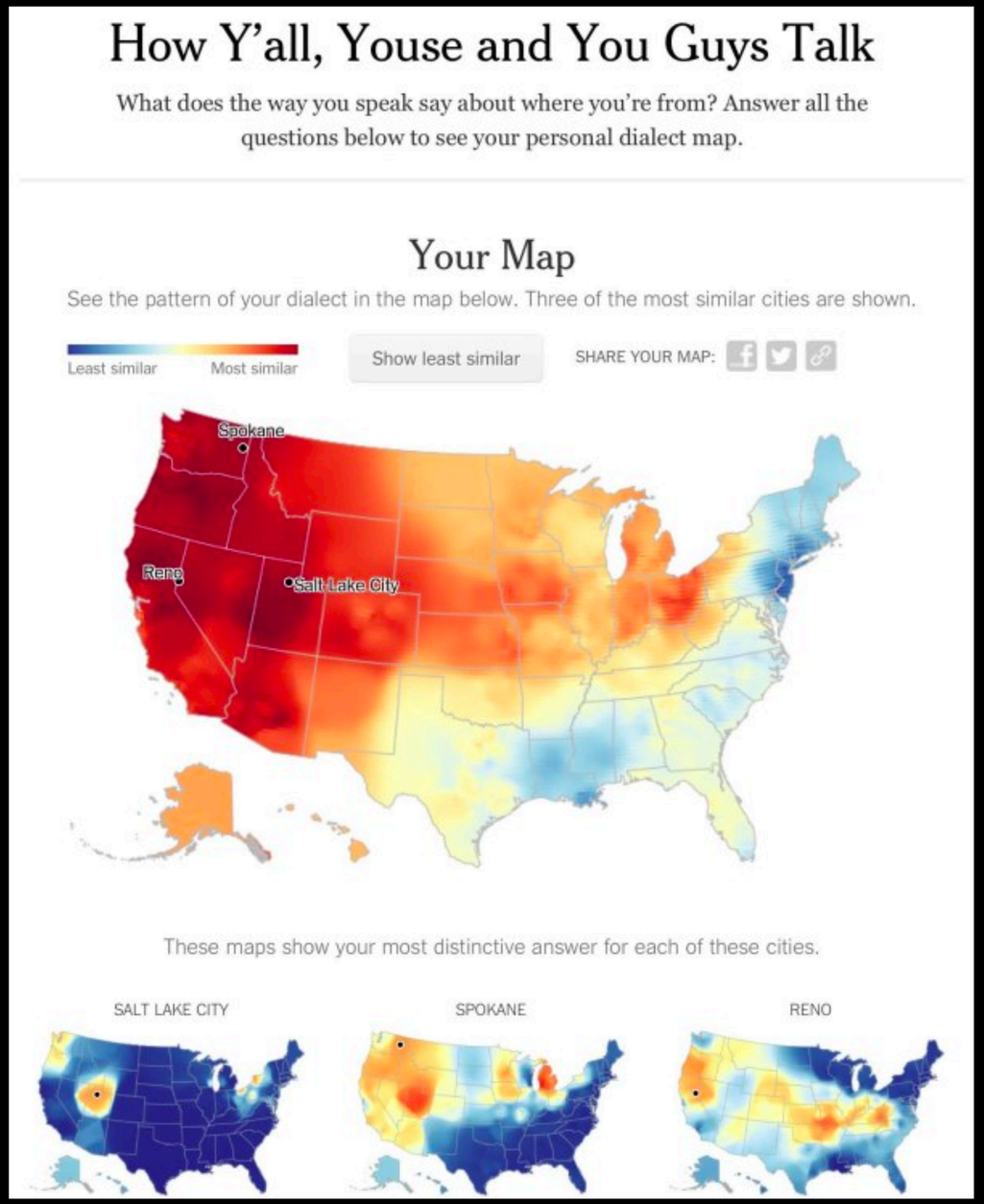
MAKING DECISIONS IN VISUALIZATION

Alberto Cairo

Coda.Br 2020

We are living through a golden age of information graphics



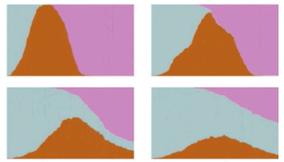
NYTimes' Dialect Quiz

https://www.nytimes.com/interactive/2014/upshot/dialect-quiz-map.html

Sections

The Washington Post
Democracy Dies in Darkness

Alberto Cairo To...



Health

Why outbreaks like coronavirus spread exponentially, and how to "flatten the curve"

By Harry Stevens March 14, 2020

PLEASE NOTE

The Washington Post is providing this story for free so that all readers have access to this important information about the coronavirus. For more free stories, sign up for our daily Coronavirus Updates newsletter.

2.6k

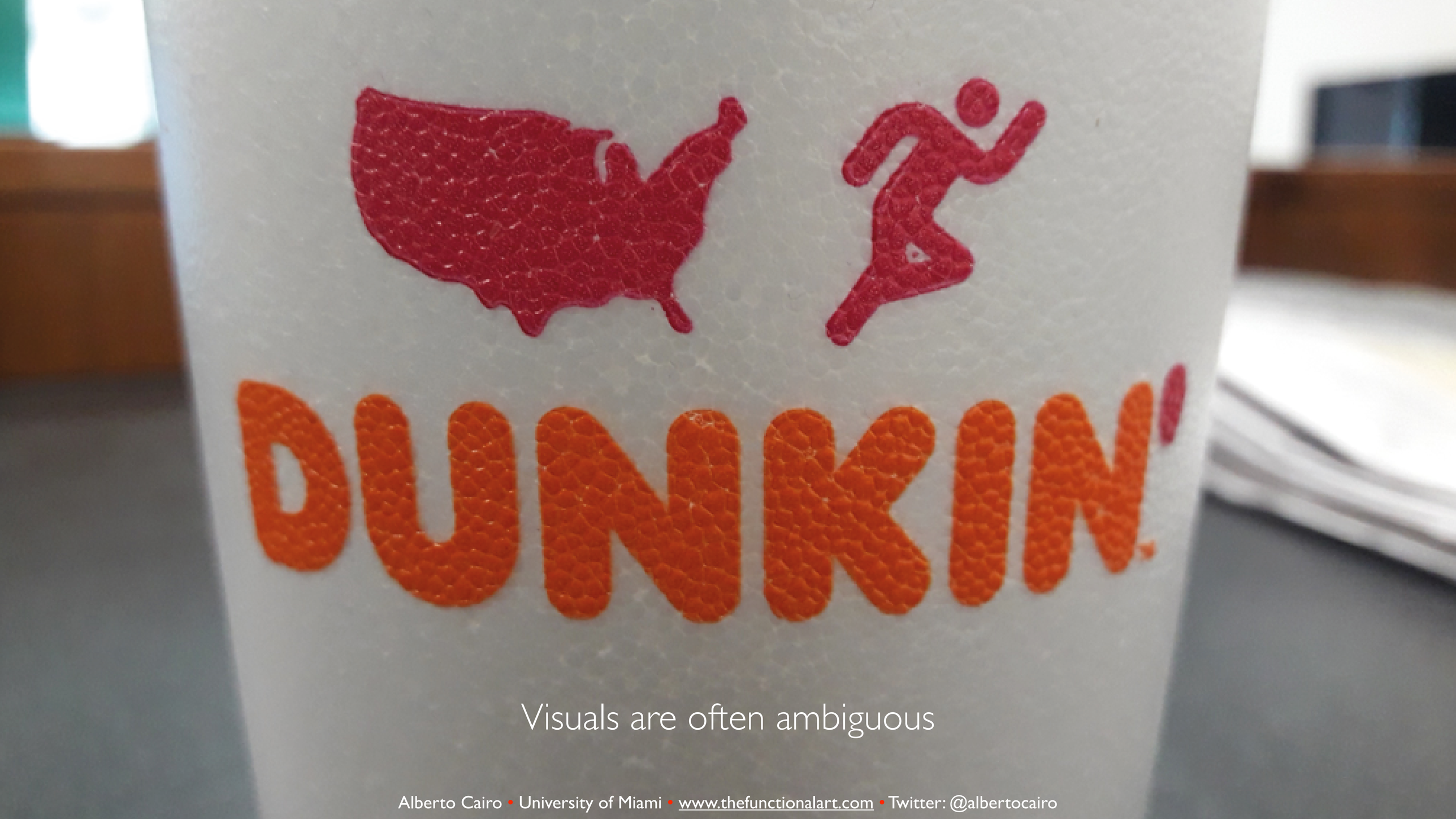
https://www.washingtonpost.com/graphics/2020/world/corona-simulator/

The Post's visual journalism, which involves staff throughout the newsroom, has attracted large audiences and contributed to record subscriber growth. Six of the seven most visited stories in The Washington Post's history have been graphics, including the coronavirus simulator that became the most visited article in The Post's history, with more than three times as many visits as the second. It also includes this year's Democratic candidate quiz, which set the record for converting readers to subscribers.

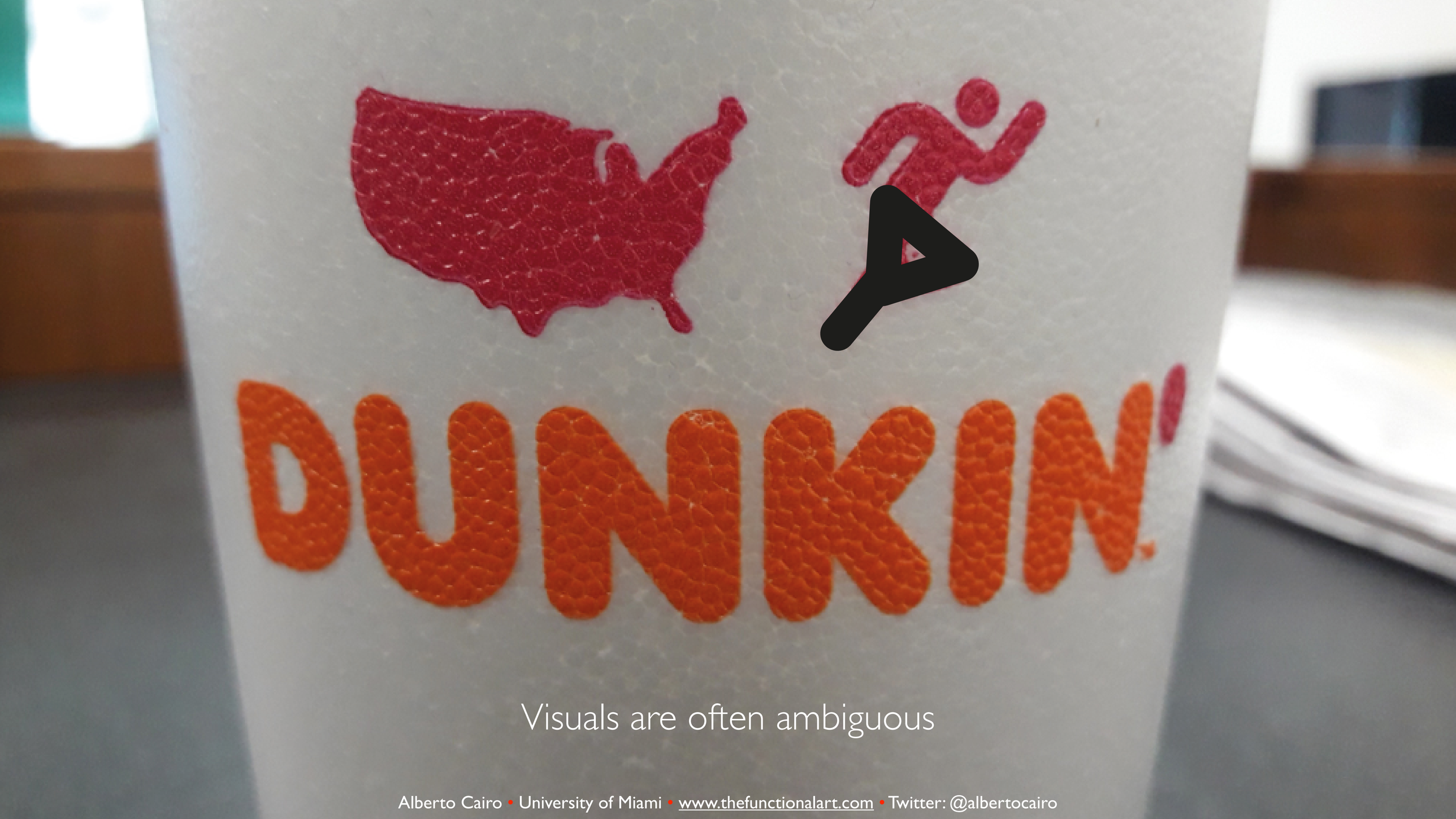
https://www.washingtonpost.com/pr/2020/06/26/washington-post-expand-graphics-design-teams-with-14-new-positions/

At the same time, we're still dealing with some misconceptions and myths:

1. "A picture is worth a thousand words"
2. "Visualization is intuitive"
3. "The data should speak for itself"
4. "Show, don't tell!"
5. "Learn the rules of visualization (by reading this book by [insert author's name here])!"



Visuals are often ambiguous



Visuals are often ambiguous

Visualizations can't be designed based just on our personal preferences—although these *are* important.

Visualization is a bit like writing: beyond some conventions and constraints regarding symbols, visual grammar, perception, and cognition, visualization **can't be based on *"rules"* that are set in stone**.

Instead, when designing visualizations, we need to be guided by **reasoned, justifiable choices**.

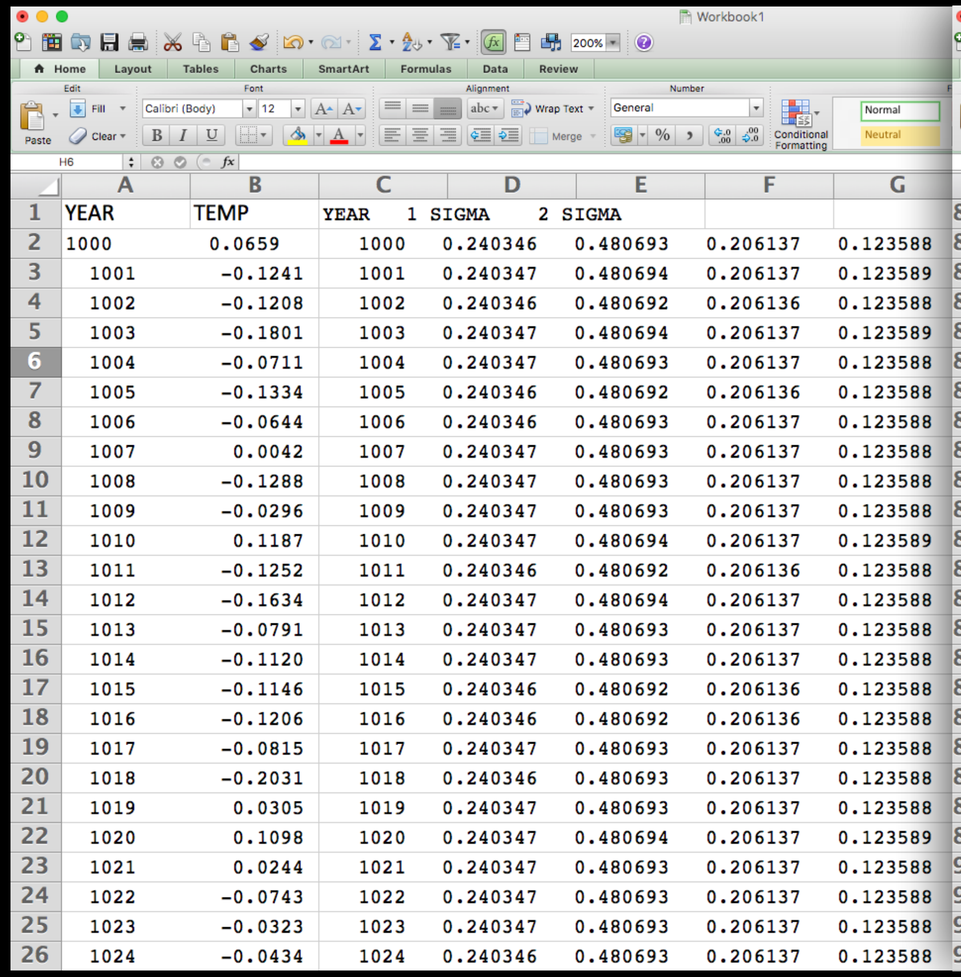
"Facts give us **reasons** […] when they count in favor of our having some belief or desire, or acting in some way."

Derek Parfit, *On What Matters*

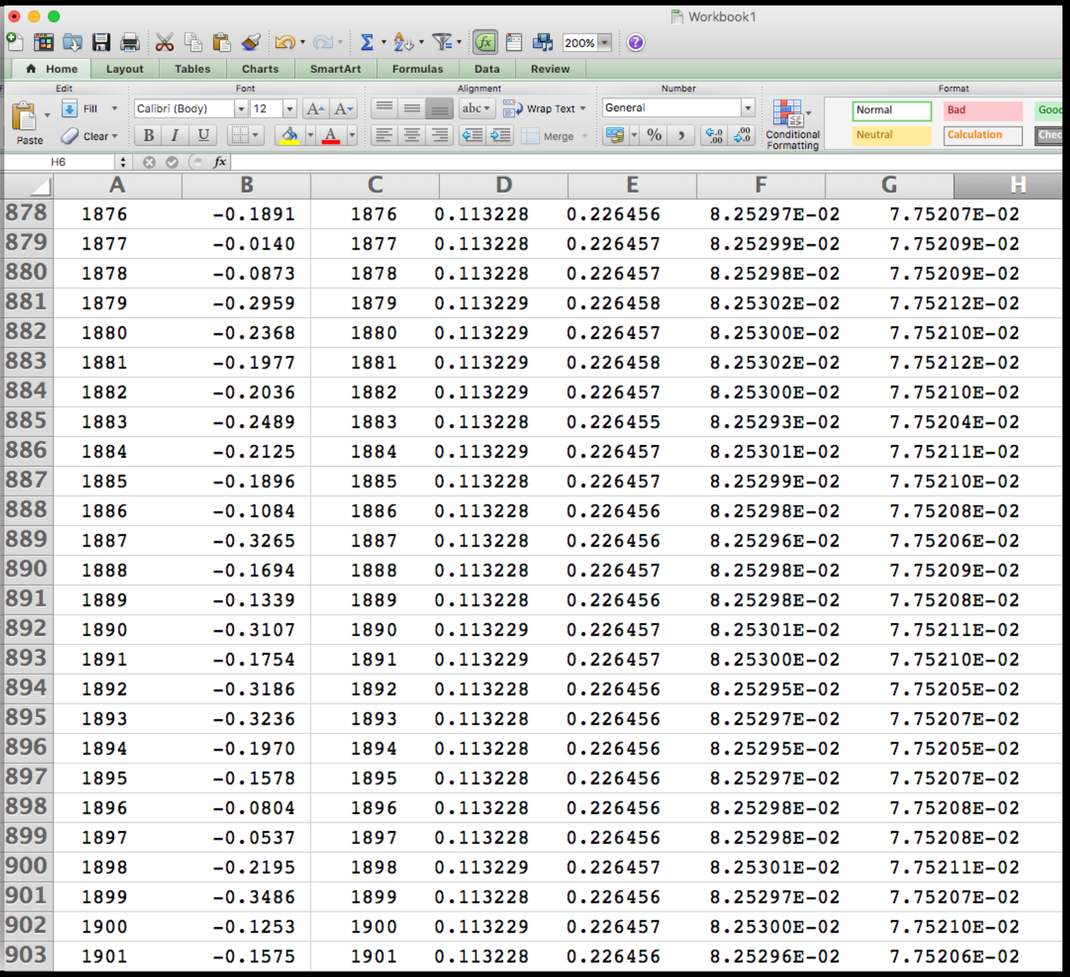
1. Why should my visualization exist?

Do the potential benefits of designing my visualization outweigh the possible harm it might cause?

Detecting patterns



	A	B	C	D	E	F	G
1	YEAR	TEMP	YEAR	1 SIGMA	2 SIGMA		
2	1000	0.0659	1000	0.240346	0.480693	0.206137	0.123588
3	1001	-0.1241	1001	0.240347	0.480694	0.206137	0.123589
4	1002	-0.1208	1002	0.240346	0.480692	0.206136	0.123588
5	1003	-0.1801	1003	0.240347	0.480694	0.206137	0.123589
6	1004	-0.0711	1004	0.240347	0.480693	0.206137	0.123588
7	1005	-0.1334	1005	0.240346	0.480692	0.206136	0.123588
8	1006	-0.0644	1006	0.240346	0.480693	0.206137	0.123588
9	1007	0.0042	1007	0.240347	0.480693	0.206137	0.123588
10	1008	-0.1288	1008	0.240347	0.480693	0.206137	0.123588
11	1009	-0.0296	1009	0.240347	0.480693	0.206137	0.123588
12	1010	0.1187	1010	0.240347	0.480694	0.206137	0.123589
13	1011	-0.1252	1011	0.240346	0.480692	0.206136	0.123588
14	1012	-0.1634	1012	0.240347	0.480694	0.206137	0.123588
15	1013	-0.0791	1013	0.240347	0.480693	0.206137	0.123588
16	1014	-0.1120	1014	0.240347	0.480693	0.206137	0.123588
17	1015	-0.1146	1015	0.240346	0.480692	0.206136	0.123588
18	1016	-0.1206	1016	0.240346	0.480692	0.206136	0.123588
19	1017	-0.0815	1017	0.240347	0.480693	0.206137	0.123588
20	1018	-0.2031	1018	0.240346	0.480693	0.206137	0.123588
21	1019	0.0305	1019	0.240347	0.480693	0.206137	0.123588
22	1020	0.1098	1020	0.240347	0.480694	0.206137	0.123589
23	1021	0.0244	1021	0.240347	0.480693	0.206137	0.123588
24	1022	-0.0743	1022	0.240347	0.480693	0.206137	0.123588
25	1023	-0.0323	1023	0.240347	0.480693	0.206137	0.123588
26	1024	-0.0434	1024	0.240346	0.480693	0.206137	0.123588



	A	B	C	D	E	F	G	H
878	1876	-0.1891	1876	0.113228	0.226456	8.25297E-02	7.75207E-02	
879	1877	-0.0140	1877	0.113228	0.226457	8.25299E-02	7.75209E-02	
880	1878	-0.0873	1878	0.113228	0.226457	8.25298E-02	7.75209E-02	
881	1879	-0.2959	1879	0.113229	0.226458	8.25302E-02	7.75212E-02	
882	1880	-0.2368	1880	0.113229	0.226457	8.25300E-02	7.75210E-02	
883	1881	-0.1977	1881	0.113229	0.226458	8.25302E-02	7.75212E-02	
884	1882	-0.2036	1882	0.113229	0.226457	8.25300E-02	7.75210E-02	
885	1883	-0.2489	1883	0.113228	0.226455	8.25293E-02	7.75204E-02	
886	1884	-0.2125	1884	0.113229	0.226457	8.25301E-02	7.75211E-02	
887	1885	-0.1896	1885	0.113228	0.226457	8.25299E-02	7.75210E-02	
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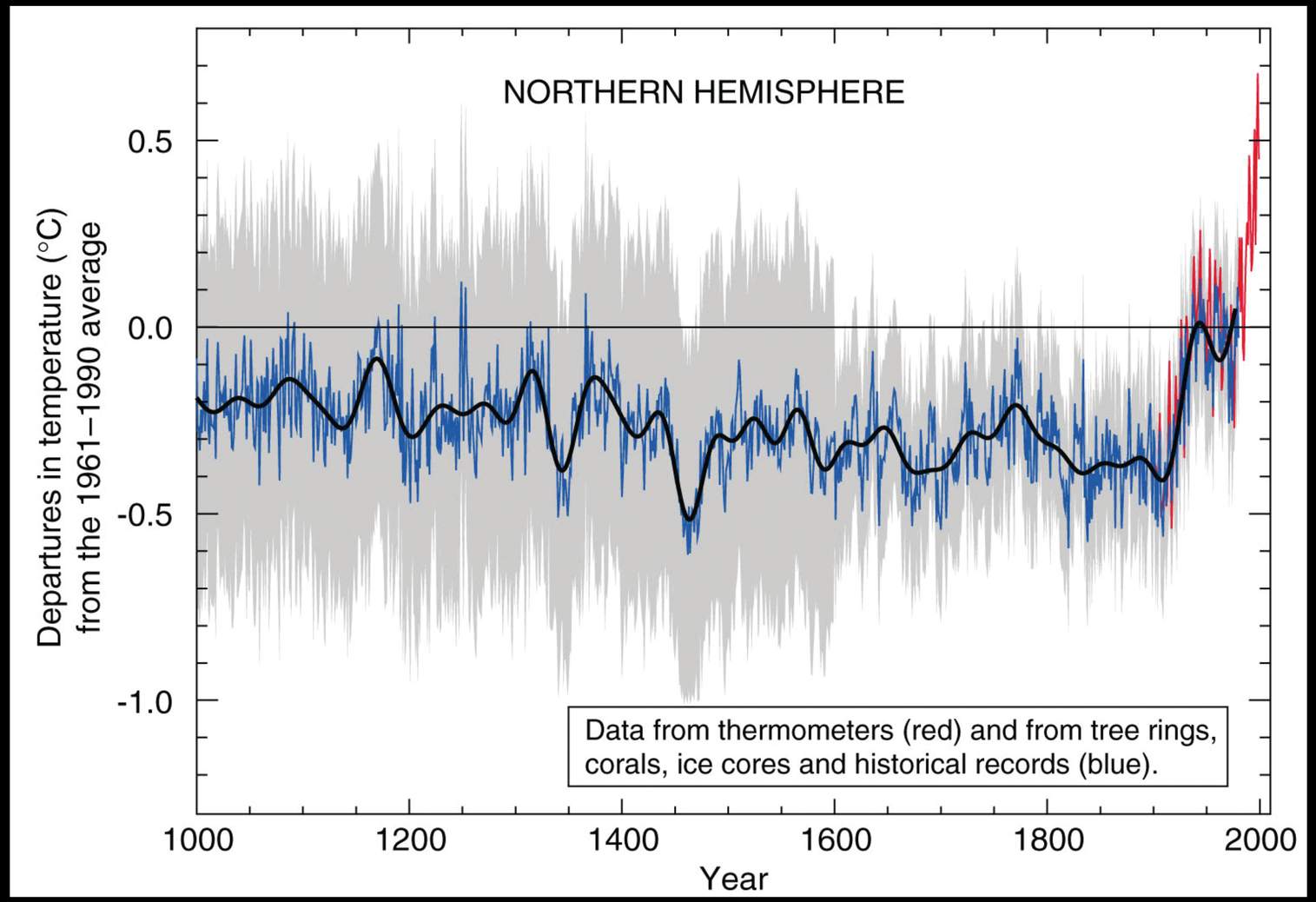
889	1887	-0.3265	1887	0.113228	0.226456	8.25296E-02	7.75206E-02	
890	1888	-0.1694	1888	0.113228	0.226457	8.25298E-02	7.75209E-02	
891	1889	-0.1339	1889	0.113228	0.226456	8.25298E-02	7.75208E-02	
892	1890	-0.3107	1890	0.113229	0.226457	8.25301E-02	7.75211E-02	
893	1891	-0.1754	1891	0.113229	0.226457	8.25300E-02	7.75210E-02	
894	1892	-0.3186	1892	0.113228	0.226456	8.25295E-02	7.75205E-02	
895	1893	-0.3236	1893	0.113228	0.226456	8.25297E-02	7.75207E-02	
896	1894	-0.1970	1894	0.113228	0.226456	8.25295E-02	7.75205E-02	
897	1895	-0.1578	1895	0.113228	0.226456	8.25297E-02	7.75207E-02	
898	1896	-0.0804	1896	0.113228	0.226456	8.25298E-02	7.75208E-02	
899	1897	-0.0537	1897	0.113228	0.226456	8.25298E-02	7.75208E-02	
900	1898	-0.2195	1898	0.113229	0.226457	8.25301E-02	7.75211E-02	
901	1899	-0.3486	1899	0.113228	0.226456	8.25297E-02	7.75207E-02	
902	1900	-0.1253	1900	0.113229	0.226457	8.25300E-02	7.75210E-02	
903	1901	-0.1575	1901	0.113228	0.226456	8.25296E-02	7.75206E-02	

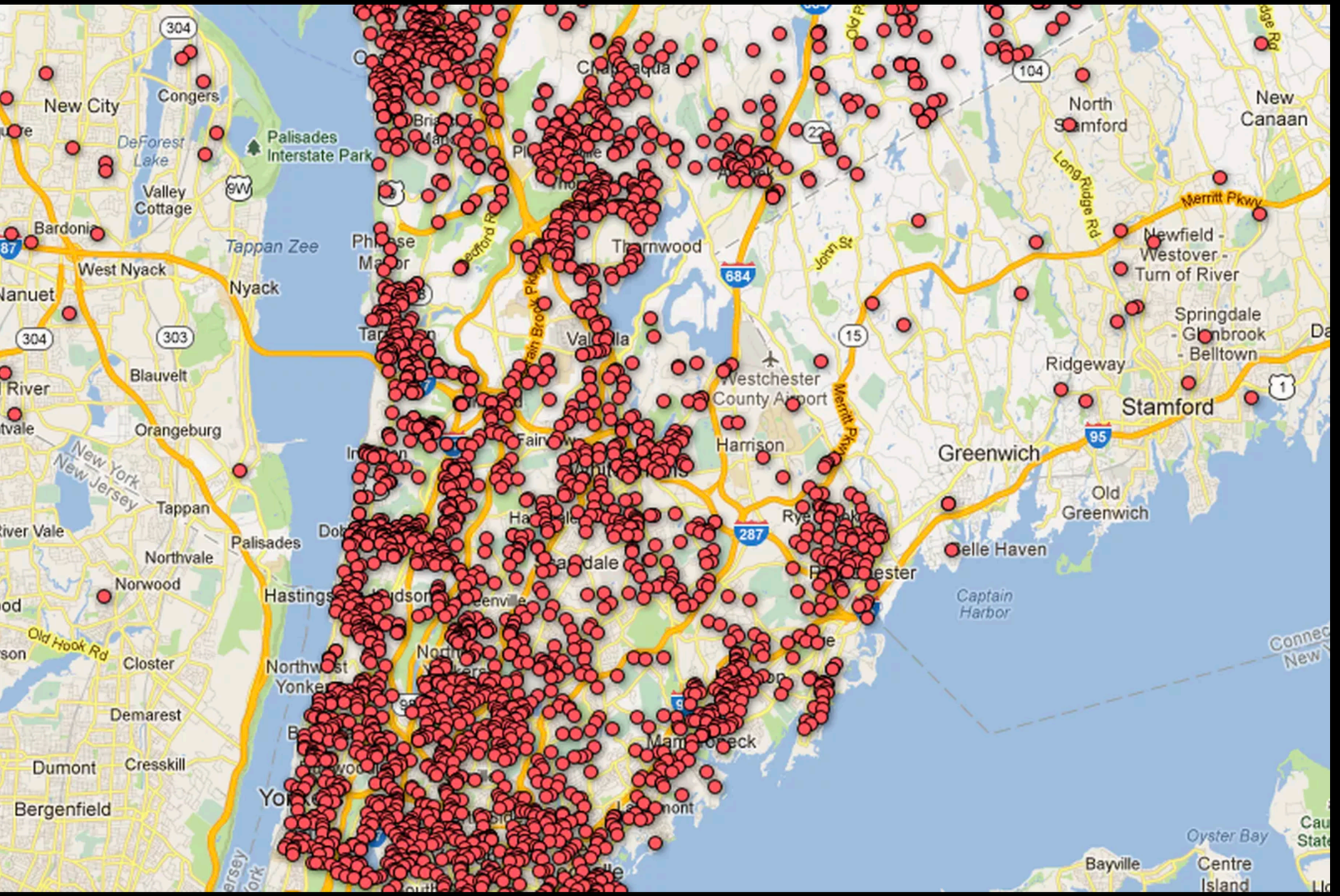
Detecting patterns



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

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

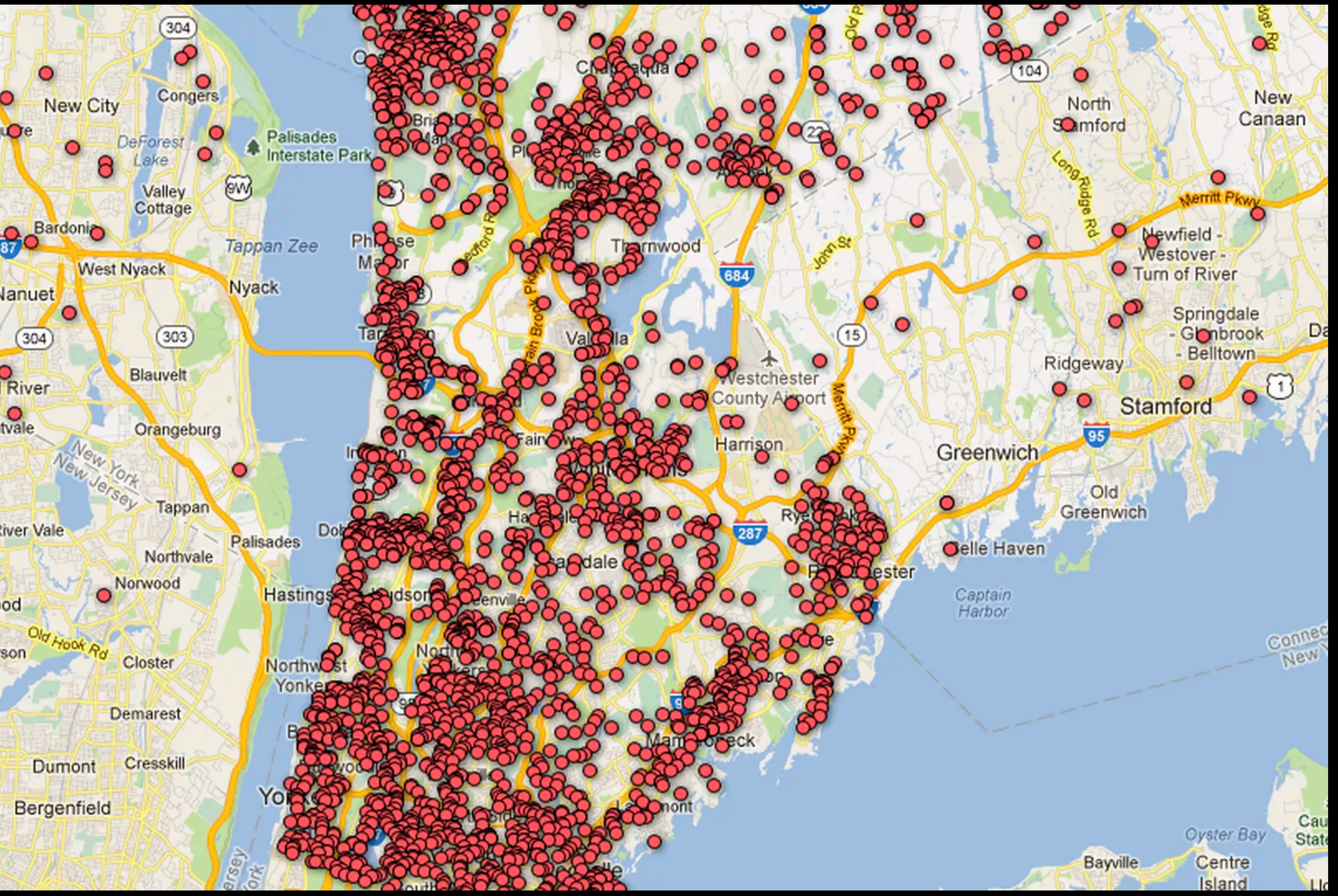
Published Dec. 23, 2012 (the Sandy Hook Elementary School shooting was on Dec. 14)



"Where are the gun permits in your neighborhood?" That's the question posed by **The Journal News**, a New York newspaper that published a Google map on Sunday that shows the names and addresses of pistol or revolver permits in Westchester and Rockland counties."

https://www.theverge.com/2012/12/25/3802960/new-york-newspaper-posts-map-with-names-addresses-of-gun-owners

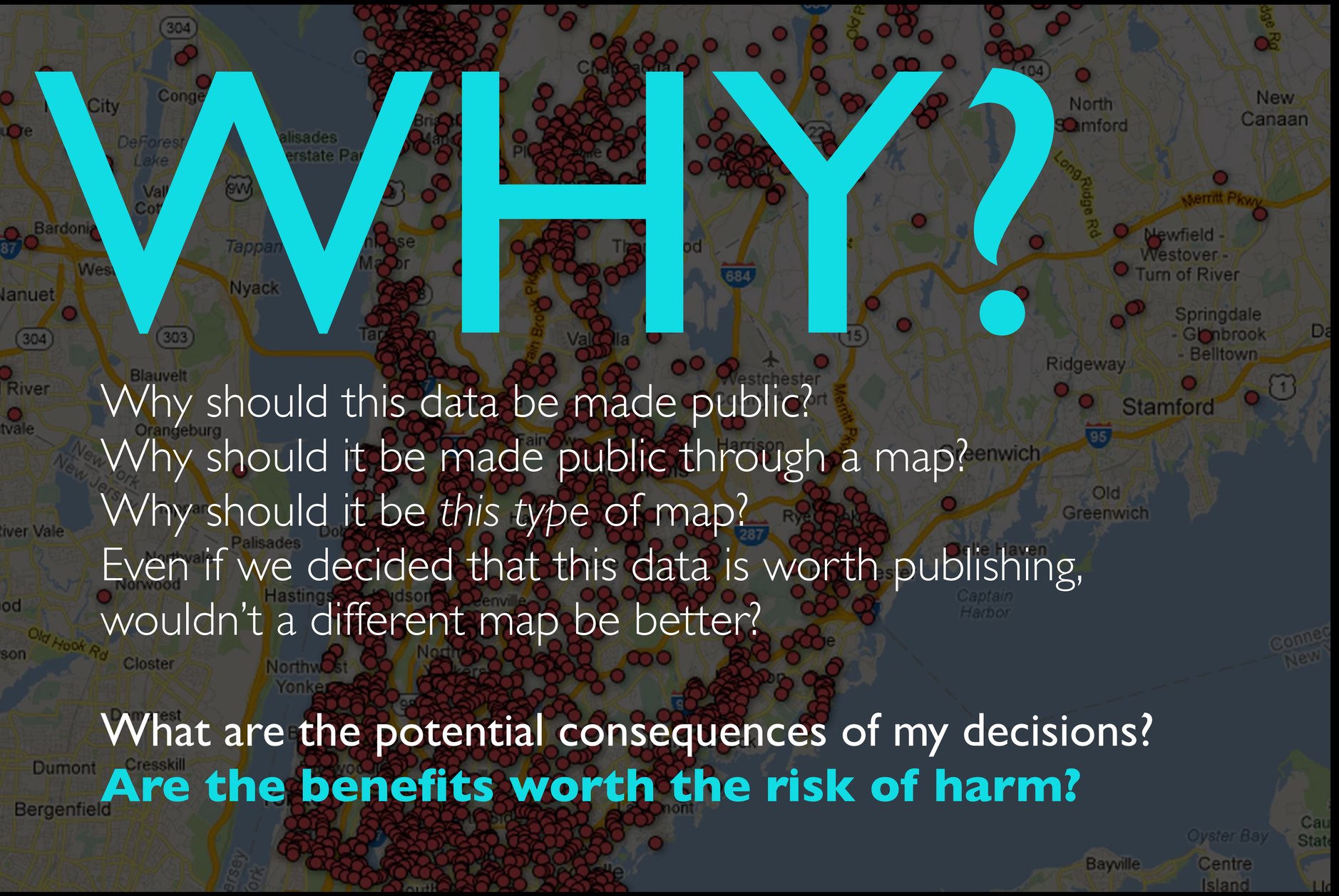
Published Dec. 23, 2012 (the Sandy Hook Elementary School shooting was on Dec. 14)



"We felt sharing information about gun permits in our area was important in the aftermath of the Newtown shootings."

Janet Hasson, president and publisher of the Journal News Media Group

Published Dec. 23, 2012 (the Sandy Hook Elementary School shooting was on Dec. 14)



2. What to visualize?

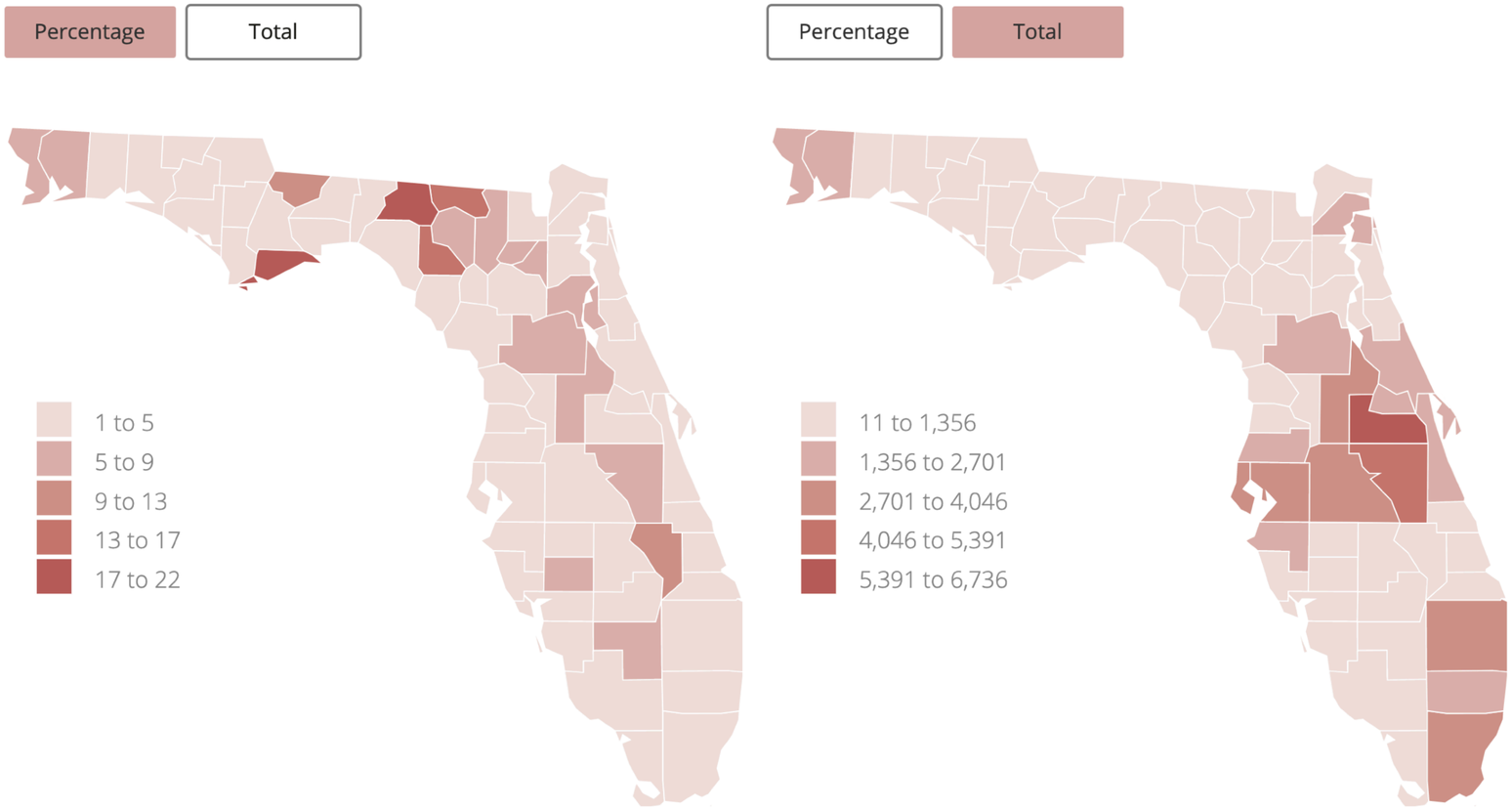
Do I understand my data, its limitations, uncertainty, or glitches?

What or who is being measured (*o not being measured*,) and why?

AT SCHOOL WITHOUT A ROOF

http://www.lmelgar.me/without-a-roof/

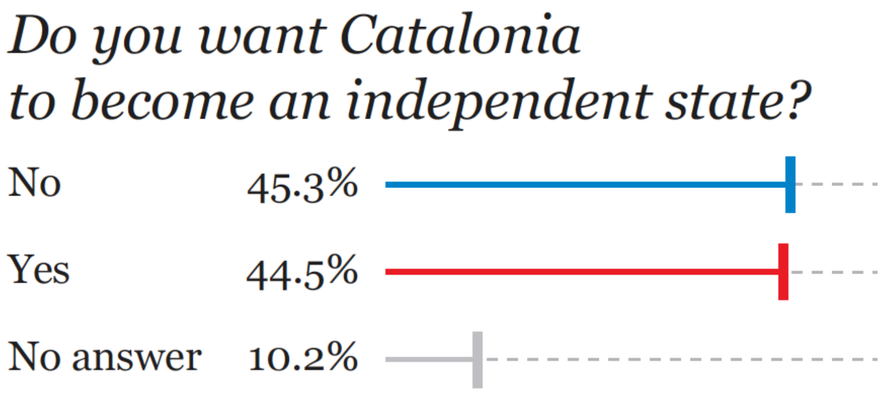
In Florida more than 71,000 students are homeless. During the last decade, this population rocketed as a result of the recession and how hard it has become for the poorest families to find affordable housing.



https://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.

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.



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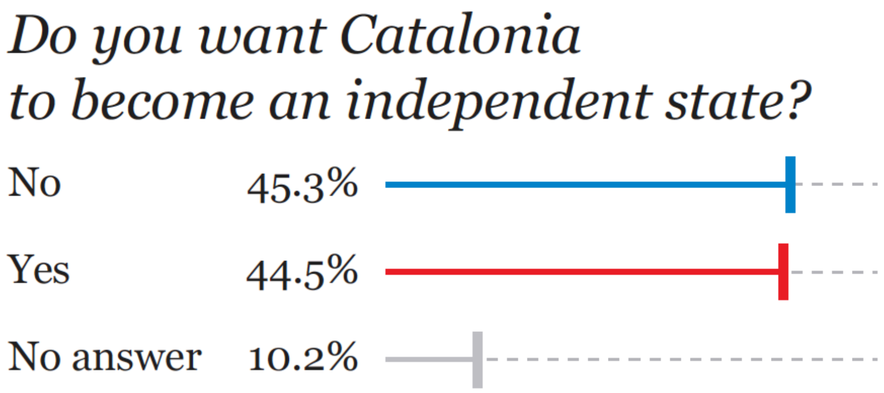

"The margin of error of the poll is 2.95, a relevant fact considering the tight difference between the YES and the NO to the independence of Catalonia"

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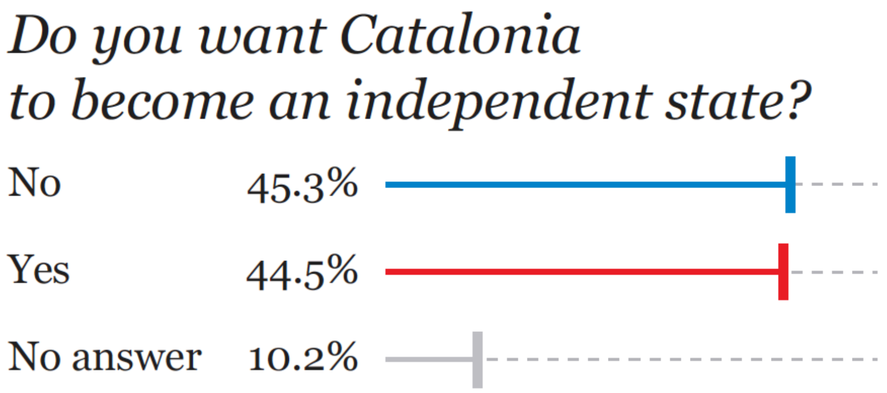

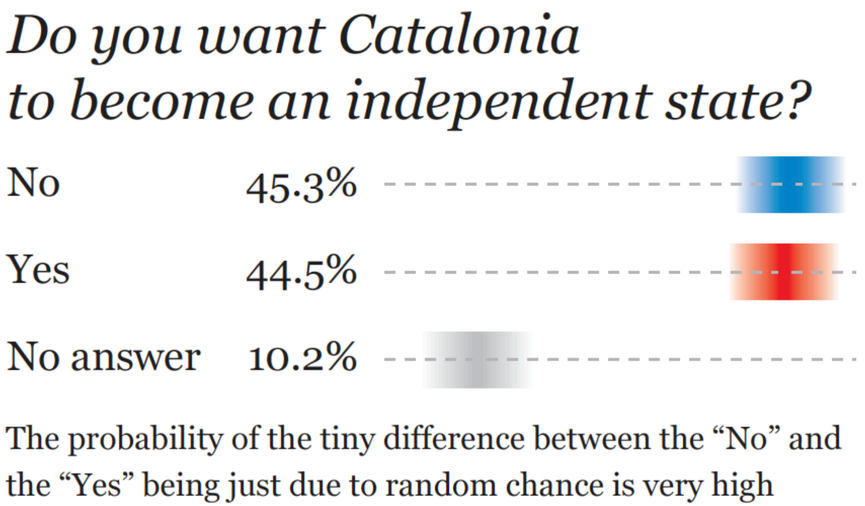

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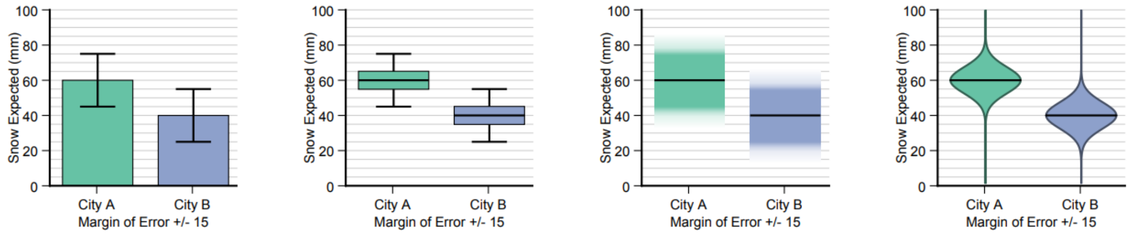
Disclosing limitations and uncertainty

Uncertainty and graphicacy
How should statisticians, journalists, and designers reveal uncertainty in graphics for public consumption?

https://ec.europa.eu/eurostat/cros/powerfromstatistics/OR/PfS-OutlookReport-Cairo.pdf

Error Bars Considered Harmful:
Exploring Alternate Encodings for Mean and Error

Michael Correll *Student Member, IEEE*, and Michael Gleicher *Member, IEEE*



(a) **Bar chart** with error bars: the height of the bars encodes the sample mean, and the whiskers encode a 95% t-confidence interval.

(b) **Modified box plot**: The whiskers are the 95% t-confidence interval, the box is a 50% t-confidence interval.

(c) **Gradient plot**: the transparency of the colored region corresponds to the cumulative density function of a t-distribution.

(d) **Violin plot**: the width of the colored region corresponds to the probability density function of a t-distribution.

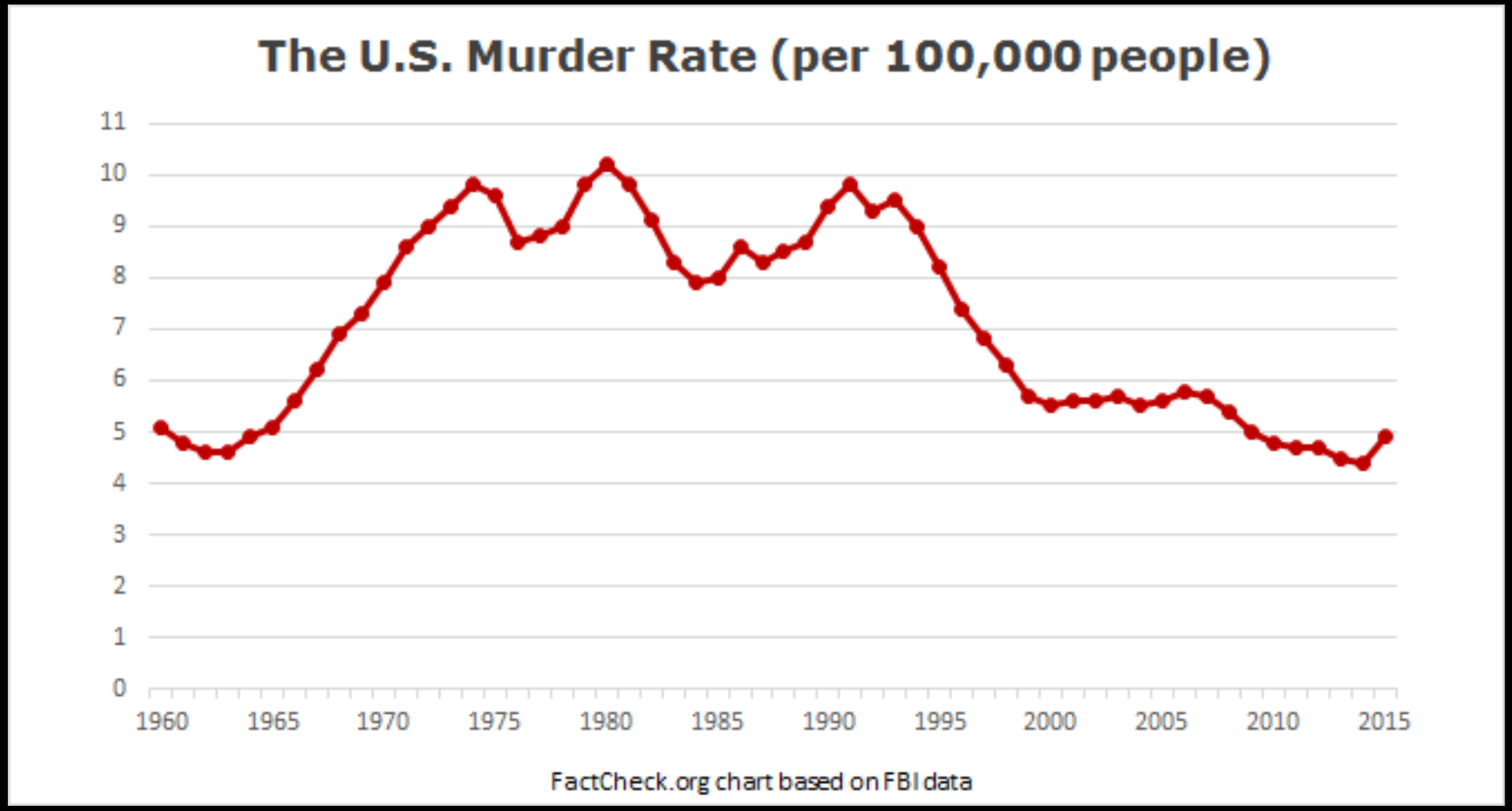
https://graphics.cs.wisc.edu/Papers/2014/CG14/Preprint.pdf

Collection of papers about visualizing uncertainty:
https://www.dropbox.com/sh/jk4ginxyai6ylqu/AABvqdyT1hJtyFN9nKNHyX9Ba?dl=0

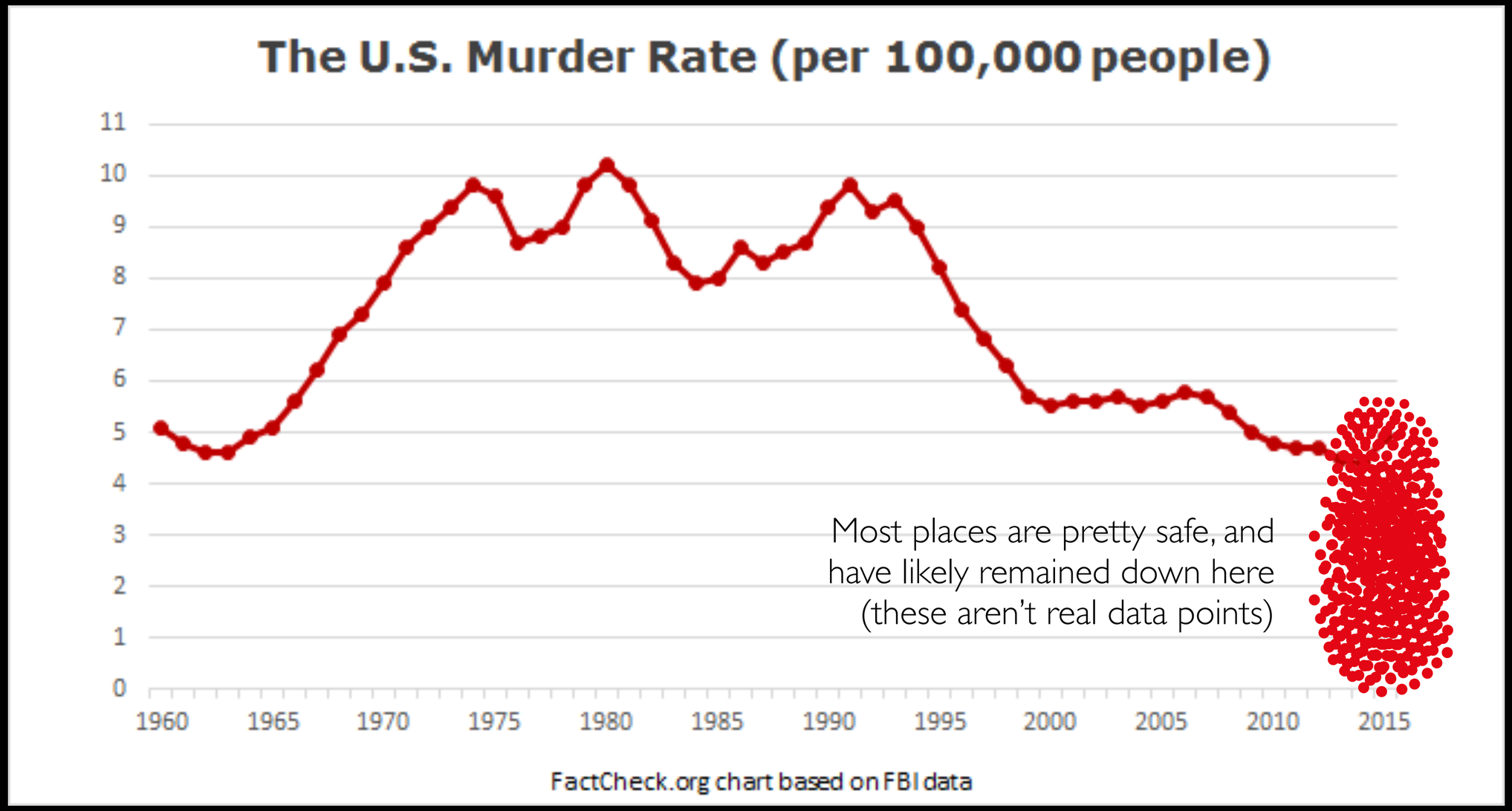
3. How much to visualize?

Am I showing too little?

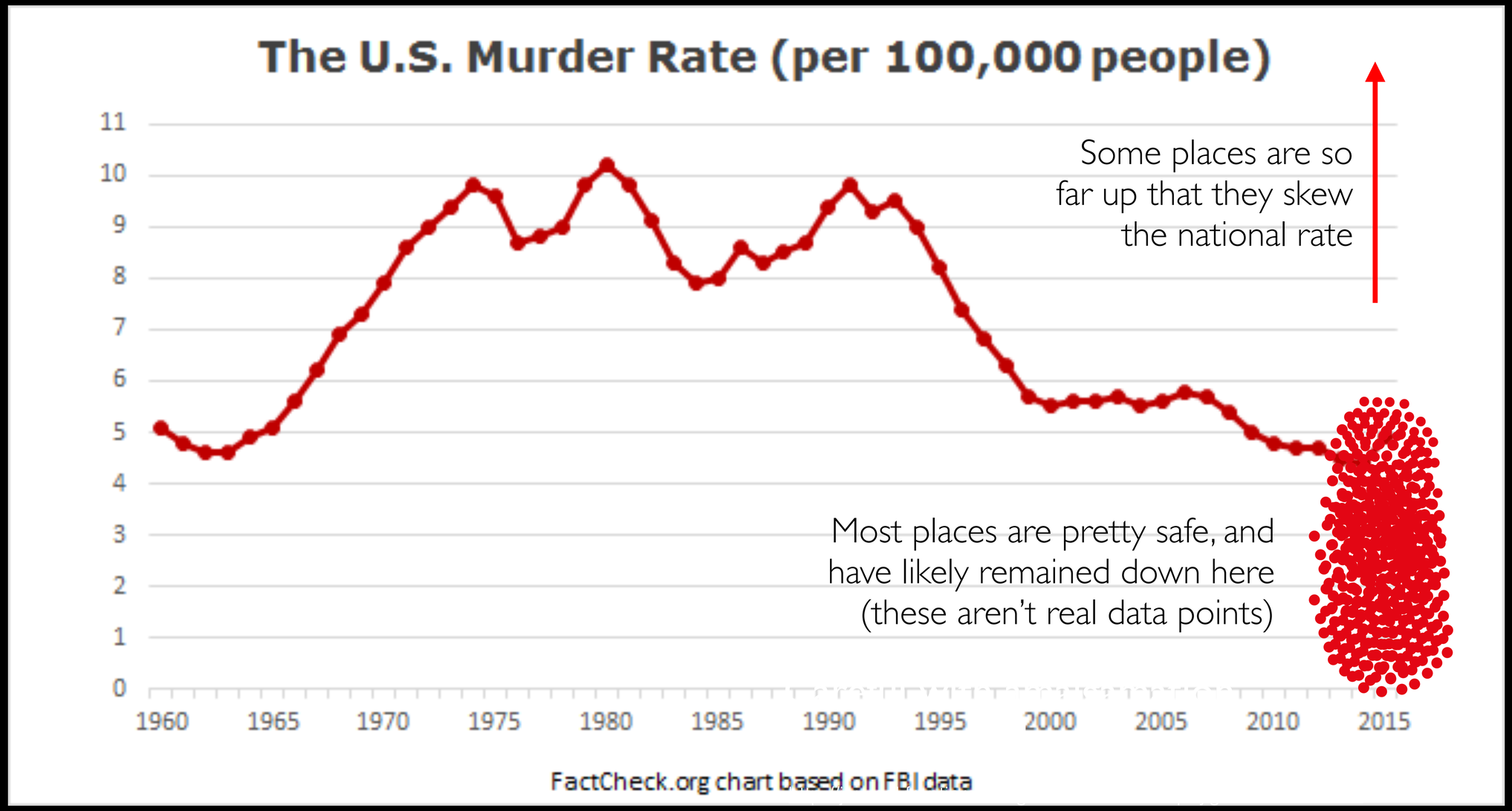
Am I showing too much?


The U.S. Murder Rate (per 100,000 people)
11
10
9
8
7
6
5
4
3
2
1
0
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
FactCheck.org chart based on FBI data

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



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



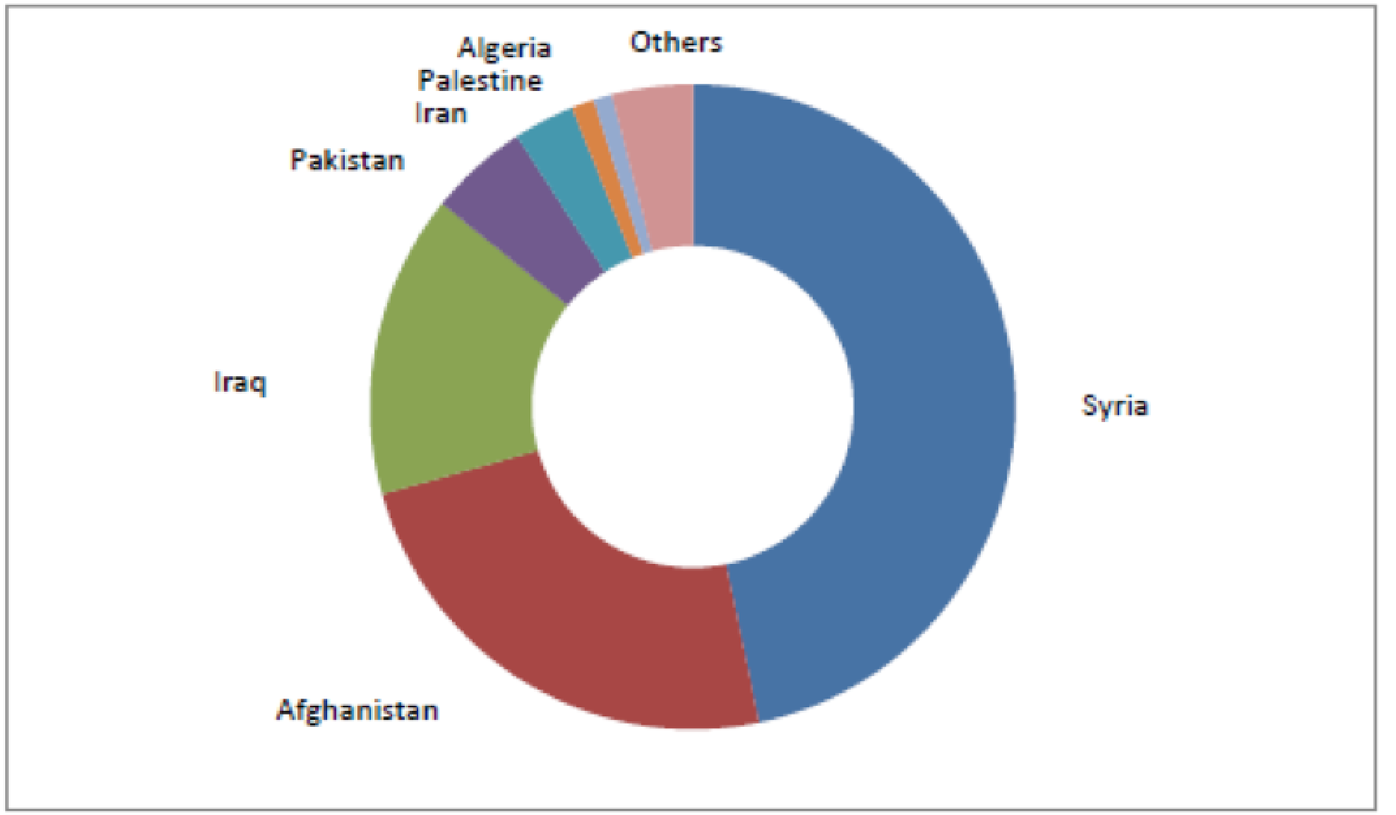
4. How to visualize it?

What types of charts or maps should I use?

What is the best way to organize the visualization?

Figure 2 - Main nationalities of arriving migrants – 2016

Greece



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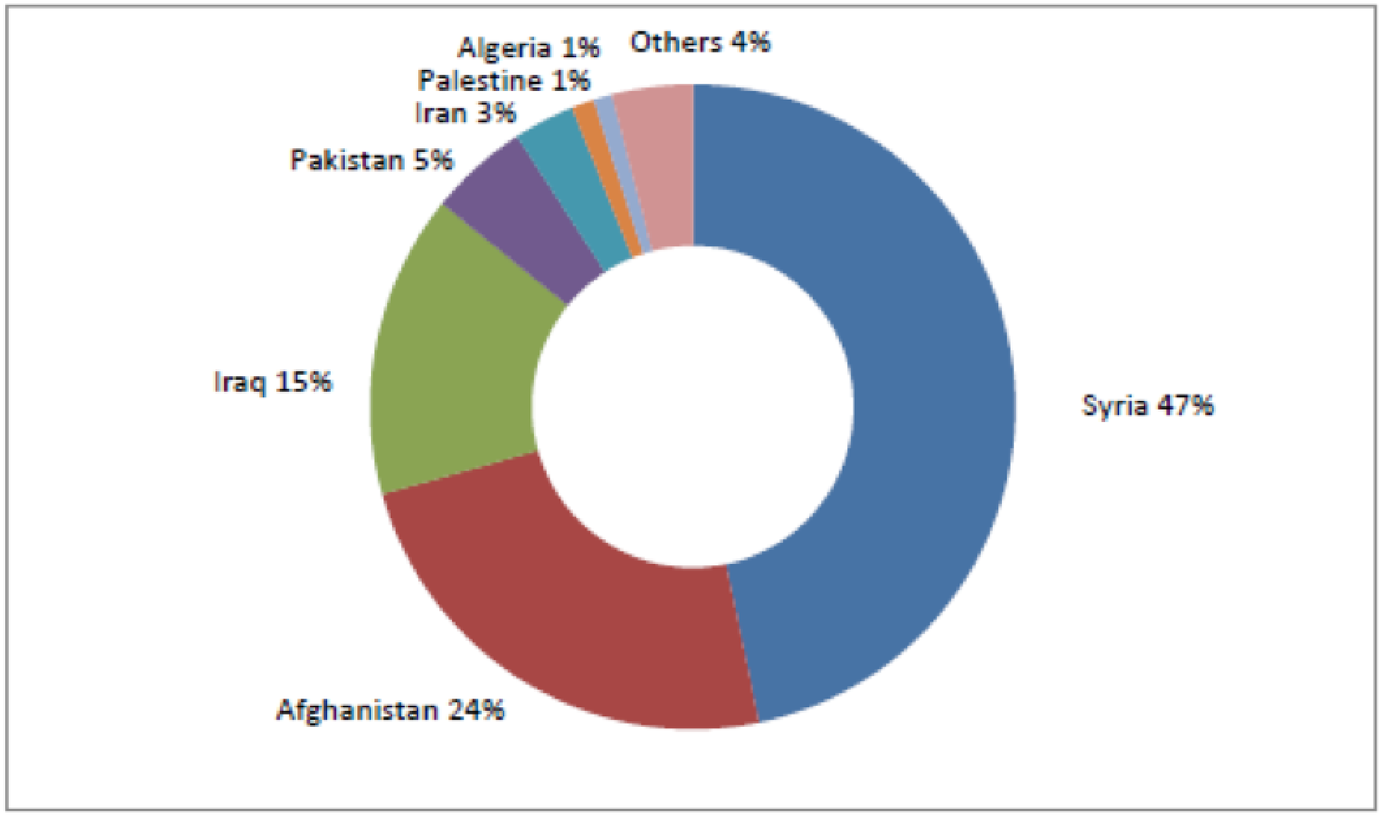
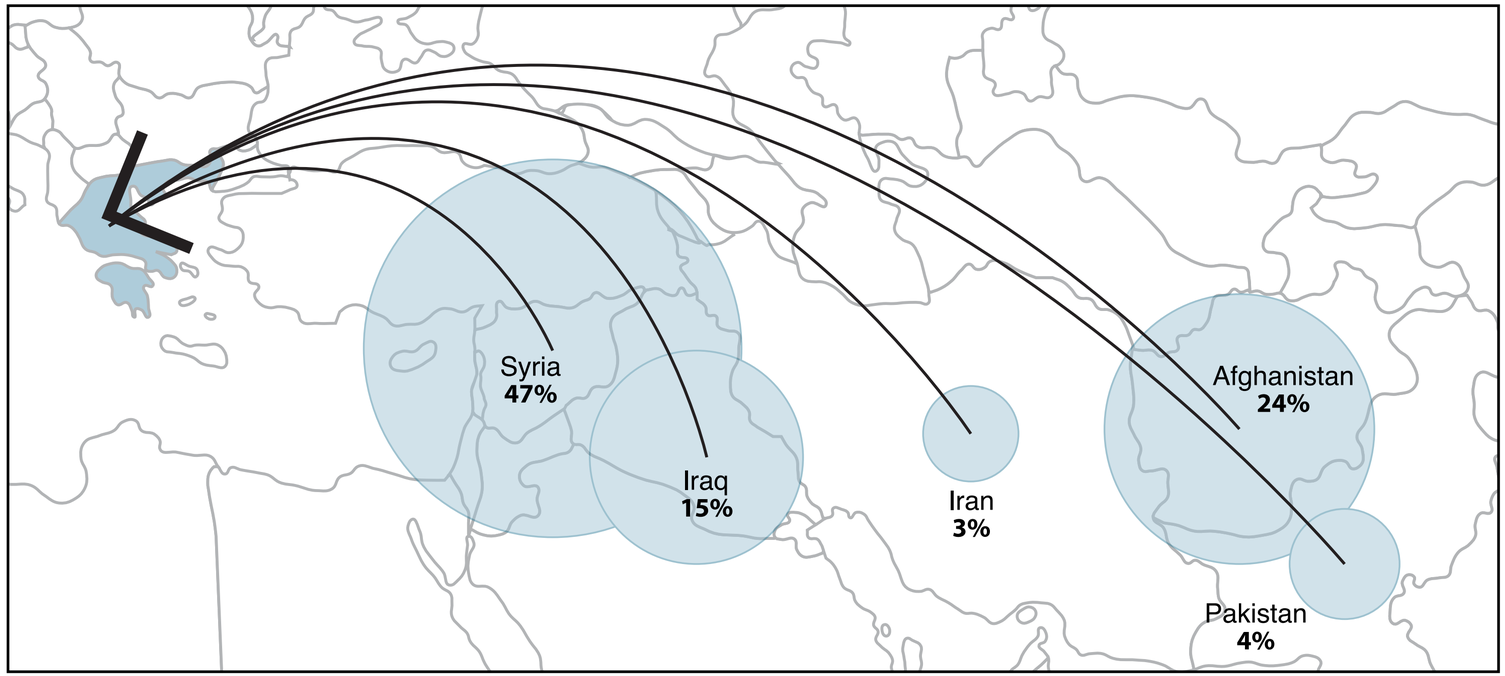
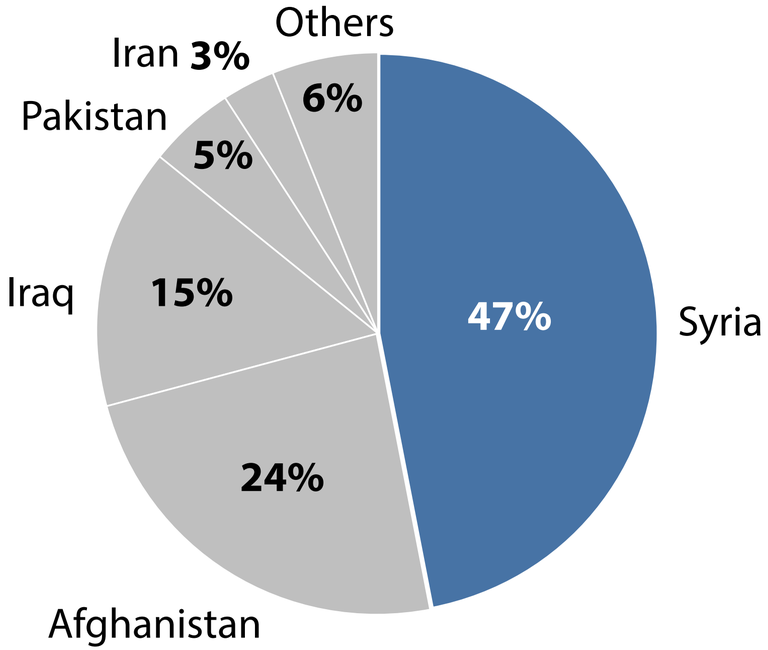
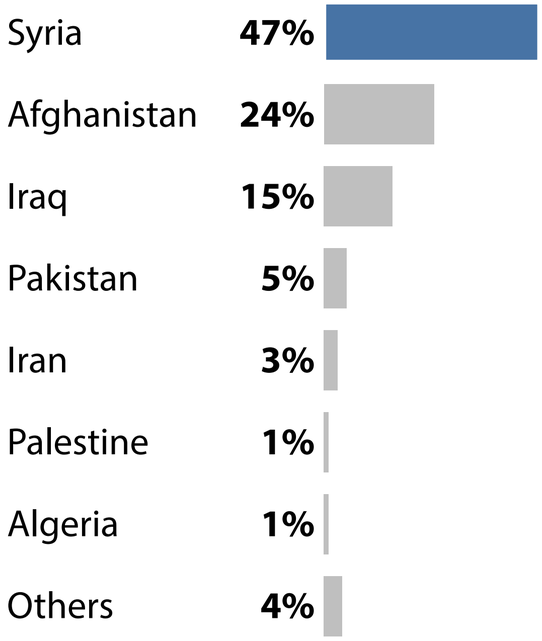
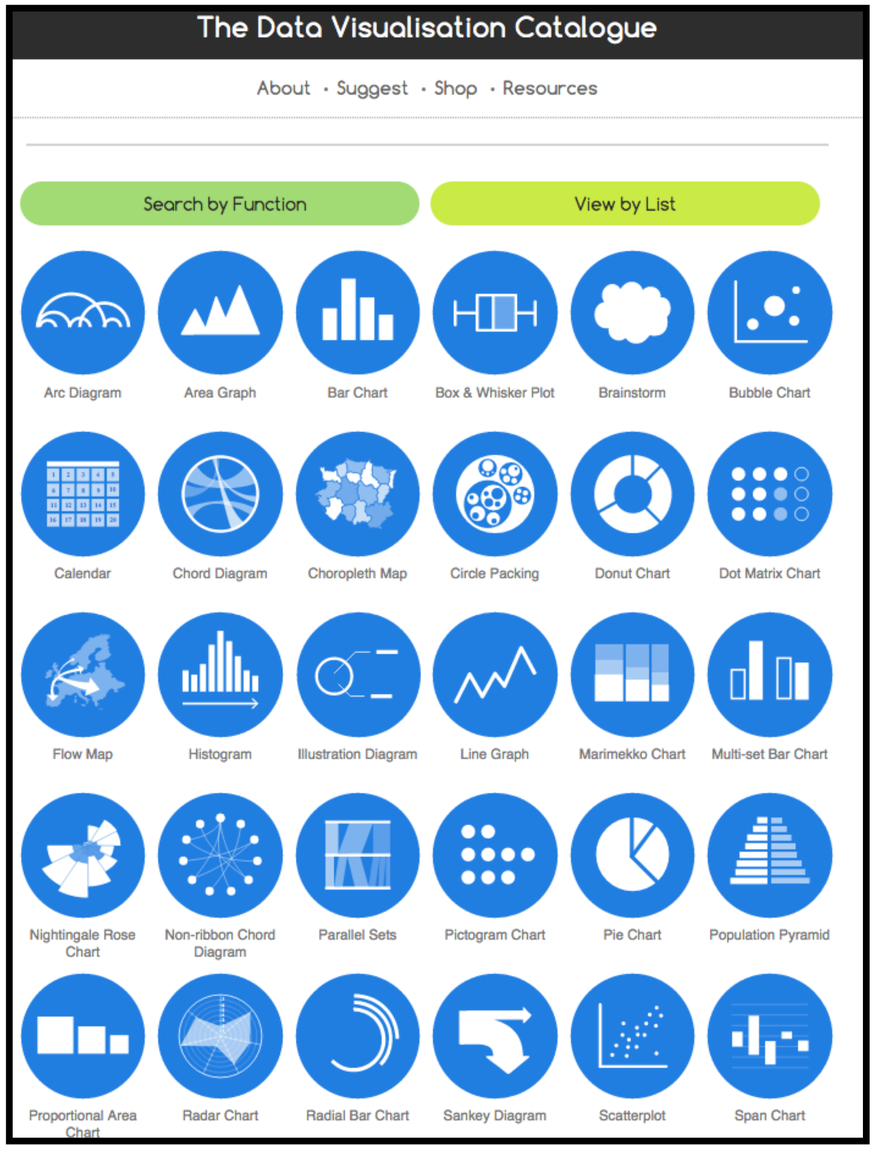


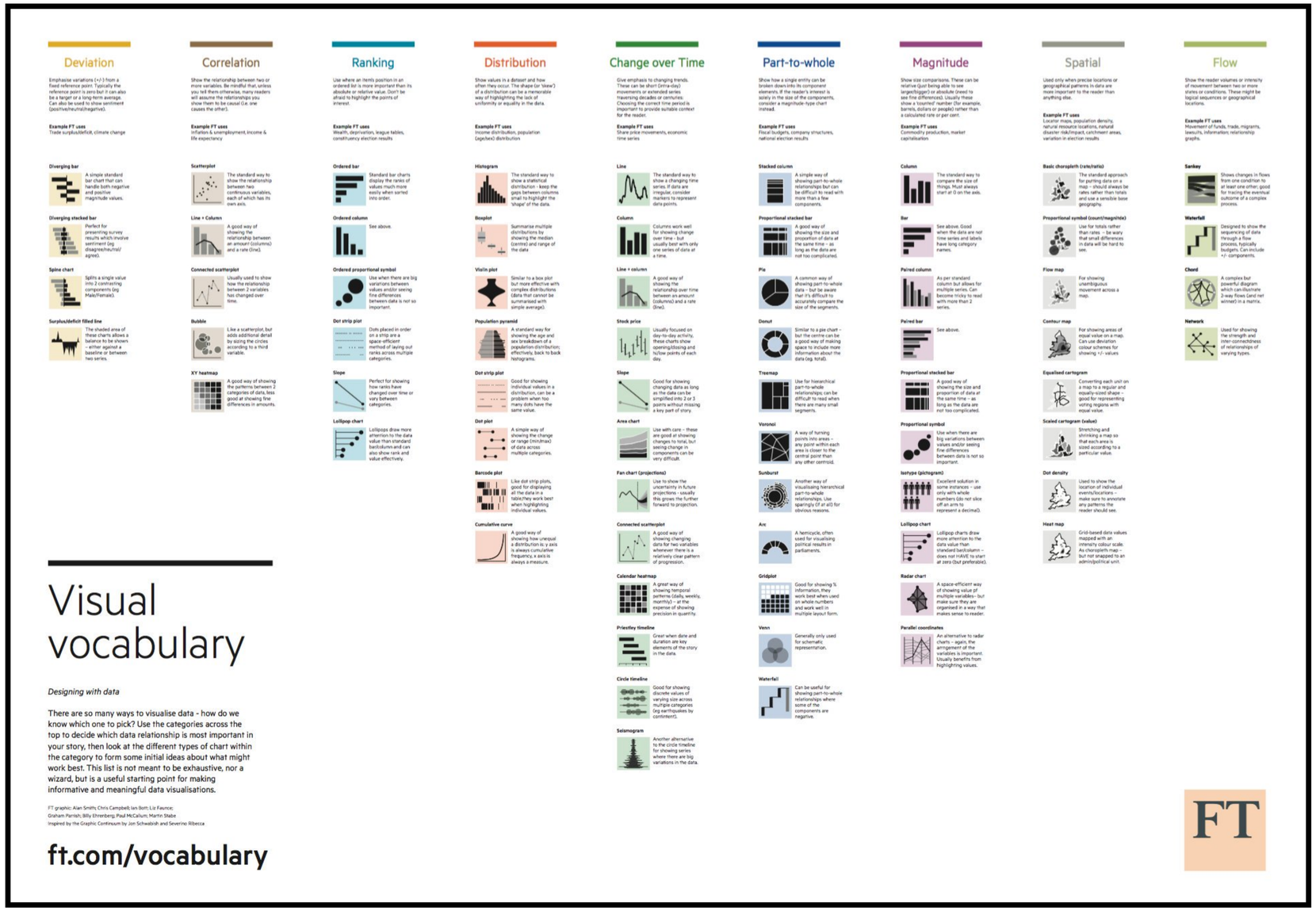






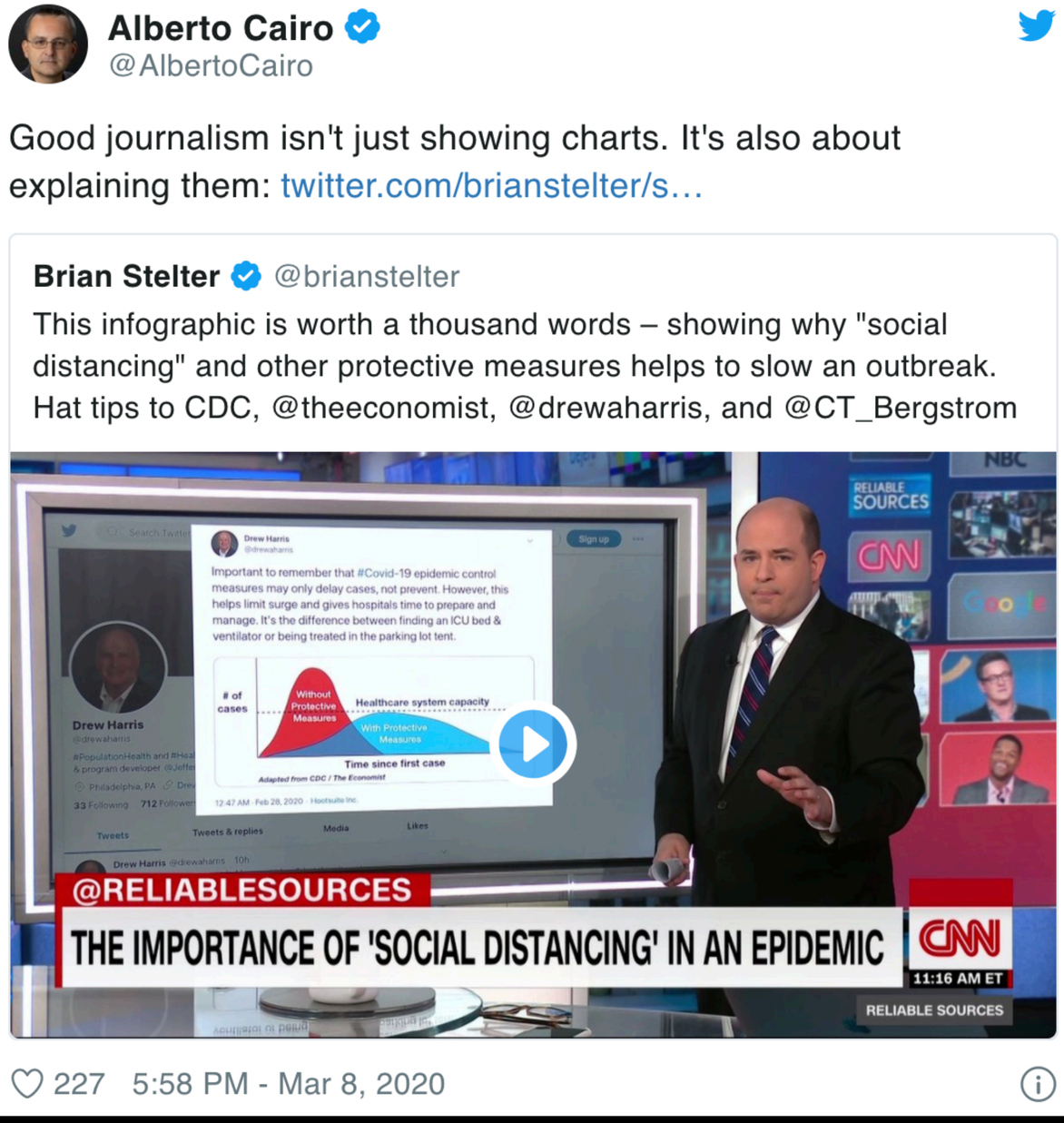
Alberto Cairo • University of Miami • www.thefunctionalart.com • Twitter: @albertocairo



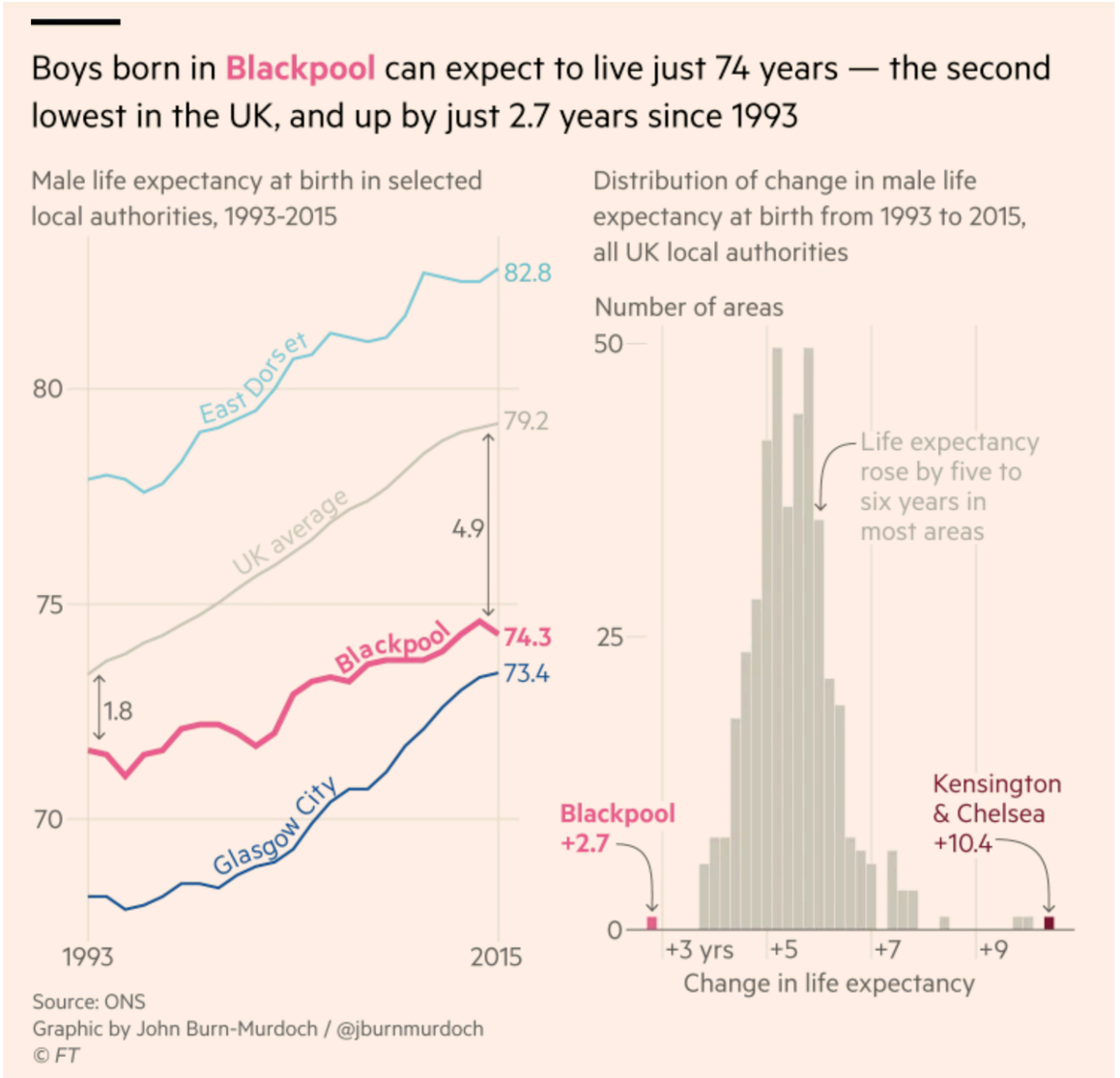


http://www.datavizcatalogue.com/

https://github.com/ft-interactive/chart-doctor/blob/master/visual-vocabulary/Visual-vocabulary.pdf



https://twitter.com/AlbertoCairo/status/1236773377865658370



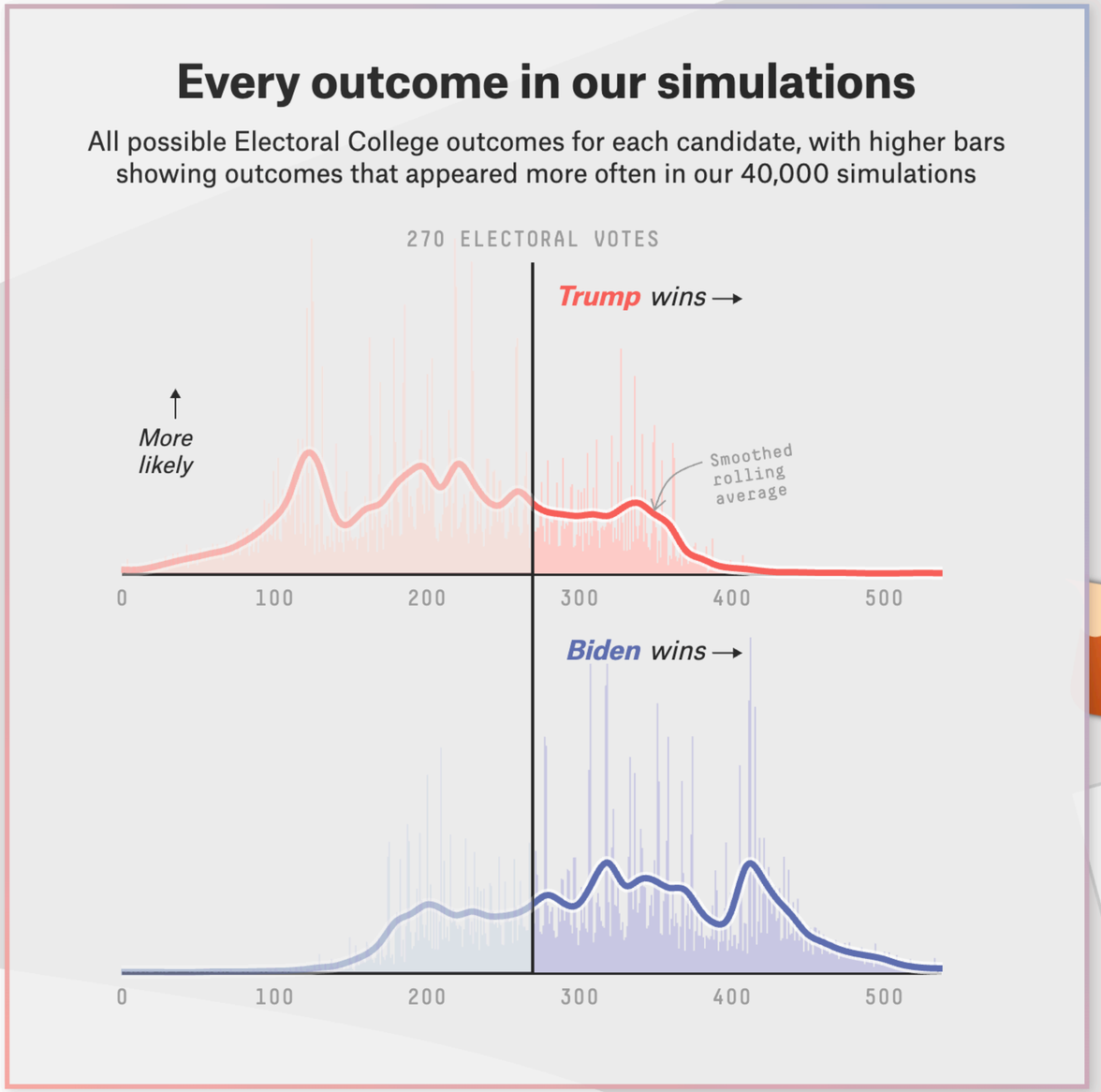
"Design secrets behind the FT's best charts of the year"
https://www.ft.com/content/4743ce96-e4bf-11e7-97e2-916d4fbac0da

"I and my colleagues here at the FT, we really do think one of the most valuable things we can do as data visualization practitioners is add this expert annotation layer."

John Burn-Murdoch

Financial Times

https://policyviz.com/podcast/episode-155-john-burn-murdoch/



More bars to the right of the 270 line means more simulations where that candidate wins. Some of the bars represent really weird outcomes, but you never know!

https://projects.fivethirtyeight.com/2020-election-forecast/

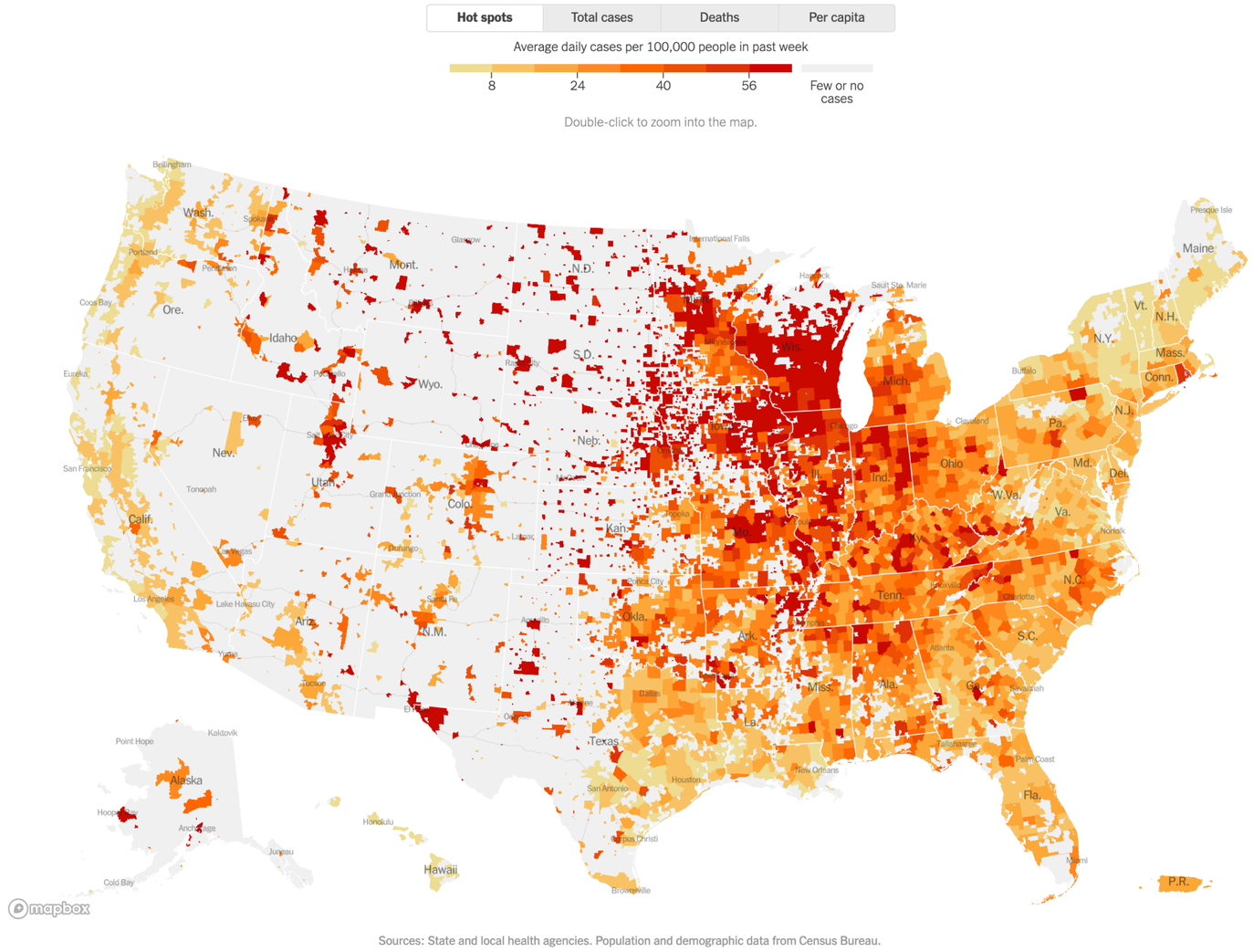
5. What style to use?

Not all visualizations need to be minimalist.

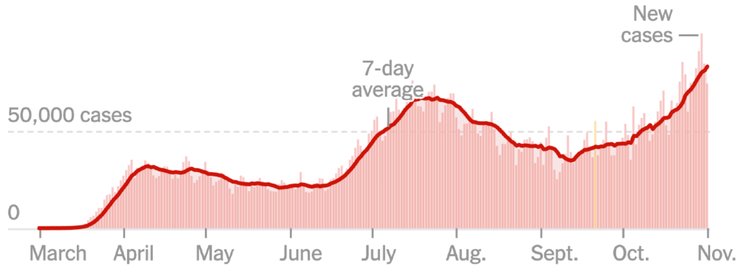
Not all visualizations need to be flashy and innovative, either.

Standard visualizations

Appropriate for graphics we use all the time



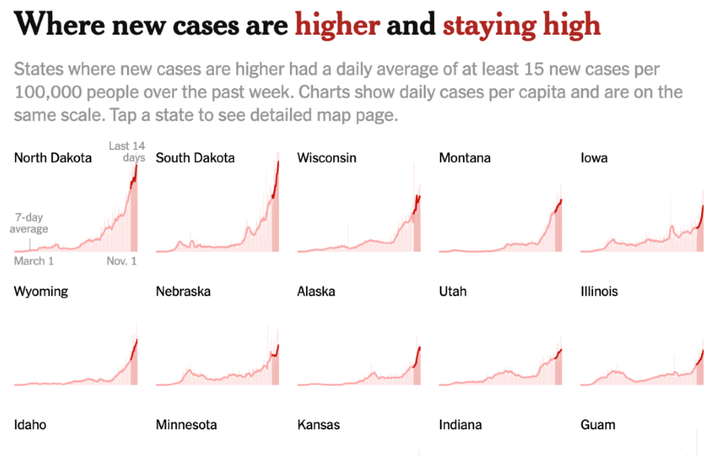
Sources: State and local health agencies. Population and demographic data from Census Bureau.



	TOTAL REPORTED	ON NOV. 1	14-DAY CHANGE
Cases	9.2 million+	74,113	+45% ↗
Deaths	230,937	427	+17% →

Day with data reporting anomaly.

Includes confirmed and probable cases where available. 14-day change trends use 7-day averages.



https://www.nytimes.com/interactive/2020/us/coronavirus-us-cases.html

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Fully customized style:

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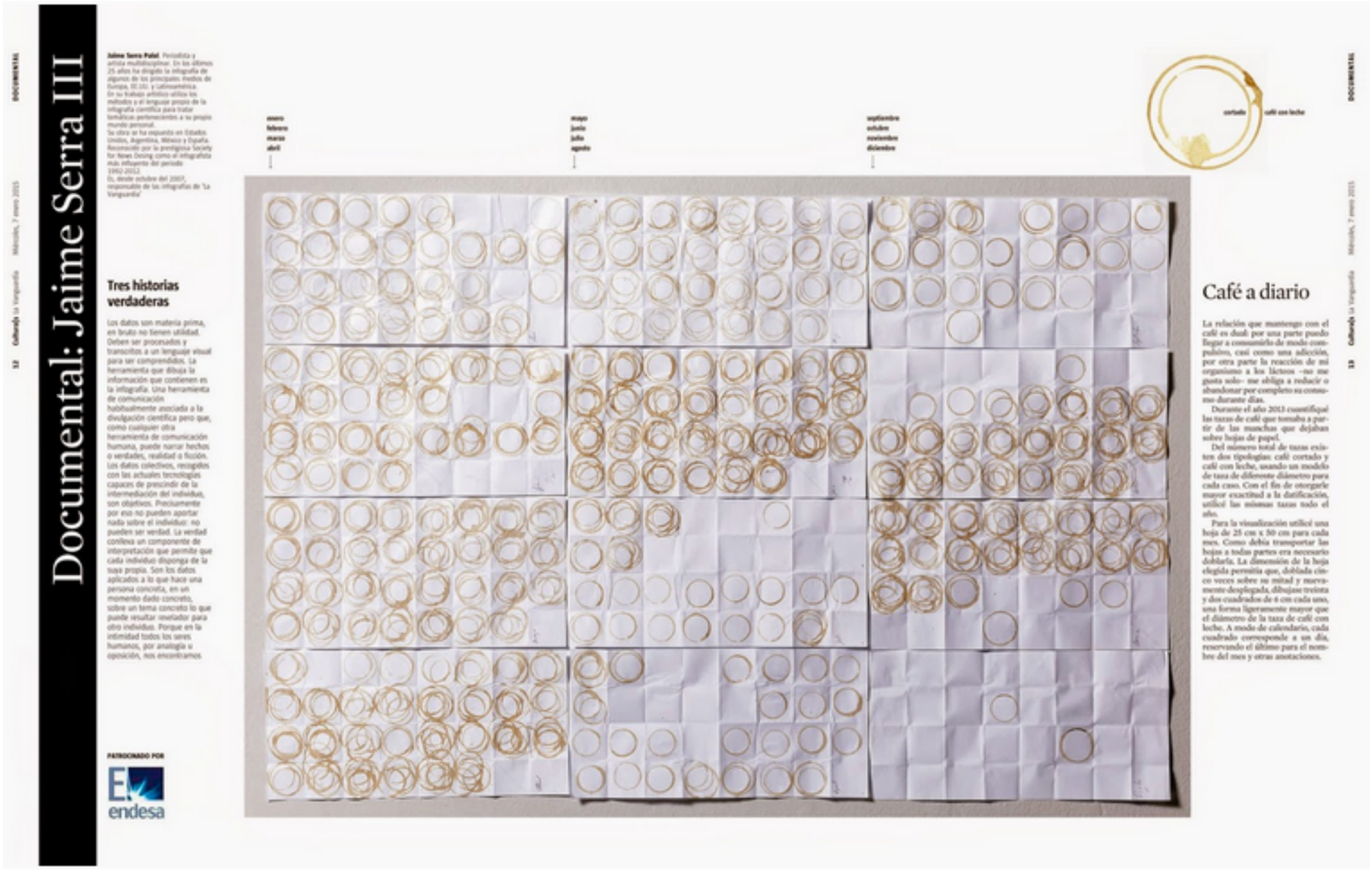

Unusual or unique visualizations

http://piaui.folha.uol.com.br/lupa/epicentro/

The purpose of visualization isn't visualization per se. The purpose of visualization is to help people **make sense of the world** through a combination of visuals and words.

The End.

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