

# Data visualization

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Data visualization as communication



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*Visualizations act as a campfire around which we gather to tell stories.*

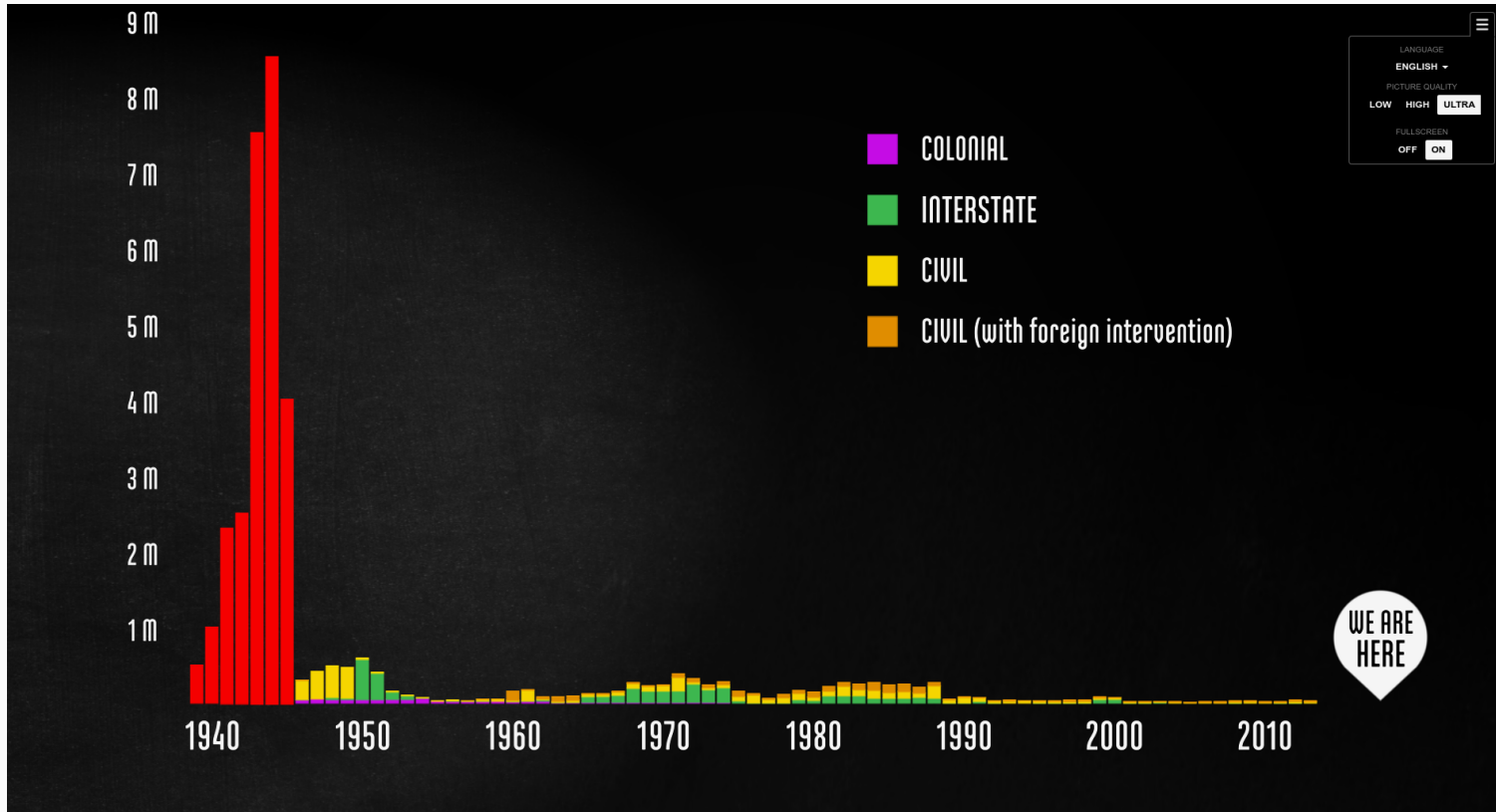
— Al Shalloway (Founder and CEO of [Net Objectives](#))

# Effective presentations ↔ effective visuals



Source: [Digital Image](#), AP photo used on *Business Insider*, accessed September 10, 2017. [www.businessinsider.com/the-first-iphone-2013-12](http://www.businessinsider.com/the-first-iphone-2013-12).

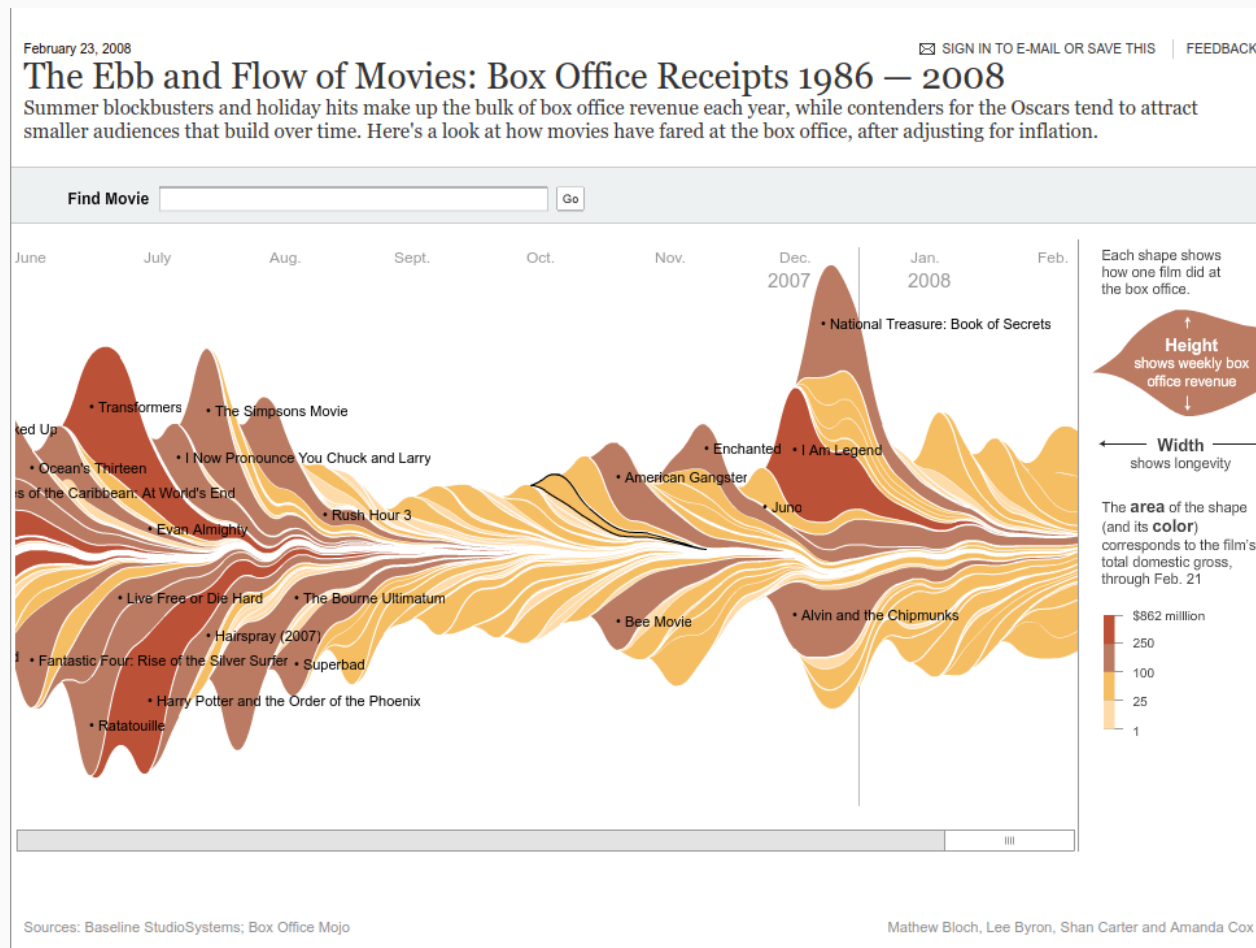
# Visualizations can lead to comprehension...



Source: The Fallen of World War II, [www.fallen.io/ww2/](http://www.fallen.io/ww2/)



# ...or to confusion



Source: Bloch, Mathew. "The Ebb and Flow of Movies - Box Office Receipts 1986 — 2008." *New York Times*, Lee Bryon, Shan Carter, Amanda Cox, 23 Feb. 2008. [www.nytimes.com/interactive/2008/02/23/movies/20080223\\_REVENUE\\_GRAPHIC.html](http://www.nytimes.com/interactive/2008/02/23/movies/20080223_REVENUE_GRAPHIC.html).

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- Engineers at Morton Thiokol, who supplied solid rocket motors to NASA, warned about this on January 27th, 1986 in a conference call
- NASA and the managers at Morton Thiokol overruled their concerns, unpersuaded by the engineers

# The engineers presented tables like this one

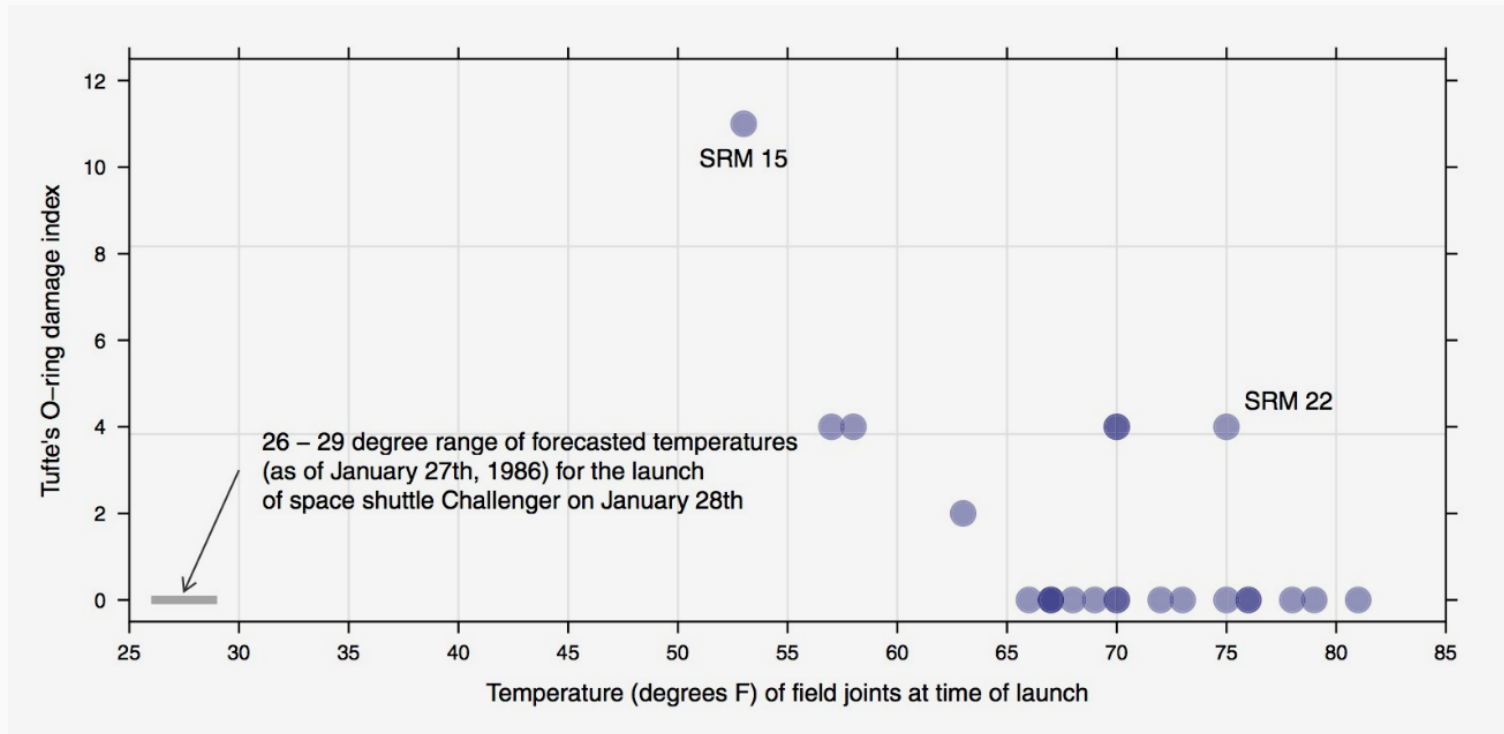
HISTORY OF O-RING TEMPERATURES  
(DEGREES - F)

<u>MOTOR</u>	<u>MBT</u>	<u>AMB</u>	<u>O-RING</u>	<u>WIND</u>
DM-4	68	36	47	10 MPH
DM-2	76	45	52	10 MPH
QM-3	72.5	40	48	10 MPH
QM-4	76	48	51	10 MPH
SRM-15	52	64	53	10 MPH
SRM-22	77	78	75	10 MPH
SRM-25	55	26	29 27	10 MPH 25 MPH

Source: Figure 2.18(a) in *Modern Data Science with R* by Benjamin Baumer, Daniel Kaplan, and Nicholas Horton.

# Edward Tufte's critique of the Challenger disaster

Mathematician Edward Tufte issued a critique and argued that the data should have been presented this way:

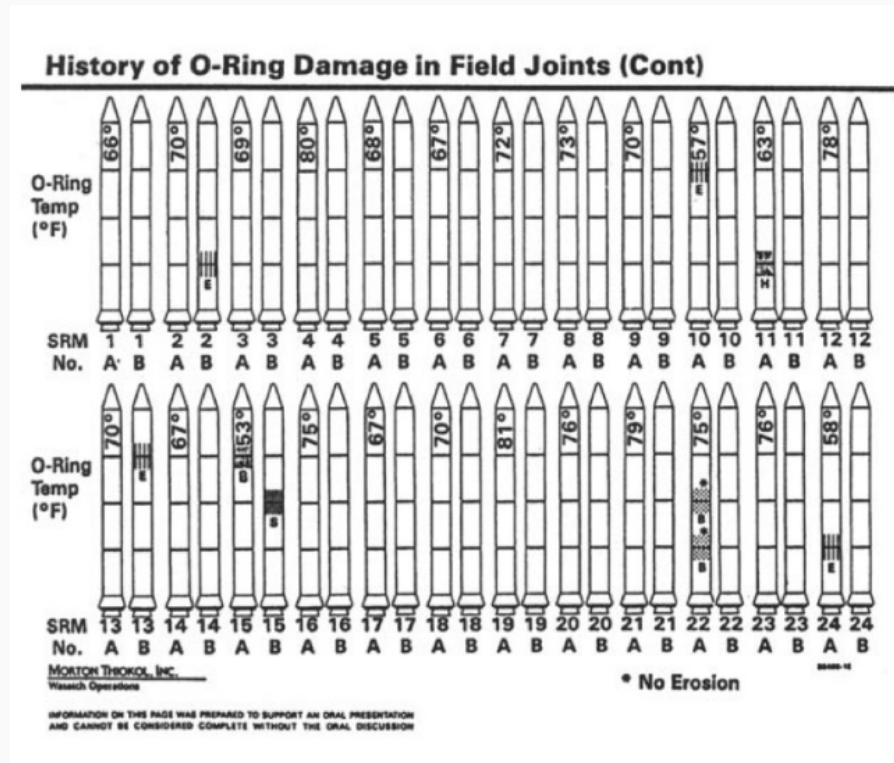


Source: Figure 2.17 in *Modern Data Science with R* by Benjamin Baumer, Daniel Kaplan, and Nicholas Horton.



# "Chartjunk" in Challenger Congressional Hearings

This information was presented in Congressional Hearings about the incident in this format:



Source: Figure 2.18(b) in *Modern Data Science with R* by Benjamin Baumer, Daniel Kaplan, and Nicholas Horton.

# *How to Lie with Statistics*

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***General method:*** *Violate conventions and expectations*

# Example 1: gun deaths in Florida over time

## **Context**

Florida passed a "Stand Your Ground" law in 2005.

Advocates claimed it would reduce crime, opponents argued it would increase use of lethal force

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## Context

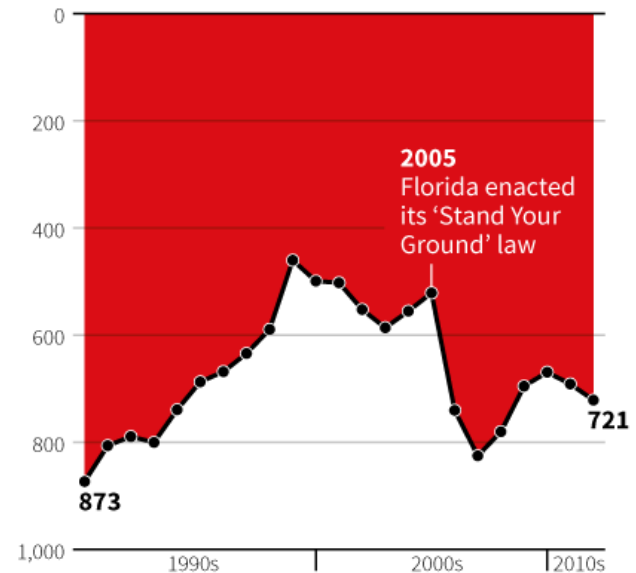
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Advocates claimed it would reduce crime, opponents argued it would increase use of lethal force

If you wanted to use data to answer this question, and you came across this graphic published by the news organization Reuters, what would you conclude?

## Gun deaths in Florida

Number of murders committed using firearms



Source: Florida Department of Law Enforcement

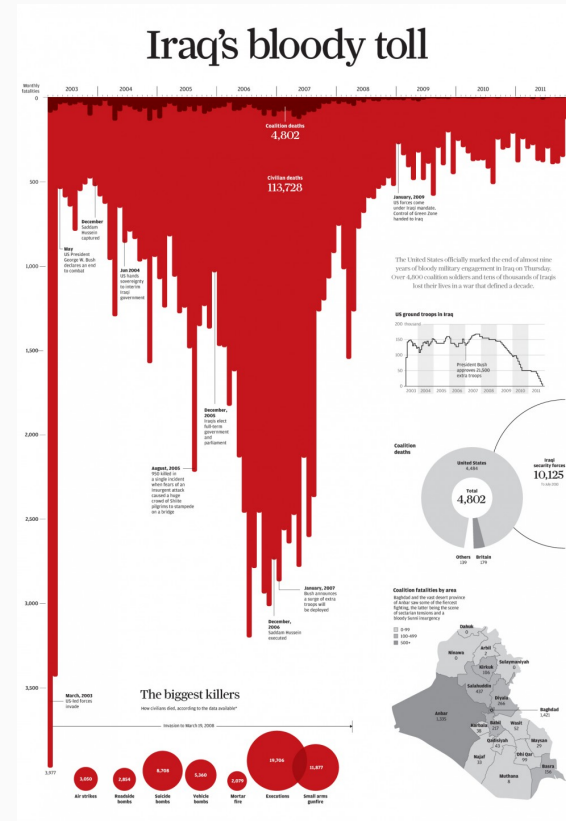
C. Chan 16/02/2014

REUTERS

Source: Chen, Christine. "Gun deaths in Florida." *Reuters*, 16 Feb. 2014. [graphics.thomsonreuters.com/14/02/US-FLORIDA0214.gif](http://graphics.thomsonreuters.com/14/02/US-FLORIDA0214.gif).

# Example 1: gun deaths in Florida over time

The image's creator posted on Twitter to explain her design choices for the visualization.

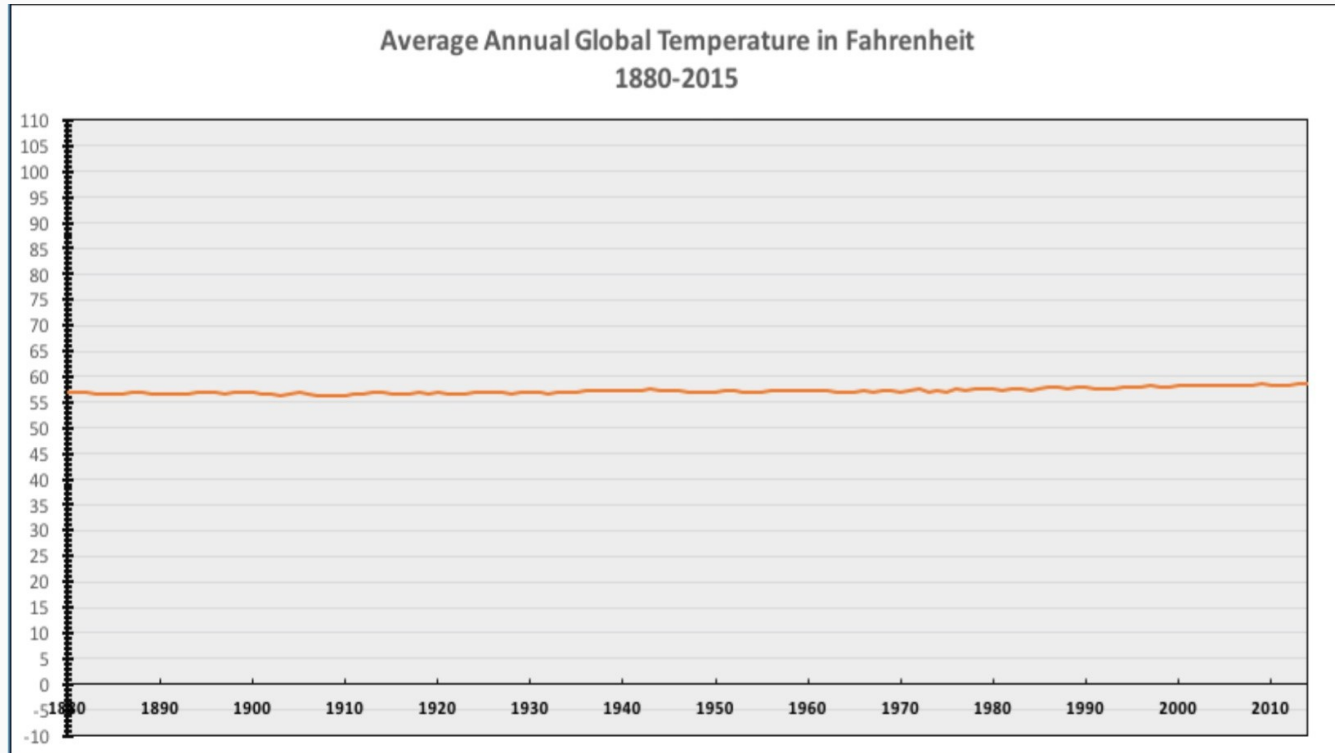


Sources: @ChristineHHChan, *Twitter*, 15 Apr. 2014, 2:30 a.m., [twitter.com/ChristineHHChan/status/455971447169511424](https://twitter.com/ChristineHHChan/status/455971447169511424);  
@ChristineHHChan, *Twitter*, 15 Apr. 2014, 2:31 a.m., [twitter.com/ChristineHHChan/status/455971685783441408](https://twitter.com/ChristineHHChan/status/455971685783441408); Scarr, Simon. "Iraq's bloody toll." *South China Morning Post*, 17 Dec. 2011. [scmp.com/infographics/article/1284683/iraqs-bloody-toll](http://scmp.com/infographics/article/1284683/iraqs-bloody-toll).



# Example 2: average global temperature over time

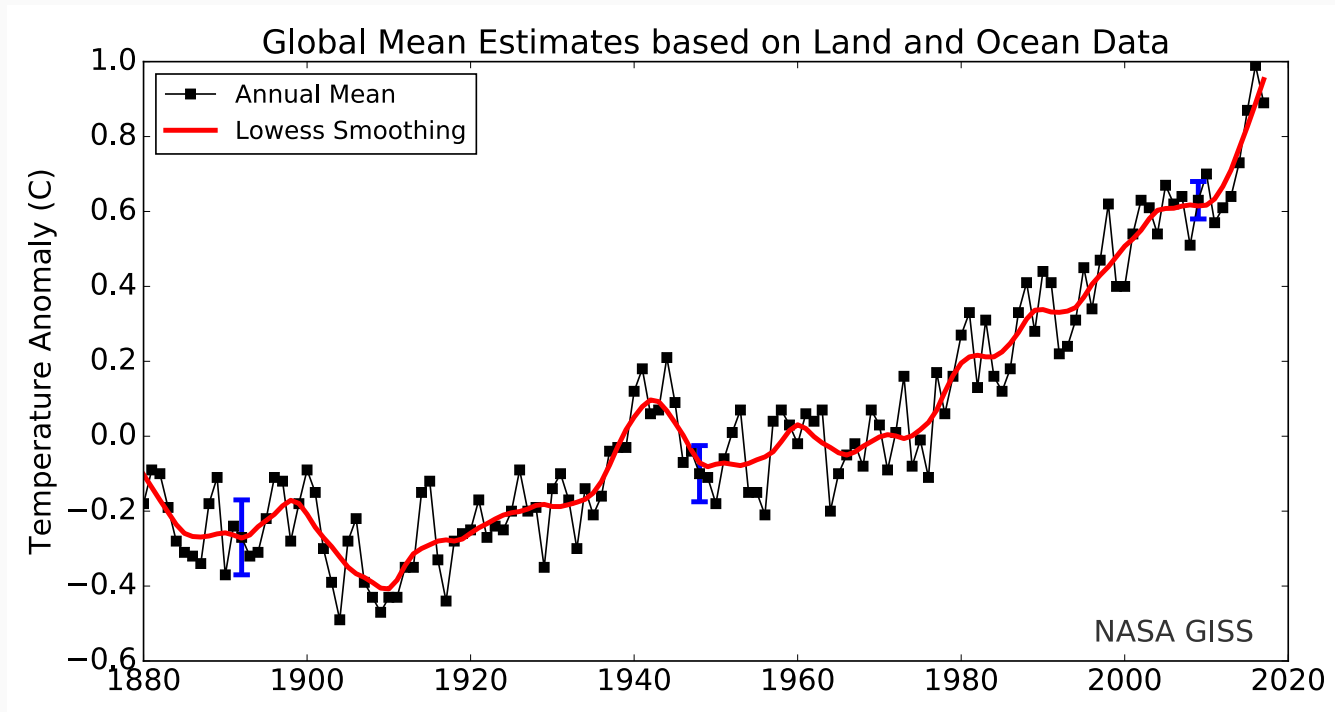
The political/editorial magazine National Review **tweeted the following visualization** on December 14, 2015.



Source: "Average Annual Global Temperature in Fahrenheit." *Powerline*, Steven Hayward, Global-2-copy, 21 Oct. 2015. [www.powerlineblog.com/archives/2015/10/the-only-global-warming-chart-you-need-from-now-on.php](http://www.powerlineblog.com/archives/2015/10/the-only-global-warming-chart-you-need-from-now-on.php).

# Example 2: average global temperature over time

Here's a conventional plot of the average global temperature data



Source: "Global Mean Estimates based on Land and Ocean Data." NASA Goddard Institute for Space Studies, Sep. 2018. [data.giss.nasa.gov/gistemp/graphs/](https://data.giss.nasa.gov/gistemp/graphs/).

## Side note: How do we have a record going back to the 1880s?

Temperatures from the 1800s and onward were recorded using thermometers at various locations around the globe, and by the 1880s thermometers had become precise. Systematic measurements began around the mid-1800s at various army posts, and in 1891 the National Weather Service was formed to continue the effort.

Source: National Oceanic and Atmospheric Administration. "How do we observe today's climate?", [www.climate.gov/maps-data/primer/measuring-climate](http://www.climate.gov/maps-data/primer/measuring-climate).

# Principles and ethics for scientific visualizations

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5. If you leave something out of a visualization, say so and justify it
6. Strongly consider including your datasets and any scripts used to create figures with your reports or journal articles

# Credits

License

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Acknowledgments

Illustrative examples (*Challenger* disaster, *How to Lie with Statistics*, Gun deaths in Florida, average global temperatures) and **principles and ethics for scientific visualizations** adapted from *Modern Data Science with R* by Benjamin Baumer, Daniel Kaplan, and Nicholas Horton, chapters 2 and 6.