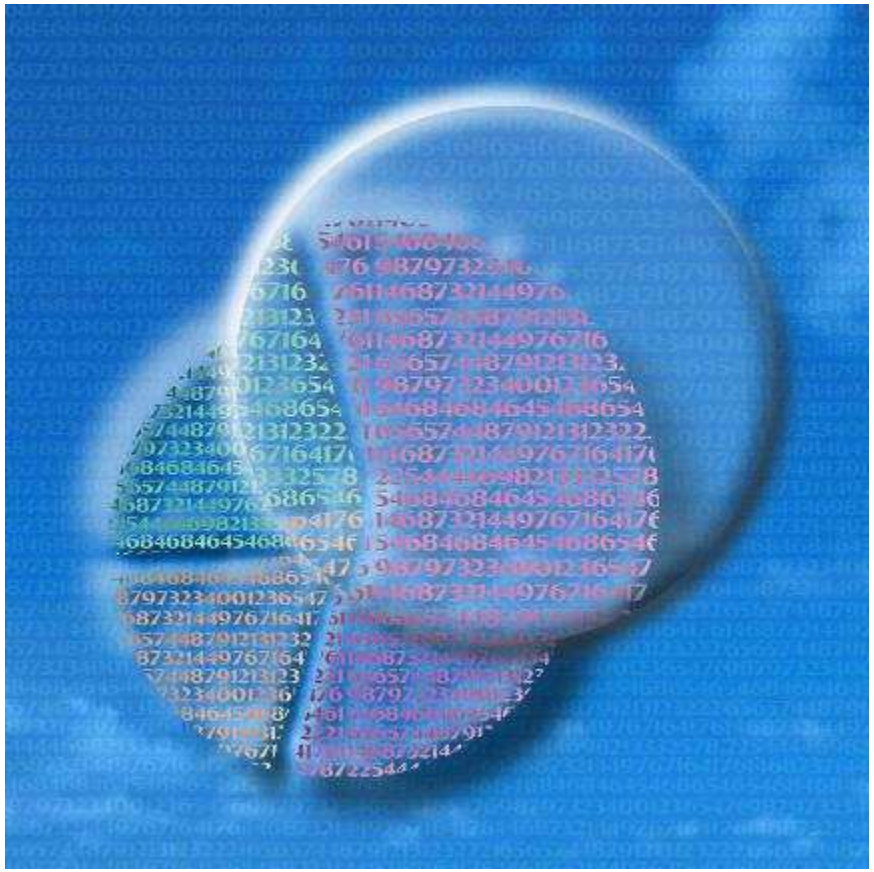

Science on the Verge

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)

New Currents in Science: The Challenges of Quality
Joint Research Centre, Ispra, 3-4 March 2016

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Presentations

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Caeteris are never paribus

Where to find this presentation

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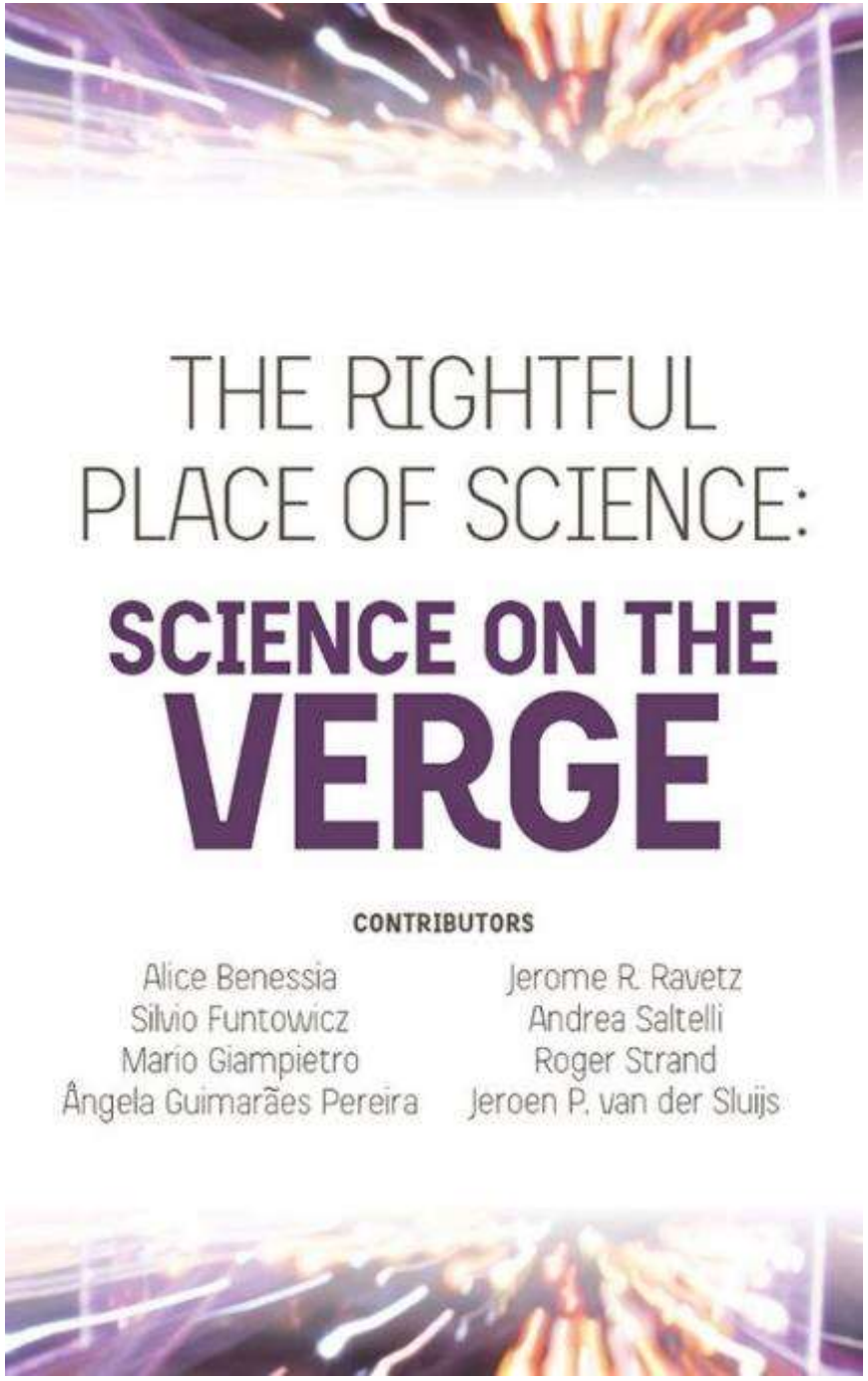
sensitivity analysis,
sensitivity auditing,
science for policy,
impact assessment

Published by the Consortium for Science, Policy and Outcomes at Arizona State University, March 2016, on Amazon.

http://www.amazon.com/Rightful-Place-Science-Verge/dp/0692596380/ref=sr_1_1?s=books&ie=UTF8&qid=1456255907&sr=1-1&keywords=saltelli

http://www.andreasaltelli.eu/science-on-the-verge



THE RIGHTFUL PLACE OF SCIENCE:

SCIENCE ON THE VERGE

"Wow. This penetrating, frightening, provocative and irrefutable view of the debasing of science cuts to—and through—the bone. Every producer, consumer and believer of 'science' should read this book, whether interested in pesticides, GMOs, nuclear power, climate change, psychology or fiscal policy."

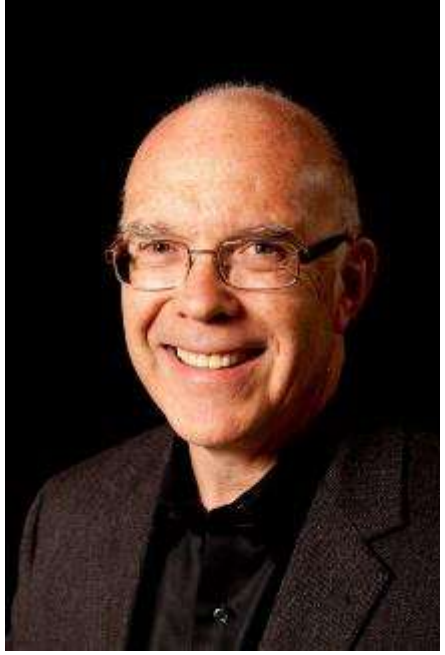
Professor Philip B. Stark, Associate Dean, Division of Mathematical and Physical Sciences, University of California Berkeley

"An uncomfortable but vital diagnosis of the trouble with science. It describes valuable efforts by scientists to heal themselves, including movements for open access and social responsibility, but is clear about the limits of these endeavours. This book is certainly critical, but it is resolutely constructive."

Professor Jack Stilgoe, Senior Lecturer, Department of Science and Technology Studies, University College London

Is there a crisis?

- Generation of new data/ publications at an unprecedented rate.
- Compelling evidence that the majority of these discoveries will not stand the test of time.
- Failure to adhere to good scientific practice & the desperation to publish or perish.
- This is a multifaceted, multistakeholder problem.
- No single party is solely responsible, and no single solution will suffice.



C. Glenn Begley

John P. A. Ioannides

Begley, C. G., and Ioannidis, J. P., 2015, Reproducibility in Science. Improving the Standard for Basic and Preclinical Research, Circulation Research, 116, 116-126, doi: 10.1161/CIRCRESAHA.114.303819

Laboratory experiments cannot be trusted without independent verification (Sanderson 2013), rules are proposed to spot "suspected work [...in] the majority of preclinical cancer papers in top tier journals" (Begley 2013), "[...] an estimated 85% of research resources are wasted" (Ioannidis 2014), "an estimated US$200 billion were wasted in the US in 2010" (Lancet, 2015)

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

Begley, C. G., and Lee M. E., 2012, Drug Development: Raise Standards for Preclinical Cancer Research, Nature, 483, 531–533.

Begley CG 2013 Reproducibility: Six red flags for suspect work Nature 497 433–434.

Sanderson K 2013 Bloggers put chemical reactions through the replication mill Nature 21 January 2013.

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

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

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

“There is no cost to getting things wrong. The cost is not getting them published.” Brian Nosek.

A landmark effort to reproduce the findings of 100 recent papers in psychology failed in more than half the cases – and the effects were smaller than claimed in the original studies (Brian Nosek's work).

Brian Nosek
Professor, Department of Psychology
University of Virginia

Baker, M., 2015, Over half of psychology studies fail reproducibility test. Largest replication study to date casts doubt on many published positive results, Nature, 27 August 2015.

OSC, Open Science Collaboration, 2015, Estimating the reproducibility of psychological science, SCIENCE, 349(6251) aac4716. DOI: 10.1126/science.aac4716

Yong, E., Nobel laureate challenges psychologists to clean up their act, Nature, News, 03 October 2012.

"Belinda Phipps, who took over at the Science Council last year, accused the sector of complacency and said the public trusted scientists only because they did not understand their work."

Whipple, T., The Times, February 22, 2016

THE TIMES

Science

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Welcome to your preview of The Times

Scientists 'should take ethics oath like doctors'

Tom Whipple Science Editor
Published at 12:01AM, February 22 2016

Scientists need their own version of the Hippocratic oath and a regulation system similar to doctors to avoid a big scandal, the head of their standards body has said.

Studies suggest that a significant proportion of scientific papers are not repeatable
Monty Rakusen/Corbis

Post a comment

"What struck me, coming into this sector is just how unregulated it is compared to the medical profession," Ms Phipps said. "Think what damage a scientist could do if he or she behaved badly or fraudulently. The potential damage is enormous, yet there is almost no regulation."

Whipple, T., The Times, February 22, 2016

THE TIMES

Science

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Monty Rakusen/Corbis

Post a comment

Solutions from within:

- Four international conferences on science integrity; Pledges; Replication initiatives…
- San Francisco declaration, (2012)
- Ioannides (2014): a checklist of remedies

John P. A. Ioannides

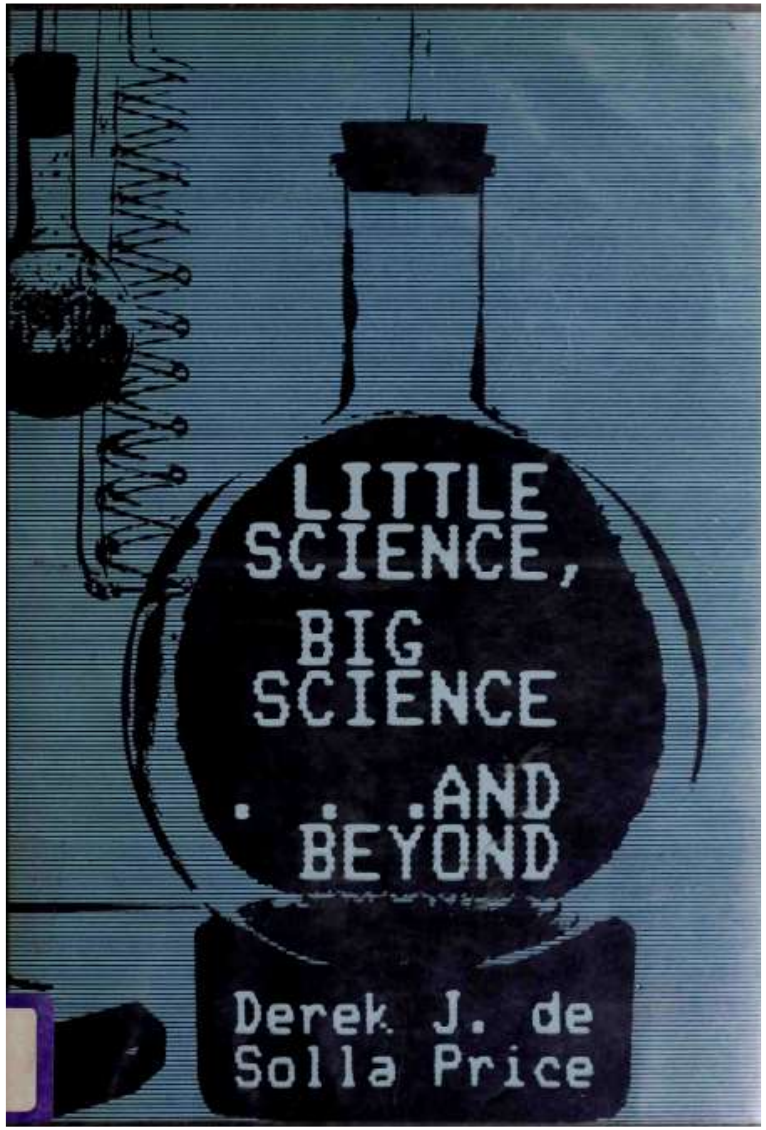
"[…] adoption of large-scale collaborative research; replication culture; registration; sharing; reproducibility practices; better statistical methods; […] and improvement in study design standards, peer review, […] training of the scientific workforce"

Declaration: http://am.ascb.org/dora/ , drafted by publishers, with separate recommendations for institutions, publishers, organizations that supply metrics and researchers.
Lancet, Editorial, 2015, Rewarding true inquiry and diligence in research, 385, p. 2121.
Wilsdon, J., 2015, We need a measured approach to metrics, Nature, 523, 129.
Ioannidis, J. P. (2014). How to Make More Published Research True. PLoS medicine, 11(10), e1001747.

Root causes?

A perspective from science and technology studies

There were rare anticipations of this crisis. 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).

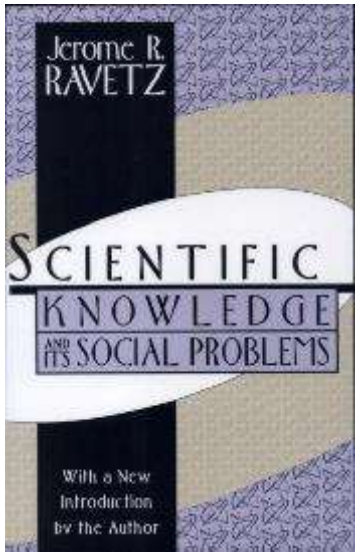
Ravetz, J., 1971, Scientific Knowledge and its Social Problems, Oxford University Press, p. 22.

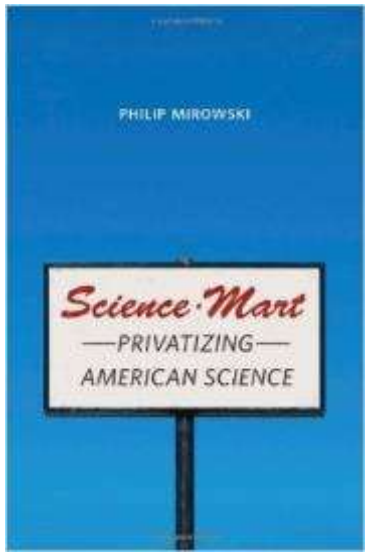
Lyotard, J.-F. 1979. La Condition postmoderne. Rapport sur le savoir, Paris : Minuit, Chapter 10.

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

Jerome R. Ravetz

Jean-François Lyotard



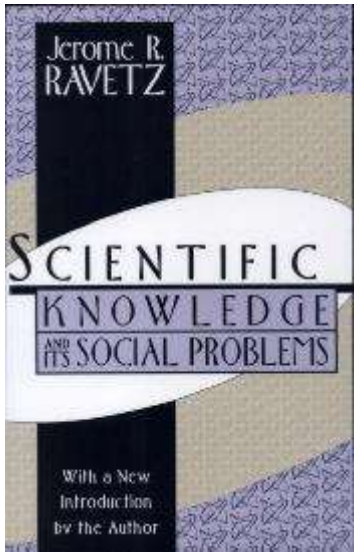


Philip Mirowski

p.22: About the industrialization of science and the weakening of its quality control mechanism:

"The problem of quality control in science is [...] at the centre of the social problems of the industrialized science [...]. If it 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, p.22.



Jerome R. Ravetz

Different readings of the crisis :

- Poor training, statistical design, hubris of data mining, incentives
- Science victim of its own success, exponential growth, senility by exponential growth & hyper-specialization
- Science as another victim of the neoliberal ideology
- Science as a social enterprise whose quality control apparatus suffers under the mutated conditions of technoscience

So far a about science's own governance crisis;

How about science for policy & science's advice?

Ignoring the connection between science's crisis and science advice?

The OECD report on Science Advice 2015; not a single mention of science's crisis. Only 'crisis situations' ignoring that science itself is into one.

http://www.oecd-ilibrary.org/docserver/download/5js33l1jcpwb.pdf?expires=1442656356&id=id&accname=guest&checksum=AF1467AD25FF8BE6516083077CCEE31A

Likewise at: http://www.ingsa.org/events/2016-conference/

OECDpublishing

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/10.1787/5js33l1jcpwb-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

How both republicans and democrats appeal to a disingenuous vision of neutral and factual science to advance their respective agendas – The story of the 2015 Secret Science Reform Act

"Science is the battleground, but it cannot adjudicate this dispute"

Those aspect of science most used in policy (mathematical and statistical modelling) are also those more problematic

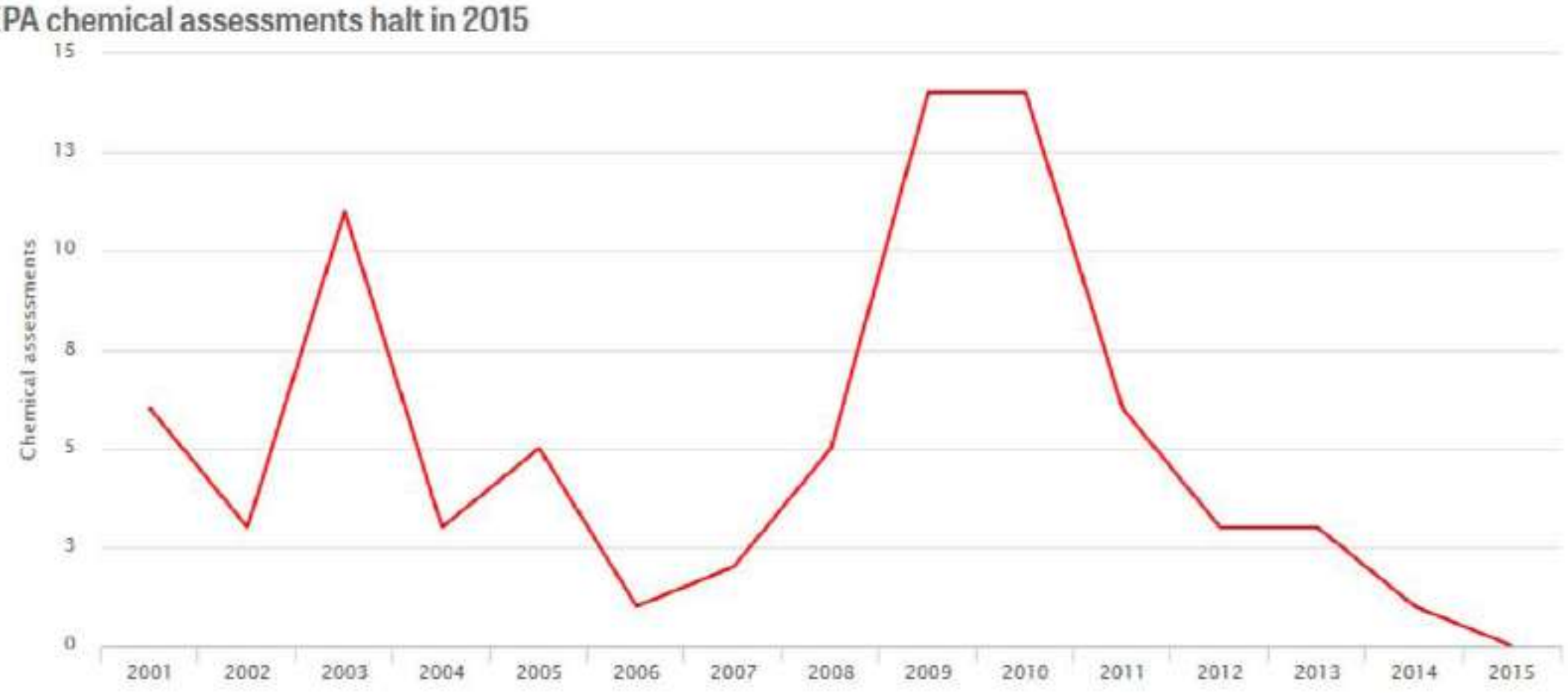
Sarewitz, D., 2015, Reproducibility will not cure what ails science, Nature, 525, p. 159.

WORLD VIEW *A personal take on events*

MICHAEL J. LEMONICK

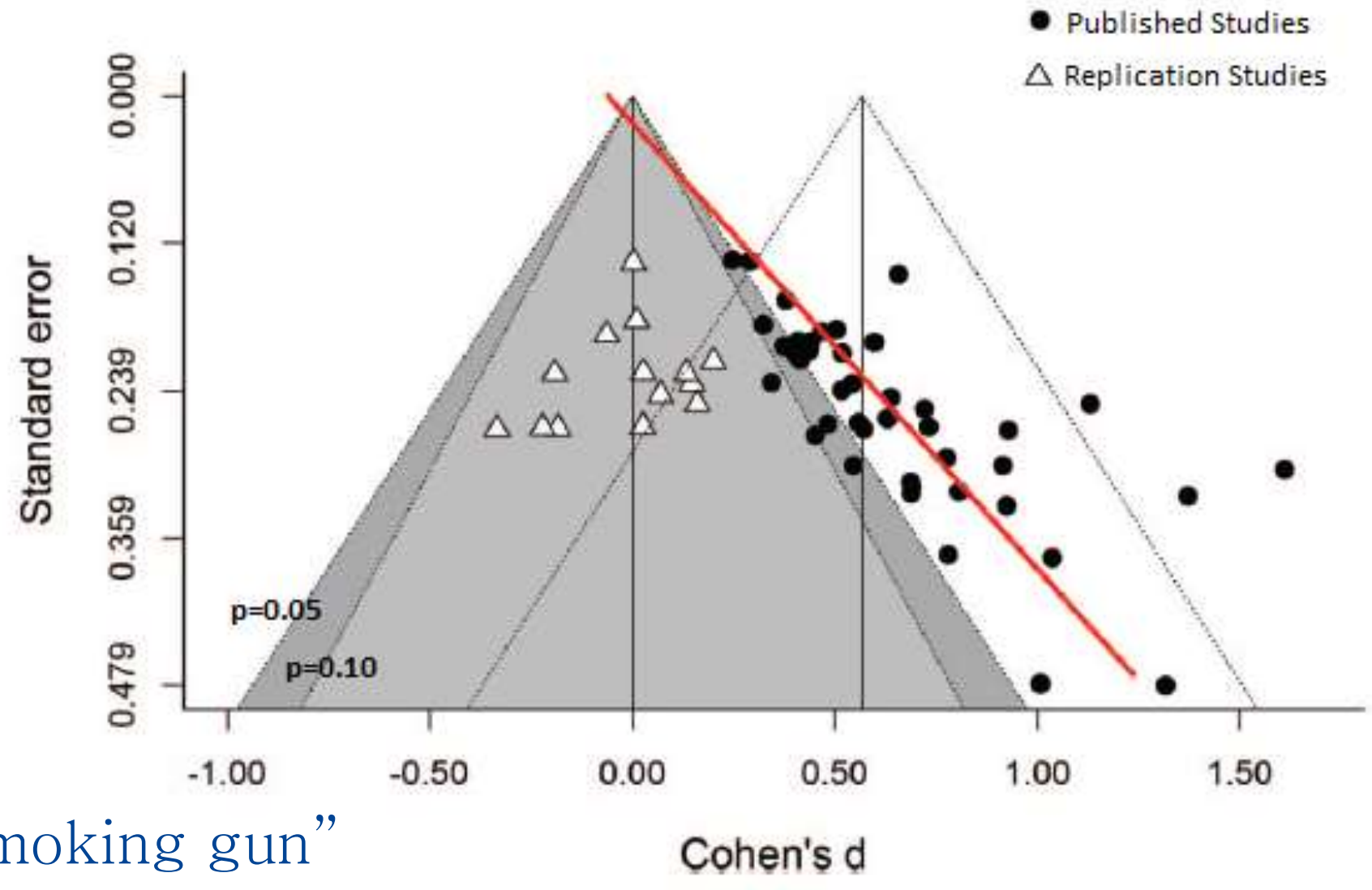
Reproducibility will not cure what ails science

A bill to make data for environmental regulation more transparent reveals the fuzzy boundary between science and ideology, argues **Daniel Sarewitz**.



"Activity at the Environmental Protection Agency office that issues scientific reports on the toxicity of chemicals has nearly ground to a halt in recent years."

Meet the 'rented white coats' who defend toxic chemicals - How corporate-funded research is corrupting America's courts and regulatory agencies, by David Heath, http://www.publicintegrity.org/2016/02/08/19223/meet-rented-white-coats-who-defend-toxic-chemicals



"P-hacking's smoking gun"

Shanks et al. (2015) JEP:General

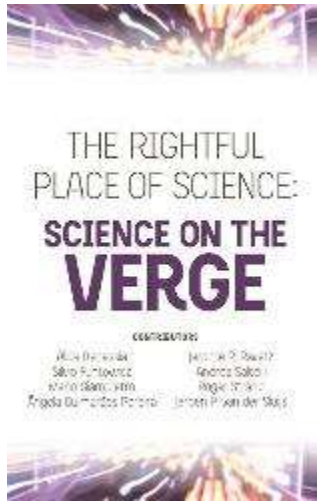
Journal of Experimental Psychology: General, 144(6), Dec 2015, e142-e158. "Romance, Risk, and Replication: Can Consumer Choices and Risk-Taking Be Primed by Mating Motives?", Shanks DR, Vadillo MA, Riedel B, Clymo A, Govind S, Hickin N, Tamman AJ, Puhlmann LM.

Quantification as an instrument of hypocognition? Simplifications, linearization and compressions of understandings; Socially constructed ignorance?

Ravetz, J. R., 1987. "Usable Knowledge, Usable Ignorance, Incomplete Science with Policy Implications, Knowledge, Creation, Diffusion, Utilization, 9(1): 87-116.

Rayner, S., 2012. "Uncomfortable knowledge: the social construction of ignorance in science and environmental policy discourses", Economy and Society, 41(1): 107-125.

Saltelli, A., Giampietro, M., 2015, The fallacy of evidence based policy, Verge book ➔



Need for responsible quantification

Saltelli, A., Funtowicz, S., When all models are wrong: More stringent quality criteria are needed for models used at the science-policy interface, Issues in Science and Technology, Winter 2014, 79-85.http://issues.org/30-2/andrea/

See also JRC workshop on responsible quantification Brussels, June 2015
https://ec.europa.eu/jrc/en/event/conference/use-quantitative-information

Remedies from without

Could the movement known as ‘Citizens’ Science’ respond to official science’s predicaments (McQuillan, 2014) and ‘pick up the gauntlet’ thrown by official science’s contested hegemony?

Dan McQuillan

McQuillan, D., 2014, The Countercultural Potential of Citizen Science, Media and Communication Journal, Vol. 17, No. 6 (2014) - 'counterculture', http://research.gold.ac.uk/11482/1/mcquillan-countercultural-potential-of-citizen-science.pdf

New forms of science and of quality control:

"Is the internet to science what the Gutenberg press was to the church? [...] the new social media have given strength to the extended peer community in science in a way reminiscent of the contribution of printing to the Reformation."

Peer Review and Quality Control, S. Funtowicz & J. Ravetz, International Encyclopedia of the Social & Behavioral Sciences, 2nd edition, 2015.

Ravetz, J. R. and Funtowicz, S. O., 2015. "Science, New Forms of", in Wright, J. D., (ed.), International Encyclopedia of the Social and Behavioral Sciences, 2nd edition, Vol. 21: 248–254. Oxford: Elsevier.

Where to go from here? Last hints:

- Extended peer review to maintain trust (PNS);
- A new ecology: 'amateur-citizen' and 'activist-citizen' scientists (from counting galaxies to Love Canal);
- The emergence of a 'scientist-citizen' movement within established science itself?

Jack Stilgoe

Stilgoe, J., 2009. Citizen Scientists: reconnecting science with civil society. London: Demos.

The book's chapters

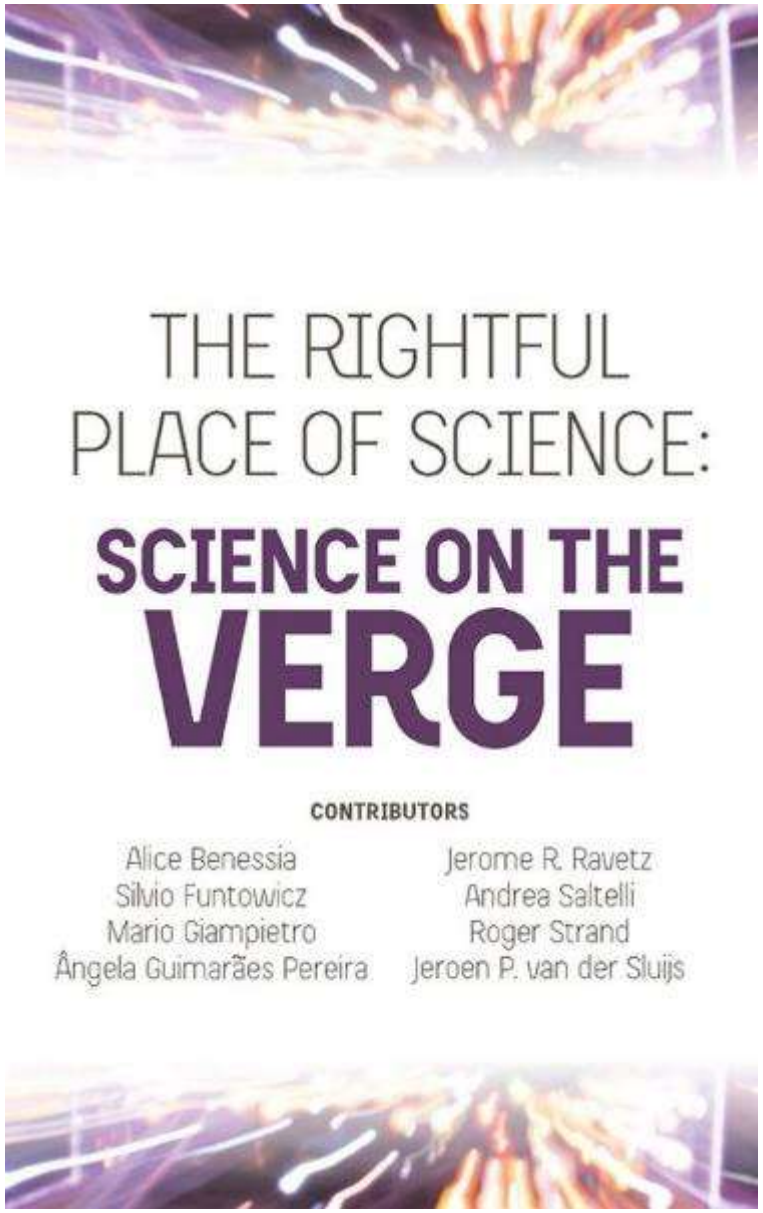
Dan Sarewitz, Preface Pedro Almodóvar, Jonathan Swift, the floating island of Laputa and a portrayal of XVIII science; what lesson for science's present predicaments

Chapter 1. Andrea Saltelli, Jerome Ravetz, Silvio Funtowicz, Who will solve the crisis in science? Is there a crisis? What is being done 'from within'? Is this sufficient? What are the diagnoses for the crisis' root causes, and what are the solutions 'from without'?

Chapter 2. Andrea Saltelli, Mario Giampietro, The fallacy of evidence based policy Quantification as hypocognition; socially constructed ignorance & uncomfortable knowledge; ancien régime syndrome; quantitative story telling

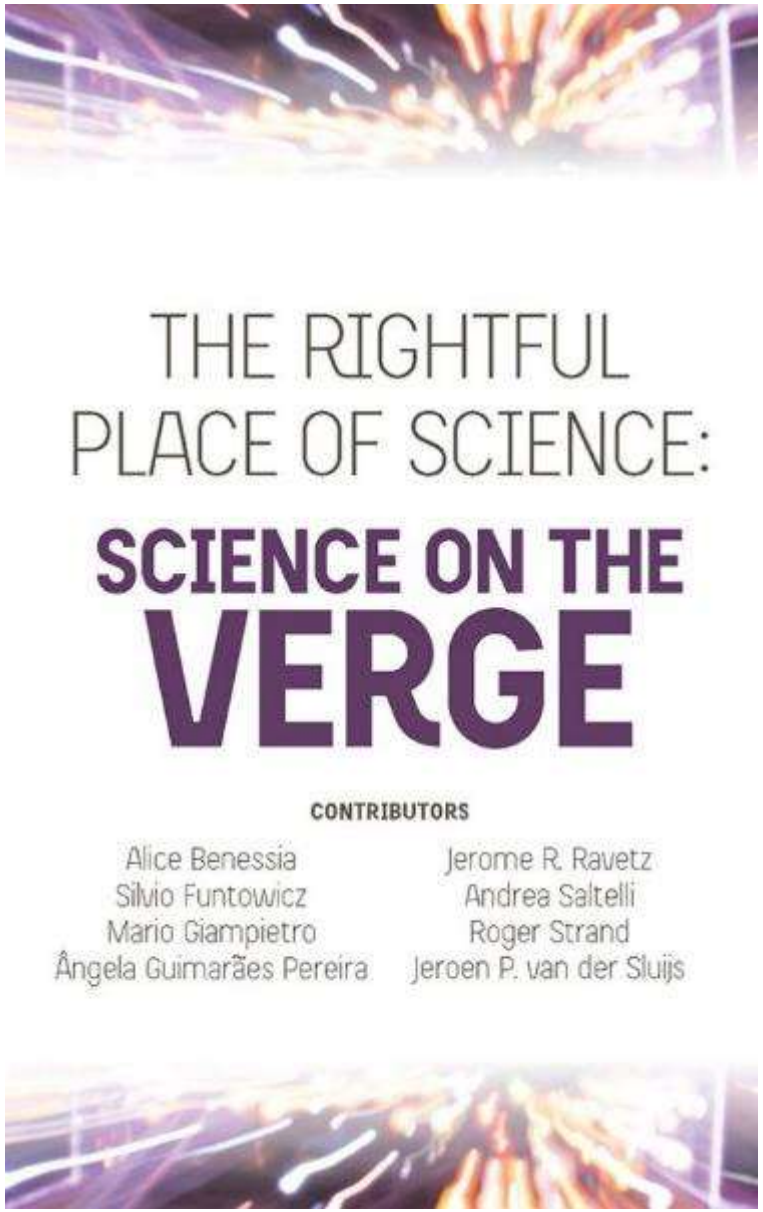
Chapter 3. Alice Benessia, Silvio Funtowicz, **Never late, never lost, never unprepared** Trajectories of innovation and modes of demarcation of science from society: 'separation', 'hybridization' and 'substitution'; what contradictions these trajectories generate

Chapter 4. Ângela Guimarães Pereira, Andrea Saltelli , **Institutions on the verge: working at the science policy interface**
The special case of the European Commission's in house science service; the Joint Research Centre as a boundary institutions; diagnosis, challenges and perspectives



Chapter 5. Jeroen van der Sluijs, Numbers running wild Uses and abuses of quantification a the loss of 'craft skills' with numbers; 7.9% of all species shall become extinct

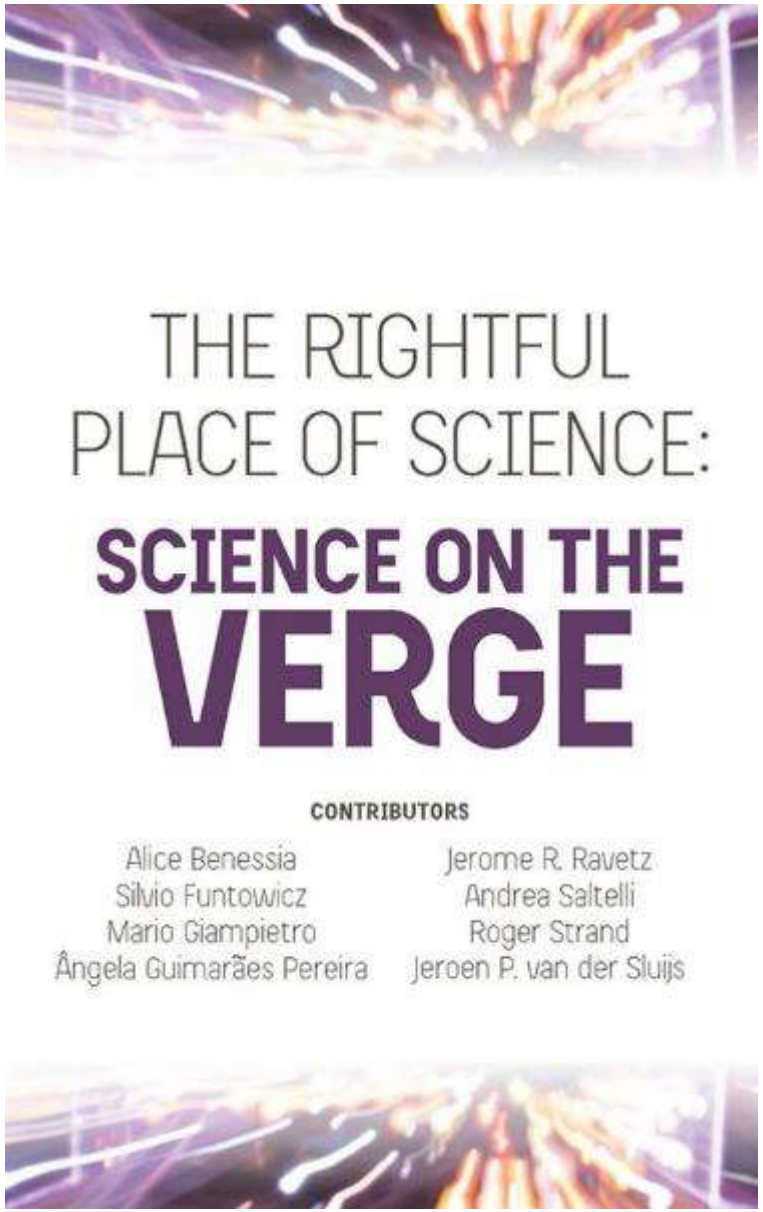
Chapter 6. Roger Strand, Doubt has been eliminated Gro Harlem Brundtland's famous 2007 speech, after the Fourth IPCC report and the Stern review; when science becomes a 'life philosophy'; science as the metaphysics of modernity; the Norwegian Research Ethics Committee for Science and Technology inquiry



A snapshot of a rapidly unfolding crisis in the governance of science, associated with emerging concerns about its reproducibility and integrity;

While trust in science as such appears to be still substantially unscathed, the use of science to adjudicate policy disputes is increasingly conflicted;

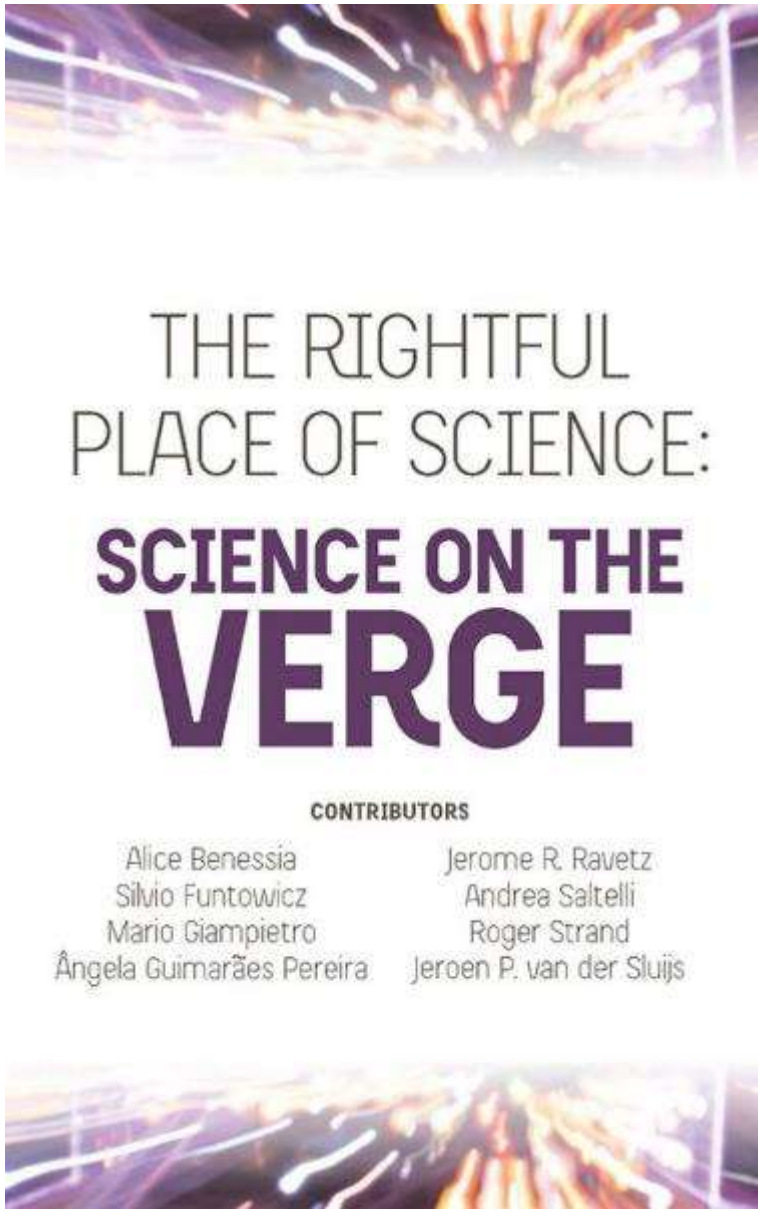
This entails a crisis in the dual legitimacy system at the heart of modernity: that of science providing the facts and policy taking care of the values;



The crisis has ethical, epistemological, methodological and even metaphysical dimensions;

Root causes of the crisis, from history and philosophy of science scholarship to present-day historical critique of commodified science;

The crisis of science *qua science* impacts science as used for policy.



Points of intense friction in the present dynamics

- paradigm of evidence-based policy
- use of science to produce implausibly precise numbers and reassuring techno-scientific imaginaries
- use of science to ‘compel’ decision by the sheer strength of ‘facts’