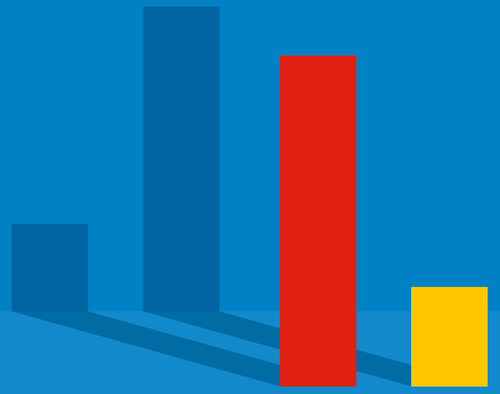
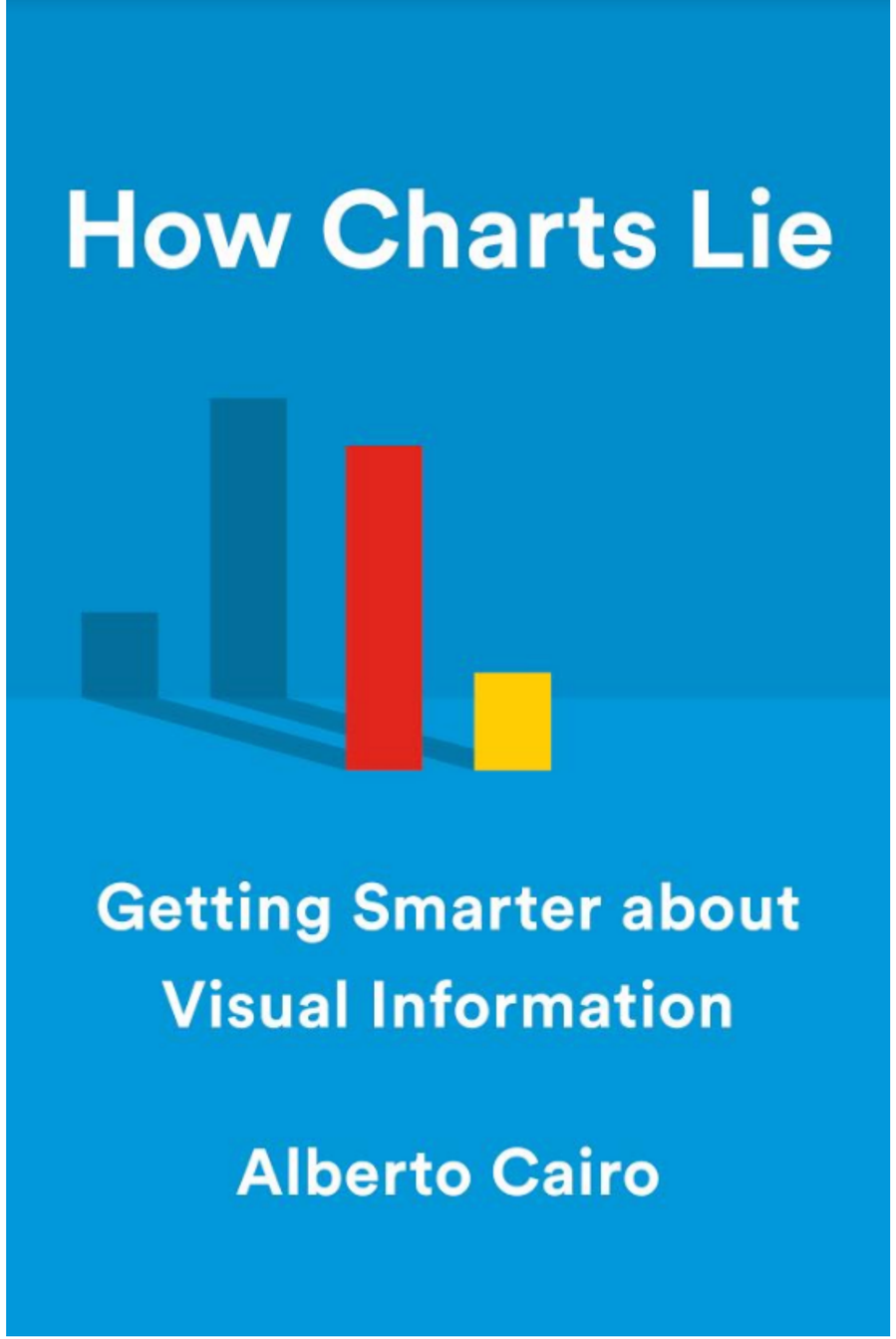
SDSS 2019



what you design
is not what people see

ALBERTO CAIRO



New book to be published by W.W. Norton (October 2019)

To pre-order:

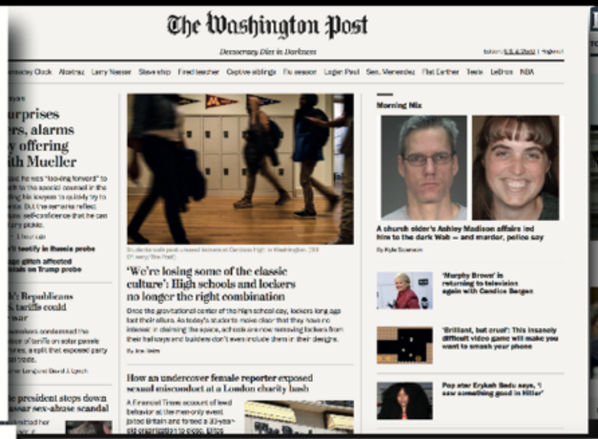
W.W. Norton: https://books.wwnorton.com/books/detail.aspx?ID=4294998829

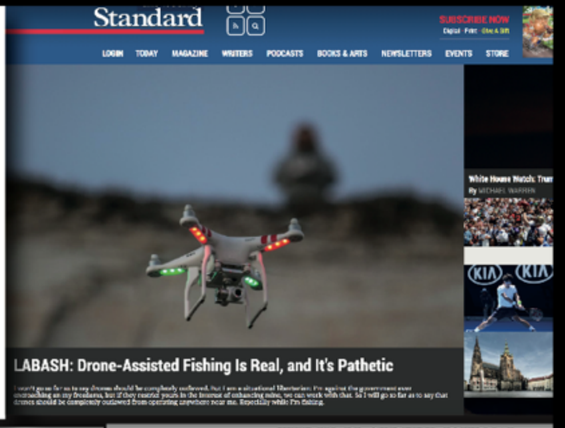
IndieBound: https://www.indiebound.org/book/9781324001560

Barnes&Noble: https://www.barnesandnoble.com/w/how-charts-lie-alberto-cairo/1130420282?ean=9781324001560

Amazon: https://www.amazon.com/How-Charts-Lie-Getting-Information/dp/1324001569/ref=sr_1_1?keywords=how+charts+lie&qid=1551105523&s=gateway&sr=8-1

A golden age of visualization





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

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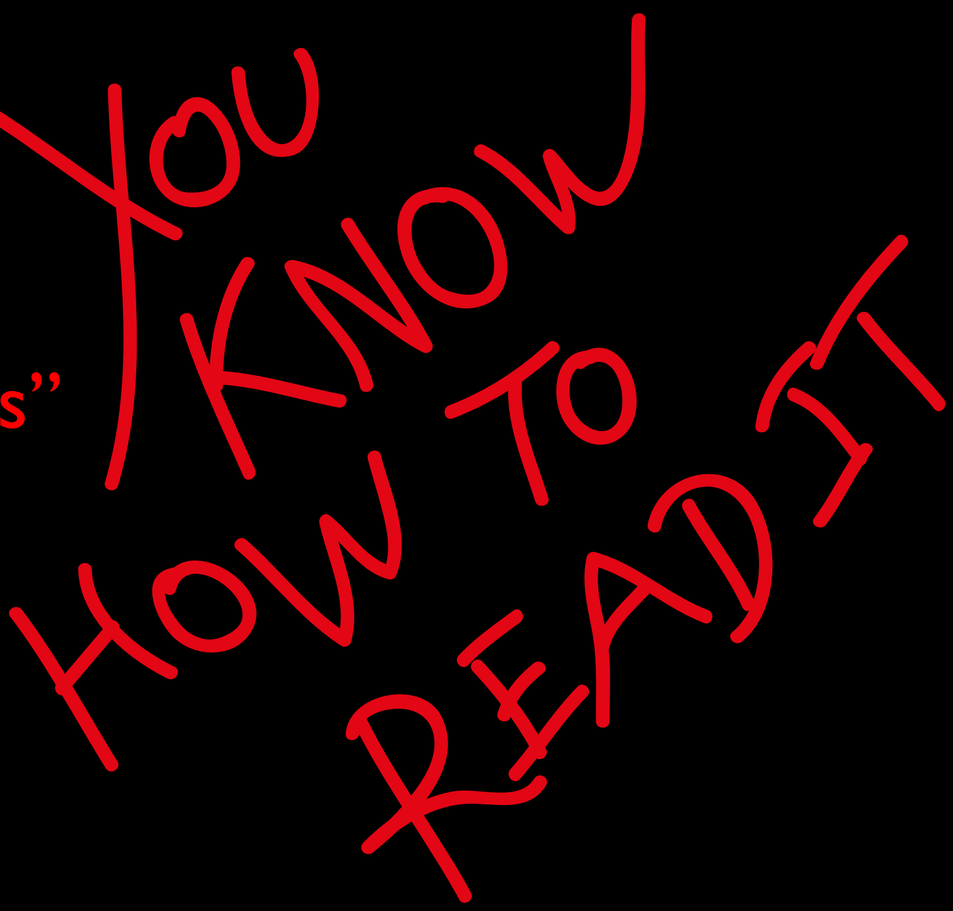
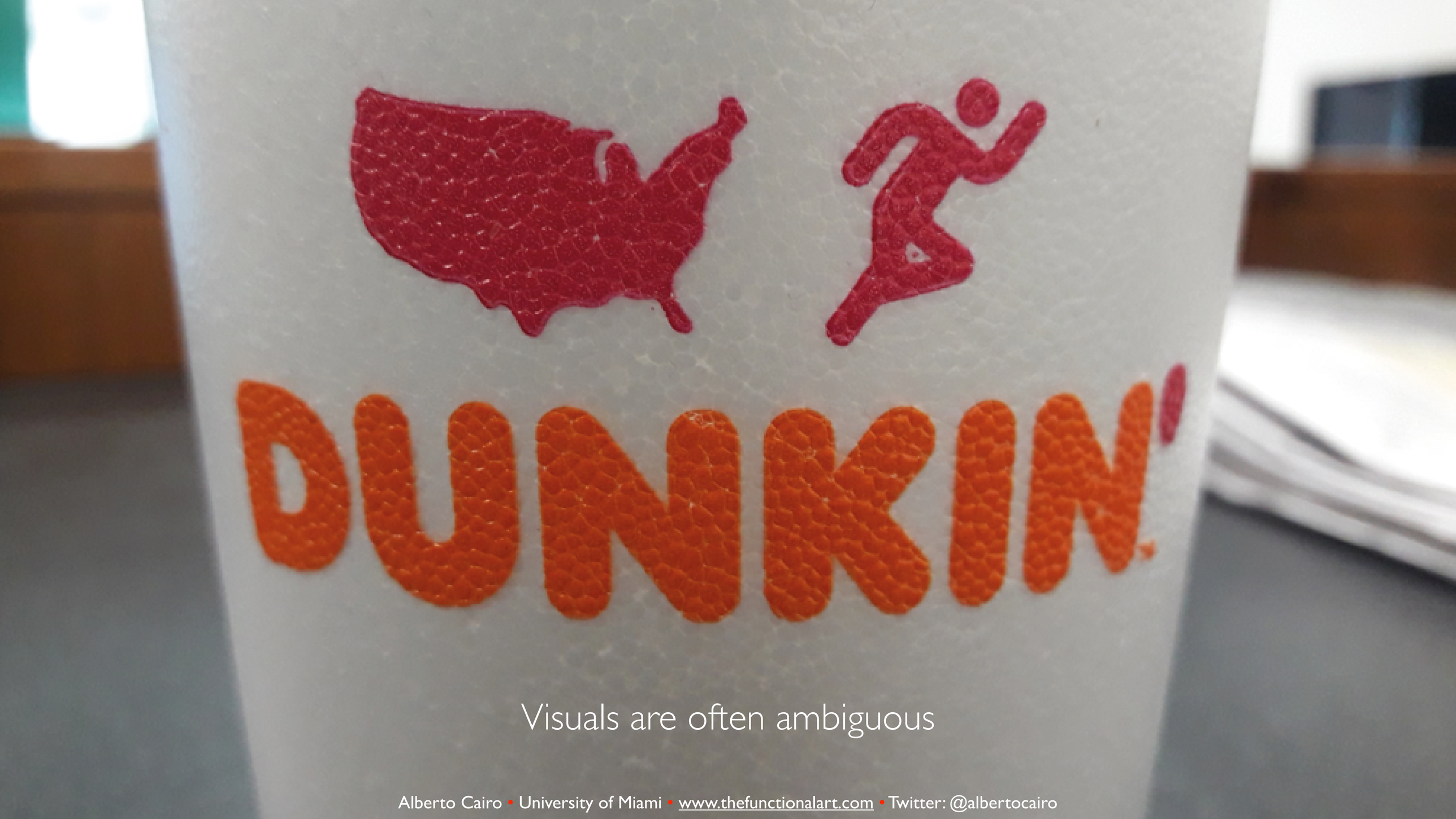
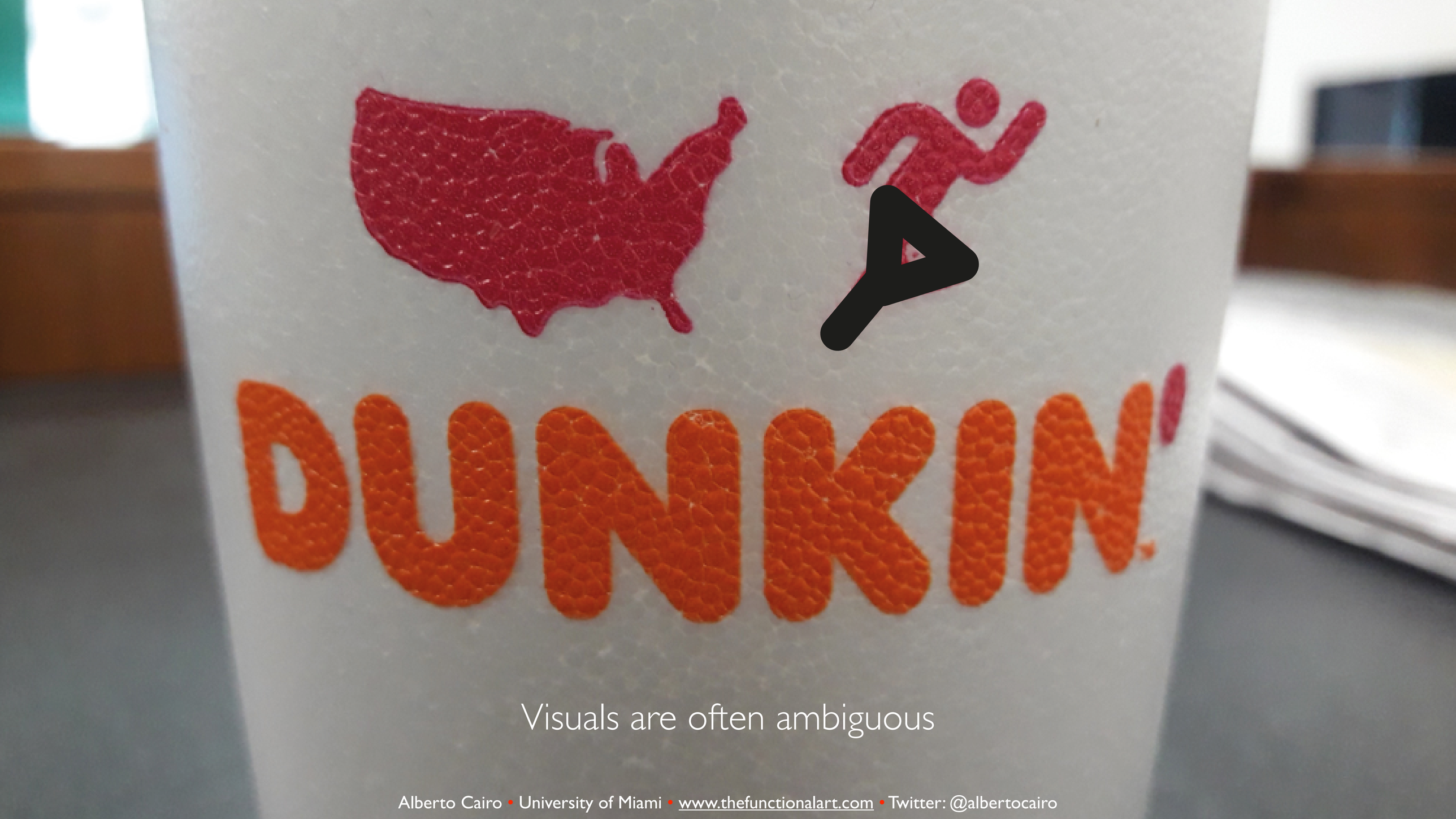


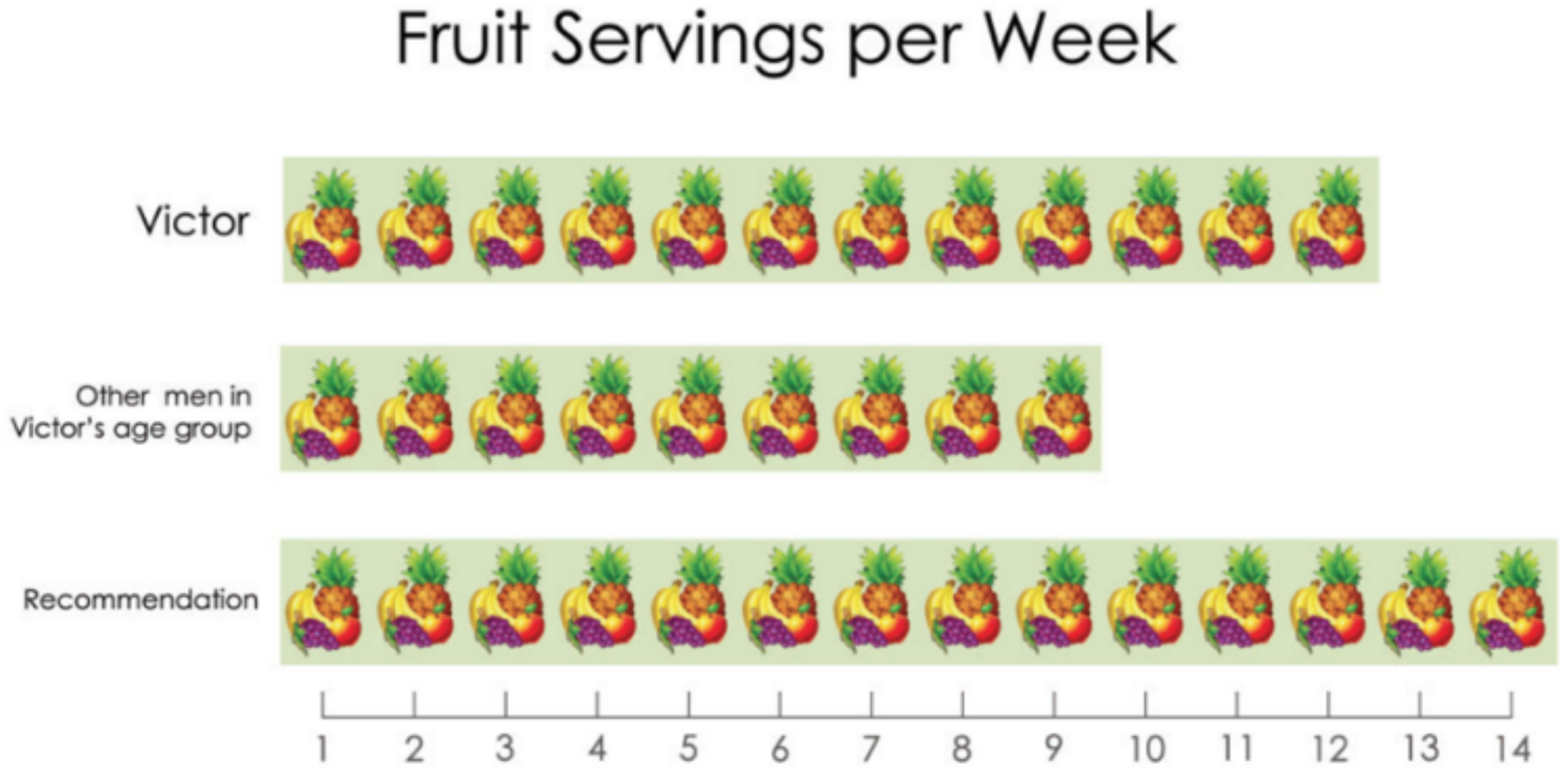


Visuals are often ambiguous



Visuals are often ambiguous

Figure 1: Infographic of Victor's fruit serving consumption per week as compared to that of other men in his age group and to the minimum recommended servings.



Arcia, A. et. al. "Sometimes More Is More: Iterative participatory design of infographics for engagement of community members with varying levels of health literacy." Journal of the American Medical Informatics Association. Jan;23(1):174-83. doi: 10.1093/jamia/ocv079. Epub 2015 Jul 13.

Challenge 1

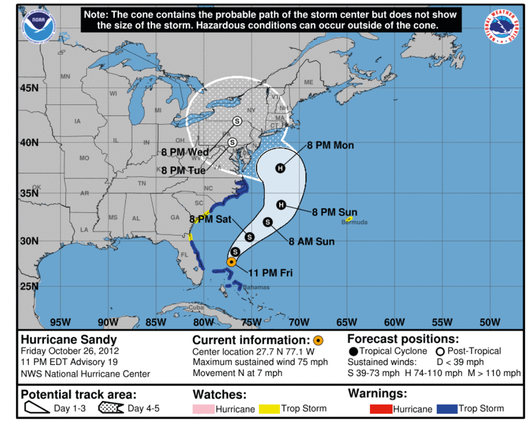
LACK OF SHARED MENTAL MODELS

THE COMPREHENSION GAP

Mental models

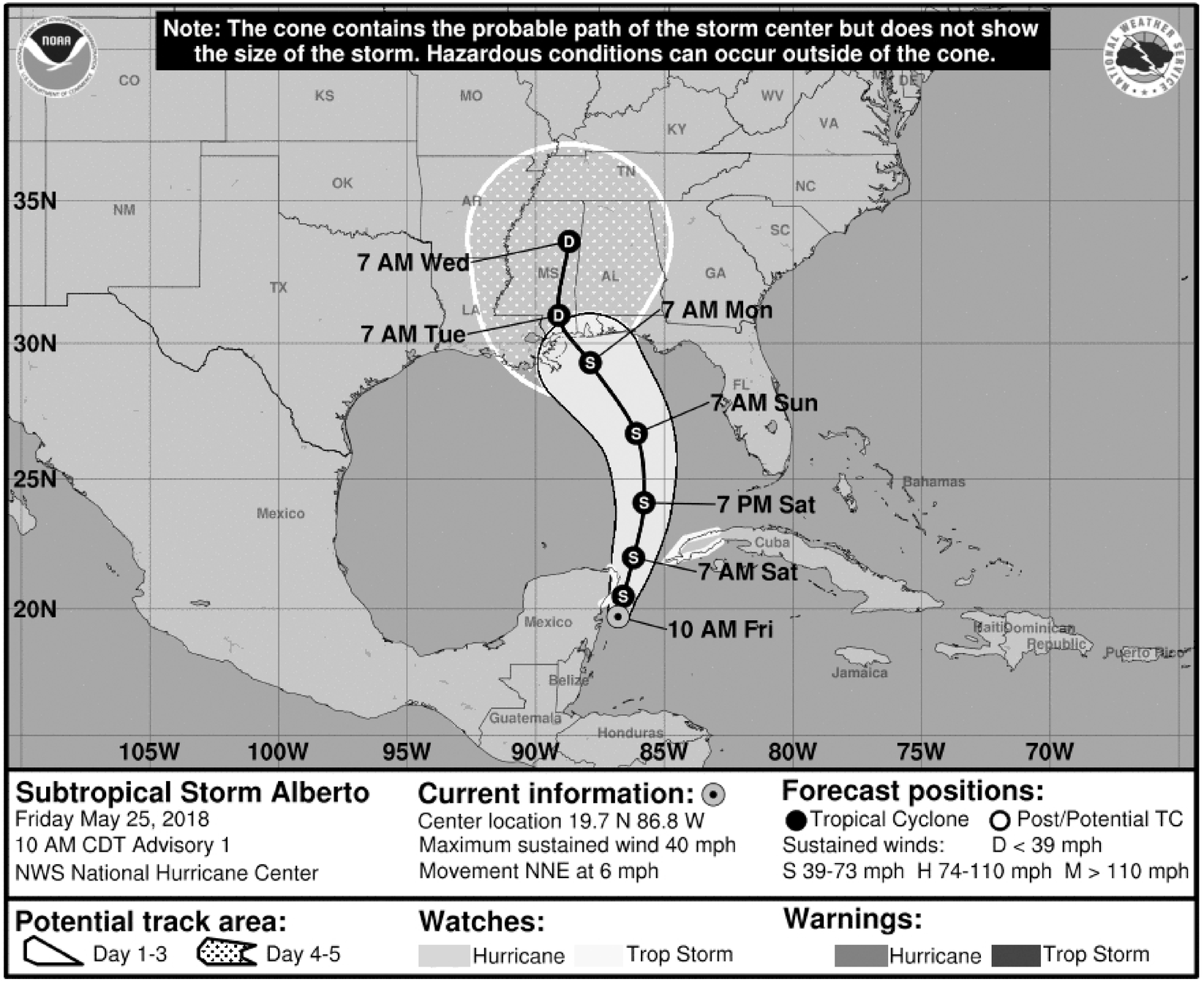
VISUALIZATION DESIGNER

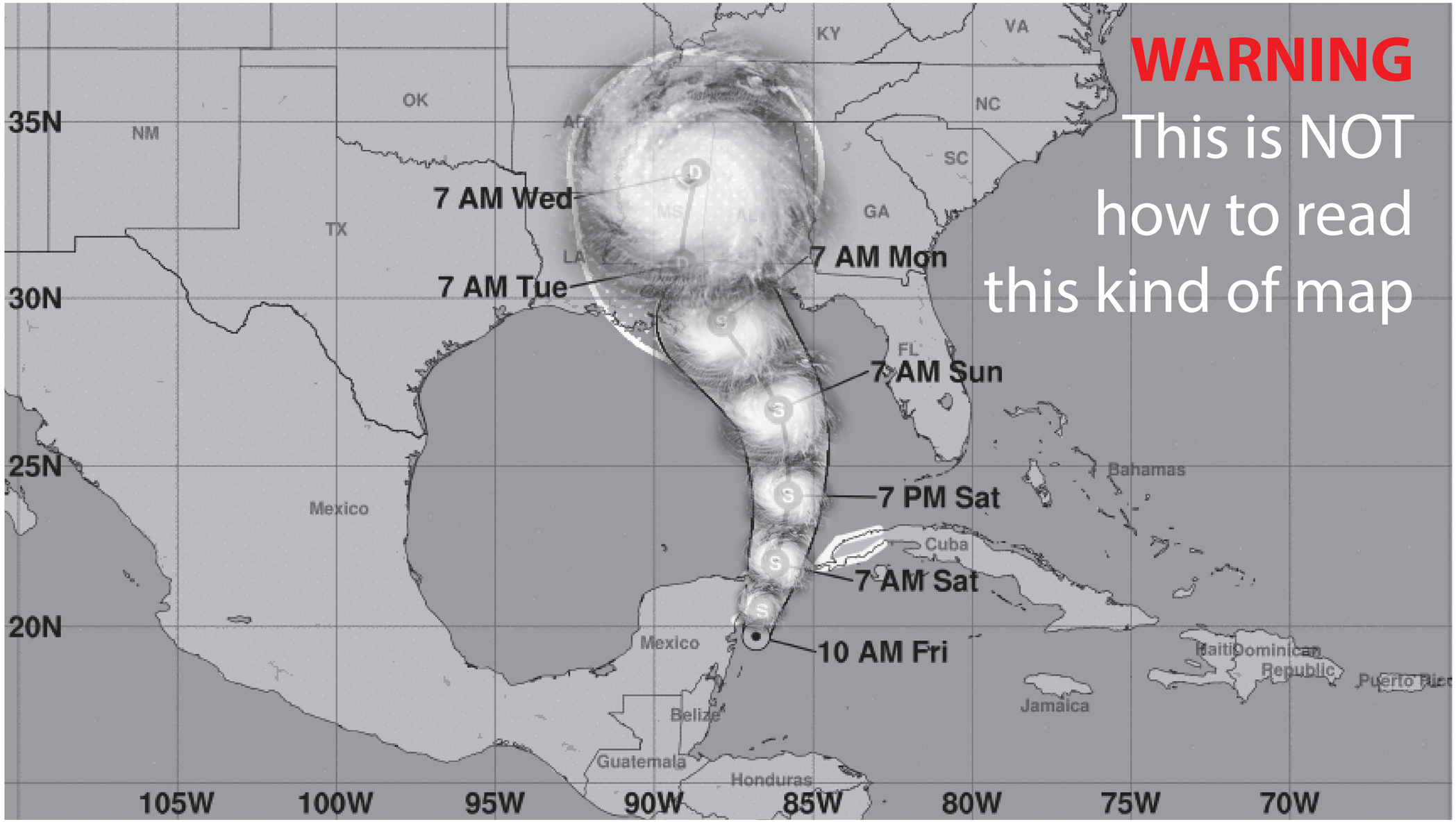
DATA
+
SYMBOLS
+
ENCODINGS
+
ANNOTATIONS
=
VISUALIZATION



Mental models

READER


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.
7 AM Wed
7 AM Tue
7 AM Mon
7 AM Sun
7 PM Sat
7 AM Sat
10 AM Fri
35N
30N
25N
20N
105W
100W
95W
90W
85W
80W
75W
70W
CO
KS
MO
WV
KY
VA
DE
TN
NC
OK
NM
AR
SC
MS
AL
GA
TX
LA
FL
Bahamas
Mexico
Cuba
Haiti
Dominican Republic
Puerto Rico
Jamaica
Belize
Guatemala
Honduras
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


WARNING
This is NOT
how to read
this kind of map
7 AM Wed
7 AM Tue
7 AM Mon
7 AM Sun
7 PM Sat
7 AM Sat
10 AM Fri
35N
30N
25N
20N
105W
100W
95W
90W
85W
80W
75W
70W
KY
VA
NC
SC
GA
FL
OK
NM
TX
LA
MS
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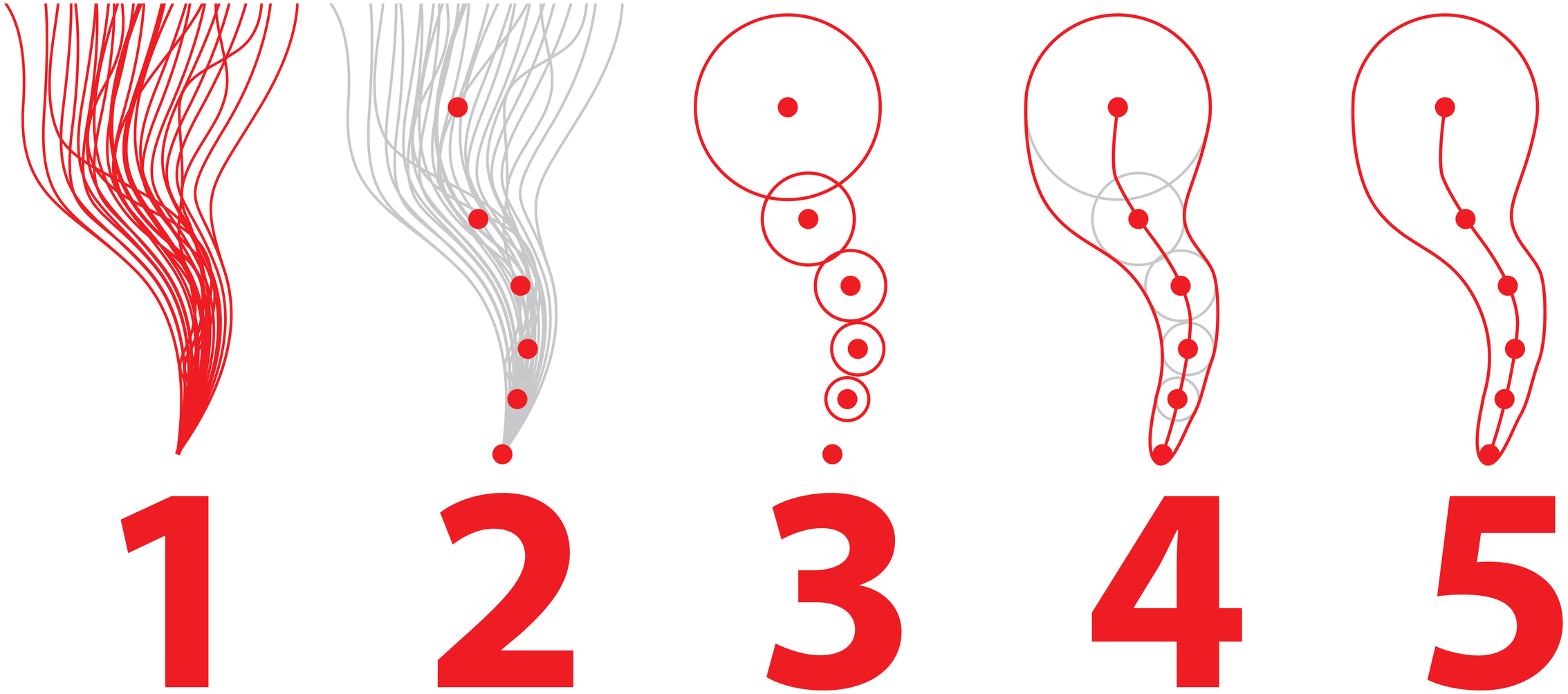
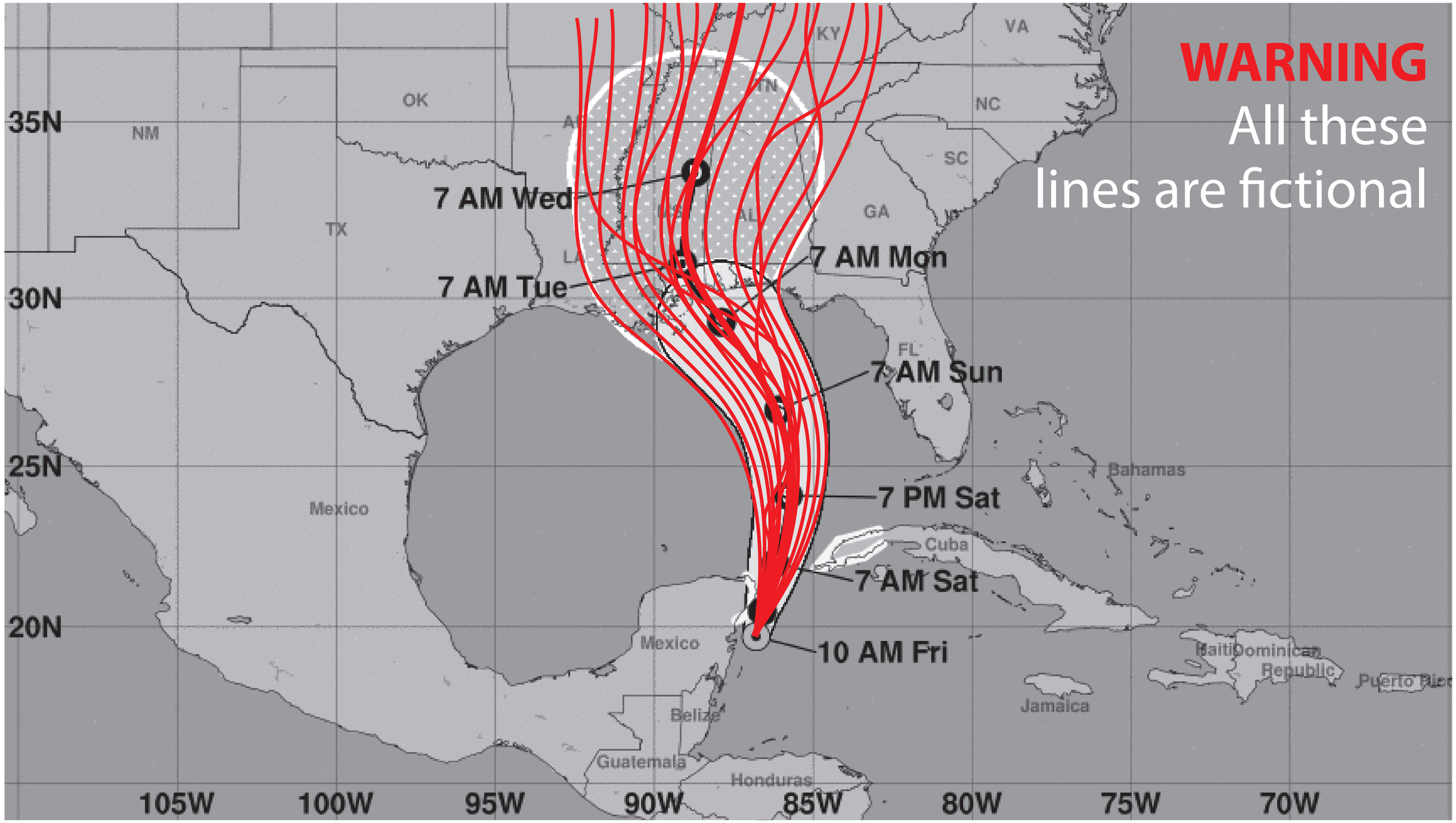
Mexico
Cuba
Bahamas
Jamaica
Haiti
Dominican Republic
Belize
Guatemala
Honduras


1
2
3
4
5


WARNING
All these lines are fictional
7 AM Wed
7 AM Tue
7 AM Mon
7 AM Sun
7 PM Sat
7 AM Sat
10 AM Fri
35N
30N
25N
20N
105W
100W
95W
90W
85W
80W
75W
70W
NM
OK
TX
LA
AR
MS
AL
TN
KY
VA
NC
SC
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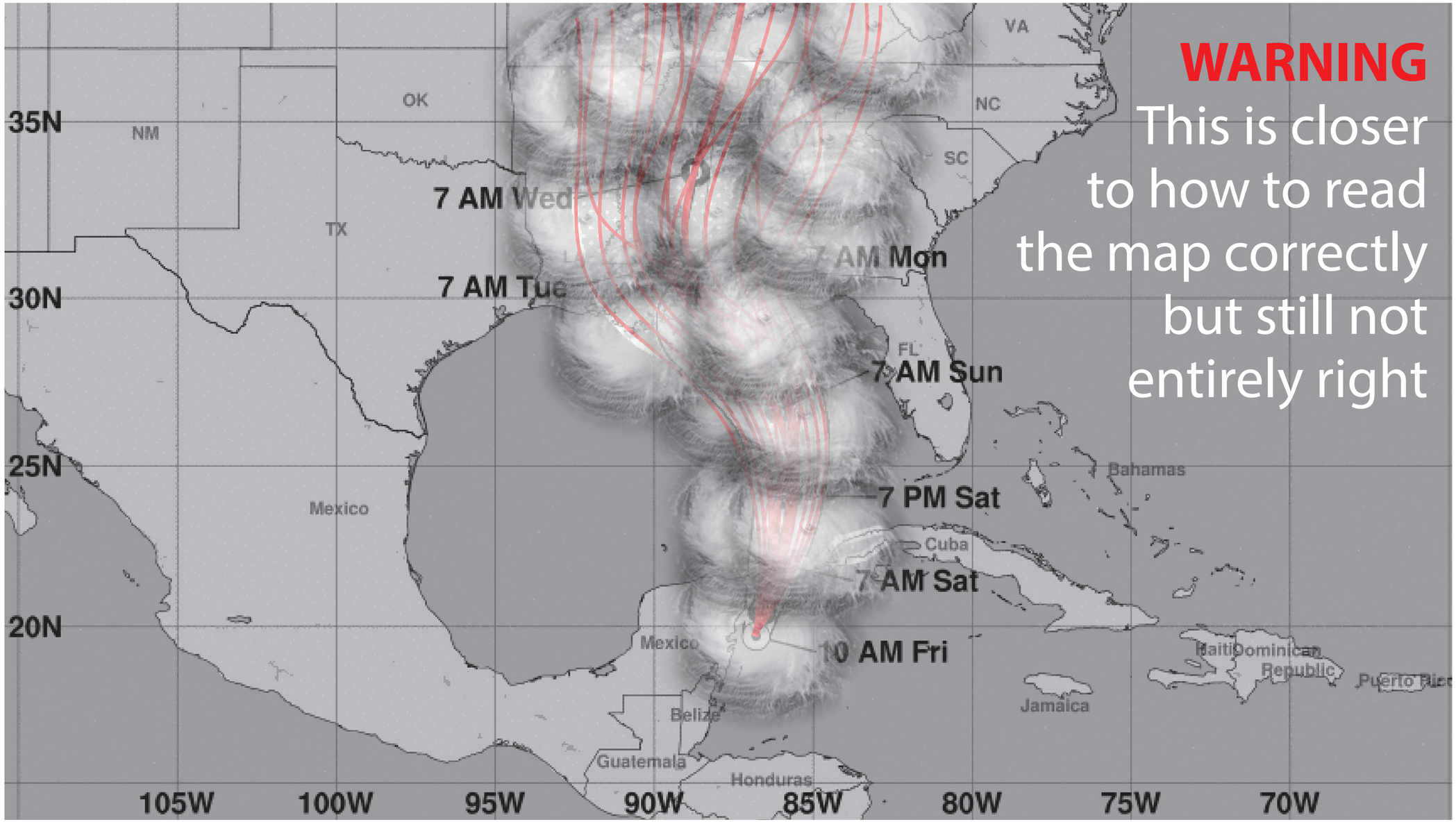
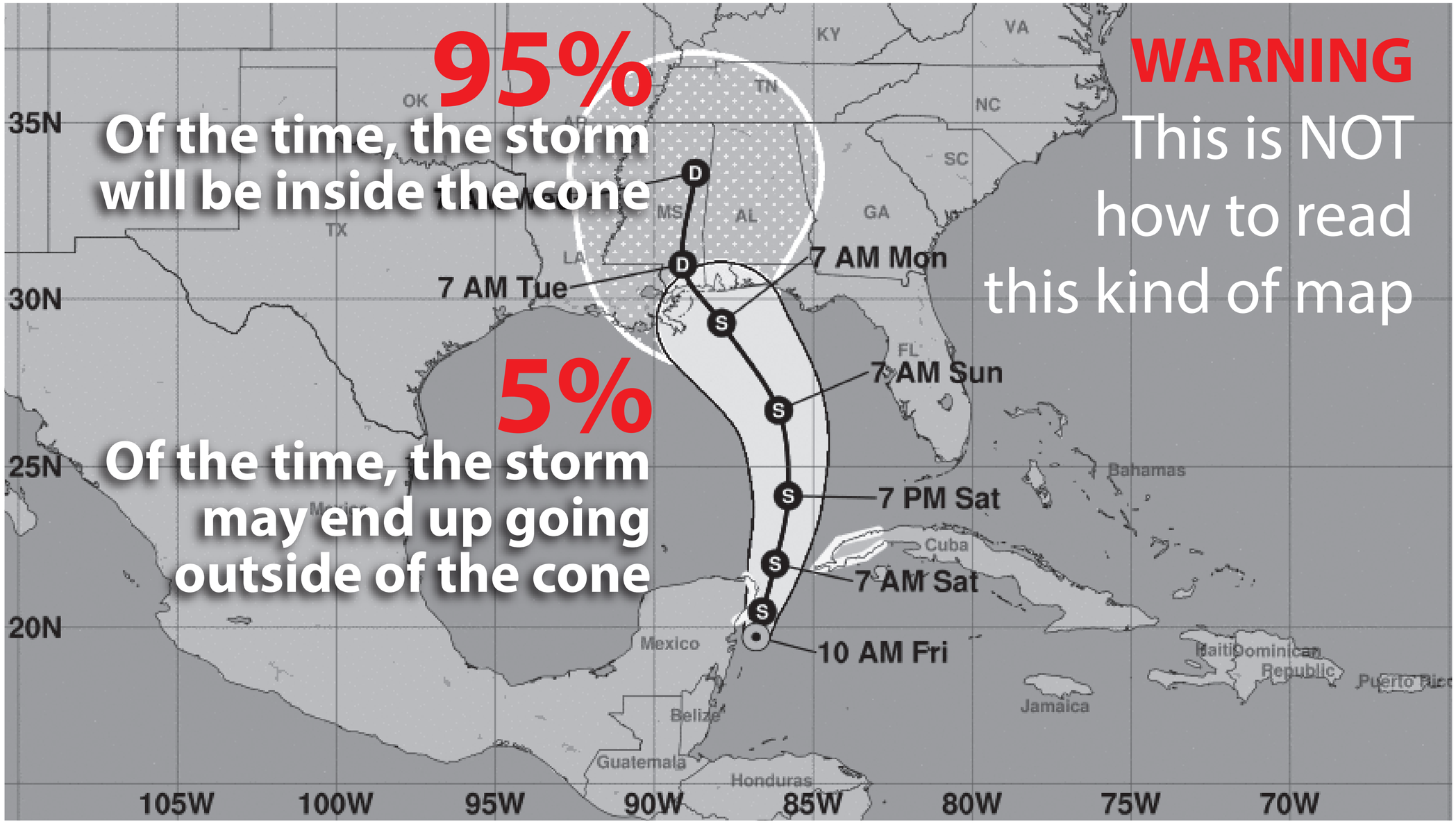
Cuba
Bahamas
Haiti
Dominican Republic
Puerto Rico
Jamaica
Belize
Guatemala
Honduras


WARNING
This is closer to how to read the map correctly but still not entirely right
35N
30N
25N
20N
105W
100W
95W
90W
85W
80W
75W
70W
NM
OK
TX
VA
NC
SC
FL
Mexico
Cuba
Bahamas
Haiti
Dominican Republic
Puerto Rico
Jamaica
Belize
Guatemala
Honduras
7 AM Wed
7 AM Tue
7 AM Mon
7 AM Sun
7 PM Sat
7 AM Sat
10 AM Fri


95%
Of the time, the storm will be inside the cone
5%
Of the time, the storm may end up going outside of the cone
WARNING
This is NOT how to read this kind of map
7 AM Tue
7 AM Mon
7 AM Sun
7 PM Sat
7 AM Sat
10 AM Fri
35N
30N
25N
20N
105W
100W
95W
90W
85W
80W
75W
70W
KY
VA
TN
NC
SC
OK
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Cuba
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Haiti
Dominican Republic
Puerto Rico
Jamaica
Belize
Guatemala
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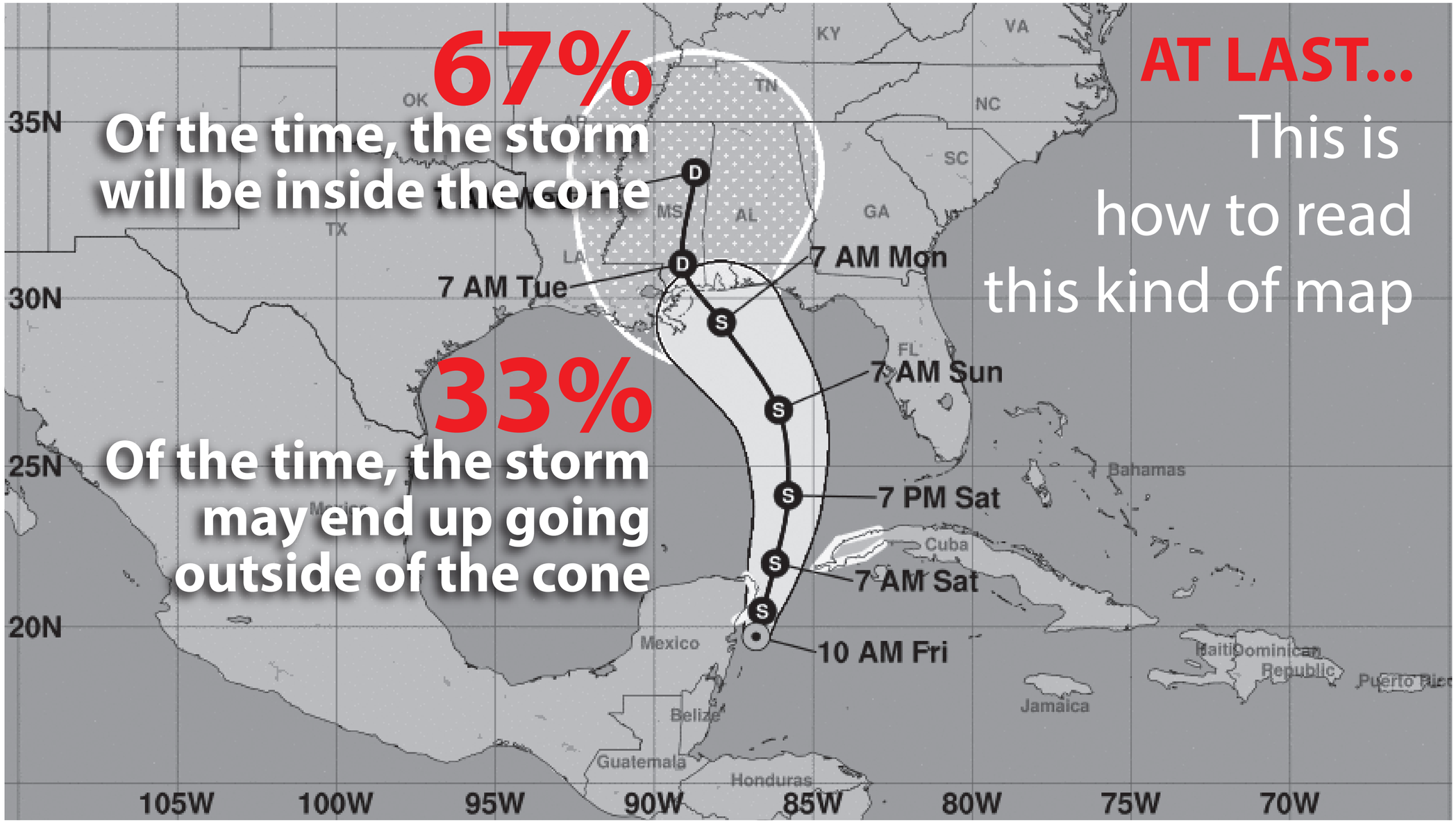
67%
Of the time, the storm will be inside the cone
33%
Of the time, the storm may end up going outside of the cone
AT LAST...
This is how to read this kind of map
7 AM Tue
7 AM Mon
7 AM Sun
7 PM Sat
7 AM Sat
10 AM Fri
35N
30N
25N
20N
105W
100W
95W
90W
85W
80W
75W
70W
KY
VA
TN
NC
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OK
MS
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Bahamas
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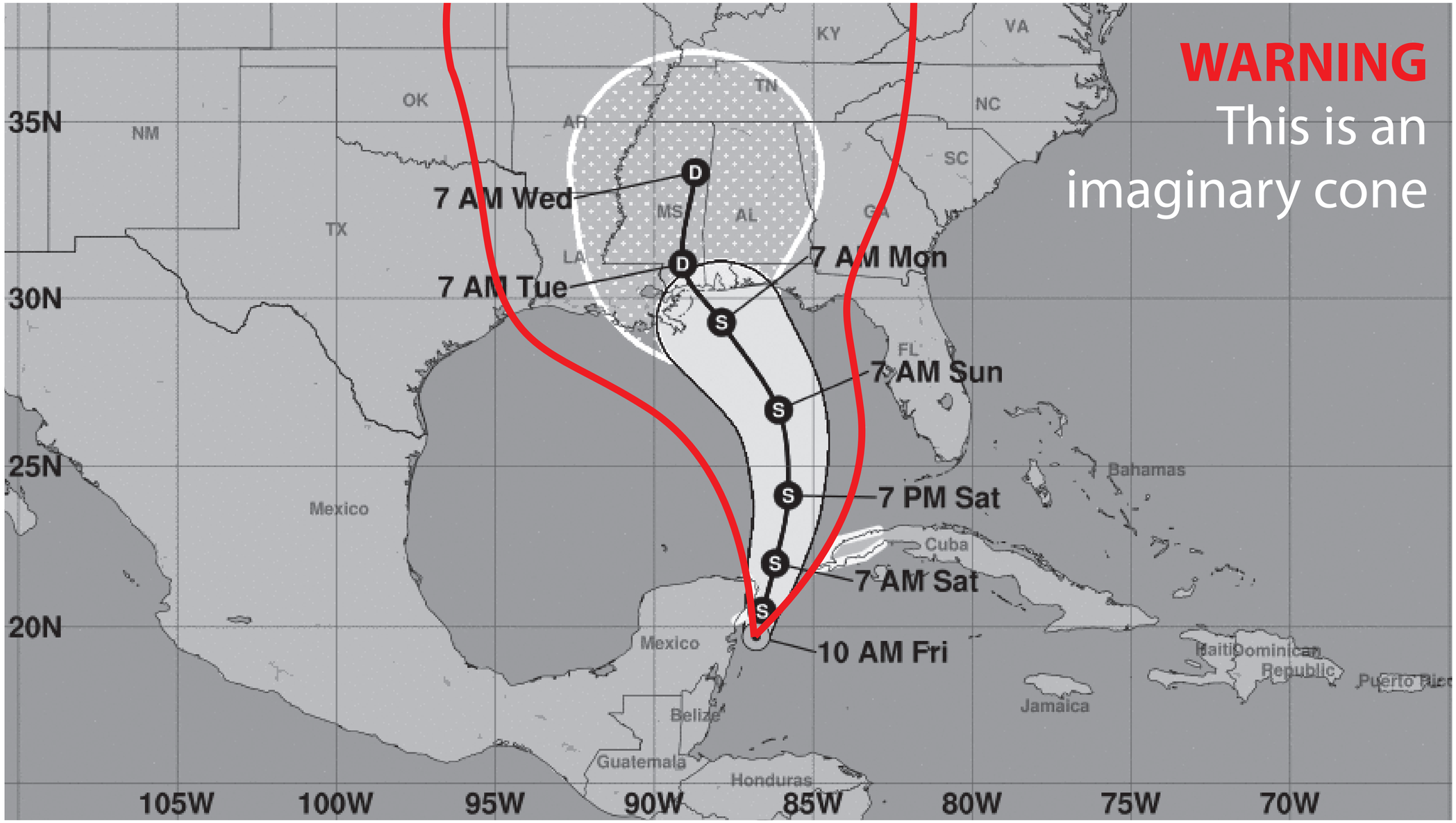
Haiti
Dominican Republic
Puerto Rico
Jamaica
Belize
Guatemala
Honduras


WARNING
This is an imaginary cone
7 AM Wed
7 AM Tue
7 AM Mon
7 AM Sun
7 PM Sat
7 AM Sat
10 AM Fri
35N
30N
25N
20N
105W
100W
95W
90W
85W
80W
75W
70W
KY
VA
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NM
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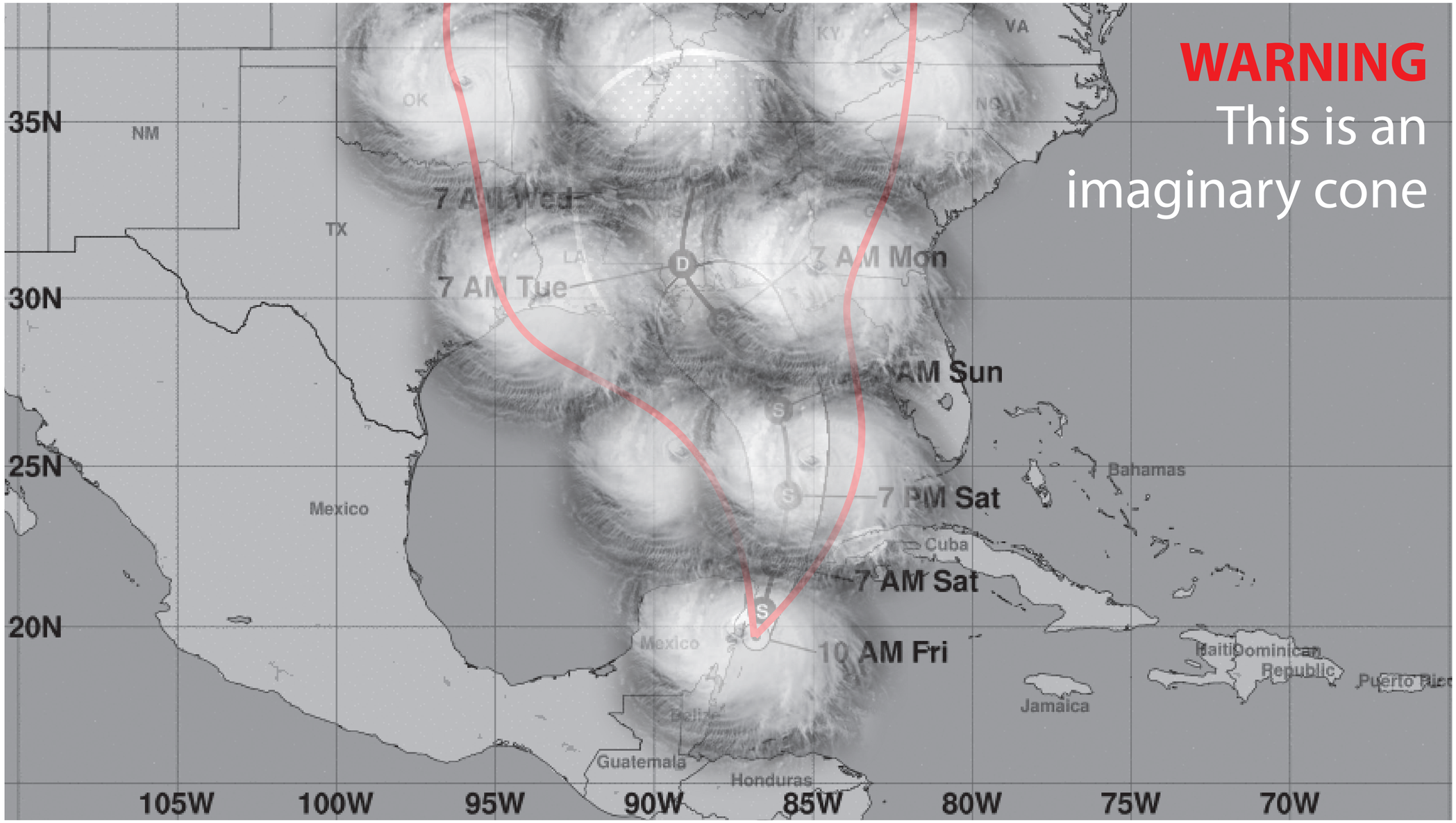
Haiti
Dominican Republic
Puerto Rico
Jamaica
Belize
Guatemala
Honduras


WARNING
This is an imaginary cone
7 AM Wed
7 AM Tue
7 AM Mon
AM Sun
7 PM Sat
7 AM Sat
10 AM Fri
35N
30N
25N
20N
105W
100W
95W
90W
85W
80W
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TN
NC
SC
Mexico
Bahamas
Cuba
Jamaica
Haiti
Dominican Republic
Puerto Rico
Guatemala
Honduras

Challenge 2

CONFIRMATION

We constantly see patterns. Once we identify patterns that look meaningful —even if they are just the product of randomness— our brains try to connect them with causal links and shape them as stories. Then, we strive to confirm them, never to challenge them

https://twitter.com/TreyYingst?ref_src=twsrc%5Egoogle%7Ctwcamp%5Eserp%7Ctwgr%5Eauthor

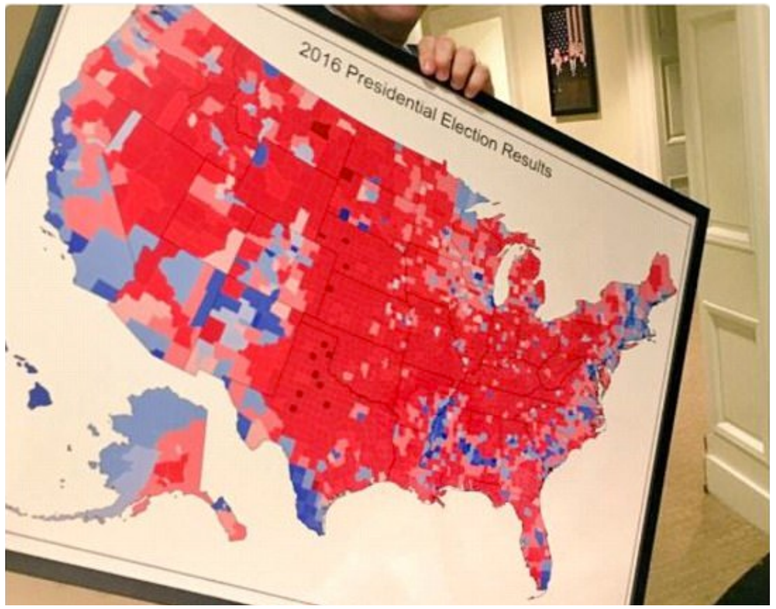
Gideon Resnick @GideonResnick · 32m

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

"Here, you can take that, t**hat's the final map of the numbers**," the Republican president said from his desk in the Oval Office, handing out maps of the United States with areas he won marked in red. "It's pretty good, right? T**he red is obviously us**."

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

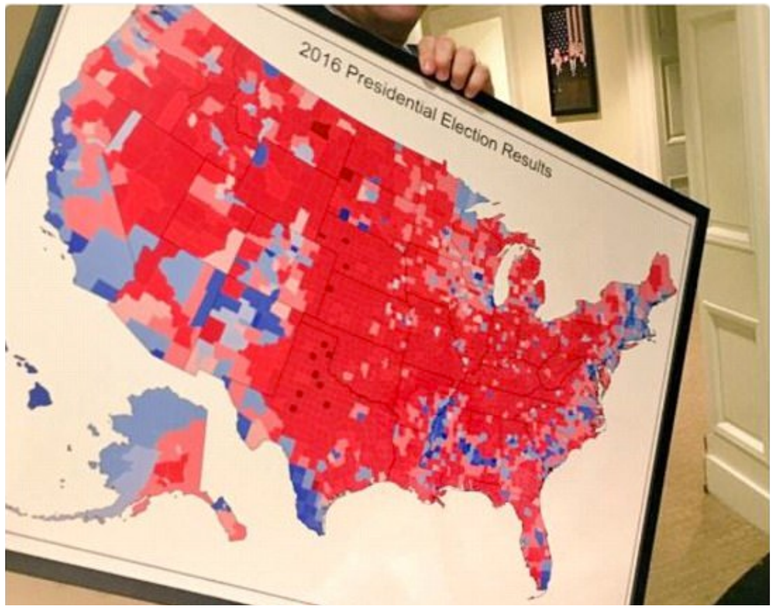


Surface on the
county-level map:

Red: 80%

Blue: 20%

VICTORY BY A LANDSLIDE!!!!!!

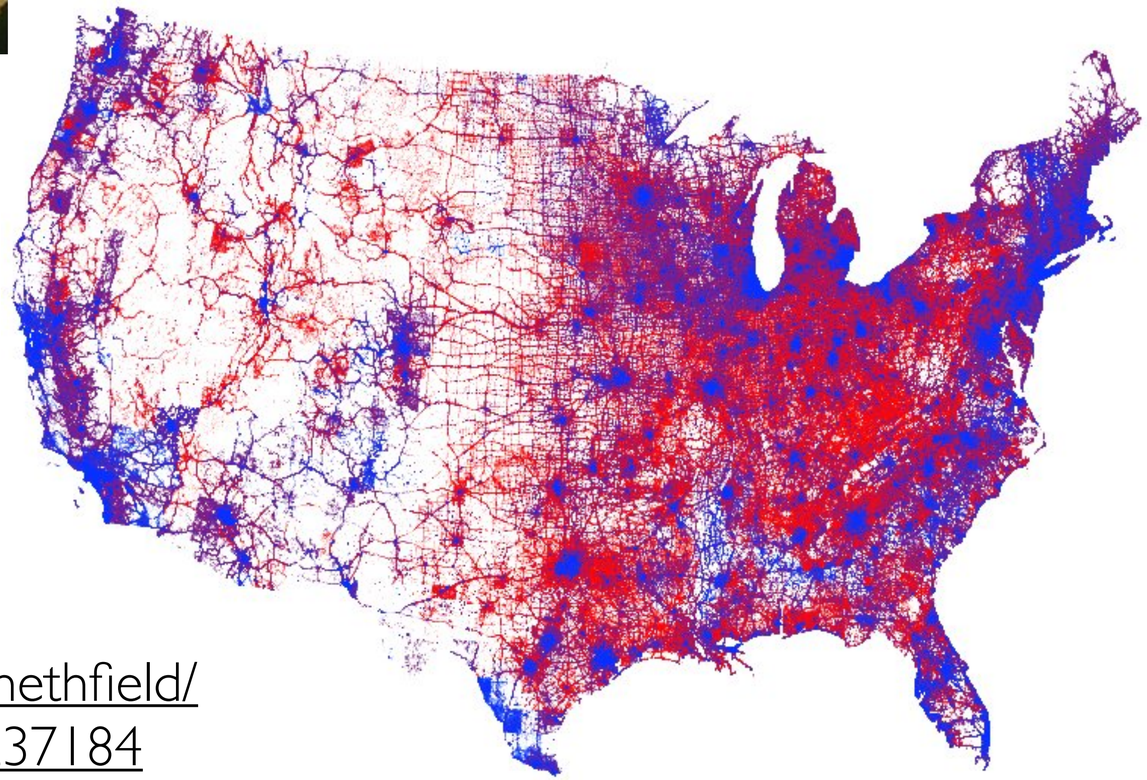


Surface on the
county-level map:

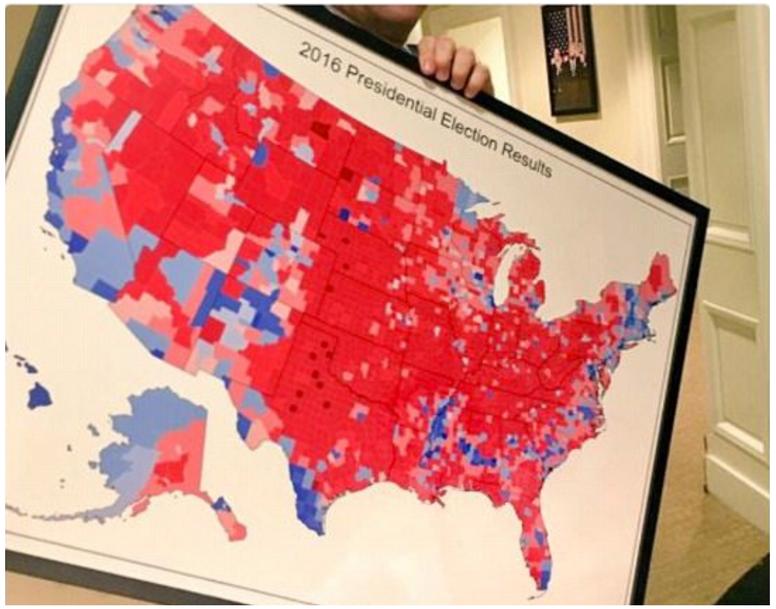
Red: 80%

Blue: 20%

VICTORY BY A LANDSLIDE???



Map by Kenneth Field
https://twitter.com/kennethfield/status/970827334038237184



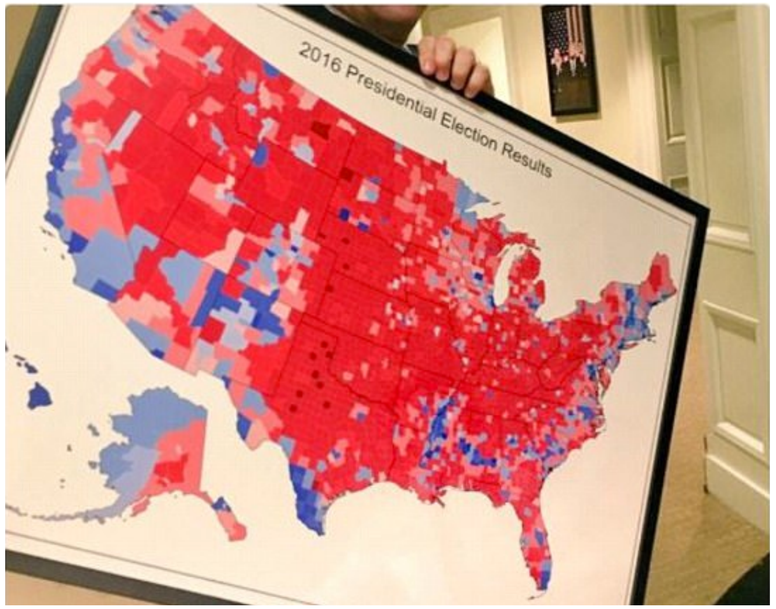
Surface on the county-level map:

Red: 80%

Blue: 20%

SHARE OF THE POPULAR VOTE IN THE 2016 PRESIDENTIAL ELECTION

Donald Trump	**46.1%**	62,984,825 votes
Hillary Clinton	**48.2%**	65,853,516 votes
Other candidates	**5.7%**	



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Donald Trump	**46.1%**	62,984,825 votes
Hillary Clinton	**48.2%**	65,853,516 votes
Other candidates	**5.7%**	

PERCENTAGE OF ELIGIBLE VOTERS

Didn't vote	**40.0%**
Voted for Donald Trump	**27.7%**
Voted for Hillary Clinton	**28.9%**
Voted for other candidates	**3.4%**

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

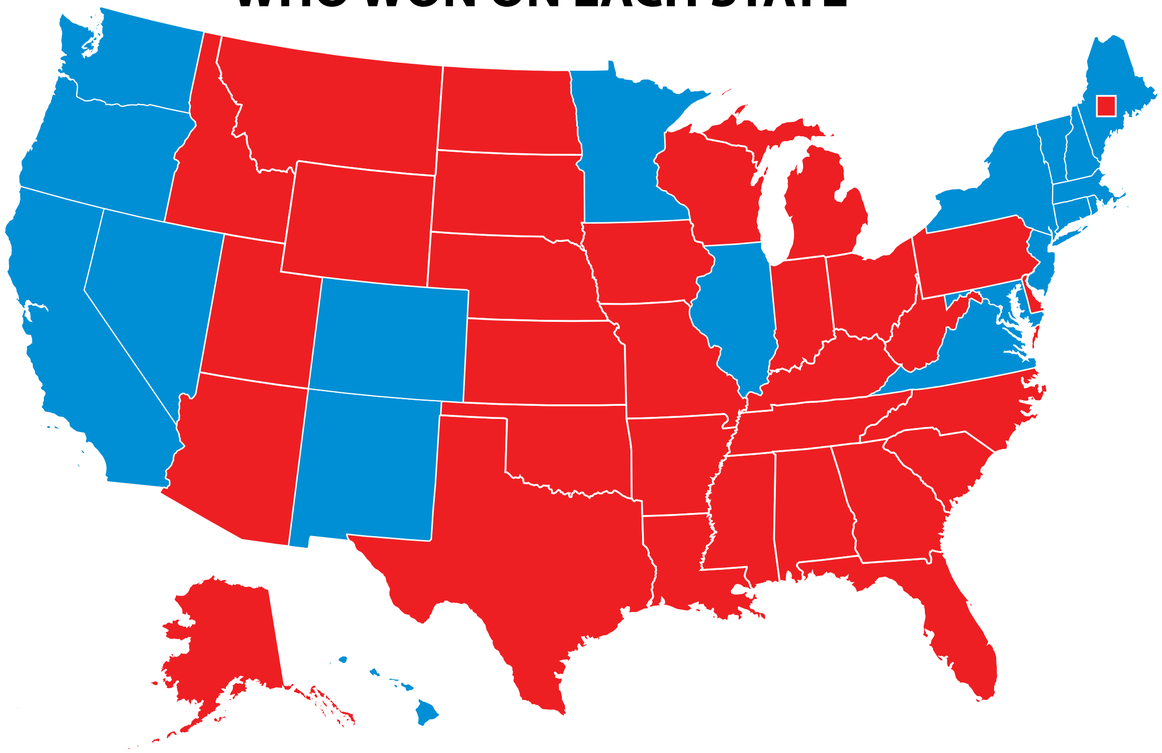
ELECTORAL VOTES

TRUMP
304

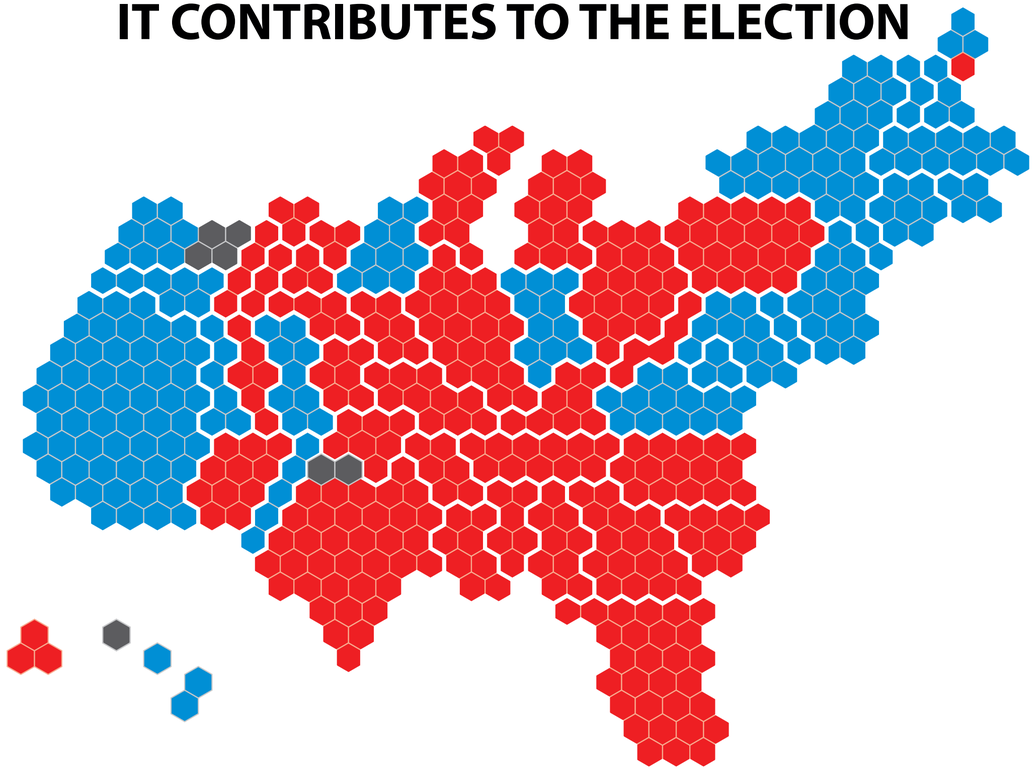
Other: 7

CLINTON
227

WHO WON ON EACH STATE



STATE SIZE ADJUSTED BY ELECTORAL VOTES IT CONTRIBUTES TO THE ELECTION

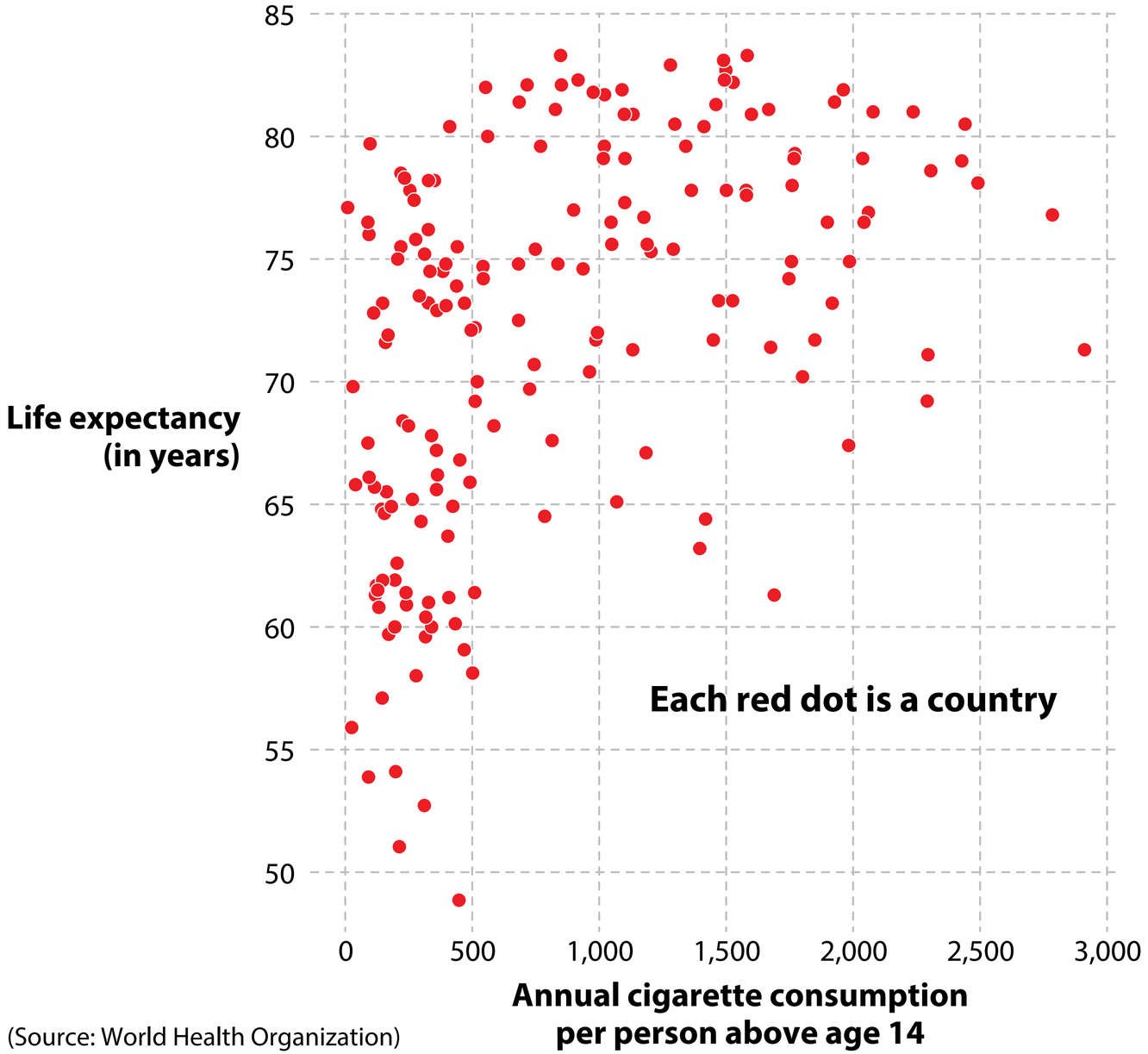


Alberto Cairo • University of Miami • www.thefunctionalart.com • Twitter: @albertocairo

Challenge 3

INCORRECT (MENTAL) DESCRIPTIONS

The way we describe the content of a chart to
ourselves may bias our understanding of that chart

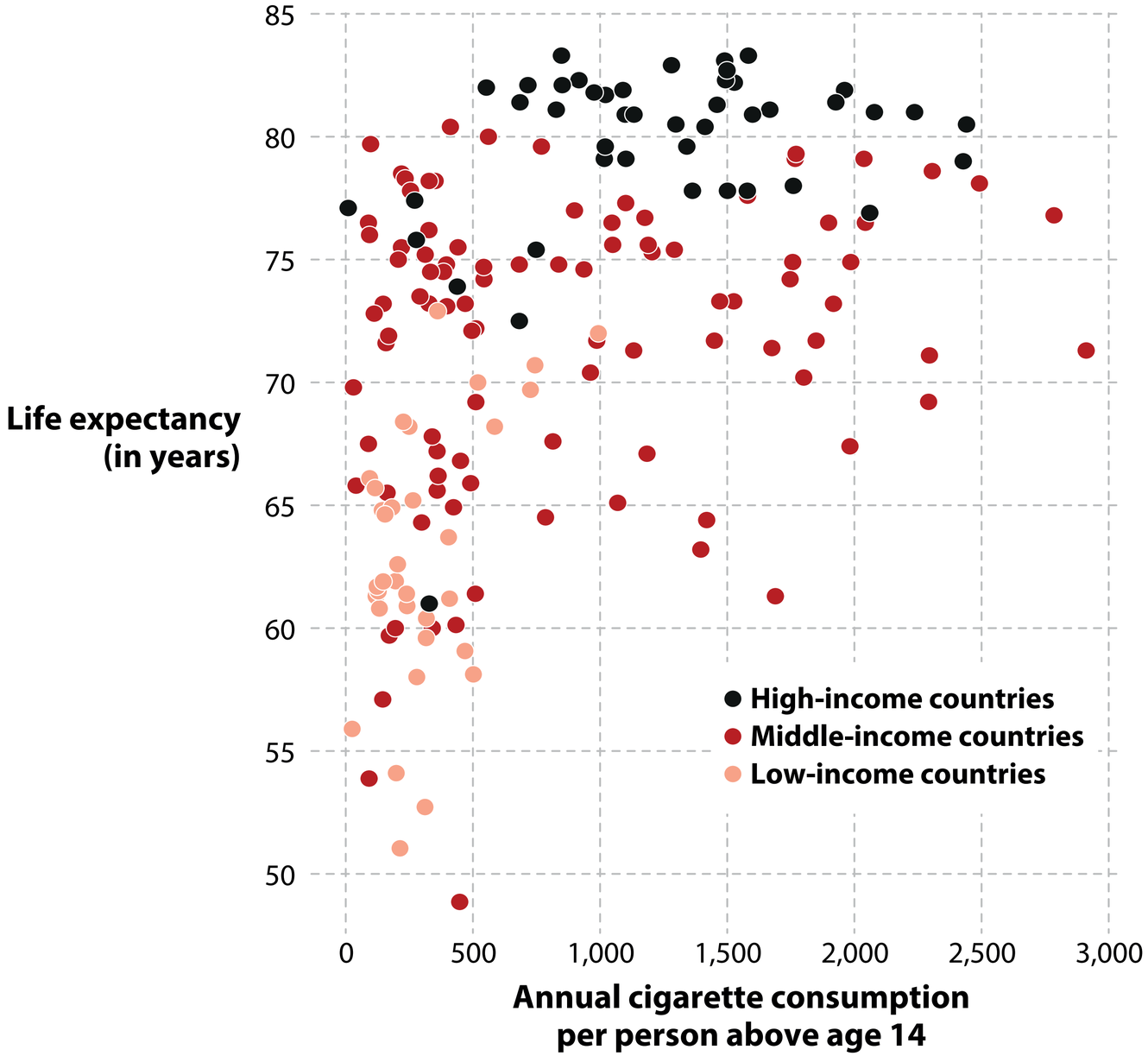


(Source: World Health Organization)

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



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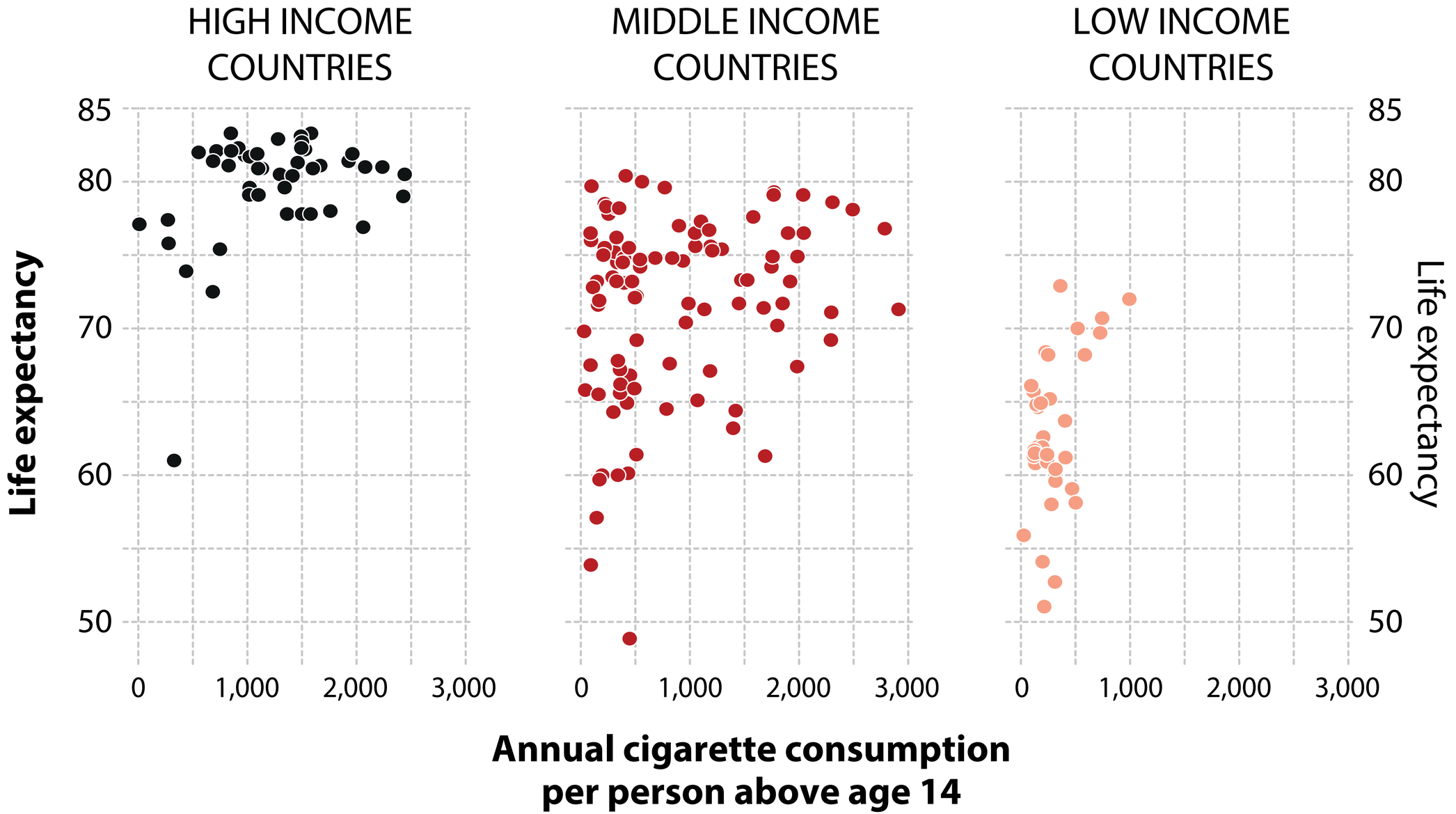
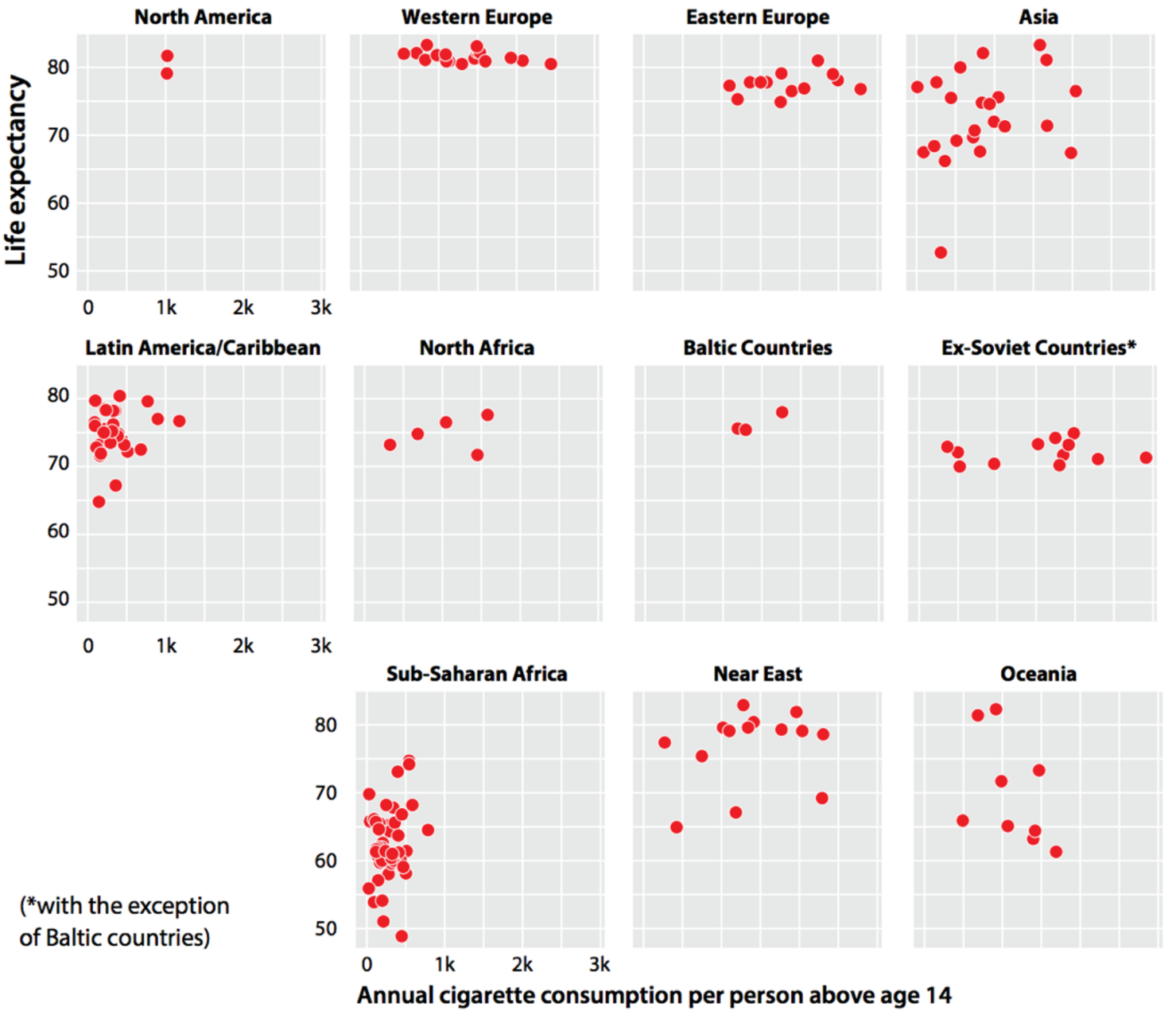
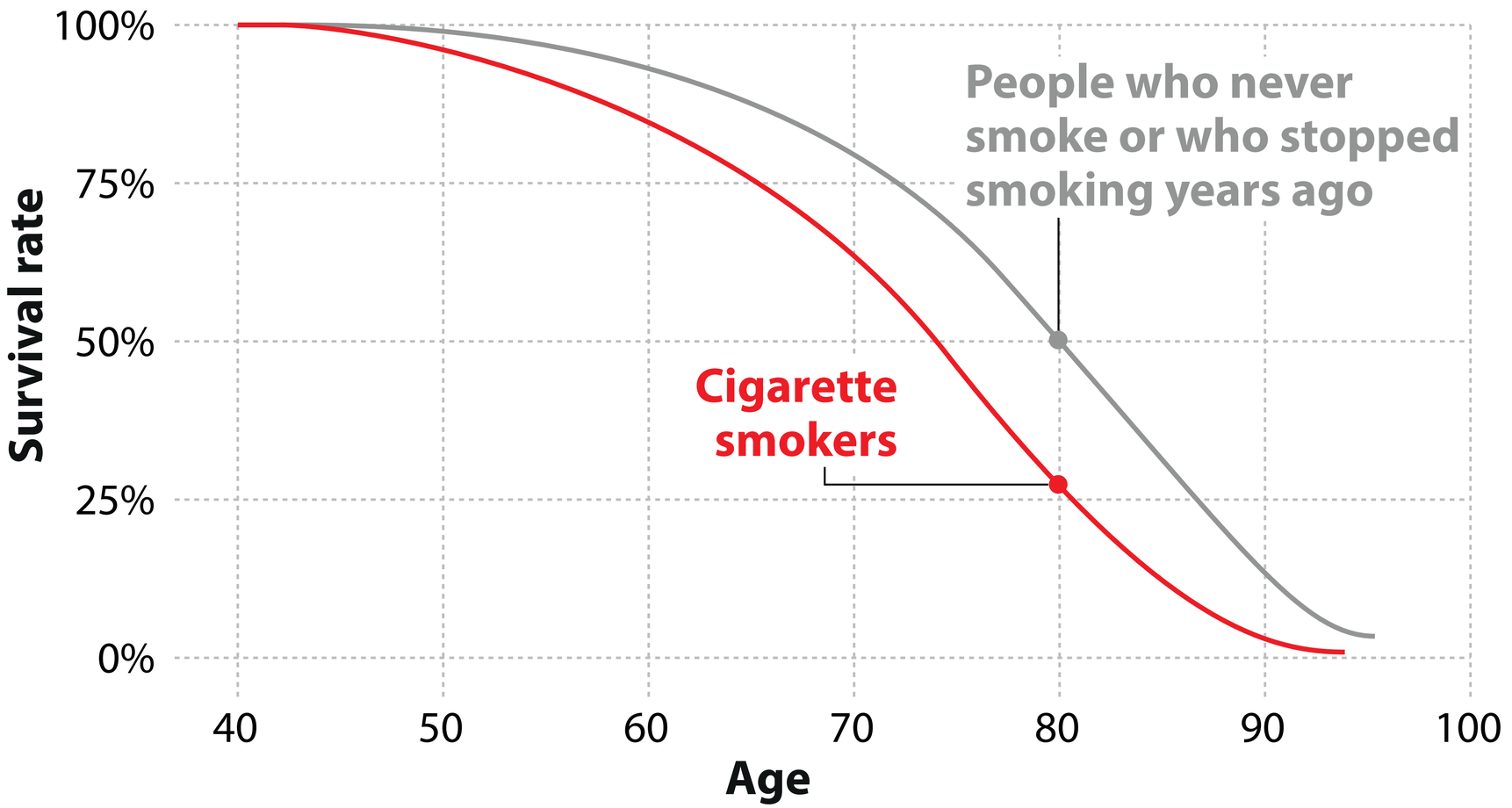


Be careful with amalgamation paradoxes and with the ecological fallacy



Be careful with amalgamation paradoxes and with the ecological fallacy

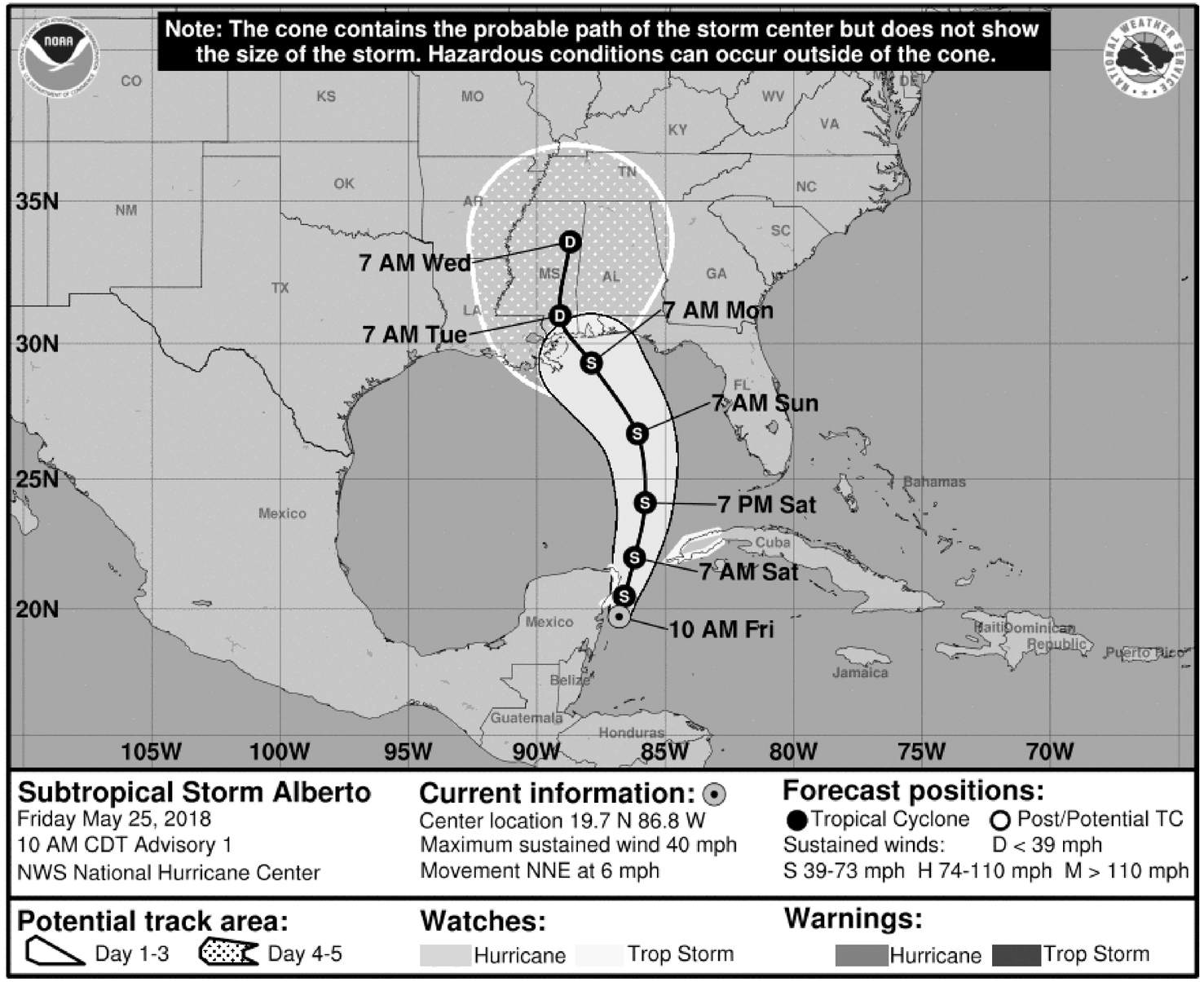


Be careful with amalgamation paradoxes and with the ecological fallacy

WHAT TO DO?

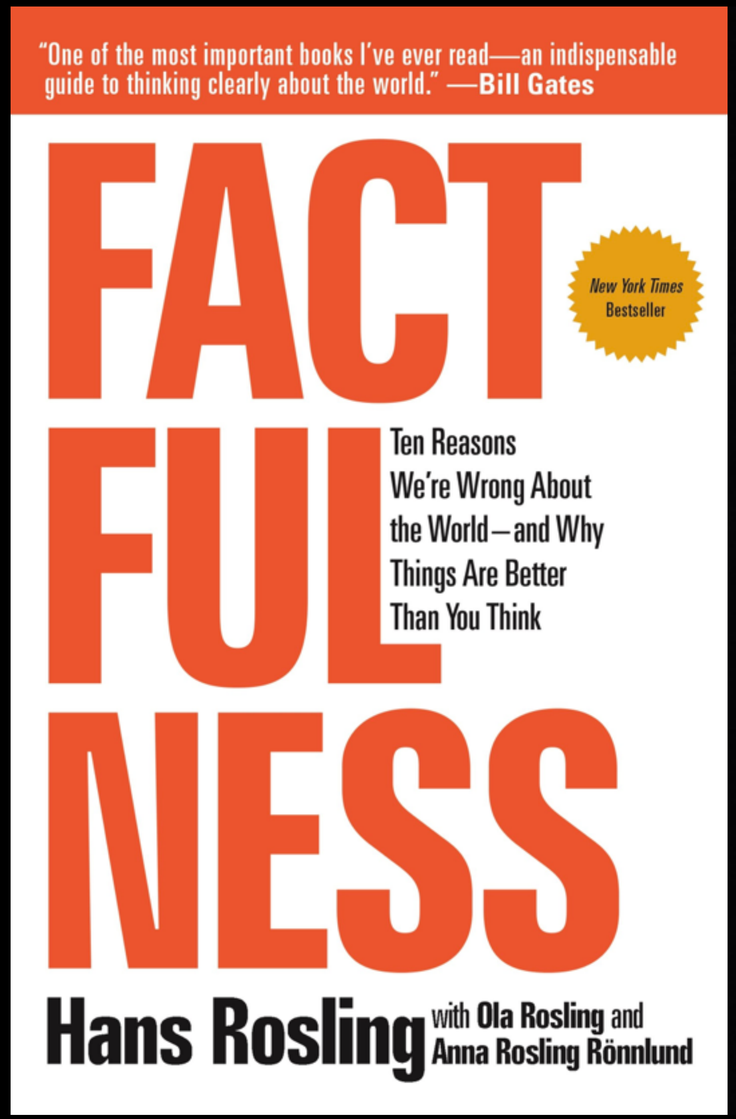
Let's test our graphics more often
with non-experts

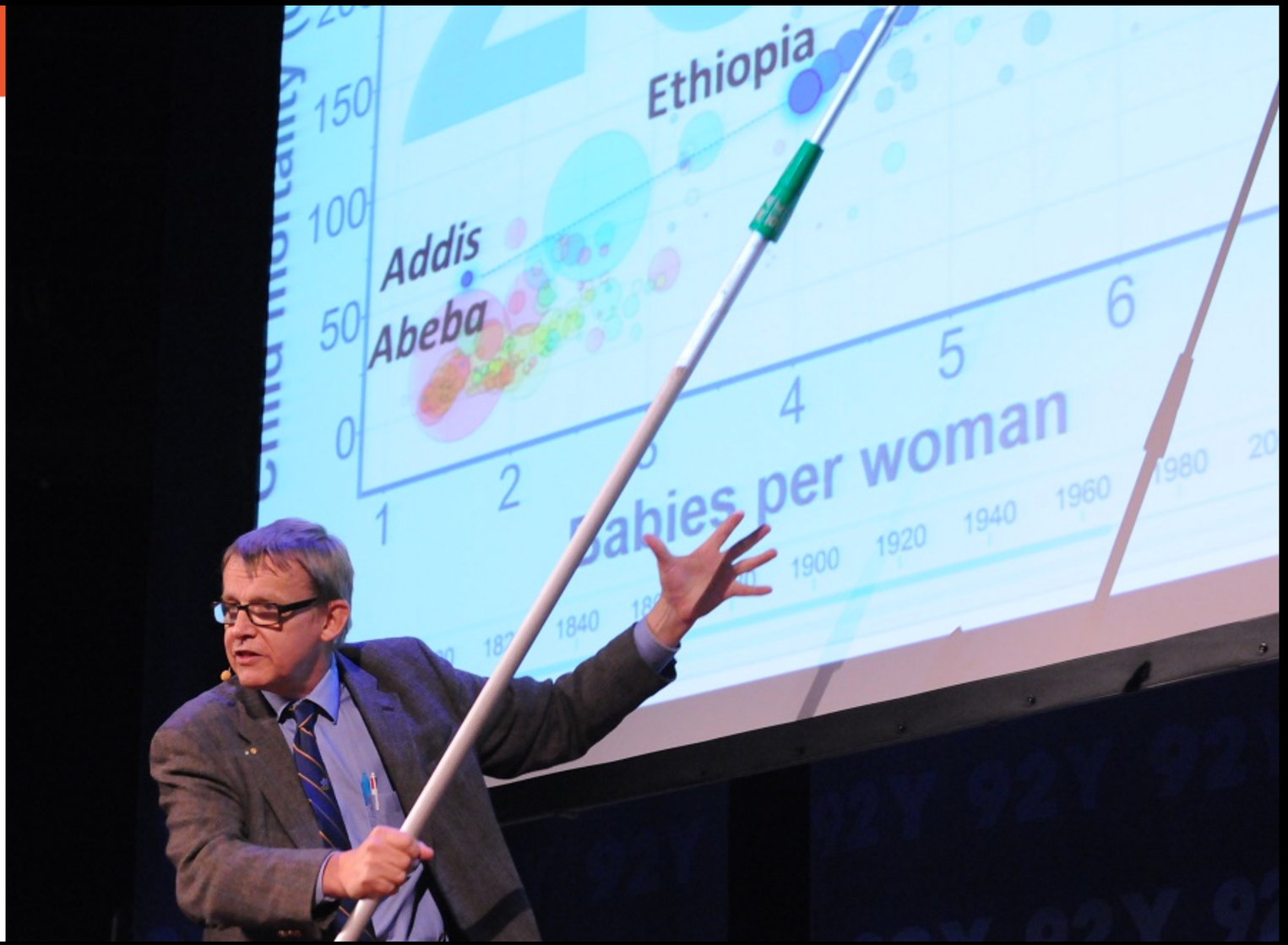
If your audience isn't your peers, or if you don't know your audience well,
explain and clarify more



We can add "how to read this chart" explainers to our visualizations

If your audience isn't your peers, or if you don't know your audience well, don't fear redundancy. **Show AND tell**





Hans Rosling: www.gapminder.org

If your audience isn't your peers, or if you don't know your audience well, don't fear redundancy. **Show AND tell**

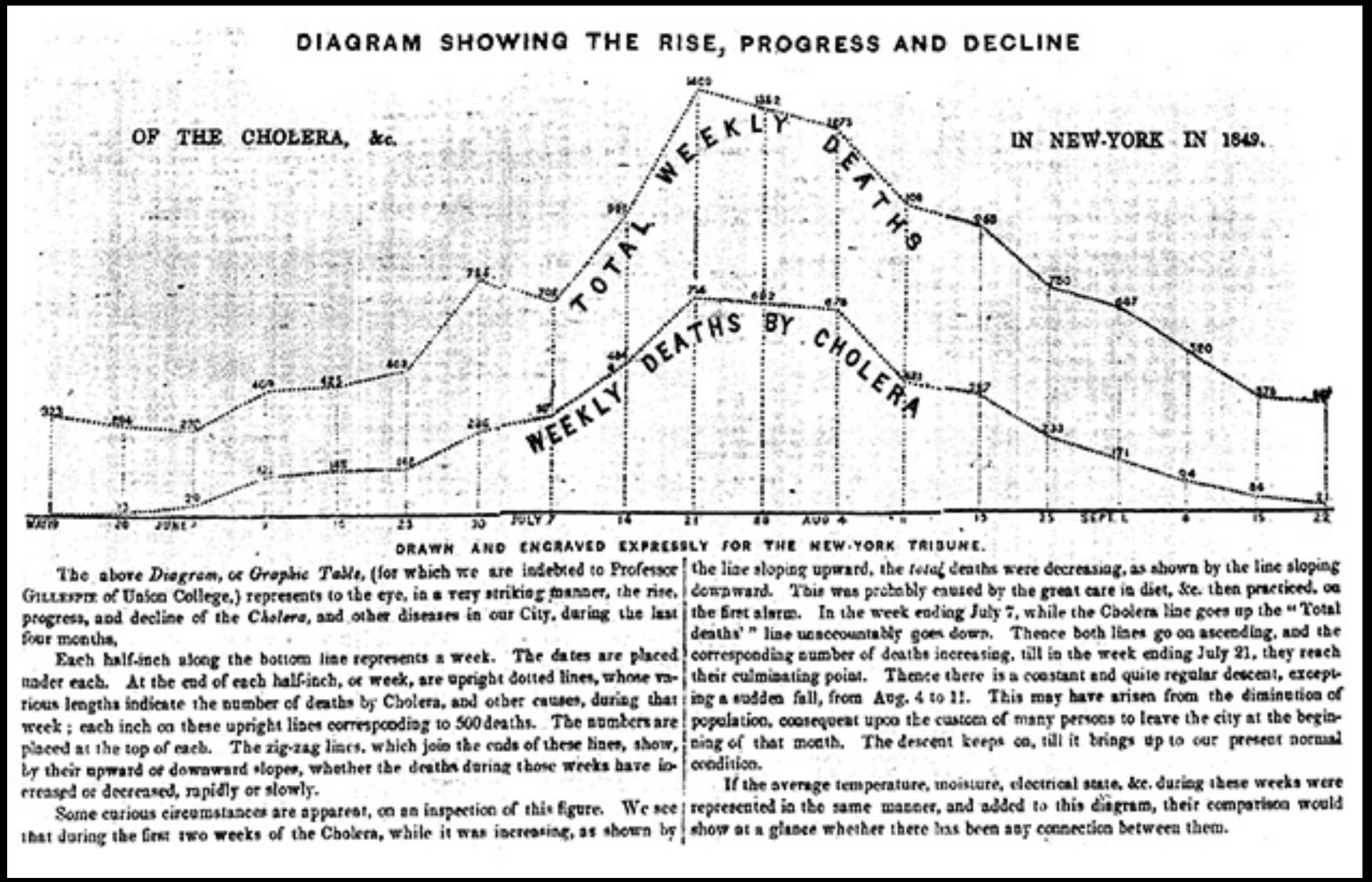


DIAGRAM SHOWING THE RISE, PROGRESS AND DECLINE

OF THE CHOLERA, &c. IN NEW-YORK IN 1849.

TOTAL WEEKLY DEATHS

WEEKLY DEATHS BY CHOLERA

MARCH 26 JUNE 2 9 16 23 30 JULY 7 14 21 28 AUG 4 11 18 25 SEPT. 1 8 15 22

DRAWN AND ENGRAVED EXPRESSLY FOR THE NEW-YORK TRIBUNE.

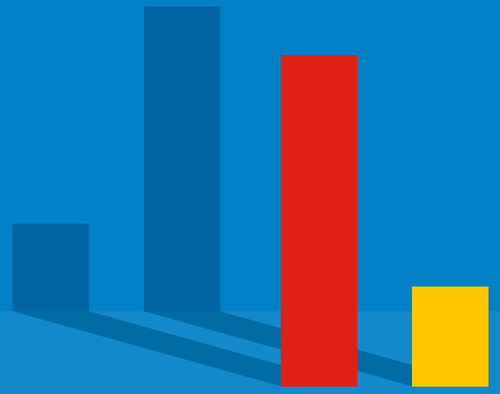
The above *Diagram, or Graphic Table,* (for which we are indebted to Professor GILLESPIE of Union College,) represents to the eye, in a very striking manner, the rise, progress, and decline of the *Cholera,* and other diseases in our City, during the last four months.

Each half-inch along the bottom line represents a week. The dates are placed under each. At the end of each half-inch, or week, are upright dotted lines, whose various lengths indicate the number of deaths by Cholera, and other causes, during that week; each inch on these upright lines corresponding to 500 deaths. The numbers are placed at the top of each. The zig-zag lines, which join the ends of these lines, show, by their upward or downward slopes, whether the deaths during those weeks have increased or decreased, rapidly or slowly.

Some curious circumstances are apparent, on an inspection of this figure. We see that during the first two weeks of the Cholera, while it was increasing, as shown by the line sloping upward, the *total* deaths were decreasing, as shown by the line sloping downward. This was probably caused by the great care in diet, &c. then practiced, on the first alarm. In the week ending July 7, while the Cholera line goes up the "Total deaths'" line unaccountably goes down. Thence both lines go on ascending, and the corresponding number of deaths increasing, till in the week ending July 21, they reach their culminating point. Thence there is a constant and quite regular descent, excepting a sudden fall, from Aug. 4 to 11. This may have arisen from the diminution of population, consequent upon the custom of many persons to leave the city at the beginning of that month. The descent keeps on, till it brings up to our present normal condition.

If the average temperature, moisture, electrical state, &c. during these weeks were represented in the same manner, and added to this diagram, their comparison would show at a glance whether there has been any connection between them.

Scott Klein: https://www.propublica.org/nerds/infographics-in-the-time-of-cholera



THANK YOU!

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