

Sensitivity Auditing ... backstage

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ROME, November 10-11 2015 CHALLENGES OF BIG DATA FOR ECONOMIC MODELING AND MANAGEMENT: TOOLS FROM EFFICIENCY ANALYSIS, SENSITIVITY ANALYSIS, SENSITIVITY AUDITING AND PHYSICS OF COMPLEX SYSTEMS Department of Computer, Control and Management Engineering Antonio Ruberti (DIAG) Sapienza University of Rome, Aula Magna, Via Ariosto, 25

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Topics for this course Sensitivity Analysis Sensitivity Auditing Impact Assessment ← Science advice **←** Science's crisis \leftarrow Science and Technology Studies (STS) ←

Science advice at the time of science's crisis

- Prevailing models of science for policy and in society; The 'demarcation' model' for the use of science in policy is implausible. The problems with the double legitimacy system;
- 2) Policy advice impacted by concurrent crises: crisis of citizens' trust in institutions, crisis of science's (including economics') own practice and governance (reproducibility); Hybridization of styles;
- 3) Concerned institutions discount the severity of the crisis.

Science advice at the time of science's crisis

4) Persistent critique from philosophers first and from scholars of science and technology studies later;

5) Is the present crisis an opportunity to investigate alternative epistemologies and governance arrangements?

Science advice at the time of science's crisis

6) Quantification in the context of evidence based policy. The special place of mathematical and statistical modelling as master tools of science advice.

7) The crises of science (reproducibility, quality control, skills) and economic thought (loss of diversity, physics envy, 'mathiness') although apparently unrelated are in fact twin crises.

Guimarães Pereira, Â., and Funtowicz, S., Eds., 2015, The end of the Cartesian dream, Routledge's series: Explorations in Sustainability and Governance.

Saltelli, A., and Giampietro, M., 2015, What is wrong with evidence based policy? Draft, Submitted for a special issue on FUTURES, August 2015. http://www.andreasaltelli.eu/file/repository/FUTURES_Saltelli_Giampietro_3.pdf

Rommetveit K Strand R Fjelland R & Funtowicz S, 2013 What can history teach us about the prospects of a European Research Area? Study procured by the Joint Research Centre EUR report 2612 (http://www.ibno/sites/w3uibno/files/attachments/histera_final_report_25_2pdf)

See also: The Rightful Place of Science: Science on the verge, An anthology by Alice Benessia, Mario Giampietro, Silvio Funtowicz, Jerome Ravetz, Angela Pereira, Andrea Saltelli, Roger Strand, Jeroen P. van der Sluijs, with a preface of Dan Sarewitz, Published by the Consortium for Science, Policy and Outcomes at Arizona State University, to appear winter 2015.

Ravetz, J. R. and Saltelli, A., 2015b. "Policy: The future of public trust in science", Nature, 524: p. 161.

Contributors: Jerry Ravetz, Silvio Funtowicz, Ângela Guimarães Pereira, Ragnar Fjelland, David Waltner-Toews, Edvin Schei, Roger Strand, Fern Wickson, Alice Benessia, Mariachiara Tallacchini, Paula Curvelo, Daniel Sarewitz, Andrea Saltelli

EDITED BY ÂNGELA GUIMARÃES PEREIRA AND SILVIO FUNTOWICZ SCIENCE, PHILOSOPHY AND **SUSTAINABILITY** THE END OF THE CARTESIAN DREAM **ROUTLEDGE EXPLORATIONS** IN SUSTAINABILITY AND GOVERNANCE earthscan

2015

Demarcation: facts separate from values

On demarcation:

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

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



Anne Glover

Evidence based policy – in the prevailing positivistic narrative – is predicated on a separation of facts from values, of scientists from their customers, on demarcation of roles. 'Demarcation model' of science's input to policy

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



Silvio Funtowicz University Of Bergen

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

The demarcation model is challenged in more recent epistemologies:

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

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

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



Sheila Jasanoff

Post Normal Science's model of Extended Participation across disciplines – acknowledging that different disciplines see though different lenses, and across communities of both experts and stakeholders;

> Jerry Ravetz and Silvio Funtowicz



From 'speaking truth to power' towards 'working deliberatively within imperfections';

Science is but one among a plurality of relevant knowledges;

Facts become '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.

Where did this separation originate?



Francis Bacon (1561-1626)

Magnalia Naturae, in the New Atlantis (1627), 'Wonders of nature, in particular with respect to human use' Demarcation is part of the Cartesian dream of man as master and possessor of nature, of prediction and control, of Bacon's prediction of the wonders of science.



René Descartes (1596-1650)

Discourse on Method (1637)



Francis Bacon (1561–1626)

Magnalia Naturae, in the New Atlantis (1627), 'Wonders of nature, in particular with respect to human use' Magnalia Naturae, in the New Atlantis (1627), 'Wonders of nature, in particular with respect to human use'

The prolongation of life; The restitution of youth in some degree; The retardation of age; The curing of diseases counted incurable; The mitigation of pain; More easy and less loathsome purgings; The increasing of strength and activity; The increasing of ability to suffer torture or pain; The altering of complexions, and fatness and leanness; The altering of statures; The altering of features; The increasing and exalting of the intellectual parts; Versions of bodies into other bodies; Making of new species; Transplanting of one species into another; Instruments of destruction, as of war and poison; Exhilaration of the spirits, and putting them in good disposition; Force of the imagination, either upon another body, or upon the body itself; Acceleration of time in maturations; Acceleration of time in clarifications; Acceleration of putrefaction; Acceleration of decoction; Acceleration of germination; Making rich composts for the earth; Impressions of the air, and raising of tempests; Great alteration; as in induration, emollition, &c; Turning crude and watery substances into oily and unctuous substances; Drawing of new foods out of substances not now in use; Making new threads for apparel; and new stuffs, such as paper, glass, &c; Natural divinations; Deceptions of the senses; Greater pleasures of the senses; Artificial minerals and cements.



Francis Bacon (1561-1626)

Magnalia Naturae, in the New Atlantis (1627), 'Wonders of nature, in particular with respect to human use' Magnalia Naturae, in the New Atlantis (1627), 'Wonders of nature, in particular with respect to human use'

The prolongation of life; The restitution of youth in some degree; The retardation of age; The curing of diseases counted incurable; The mitigation of pain; [...]

Drawing of new foods out of substances not now in use; Making new threads for apparel; and new stuffs, such as paper, glass, &c; Natural divinations; Deceptions of the senses; Greater pleasures of the senses; Artificial minerals and cements. The study of letters leading to "doubts and errors"; Comparing "disquisitions of the ancient moralists to very towering and magnificent palaces with no better foundation than sand and mud"; condemnation of humanities and exaltation of mathematics.



René Descartes (1596-1650)

Discourse on Method (1637)

"I perceived it to be possible to arrive at knowledge highly useful in life; and in room of the Speculative Philosophy $[\cdots]$, to discover a Practical, by means of which, knowing the force and action of fire, water, air, the stars, the heavens, and all the other bodies that surround us, [...] we might also apply them $[\cdots]$, and thus render ourselves the lords and possessors of nature."



René Descartes (1596-1650)

Discourse on Method (1637)

In the formulation of Condorcet:

"All the errors in politics and in morals are founded upon philosophical mistakes, which, themselves, are connected with physical errors" (Ninth Epoch)



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

'Sketch for a Historical Picture of the Progress of the Human Spirit' Considering the possibility of overpopulation leading to war due to scarcity of resources, he concludes that this would not happen because technical progress and ethical progress will go hand in hand. Man will understand that his duty "will consist not in the question of giving existence to a greater number of beings, but happiness." (Tenth Epoch)



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

'Sketch for a Historical Picture of the Progress of the Human Spirit' 'mathématique sociale'

'Condorcet method', 'Condorcet winner',

'Condorcet-Kemeny-Young-Levenglick (C-K-Y-L) ranking procedure'



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

'Sketch for a Historical Picture of the Progress of the Human Spirit'

Feldman, J., 2005, Condorcet et la mathematique sociale: enthousiasmes et bemols, Mathematics and Social Sciences, 172(4), 7-41, http://www.ehess.fr/revue-msh/pdf/N172R955.pdf Munda G. (2007) - Social multi-criteria evaluation, Springer-Verlag, Heidelberg, New York, Economics Series Closer to our times Vannevar Bush's dream was couched in the 'Endless Frontier' metaphor (1945):

"One of our hopes is that after the war there will be full employment. […] To create more jobs we must make new and better and cheaper products […] founded on new principles and new conceptions which in turn result from basic scientific research. […the] Government should foster the opening of new frontiers. It opened the seas to clipper ships and furnished land for pioneers. Although these frontiers have more or less disappeared, the frontier of science remains."



Vannevar Bush (1890-1974)

Science the Endless frontier (1945)

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

"The question of the legitimacy of science has been indissociably linked to that of the legitimation of the legislator since the time of Plato. From this point of view, the right to decide what is true is not independent of the right to decide what is just,[…] there is a strict interlinkage between the kind of language called science and the kind called ethics and politics …"

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



Jean-François Lyotard

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

[…] Trust in Science and trust in the prevailing social order are linked."



Shapin, S., Schaffer, S., 1985, Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life, Princeton, 2011 Edition

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

Shapin, S., Schaffer, S., 1985, Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life, Princeton, 2011 Edition



Shapin and Schaffer's book inspired Bruno Latour's 'Nous n'avons jamais été modernes', 1991, and was 'hot' during the 'science wars'.



Bruno Latour



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

We were nourished (and professionally trained) with the principles of the Cartesian dream.

This has profound governance implications due to the centrality of science in the formulation adjudication of policy.

Crises





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"



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 (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

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.


'Scientists Who Cheat'





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? "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.



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 June 2015 signed by 12,000 individuals, and 570 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: <u>http://am.ascb.org/dora/</u>, 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. 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-predatorypublishers-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 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







Philip Mirowski

Chapter 10 on delegitimation: "[…] The grand narrative has lost its credibility, regardless of what mode of unification it uses, regardless of whether it is a speculative narrative or a narrative of emancipation"

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. $[\cdots]$ 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 $[\cdots]$ 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.





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.





"...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.





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.





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.





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 \cdots became more and more looking as profit seeking organization (technology transfer offices in every campus) \cdots then research ended up outsourced again to contract-based research organizations (CRO's) \cdots

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





Philip Mirowski



NATURE | RESEARCH HIGHLIGHTS: SOCIAL SELECTION

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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:



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

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)



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

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 $[\cdots]$ is a valuable building block for the future of academic publishing"

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







See Ravetz's warning "If there were not a test of each paper ..."

So far a about science's own governance crisis … how about science for policy and science's advice?

Do institutions chose to ignore 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=14 42656356&id=id&accname=guest&checksum=AF1467AD25FF 8BE6516083077CCEE31A **OECD** publishing

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. <u>http://dx.doi.org/10.1787/5js33l1jcpwb-en</u>

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



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.

Saltelli, A. and Funtowicz, S., 2014, When all models are wrong: More stringent quality criteria are needed for models used at the science-policy interface, Issues in Science and Technology, vol. winter, pp. 79-85.

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

"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"

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.



Daniel Sarewitz, Arizona State University [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.

"Growing concerns about the quality of published scientific results have often singled out bad statistical practices and modelling assumptions, and have typically focused on the very types of science that often underlie regulations $[\cdots]$ ".

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

We must accept the persistence in our modernity of what Collingridge and Reeve (1986) call the twin myths of rationality (policy action is predicated on the accumulation of facts and the taming of uncertainty) and 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

Collingridge, David

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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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. Winner, 1986; Funtowicz and Ravetz, 1994a)

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. (1994a). The worth of a songbird: Ecological economics as a post-normal science. Ecological Economics 10(3), 197-207.

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. Trust

"the great ideas which once inspired Europe seem to have lost their attraction, only to be replaced by the bureaucratic technicalities of its institutions."



"As the European Union has expanded, there has been growing mistrust on the part of citizens towards institutions considered to be aloof, engaged in laying down rules perceived as insensitive to individual peoples, if not downright harmful" (Strasbourg, November 25, 2014)

http://en.radiovaticana.va/news/2014/11/25/pope_francis_address_to_european_parliament/1112318
For Helga Nowotny, former head of the ERC, scientists are losing public trust by 'overselling' research.

... not due to deliberate deception, but because scientists have "internalised" the demands for certainty from research councils, who are in turn responding to the expectations of government and the public.



Helga Nowotny

Matthews, D., 2015, Helga Nowotny: scientists are losing public trust by 'overselling' research, Times Higher Education,

https://www.timeshighereducation.com/news/helga-nowotny-scientists-are-losing-public-trust-overselling-research

"Is industry funding undermining trust in science? How valid are fears that financial conflicts of interest are damaging confidence in academic research? [...] In economics, medicine, energy and a host of other subjects, there are fears that financial conflicts of interest give the impression that academic findings are up for sale."

Film Inside Job. Interview with Frederic Mishkin, a banking professor at Columbia University, praising Iceland's "strong" banking regulation system two year before it went bust.

Matthews, D., 2015, Is industry funding undermining trust in science?, Times Higher Education,

https://www.timeshighereducation.com/features/is-industry-funding-undermining-trust-in-science

"medical paradigms found, then lost, then regained, then placed in a kind of scientific limbo occur in the field of nutrition"

- dietary cholesterol and
- trans-fats
- caffeine
- wine
- sugar-
- gluten.

Barash, D.P., 2015, Paradigm Lost, EON, http://aeon.co/magazine/science/why-scientific-paradigms-keep-changing/

Ancel Keys 'seven nations' study showed a correlation between a diet with animal fats and heart disease. It did not take long for the flaws to be exposed, but it was already entrenched with the major charities and the medical profession.

"As a side-effect, studies on the dangers of refined sugar were discounted, and it was ignored in dietary advice. About a half-century elapsed before the situation was corrected, and the experts changed their advice, but not before science-based malnutrition had claimed thousands of victims and public's perception had been shaken." (Ravetz, 2015, work in progress)

A commentator notes recently: "Mistrust of medical science is not merely the product of ignorance" (Evans, 2015).

Evans, R.J., 2015, Mistrust of medical science is not merely the product of ignorance, www.opendemocracy.net /, October 23.

Economics…

Twin crises in science and economic thought:

Four conferences on science integrity

http://www.wcri2015.org/

A conference on 'What's Wrong with the Economy—and with Economics?

http://www.nybooks.com/blogs/gallery/2015/mar/29/whats-wrong-with-the-economy/







Philip Mirowski





Erik Reinert

See: Reinert, E.S., 2012, Economics and the Public Sphere: The Rise of Esoteric Knowledge, Refeudalization, Crisis and Renewal.

Social Science Research Council, Essay,

http://publicsphere.ssrc.org/reinert-economics-and-the-public-sphere/





Common element of the two crises: statistics and mathematical modelling: a new lingo: statisticulation, mathiness,...

Mathiness: 'uses a mixture of words and symbols, but instead of making tight links, it leaves ample room for slippage between statements in natural versus formal language and between statements with theoretical as opposed to empirical content', by Paul Romer



Paul Romer

Romer, P. M., Mathiness in the Theory of Economic Growth, American Economic Review: Papers & Proceedings 2015, 105(5): 89–93. Paul Romer's Blog quotes of Feynman's Cargo Cult lecture in relation to intellectual honesty

http://paulromer.net/feynman-integrity/

Feynman argued for the moral commitment of scientists to go out of their way to try to falsify their own work, following a tradition in science from Karl Popper to Robert K. Merton.

Cargo Cult Science

by RICHARD P. FEYNMAN

Some remarks on science, pseudoscience and learning how to not fool yourself. Caltech's 1974 commencement address.





In relation to the predicaments of evidence based policy and the possible diseases of economics:



Ravetz, J., 1971, p. 366 [Chapter on IMMATURE AND INEFFECTIVE FIELDS OF INQUIRY]

[…] The situation becomes worse when an immature or ineffective field is enlisted in the work of resolution of some practical problem. In such […a] context […] the relevant immature field functions to a great extent as a 'folk-science'. This is a body of accepted knowledge whose function is not to provide the basis for further advance, but to offer comfort and reassurance to some body of believers.

See also Jerry Ravetz, Economics as an elite folk science: the suppression of uncertainties, Journal of Post-Keynesian Economics, Winter 1994-95, 17(2).

Critical economists have always wandered …

Hendry, D.A., 1980, Econometrics-Alchemy or Science? Economica, 47, 387-406.

"It will be remembered that the seventy translators of the Septuagint were shut up in seventy separate rooms with the Hebrew text and brought out with them, when they emerged, seventy identical translations. Would the same miracle be vouchsafed if seventy multiple correlators were shut up with the same statistical material?"

Keynes, J. M., 1940, On a Method of Statistical Business-Cycle Research. A Comment, The Economic Journal, Vol. 50, No. 197 (Mar., 1940), 154-156.

Problematic quantifications

Concrete numbers: Evidence based policy and numbers -



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

Theodore M. Porter **TRUSTIN SUBJUE SUBJUE The Pursuit of Objectivity in Science and Public Life** 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."

Quantification: the discrete charm of bureaucracies?

Trust, authority and styles of quantification: two different stories









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







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



Workshop 'Significant digits. Responsible Use of Quantitative Information', Brussels, 11,9–10 June 2015, organized by the Joint Research Centre of the European Commission.

John Kay, Financial Times

Mario Giampietro, ICREA-ICTA, Barcelona





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

Mathematical modelling

errors, misuse, abuse



THE NEW YORKER

"Carmen Reinhart and Kenneth Rogoff […] famous (now infamous) research that conservative politicians around the world had seized upon to justify pennypinching Policies …"

John Cassidy, April 2013 issue



"... rising levels of government debt are associated with much weaker rates of economic growth, indeed negative ones ..."

It was instead a coding error uncovered by three researchers at the university of Michigan.



"In Britain and Europe, great damage has been **THE NEW YORKER** done as a result."

Saltelli, A. and Funtowicz, S., 2014, When all models are wrong: More stringent quality criteria are needed for models used at the science-policy interface, Issues in Science and Technology, vol. winter, pp. 79-85.



Perils of placing faith in a thin theory

By Wolfgang Münchau

Reinhart and Rogoff told policy makers what they wanted to hear

"As for Profs Reinhart and Rogoff, I suspect that they, too, will be mostly remembered for the fact that their policies have been tried"

Munchau, W., 2013, Perils of placing faith in a thin theoryFinancial Times, April 21.

Kenneth Rogoff (2015) still defines 'a very good idea' to 'employ technocrats to provide objective analysis' in the columns of the Financial Times.

Rogoff, K., 2015, World's economic slowdown is a hangover not a coma, Financial Times, October 9.





"To be fair, DSGE and similar macroeconomic models were first conceived as theorists' tools. But why, then, are they being relied on as the platform upon which so much practical policy advice is formulated? And what has caused them to become, and to stay, so firmly entrenched?"

Quote from Miller, B., 2010, Opening Address, The Hearing Charter of the House Committee on Science and Technology and sworn testimony of economists Sidney Winter, Scott Page, Robert Solow, David Colander and V.V. Chari, in Mirowski, P., 2013, Never Let a Serious Crisis Go to Waste: How Neoliberalism Survived the Financial Meltdown, Verso Books.



Counting climate's dollars. Occupational psychosis or valuable input?



Foreword by Michael R. Bloomberg, Henry M. Paulson, and Thomas F. Steyer



TREVOR HOUSER, SOLOMON HSIANG, Robert Kopp, and kate larsen

Contributions by Karen Fisher-Vanden, Michael Greenstone, Geoffrey Heal, Michael Oppenheimer, Nicholas Stern, and Bob Ward





"[...] the report forecasts—at the level of individual counties in the U.S.—energy costs and demand, labor supply, mortality, violent crime rates, and real estate property prices up to the year 2100 [...] The report presents the amount of computer power and data generated as evidence of the scientific legitimacy of the enterprise. The authors note, however, that out of an abundance of caution they did not model deterioration in cognitive performance as temperatures rise"

Saltelli, A., Stark, P.B., Becker, W., and Stano, P., 2015, Climate Models As Economic Guides Scientific Challenge or Quixotic Quest? Spring issue of Science and Technology (IST) April 2015.



TREVOR HOUSER, SOLOMON HSIANG, Robert Kopp, and kate larsen

Contributions by Karen Fisher-Vanden, Michael Greenstone, Geoffrey Heal, Michael Oppenheimer, Nicholas Stern, and Bob Ward



Missing

points

The Stern review makes the case for urgent action against climate change based on a cost benefit analysis (CBA). We have shown that the stipulated uncertainties in the CBA do not allow any useful conclusion.





Saltelli, A., and d'Hombres, B. 2010, 'Sensitivity Analysis Didn't Help. A Practitioner's Critique of the Stern Review', Global Environmental Change, vol. 20, pp. 298–302.

% loss in GDP per capita



THE LOGIC, URGENCY, AND PROMISE OF TACKLING CLIMATE CHANGE

"Integrated assessment models have produced valuable insights" p. 139

"In Chapter six of the Stern review we made use of the PAGE model" p. 345

Then, after a list of criticism moved to the realism of IAM's:

"[\cdots] the point is that estimates based on these models are very sensitive to assumptions and are likely to lead to gross underestimation" p.139

Nicholas Stern

Why

Are We

Waiting?

OF TACKLING CLIMATE CHANGE



Things to be incorporated in 'formal modelling'

"Damage to social, organizational or environmental capital […]

Damage to stock of capitals and land […] Damage to overall factor productivity […] Damage to learning and endogenous growth", p. 145

'formal modelling' as to produce 'numbers'?



Nicholas Stern

Evidence based policy or policy based evidence?

PETRUCHIO: I say it is the moon. KATHERINE: I know it is the moon. PETRUCHIO: Nay, then you lie. It is the blessed sun. KATHERINE: Then God be blessed, it is the blessed sun. But sun it is not, when you say it is not, And the moon changes even as your mind. What you will have it named, even that it is, And so it shall be so for Katherine.

(Shakespeare, the Taming of the Shrew, Act IV)



Financial Times titles "Free Lunch: Policy-based evidencemaking" (Wilkes, 2015)...

A politician says "Greenpeace […] wants is policy based evidence making not evidence based policy making (Sanderson, 2015) …

Wilkes, G., 2015, Free Lunch: Policy-based evidence-making, Financial Times, July 3. Sanderson, A.B., 3 Feb 2015, Breitbart, see <u>http://www.breitbart.com/london/2015/02/03/academic-attacks-greenpeace-for-ignoring-the-evidence-on-gm-crops/</u>; the politician is UKIP Energy Spokesman Roger Helmer MEP. "This need [for evidence] has been reified in the UK and elsewhere, as routines of 'evidence-based policy'-making have been hardwired into the business of Government. […]such approaches are fundamentally flawed [because] Government […] seeks to capture and control the knowledge producing processes to the point where this type of 'research' might best be described as 'policy-based evidence'."

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





OFFICE OF THE PRIME MINISTER'S CHIEF SCIENCE ADVISOR

Professor Sir Peter Gluckman, ONZ KNZM FRSNZ FMedSci FRS Chief Science Advisor

"evidence informed" rather than "evidence based"

"I have come to understand that the primary functions and greatest challenges for a science adviser are providing advice not on straightforward scientific matters, but instead on issues that have the hallmarks of what has been called post-normal science"

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

Recipes?
Ethical, epistemological, and methodological elements of the interlinked crises of science governance and science for policy

Elements of solutions may include:

-Unlearn what needs to be unlearned

- -Foster skills to spot socially constructed ignorance
- -Reconsidering the role of economics

Elements of solutions may include:

- -From Latin to vernacular
- -Foster skills for responsible use of quantitative information
- -Quantitative story-telling as opposed to spurious quantification
- -Work deliberatively within imperfections
- -Engage with new forms of science and citizens generated content



Statisticulation: Statistical manipulation, Huff, D., 1993, How to lie with statistics, Norton & Company



Manners and styles

Intolerance:

Climate debate: from 'deniers' to 'Nazis' to calls for a world court to rule on climate science to quash sceptics

Snydersept, T., 2015, The Next Genocide, New York Times, Sept. 12, http://www.nytimes.com/2015/09/13/opinion/sunday/the-nextgenocide.html?action=click&pgtype=Homepage&module=opinion-c-col-top-region%C2%AEion=opinion-c-coltop-region&WT.nav=opinion-c-col-top-region&_r=1

Vaughan, A., World court should rule on climate science to quash sceptics, says Philippe Sands, The Guardian, Friday 18 September 2015, http://www.theguardian.com/environment/2015/sep/18/world-court-should-rule-on-climate-science-quash-sceptics-philippe-sands?CMP=twt_a-science_b-gdnscience