

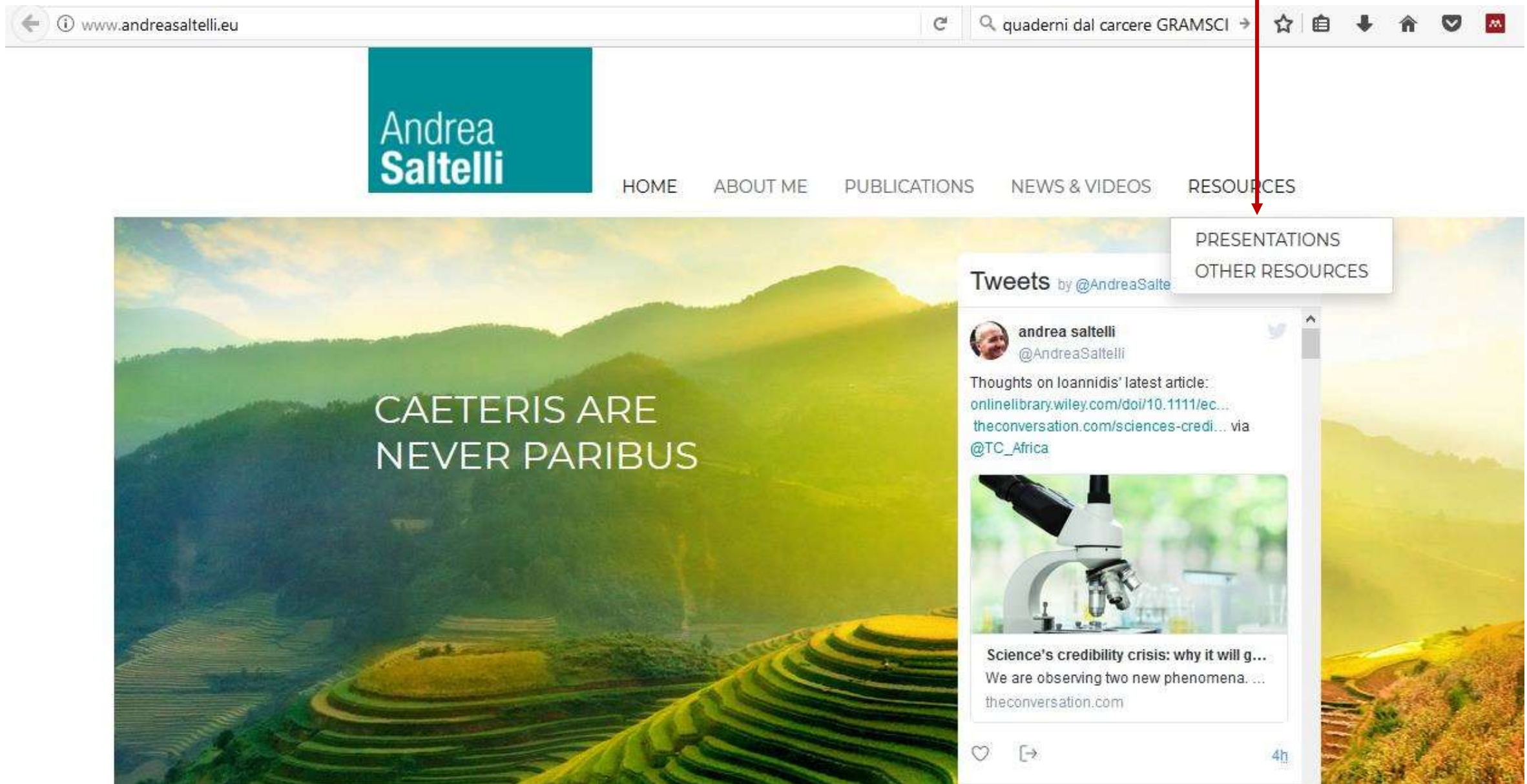
# The case of the p-test and science reproducibility problems

Andrea Saltelli

Centre for the Study of the Sciences and the Humanities,  
University of Bergen, and Open Evidence Research, Open  
University of Catalonia; August 27<sup>th</sup>–September 1<sup>st</sup>, 2018,  
Course Numbers for policy, Castelldefels (Barcelona)



# Where to find this talk: [www.andreasaltelli.eu](http://www.andreasaltelli.eu)



The screenshot shows the homepage of the website [www.andreasaltelli.eu](http://www.andreasaltelli.eu). The browser's address bar displays the URL. The website features a teal header with the name "Andrea Saltelli" and a navigation menu with links: HOME, ABOUT ME, PUBLICATIONS, NEWS & VIDEOS, and RESOURCES. A red arrow points from the "RESOURCES" link to a dropdown menu that contains "PRESENTATIONS" and "OTHER RESOURCES". The main content area has a background image of terraced rice fields with the text "CAETERIS ARE NEVER PARIBUS". On the right, there is a "Tweets" section by @AndreaSalte, featuring a tweet from andrea saltelli (@AndreaSaltelli) about a science credibility crisis, accompanied by a photo of a microscope.

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Andrea Saltelli

HOME ABOUT ME PUBLICATIONS NEWS & VIDEOS RESOURCES

PRESENTATIONS  
OTHER RESOURCES

Tweets by @AndreaSalte

andrea saltelli  
@AndreaSaltelli

Thoughts on Ioannidis' latest article:  
[onlinelibrary.wiley.com/doi/10.1111/ec...](https://onlinelibrary.wiley.com/doi/10.1111/ec...)  
[theconversation.com/sciences-credi...](https://theconversation.com/sciences-credi...) via  
@TC\_Africa

Science's credibility crisis: why it will g...  
We are observing two new phenomena...  
[theconversation.com](https://theconversation.com)

4h

# The P-test saga

Downloaded from <http://rsos.royalsocietypublishing.org/> on January 13, 2017

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OPEN SCIENCE

[rsos.royalsocietypublishing.org](http://rsos.royalsocietypublishing.org)

Review



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click for updates

**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

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David Colquhoun

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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**”



A classic exercise in screening

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

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

The test has a 5% false positive rate

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

➔ Don't despair (yet)

## Another exercise in screening (Colquhoun 2014)

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

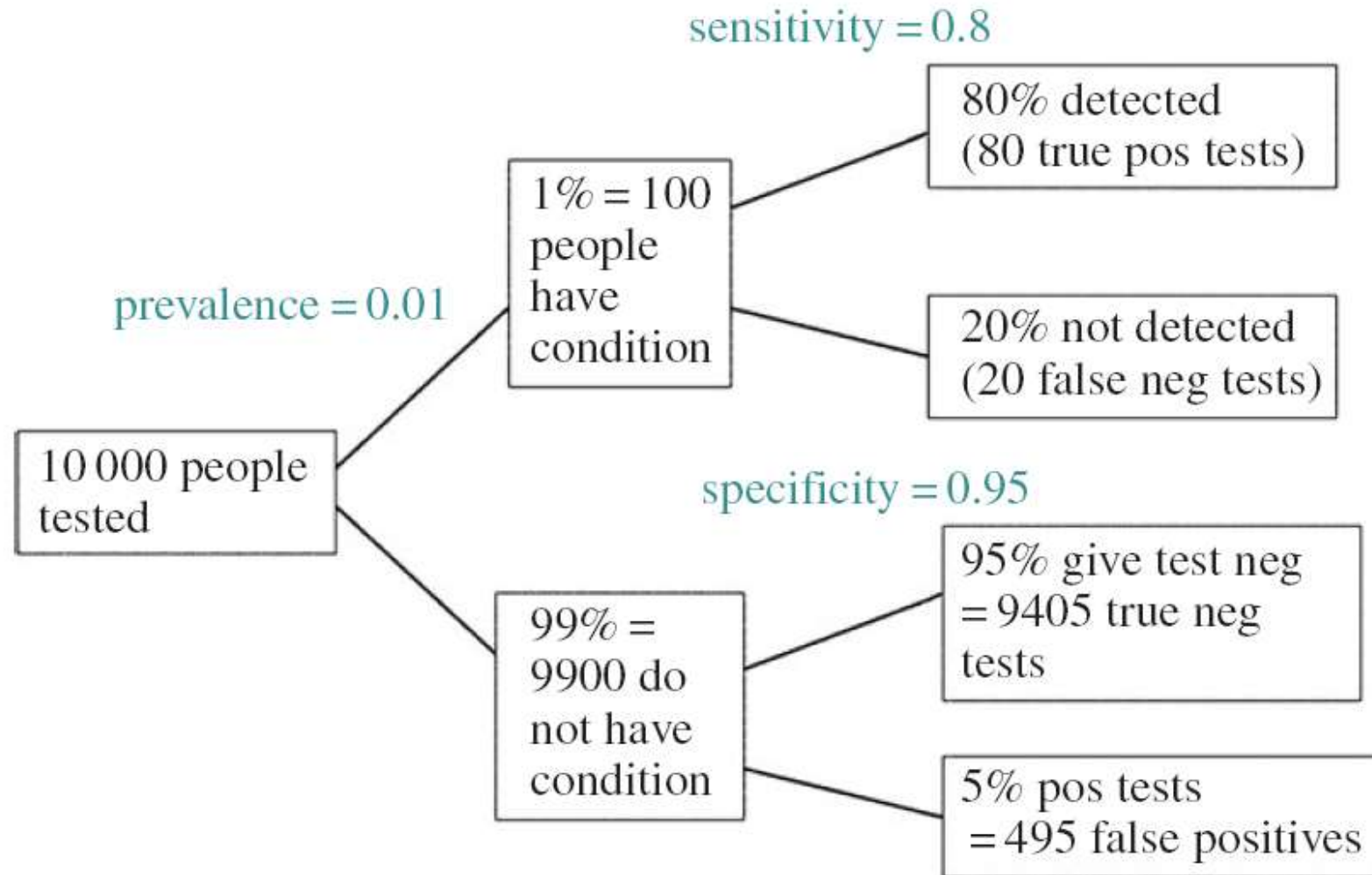
MCI prevalence in the population 1%, i.e. in a sample of 10,000 then 100 have MCI and 9,900 don't

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

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

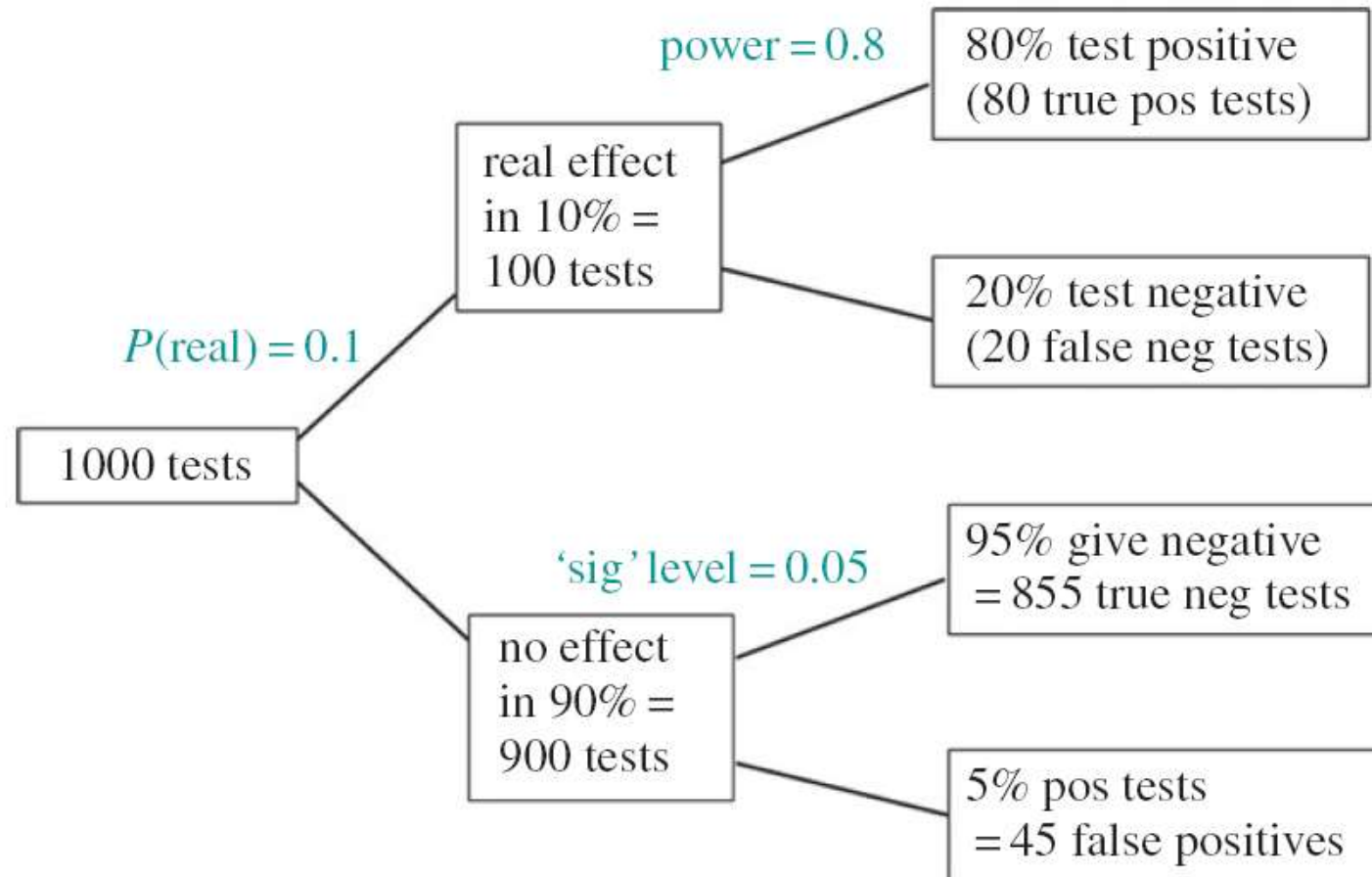
➔ It does not make sense to screen the population for MCI!

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



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

# We now consider tests instead of individuals



➔ 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 in one in three

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

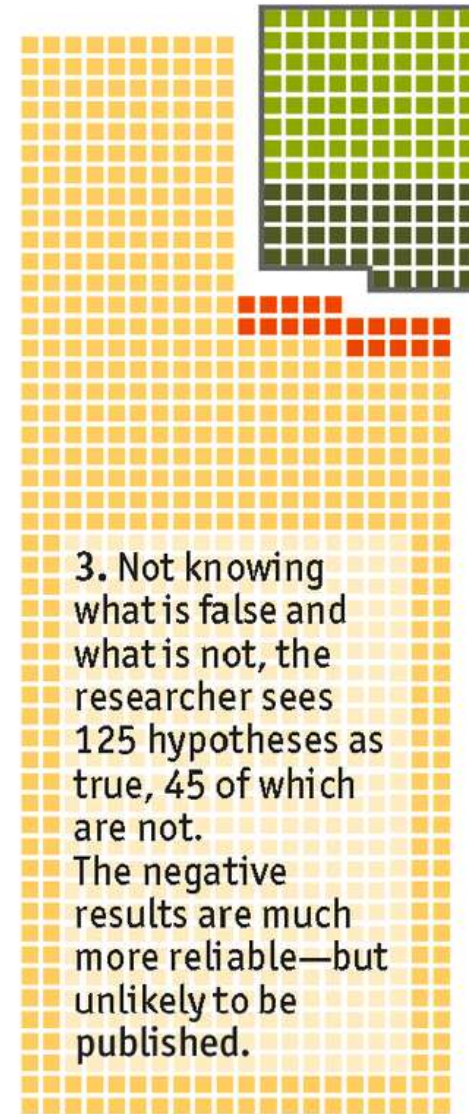
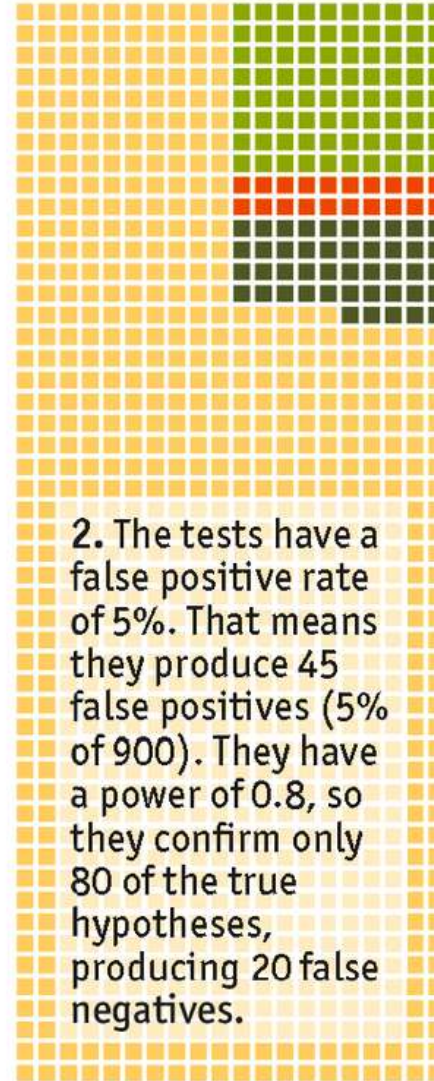
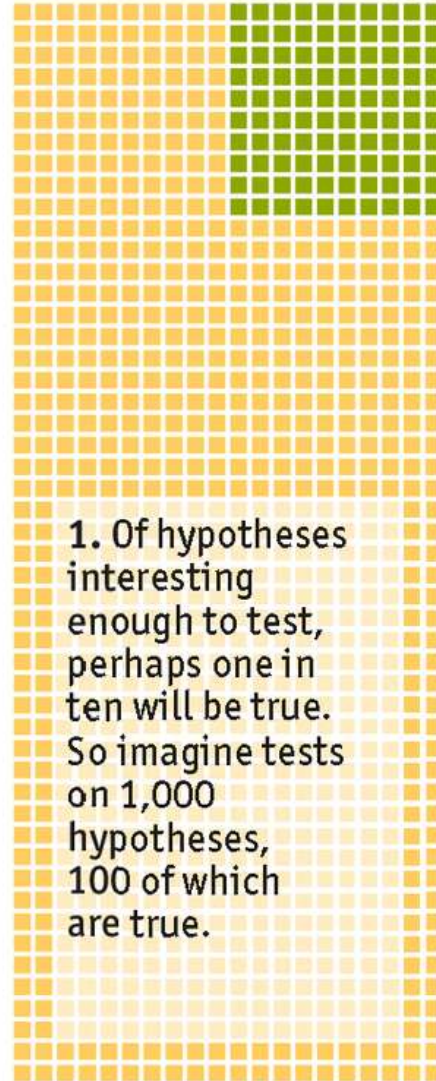




## Unlikely results

How a small proportion of false positives can prove very misleading

False True False negatives False positives



The false discovery rate is  $\sim$  the dark area divided by the green one

# Crisis in statistics?

Statistics is experiencing a quality control crisis





Effect or no  
effect?



**nature**  
International journal of science

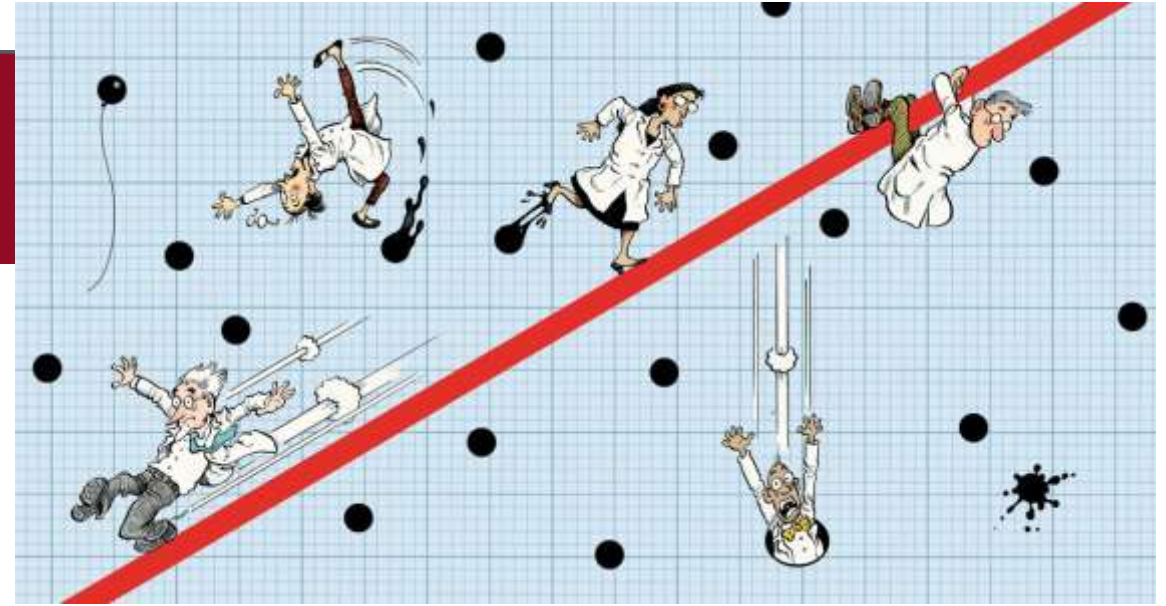


**nature**  
International journal of science

COMMENT • 28 NOVEMBER 2017

# Five ways to fix statistics

*As debate rumbles on about how and how much poor statistics is to blame for poor reproducibility, Nature asked influential statisticians to recommend one change to improve science. The common theme? The problem is not our maths, but ourselves.*



Jeff Leek , Blakeley B. McShane, Andrew Gelman , David Colquhoun , Michèle B. Nuijten  & Steven N. Goodman 



—  
CORRESPONDENCE • 16 JANUARY 2018



# Fixing statistics is more than a technical issue

[Andrea Saltelli](#)  & [Philip Stark](#)

<https://www.nature.com/articles/d41586-018-00647-9>

—  
CORRESPONDENCE • 16 JANUARY 2018



# Integrity must underpin quality of statistics

[Jerome Ravetz](#) 

<https://www.nature.com/articles/d41586-018-00648-8>

The great paradox of science is that passionate practitioners must carefully produce dispassionate facts (J. Ravetz *Scientific Knowledge and its Social Problems* Oxford Univ. Press; 1971). Meticulous technical and normative judgement, as well as morals and morale, are necessary to navigate the forking paths of the statistical garden (Saltelli and Stark, 2018)



All users of statistical techniques, as well as those in other mathematical fields such as modelling and algorithms, need an effective societal commitment to the maintenance of quality and integrity in their work. If imposed alone, technical or administrative solutions will only breed manipulation and evasion (Ravetz, 2018)

# Statistics reacts

The discipline of statistics has been going through a phase of critique and self-criticism, due to mounting evidence of poor statistical practice of which misuse and abuse of the P-test is the most visible sign

**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

+ twenty ‘dissenting’ commentaries

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

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

**P-hacking** (fishing for favourable p-values) and  
**HARKing** (formulating the research **H**ypothesis  
After the **R**esults are **K**nown);  
Desire to achieve a sought for – or simply  
publishable – result leads to fiddling with the data  
points, the modelling assumptions, or the research  
hypotheses themselves

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

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

A. Gelman and E. Loken, “The garden of forking paths: Why multiple comparisons can be a problem, even when there is no ‘fishing expedition’ or ‘p-hacking’ and the research hypothesis was posited ahead of time,” 2013.

IN PRACTICE

## Cargo-cult statistics and scientific crisis

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ROYAL  
STATISTICAL  
SOCIETY  
DATA · EVIDENCE · DECISIONS

ASA  
AMERICAN STATISTICAL  
ASSOCIATION

significance

The mechanical, ritualistic application of statistics is contributing to a crisis in science. Education, software and peer review have encouraged poor practice – and it is time for statisticians to fight back. By **Philip B. Stark** and **Andrea Saltelli**

# Crisis in science?

There have recently been alarms as to the scientific quality arrangement is several disciplines. The most visible symptom of this possible dysfunction is the so-called reproducibility crisis



The  
Economist

OCTOBER 19TH-25TH 2013

[Economist.com](http://Economist.com)

Washington's lawyer surplus

How to do a nuclear deal with Iran

Investment tips from Nobel economists

Junk bonds are back

The meaning of Sachin Tendulkar

HOW  
SCIENCE  
GOES  
WRONG

On the radar:  
October 2013





# Why Most Published Research Findings Are False

John P. A. Ioannidis

2005



John P. A.  
Ioannides

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



Failed replications, entire subfields going bad,  
fraudulent peer reviews, predatory publishers,  
perverse metrics, statistics on trial ...

... misleading science advice, institutions on  
denial, a new breed of science wars

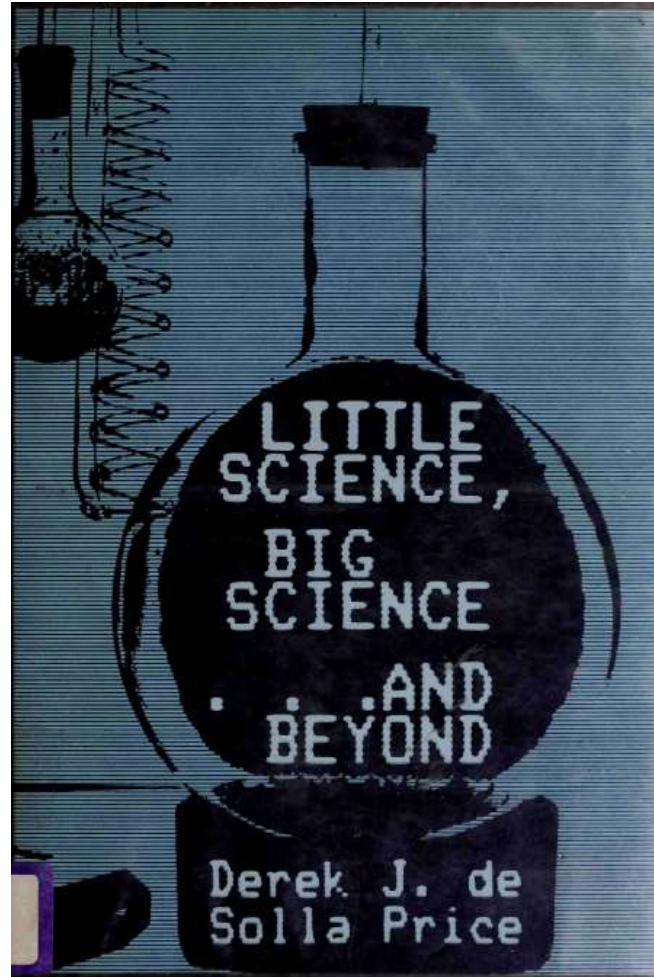
The crisis is methodological, epistemological,  
ethical and metaphysical

Scholars who saw it coming

...

and how they were vindicated

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.



~ 2.2 million  
articles a year  
(2016) over  
~ 30,000 journals

newsblog

*Nature* brings you breaking news from the world of science

NEWS BLOG

## Global scientific output doubles every nine years

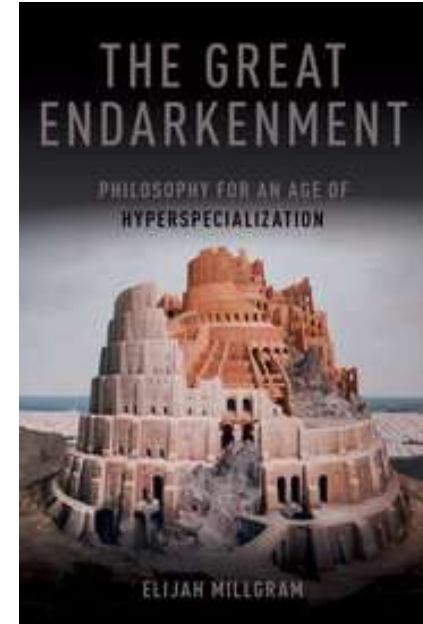
07 May 2014 | 16:46 GMT | Posted by Richard Van  
Noorden | Category: Policy, Publishing

<https://www.aje.com/en/arc/scholarly-publishing-trends-2016/>

<http://blogs.nature.com/news/2014/05/global-scientific-output-doubles-every-nine-years.html>

Derek de Solla Price ↔ Elijah Millgram

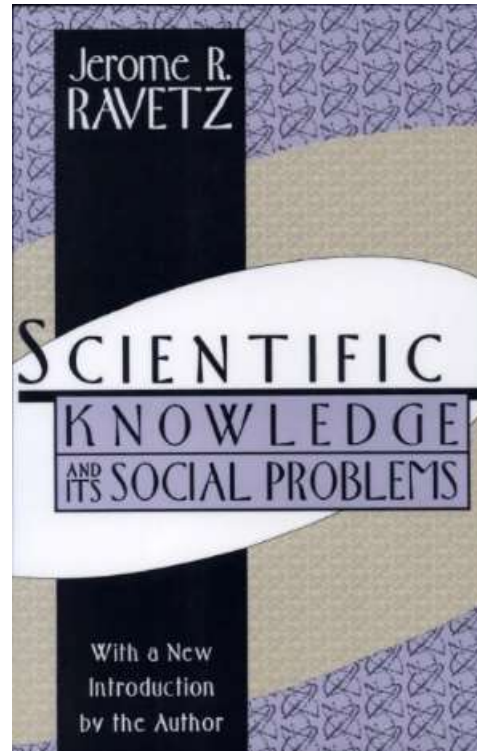
The Great Endarkenment.  
Philosophy for an Age of Hyperspecialization  
By Elijah Millgram



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)

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

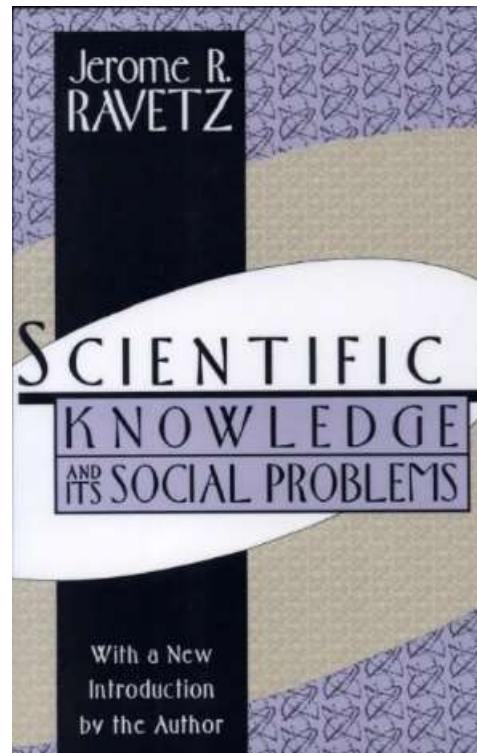
Ravetz, J., 1971, Scientific Knowledge and its Social Problems, Oxford University Press.



Jerome R.  
Ravetz

“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”

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



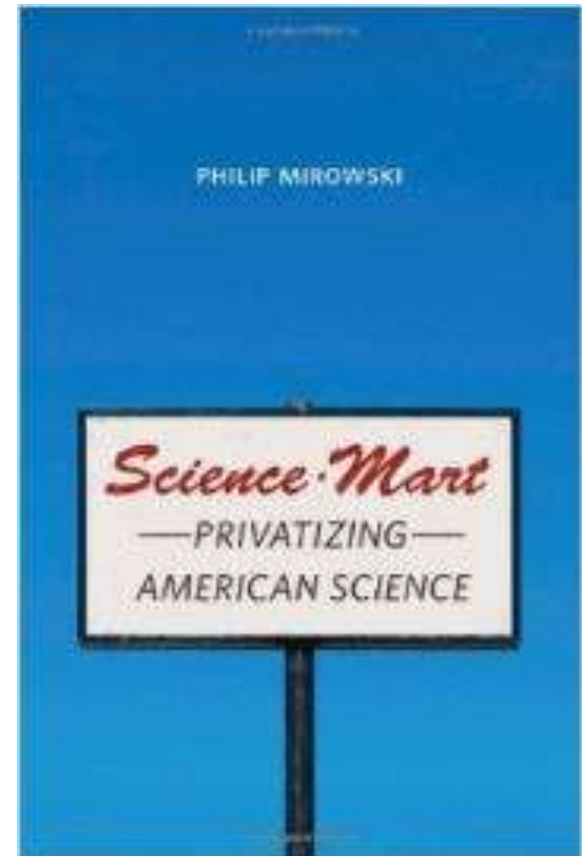
Jerome R.  
Ravetz

... neoliberal ideologies lead to decreasing state funding of science, which becomes privatized ... knowledge as a monetized commodity replaces knowledge as a public good → collapse of quality



Philip Mirowski

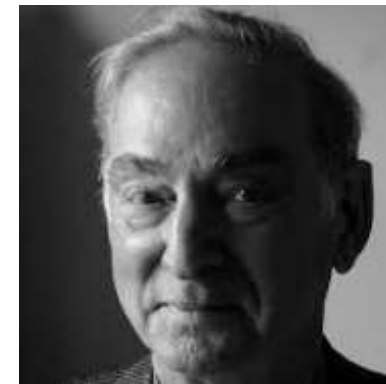
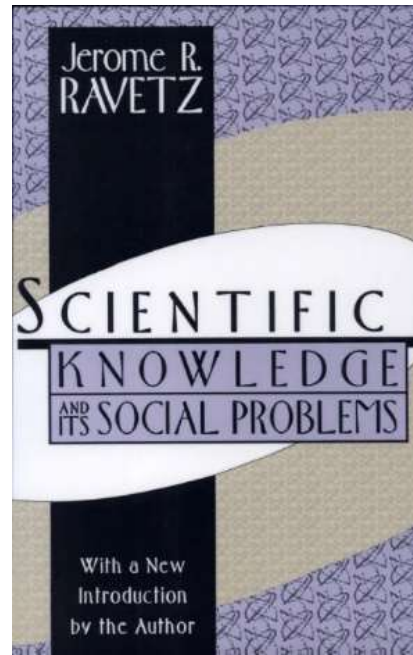
Mirowski, P. 2011. *Science-Mart: Privatizing American Science*, Harvard University Press.





p. 179. For it is possible for a field to be diseased [...] reforming a diseased field is a task of great delicacy [...] not even an apparatus of institutional structures can do anything to maintain or restore the health of a field **in the absence of an essential ethical element operating through the interpersonal channel of communication.**

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




Jerome R.  
Ravetz

 OPEN ACCESS

ESSAY

June 21, 2017

Why Most Clinical Research Is Not Useful

John P. A. Ioannidis 

Published: June 21, 2016 • <https://doi.org/10.1371/journal.pmed.1002049>

THE POWER OF BIAS IN ECONOMICS RESEARCH\*

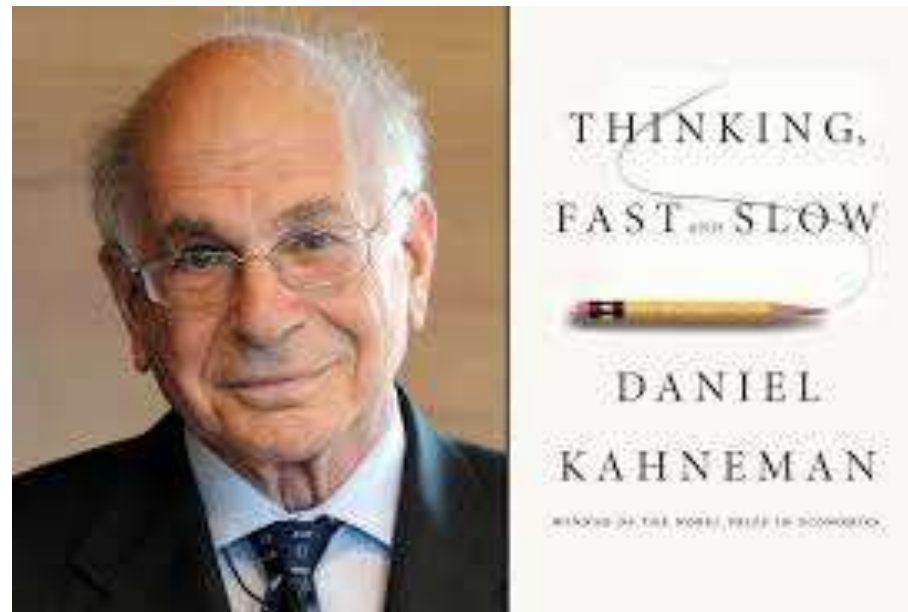
*John P. A. Ioannidis, T. D. Stanley and Hristos Doucouliagos*

October 27, 2017

Rather than isolated instances  
of corruption now entire fields  
of research are found diseased



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/>



# An existential crisis?

Most observers have noted that the crisis has technical as well as ethical and behavioural elements which interact with one another – e.g. the ‘publish or perish’ obsession has an impact on selection bias – the tendency to favour positive over negative results

Bad science reproduces  
better than the good sort

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Research



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**Cite this article:** Smaldino PE, McElreath R.

2016 The natural selection of bad science.

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

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

Received: 1 June 2016

Accepted: 17 August 2016

# The natural selection of bad science

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Paul E. Smaldino<sup>1</sup> and Richard McElreath<sup>2</sup>

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<sup>1</sup>Cognitive and Information Sciences, University of California, Merced, CA 95343, USA

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

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

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

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

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>

Bad science is 'sticky'

Article | Open Access  

## Do rebuttals affect future science?

Jeannette A. Banobi , Trevor A. Branch, Ray Hilborn

First published: 30 March 2011 | <https://doi.org/10.1890/ES10-00142.1> | Cited by: 13

“We examined seven high-profile original articles and their rebuttals, finding that original articles were cited 17 times more than rebuttals, and that annual citation numbers were unaffected by rebuttals”

For Gigerenzer & Marewski statistics has changed the nature all disciplines ...

... Creating a persistent surrogate science based on worshipping P-values

Better to have no beliefs than to embrace falsehoods... (→ F. Bacon's idols)

G. Gigerenzer and J. N. Marewski, "Surrogate Science," J. Manage., vol. 41, no. 2, pp. 421–440, Feb. 2015.

MBI: Magnitude-based inference:  
persistent bad stats in sports research

MBI false positive rate two to six time  
higher than in NHST (Null hypothesis significance testing)

Christie Aschwanden and Mai Nguyen, How Shoddy Statistics Found A Home In Sports Research, Fivethirtyeight, May 16, 2018, <https://fivethirtyeight.com/features/how-shoddy-statistics-found-a-home-in-sports-research/>

K. L. Sainani, The Problem with 'Magnitude-Based Inference,' Medicine & Science in Sports & Exercise (MSSE), p. 1, Apr. 2018.



Bad science in  
bad journals?



**frontiers**

in Human Neuroscience

## **Prestigious Science Journals Struggle to Reach Even Average Reliability**

“...an accumulating body of evidence suggests that methodological quality & reliability of published research works in several fields may be decreasing with increasing journal rank” (20 February, 2018)

Cutting corners effect?

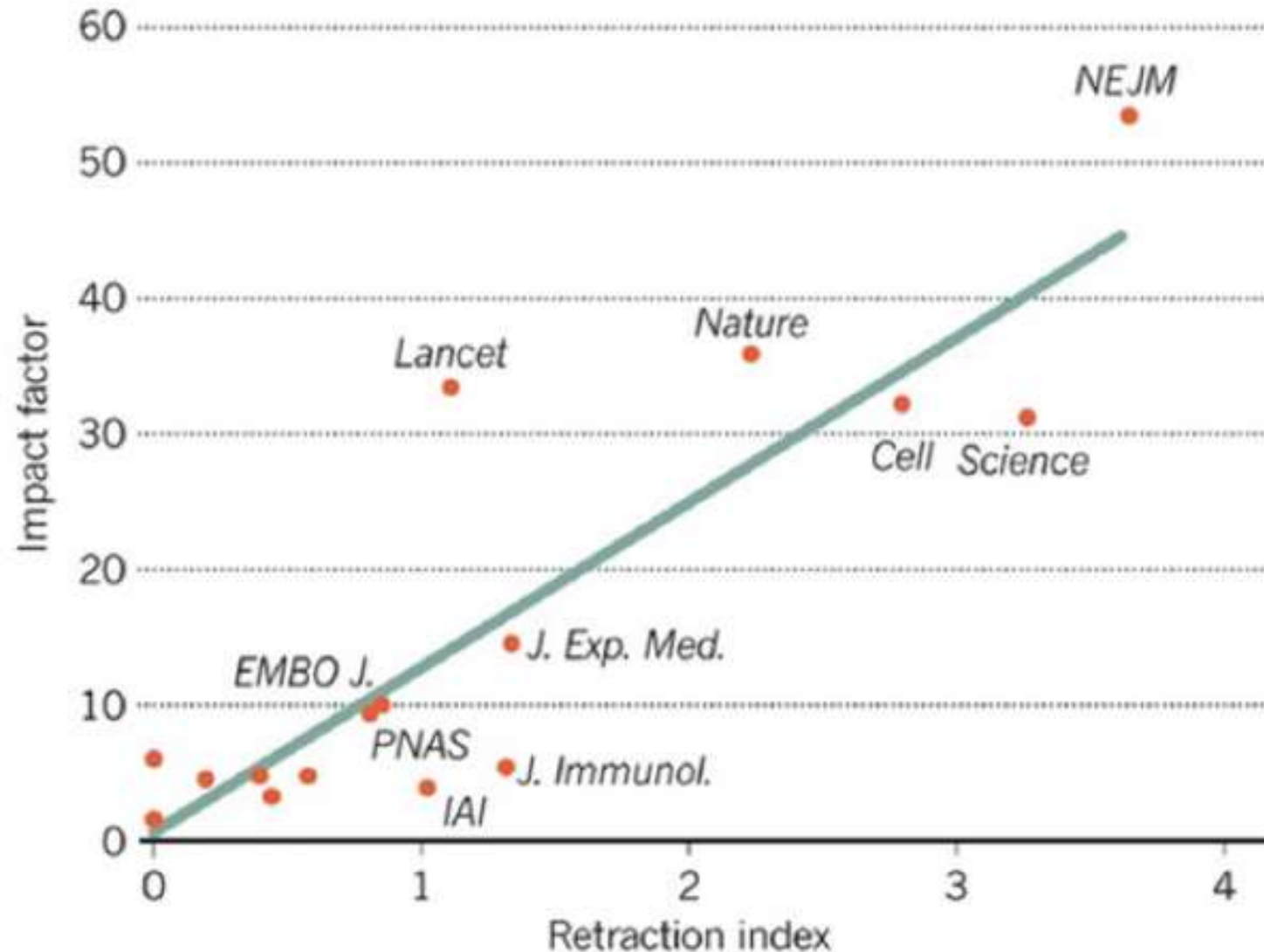


**Björn Brembs\***

Institute of Zoology—Neurogenetics, Universität Regensburg, Regensburg, Germany

## RETRACTION RELATION

Journals with higher impact factors also have a higher rate of retractions.



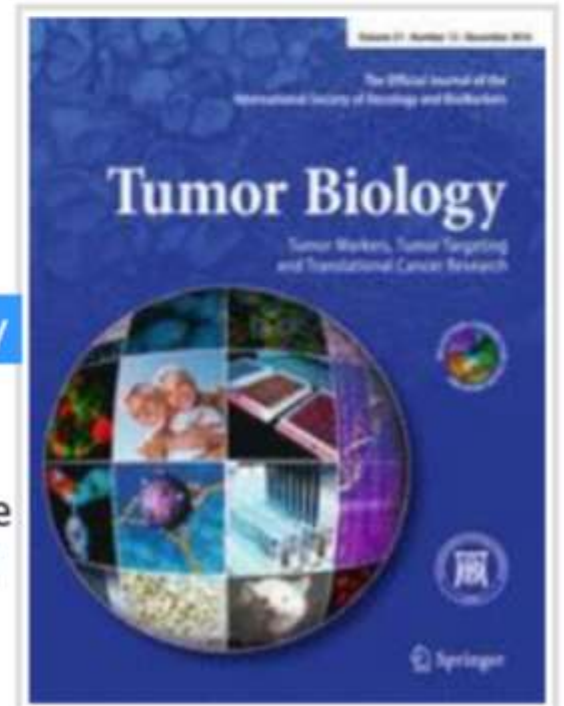
Fang FC, Casadevall A and Morrison R (2011) Retracted science and the retraction index. *Infection and Immunity* 79(10): 3855–3859

### 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](#).



Unintended effects of reforms



# Good intentions going bad

TABLE 1. GROWING PERVERSE INCENTIVES IN ACADEMIA

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

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

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



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## *Incentive*

---

“Researchers rewarded for increased number of publications.”

### *Intended effect*

---

“Improve research productivity,” provide a means of evaluating performance.

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

### *Actual effect*

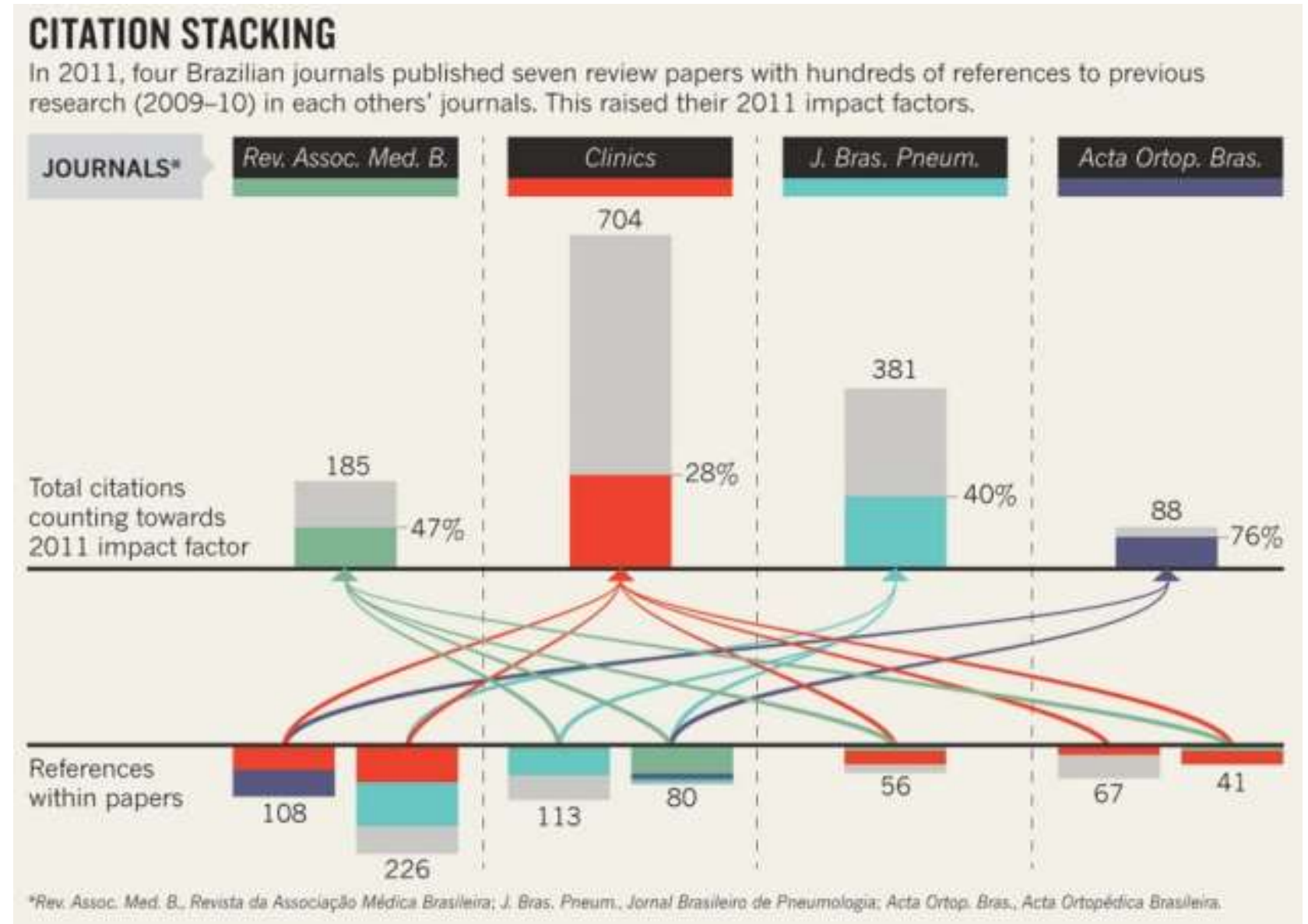
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“Avalanche of” substandard, “incremental papers”; poor methods and increase in false discovery rates leading to a “natural selection of bad science” (Smaldino and McElreath, 2016); reduced quality of peer review

See also P. Mirowski, “The future(s) of open science,” Soc. Stud. Sci., vol. 48, no. 2, pp. 171–203, Apr. 2018.

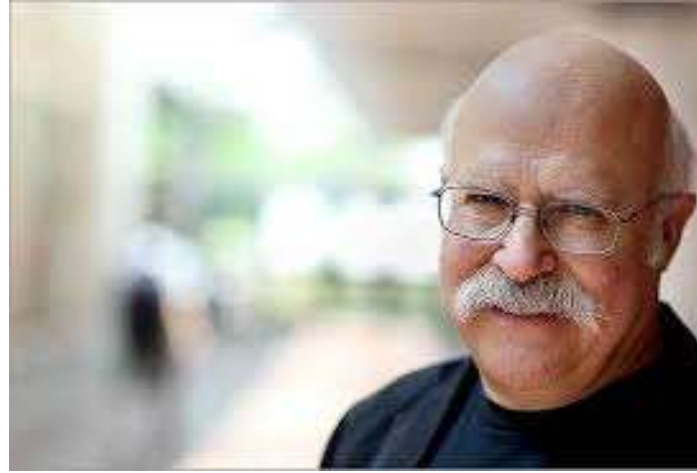
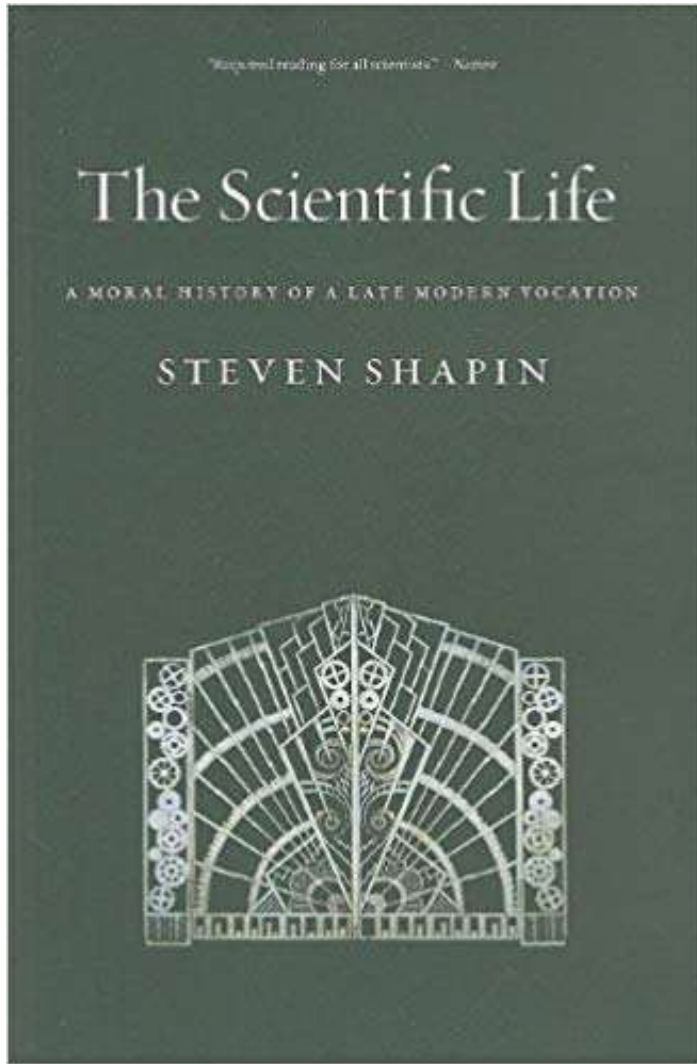
Gaming the system

# 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

Lost ethos?



Steven Shapin

Is scientists' civility to each other what holds the venture together?

But someone disagrees: J.R. Ravetz, *Morals and manners in modern science*, *Nature*, 457(5), 662–663.



Renewable sources  
100% of energy in US by  
2050, says Jacobson...

...and sues for \$10-  
million a dissenter



**Los Angeles Times**

A Stanford professor drops his ridiculous defamation lawsuit against his  
scientific critics

<http://www.latimes.com/business/hiltzik/la-fi-hiltzik-jacobson-lawsuit-20180223-story.html>

# World court should rule on climate science to quash sceptics, says Philippe Sands

International Court of Justice ruling would settle the scientific dispute and pave the way for future legal cases on climate change, says high-profile lawyer

Adam Vaughan

 @adamvaughan\_uk

Friday 18 September 2015 10.34 BST



 Shares  Comments


1,805

710



Save for later



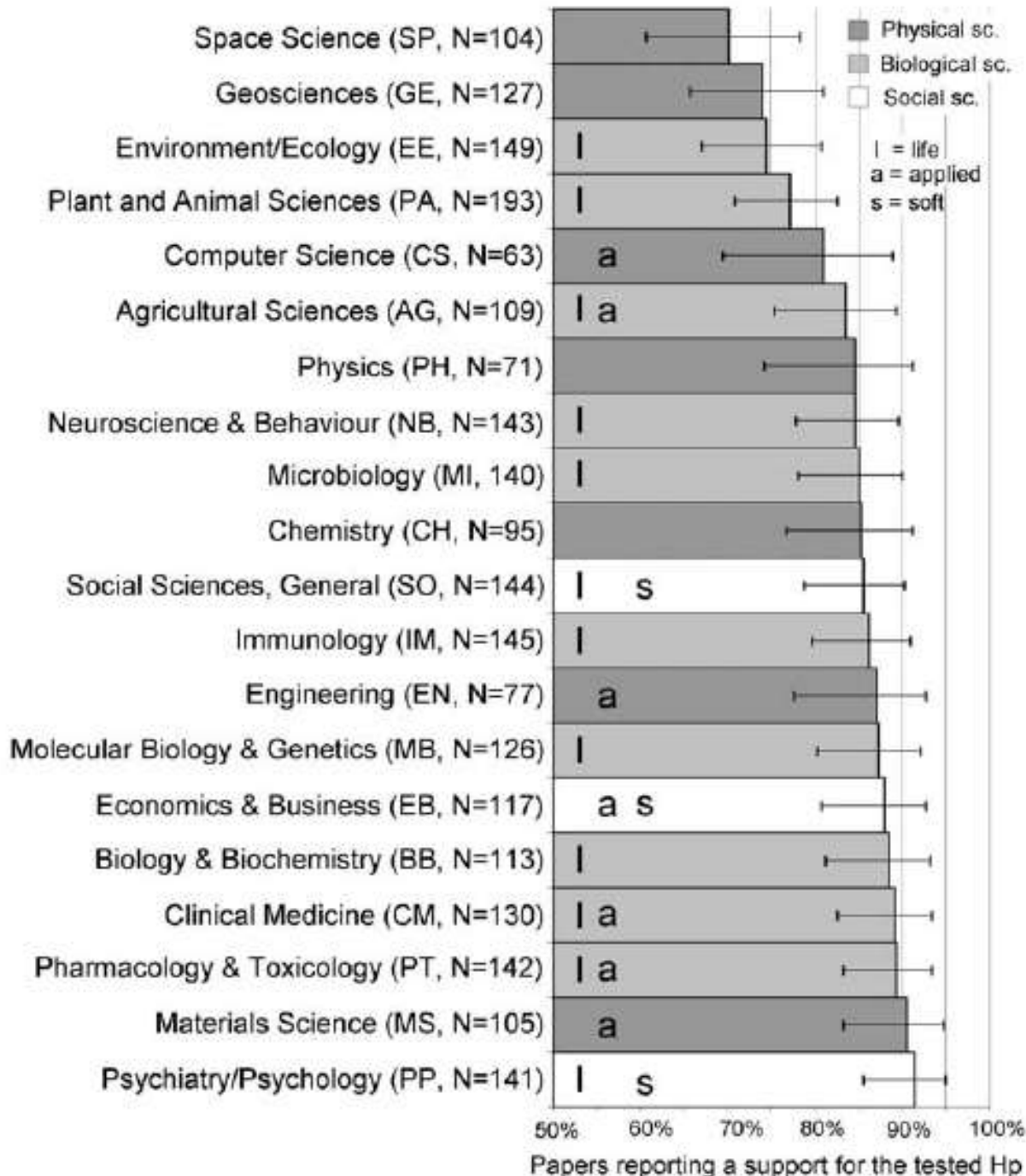
 Philippe Sands QC says a court ruling would carry more weight with public opinion than science alone.  
Photograph: Antonio Zazueta Olmos/Antonio Olmos

Not all disciplines  
the same

# “Positive” Results Increase Down the Hierarchy of the Sciences

Daniele Fanelli\*

INNOGEN and ISSI-Institute for the Study of Science, Technology & Innovation, The University of Edinburgh, Edinburgh, United Kingdom



“odds of reporting a positive result ~5 times higher among papers in the disciplines of Psychology and Psychiatry and Economics and Business than Space Science”

April 7, 2010

# Physics as a model:

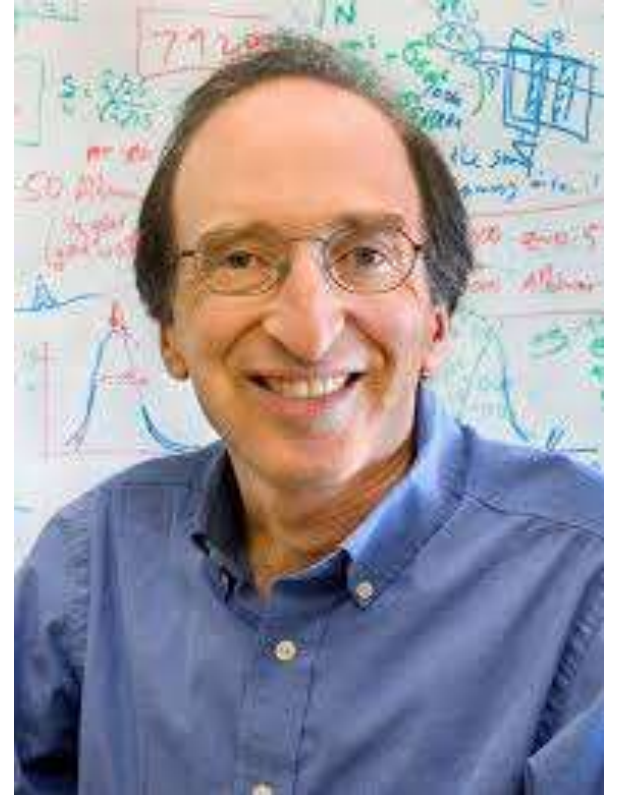
Following several high-profile errors, the particle physics community now invests great effort into intensive checking and re-checking of data prior to publication. By filtering results through independent working groups, physicists are encouraged to criticise.

R. Horton, “Offline: What is medicine’s 5 sigma?,” **Lancet**, vol. 385, p. 1380, 2015.



Saul Perlmutter, an astrophysicist at the University of California, Berkeley.

“Science is an ongoing race between our inventing ways to fool ourselves, and our inventing ways to avoid fooling ourselves.



Saul Perlmutter

R. Nuzzo, “How scientists fool themselves – and how they can stop,”  
Nature, vol. 526, no. 7572, pp. 182–185, Oct. 2015.

From science crisis to  
science wars?

# A new breed of science wars, predicted in 2016



January 27, 2017

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

Andrea Saltelli, *University of Bergen* and Silvio Oscar Funtowicz, *University of Bergen*

Scientists must bear some responsibility for the post-truth era and the current crisis in democracy.



November 16, 2016

## Science wars in the age of Donald Trump

Andrea Saltelli, *University of Bergen* and Silvio Oscar Funtowicz, *University of Bergen*

Is the election of Donald Trump going to reignite a futile war between science and anti-science?

# What the present science war looks like:

## **Opinion: Is science really facing a reproducibility crisis, and do we need it to?**

Daniele Fanelli

PNAS March 12, 2018. 201708272; published ahead of print March 12, 2018. <https://doi.org/10.1073/pnas.1708272114>



“The new “science is in crisis” narrative is not only empirically unsupported, but also quite obviously counterproductive. Instead of inspiring younger generations to do more and better science, it might foster in them cynicism and indifference. Instead of inviting greater respect for and investment in research, it risks discrediting the value of evidence and feeding antiscientific agendas.”

# What the present science war looks like:

## **Crisis or self-correction: Rethinking media narratives about the well-being of science**

Kathleen Hall Jamieson

PNAS March 13, 2018. 115 (11) 2620-2627; published ahead of print March 12, 2018. <https://doi.org/10.1073/pnas.1708276114>



“Because those whose work is prominently cited to certify that science is broken [Ioannidis, Oransky, Begley, and Nosek among them] are spearheading efforts to solve identified problems, their work is evidence of the resilience of science”



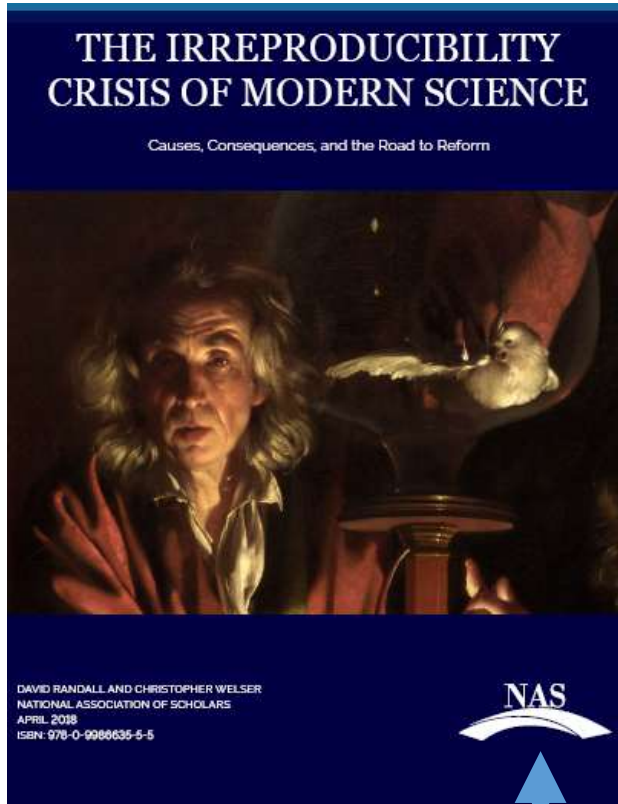
“Even well-intentioned academics, perceiving an attack on science, may be tempted to take an unproductive, hand-waving defensive position: ‘We have no problem with reproducibility’, ‘everything is fine’, ‘science is making progress’.”



John P. A.  
Ioannides

J. P. A. Ioannidis, “All science should inform policy and regulation,” PLOS Med., vol. 15, no. 5, p. e1002576, May 2018.

On the other side: (conservatives, corporations)



Crisis? Yes, due to progressives' assault on higher education with ideologies such as “neo-Marxism, radical feminism, historicism, post-colonialism, deconstructionism, post-modernism, liberation theology”

National Association of Scholars

# THE IRREPRODUCIBILITY CRISIS OF MODERN SCIENCE

Causes, Consequences, and the Road to Reform



DAVID RANDALL AND CHRISTOPHER WELSER  
NATIONAL ASSOCIATION OF SCHOLARS  
APRIL 2018  
ISBN: 978-0-9988635-5-5



“Congress should pass an expanded Secret Science Reform Act to prevent government agencies from making regulations based on irreproducible research ...”

**THE GLOBAL WARMING  
POLICY FOUNDATION**

Director: Dr Benny Peiser



Common Sense on  
Climate Change

Date: 27/10/16 | Global Warming Policy Foundation

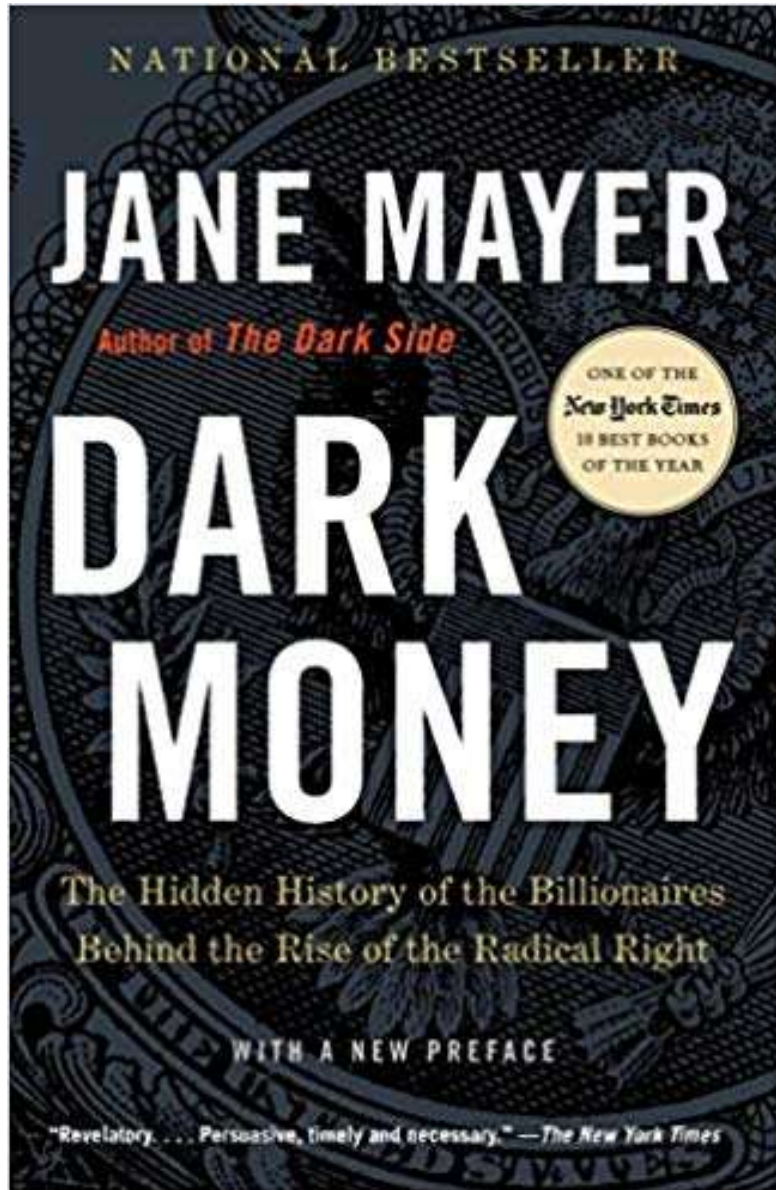
# PEER REVIEW

## Why skepticism is essential

Donna Laframboise

“If half of published, peer-reviewed papers ‘may simply be untrue’, half of the papers cited by the IPCC may also be untrue...”





Chapter 8, The  
fossils, on Koch  
brothers against  
climate



# Gaming the crisis, also in Europe

Please cite this paper as:

OECD (2015), "Scientific Advice for Policy Making: The Role and Responsibility of Expert Bodies and Individual Scientists", *OECD Science, Technology and Industry Policy Papers*, No. 21, OECD Publishing, Paris.  
<http://dx.doi.org/10.1787/5js3311jcpwb-en>



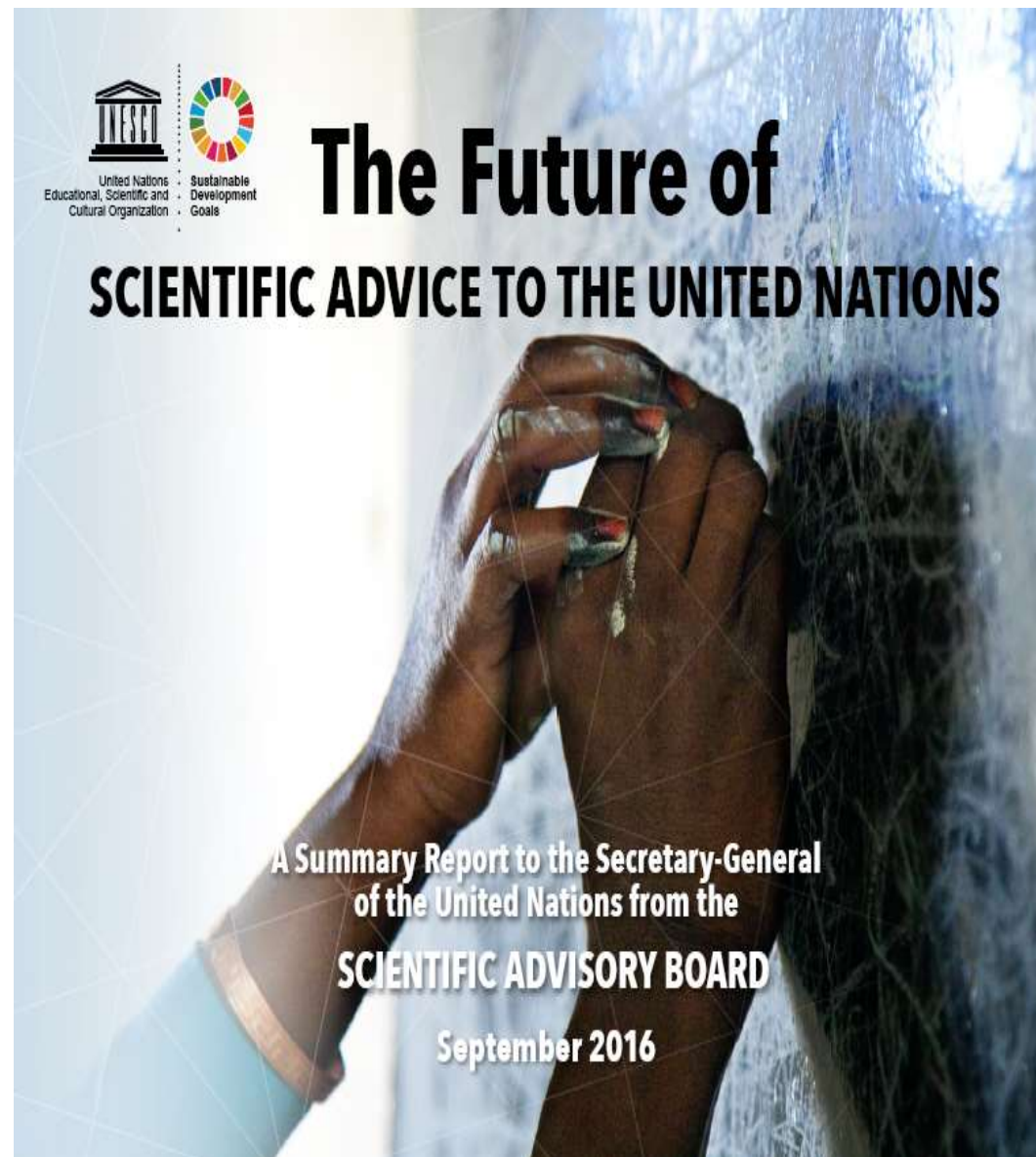
OECD Science, Technology and Industry  
Policy Papers No. 21

## Scientific Advice for Policy Making

THE ROLE AND RESPONSIBILITY OF EXPERT  
BODIES AND INDIVIDUAL SCIENTISTS

OECD

2015

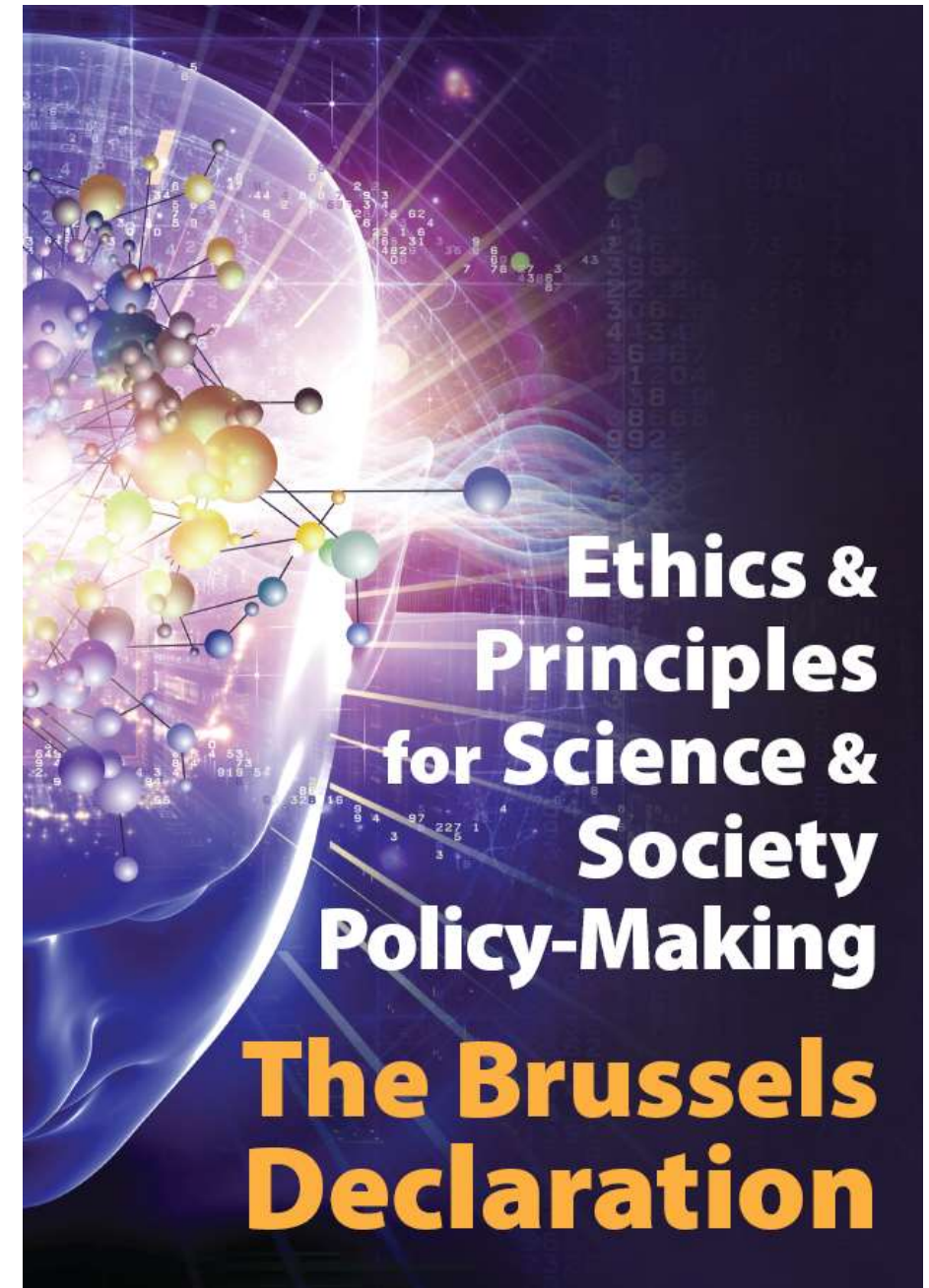


2016

Adopted Feb. 2017 at AAAS  
symposium, 5y gestation

Hundreds of experts involved

- No crisis
- No effect of crisis on  
evidence based policy



... extensive involvement of tobacco and alcohol industry actors... the Declaration offers potential to serve as a vehicle for advancing the vested interests of corporate sectors in public policymaking and appears to have been regarded in this way by a range of organisations related to the alcohol industry

J. McCambridge, M. Daube, and M. McKee, “Brussels Declaration: a vehicle for the advancement of tobacco and alcohol industry interests at the science/policy interface?,” Tob. Control, p. tobaccocontrol-2018-054264, Jun. 2018.

L. Bero, “Ten tips for spotting industry involvement in science policy.,” Tob. Control, p. tobaccocontrol-2018-054386, Jun. 2018.

A left-right divide in the reading of the  
present predicaments is unhelpful and  
dangerous

The same for a too complacent attitude of  
science institutions toward corporate interests

Ewen Callaway, 2018, CRISPR plants now subject to tough GM laws in European Union, Top court's ruling threatens research on gene-edited crops in the bloc, Nature,  
doi: 10.1038/d41586-018-05814-6, <https://www.nature.com/articles/d41586-018-05814-6>

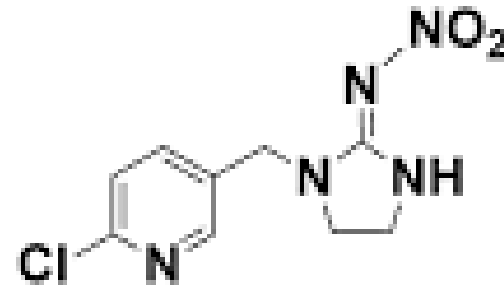


Alternative reading of the crisis: structural contradictions have emerged in modern science

Addressing them should be the focus of our attention

J.R. Ravetz, Postnormal Science and the maturing of the structural contradictions of modern European science, *Futures*, 43(2), (2011), pp. 142–148.

Shoddy science, entrepreneurial science, reckless science, and dirty science (Ravetz, 1971)



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

# Contradictions between:

- the public image of science and its roles;
- real and acknowledged uncertainty in science's pronouncements;
- technological progress and technological risk

...

J.R. Ravetz, Postnormal Science and the maturing of the structural contradictions of modern European science, *Futures*, 43(2), (2011), pp. 142–148.

# What is science, or who is a scientist?



Mark Edwards,  
Aleksandr Kogan

Paolo Macchiarini,  
Rick Mishkin



# Does history repeats itself?

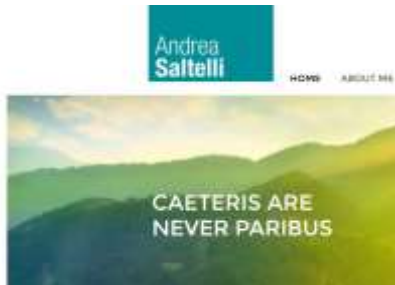
(Love canal, Flint...)



Lois Gibbs



Marc Edwards



[http://www.andreasaltelli.eu/file/repository/LOVE\\_CANAL.pdf](http://www.andreasaltelli.eu/file/repository/LOVE_CANAL.pdf)  
[https://en.wikipedia.org/wiki/Flint\\_water\\_crisis](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>



# Different cultures, different reactions



Yoshiki Sasai 1962 – 2014

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

# Different cultures, different reactions



Aaron Swartz, 1986 – 2013

<https://www.rollingstone.com/culture/news/the-brilliant-life-and-tragic-death-of-aaron-swartz-20130215>

# The End



@andreasaltelli

Science' reproducibility crisis: a political and industrial battleground

**Conservatives and corporate interests:** weaken regulations

**Their opponents:** deny the existence of a crisis

This right-left divide unhelpful and dangerous

Structural contradictions have matured in modern science

Time we address them

# Where to?

- Reformation
- Collapse
- Techno-split



Reformation?

Science exhibits pathologies /  
corruptions comparable to the  
traffic in indulgencies which  
enraged Luther ~1517



Silvio Funtowicz

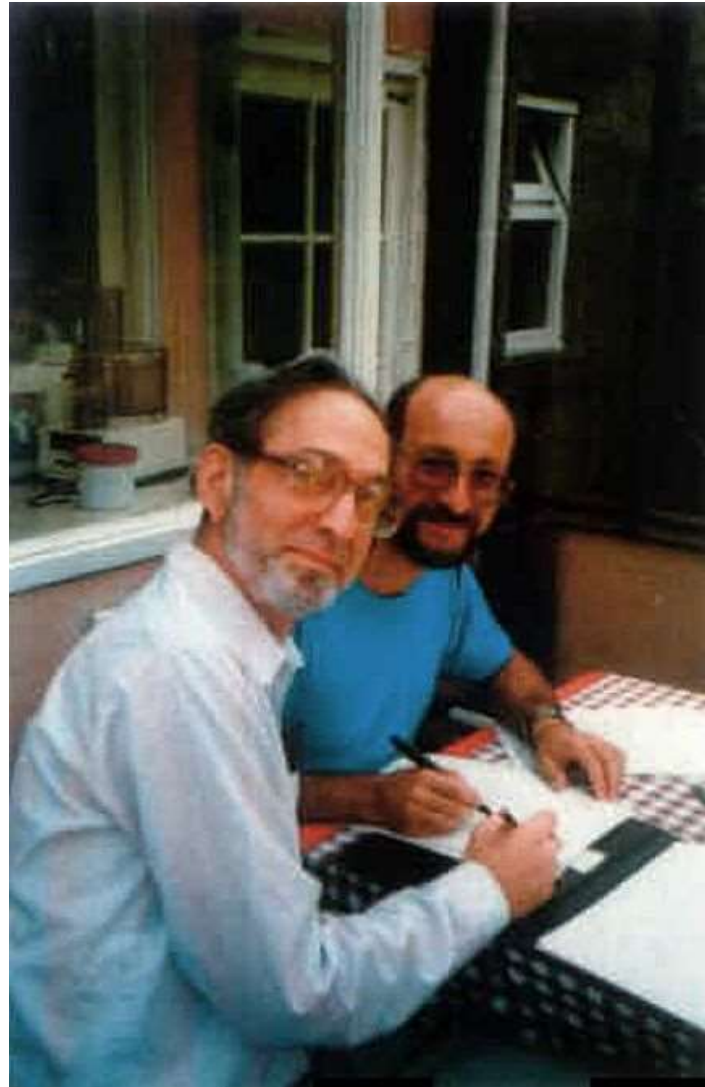
The internet the new press?

Reformation from combination of  
corruption, indignation and  
revolutionary technology

Is the same possible for  
science?



Silvio Funtowicz



Funtowicz and Ravetz, Sheffield ~1988

Collapse?

Planetary boundary or reckless science  
(Insectageddon)

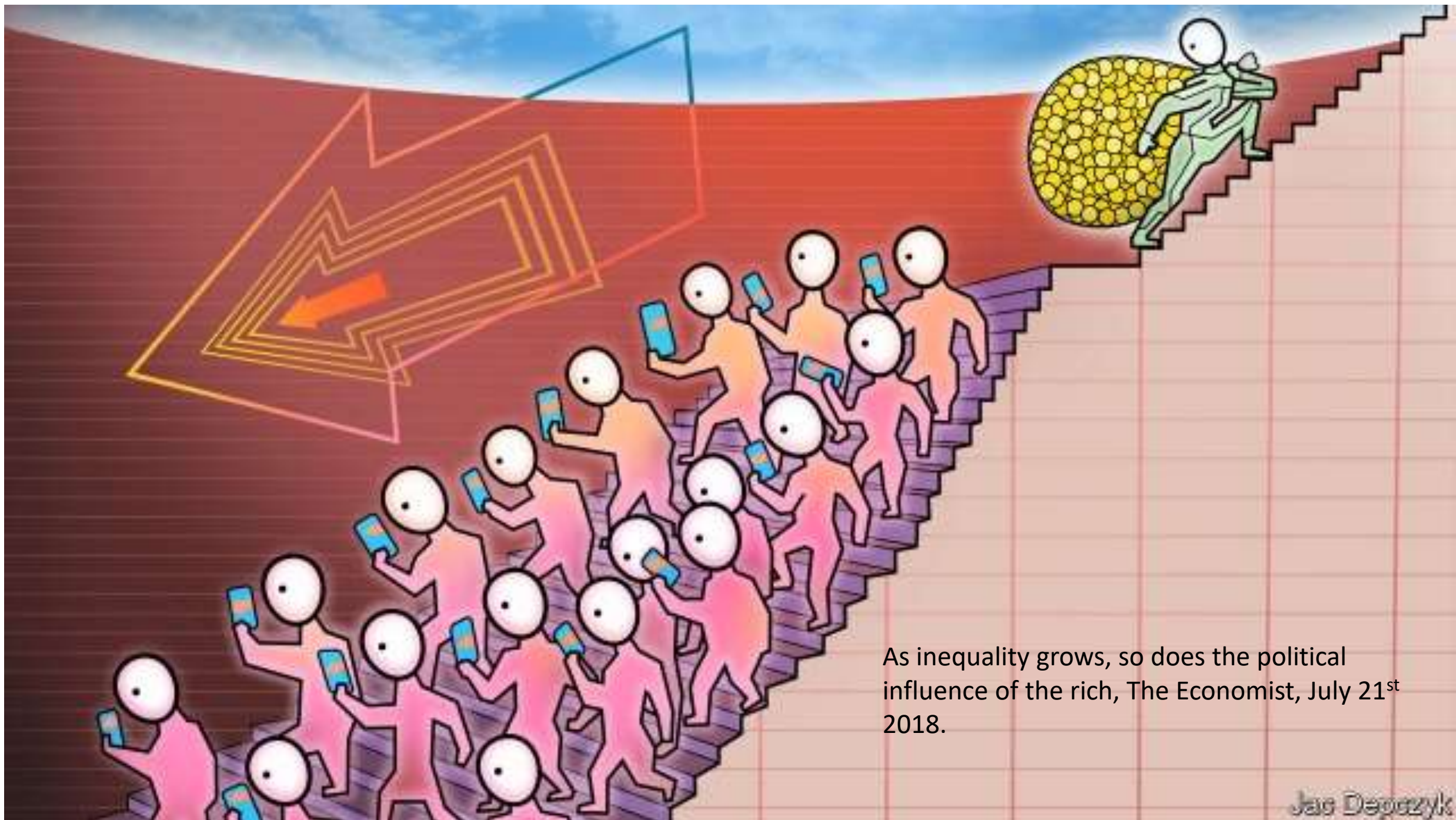
Conspiracy theories obfuscate actual  
misdeeds of authorities and corporations

...

# Techno-split (*sensu* Jeremy Lent)







As inequality grows, so does the political influence of the rich, *The Economist*, July 21<sup>st</sup> 2018.

# Techno-split?



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/>



The Observer Yuval Noah Harari

## **Yuval Noah Harari extract: 'Humans are a post-truth species'**



In his new book, 21 Lessons for the 21st Century, the bestselling author turns his attention to the problems we face today. Here, he argues that 'fake news' is much older than Facebook

Harari's 3 rules: 1) Pay for your information 2) inform yourself if you care and 3) scientists, please engage more.

1. is a market solution fostering inequality, 2. is the deficit model (again), and 3. on whose side?