

Books & arts

How science breeds nonsense

Tools of rationality are increasingly being used to undermine rationality itself. **By Eric-Jan Wagenmakers**

Science is under attack. Ironically, the weapons are products of science itself: the propagation of misleading information, the torturing of data to ‘prove’ claims about anything, the mining of data untroubled by any hypothesis about what you might find. As Gary Smith writes in *Distrust*, “Disinformation is spread by the Internet that scientists created. Data torturing is driven by scientists’ insistence on empirical evidence. Data mining is fuelled by the big data and powerful computers that scientists created.”

Smith, an economist at Pomona College in Claremont, California, has form in this sort of critique: he wrote the 2018 book *The AI Delusion* and, together with mathematician Jay Cordes, the 2019 book *The 9 Pitfalls of Data Science*. Throughout *Distrust*, he underscores his claims with compelling examples. Take cryptocurrencies, one of his pet peeves. Disinformation and fake trades manipulate their value; data torturing underpins models that supposedly predict their prices; and data-mining creates them in the first place.

He discusses in detail other examples of science being under attack. He sets out how, for example, food-marketing researcher Brian Wansink’s claims about dieting – that people eat less if their food comes on a small plate or if their kitchen is painted in neutral earth tones, for instance – were featured in numerous peer-reviewed papers and led to two bestselling books. A classic case of data torturing and sloppy science, the saga known as pizzagate (supposedly the data were largely collected in an Italian diner) eventually led to 18 retractions and numerous expressions of concern about other papers.

Then there is the supercomputer IBM Watson, which has data-mining capabilities that would supposedly have revolutionized health care. IBM invested more than US\$15 billion on a system that has not yet produced a single peer-reviewed paper but has instead, while employed at the University of Texas MD Anderson Cancer Center in Houston, produced “multiple examples of unsafe and incorrect treatment recommendations”. Don’t even mention former US president Donald



Sloppy science: eating pizza from a small box doesn’t necessarily mean you eat less.

Trump and COVID-19, the hydroxychloroquine hoax, conspiracy theories of varying stripes, the fake texts and images created by generative artificial intelligence, claims for the reality of extra-sensory perception, the effectiveness of power posing and so on.

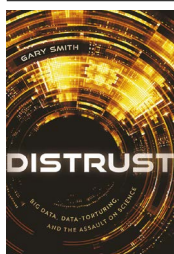
Distrust is a veritable page-turner, and I finished it in a few sittings. On a higher level, it is a call for common sense, for scepticism, for methodological rigour and for epistemic modesty. I suspect most scientists will love it.

But in places it misses the mark. I found the lack of proper scientific referencing disappointing. I can hardly fault the author, as I have not included explicit references here either, for fear of not

fitting the mould of *Nature* book reviews. But a book on disinformation ought to religiously cite its sources for any claim that it makes.

Other miscues are more notable. Every year, the *British Medical Journal (BMJ)* publishes articles in its notorious (and entertaining) Christmas issue that purposely take things to extremes and draw conclusions that are patently ridiculous. Smith seems to take these articles at least semi-seriously. After demonstrating that many of the articles result from cherry-picking and *P*-hacking – torturing out statistically significant effects from data – he discusses a paper in which remote prayer was shown to improve outcomes for hospitalizations that had occurred several years earlier (because the authors were unwilling to assume that “God is limited by a linear time”). At this point, Smith notes, “I read that sentence twice and realized that this was a prank paper.” But so are the other *BMJ* papers that Smith critiques.

Distrust also pays little attention to the methodological improvements that scientists have embraced over the past decade to right the ship, or at least to counter data torturing



Distrust: Big Data, Data-Torturing, and the Assault on Science

Gary Smith
Oxford Univ. Press (2023)

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and data mining. Only in the final chapter ('Restoring the Luster of Science') does the author provide a short, superficial discussion of ways to counteract questionable research practices. To my mind, the question of what should be done has a simple answer: academic journals should adopt the practices set out in Level 2 of the Transparency and Openness Promotion (TOP) Guidelines established by the Open Science Foundation in 2014. (Full disclosure: I was part of the committee of scientists that formulated the original guidelines.)

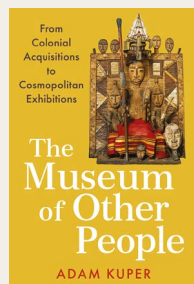
Distrust does mention pre-registration as a possible countermeasure: committing to a specific analysis plan in advance of data collection. But Smith argues that "relatively few journals currently require pre-registration – perhaps because it is so easy to game the system: collect the data, torture or mine the data to obtain interesting results, and then file a pre-plan that does not reveal that the study has already been completed." However, many reputable medical journals effectively require pre-registration for publishing clinical trials. Although scientists can circumvent the rules, doing so would be outright fraud. Researchers who stoop that low might as well just make up the data from scratch.

The book joins a growing chorus saying that schools and universities ought to teach courses in quantitative literacy to counter the wider societal problem of scientific disinformation. French scholar Pierre-Simon de Laplace was already arguing for that in 1814; what *Distrust* often lacks is a prescription for what this might entail. One concrete recommendation is that "statistics courses in all disciplines should include substantial discussion of Bayesian methods". I describe myself as a dedicated Bayesian and would argue that Bayesian methods of statistical inference are the bedrock of all rationality, so I fully support this idea; yet only two pages in the book are devoted to talking about this method.

The broader question is whether any educational initiative would do much good. As a species, humans have always been shockingly biased and gullible. Raw intelligence does not seem to provide much, if any, protection against misinformation. Alongside the entertaining examples of people believing weird things, I would have wanted a discussion of 'why people believe weird things'. Michael Shermer's 1997 book of that title could easily have been the main source for at least one extra chapter. The many examples of bad science in this highly readable, topical book are educational and distressing, but the focus is too much on the disease, and too little on the potential cures. *Distrust* lights a few candles, but mostly curses the darkness.

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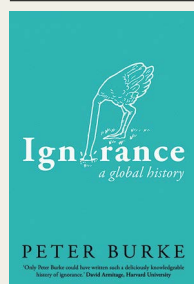
Books in brief



The Museum of Other People

Adam Kuper *Profile* (2023)

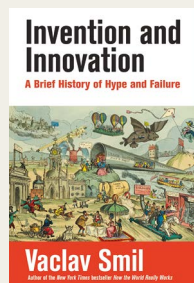
This fascinating history by anthropologist Adam Kuper discusses ethnology museums, mainly in Europe and the United States, established during the colonial period. He argues that it is time to turn such institutions into 'cosmopolitan museums' that include challenging perspectives and contrasting points of view — backed by research and scholarship, not "mystical insight" or the "authority of identity". But he also recognizes that "the force is with those who demand the restitution of colonial collections".



Ignorance

Peter Burke *Yale Univ. Press* (2023)

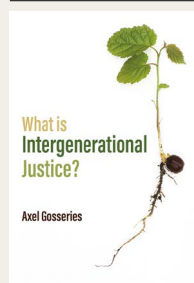
Having published a study of polymathy in 2020, cultural historian Peter Burke now tackles its opposite: ignorance. Both have long been key to scientific progress. "Thoroughly conscious ignorance is the prelude to every real advance in science," remarked physicist James Clerk Maxwell in the nineteenth century. Chapters also consider the relevance of ignorance to business, geography, politics, religion and war. Burke argues, with encyclopedic cogency, that we should think of 'knowledges' and 'ignorances' — plural rather than singular.



Invention and Innovation

Vaclav Smil *MIT Press* (2023)

As an environmentalist and energy writer, Vaclav Smil is well placed to analyse the impact of past and promised inventions and innovations. He distinguishes between these concepts: innovation, he says, involves "mastering new materials, products, processes and ideas". He focuses engagingly on three types of "failed" invention: welcomed but then unwelcome (for example, leaded petrol and the pesticide DDT); over-hyped (such as nuclear fission and supersonic flight); and undelivered (including travel by vacuum tube and controlled nuclear fusion).



What Is Intergenerational Justice?

Axel Gosseries *Polity* (2023)

What duties do we have to future generations, both living and unborn? What does 'justice' mean in the intergenerational context? On topics such as climate change, we have to "divide cakes without knowing how many guests will join us and what their tastes will be", comments political philosopher Axel Gosseries. Despite the emotive subject, his language and tone are academic. Greenhouse gases and extinction are discussed, but not Greenpeace and Extinction Rebellion — even though he accepts the need for "radical changes".



The One

Heinrich Päs *Basic* (2023)

Theoretical physicist Heinrich Päs begins his intriguing, controversial book for general readers on the mysteries of quantum physics by asking, how can standing under a star-studded night sky make us feel at once insignificant yet "strangely at home in the universe"? He answers, essentially, that everything — including quantum particles — is part of the same fundamental whole. He is a monist, convinced by a comment by ancient Greek philosopher Heraclitus: "From all things One and from One all things." **Andrew Robinson**