

F5 NGINX

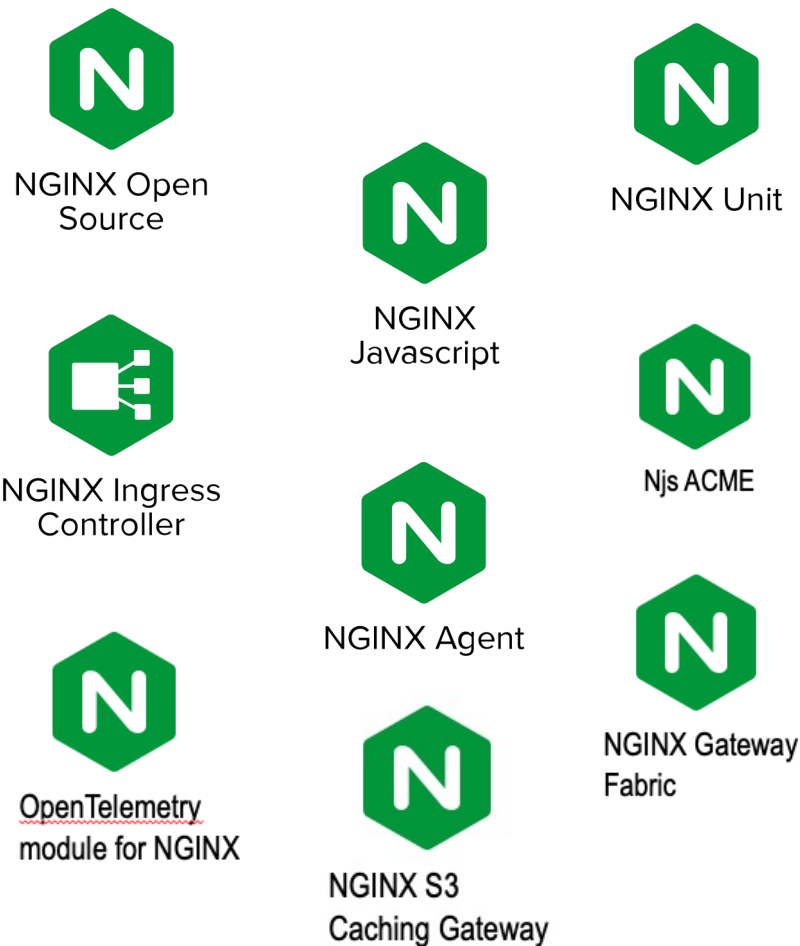
The Subtle Art of Misleading with Statistics

Dave McAllister
Sr. Open Source Technologist – NGINX

NGINX and Open Source

NGINX Promises for our open source

- We will continue to offer our open source projects under accepted open source licenses
- We will not remove features from our open source technology to move them to a paid feature
- We will not impose artificial limits on the use of our open source projects
- We will continue to enhance and improve our active projects
- We will continue to develop and release new open source projects that move the Web and applications forward
- We will commit to open consistency and transparency in our acceptance of contributions, with open and fair access to all.



“Lies, Damned lies, and Statistics”

by Jef Mallett

May 08, 2006



The Power of Statistics

It's a data-driven world

- Evidence-Based Decisions
 - Performance Tracking
 - Resource Allocation
 - Identifying Patterns
 - Setting Realistic Goals
- Data Interpretation and Decision-making
 - Performance Metrics and KPIs
 - Cultural Impact
 - Risk Management

“It is the mark of a truly intelligent person to be moved by statistics.” - George Bernard Shaw

But the Numbers Game is Just That, a Game

- Misinterpretation
- Cherry-Picking Data
- Correlation vs. Causation
- Visualization
- Ignoring Margin of Error
- Spurious Precision
- Survivorship Bias

Figures don't lie, but liars can figure." - Darrell Huff



The “Mean”ing of Averages

- Current average income per person in US = 59,384
- Average household size in US = 2.63 people
- Household income should be = \$156,179.92 (It's not)

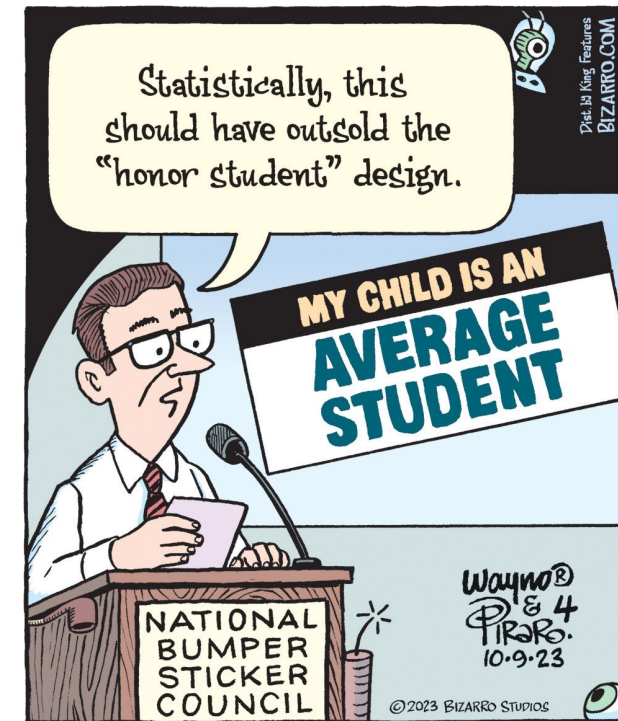
To earn a million dollars, you just need to have 14.8 kids, right?

Your KPI for downtime is 1 hour per month trailing.

Which one would you rather report?

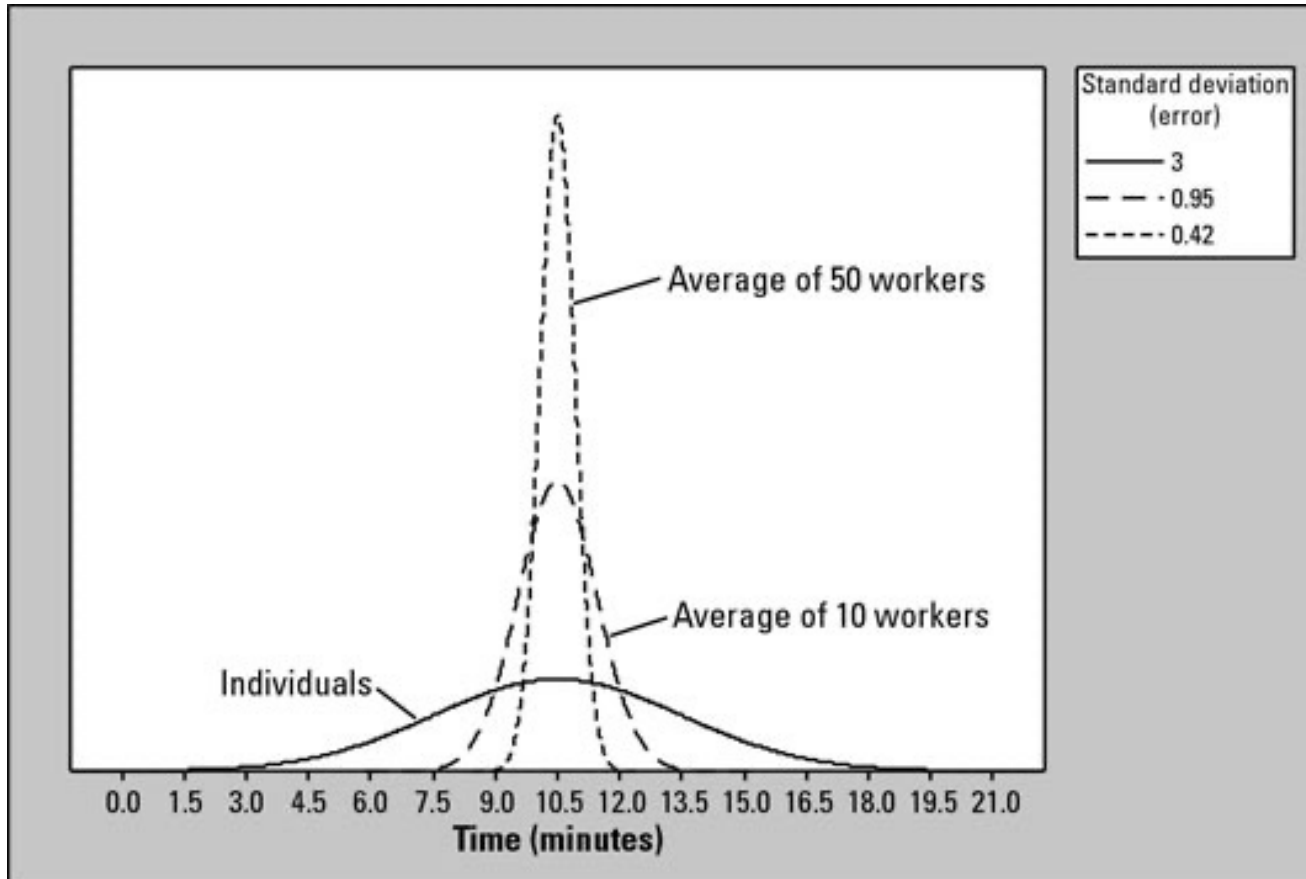
1.56 Hours/month or 0.53 Hours/month

“It is now proved beyond doubt that smoking is one of the leading causes of statistics.” – Fletcher Knebel



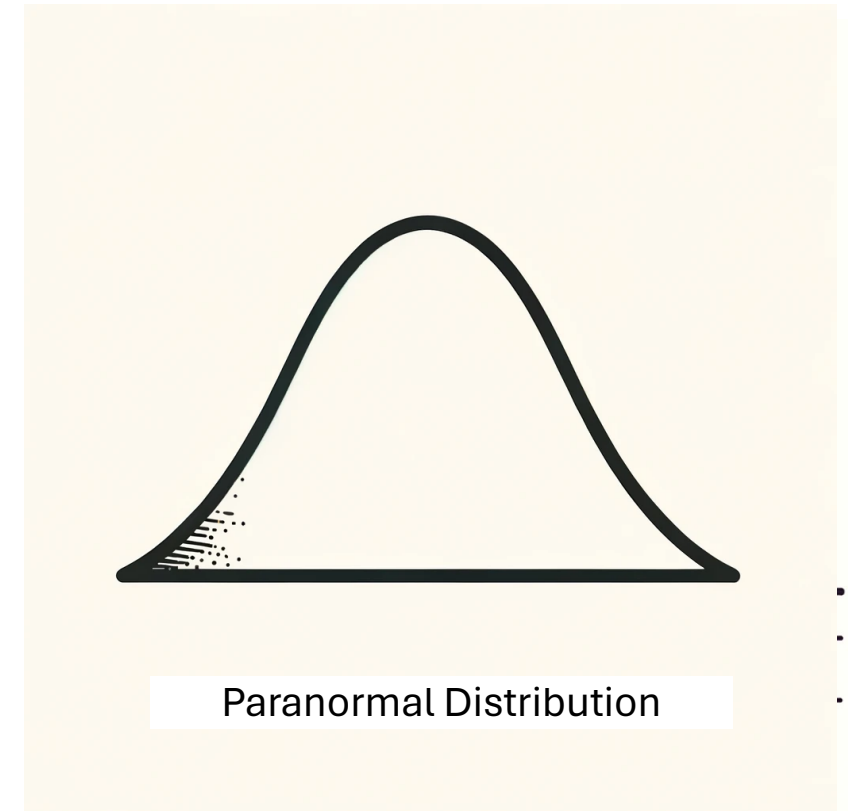
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Deviant Behavior



[How Sample Size Affects Standard Error - dummies](#)

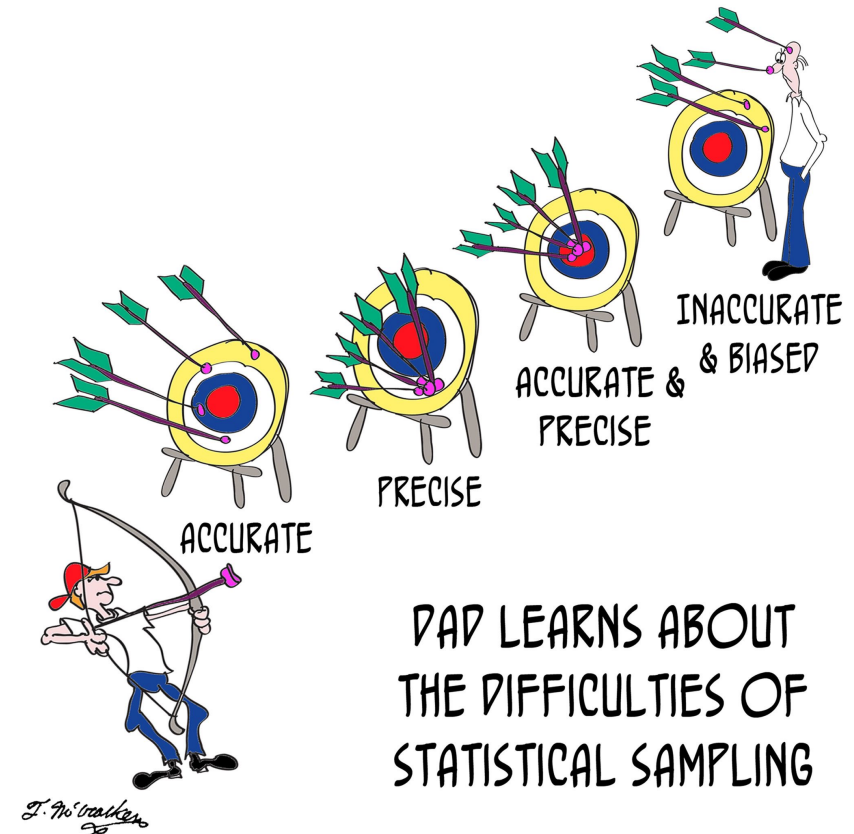
In ancient times they had no statistics so they had to fall back on lies. – Stephen Leacock



TANSTAAFS (with apologies to Robert Heinlein)

- Results are only as good as the sample data.
 - But it can be really convincing
 - Size matters (4 out of 5 SREs prefer OpenTofu)
- Bias is the hidden trap
 - If you can't find the bias, look harder
If you sample only iPhone users, Android doesn't exist
 - So is access
If you sample in a first class airline lounge, well...
 - Questions (and interviewers) can be their own bias

Accuracy of observation is the equivalent of accuracy of thinking. – Wallace Stevens



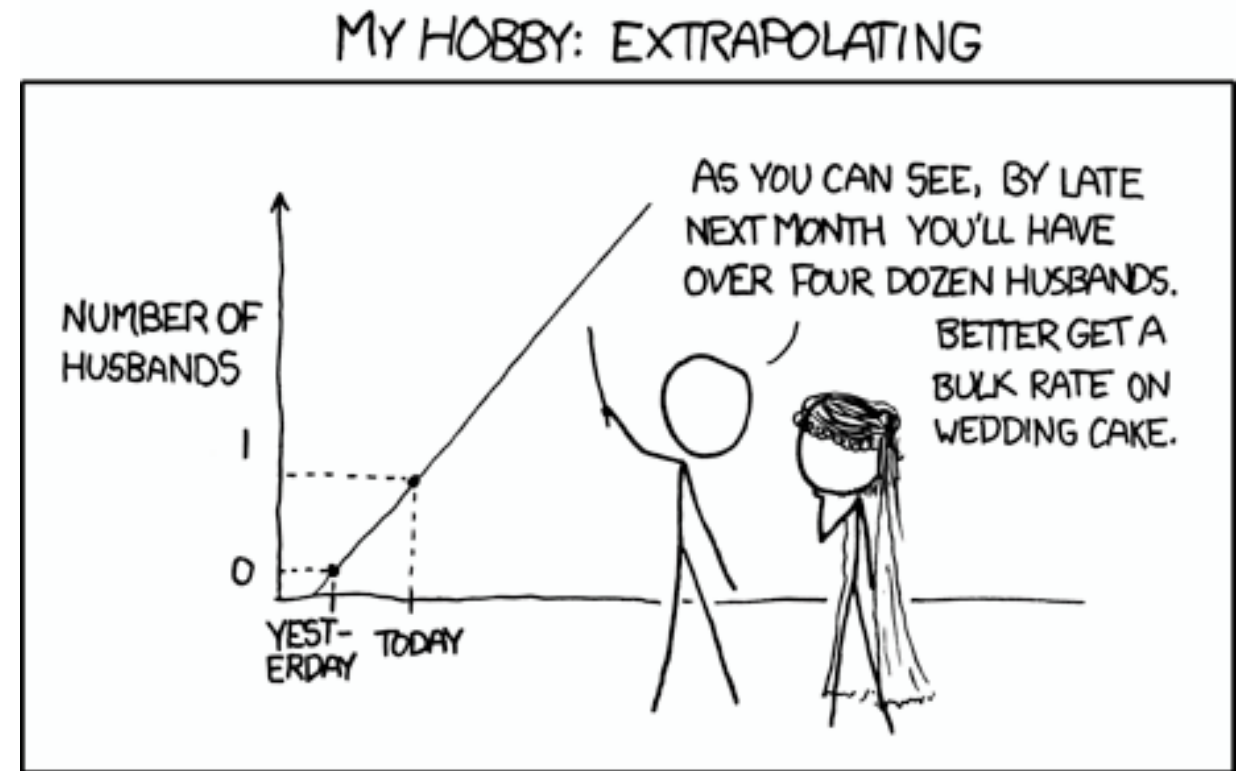
**DAD LEARNS ABOUT
THE DIFFICULTIES OF
STATISTICAL SAMPLING**

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Being Too Up-to-Date

Recency Bias

- Cognitive Bias that favors recent events
 - Significantly skews perception and decision-making
 - Undue weight to new information
 - Emotional impact
 - Trend Extrapolation
- If there have been no recent outages or incidents
 - Perception that the system is very stable
 - Complacency
 - Inadequate preparation for potential failures



The type of measure used placed constraints on which statistics can be used. – Stanley Smith Stevens

DevOps Survey and Bias

You are trialing a new deployment tool for speed and reliability

You sample via survey all the engineers who were invited to try the new tool

Q1: How happy are you with the new and improved tool?

Q2: Would you agree that the new tool has streamlined your deployment?

Q3: How beneficial has the new tool been?

1. Self-selection Bias: Do the respondents cover the entire group?
2. **Confirmation Bias:** Is the leading team wording questions to get skewed answers
3. Recency Bias: Is the last experience what is being reported?
4. Status Quo Bias: Is change scary?

Definition of Statistics: The science of producing unreliable facts from reliable figures. – Evan Esar

DevOps Survey and Bias

You are trialing a new deployment tool for speed and reliability

You sample via survey all the engineers who were invited to try the new tool

Q1: How happy are you with the new and improved tool based on your most recent deployment?

Q2: How much did the tool help in your last deployment?

Q3: Most recently, how beneficial has the new tool been?

1. Self-selection Bias: Do the respondents cover the entire group?
2. Confirmation Bias: Is the leading team wording questions to get skewed answers
3. **Recency Bias:** Is the last experience what is being reported?
4. Status Quo Bias: Is change scary?

Definition of Statistics: The science of producing unreliable facts from reliable figures. – Evan Esar

DevOps Survey and Bias

You are trialing a new deployment tool for speed and reliability

You sample via survey all the engineers who were invited to try the new tool

Q1: How disruptive was the new tool?

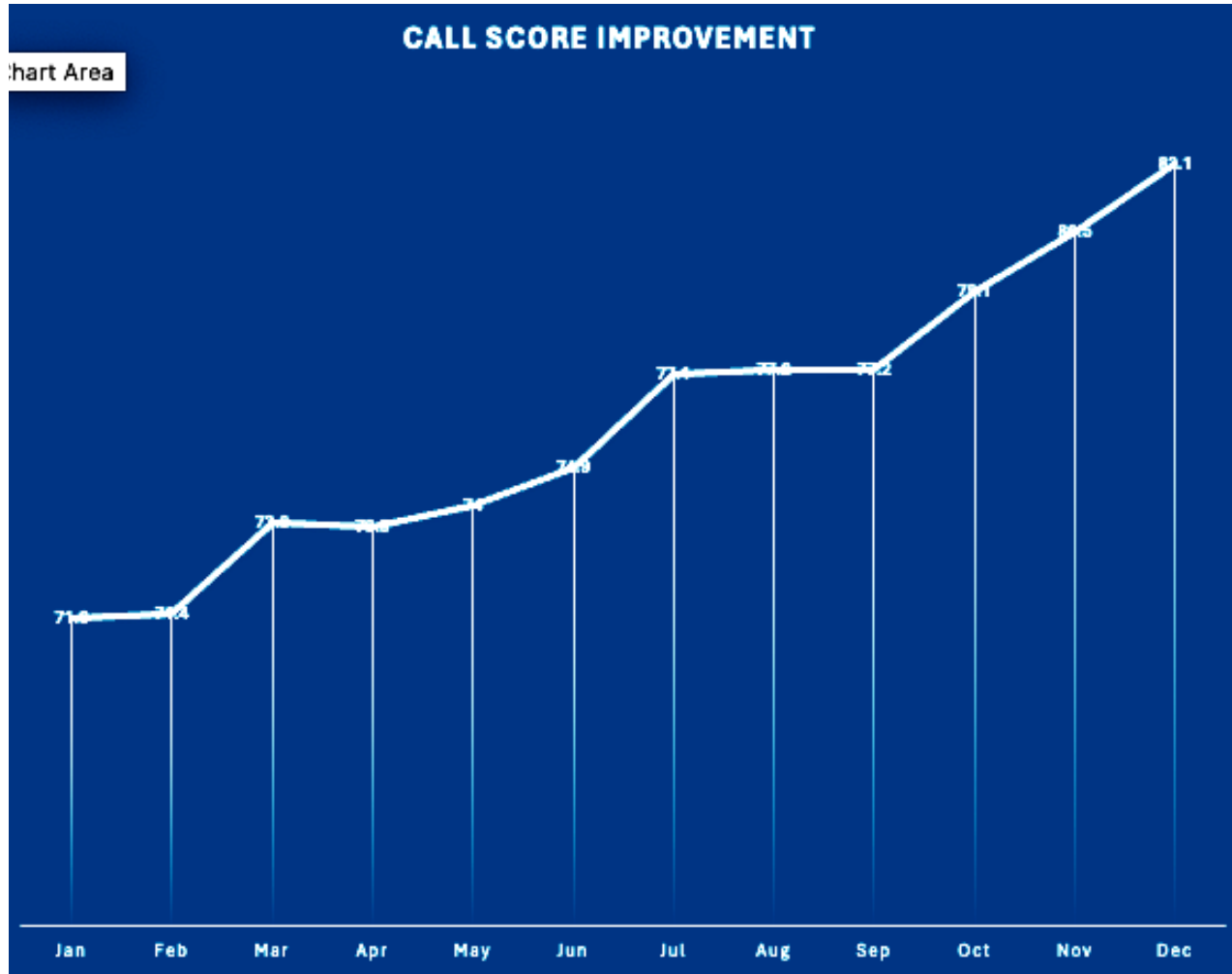
Q2: Is the existing process more reliable?

Q3: How much effort did you spend on using the new tool?

1. Self-selection Bias: Do the respondents cover the entire group?
2. Confirmation Bias: Is the leading team wording questions to get skewed answers
3. Recency Bias: Is the last experience what is being reported?
4. **Status Quo Bias** Is change scary?

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A Picture is Worth a Thousand Lies

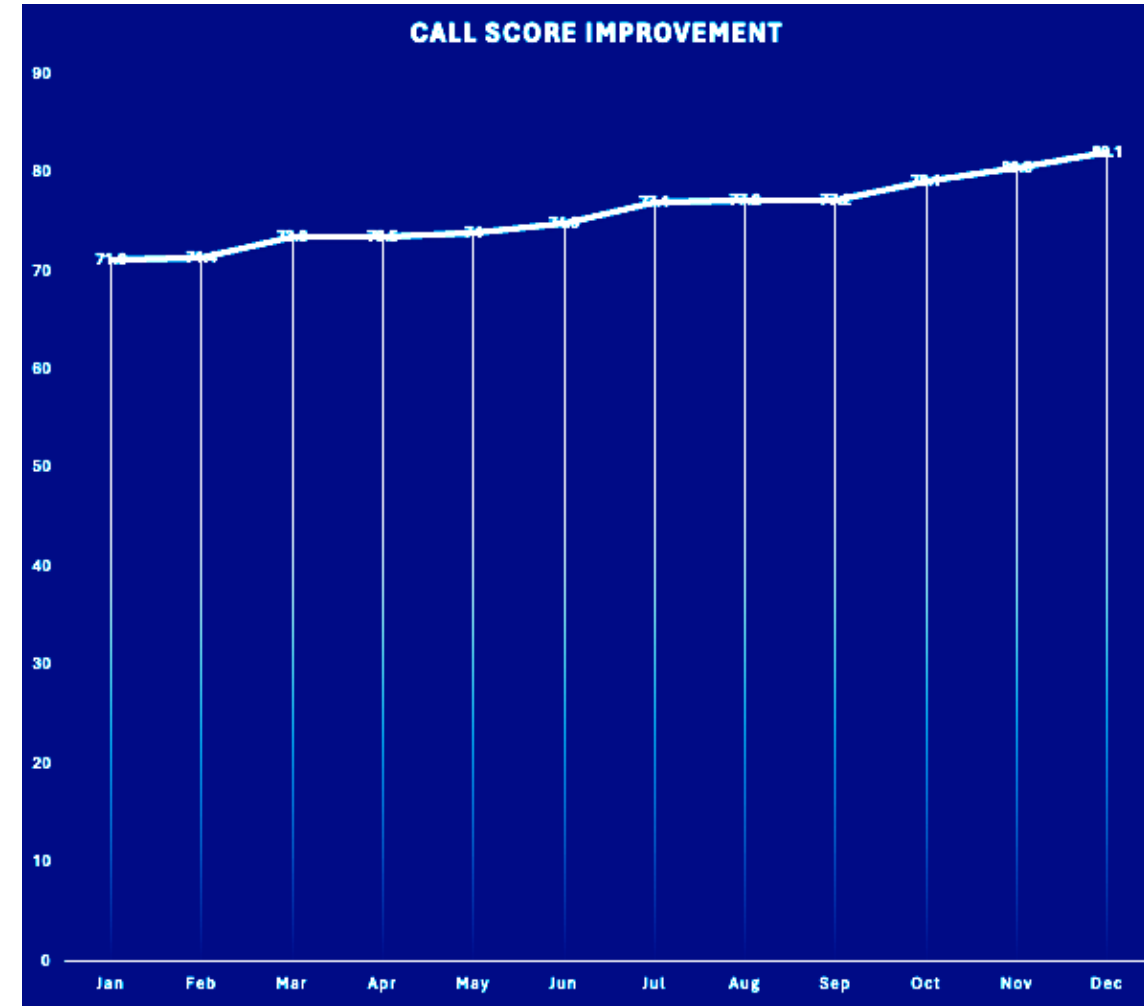
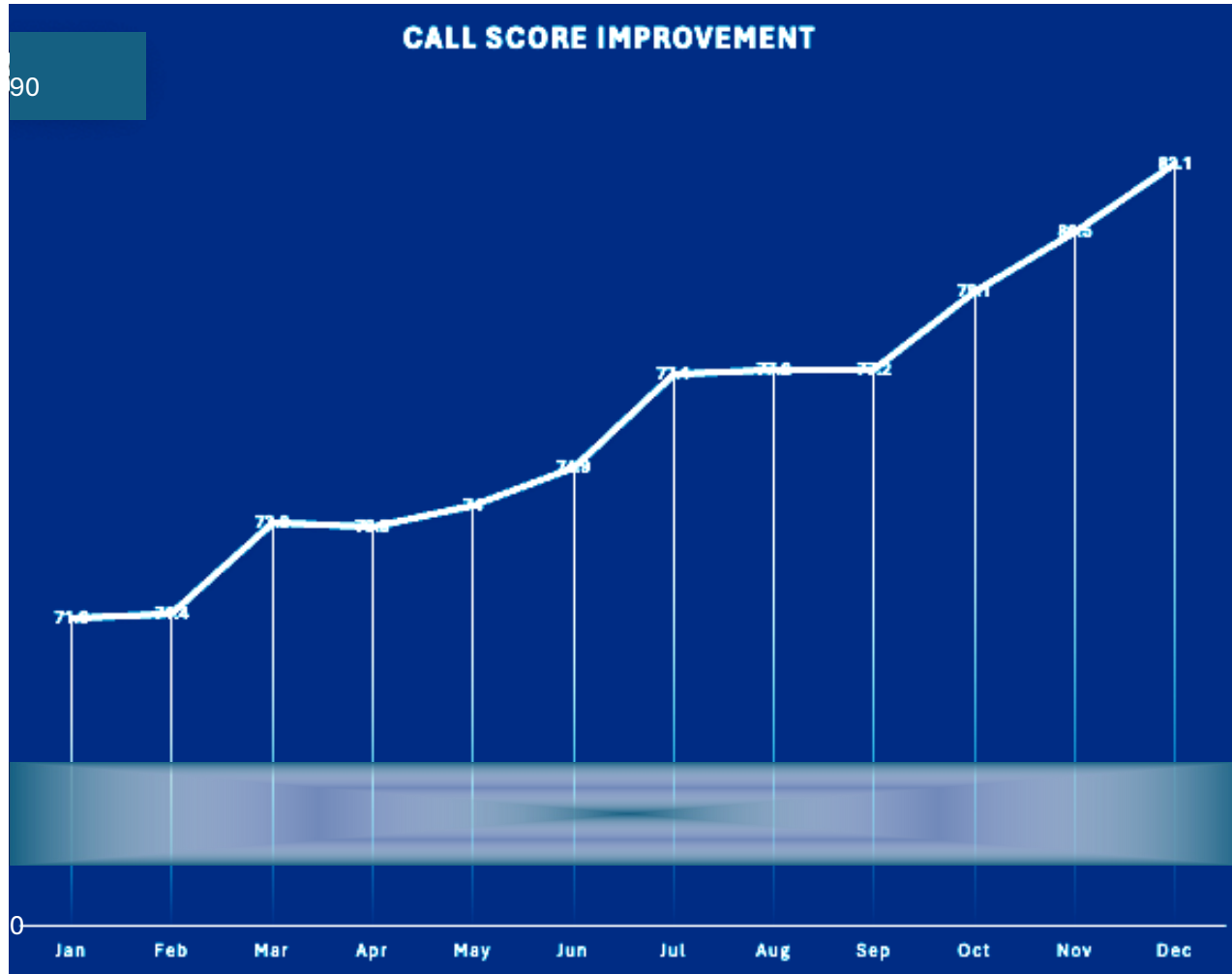


“And now, out of thin air, I present to you the very numbers you were hoping to see.”

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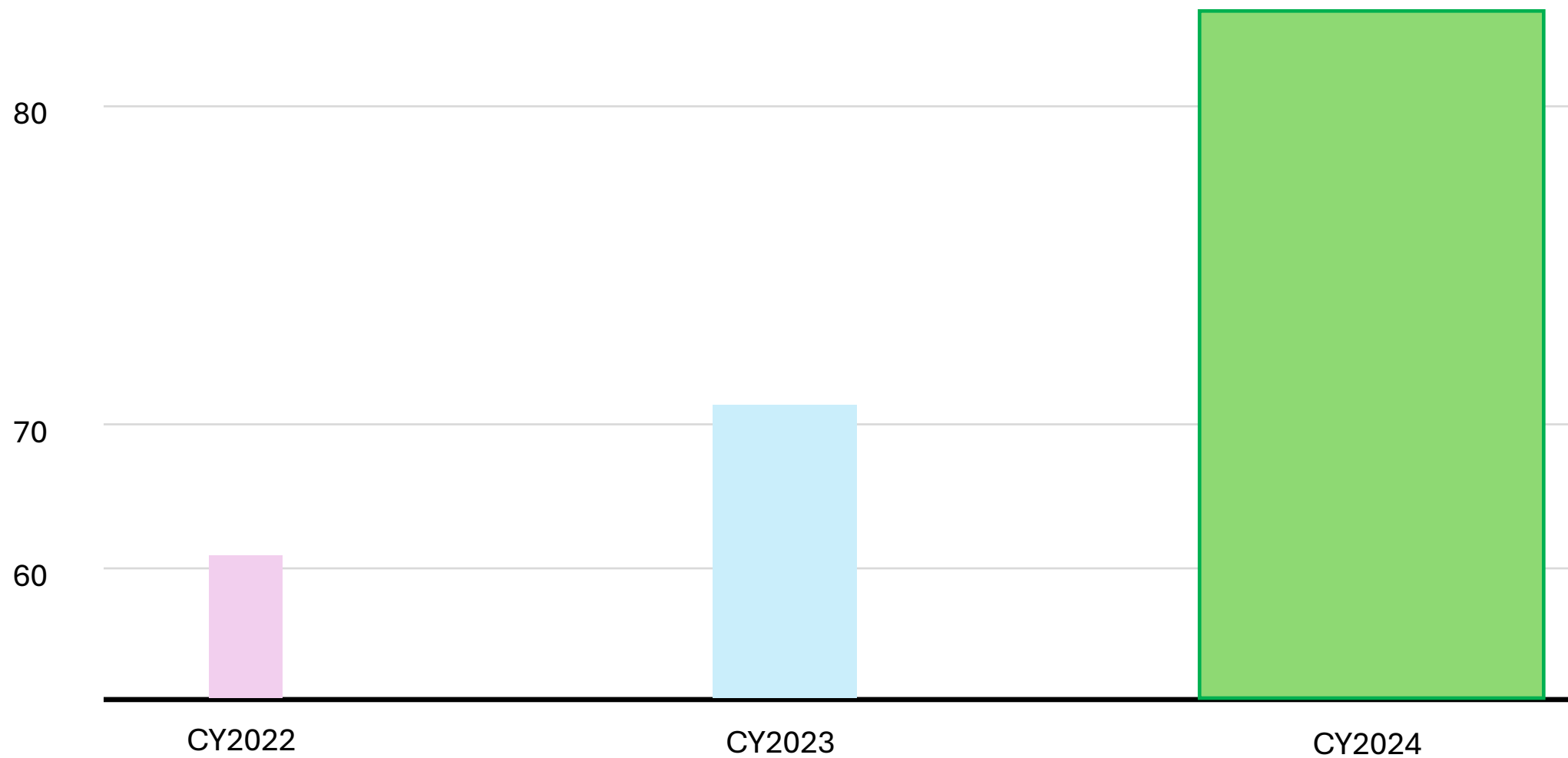
“Beware of misleading visual representations, such as manipulated graphs” – Darrell Huff

A Picture is Worth a Thousand Lies



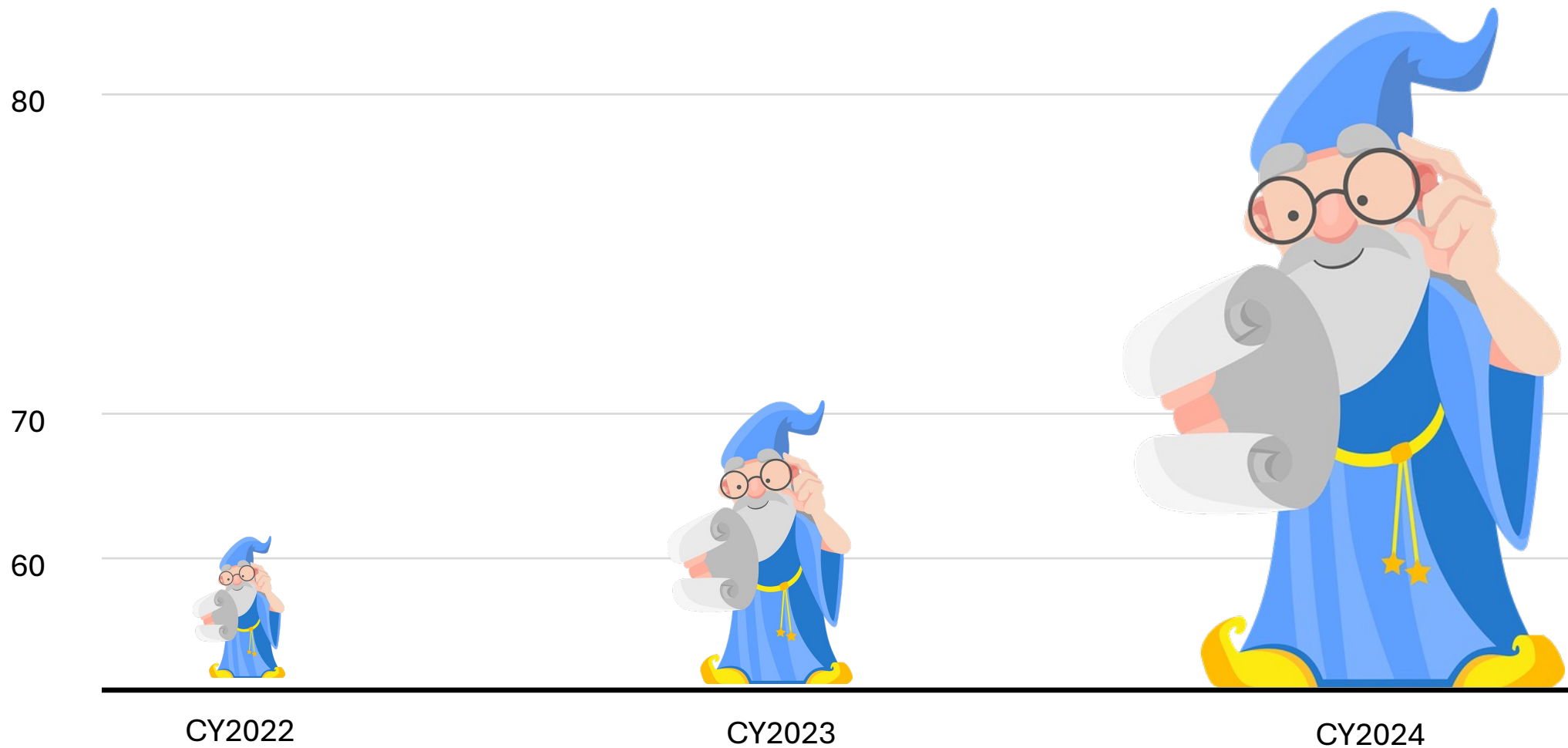
“Statistics are used a lot like a drunk uses a lamppost: for support, not illumination” – Vin Scully

The Power of Suggestion



“There are two kinds of statistics, the kind you look up and the kind you make up” – Rex Stout

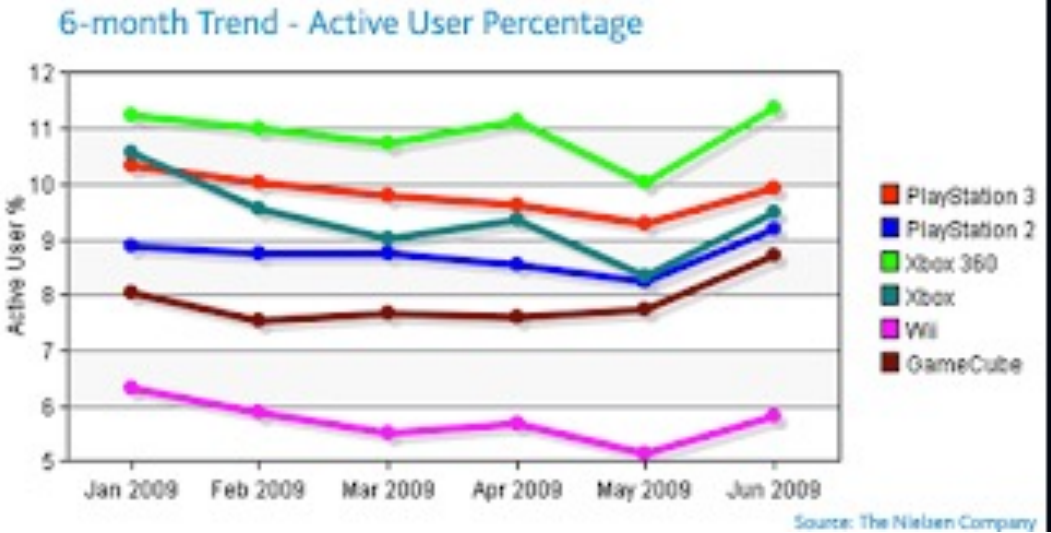
The Power of Suggestion – One Dimensional Picture



“You can shape statistics to make them look however you want them to.” – Jamie Carragher

Reading Between the Numbers

Adventures In Mislading Graphs ~ Crazy Test Blog

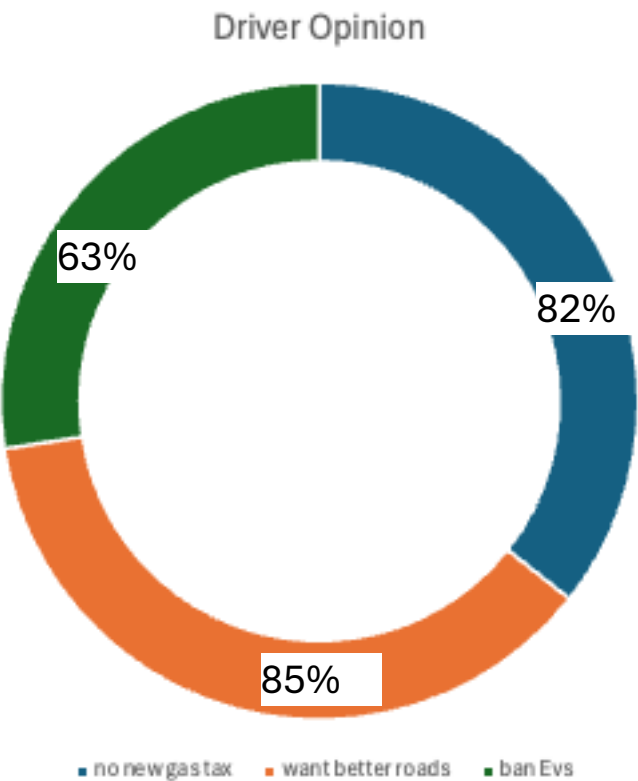


There are 50 million Wii owners. 6% of that number is 3 million.

There are 30 million 360 owners. 11% of that number is 3.3 million.

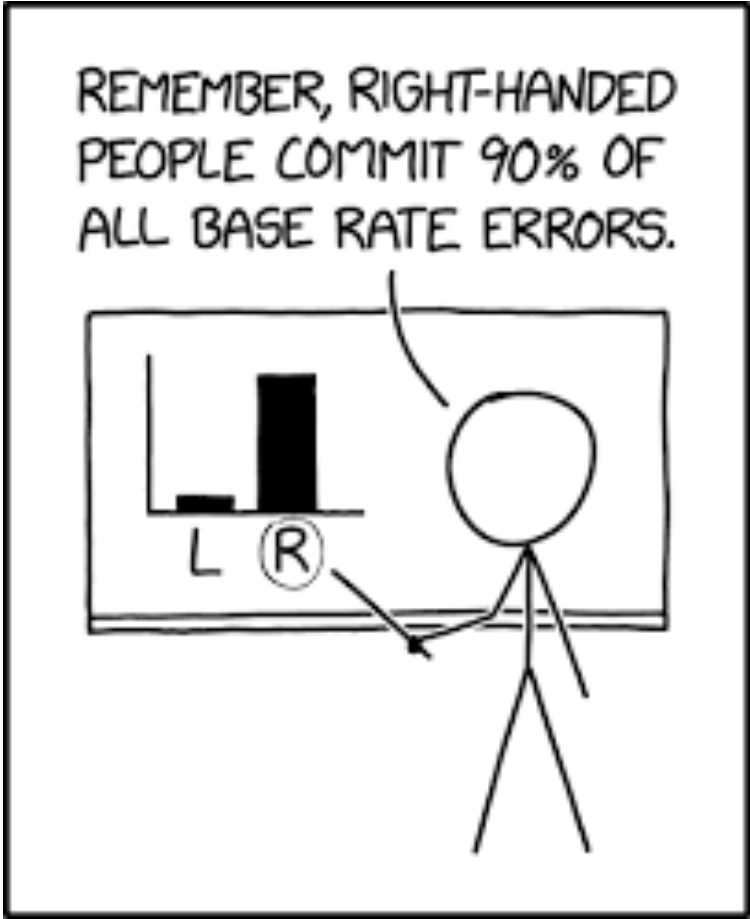
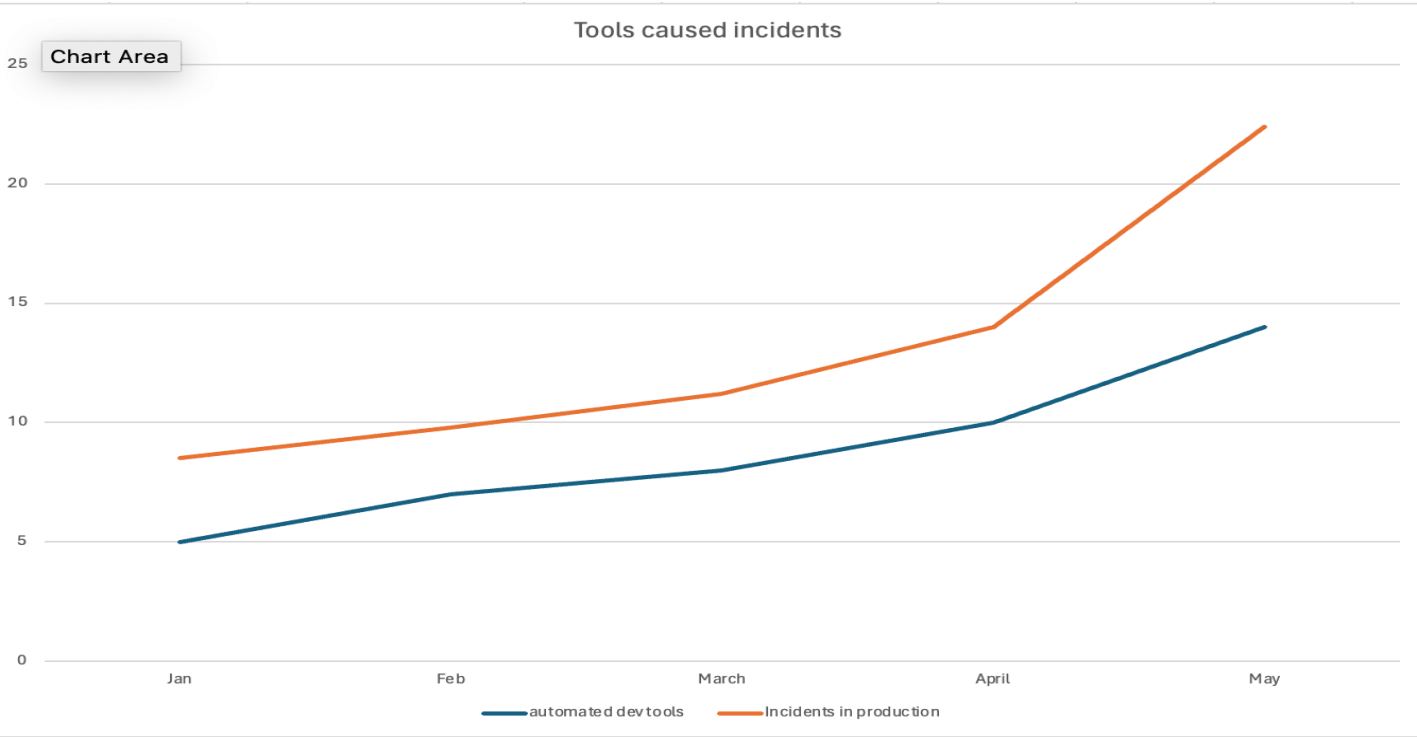
There are 20 million PS3 owners. 10% of that number is 2 million.

H/T Lee Evans



If B Follows A, then A Causes B

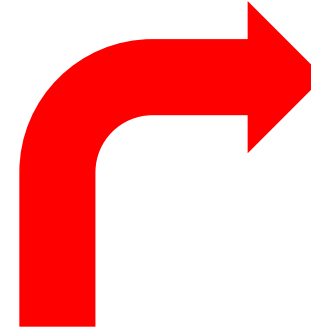
You want to prove you have too much automation. Your DevOps team notices that as the number of deployment automation scripts increases, the number of incidents in production increases.



Those who use 'Correlation is not the same as causation' as a magic incantation to dismiss all fact-using professions are fools holding a lit match in one hand and an open gas can in the other, screaming, 'One has nothing to do with the other!'

Usually Stated as “Correlation is Not Causation”

- Confounding Variable
- Reverse Causation
- Coincidence
- Bidirectional Causation
- Sampling Bias
- Measurement Errors



Correlation



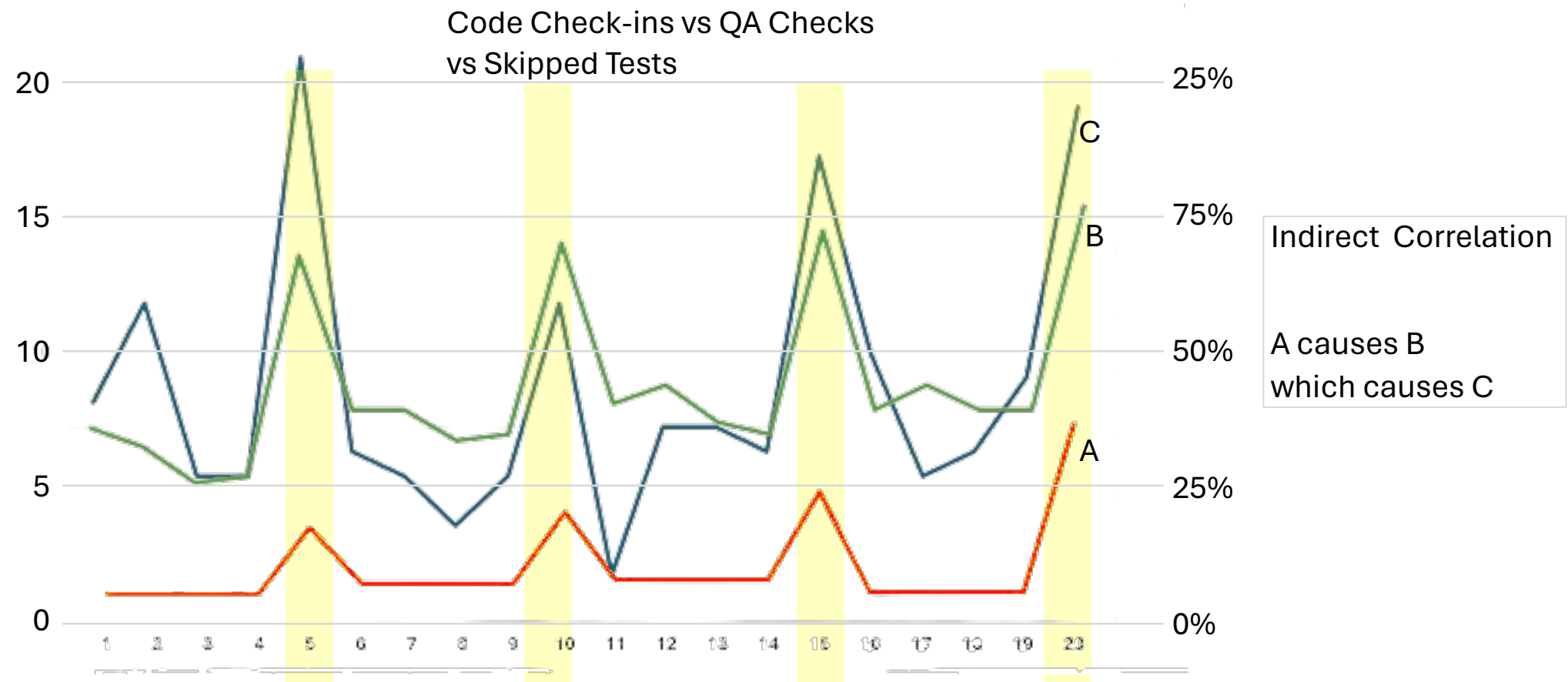
Causation



My favorite sneaky correlation

Code check-in versus deadlines

Welcome to p-hacking



Data Dredging and p-hacking

Data dredging

- The practice of searching through large volumes of data to find patterns or relationships that can be presented as statistically significant

P-hacking

- Manipulating the data analysis process to achieve statistically significant results.

"The answer to the ultimate question of life, the universe and everything is 42."

Douglas Adams, *The Hitchhiker's Guide to the Galaxy*

Instead of starting with a hypothesis and testing it, I instead abused the data to see what correlations shake out. It's a dangerous way to go about analysis, because any sufficiently large dataset will yield strong correlations completely at random. – Tyler Vigen

“Eighty-two percent of the country understands that
it was a rigged election,”

March 2nd, 2024

Post Hoc, Ergo Propter Hoc

‘After this, therefore because of this’

Initial source : Public Religion Research Institute.

Publish date 01-Nov-2021
(they did a good job, btw)

Total Sample : 2508

People trusting far-right sources completely: 90

People trusting Fox News completely: ~66

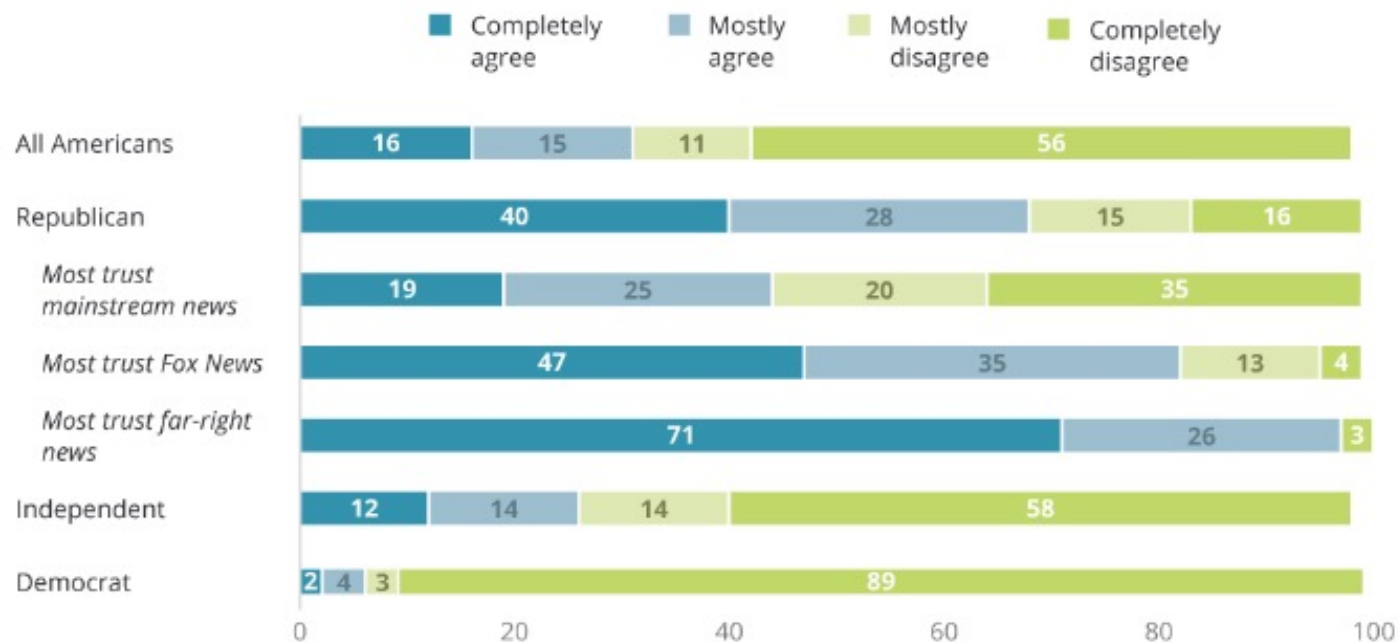
So at 82%, 54 people out of 66 believe

Or 54 out of 2508

2.15%

FIGURE 4.1 Belief That the 2020 Presidential Election Was Stolen From Trump, by Party Affiliation and Trusted News Source

Percent who agree that the election was stolen from Donald Trump:



Source: PRRI 2021 American Values Survey.

42

“The Answer to the Ultimate Question
of Life, the Universe, and Everything”

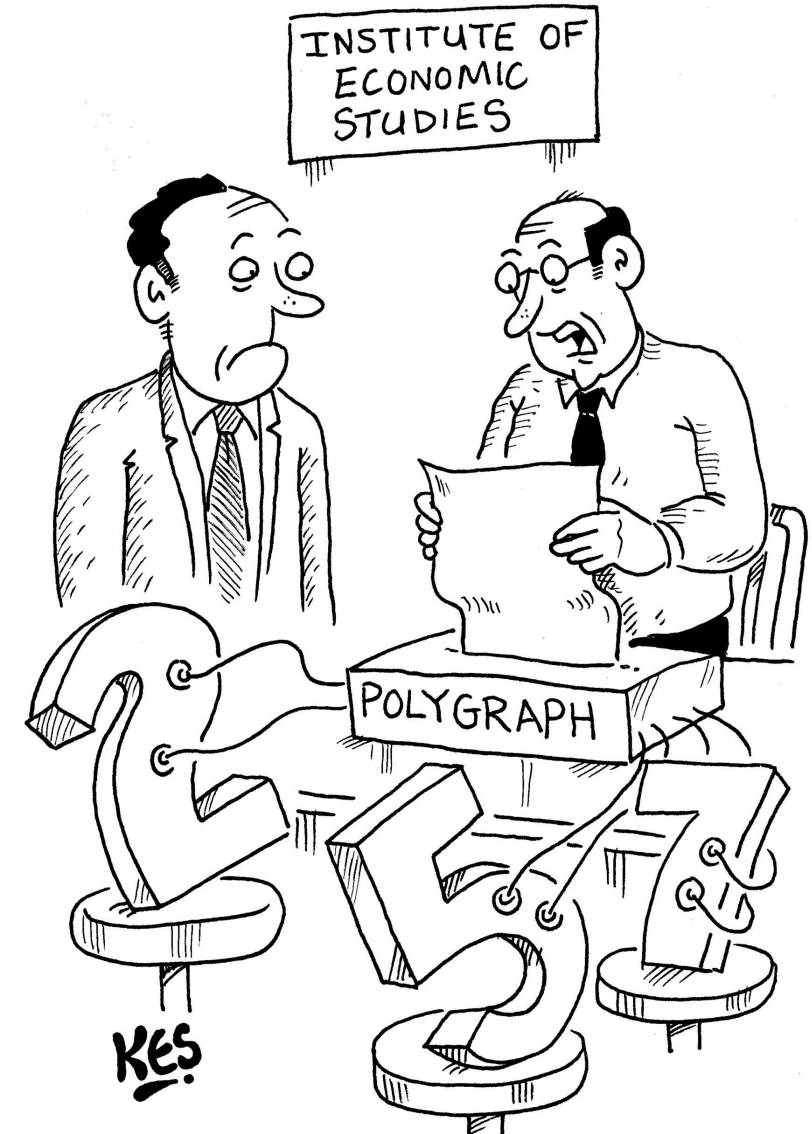
A Simple Way to Mislead?

Statistics are informative, enlightening and pretty cool.
But always apply the ultimate test: “Does this make sense?”

Look out for:

- Conscious and Unconscious bias
- Selection bias
- Selection size
- Bait and switch subjects
- Personal bias
- Firsters

Numbers don't lie. People do. – Hugh Baker



"Actually, according to this the numbers do lie."

CartoonStock.com

Some suggested reading

Statistics for the Rest of Us – Albert Rutherford

How to Lie with Statistics – Darrell Huff

Lying Numbers – Hugh Barker

Naked Statistics – Charles Wheelan

Statistics for Dummies – Deborah J Rumsey

Standard Deviations: Flawed Assumptions, Tortured Data, and Other Ways to Lie with Statistics – Gary Smith

Misleading Statistics – Real Life Examples Of Data Misuse (datapine.com)

Spurious Correlations (tylervigen.com)

A History of Bayes' Theorem



Statistics are history. And history is always written by the winners.

– Dave McAllister

Questions?

Dave McAllister

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<https://www.github.com/dwmcallister>



