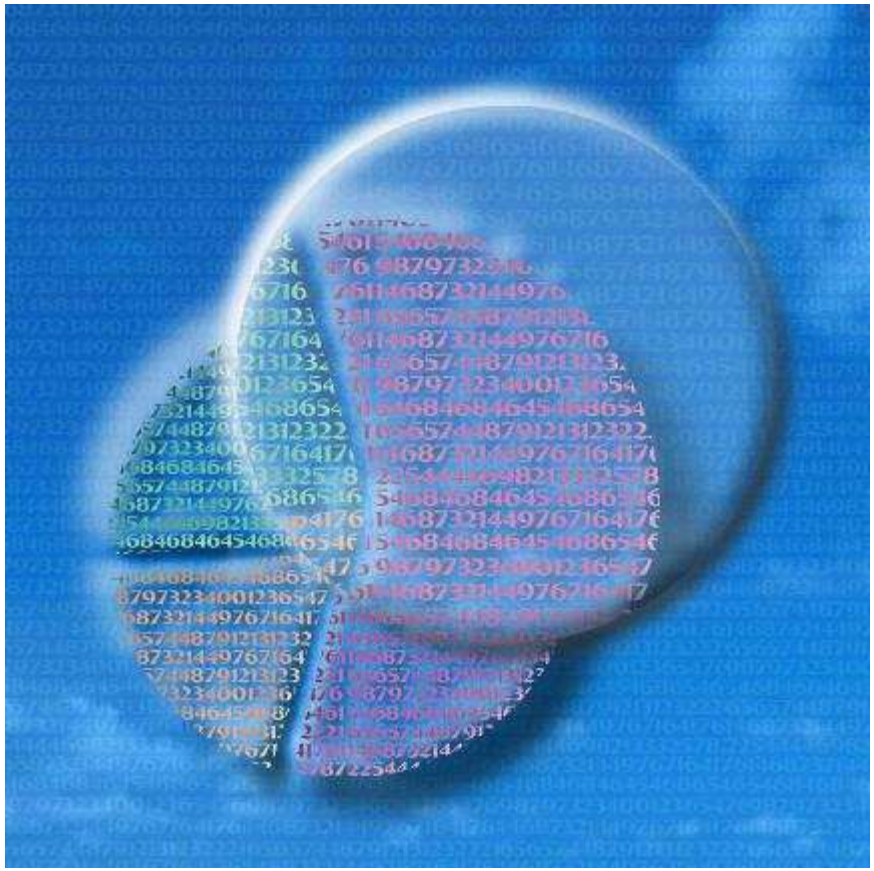


Course at ICTA: 'Sensitivity analysis, sensitivity auditing and beyond' Lesson 3: Ethics of quantification

Andrea Saltelli
Centre for the Study of the Sciences and the Humanities (SVT) – University of Bergen (UIB)
Institut de Ciència i Tecnologia Ambientals (ICTA) – Universitat Autonoma de Barcelona (UAB)

Barcelona, Bellaterra Campus, February 6-8 2017

Where to find this talk: www.andreasaltelli.eu

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

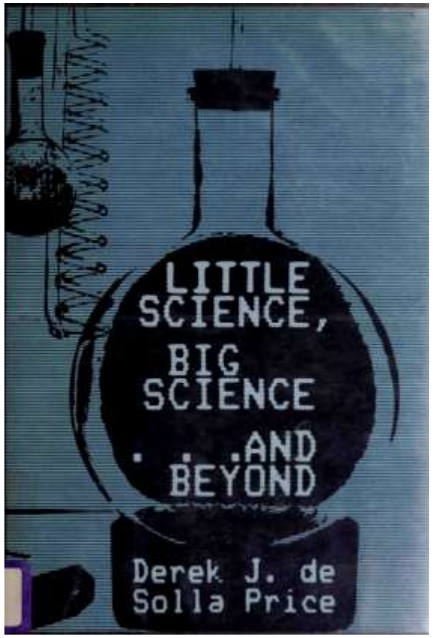
= more material on my web site

= discussion time

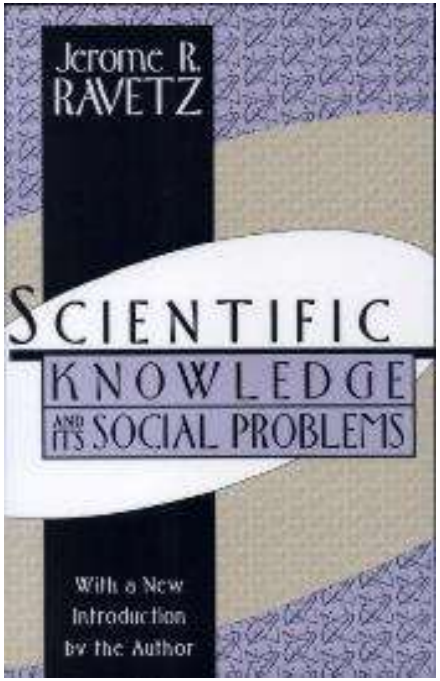
Context: A matter of opinion

1. Science is in a deep existential crisis which has ethical, epistemological, methodological and even metaphysical dimensions
2. Likewise democracy which has with science a legitimacy arrangement
3. Science and its institutions are committed to the status quo & attempt to evade a critical reflection
4. Solutions aren't forthcoming anytime soon
5. There are yet few areas of 'Reformation' where science and society work together

First thesis: Science is in a deep existential crisis which has ethical, epistemological, methodological and even metaphysical dimensions. This was neatly predicted by E. de Solla Price, Jerome R. Ravetz and others five decades ago



Derek J. de Solla Price



Jerome R. Ravetz

de Solla Price, D.J., 1963, Little science big science, Columbia University Press.
Ravetz, J., 1971, Scientific Knowledge and its Social Problems, Oxford University Press.

Summary Points

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

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

John P. A. Ioannides

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

Lancet, Editorial, 2015, Rewarding true inquiry and diligence in research, 385, p. 2121.
Ioannidis JPA, 2016, Why Most Clinical Research Is Not Useful, PLoS Med 13(6): e1002049. doi:10.1371/journal.pmed.1002049

nature International weekly journal of science

Home | News & Comment | Research | Careers & Jobs | Current Issue | Archi

Archive > Volume 533 > Issue 7604 > News Feature > Article

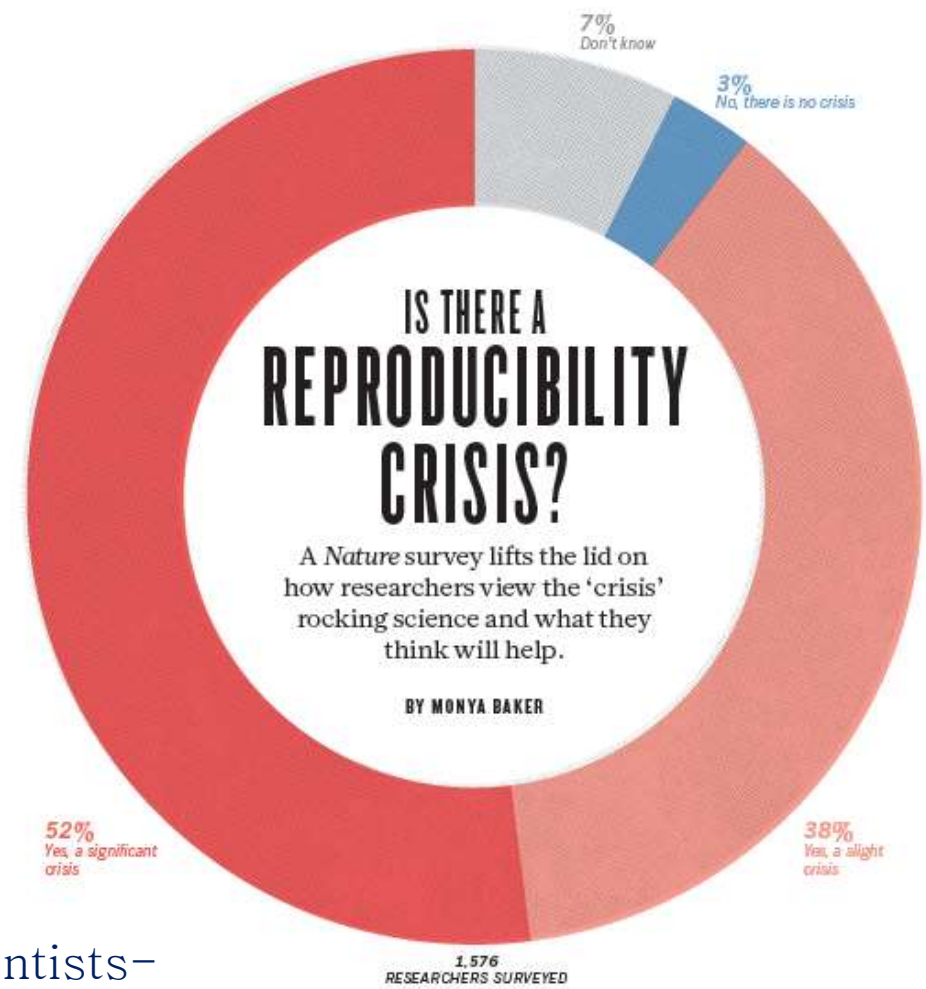
NATURE | NEWS FEATURE

1,500 scientists lift the lid on reproducibi

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 International weekly journal of science

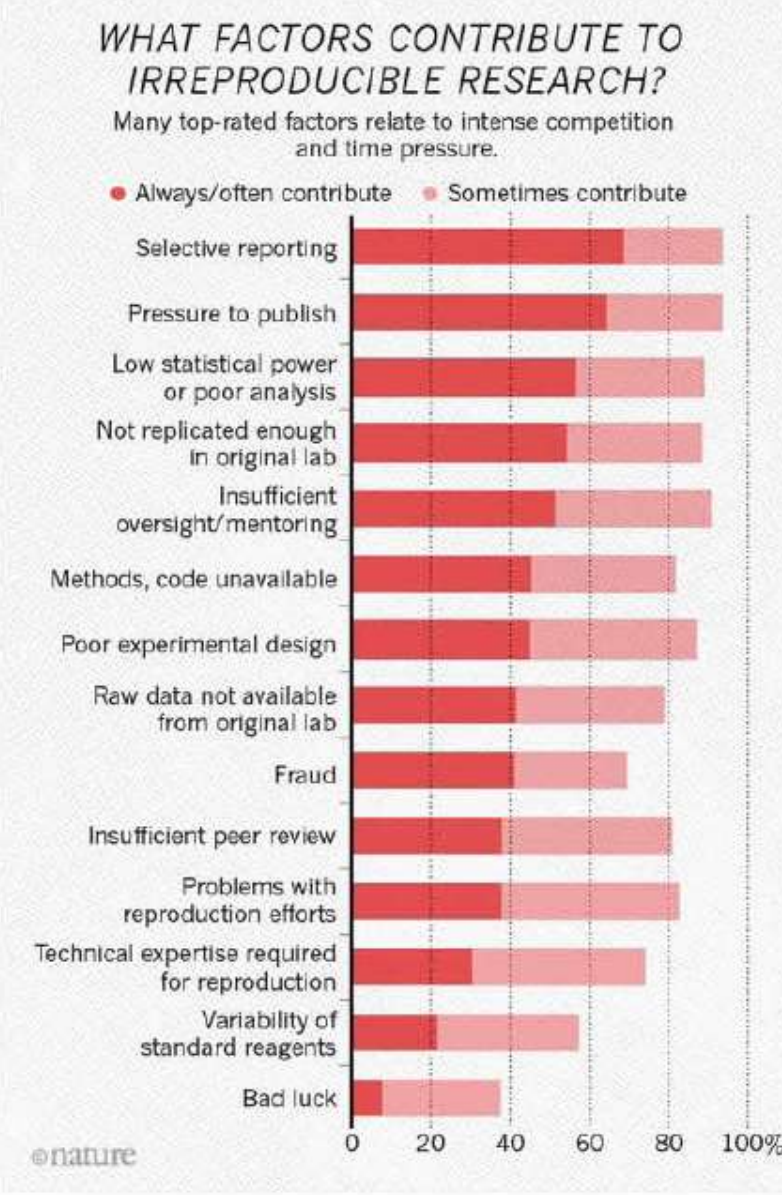
NATURE | NEWS FEATURE

1,500 scientists lift the lid on reproducibility

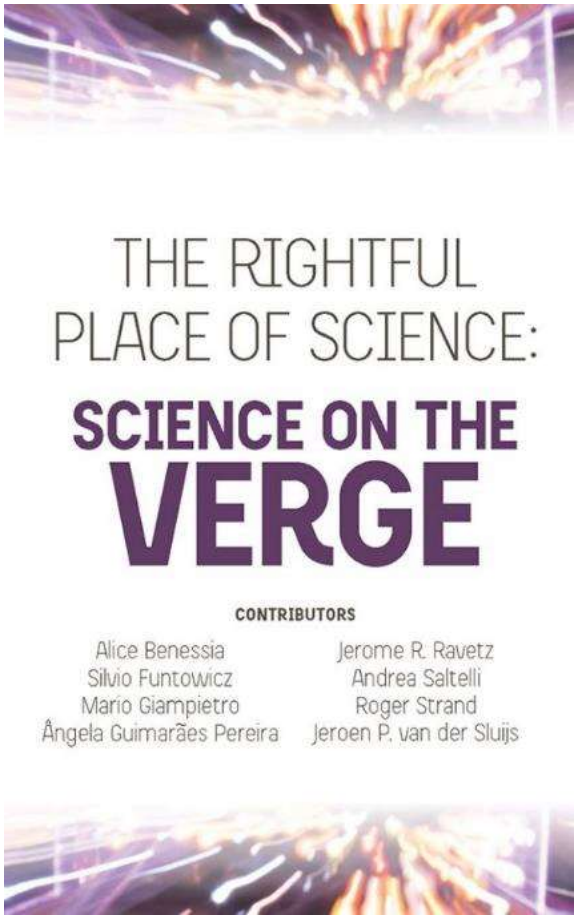
Survey sheds light on the 'crisis' rocking research.

Monya Baker

25 May 2016 | Corrected: 28 July 2016



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



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

The Rightful Place of Science: Science on the Verge

Paperback – 20 Feb 2016

by Andrea Saltelli (Author), Alice Benessia (Author), & 7 more

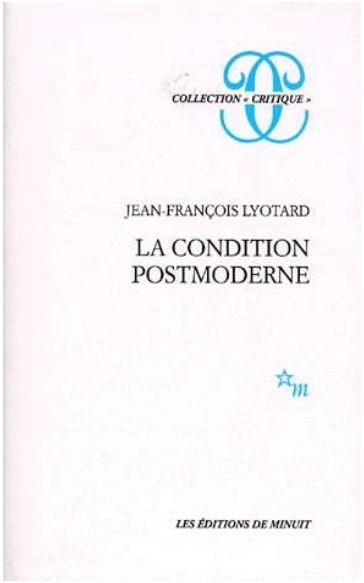
★★★★★ 1 customer review

See all formats and editions

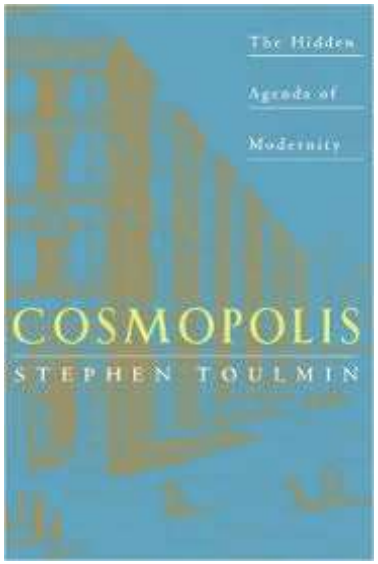
Kindle Edition	Paperback
£3.61	£6.99

Thesis 2: Likewise in crisis is democracy which has with science a legitimacy arrangement

Michael Polanyi



Jean-François Lyotard



Stephen Toulmin

➔ today post-BREXIT, post-Trump, post-truth brouhaha, the demise of expertise …

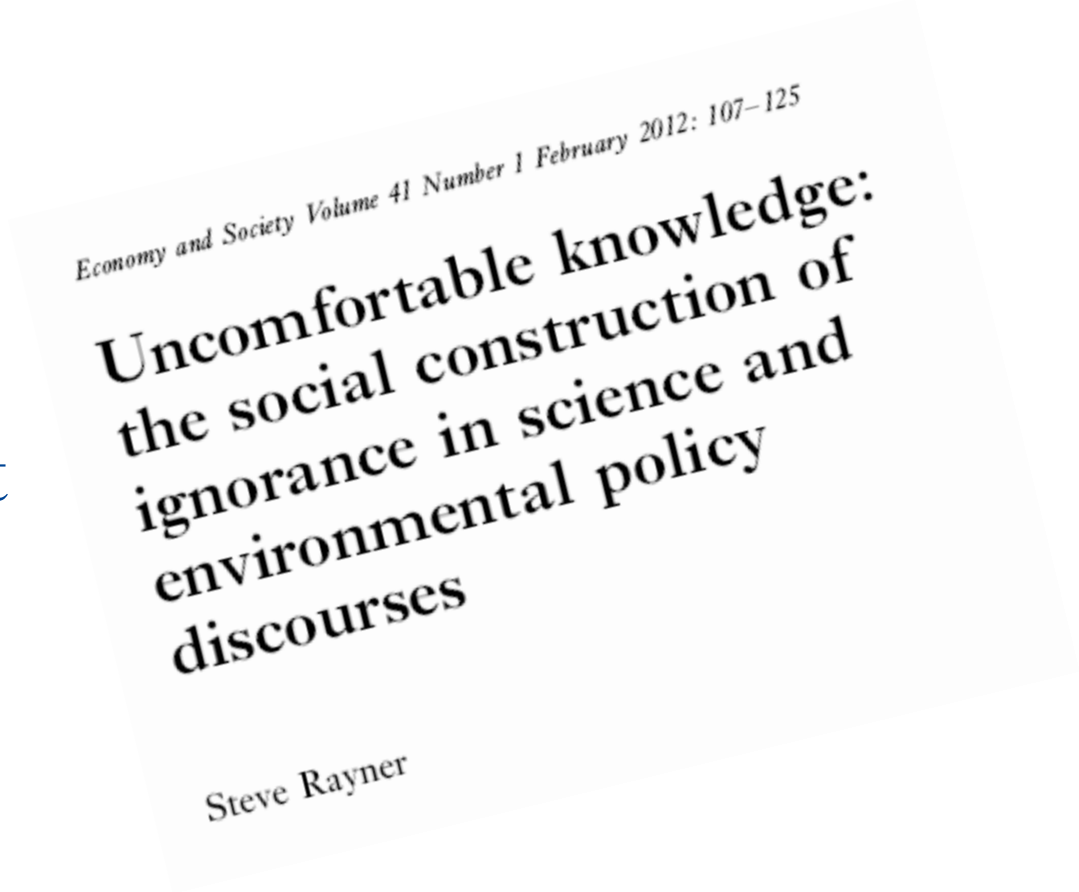
Thesis 3: Science and its institutions are committed to the status quo & attempt to evade a critical reflection with:

Denial

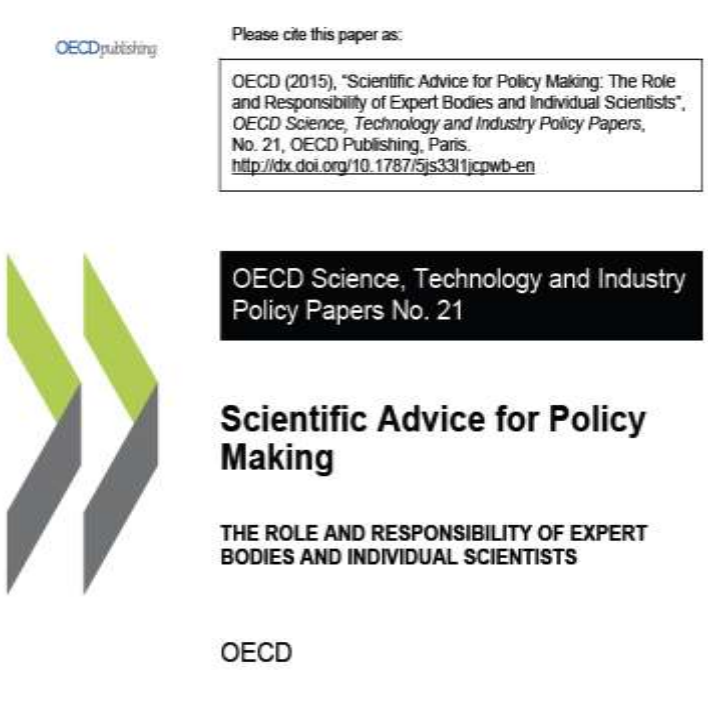
Dismissal

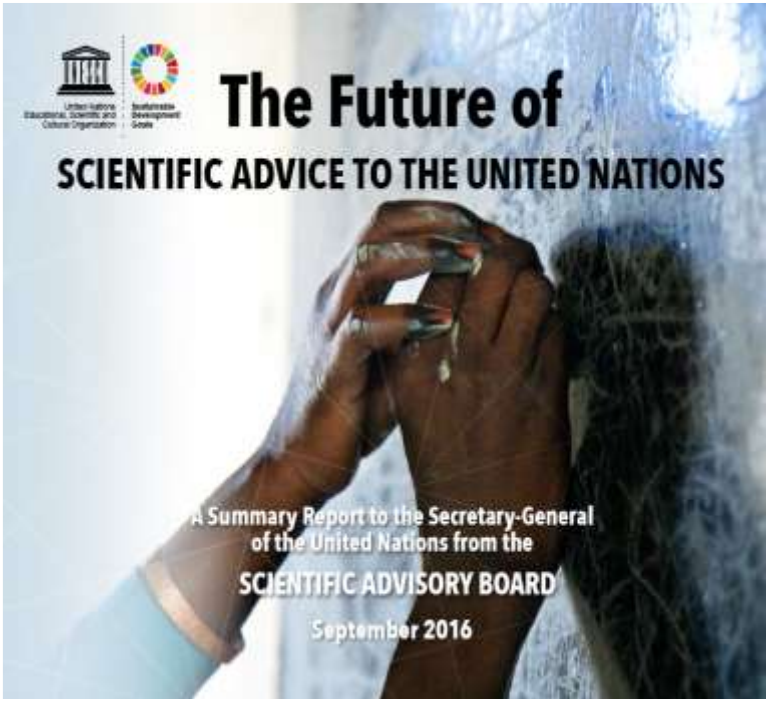
Diversion

Displacement



Denial





2015

2016

We can solve it!

nature.com > nature human behaviour > perspectives > article

MENU

nature human behaviour

Altmetric: 1,978 Views: 40,227 More detail »

Perspective | OPEN

A manifesto for reproducible science

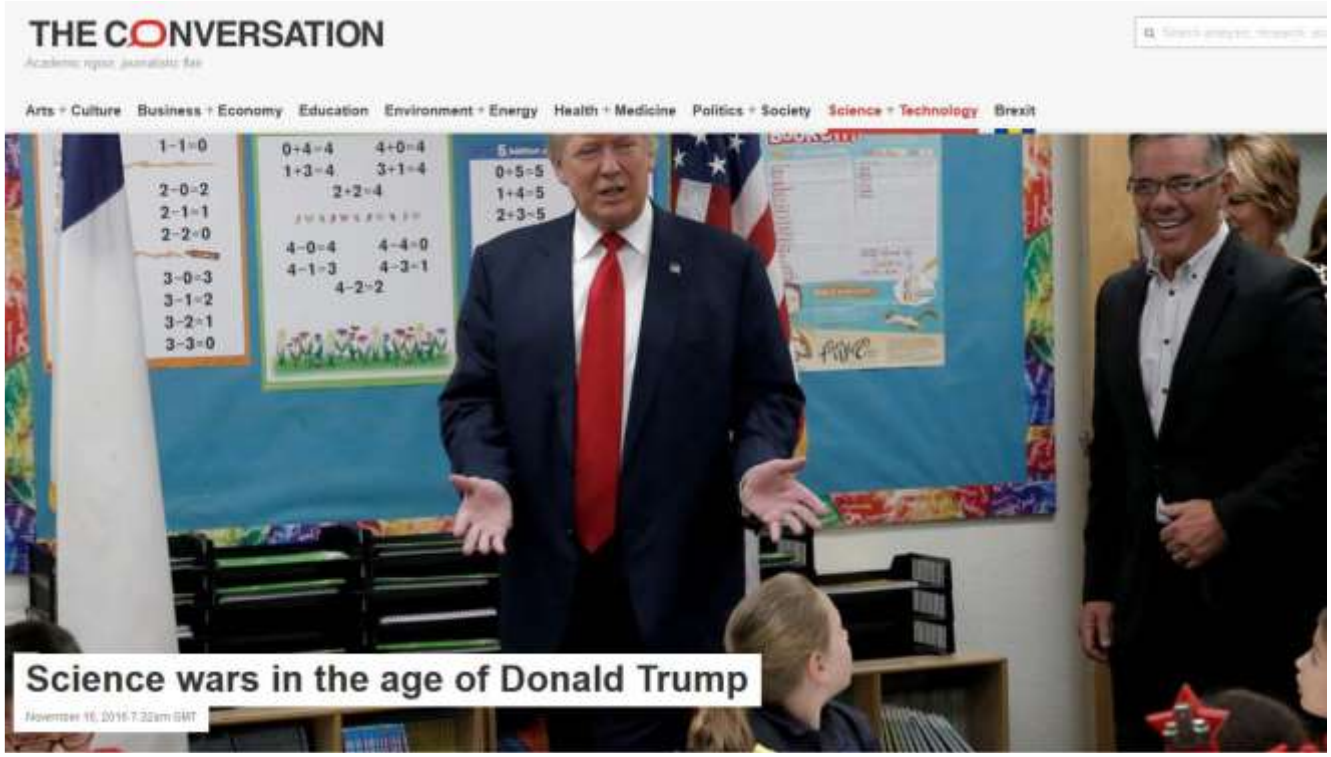
Marcus R. Munafò, Brian A. Nosek, Dorothy V. M. Bishop, Katherine S. Button, Christopher D. Chambers, Nathalie Percie du Sert, Uri Simonsohn, Eric-Jan Wagenmakers, Jennifer J. Ware & John P. A. Ioannidis

Nature Human Behaviour **1**, Article number: 0021 (2017) doi:10.1038/s41562-016-0021

Published online: 10 January 2017

"[…] measures [to] improving the transparency, reproducibility and efficiency of scientific research"

Diversion (There is a problem, and this is due to an ongoing war on science between the educated liberal left and the ignorant conservative right)



Authors

Andrea Saltelli
Adjunct professor, University of Bergen

Silvio Oscar Funtowicz
Adjunct Professor Centre for the Study of the Sciences and the Humanities, University of Bergen

https://theconversation.com/science-wars-in-the-age-of-donald-trump-67594

Displacement (This is the post-truth era)

THE CONVERSATION

Academic rigour, journalistic flair

Arts + Culture | Business + Economy | Education | Environment + Energy | Health + Medicine | Politics + Society | Science + Technology | Brexit

To tackle the post-truth world, science must reform itself

January 27, 2017 7.33am GMT

Authors

Andrea Saltelli
Adjunct professor, University of Bergen

Silvio Oscar Funtowicz
Adjunct Professor Centre for the Study of the Sciences and the Humanities, University of Bergen

https://theconversation.com/to-tackle-the-post-truth-world-science-must-reform-itself-70455

Thesis 4: Solutions aren't forthcoming anytime soon, but:

Church / indulgencies =

Science / predatory publishers, citation cartels, trade in authorship, sugar-cholesterol scandal …

Martin Luther

Johann Tetzel

A combination of corruption, rage and new technology could mobilise major social change (Silvio Funtowicz)

Martin Luther

Johann Tetzel

Thesis 5: Areas of resistance and 'Reformation' where science and society work together – emergence of a new polity of science, including citizen scientists and scientist-citizens

Jeffrey Beall

Lois Gibbs

Timothy Gowers

Marc Edwards

http://scholarlyoa.com/2015/01/02/bealls-list-of-predatory-publishers-2015/#more-4719
https://www.bu.edu/lovecanal/canal/
http://journals.plos.org/plosone/article?id=10.1371%2Fjournal.pone.0127502
https://en.wikipedia.org/wiki/Flint_water_crisis; http://flintwaterstudy.org/;
http://www.nytimes.com/2016/08/21/magazine/flints-water-crisis-and-the-troublemaker-scientist.html

An even newer sort of heroes?

John and Laura Arnold

Brian Nosek, the Reproducibility Project.

John Ioannidis, Meta-research innovation centre at Stanford

Ben Goldacre, alltrials.net

Gary Taubes, The case against sugar

https://www.wired.com/2017/01/john-arnold-waging-war-on-bad-science/

Yoshiki Sasai

http://www.nature.com/news/stem-cell-pioneer-blamed-media-bashing-in-suicide-note-1.15715

Discussion points

- Free instant poll: is so bad?

Problematic quantifications?

"What follows is a hypothetical executive summary from an imagined Food and Agriculture Organization (FAO) report on the state of the world's food systems, written from the perspective of the 2050s"

Executive Summary: FAO State of World Agriculture in 2050 Draft Report

"[…]this FAO report presents evidence that the international food system of the second half of the 21st century is more sustainable than the food system of the late 20th or early 21st centuries.

[…] today more people are being fed on less land and agriculture is requiring fewer inputs"

Executive Summary: FAO State of World Agriculture in 2050 Draft Report

"[…] despite there being 10 billion people on the planet, today agriculture requires 438 million hectares* less land than it did in 2015, yet produces more adequate nutrition for all."

Executive Summary: FAO State of World Agriculture in 2050 Draft Report

Three digits

"[…] despite there being 10 billion people on the planet, today agriculture requires 438 million hectares* less land than it did in 2015, yet produces more adequate nutrition for all."

*Authors' estimate

This [438 Mha] figure was arrived at by assuming that:

- Agriculture shifts away from over production of cereals, oils, and sugars, but increases fruit and vegetables;
- Agricultural yields increase ~1%/y between now and 2050.
- Protein consumption shifts from 86% animals and 14% plants to 50% animal and 50% plant.

"Please contact the authors for references etc. pertaining to these calculations"

The Washington Post

Speaking of Science

107 Nobel laureates sign letter blasting Greenpeace over GMOs

https://www.washingtonpost.com/news/speaking-of-science/wp/2016/06/29/more-than-100-nobel-laureates-take-on-greenpeace-over-gmo-stance/

By Joel Achenbach

While Greenpeace and other organizations oppose genetically engineered food, more than 100 Nobel laureates are taking a stand on the side of GMOs. Here's a look at each side's arguments. (Jenny Starrs/The Washington Post)

"While Greenpeace and other organizations oppose genetically engineered food, more than 100 Nobel laureates are taking a stand on the side of GMOs. Here's a look at each side's arguments. (Jenny Starrs/The Washington Post)"

From the Noble laureates' letter:

"Greenpeace has spearheaded opposition to Golden Rice, which has the potential to reduce or eliminate much of the death and disease caused by a vitamin A deficiency (VAD), which has the greatest impact on the poorest people in Africa and Southeast Asia.

[…] a total of one to two million preventable deaths occur annually as a result of VAD, […] VAD itself is the leading cause of childhood blindness globally affecting 250,000 – 500,000 children each year. Half die within 12 months of losing their eyesight"

From the Noble laureates' letter:

"[…] Opposition based on emotion and dogma contradicted by data must be stopped.

How many poor people in the world must die before we consider this a "**crime against humanity**"?"

http://supportprecisionagriculture.org/nobel-laureate-gmo-letter_rjr.html

Opposing evidence

Nutritionally: not enough beta carotene

Golden rice not authorized yet

More politically viable alternative successful

Dangerous colour

Low yield of the modified variety …

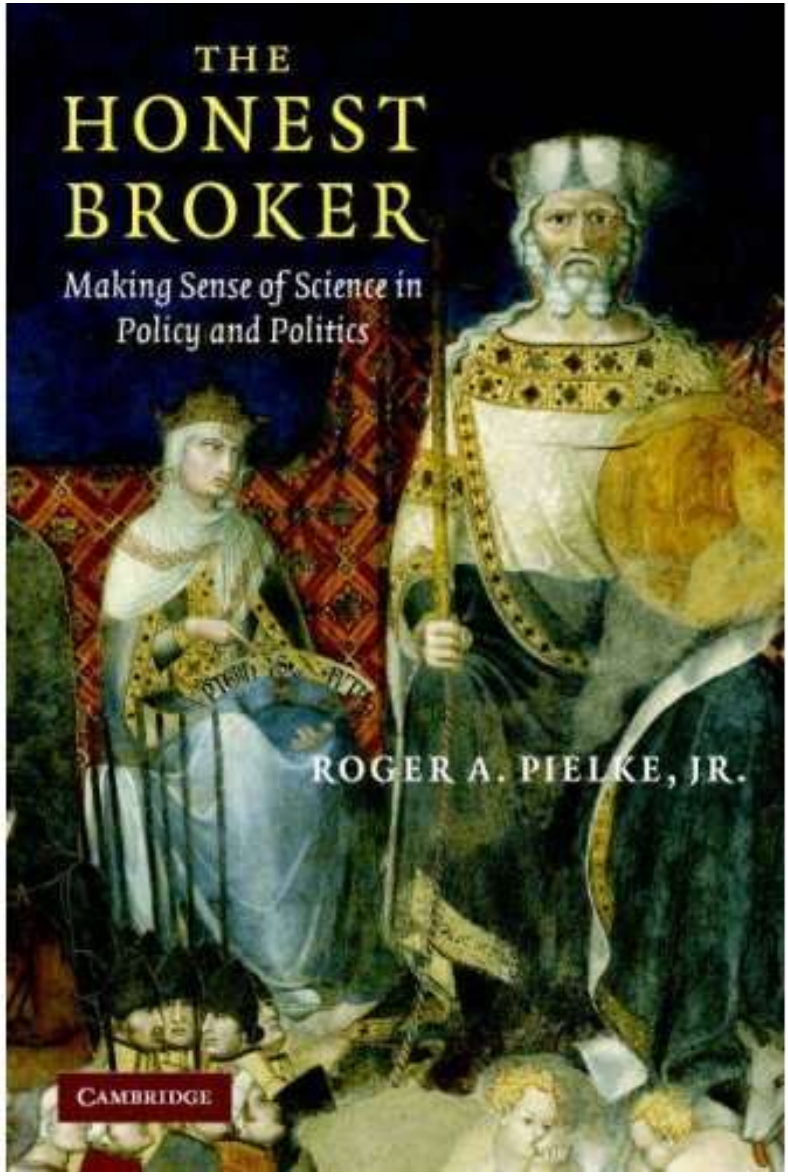
http://www.ecowatch.com/greenpeace-to-nobel-laureates-its-not-our-fault-golden-rice-has-failed-1896697050.html

See also Tiziano Gomiero, Andrea Saltelli and Mario Giampietro, The complexity of science for policy: the case of the delayed commercialization of the Golden Rice, Submitted October 2016.

- When is it OK for science to engage in advocacy?

Interesting reading on the topic: https://theconversation.com/should-scientists-engage-in-activism-72234

The argument: better honest brokers of policy alternatives then 'stealth advocates'



The Honest Broker: Making Sense of Science in Policy and Politics by Roger A. Pielke Jr.

See also http://www.americanscientist.org/bookshelf/pub/speaking-honestly-to-power

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 mathematique 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)

http://www.bartleby.com/34/1/6.html

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'

http://oll.libertyfund.org/titles/1669

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’

http://oll.libertyfund.org/titles/1669

‘Mathématique sociale’:

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

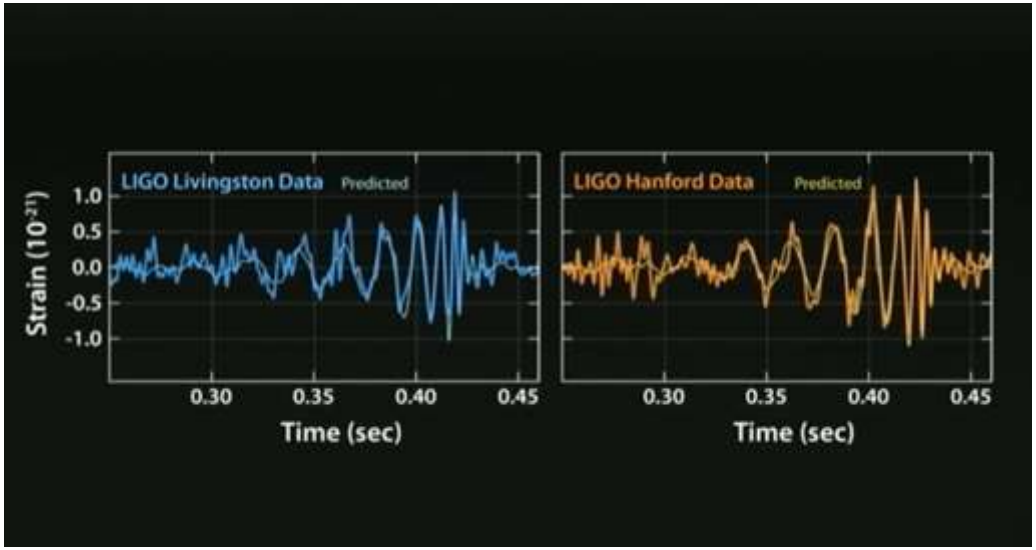
Nicolas de Caritat,
marquis de Condorcet
(1743- 1794)

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

Condorcet’s algorithms and Descartes’ Geometry

Feldman, J., 2005, Condorcet et la mathematique 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



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/

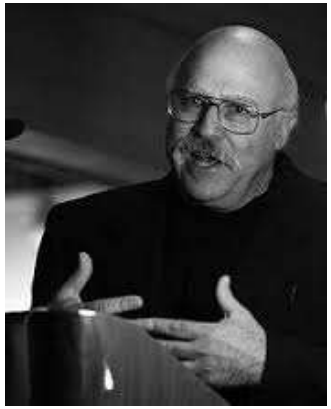
Closer to our times the dream was couched in the 'Endless Frontier' metaphor by Vannevar Bush, 1945:

"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)

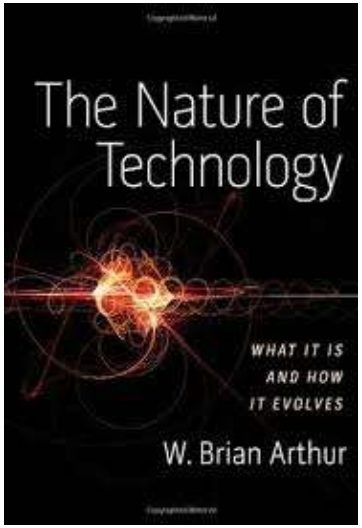
Bush, V. (1945) Science: the endless frontier, United States Office of Scientific Research and Development, U.S. Govt. print office.

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



Steven Shapin

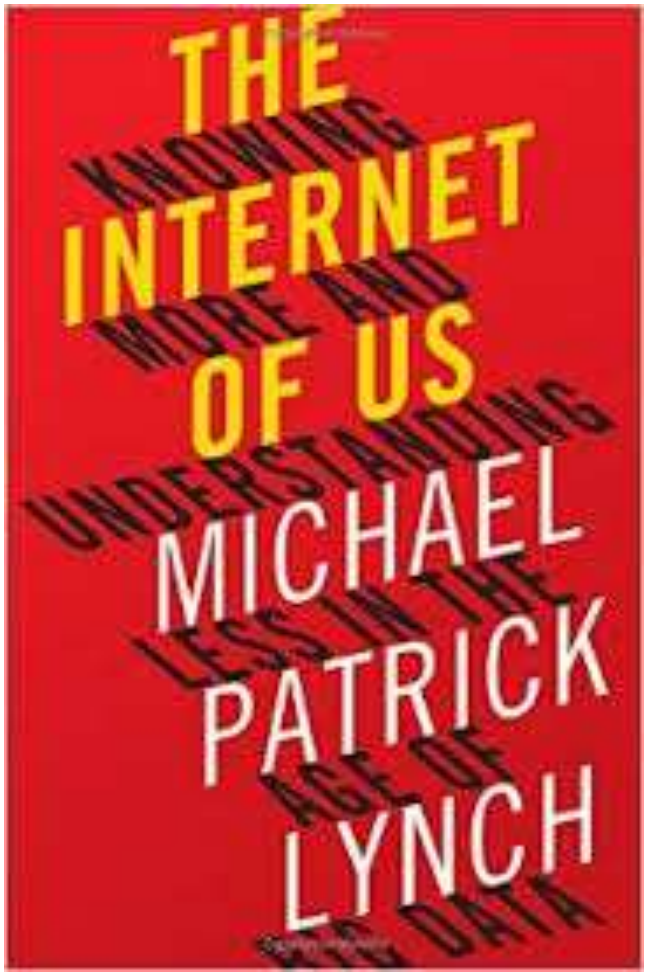
The dream was spectacularly successful, in all fields of endeavor, leading to what Steven Shapin calls 'invisible science'



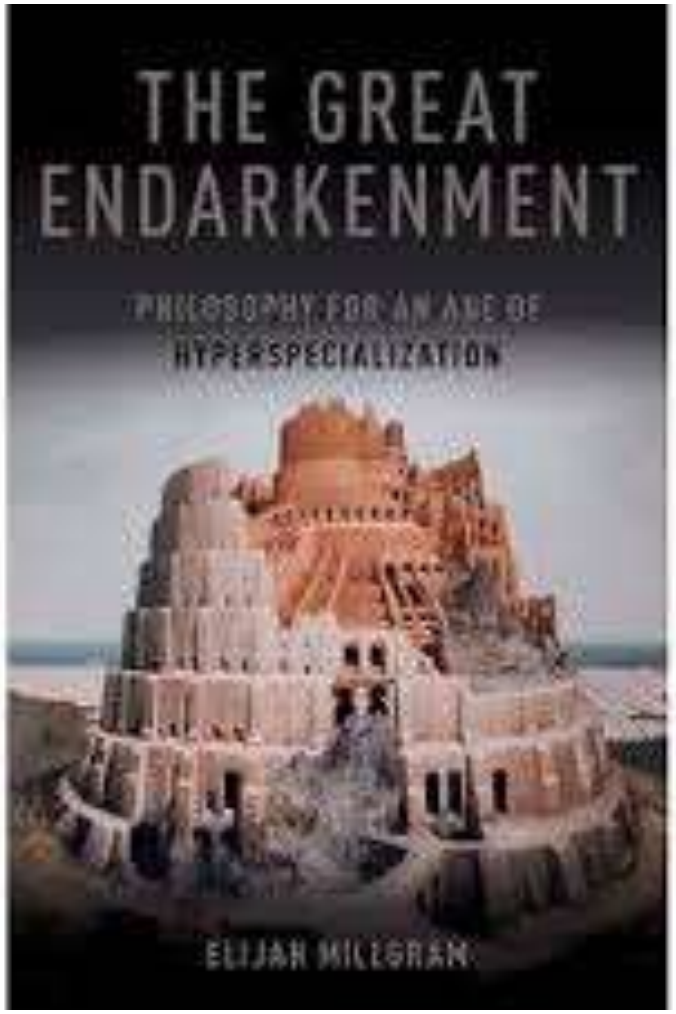
It also lead to techno-science, to technology 'creating itself from itself',…

Steven Shapin, 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 technology which redefines the meaning of ‘knowing’ into ‘Google-knowing’



… To a world
impossible to make sense of

… to a host of other issues and fears

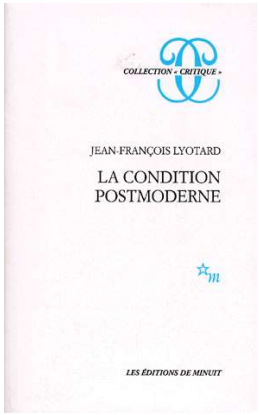
Irreversible loss of jobs?

Weaponization of big data?

Technology disempowering the individual?

The undoing 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 …”

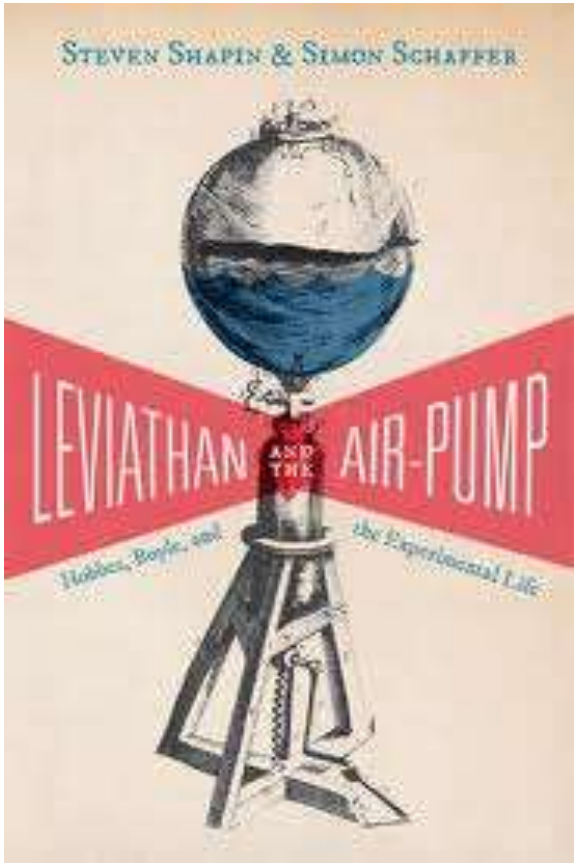


Jean-François Lyotard

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

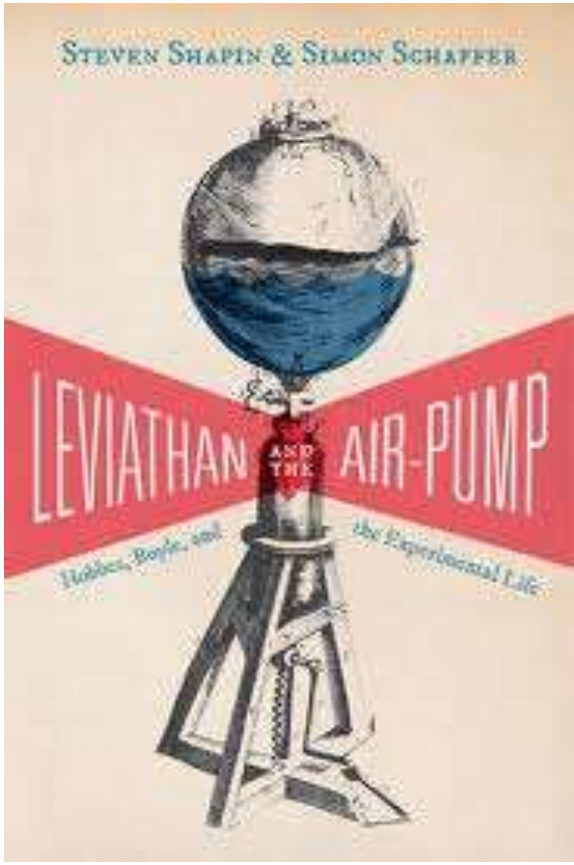
“Solutions to the problem of knowledge are solutions to the problem of social order.

[…] 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

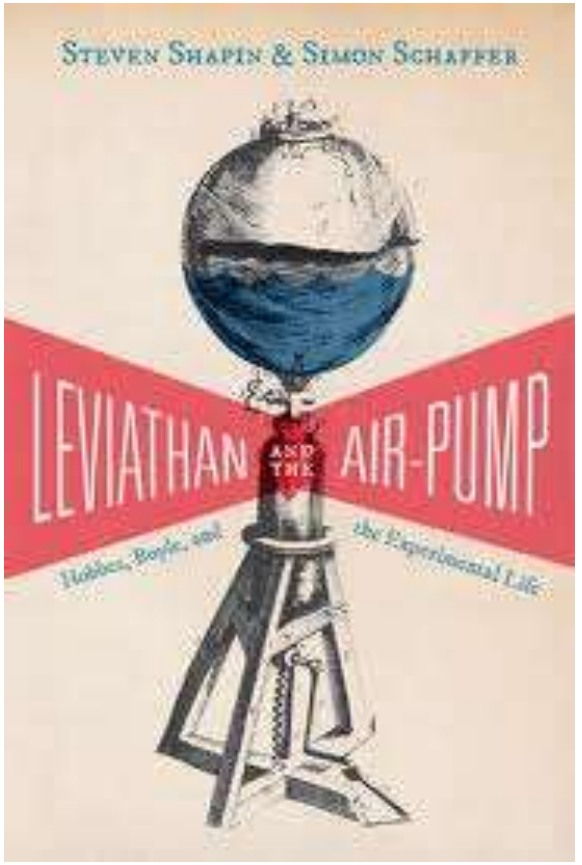
Establishing ‘matter of facts’ under controlled ‘laboratory’ experiments before witnesses as a way to subtract the discourse about knowledge from religious squabbles …



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



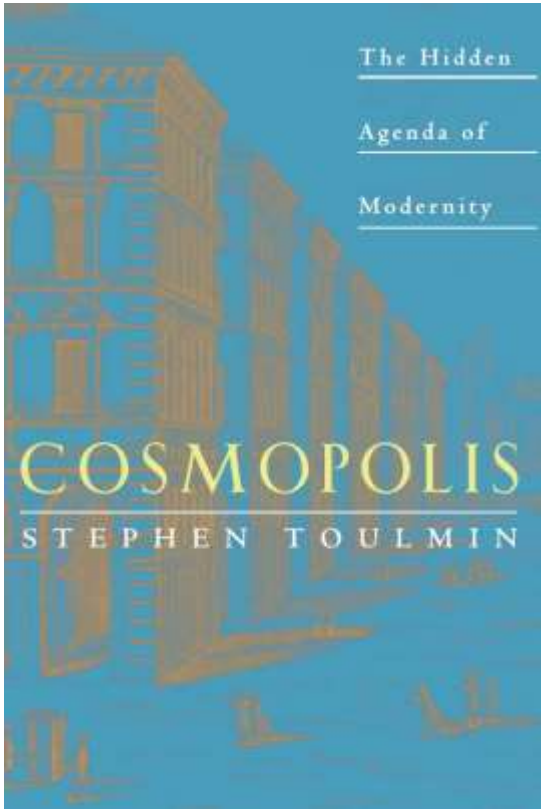
Latour, B., 1991, Nous n'avons jamais été modernes, Editions La découverte, 1993; We Have Never Been Modern. Cambridge, Harvard UP.

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

Interesting reading on the topic: https://theconversation.com/should-scientists-engage-in-activism-72234

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

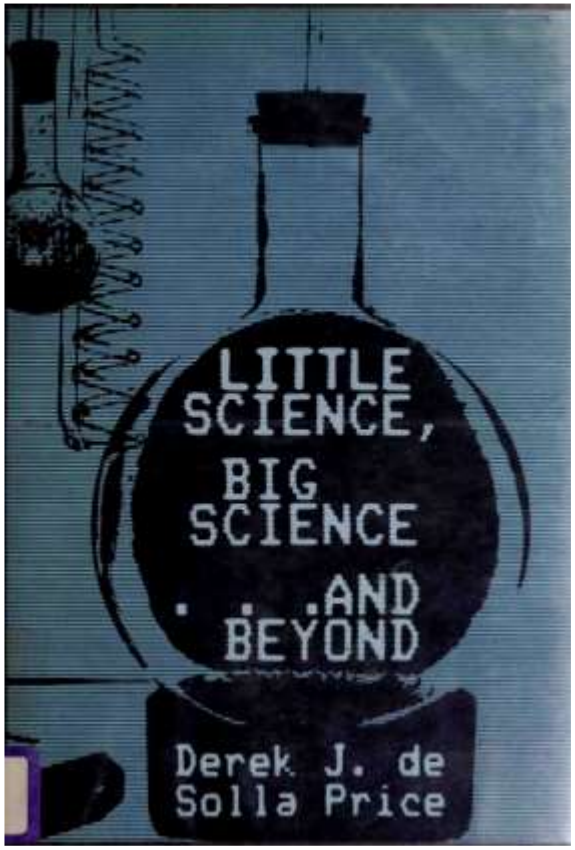
Stephen Toulmin



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

The collapse?

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.

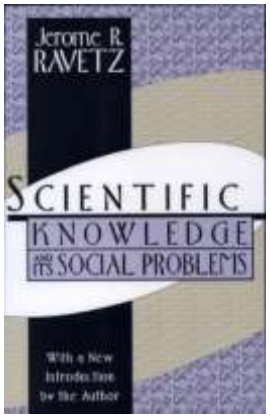
Lyotard, J.-F. 1979. La Condition postmoderne. Rapport sur le savoir, Paris : Minuit, Chapter 10.

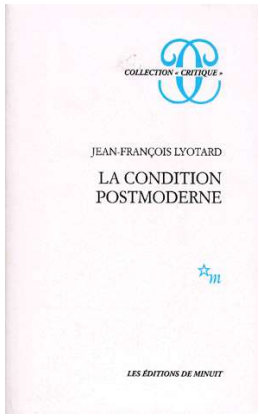
Mirowski, P. 2011. Science-Mart: Privatizing American Science, Harvard University Press.

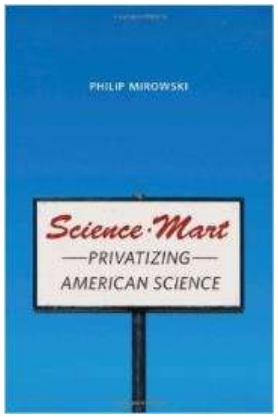
Jerome R. Ravetz

Jean-François Lyotard

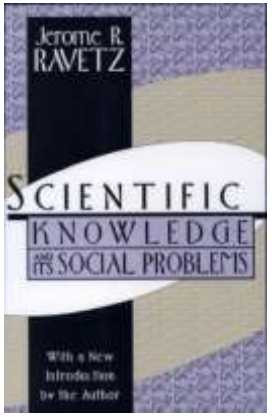
Philip Mirow







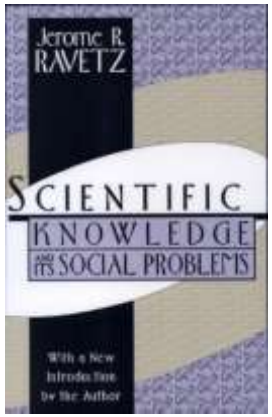
p.22: “with the industrialization of science, certain changes have occurred which weaken the operation of the traditional mechanism of quality control and direction at the highest level.



Jerome R. Ravetz

Ravetz, J., 1971, Scientific Knowledge
Social Problems, Oxford University Pr

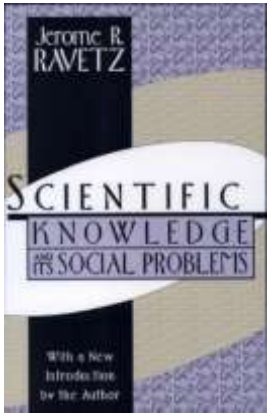
p.22: [⋯] The problem of quality control in science is thus at the centre of the social problems of the industrialized science of the present period."



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”

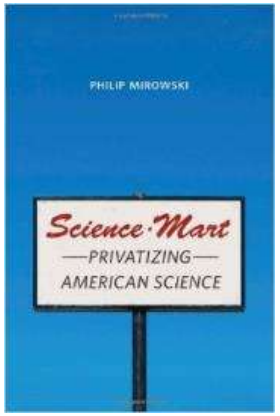


Jerome R. Ravetz

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

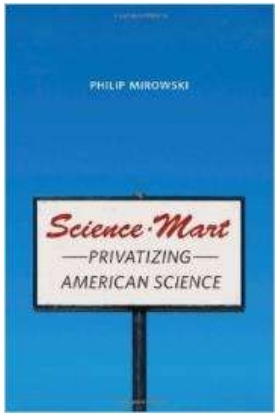
After the eighties neoliberal ideologies succeeded in decreasing state intervention in the funding of science, which became increasingly privatized … Knowledge as a monetized commodity replaces knowledge as public good…

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.

Unreliable research

Trouble at the lab

Scientists like to think of science as self-correcting. To an alarming degree, it is not

Oct 19th 2013 | From the print edition

Open access, freely available online

Essay

Why Most Published Research Findings Are False

John P. A. Ioannidis

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.

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

A collapse in craft skills?

"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

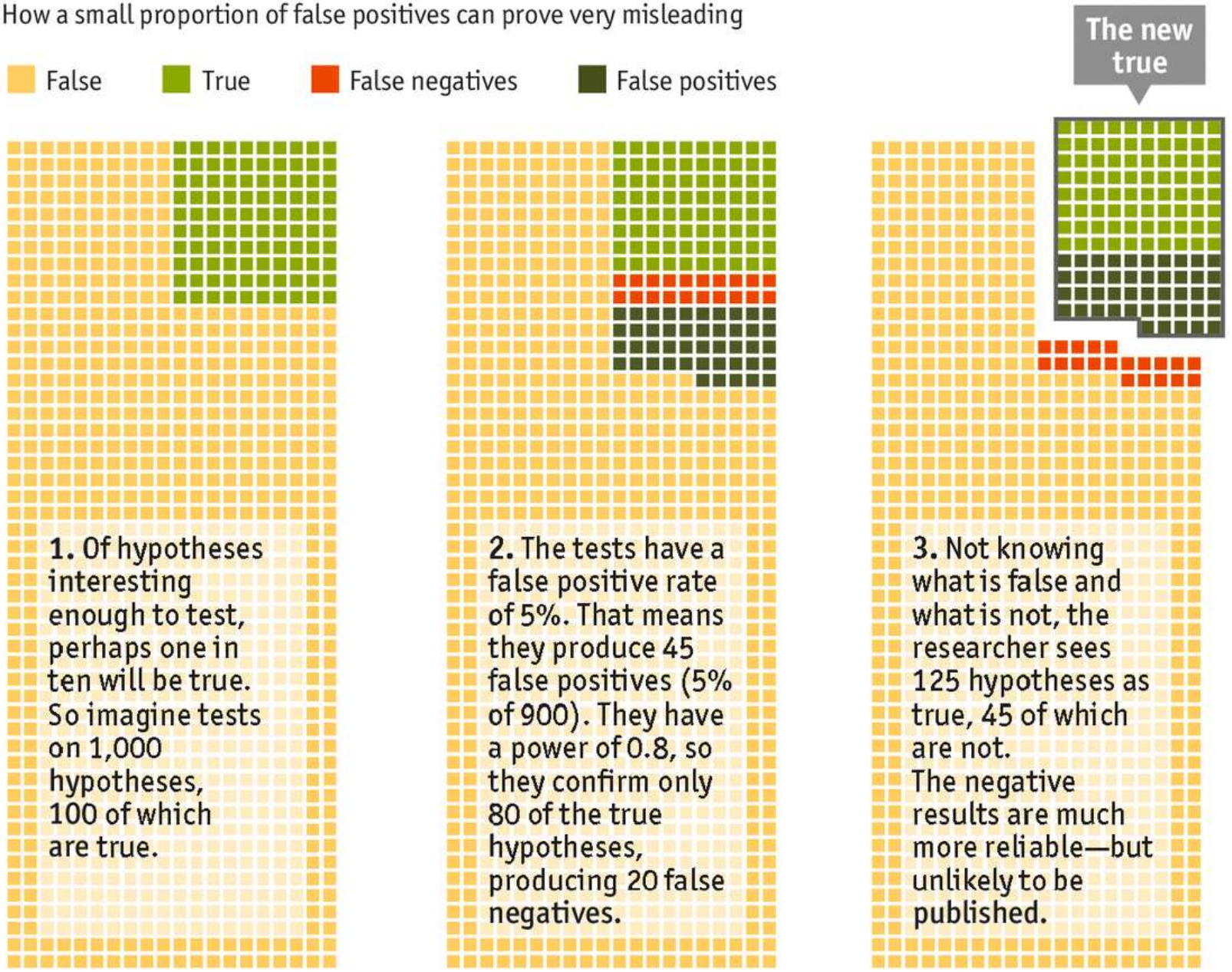
… and twenty 'dissenting' commentaries

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/

Unlikely results

How a small proportion of false positives can prove very misleading



http://www.economist.com/blogs/graphicdetail/2013/10/daily-chart-2

ROYAL SOCIETY OPEN SCIENCE

rsos.royalsocietypublishing.org

Review

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

How was it possible that this important statistical tool was misused for several decades with grave consequences for science?

Same story as with sensitivity analysis, with the aggravating circumstance that statistics is a well established discipline while SA is not

LEADER 13 April 2016

Science isn't as solid as it should be – but science can fix it

Unconscious biases and data-torturing are weakening our knowledge base – but unlike politicians and bankers, scientists aren't covering up their failings

Crisis? Fix it...
Stanislav Chernivchan/EyeEm

FEATURE 13 April 2016

Why so much science research is flawed – and what to do about it

Dodgy results are fuelling flawed policy decisions and undermining medical advances. They could even make us lose faith in science. **New Scientist** investigates

An alarming amount of research is flawed
Brett Ryder

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

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

THE CONVERSATION

Academic rigour, journalistic flair

Arts + Culture | Business + Economy | Education | Environment + Energy | Health + Medicine | Politics + Society | Science + Technology

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

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.

Discussion points

- Are we (my team, my organization) into evidence based policy or policy based evidence?

Demarcation: facts separate from values

On demarcation:

"the incoming commission must find better ways of separating evidence-gathering processes from the 'political imperative'", A. Glover, former Chief Science Adviser of President Barroso (Wildson, 2014).

Anne Glover

Wilsdon, J. 2014. Evidence-based Union? A new alliance for science advice in Europe. In The Guardian. Available at: http://www.theguardian.com/science/political-science/2014/jun/23/evidence-based-union-a-new-alliance-for-science-advice-in-europe

Evidence based policy – in the prevailing positivistic narrative – is predicated on a separation of facts from values, of scientists from their customers, on demarcation of roles.

‘Demarcation model’ of science’s input to policy

- Protecting science from the political interference…
- Preventing possible abuse of science…
- … and scientific information driven by agendas…
- Prescribes a clear demarcation between the institutions (and individuals) who provide the science, and those where it is used.

Funtowicz, S. 2006. What is Knowledge Assessment? In Guimarães Pereira, Â., Guedes Vaz, S. and Tognetti, S. (eds) Interfaces between Science and Society. Greenleaf Publishers, Sheffield.

The demarcation model is challenged in more recent epistemologies:

‘Post Normal Science’ (Funtowicz and Ravetz, 1993), ‘Co-production of knowledge’ model (Jasanoff, 1996).

Sheila Jasanoff

Funtowicz, S. O. & Ravetz, J. R. 1993. Science for the post-normal age. Futures, 25(7), 739–755.

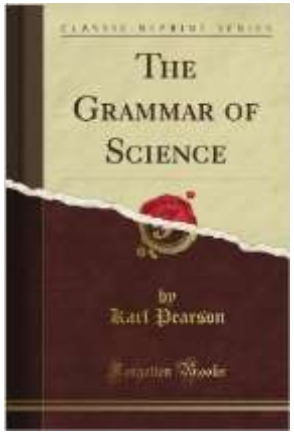
Jasanoff, S. 1996, Beyond Epistemology: Relativism and Engagement in the Politics of Science. Social Studies of Science. 26(2) 393-418.

Trust in science, trust in quantification

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

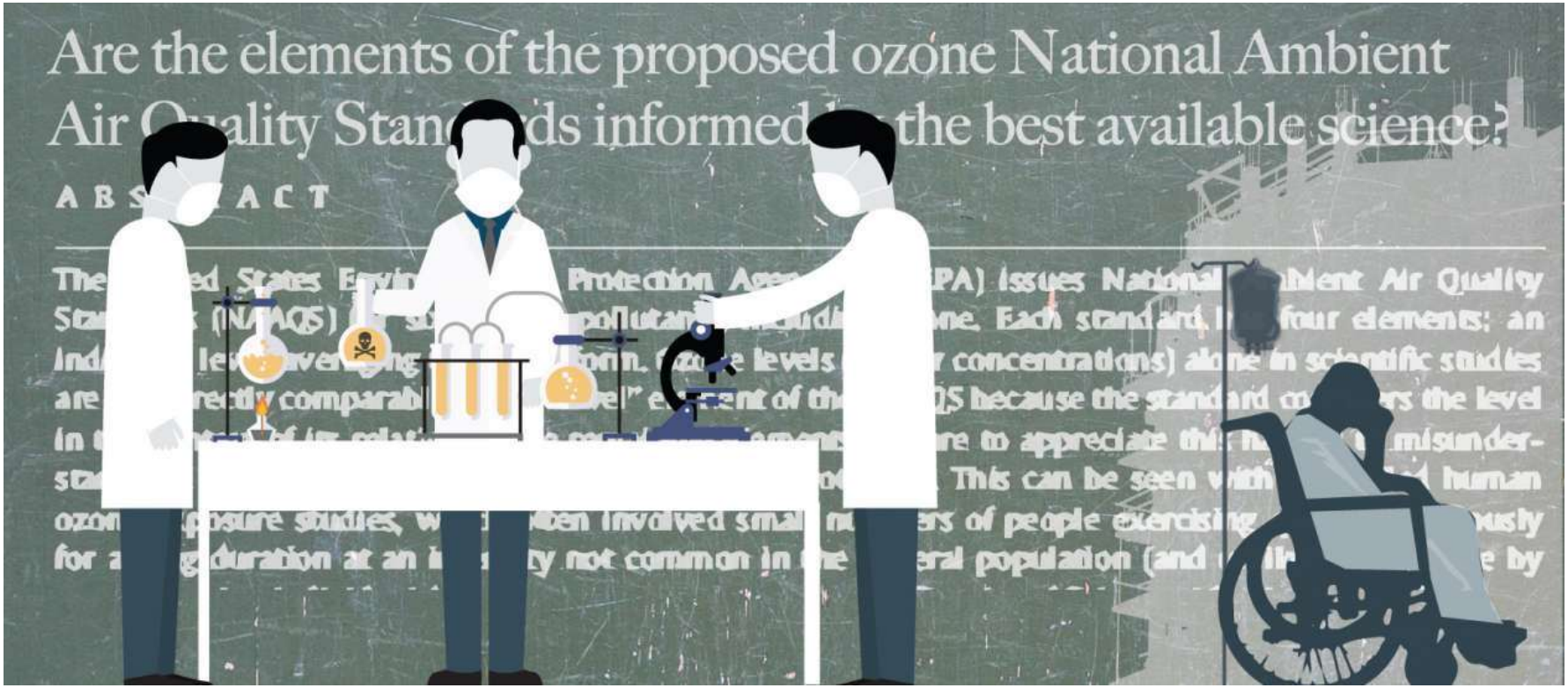
Acting as independent arbiters to shape government policy, many researchers also have corporate roles that are sometimes undisclosed.

By ERIC LIPTON, NICHOLAS CONFESSORE and BROOKE WILLIAMS AUG. 8, 2016 The New York Times

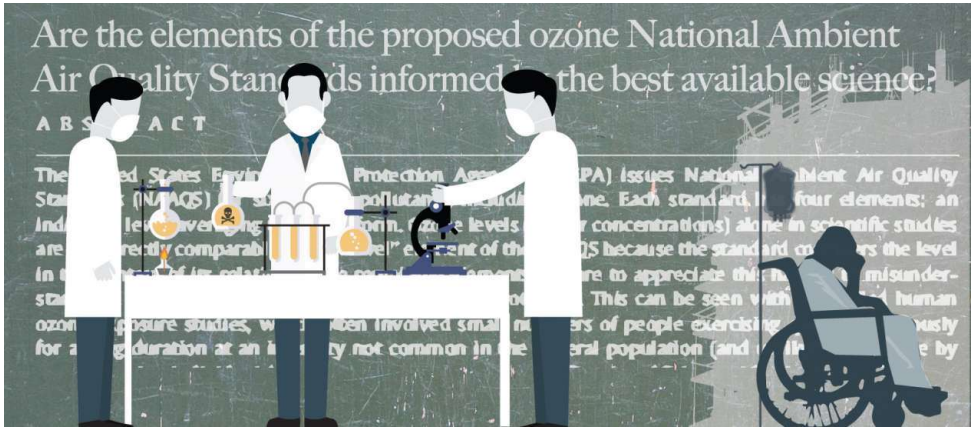
http://www.nytimes.com/2016/08/09/us/politics/think-tank-scholars-corporate-consultants.html?_r=0

Lobbyists recruit laws 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

The JAMA Network Journals > Collections Store Physician Jobs About Mobile

JAMA Internal Medicine

Home Current Issue All Issues Online First Collections CME Multimedia

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]"

http://archinte.jamanetwork.com/article.aspx?articleid=2548255

Voices of concern:

"science has taken a turn towards darkness" (Richard Horton, editor-in-chief of The Lancet, 2015)

"Science is turning back to the dark ages" (Phillips, 2016)

"If Donald Trump were to trigger a crisis in Western democracy, scientists would need to look at their part in its downfall" (Macilwain, 2016)

Horton, R., 2015, Comment, Offline: What is medicine's 5 sigma? The Lancet, 385, 1380.
Phillips, M., 2016, Science is turning back to the dark ages, Times, March 4.
Macilwain, C., 2016, The elephant in the room we can't ignore, Nature, 531, 277.

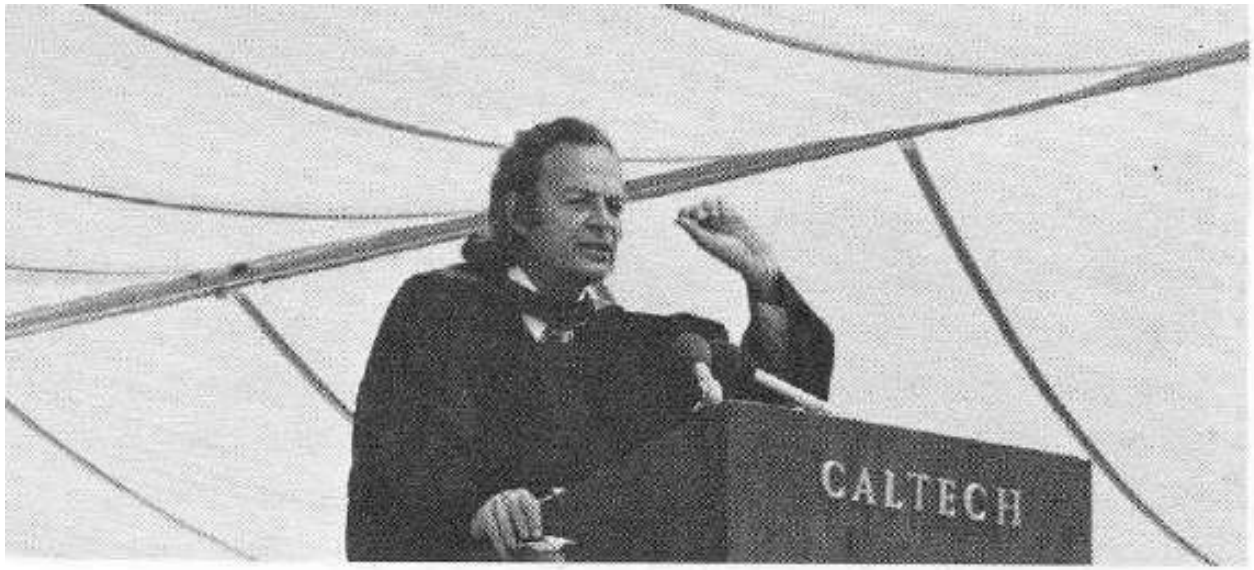
Economics?

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

6 Questions About Economists, and Physicists

7 Loyalty Can Corrode The Norms of Science

9.1 The Norms of Science

10 The Trouble Ahead For All of Economics

https://paulromer.net/wp-content/uploads/2016/09/WP-Trouble.pdf

The Trouble With Macroeconomics

PAUL ROMER
Stern School of Business
New York University

Wednesday 14th September, 2016

"striking parallels between the characteristics of string-theorists in particle physics and postreal Macroeconomists"

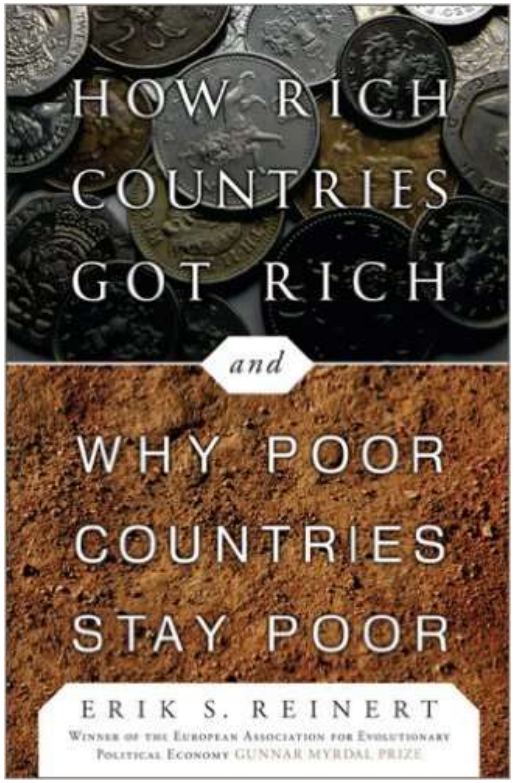
A different diagnosis for a diseased economics: for Erik Reinert's: economics has reverted to scholasticism

Erik Reinert

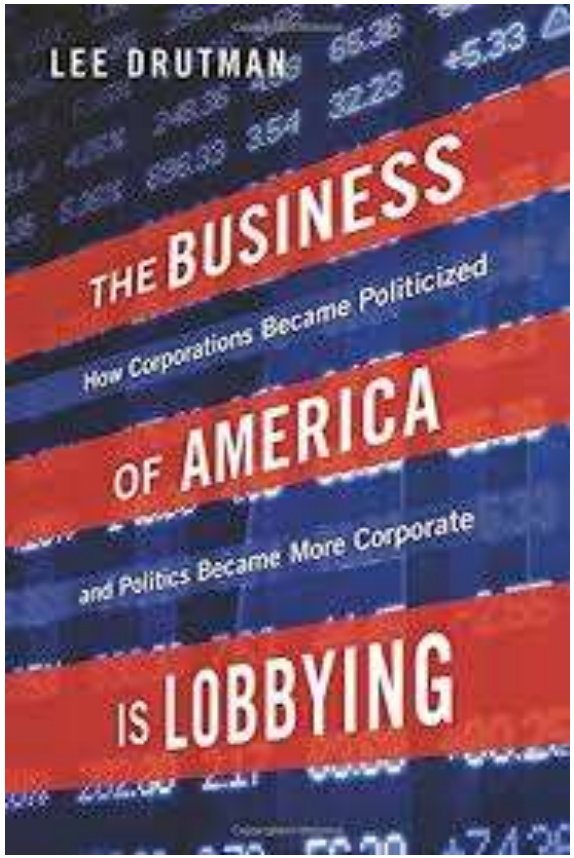
… forgetting an important continental tradition

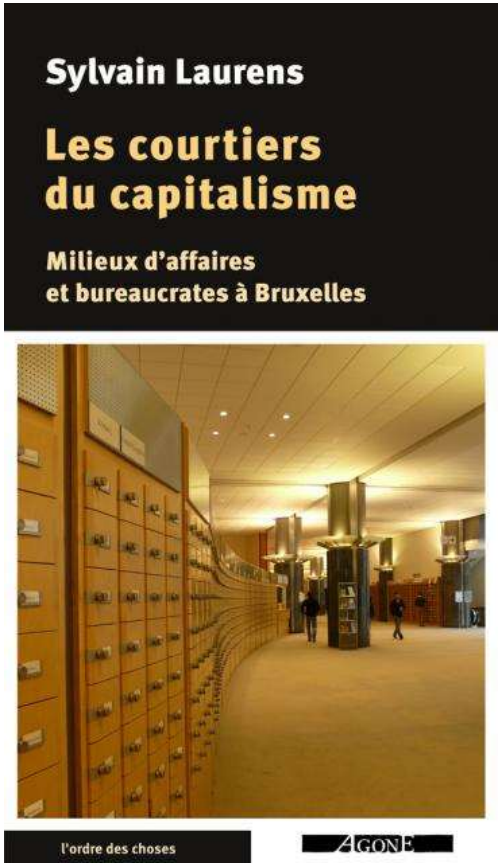
… implications for developments

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



Evidence as the currency of lobbies





Lee Drutman

Sylvain Laurens

Some quick read:
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"

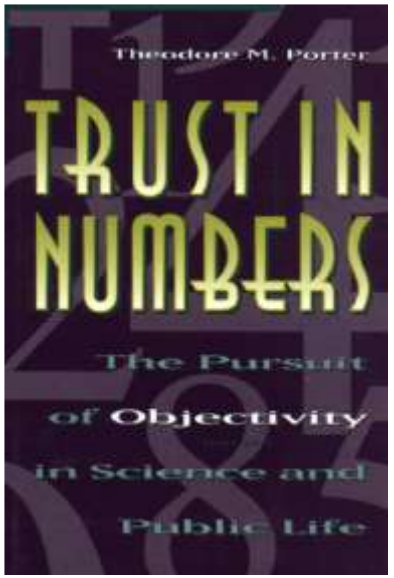
Book written for the lobbyists: The regulation game, Owen & Braeutigam, 1978

"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)

Trust and quantification.

Theodor M. Porter



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

ECOLE NATIONALE
DES PONTS ET CHAUSSEES

US Army Corps of Engineers®

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

ECOLE NATIONALE
DES PONTS ET CHAUSSEES

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?

Post Normal Science and related tools

Post-Normal Science: a reaction to the hyper precision of cost benefit and risk analysis as applied to solve ecological problems; an example:

"How much is a songbird worth?"

Funtowicz, S.O. and Ravetz, J.R. (1994). The worth of a songbird: Ecological economics as a post-normal science. Ecological Economics 10(3), 197-207.

ELSEVIER

Ecological Economics 10 (1994) 197–207

ECOLOGICAL ECONOMICS

The worth of a songbird: ecological economics as a post-normal science

Silvio O. Funtowicz [a], Jerome R. Ravetz [b,*]

[a] *CEC-Joint Research Centre, Institute for Systems Engineering and Informatics, I-21020 Ispra (Va), Italy*
[b] *The Research Methods Consultancy Ltd., Gresham House, 144 High Street, Edgware, Middx HA8 7EZ, UK*

(Received 21 December 1992; accepted 30 July 1993)

A PNS 'classic'

Funtowicz and Ravetz pick a paper on the economics of the greenhouse effect “since the paper displays considerable sophistication in the handling of uncertainties in data.”

They note:
“the paper by Nordhaus is liberally sprinkled with caveats...”

One such caveat is – in the words of William Nordhaus – the difficulty to move from the "terra infirma of climate change to the terra incognita of the social and economic impacts of climate change" … but:

Having duly acknowledged Nordhaus' careful wording on uncertainty F&R proceed to deconstruct his work using the freshly minted NUSAP.

ELSEVIER

Ecological Economics 10 (1994) 197–207

ECOLOGICAL ECONOMICS

The worth of a songbird: ecological economics as a post-normal science

Silvio O. Funtowicz [a], Jerome R. Ravetz [b,*]

[a] *CEC-Joint Research Centre, Institute for Systems Engineering and Informatics, I-21020 Ispra (Va), Italy*
[b] *The Research Methods Consultancy Ltd., Gresham House, 144 High Street, Edgware, Middx HA8 7EZ, UK*

(Received 21 December 1992; accepted 30 July 1993)

"[Although] in his rhetoric at least, the author shows a clear awareness of the presence of the various sorts of uncertainty, […he] does not successfully manage the problems of uncertainty."

Table 1
Impact estimates for different sectors, for doubling of CO_2, U.S. (positive number indicates gain; negative number loss) (Nordhaus, 1991, Table 6, p. 932)

Sectors	Billions (1981 $)
Severely impacted sectors	
Farms	
Impact of greenhouse warming and CO_2 fertilisation	−10.6 to +9.7
Forestry, fisheries, other	Small + or −
Moderately impacted sectors	
Construction	+
Water transportation	?
Energy and utilities	
Energy (electric, gas, oil)	
Energy demand	−1.65
Non-electric space heating	1.16
Water and sanitary	−?
Real estate	
Land-rent component	
Estimate of damage from sea-level rise	
Loss of land	−1.55
Protection of sheltered areas	−0.90
Protection of open coasts	−2.84
Hotels, lodging, recreation	?
Total	
Central estimate	
Billions, 1981 level of national income	−6.23
Percentage of national income	−0.26

Sources for Table 6: Underlying data on impacts are summarised in EPA (1988). Translation into national-income accounts by author. Details are available on request.

"The hyper-precision in the expression of the key number - 0.26% […] shows that this is one of those 'magic numbers' designed to produce confidence in the existence of a hard core of objective fact deep inside the mass of intuitive fuzz."

For Nordhaus - based on a 'hunch' this -0.26% could become -2% …

Table 1
Impact estimates for different sectors, for doubling of CO_2, U.S. (positive number indicates gain; negative number loss) (Nordhaus, 1991, Table 6, p. 932)

Sectors	Billions (1981 $)
Severely impacted sectors	
Farms	
Impact of greenhouse warming and CO_2 fertilisation	−10.6 to +9.7
Forestry, fisheries, other	Small + or −
Moderately impacted sectors	
Construction	+
Water transportation	?
Energy and utilities	
Energy (electric, gas, oil)	
Energy demand	−1.65
Non-electric space heating	1.16
Water and sanitary	−?
Real estate	
Land-rent component	
Estimate of damage from sea-level rise	
Loss of land	−1.55
Protection of sheltered areas	−0.90
Protection of open coasts	−2.84
Hotels, lodging, recreation	?
Total	
Central estimate	
Billions, 1981 level of national income	−6.23
Percentage of national income	−0.26

Sources for Table 6: Underlying data on impacts are summarised in EPA (1988). Translation into national-income accounts by author. Details are available on request.

The myth of scientific quantification via risk or cost benefit analyses, including of the impact of new technologies, has been at the hearth of the critique of the ecological moment (e.g. Schumacher, 1973; Winner, 1986; Funtowicz and Ravetz, 1994)

E. F. Schumacher, 1973, Small Is Beautiful. Economics as if People Mattered, Penguin Perennial,

Winner, L., 1986. The Whale and the Reactor: a Search for Limits in an Age of High Technology. The University of Chicago Press, 1989 edition.

Funtowicz, S.O. and Ravetz, J.R. (1994). The worth of a songbird: Ecological economics as a post-normal science. Ecological Economics 10(3), 197-207.

[…] quality is much more difficult to 'handle' than quantity, just as the exercise of judgment is a higher function than the ability to count and calculate.

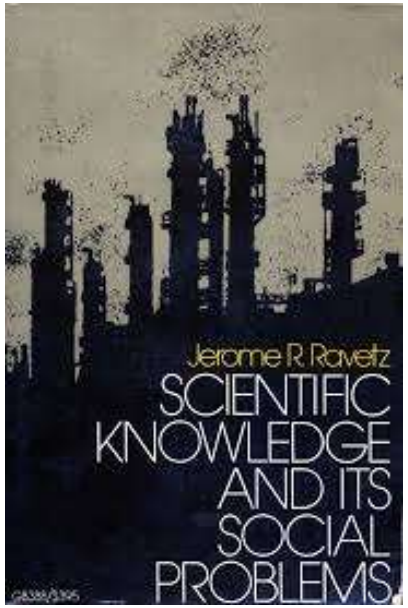
Ernst Friedrich "Fritz" Schumacher

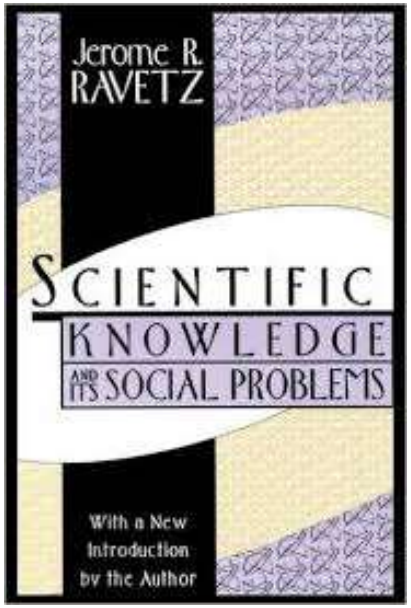
Quantitative differences can be more easily grasped and certainly more easily defined than qualitative differences: their concreteness is beguiling and gives them the appearance of scientific precision, even when this precision has been purchased by the suppression of vital differences of quality.

E. F. Schumacher, 1973, Small Is Beautiful. Economics as if People Mattered, Penguin Perennial,

Where PNS comes from:

In 1971: a new critical science; from a science to domesticate nature (Bacon) to a science to remedy damages done by science and technology





The book includes a detailed prediction of the present problems of science quality system

Where PNS comes from: book in 1990 introducing key concepts of uncertainty and quality

"Ignorance and error interact with knowledge and power more intimately than was ever conceived hitherto"

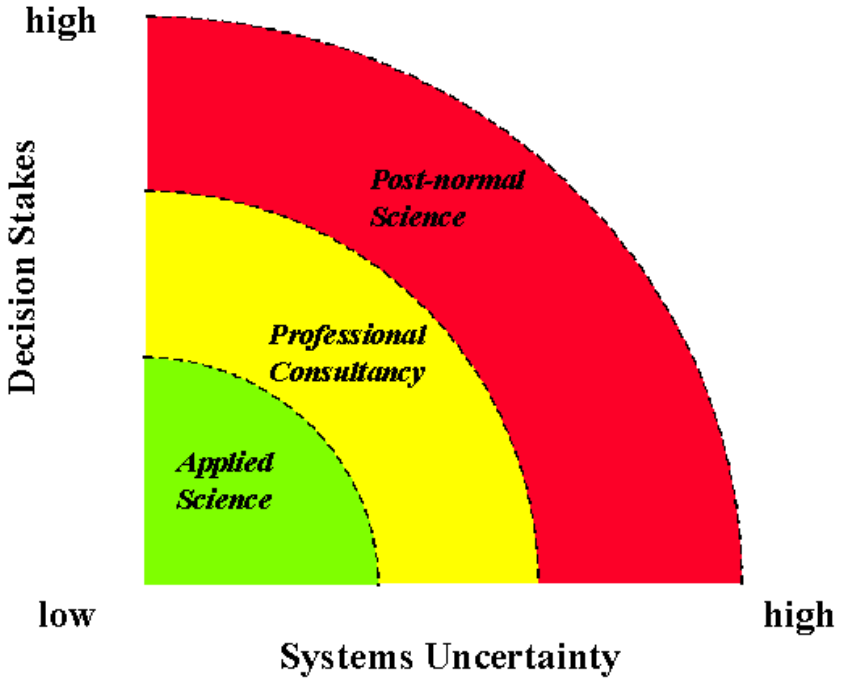
Even 'numbers' need an assessment of quality ➔ NUSAP

Funtowicz, S. O. and Ravetz, J. R., 1990, Uncertainty and quality in science for policy, Dordrecht: Kluwer.

What is PNS? An empirical insights, not a doctrine

The **Mantra:** Facts uncertain, stakes high, values in dispute, decisions urgent

The iconic diagram: uncertainty (extending probability) and stakes (extending harm) not independent



Funtowicz, S. O. & Ravetz, J. R. 1993. Science for the post-normal age. Futures, 25(7), 739–755.

The mission to truth replaced by the mission to quality

From ‘speaking truth to power’ towards ‘working deliberatively within imperfections’;

PNS concentrates on: the communication of uncertainty, the assessment of quality, and the justification and practice of the extended peer communities.

Funtowicz, S. O. & Ravetz, J. R. 1993. Science for the post-normal age. Futures, 25(7), 739–755.

Post Normal Science's model of Extended Participation:

1. Across disciplines – acknowledging that different disciplines see though different lenses, and
2. Across communities of both experts and stakeholders; issues of fairness and quality.

Funtowicz, S. O. & Ravetz, J. R. 1993. Science for the post-normal age. Futures, 25(7), 739–755.

Example of fields where PNS can be of use:

"eradication of exogenous pests […], offshore oil prospecting, legalization of recreational psychotropic drugs, water quality, family violence, obesity, teenage morbidity and suicide, the ageing population, the prioritization of early -childhood education, reduction of agricultural greenhouse gases, and balancing economic growth and environmental sustainability"

Gluckman, P., 2014, Policy: The art of science advice to government, Nature, 507, 163–165.

NUSAP, is a notational system for the management and communication of uncertainty in science for policy

Funtowicz, S. O. and Ravetz, J. R., 1990, Uncertainty and quality in science for policy, Dordrecht: Kluwer.

PNS toolbox

NUSAP is based on five categories for characterizing any quantitative statement: Numeral, Unit, Spread, Assessment and Pedigree

Jeroen van der Sluijs,

van der Sluijs, J., Craye, M., Funtowicz, S., Kloprogge, P., Ravetz, J., and Risbey, J. (2005) Combining Quantitative and Qualitative Measures of Uncertainty in Model based Environmental Assessment: the NUSAP System, Risk Analysis, 25 (2). p. 481-492.see also http://www.nusap.net/

Classic scientific notational system:

"Numeral"

"Unit Spread"

For problems in the post-normal domain, add two qualifiers: Assessment & Pedigree

- **"Assessment"** expresses expert judgement on reliability of numeral + spread
- **"Pedigree"** expresses multi-criteria evaluation of the strength of a number by looking at:
  - Background history by which the number was produced
  - Underpinning and scientific status of the number

Example Pedigree matrix parameter strength

Code	Proxy	Empirical	Theoretical basis	Method	Validation
4	Exact measure	Large sample direct mmts	Well established theory	Best available practice	Compared with indep. mmts of same variable
3	Good fit or measure	Small sample direct mmts	Accepted theory partial in nature	Reliable method commonly accepted	Compared with indep. mmts of closely related variable
2	Well correlated	Modeled/derived data	Partial theory limited consensus on reliability	Acceptable method limited consensus on reliability	Compared with mmts not independent
1	Weak correlation	Educated guesses / rule of thumb est	Preliminary theory	Preliminary methods unknown reliability	Weak / indirect validation
0	Not clearly related	Crude speculation	Crude speculation	No discernible rigour	No validation

Why extended participation is important?

Transactions of the Institute of British Geographers
Royal Geographical Society with IBG
Advancing geography and geographical learning

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, …

Years of modeling stream flow and cost/benefit ratios for flood protection structures had failed to consider an alternative intervention—upstream storage of flood waters until local stakeholders were brought into the modeling process.

According to Lane and colleagues, upstream storage was neglected in the models because of the "use of a pit-filling algorithm that made sure that all water flows downhill"!

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

Frank Miedema

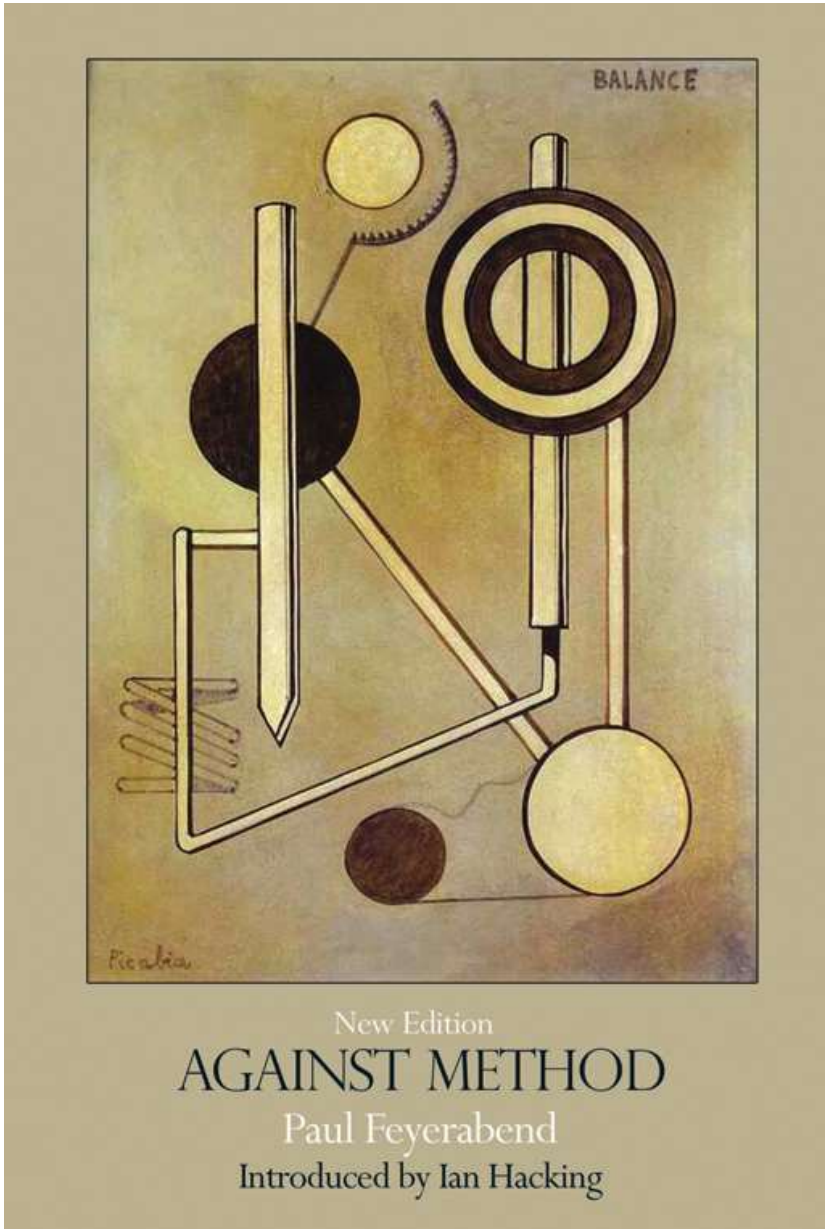
theguardian

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

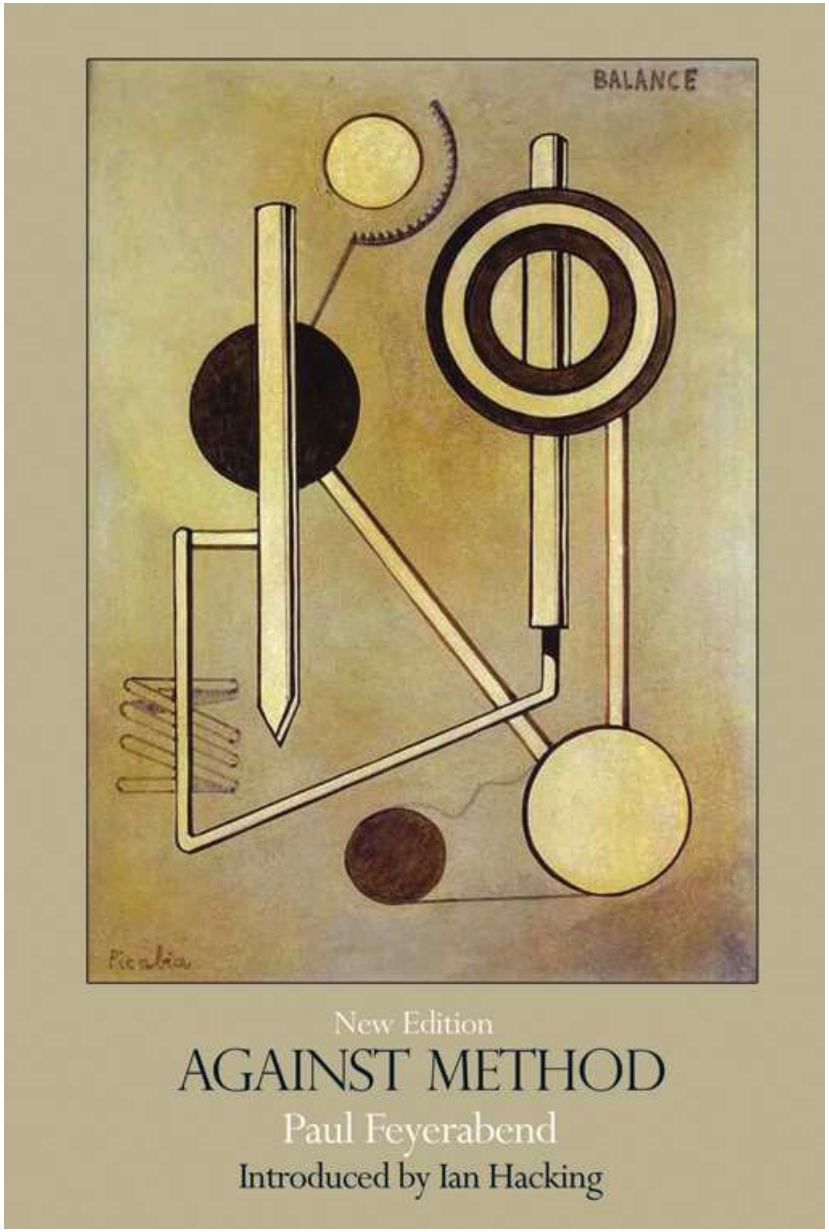
Thursday 12 May 2016 09.00 BST

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.

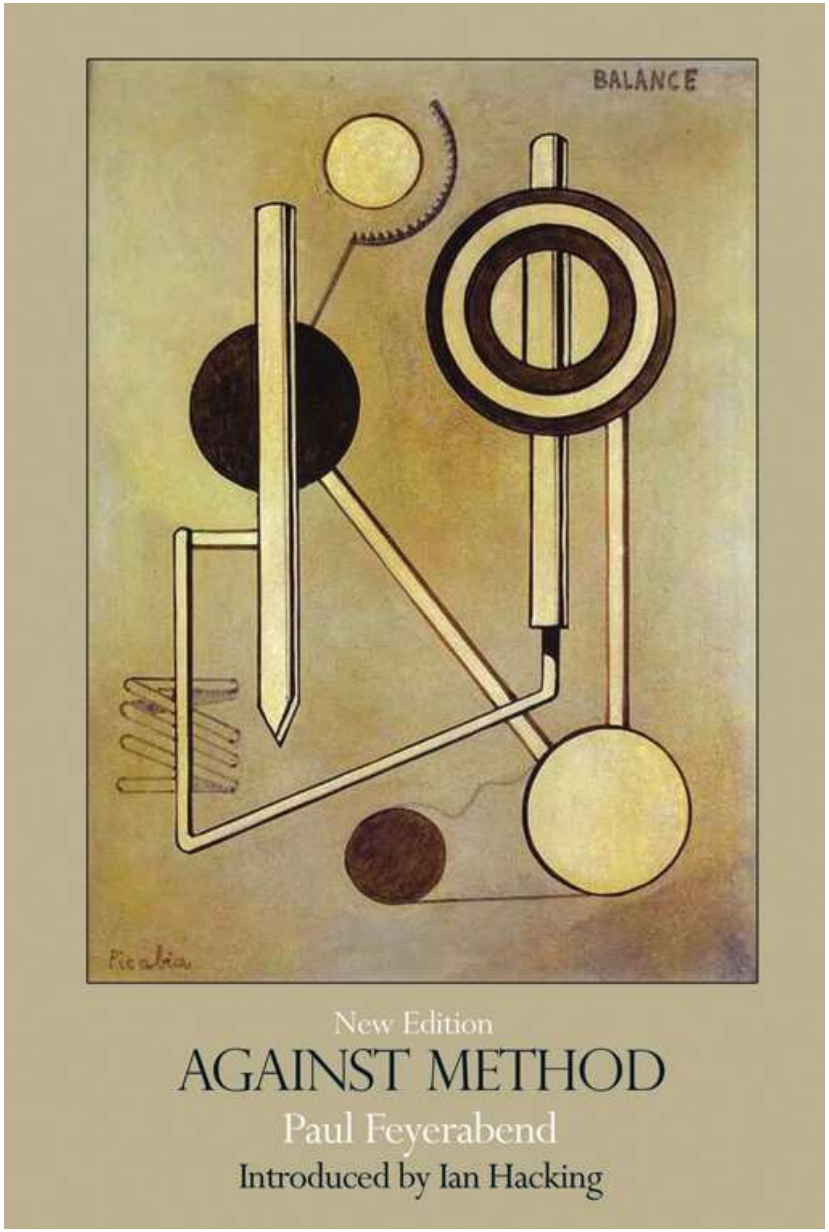


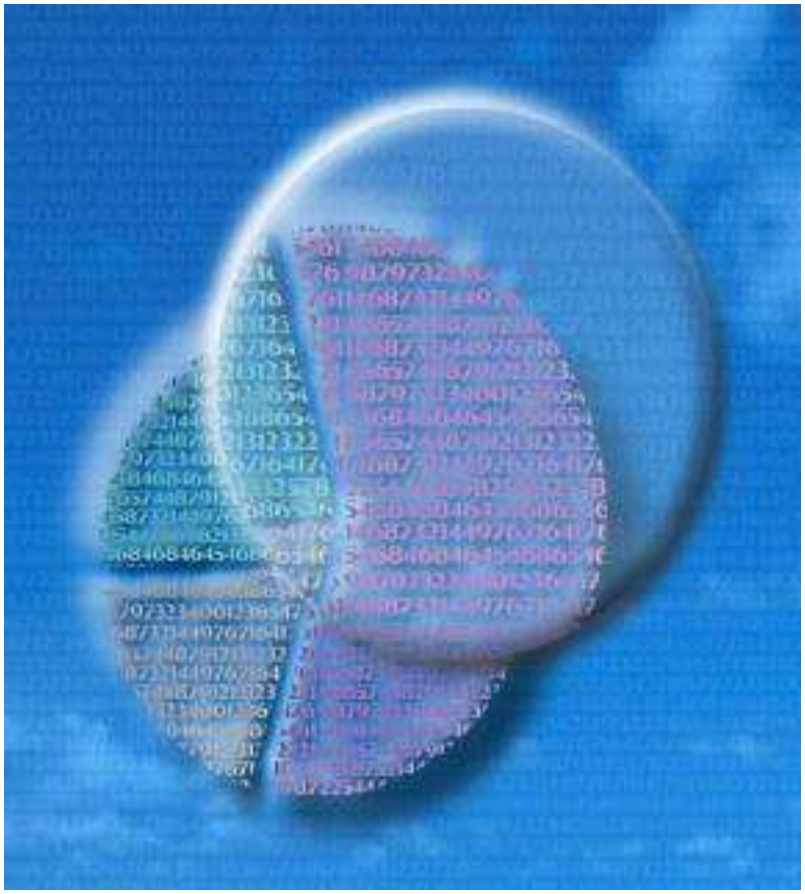
The objections that citizens do not have the expertise to judge scientific matters overlooks that important problems often lie across the boundaries of various sciences so that scientists within these sciences don't have the needed expertise either.



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.**

P. 262





END

Twitter:
@andreasaltelli