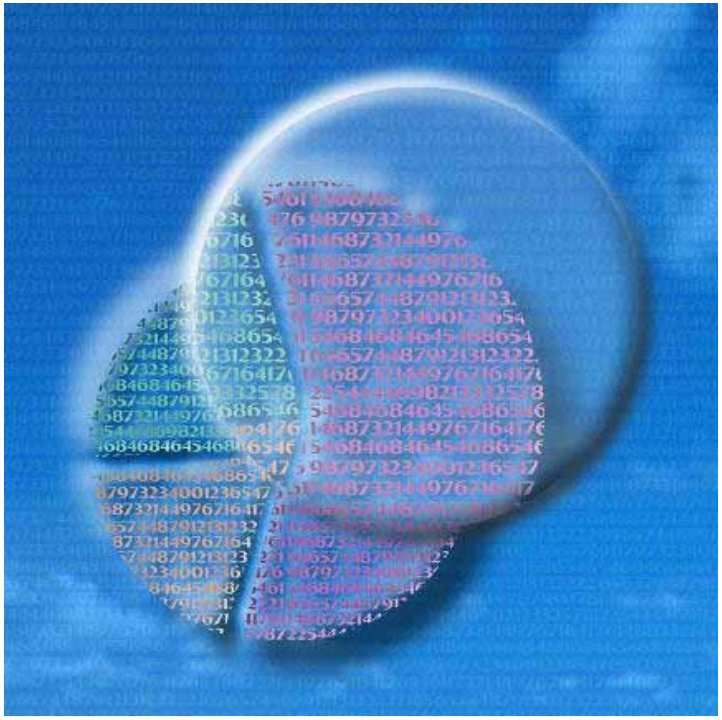


Science on the Verge

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)

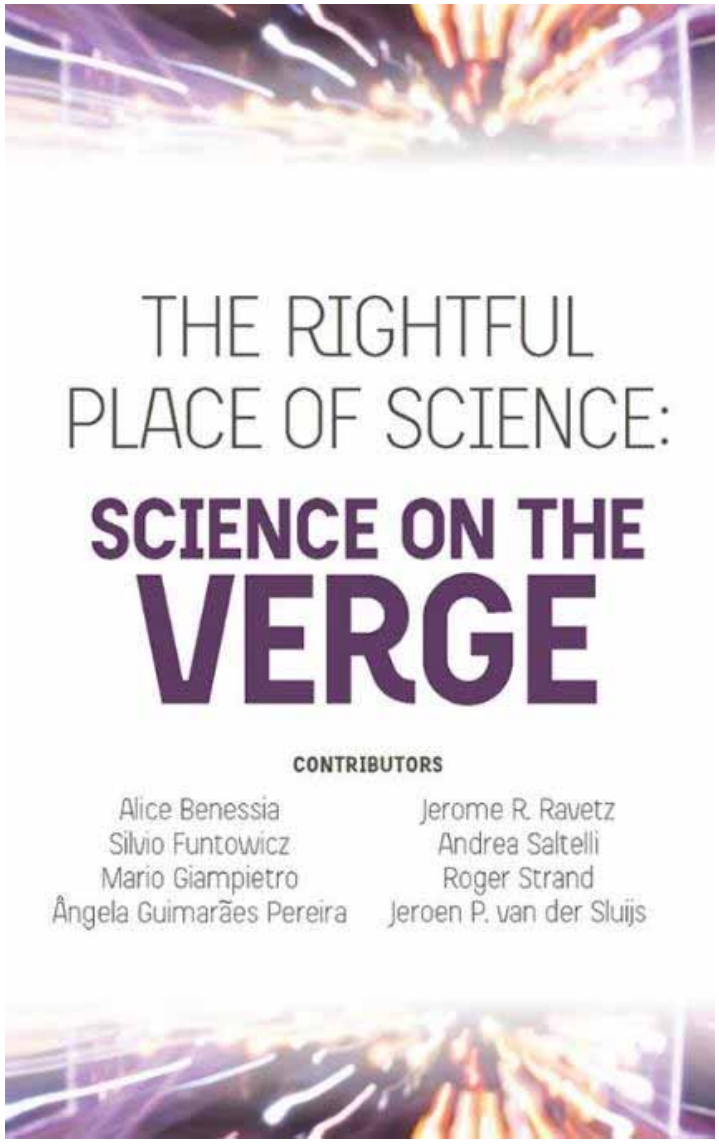
Symposium at Copernicus Institute, Utrecht, Ruppertbuilding room 134,

25 February 2016, h16.30-18.00

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

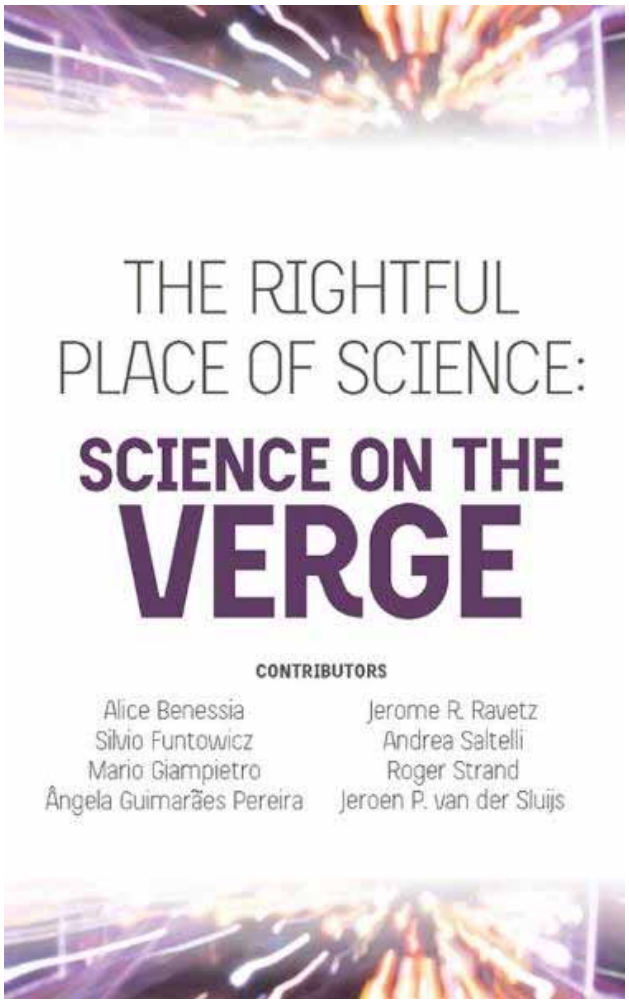
"An uncomfortable but vital diagnosis of the trouble with science. It describes valuable efforts by scientists to heal themselves, including movements for open access and social responsibility, but is clear about the limits of these endeavours. This book is certainly critical, but it is resolutely constructive."

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

Dan Sarewitz, Preface Almodóvar, Swift, Laputa's portrayal of XVIII science, science's present predicaments

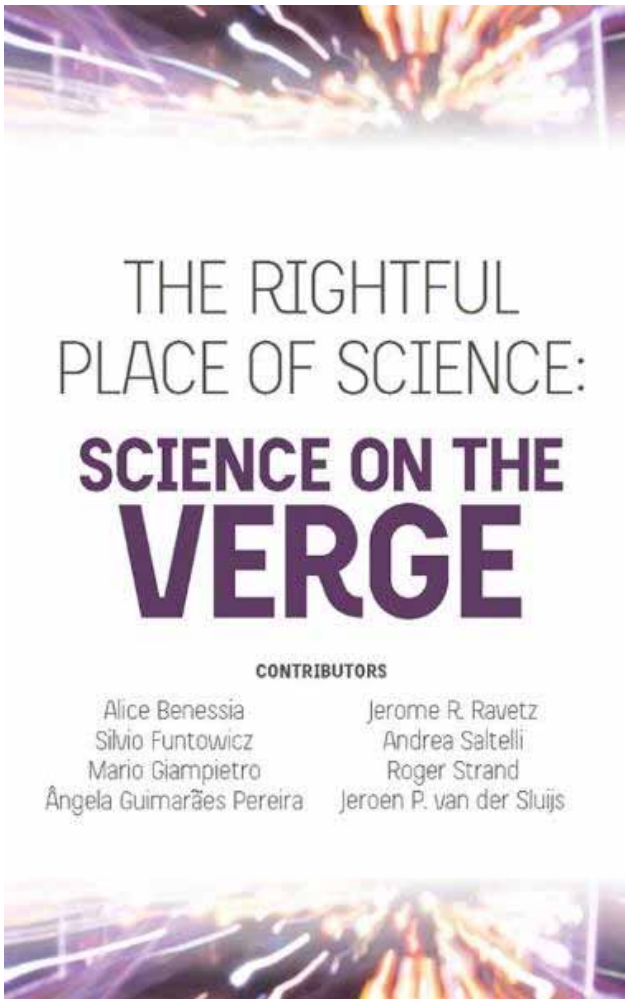
Chapter 1. Andrea Saltelli, Jerome Ravetz, Silvio Funtowicz, Who will solve the crisis in science? This talk

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



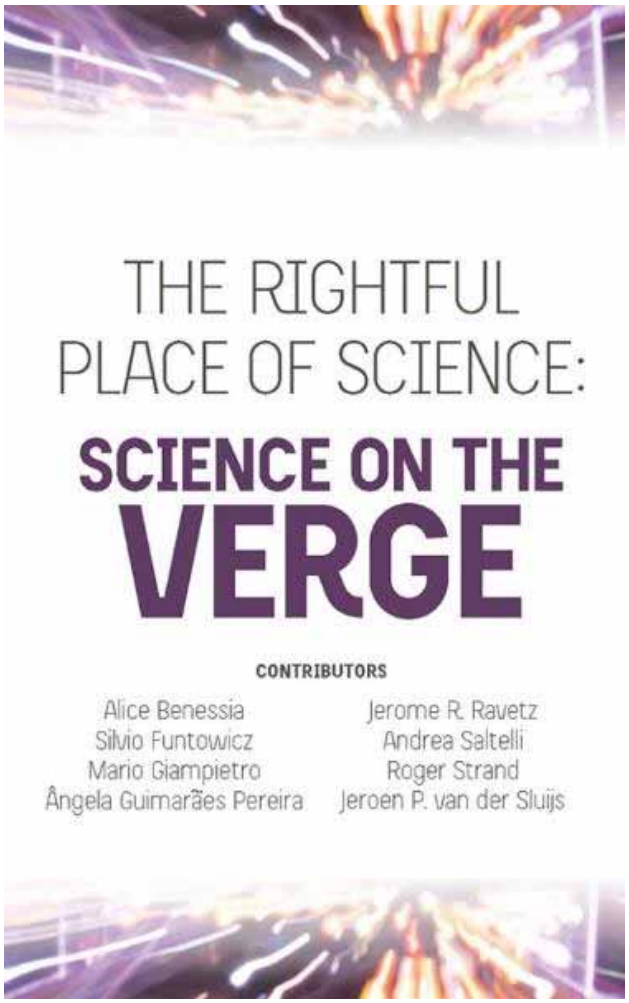
Chapter 3. Alice Benessia, Silvio Funtowicz, **Never late, never lost, never unprepared** Trajectories of innovation and modes of demarcation of science from society: ‘separation’, ‘hybridization’ and ‘substitution’; what contradictions these trajectories generate

Chapter 4. Ângela Guimarães Pereira, Andrea Saltelli , **Institutions on the verge: working at the science policy interface**
The special case of the 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

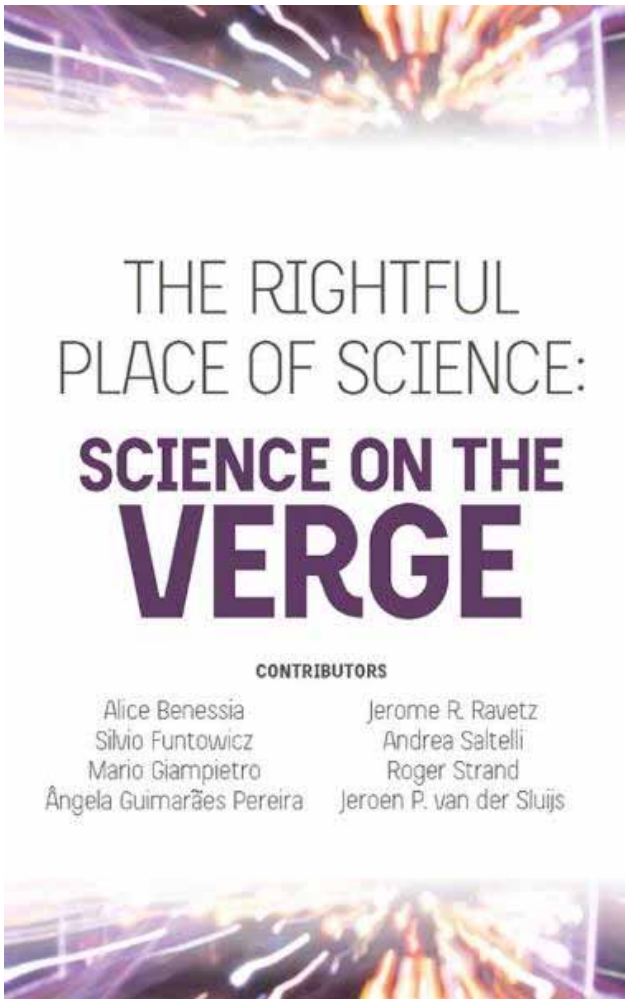
Chapter 6. Roger Strand, Doubt has been eliminated Gro Harlem Brundtland’s famous 2007 speech, after the Fourth IPCC report and the Stern review; when science becomes a ‘life philosophy’; science as the metaphysics of modernity; the Norwegian Research Ethics Committee for Science and Technology inquiry



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;

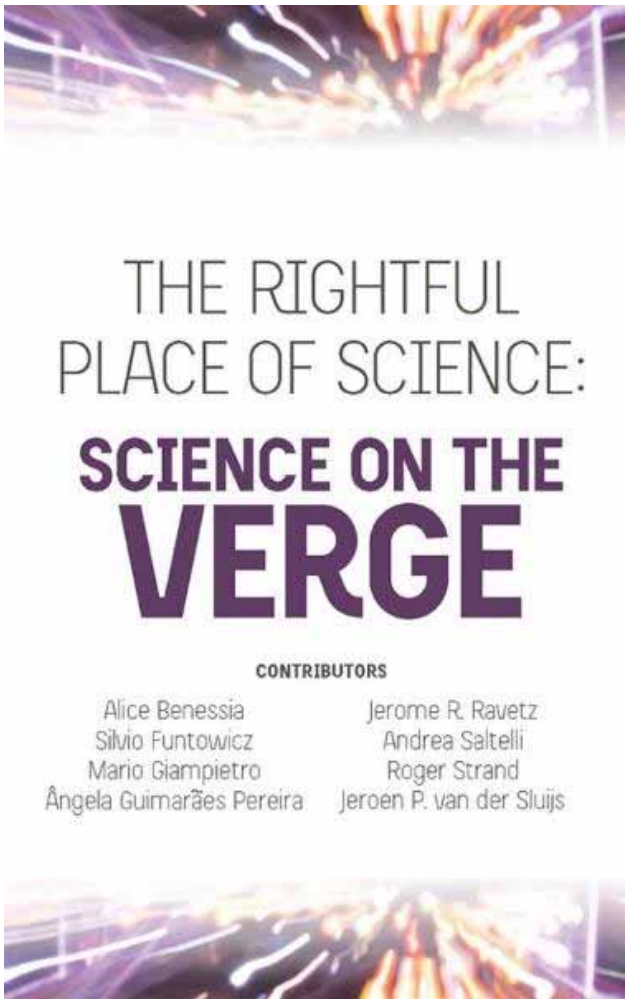
This entails a crisis in the dual legitimacy system at the heart of modernity: that of science providing the facts and policy taking care of the values;



It has ethical, epistemological, methodological and even metaphysical dimensions;

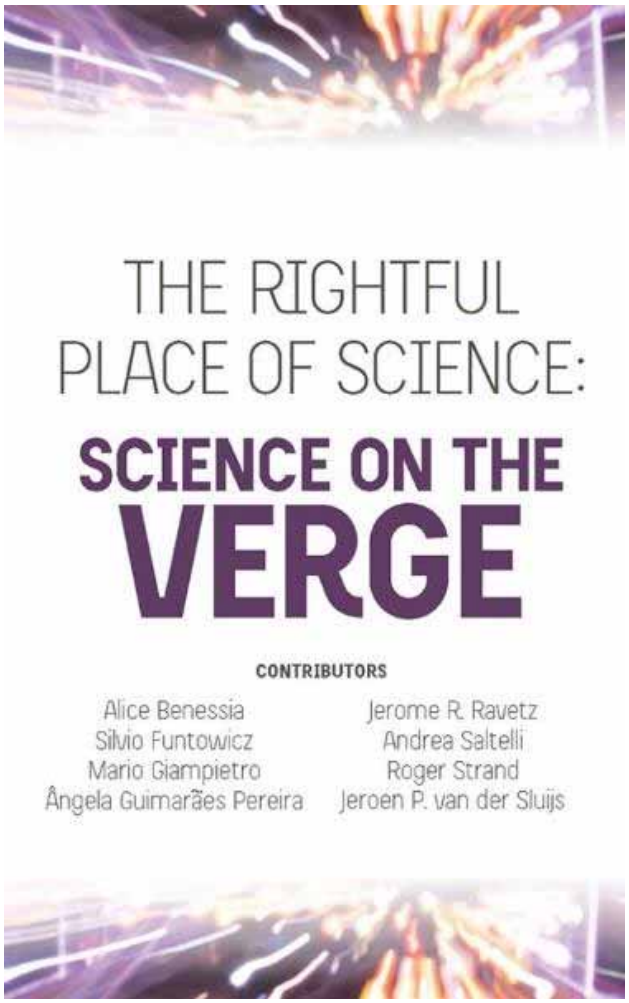
Root causes of the crisis, from STS scholarship to the present-day historical critique of commodified science, and denial;

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
- loci where these paradigms came under major strain - boundary institutions at the science-policy-law interfaces.



Crisis

More controversy – wicked issues

More and more issues become ‘wicked’ , meaning by this deeply entangled in a web of hardly separable facts, interests and values… (GMO, climate, the use of statistics in Education (PISA), bees and pesticides, children born to gay couples, culling of badgers, …)

“Science still commands enormous—if sometimes bemused—respect. But its privileged status is founded on the capacity to be right most of the time and to correct its mistakes when it gets things wrong. […] The false trails laid down by shoddy research are an unforgivable barrier to understanding”
(October 2013)

"Preclinical Reproducibility and Robustness Channel [an electronic journal to publish replication studies] launched on February 4th".

The article also mentions the Meta-Research Innovation Centre at Stanford, in California, opened in 2014.

(February 2016)

Issues with trust / quality in the scientific enterprise

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).

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

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

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

Issues with trust / quality in the scientific enterprise

In a landmark study of results in cancer science Begley and Ellis were able to reproduce only 11 per cent of the original findings (2012).

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

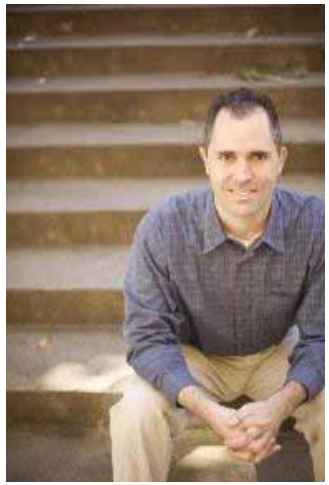
"Shoddy science" is not confined to natural sciences: social sciences are also affected; "I see a train wreck looming" warns Daniel Kahneman; Joseph Stiglitz condemns perverse incentives in the modelling of financial products at the hearth of the present crisis.

Daniel
Kahneman

Joseph
Stiglitz

Yong, E., Nobel laureate challenges psychologists to clean up their act, Nature, News, 03 October 2012.
Stiglitz, J. (2010) Freefall, Free Markets and the Sinking of the Global Economy, Penguin, London.

Another 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

The New York Times

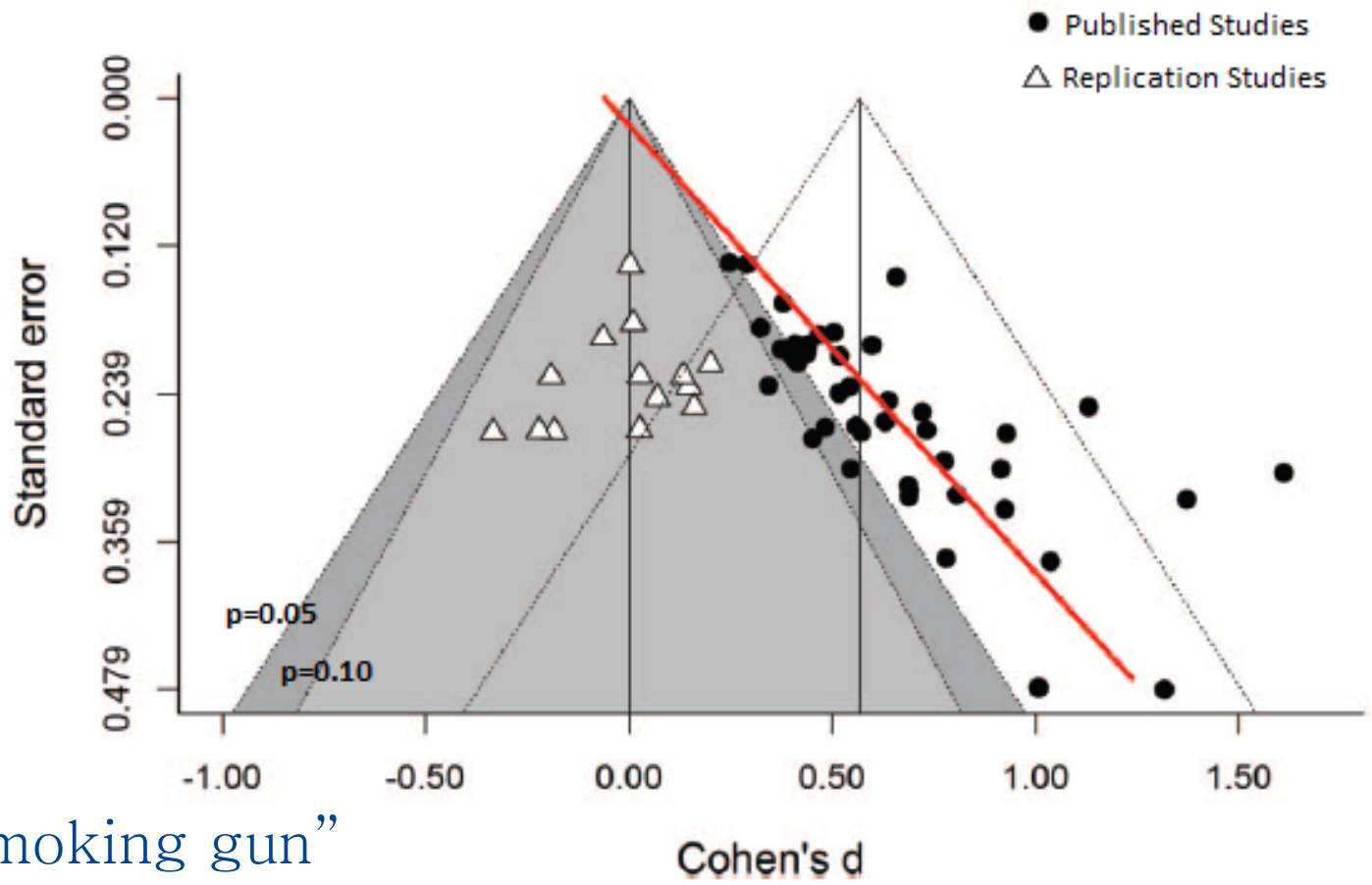
‘Scientists Who Cheat’

nature

Misplaced faith.

The public trusts scientists much more than scientists think. But should it?’

New York Times, 2015, Scientists Who Cheat, Editorial, June 1.
Nature, 2015, Misplaced faith, Editorial, June 2. The public trusts scientists much more than scientists think. But should it?



"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.

“[…]a meta-analysis of this literature reveals strong evidence of either publication bias or p-hacking (or both).

We […] report 8 studies with a total sample of over 1,600 participants which sought to reproduce these effects.

None of the studies, including one that was fully preregistered, was successful.

The results question the claim that romantic primes can influence risk-taking and other potentially harmful behaviors.”

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

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

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.

Issues with trust / quality in the scientific enterprise

Initiatives:
http://retractionwatch.wordpress.com
http://www.reproducibilityinitiative.org

Fixing the mess is not easy:
'Sluggish data sharing hampers reproducibility effort',
(Van Noorden, 2015).

Nature biotechnology. Further Confirmation Needed, Editorial, Nature Biotechnology 30, 2012, 806.

Van Noorden, R., Sluggish data sharing hampers reproducibility effort, Nature, News, June 3rd 2015.

Begley, C.G., Buchan A.M., and Dirnagl, U., 2015, Institutions must do their part for reproducibility, Nature, 525, p. 25-27.

Solutions from within:

Four international conferences have already been held on science integrity between 2007 and 2015 (May 31, 2015, about 600 delegates from over 50 countries and all continents, Rio de Janeiro)

San Francisco declaration, (2012), as of February 2016 signed by ~13,000 individuals, and 620 organizations.

“Do not use journal-based metrics, such as Journal Impact Factor, as a surrogate measure of the quality of individual research articles to assess an individual scientist’s contributions, or in hiring, promotion, or funding decisions.”

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.

Solutions from within:

How to Make More Published Research True (Ioannides 2014)

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, reporting and dissemination of research, and training of the scientific workforce"

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

Solutions from within – randomization & counterfactuals!

How to Make More Published Research True (Ioannides 2014)

John P. A. Ioannides

“Selection of interventions to improve research practices requires rigorous examination and experimental testing whenever feasible”

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

Solutions from within – incentives & currencies

How to Make More Published Research True (Ioannides 2014)

John P. A. Ioannides

"Modifications [] in the reward system for science, affecting the exchange rates for currencies (e.g., publications and grants) and purchased academic goods (e.g., promotion and other academic or administrative power) and introducing currencies that are better aligned with translatable and reproducible research"

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

For The Lancet:

The coming together of the three themes—research integrity; research reward systems; and increasing value and reducing waste in research—is helpful and has greater potential in effecting change than each on its own [···] the true challenge we face is creating a sustainable research environment that fulfils science's true purpose—inquiry to deliver progress for society and our planet.

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

Brave efforts from within:

Jeffrey Beall, librarian, University of Colorado, Denver. Monitors predatory open access publishers.

http://scholarlyoa.com/2015/01/02/bealls-list-of-predatory-publishers-2015/#more-4719.

"**Misleading metrics** list includes companies that "calculate" and publish counterfeit impact factors [⋯] The **Hijacked journals** list includes journals for which someone has created a counterfeit website, stealing the journal's identity and soliciting articles submissions using the author-pays model (gold open-access)"

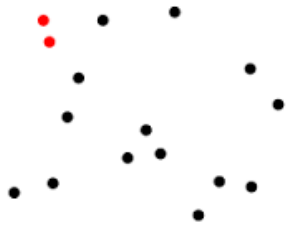
Brave efforts from within:

Timothy Gowers, mathematician, Fields medalist, boycott of Elsevier, slogans: ‘Academic Spring’, ‘Occupy Elsevier’.

Whitfield, J., 2012, Elsevier boycott gathers pace: Rebel academics ponder how to break free of commercial publishers, Nature, doi:10.1038/nature.2012.10010

Larivière V, Haustein S, Mongeon P (2015) The Oligopoly of Academic Publishers in the Digital Era. PLoS ONE 10(6): e0127502, http://journals.plos.org/plosone/article?id=10.1371%2Fjournal.pone.0127502

Take home points of the discussion on the crisis:



There is a crisis in the science's own quality control mechanism.

Reproducibility is a key issue. Systems of incentives, peer review, use of metrics top the discussion

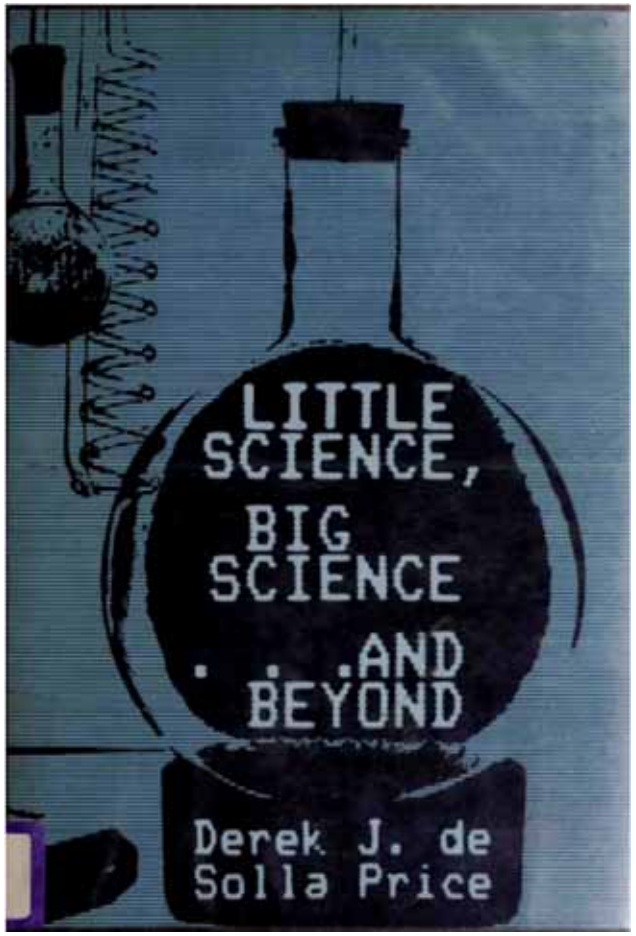
The crisis has broken out of the confines of academia and is lived in public spaces.

There are institutional and individual solutions 'from within' to tackle this issue, as well as controversy.

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

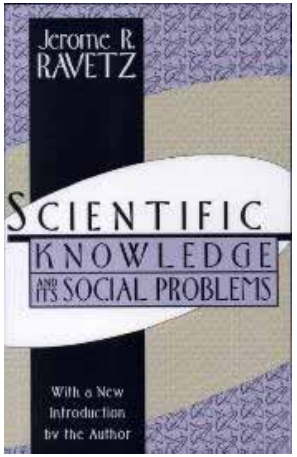
de Solla Price, D.J., 1963, Little science big science, Columbia University Press.

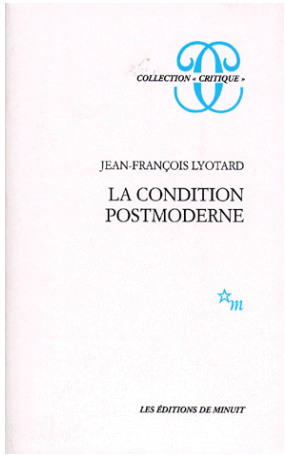
Science/knowledge degenerates when it becomes a commodity for Ravetz (1971), Lyotard (1979) and Mirowski (2011).

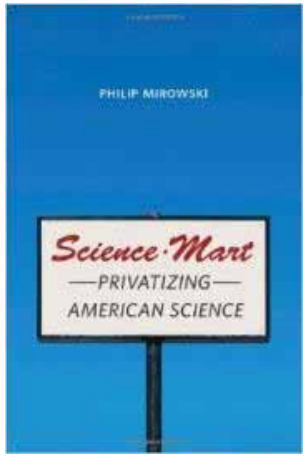
Ravetz, J., 1971, Scientific Knowledge and its Social Problems, Oxford University Press, p. 22.

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.







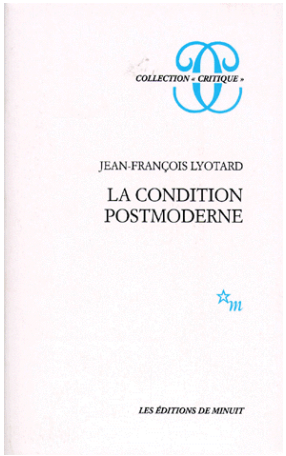
Jerome R. Ravetz

Jean-François Lyotard

Philip Mirowski

Chapter 10 on delegitimation: “[…] The grand narrative [knowledge (science-based) as bildung, emancipation…] has lost its credibility”

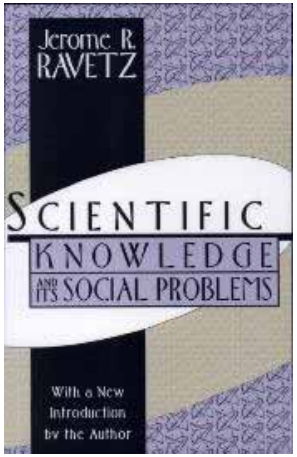
Lyotard, J.-F. 1979. La Condition postmoderne. Rapport sur le savoir, Paris : Minuit, Chapter 10.



Jean-François Lyotard

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

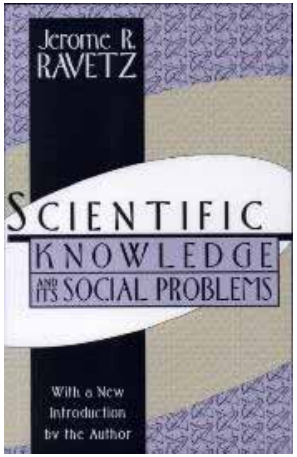
Ravetz, J., 1971, Scientific Knowledge and its Social Problems, Oxford University Press, p.22.



Jerome R. Ravetz

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…”

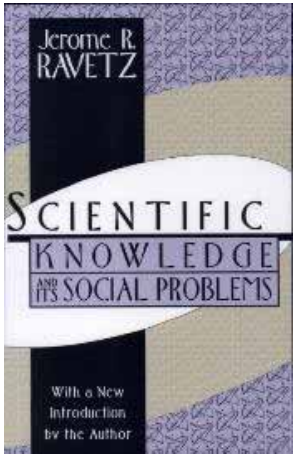
Ravetz, J., 1971, Scientific Knowledge and its Social Problems, Oxford University Press, p.22.



Jerome R. Ravetz

“…If either of these conditions is lacking […] then bad work will be produced […] 'morale' is an important component of scientific activity; and any view of science which fails to recognize the special conditions necessary for the maintenance of morale in science is bound to make disastrous blunders in the planning of science”

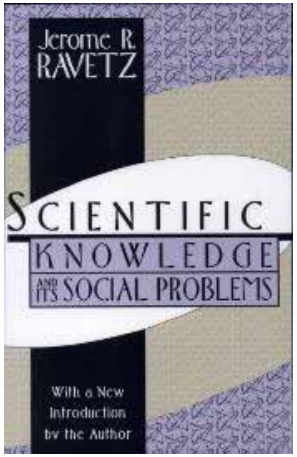
Ravetz, J., 1971, Scientific Knowledge and its Social Problems, Oxford University Press, p.22.



Jerome R. Ravetz

p. 176: “If there were not a test of each paper before its acceptance by a journal, then every intending user would be forced to examine it at length before investing any of his resources in work which relied on it. Under such circumstances, the co-operative work of science as we know it could not take place”

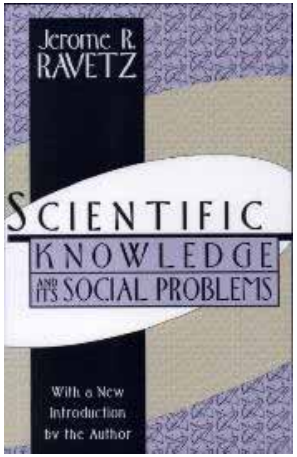
Ravetz, J., 1971, Scientific Knowledge and its Social Problems, Oxford University Press, p.22.



Jerome R. Ravetz

p. 407: “No formal system of imposed penalties and rewards will guarantee the maintenance of quality, for the tasks of scientific inquiry are generally too subtle to be so crudely assessed; nor will the advantages to an individual of a good reputation of his group be sufficient to induce a self-interested individual to make sacrifices to maintain it. Only the identification with his colleagues, and the pride in his work, both requiring good morale, will ensure good work”

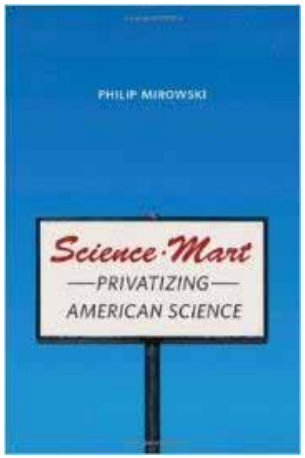
Ravetz, J., 1971, Scientific Knowledge and its Social Problems, Oxford University Press, p.22.



Jerome R. Ravetz

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

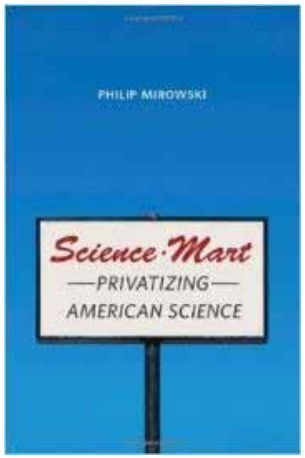
Mirowski, P. 2011. Science-Mart: Privatizing American Science, Harvard University Press.



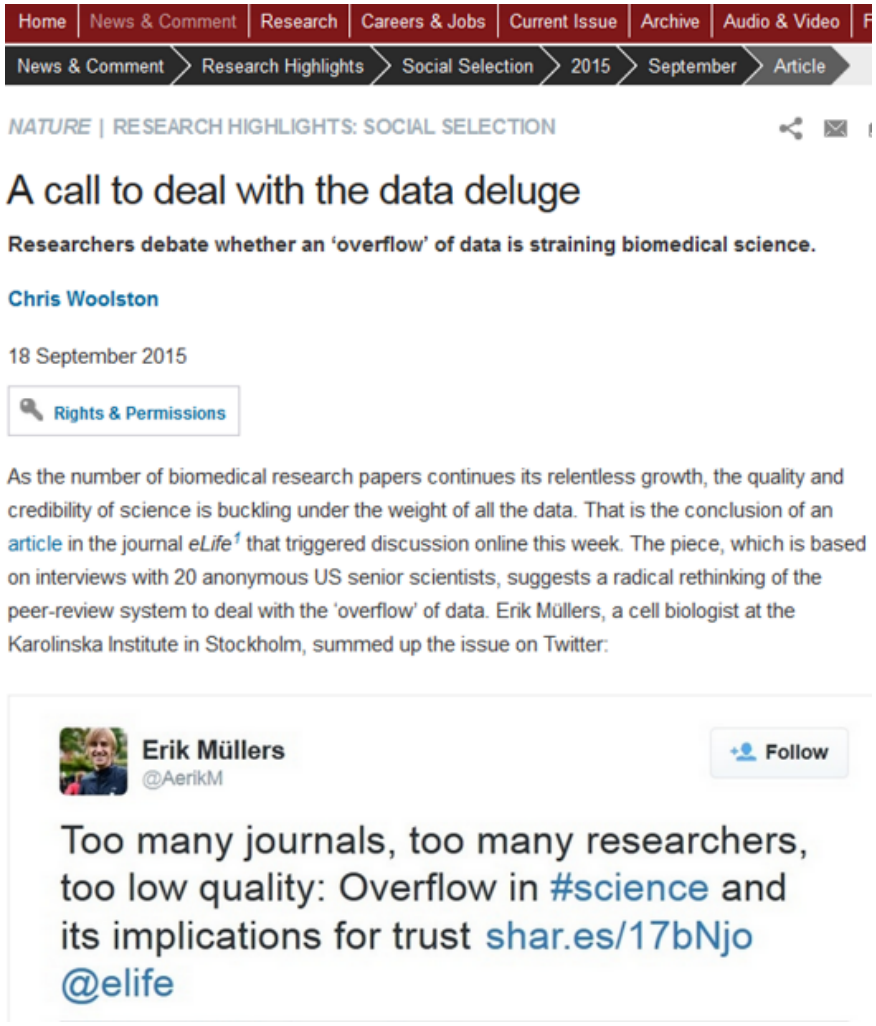
Philip Mirowski

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

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



Philip Mirowski



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NATURE | RESEARCH HIGHLIGHTS: SOCIAL SELECTION

A call to deal with the data deluge

Researchers debate whether an 'overflow' of data is straining biomedical science.

Chris Woolston

18 September 2015

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As the number of biomedical research papers continues its relentless growth, the quality and credibility of science is buckling under the weight of all the data. That is the conclusion of an article in the journal *eLife*[1] that triggered discussion online this week. The piece, which is based on interviews with 20 anonymous US senior scientists, suggests a radical rethinking of the peer-review system to deal with the 'overflow' of data. Erik Müllers, a cell biologist at the Karolinska Institute in Stockholm, summed up the issue on Twitter:

Erik Müllers
@AerikM

Follow

Too many journals, too many researchers, too low quality: Overflow in #science and its implications for trust shar.es/17bNjo @elife

Derek J. de Solla Price's prophecy ...

Siebert, S., Machesky, L. M., and Insall, R. H. (2015) Overflow in science and its implications for trust. eLife, 4, e10825. (doi:10.7554/eLife.10825)

Abstract

To explore increasing concerns about scientific misconduct and data irreproducibility in some areas of science, we interviewed a number of senior biomedical researchers. These interviews revealed a perceived decline in trust in the scientific enterprise, in large part because the quantity of new data exceeds the field's ability to process it appropriately. This phenomenon—which is termed 'overflow' in social science—has important implications for the integrity of modern biomedical science.

Siebert, S., Machesky, L. M., and Insall, R. H. (2015) Overflow in science and its implications for trust. eLife, 4, e10825. (doi:10.7554/eLife.10825)

“Springer and Université Joseph Fourier release SciDetect to discover fake scientific papers”

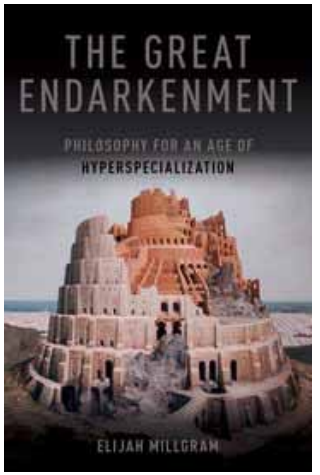
“The open source software discovers text that has been generated with the SCIgen computer program and other fake-paper generators like Mathgen and Physgen […]

SciDetect […] is a valuable building block for the future of academic publishing”

https://www.springer.com/gp/about-springer/media/press-releases/corporate/springer-and-universit%C3%A9-joseph-fourier-release-scidetect-to-discover-fake-scientific-papers--/54166

See Ravetz’s warning “If there were not a test of each paper …”

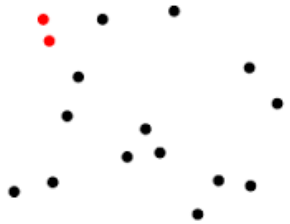
The Great Endarkenment.
Philosophy for an Age of Hyperspecialization
By Elijah Millgram



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)

Take home points from the lesson from science and technology studies. Two (three?) readings:



Science victim of its own success, exponential growth, senility by hyperspecialization (de Solla Price, Milgram)

Science as a social enterprise whose quality control apparatus suffers under the mutated conditions of technoscience (Ravetz)

There is also a perhaps mainstream technical reading of the crisis in terms of poor training, statistical design, hubris of data mining (Ioannidis,…)

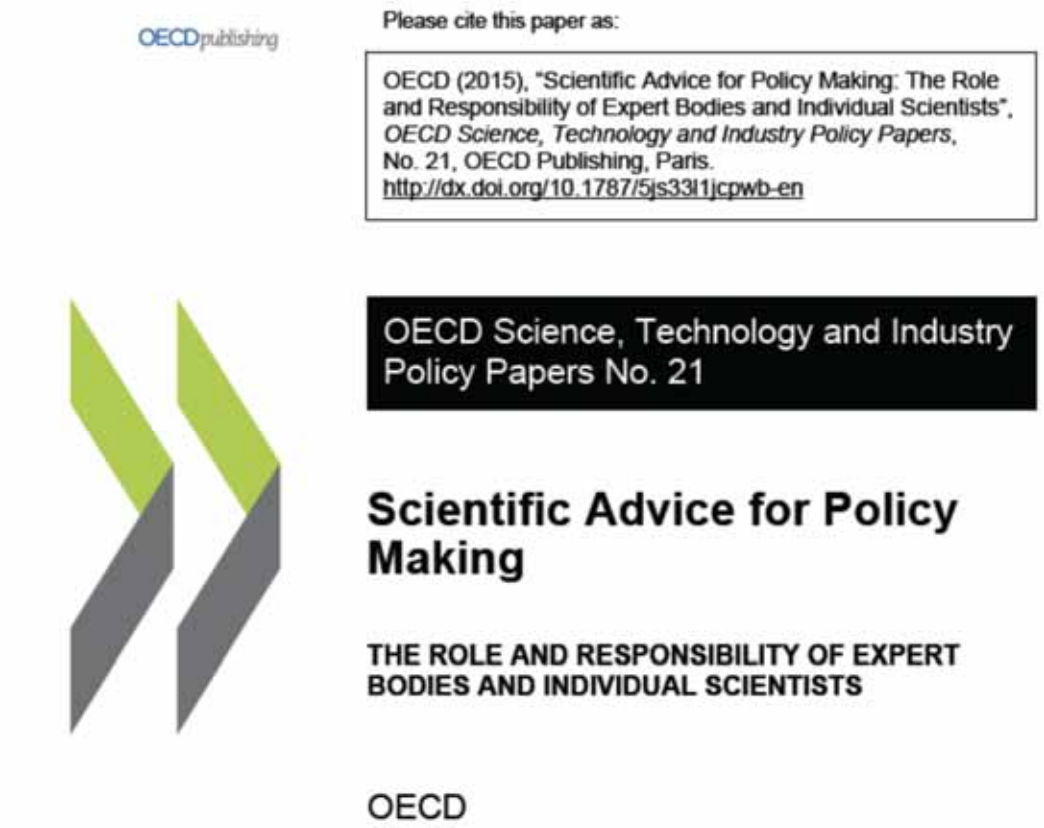
So far a about science's own governance crisis …

… how about science for policy and 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



WORLD VIEW *A personal take on events*

MICHAEL 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**.

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

"[while] the US National Academies is preparing to publish a high-profile report on scientific integrity that will flag irreproducibility as a key concern for the research enterprise [⋯] uncomfortable issues will emerge at the interface of research and 'evidence-based' policy."

The story of the 2015 Secret Science Reform Act to "prohibit the Environmental Protection Agency from proposing, finalizing, or disseminating regulations or assessments based upon science that is not transparent or reproducible"

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

WORLD VIEW *A personal take on events*

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**.

How both republicans and democrats appeal to a disingenuous vision of neutral and factual science to advance their respective agendas

“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

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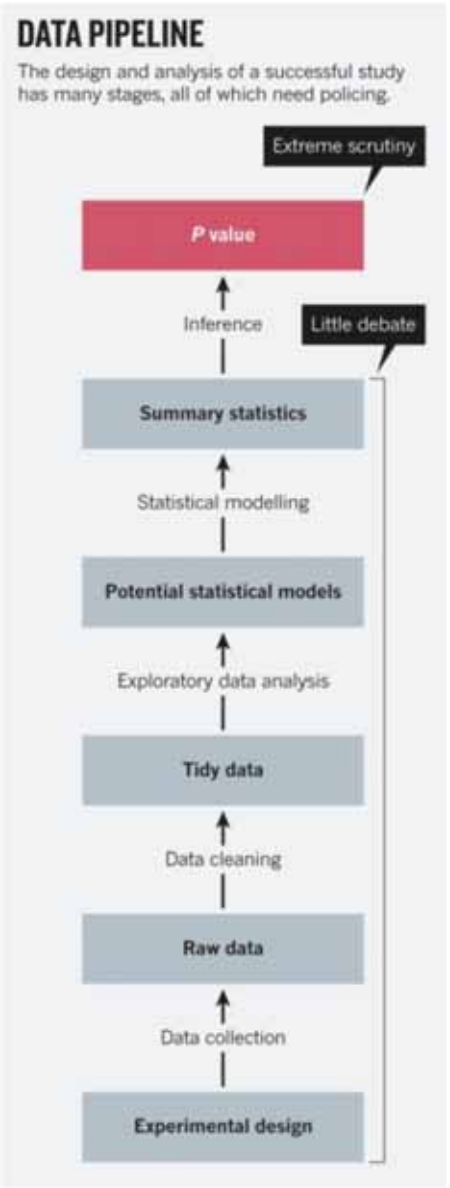

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NATURE | COMMENT

Statistics: *P* values are just the tip of the iceberg

Jeffrey T. Leek & Roger D. Peng

28 April 2015

Ridding science of shoddy statistics will require scrutiny of every step, not merely the last one, say Jeffrey T. Leek and Roger D. Peng.

Leek J.T., and Peng, R.D., 2015, P values are just the tip of the iceberg, Nature, 520, p. 612.

More stringent quality criteria are needed for models used at the science-policy interface [...] current modeling practices [...] are a significant threat to the legitimacy and the utility of science in contested policy environments [...]

ISSUES
IN SCIENCE AND TECHNOLOGY

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Volume XXX Issue 2, Winter 2014

When All Models Are Wrong

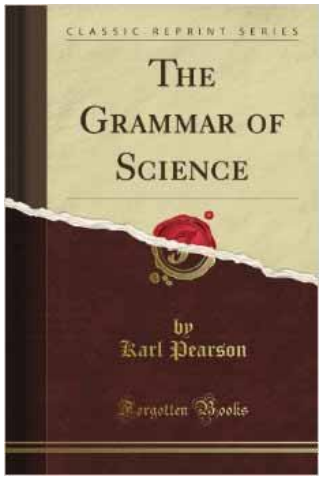
by Andrea Saltelli, Silvio Funtowicz

Available online:
http://issues.org/30-2/andrea/

Science as a solution? Karl Pearson (a social Darwinist) suggests not wasting resources on social programs as:

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

Karl Pearson



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

Evidence based policy
or
policy based evidence?

“The notion that science can be used to reconcile political disputes is fundamentally flawed.”

The example of contested 2000 presidential election between George W. Bush and Al Gore.

“How science makes environmental controversies worse”

Daniel Sarewitz, Arizona State University

Sarewitz, D., 2004, How science makes environmental controversies worse, Environmental Science & Policy 7 (2004) 385–403.

Sarewitz, D., 2006, Liberating Science from Politics, American Scientist, 94(2) 104–107.

“[there is] a profound misunderstanding of the relation between science and politics. The idea that a set of scientific facts can reconcile political differences and point the way toward a rational solution is fundamentally flawed. The reality is that when political controversy exists, the scientific enterprise is ideally suited to exacerbating disagreement, rather than resolving it.”

Sarewitz, D., 2006, Liberating Science from Politics, American Scientist, 94(2) 104-107.

Collingridge and Reeve (1986) twin myths of rationality:

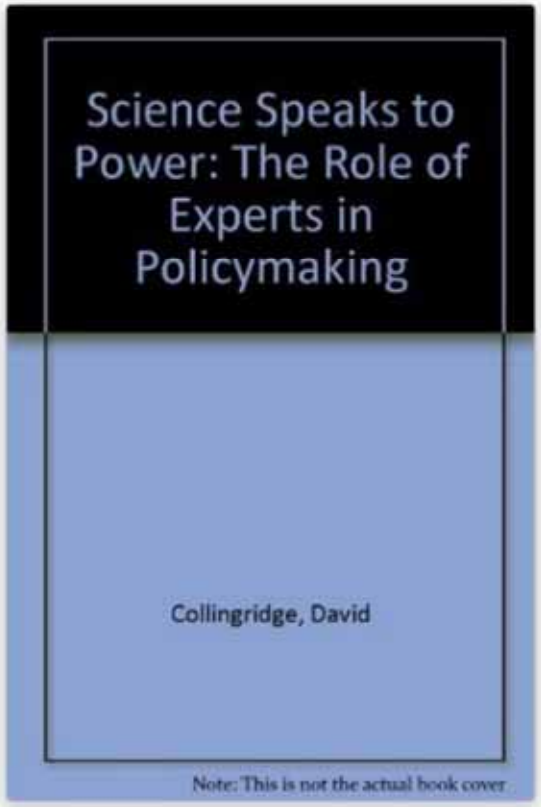
1. policy action is predicated on the accumulation of facts and the taming of uncertainty and

2. the power of science (whereby science is there to provide dispassionate facts to adjudicate controversies).

Collingridge, D. and Reeve, C., 1986, Science Speaks to Power: The Role of Experts in Policy Making. London: Frances Pinter.

Collingridge and Reeve advocate as model for policy decision one of least dependence on science.

Collingridge, D. and Reeve, C., 1986, Science Speaks to Power: The Role of Experts in Policy Making. London: Frances Pinter.



Science Speaks to Power: The Role of Experts in Policymaking Hardcover – 31 Dec 1986

by David Collingridge (Author), Colin Reeve (Author)

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“This need [for evidence] has been reified in the UK and elsewhere, as routines of 'evidence-based policy'-making have been hardwired into the business of Government. […]such approaches are fundamentally flawed [because] Government […] seeks to capture and control the knowledge producing processes to the point where this type of 'research' might best be described as 'policy-based evidence'.”

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

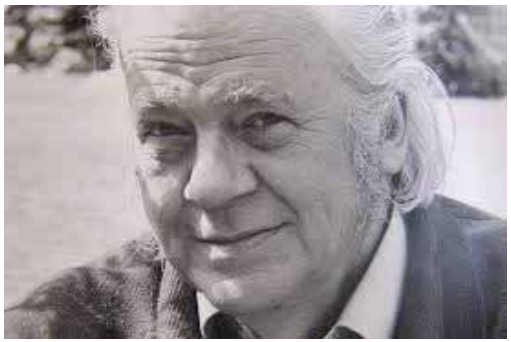
The myth of scientific quantification via risk or cost benefit analyses, including of the impact of new technologies, has been at the hearth of the critique of the ecological moment (e.g. Schumacher, 1973; Winner, 1986; Funtowicz and Ravetz, 1994)

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

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

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

[…] quality is much more difficult to 'handle' than quantity, just as the exercise of judgment is a higher function than the ability to count and calculate. Quantitative differences can be more easily grasped and certainly more essay defined than qualitative differences: their concreteness is beguiling and gives them the appearance of scientific precision, even when this precision has been purchased by the suppression of vital differences of quality.



Ernst Friedrich "Fritz" Schumacher

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

Techniques (such as CBA) is never neutral; according to Winner (1986) ecologists should not fall into the trap of cost benefit and risk analyses

(Chapter ON NOT HITTING THE TAR-BABY)

Langdon Winner

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

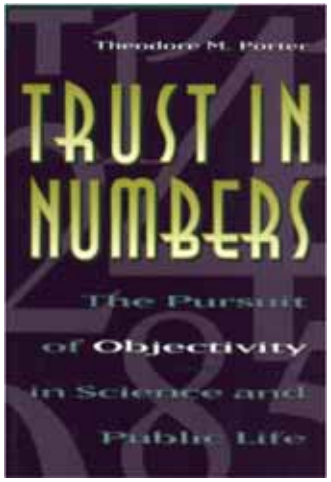
The development of Post-Normal Science can be seen as a reaction to the hyper precision of cost benefit and risk analysis as applied to solve ecological problems: “How much is a songbird worth?”

Example: deconstruction of the economics of climate change.

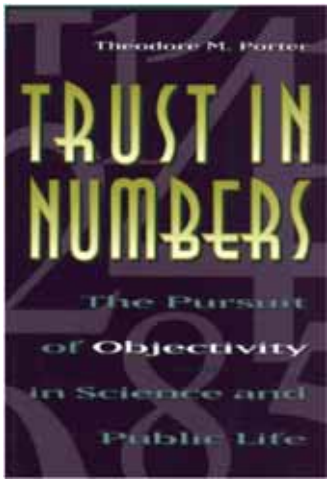
Funtowicz, S.O. and Ravetz, J.R. (1994). The worth of a songbird: Ecological economics as a post-normal science. Ecological Economics 10(3), 197-207.

p. 8: “The appeal of numbers is especially compelling to bureaucratic officials who lack the mandate of a popular election, or divine right. Arbitrariness and bias are the most usual grounds upon which such officials are criticized. A decision made by the numbers (or by explicit rules of some other sort) has at least the appearance of being fair and impersonal.”

Theodor M. Porter



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



p. 8: “Scientific objectivity thus provides an answer to a moral demand for impartiality and fairness. Quantification is a way of making decisions without seeming to decide. Objectivity lends authority to officials who have very little of their own.”

Trust, authority and styles of quantification: two different stories

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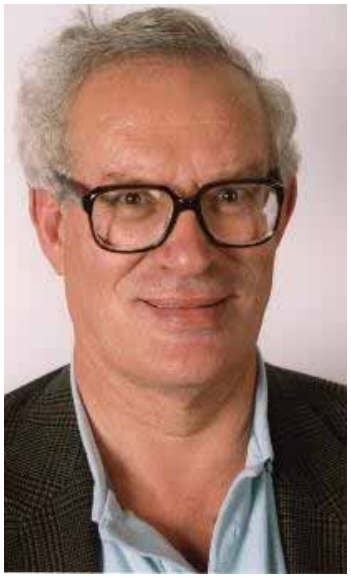
Porter's story: Quantification needs judgment which in turn needs trust …without trust quantification becomes mechanical, a system, and 'systems can be played'.

Quantification as an instrument of hypocognition = radical 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 ➔



Charles Goodhart

p. 44 “Any … measures necessarily involve a loss of information … [and distorts behavior]” (Porter, 1995)

This is what we normally call Goodhart’s law, from Charles Goodhart. "When a measure becomes a target, it ceases to be a good measure."

http://cyberlibris.typepad.com/blog/files/Goodharts_Law.pdf

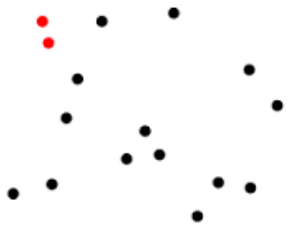
Watch the videos from the workshop 'Significant digits. Responsible Use of Quantitative Information', Brussels, 11,9-10 June 2015.

https://ec.europa.eu/jrc/en/event/conference/use-quantitative-information

John Kay, Financial Times

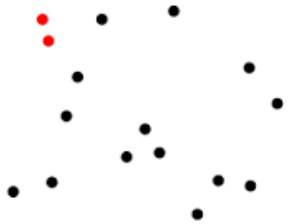
Philip Stark,
University of Berkeley

Take home points on science for policy



- Contradiction between what science can deliver and what can be asked of science (Collingridge, Sarewitz)
- Scientific tools most often used in science for policy are also the most vulnerable to corruption or abuse (e.g. modelling)
- The problem of policy based evidence turning into its opposite
- Problematic quantifications (Porter, Kay, Stark,…)

Take home points on science for policy



- Contradiction between what science can deliver and what can be asked of science (Collingridge, Sarewitz)
- Scientific tools most often used in science for policy are also the most vulnerable to corruption (e.g. modelling) ➔ problematic quantifications
- The problem of policy based evidence turning into its opposite

Remedies

Since there are different diagnose for the crisis:

-A technical problem (poor [knowledge of] statistics)
-A governance problem (poor incentives, wrong metrics, ...)
-A problem of size (exponential growth, too many papers, we all becoming serial hyperspecializers, methodological aliens)
-A social problem (mutated ethos)

... Then the remedies can vary

Solutions from within

- individual: pledges, checklists,...
- institutional: pledges, declarations,...
- toolboxes (NUSAP, sensitivity auditing,...)

Solution from without:

- New epistemologies
- New form of science
- New forms of quality assurance

Something needs to be unlearned

- That science produces infallibly the good and the truth
- That every problem has a neat solution precise to the third digit ...
- The demarcation model; the Cartesian dream; the way science is taught ...

Scholars of history and philosophy of science, of science and technology studies (STS) need to be brought in the fray

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

“I would argue that the nearest thing to a real challenge to orthodox science is the proposal for a post-normal science, which pre-dates the current wave of citizen science.”

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

“[PNS] extends traditional peer review into an extended peer community, which includes all the stakeholders in an issue, and may involve active research as well as quality assessment [and links] with community-oriented citizen science.”

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

PNS in pills:

- Extended peer review
- From ‘speaking truth to power’ towards ‘working deliberatively within imperfections’;
- Science is but one among a plurality of relevant knowledges;

- From facts to ‘extended facts’.

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

Funtowicz, S and Ravetz J 1990, Uncertainty and Quality in Science for Policy, Kluwer Academic Publishers, Dordrecht.

New forms of quality control:

"Is the internet to science what the Gutenberg press was to the church?"

Silvio Funtowicz

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

“[…] 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.

“Collegial peer review is being rapidly transformed to review by an ‘extended peer community,’ raising important issues to the governance of science.”

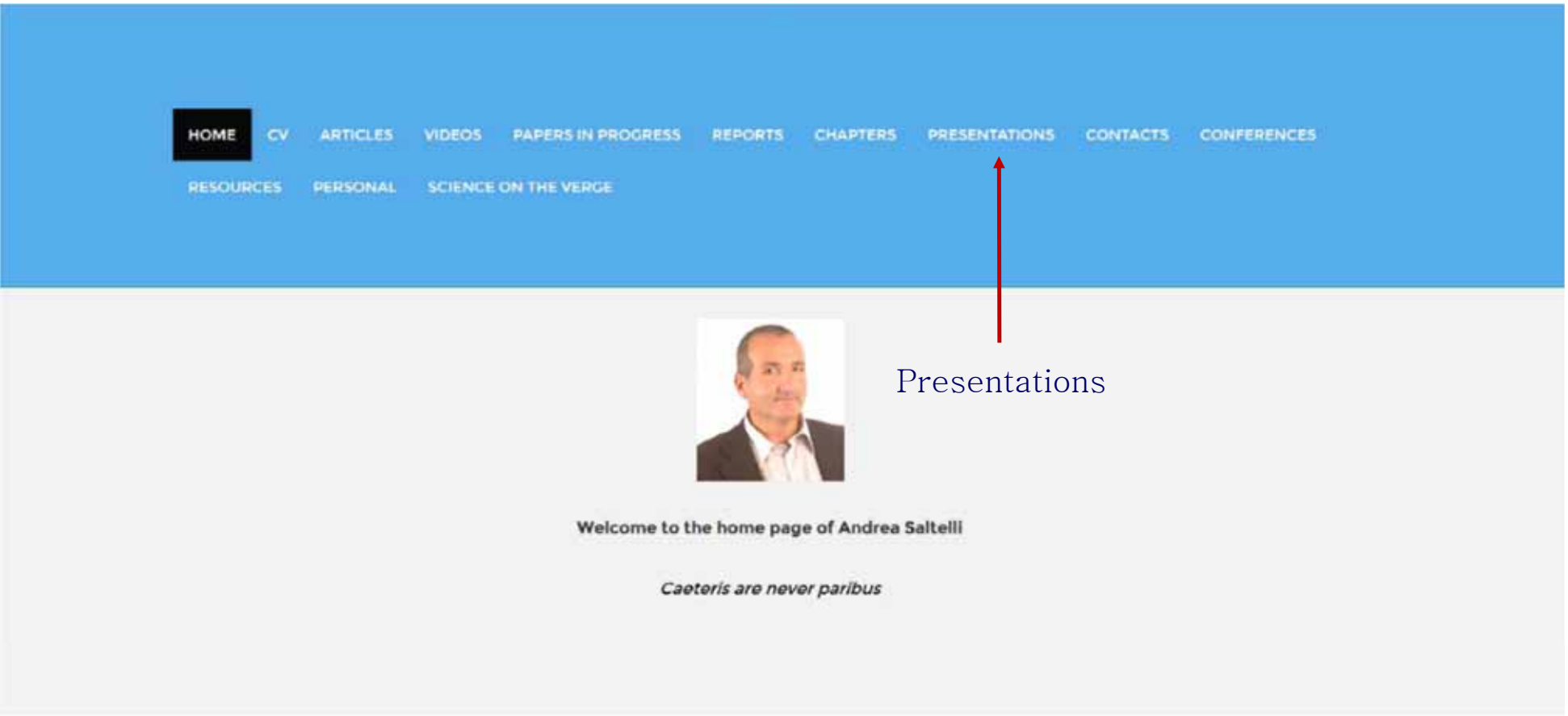
Peer Review and Quality Control, S. Funtowicz & J. Ravetz, International Encyclopedia of the Social & Behavioral Sciences, 2nd edition, 2015.

Where to go from here? Last hints:

- Extended peer review to maintain trust;
- 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.



Presentations

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andrea.saltelli@uib.no

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

END