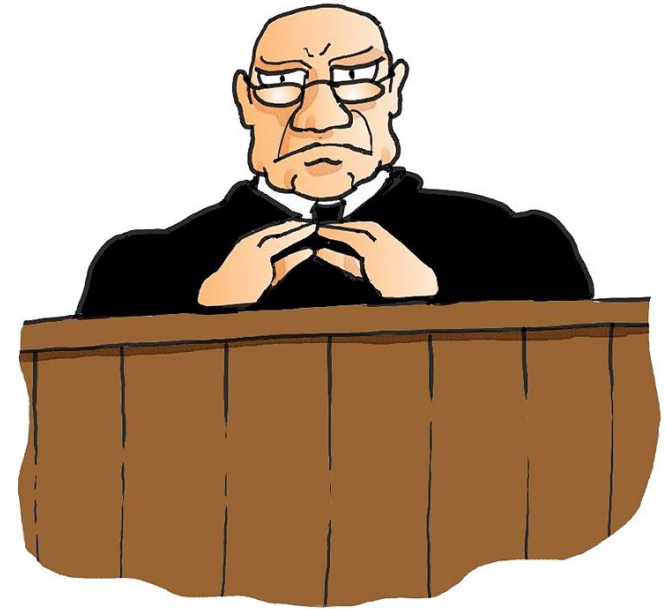


It's Not What We Said, It's Not What They Heard, It's What They Say They Heard



Barry D. Nussbaum, President
American Statistical Association

Fall Technical Conference
Philadelphia, Pennsylvania
October 6, 2017

Variations in Terminology



**The Supreme Court of the
United States gets
“significance” right**

Matrixx and *Zicam*

Between 1999 to 2004 Matrixx received reports that *Zicam* caused anosmia (loss of sense of smell).

Most of the cases were apparently total and permanent loss of the ability to smell.

NOT SUCH A BIG SURPRISE: A lawsuit was filed

Matrixx and *Zicam*

However Matrixx did not disclose these reports and announced they had a “very strong momentum” and “poised for growth” (*Zicam* was roughly two thirds of its sales).

After a link between *Zicam* and anosmia was broadcast on television in 2004, Matrixx’s stock price dropped from \$13.04 to \$9.94 (a decline of 24%).

Matrixx's argument

Matrixx argued that back in 2004 they should not have been required to disclose small numbers of unreliable reports as all drug companies receives anecdotal reports on alleged adverse health effects.

Matrixx also argued they should only face liability for securities fraud if the reports had been statistically significant.

The lower court and appeal

A suit was filed against Matrixx alleging its statements about business growth and *Zicam's* safety were false and misleading.

The District Court dismissed the case but on appeal the Ninth Circuit Court of Appeals reversed and remanded (sent back).

Matrixx filed a petition for a writ of *certiorari* (review) which the Supreme Court accepted and considered in January, 2011.

Sotomayor's Opinion



The Supreme Court in a unanimous decision rejected Matrixx's argument that information can be material only if it meets some standard of statistical evidence.

“Given that medical professionals and regulators act on the basis of evidence of causation that is not statistically significant, it stands to reason that in certain cases reasonable investors would as well” (Justice Sonia Sotomayor).

The Supreme Court Decision

The Supreme Court said that the presence or absence of statistical significance is not the key factor as to whether an adverse effect is material.

“The lack of statistically significant data does not mean that the medical experts have no reliable basis for inferring a causal link between a drug and adverse events” Justice Sonia Sotomayor.

Conclusion: Statistical significance is only a part of the quantitative aspects in the interpretation of results.

My Two Cents



1. The Supreme Court did not explicitly say anything about the “effect size”. This was a pretty large effect.
2. Note correspondence with ASA Principle 3: Scientific conclusions and business or policy decisions should not be based only on whether a p-value passes a specific threshold

An Important Victory Using Basic Statistics

USA vs. Chrysler Motors

➤ The Problem

- Ancillary data showed large exceedences of carbon monoxide values in 1975 Chryslers**
- 208,000 vehicles with large displacements are involved**
- Vehicles were “in-use” at the time**
- Must be measured according to dynamometer test**

An Important Victory Using Basic Statistics (cont.)

➤ Statistical Concerns

- What is the population?**
- How do you do a random selection?**
- How do you make sure they are representative?**
- What incentive do you give a vehicle owner?**
- How do you find properly maintained and used vehicles?**
- Are there any distributional assumptions**
- What is the sample size?**

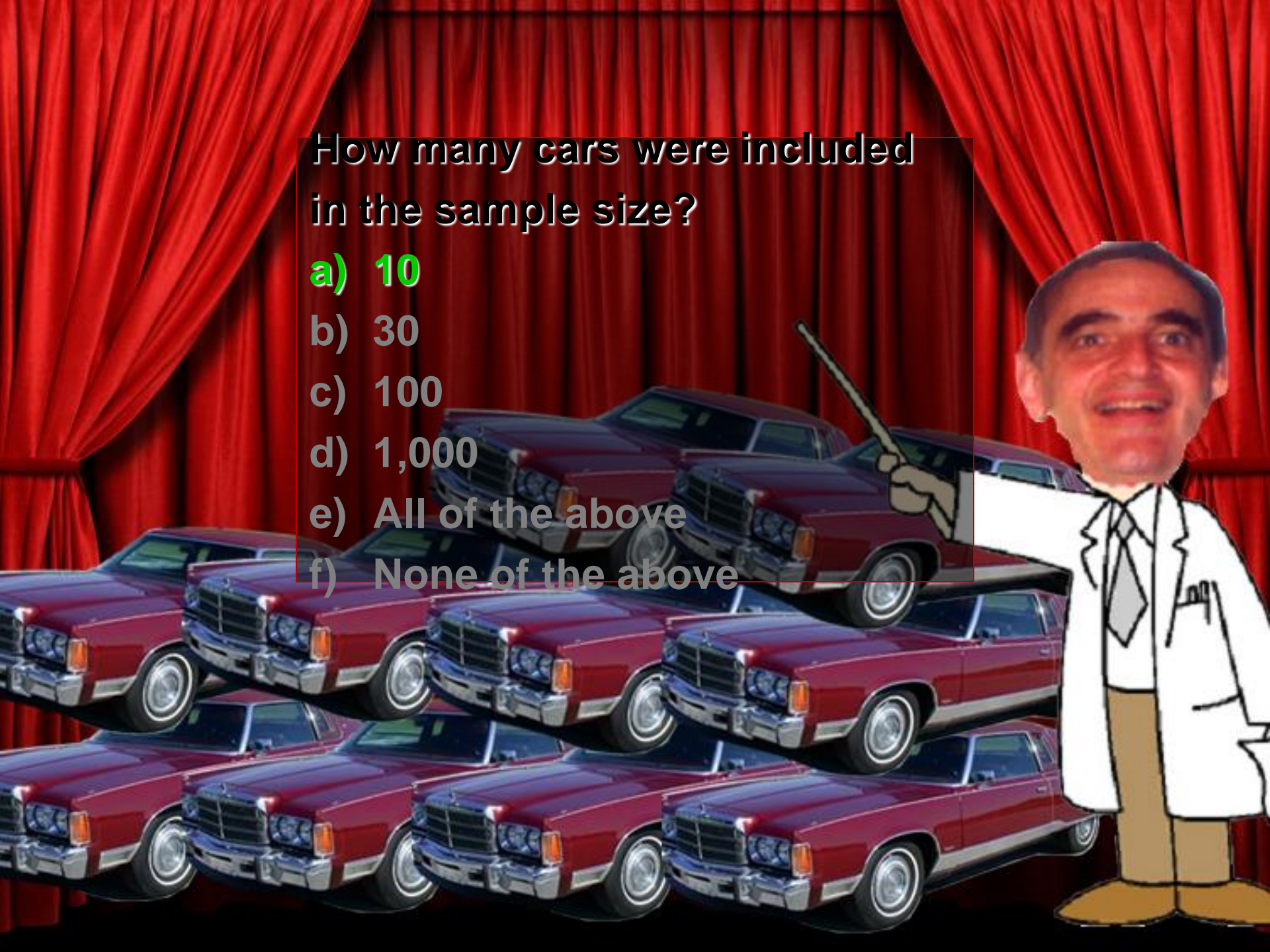
The background of the slide consists of a pair of red, vertically pleated curtains. The curtains are pulled back slightly at the top, creating a central opening. The lighting is somewhat dim, with the center of the opening being brighter than the edges. The overall color scheme is a rich, dark red.

**How many cars were included
in the sample size?**

- a) 10**
- b) 30**
- c) 100**
- d) 1,000**
- e) All of the above**
- f) None of the above**

How many cars were included
in the sample size?

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This Creates Two Issues

Issue 1: YOU



Issue 2: The Judge



What Did We Say ?

The 95% one-sided confidence limit is 0.74

So we told the judge:

We are quite confident that at least 74% of these vehicles would fail.

A Digression for Chemistry

- Urban dynamometer driving cycle (LA-4)
 - The “average” morning commute
 - Temperature and humidity controlled
 - 7.5 miles with frequent stops
 - Average speed is 19.6 miles per hour
 - EPA measures tailpipe emissions
 - Carbon in = carbon out
 - So what can you estimate based on all this?

Simple Presentation of Data Used in Policy

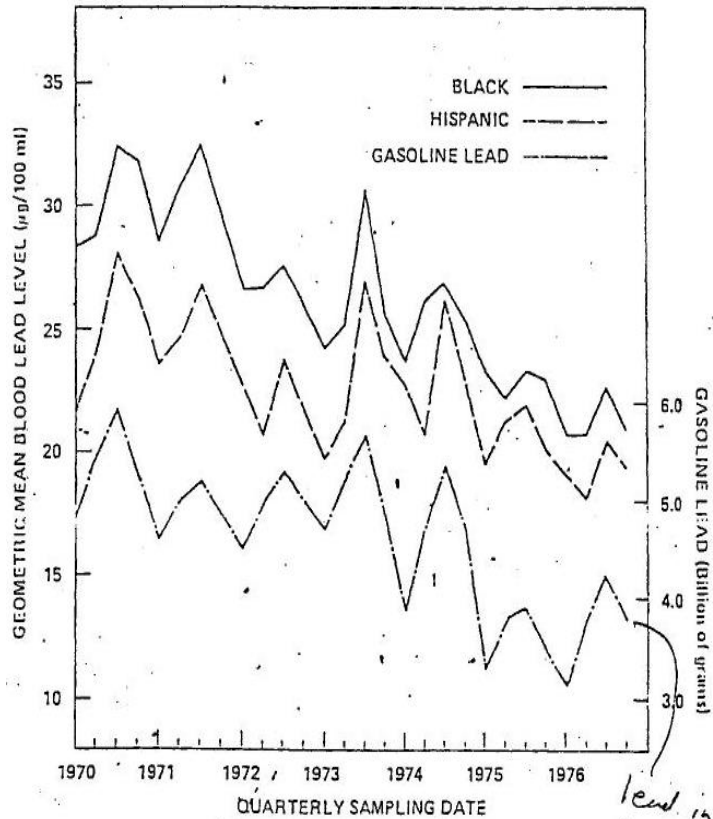


Fig. 2

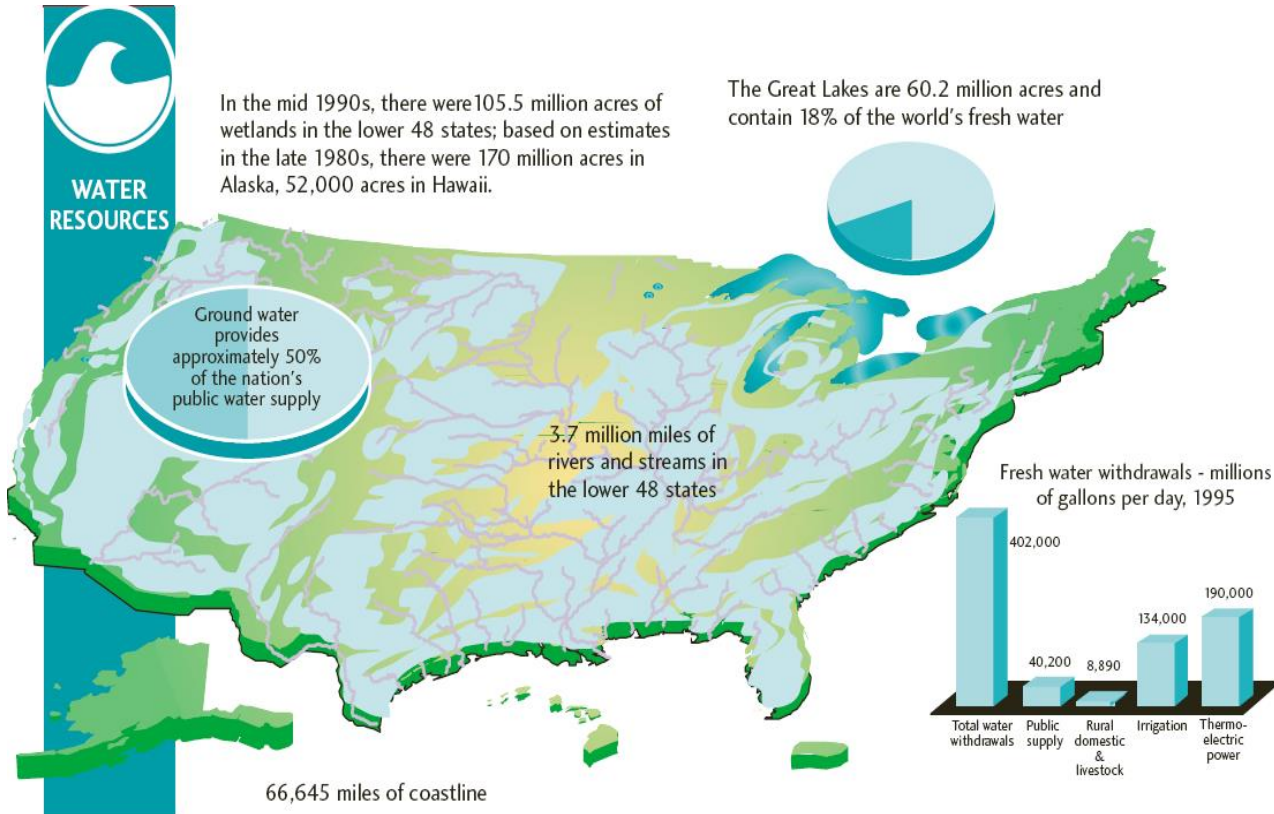
lead in
gasoline
14 N.Y.N.J.C

The background of the slide consists of a pair of red curtains, likely velvet or a similar heavy fabric, hanging from a top edge. The curtains are pulled back in the center, creating a dark opening. The lighting is somewhat dramatic, with the curtains appearing to have a slight sheen and deep shadows in the folds. The overall color palette is monochromatic, dominated by various shades of red and dark tones.

How long is the U.S. coastline?

- a) 95,000 miles**
- b) 19,924 km**
- c) 66,645 miles**
- d) 58,618 miles**
- e) 66,419 miles**
- f) Any of the above**
- g) None of the above**

EPA's Report on the Environment



The Richardson Effect

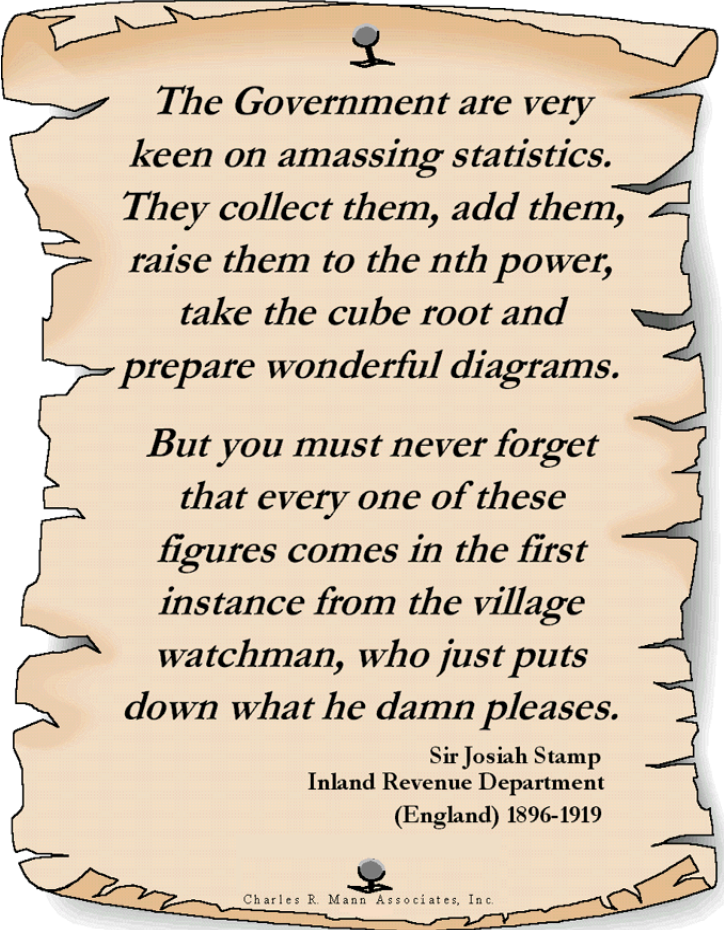


The background of the slide consists of a pair of red, vertically pleated curtains that are drawn back to reveal a dark stage. The curtains are tied back with rings, and the lighting is focused on the central area where the text is located.

How long is the U.S. coastline?

- a) 95,000 miles
- b) 19,924 km
- c) 66,645 miles
- d) 58,618 miles
- e) 66,419 miles
- f) Any of the above**
- g) None of the above

Accuracy of Data Collection Efforts



The Government are very keen on amassing statistics. They collect them, add them, raise them to the nth power, take the cube root and prepare wonderful diagrams.

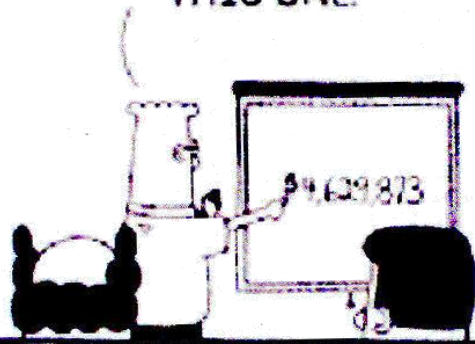
But you must never forget that every one of these figures comes in the first instance from the village watchman, who just puts down what he damn pleases.

Sir Josiah Stamp
Inland Revenue Department
(England) 1896-1919

Charles R. Mann Associates, Inc.

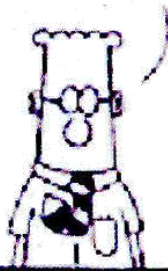
DILBERT | SCOTT ADAMS

I DIDN'T HAVE ANY
ACCURATE NUMBERS
SO I JUST MADE UP
THIS ONE.



www.dilbert.com
scottadams@aol.com

STUDIES HAVE SHOWN
THAT ACCURATE
NUMBERS AREN'T ANY
MORE USEFUL THAN THE
ONES YOU MAKE UP.

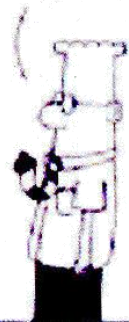


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HOW
MANY
STUDIES
SHOWED
THAT?



EIGHTY-
SEVEN.



Summary

- **Ensuring the proper interpretation of data is challenging**
- **KNOW the problem**
- **Getting the sample is the real trick**
- **Don't make the model too complex**
- **Simple, digestible presentations for policy-makers are essential. Put yourself in their seat**
- **This sounds awfully simple but don't be fooled, it is quite powerful!**

