# Is there really a crisis in science?

@andreasaltelli, Centre for the Study of the Sciences and the Humanities, University of Bergen &
Institut de Ciència i Tecnologia Ambientals – Universitat Autonoma de Barcelona

Seminar at Technical University of Denmark – DTU, Lyngby Campus, Chemical Engineering, June 1st 2017

Where to find this talk: www.andreasaltelli.eu


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

# The spirit of P

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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

"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"

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

# 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?

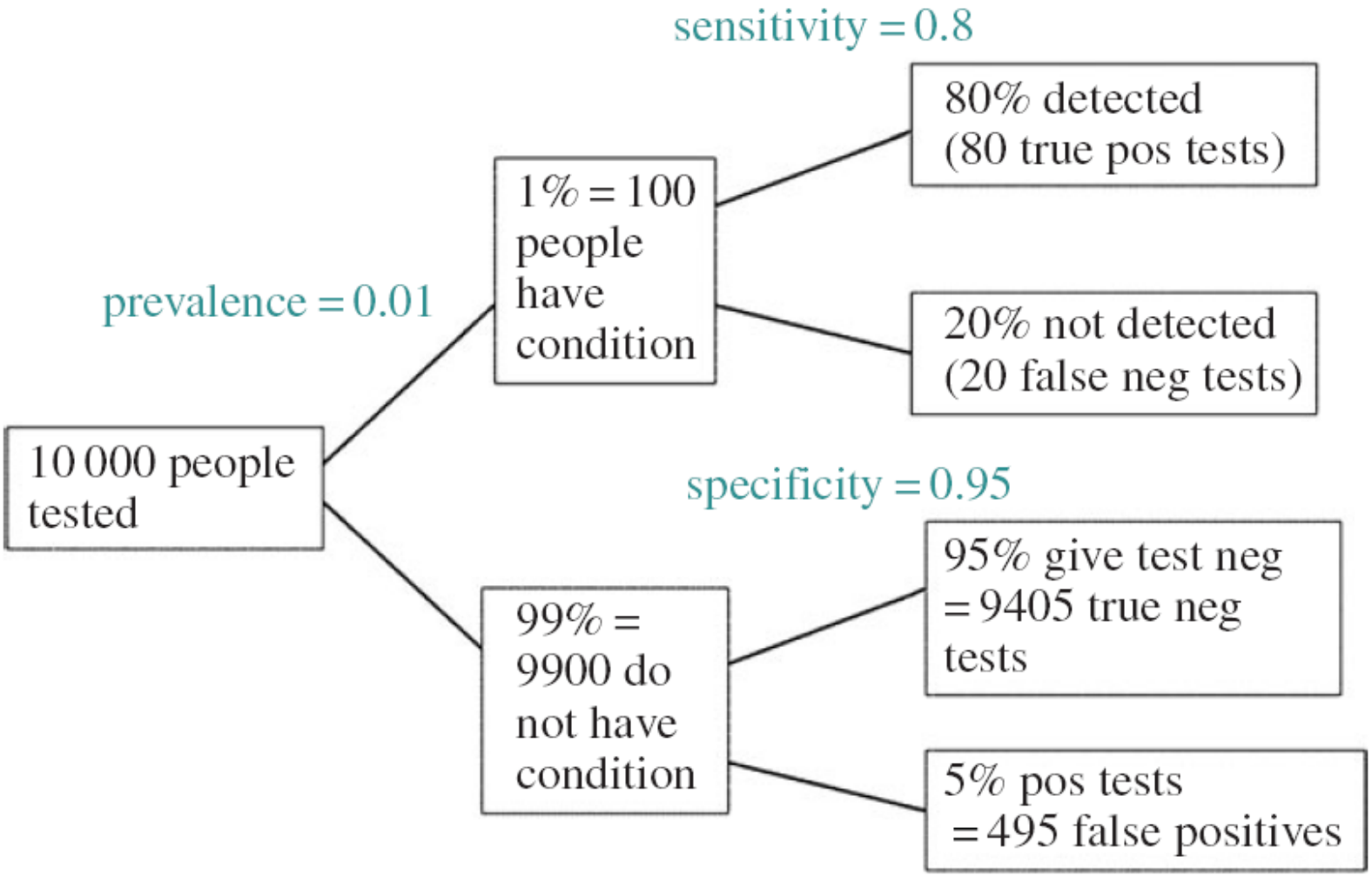
MCI prevalence in the population 1%, i.e. in a sample of 10,000 then 100 have MCI and 9,900 don't

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!

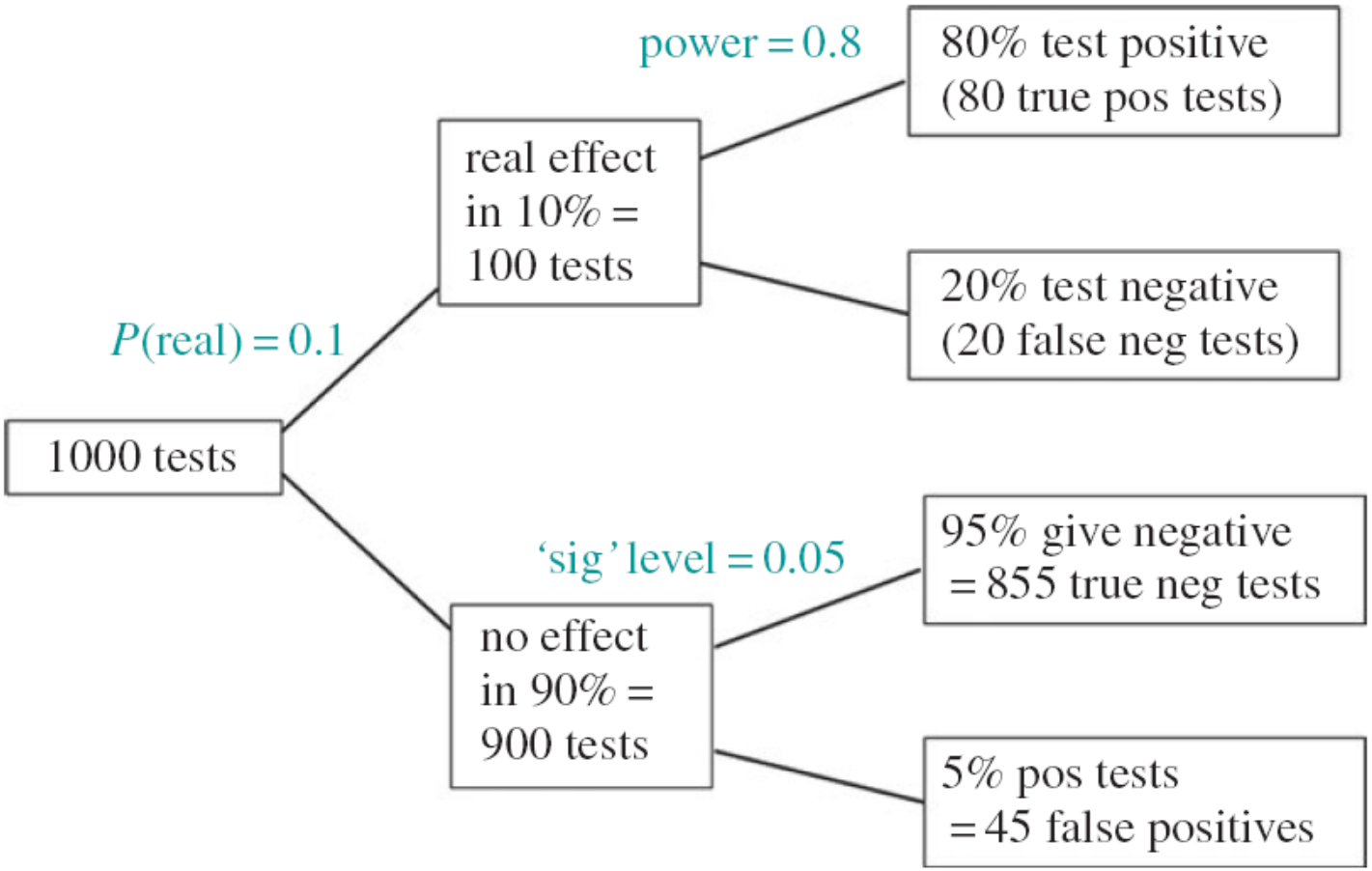
# The number 86% = 495/(495+80) is our false discovery rate




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 same concept of false discovery rate applies to the problem of significance test in experimental life

# We now consider tests (**studies!**) instead of individuals

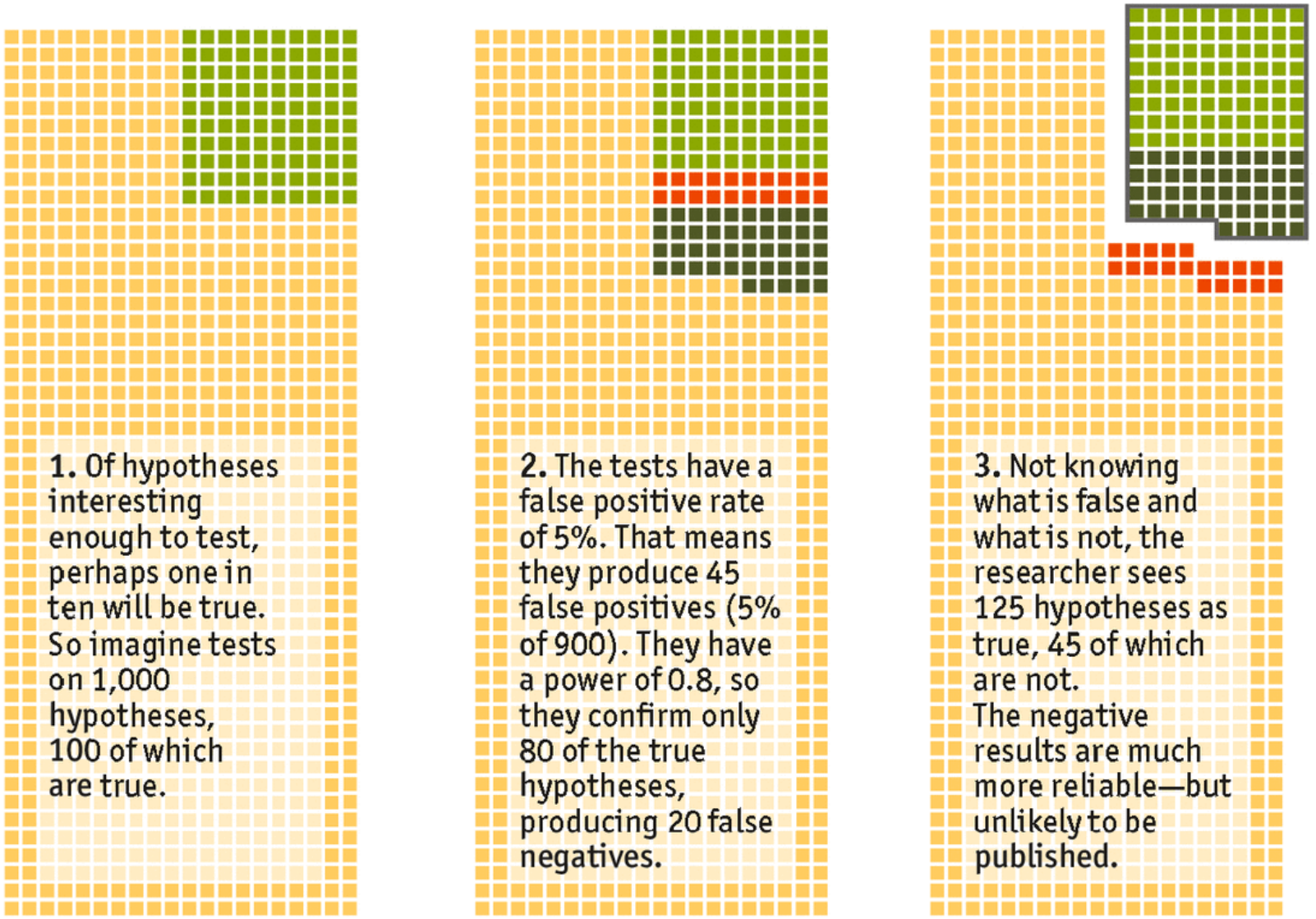



Colquhoun D. 2014 An investigation of the false discovery rate and the misinterpretation of p-values. R. Soc. Open sci. 1: 140216. http://dx.doi.org/10.1098/rsos.140216

## Unlikely results

How a small proportion of false positives can prove very misleading

The false discovery rate is ~the dark divided by the light green




Source: *The Economist*

➔ 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

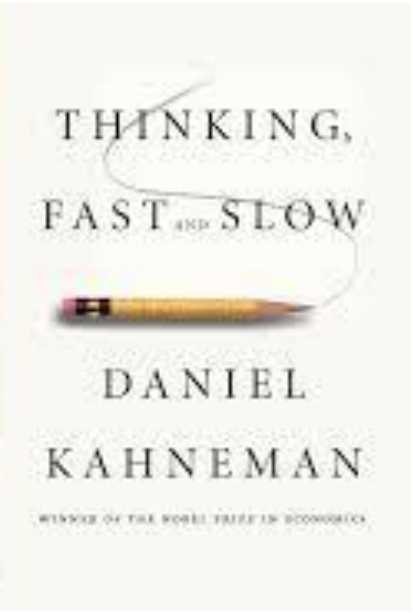
Replicability-Index
*Improving the replicability of empirical research*

# 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**

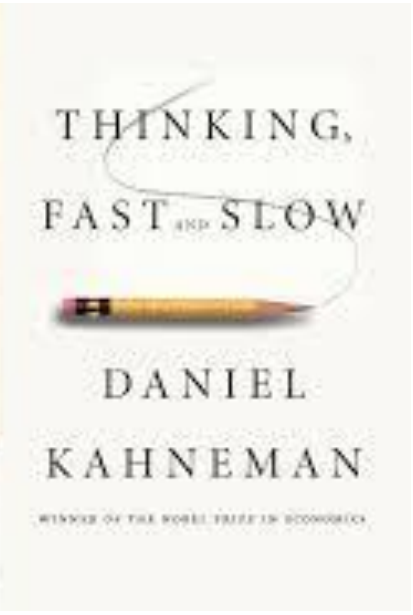
Reconstruction of a Train Wreck: How Priming Research Went off the Rails




"[…]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-of-the-rails/comment-page-1/

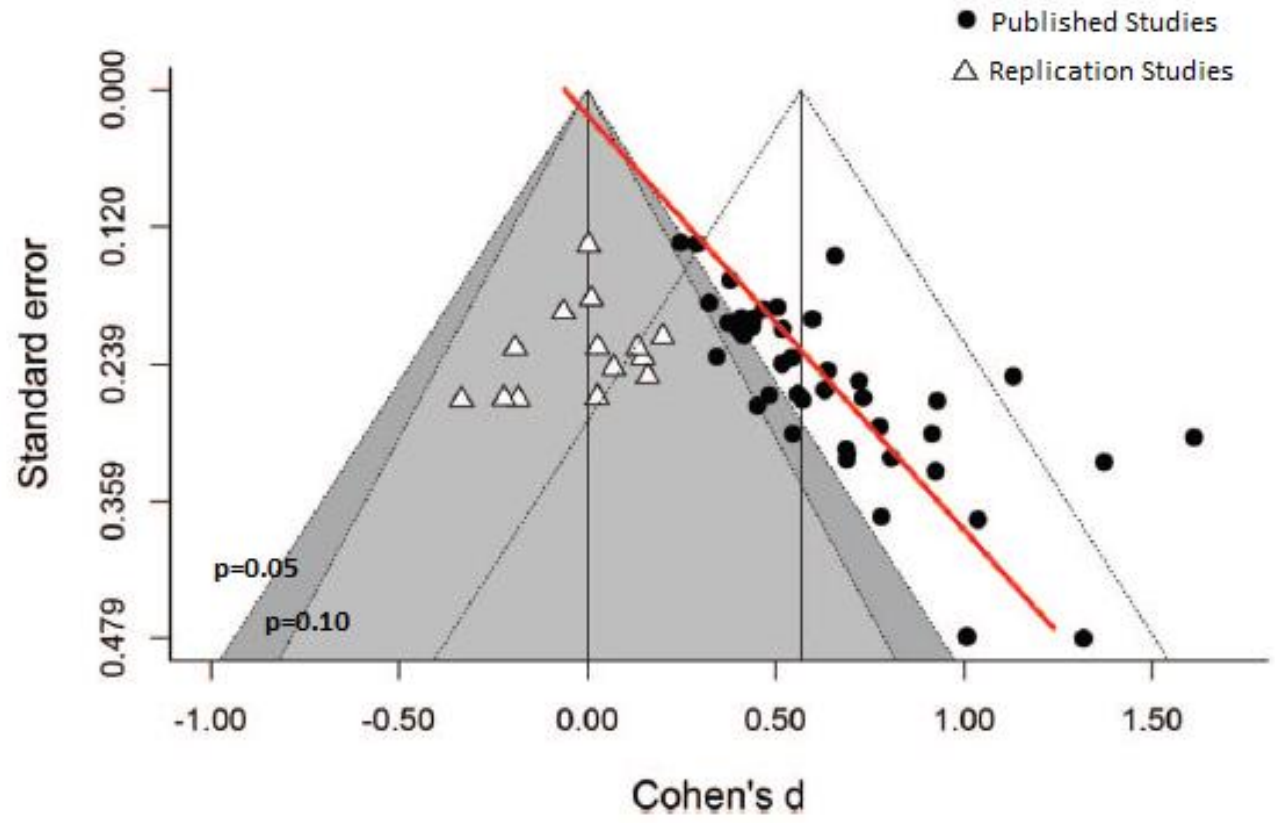
Reconstruction of a Train Wreck: How Priming Research Went off the Rails




"… 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/comment-page-1/

# 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, Puhlmann LM.: http://www.ncbi.nlm.nih.gov/pubmed/26501730

IN FOCUS NEWS

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

ASA News
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**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/

**Special Issue:**
Bayesian Probability and Statistics in Management Research

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


**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*

There is no universal method of scientific inference …

…it is better to have no beliefs than to embrace falsehoods…

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

**Special Issue:**
Bayesian Probability and Statistics in Management Research

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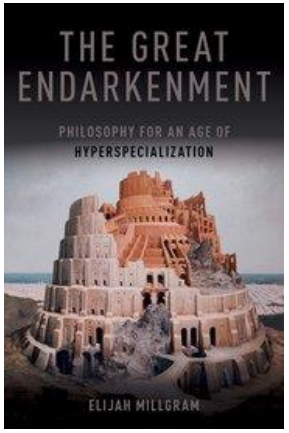
**Editorial Commentary**

## 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*

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

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

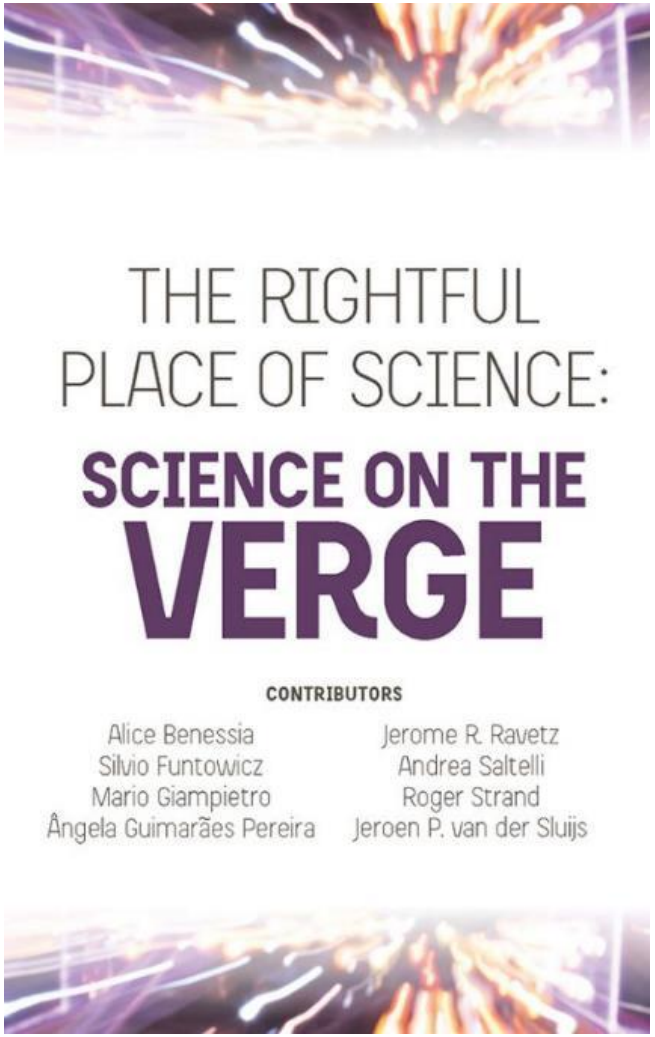



Describes a world in which all knowledge and products are the result of some form of extremely specialized expertise, and in which expertise is itself highly circumscribed, since experts depend in turn on other experts whose knowledge claims and styles of argumentation cannot be exported from one discipline to the next. ➔ “serial hyperspecializers” (p. 26)

Experts thus become “logical aliens” (p. 32)

# Theses for today

**First thesis:** Science is in a deep existential crisis which has ethical, epistemological, methodological and even metaphysical dimensions.



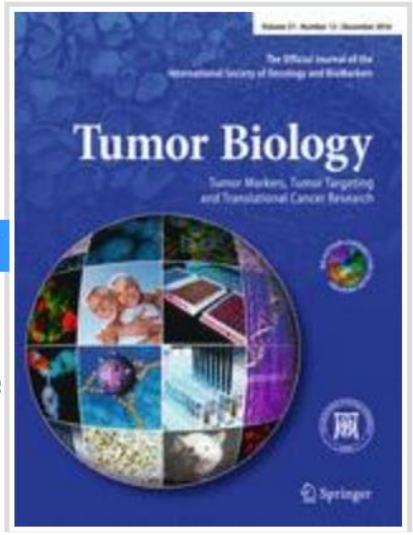

A crisis looms over the scientific enterprise. Not a day passes without news of retractions, failed replications, fraudulent peer reviews, or misinformed science-based policies

Retraction Watch April 20, 2017 Tracking retractions as a

# 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.

Article | Figures & data | Metrics | Article & author info

# Reproducibility in cancer biology: Making sense of replications

Brian A Nosek, Timothy M Errington

Center for Open Science, United States; University of Virginia, United States

DOI: http://dx.doi.org/10.7554/eLife.23383
Published January 19, 2017
Cite as eLife 2017;6:e23383

January 19, 2017

## Abstract

The first results from the Reproducibility Project: Cancer Biology suggest that there is scope for improving reproducibility in pre-clinical cancer research.

DOI: http://dx.doi.org/10.7554/eLife.23383.001

PART OF A
REPRODUCIBILITY PROJECT
Cancer Biology

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> Current Issue > vol. 114 no. 14 > Daniele Fanelli, 3714–3719, doi: 10.1073/pnas.1618569114

Check for updates

# Meta-assessment of bias in science

April 04, 2017

Daniele Fanelli[a,1], Rodrigo Costas[b], and John P. A. Ioannidis[a,c,d,e]

Author Affiliations

Edited by Susan T. Fiske, Princeton University, Princeton, NJ, and approved February 14, 2017 (received for review November 8, 2016)

This Issue


April 4, 2017
vol. 114 no. 14
Masthead (PDF)
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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



*Paul Thacker, freelance journalist*

Author affiliations

thackerpd@gmail.com

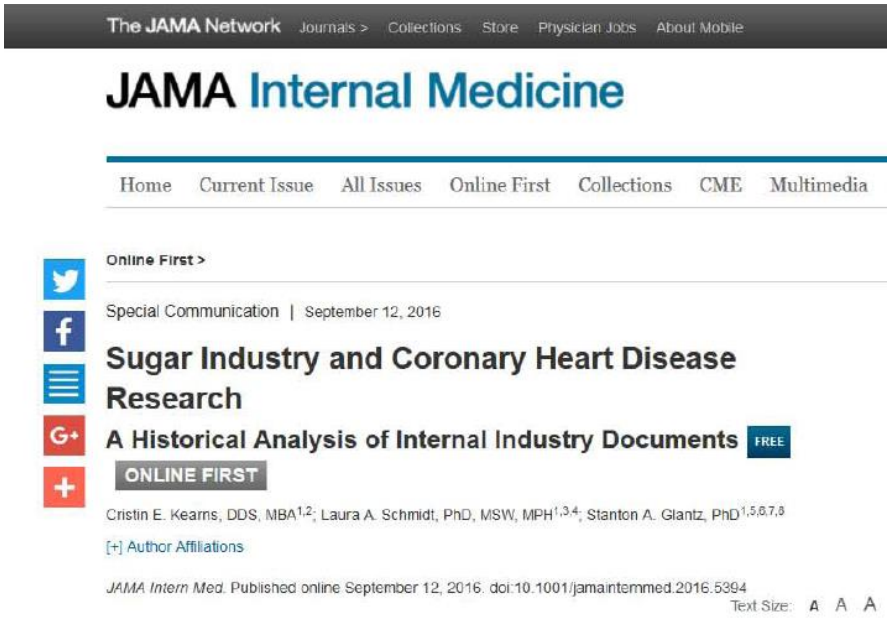
April 05, 2017

“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.

[…] When challenged about funding of the series of conferences, the academics involved weren’t forthcoming about industry involvement.”

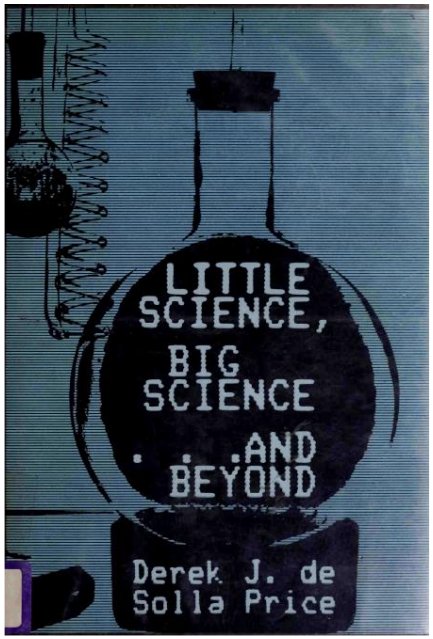

See also https://www.theguardian.com/society/2016/apr/07/the-sugar-conspiracy-robert-lustig-john-yudkin, and the story of US President Dwight Eisenhower heart attack,…

"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]"

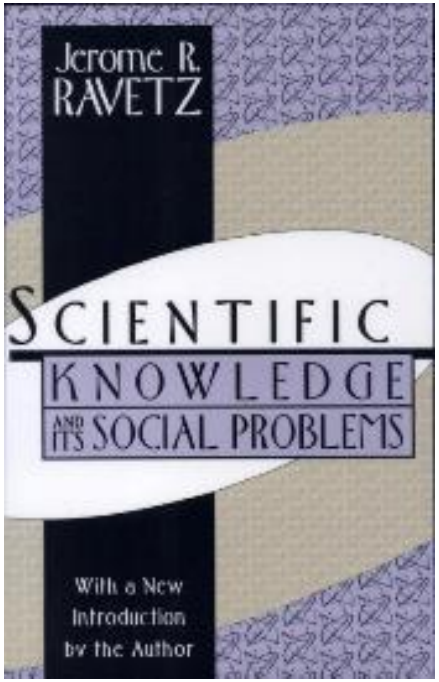



http://archinte.jamanetwork.com/article.aspx?articleid=2548255

# The crisis was predicted by E. de Solla Price, Jerome R. Ravetz and others five decades ago



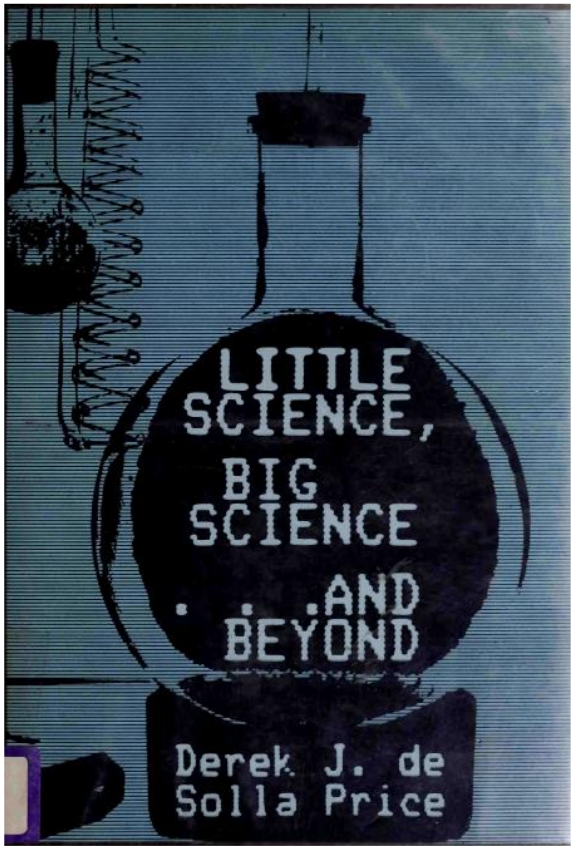

Derek J. de Solla Price




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.

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.

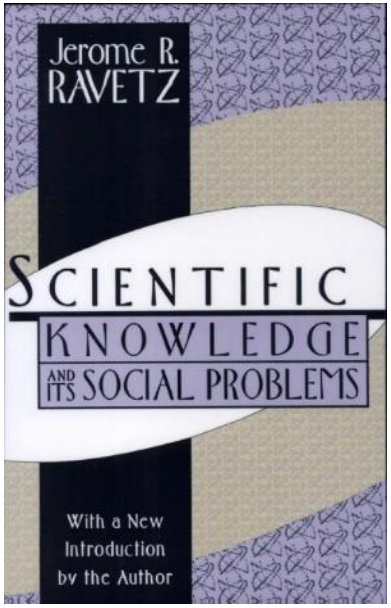

# Science/knowledge degenerates when it becomes a commodity for Ravetz (1971), and Mirowski (2011).

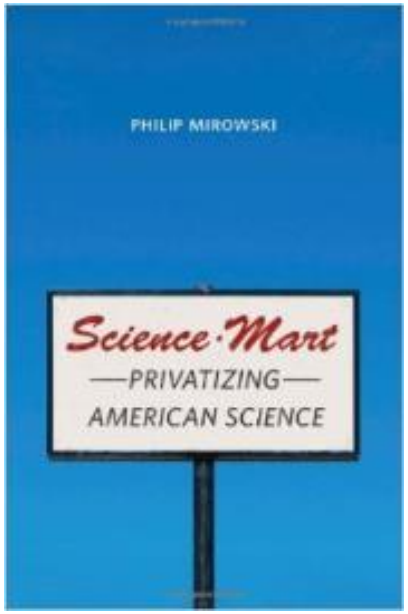
Ravetz, J., 1971, Scientific Knowledge and its Social Problems, Oxford University Press, p. 22.

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

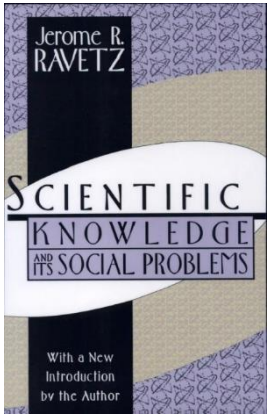
Jerome R. Ravetz

Philip Mirowski



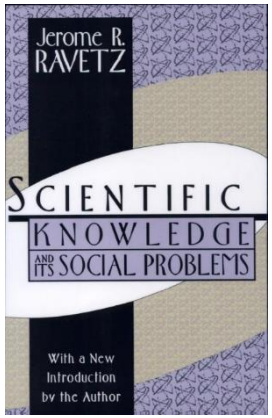
p.22: “with the industrialization of science, certain changes have occurred which weaken the operation of the traditional mechanism of quality control and direction at the highest level.




Jerome R. Ravetz

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

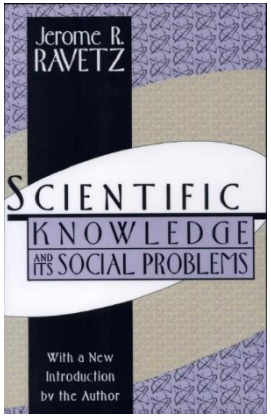
p.22: […] The problem of quality control in science is thus at the centre of the social problems of the industrialized science of the present period.”




Jerome R. Ravetz

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

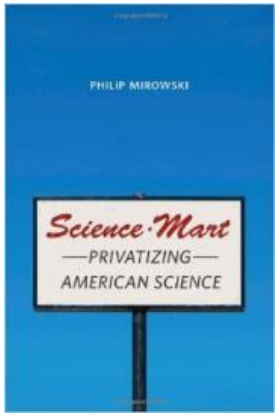
p.22: “If [science] fails to resolve this problem [⋯] then the immediate consequences for morale and recruitment will be serious; and those for the survival of science itself, grave”




Jerome R. Ravetz

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

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)…

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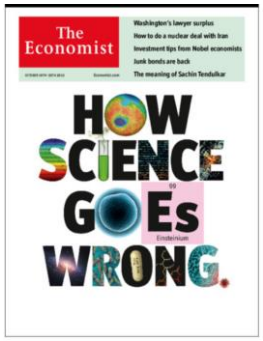





Unreliable research

# 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



John P. A. Ioannides

*Open access, freely available online*

**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.

Open access, freely available online

Essay

# Why Most Published Research Findings Are False

John P. A. Ioannidis

John P. A. Ioannides

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.

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

# More from the same author

**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

THE LANCET

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.

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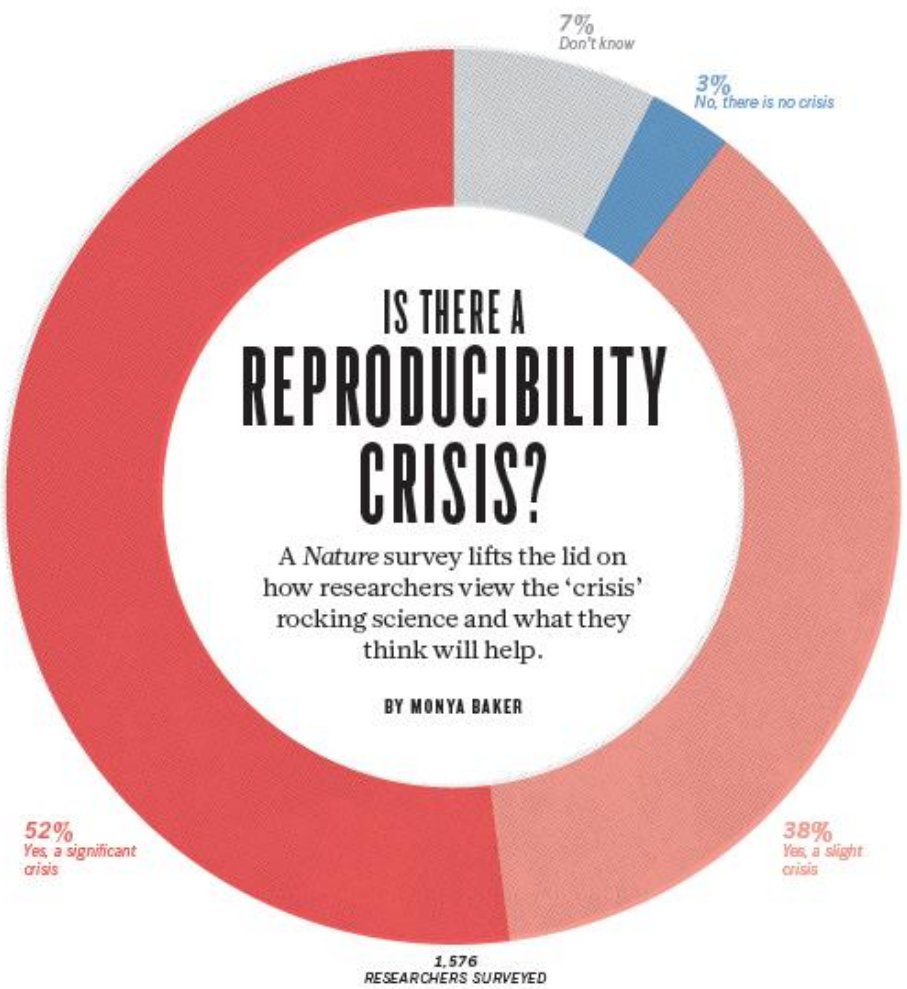
NATURE | NEWS FEATURE

# 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

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NATURE | NEWS FEATURE

# 1,500 scientists lift the lid on reproducibility

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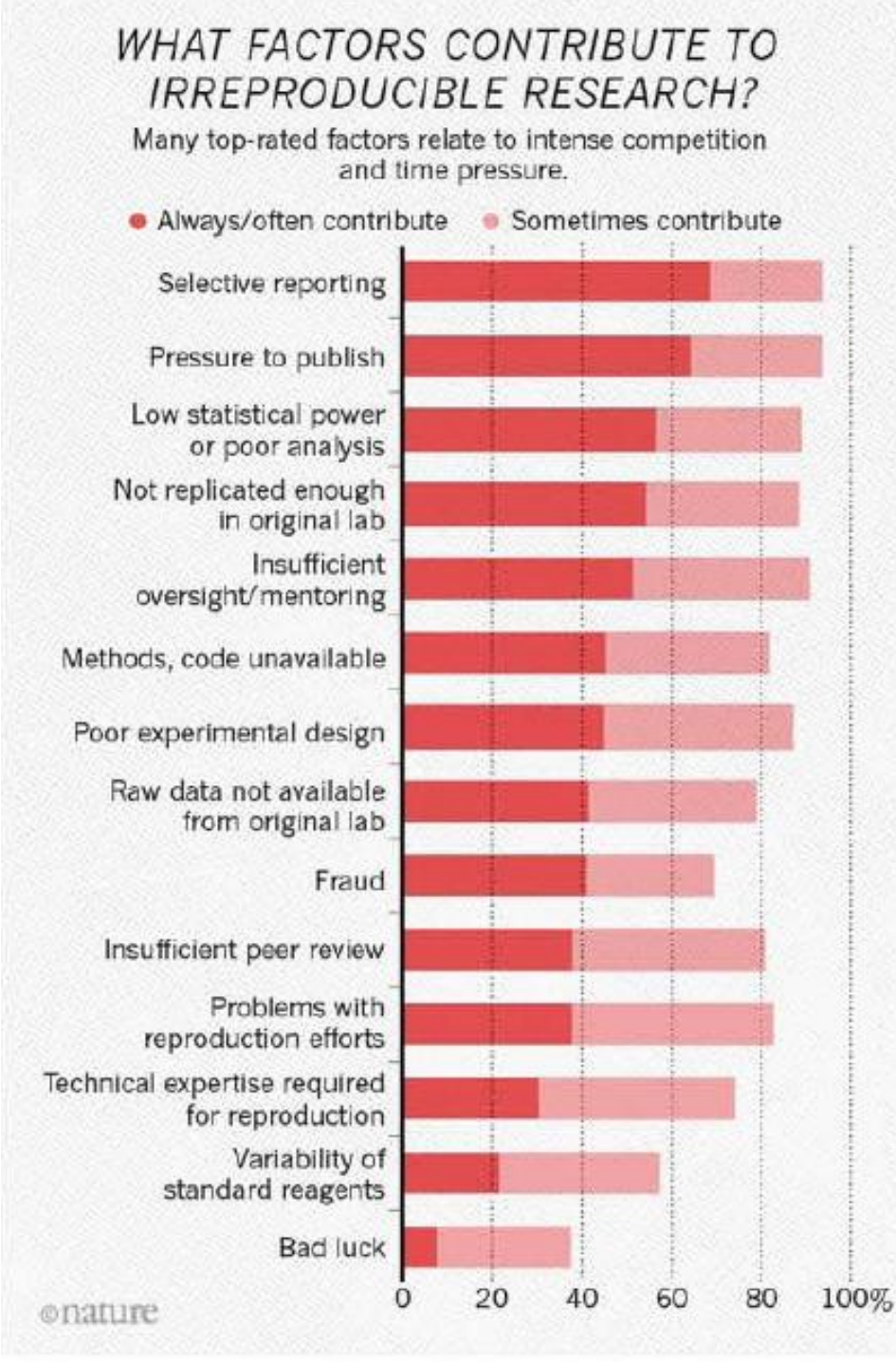
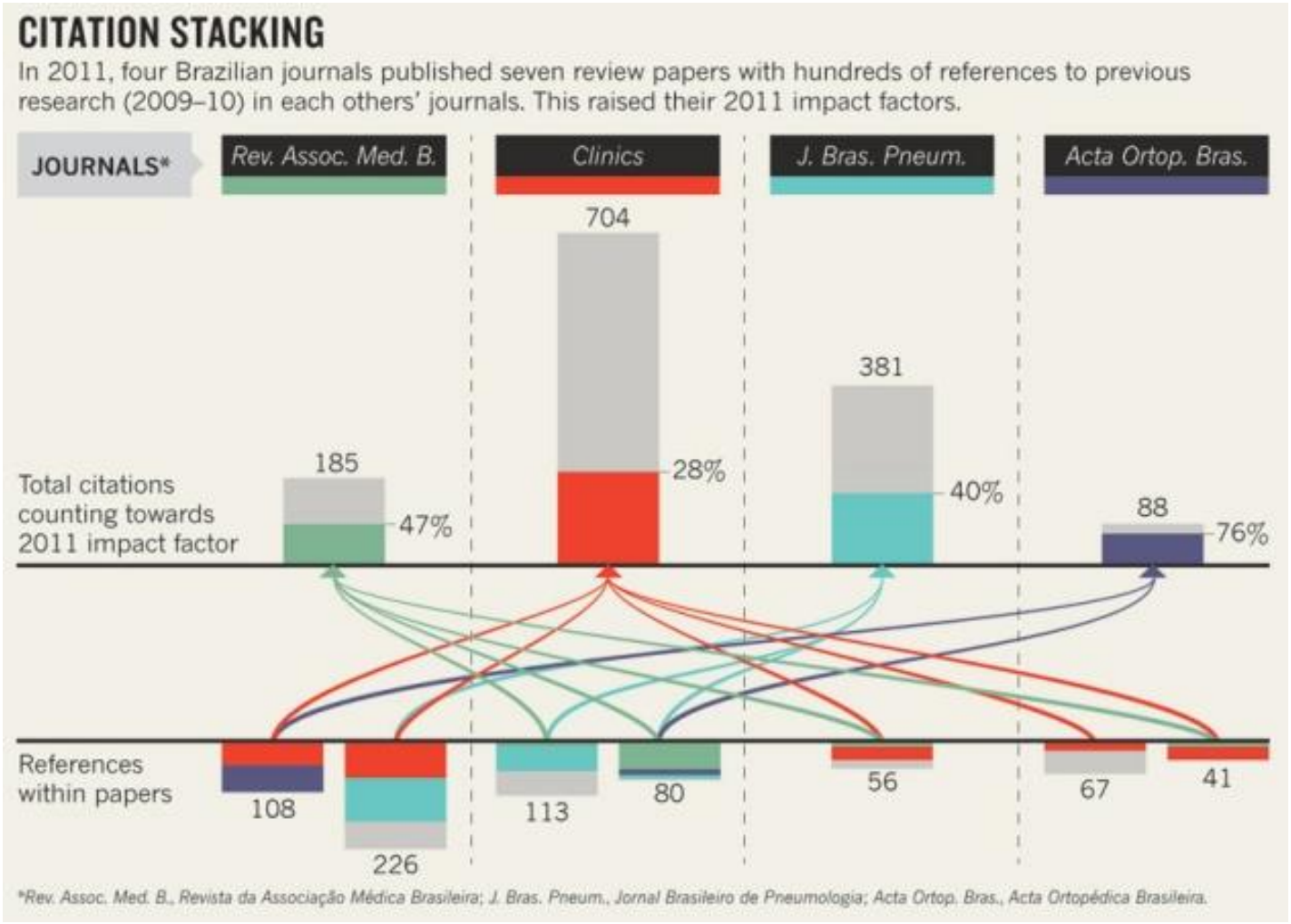


# Use and abuse of metrics: from self-citation to citation cartels to citation stacking …




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

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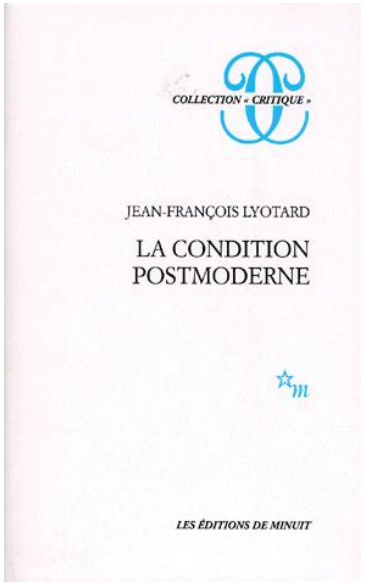
# Science in crisis: from the sugar scam to Brexit, our faith in experts is fading

September 27, 2016 4.43pm AEST

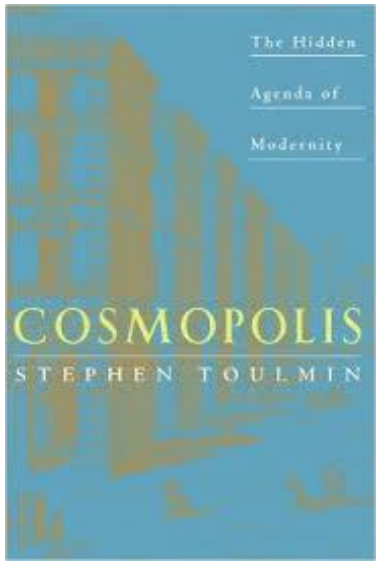
A summary of the crisis versus post-truth nexus

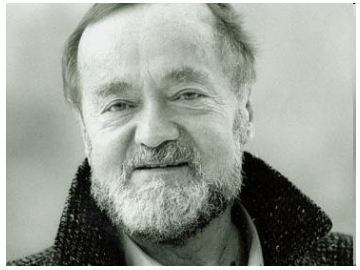
https://theconversation.com/science-in-crisis-from-the-sugar-scam-to-brexit-our-faith-in-experts-is-fading-65016

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




Jean-François Lyotard



Stephen Toulmin

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

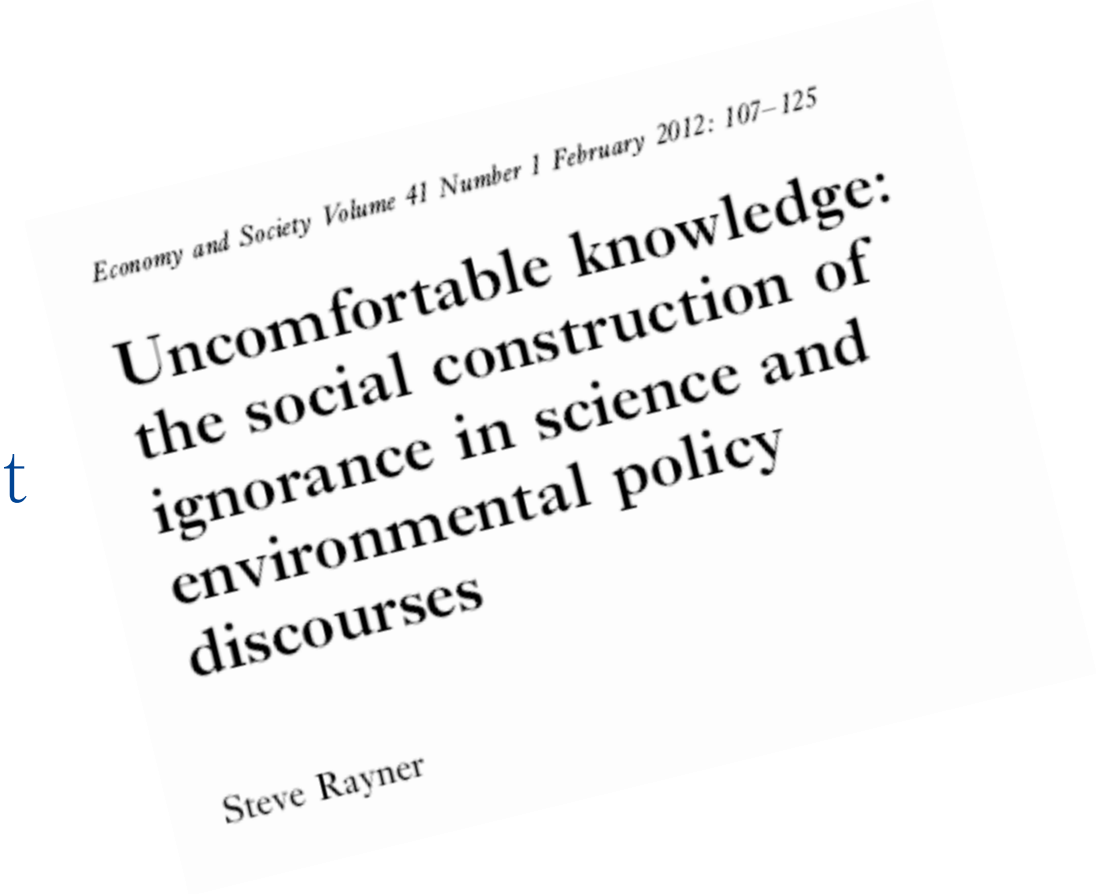
**Thesis 3:** Science and its institutions are committed to the status quo & attempt to evade a critical reflection with:

Denial

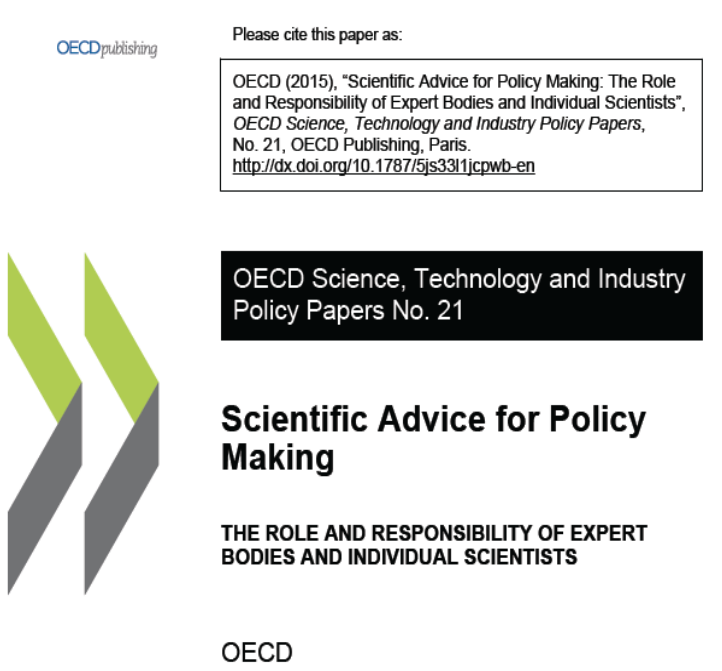
Dismissal

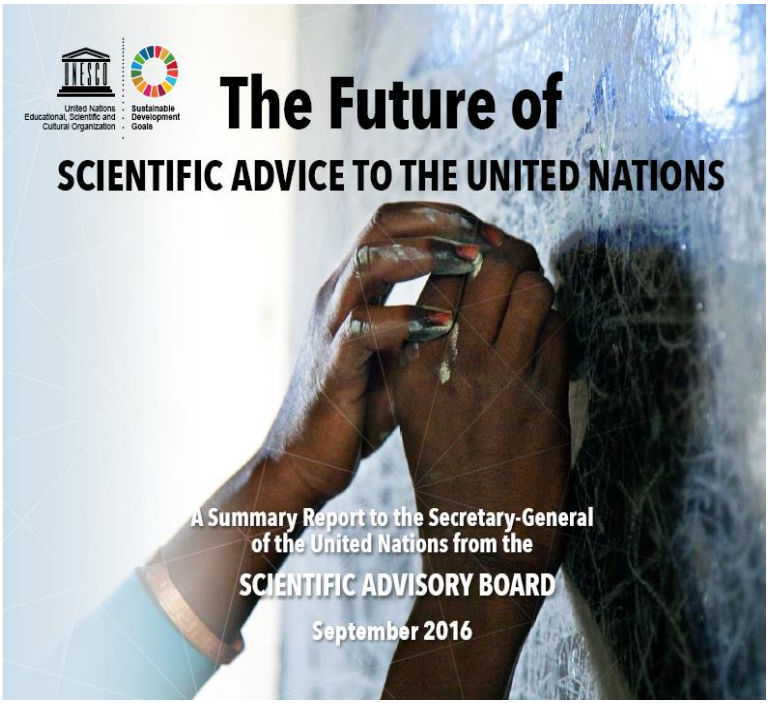
Diversion

Displacement



# Denial (1)



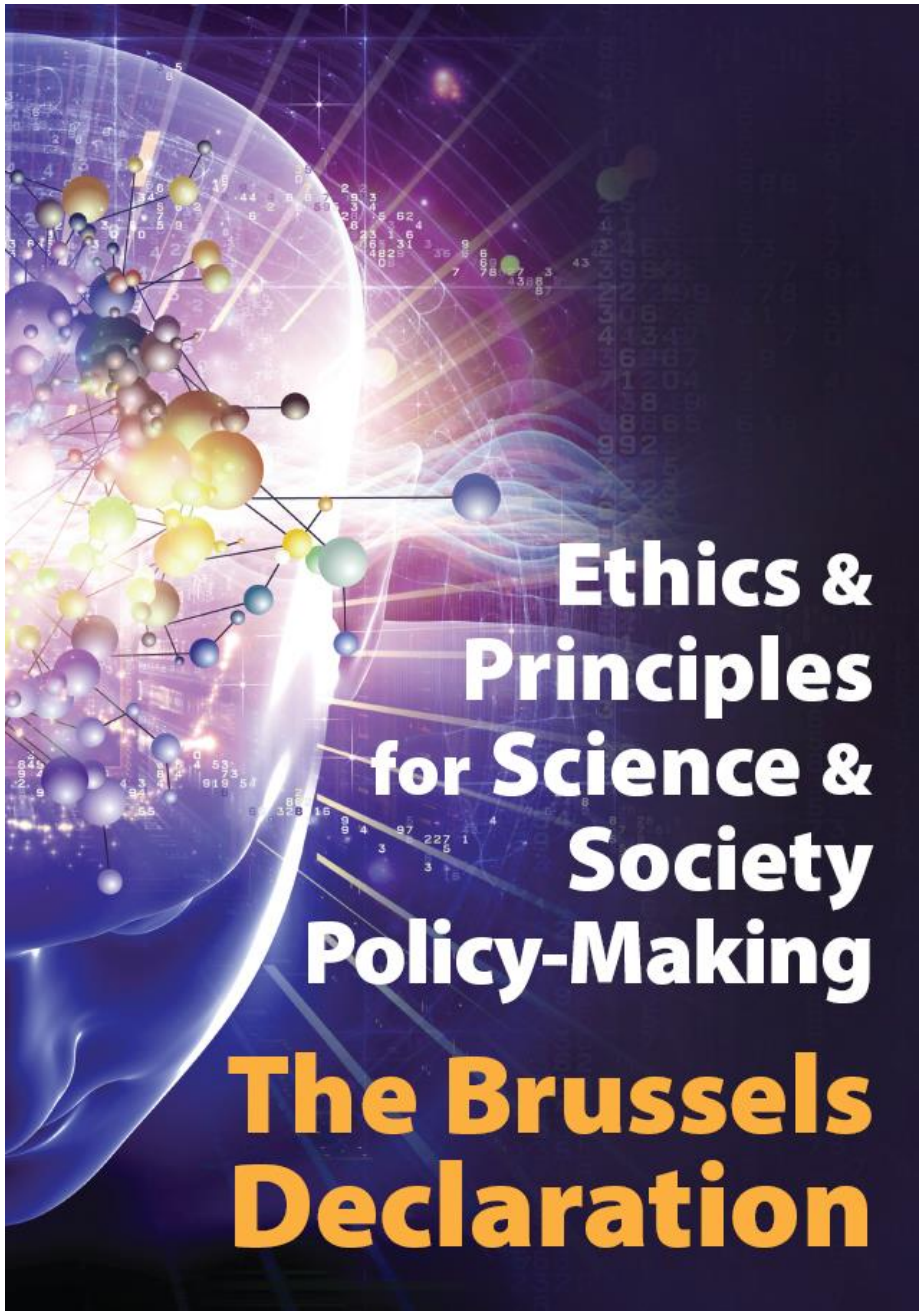

2015

2016

# Denial (2)

Adopted on 17th February, 2017, at symposium of American Association for the Advancement (AAAS) after 5 y gestation, hundreds of experts involved

- No crisis
- No effect of crisis on evidence based policy
- No asymmetries in the use and availability of evidence for policy (citizens same power as lobbyists)



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]

Denial (3)

JCE
JOURNAL OF CLINICAL EPIDEMIOLOGY



< Previous Article | May 2016 Volume 73, Pages 82–86 | Next Article >



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

John P.A. Ioannidis

Power asymmetries in the framing of issues;
Instrumental use of quantification to obfuscate;
➔ open the space of possible narratives and control their quality **(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)**

# Dismissal? We can solve it!


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

# But …can we do it from the inside?

TABLE 1. GROWING PERVERSE INCENTIVES IN ACADEMIA

| *Incentive* | *Intended effect* | *Actual effect* |
|---|---|---|
| "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*

"Researchers rewarded for increased number of publications."

*Intended 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

# Dismissal (2)

A different theory is:
'too many scientists
=
many bad papers'
==> stick to the good (high H) scientists!

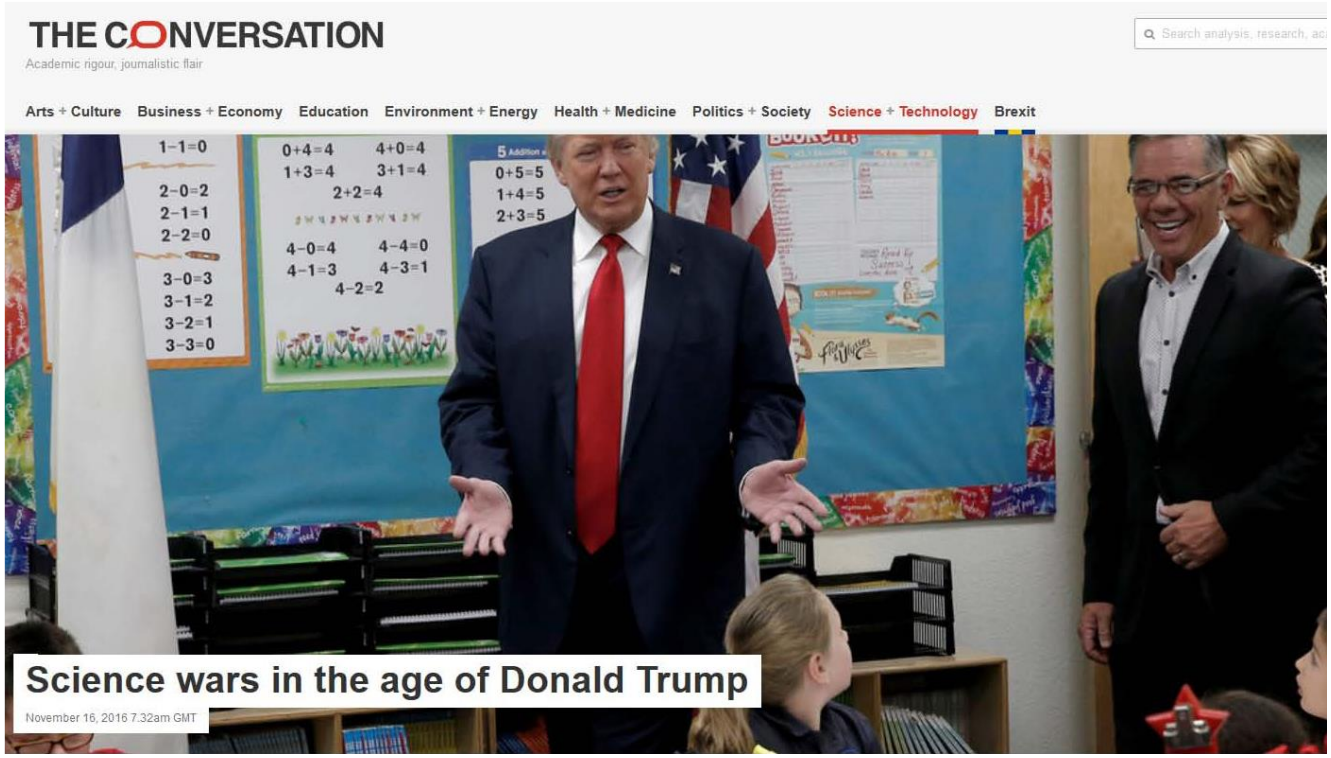

But: "studies by highly cited authors ... were not more affected by bias than average"

https://phys.org/news/2017-03-scientific-bias-problems.html

http://www.pnas.org/content/114/14/3714.abstract

**Daniele Fanelli, Rodrigo Costas, and John P. A. Ioannidis, Meta-assessment of bias in science, PNAS vol. 114 no. 14, 3714–3719**

# 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)

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

# Displacement (This is the post-truth era)

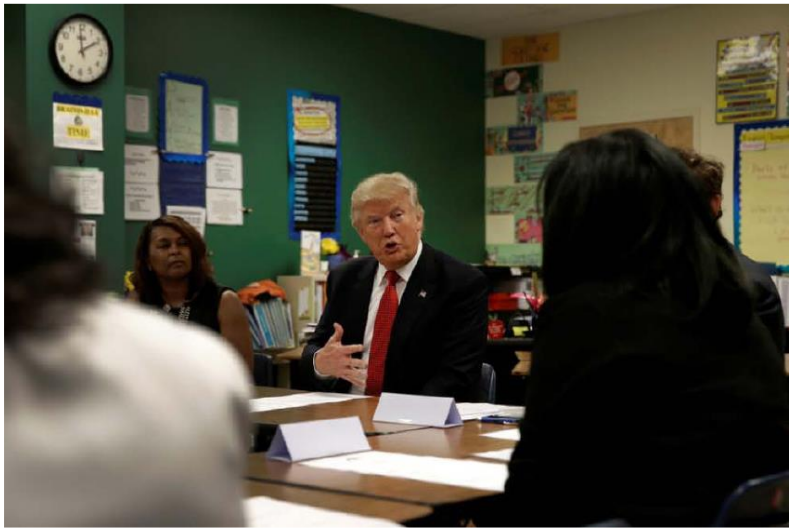
THE CONVERSATION

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

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

# Displacement (This is the post-truth era)


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Was policy based on evidence before Brexit and Trump?

"Trump is not science's problem. Science is."

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

**Thesis 4:** Solutions aren't forthcoming anytime soon

THE ROYAL SOCIETY
PUBLISHING

ROYAL SOCIETY
OPEN SCIENCE



# The natural selection of bad science

Paul E. Smaldino, Richard McElreath

Published 21 September 2016. DOI: 10.1098/rsos.160384

“Poor research design … encourage false-positive findings. Such poor methods persist despite perennial calls for improvement, suggesting that they result from something more than just misunderstanding”

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

“Some normative methods of analysis have almost certainly been selected to further publication instead of discovery”

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

"[via a meta analysis & modelling exercise we study] the logical consequences of structural incentives[ and how] competing laboratories investigate novel or previously published hypotheses using culturally transmitted research methods."

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

“As in the real world, successful labs produce more ‘progeny,’ [⋯] Selection for high output leads to poorer methods and increasingly high false discovery rates [⋯] Improving the quality of research requires change at the institutional level.”

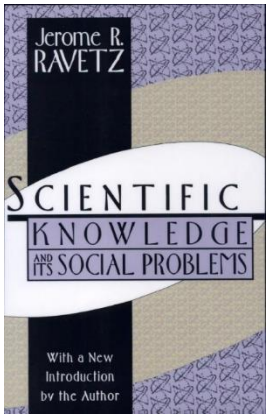
Smaldino PE, McElreath R., 2016 The natural selection of bad science. R. Soc. open sci. 3: 160384. http://dx.doi.org/10.1098/rsos.160384

p.22-23; Two separate factors are necessary for the achievement of worthwhile scientific results:

a community of scholars with a shared knowledge of the standards of quality appropriate for their work and a shared commitment to enforce those standards by the informal sanctions the community possesses;

and individuals whose personal integrity sets standards at least as high as those required by their community.

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


Jerome R. Ravetz

# Puzzling futures

# **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

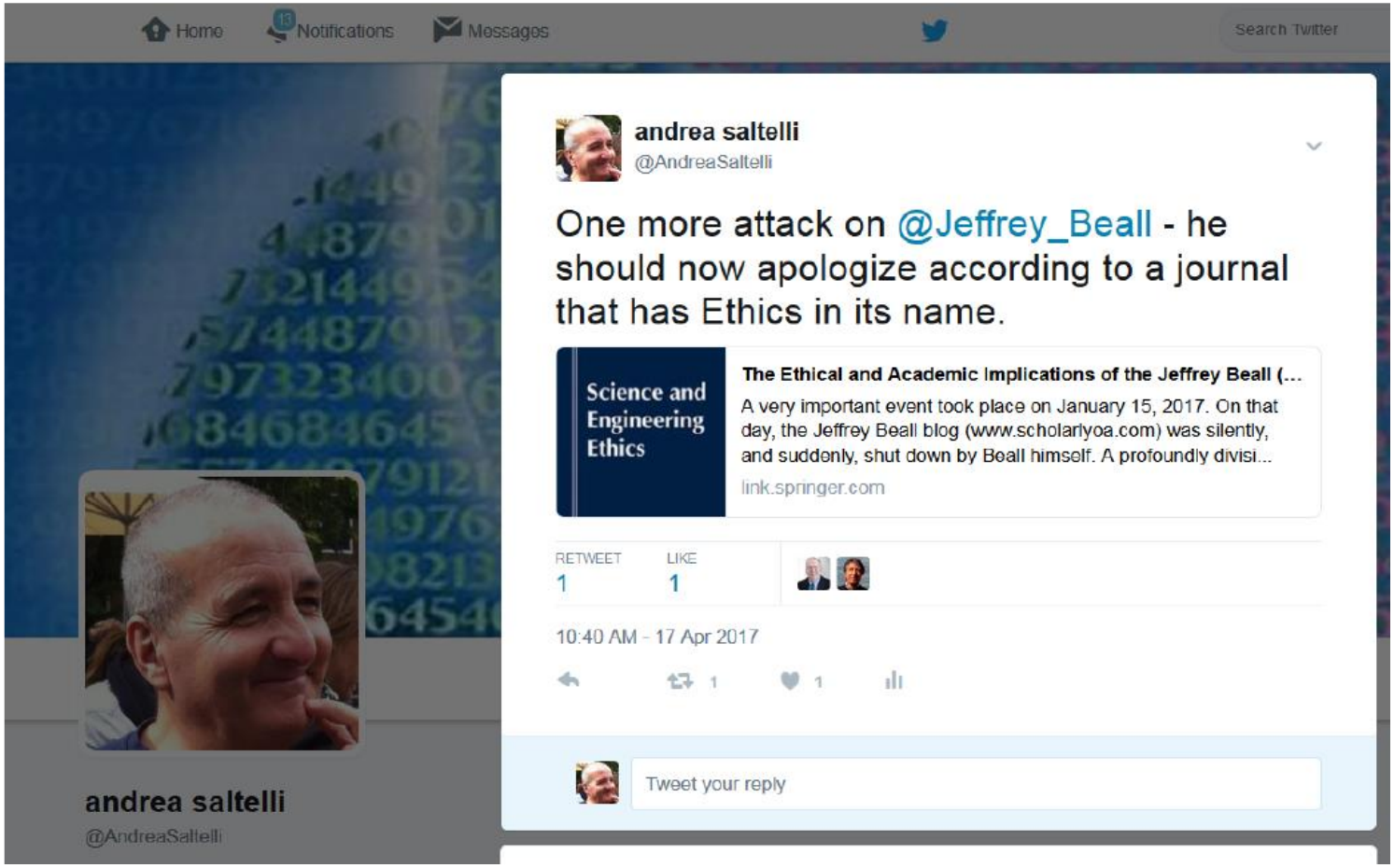
Timothy Gowers

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

# Has science become an endeavor where attempts to fix a diseased system lead you to disgrace?

Jeffrey Beall


http://www.npr.org/sections/thetwo-way/2013/05/15/184233141/publisher-threatens-librarian-with-1-billion-lawsuit
http://retractionwatch.com/2017/01/17/bealls-list-potential-predatory-publishers-go-dark/

# Who pays to fight bad science?

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/

# Who pays to fight bad science?

Bill & Melinda Gates

"Bill & Melinda Gates […] the world's biggest source of charitable money for scientific endeavours ($4bn a year) …

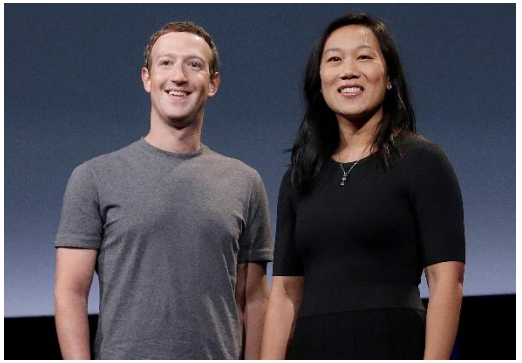
[its research] must be freely available to all [and] will pay the cost of putting such research in one particular repository of freely available papers

[they] offered the publishers of *Science*, $100,000 to make papers published this year about Gates-sponsored research free to read from the beginning.

http://www.economist.com/news/science-and-technology/21719438-about-change-findings-medical-research-are-disseminated-too

# Who pays to fight bad science?

"Mark Zuckerberg & Priscilla Chan will disburse $50m to 47 local scientists on condition they made their work available as preprints."



Mark Zuckerberg & Priscilla Chan

http://www.economist.com/news/science-and-technology/21719438-about-change-findings-medical-research-are-disseminated-too

# Rare examples of a different culture

Yoshiki Sasai

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

Could the reformation offer inspiration?

Martin Luther

Johann Tetzel

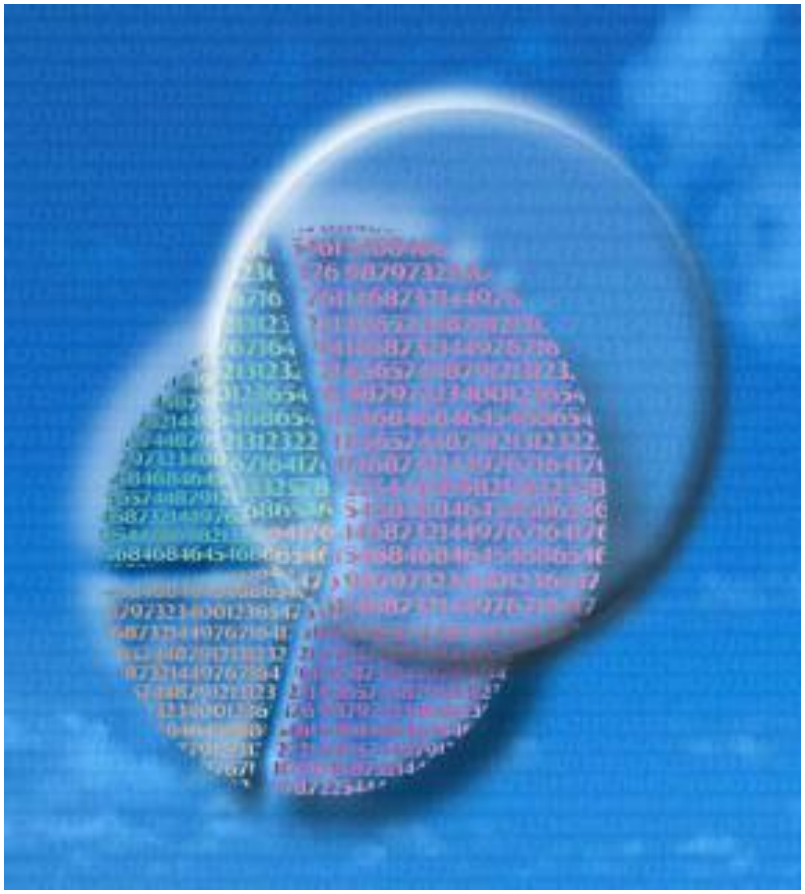
Science exhibits ‘indulgencies-like’ pathologies:

Predatory (or simply greedy) publishers, scandals in peer review, in trade of authorship, in faulty policy prescriptions), domination of corporate interests in science …

Martin Luther

Johann Tetzel

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 few areas of 'Reformation' where science and society work together



# END

Twitter:
@andreasaltelli

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# Scientists' march on Washington is a bad idea – here's why

March 8, 2017 6.54pm AEDT

Some questioned the concept of the Women's March on Washington. Now scientists will march against Donald Trump. Is that a good idea?

Author

Andrea Saltelli
Adjunct Professor Centre for the Study of the Sciences and the Humanities, University of Bergen, University of Bergen

# The Republic of Science: Its Political and Economic Theory
## Michael Polanyi

[This article originally appeared in *Minerva* 1:54-74, 1962 and is put on WWW with kind permission from Kluwer Academic Publishers (http://www.wkap.nl) and John C. Polanyi.]

Michal Polanyi

Polanyi's theses:

Science as a market driven by higher principles

…

Which feeds society's thirst for self improvement

…

Science as a community of practice capable of self-governance …

https://theconversation.com/scientists-march-on-washington-is-a-bad-idea-heres-why-73305

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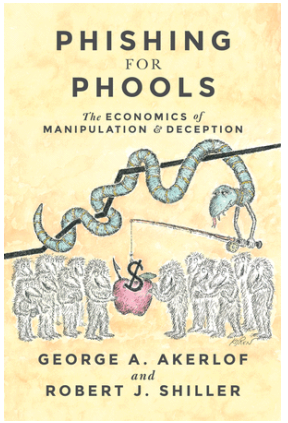
# Today:

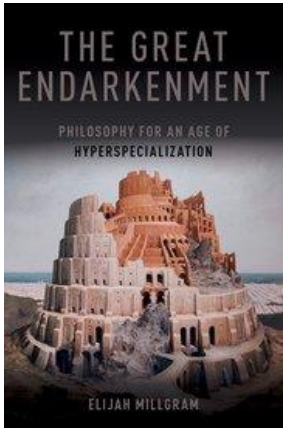
Science and innovation driven by imperfect markets

Society's self improvement likewise entrusted to market forces

Science divided by practices (methodological aliens)

https://theconversation.com/scientists-march-on-washington-is-a-bad-idea-heres-why-73305



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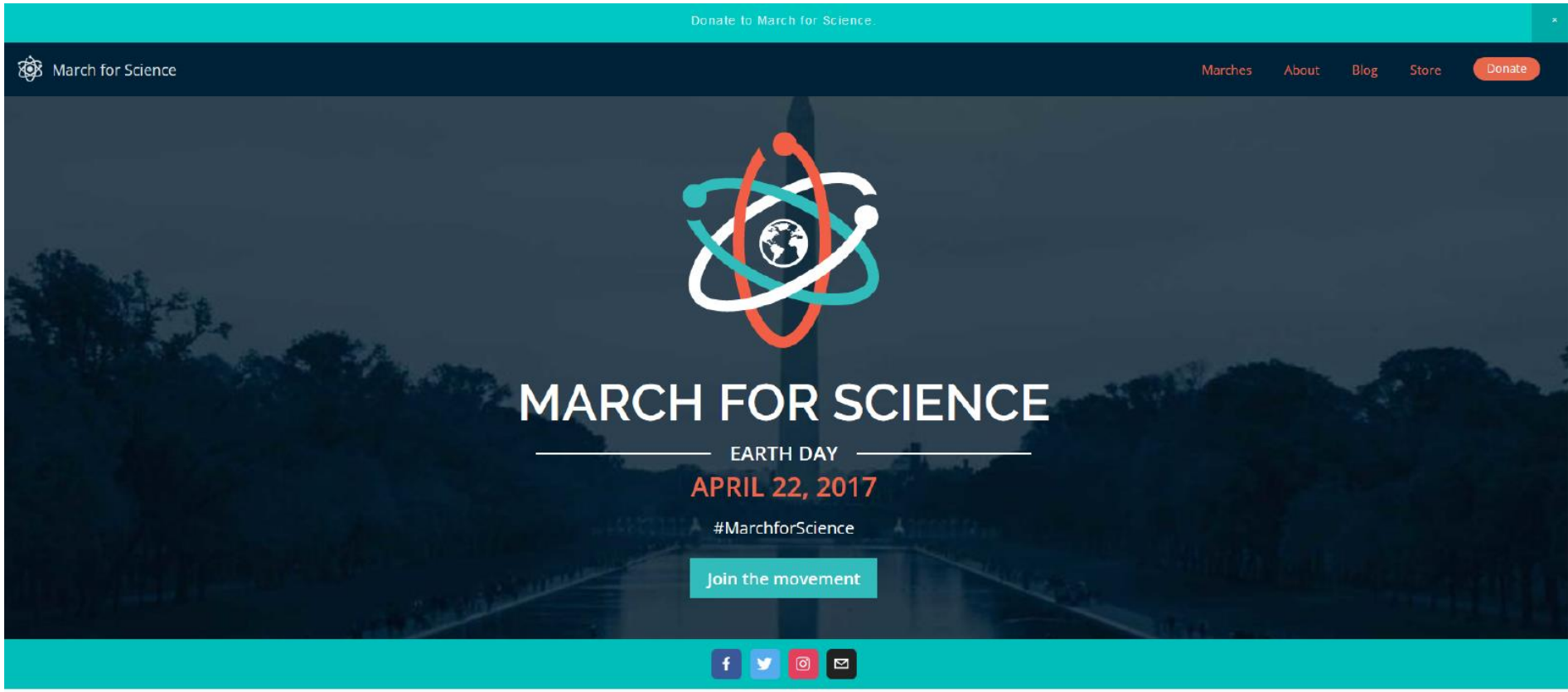
"Our activism would be better inspired by the radical 1970s-era movements that sought to change the world by changing first science itself. They sought to provide scientific knowledge and technical expertise to local populations and minority communities while giving those same groups a chance to shape the questions asked of science."

https://theconversation.com/scientists-march-on-washington-is-a-bad-idea-heres-why-73305

# On the march: the spirit of the time in the house of science


Source: The Conversation, https://theconversation.com/scientists-march-on-washington-is-a-bad-idea-heres-why-73305


Donate to March for Science.
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EARTH DAY
APRIL 22, 2017
#MarchforScience
Join the movement

The March for Science is the first step of a global movement to defend the vital role science plays in our health, safety, economies, and governments.

**It's time to get off the sidelines and make a difference.**

Register to attend your local march

The March for Science champions robustly funded and publicly communicated science as a pillar of human freedom and prosperity. We unite as a diverse, nonpartisan group to call for science that upholds the common good and for political leaders and policy makers to enact evidence based policies in the public interest.

The March for Science is a celebration of science.  It's not only about scientists and politicians; it is about the very real role that science plays in each of our lives and the need to respect and encourage research that gives us insight into the world.

Nevertheless, the march has generated a great deal of conversation around whether or not scientists should involve themselves in politics. In the face of an alarming trend toward discrediting scientific consensus and restricting scientific discovery, we might ask instead: can we afford not to speak out in its defense?

There is no Planet B. Join the #MarchForScience.

# What if even she is wrong?

Series  over series where lab-based forensics (science) adjudicates cases …

… but 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