

Ethics of quantification

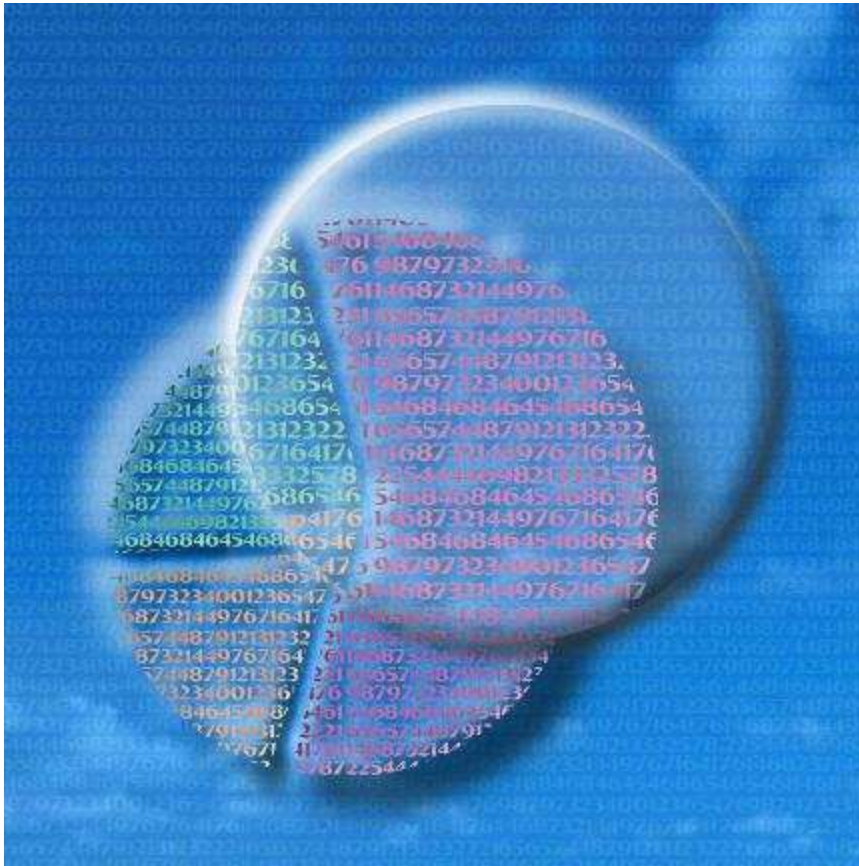
Andrea Saltelli

Centre for the Study of the
Sciences and the Humanities
(SVT), University of Bergen
(UIB)

Course:

Theory of Science and Ethics,
for the PhD students from the
Faculty of Science and
Mathematics of
Bergen University

September 13, 2017



CAETERIS ARE
NEVER PARIBUS

Tweets by @AndreaSaltelli



andrea saltelli

@AndreaSaltelli

Sign and donate. What these people are doing is unique. twitter.com/Jeroen_vdSluisj...



24/11



andrea saltelli

@AndreaSaltelli

Lovely (also in the sense of 'of love') piece by an Italian scholar [@robertocalasso](https://twitter.com/robertocalasso):

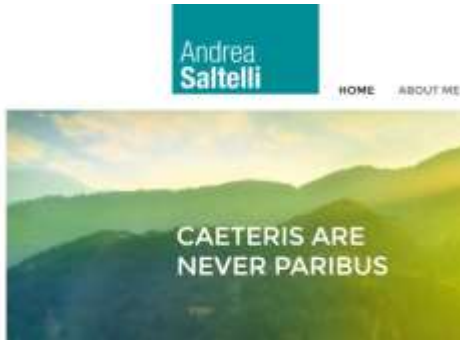
nybooks.com/articles/2016/...



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sensitivity analysis, sensitivity auditing, science for policy, impact assessment



= more material on my web site



= discussion time

The spirit of p

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Review



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Cite this article: Colquhoun D. 2014 An investigation of the false discovery rate and the misinterpretation of p -values. *R. Soc. open sci.* **1**: 140216.

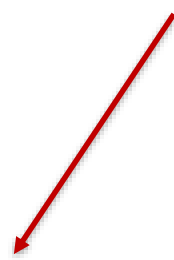
<http://dx.doi.org/10.1098/rsos.140216>

An investigation of the false discovery rate and the misinterpretation of p -values

David Colquhoun

Department of Neuroscience, Physiology and Pharmacology, University College London, Gower Street, London WC1 6BT, UK

“If you are foolish enough to define ‘statistically significant’ as anything less than $p=0.05$ then... you have a 29% chance (at least) of making a fool of yourself.



Who would take a risk like that? Judging by the medical literature, most people would. No wonder there is a problem”

P values by way of an example

- Two groups, one with a placebo, one with the treatment
- Random allocation to groups (+more!)
- The difference d between the means of the two groups is tested (is it different from zero?)
- $p=0.05$ implies that if there were no effect the probability of observing a value equal to d or higher would be 5%

“At first sight, it might be thought that this procedure would guarantee that you would make a fool of yourself only once in every 20 times that you do a test”

Colquhoun D. 2014 An investigation of the false discovery rate and the misinterpretation of p-values. R. Soc. Open sci. 1: 140216. <http://dx.doi.org/10.1098/rsos.140216>

“The classical p-value does exactly what it says. But it is a statement about what would happen if there were no true effect. That cannot tell you about your long-term probability of making a fool of yourself, simply because sometimes there really is an effect. In order to do the calculation, **we need to know a few more things**”

Colquhoun D. 2014 An investigation of the false discovery rate and the misinterpretation of p-values. R. Soc. Open sci. 1: 140216. <http://dx.doi.org/10.1098/rsos.140216>

A classic exercise in screening

You test positive for AIDS (one test only). Time for despair?

Only one 1 in 100,000 has AIDS in your population

The test has a 5% false positive rate

Already one can say: in a population of say 100,000 one will have AIDS and 5,000 (5% of 100,000) will test positive

➔ Don't despair (yet)

Another exercise in screening (Colquhoun 2014)

You test positive for mild cognitive impairment (MCI) (one test only).
Time to retire?

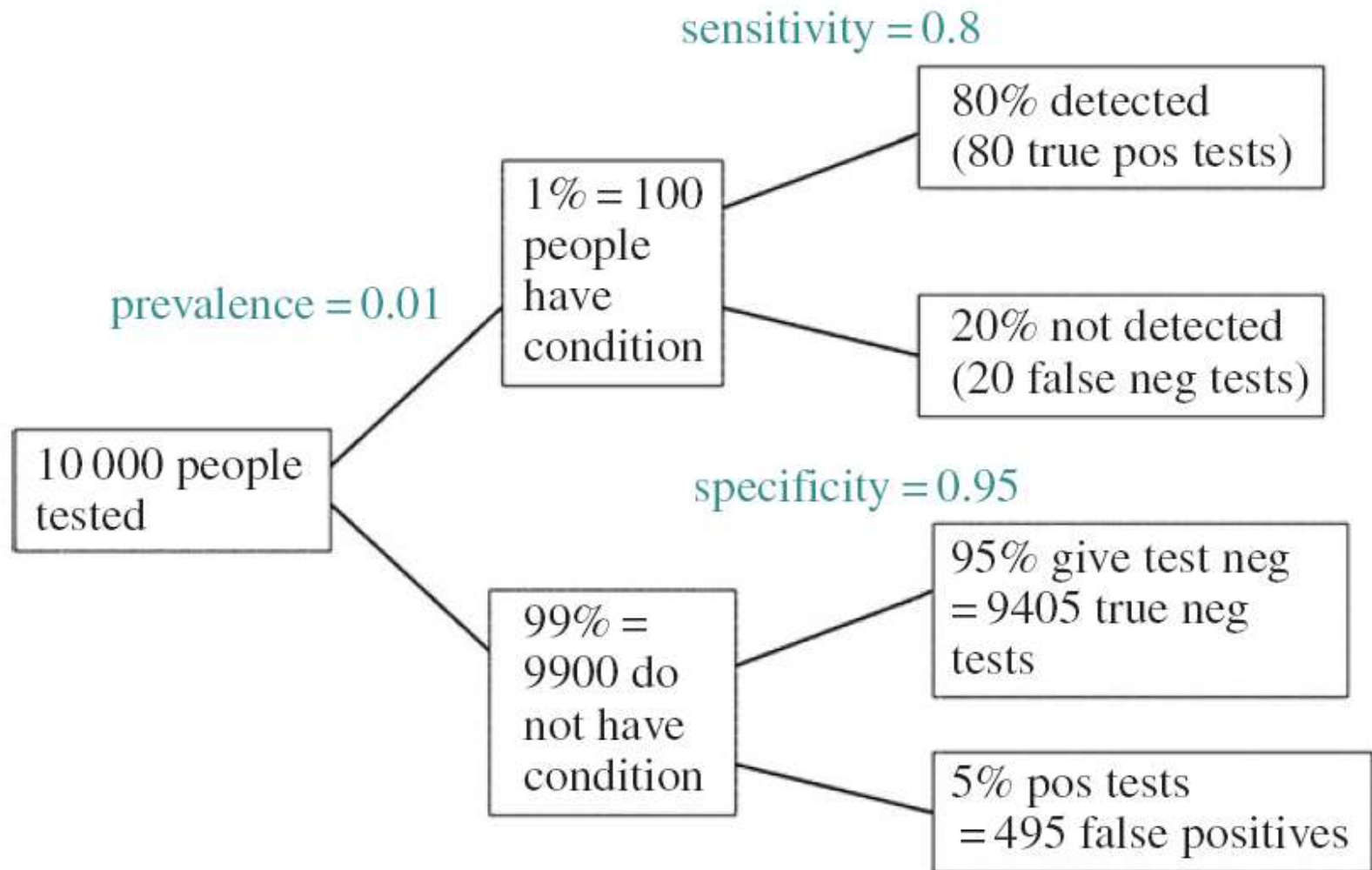
MCI prevalence in the population 1%, i.e. in a sample of 10,000 then 100 have MCI and 9,900 don't

The test has a 5% **false positive** rate; of the 9,900 who don't have MCI 495 test (false) positive and the remaining 9,405 (true) negative

The test does not pick all the 100 MCI but only 80; there will be 20 **false negative**. So we see $80 + 495 = 575$ positive of which only 80 (a 14%) are true and the remaining 86% false

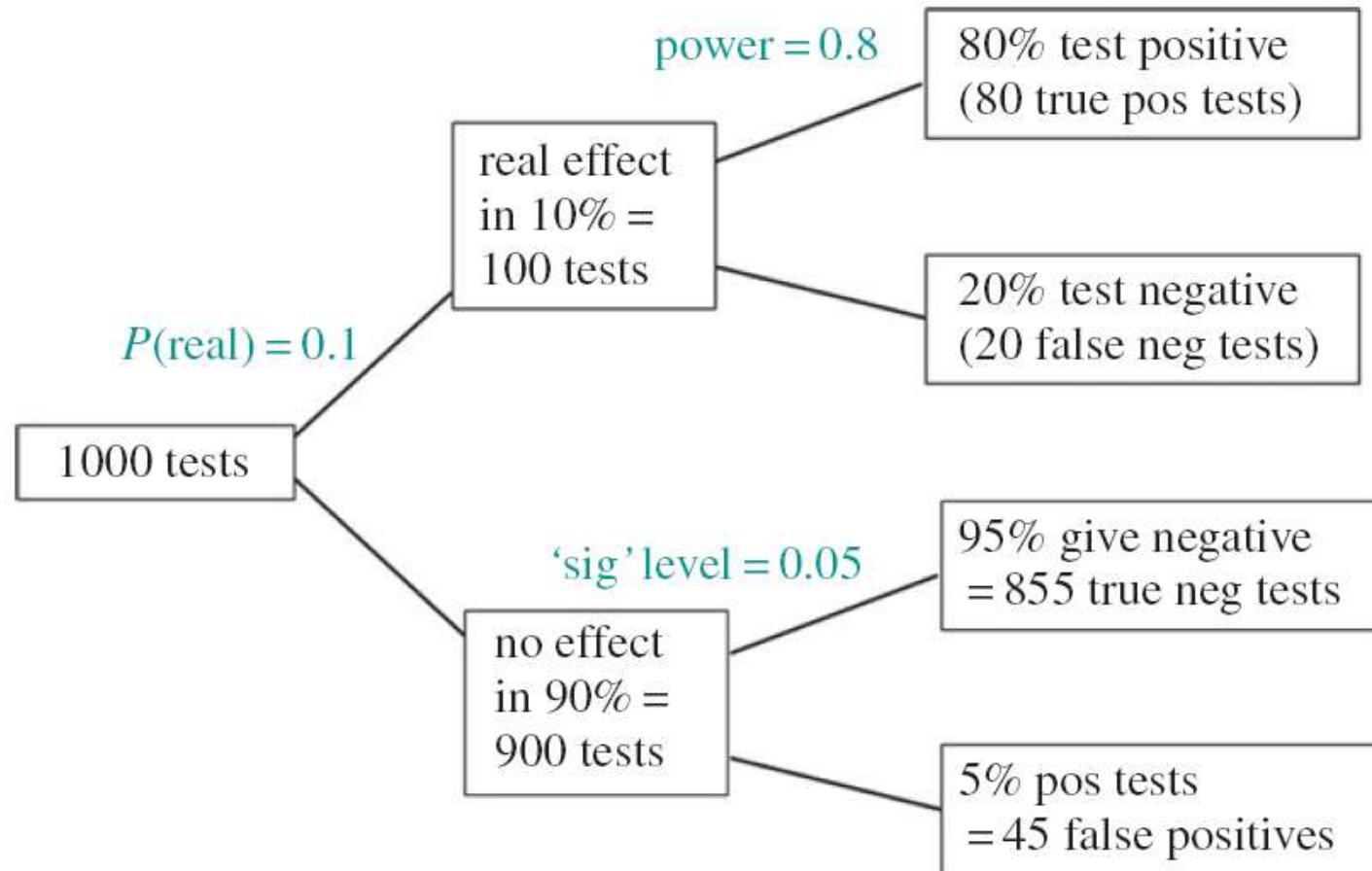
➔ It does not make sense to screen the population for MCI!

The number $86\% = 495/(495+80)$ is our **false discovery rate**



The same concept of false discovery rate applies to the problem of significance test

We now consider tests instead of individuals

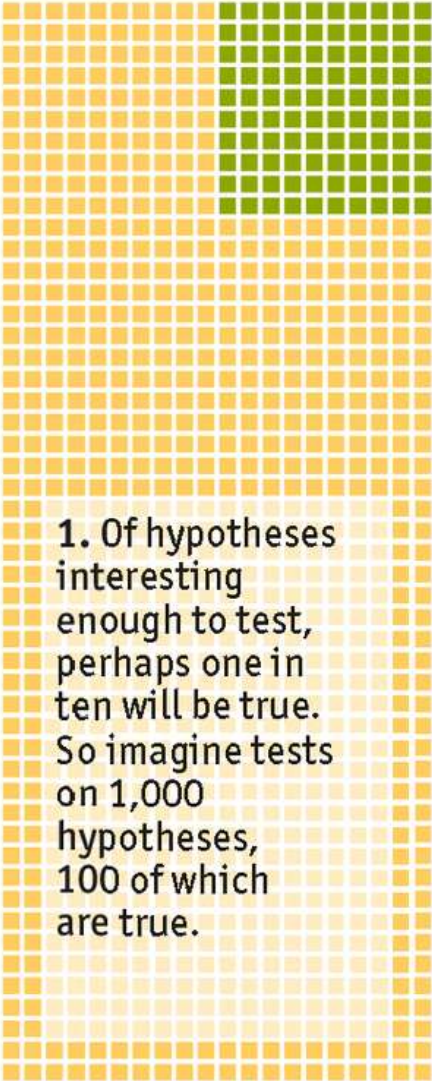


Unlikely results

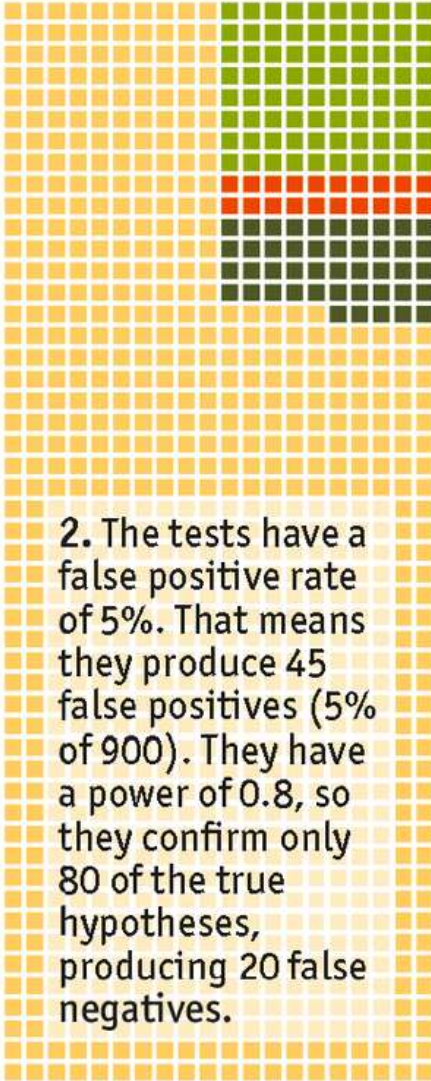
How a small proportion of false positives can prove very misleading

False True False negatives False positives

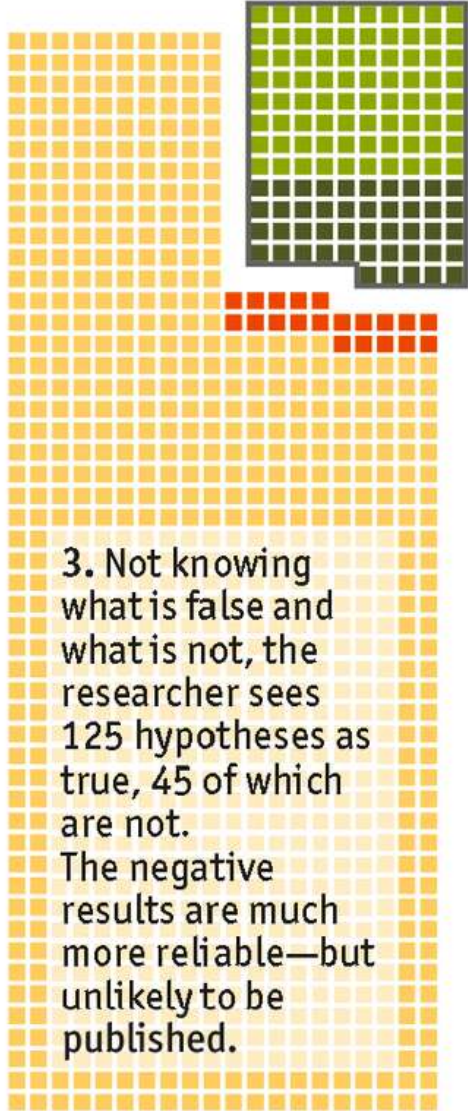
The false discovery rate is \sim the dark divided by the dark plus light green



1. Of hypotheses interesting enough to test, perhaps one in ten will be true. So imagine tests on 1,000 hypotheses, 100 of which are true.



2. The tests have a false positive rate of 5%. That means they produce 45 false positives (5% of 900). They have a power of 0.8, so they confirm only 80 of the true hypotheses, producing 20 false negatives.



3. Not knowing what is false and what is not, the researcher sees 125 hypotheses as true, 45 of which are not. The negative results are much more reliable—but unlikely to be published.

➔ We see 125 hypotheses as true 45 of which are not;
the false discovery rate is $45/125 = 36\%$

Significance $p=0.05$ ➔ false discovery rate of 36%

We now know that $p=0.05$ did not correspond to a
chance in twenty of being wrong but to one in three

How many numbers did we need to know to reach this
conclusion?



The curse of p

Replicability-Index

Improving the replicability of empirical research



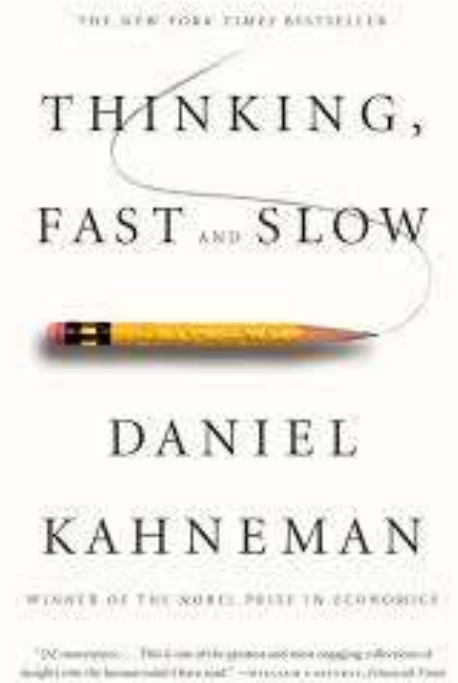
Reconstruction of a Train Wreck: How Priming Research Went off the Rails

🕒 February 2, 2017 📖 Kahneman, Priming, r-index, Statistical Power, Thinking Fast and Slow

Authors: Ulrich Schimmack, Moritz Heene, and Kamini Kesavan



Reconstruction of a Train Wreck: How Priming Research Went off the Rails

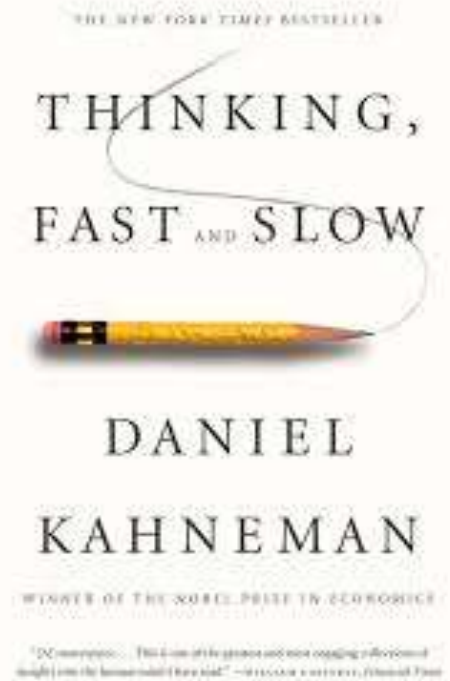


“[...]questions have been raised about the robustness of priming results ... your field is now the poster child for doubts about the integrity of psychological research...”

<https://replicationindex.wordpress.com/2017/02/02/reconstruction-of-a-train-wreck-how-priming-research-went-off-the-rails/>



Reconstruction of a Train
Wreck: How Priming
Research Went off
the Rails



“... people have now attached a question mark to the field, and it is your responsibility to remove it... I recently wrote a book that emphasizes priming research ... My reason for writing this letter is that I see a train wreck looming” (Kahneman, 2012)

<https://replicationindex.wordpress.com/2017/02/02/reconstruction-of-a-train-wreck-how-priming-research-went-of-the-rails/>

REPRODUCIBILITY

Statisticians issue warning on *P* values

Statement aims to halt missteps in the quest for certainty.

“Misuse of the p value — a common test for judging the strength of scientific evidence — is contributing to the number of research findings that cannot be reproduced”

Baker, M., 2016, Statisticians issue warning on P values, *Nature*, 531, 151

AMERICAN STATISTICAL ASSOCIATION RELEASES STATEMENT ON STATISTICAL SIGNIFICANCE AND *P*-VALUES

*Provides Principles to Improve the Conduct and Interpretation of Quantitative
Science*

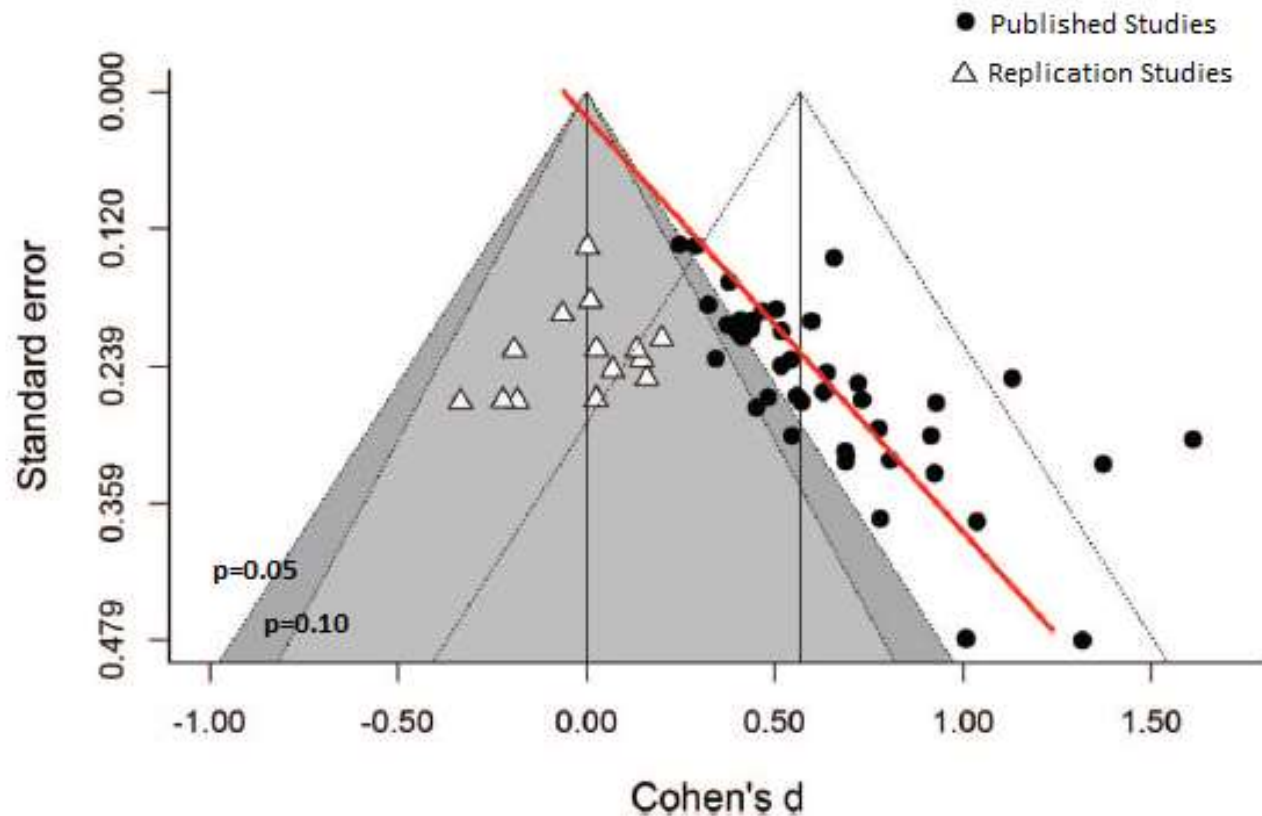
March 7, 2016

... and twenty ‘dissenting’ commentaries

Wasserstein, R.L. and Lazar, N.A., 2016. ‘The ASA's statement on p-values: context, process, and purpose’, *The American Statistician*, DOI:10.1080/00031305.2016.1154108.

See also Christie Aschwanden at <http://fivethirtyeight.com/features/not-even-scientists-can-easily-explain-p-values/>

P-hacking; a smoking gun?



Shanks et al. (2015) JEP:General

J Exp Psychol Gen. 2015 Oct 26. "Romance, Risk, and Replication: Can Consumer Choices and Risk-Taking Be Primed by Mating Motives?", Shanks DR, Vadillo MA, Riedel B, Clymo A, Govind S, Hickin N, Tamman AJ, Puhmann LM.: <http://www.ncbi.nlm.nih.gov/pubmed/26501730>

An important statistical tool misused for several
decades with grave consequences for science;
how did this come to be?

Special Issue:
Bayesian Probability and Statistics
in Management Research

Journal of Management
Vol. 41 No. 2, February 2015 421–440
DOI: 10.1177/0149206314547522
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Editorial Commentary

Surrogate Science: The Idol of a Universal Method for Scientific Inference

Gerd Gigerenzer

Max Planck Institute for Human Development

Julian N. Marewski

University of Lausanne

Surrogate Science: The Idol of a Universal Method for Scientific Inference

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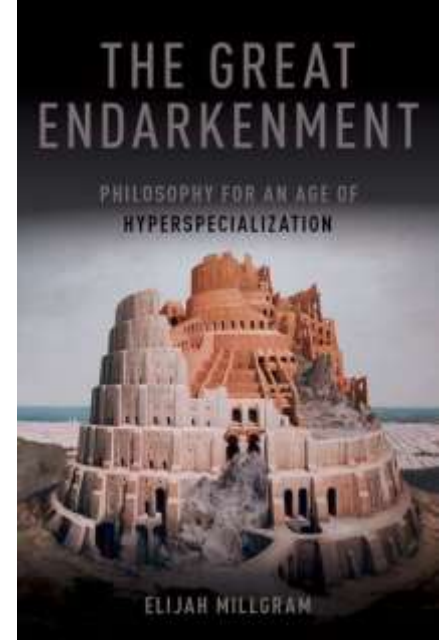
University of Lausanne

There is no universal method of scientific
inference ...

...it is better to have no beliefs than to embrace
falsehoods... (➔ F. Bacon's idols)

Statistical methods are not simply applied to a
discipline; they change the discipline itself, ...

The Great Endarkenment.
Philosophy for an Age of
Hyperspecialization, by
Elijah Millgram



Describes a world in which all knowledge and products are the result of specialized expertise, where experts depend in turn on other experts whose knowledge claims and styles of argumentation cannot be exported across disciplines

Scientist as “serial hyperspecializers” (p. 26)
Experts thus become “logical aliens” (p. 32)

- p-hacking (fishing for favourable p-values) and harking (formulating the research Hypothesis After the Results are Known);
- desire to achieve a sought for - or simply publishable - result leads to fiddling with the data points, the modelling assumptions, the statistical analysis, or the research hypotheses themselves.

Leamer, E. E. Tantalus on the Road to Asymptopia. J. Econ. Perspect. 24, 31–46 (2010).

Kerr, N. L. HARKing: Hypothesizing After the Results are Known. Personal. Soc. Psychol. Rev. 2, 196–217 (1998).

Good intentions going bad

TABLE 1. GROWING PERVERSE INCENTIVES IN ACADEMIA

<i>Incentive</i>	<i>Intended effect</i>	<i>Actual effect</i>
“Researchers rewarded for increased number of publications.”	“Improve research productivity,” provide a means of evaluating performance.	“Avalanche of” substandard, “incremental papers”; poor methods and increase in false discovery rates leading to a “natural selection of bad science” (Smaldino and McElreath, 2016); reduced quality of peer review
“Researchers rewarded for increased number of citations.”	Reward quality work that influences others.	Extended reference lists to inflate citations; reviewers request citation of their work through peer review
“Researchers rewarded for increased grant funding.”	“Ensure that research programs are funded, promote growth, generate overhead.”	Increased time writing proposals and less time gathering and thinking about data. Overselling positive results and downplay of negative results.
Increase PhD student productivity	Higher school ranking and more prestige of program.	Lower standards and create oversupply of PhDs. Postdocs often required for entry-level academic positions, and PhDs hired for work MS students used to do.
Reduced teaching load for research-active faculty	Necessary to pursue additional competitive grants.	Increased demand for untenured, adjunct faculty to teach classes.
“Teachers rewarded for increased student evaluation scores.”	“Improved accountability; ensure customer satisfaction.”	Reduced course work, grade inflation.
“Teachers rewarded for increased student test scores.”	“Improve teacher effectiveness.”	“Teaching to the tests; emphasis on short-term learning.”
“Departments rewarded for increasing U.S. News ranking.”	“Stronger departments.”	Extensive efforts to reverse engineer, game, and cheat rankings.
“Departments rewarded for increasing numbers of BS, MS, and PhD degrees granted.”	“Promote efficiency; stop students from being trapped in degree programs; impress the state legislature.”	“Class sizes increase; entrance requirements” decrease; reduce graduation requirements.
“Departments rewarded for increasing student credit/contact hours (SCH).”	“The university’s teaching mission is fulfilled.”	“SCH-maximization games are played”: duplication of classes, competition for service courses.

Modified from Regehr (pers. comm., 2015) with permission.

Academic Research in the 21st Century: Maintaining Scientific Integrity in a Climate of Perverse Incentives and Hyper-competition, Marc A. Edwards and Siddhartha Roy, ENVIRONMENTAL ENGINEERING SCIENCE, 34(1), 2017

Incentive

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Actual effect

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Academic Research in the 21st Century: Maintaining Scientific Integrity in a Climate of Perverse Incentives and Hyper-competition, Marc A. Edwards and Siddhartha Roy, ENVIRONMENTAL ENGINEERING SCIENCE, 34(1), 2017

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Research



Cite this article: Smaldino PE, McElreath R.

2016 The natural selection of bad science.

R. Soc. open sci. **3**:160384.

<http://dx.doi.org/10.1098/rsos.160384>

Received: 1 June 2016

Accepted: 17 August 2016

The natural selection of bad science

Paul E. Smaldino¹ and Richard McElreath²

¹Cognitive and Information Sciences, University of California, Merced, CA 95343, USA

²Department of Human Behavior, Ecology, and Culture, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany

PES, 0000-0002-7133-5620; RME, 0000-0002-0387-5377

Poor research design and data analysis encourage false-positive findings. Such poor methods persist despite perennial calls for improvement, suggesting that they result from something more than just misunderstanding. The persistence of poor methods results partly from incentives that favour them, leading to the natural selection of bad science. This dynamic requires no conscious strategizing—no deliberate cheating nor loafing—by scientists, only that publication is a principal factor for

[redacted] The persistence of poor methods results partly from incentives that favour them, leading to the natural selection of bad science. This dynamic requires no conscious strategizing—no deliberate cheating nor loafing—by scientists, only that publication is a principal factor for career advancement. [redacted]

Smaldino PE, McElreath R., 2016 The natural selection of bad science. R. Soc. open sci. 3: 160384. <http://dx.doi.org/10.1098/rsos.160384>

[redacted] As in the real world, successful labs produce more 'progeny,' such that their methods are more often copied and their students are more likely to start labs of their own. Selection for high output leads to poorer methods and increasingly high false discovery rates. [redacted]

[redacted] Improving the quality of research requires change at the institutional level.

Smaldino PE, McElreath R., 2016 The natural selection of bad science. R. Soc. open sci. 3: 160384. <http://dx.doi.org/10.1098/rsos.160384>

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nature human behaviour




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Perspective | [OPEN](#)

A manifesto for reproducible science

Marcus R. Munafò , Brian A. Nosek, Dorothy V. M. Bishop, Katherine S. Button, Christopher D. Chambers, Nathalie Percie du Sert, Uri Simonsohn, Eric-Jan Wagenmakers, Jennifer J. Ware & John P. A. Ioannidis

Nature Human Behaviour **1**,
Article number: 0021 (2017)
[doi:10.1038/s41562-016-0021](https://doi.org/10.1038/s41562-016-0021)

Published online: 10 January 2017

“[...] measures [to] improving the transparency, reproducibility and efficiency of scientific research”

Algorithms

Algorithms decide upon an ever-increasing list of cases, such as recruiting, carriers - including of researchers, prison sentencing, paroling, custody of minors...

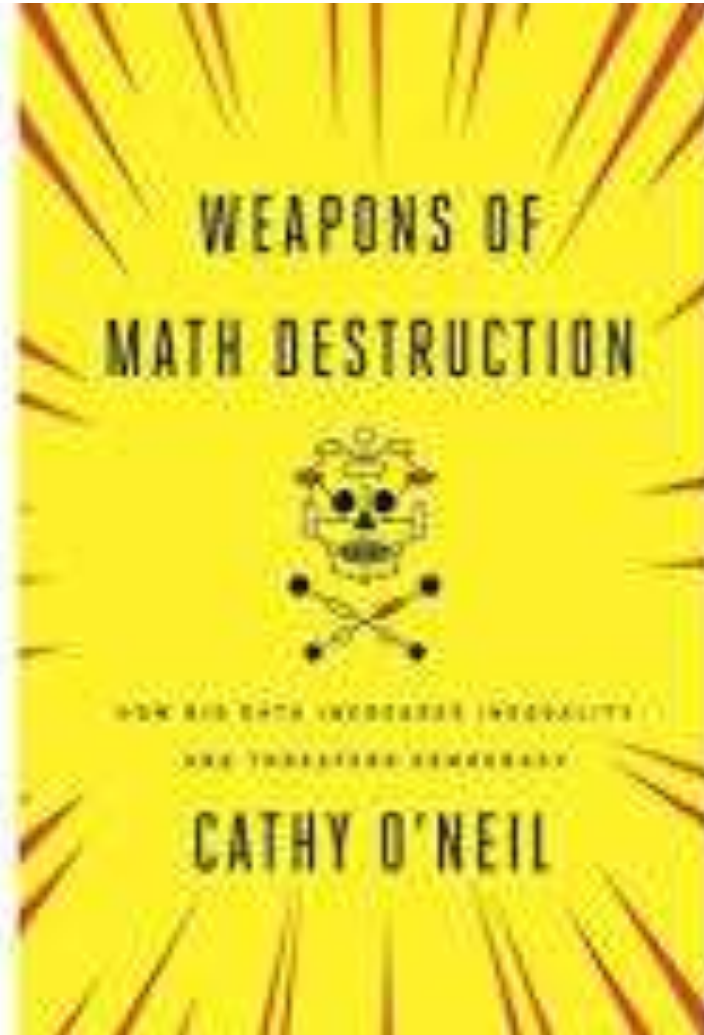


Alexander, L. Is an algorithm any less racist than a human? | Technology | The Guardian. Available at <https://www.theguardian.com/technology/2016/aug/03/algorithm-racist-human-employers-work> (2016) (Accessed: 30th August 2017).

Abraham C. Turmoil rocks Canadian biomedical research community. Statnews, Available at <https://www.statnews.com/2016/08/01/cihr-canada-research/> (2016) (Accessed: 30th August 2017).

Brauneis, R. & Goodman, E. P. Algorithmic Transparency for the Smart City, Yale Journal of Law & Technology (2017), Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3012499 (Accessed: 30th August 2017).

A book on algorithms titles “Weapons of Math Destruction”.



O'Neil, C. Weapons of math destruction : how big data increases inequality and threatens democracy. (Crown/Archetype, 2016).

In New York, where algorithms are used by the administration for a large array of decisions, the mayor has decided to pursue legislation for “algorithmic audits”.

The New York Times

Showing the Algorithms Behind New York City Services

About New York

By JIM DWYER AUG. 24, 2017



Let us say that [James Vacca](#) is not necessarily the first person you'd think would begin a deeply necessary revolution to peel away some of the secrecy around technology that shapes government decisions. In the 1980s, Mr. Vacca admitted, he told an aide that it would be a waste of money to replace office typewriters with

About New York

Twice a week, a chronicle of New York and New Yorkers.

[Online Chats Tie Politicians to the Troll of Staten Island](#)

SEP 7

Dwyer J. Showing the Algorithms Behind New York City Services - The New York Times. New York Times Aug. 24, (2014).

Governments may welcome the non-transparency provided by algorithms

Governments may recur to algorithms to implements rules which - if applied by human subject - would be either legislated or made through administrative rulemaking =

= Big data prediction models used without political or at least traceable administrative procedure.

Brauneis, R. & Goodman, E. P. Algorithmic Transparency for the Smart City, Yale Journal of Law & Technology (2017), Available at:
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3012499 (Accessed: 30th August 2017).

Normative issues in statistical models, ethical problems raised about the use of algorithms;

Part of a broader picture? How about modelling in general?

The Economist

OCTOBER 19TH-25TH 2013

Economist.com

Washington's lawyer surplus

How to do a nuclear deal with Iran

Investment tips from Nobel economists

Junk bonds are back

The meaning of Sachin Tendulkar

HOW SCIENCE GOES WRONG.



Essay

Why Most Published Research Findings Are False

John P. A. Ioannidis

J. P. A. Ioannidis, Why Most Published Research Findings Are False, PLoS Medicine, August 2005, 2(8), 696–701.

relationships probed in each scientific field. In this framework, a research finding is less likely to be true when the studies conducted in a field are smaller; when effect sizes are smaller; when there is a greater number and lesser preselection of tested relationships; where there is greater flexibility in designs, definitions, outcomes, and analytical modes; when there is greater financial and other interest and prejudice; and when more teams are involved in a scientific field in chase of statistical significance.



What if even she is wrong?



On TV series over series where lab-based
forensics (science) adjudicates cases

Forensics [as well as medicine, biology,
economics, health, nutrition ...] has
produced serious misdiagnoses



Butler, J. M. U.S., Forensic Sci. Int. Genet. 18, 4–20 (2015).

National Academy of Sciences (NAS) report “Strengthening
Forensic Science in the United States: A Path Forward”,
<https://www.ncjrs.gov/pdffiles1/nij/grants/228091.pdf>

Science in crisis: from the sugar scam to Brexit, our faith in experts is fading

September 27, 2016 4:43pm AEST



<https://theconversation.com/science-in-crisis-from-the-sugar-scam-to-brexit-our-faith-in-experts-is-fading-65016>

Waste of resources?

Summary Points

- Currently, many published research findings are false or exaggerated, and an estimated 85% of research resources are wasted.



John P. A.
Ioannides

Ioannidis, J. P. (2014). How to Make More Published Research True. *PLoS medicine*, 11(10), e1001747

Ioannidis JPA, 2016, Why Most Clinical Research Is Not Useful, *PLoS Med* 13(6): e1002049. doi:10.1371/journal.pmed.1002049

Waste of resources?

For Lancet (2015) an estimated US\$200 billion were wasted in the US in 2010

THE LANCET

Volume 378 - Number 9734 - Pages 1-68 - July 3-9, 2010

www.thelancet.com

Lancet, Editorial, 2015, Rewarding true inquiry and diligence in research, 385, p. 2121.

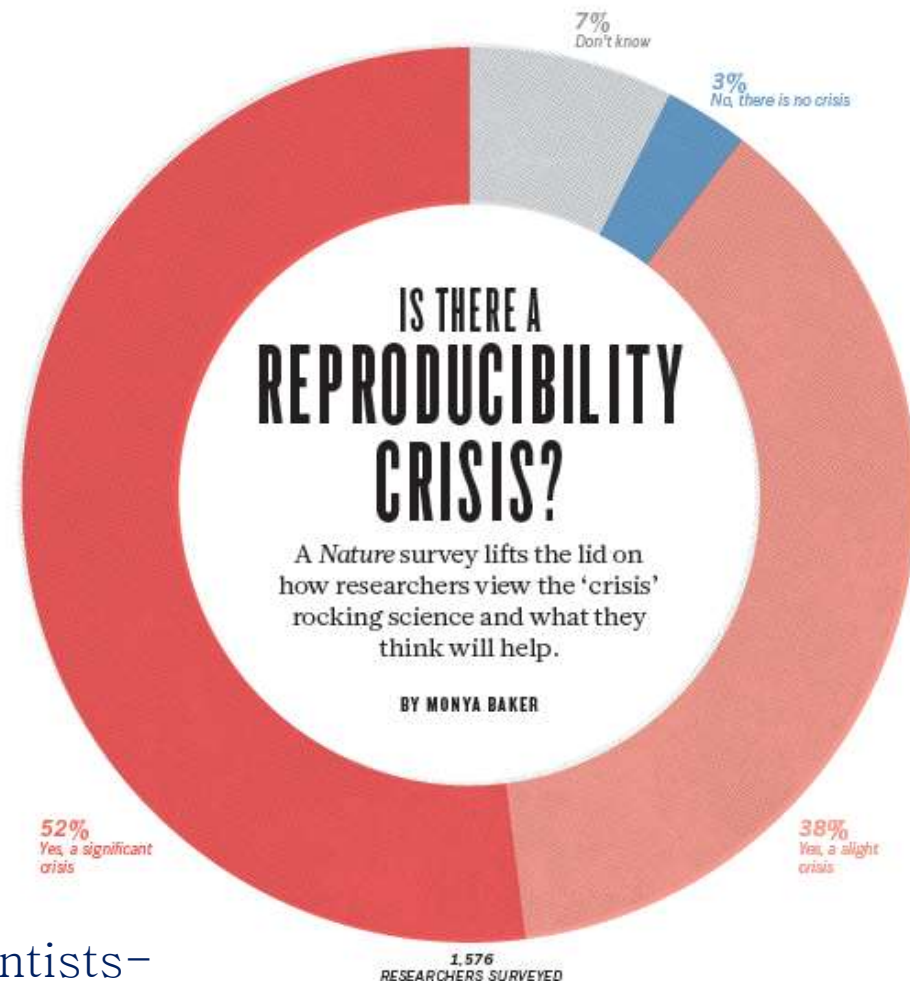
NATURE | NEWS FEATURE

1,500 scientists lift the lid on reproducibility

Survey sheds light on the 'crisis' rocking research.

Monya Baker

25 May 2016 | Corrected: 28 July 2016



<http://www.nature.com/news/1-500-scientists-lift-the-lid-on-reproducibility-1.19970>

NATURE | NEWS FEATURE

1,500 scientists lift the lid on reproducibility

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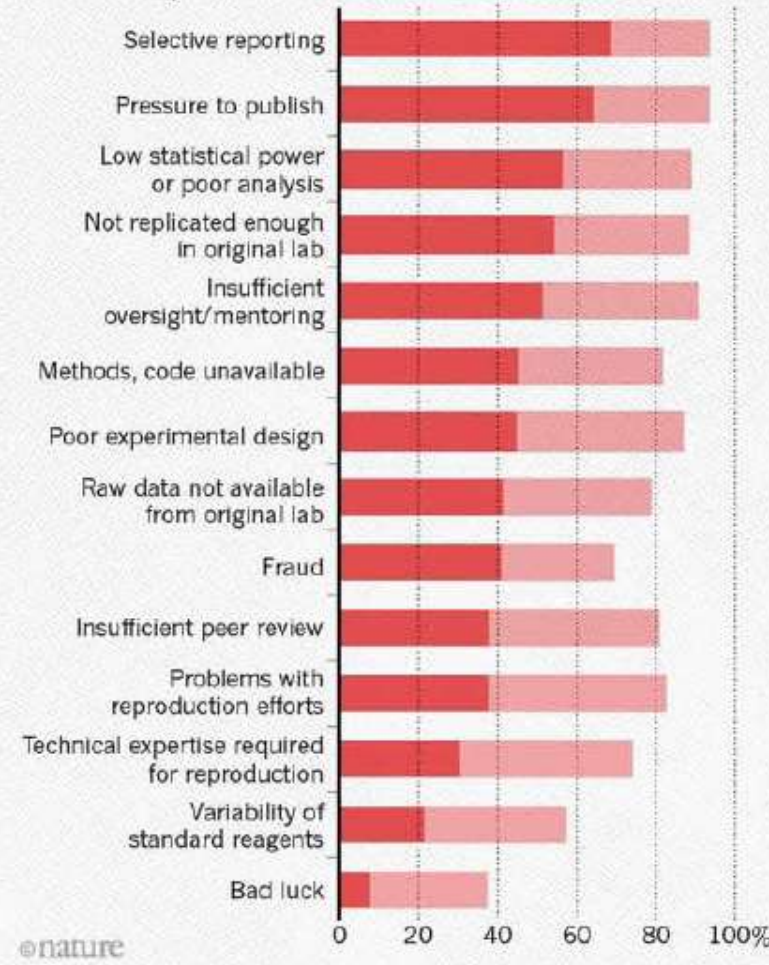
25 May 2016 | Corrected: 28 July 2016

<http://www.nature.com/news/1-500-scientists-lift-the-lid-on-reproducibility-1.19970>

WHAT FACTORS CONTRIBUTE TO IRREPRODUCIBLE RESEARCH?

Many top-rated factors relate to intense competition and time pressure.

● Always/often contribute ● Sometimes contribute



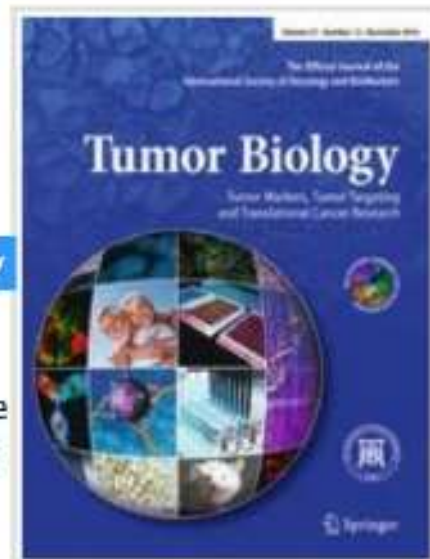
@nature

A new record: Major publisher retracting more than 100 studies from cancer journal over fake peer reviews

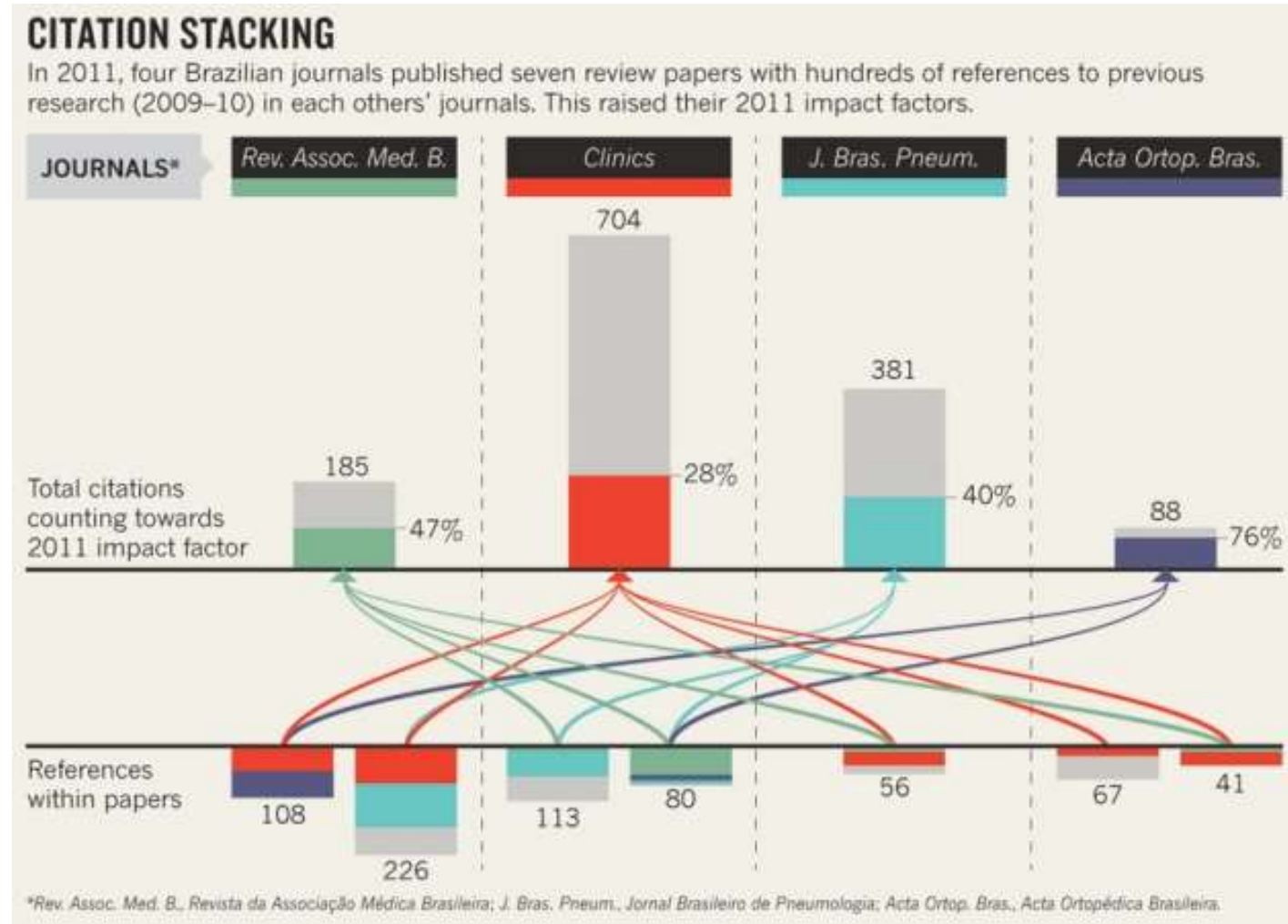
with 11 comments

Springer is [retracting 107 papers](#) from one journal after discovering they had been accepted with fake peer reviews. Yes, 107.

To submit a fake review, someone (often the author of a paper) either makes up an outside expert to review the paper, or suggests a real researcher — and in both cases, provides a fake email address that comes back to someone who will invariably give the paper a glowing review. In this case, Springer, the publisher of *Tumor Biology* through 2016, told us that an investigation produced “clear evidence” the reviews were submitted under the names of real researchers with faked emails. Some of the authors may have used a third-party editing service, which may have supplied the reviews. The [journal is now published by SAGE](#).



Use and abuse of metrics: from self-citation to citation cartels to citation stacking ...



Richard Van Noorden, 2017, Brazilian citation scheme outed. Thomson Reuters suspends journals from its rankings for 'citation stacking'. Nature, 27 August 2013



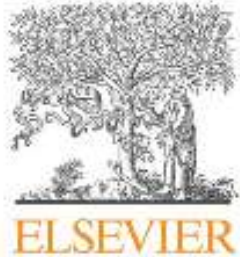
THE RIGHTFUL
PLACE OF SCIENCE:
**SCIENCE ON THE
VERGE**

CONTRIBUTORS

Alice Benessia	Jerome R. Ravetz
Silvio Funtowicz	Andrea Saltelli
Mario Giampietro	Roger Strand
Ângela Guimarães Pereira	Jeroen P. van der Sluijs



A crisis looms over the scientific enterprise. Not a day passes without news of retractions, failed replications, fraudulent peer reviews, or misinformed science-based policies



Contents lists available at ScienceDirect

Futures

journal homepage: www.elsevier.com/locate/futures



What is science's crisis really about?

Andrea Saltelli^{a,b,*}, Silvio Funtowicz^a

^a Centre for the Study of the Sciences and the Humanities (SVT), University of Bergen, Norway

^b Institute of Environmental Science and Technology (ICTA), Universitat Autònoma de Barcelona, Spain

More reading, available (open) on FUTURES

How did we get
here?

Why quantification becomes an instrument of hypocognition?

What is a socially constructed ignorance?

All starts with a dream:



Francis Bacon
(1561–1626)

Magnalia Naturae, in the
New Atlantis (1627),
*‘Wonders of nature, in
particular with respect to
human use’*

We call the Cartesian dream
the idea of man as master and
possessor of nature, of
prediction and control, of
Bacon’s wonders of science
and of Condorcet’s
mathématique sociale...



Nicolas de Caritat,
marquis de Condorcet
(1743– 1794)

‘Sketch for a Historical Picture of the
Progress of the Human Spirit’



René
Descartes
(1596–1650)

Discourse on Method
(1637)

Magnalia Naturae, in the New Atlantis (1627),
‘Wonders of nature, in particular with respect to human use’



Francis Bacon
(1561–1626)

The prolongation of life; The restitution of youth in some degree; The retardation of age; The curing of diseases counted incurable; The mitigation of pain; More easy and less loathsome purgings; The increasing of strength and activity; The increasing of ability to suffer torture or pain; The altering of complexions, and fatness and leanness; The altering of statures; The altering of features; The increasing and exalting of the intellectual parts; Versions of bodies into other bodies; Making of new species; Transplanting of one species into another; Instruments of destruction, as of war and poison; Exhilaration of the spirits, and putting them in good disposition; Force of the imagination, either upon another body, or upon the body itself; Acceleration of time in maturations; Acceleration of time in clarifications; Acceleration of putrefaction; Acceleration of decoction; Acceleration of germination; Making rich composts for the earth; Impressions of the air, and raising of tempests; Great alteration; as in induration, emollition, &c; Turning crude and watery substances into oily and unctuous substances; Drawing of new foods out of substances not now in use; Making new threads for apparel ; and new stuffs, such as paper, glass, &c; Natural divinations; Deceptions of the senses; Greater pleasures of the senses; Artificial minerals and cements.



Francis Bacon
(1561–1626)

Magnalia Naturae, in the New Atlantis (1627),
‘Wonders of nature, in particular with respect to human use’

The prolongation of life; The restitution of youth in some degree; The retardation of age; The curing of diseases counted incurable; The mitigation of pain; [...]

Drawing of new foods out of substances not now in use; Making new threads for apparel; and new stuffs, such as paper, glass, &c; Natural divinations; Deceptions of the senses; Greater pleasures of the senses; Artificial minerals and cements.

The study of letters leading to
“doubts and errors”;

Comparing “disquisitions of the
ancient moralists to very towering
and magnificent palaces with no
better foundation than sand and
mud”;

Condemnation of humanities and
exaltation of mathematics.



René
Descartes
(1596–1650)

Discourse on
Method (1637)

“I perceived it to be possible to arrive at knowledge highly useful in life; and in room of the Speculative Philosophy [...], to discover a Practical, by means of which, knowing the force and action of fire, water, air, the stars, the heavens, and all the other bodies that surround us, [...]we might also apply them [...], and thus render ourselves the lords and possessors of nature.”



René
Descartes
(1596–1650)

Discourse on
Method (1637)

In the formulation of Condorcet:

“All the errors in politics and in morals are founded upon philosophical mistakes, which, themselves, are connected with physical errors” (Ninth Epoch)



Nicolas de Caritat,
marquis de Condorcet
(1743– 1794)

‘Sketch for a Historical Picture
of the Progress of the Human
Spirit’

Overpopulation? War due to scarcity of resources? Will not happen because technical progress and ethical progress will go hand in hand. Man will understand that his duty “will consist not in the question of giving existence to a greater number of beings, but happiness.” (Tenth Epoch)



Nicolas de Caritat,
marquis de Condorcet
(1743– 1794)

‘Sketch for a Historical Picture
of the Progress of the Human
Spirit’

‘Mathématique sociale’:

We still use today terms such as ‘Condorcet method’, ‘Condorcet winner’, ‘Condorcet–ranking procedure’



Nicolas de Caritat,
marquis de Condorcet
(1743– 1794)

‘Sketch for a Historical Picture
of the Progress of the Human
Spirit’

Feldman, J., 2005, Condorcet et la mathématique sociale: enthousiasmes et bemols, *Mathematics and Social Sciences*, 172(4), 7–41,
<http://www.ehess.fr/revue-msh/pdf/N172R955.pdf>

Munda G. (2007) – *Social multi-criteria evaluation*, Springer-Verlag, Heidelberg, New York, Economics Series

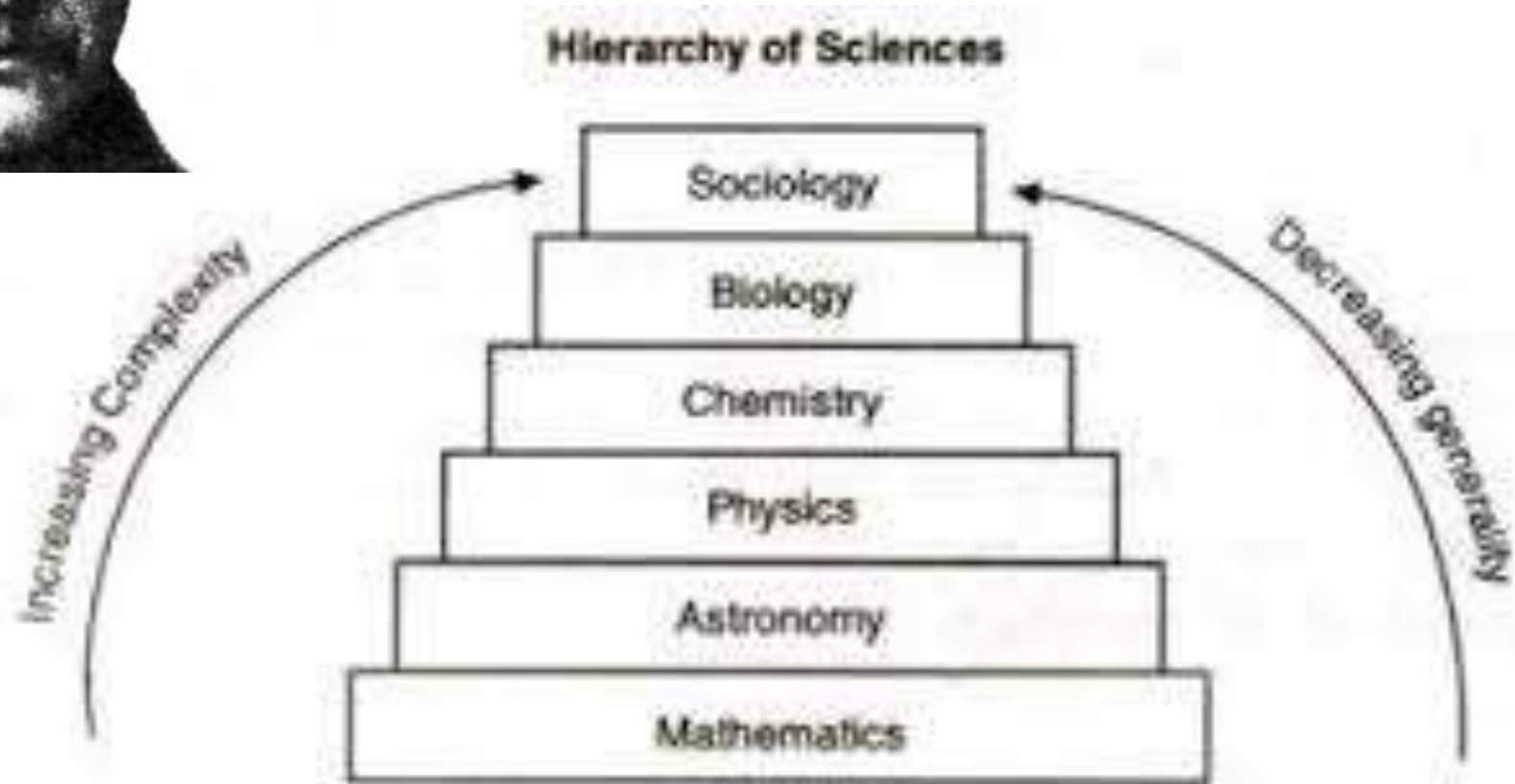


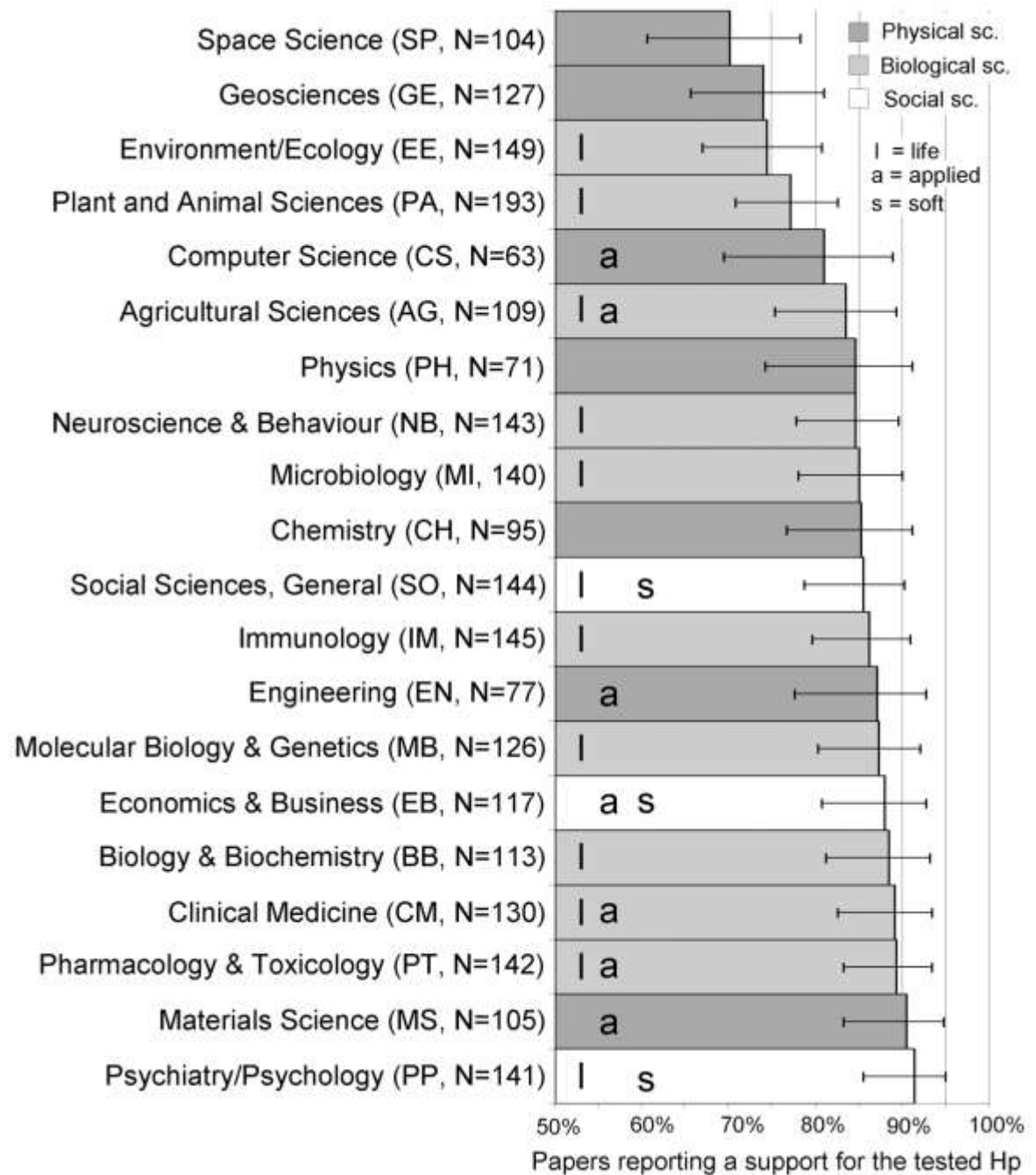
Condorcet's algorithms
and Descartes' Geometry,
the dream always had a
quantification agenda





Auguste Comte (1798–1857),
positivism,
the birth of sociology





Daniele Fanelli: Positive”
Results Increase Down the
Hierarchy of the Sciences”
PLoS ONE, 2010, 5,(4) e10068

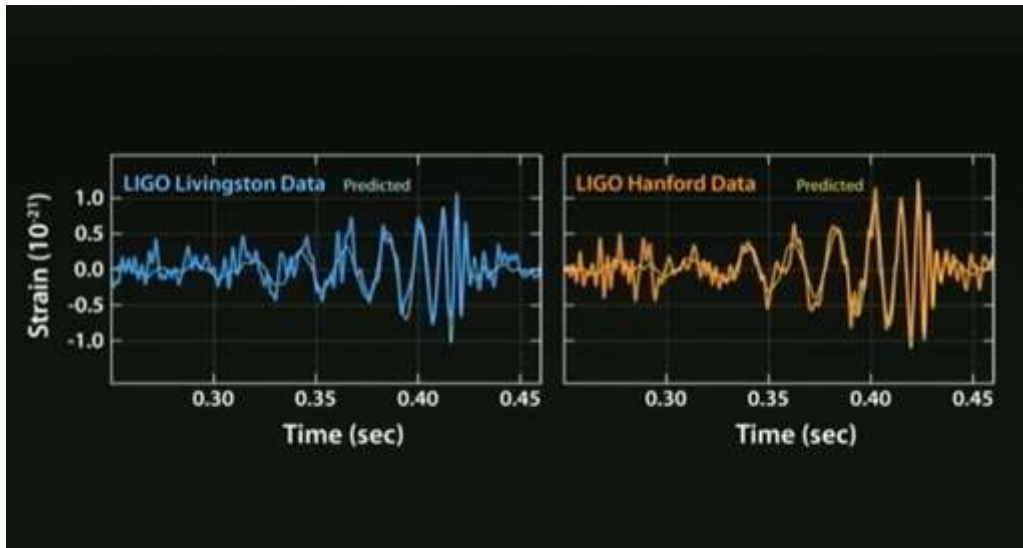
Closer to our times the dream was couched in the ‘Endless Frontier’ metaphor by Vannevar Bush, 1945:

“One of our hopes is that after the war there will be full employment. [...] To create more jobs we must make new and better and cheaper products [...] founded on [...] basic scientific research. [...]the] Government [...] opened the seas to clipper ships and furnished land for pioneers. Although these frontiers have more or less disappeared, the frontier of science remains.”



Vannevar Bush
(1890–1974)

Bush, V. (1945) Science: the endless frontier, United States Office of Scientific Research and Development, U.S. Govt. print office.



Making the dream true: Gravitational waves; from J. Weber's cylinder to LIGO

A Madman Dreams of Tuning Machines: The Story of
Joseph Weber, the Tragic Hero of Science Who Followed
Einstein's Vision and Pioneered the Sound of Space-Time,
By Maria Popova,

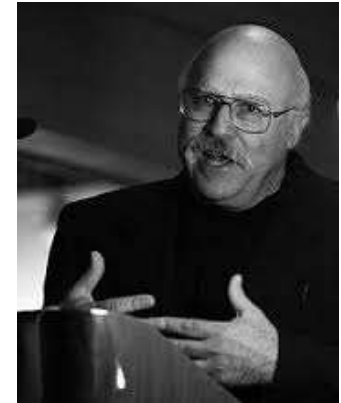
<https://www.brainpickings.org/2016/04/25/black-hole-blues-janna-levin-joseph-weber/>



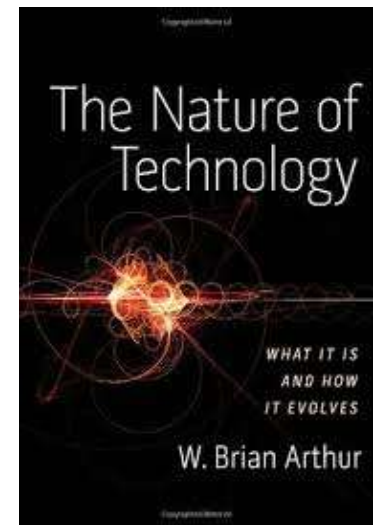
If you are a natural scientists you were nourished and trained in the Cartesian dream, what S. Toulmin called ‘The hidden agenda of modernity’

The dream was spectacularly successful, in all fields of endeavor, leading to what Steven Shapin calls ‘invisible science’

It also lead to techno–science, to technology ‘creating itself from itself’,...



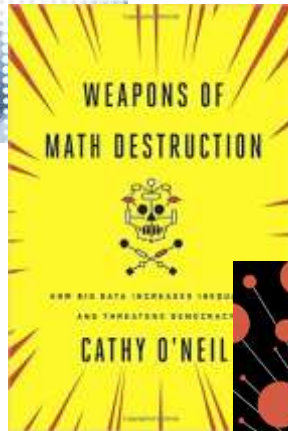
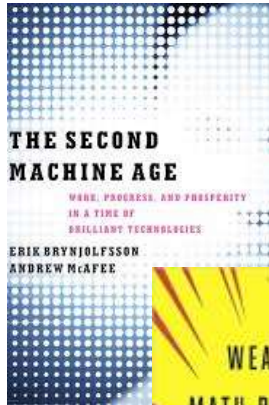
Steven Shapin



Steven Shapin, 2016, Invisible Science, The Hedgehog Review: Vol. 18 No. 3 (Fall 2016)

W.B. Arthur, The nature of technology, Free Press, New York, 2009.

... to a host of other issues and fears



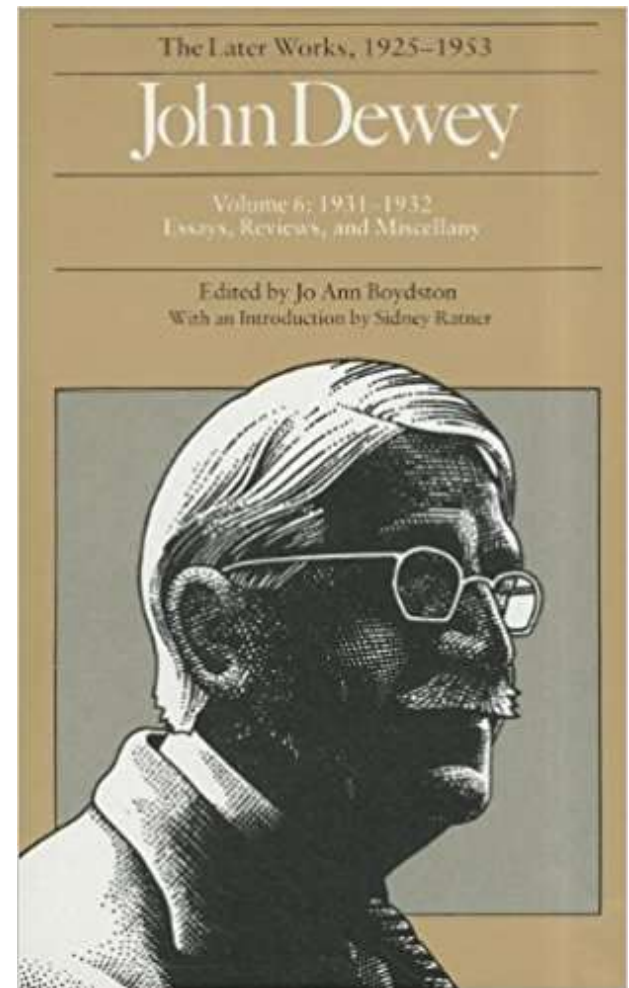
Irreversible loss of
jobs?

Weaponization of big
data?

Technology
disempowering the
individual?

Here lies the heart of our present social problem. Science has hardly been used to modify men's fundamental acts and attitudes in social matters. It has been used to extend enormously the scope and power of interests and values which anteceded its rise. Here is the contradiction in our civilization. The potentiality of science as the most powerful instrument of control which has ever existed puts to mankind its one outstanding present challenge.

From J. Dewey 'Science and Society' in John Dewey: The Later Works, 1925-1953: 1931-1932, Vol. 6-ExLibrary



John Dewey
1859-1952

The critique of the Cartesian dream

“The question of the legitimacy of science has been indissociably linked to that of the legitimation of the legislator since the time of Plato. From this point of view, the right to decide what is true is not independent of the right to decide what is just, [...] there is a strict interlinkage between the kind of language called science and the kind called ethics and politics ...”

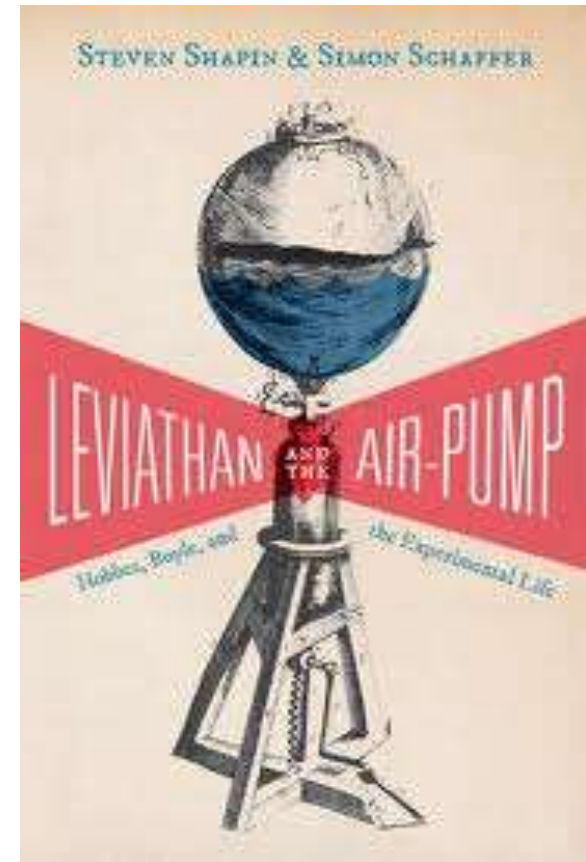


Jean-François
Lyotard

Lyotard, J.-F. 1979. La Condition postmoderne. Rapport sur le savoir, Paris : Minuit.

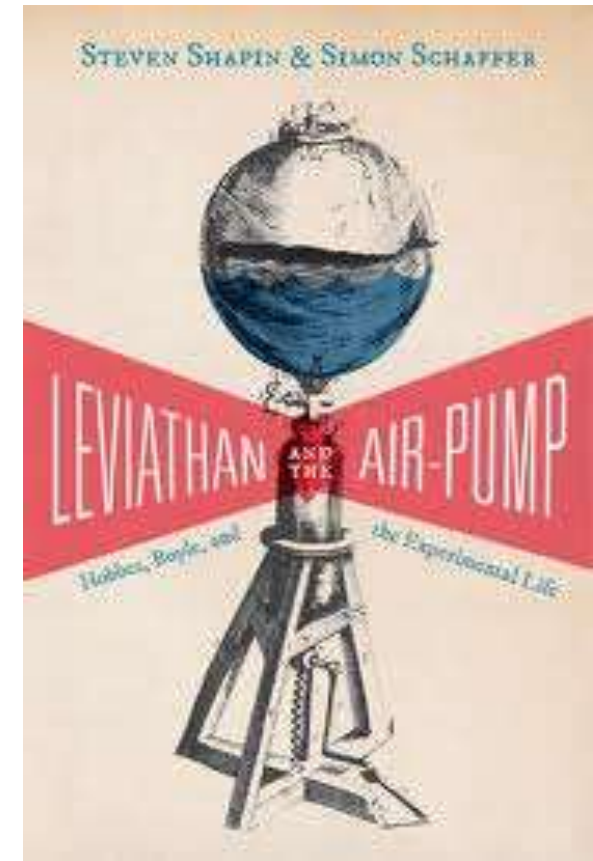
“Solutions to the problem of knowledge are solutions to the problem of social order.

[...] Trust in Science and trust in the prevailing social order are linked.”



Shapin, S., Schaffer, S., 1985, Leviathan and the Air-Pump:
Hobbes, Boyle, and the Experimental Life, Princeton, 2011
Edition

Establishing ‘matter of facts’
under controlled ‘laboratory’
experiments before witnesses as a
way to subtract the discourse
about knowledge from religious
squabbles ...

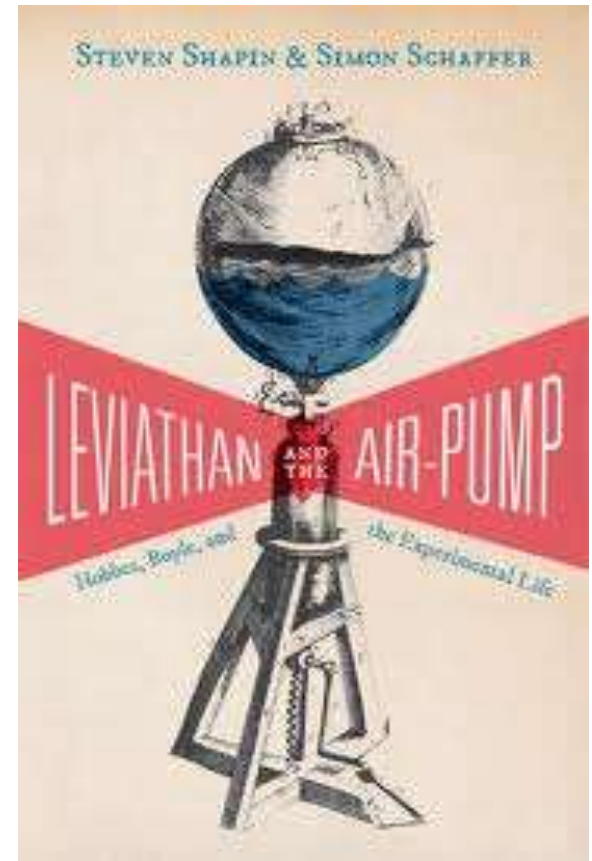


Shapin, S., Schaffer, S., 1985, *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life*, Princeton, 2011 Edition

Shapin and Schaffer's book inspired Bruno Latour's 'Nous n'avons jamais été modernes', 1991, and was 'hot' during the 'science wars'.



Bruno Latour

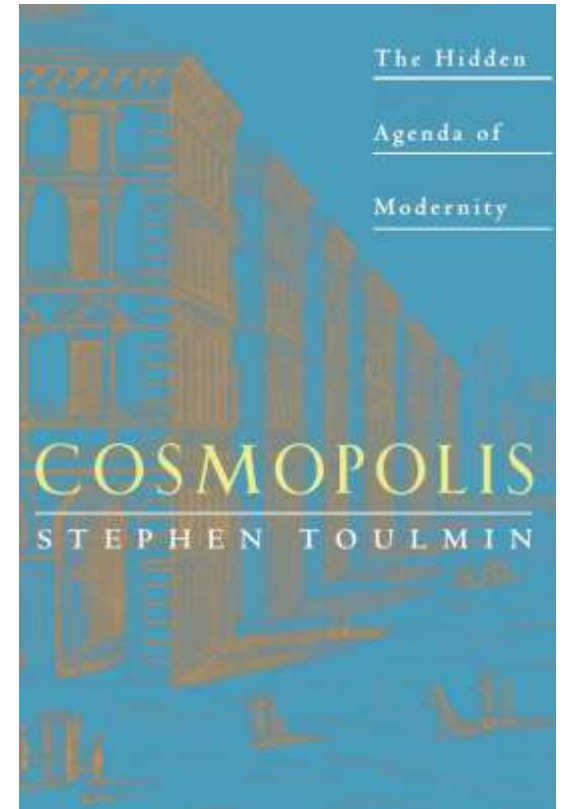


Latour, B., 1991, *Nous n'avons jamais été modernes*, Editions La découverte, 1993; *We Have Never Been Modern*. Cambridge, Harvard UP.

Stephen Toulmin: Modernity as
a counter-Renaissance;
Descartes versus Montaigne; the
delusion of a Newtonian view of
society



Stephen
Toulmin

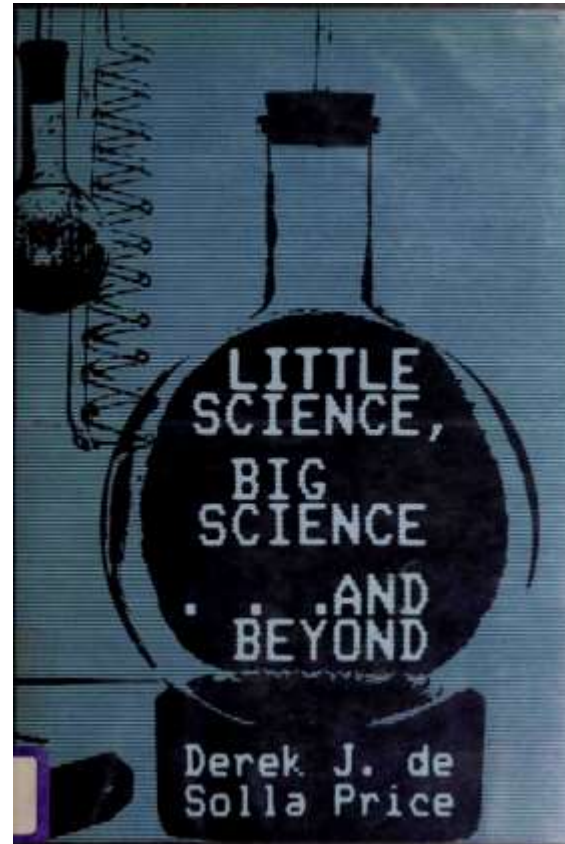


Stephen Toulmin, 1990, *Cosmopolis: The Hidden Agenda of Modernity*, The University of Chicago Press

- Rationality versus reasonableness;
is there a tension – in my personal
experience



In 1963 Derek J. de Solla Price prophesized that Science would reach saturation (and in the worst case senility) under its own weight, victim of its own success and exponential growth (pp 1-32).



Derek J. de Solla Price

de Solla Price, D.J., 1963, Little science big science, Columbia University Press.

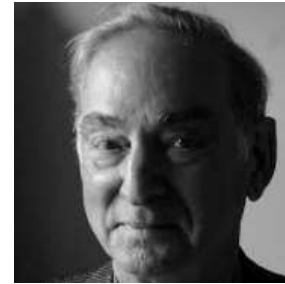


Science/knowledge degenerates when it becomes a commodity for Ravetz (1971), Lyotard (1979) and Mirowski (2011).

Ravetz, J., 1971, *Scientific Knowledge and its Social Problems*, Oxford University Press, p. 22.

Lyotard, J.-F. 1979. *La Condition postmoderne. Rapport sur le savoir*, Paris : Minuit, Chapter 10.

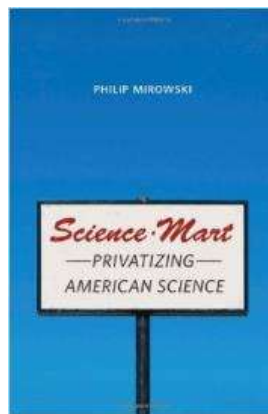
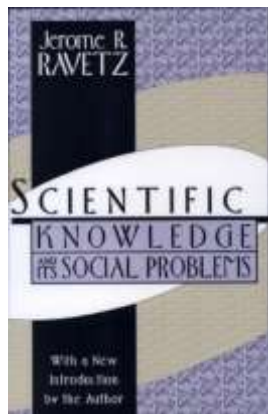
Mirowski, P. 2011. *Science-Mart: Privatizing American Science*, Harvard University Press.



Jerome R.
Ravetz



Jean-François
Lyotard



Philip Mirow

p.22: “with the industrialization of science, certain changes have occurred which weaken the operation of the traditional mechanism of quality control and direction at the highest level.



Jerome R.
Ravetz

Ravetz, J., 1971, Scientific Knowledge and its Social Problems, Oxford University Press, p.22.



p.22: [...] The problem of quality control in science is thus at the centre of the social problems of the industrialized science of the present period.”



Jerome R.
Ravetz

Ravetz, J., 1971, Scientific Knowledge and its Social Problems, Oxford University Press, p.22.

p.22: “If [science] fails to resolve this problem [...] then the immediate consequences for morale and recruitment will be serious; and those for the survival of science itself, grave”

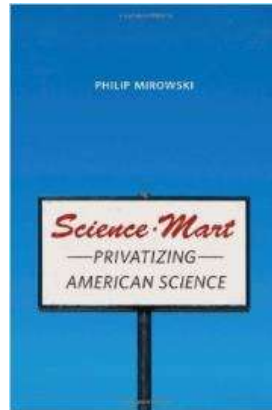


Jerome R.
Ravetz

Ravetz, J., 1971, Scientific Knowledge and its Social Problems, Oxford University Press, p.22.

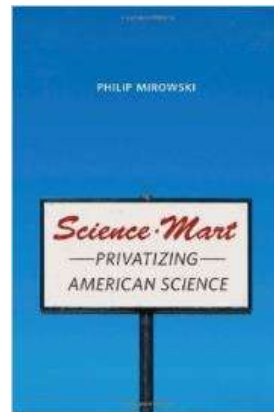
After the eighties neoliberal ideologies succeeded in decreasing state intervention in the funding of science, which became increasingly privatized ... Knowledge as a monetized commodity replaces knowledge as public good...

Mirowski, P. 2011. *Science-Mart: Privatizing American Science*, Harvard University Press.



Philip Mirowski

In house science labs of major corporation were closed and research outsourced to universities which ... became more and more looking as profit seeking organization (technology transfer offices in every campus) ... then research ended up outsourced again to contract-based research organizations (CRO's)...



Philip Mirowski

Mirowski, P. 2011. Science-Mart: Privatizing American Science, Harvard University Press.

Evidence based
policy or its
opposite?

PETRUCHIO: I say it is the moon.

KATHERINE: I know it is the moon.

PETRUCHIO: Nay, then you lie. It is
the blessèd sun.

KATHERINE: Then God be blessed,
it is the blessèd sun.

But sun it is not, when you say it is not,
And the moon changes even as your mind.

...



Shakespeare, the
Taming of the
Shrew, Act IV.

The expression ‘Policy based evidence’ has entered the public discourse.

Warring parties accuse one another of the sin.

“Greenpeace [...] wants is policy based evidence making not evidence based policy making” (Sanderson, 2015) ...

Wilkes, G., 2015, Free Lunch: Policy-based evidence-making, Financial Times, July 3.

Sanderson, A.B., 3 Feb 2015, Breitbart, see

<http://www.breitbart.com/london/2015/02/03/academic-attacks-greenpeace-for-ignoring-the-evidence-on-gm-crops/>; the politician is UKIP Energy Spokesman Roger Helmer MEP.

“This need [for evidence] has been reified in the UK and elsewhere, as routines of 'evidence-based policy'-making have been hardwired into the business of Government.

[...]such approaches are fundamentally flawed [because] Government [...] seeks to capture and control the knowledge producing processes to the point where this type of 'research' might best be described as 'policy-based evidence'.”

Boden, R. and Epstein D., 2006, Managing the Research Imagination? Globalisation and Research in Higher Education. *Globalisation, Societies and Education*, 223–236.



Futures

Available online 7 February 2017

In Press, Corrected Proof



Original research article

What is wrong with evidence based policy, and how can it be improved?

Andrea Saltelli ^{a, b, c}  , Mario Giampietro ^{a, c, d}

- There is a crisis of science's governance forcing to reconsider evidence based policy as it is being practiced at present.
- The closure of any issue in a pre-established frame used for quantification may correspond to normative and political stances.



Original research article

What is wrong with evidence based policy, and how can it be improved?

Andrea Saltelli ^{a, b, c, g}, , Mario Giampietro ^{a, c, d}

- The use of mathematical modelling and indicators conveys a spurious impression of precision, prediction and control.
- Better styles of evidence based policy should flag the existence of ‘uncomfortable knowledge’ usually avoided in policy discussions.
- We suggest a strategy – Quantitative storytelling – to opening the space of possible narratives and control their quality .



Contents lists available at ScienceDirect

Futures

journal homepage: www.elsevier.com/locate/futures



Original research article

What is wrong with evidence based policy, and how can it be improved?

Andrea Saltelli^{a,b,c,*}, Mario Giampietro^{a,c,d}



Journal of Clinical Epidemiology 73 (2016) 82–86

**Journal of
Clinical
Epidemiology**

Evidence-based medicine has been hijacked: a report to David Sackett

John P.A. Ioannidis^{a,b,c,d,*}

^aDepartment of Medicine, Stanford Prevention Research Center, Stanford, CA 94305, USA

^bDepartment of Health Research and Policy, Stanford University School of Medicine, Stanford, CA 94305, USA

^cDepartment of Statistics, Stanford University School of Humanities and Sciences, Stanford, CA 94305, USA

^dMeta-Research Innovation Center at Stanford (METRICS), Stanford University, Stanford, CA 94305, USA

Accepted 18 February 2016; Published online 2 March 2016

Power asymmetries in the framing of issues: those who have the deepest pockets marshal the best evidence; Instrumental use of quantification to obfuscate; (Saltelli and Giampietro, 2017)

Evidence based medicine hijacked to serve corporate agendas. Meta-analyses and guidelines serving vested interests. “Under market pressure, clinical medicine has been transformed to finance-based medicine” (Ioannidis, 2016)

Discussion points



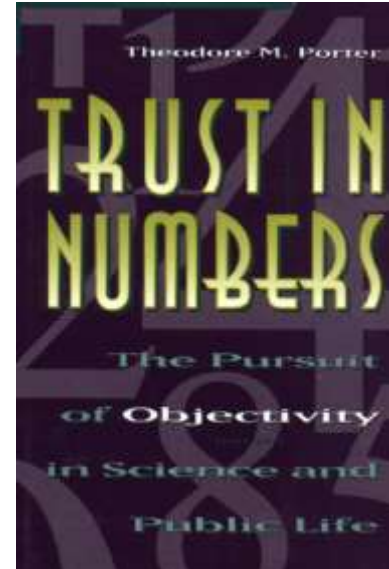
- Evidence based policy or policy based evidence?
What do I see around me (university,
institutions, governments...)

Trust in science,
trust in
quantification

Trust and quantification.

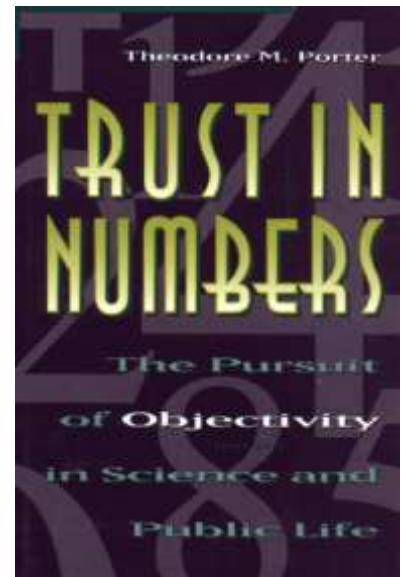


Theodor M. Porter



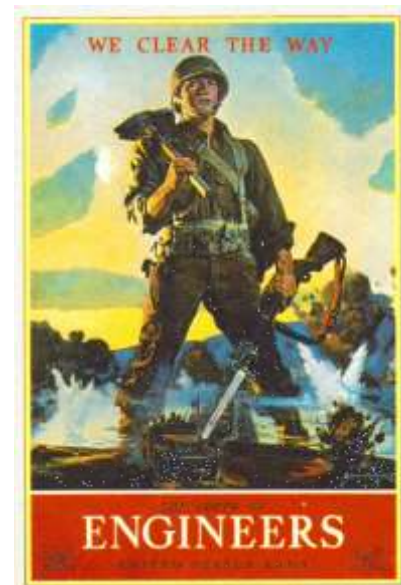
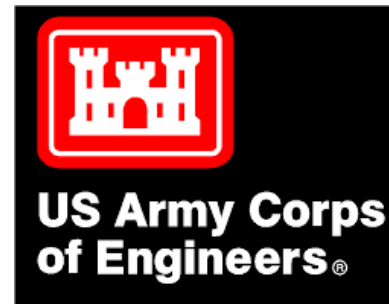
Theodore M. Porter, *Trust in Numbers, The Pursuit of Objectivity in Science and Public Life*, Princeton 1995

‘The appeal of numbers is especially compelling to bureaucratic officials who lack the mandate of a popular election, or divine right [...] Quantification is a way of making decisions without seeming to decide. Objectivity lends authority to officials who have very little of their own’ (1995, p. 8).



Theodore M. Porter, *Trust in Numbers, The Pursuit of Objectivity in Science and Public Life*, Princeton 1995

Trust, authority and styles of quantification: two different stories



Porter's story: Quantification needs judgment
which in turn needs trust ...without trust
quantification becomes mechanical, a system, and
systems can be played

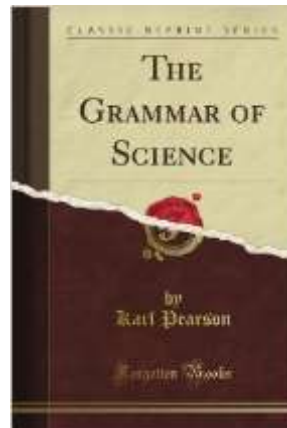


Is science always right? Karl Pearson (a social Darwinist) suggests not wasting resources on social programs as:

“No degenerate and feeble stock will ever be converted into healthy and sound stock by the accumulated effects of education, good laws, and sanitary surroundings”



Karl Pearson



Pearson, K., 1892, The Grammar of Science, Walter Scott Publisher, London, p.32.

Think Tank Scholar or Corporate Consultant? It Depends on the Day

Acting as independent arbiters to shape government policy, many researchers also have corporate roles that are sometimes undisclosed.

By ERIC LIPTON, NICHOLAS CONFESSORE and BROOKE WILLIAMS

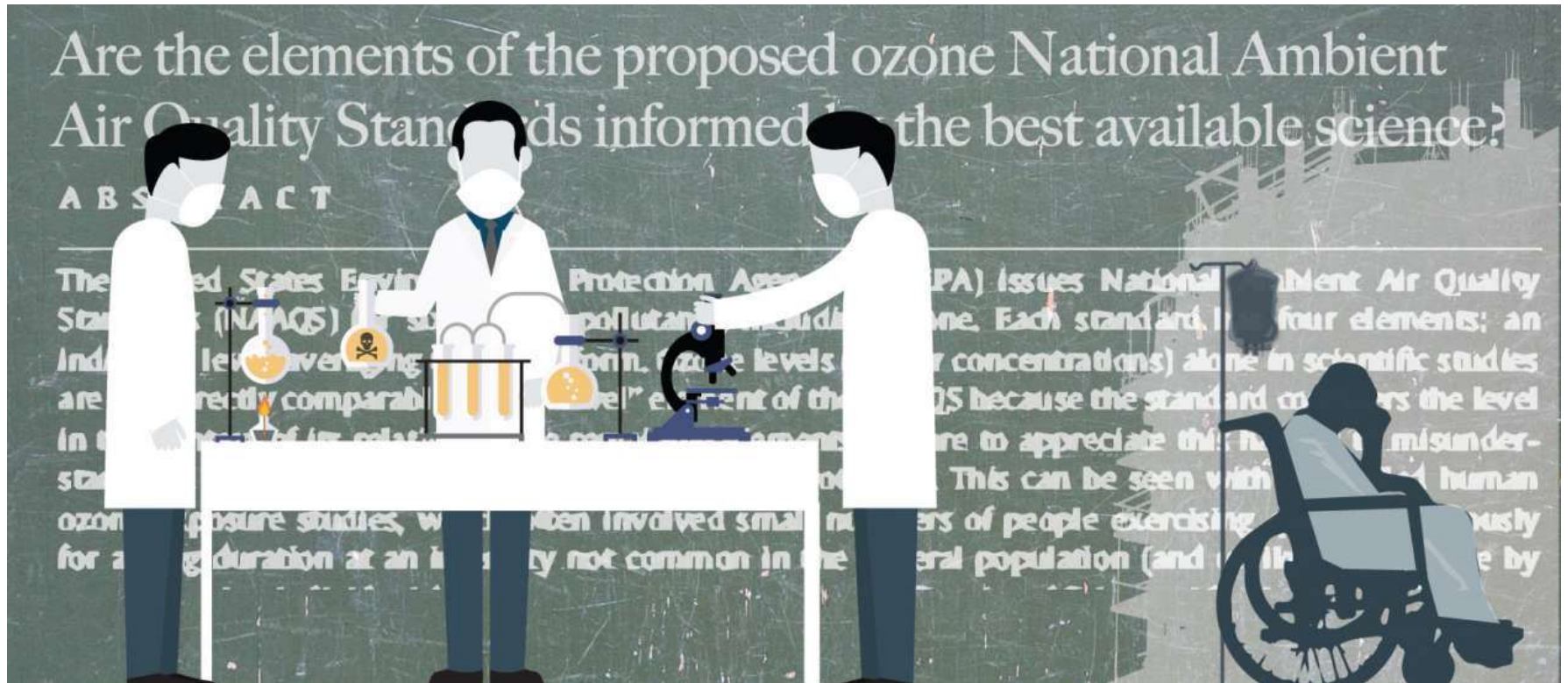
AUG. 8, 2016

The New York Times

http://www.nytimes.com/2016/08/09/us/politics/think-tank-scholars-corporate-consultants.html?_r=0

Lobbyists recruit law firms which in turn recruit scientific services for their customer;

<http://www.publicintegrity.org/2016/02/08/19223/meet-rented-white-coats-who-defend-toxic-chemicals>



“Nearly half of Gradient’s articles that are peer-reviewed are published in two journals with strong ties to industry, *Critical Reviews in Toxicology* and *Regulatory Toxicology and Pharmacology*” [Gradient is the research services company enrolled by law firms]



<http://www.publicintegrity.org/2016/02/08/19223/meet-rented-white-coats-who-defend-toxic-chemicals>

JAMA Internal Medicine

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Online First >



Special Communication | September 12, 2016

Sugar Industry and Coronary Heart Disease Research

A Historical Analysis of Internal Industry Documents **FREE**

ONLINE FIRST

Cristin E. Kearns, DDS, MBA^{1,2}; Laura A. Schmidt, PhD, MSW, MPH^{1,3,4}; Stanton A. Glantz, PhD^{1,5,6,7,8}

[+] Author Affiliations

JAMA Intern Med. Published online September 12, 2016. doi:10.1001/jamainternmed.2016.5394

Text Size: A A A

See also <https://www.theguardian.com/society/2016/apr/07/the-sugar-conspiracy-robert-lustig-john-yudkin>, and the story of US President Dwight Eisenhower heart attack,...

“our findings suggest the industry sponsored a research program in the 1960s and 1970s that successfully cast doubt about the hazards of sucrose while promoting fat as the dietary culprit in CHD [coronary hearth disease]”

The screenshot displays the JAMA Internal Medicine website interface. At the top, a dark navigation bar contains the text "The JAMA Network" followed by links for "Journals >", "Collections", "Store", "Physician Jobs", and "About Mobile". Below this, the "JAMA Internal Medicine" logo is prominently displayed. A secondary navigation bar includes links for "Home", "Current Issue", "All Issues", "Online First", "Collections", "CME", and "Multimedia". The main content area features a vertical sidebar on the left with social media icons for Twitter, Facebook, and Google+, along with a plus sign for additional options. The main text area begins with the heading "Online First >" followed by the date "September 12, 2016". The article title, "Sugar Industry and Coronary Heart Disease Research", is displayed in a large, bold font. Below the title, the subtitle "A Historical Analysis of Internal Industry Documents" is shown, accompanied by a "FREE" badge. A "ONLINE FIRST" badge is also present. The authors' names, "Cristin E. Kearns, DDS, MBA^{1,2}; Laura A. Schmidt, PhD, MSW, MPH^{1,3,4}; Stanton A. Glantz, PhD^{1,5,6,7,8}", are listed below the subtitle. A link for "[+] Author Affiliations" is provided. At the bottom of the page, the publication information "JAMA Intern Med. Published online September 12, 2016. doi:10.1001/jamainternmed.2016.5394" is displayed, along with a "Text Size" option and three icons for adjusting the text size.

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Online First >

Special Communication | September 12, 2016

Sugar Industry and Coronary Heart Disease Research

A Historical Analysis of Internal Industry Documents FREE

ONLINE FIRST

Cristin E. Kearns, DDS, MBA^{1,2}; Laura A. Schmidt, PhD, MSW, MPH^{1,3,4}; Stanton A. Glantz, PhD^{1,5,6,7,8}

[\[+\] Author Affiliations](#)

JAMA Intern Med. Published online September 12, 2016. doi:10.1001/jamainternmed.2016.5394

Text Size: A A A

Feature

Coca-Cola's secret influence on medical and science journalists

BMJ 2017 ; 357 doi: <https://doi.org/10.1136/bmj.j1638> (Published 05 April 2017)

Cite this as: *BMJ* 2017;357:j1638

[Article](#)[Related content](#)[Metrics](#)[Responses](#)

Paul Thacker, freelance journalist

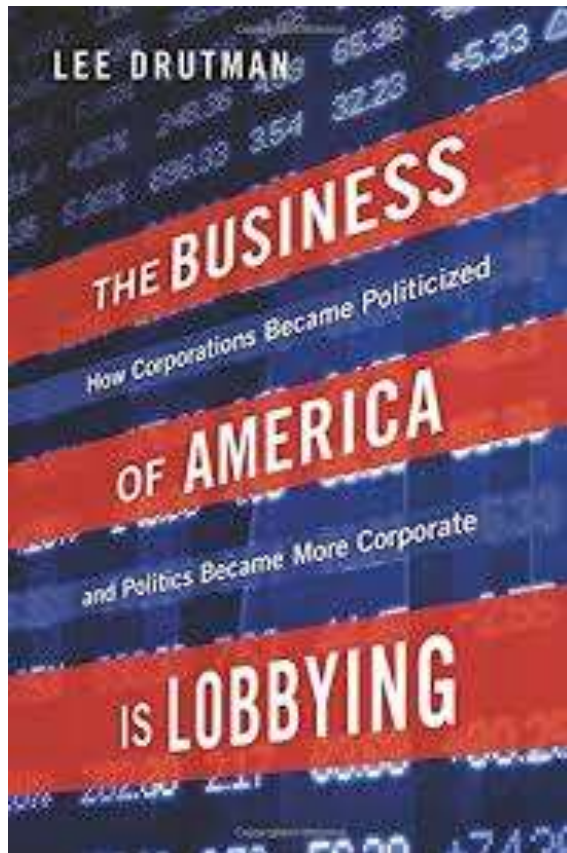
[Author affiliations ▾](#)

thackerpd@gmail.com

“Industry money was used to covertly influence journalists with the message that exercise is a bigger problem than sugar consumption in the obesity epidemic, documents obtained under freedom of information laws show.

The documents detail how Coca-Cola funded journalism conferences at a US university in an attempt to create favourable press coverage of sugar sweetened drinks. When challenged about funding of the series of conferences, the academics involved weren't forthcoming about industry involvement.”

Evidence as the
currency of
lobbies



Lee Drutman



l'ordre des choses

AGONE



Sylvain Laurens

<http://www.nybooks.com/articles/2016/04/07/how-lobbyists-win-in-washington/>

<http://www.contretemps.eu/lectures/lire-extrait-courtiers-capitalisme-sylvain-laurens>

Both works (resp. US, EU) make the point that evidence is the currency of lobbies.

In the use of evidence actors with deepest pockets may prevail. A worrying asymmetry.

A truly black pearl: a candid admission in a book written for the lobbyists: The regulation game, Owen & Braeutigam, 1978



“Regulatory policy is increasingly made with the participation of experts, especially academics. A regulated firm or industry should be prepared whenever possible to co-opt these experts. This is most effectively done by identifying the leading expert in each relevant field and hiring them as consultants or advisors or giving them research grant or the like”

Book written for the lobbyists: The regulation game, Owen & Braeutigam, 1978



“This activity requires a modicum of finesse; it must not be too blatant, for the experts themselves must not recognize that they have lost their objectivity and freedom of action”

Owen B. M. and Braeutigam, R., Regulation Game: Strategic Use of the Administrative Process, page 7, Harper Business (1978)

Discussion points



- Do I see a relationship between trust and quantification?
- Are we (my team, my organization) more like the 'corps des ingénieurs des ponts et chaussées' or the US Army corps of Engineers?

Economics?

The Mathiness discussion in Economics

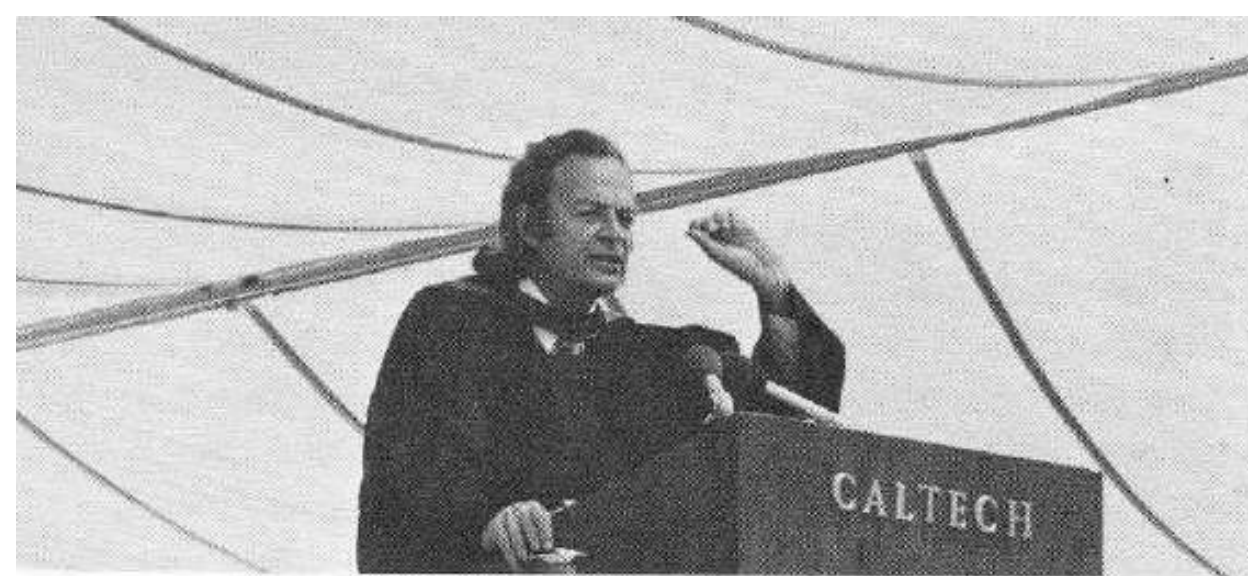
“The style that I am calling mathiness lets academic politics masquerade as science. Like mathematical theory, mathiness uses a mixture of words and symbols, but instead of making tight links, it leaves ample room for slippage between statements in natural versus formal language and between statements with theoretical as opposed to empirical content.”



Paul Romer
Since July 18
2016 Chief
Economist of
the World Bank

<https://paulromer.net/mathiness/>

See also <https://paulromer.net/feynman-integrity/>



Cargo Cult Science

by RICHARD P. FEYNMAN

**Some remarks on science, pseudoscience,
and learning how to not fool yourself.
Caltech's 1974 commencement address.**



Appeals to
Richard
Feynman's
famous speech

<https://paulromer.net/feynman-integrity/>



The Trouble With Macroeconomics

PAUL ROMER
Stern School of Business
New York University

Wednesday 14th September, 2016

2 Post-Real Models

5.4 Identification by Obfuscation

10 The Trouble Ahead For All of Economics

A different diagnosis for a diseased economics: for Erik Reinert's: economics has reverted to scholasticism

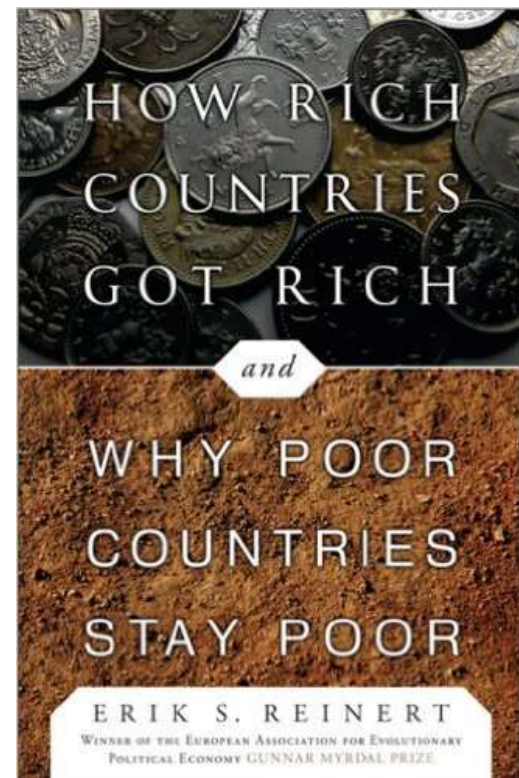
... forgetting an important continental tradition

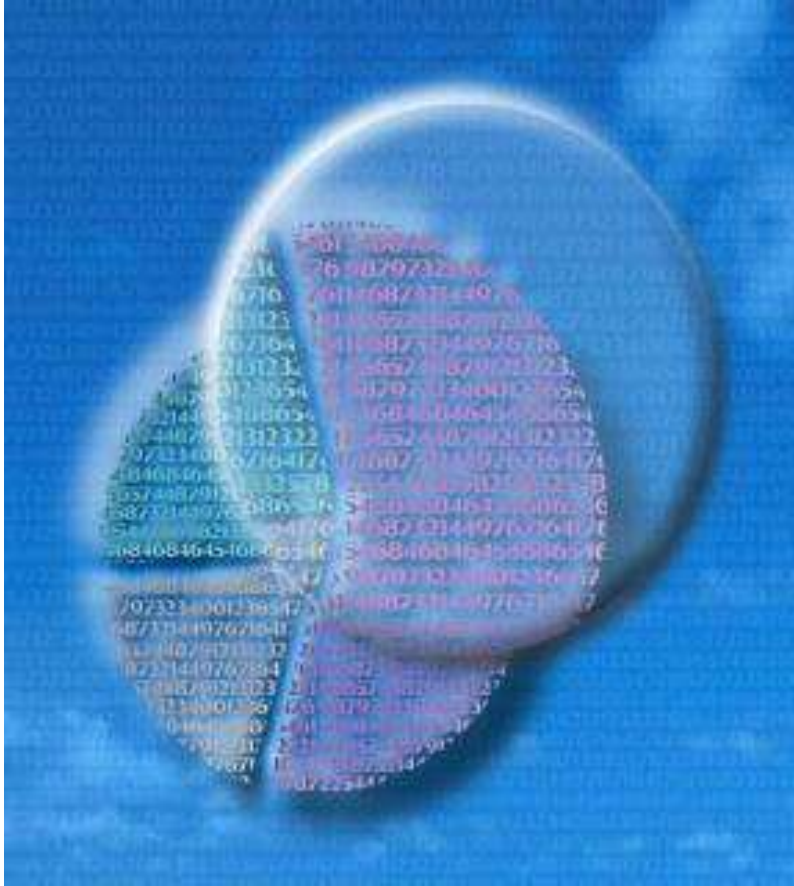
... implications for developments

http://www.andreasaltelli.eu/file/repository/Full_Circle_scholasticism_2.pdf



Erik Reinert





END

Twitter:
@andreasaltelli

Participation

Why extended participation is important?



Doing flood risk science differently: an experiment in radical scientific method

S N Lane*, N Odoni*, C Landström**, S J Whatmore**,
N Ward† and S Bradley‡

Lane, S. N., Odoni, N., Landström, C., Whatmore, S. J., Ward, N. and Bradley, S., 2011. "Doing flood risk science differently: an experiment in radical scientific method." Transactions of the Institute of British Geographers, 36: 15–36.

[...] knowledge regarding flooding was **co-produced**. This illustrates a way of working with experts, both **certified** (academic natural and social scientists) and **noncertified** (local people affected by flooding), [...] We reveal a **deep and distributed understanding** of flood hydrology across all experts, certified and uncertified, ...

To confront 21st century challenges, science must rethink its reward system

Frank Miedema

theguardian

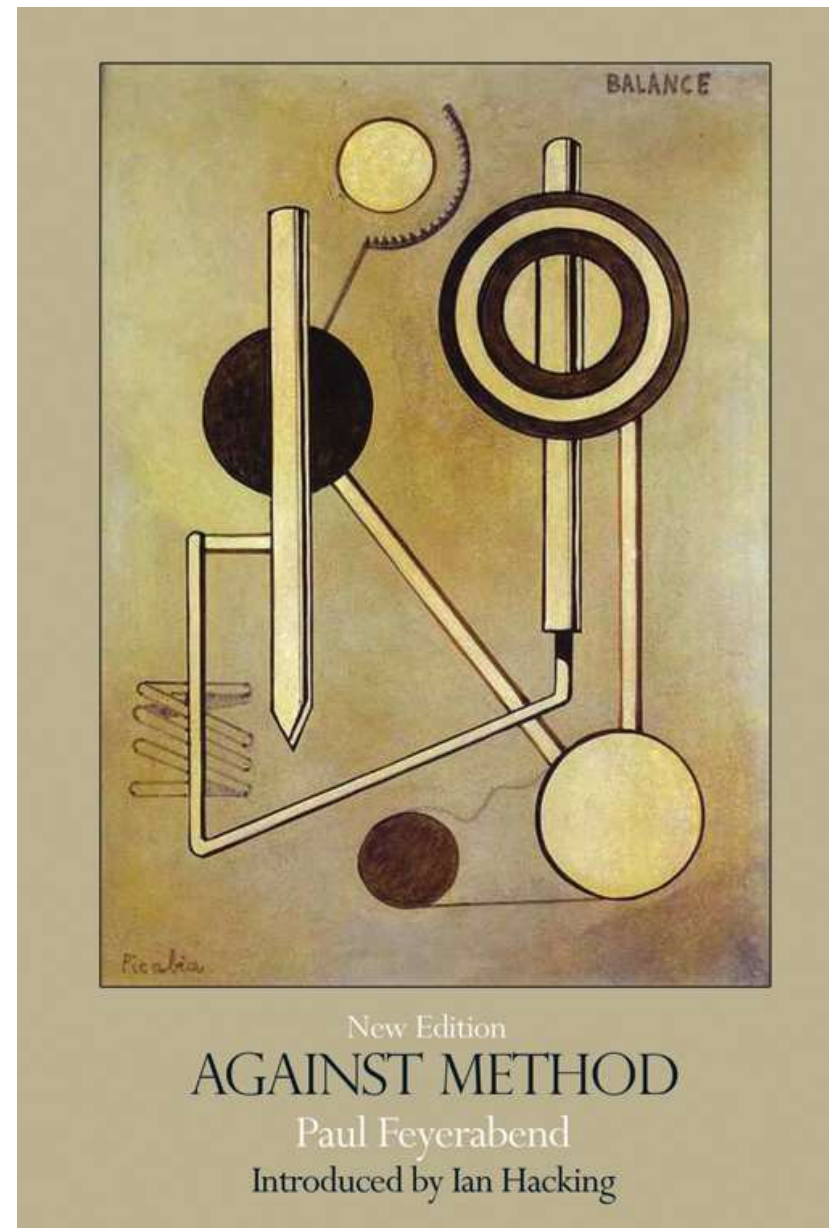
One of Science in Transition's founders describes how his experience as a young HIV/AIDS researcher convinced him that science needs to change

Thursday 12 May 2016 09:00 BST

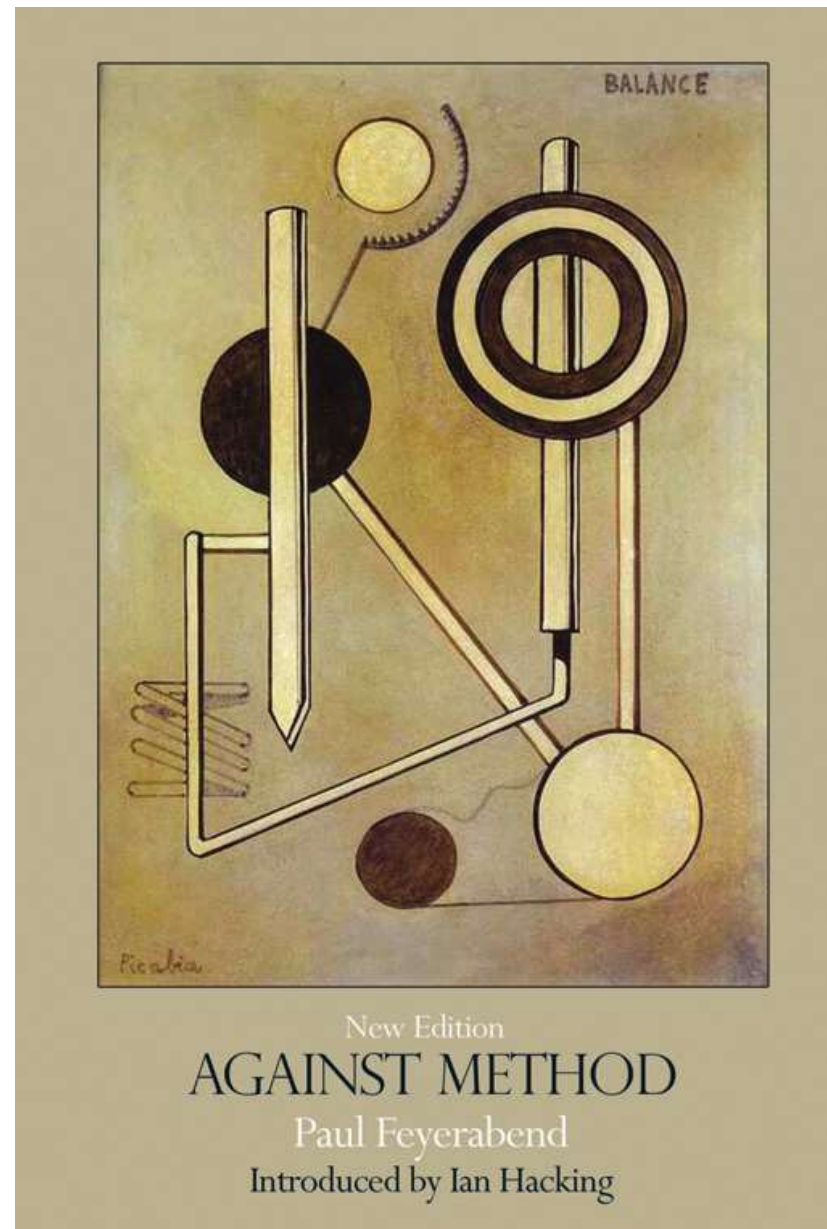
AIDS and
medicine: patients
have questions
which researchers
are unable to
anticipate



[...] in a democracy
local populations not
only will, but also
should, use the sciences
in ways most suitable to
them.



The objections that citizens do not have the expertise to judge scientific matters overlooks that important problems often lie across the boundaries of various sciences so that scientists within these sciences don't have the needed expertise either.



Moreover doubtful cases always produce experts from one side, experts for the other side, and experts in between. But the competence of the general public could be vastly improved by an education that exposes expert fallibility instead of acting as if it did not exist.

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