



Sensitivity Auditing

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 Autònoma de Barcelona (UAB)

Summer School on Sensitivity Analysis –
SAMO 2016, Villa Orlandi, Anacapri –
July 4–8, 2016



andrea.saltelli@uib.no

www.andreasaltelli.eu

HOME

CV

ARTICLES

VIDEOS

PAPERS IN PROGRESS

REPORTS

CHAPTERS

PRESENTATIONS

CONTACTS

CONFERENCES

RESOURCES

PERSONAL



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Caeteris are never paribus

Presentations

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andrea.saltelli@uib.no

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

ICTA-UAB SEMINAR

Is there really a crisis in science?



Andrea Saltelli

Researcher at ICTA-UAB and University of Bergen

Andrea Saltelli will present key insight from his co-authored book "Science on the Verge" [1].

The authors of this book note that there is a crisis looming over the scientific enterprise. Not a day passes without news of retractions, failed replications, fraudulent peer reviews, or misinformed science-based policies. The social implications are enormous, yet this crisis has remained largely uncharted—until now. In *Science on the Verge*, luminaries in the field of post-normal science and scientific governance focus attention on worrying fault-lines in the use of science for policymaking, and the dramatic crisis within science itself. This provocative new volume in *The Rightful Place of Science* also explores the concepts that need to be unlearned, and the skills that must be relearned and enhanced, if we are to restore the legitimacy and integrity of science.

[1] Benessia, A., Funtowicz, S., Giampietro, M., Guimarães Pereira, A., Ravetz, J., Saltelli, A., Strand, R., van der Sluijs, J., 2016. *The Rightful Place of Science: Science on the Verge. The Consortium for Science, Policy and Outcomes at Arizona State University*.

Andrea Saltelli has worked in physical chemistry, environmental sciences, applied statistics, impact assessment, and science for policy. One of his academic foci is on sensitivity analysis of model output, a discipline in which statistical tools are used to interpret the output of mathematical or computational models, and sensitivity auditing, an extension of sensitivity analysis to the entire evidence-generating process in a policy context.

His latest work is a contribution to the volume *Science on the Verge* on the emerging crisis of science's quality assurance system. He is presently based at the UAB.

Thursday, June 30 2016

12.30 a.m – 1.30 p.m.

Sala Montseny Z/023 ICTA-UAB

http://www.andreasaltelli.eu/file/repository/Saltelli_Verge_Barcelona_June.pdf



THE RIGHTFUL PLACE OF SCIENCE: SCIENCE ON THE VERGE

CONTRIBUTORS

Alice Benessia	Jerome R. Ravetz
Silvio Funtowicz	Andrea Saltelli
Mario Giampietro	Roger Strand
Ângela Guimarães Pereira	Jeroen P. van der Sluijs



Does the crisis impact
science for policy &
science's advice?

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

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

THE  TIMES

Science

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Welcome to your preview of The Times

Scientists ‘should take ethics oath like doctors’



Tom Whipple Science Editor

Published at 12:01AM, February 22 2016

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

Studies suggest that a significant proportion of scientific papers are not repeatable

Monty Rakusen/Corbis

 Post a comment

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

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

THE  TIMES

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Monty Rakusen/Corbis

 Post a comment

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.

<http://www.oecd-ilibrary.org/docserver/download/5js33l1jcpwb.pdf?expires=1442656356&id=id&accname=guest&checksum=AF1467AD25F8BE6516083077CCEE31A>

OECD publishing



Please cite this paper as:

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

OECD Science, Technology and Industry
Policy Papers No. 21

Scientific Advice for Policy Making

THE ROLE AND RESPONSIBILITY OF EXPERT
BODIES AND INDIVIDUAL SCIENTISTS

OECD

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

Saltelli, A., 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*, Winter 2014, 79-85.
<http://issues.org/30-2/andrea/>

If quantification is so
problematic why the urge to
quantify at all cost?

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 easily 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 cost benefit analysis, CBA) are never neutral; according to Winner (1986) ecologists should not fall into the trap of CBA and risk analyses

(Chapter ON NOT HITTING THE TAR-BABY)



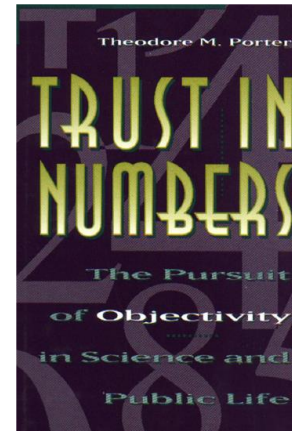
Langdon Winner

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.

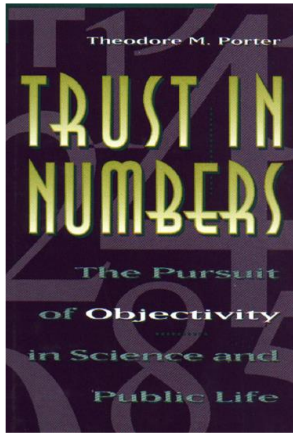
p. 8: “The appeal of numbers is especially compelling to bureaucratic officials who lack the mandate of a popular election, or divine right. Arbitrariness and bias are the most usual grounds upon which such officials are criticized. A decision made by the numbers (or by explicit rules of some other sort)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



Theodor M. Porter

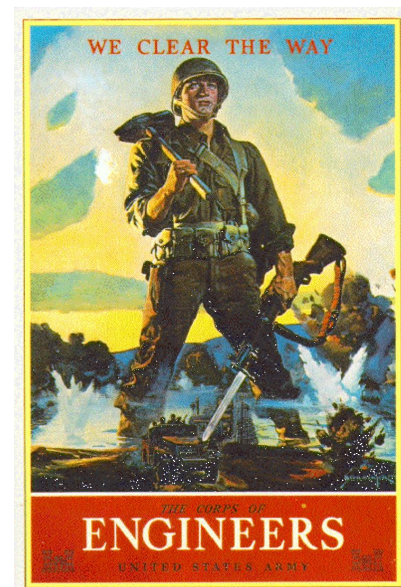
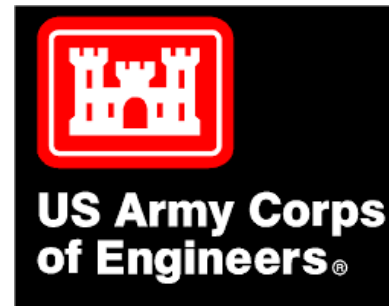


Theodore M. Porter, *Trust in Numbers, The Pursuit of Objectivity in Science and Public Life*, Princeton 1995

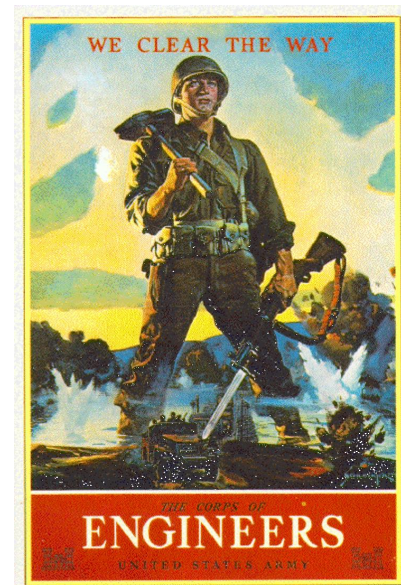


p. 8: “Scientific objectivity thus provides an answer to a moral demand for impartiality and fairness. Quantification is a way of making decisions without seeming to decide. Objectivity lends authority to officials who have very little of their own.”

Trust, authority and styles of quantification: two different stories



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





Discussion points



- Do I see a relationship between trust and quantification?
- Are we (my team, my organization) more like the ‘corps des ingénieurs des ponts et chaussées’ or the US Army corps of Engineers?
- Are we (as above) into evidence based policy or policy based evidence? Build cases for one and the other.

Sensitivity auditing in the IA toolbox

Time to look at the EC own guidelines: what do they about sensitivity auditing ?

The screenshot shows the 'Better Regulation' website of the European Commission. The header includes the European Commission logo and the text 'Better Regulation'. A navigation bar at the top right contains links for 'Press', 'Archives', 'Sitemap', 'About this site', 'Legal notice', 'Contact', 'Search', and a language selector set to 'English (en)'. The main content area is titled 'Better Regulation Guidelines' and contains three paragraphs of text explaining the guidelines' purpose and scope. A sidebar on the left lists various topics, with 'Guidelines' selected. A right sidebar features social media links, a search bar, and a feedback section.

European Commission

Better Regulation

European Commission > Better Regulation > Guidelines

Home

REFIT

Stakeholder consultations

Roadmaps / Inception Impact Assessments

Impact Assessment

Evaluation

Regulatory Scrutiny Board

Guidelines

- Better Regulation Guidelines
- Better Regulation "Toolbox"
- Key documents

Better Regulation Guidelines

These guidelines explain what Better Regulation is and how it should be applied in the day to day practices when preparing new initiatives and proposals or managing existing policies and legislation.

They cover the whole policy cycle, from policy preparation and adoption to implementation and application, to evaluation and revision of EU law. For each of these phases there are a number of Better Regulation principles, objectives, tools and procedures to make sure that the EU has the best regulation possible. These relate to planning, impact assessment, stakeholder consultation, implementation and evaluation.

The [Better Regulation Guidelines](#) are structured into chapters which cover each of the instruments of the law-making process. The corresponding [toolbox](#) gives more detailed and technical information.

Better Regulation Guidelines are based on the outcomes of public consultation exercises carried out in 2013 and 2014.

- [Public consultation on the revision of the Commission's Impact Assessment Guidelines](#)
- [Stakeholder Consultation Guidelines](#)
- [Consultation on the draft Commission Evaluation Policy Guidelines](#)

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- 19/05/2015 - Better Regulation Package

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http://ec.europa.eu/smart-regulation/guidelines/docs/br_toolbox_en.pdf

p. 392

... where there is a major disagreement among stakeholders about the nature of the problem, ... then sensitivity auditing is more suitable but sensitivity analysis is still advisable as one of the steps of sensitivity auditing.

Sensitivity auditing, [...] is a wider consideration of the effect of all types of uncertainty, including structural assumptions embedded in the model, and subjective decisions taken in the framing of the problem.

[...]

The ultimate aim is to communicate openly and honestly the extent to which particular models can be used to support policy decisions and what their limitations are.

p. 393

“In general sensitivity auditing stresses the idea of honestly communicating the extent to which model results can be trusted, taking into account as much as possible all forms of potential uncertainty, and to anticipate criticism by third parties.”

p. 393

“In particular, one should avoid giving the impression of false confidence by “quantification at all costs”. In some cases there is simply not enough data, or the process is too complex, to give a meaningful quantitative prediction.”

Responsible
quantification under
extended peer
communities and
sensitivity auditing

Sensitivity auditing

- Originates from uncertainty & sensitivity analysis
- Addresses model-based evidence used for policy

Saltelli, A., Guimarães Pereira, Â., Van der Sluijs, J.P. and Funtowicz, S., 2013, What do I make of your latinorum? Sensitivity auditing of mathematical modelling, Int. J. Foresight and Innovation Policy, 9, 2/3/4, 213–234.

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

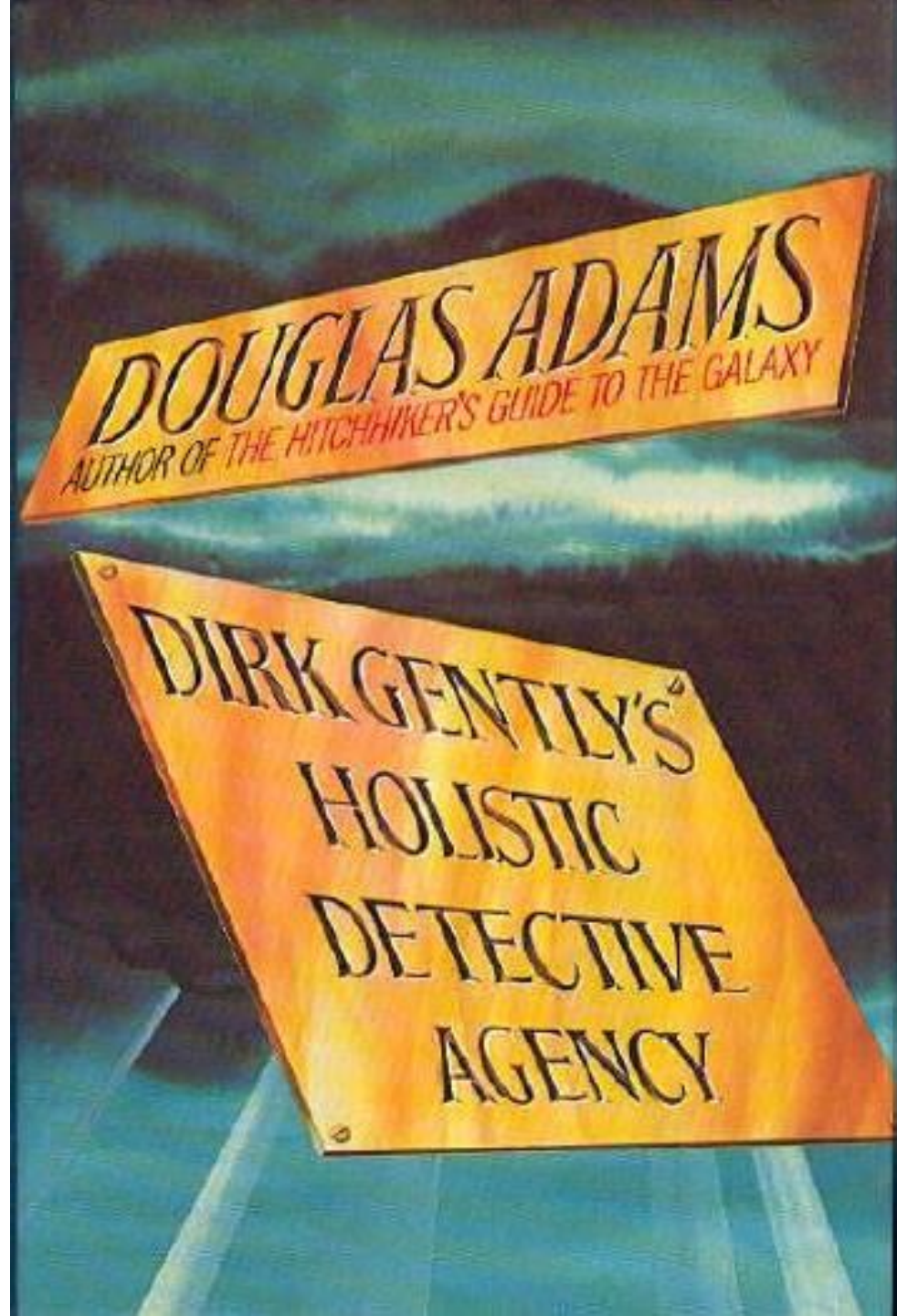
RULE ONE: Check against rhetorical use of mathematical modelling



The instrumental use of mathematical modelling to advance one's agenda can be termed rhetorical, or strategic, like the use of Latin by the elites and the clergy in the classic age.



Pocket Books 1987, p.69



RULE ONE: Check against rhetorical use of mathematical modelling

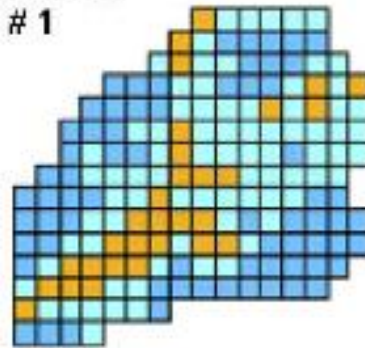
“Well, Gordon’s great insight was to design a program which allowed you to specify in advance what decision you wished it to reach, and only then to give it all the facts. The program’s task, [...], was to construct a plausible series of logical-sounding steps to connect the premises with the conclusion.”

Model structure uncertainty...

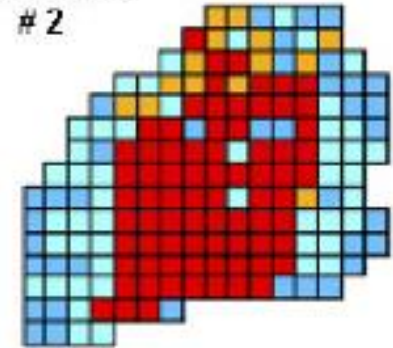
5 consultants, each using a different model were given the same question:
“which parts of this particular area are most vulnerable to pollution and need to be protected?”

(Refsgaard et al, 2006)

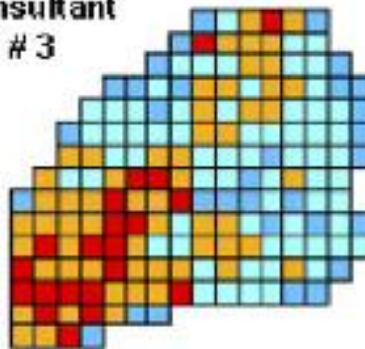
Consultant
1



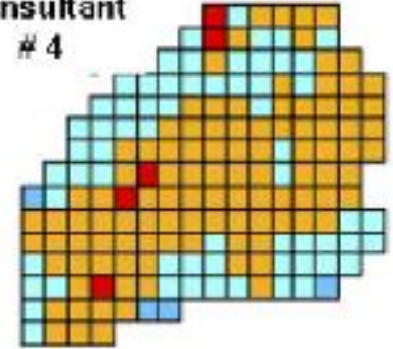
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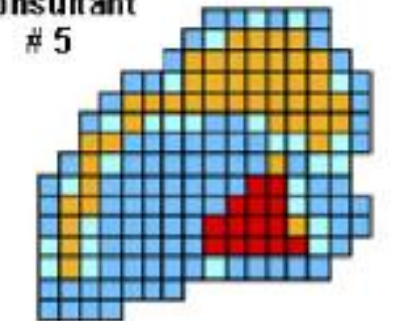
Consultant
3



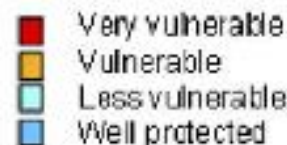
Consultant
4



Consultant
5



vulnerable areas



This and next two slides: Courtesy of Dr. Jeroen P. van der Sluijs, Centre for the Studies in the Sciences and the Humanities (SVT), University of Bergen (NO)



Dueling Visions For a Hungry World

Sparks began to fly when scientists and activists against genetically modified crops came together to assess agricultural knowledge and the role of biotech in development

When economist Carl Pray heard about plans for the first international assessment of agricultural research, a gold standard sprang to mind; the Intergovernmental Panel on Climate Change (IPCC). But things didn't turn out the way he expected.

IPCC has been pivotal in proving that climate change is real and linking it to human activities. As an agricultural economist at Rutgers University who has worked in many poor countries, Pray is convinced that agricultural research—and genetic modification in

mentally, socially and economically sustainable development through the generation, access to, and use of agricultural knowledge, science and technology?" Critics say this broad mandate made conflict inevitable and stunted the assessment's analytical rigor.

On several key issues, consensus proved elusive. Industry scientists and some academics—mainly agricultural economists and plant biologists—believe the assessment was “hijacked” by participants who oppose genetically modified (GM) crops and other common

the outcome. They note that the voice and experience of small-scale farmers, particularly women, have finally been brought to the fore by the assessment. “It really deals with issues of power, influence, and benefits,” says Marcia Ishii-Ettman of the Pesticide Action Network North America in San Francisco, California. Toby Kiers, who studies sustainable agriculture at Vrije University in Amsterdam, the Netherlands, agrees. “For technology to be most effective, farmers must be at the center, influencing how it is developed, delivered, and

loaded from www.sciencemag.org

The IFPRI had raised about \$460,000 for the modeling, which would have provided insights to help policymakers [...]

[...] But Greenpeace [...] objected that the models were not “transparent”.

Source: Dueling visions for an hungry world, Erik Stokstad, 14 MARCH 2008, 319 SCIENCE

AAAS's Web site, is a milestone: How can we reduce hunger and poverty, improve rural livelihoods, and facilitate equitable, environ-

* www.agassessment.org

community-based knowledge.

- * Create space for diverse voices and include social scientists in policy.

Watson, then the World Bank's chief scientist, suggested that the bank review the entire range of agricultural technologies and policies. Convinced that agricultural research should be considered in the context of the myriad factors

CREDIT: UNHCR/OW

We just can't predict, says N. N. Taleb, and we are victims of the ludic fallacy, of delusion of uncertainty, and so on. Modelling is just another attempt to 'Platonify' reality...



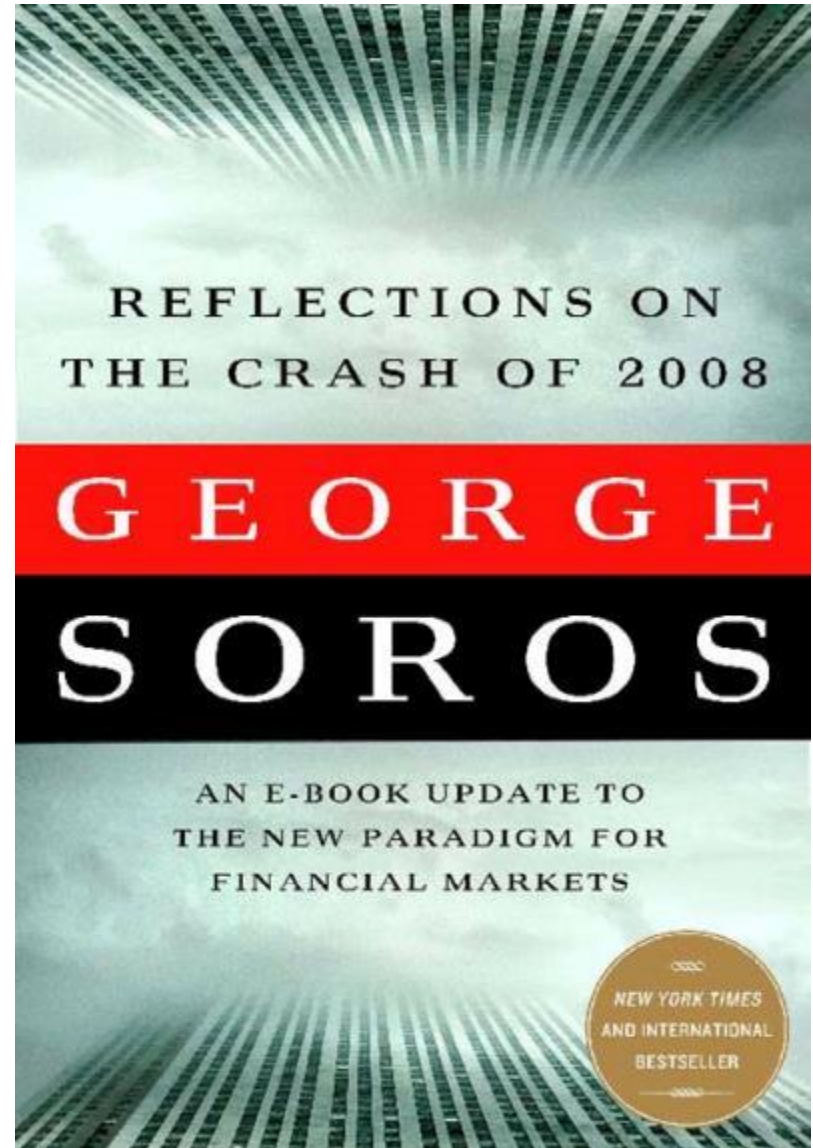
Written before the
financial crisis

Nassim Nicholas
Taleb, *The Black
Swan*, Penguin,
London 2007



Postulate of 'radical fallibility':

"Whenever we acquire some useful knowledge, we tend to extend it to areas where it is no longer applicable"



Models by their nature are like blinders. In leaving out certain things, they focus our attention on other things. They provide a frame through which we see the world.

Joseph E. Stiglitz, 2011, RETHINKING
MACROECONOMICS: WHAT FAILED, AND
HOW TO REPAIR IT, Journal of the
European Economic Association August
2011 9(4):591–645



Caeteris are
never
paribus!

“...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?”

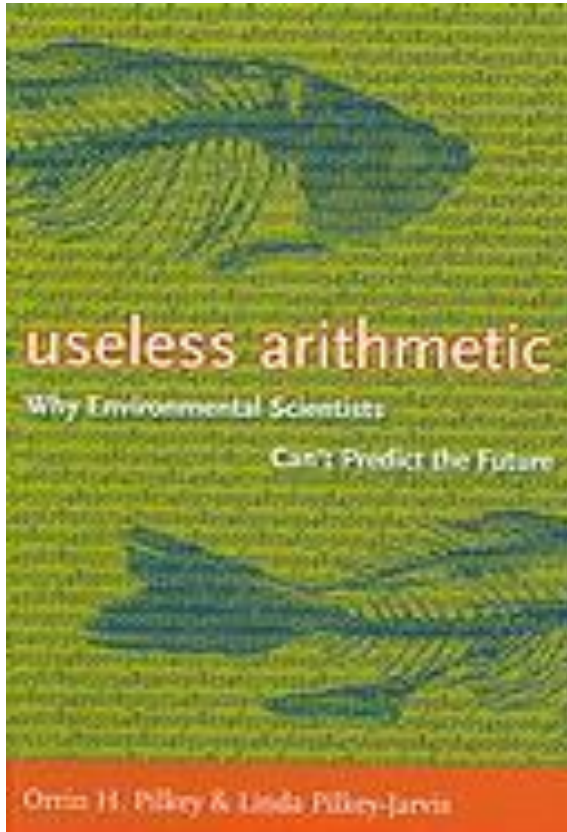


Philip Mirowski



The quote reported is 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. See book on this slide.

RULE ONE: Check against rhetorical use of mathematical modelling



Useless Arithmetic: Why
Environmental Scientists
Can't Predict the Future
by Orrin H. Pilkey and Linda
Pilkey-Jarvis

‘Quantitative mathematical
models used by policy
makers and government
administrators to form
environmental policies are
seriously flawed’

RULE ONE: Check against rhetorical use of mathematical modelling

The problem of legitimization – quantitative analysis as a rhetorical or ritual device – the story of Nobel prize laureate Kenneth Arrow:

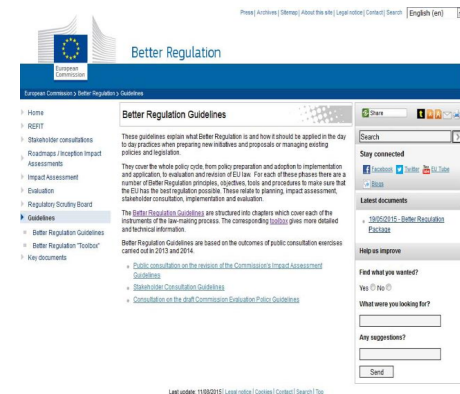
“The commanding general is well aware that the forecasts are no good. However, he needs them for planning purposes” (Szenberg, 1992).

p. 393

“Modellers could usefully consider the following principles:

1

- Before entering into contractual arrangements with third party consultants, consider the full spectrum of available models [...] [and check that] the complexity of the model is justified by the quality of information used to calibrate it, i.e. that a large **model is not being used rhetorically** to convey a spurious impression of accuracy.”



RULE TWO: Adopt an ‘assumption hunting’ attitude;

What was ‘assumed out’? What are the tacit, pre-analytic, possibly normative assumptions underlying the analysis?

E.g. in ‘Bogus Quantification: Uses and Abuses of Models’ John Kay uncovers that the UK transport WebTAG model (the standard for transport policy simulation) needs as input ‘Annual Percentage Change in Car Occupancy up to 2036.’



John Kay, London
School
Economics,
Columnist
Financial Times

John Kay's approach is called 'Assumptions hunting' in Dutch circles ...



John Kay, Financial Times

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>



Philip Stark,
University of Berkeley



Contents lists available at ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol



On the contribution of external cost calculations to energy system governance: The case of a potential large-scale nuclear accident

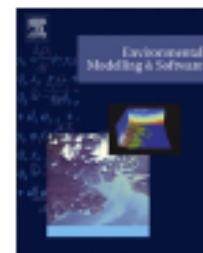
Erik Laes^{a,*}, Gaston Meskens^b, Jeroen P. van der Sluijs^c



Contents lists available at ScienceDirect

Environmental Modelling & Software

journal homepage: www.elsevier.com/locate/envsoft



A method for the analysis of assumptions in model-based environmental assessments

Penny Klopprogge^a, Jeroen P. van der Sluijs^{a,b,*}, Arthur C. Petersen^c

On the contribution of external cost calculations to energy system governance: The case of a potential large-scale nuclear accident

Erik Laes ^{a,*}, Gaston Meskens ^b, Jeroen P. van der Sluijs ^c

‘[...] calculation of the external costs of a potential large-scale nuclear accident [...] ‘An [analysis] resulted in a list of 30 calculation steps and assumptions’ ...

Who should do the hunting? Implication of Rule 2 for participatory approaches introducing a worked example from flood management.



Lane, S. N., Odoni, N., Landström, C., Whatmore, S. J., Ward, N. and Bradley, S., 2011. “Doing flood risk science differently: an experiment in radical scientific method.” *Transactions of the Institute of British Geographers*, 36: 15–36.

Doing flood risk science differently: an experiment in radical scientific method

S N Lane*, N Odoni*, C Landström**, S J Whatmore**,
N Ward† and S Bradley‡



Trans Inst Br Geogr NS 36 15–36 2011

ISSN 0020-2754 © 2010 The Authors.

Transactions of the Institute of British Geographers © 2010 Royal Geographical Society (with the Institute of British Geographers)

[...] knowledge regarding flooding was **co-produced**. This illustrates a way of working with experts, both **certified** (academic natural and social scientists) and **noncertified** (local people affected by flooding), [...] We reveal a **deep and distributed understanding** of flood hydrology across all experts, certified and uncertified, ...



Years of modeling stream flow and cost/benefit ratios for flood protection structures had failed to consider an alternative intervention—upstream storage of flood waters—until local stakeholders were brought into the modeling process.

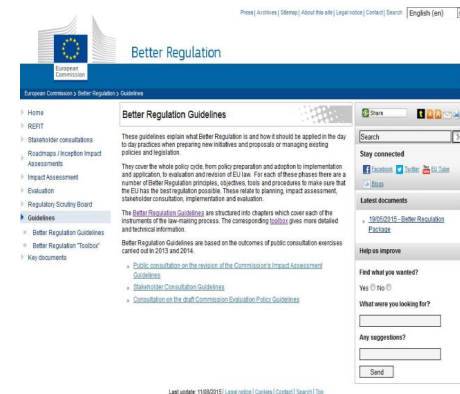
According to Lane and colleagues, upstream storage was neglected in the models because of the “use of a pit-filling algorithm that made sure that all water flows downhill”!

p. 393

“Modellers could usefully consider the following principles:

2

- Critically examine all model **assumptions**. Are there implicit or hidden assumptions which a third party might point to? Would it be possible to evaluate the impact of taking a different approach to tackle the issue? “



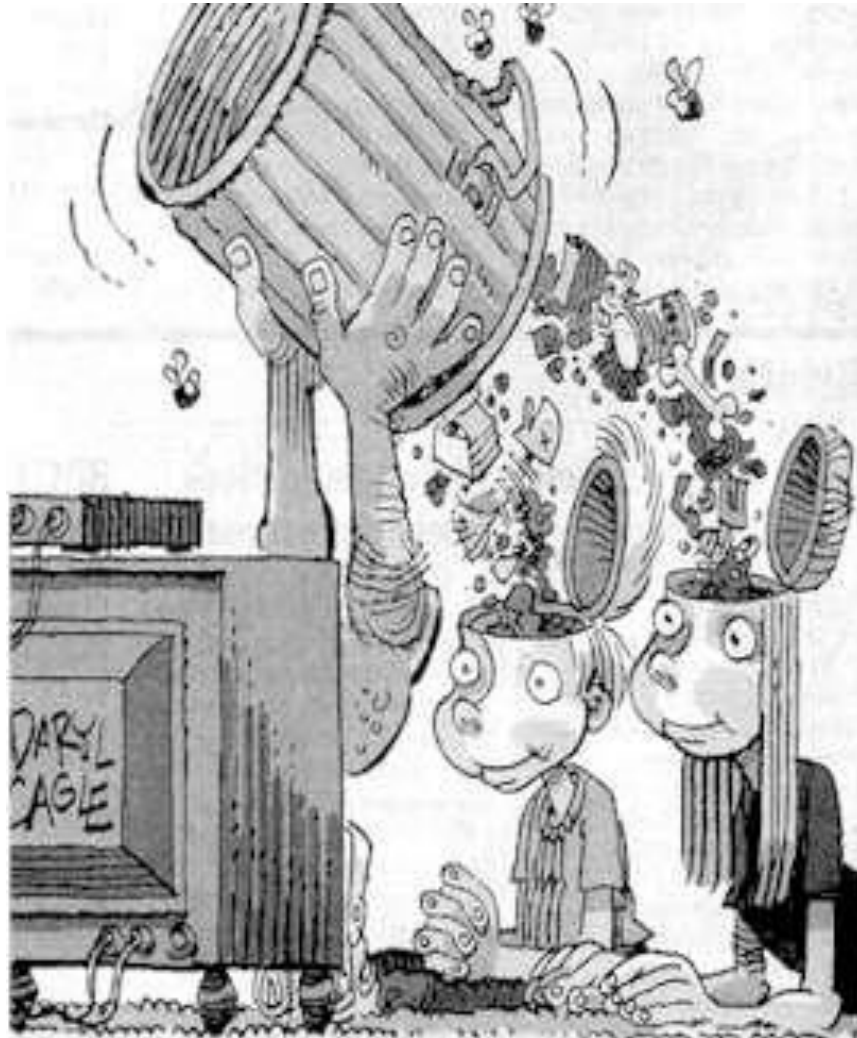


Discussion points



- Can I recall an example of ‘excessive’ or exaggerated quantification (hyper-precision)
- Am I haunted by a hidden assumptions, or by an elephants in the room nobody else sees?
- Can rule 2 lead to paralysis by analysis?

RULE THREE: detect GIGO (Garbage In, Garbage Out) Science or pseudo-science



What is GIGO (Garbage In, Garbage Out)
Science or pseudo-science “where
uncertainties in inputs must be suppressed lest
outputs become indeterminate”



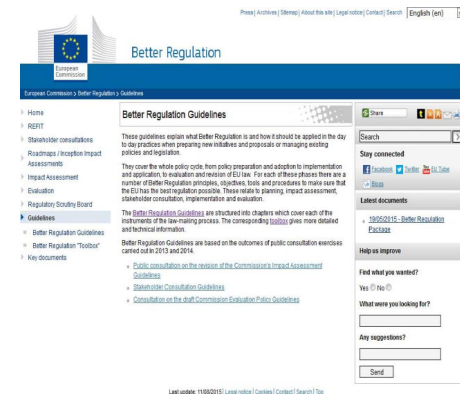
From: Uncertainty and
Quality in Science for
Policy, by Silvio
Funtowicz and Jerry
Ravetz, Springer 1990.



p. 393

“Modellers could usefully consider the following principles:

- Be careful **not to over or under-estimate uncertainties** in model input parameters. [...] Where uncertainty is particularly difficult to quantify, it may be better to discuss it in qualitative terms rather than give a spurious impression of accuracy.”



RULE FOUR: find sensitivities before sensitivities find you;



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 done as a result.”

THE NEW YORKER

“The fact that software is commercial is no guarantee that it does what it's supposed to do” (Philip B. Stark)

<http://www.stat.berkeley.edu/~stark/Preprints/auditingPosition09.htm#excel>

Philip B. Stark



Perils of placing faith in a thin theory



By Wolfgang Münchau April 21, 2013

Reinhart and Rogoff told policy makers what they wanted to hear

John Kenneth Galbraith [about] Milton Friedman: “Milton’s misfortune was that his policies had been tried.” [...]

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

RULE FOUR: find sensitivities before sensitivities find you;

From: Saltelli, A., D'Hombres, 2010, Sensitivity analysis didn't help. A practitioner's critique of the Stern review, *GLOBAL ENVIRONMENTAL CHANGE*, 20, 298-302.

The case of Stern's Review – Technical Annex to postscript



William Nordhaus,
University of Yale



Nicholas Stern, London
School of Economics

Stern, N., Stern Review on the Economics of Climate Change.
UK Government Economic Service, London,
www.sternreview.org.uk.

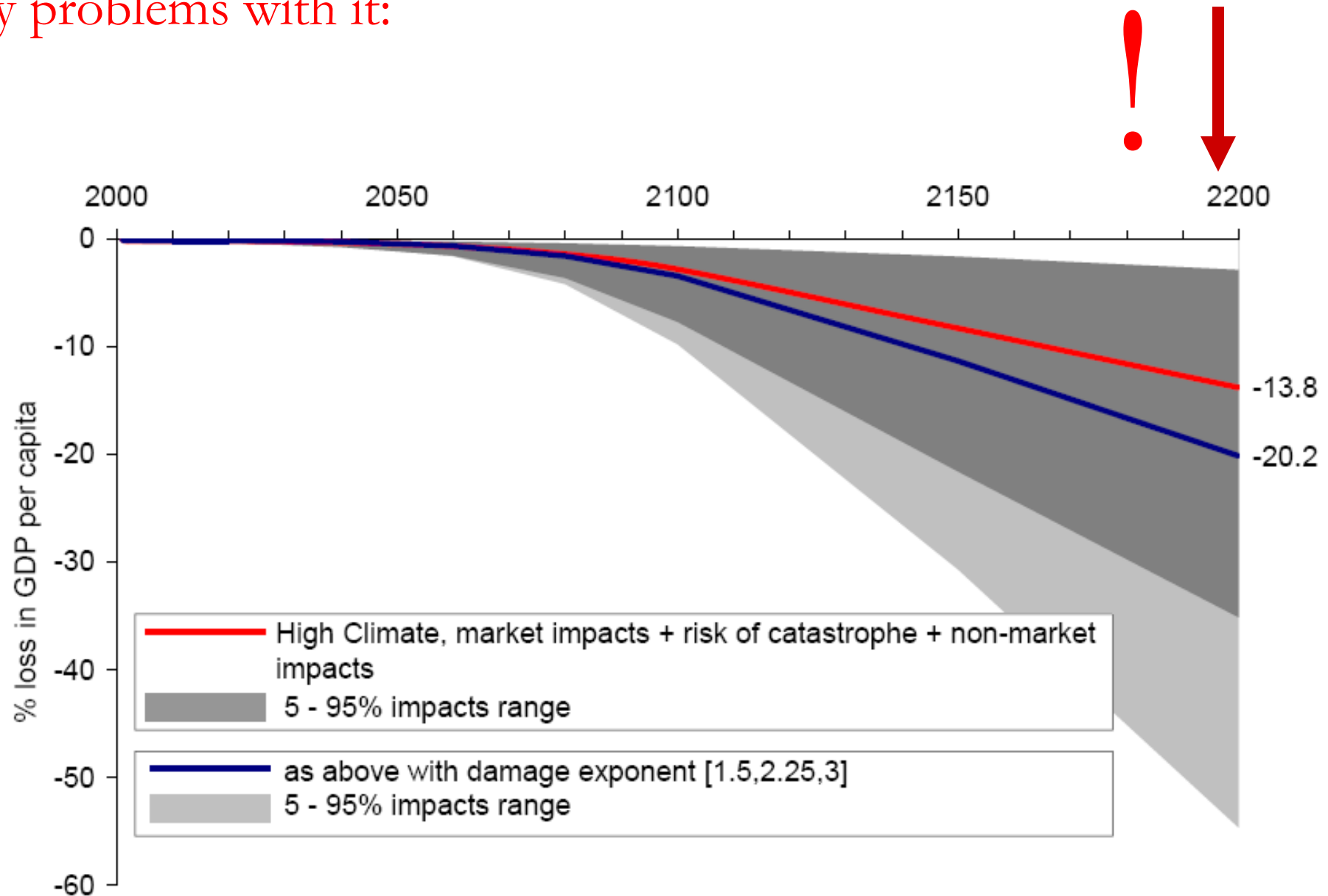
Nordhaus W., Critical Assumptions in the Stern Review on
Climate Change, *SCIENCE*, 317, 201-202, (2007).

RULE FOUR: find sensitivities before sensitivities find you;

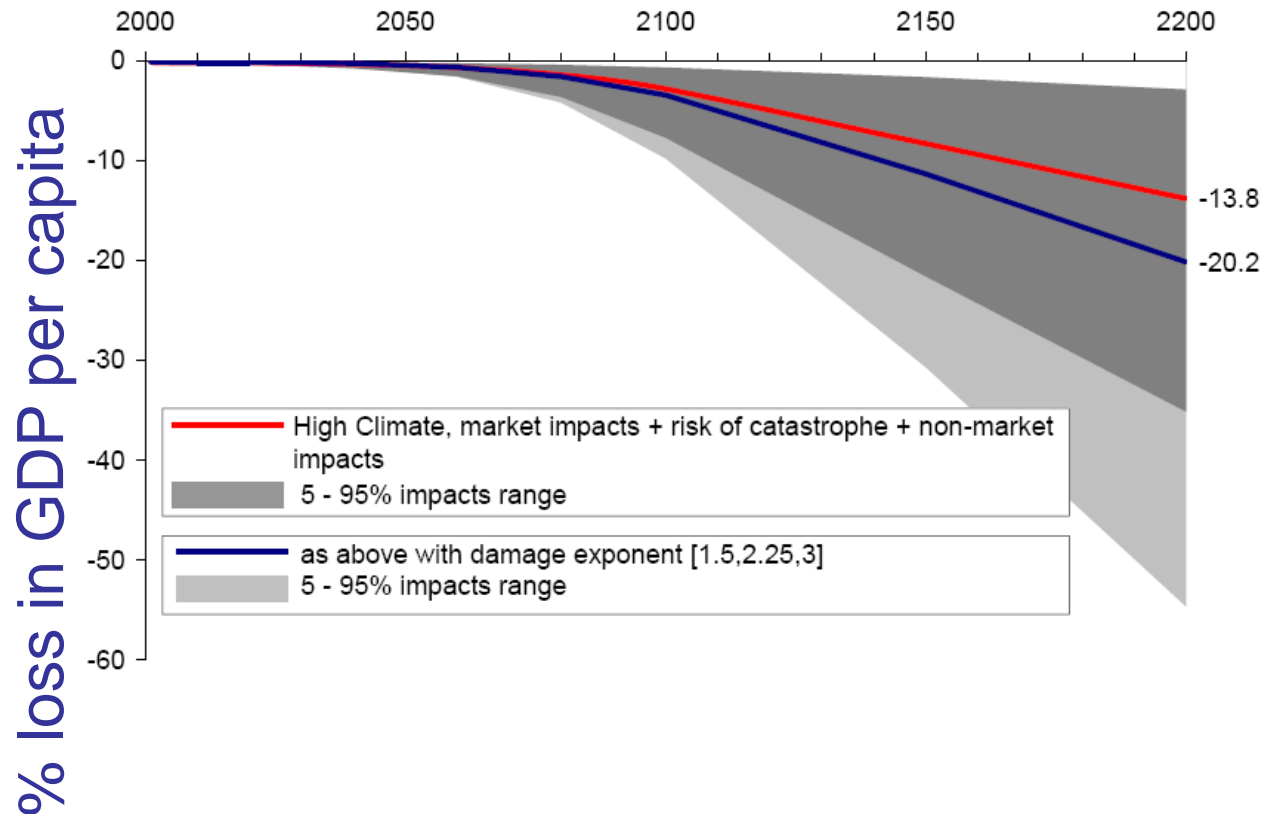
The Stern - Nordhaus exchange on *SCIENCE*

- 1) Nordhaus falsifies Stern based on 'wrong' range of discount rate
- 2) Stern's complements its review with a postscript: a sensitivity analysis of the cost benefit analysis
- 3) Stern infers: My analysis shows robustness'

My problems with it:

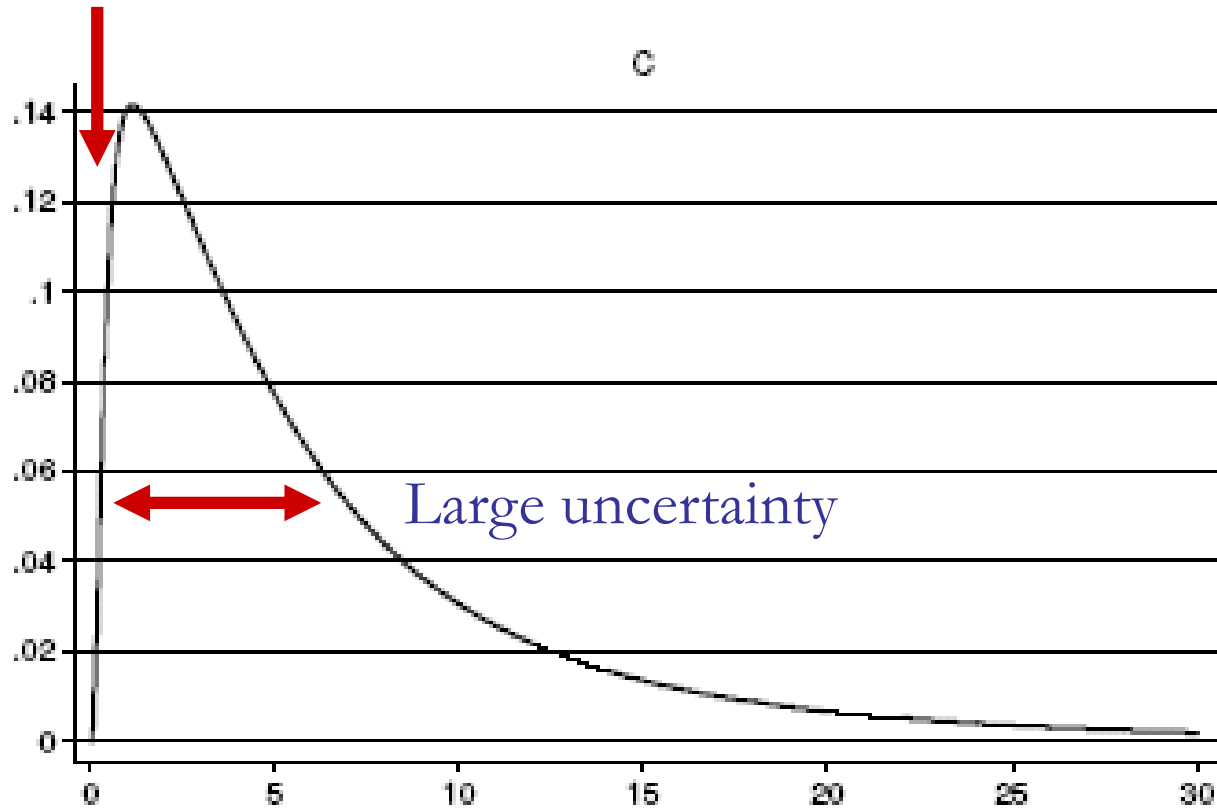


... but foremost Stern says:
changing assumptions → important effect
when instead he should admit that:
changing assumptions → all changes a lot



How was it done? A reverse engineering of the analysis

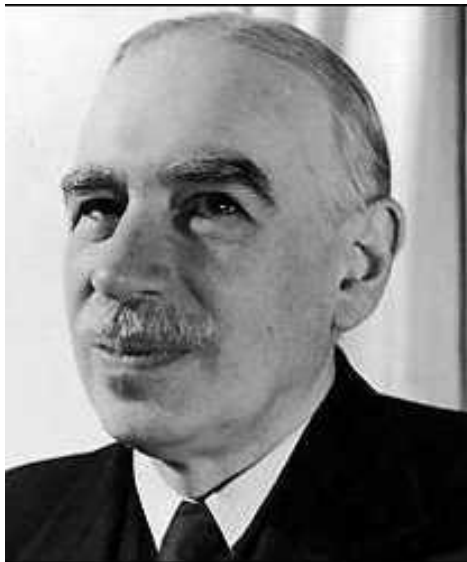
Missing points



% loss in GDP per capita

RULE FOUR: find sensitivities before sensitivities find you;

Same criticism applies to Nordhaus – both authors frame the debate around numbers which are ...



... precisely wrong

... and the story continues to these days ...

Saltelli, A., Stark, P.B., Becker, W., and Stano, P., 2015, Climate Models As Economic Guides Scientific Challenge or Quixotic Quest?, Issues in Science and Technology, Volume XXXI, Issue 3, spring 2015.

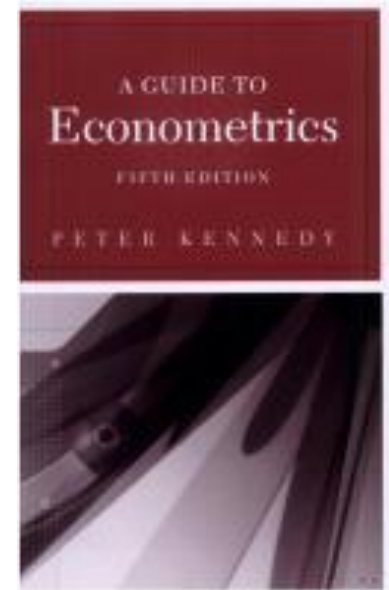
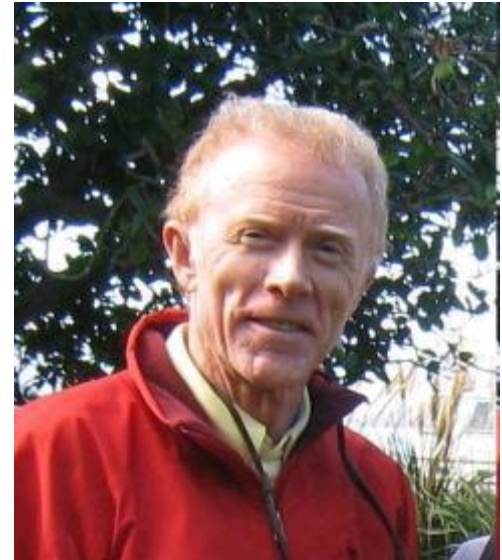
Saltelli, A., Funtowicz, S., Giampietro, M., Sarewitz, D., Stark, P.B., van der Sluijs, J.P., 2016, Climate costing is politics not science, Nature, 14 April, 532, 177.

RULE FOUR: find sensitivities before sensitivities find you;

Peter Kennedy, A Guide to Econometrics.
Anticipating criticism by applying sensitivity
analysis. This is one of the ten
commandments of applied econometrics:

<<Thou shall confess in the presence of
sensitivity.

Corollary: Thou shall anticipate criticism >>



RULE FIVE: aim for transparency

Doubts raised over Europe's green energy plan

Host of questions/ from advisers
Economic model lacks transparency

By Philip Clark in London

The credibility of a European energy review has been cast into doubt by opposition advisers who say plans to cut carbon emissions up to 50% are based on an economic model created by a single Greek university that cannot be independently verified.

The energy experts have "raised a host of questions" on how the European Commission's use of a non-transparent model could affect the review, according to a leaked report by advisers chosen by Brussels to comment on the "Energy Roadmap 2050" proposals.

The economic model, known as Primos, is owned by the National Technical University of Athens and is designed to show how the use of different groups of energy sources affect the wider economy.

The European Commission has used it for years to help guide the bloc's energy policies. But industry critics complain that its assumptions are impossible to question because the model is privately owned. One trade group, IndustriEurope, has asked for the Commission to use other, more transparent models.

The forecasting section of the energy road map, which will review the effect of changing sun, more wind and the nuclear power to meet Europe's green targets, has heightened concerns about the model's transparency. The expert advisory group report shows. One of the group's three meetings was "devoted largely" to how the Commission was using the Primos model to produce different energy mix scenarios for the road map.

"There was considerable debate about the role of the oil fuel price assumption in the Primos model," said the report by the group, which is chaired by Dieter Helm, an Oxford university economics professor, and



A refining plant in Germany: the credibility of plans to cut CO2 emissions has been called into question by experts

included bodies such as the International Energy Agency.

There were also questions on "the costs of different technologies" and "the assumption of perfect flexibility by companies but not by individuals".

The group's key concern was "what the transparency of the Primos work, and in particular the private rights in the algo-

Independent parties cannot replicate the results because the model is private property

ritms and detailed internal workings of the model", says the report, which is leaked "this day".

"The model remains the private property of the National Technical University of Athens," it says.

The consequence is that independent parties cannot verify the results. This is a substantial barrier for the Commission, not least

if the review turned out that it does have serious consequences for the credibility of the road map.

The advisory group also contends that the Primos model be made publicly available "so that its results can be replicated by interested parties".

Parsons Capital, an investor from the National Technical University of Athens who built the Primos model, told the Financial Times he agreed that transparency was important and would not mind if some of the model's workings were made public, "but not the whole thing" - not the software.

A spokeswoman for the energy commission, Gerdler Oettinger, said she would not comment on an unpublished document. The final version of the advisory group's report would be released with the energy road map next month.

Prof Capoen has been an energy consultant for many years and has held positions as bodies ranging from Greece's energy minister to the country's Public Power Corporation.

RULE FIVE: aim for transparency



“Experts have “raised a host of questions” about how the European Commission’s use of a non-transparent model could affect the energy review, according to a leaked report by energy specialists chosen by Brussels to advise on the forthcoming “Energy Roadmap to 2050”
FT November 6, 2011

RULE FIVE: aim for transparency



“The credibility of a European energy review has been cast into doubt by experts who point out that long-term plans to cut carbon emissions are based on an economic model owned by a single Greek university that cannot be independently scrutinised.”

RULE FIVE: aim for transparency

20 Apr 2016, by Peter Teffer

The EU's Joint Research Centre did not have the mandate to check for the illegal software, known as defeat devices, its representative told MEPs.

Tuesday
26th Apr 2016

euobserver

[f](#) [t](#) [g+](#) [in](#) [v](#)

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EU science body did not suspect diesel cheating



Former EU commission chief Jose Manuel Barroso (r) visiting the JRC in Ispra (Photo: European Commission)

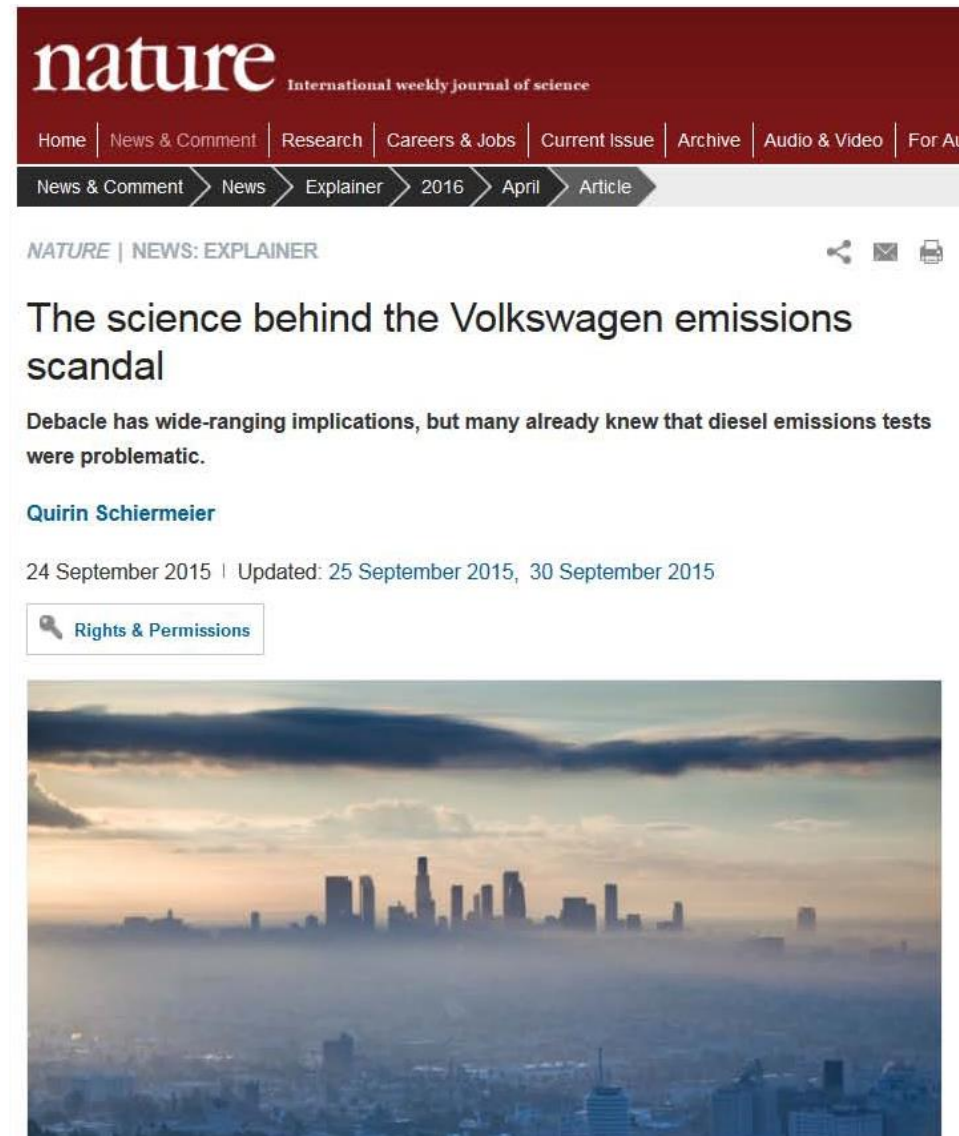
By **PETER TEFFER** [f](#) [t](#)

BRUSSELS, 20. APR, 08:51

RULE FIVE: aim for transparency

In 2011 JRC reported that average on-road emissions of tested diesel vehicles exceed allowed limits by up to 14 times[...] In 2012 JRC compared NO_x emissions [and found that VW models] still exceeded the existing emissions standard by about 260%.

All available in published peer reviewed papers



Part IX

Office of Management and Budget

**Guidelines for Ensuring and Maximizing
the Quality, Objectivity, Utility, and
Integrity of Information Disseminated by
Federal Agencies; Notice; Republication**



The OMB about
transparency

<http://www.whitehouse.gov/omb/infoereg/>

RULE FIVE: aim for transparency

[models should be made available to a third party so that it can] use the same data, computer model or statistical methods to replicate the analytic results reported in the original study.

[...] The more important benefit of transparency is that the public will be able to assess how much an agency's analytic result hinges on the specific analytic choices made by the agency.

Friday, February 22, 2002
Graphic - Federal Register, Part IX
Office of Management and Budget
Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity
of Information Disseminated by Federal Agencies; Notice; Republication

This was 2002

<http://www.whitehouse.gov/omb/inforeg/>

²⁰House Republicans Aim To Limit Power Of Environmental Protection Agency

This is 2014

The Huffington Post | by [Robin Wilkey \(/robin-wilkey\)](#)

Posted: 02/07/2014 6:18 pm EST | Updated: 02/08/2014 10:59 am EST



The bill, dubbed the Secret Science Reform Act would force the EPA to publicly release its research on a topic before issuing a policy recommendation, and require that the research be "reproducible." Supporters claim the bill will increase transparency in public policy, while opponents have accused the bill's authors of trying to keep the EPA from doing its job.

113TH CONGRESS
2D SESSION

H. R. 4012

To prohibit the Environmental Protection Agency from proposing, finalizing, or disseminating regulations or assessments based upon science that is not transparent or reproducible.

<http://beta.congress.gov/bill/113th-congress/house-bill/4012>

Accessed May 2014

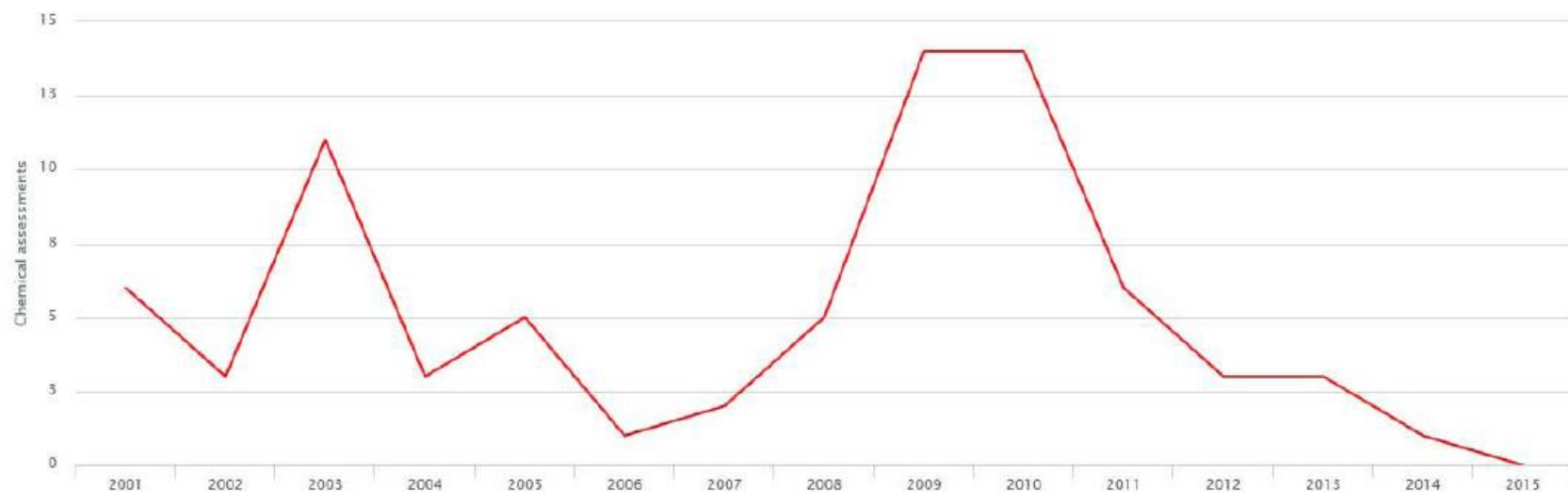
Meet the ‘rented white coats’ who defend toxic chemicals, by David Heath



How EPA assessment of hazardous chemicals has come to an halt

EPA chemical assessments halt in 2015

[f](#) [t](#) [r](#) [in](#) [Comment](#) [Email](#)



Source: Environmental Protection Agency's Integrated Risk Information System

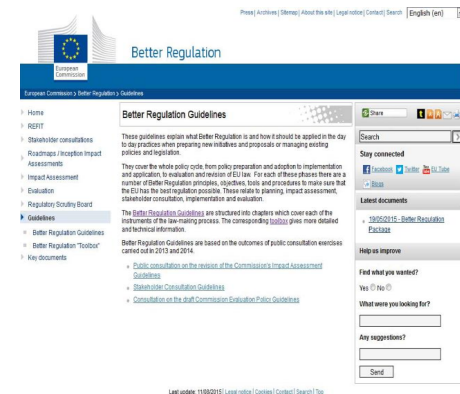
<http://www.publicintegrity.org/2016/02/08/19223/meet-rented-white-coats-who-defend-toxic-chemicals>

p. 393

“Modellers could usefully consider the following principles:

4

- Aim for transparency – when relevant and possible the model calculations should be checked by third parties.





Discussion points

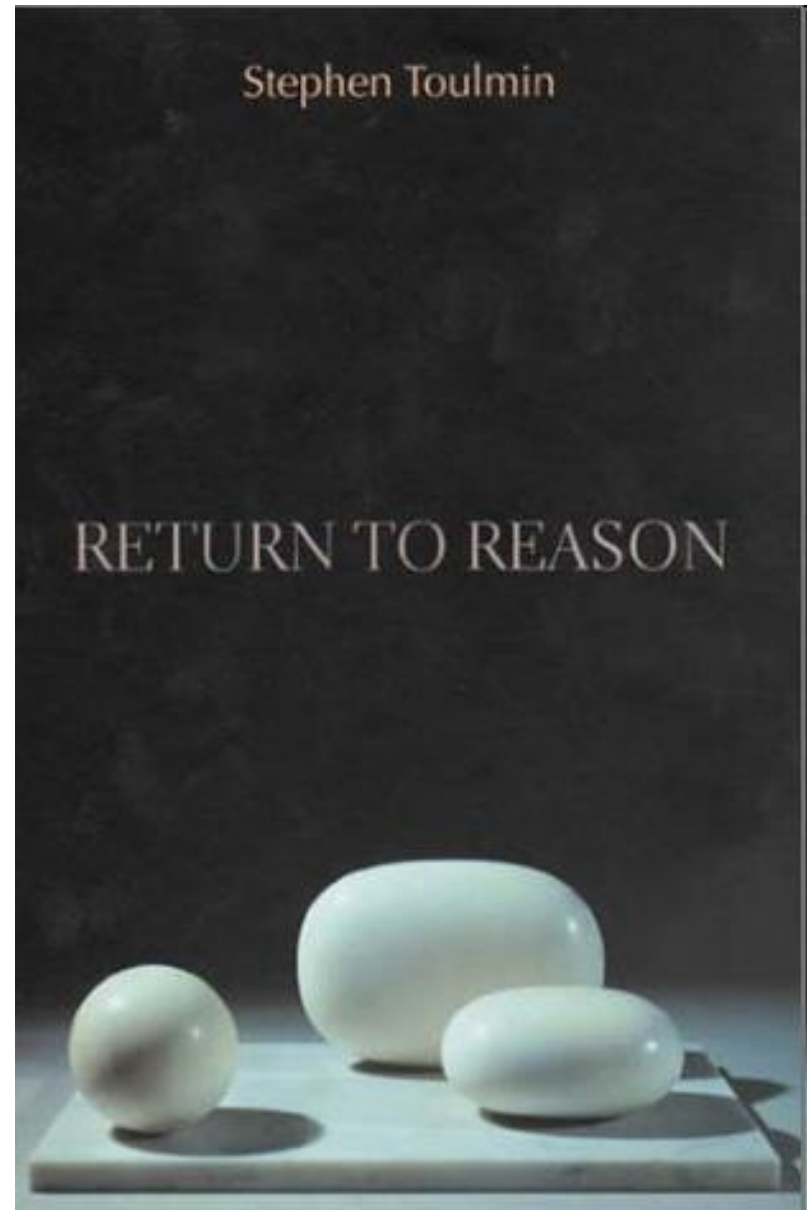


- When it comes to quantification does the end justify the means?
- Can I recall an instance where uncertainties have been either amplified or deflated instrumentally?
- Can rule 3–5 lead to paralysis by analysis?

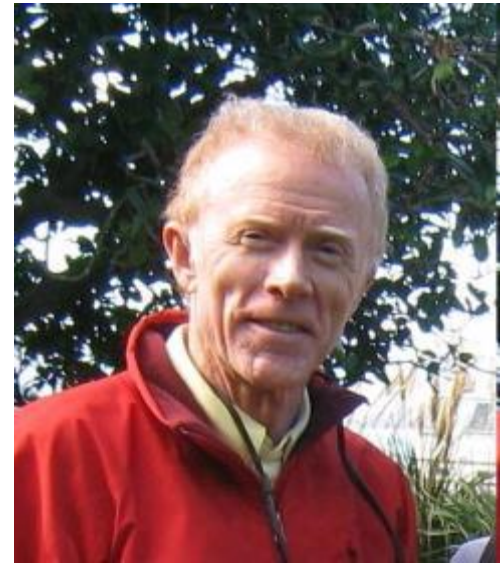
RULE SIX: Do the right sums



Do the sum right
Versus
Do the right sums
(Stephen Toulmin)
A plea for reasonableness
versus rationality



RULE SIX: Do the right sums



Peter Kennedy's commandment of applied econometrics: 'Thou shall answer the right question', Kennedy 2007

Expertise and responsibility

Rule 6

- Experts as stakeholders among many, with their occupational psychoses.
- Already discussed: most analyses offered as input to policy are framed as cost benefit analysis (monetization, the occupational psychosis of economists) or risk analyses.



Langdon Winner

Frames

- Contrary to the popular belief that climate sceptics don't know about climate science Dan Kahan (2014) has observed that the more a person is informed about climate science, the more he or she is likely to be polarized on the issue in either direction.

Frames

- The expression ‘tax relief’ is apparently innocuous but it suggests that tax is a burden, as opposed to what pays for road, hospitals, education and other infrastructures of modern life (Lakoff, 2004).

Frames

- Published road accident statistics record the conditions of the driver as to alcohol or drug use but not the make and year of the car or its safety features (Gusfield, 1981).

Gusfield, J. (1981). *The Culture of Public Problems. Drinking–Driving and the Symbolic Order.* The University of Chicago Press.

The issue of frames. How do we perceive the world. Socially constructed ignorance etc.

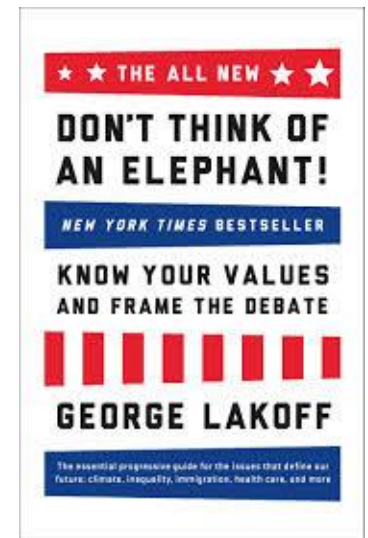
Lakoff, G., 2010, Why it Matters How We Frame the Environment, Environmental Communication: A Journal of Nature and Culture, 4:1, 70-81.

Lakoff, G., 2004-2014, Don't think of an elephant: know your values and frame the debate, Chelsea Green Publishing.

For a summary see http://www.andreasaltelli.eu/file/repository/Hypocognition_Etc.pdf



George Lakoff



Why Free Markets Make Fools of Us

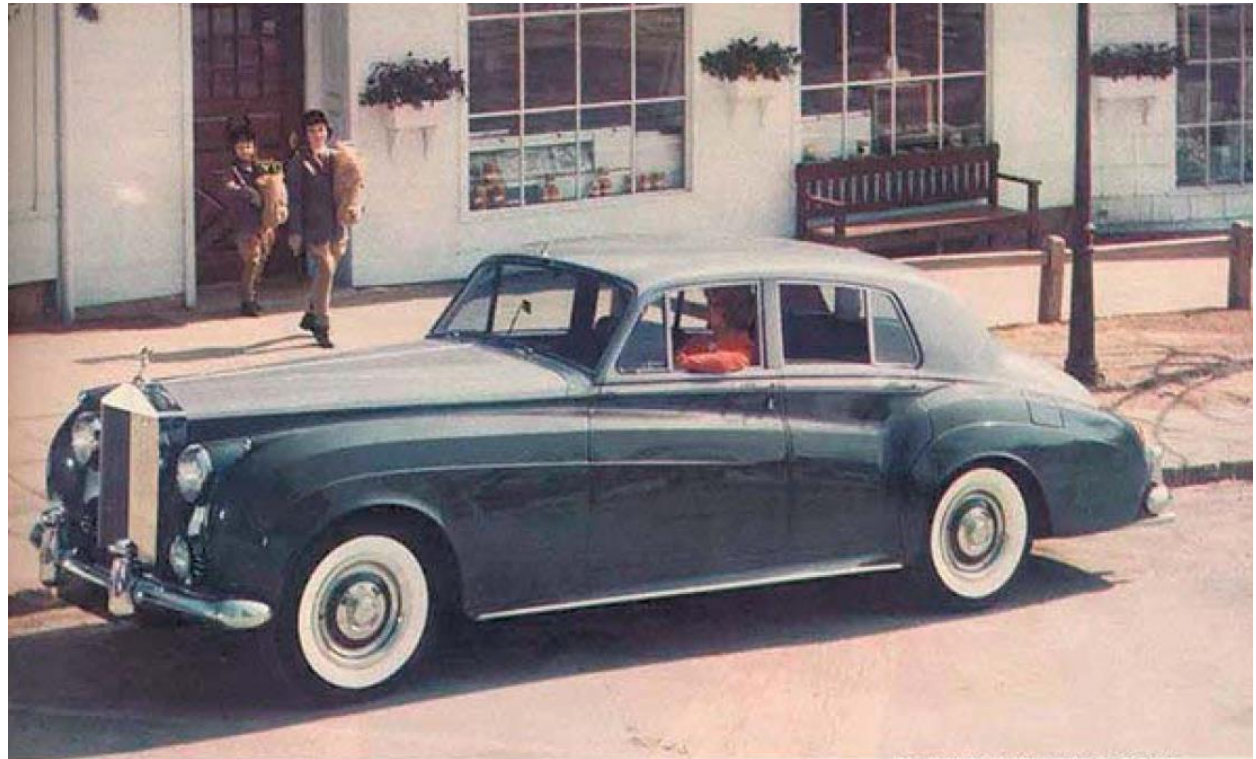
Cass R. Sunstein

OCTOBER 22, 2015 ISSUE

Phishing for Phools: The Economics of Manipulation and Deception

by George A. Akerlof and Robert J. Shiller

Princeton University Press, 272 pp., \$24.95



The Rolls-Royce Silver Cloud — \$13,995

“At 60 miles an hour the loudest noise in this new Rolls-Royce comes from the electric clock”

An advertisement for Rolls-Royce from the late 1950s

Frames and narratives

For Akerlof and Shiller – against what the ‘invisible hand’ would contend – economic actors have no choice but to exploit frames to ‘phish’ people into practices which benefit the actors not the subject phished. Implication for democracy.



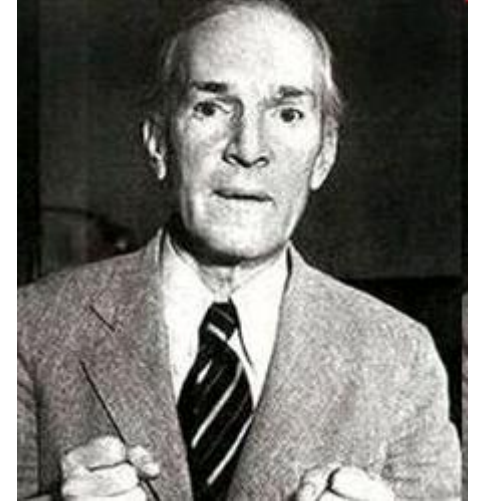
George Akerlof



Robert R. Shiller

On the persistence of narratives

“It is difficult to get a man to understand something when his salary depends upon his not understanding it.”



Upton Sinclair



Discussion points



- Can I recall an example of a framing which did not sound right to me?

RULE SEVEN: Explore diligently the space of the assumptions

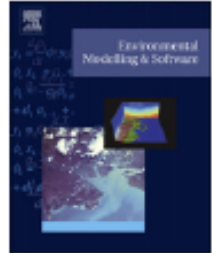
Environmental Modelling & Software 25 (2010) 1508–1517



Contents lists available at [ScienceDirect](#)

Environmental Modelling & Software

journal homepage: www.elsevier.com/locate/envsoft



How to avoid a perfunctory sensitivity analysis

Andrea Saltelli*, Paola Annoni

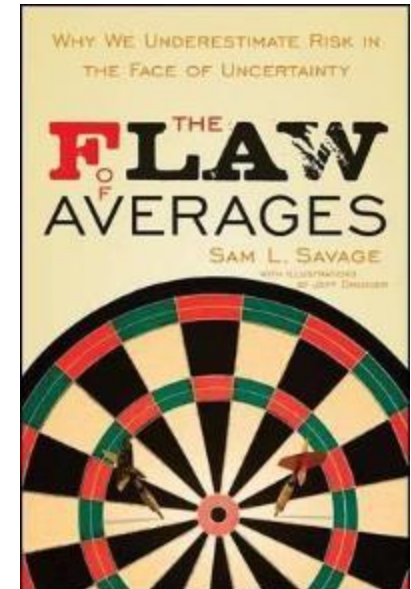
Joint Research Center, Institute for the Protection and Security of the Citizen, via E.Fermi, 2749, Ispra VA 21027, Italy

RULE SEVEN: Explore diligently the space of the assumptions

How coupled ladders are shaken
in most of available literature



How to shake coupled ladders





END

Twitter:
@andreasaltelli

Sensitivity auditing

- Context for science for policy. Science's governance crisis. Trust and legitimacy.
- Models of science for policy
- Steps of a sensitivity auditing (taken from IA toolbox as a starting point) with case studies.
- Frames and socially constructed ignorance
- Quantitative story telling
- Why these approaches demand an extended peer communities
- Participatory methods – an introduction to the second JRC training module

**The
Economist**

OCTOBER 19TH - 27TH 2013

[Economics](#)

Washington's lawyer surplus
How to do a nuclear deal with Iran
Investment tips from Nobel economists
Junk bonds are back
The meaning of Sachin Tendulkar

HOW SCIENCE GOES WRONG.

99

Einsteinium

Unreliable research

Trouble at the lab

Scientists like to think of science as self-correcting. To an alarming degree, it is not

Oct 19th 2013 | From the print edition



22K

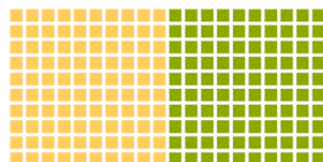


Jason Ford

Unlikely results

How a small proportion of false positives can prove very misleading

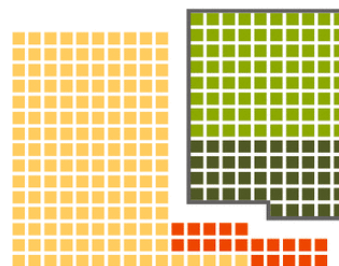
False True False negatives False positives



1. Of hypotheses interesting enough to test, perhaps one in ten will be true. So imagine tests on 1,000 hypotheses, 100 of which are true.



2. The tests have a false positive rate of 5%. That means they produce 45 false positives (5% of 900). They have a power of 0.8, so they confirm only 80 of the true hypotheses, producing 20 false negatives.



3. Not knowing what is false and what is not, the researcher sees 125 hypotheses as true, 45 of which are not. The negative results are much more reliable—but unlikely to be published.

The new true

The Economist

“A career structure which lays great stress on publishing copious papers exacerbates all these problems.”

The
Economist



Jason Ford

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



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



Brian Nosek
Professor,
Department of
Psychology
University of Virginia

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

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

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

... and a couter study saying that Nosek's team got it wrong.

Gilbert, D. T., King, G., Pettigrew, S. & Wilson, T. D. Science 351, 1037 (2016).

Solutions from within:

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



John P. A. Ioannides

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

Declaration: <http://am.ascb.org/dora/> , drafted by publishers, with separate recommendations for institutions, publishers, organizations that supply metrics and researchers.

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

Wilsdon, J., 2015, We need a measured approach to metrics, Nature, 523, 129.

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

Frames

- Contrary to the popular belief that a GMO-averse person is a risk- or technology-averse individual, an important EC study (Marris, 2001) has shown that GMO aversion is linked to frames where risk plays a very minimal role (and alimentary risk plays no role at all).

Questions about GMO deemed relevant by citizens (Marris, 2001)

- Why do we need GMOs? What are the benefits?
- Who will benefit from their use?
- Who decided that they should be developed and how?
- Why were we not better informed about their use in our food, before their arrival on the market?
- Why are we not given an effective choice about whether or not to buy and consume these products?
- Do regulatory authorities have sufficient powers and resources to effectively counter-balance large companies who wish to develop these products?



Frames; GMO presented as a food scare.

“Montpelier is **America’s only McDonald’s-free state capital**. A fitting place, then, for a law designed to satisfy the unfounded fears of foodies [...] genetically modified crops, declared safe by the scientific establishment, but reviled as **Frankenfoods** by the **Subarus-and-sandals set**”, (The Economist, 2014).



The Economist, Vermont v science, The little state that could kneecap the biotech industry, May 10th 2014

Edward E. Leamer, 1990, Let's Take the Con Out of Econometrics, American Economics Review, 73 (March 1983), 31-43.



<<I have proposed a form of organised sensitivity analysis that I call “global sensitivity analysis” in which a neighborhood of alternative assumptions is selected and the corresponding interval of inferences is identified.

Conclusions are judged to be sturdy only if the neighborhood of assumptions is wide enough to be credible and the corresponding interval of inferences is narrow enough to be useful.>>



Discussion points



- Is there a crisis then? Build a counter argument
- Should this concern me? Build an argument for and one against

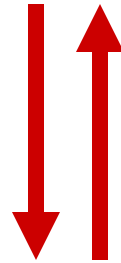


Discussion points



- Demarcating or not demarcating? (Appealing or not appealing to the neutrality of experts?). Build an argument for and one against.
- When an expert is not neutral is he/she dishonest?

Funtowicz & Ravetz's GIGO (Garbage In, Garbage Out) Science – or pseudo-science – “where uncertainties in inputs must be suppressed least outputs become indeterminate”

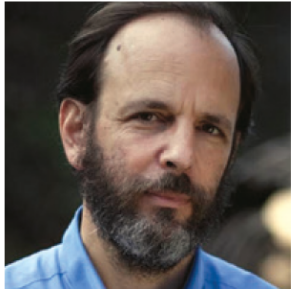


Leamer's ‘Conclusions are judged to be sturdy only if the neighborhood of assumptions is wide enough to be credible and the corresponding interval of inferences is narrow enough to be useful’.

WORLD VIEW

A personal take on events

MICHAEL TEMCHINE



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**.*

The bill is discussed in this comment on Nature from Dan Sarewitz:

Quality used against regulation, but Republicans and Democrats both appeal to a neutral (demarcated) science when this fits the respective agendas...