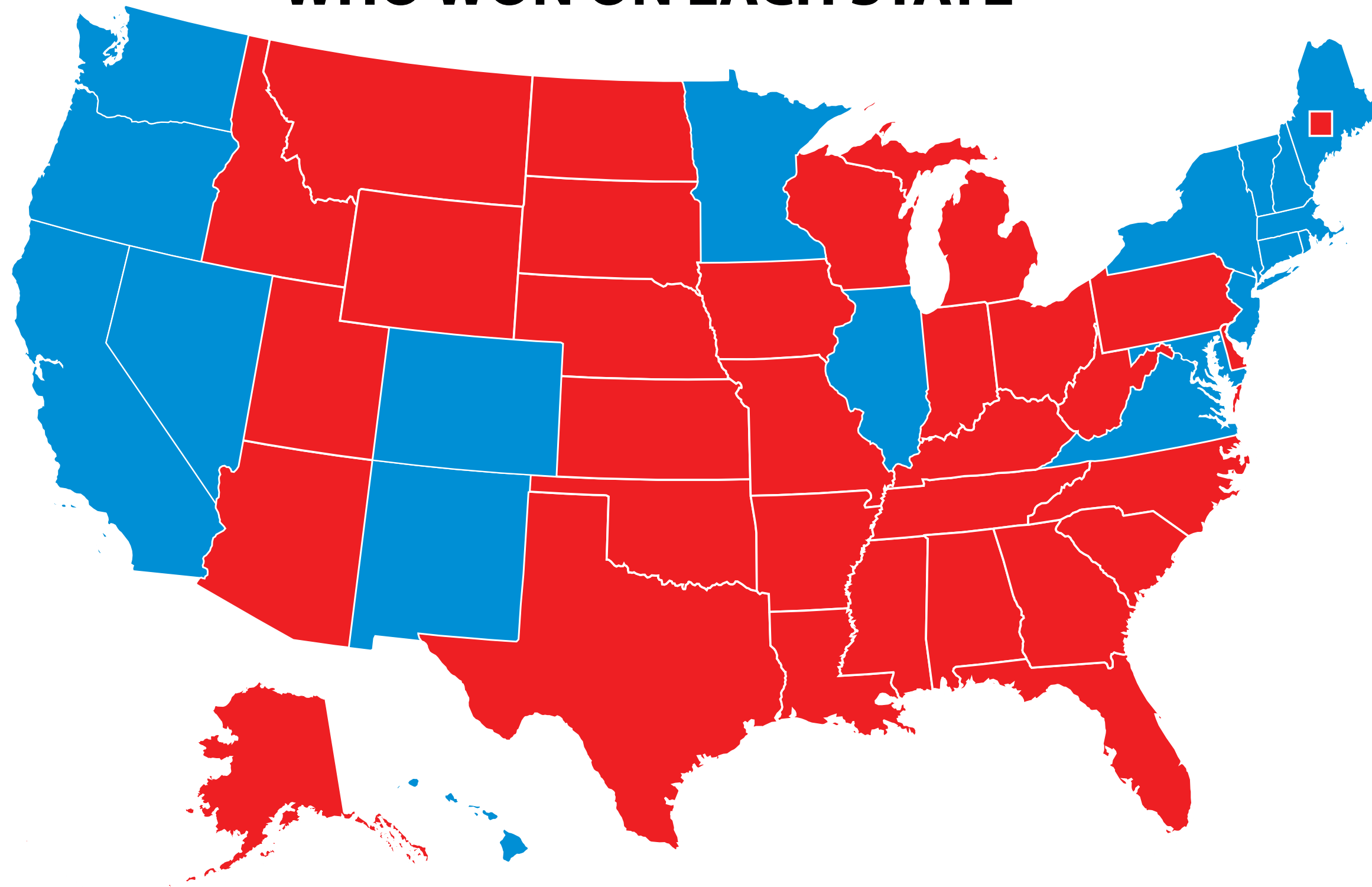
**TRUMP  
304**

Other: 7

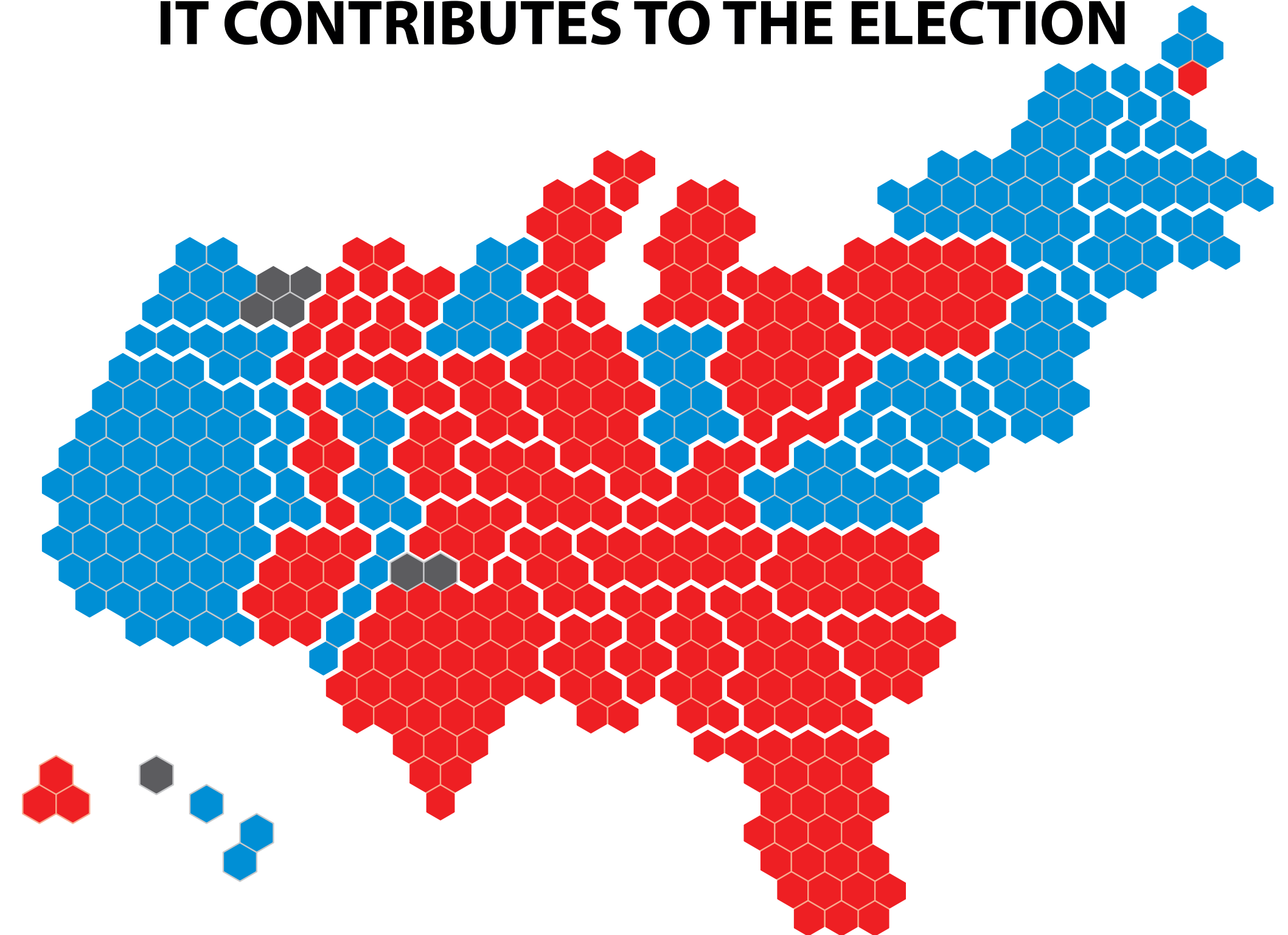
**CLINTON  
227**



**WHO WON ON EACH STATE**



**STATE SIZE ADJUSTED BY ELECTORAL VOTES  
IT CONTRIBUTES TO THE ELECTION**



We face some challenges that often  
hinder our ability to interpret charts correctly...

Challenge 1

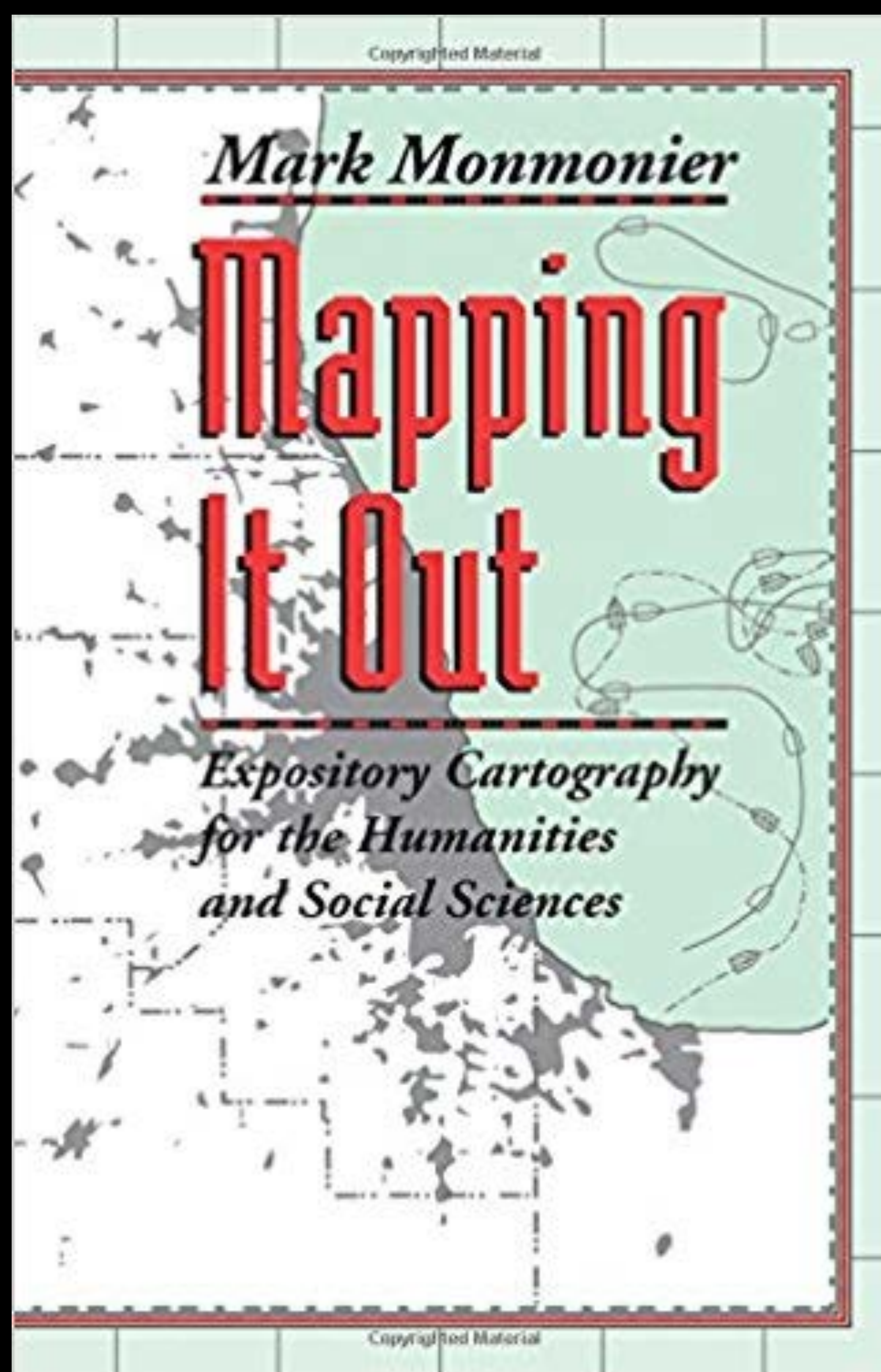
# PATTERNICITY

We constantly see patterns. Once we identify patterns that look meaningful—even if they are just the product of randomness—our brains will strive to connect them with causal links.

## Challenge 2

# IGRAPHICACY (“graphical illiteracy”)

We believe (wrongly) that charts are illustrations that can be understood at a quick glance.  
But **charts are visual arguments**. They mustn't be just *seen*; they need to be *read*.



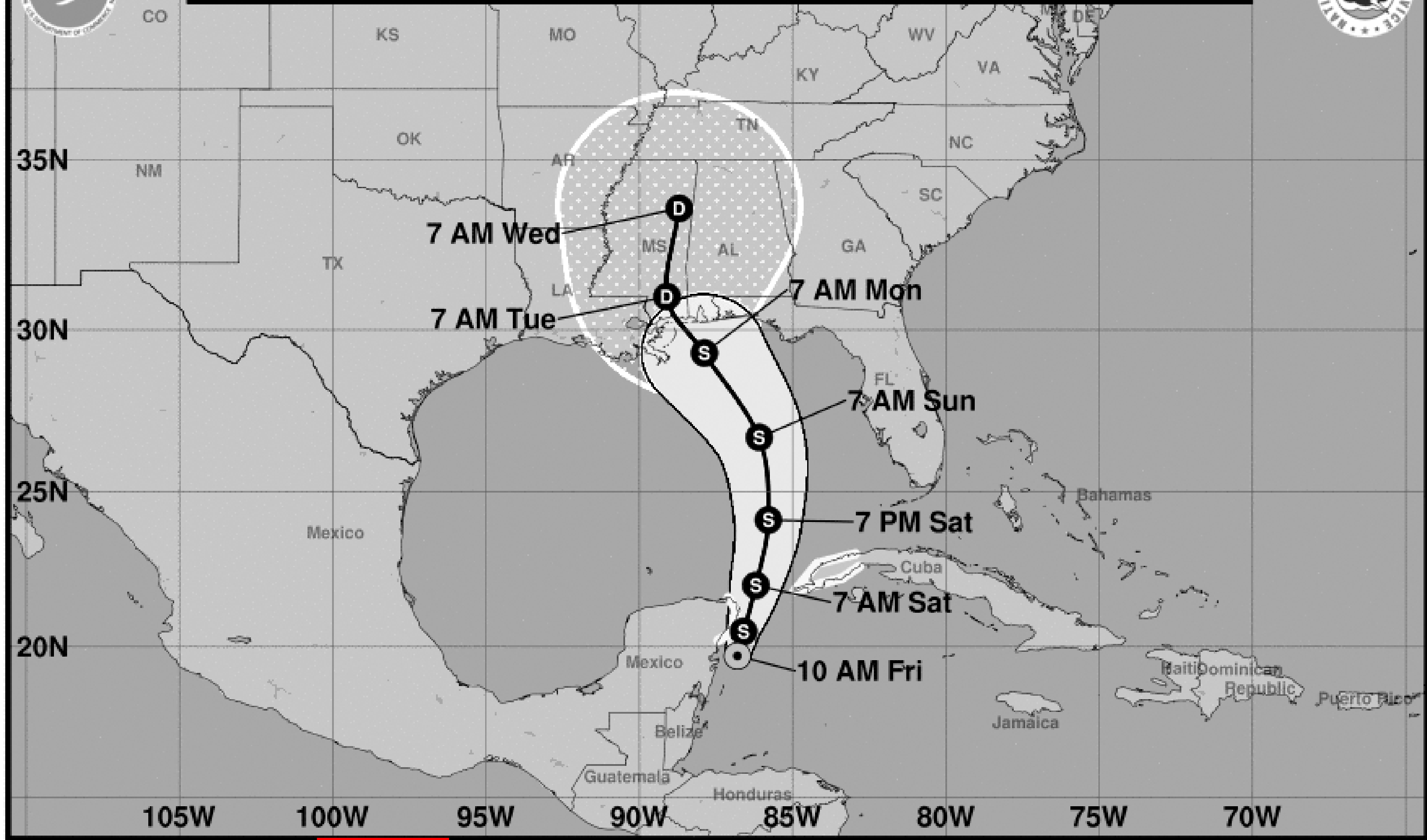
Skills for a modern  
educated citizen:

- Literacy
- Articulacy
- Numeracy
- Graphicacy**





**Note: The cone contains the probable path of the storm center but does not show the size of the storm. Hazardous conditions can occur outside of the cone.**



**Subtropical Storm Alberto**  
 Friday May 25, 2018  
 10 AM CDT Advisory 1  
 NWS National Hurricane Center

**Current information:** ●  
 Center location 19.7 N 86.8 W  
 Maximum sustained wind 40 mph  
 Movement NNE at 6 mph

**Forecast positions:**  
 ● Tropical Cyclone ○ Post/Potential TC  
 Sustained winds: D < 39 mph  
 S 39-73 mph H 74-110 mph M > 110 mph

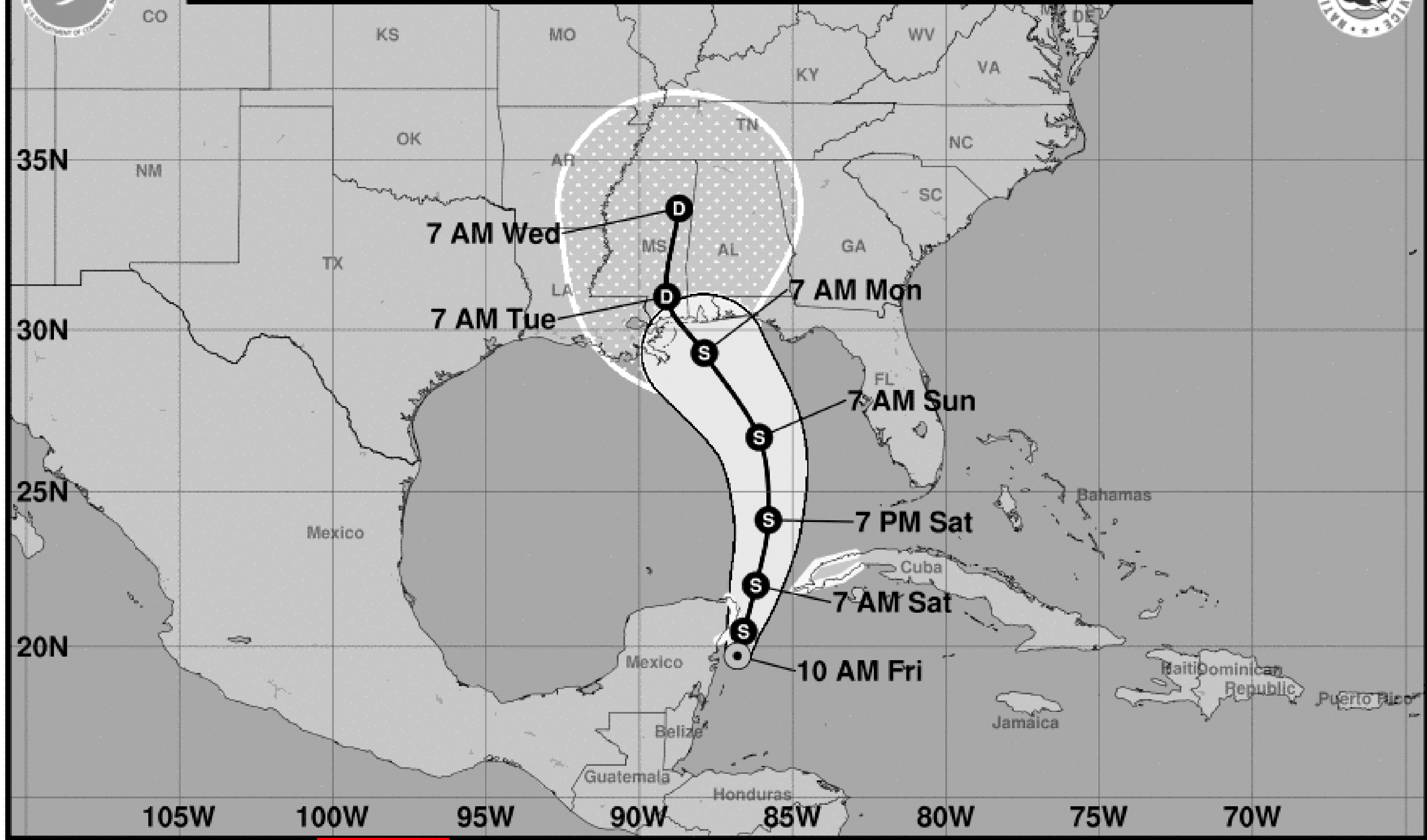
**Potential track area:**  
 ▽ Day 1-3 ▨ Day 4-5

**Watches:**  
 ■ Hurricane □ Trop Storm

**Warnings:**  
 ■ Hurricane ■ Trop Storm



**Note: The cone contains the probable path of the storm center but does not show the size of the storm. Hazardous conditions can occur outside of the cone.**



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**Potential track area:**  
 Day 1-3 Day 4-5

**Watches:**  
 Hurricane Trop Storm

**Warnings:**  
 Hurricane Trop Storm

Actual quote from an NHC news report:

“Alberto is not very well organized this morning.”



Note: The cone contains the probable path of the storm center but does not show the size of the storm. Hazardous conditions can occur outside of the cone.



# TROPICAL TRACKER

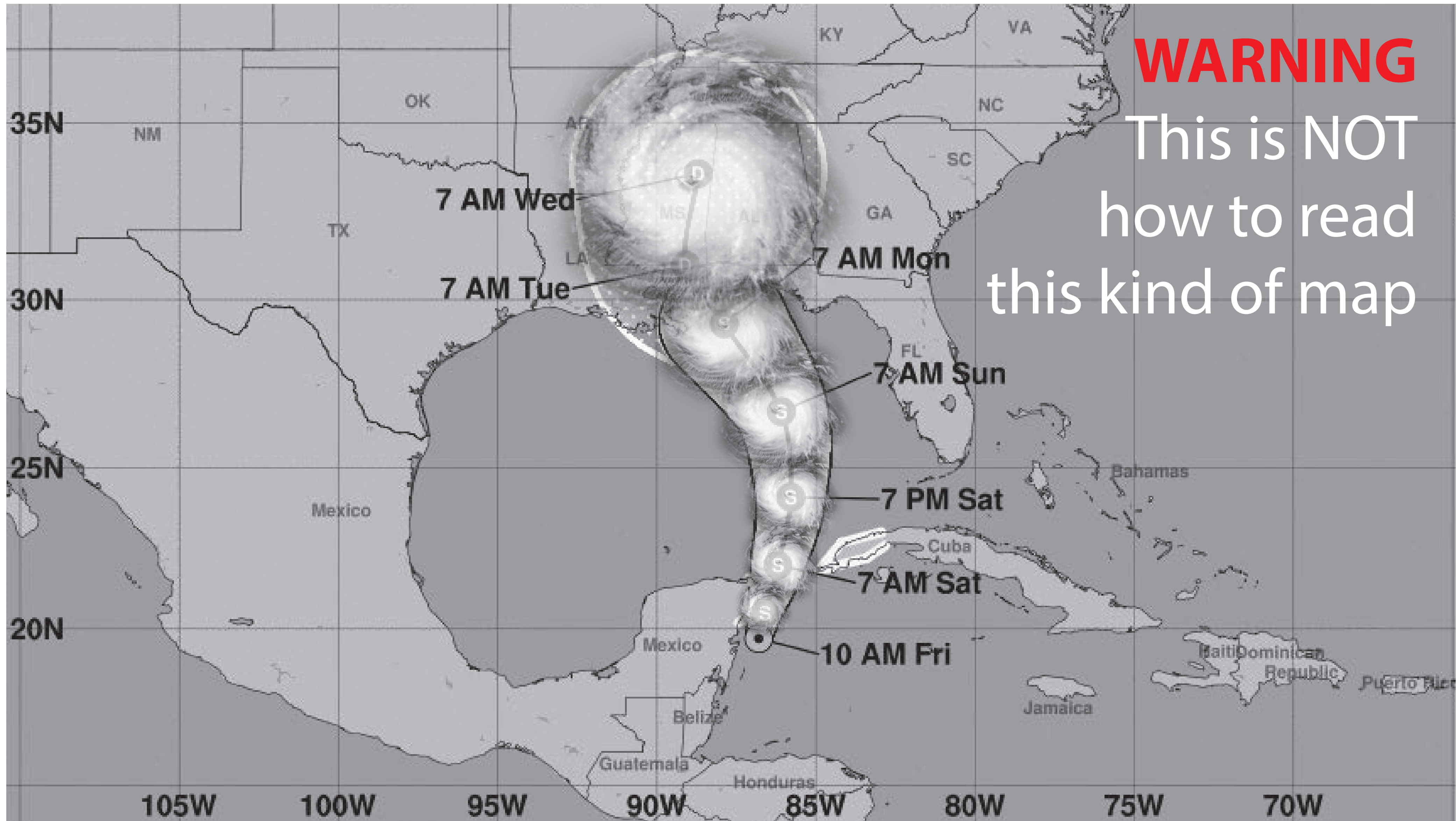
## SUBTROPICAL STORM ALBERTO

Winds: 40 mph | Gusts: 46 mph | Pressure: 1005 mb | North @ 0 mph



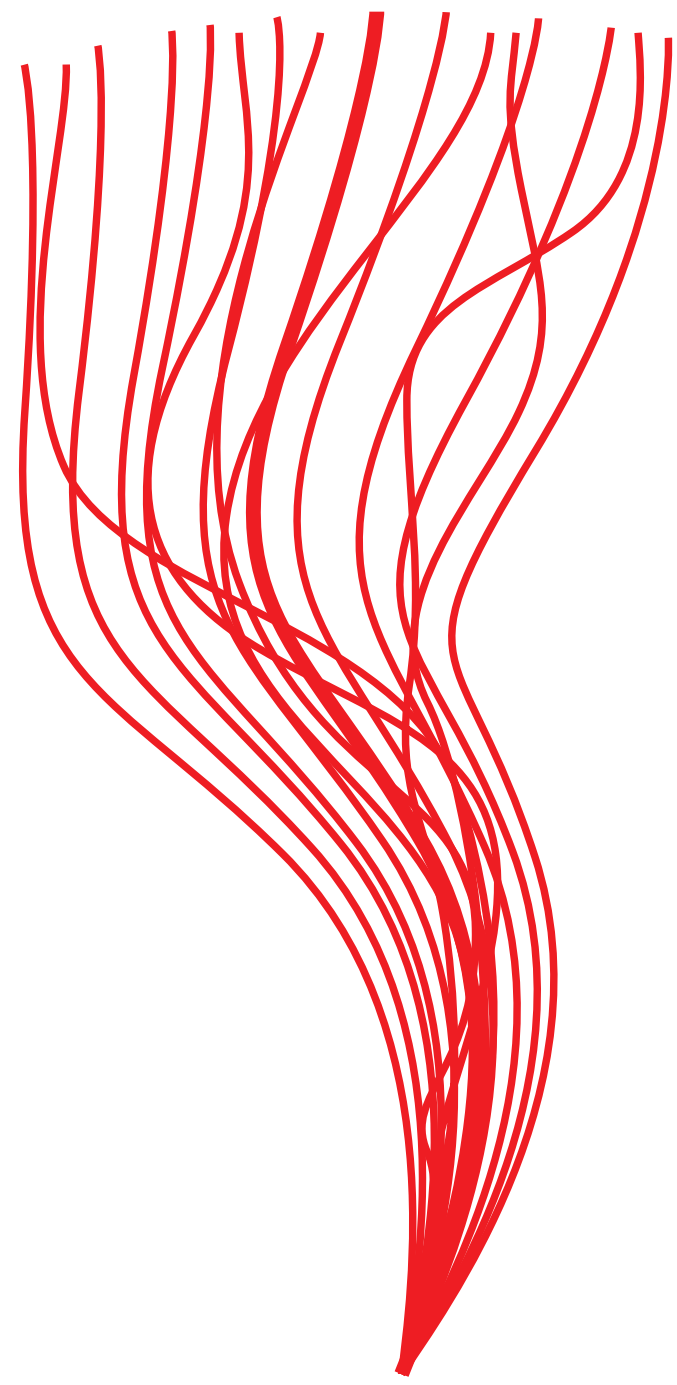
Subtropical  
Friday May 25  
10 AM CDT Ac  
NWS National

Potential t  
Day 1



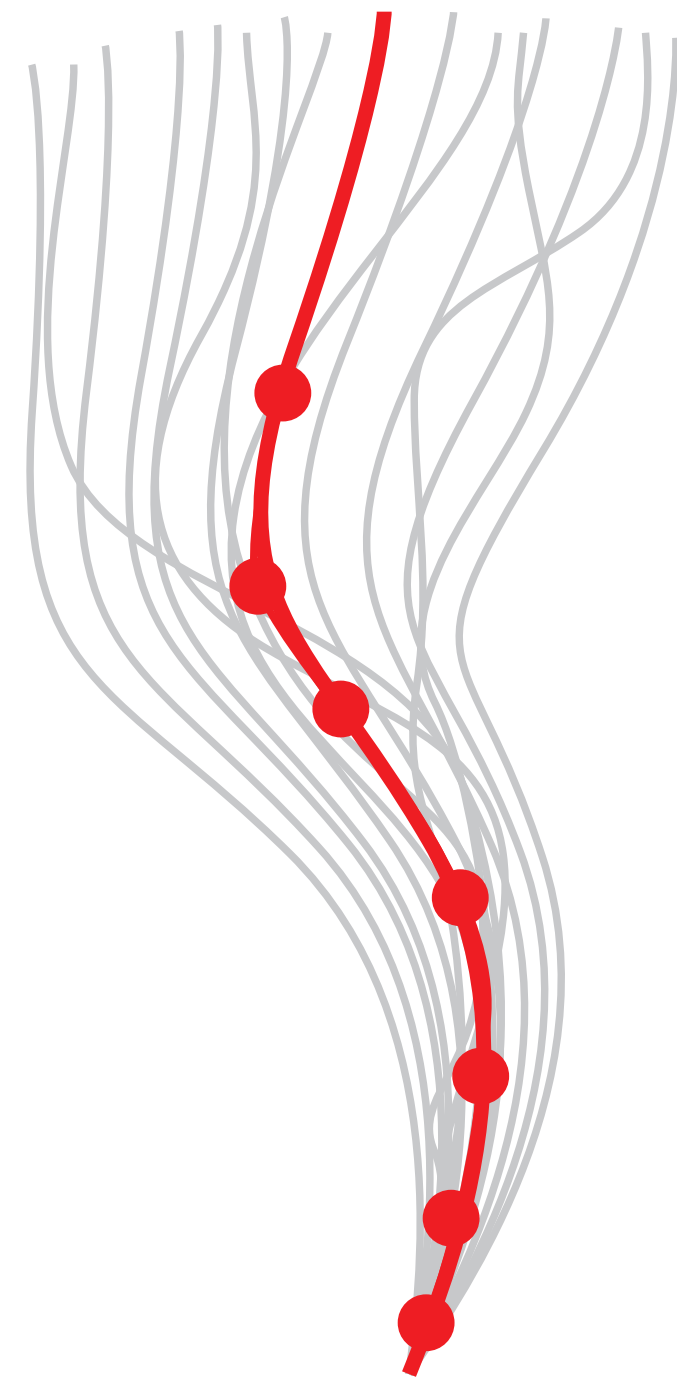
**WARNING**

This is NOT  
how to read  
this kind of map



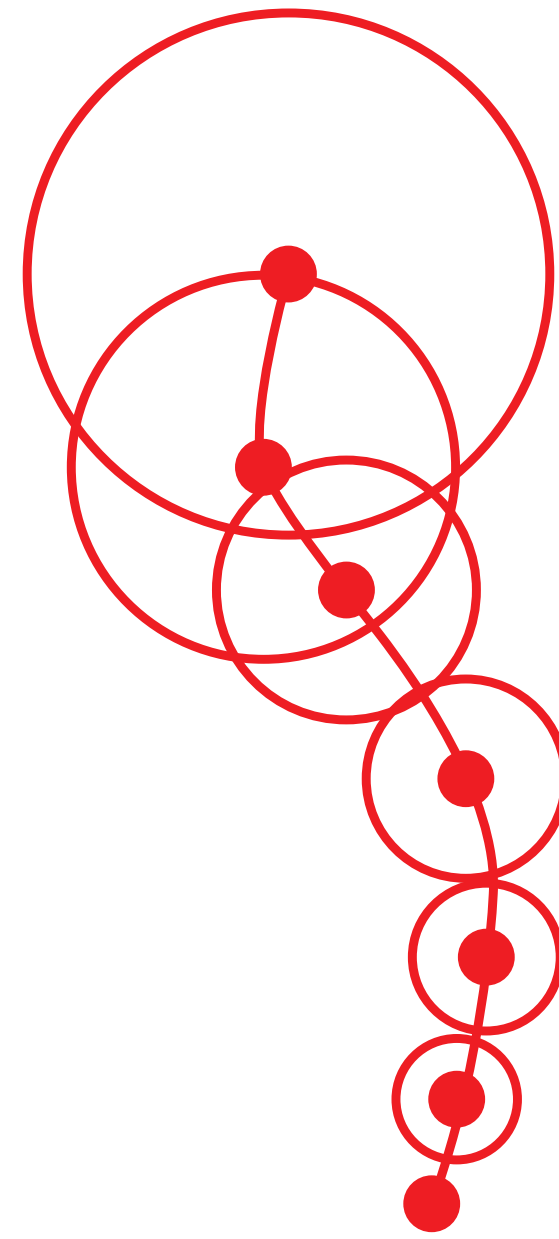
**1**

Begin with many forecasts



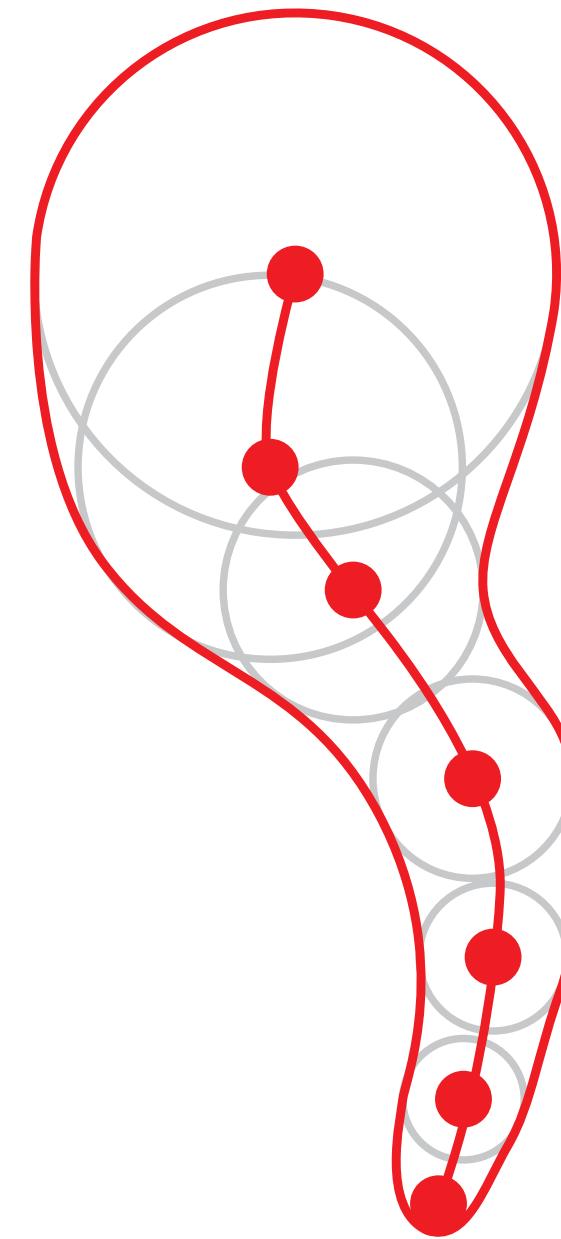
**2**

Choose the forecast you think is most likely



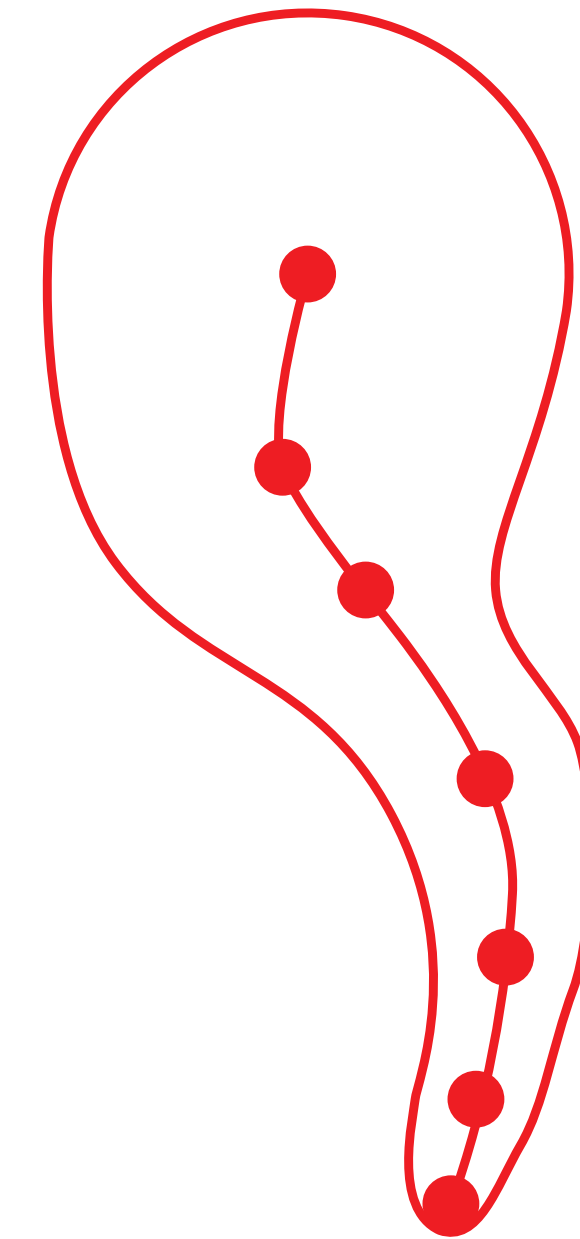
**3**

Surround the point estimates with circles representing their uncertainty.



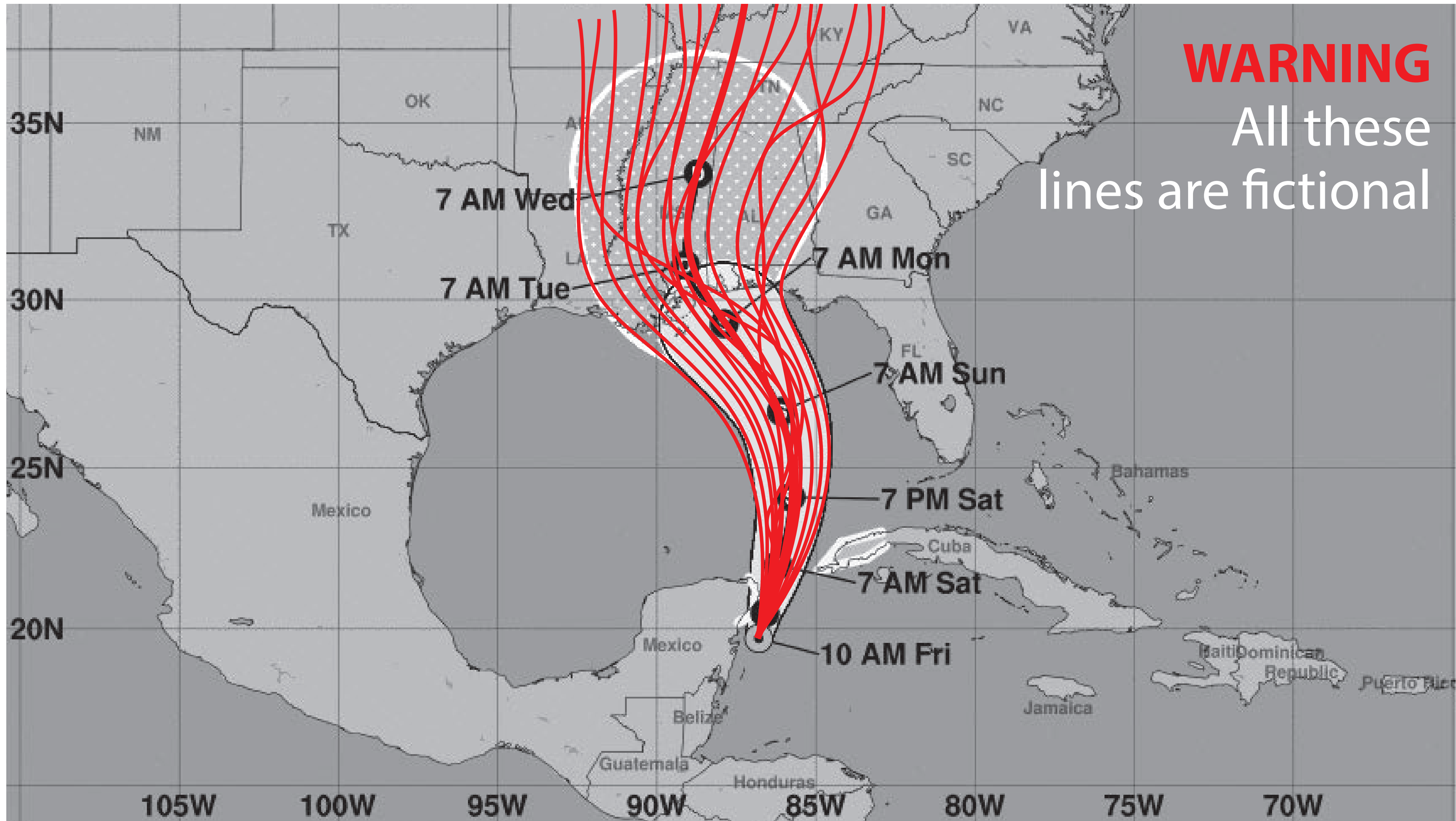
**4**

Trace a curve that connects the circles.



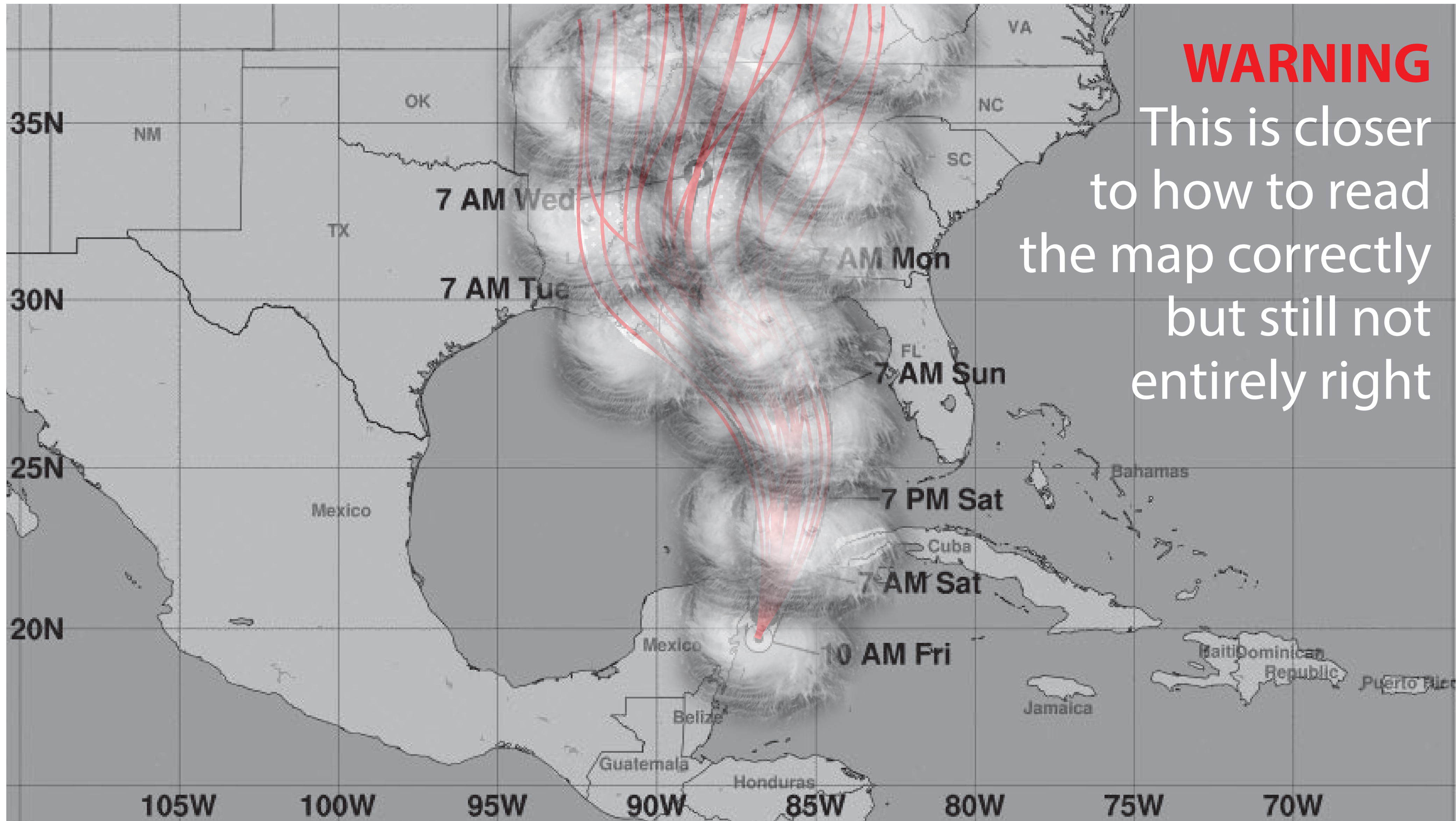
**5**

The cone of uncertainty, ready to be published.



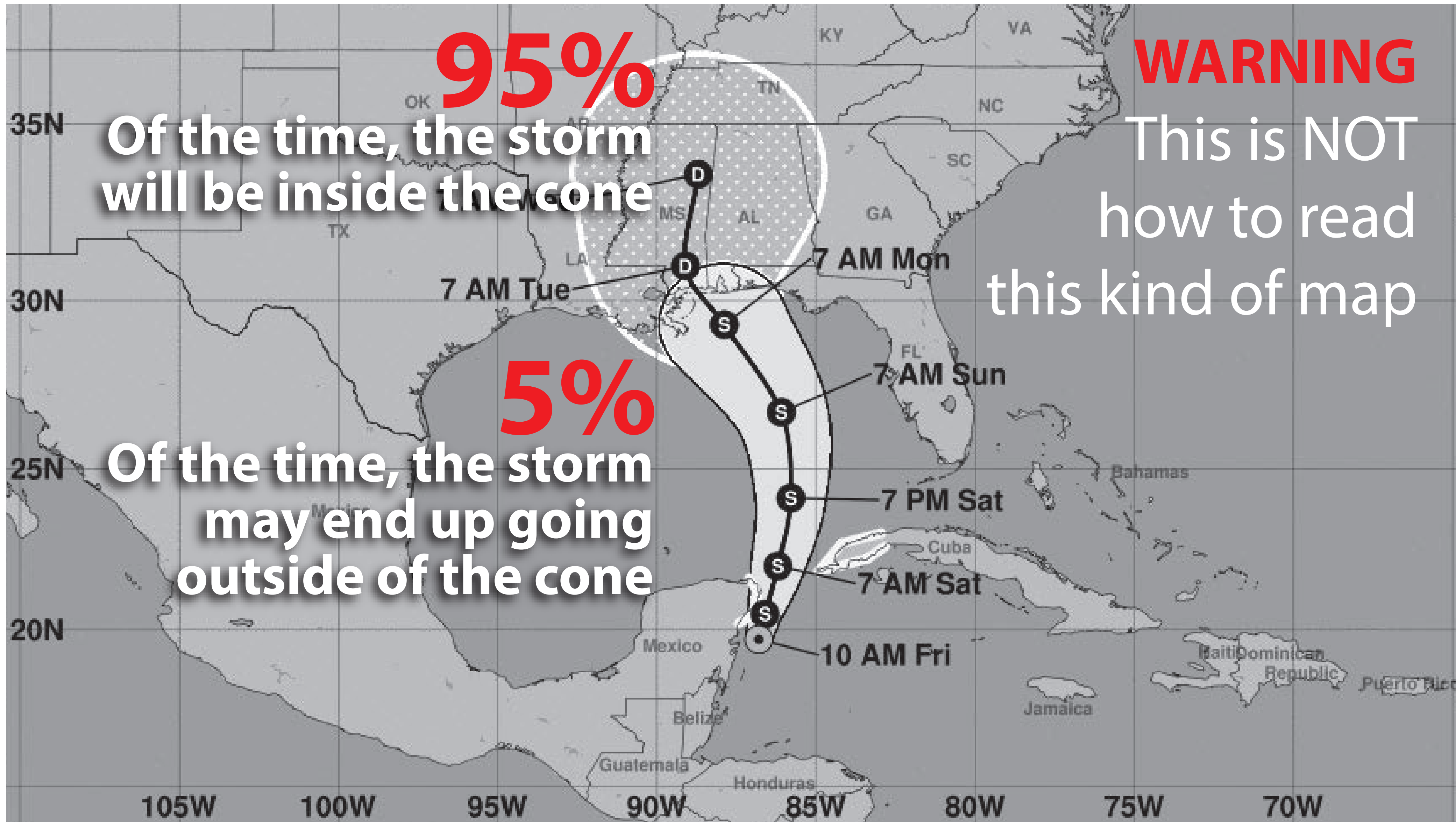
**WARNING**

All these lines are fictional

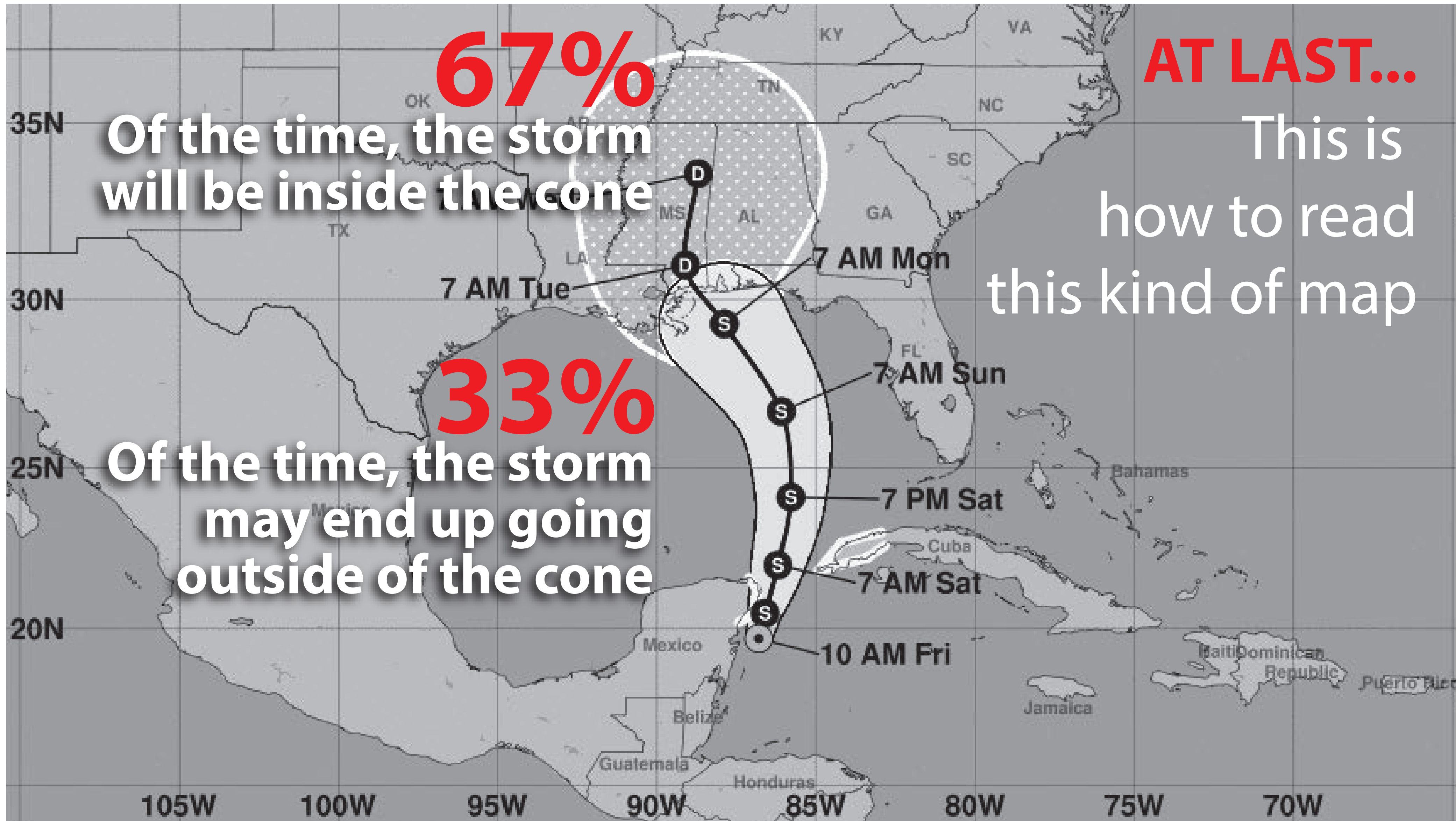


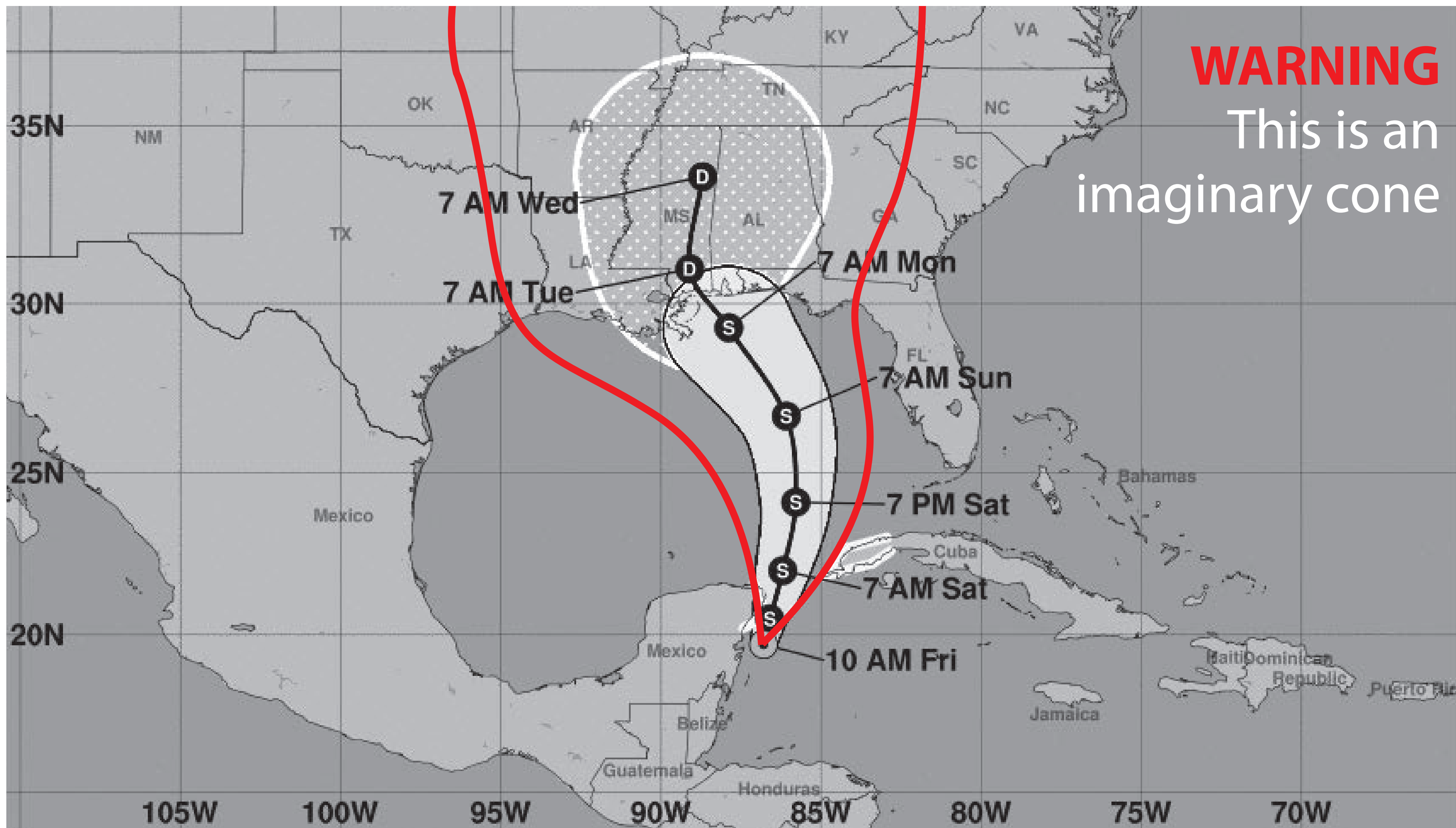
# WARNING

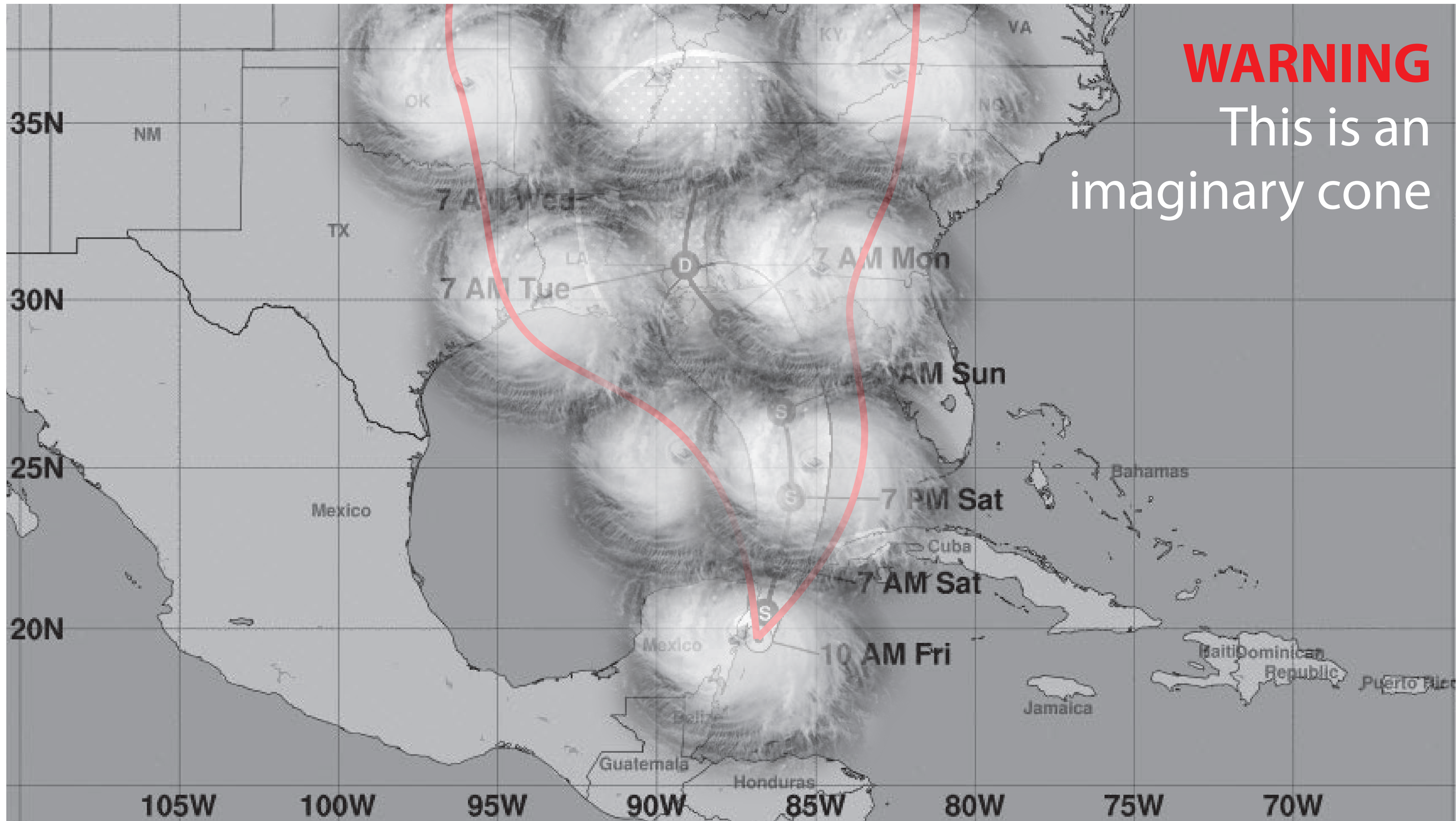
This is closer to how to read the map correctly but still not entirely right











# WARNING

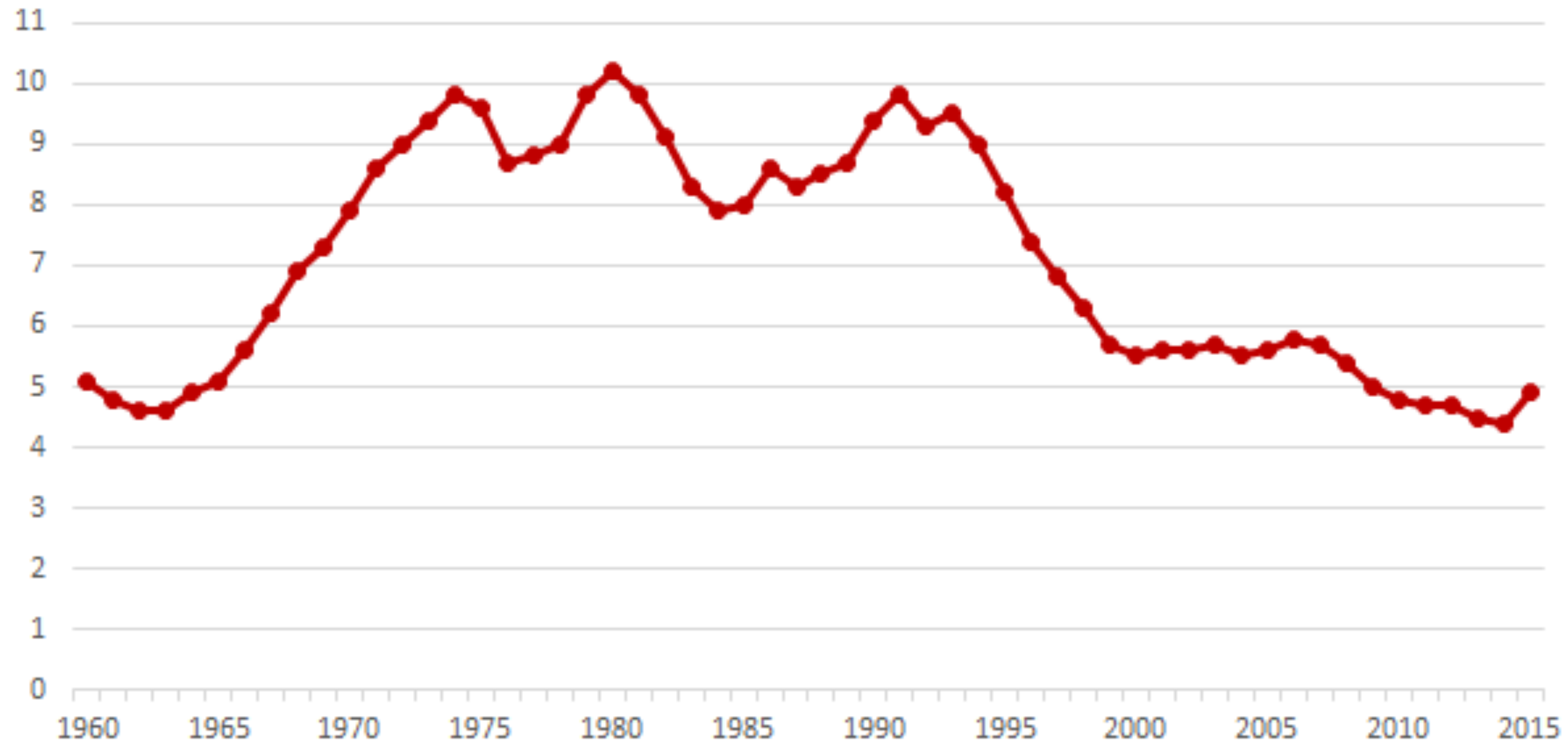
This is an imaginary cone

## Challenge 3

# FEAR OF COMPLEXITY

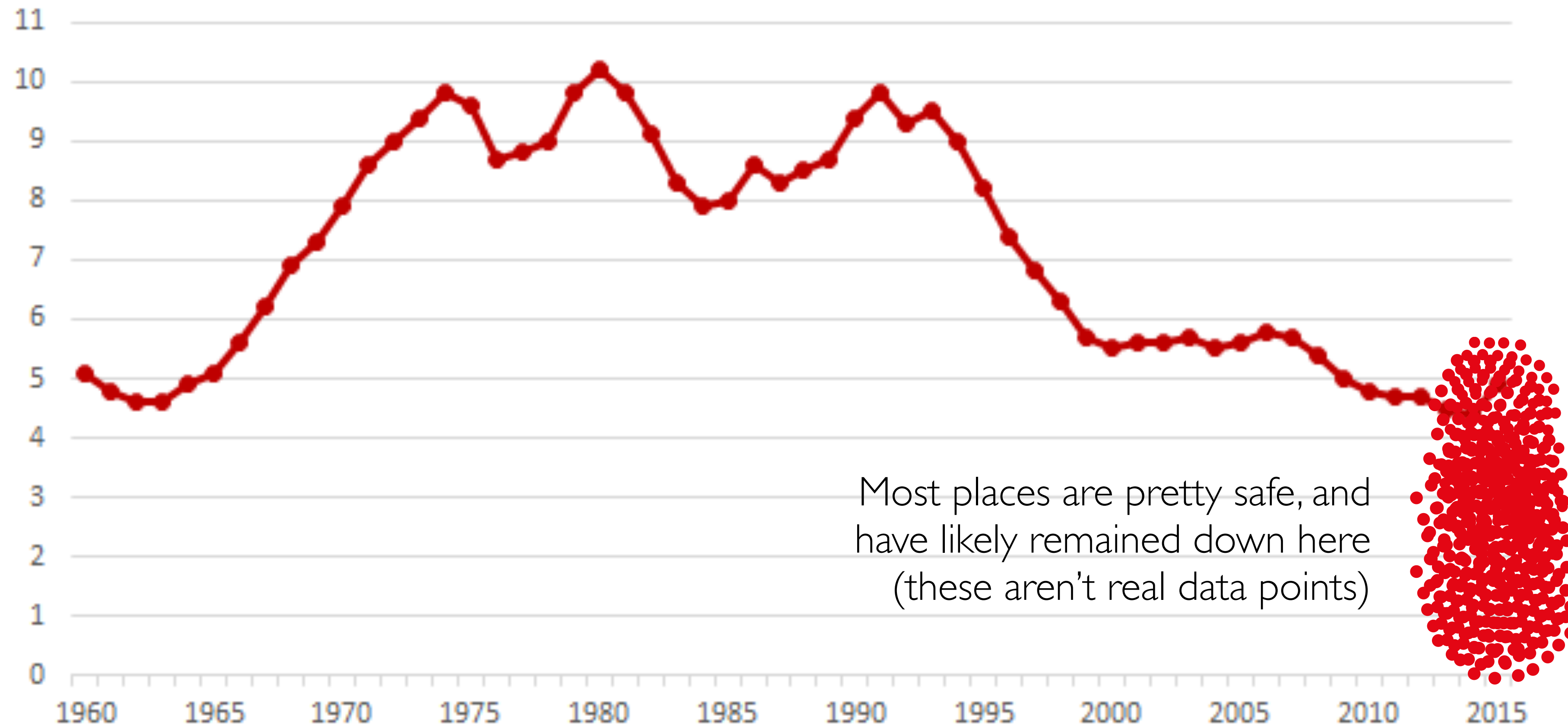
We dislike ambiguity, nuance, and complexity, and prefer simplistic stories with a closure to proper arguments, which often can't be clear, linear, or have a definite ending.

## The U.S. Murder Rate (per 100,000 people)



FactCheck.org chart based on FBI data

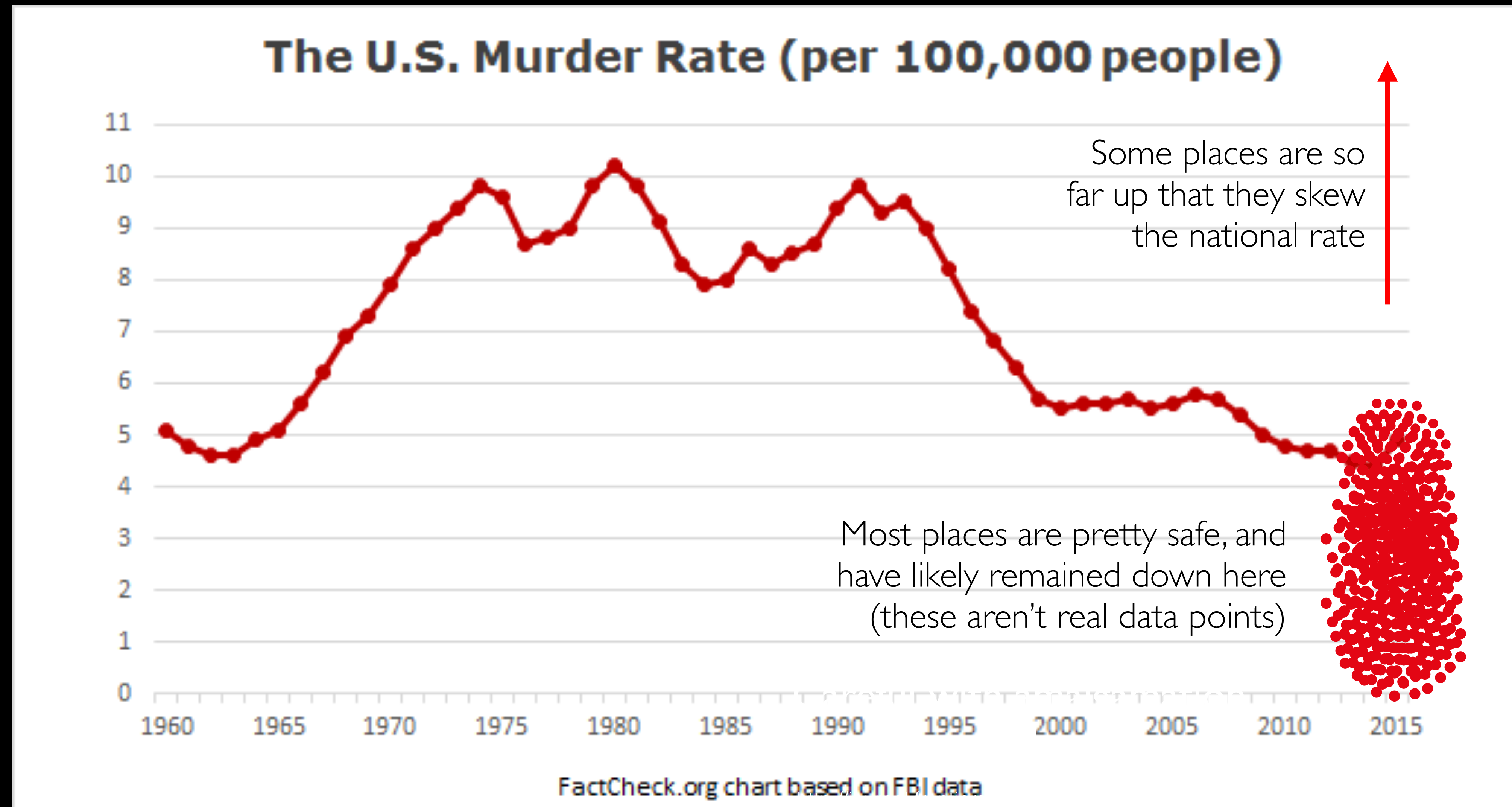
## The U.S. Murder Rate (per 100,000 people)



Most places are pretty safe, and have likely remained down here (these aren't real data points)

FactCheck.org chart based on FBI data

The danger of aggregating data too much,  
and presenting just averages and other simplistic summaries



## Challenge 4

# IGNORANCE OF UNCERTAINTY

We believe that numbers are accurate, precise, and objective. We must abandon this view.

Data is always biased, incomplete, and uncertain —and that's fine!

On the other hand, communicators need to show confidence and uncertainty in their charts when uncertainty is critical.



REGIONAL POLITICS

# Catalan public opinion swings toward “no” for independence, says survey

Growing numbers of citizens support federal model that falls short of secession from Spain



PERE RÍOS

Barcelona - 19 DIC 2014 - 10:23 EST

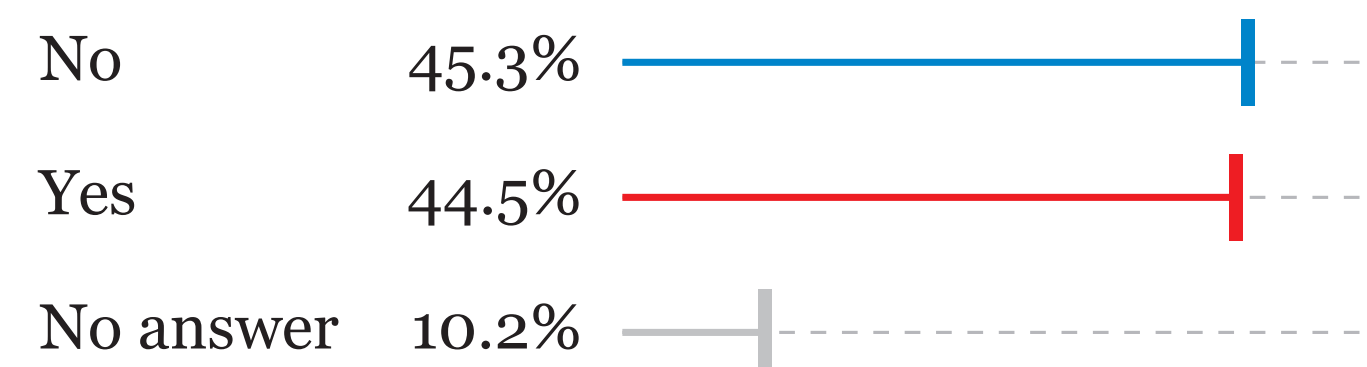
[http://ccaa.elpais.com/ccaa/2014/12/19/catalunya/1418984873\\_128596.html](http://ccaa.elpais.com/ccaa/2014/12/19/catalunya/1418984873_128596.html)

For the first time since Catalan leader Artur Mas began his ongoing independence drive in 2012, a survey shows that a majority in the region would reject secession if a referendum were held now.

<http://www.thefunctionalart.com/2014/12/adventures-in-margin-of-error.html>

The latest poll by the Catalan executive's Opinion Studies Center (CEO) shows that 45.3 percent of citizens would vote no to the question: "Would you like Catalonia to become an independent state?" compared with 44.5 percent who would support the move.

### *Do you want Catalonia to become an independent state?*

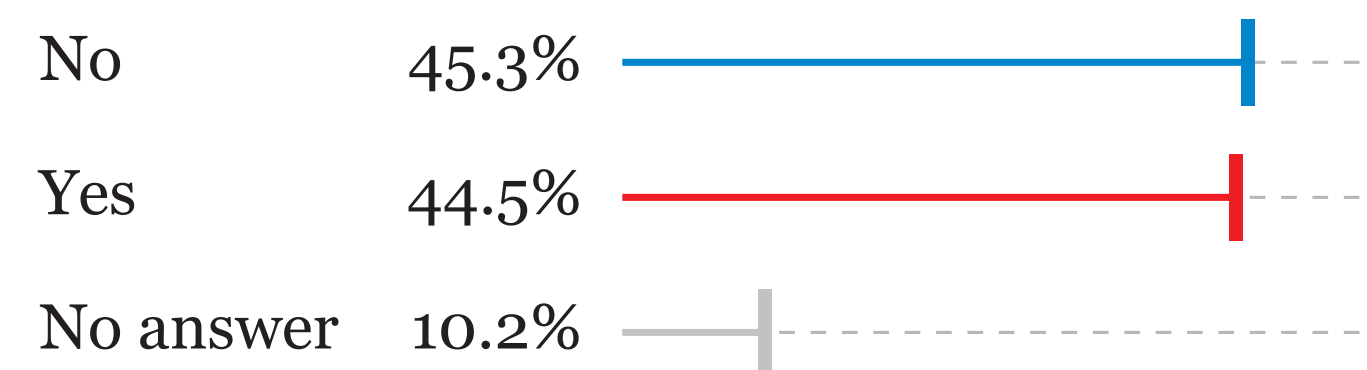


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### *Do you want Catalonia to become an independent state?*



Margin of error: +/-2.95 at 95% confidence level

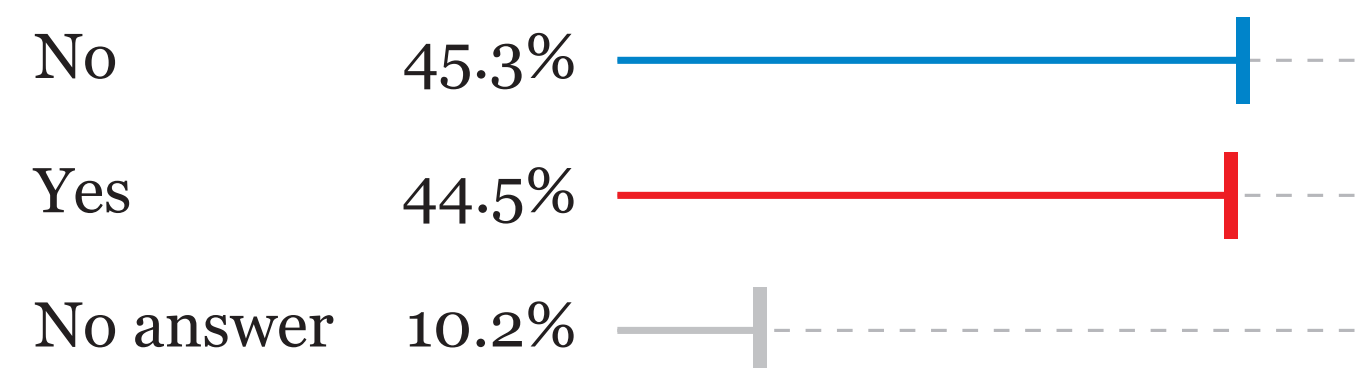
**“The margin of error of the poll is 2.95, a relevant fact considering the tight difference between the YES and the NO to the independence of Catalonia”**

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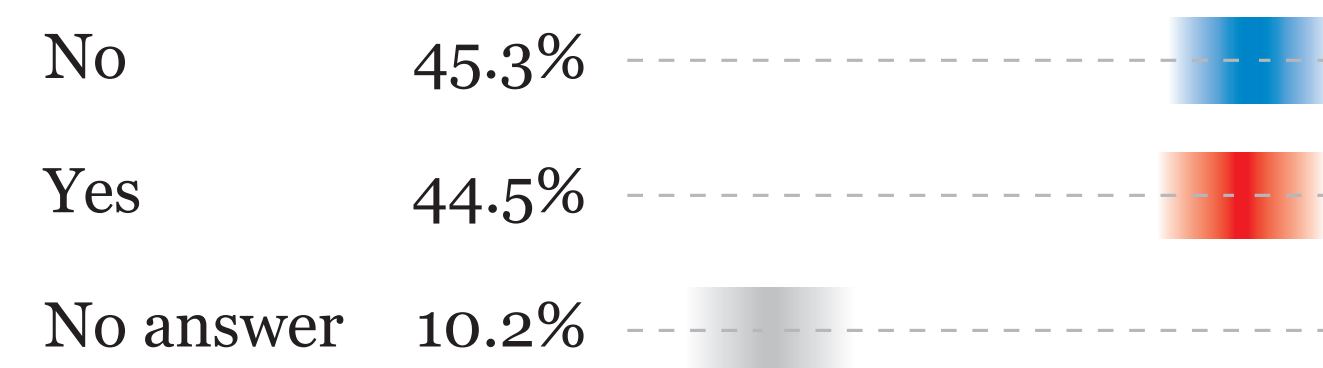
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*Do you want Catalonia to become an independent state?*



Margin of error: +/-2.95 at 95% confidence level

*Do you want Catalonia to become an independent state?*



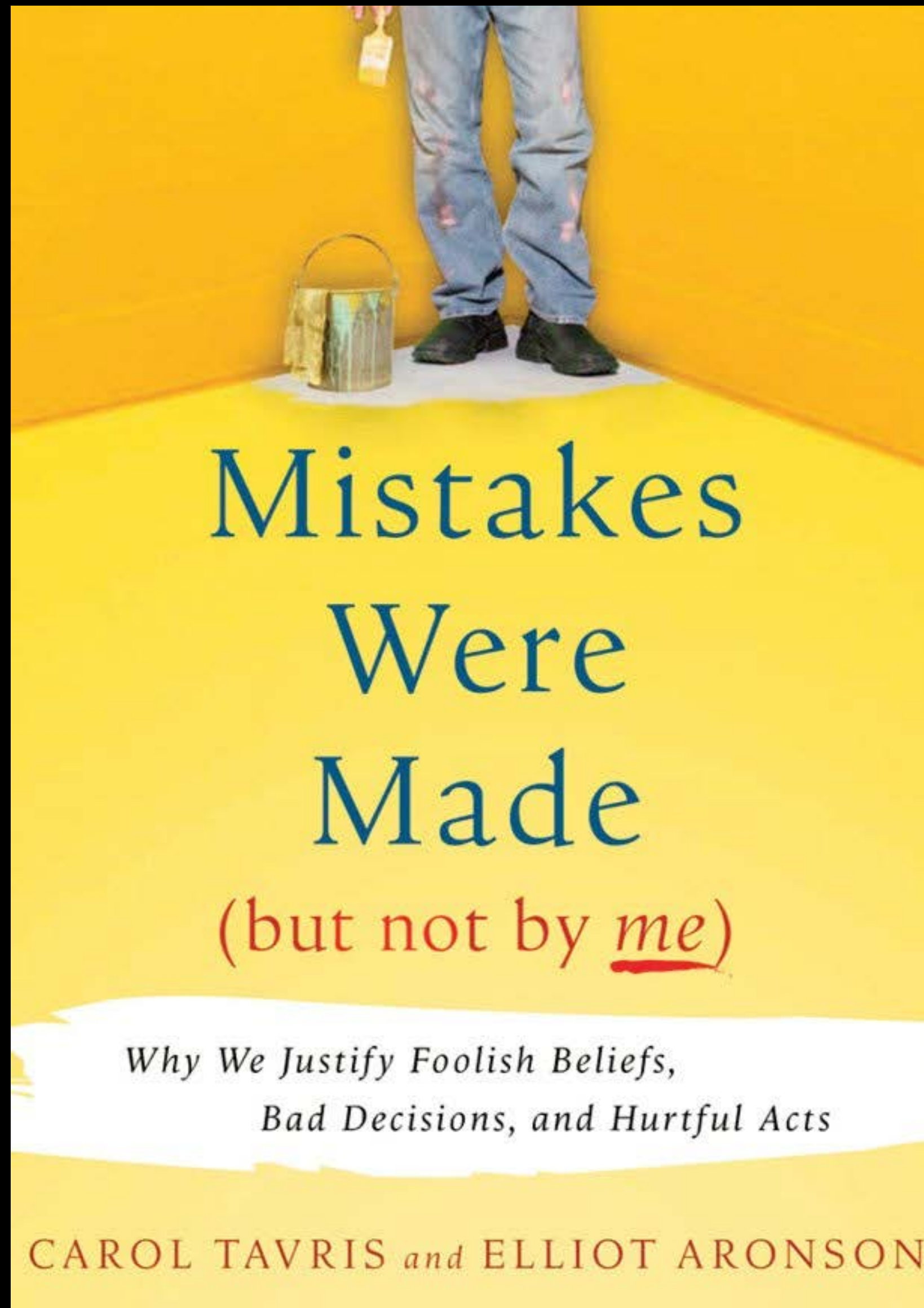
The probability of the tiny difference between the "No" and the "Yes" being just due to random chance is very high

**“The margin of error of the poll is 2.95, a relevant fact considering the tight difference between the YES and the NO to the independence of Catalonia”**

Challenge 5

# CONFIRMATION

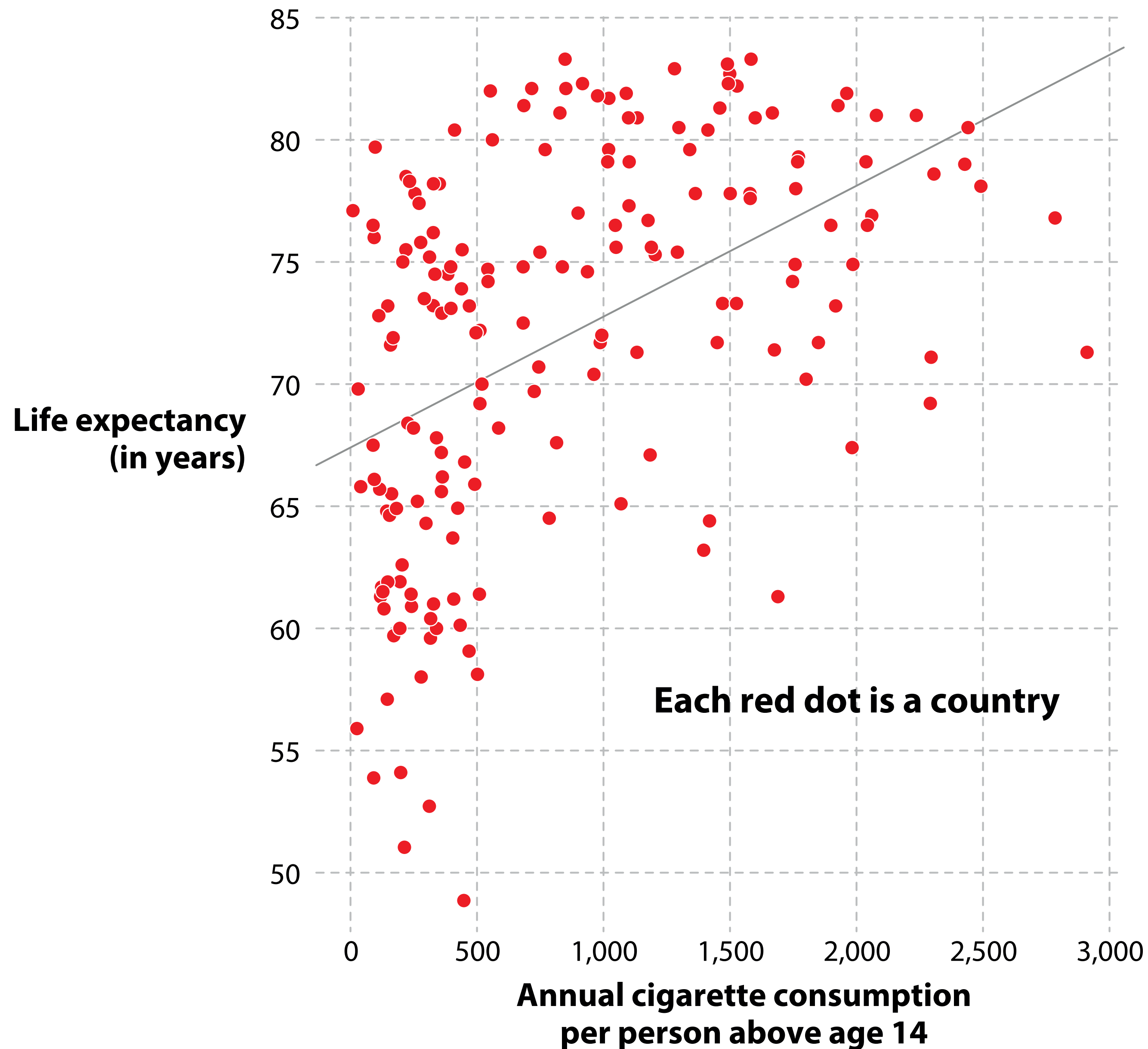
Once we create narratives connecting facts, we want them to go unchallenged, particularly if those narratives are foundational pillars of our ideological or cultural stance.



Mistakes  
Were  
Made  
(but not by me)

*Why We Justify Foolish Beliefs,  
Bad Decisions, and Hurtful Acts*

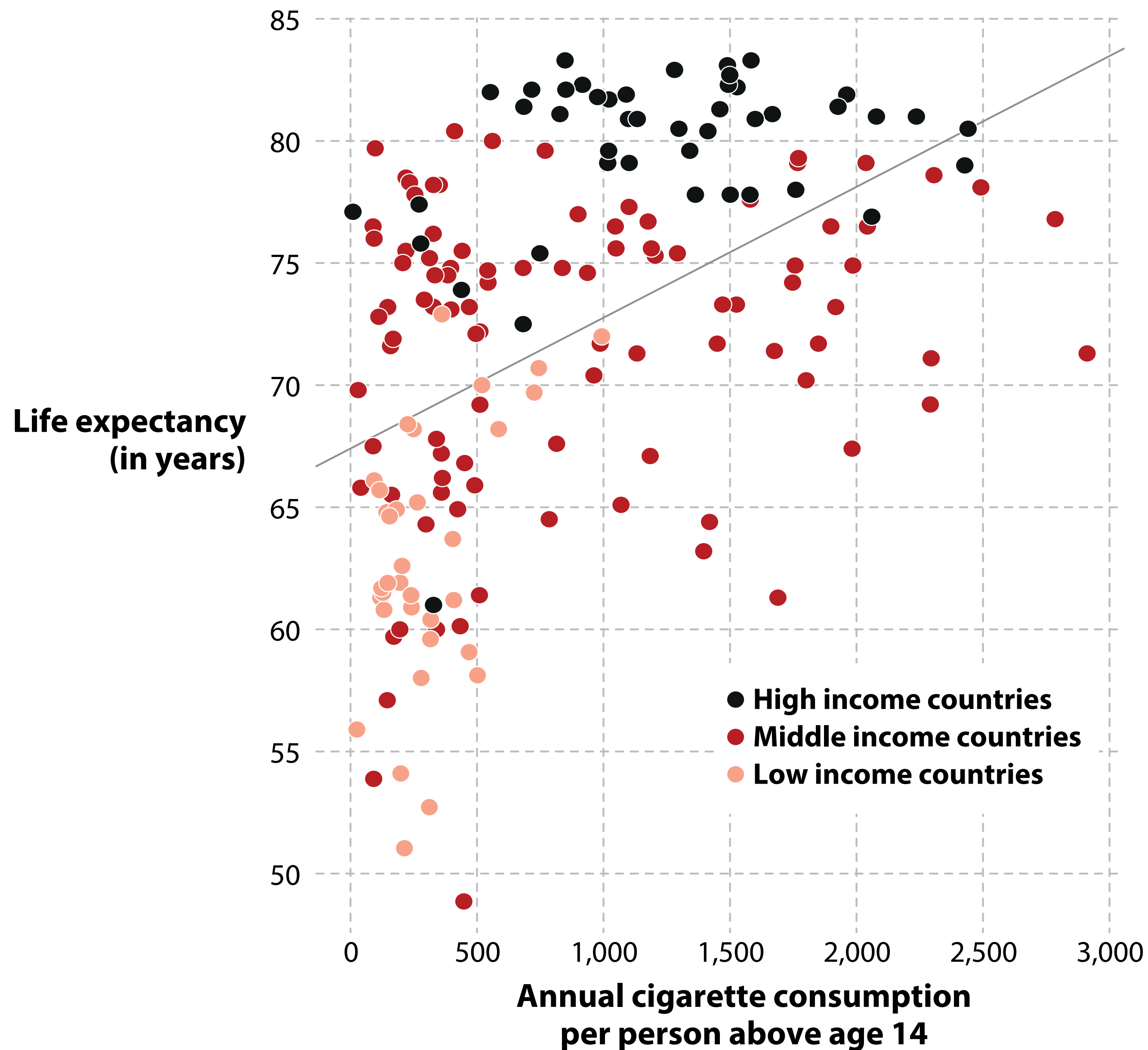
CAROL TAVRIS *and* ELLIOT ARONSON



Incorrect verbal descriptions of a chart can greatly bias our understanding of it

Smoking cigarettes can help you live longer!!!

Example provided by Heather Krause  
<https://idatassist.com>

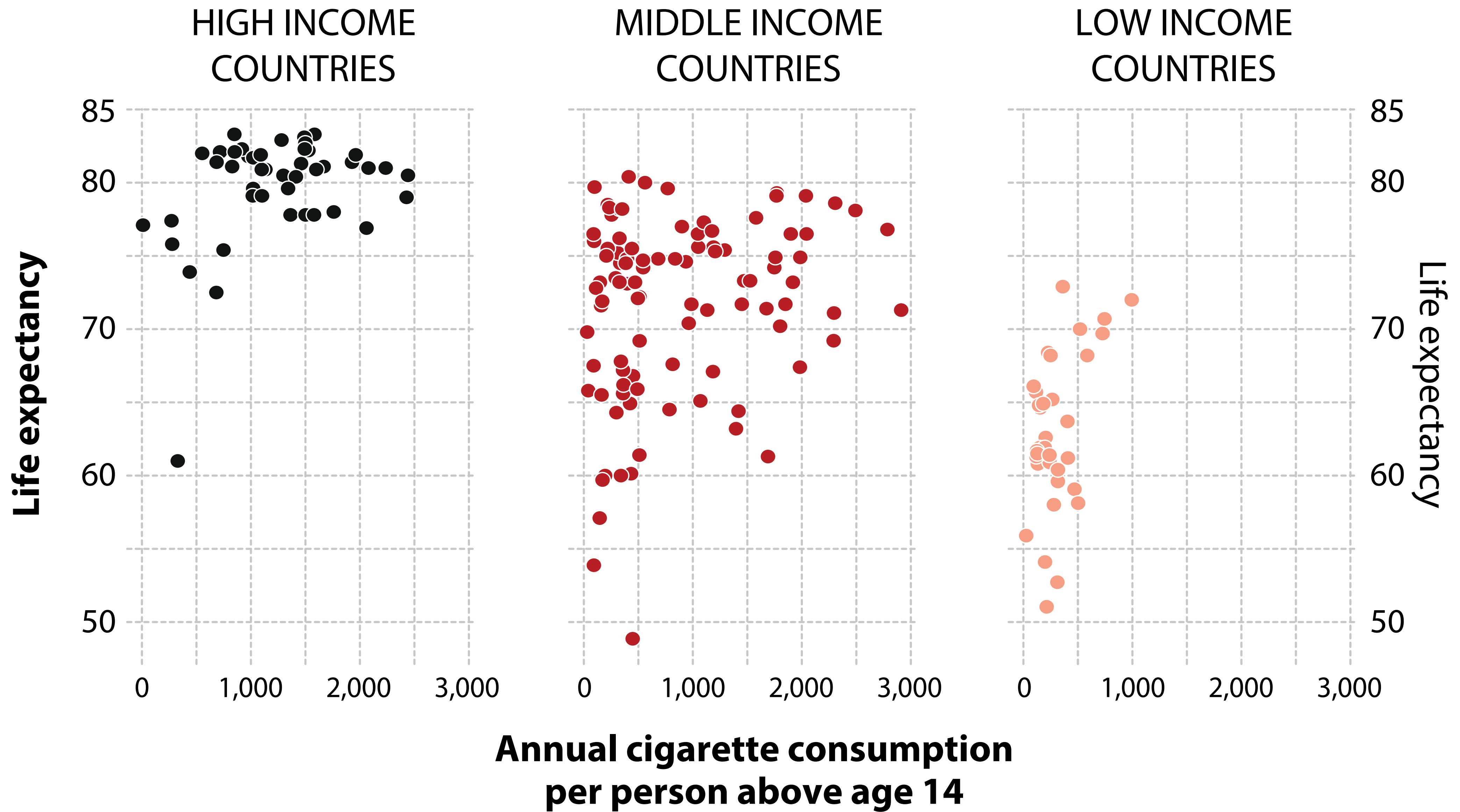


Incorrect verbal descriptions of a chart can greatly bias our understanding of it

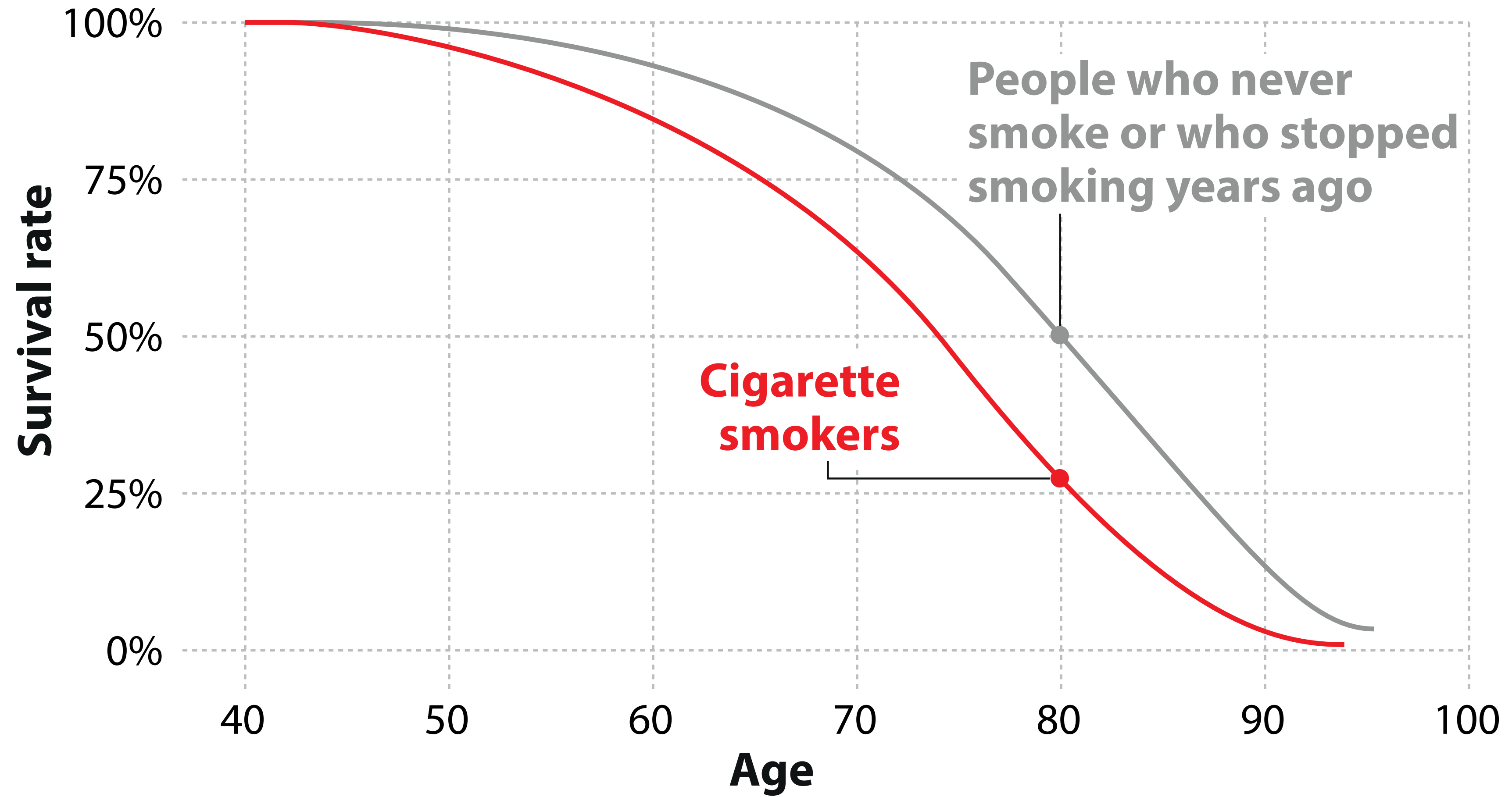
Smoking cigarettes can help you live longer??

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Be careful with amalgamation paradoxes and with the ecological fallacy



Be careful with amalgamation paradoxes and with the ecological fallacy

## Challenge 6

# RATIONALIZATION

Human intelligence didn't evolve to unveil the inner workings of reality (reason), but to persuade *ourselves* —and others— of the truthfulness of our opinions (rationalization)...

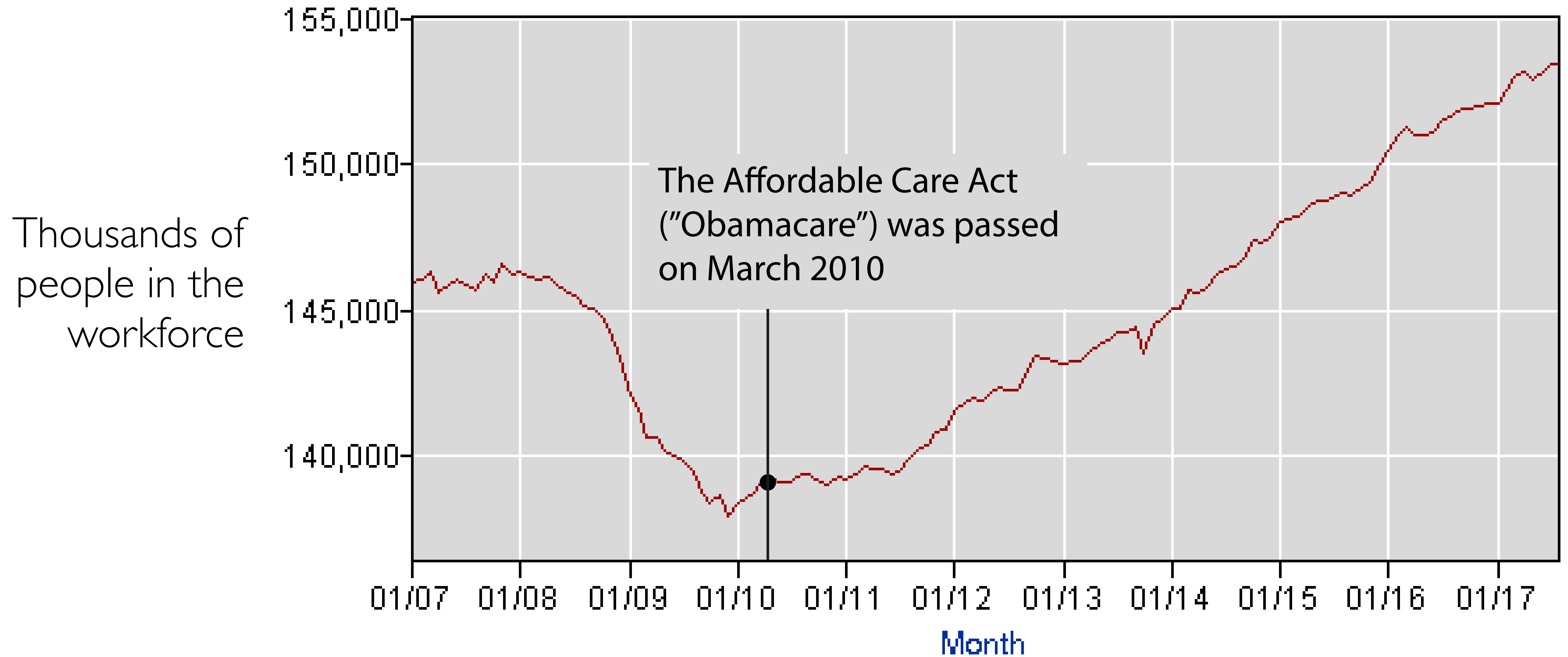
...even leading us to distort information to push our agendas.

HUGO MERCIER • DAN SPERBER

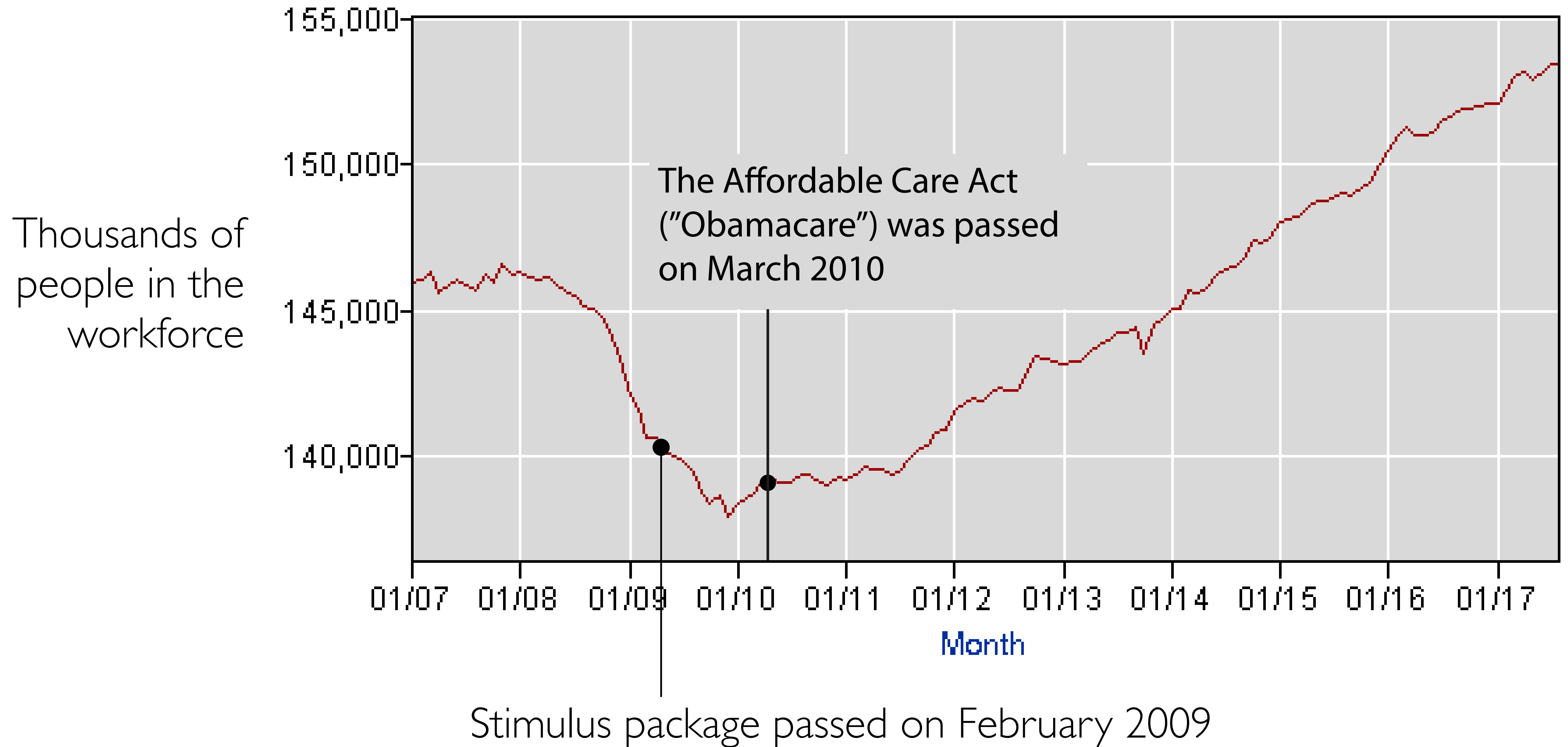
*The Enigma of Reason*



# Liberal pundit: "Obamacare is good for the job market"

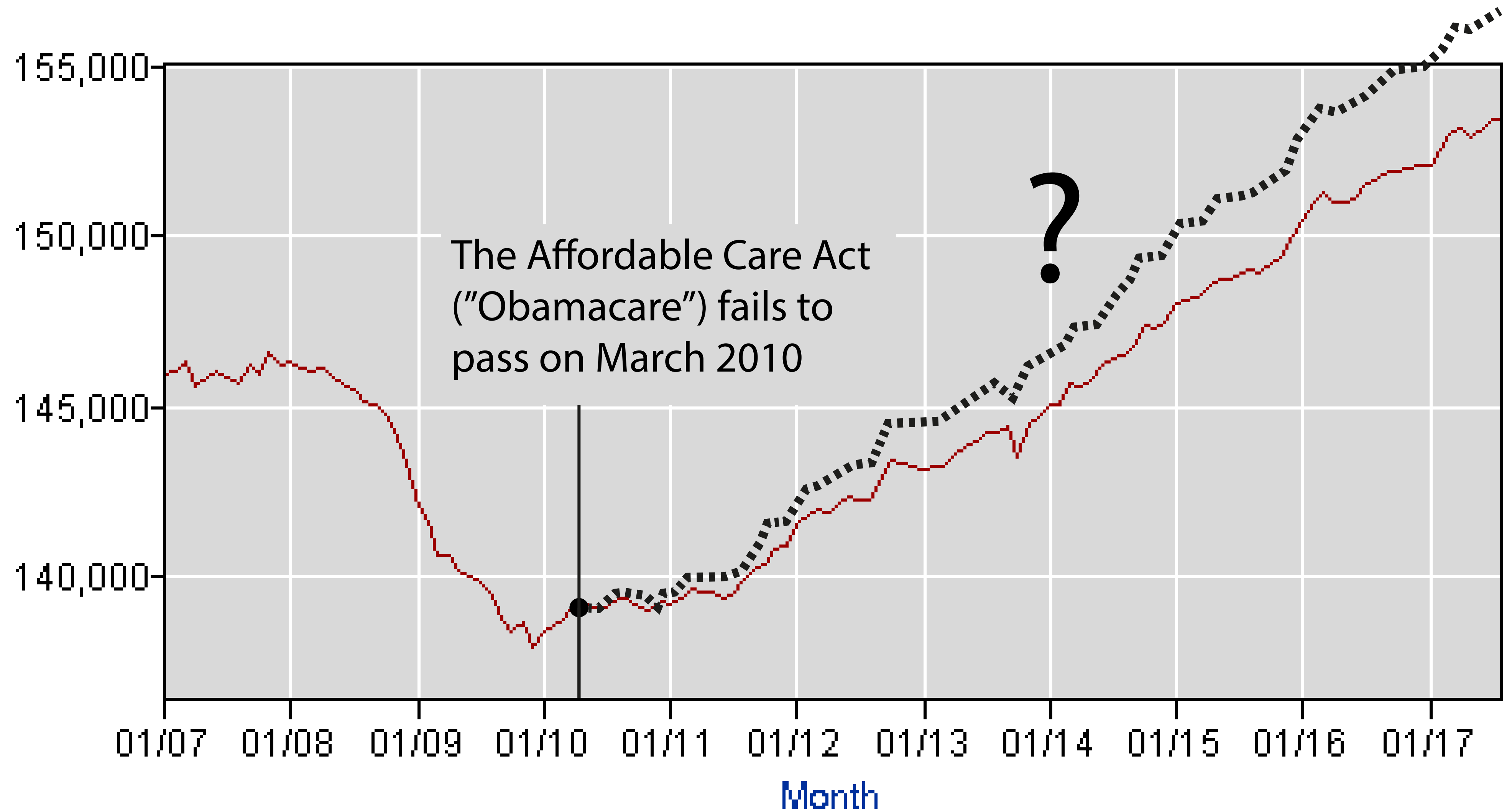


Liberal pundit: "Obamacare is good for the job market"

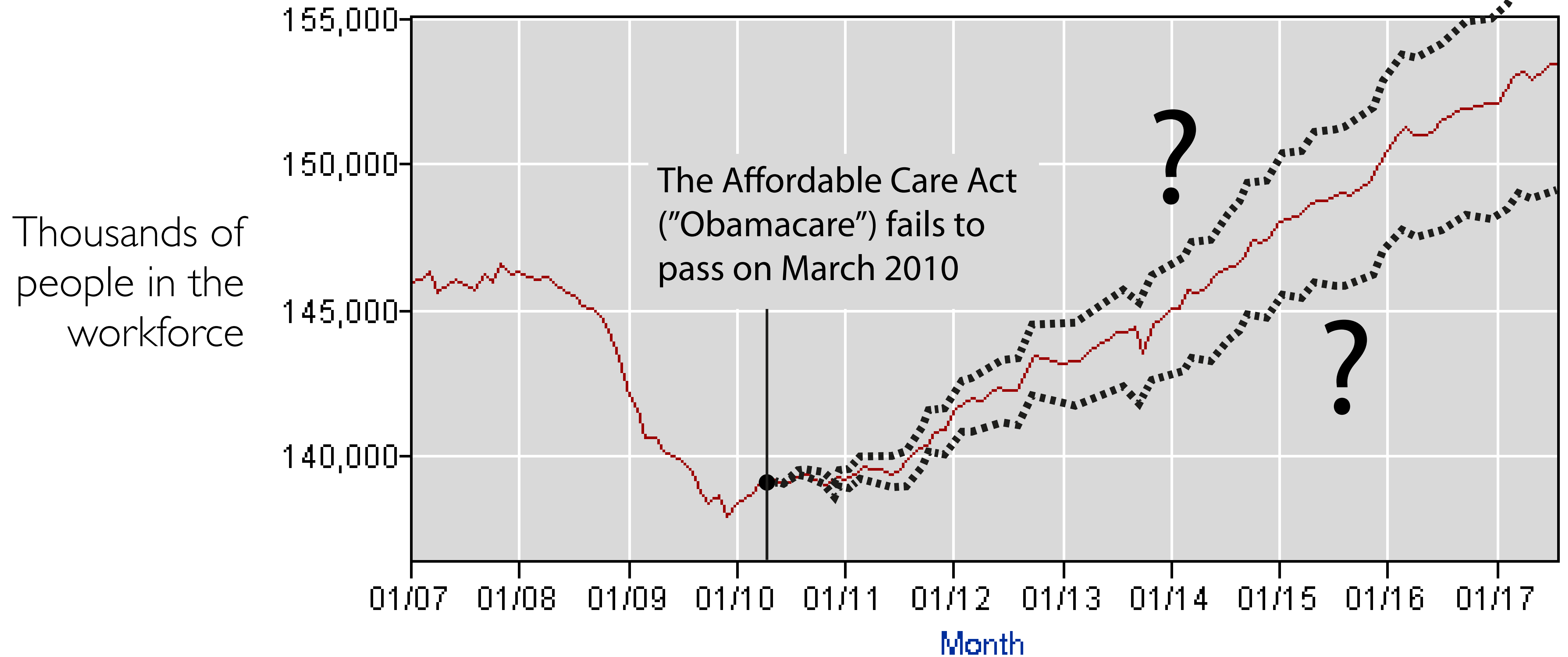


# Skeptical me: But what if Obamacare hadn't passed?

Thousands of people in the workforce



# Skeptical me: But what if Obamacare hadn't passed?





## Challenge 7

# MORAL BLINDNESS

We dislike to be held accountable for the consequences of our actions, including the effects of the information we produce or spread over our personal and online networks.

The Sunday Times top ten bestseller

# Bad Science

Ben Goldacre

"A fine lesson in how to skewer the enemies of reason and the peddlers of cant and half-truths"  
*The Economist*



"You'll laugh your head off, then throw all those expensive health foods in the bin!"  
*Observer, Book of the Year*

INCLUDES A BRILLIANT, SHOCKING AND PREVIOUSLY UNPUBLISHABLE NEW CHAPTER

NEW YORK TIMES BESTSELLER

# naked statistics

STRIPPING THE DREAD FROM THE DATA




"Brilliant, funny ... the best math teacher you never had."  
*—San Francisco Chronicle*

charles wheelan

AUTHOR OF NAKED ECONOMICS

NEW YORK  
TIMES  
BESTSELLER



# How Not to Be Wrong

## The Power of Mathematical Thinking

Jordan Ellenberg



One of BILL GATES's "10 Favorite Books"

# MINDWARE

## TOOLS FOR SMART THINKING

### RICHARD E. NISBETT

“Critical thinking” isn’t enough

# THE ETHICAL DIMENSION



We are all responsible for creating a better  
informational environment.

We are all responsible for **creating a better informational environment.**

Designers, statisticians, scientists, and journalists must create charts to **enable** conversations, not to **hinder** them.

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Readers should think twice before **sharing** charts in social media or by other means.

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**THANK YOU!**

Twitter: **@albertocairo**

Website: **<http://www.thefunctionalart.com>**