

# Ethics of quantification

Andrea Saltelli

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Research, Open University of Catalonia



MNF990 / Theory of Science and Ethics, Bergen,  
September 2020

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

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Saltelli

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#statistiques #probabilités #modélisation  
#prédiction Isabelle Bruno du #CERAPS  
@univ\_lille @CNRS\_HdF @ScPoLille nous parle  
des dérives de la #quantophrénie dans un article à  
lire sur le media @FR\_Conversation  
[https://twitter.com/FR\\_Conversation/status/1302651033164881920](https://twitter.com/FR_Conversation/status/1302651033164881920)



Sep 7, 2020

**andrea saltelli**  
@AndreaSaltelli

Pour mes amis francophones. Honoured to be co-  
author of a statactivist like Isabelle Bruno du  
#CERAPS @univ\_lille @CNRS\_HdF @ScPoLille  
@OpenEvidence @UOCNews  
Statistiques et modèles mathématiques : doit-on

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- Where are the women?
- Quantification and the roots of the Cartesian dream
- Extraordinary success of the dream
- Science's ethos
- Alarms from some quarters ...
- ... but a reassuring sociotechnical imaginary in the mainstream
- What recipes for an ethics of quantification?
  - NUSAP
  - Sensitivity auditing
- Numbers and trust
- The take of different authors
- An example of poor quantification: consequentialism?

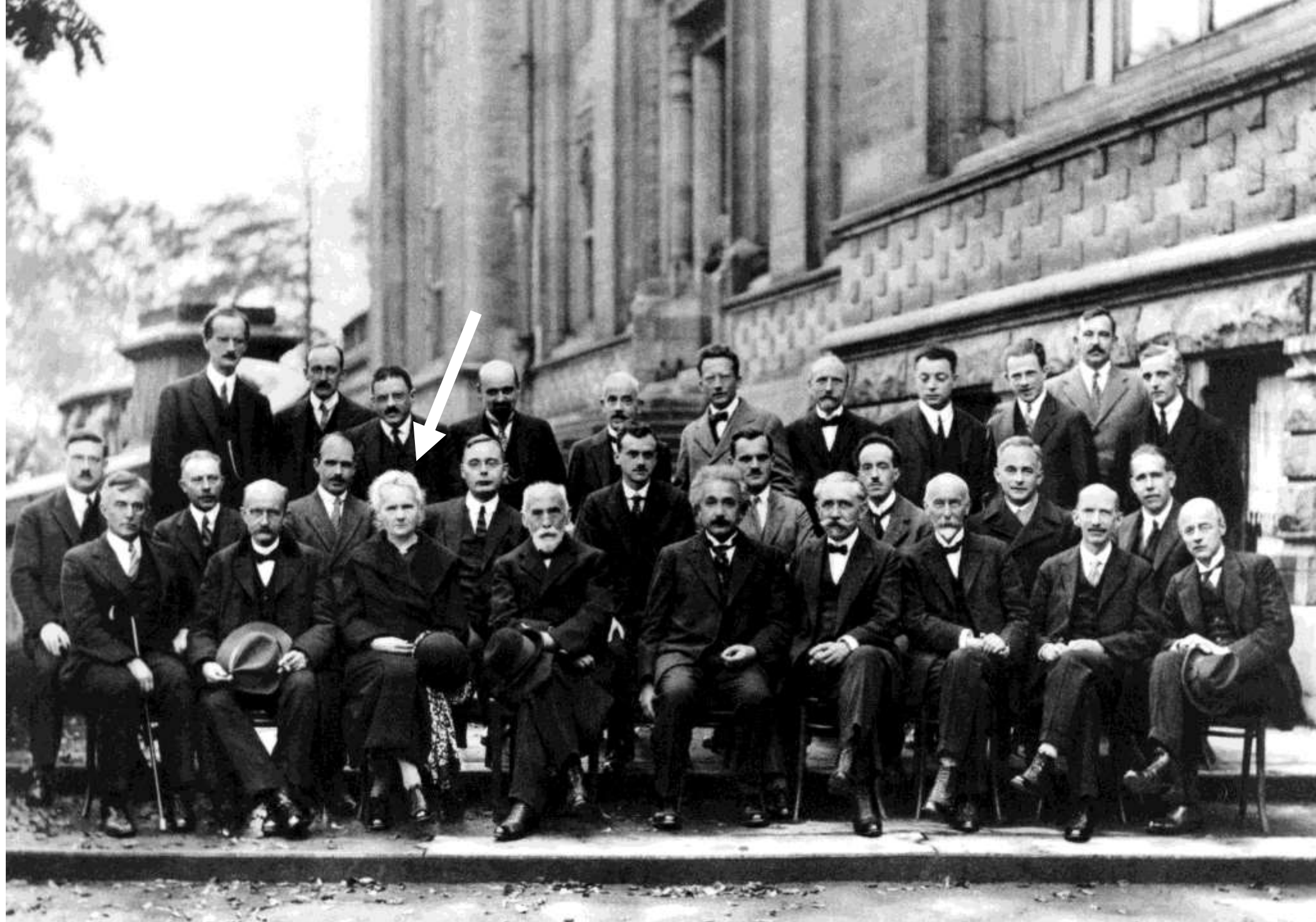
So many men,  
so few women



1911



1927





Lise Meitner

The first person to understand  
nuclear fission;

She did not win the Nobel  
prize 1944 for chemistry  
which went to her colleague  
Otto Hahn



Lise Meitner  
1878– 1968

Rosalind Elsie Franklin

Her X-ray images led to the discovery of the DNA double helix structure;

Nobel in Medicine 1962 to J. Watson, F. Crick and M. Wilkins;

She should have ideally been awarded a Nobel Prize in Chemistry (according to J. Watson)



Rosalind Elsie  
Franklin  
1920–1958



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CLIMATE HOME NEWS

Eunice Foote  
(1819–1888)

# Meet the woman who first identified the greenhouse effect

Published on 02/09/2016, 5:58pm

Eunice Foote demonstrated the heat-trapping properties of carbon dioxide at a scientific conference in 1856, newly digitised records show

By **Megan Darby**

Irish physicist John Tyndall is commonly credited with discovering the greenhouse effect, which underpins the science of climate change.

ART. XXXI.—*Circumstances affecting the Heat of the*  
by EUNICE FOOTE.

(Read before the American Association, August 23d, 1860.)

My investigations have had for their object to determine the effect of different circumstances that affect the thermal action of light that proceed from the sun.

Several results have been obtained.

First. The action increases with the density of the medium, and is diminished as it becomes more rarified.

The experiments were made with an air-pump and two cylindrical receivers of the same size, about four inches in diameter and thirty in length. In each were placed two thermometers, and the air was exhausted from one and condensed in the other. After both had acquired the same temperature they were placed in the sun, side by side, and while the action of the sun's rays rose to  $110^{\circ}$  in the condensed tube, it attained only  $85^{\circ}$  in the other. I had no means at hand of measuring the density of the air, or its condensation or rarefaction.

The observations taken once in two or three minutes are as follows:

Exhausted Tube		Condensed Tube	
In shade.	In sun.	In shade.	In sun.
73	80	75	80
76	82	78	82
80	82	80	82
83	85	82	85
84	85	85	85

This circumstance must affect the power of the sun's rays in different places, and contribute to produce their feeble action on the summits of lofty mountains.

Secondly. The action of the sun's rays was found to be more powerful in moist than in dry air.

In one of the receivers the air was saturated with water vapor, in the other it was dried by the use of chlorid of calcium.

Both were placed in the sun as before and the results were as follows:

Dry Air.		Damp Air.	
In shade.	In sun.	In shade.	In sun.
75	75	75	75
78	88	78	88
82	102	82	102
82	104	82	104
82	105	82	105
85	105	92	105

## CIRCUMSTANCES

## Affecting the Heat of the Sun's Rays.

BY MRS. EUNICE FOOTE.



Tweet



Isabel Hilton

@isabelhilton



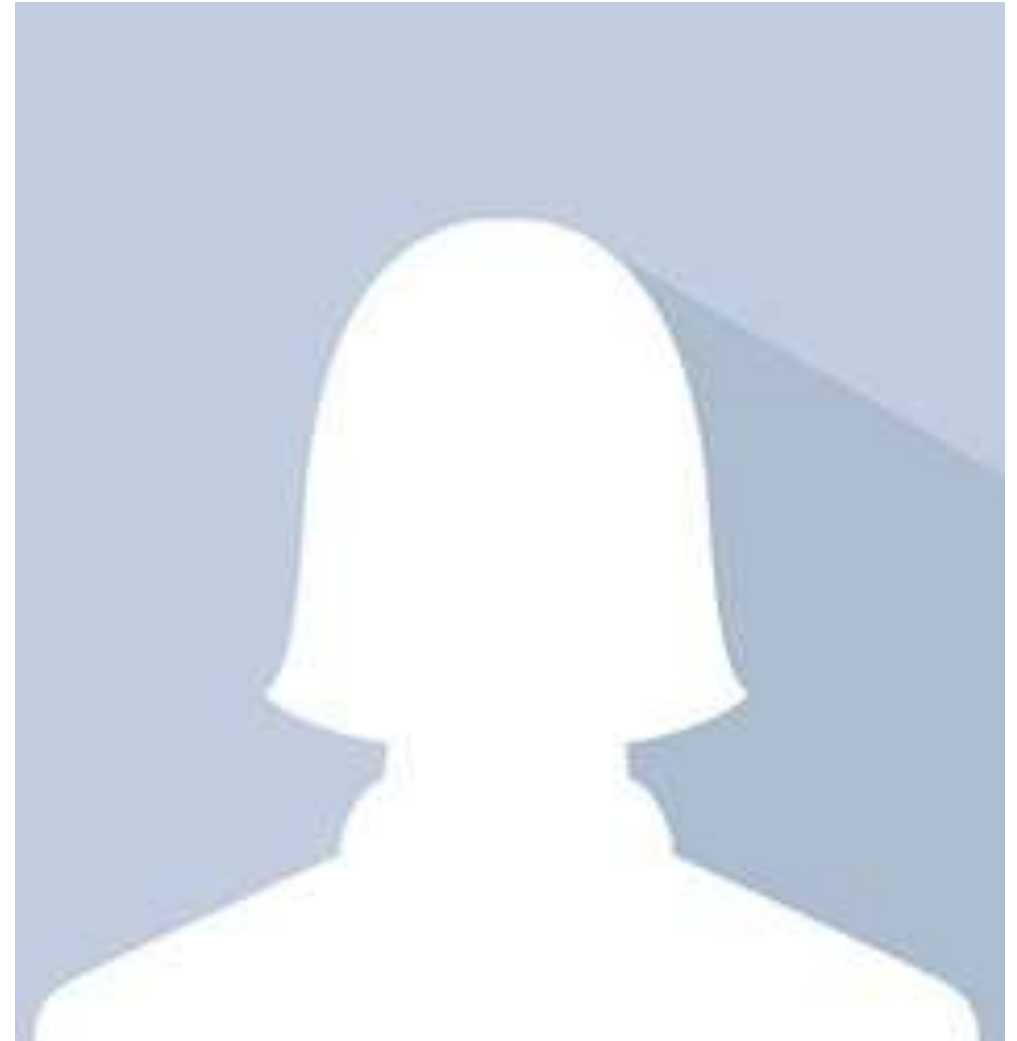
Who could have imagined that the scientist who first demonstrate the potential for global warming with an elegant experiment could be so completely forgotten. Oh, it was a woman? Now I get it.



Overlooked No More: Eunice Foote, Climate Scientist Lost to History

Foote's ingenious experiment more than 150 years ago yielded a remarkable discovery that could have helped shape modern climate science had she not bee...

[nytimes.com](https://www.nytimes.com/2020/04/21/obituaries/eunice-foote-overlooked.html)



<https://www.nytimes.com/2020/04/21/obituaries/eunice-foote-overlooked.html>



# Quantifications and the roots of the Cartesian dream



Francis Bacon  
(1561–1626)

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

We call Cartesian dream the idea  
of man as master and possessor  
of nature, of prediction and  
control, of Bacon's wonders of  
science and of Condorcet's  
mathematique sociale...



René Descartes  
(1596–1650)  
Discourse on Method  
(1637)



Nicolas de Caritat, marquis de  
Condorcet  
(1743– 1794)  
'Sketch for a Historical Picture of  
the Progress of the Human Spirit'



Francis Bacon  
(1561–1626)

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.





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

Francis Bacon (1561–1626)

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, etc.; 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 [...], 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 [...], 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’

Overpopulation? War due to scarcity of resources? Will 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’: We still use today terms such as ‘Condorcet method’, ‘Condorcet winner’, ‘Condorcet–ranking procedure’



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

Feldman, J., 2005, Condorcet et la mathématique 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





Condorcet's  
algorithms and  
Descartes'  
Geometry: the  
dream always had a  
quantification  
agenda



Closer to our times the dream was couched in the 'Endless Frontier' metaphor by Vannevar Bush, 1945:

Vannevar Bush  
(1890–1974)



“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 [...] basic scientific research. [...]the] Government [...] opened the seas to clipper ships and furnished land for pioneers. Although these frontiers have more or less disappeared, the frontier of science remains.”

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

The ethos of open  
science, the  
republic of  
science, CUDOS



Robert K. Merton

M. Polanyi, J. Ziman, and S. Fuller, "The republic of science: its political and economic theory," *Minerva*, vol. 38, pp. 1–32.



Michal Polanyi

**Communalism** – the common ownership of scientific discoveries, according to which scientists give up intellectual property rights in exchange for recognition and esteem (Merton actually used the term Communism, but had this notion of communalism in mind, not Marxism);

**Universalism** – according to which claims to truth are evaluated in terms of universal or impersonal criteria, and not on the basis of race, class, gender, religion, or nationality;

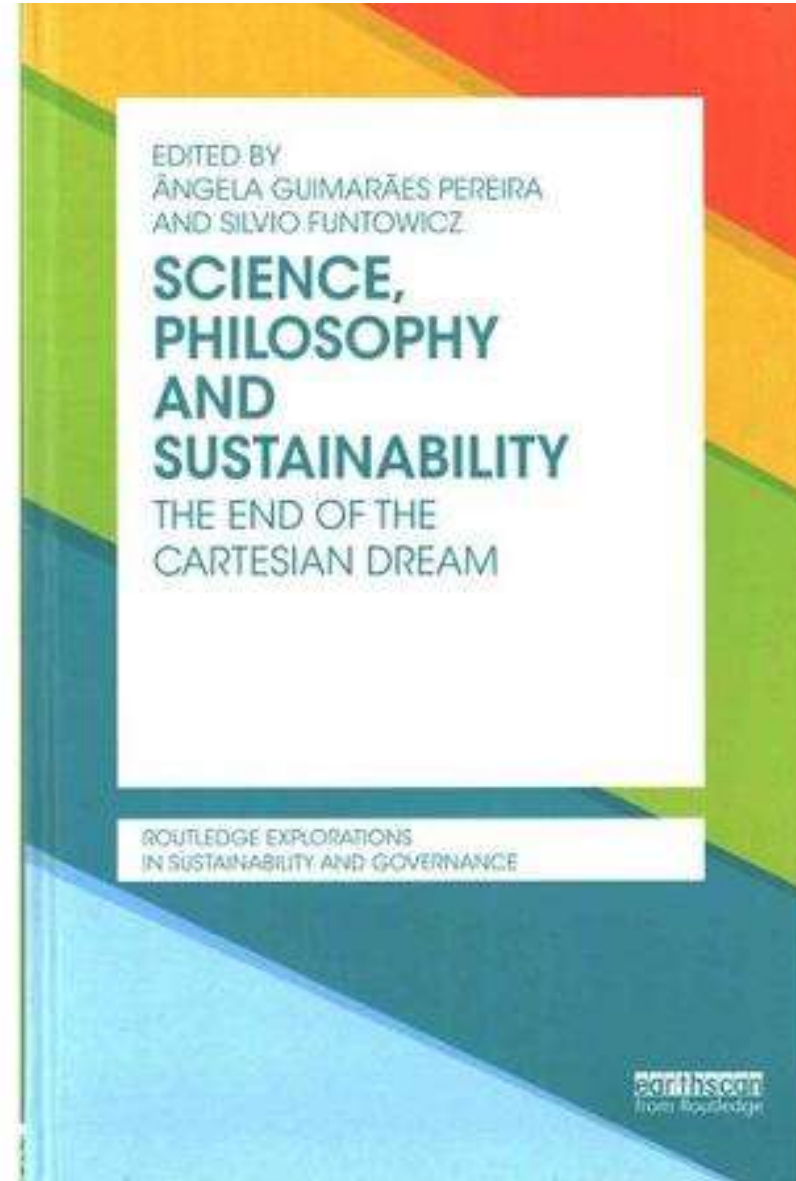
**Disinterestedness** – according to which scientists are rewarded for acting in ways that outwardly appear to be selfless;

**Organized Skepticism** – all ideas must be tested and are subject to rigorous, structured community scrutiny.



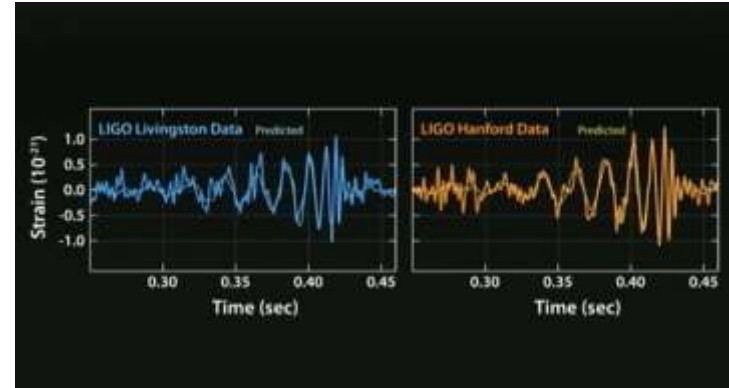
# Some reading on the Cartesian Dream

Ravetz, J., R., 2015, Descartes and the rediscovery of ignorance, in Guimarães Pereira, Â., and Funtowicz, S., Eds., 2015, The end of the Cartesian dream, Routledge.

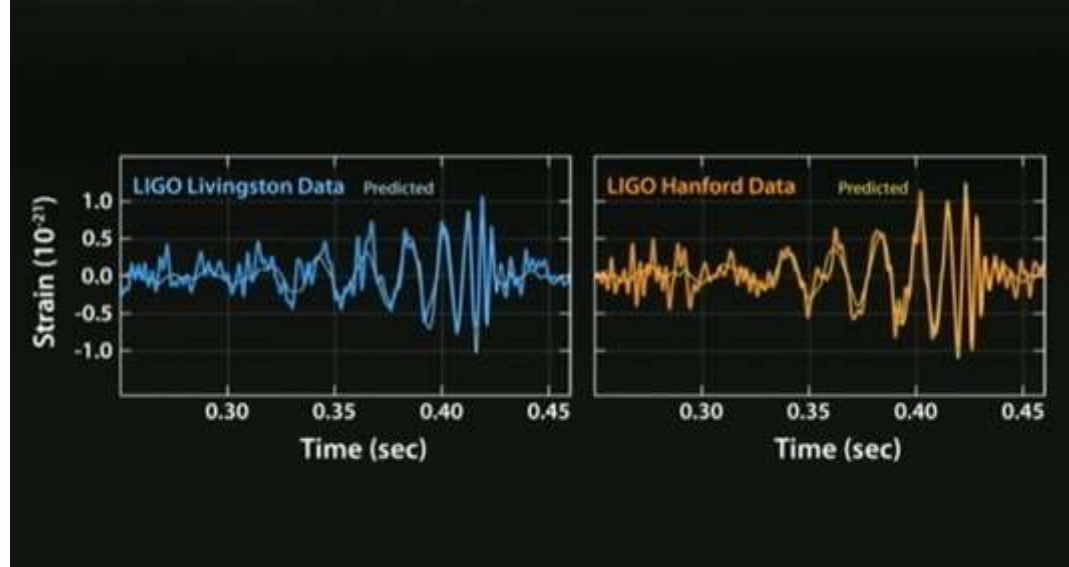


The success of  
the Cartesian  
dream

# The keeping of the promise: Gravitational waves, from J. Weber's cylinder to LIGO



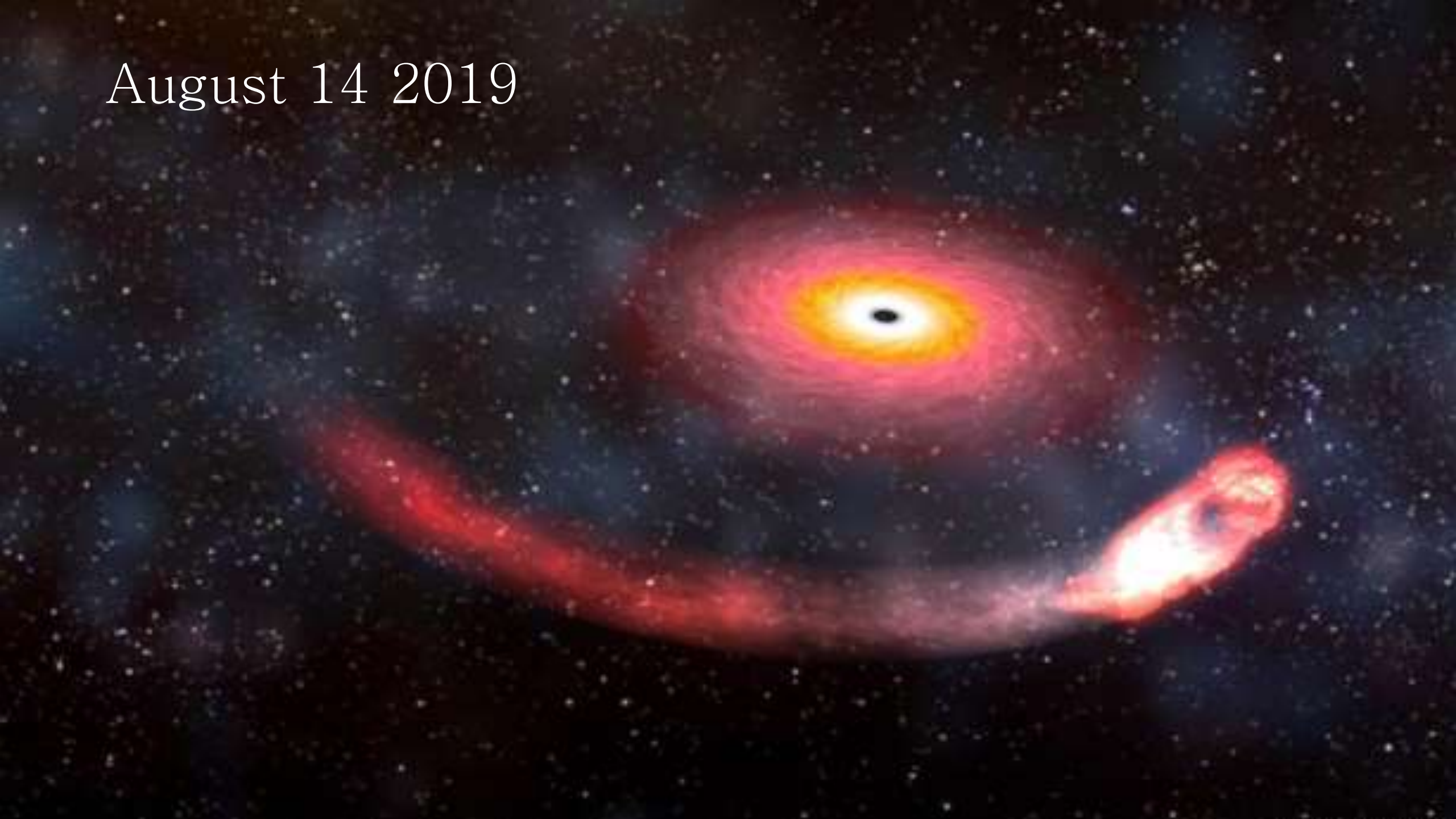
A Madman Dreams of Tuning Machines: The Story of Joseph Weber, the Tragic Hero of Science Who Followed Einstein's Vision and Pioneered the Sound of Space-Time, By Maria Popova, <https://www.brainpickings.org/2016/04/25/black-hole-blues-janna-levin-joseph-weber/>



<https://www.brainpickings.org/2016/04/25/black-hole-blues-janna-levin-joseph-weber/>



August 14 2019



# **‘It’s mindboggling!’: astronomers detect most powerful black-hole collision yet**

Gravitational-wave detections suggest merging black holes fell into ‘forbidden’ range of masses.

Davide Castelvecchi

---

“the two objects were estimated to weigh around 85 and 66 solar masses”

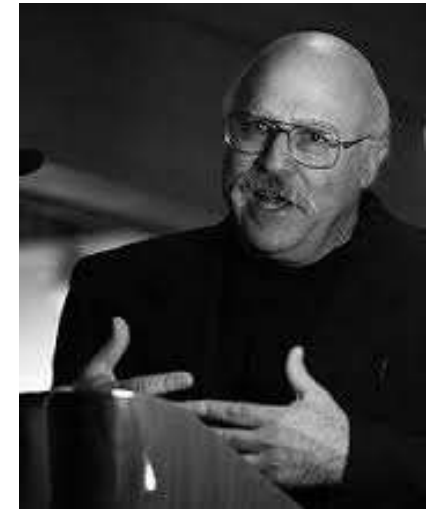
“In their latest discovery, the LIGO and Virgo detectors sensed only the last four ripples produced by the spiralling black holes, with a frequency that rose from 30 to 80 Hertz within one-tenth of a second”

If you are a natural scientists you were nourished and trained in the Cartesian dream, (S. Toulmin: ‘The hidden agenda of modernity’)



Stephen  
Toulmin

The dream was spectacularly successful, in all fields of endeavor, leading to what Steven Shapin calls ‘invisible science’



Steven Shapin

Steven Shapin, 2016, Invisible Science, The Hedgehog Review: Vol. 18 No. 3 (Fall 2016).

Many voices of  
alarm as to misuse  
of quantification



Blurring lines:

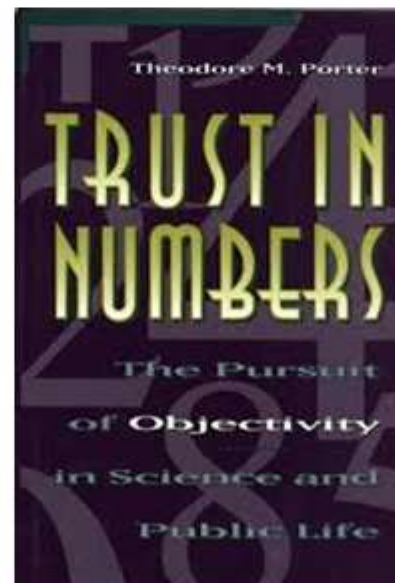
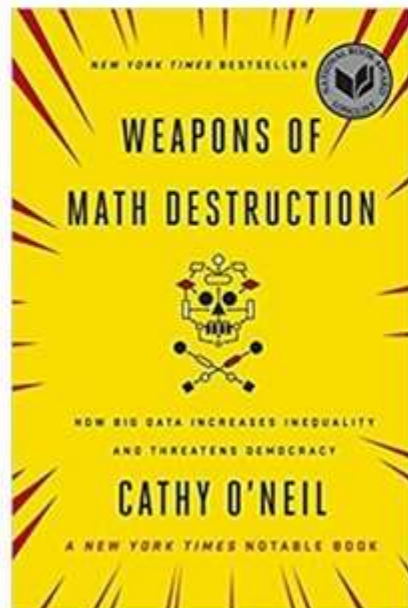
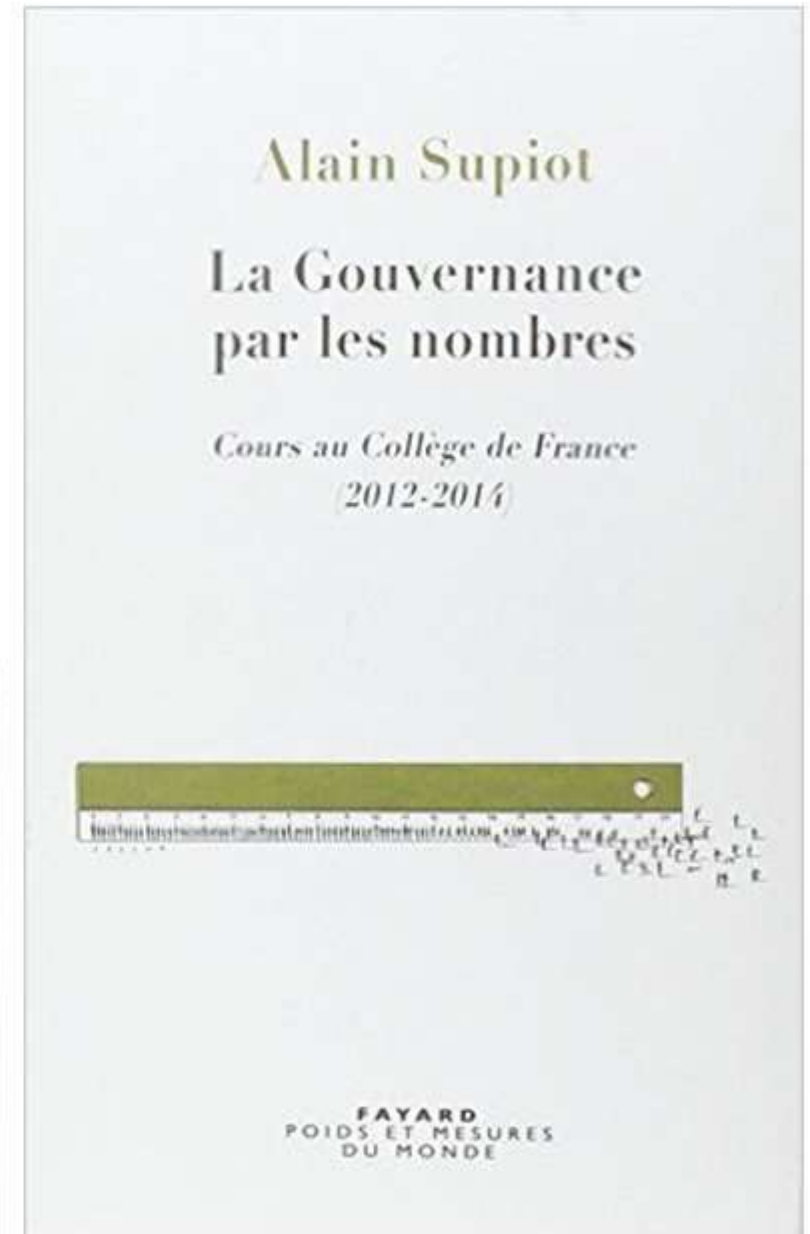
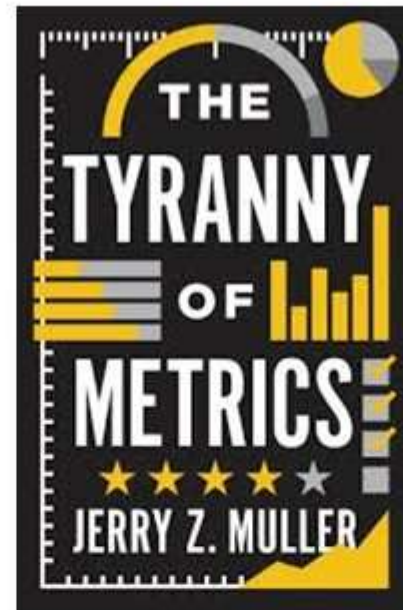
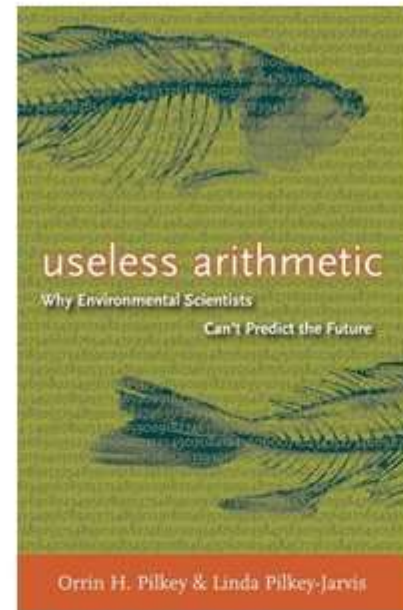
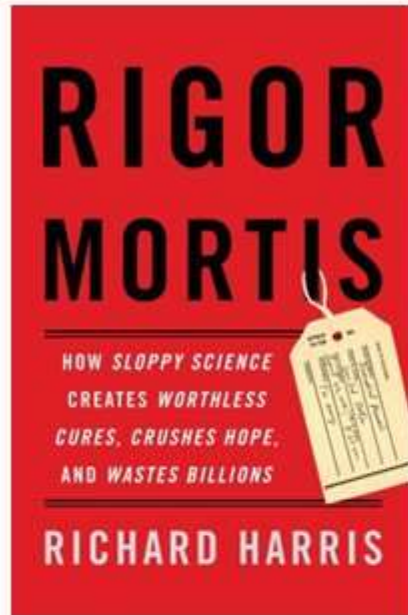
“what qualities are specific to rankings, or indicators, or models, or algorithms?”



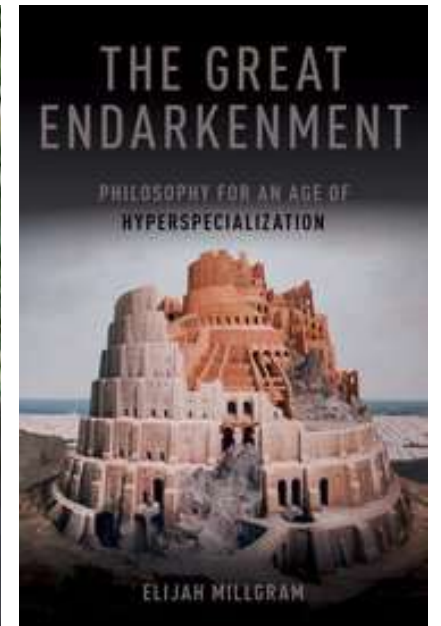
Elizabeth  
Popp Berman

E. Popp Berman and D. Hirschman, *The Sociology of Quantification*: Where Are We Now?, *Contemp. Sociol.*, vol. in press, 2017.

# Algorithms, models, metrics, statistics...



Abandon the dream of a “procedural utopia”, a machinery to take the right decision based on a set of logical rules and methods



E. Millgram The Great Endarkenment, p. 23

This dream started with  
Condorcet's *Mathématique  
sociale*; Bentham's utilitarianism;

Then the afterwar 'decisionism'  
(G. Majone) – the idea that  
decisions can always  
systematically arrived at given a  
modicum of computation, and is  
still dominating





The critique of Andrew Stirling:

“[...] rhetoric clamour [surrounds] ‘expected utility’, ‘decision theory’, ‘life cycle assessment’, ‘ecosystem services’ ‘sound scientific decisions’ and ‘evidence-based policy’

[...] Each technique routinely delivers its answers with formidable levels of precision. Yet the resulting impression of accuracy is deeply misplaced”



Andrew Stirling

PATHWAYS TO SUSTAINABILITY

# THE POLITICS OF UNCERTAINTY

Challenges of Transformation

Edited by Ian Scoones  
and Andy Stirling

earthscan  
from Routledge

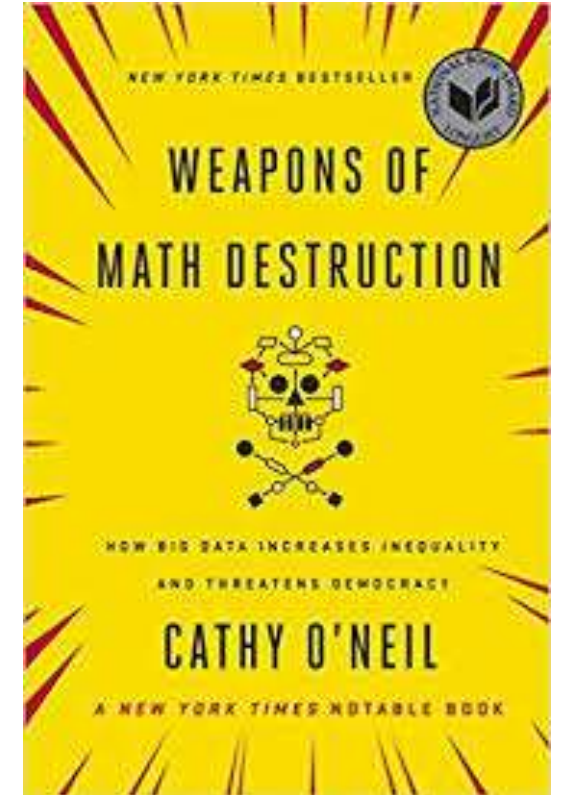
Open access version here:

[https://www.taylorfrancis.com/  
books/e/9781003023845](https://www.taylorfrancis.com/books/e/9781003023845)

# Alarm for Weapons of Math Destruction



Cathy O'Neil

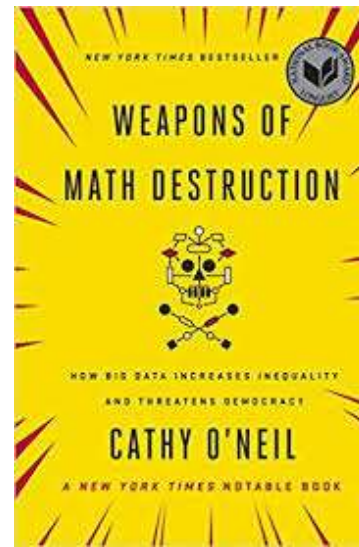


O'Neil, C. (2016). Weapons of math destruction : how big data increases inequality and threatens democracy. Random House Publishing Group.

Opacity (also because of trade secrecy) of algorithms used to decide on recruiting, carriers (including of researchers), prison sentencing, paroling, custody of minors, political campaigns...

O'Neil, C. (2016). Weapons of math destruction : how big data increases inequality and threatens democracy. Random House Publishing Group.

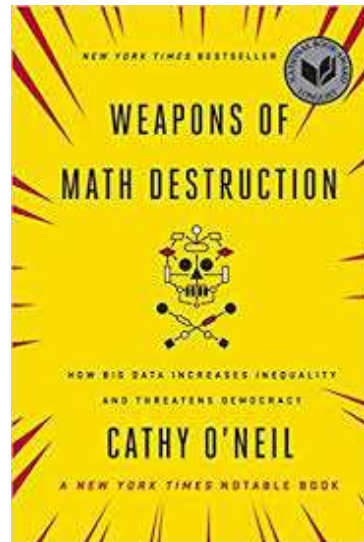
Brauneis, R., & Goodman, E. P. (2018). Algorithmic Transparency for the Smart City. Yale Journal of Law & Technology, 20, 103–176. Retrieved from [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3012499](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3012499)





Opacity coupled with opportunity for scale and damage and with non-appealability make them an instrument of oppression & inequality

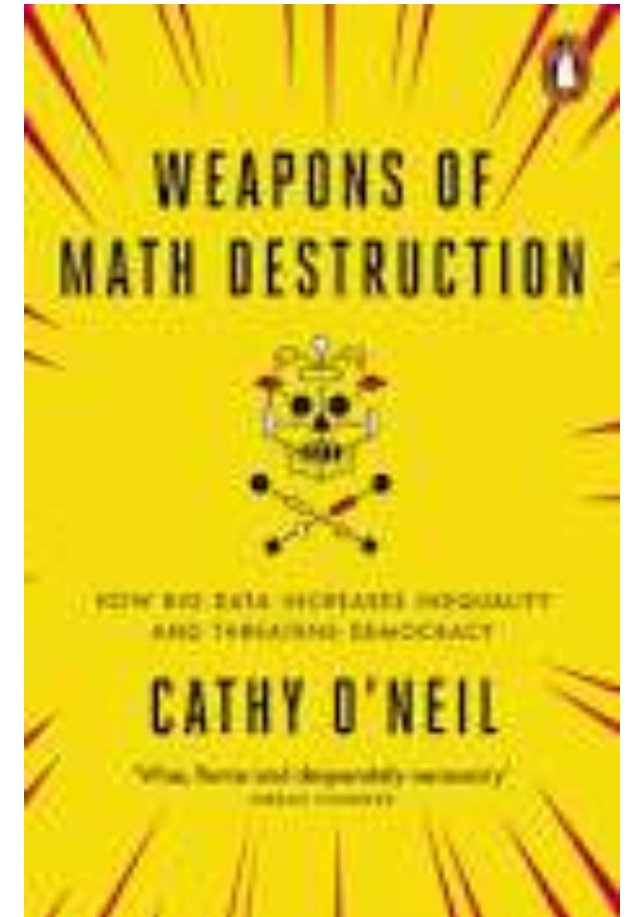
Cathy O'Neil Google talk <https://www.youtube.com/watch?v=TQHs8SA1qpk>



# Weapons of math destruction: opaque, harm, scale

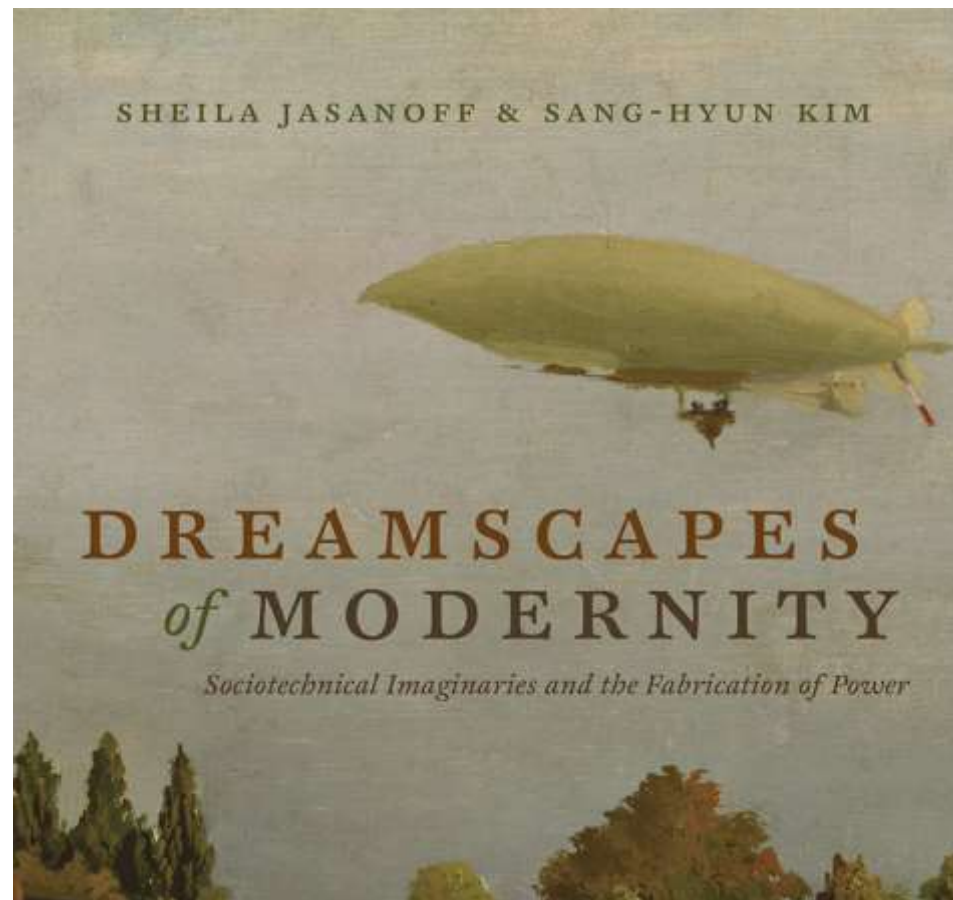


Cathy O'Neil

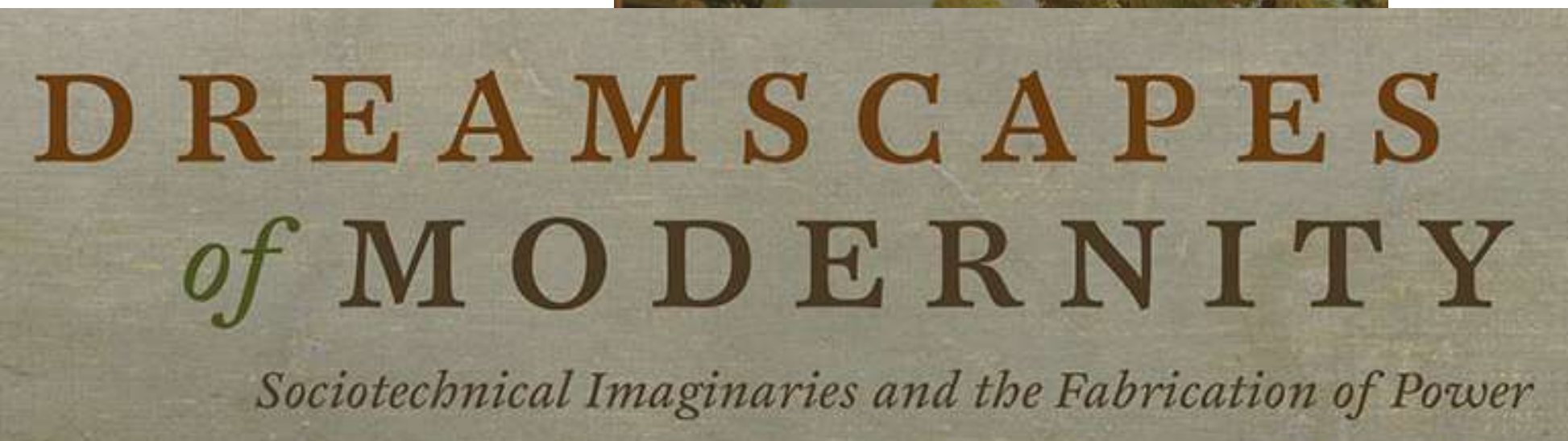


And yet ...

# Sociotechnical Imaginaries

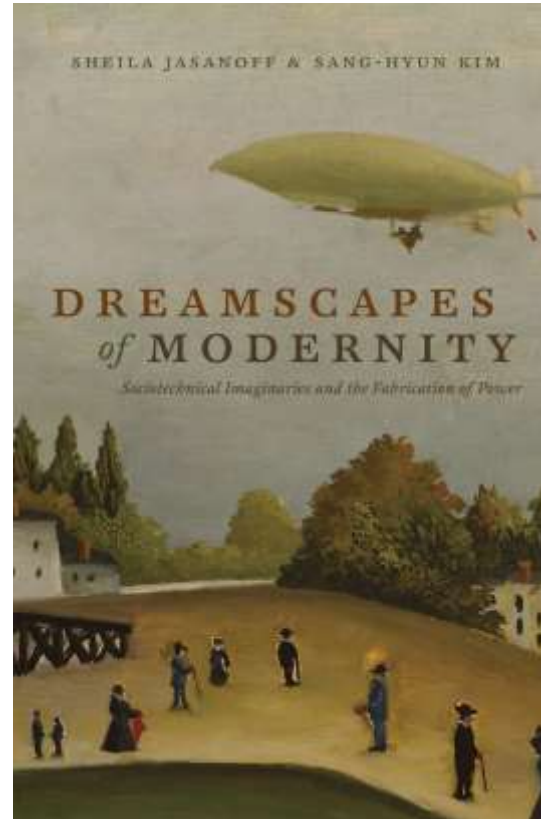


Sheila Jasanoff





How visions of scientific and technological progress carry with them implicit ideas about public purposes, collective futures, and the common good



Sheila Jasanoff

Which is the prevailing  
sociotechnical imaginary?

One where policy can be  
neatly designed given the  
right amount of  
computation?

# ‘Decisionism’ is mainstream

Cass Sunstein, winner of  
the 2018 Holberg Prize



“In a series of books (The Cost Benefit State, 2002, Risk and Reason, 2002, and The Laws of Fear, 2004), Sunstein shows the ways in which cost benefit analysis can discipline regulatory agencies”

<https://www.holbergprisen.no/en/holberg-prize/prize-winners/cass-r-sunstein>



# Can technocracy be saved? An interview with Cass Sunstein.

Obama's regulation czar makes the case that "the issues that most divide us are fundamentally about facts rather than values."

By Dylan Matthews | @dylanmatt | dylan@vox.com | Oct 22, 2018, 9:00am EDT

<https://www.vox.com/future-perfect/2018/10/22/18001014/cass-sunstein-cost-benefit-analysis-technocracy-liberalism>



“Often, immersion  
in the facts often  
makes value  
disagreements feel  
much less  
relevant”  
(C. Sunstein)



<https://www.vox.com/future-perfect/2018/10/22/18001014/cass-sunstein-cost-benefit-analysis-technocracy-liberalism>

# The Sameness of Cass Sunstein

His books keep pushing the same technocratic fixes. But today's most pressing questions cannot be depoliticized.

By **AARON TIMMS** | June 20, 2019

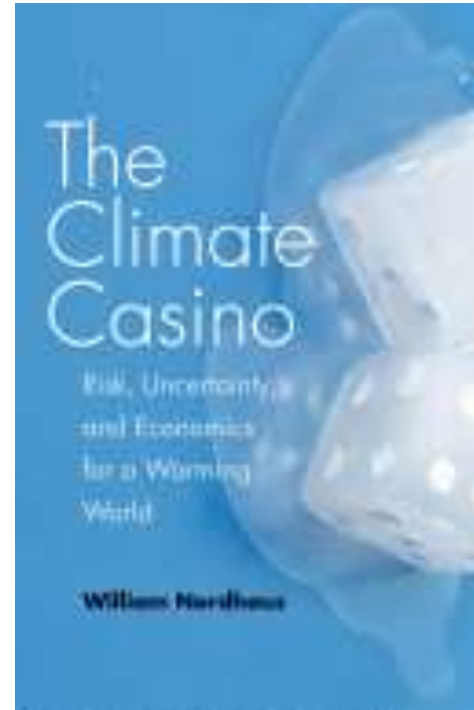
A critique of Sunstein's faith in 'nudge' and cost benefit analysis



<https://newrepublic.com/article/154236/sameness-cass-sunstein>

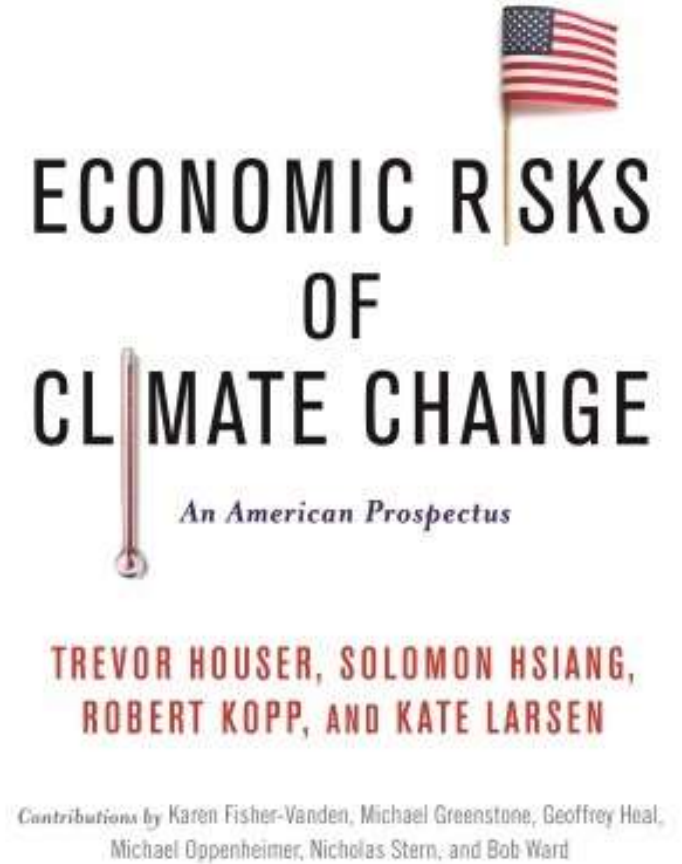
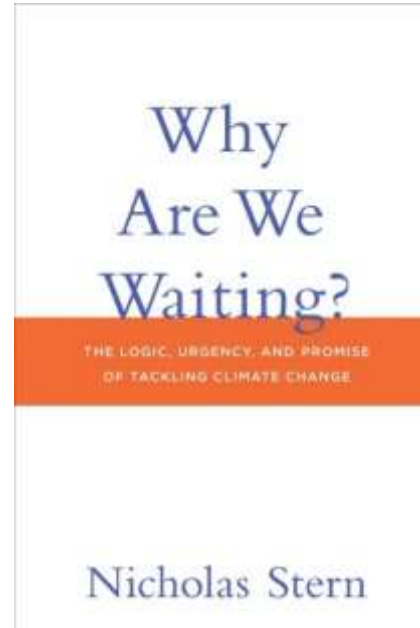
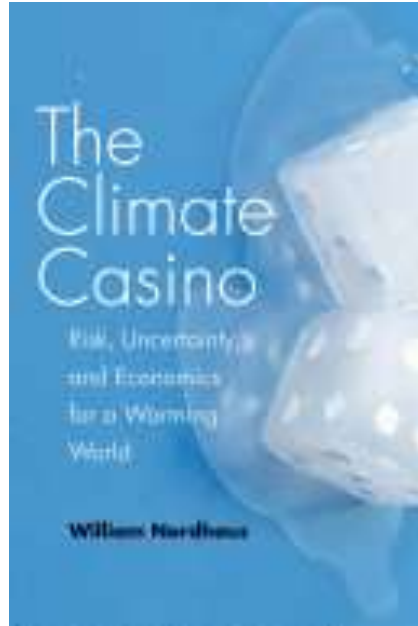
One of the winner of Nobel prize for economics 2018 is Willem Nordhaus, for his work on the economics of climate change.

Cost benefit analysis to the year 2100?





# Are these licit quantifications?



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 (IST), Volume XXXI Issue 3, Spring 2015, <https://issues.org/climate-models-as-economic-guides-scientific-challenge-or-quixotic-quest/>

In a context of  
crisis

The  
Economist

OCTOBER 19TH-25TH 2013

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

Washington's lawyer surplus

How to do a nuclear deal with Iran

Investment tips from Nobel economists

Junk bonds are back

The meaning of Sachin Tendulkar

HOW  
SCIENCE  
GOES  
WRONG

On the radar:  
October 2013



## Futures

Volume 91, August 2017, Pages 5-11



# What is science's crisis really about?

Andrea Saltelli <sup>a, b</sup>  , Silvio Funtowicz <sup>a</sup>



## Futures

Volume 104, December 2018, Pages 85-90



# Why science's crisis should not become a political battling ground

Andrea, Saltelli 



Silvio Funtowicz

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




Brow

 OPEN ACCESS

ESSAY

June 21, 2017

Why Most Clinical Research Is Not Useful

John P. A. Ioannidis 

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

THE  
ECONOMIC  
JOURNAL



*The Economic Journal*, 127 (October), F236–F265. Doi: 10.1111/eoj.12461 © 2017 Royal Economic Society. Published by John Wiley & Sons, 9600 Garsington Road, Oxford OX4 2DQ, UK and 350 Main Street, Malden, MA 02148, USA.

THE POWER OF BIAS IN ECONOMICS RESEARCH\*

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

October 27, 2017



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

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

Daniele Fanelli

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



“The new “science is in crisis” narrative is not only empirically unsupported, but also quite obviously counterproductive”

# Statistical and mathematical modelling



# Crisis in statistics?



**nature**  
International journal of science



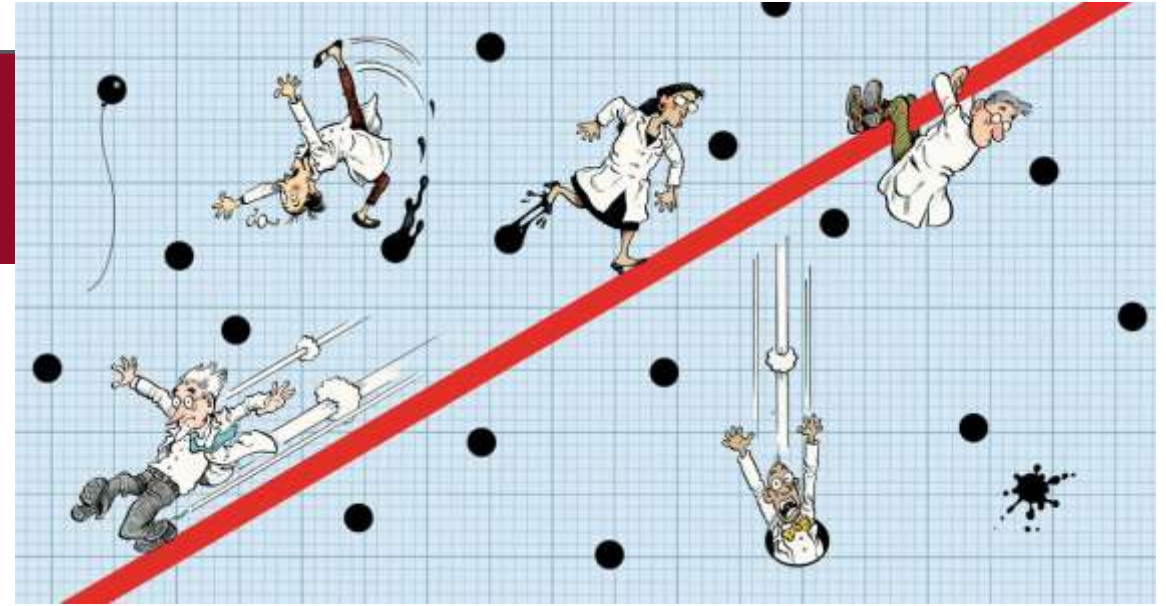


**nature**  
International journal of science

**COMMENT** • 28 NOVEMBER 2017

# Five ways to fix statistics

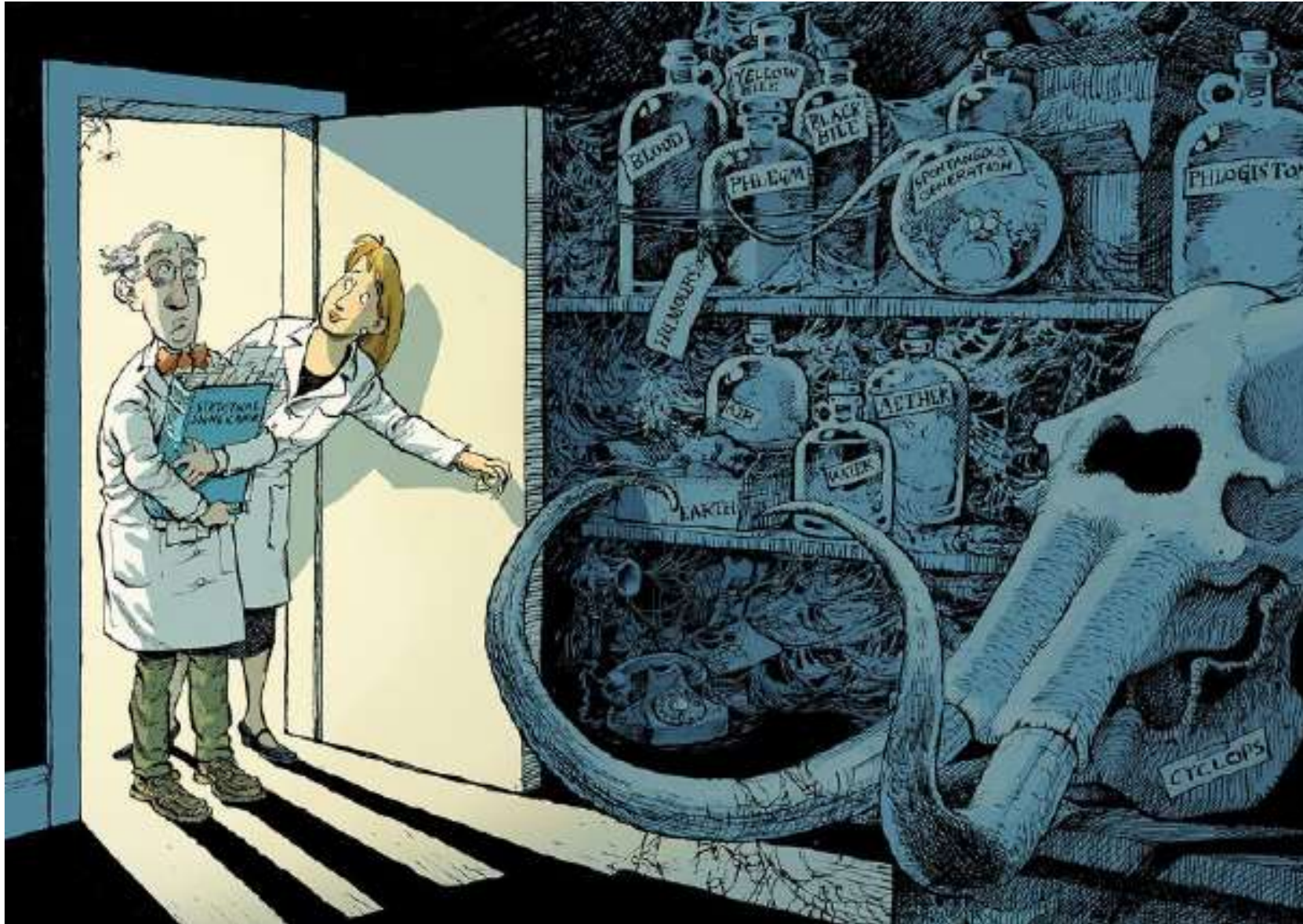
*As debate rumbles on about how and how much poor statistics is to blame for poor reproducibility, Nature asked influential statisticians to recommend one change to improve science. The common theme? The problem is not our maths, but ourselves.*



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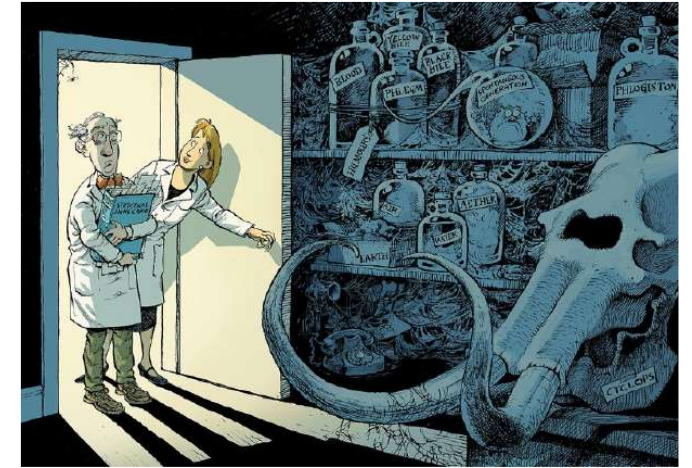
Jeff Leek , Blakeley B. McShane, Andrew Gelman , David Colquhoun , Michèle B. Nuijten  & Steven N. Goodman 





Throw away  
the concept of  
statistical  
significance?





COMMENT • 20 MARCH 2019

# Scientists rise up against statistical significance

Valentin Amrhein, Sander Greenland, Blake McShane and more than 800 signatories call for an end to hyped claims and the dismissal of possibly crucial effects.

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Valentin Amrhein , Sander Greenland & Blake McShane

See the discussion on the blog of Andrew Gelman <https://statmodeling.stat.columbia.edu/>

Statistical wars? See:

Andrew Gelman

<https://statmodeling.stat.columbia.edu/>



# Is mathematical modelling affected?



nature  
COMMUNICATIONS



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[Published: 27 August 2019](#)

A short comment on statistical  
versus mathematical modelling

Andrea Saltelli 

Unlike statistics, modelling  
is not a discipline ...

... mathematical modelling cannot do this:



**AMERICAN STATISTICAL ASSOCIATION RELEASES STATEMENT ON  
STATISTICAL SIGNIFICANCE AND *P*-VALUES**

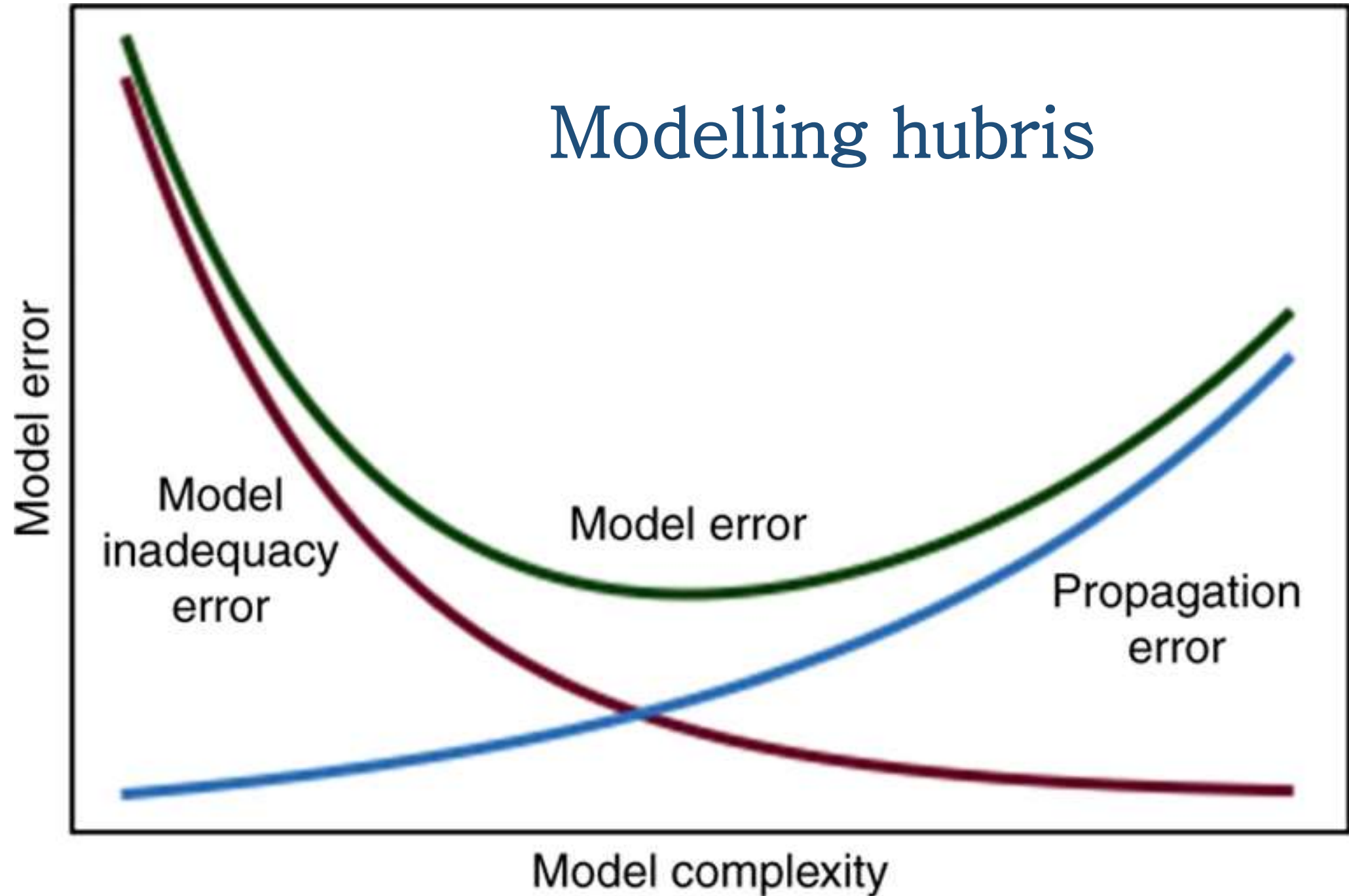
*Provides Principles to Improve the Conduct and Interpretation of Quantitative  
Science*

March 7, 2016

Wasserstein, R.L. and Lazar, N.A., 2016. 'The ASA's statement on p-values: context, process, and purpose', *The American Statistician*, Volume 70, 2016 – Issue 2, Pages 129–133.



# Modelling hubris



# Five ways to ensure that models serve society: a manifesto

Pandemic politics highlight how predictions need to be transparent and humble to invite insight, not blame.

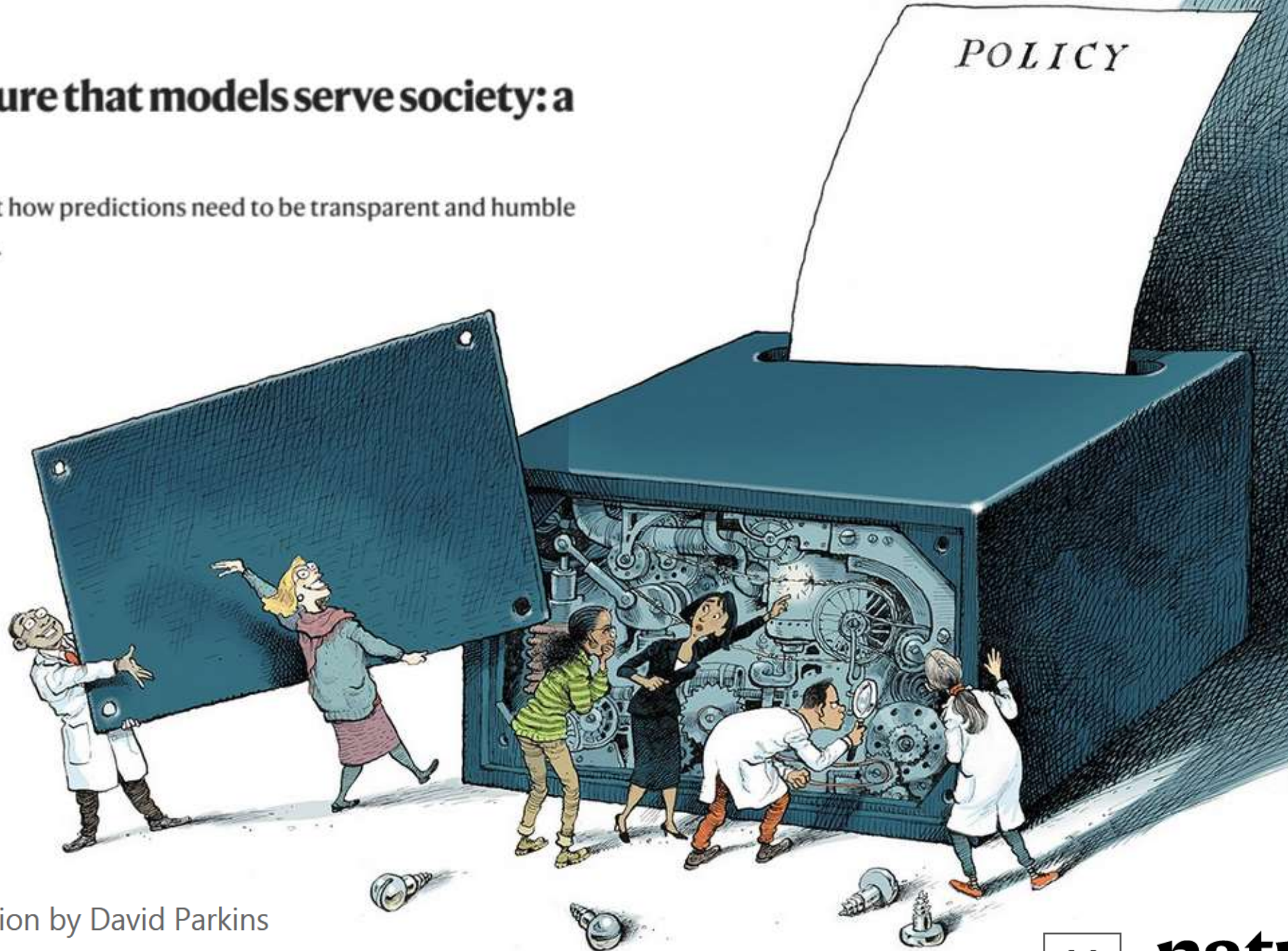


Illustration by David Parkins



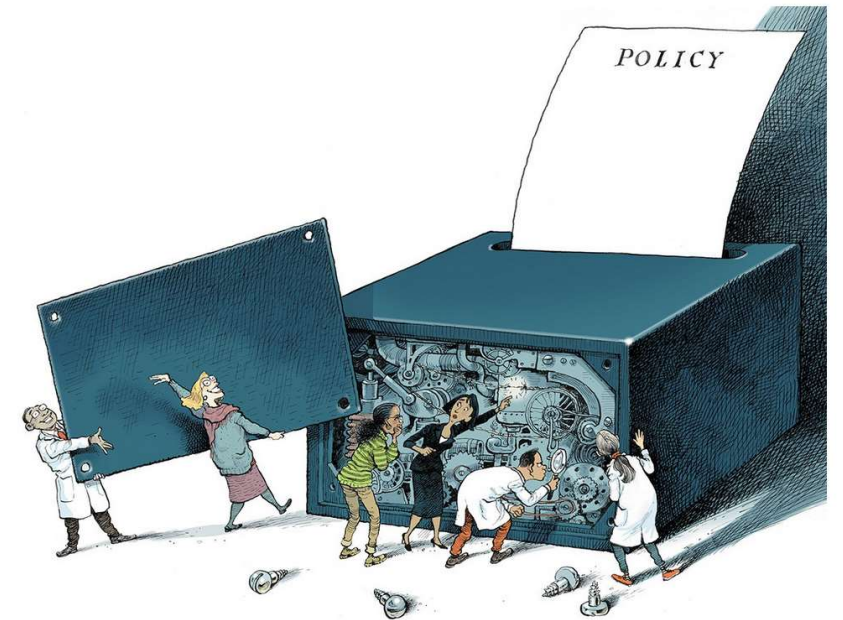
**nature**



# Five ways to ensure that models serve society: a manifesto

Pandemic politics highlight how predictions need to be transparent and humble to invite insight, not blame.

Andrea Saltelli , Gabriele Bammer, Isabelle Bruno, Erica Charters, Monica Di Fiore, Emmanuel Didier, Wendy Nelson Espeland, John Kay, Samuele Lo Piano, Deborah Mayo, Roger Pielke Jr, Tommaso Portaluri, Theodore M. Porter, Arnald Puy, Ismael Rafols, Jerome R. Ravetz, Erik Reinert, Daniel Sarewitz, Philip B. Stark, Andrew Stirling, Jeroen van der Sluijs & Paolo Vineis





# Mind the assumptions

Assess uncertainty and sensitivity

## Mind the hubris

Complexity can be the enemy of relevance

## Mind the framing

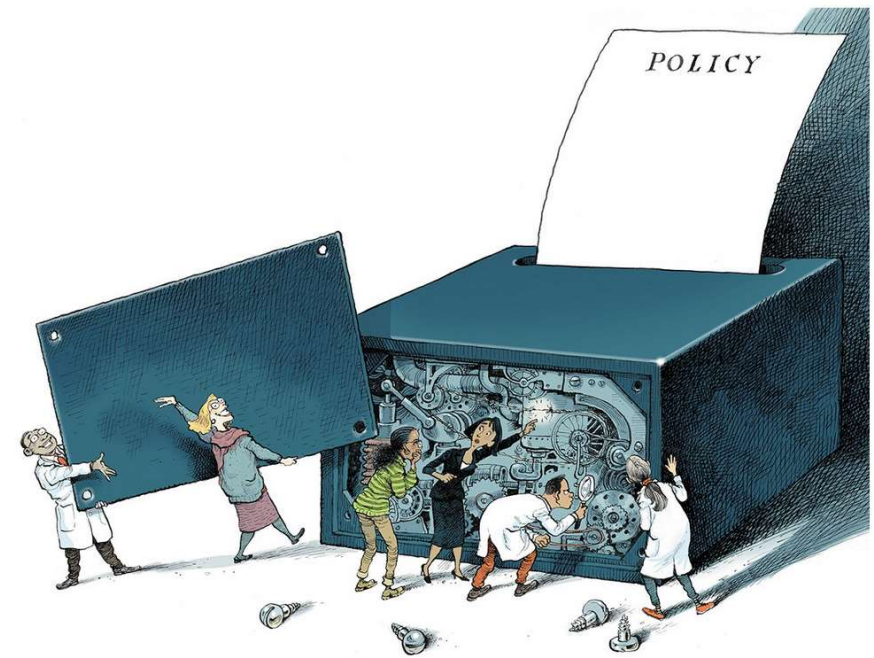
Match purpose and context

## Mind the consequences

Quantification can backfire.

## Mind the unknowns

Acknowledge ignorance



### SUPPLEMENTARY INFORMATION

#### 1. Additional information and references

>260 references

What recipes for an ethics of  
quantification?





Futures

Volume 116, February 2020, 102509



Essays

# Ethics of quantification or quantification of ethics?

Andrea Saltelli

[Show more](#)

<https://doi.org/10.1016/j.futures.2019.102509>

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Humanities & Social Sciences  
Communications

Article | [Open Access](#) | Published: 19 August 2020

## From sociology of quantification to ethics of quantification

Andrea Saltelli [✉](#) & Monica Di Fiore [✉](#)

*Humanities and Social Sciences Communications* **7**, Article number: 69 (2020) | [Cite this article](#)

**852** Accesses | **25** Altmetric | [Metrics](#)



Ongoing (2020) research on ethics of quantification – there was an SVT symposium in December 2019

Tools and practices to:

- tame modelling hubris,
- make quantifications interpretable, conveyable in plain English,
- and context/purpose specific
- models as tools not as masters

NUSAP

Numeral, Unit, Spread

+

Assessment (qualitative judgement on quantification)

Pedigree (qualitative assessment of mode of production and anticipated use)

THEORY AND DECISION LIBRARY

SERIES A: PHILOSOPHY AND METHODOLOGY  
OF THE SOCIAL SCIENCES

SILVIO O. FUNTOWICZ AND JEROME R. RAVETZ

UNCERTAINTY AND QUALITY  
IN  
SCIENCE FOR POLICY

KLUWER ACADEMIC PUBLISHERS



Jeroen  
van der Sluijs

## Example Pedigree matrix parameter strength

Code	Proxy	Empirical	Theoretical basis	Method	Validation
4	Exact measure	Large sample direct mmts	Well established theory	Best available practice	Compared with indep. mmts of same variable
3	Good fit or measure	Small sample direct mmts	Accepted theory partial in nature	Reliable method commonly accepted	Compared with indep. mmts of closely related variable
2	Well correlated	Modeled/derived data	Partial theory limited consensus on reliability	Acceptable method limited consensus on reliability	Compared with mmts not independent
1	Weak correlation	Educated guesses / rule of thumb est	Preliminary theory	Preliminary methods unknown reliability	Weak / indirect validation
0	Not clearly related	Crude speculation	Crude speculation	No discernible rigour	No validation

<http://www.nusap.net/>





# Sensitivity Auditing

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## **What do I make of your latinorum? Sensitivity auditing of mathematical modelling**

---

Saltelli, A., Guimarães Pereira, Â.,  
Van der Sluijs, J.P. and Funtowicz, S.



Ângela Guimarães Pereira

# The rules of sensitivity auditing

1. Check against rhetorical use of mathematical modelling;
2. Adopt an “assumption hunting” attitude; focus on unearthing possibly implicit assumptions;
3. Check if uncertainty been instrumentally inflated or deflated.

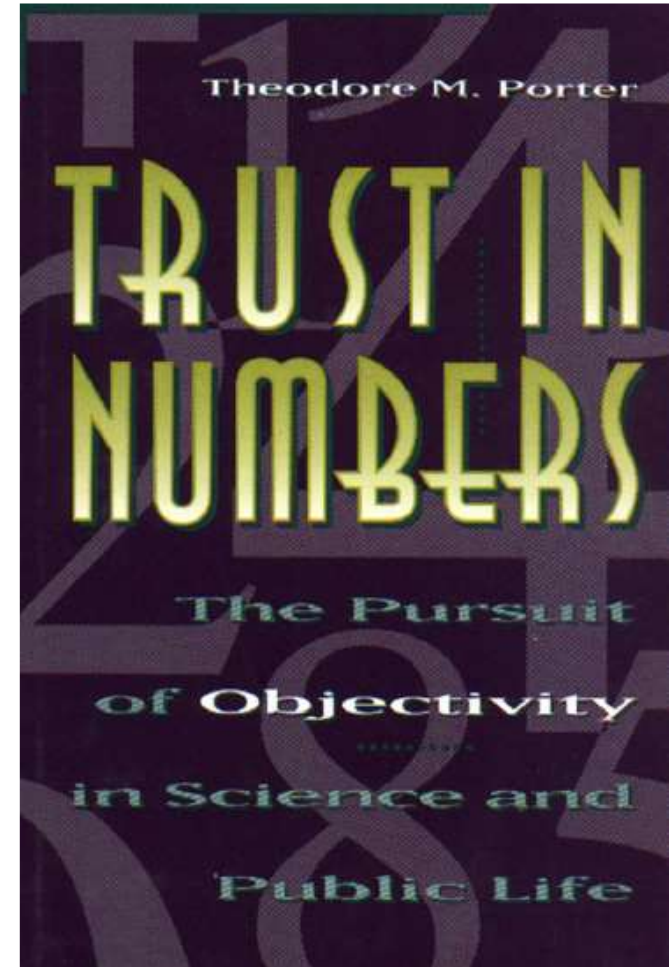
4. Find sensitive assumptions before these find you; do your SA before publishing;
5. Aim for transparency; Show all the data;
6. Do the right sums, not just the sums right;
7. Perform a proper global sensitivity analysis.



# Numbers and trust

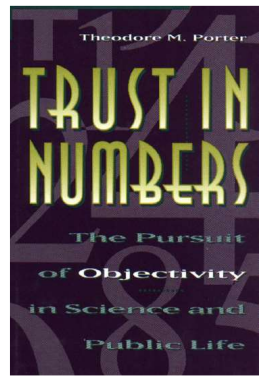


Theodor  
M. Porter



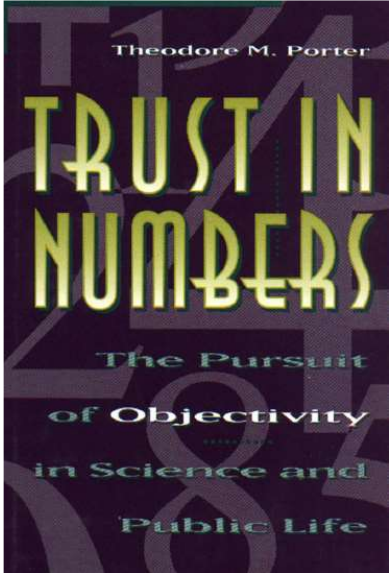
Theodore M. Porter, *Trust in Numbers,  
The Pursuit of Objectivity in Science and Public Life*, Princeton 1995

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.”

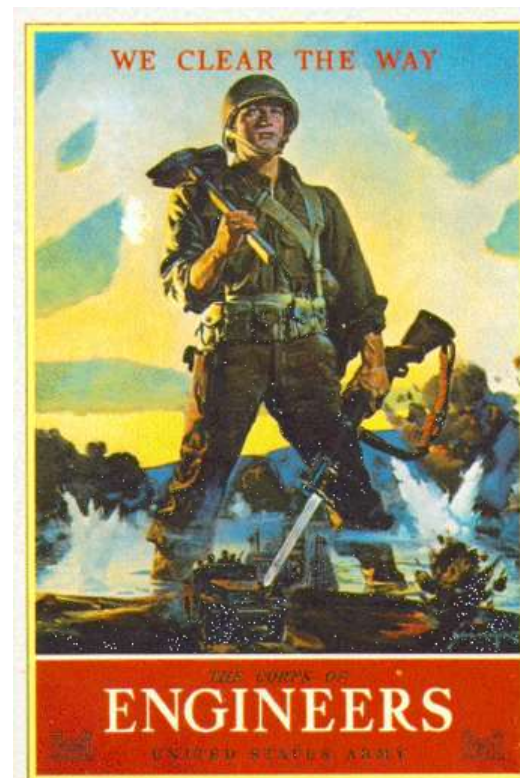
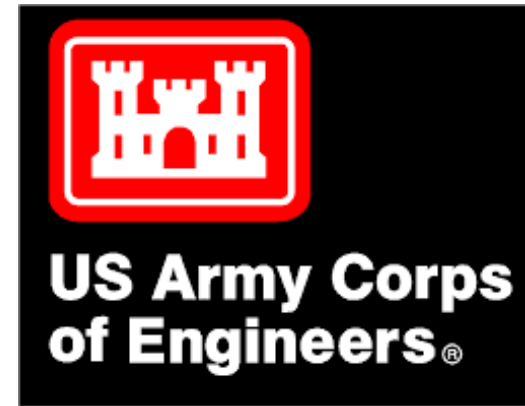


p. 8: “Scientific objectivity thus provides an answer to a moral demand for impartiality and fairness.

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'.





Charles Goodhart

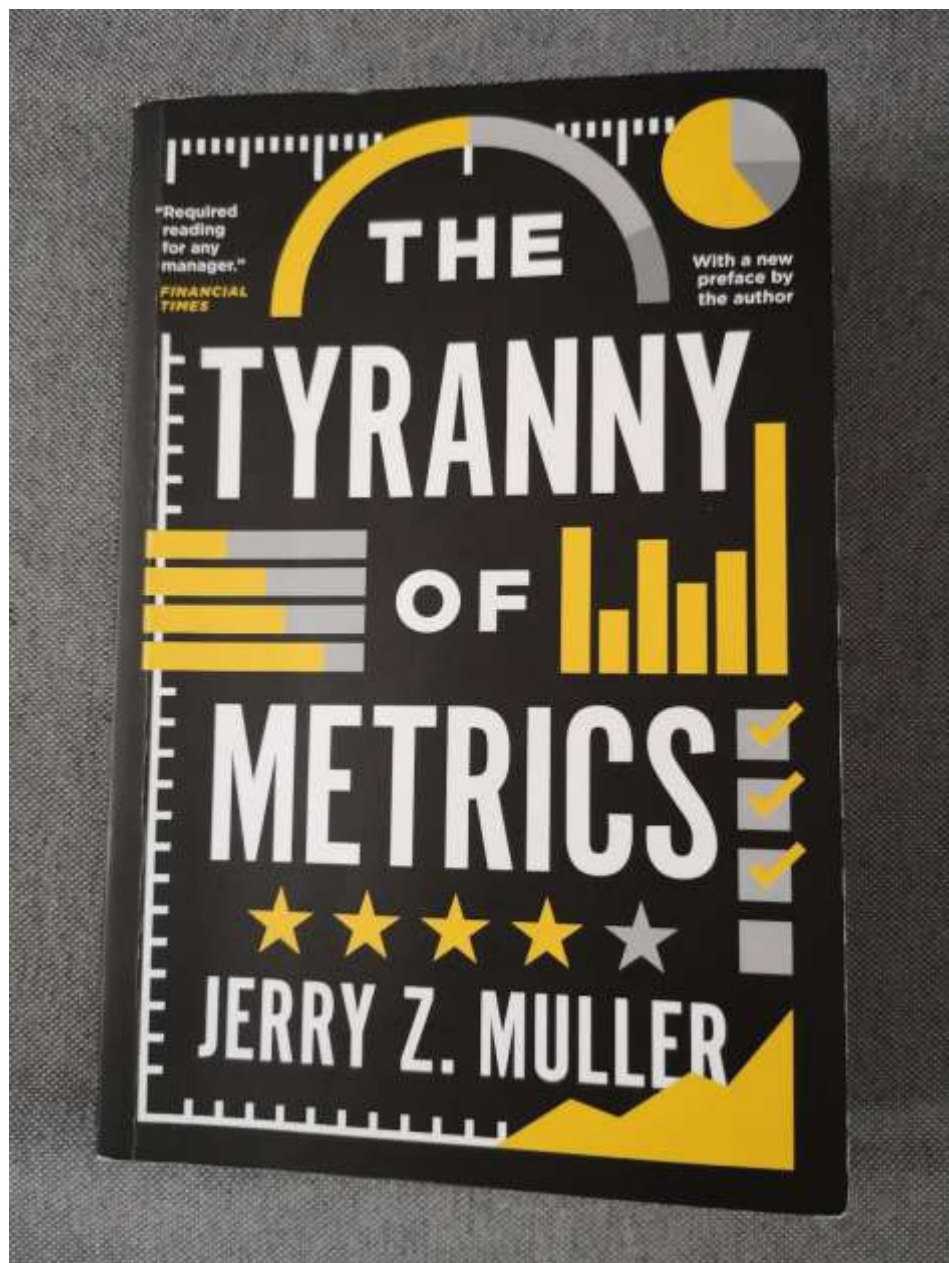
p. 44 “Any ... measures necessarily involve a loss of information ... [and distorts behavior]” (Porter, 1995)

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."

Also known as Campbell's law (1976);

[https://en.wikipedia.org/wiki/Goodhart%27s\\_law](https://en.wikipedia.org/wiki/Goodhart%27s_law)

The take of  
different  
authors



J. Z. Muller, The tyranny of metrics. Princeton University Press , 2018.

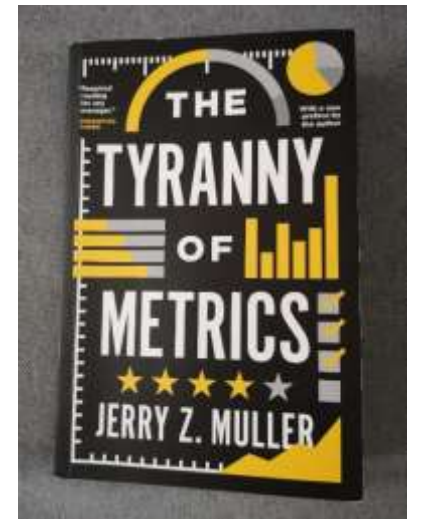


Metric fixation, or the irresistible pressure to measure performance

Gaming of metrics (recall Goodhart law)

“The calculative is the enemy of the imaginative”

A wealth of case studies from education to war to medicine to foreign aid..

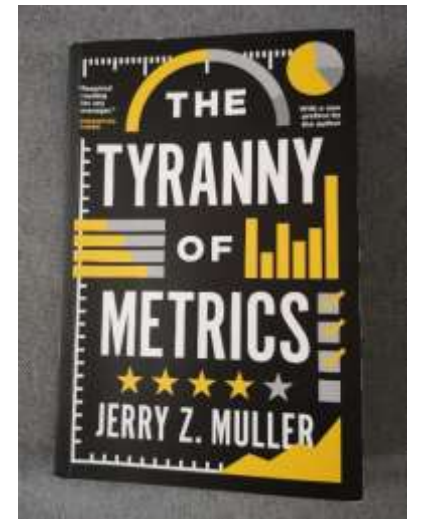




# Critiques of metrics

From the left: metric fixation promotes deskilling

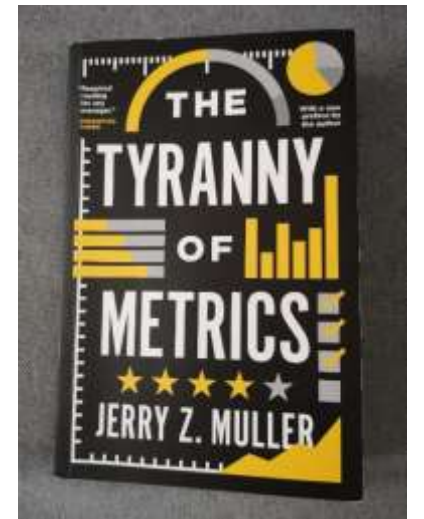
From the right (Friedrich Hayek):  
metric fixation reproduces features of  
the soviet system



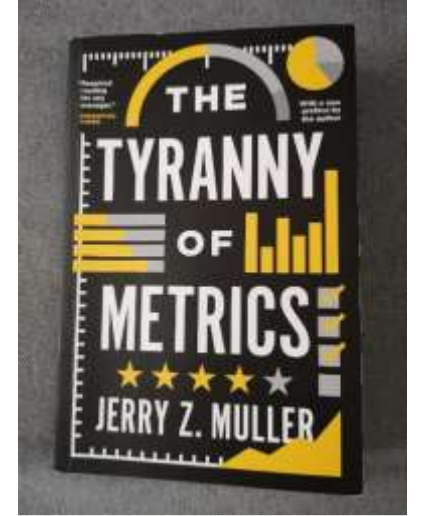
# Critiques of metrics

An epistemological critique: metrics privilege abstract and formulaic knowledge against practical and tacit knowledge

(Greek concept of metis)



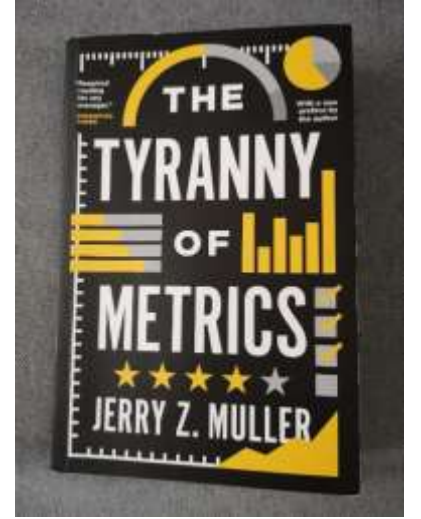
# Unintended consequences: a litany



- Goal displacement
- Short termism
- Diminishing utility
- Rule cascade
- Discouraging risk taking
- Discouraging innovation
- Rewarding luck
- Discouraging cooperation and common purpose
- Degrading work
- Time waste
- Loss of productivity

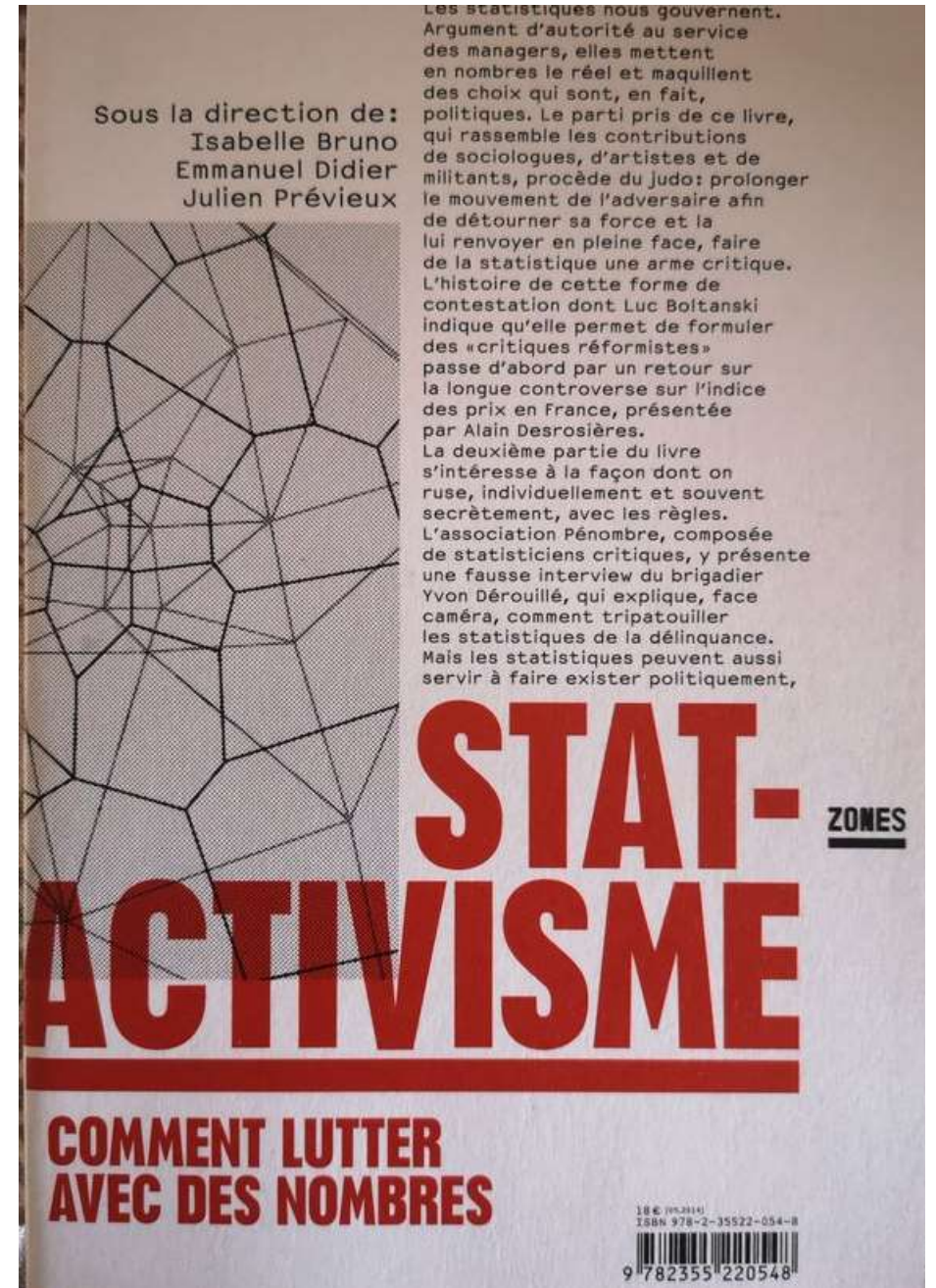
## A concluding remark

Considering all of the above keep in mind at every step that “the best use of metrics may be not to use it at all”



# Do we need a movement of resistance?

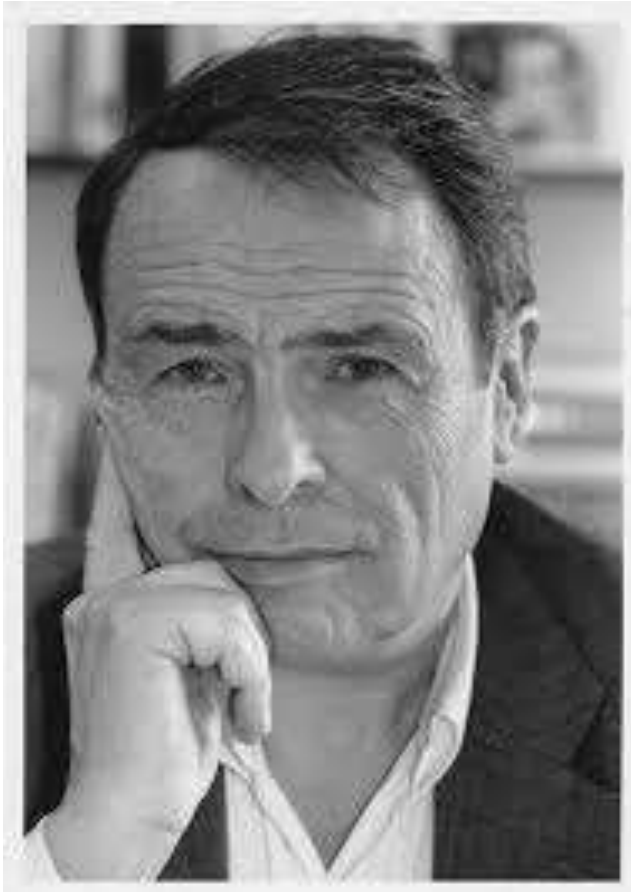
I. Bruno, E. Didier, and J. Prévieux, Stat-activisme. Comment lutter avec des nombres. Paris: Zones, La Découverte, 2014





# How to be a "statactiviste"?

1. Deconstruct existing metrics, including using irony (Pierre Bourdieu, *Les héritiers*).



La sociologie,  
ça doit être  
rigolo

(Sociology must be fun)



# How to be a "statactiviste"?

2. Gaming metrics (statistical judo) – use Goodhart's law to your advantage – or make the ruse public.

- Police statistics in NY



# How to be a "statactiviste"?

3. Bring to the surface what is hidden / unsaid/ excluded – new social classes, marginalization, minorities:

- ‘Creative class’ or ‘precarious intellectuals’?





# How to be a "statactiviste"?

## 4. Measure something different.

- Suicides at France Telecom;
- BIP 40, a new French measure of poverty/inequality



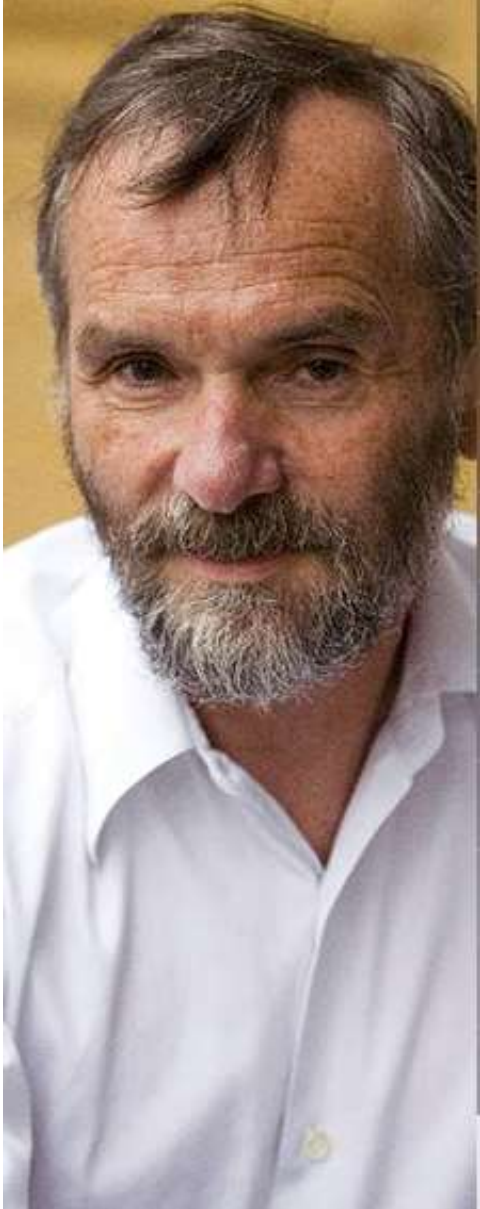
# Important:

“Quantification should not be abandoned to the advantage of exalting qualities, singularities, and the incommensurable. Such an abandon would be a tactical error”





# Alain Supiot

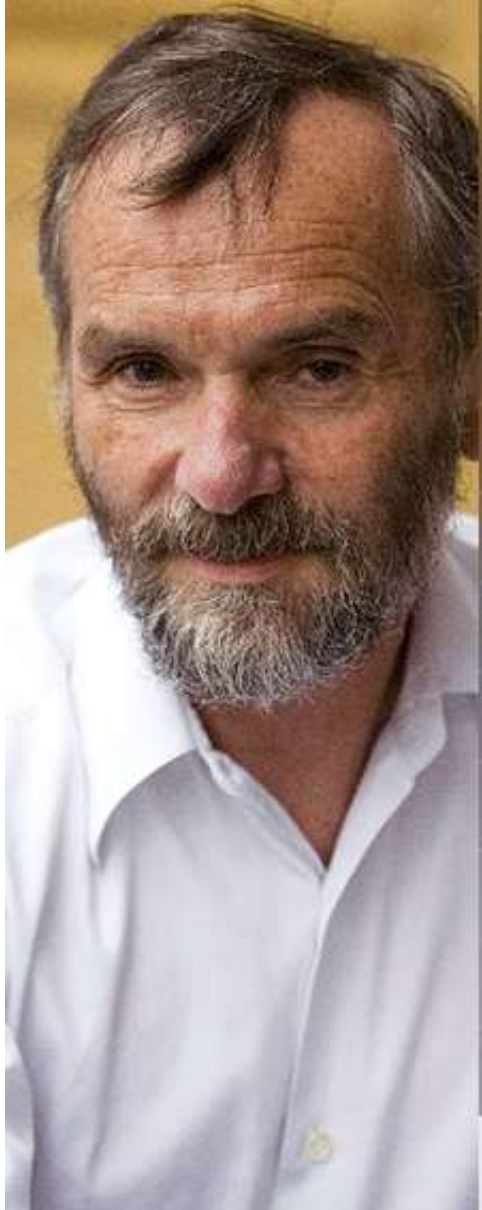


An indictment of the  
Total Market and the  
normative uses of  
economic quantification

<https://www.college-de-france.fr/site/en-alain-supiot/Governance-by-Numbers-Introduction.htm>



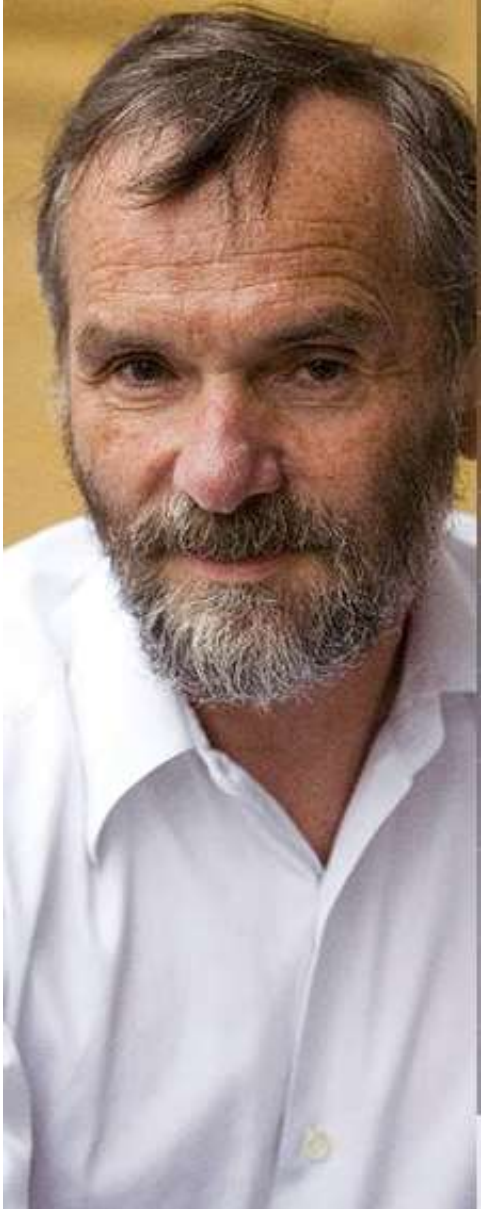
# Alain Supiot



...we have entered the era of the cybernetic imaginary, which revives the West's age-old dream of grounding social harmony in calculations.

Repudiating the goal of governing by just laws, this new discourse advocates in its stead the attainment of measurable objectives efficiently

# Alain Supiot



... This leaves no option open to populations or countries than to ride roughshod over social legislation, and pledge allegiance to those stronger than they are

# Poor quantifications: an example





EARTH  
OVERSHOOT  
DAY

[ABOUT](#)

[BLOG](#)

[SOLUTIONS](#)

[STEPS TO #MOVETHEDATE](#)

[NEWSROOM](#)

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# EARTH OVERSHOOT DAY WAS JULY 29

*On That Day, Humanity Exhausted The Biological Resources Our Planet Can Renew This Whole Year. Check Out Solutions Below So We Stop Increasing The Global Ecological Deficit.*



At 8.00 am?



We use 1.75 planets  
Or 17.5? 175? 1,750? ...Infinity?

How many plastic bottles are we  
allowed to throw in the sea in a  
year?

Try replacing plastic bottles with extinction of a species, or collapse of a  
fishery, or a Fukushima,...



Move the date  
forward 5 days  
every years  
suggests Mathis  
Wackernagel

The Ecological Footprint suggests compressing sustainability to a single metric (acres of equivalent land). CO2 emissions from energy demand dominate the output.





Contents lists available at [ScienceDirect](#)

## Ecological Indicators

journal homepage: [www.elsevier.com/locate/ecolind](http://www.elsevier.com/locate/ecolind)



## Footprints to nowhere

Mario Giampietro<sup>a,c</sup>, Andrea Saltelli<sup>b,\*</sup>



<sup>a</sup> Institute of Environmental Science and Technology (ICTA), Universitat Autònoma de Barcelona, 08193 Bellaterra, Spain

<sup>b</sup> Institute for the Protection and Security of the Citizen (IPSC), The European Commission, Joint Research Centre, TP 361, 21027 Ispra, VA, Italy

<sup>c</sup> Catalan Institution for Research and Advanced Studies (ICREA), Passeig Lluís Companys, 23, 08010 Barcelona, Spain



Giampietro, M., and Saltelli, A., 2014, Footprints to nowhere, Ecological Indicators, 46, 610–621.

Goldfinger, S., Wackernagel, M., Galli, A., Lazarus, E., Lin, D., 2014, Footprint facts and fallacies: A response to Giampietro and Saltelli (2014) “Footprints to Nowhere”, 46, 622–632.

Giampietro, M., and Saltelli, A., 2014, Footworking in Circles, Ecological Indicators, 46 (2014) 260–263.

Alessandro Galli , Mario Giampietro , Steve Goldfinger, Elias Lazarus, David Lin, Andrea Saltelli , Matthis Wackernagel , Felix Müller, 2016, Questioning the ecological footprint , Ecological Indicators, 69, 224–232.

All the story...



HOME ABOUT ME



Stop here



@andreasaltelli

# Assignment

Take one of the four CUDOS; one student will argue pro while another will argue against, like in court.

Make sure you don't take all the same principle!

**Communalism** – the common ownership of scientific discoveries, according to which scientists give up intellectual property rights in exchange for recognition and esteem (Merton actually used the term Communism, but had this notion of communalism in mind, not Marxism);

**Universalism** – according to which claims to truth are evaluated in terms of universal or impersonal criteria, and not on the basis of race, class, gender, religion, or nationality;

**Disinterestedness** – according to which scientists are rewarded for acting in ways that outwardly appear to be selfless;

**Organized Skepticism** – all ideas must be tested and are subject to rigorous, structured community scrutiny.



# The End



@andreasaltelli

## **What issues for an ethics of quantification?**

- The issue of trust.
- A defence against abuse
- To prevent consequentialism in scientific quantification
- To moderate excesses of optimism about the merits of quantification
- For the non-neutrality of the techniques; for the non-separability of facts and values
- For the need to contextualize any quantification
- To deter quantification hubris

## **What recipes would be offered by an ethics of quantification?**

- A license not-to-quantify
- Taming hubris: memento Figure 1.
- Make use of the existing disciplinary arrangements
- Make quantifications interpretable, conveyable in plain English and context specific; use existing pedigrees
- NUSAP
- Sensitivity auditing