Statistical Inference: Some preliminaries.

Jordi Vitrià

A **cognitive bias** is a systematic pattern of deviation from rationality in judgment.

Individuals create their own "subjective reality" from their perception of the input.

20 COGNITIVE BIASES THAT SCREW UP YOUR DECISIONS

1. Anchoring bias.

People are **over-reliant** on the first piece of information they hear. In a salary negotiation, whoever makes the first offer establishes a range of reasonable possibilities in each person's mind.

2. Availability heuristic.

People **overestimate the importance** of information that is available to them. A person might argue that smoking is not unhealthy because they know someone who lived to 100 and smoked three packs a day.

3. Bandwagon effect.

The probability of one person adopting a belief increases based on the number of people who hold that belief. This is a powerful form of **groupthink** and is reason why meetings are often unproductive.

4. Blind-spot bias.

Failing to recognize your own cognitive biases is a bias in itself. People notice cognitive and motivational biases much more in others than in themselves.

5. Choice-supportive bias.

When you choose something, you tend to feel positive about it, even if that **choice has flaws**. Like how you think your dog is awesome — even if it bites people every once in a while.

6. Clustering illusion.

This is the tendency to **see patterns in random events**. It is key to various gambling fallacies, like the idea that red is more or less likely to turn up on a roulette table after a string of reds.

7. Confirmation bias.

We tend to listen only to information that confirms our **preconceptions** — one of the many reasons it's so hard to have an intelligent conversation about climate change.

8. Conservatism bias.

Where people favor prior evidence over new evidence or information that has emerged. People were **slow to accept** that the Earth was round because they maintained their earlier understanding that the planet was flat.

9. Information bias.

The tendency to **seek information when it does not affect action**. More information is not always better. With less information, people can often make more accurate predictions.

10. Ostrich effect.

The decision to **ignore dangerous or negative information** by "burying" one's head in the sand, like an ostrich. Research suggests that investors check the value of their holdings significantly less often during bad markets.

11. Outcome bias.

Judging a decision based on the **outcome** — rather than how exactly the decision was made in the moment. Just because you won a lot in Vegas doesn't mean gambling your money was a smart decision.

12. Overconfidence.

Some of us are **too confident about our abilities**, and this causes us to take greater risks in our daily lives. Experts are more prone to this bias than laypeople, since they are more convinced that they are right.

13. Placebo effect.

When **simply believing** that something will have a certain effect on you causes it to have that effect. In medicine, people given fake pills often experience the same physiological effects as people given the real thing.

14. Pro-innovation bias.

When a proponent of an innovation tends to **overvalue its usefulness** and undervalue its limitations. Sound familiar, Silicon Valley?

15. Recency.

The tendency to weigh the **latest information** more heavily than older data. Investors often think the market will always look the way it looks today and make unwise decisions.

16. Salience.

Our tendency to focus on the **most easily recognizable features** of a person or concept. When you think about dying, you might worry about being mauled by a lion, as opposed to what is statistically more likely, like dying in a car accident.

17. Selective perception.

Allowing our expectations to **influence how we perceive** the world. An experiment involving a football game between students from two universities showed that one team saw the opposing team commit more infractions.

18. Stereotyping.

Expecting a group or person to have certain qualities without having real information about the person. It allows us to quickly identify strangers as friends or enemies, but people tend to **overuse and abuse** it.

19. Survivorship bias.

An error that comes from focusing only on surviving examples, causing us to **misjudge a situation**. For instance, we might think that being an entrepreneur is easy because we haven't heard of all those who failed.

20. Zero-risk bias.

Sociologists have found that **we love certainty** — even if it's counterproductive. Eliminating risk entirely means there is no chance of harm being caused.

Cognitive Bias

"**Naïve inductivism**": a belief that all scientists seeing the same data should come to the same conclusions.

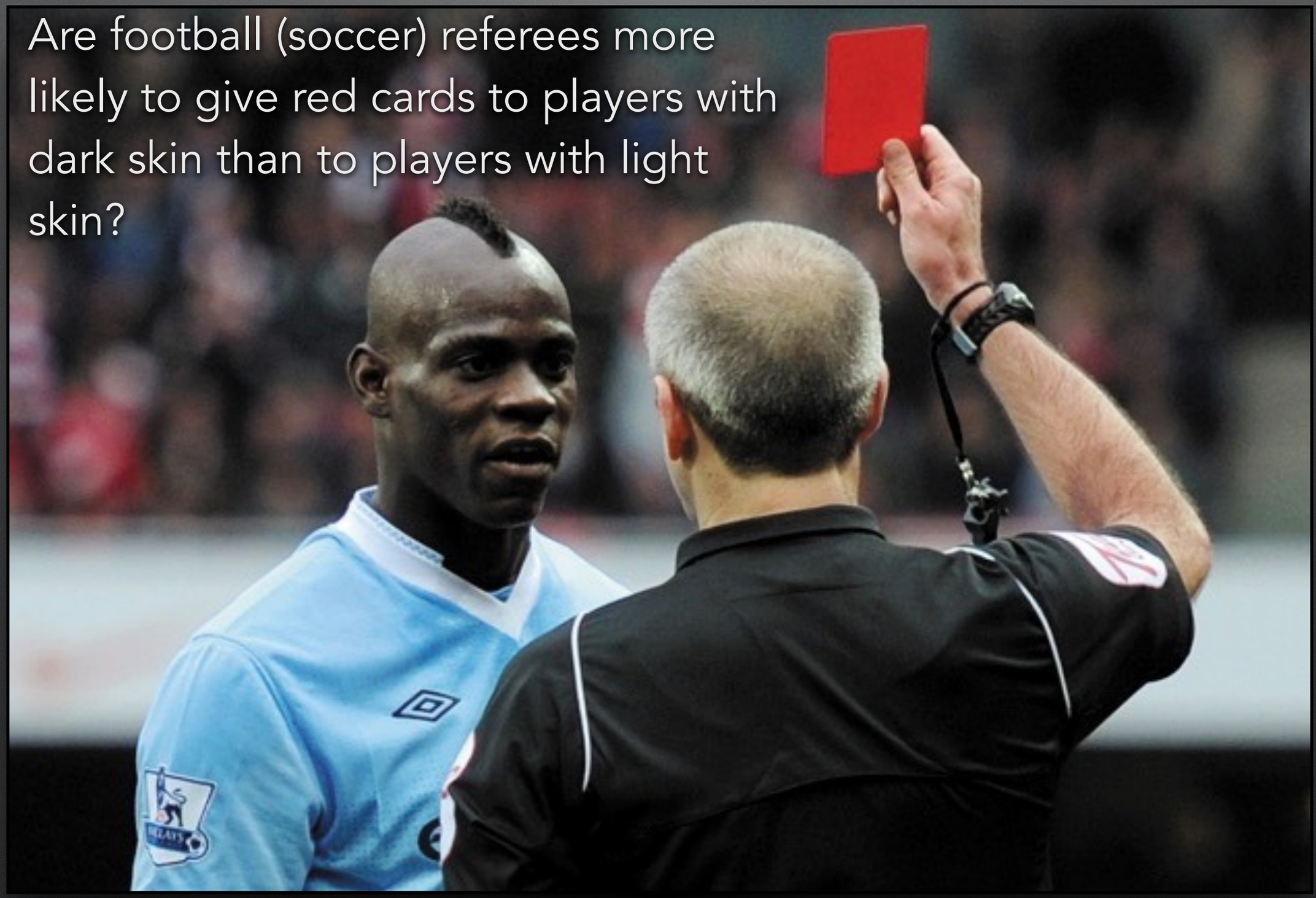
In "**Of P-Values and Bayes: A Modest Proposal**", Steven N. Goodman, 2001

Source:
http://www.nature.com/news/crowdsourced-research-many-hands-make-tight-work-1.18508

By implication, anyone who draws a different conclusion must be doing so for nonscientific reasons.

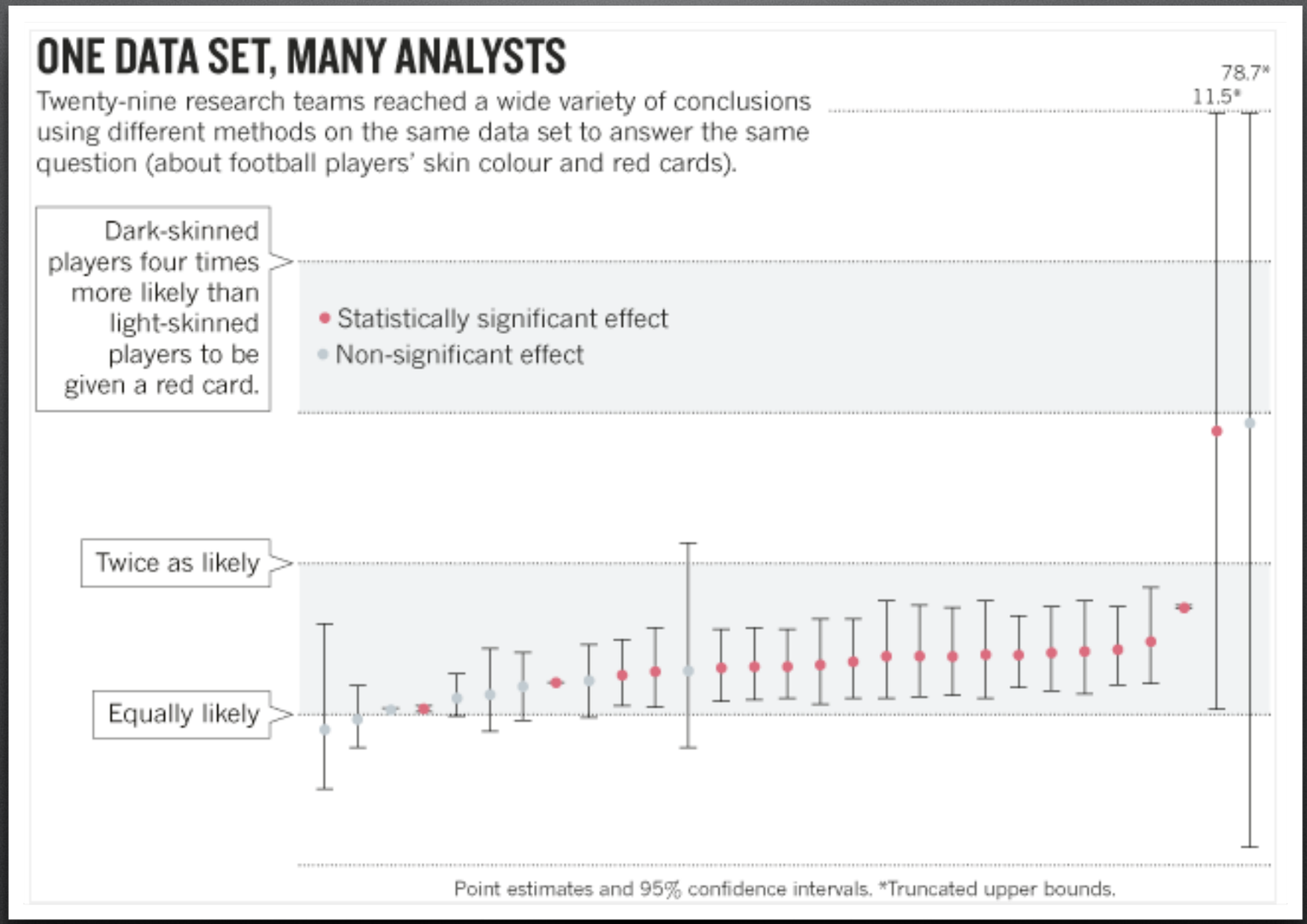
It is a belief that scientific reasoning requires little more than statistical model fitting, or in our case, reporting odds ratios, P-values and the like, to arrive at the truth.

Cognitive Bias



Source: http://www.nature.com/news/crowdsourced-research-many-hands-make-tight-work-1.18508

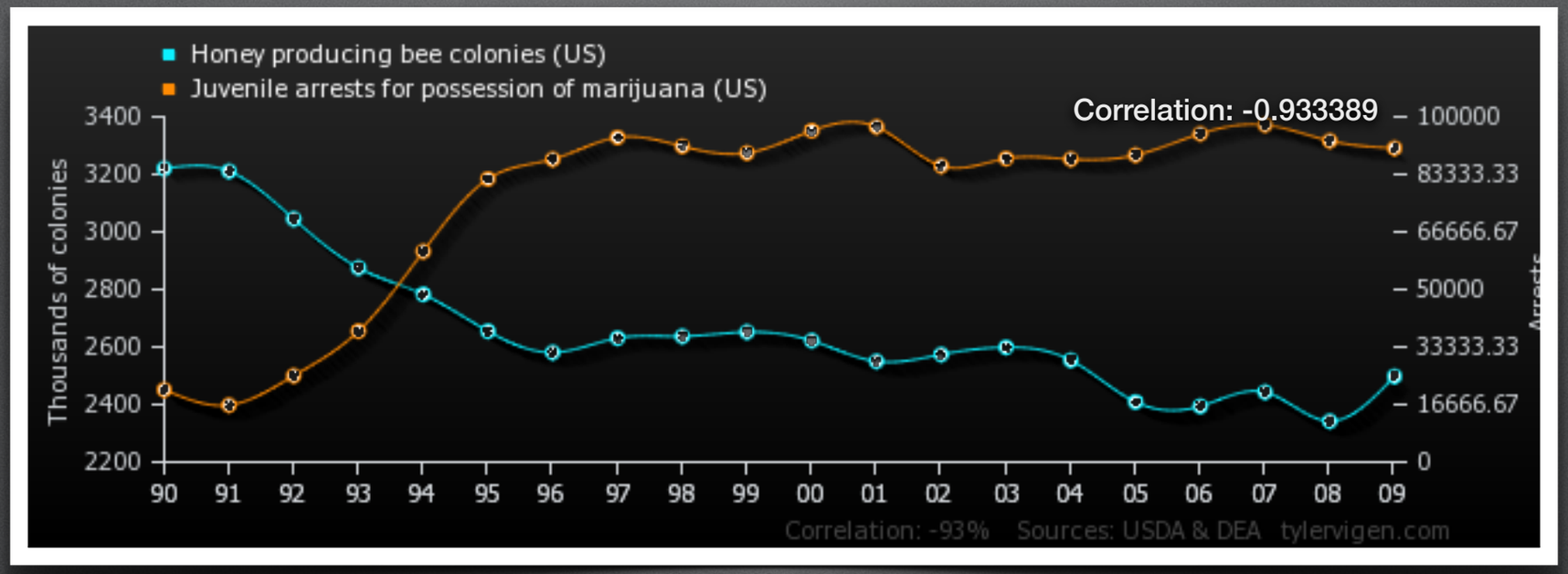
Cognitive Bias

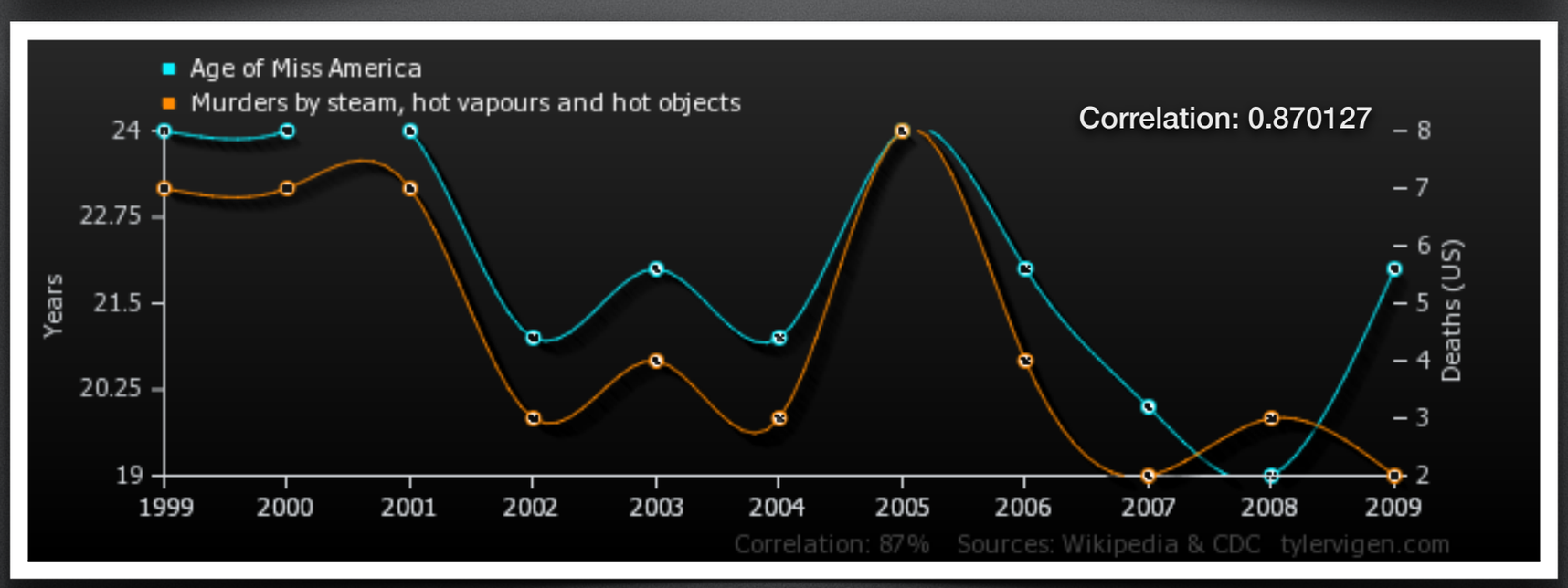


Bad methodology

Feature Engineering (Priors)

Randomness





Source: Spurious Correlations
http://www.tylervigen.com/

Randomness

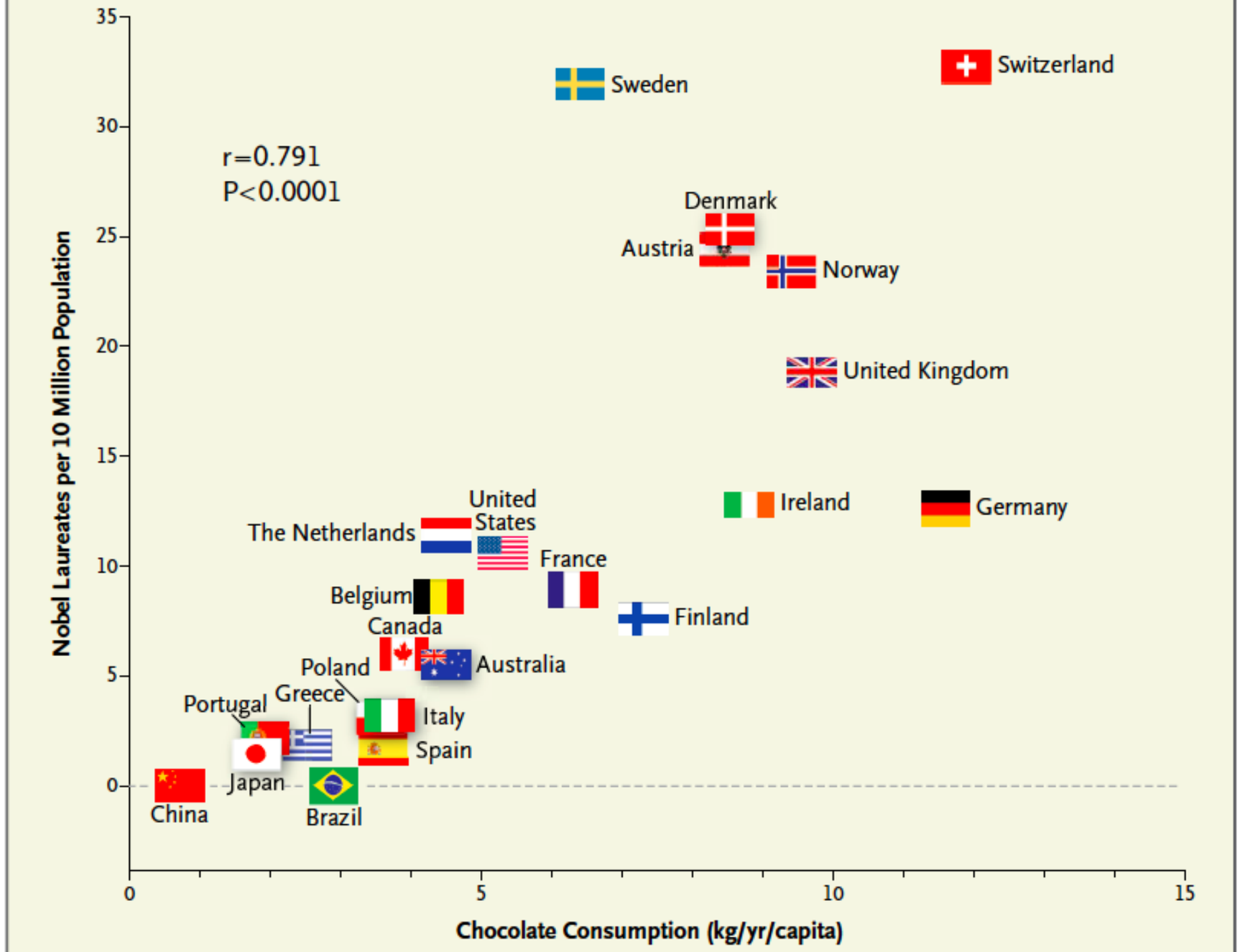


Figure 1. **Correlation between Countries' Annual Per Capita Chocolate Consumption and the Number of Nobel Laureates per 10 Million Population.**

Randomness

The NEW ENGLAND JOURNAL of MEDICINE

OCCASIONAL NOTES

Chocolate Consumption, Cognitive Function, and Nobel Laureates

Franz H. Messerli, M.D.

N Engl J Med 2012; 367:1562-1564 | October 18, 2012 | DOI: 10.1056/NEJMon1211064

Dietary flavonoids, abundant in plant-based foods, have been shown to improve cognitive function. Specifically, a reduction in the risk of dementia, enhanced performance on some cognitive tests, and improved cognitive function in elderly patients with mild impairment have been associated with a regular intake of flavonoids.[1,2] A subclass of flavonoids called flavanols, which are widely present in cocoa, green tea, red wine, and some fruits, seems to be effective in slowing down or even reversing the reductions in cognitive performance that occur with aging. Dietary flavanols have also been shown to improve endothelial function and to lower blood pressure by causing vasodilation in the peripheral vasculature and in the brain.[3,4] Improved cognitive performance with the administration of a cocoa polyphenolic extract has even been reported in aged Wistar–Unilever rats.[5]

Since chocolate consumption could hypothetically improve cognitive function not only in individuals but also in whole populations, I wondered whether there would be a correlation between a country's level of chocolate consumption and its population's cognitive function. To my knowledge, no data on overall national cognitive function are publicly available. Conceivably, however, the total number of Nobel laureates per capita could serve as a surrogate end point reflecting the proportion with superior cognitive function and thereby give us some measure of the overall cognitive function of a given country.

Randomness

In 2012 Professor Kahneman wrote:

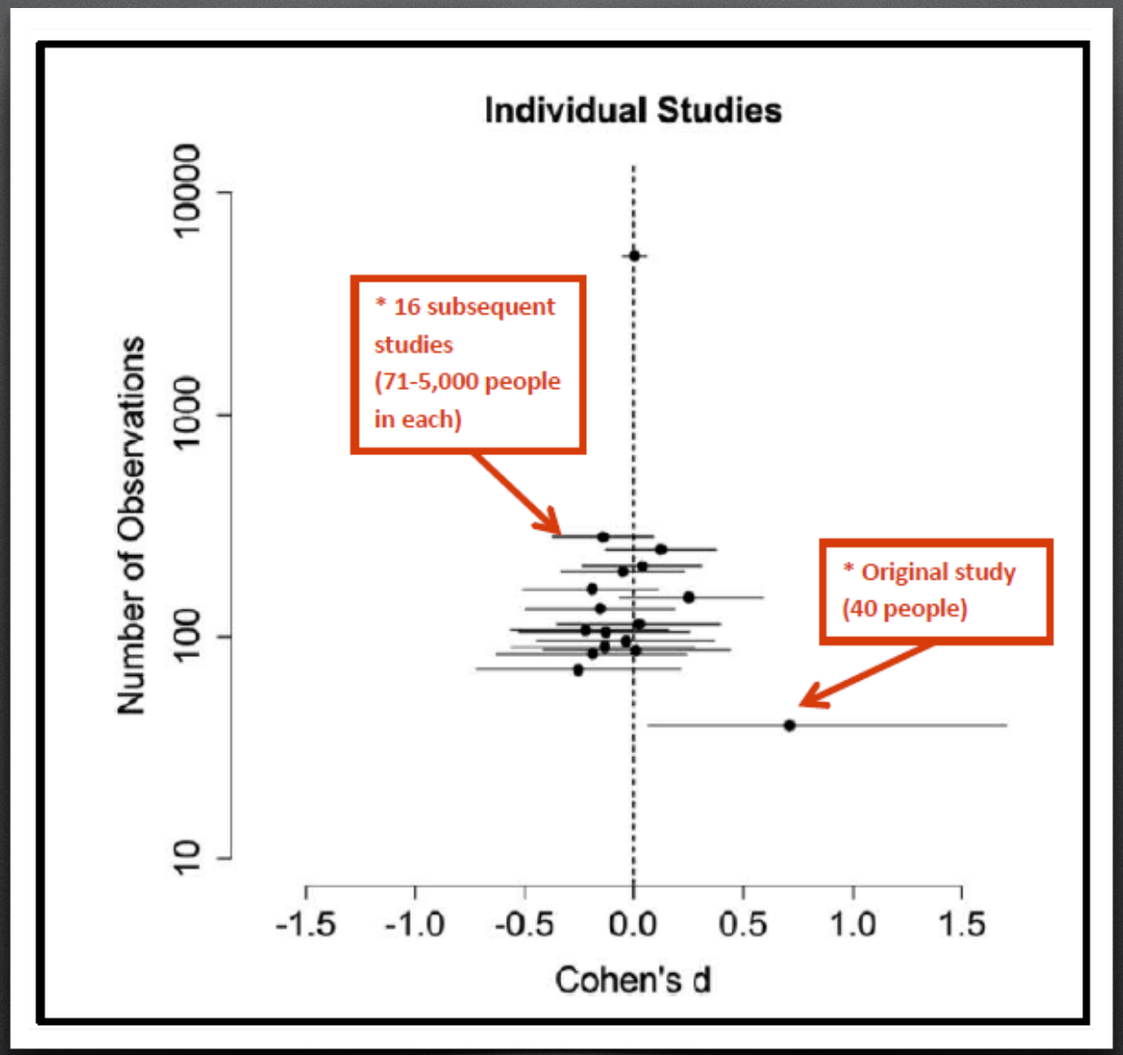
"90% of the students who saw the CRT in normal font made at least one mistake in the test, but the proportion dropped to 35% when the font was barely legible. You read this correctly: performance was better with the bad font."

http://www.terryburnham.com/2015/04/a-trick-for-higher-sat-scores.html

Randomness

The original paper reached its conclusions based on the test scores of 40 people.

If you analyze a total of over 7,000 people by looking at the original study and 16 additional studies:



http://www.terryburnham.com/2015/04/a-trick-for-higher-sat-scores.html

Randomness

Storks Deliver Babies ($p = 0.008$)

KEYWORDS:
Teaching;
Correlation;
Significance;
p-values.

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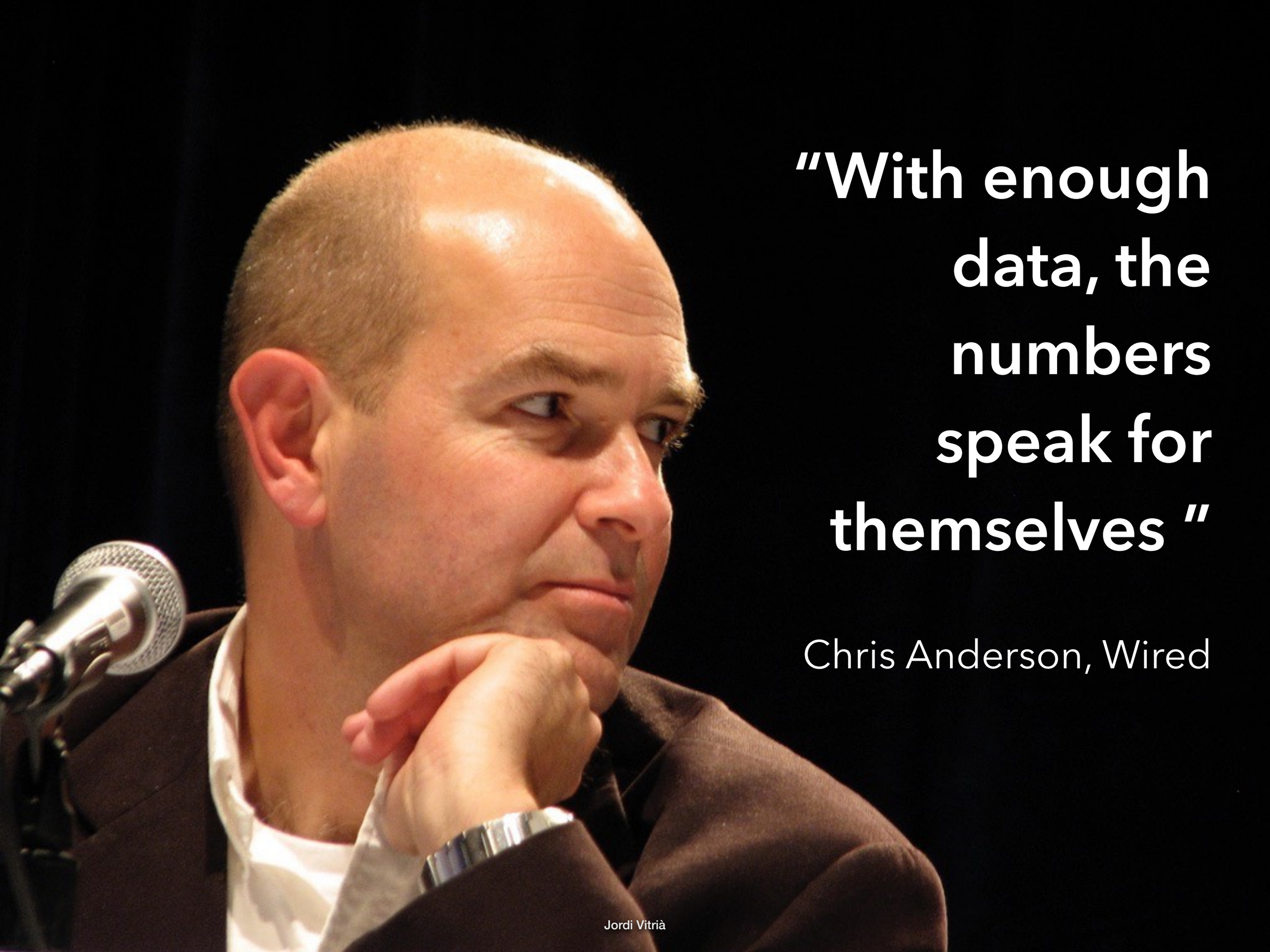
Summary
This article shows that a highly statistically significant correlation exists between stork populations and human birth rates across Europe. While storks may not deliver babies, unthinking interpretation of correlation and *p*-values can certainly deliver unreliable conclusions.

Country	Area (km^2)	Storks (pairs)	Humans (10^6)	Birth rate (10^3/yr)
Albania	28,750	100	3.2	83
Austria	83,860	300	7.6	87
Belgium	30,520	1	9.9	118
Bulgaria	111,000	5000	9.0	117
Denmark	43,100	9	5.1	59
France	544,000	140	56	774
Germany	357,000	3300	78	901
Greece	132,000	2500	10	106
Holland	41,900	4	15	188
Hungary	93,000	5000	11	124
Italy	301,280	5	57	551
Poland	312,680	30,000	38	610
Portugal	92,390	1500	10	120
Romania	237,500	5000	23	367
Spain	504,750	8000	39	439
Switzerland	41,290	150	6.7	82
Turkey	779,450	25,000	56	1576

Table 1. Geographic, human and stork data for 17 European countries

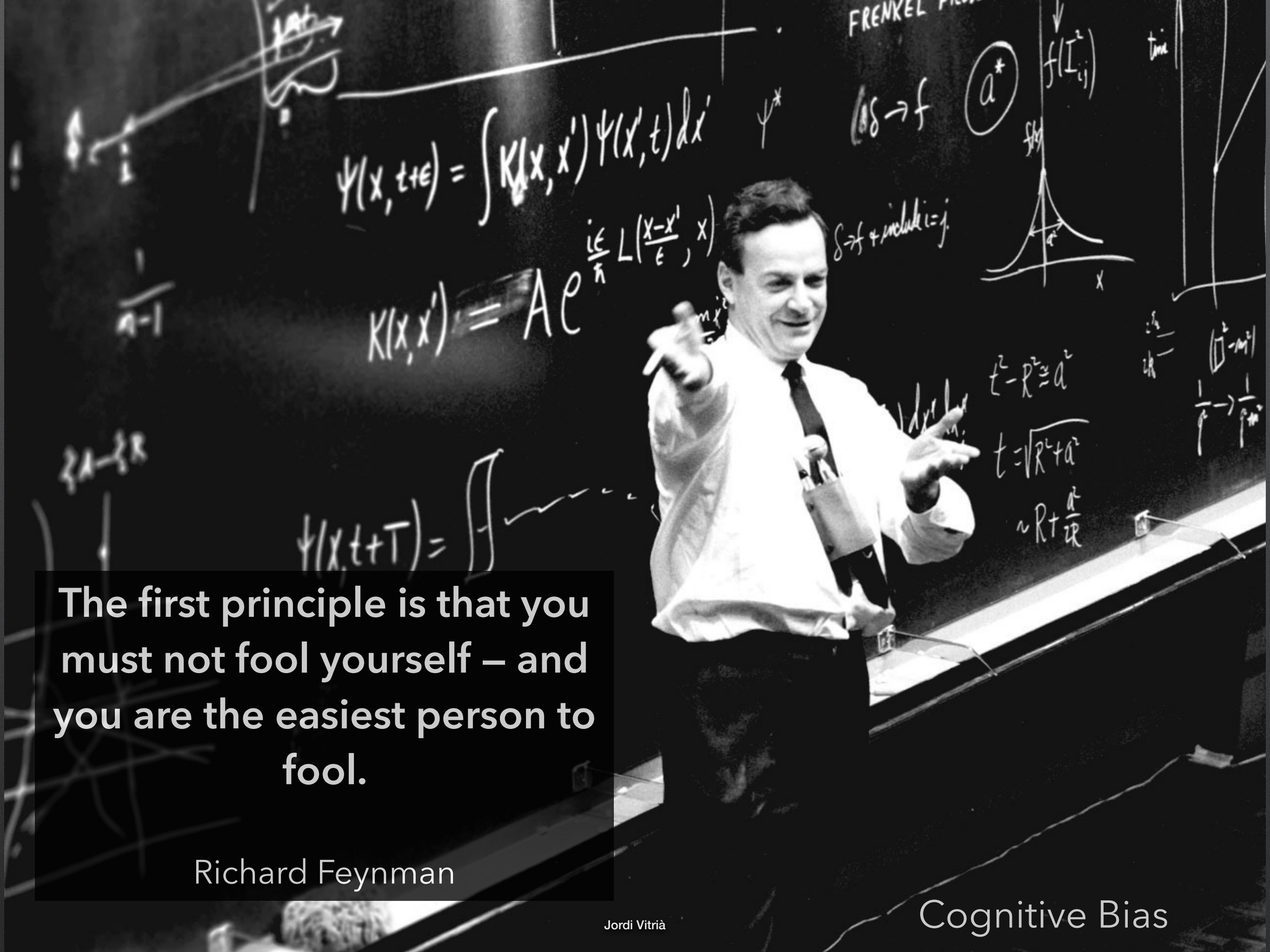


"With enough data, the numbers speak for themselves "

Chris Anderson, Wired

Jordi Vitrià

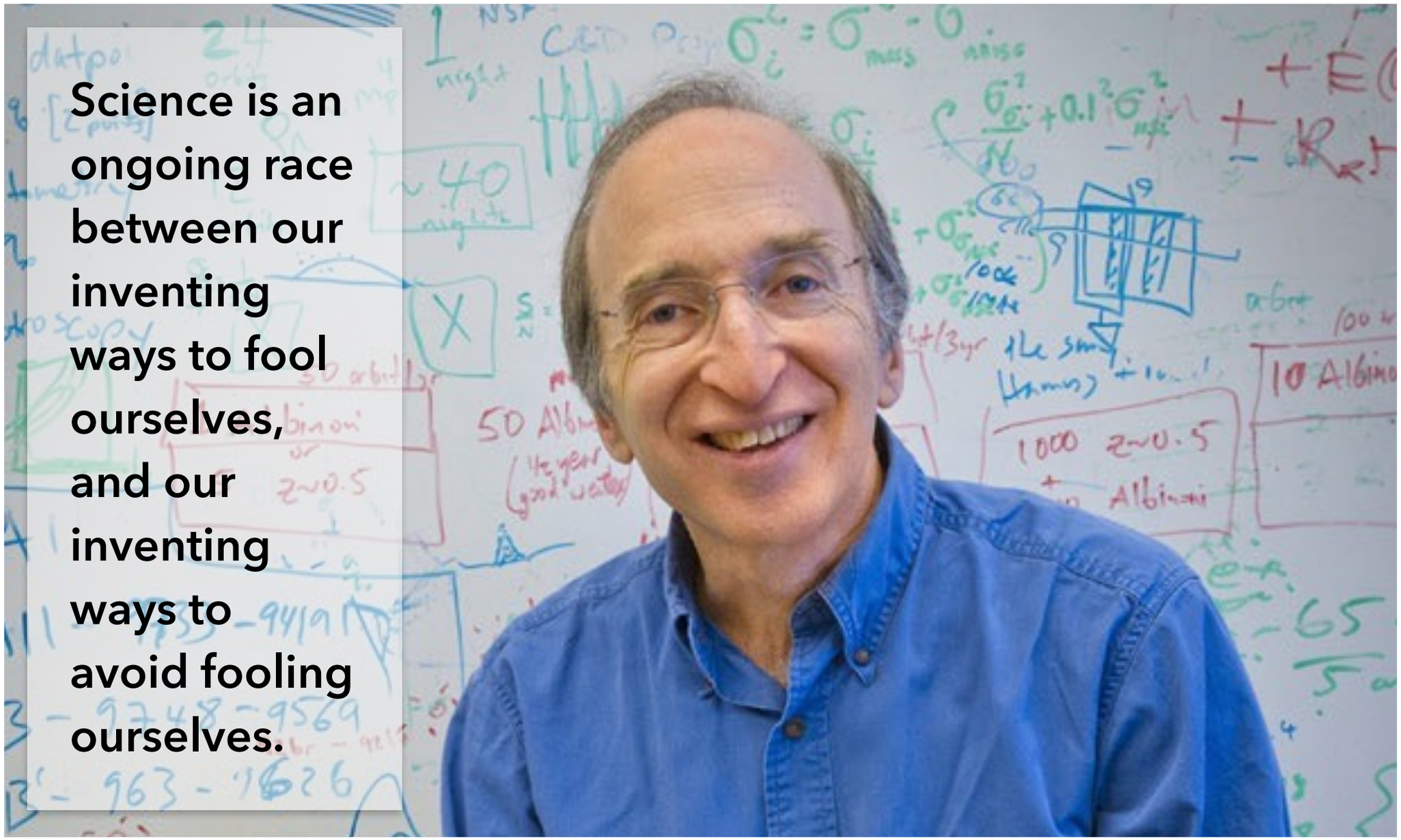

“The numbers have no way of speaking for themselves”
Nate Silver
Jordi Vitrià



Jordi Vitrià

Cognitive Bias

Data science is **difficult**, but not more difficult than general science.



Saul Perlmutter, Astrophysicist, UC Berkeley