How to fight against fake data and visualizations — from the left and from the right

A talk by Alberto Cairo
www.trumperytour.com
#visualTrumpery
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

here's a pic from reuters of Trump with the electoral maps he showed to reporters yesterday
Surface on the county-level map:

**Red: 80%**

**Blue: 20%**
SHARE OF THE POPULAR VOTE IN THE 2016 PRESIDENTIAL ELECTION

<table>
<thead>
<tr>
<th>Candidate</th>
<th>Vote Share</th>
<th>Total Votes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Donald Trump</td>
<td>46.1%</td>
<td>62,984,825 votes</td>
</tr>
<tr>
<td>Hillary Clinton</td>
<td>48.2%</td>
<td>65,853,516 votes</td>
</tr>
<tr>
<td>Other candidates</td>
<td>5.7%</td>
<td></td>
</tr>
</tbody>
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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%

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%
Surface on the county-level map:

Red: 80%
Blue: 20%

Bubble size is proportional to the number of votes received just by the candidate who won on each county.
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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VOTES FOR DONALD TRUMP

VOTES FOR HILLARY CLINTON

Bubble size is proportional to the number of votes per county
WHO WON ON EACH STATE

STATE SIZE ADJUSTED ELECTORAL VOTES

IT CONTRIBUTES TO THE ELECTION

TRUMP
306
270

ELECTORAL VOTES

CLINTON
232

SHARE OF THE POPULAR VOTE IN THE 2016 PRESIDENTIAL ELECTION

Donald Trump
46.1%

Hillary Clinton
48.2%

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5.7%

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VOTES FOR HILLARY CLINTON
This is what truly matters in a presidential election

ELECTORAL VOTES

**TRUMP**

306

**CLINTON**

232

WHO WON ON EACH STATE

STATE SIZE ADJUSTED BY ELECTORAL VOTES IT CONTRIBUTES TO THE ELECTION
Kid Rock for US Senate
Be respectful of people's Dumbfuckistani pride!
All these misused and misunderstood charts got me worried.

They reinforced a concern I’ve had for quite a while
I've spent my career doing charts of different kinds:
Pictorial explanations, statistical graphs, data maps, etc.
A good visualization helps you see more and better:

A visualization is a representation designed to enable exploration, discovery, or communication.
Length or height

Position

Area

Angle/area

Line weight

Hue and shade

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

Data visualization
Length or height

Position

Area

Angle/area

Line weight

Hue and shade

Figures represented in all these graphics: 22%, 25%, 34%, 29%, 32%
**Length or height**

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
</table>

**Position**

A
B
C
D
E

**Area**

A
B
C
D
E

**Angle/area**

A
B
C
D
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**Line weight**

A
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C
D
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**Hue and shade**

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Data visualization

Figures represented in all these graphics: 22%, 25%, 34%, 29%, 32%
Visualization has become very popular, and it’s everywhere nowadays.
When done well, visualization can help us notice patterns and trends that would go unnoticed otherwise. It makes complexity understandable.
This is all great, but here’s my concern:
DO PEOPLE WHO DESIGN CHARTS KNOW WHAT THEY ARE DOING? CAN MOST PEOPLE READ CHARTS CORRECTLY?

a) Do people understand their grammar and vocabulary?

b) If they do, do people interpret the messages contained in those charts well?
Pew Research Center
Survey 2014
63% of American Adults Can Correctly Read This Chart

Which of the following statements best describes the data in the graph below?

- Average number of decayed teeth per person in different countries
- Average sugar consumption (grams per person per day)
63% of American Adults Can Correctly Read This Chart

Which of the following statements best describes the data in the graph below?

Average number of decayed teeth per person in different countries

Average sugar consumption (grams per person per day)
The Persuasive Power of Data Visualization

Anshul Vikram Pandey  
New York University

Anjali Manivannan  
New York University

Oded Nov  
New York University

Margaret L. Satterthwaite  
NYU School of Law, satterth@exchange.law.nyu.edu

Enrico Bertini  
New York University

After looking into common effects in attitude formation and change we searched for specific mentions to the graphical appearance of charts as a driver for persuasion. Some of the comments we collected seem to back up the findings we found in our results. Some participants explicitly mention the charts as being the main reason for their change: “I already knew that increased incarceration didn’t lower crime, but I wasn’t sure of the statistics. To see it on the graphs is really eye opening.”; “I was influenced by the bar graph showing the reasons why the survey respondents played video games.”; “I would not know exact numbers on this issue - the graphs gave a visual and helped identify the numbers”; “Seeing the graphs conflicted with my previous opinion, so I feel like I need to reevaluate my stance in a way.”

It is also important to mention that the graphical appearance of charts is not the only factor that has a strong impact on people’s attitude. In our collected feedback, we found numerous references to statistics and numbers, suggesting that mere exposure to data does have a persuasive effect – maybe at least partially due to the increased sense of objectivity evidenced by numbers carries. We found comments like: “It was concrete data that seemed compelling.”; “Seeing numbers is a good indicator of change rather than just reading what someone has to say”; “It showed a large amount of different sources, which made it more credible”. More research is needed to disentangle what kind of specific effects each of these components have on persuasion.
A 2014 study published in *Public Understanding of Science* takes a different approach in looking at how the presentation of ad content can influence its effectiveness. The study, “Blinded with Science: Trivial Graphs and Formulas Increase Ad Persuasiveness and Belief in Product Efficacy,” looked at how ostensibly “scientific” graphical elements in a medication ad can increase consumers’ belief in its effectiveness. The scholars — Aner Tal and Brian Wansink of Cornell University — used several experiments to explore their hypothesis.

In the first, 61 participants recruited through Amazon’s *Mechanical Turk* were given information about a medication that supposedly increased immune response and decreased the chance of catching colds. Half were shown a bar graph purportedly illustrating the medication’s effects and half were not. A second experiment, with 56 participants recruited from a U.S. university, tested whether any effects could be due to simple repetition — that the graphs presented the same information twice, visually as well as verbally. Finally, a third experiment with 57 participants concerned a drug that supposedly reduced inflammation; information to half the group was presented with a chemical formula, half without.

The study’s findings include:

- Together, the three experiments indicate that claims about medications were found to be more persuasive when accompanied by graphs and formulas. “This appears to be due to the association of such elements with science, rather than increased comprehensibility, use of visuals or recall.”
- Part of the graphs’ persuasiveness stems from their simplicity: They are easily understood, even if their scientific foundation, validity and essential truthfulness are opaque.
- Graphs may increase persuasion because of their “signaling” value. “Even understanding them and knowing that they provide no additional information, people may take their presence as a cue to the scientific nature of claims, leading to increases in persuasiveness due to scientific ethos.”
- The higher participants’ belief in science, the more they were affected by the presence of graphs and formulas.

“These findings demonstrate that companies can easily abuse the prestige with which science is held. Adding even trivial or peripheral elements that are associated with scientific objectivity can help persuade people of product efficacy,” the authors write. “This must be guarded against in a wide variety of different contexts, including advertising, product packaging, web-design, sales visits, and press releases.”
GRAPHICACY
How to become better readers of charts
Skills for a modern educated citizen:

— Literacy
— Articulacy
— Numeracy
— Graphicacy

(I'd add "computeracy")
The word 'Trumpery' has origins tracing to 15th Century Middle English. How prescient.
merriam-webster.com/dictionary/tru...

_Trumpery_ derives from the Middle English _trompery_ and ultimately from the Middle French _tromper_, meaning "to deceive." (You can see the meaning of this root reflected in the French phrase _trompe-l'oeil_-literally, "deceives the eye"-which in English refers to a style of painting with photographically realistic detail.) _Trumpery_ first appeared in English in the mid-15th century with the meanings "deceit or fraud" (a sense that is now obsolete) and "worthless nonsense." Less than 100 years later, it was being applied to material objects of little or no value. The verb phrase _trump up_ means "to concoct with the intent to deceive," but there is most likely no etymological connection between this phrase and _trumpery._
The first rule of good consumers of information (this includes readers of charts):

READ BEYOND THE TITLE AND PAY ATTENTION

Charts are never meant to just be seen
They are meant to be read
SLIDES + EXTRA READINGS
https://tinyurl.com/yae3scoc

USE THEM!

alberto.cairo@gmail.com
Second rule: abandon the following clichés (and help other people abandon them, too)
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“A picture is worth a thousand words”
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“A picture is worth a thousand words”

“This chart (or data) speaks for itself”

“This chart (or charts) shows everything you need to know about X!”
The elements of good chart readership
Reading charts

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NUMBER OF METAL BANDS PER 1 MILLION PEOPLE
(Encyclopaedia Metallum, May 2016)

Source: Encyclopaedia Metallum
The most metal of the metal bands

Judas Priest
External features:

- Long hair
- Defiant poses
- Scowling faces
- Leather clothing
- Spikes
- Tight black pants
- Harley-Davidson bikes
Performing features:

Thundering drums
Elaborate and endless guitar riffs
Synchronized head banging
A singer that sounds like a pissed banshee

Aggressive (and goofy) lyrics
Faster than a bullet
Terrifying scream
Enraged and full of anger
He is half man and half machine
Rides the metal monster
Breathing smoke and fire
Closing in with vengeance soaring high

He is the painkiller
This is the painkiller
Planets devastated
Mankind's on its knees…
Performing features:

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Judas Priest

The most metal of the metal bands

Are all these bands more similar than not to Judas Priest?
The most metal of the metal bands

“Metal”?
America’s health care prices are out of control. These 11 charts prove it.
America’s health care prices are out of control. These 11 charts prove it.

Average household disposable income:
- U.S: $41,000
- Switzerland: $36,000
- Spain: $22,000
- UK: $35,000
- Australia: $33,000

Relative cost of cataract surgery:
- U.S: 8%
- Switzerland: 6%
- Spain: 8%
- UK: 9%
2015 Survey Overview

This year’s survey has been conducted in much the same way as the previous study, which includes pricing for several specialty prescription drugs, other prescription drugs and a selection of typical medical procedures. Prices for each country were submitted by participating federation member plans, and are drawn from public or commercial sectors as follows:

- Prices for the United States were derived from over 370 million medical claims and over 170 million pharmacy claims that reflect prices negotiated and paid to health care providers.

- Prices for Australia, New Zealand, Spain, South Africa, Switzerland and the UK are from the private sector, with data provided by one private health plan in each country.

Comparisons across different countries are complicated by differences in sectors, fee schedules, and systems. In addition, a single plan’s prices may not be representative of prices paid by other plans in that market.
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Always tell yourself:
“A chart shows as much as it hides — so think about what might be missing”

Counties with the LOWEST kidney cancer death rates
(1980-1989)

From *Teaching Statistics: A Bag of Tricks*
Andrew Gelman, Deborah Nolan
Always tell yourself:
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Counties with the LOWEST kidney cancer death rates (1980-1989)

Counties with the HIGHEST kidney cancer death rates (1980-1989)

From *Teaching Statistics: A Bag of Tricks*  
Andrew Gelman, Deborah Nolan

Alberto Cairo • University of Miami • www.thefunctionalart.com • Twitter: @albertocairo
Chocolate And Nobel Prizes Linked In Study

You don’t have to be a genius to like chocolate, but geniuses are more likely to eat lots of chocolate, at least according to a new paper published in the August New England Journal of Medicine. Franz Messerli reports a highly significant correlation between a nation’s per capita chocolate consumption and the rate at which its citizens win Nobel Prizes.

Building on research raising the possibility that the flavonols in chocolate may enhance cognitive performance, Messerli “wondered whether there would be a correlation between a country’s level of chocolate consumption and its population’s cognitive function.” Using the success of a

Eating chocolate may help you win Nobel Prize

A study published in the Oct. 10 issue of the New England Journal of Medicine on the relationship between chocolate consumption and the number of Nobel Prize winners a country has and suggests it’s a sign that the sweet treat can boost brain power.

Take this with a grain of salt, or perhaps some almonds or hazelnuts: A study ties chocolate consumption to the number of Nobel Prize winners a country has and suggests it’s a sign that the sweet treat can boost brain power.

No, this does not appear in the satirical Onion newspaper. It’s in the prestigious New England Journal of Medicine, which published it online Wednesday as a “snob” rather than a rigorous, peer-reviewed study.

The best “brain food” might be chocolate, a new study out in the New England Journal of
The only possible outlier in Figure 1 seems to be Sweden. Given its per capita chocolate consumption of 6.4 kg per year, we would predict that Sweden should have produced a total of about 14 Nobel laureates, yet we observe 32. Considering that in this instance the observed number exceeds the expected number by a factor of more than 2, one cannot quite escape the notion that either the Nobel Committee in Stockholm has some inherent patriotic bias when assessing the candidates for these awards or, perhaps, that the Swedes are particularly sensitive to chocolate, and even minuscule amounts greatly enhance their cognition.

Dr. Messerli reports regular daily chocolate consumption, mostly but not exclusively in the form of Lindt’s dark varieties.
Journalists were not the only ones to take the column too seriously.
From: The Journal of Nutrition:

“Does Chocolate Consumption Really Boost Nobel Award Chances? The Peril of Over-Interpreting Correlations in Health Studies”

Alberto Cairo • University of Miami • www.thefunctionalart.com • Twitter: @albertocairo
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Ganó el hijo de Chávez: Nicolás Maduro es el Presidente Electo de Venezuela (+Video)

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Nicolás Maduro: Hoy es un día de historia, vamos con Cristo Redentor (+Fotos)

Telediario Venezuela

Alberto Cairo • University of Miami • www.thefunctionalart.com • Twitter: @albertocairo
Always read the X-axis and the Y-axis labels

- Non-zero baseline
- Zero baseline
Always read the X-axis and the Y-axis labels

“Double the axes, double the mischief”
(Quote from Gary Smith’s *Standard Deviations*)

http://www.thefunctionalart.com/2015/10/if-you-see-bullshit-say-bullshit.html
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Graph by: Emily Schuch

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Demand an appropriate amount of data and detail. Distrust summary statistics (mean, median, etc.) and isolated figures.
Jobless rate after first 3 months: Trump vs. Obama vs. Bush vs. Clinton.

<table>
<thead>
<tr>
<th></th>
<th>Beginning of presidency</th>
<th>End of presidency</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinton</td>
<td>7.3%</td>
<td>4.2%</td>
<td>-3.1</td>
</tr>
<tr>
<td>Bush</td>
<td>4.2%</td>
<td>7.8%</td>
<td>+3.6</td>
</tr>
<tr>
<td>Obama</td>
<td>7.8%</td>
<td>4.8%</td>
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Careful with amalgamation paradoxes and outliers

careful with amalgamation paradoxes and outliers

most neighborhoods in most cities are pretty safe, and have likely remained down here (these aren’t real data points)

factcheck.org chart based on fbi data

careful with amalgamation paradoxes and outliers


alberto cairo • university of miami • www.thefunctionalart.com • twitter: @albertocairo
Some neighborhoods in certain cities are so far up that they skew the national rate.

Most neighborhoods in most cities are pretty safe, and have likely remained down here (these aren’t real data points).

Careful with amalgamation paradoxes and outliers.

The news from the F.B.I. crime data was alarming: The murder rate rose sharply last year, driven by jumps in several major cities.

Four urban areas — Baltimore, Chicago, Milwaukee and Washington — accounted for about a fifth of the increase in homicides in 2015. Those cities, however, make up only about 1 percent of the nation’s population.

But whether crime is up or down depends on what data is being looked at — and who is doing the looking.

The F.B.I. data showed that violent crime rose about 4 percent last year from 2014, and homicides increased 10.8 percent. Yet crime over all fell in 2015 for the 14th consecutive year.

And the total number of homicides last year was fewer than 20 years ago even as the country's population increased, criminologists said. There were 19,645 homicides in 1996 in a nation of 265 million; in 2015, there were 15,696 in a population of 321 million.

What that data means, criminologists and police officials said, is that the decline in homicides has been so significant in the last quarter century that sudden increases in the number of killings in just a few cities can skew the entire national picture, even as the country has one of its safest periods on record.

“It isn’t a national trend, it’s a city trend, and it’s not even a city trend, but a problem in certain neighborhoods,” said Richard A. Berk, a professor of statistics and criminology at the University of Pennsylvania. “Certainly, people around the country should not be worried. People in Chicago shouldn’t be worried. But people in certain neighborhoods might be.”

Criminologists and police officials point out that homicides do not usually disrupt entire cities. Instead, they occur in particular neighborhoods — and on the same blocks — leaving much of the rest of the city relatively untouched.

Explanations for the increase in homicides in certain American cities are largely guesswork. Criminologists acknowledge that the required analysis has not been done in the neighborhoods where killings are occurring — or even an agreement of what such a study should include — to arrive at any but the broadest conclusions.

Careful with amalgamation paradoxes and outliers

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

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

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.

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?

<table>
<thead>
<tr>
<th>Choice</th>
<th>Percentage</th>
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<tr>
<td>No</td>
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Margin of error: +/-2.95 at 95% confidence level

The probability of the tiny difference between the “No” and the “Yes” being just due to random chance is very high.
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5. Is uncertainty relevant? If so, is it revealed?
A critical thinking revolution won’t lead us anywhere if it isn’t paired with a moral reasoning revolution.
BUILD
BUILD

DESTROY
BUILD  DESTROY

Make your choice
ETHICS: what I’d ask everyone to do

Strive to become aware of your own cognitive and ideological biases and fight against them to avoid self-deception.

In any argument, being truthful matters more than being the winner. Don’t twist facts to fit your agenda. Don’t lie. Don’t bullshit.

Don’t share data and graphics in social media without making sure that they are legitimate. Take a couple of minutes to read them and check their sources.

Help me teach these principles

Use the materials I shared with you—including these slides—at will.

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THANK YOU!

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