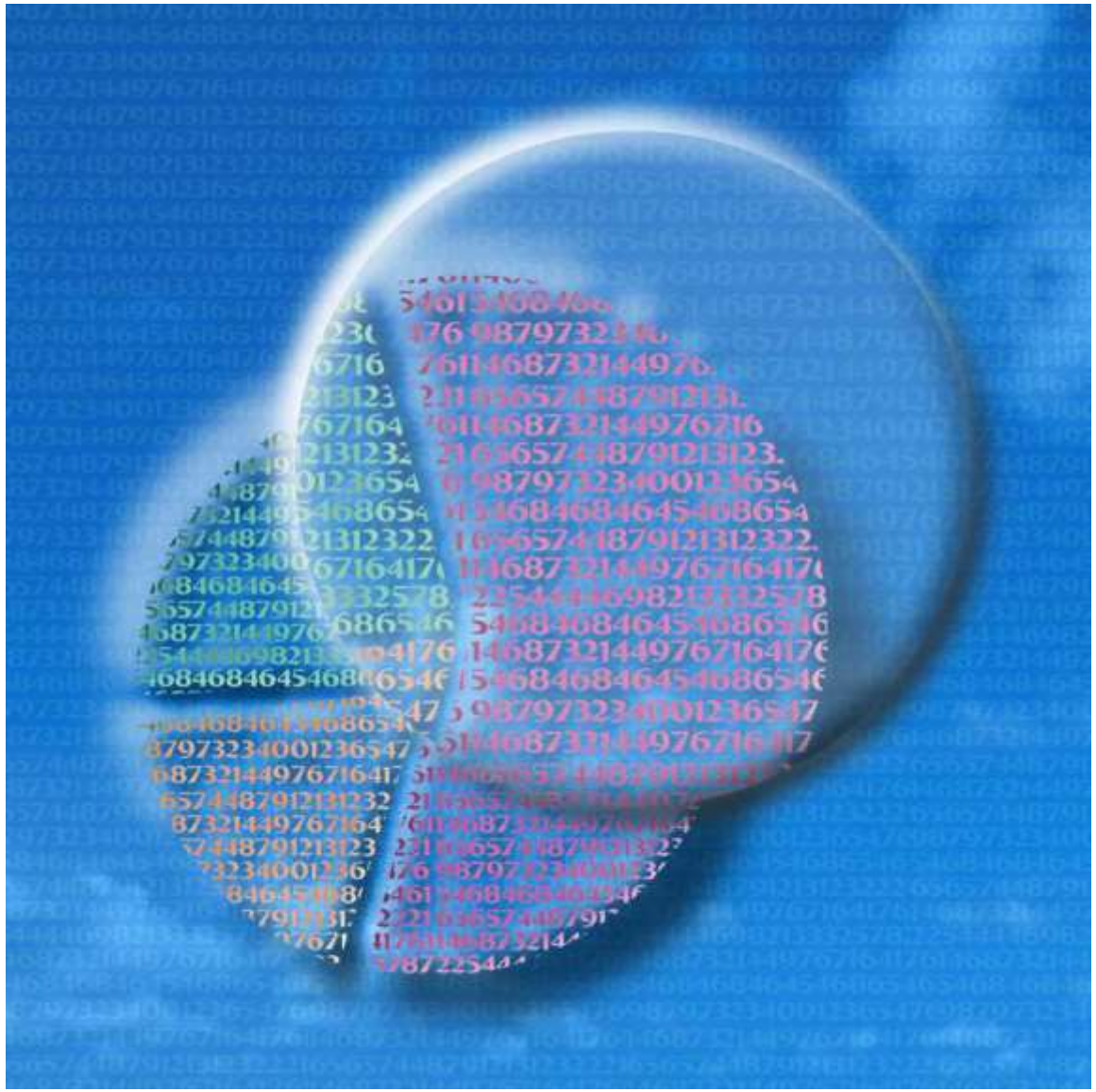


Sensitivity Auditing

Andrea Saltelli

SAMO Summer School,
Ispra, June 10, 2022

upf. BARCELONA SCHOOL OF MANAGEMENT

CNR ISTC ISTITUTO DI SCIENZE E TECNOLOGIE DELLA COGNIZIONE

UNIVERSITAS BERGENSIS

Andrea Saltelli

www.andreasaltelli.eu

Find this talk here

HOME ABOUT ME PUBLICATIONS NEWS & VIDEOS RESOURCES

Do we live immersed in fantastic numbers?

OPINION

PETER COY

‘The Most Important Number You’ve Never Heard Of’

Sept. 17, 2021

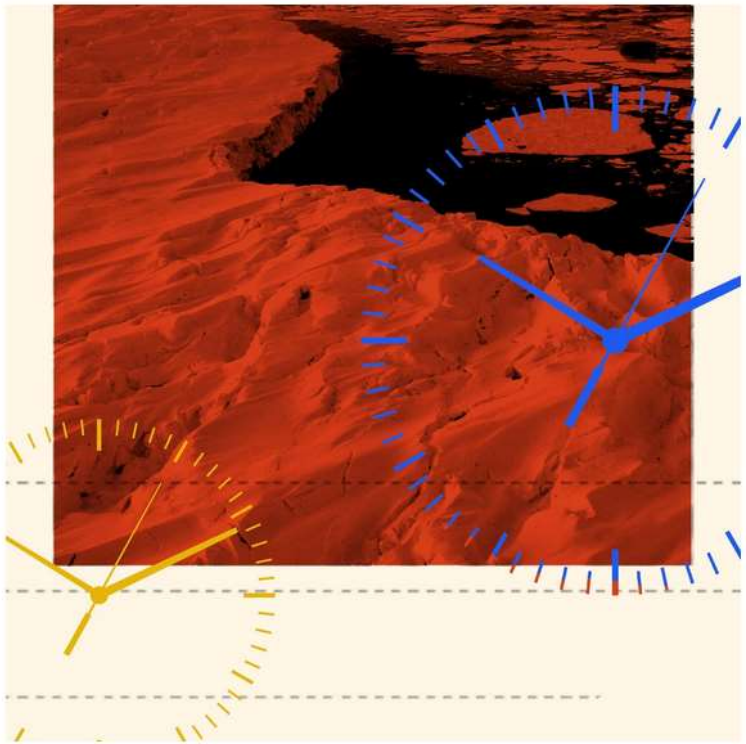


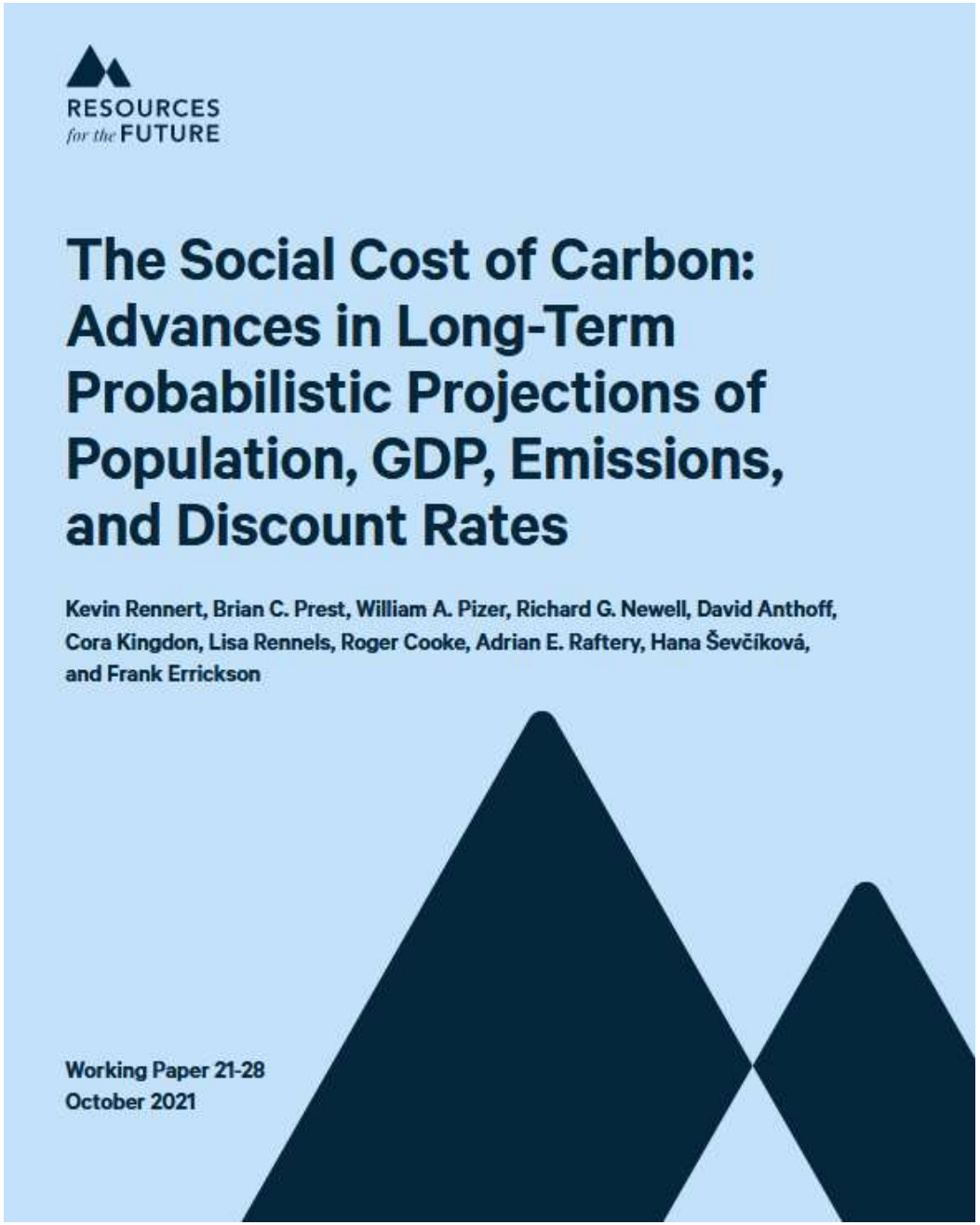
Illustration by Arsh Raziuddin, The New York Times

“social cost of carbon:

=$56 a ton on average at a 3 percent discount rate

=$171 a ton on average at a 2 percent discount rate”

The New York Times



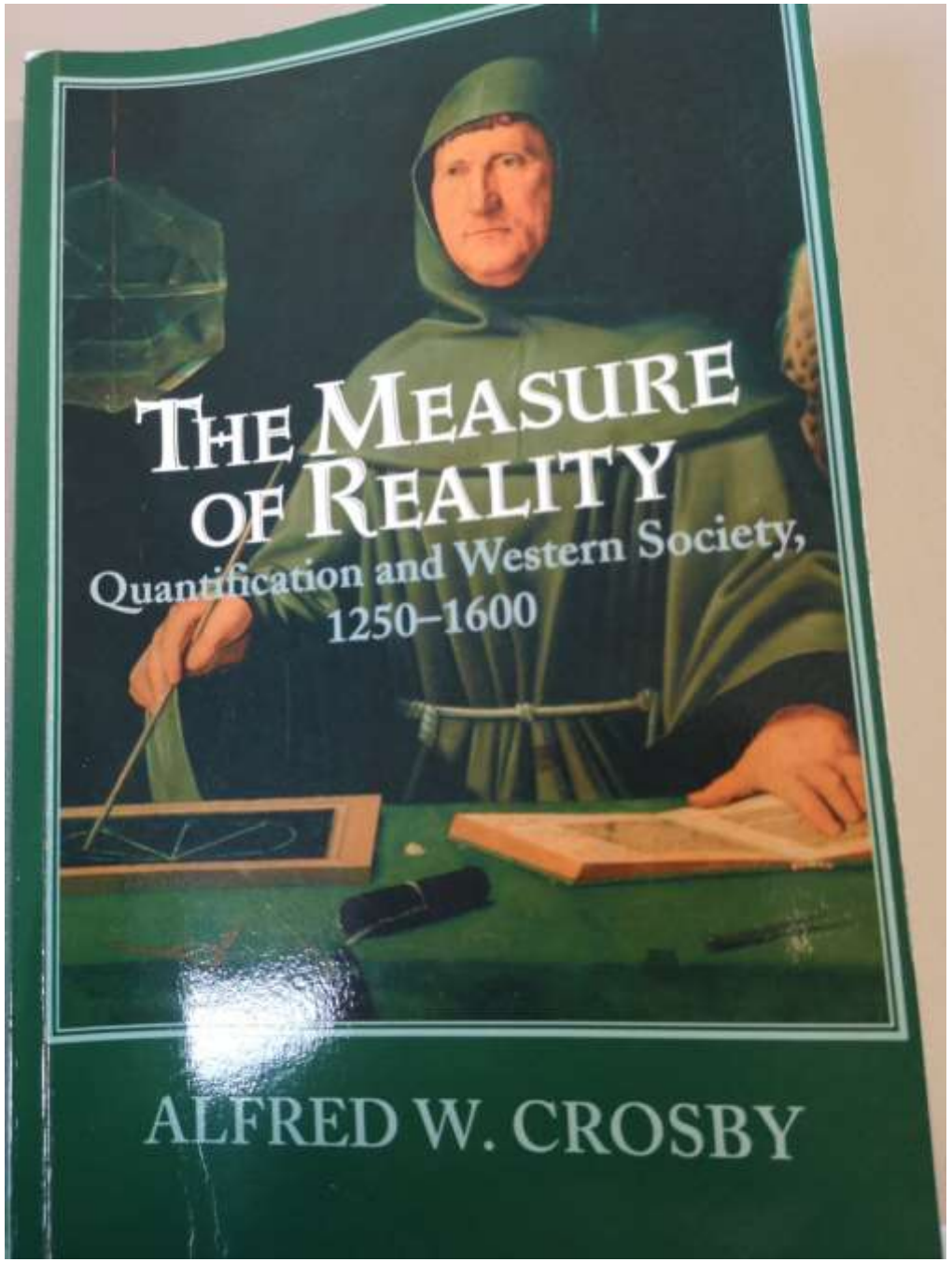
Averaged till year 2300

Feeds into policy design

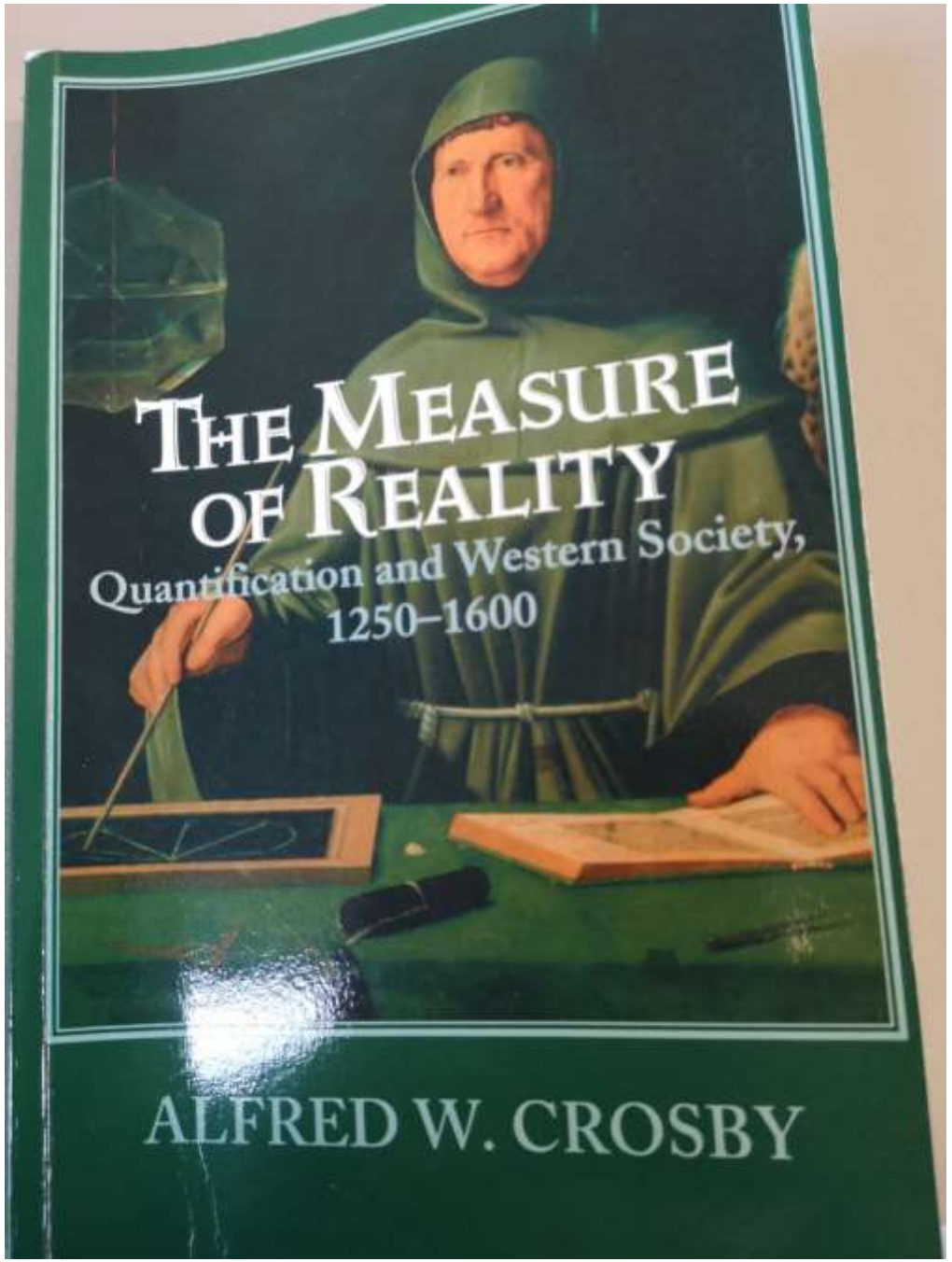
We have perhaps reached a complex epistemic state, where on the one hand ‘everybody knows’ that some numbers are pseudo-precise and that numbers can be gamed, while the game works only because most people don’t know about it

Jerome R. Ravetz

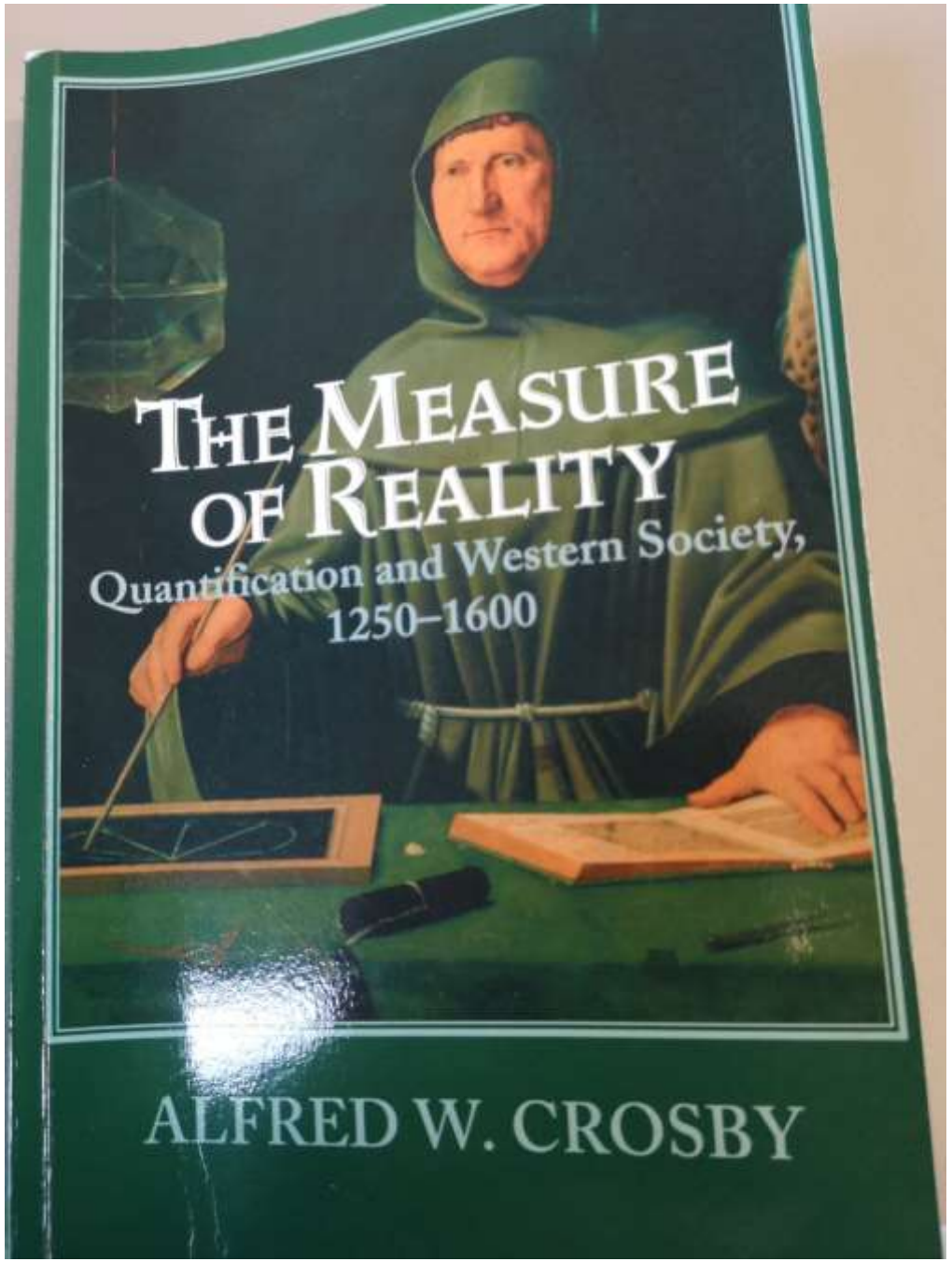
How did we get there?



Were quantification and visualization the engine inside the engine of western success and domination?



Quantification and visualization of space and time gave rise in the XIV century to a true revolution, in music, painting, accounting, cartography, astronomy …



… a revolution that in the following two centuries XV-XVI ensured the epochal success of the West and its domination over the rest of the world

Pieter Bruegel the Elder, Temperance, 1560

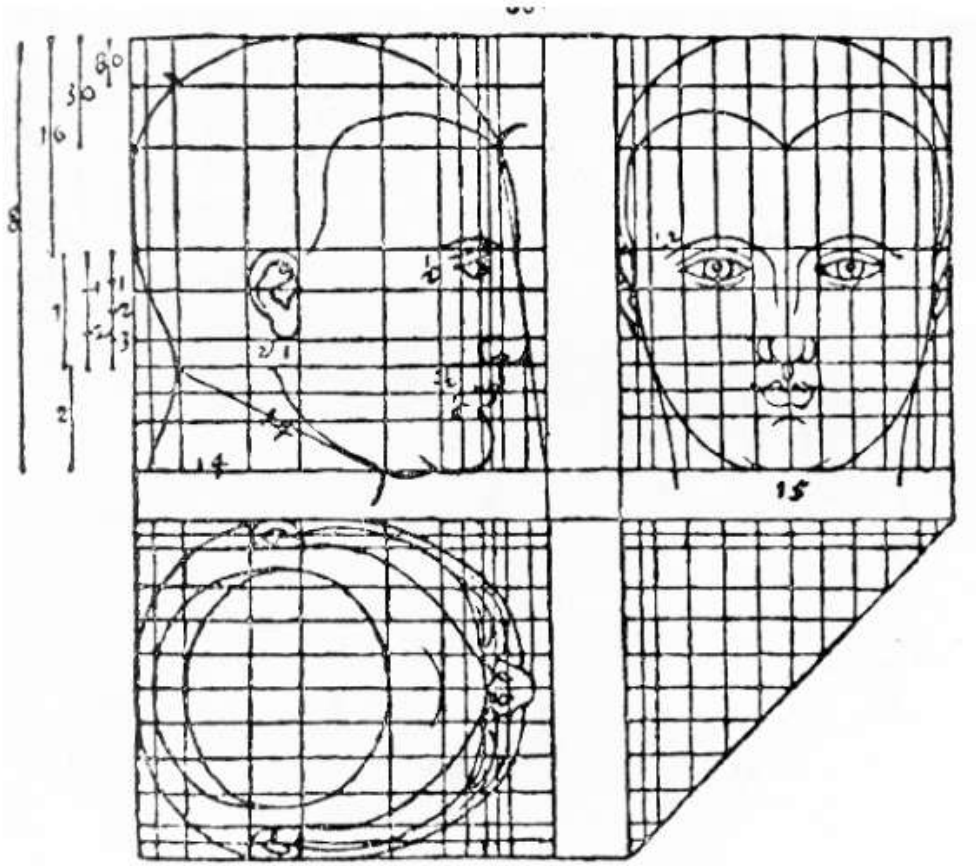
Measuring, military technology (math), dispute on a printed bible, learning, accounting, perspective, polyphonic music, the windmill, the watch …

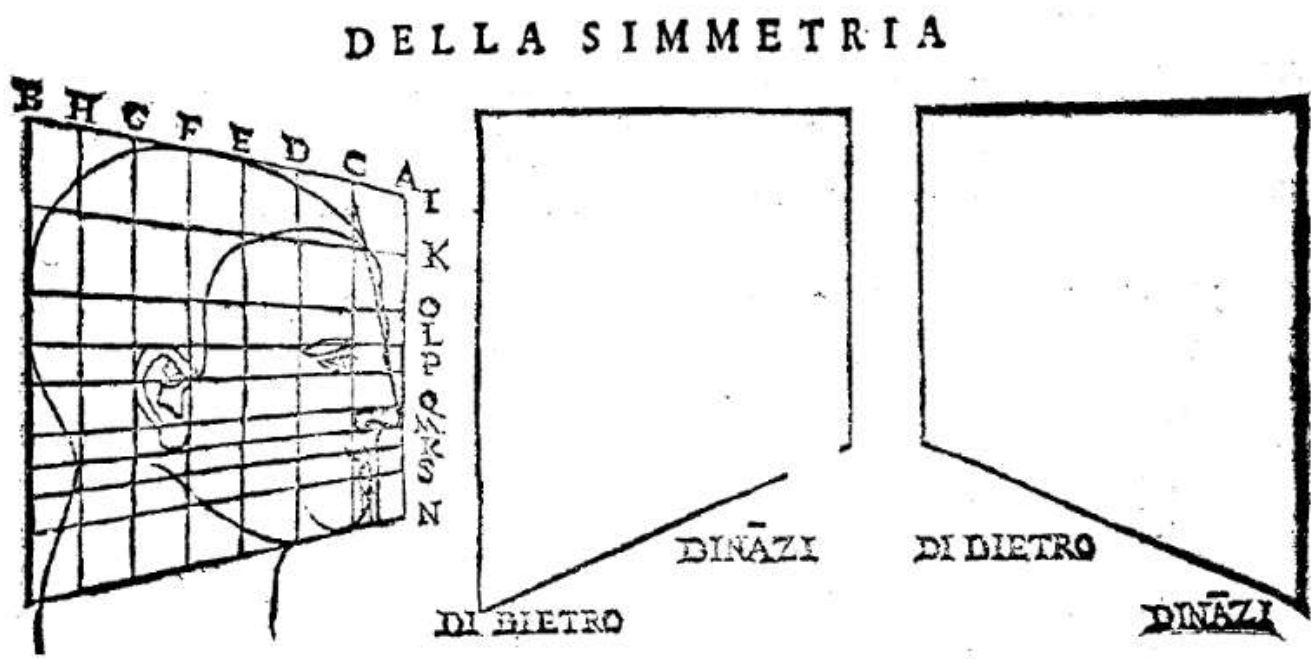
From the abacus to Arabic numerals

Boethius versus Pythagoras

The Annunciation, Carlo Crivelli (1435, 1495)

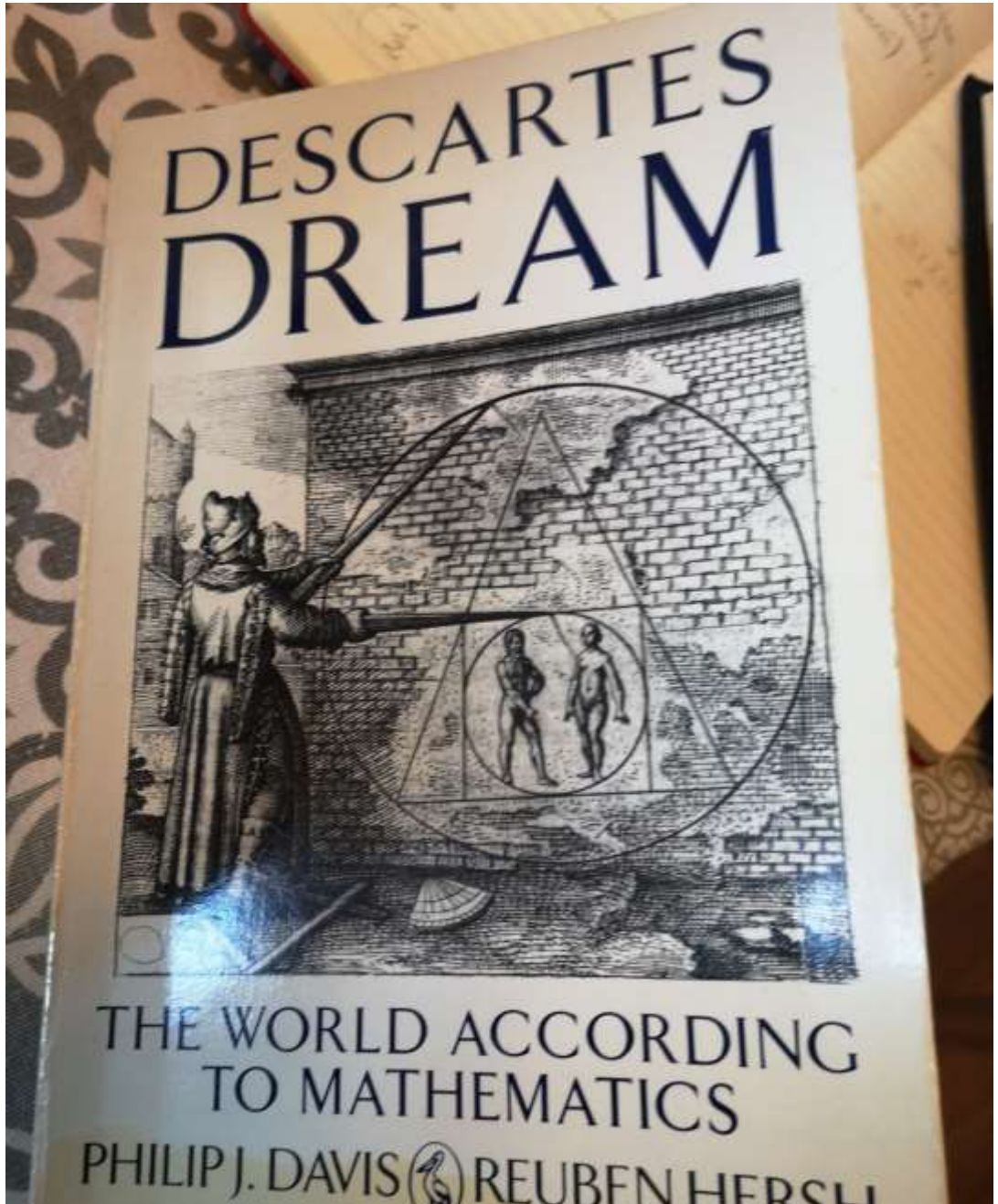
Draftsman Drawing a Reclining Nude
Albrecht Dürer (1471-1528)





From “De Varietate figurarum”
Albrecht Dürer (1471-1528)

Quantifications and the roots of the Cartesian dream



Descartes method, algebra and geometry, were “so fruitful, extending to all of mathematics and to science in general, that it would not be a mistake to call our age and all its scientific aspirations Cartesian.” p. 260

THE SOCIAL TYRANNY OF NUMBERS

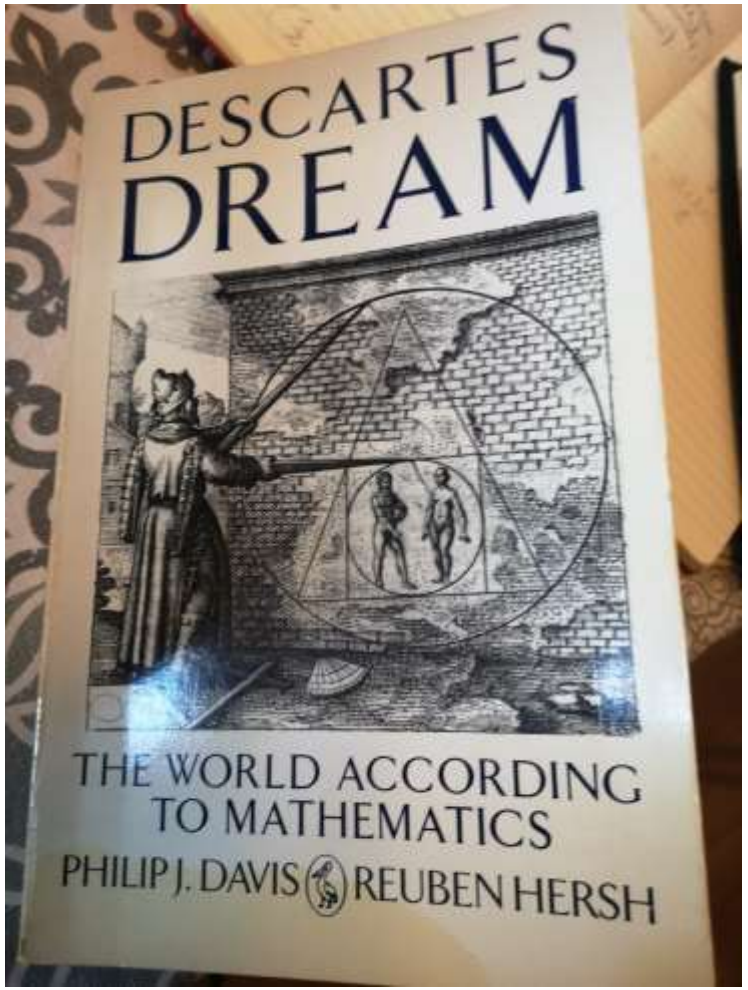
Mathematics and Rhetoric

The Criterion Makers: Mathematics and Social Policy

The Computerization of Love

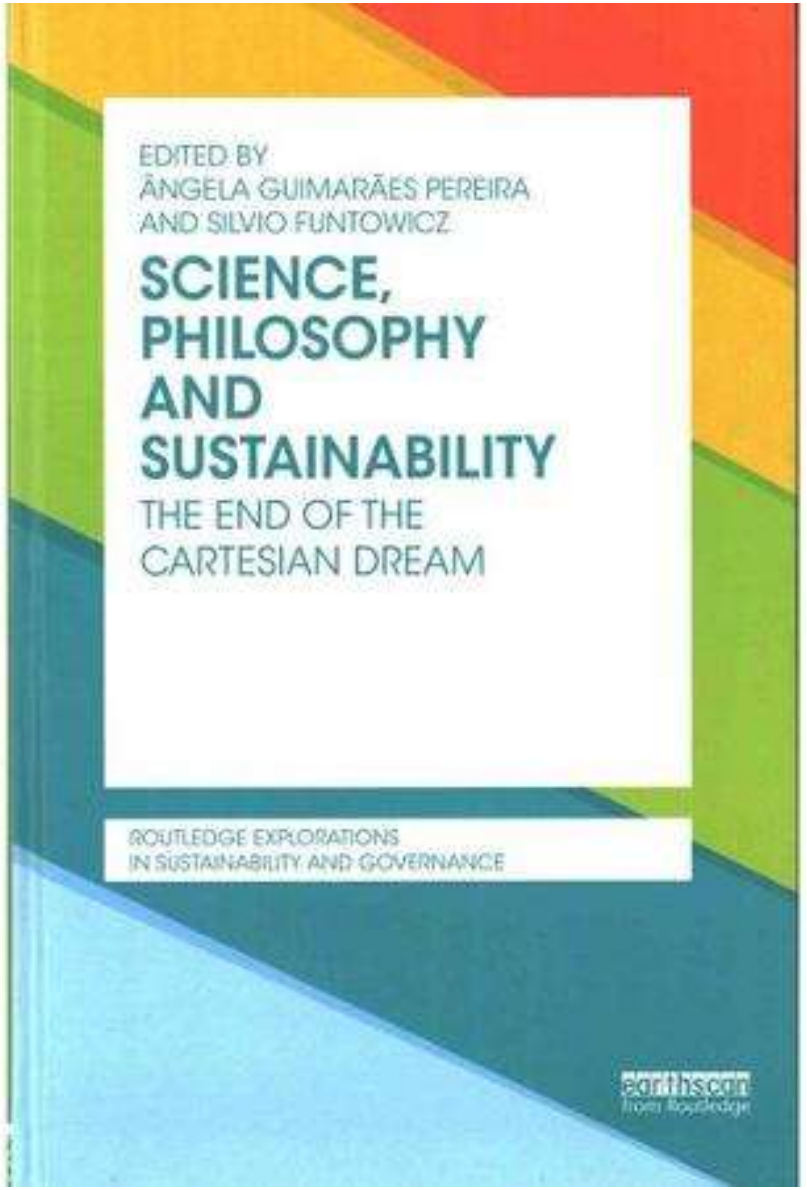
Testing

Mathematics as a Social Filter



Quantification as a key element of the Cartesian Dream

Guimarães Pereira, Â, and Funtowicz, S, Eds, 2015, **The end of the Cartesian dream**, Routledge.



Separate but related stories

Cartesian dream: possess and domination of nature

The ‘procedural utopia’: grounding social harmony and progress in calculations

Francis Bacon
(1561-1626)

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)

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

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.

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;
...

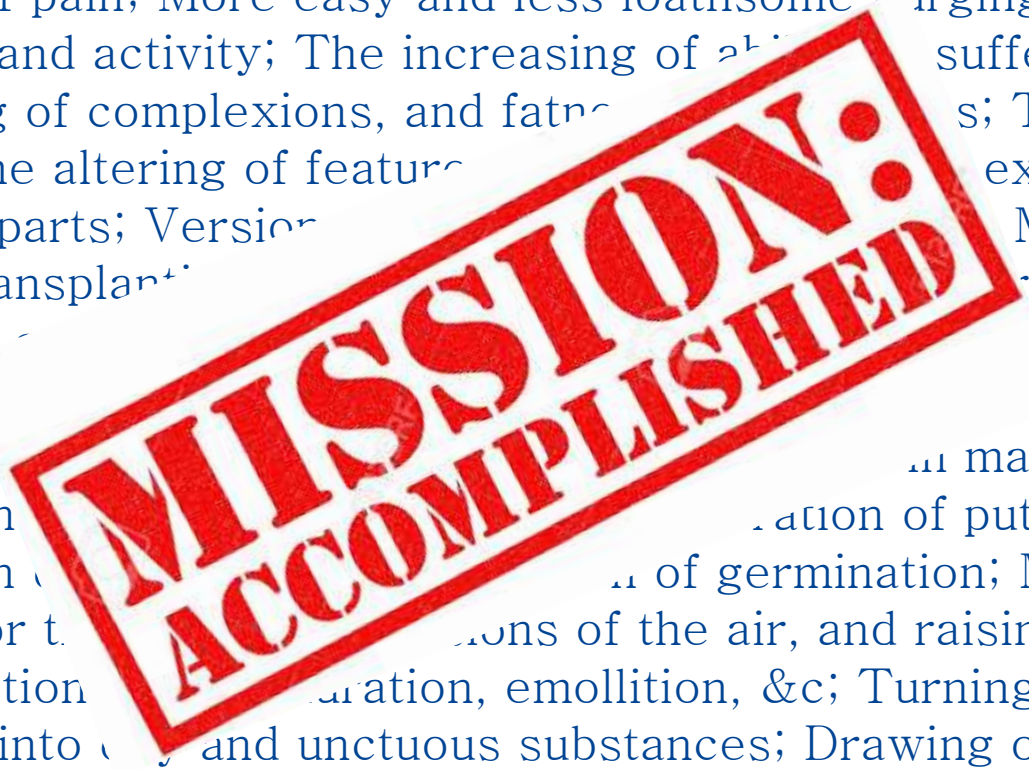
Natural divinations; Deceptions of the senses; Greater pleasures of the senses; Artificial minerals and cements.

Francis Bacon
(1561–1626)

Magnalia Naturae, in the New Atlantis (1627),

'Wonders of nature, in particular with respect to human use'

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 ab… suffer torture or pain; The altering of complexions, and fatn… s; The altering of statures; The altering of featur… exalting of the intellectual parts; Versio… Making of new species; Transplant… uments of destruction … its, and putting them in go… upon another body, or up… maturations; Acceleration … ation of putrefaction; Acceleration … of germination; Making rich composts for t… ions of the air, and raising of tempests; Great alteration … ation, emollition, &c; Turning crude and watery substances into … 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.



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 […]

René Descartes (1596-1650)

Discourse on Method (1637)

http://www.bartleby.com/34/1/6.html

“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)

http://www.bartleby.com/34/1/6.html

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’

http://oll.libertyfund.org/titles/1669

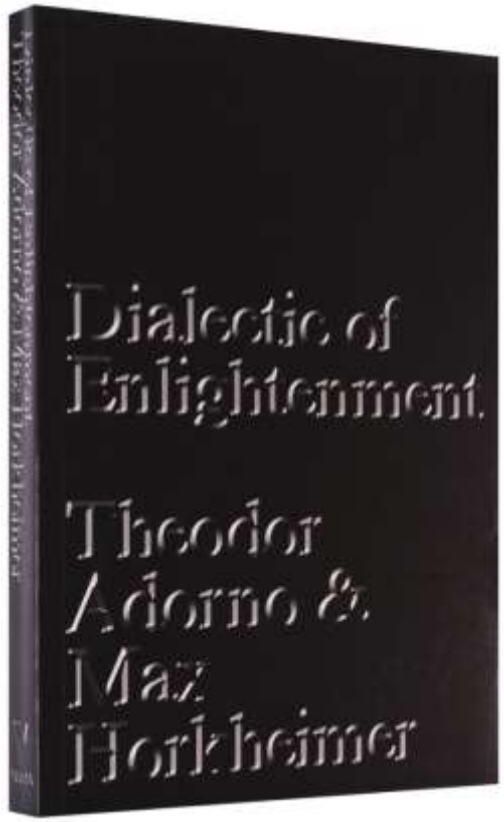
Overpopulation? War due to scarcity of resources? Will not happen because technical progress and ethical progress will go hand in hand. Man will understand that his duty “will consist not in the question of giving existence to a greater number of beings, but happiness.” (Tenth Epoch)

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

http://oll.libertyfund.org/titles/1669

“Technical progress and ethical progress will go hand in hand”

Marquis de Condorcet



= progressive view of enlightenment attacked by the Frankfurt school

‘Mathématique sociale’: We still use today terms such as ‘Condorcet method’, ‘Condorcet winner’, ‘Condorcet-ranking procedure’

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

‘

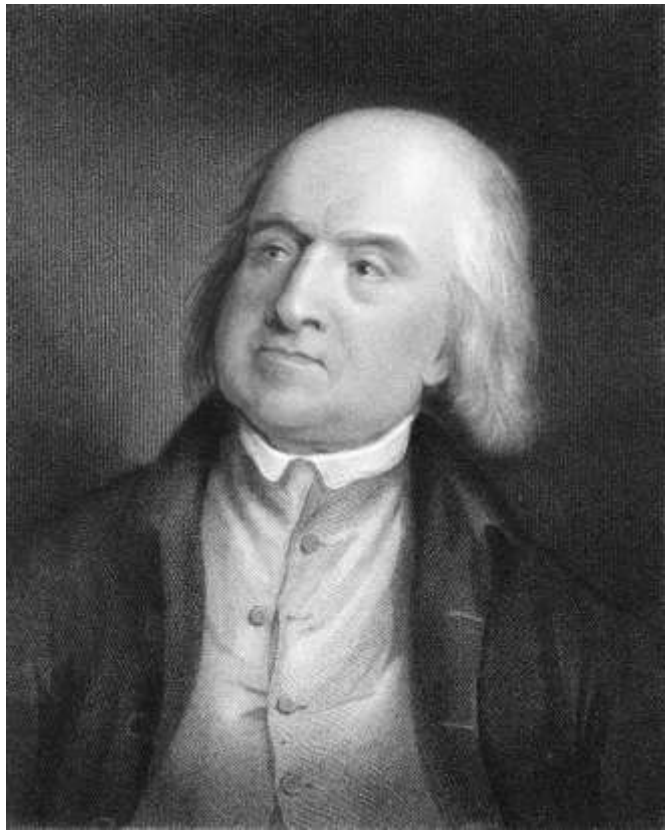
Feldman, J., 2005, Condorcet et la mathematique sociale: enthousiasmes et bemols, Mathematics and Social Sciences, 172(4), 7-41, http://www.ehess.fr/revue-msh/pdf/N172R955.pdf

Munda G. (2007) - Social multi-criteria evaluation, Springer-Verlag, Heidelberg, New York, Economics Series

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

Condorcet's Mathématique sociale had its continuation in Jeremy Bentham's utilitarianism

Marquis de Condorcet
(1743- 1794)



Felicific calculus: 'The greatest good for the greatest number'

(utility or hedonistic calculus)

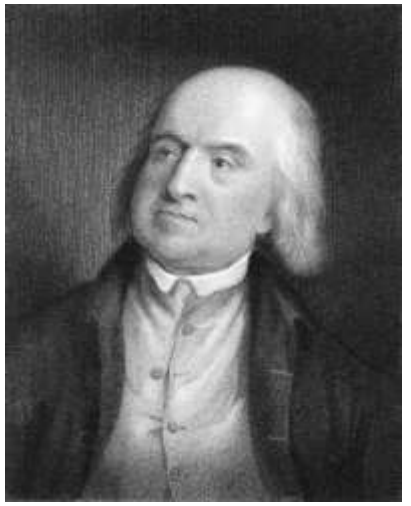
Jeremy Bentham
(1748-1832)

Artork: Adam Simpson, New York Times

- Intensity: How strong is the pleasure?
- Duration: How long will the pleasure last?
- Certainty or uncertainty: How likely or unlikely is it that the pleasure will occur?
- Propinquity or remoteness: How soon will the pleasure occur?
- Fecundity: The probability that the action will be followed by sensations of the same kind.
- Purity: The probability that it will not be followed by sensations of the opposite kind.
- Extent: How many people will be affected?

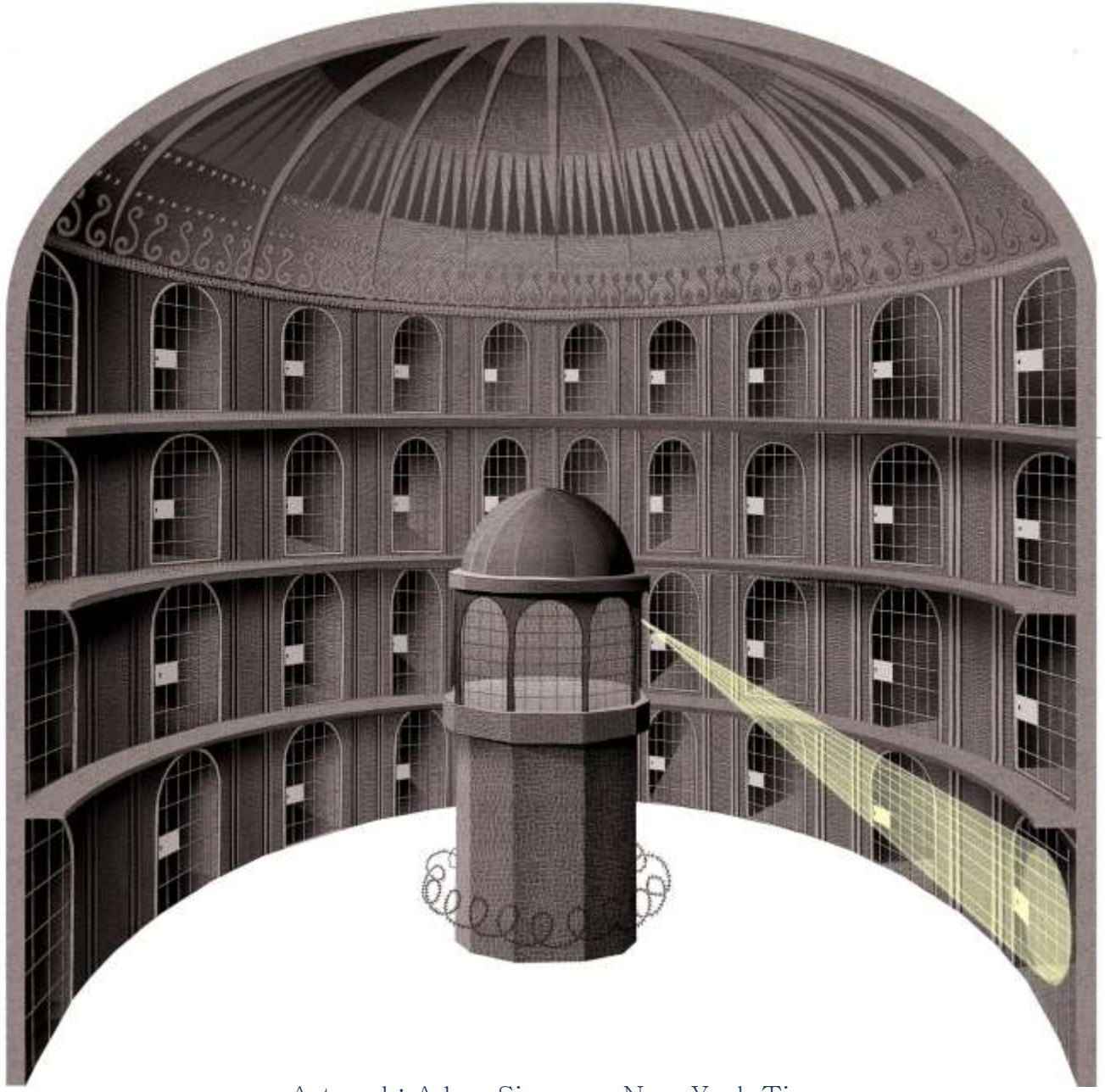
Jeremy Bentham

- Intensity: How strong is the pleasure?
- Duration: How long will the pleasure last?
- Certainty or uncertainty: How likely or unlikely is it that the pleasure will occur?
- Propinquity or remoteness: How soon will the pleasure occur?
- Fecundity: The probability that the action will be followed by sensations of the same kind.
- Purity: The probability that it will not be followed by sensations of the opposite kind.
- Extent: How many people will be affected?



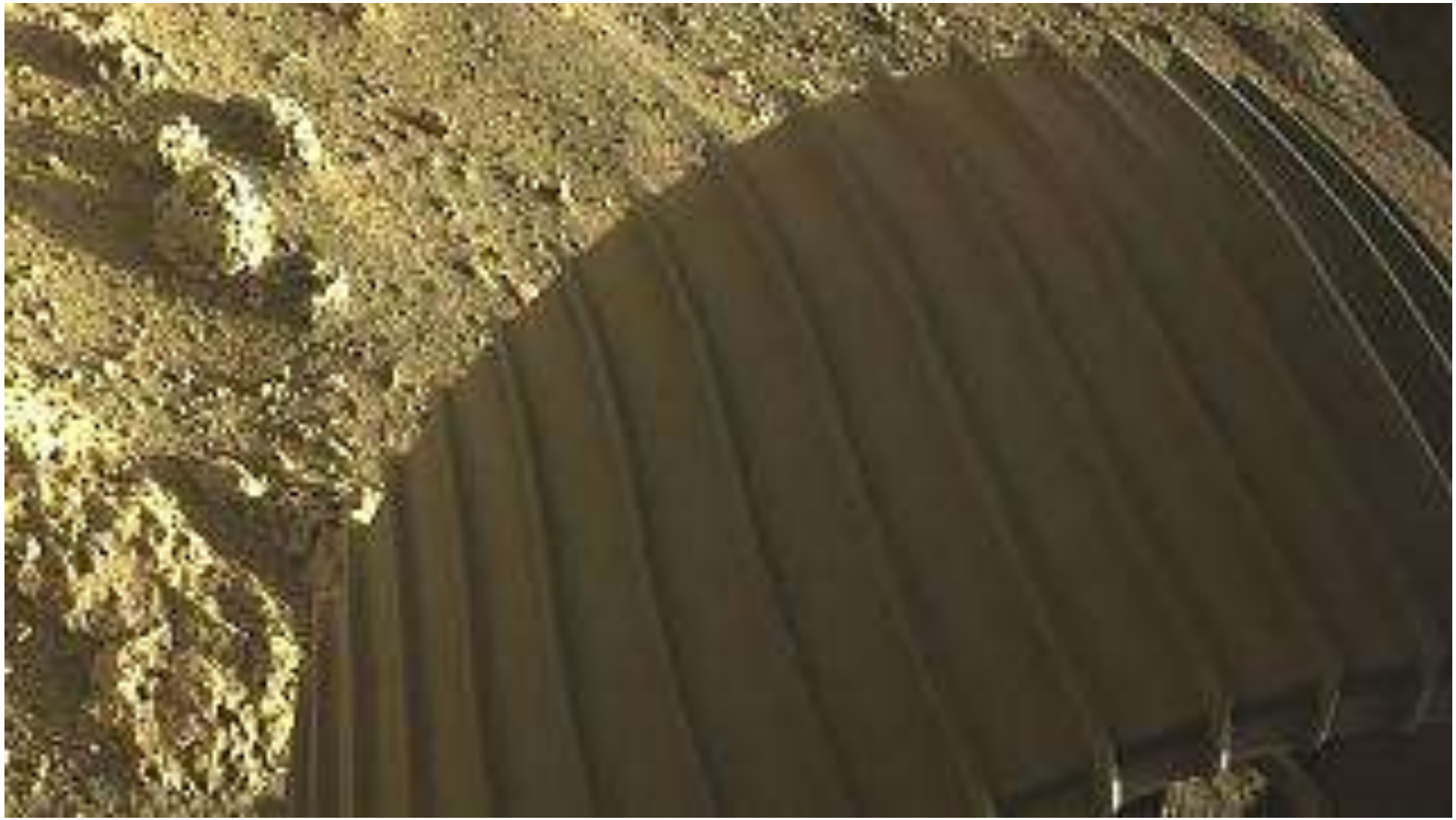
"The utilitarian ethic, of 'the greatest good for the greatest number', was an implicit quantification of ethics, needed for the post-theological age" (Jerome R. Ravetz)

Bentham's Panopticon



Artwork: Adam Simpson, New York Times

The success of the Cartesian dream

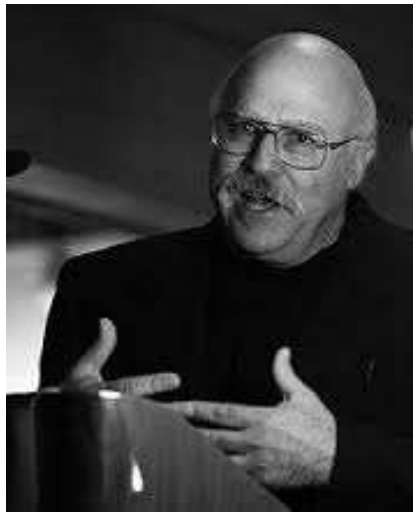


February 18, 2021, Landing of Perseverance on Mars

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'



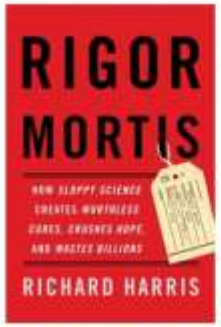
Steven Shapin

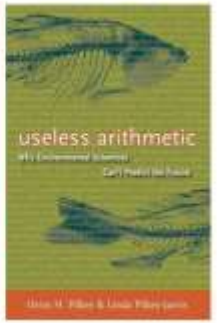
Steven Shapin, 2016, Invisible Science, The Hedgehog Review: Vol. 18 No. 3 (Fall 2016).

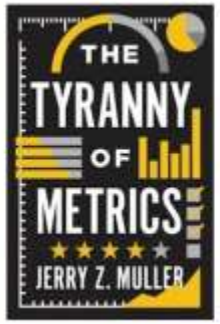
Many voices of alarm as to misuse of quantification

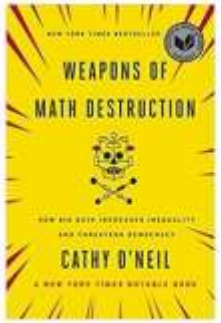
And an explosion of works, from within and without, from many disciplines

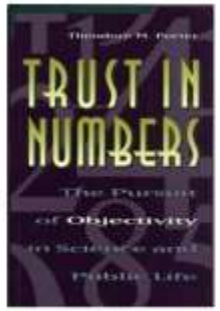
Sociology of quantification:

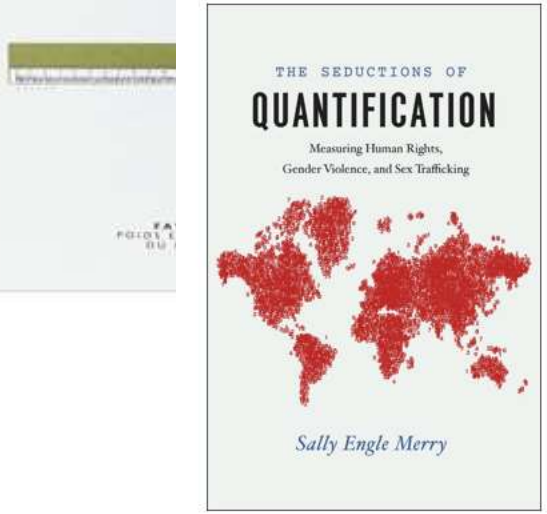


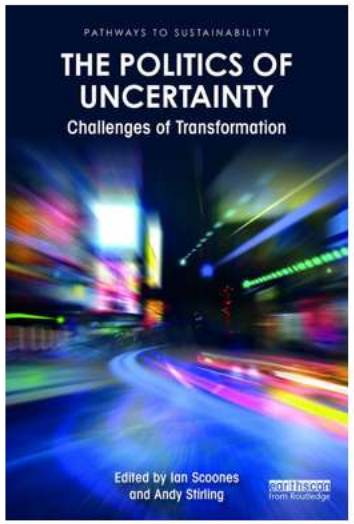


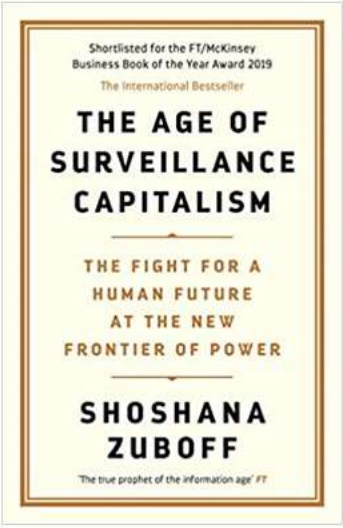


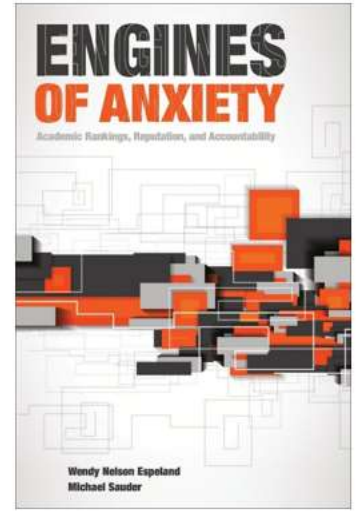




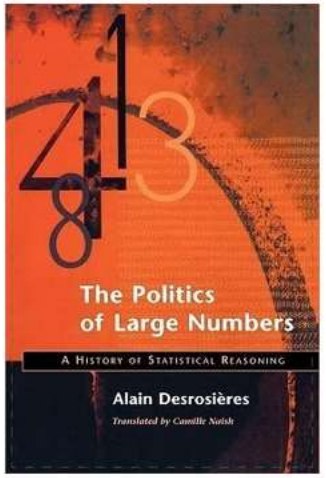


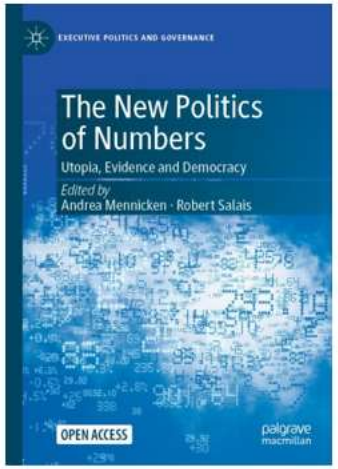






a flood of disciplinary work …





… to the effect that quantifying has consequences

Dangers of mathematization of economics

Wolfgang Drechsler

Erik S. Reinert

Paul Romer

Philip Mirowski

W. Drechsler, “On the possibility of quantitative-mathematical social science, chiefly economics,” *J. Econ. Stud.*, vol. 27, no. 4/5, pp. 246–259, 2000.

E. S. Reinert, “Full circle: economics from scholasticism through innovation and back into mathematical scholasticism,” *J. Econ. Stud.*, vol. 27, no. 4/5, pp. 364–376, Aug. 2000.

P. Romer, “Mathiness in the Theory of Economic Growth,” *Am. Econ. Rev.*, vol. 105, no. 5, pp. 89–93, May 2015.

Mirowski, Philip. 2013. Never Let a Serious Crisis Go to Waste: How Neoliberalism Survived the Financial Meltdown. Verso.

IIPP UCL Institute for Innovation and Public Purpose

UCL

WORKING PAPER
WP 2021/07

Altered States: Cartesian and Ricardian dreams

Erik S. Reinert
Tallinn University of Technology
UCL Institute for Innovation and Public Purpose

Monica di Fiore
Institute for Cognitive Sciences and Technologies, Consiglio Nazionale delle Ricerche

Andrea Saltelli
Open Evidence Research, Universitat Oberta de Catalunya (UOC)

Jerome R. Ravetz
Institute for Science, Innovation and Society, University of Oxford

Why ethics of quantification is needed now

Andrea Saltelli
Open Evidence Research, Universitat Oberta de Catalunya, Barcelona, Spain

Antonio Andreoni
UCL Institute for Innovation and Public Purpose; South African Research Chair in Industrial Development, University of Johannesburg, South Africa

Wolfgang Drechsler
Tallinn University of Technology, Estonia;
UCL Institute for Innovation and Public Purpose;
Davis Center at Harvard University, United States

Jayati Ghosh
University of Massachusetts Amherst, United States;
UCL Institute for Innovation and Public Purpose

Rainer Kattel
UCL Institute for Innovation and Public Purpose

Ingrid H. Kvangraven
Department of Politics, University of York

Ismael Rafols
Centre for Science and Technology Studies, Leiden University, the Netherlands

Erik S. Reinert
Tallinn University of Technology, Estonia;
UCL Institute for Innovation and Public Purpose

Andy Stirling
Science Policy Research Unit, University of Sussex

Ting Xu
School of Law at the University of Essex

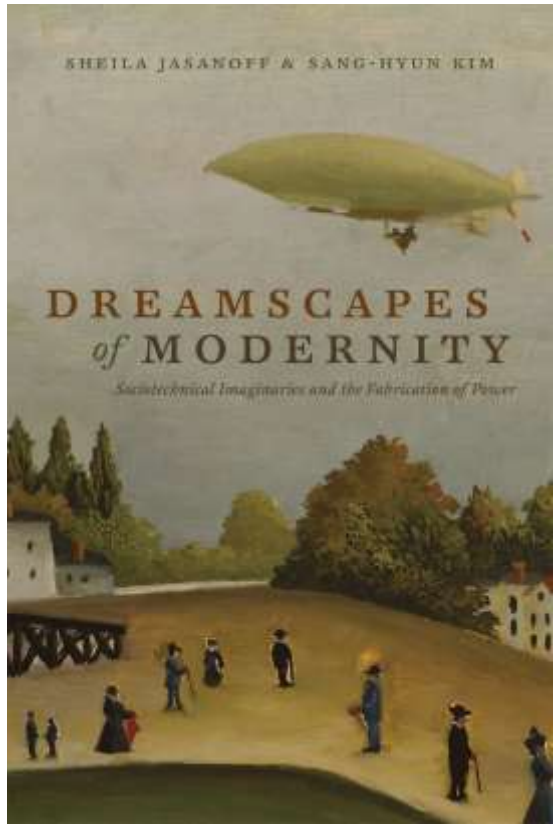
IIPP UCL Institute for Innovation and Public Purpose

WORKING PAPER
WP 2021/05

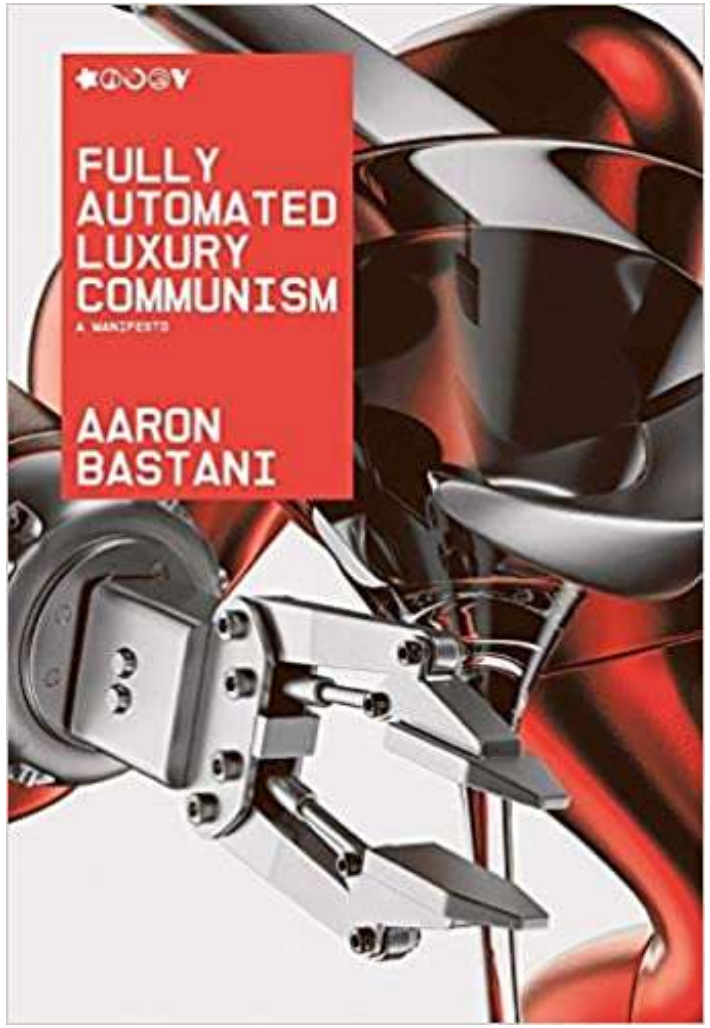
UCL

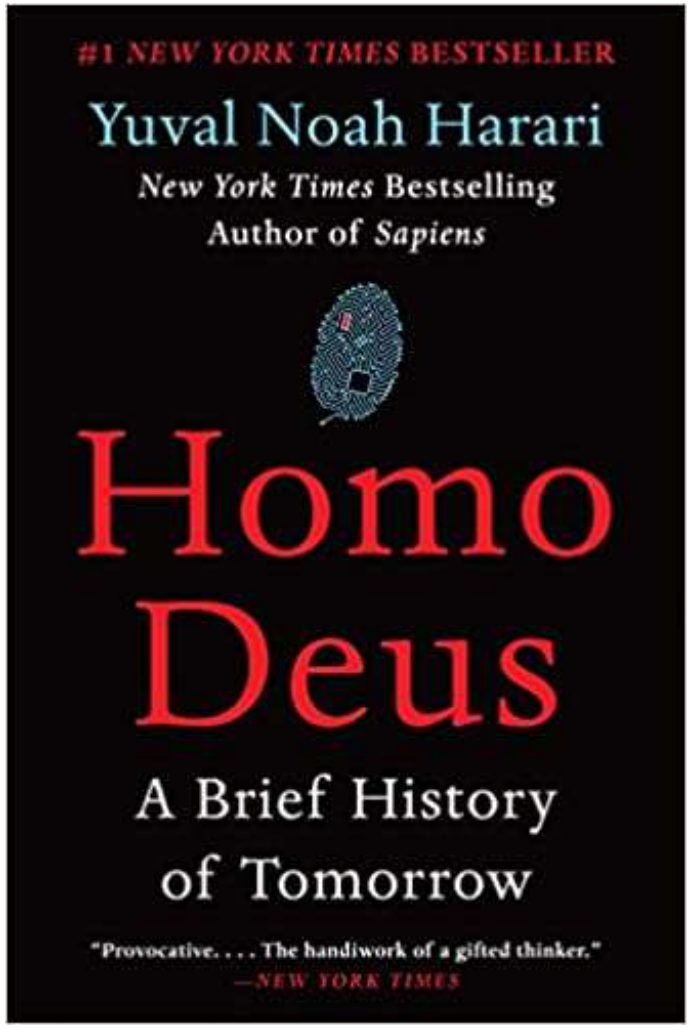
And yet …which is the prevailing sociotechnical imaginary ?

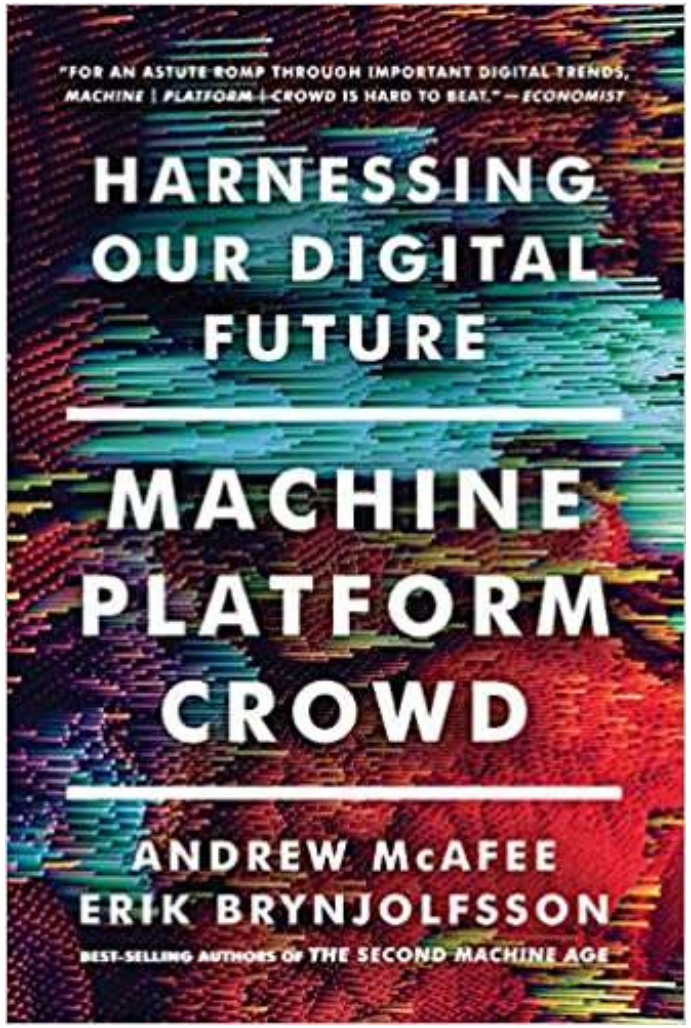
Sociotechnical imaginary: How visions of scientific and technological progress carry with them implicit ideas about public purposes, collective futures, and the common good



Sheila Jasanoff


FULLY AUTOMATED LUXURY COMMUNISM
A MANIFESTO
AARON BASTANI


#1 NEW YORK TIMES BESTSELLER
Yuval Noah Harari
New York Times Bestselling
Author of Sapiens
Homo Deus
A Brief History of Tomorrow
"Provocative. . . . The handiwork of a gifted thinker."
—NEW YORK TIMES


"FOR AN ASTUTE ROMP THROUGH IMPORTANT DIGITAL TRENDS, MACHINE | PLATFORM | CROWD IS HARD TO BEAT." —ECONOMIST
HARNESSING OUR DIGITAL FUTURE
MACHINE PLATFORM CROWD
ANDREW McAFEE
ERIK BRYNJOLFSSON
BEST-SELLING AUTHORS OF THE SECOND MACHINE AGE

Good news!

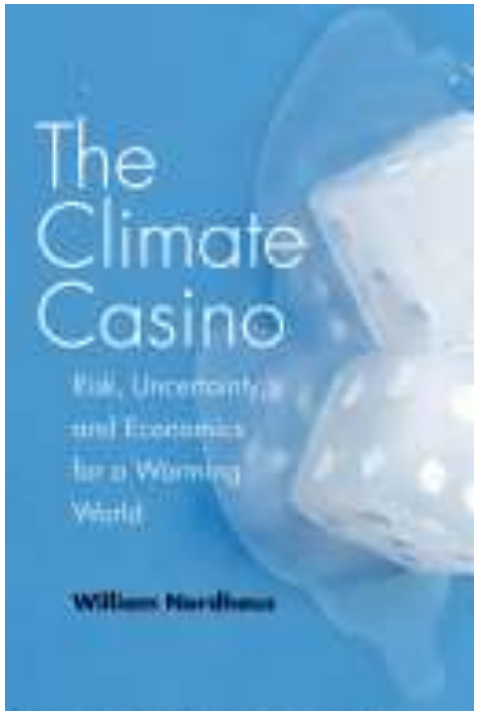
Which is the prevailing sociotechnical imaginary for quantification?

‘Decisionism’ is mainstream

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

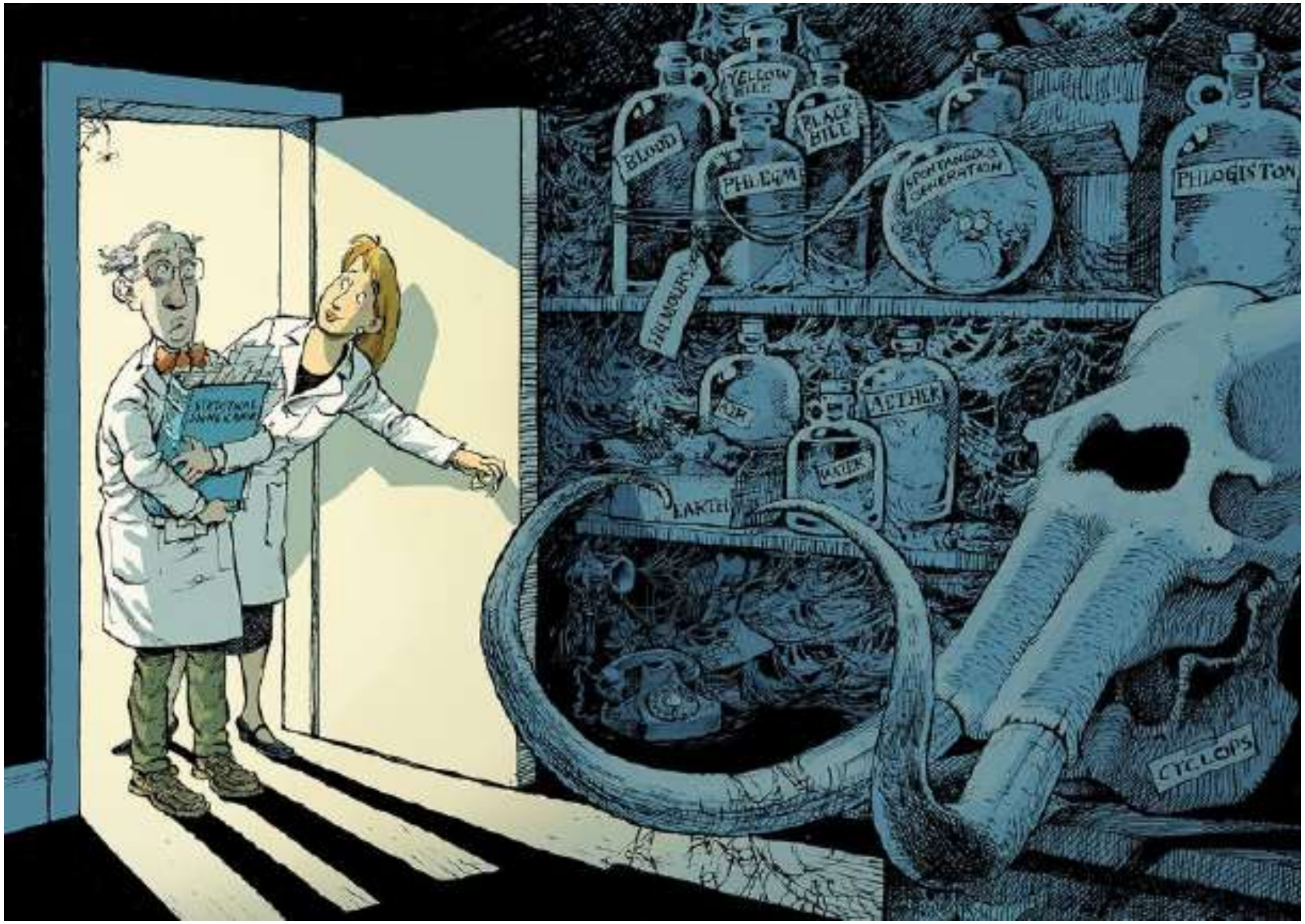
Cass Sunstein, winner of the 2018 Holberg Prize

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



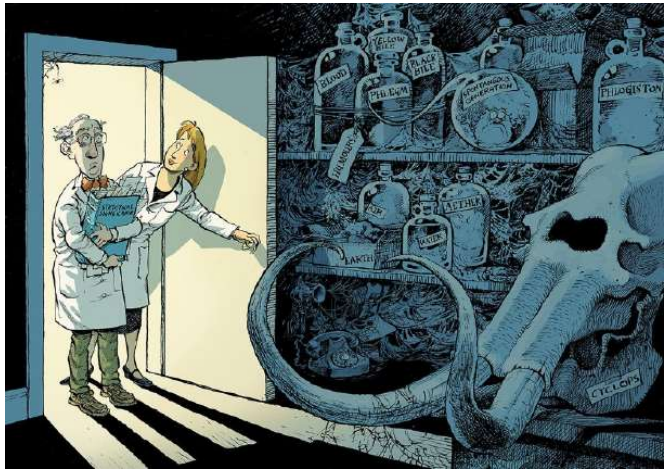
Cost benefit analysis to the year 2100?

Statistical and mathematical modelling



Throw away the concept of statistical significance?

nature
International journal of science



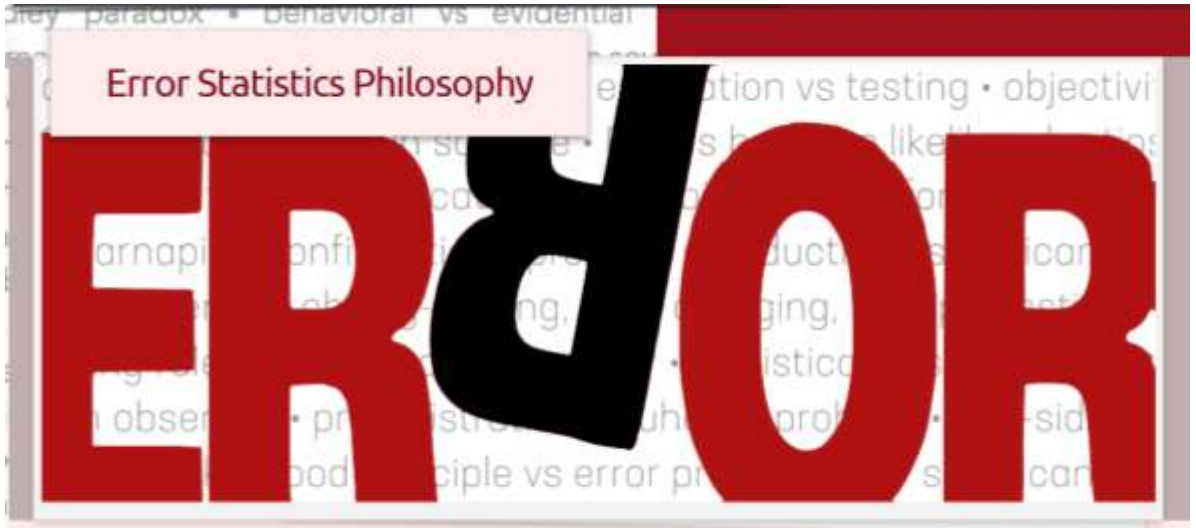
COMMENT · 20 MARCH 2019

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.

Valentin Amrhein ✉, Sander Greenland & Blake McShane

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



Statistics in the wake of the reproducibility crisis

Statistical wars?

Sensitivity Auditing for mathematical modelling?

Unlike statistics, mathematical modelling is not a discipline…

nature COMMUNICATIONS

Comment | Open Access | Published: 27 August 2019

A short comment on statistical versus mathematical modelling

Andrea Saltelli

Int. J. Foresight and Innovation Policy, Vol. 9, Nos. 2/3/4, 2013

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.

EC impact assessment guidelines: sensitivity analysis & auditing

European Commission. November 2021. “Better Regulation: Guidelines and Toolbox.” https://ec.europa.eu/info/law/law-making-process/planning-and-proposing-law/better-regulation-why-and-how/better-regulation-guidelines-and-toolbox_en

Sensitivity auditing in the EC Guidelines (p. 563)

"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."

Sensitivity auditing in the EC Guidelines (p. 563)

"In general, sensitivity auditing stresses the idea of clearly communicating the extent to which particular models can be used to support policy decisions and their results can be trusted, taking into account as much as possible all forms of potential uncertainty, …"

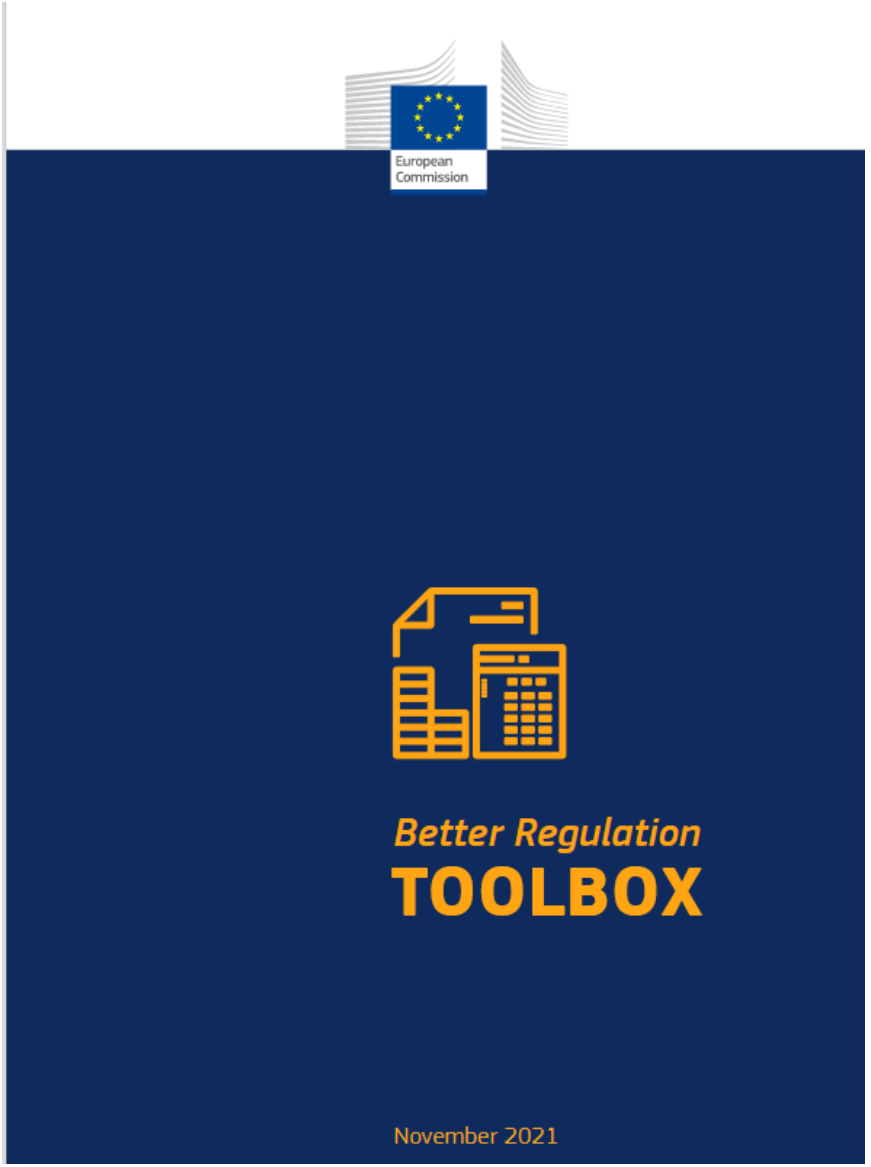
Sensitivity auditing in the EC Guidelines (p. 563)

"… and to
anticipate criticism by third parties. In particular, one should avoid giving the impression of false confidence by 'quantification at all costs'."

Sensitivity auditing in the EC Guidelines (p. 563)

"In some cases there is simply not enough data, or the process is too complex, to give a meaningful quantitative prediction."

From sensitivity auditing (2013) to the Manifesto (2022)



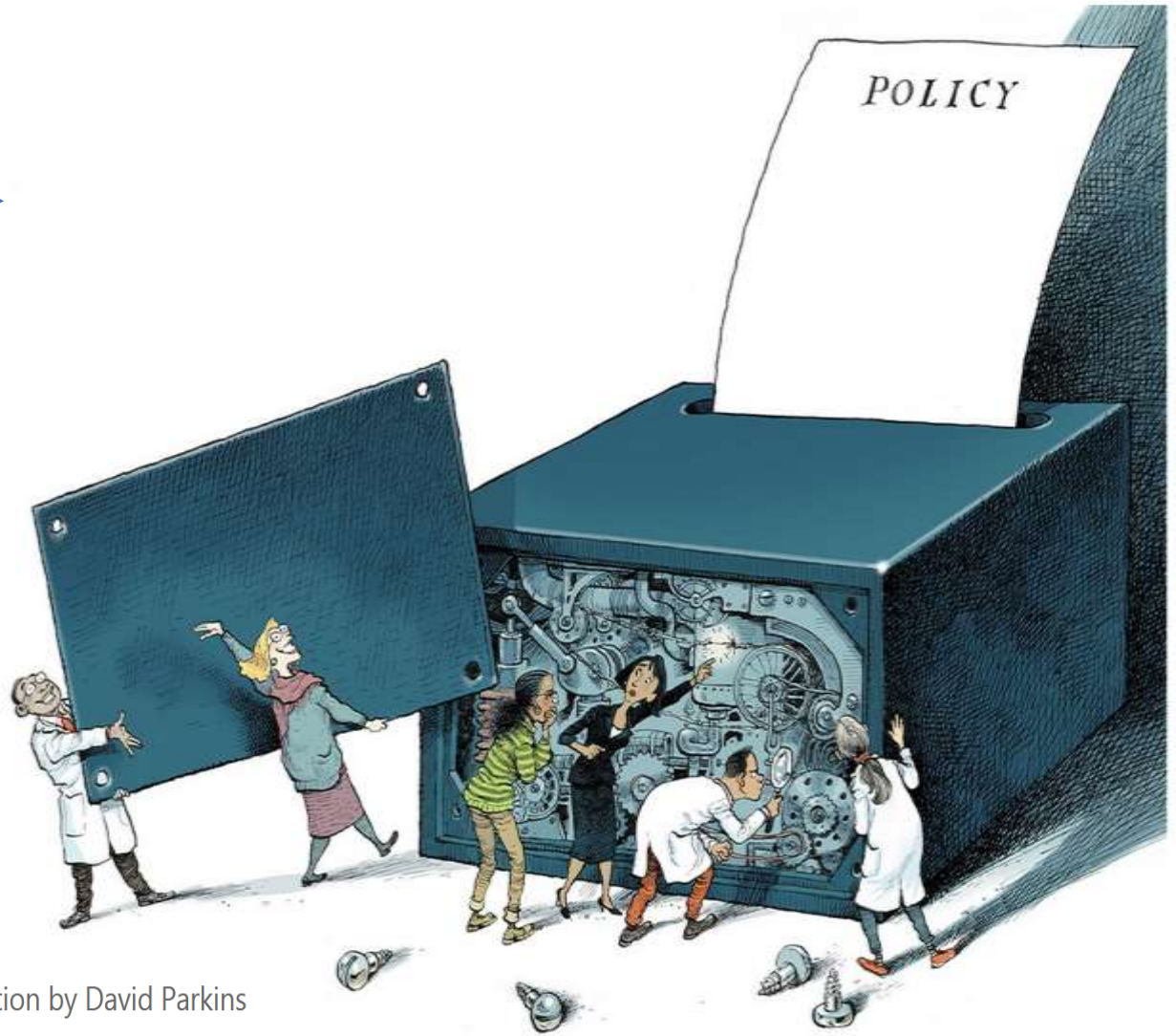


Illustration by David Parkins

COMMENT · 24 JUNE 2020

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.

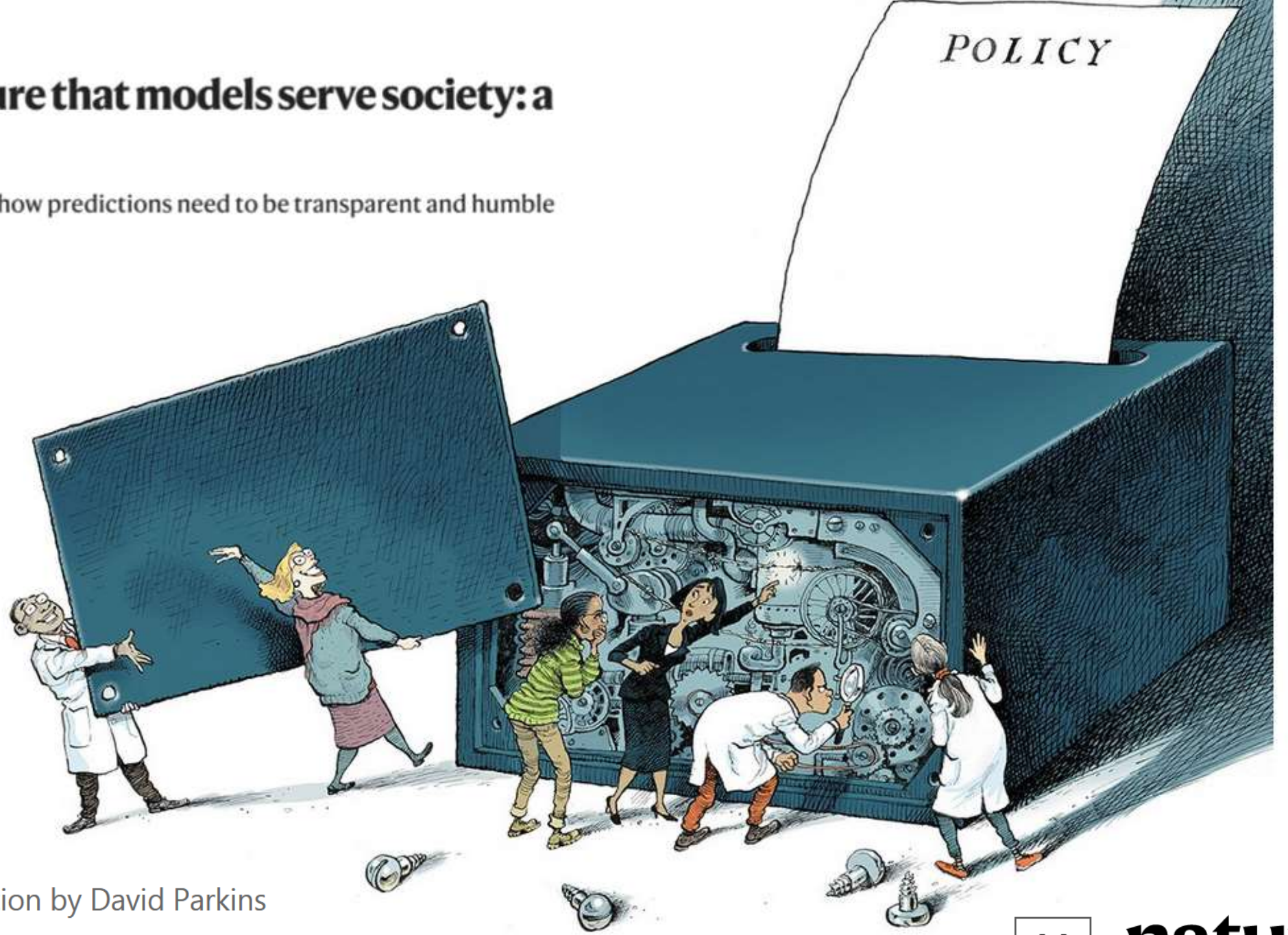


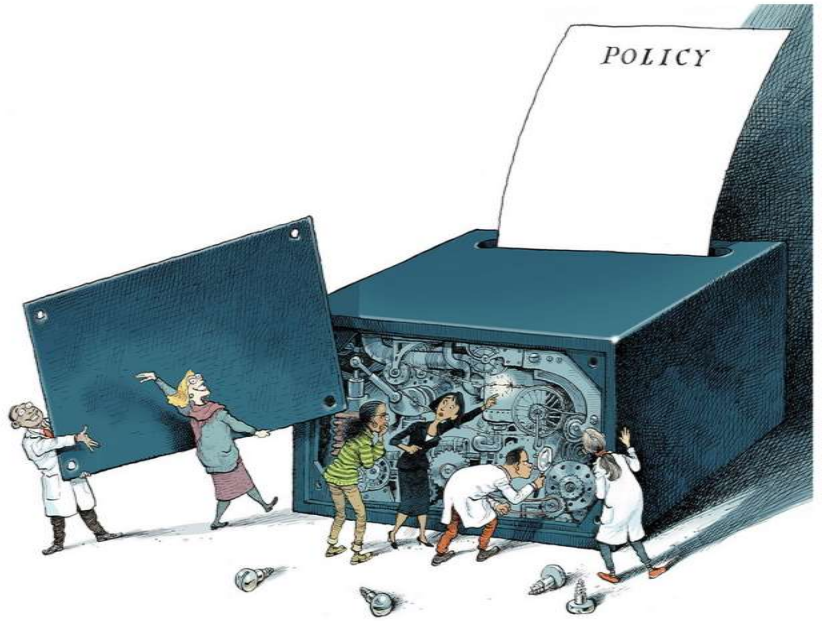
Illustration by David Parkins

nature

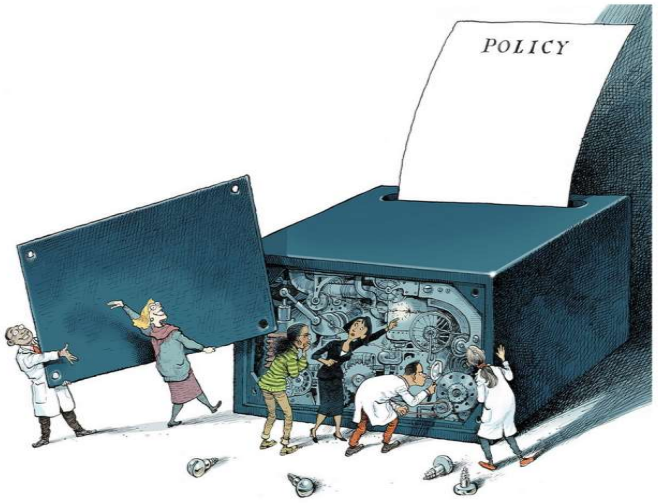
Andrea Saltelli ✉, Gabriele Bammer, Isabelle Bruno, Erica Charters, Monica Di Fiore, Emmanuel Didier, Wendy Nelson Espeland, John Kay, Samuele Lo Piano, Deborah Mayo, Roger Pielke Jr, Tommaso Portaluri, Theodore M. Porter, Arnald Puy, Ismael Rafols, Jerome R. Ravetz, Erik Reinert, Daniel Sarewitz, Philip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

3 modellers Lo Piano, Puy, Saltelli
2 experts models and society Pielke, van der Sluijs
3 statisticians Mayo, Stark, Portaluri
2 statactivistes Bruno, Didier
2 economists Kay, Raynert
1 epidemiologist Vineis

2 sociologists of quantification Espeland, Porter
3 STS scholars Bammer, Sarewitz, Stirling
1 philosopher Ravetz
1 historian Charters
1 political scientists Di Fiore
1 expert RRI - Open Science Rafols

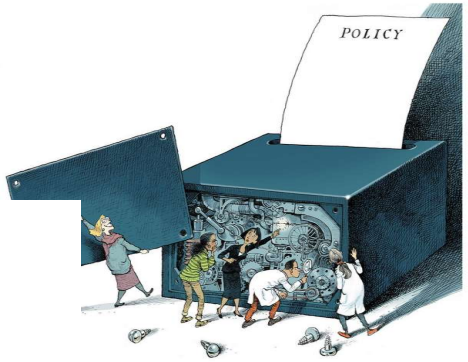


COVID has put mathematical models in the limelight



➔ Power & controversy

Power



The New York Times

Behind the Virus Report That Jarred the U.S. and the U.K. to Action

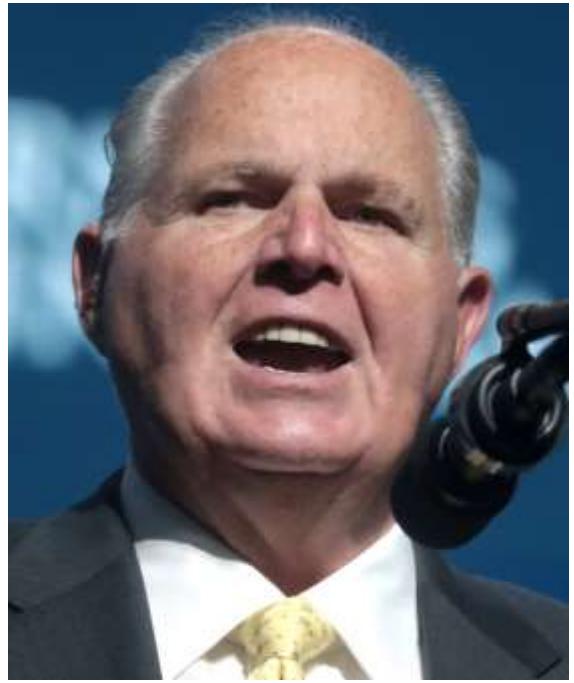
It wasn't so much the numbers themselves, frightening though they were, as who reported them: Imperial College London.

Landler, Mark, and Stephen Castle. 2020. Behind the Virus Report That Jarred the U.S. and the U.K. to Action - The New York Times.

Conflicts, when questions of urgency, stakes, values and uncertainty collide

Rush Limbaugh

"Wild-Ass Covid numbers … The minute I hear anybody start talking about models and modeling, I blanch"



Rhodes, Tim, and Kari Lancaster. 2020. "**Mathematical Models as Public Troubles in COVID-19 Infection Control: Following the Numbers**", Health Sociology Review 1-18. doi: 10.1080/14461242.2020.1764376

Mind the assumptions

Assess uncertainty and sensitivity

Mind the hubris

Complexity can be the enemy of relevance

Mind the framing

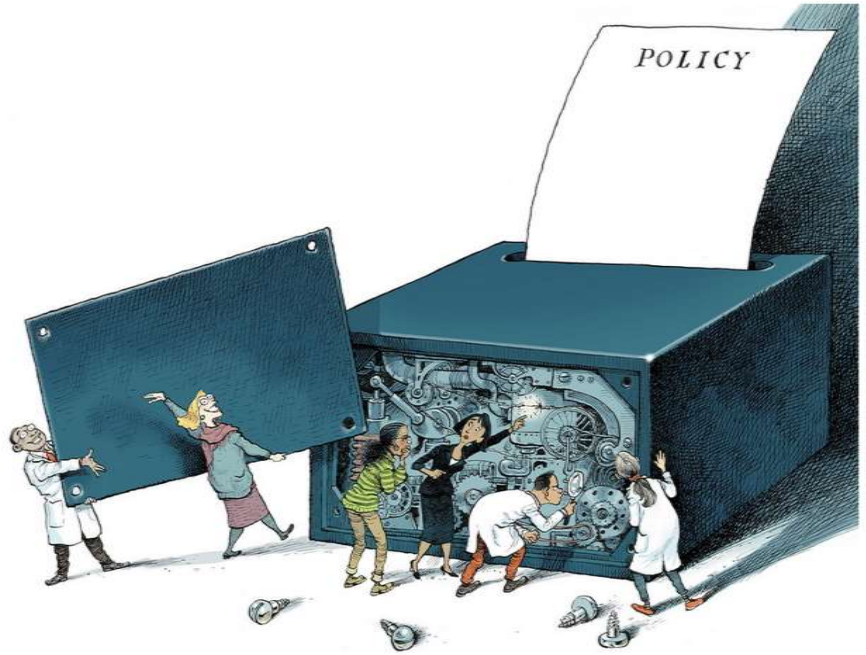
Match purpose and context

Mind the consequences

Quantification can backfire

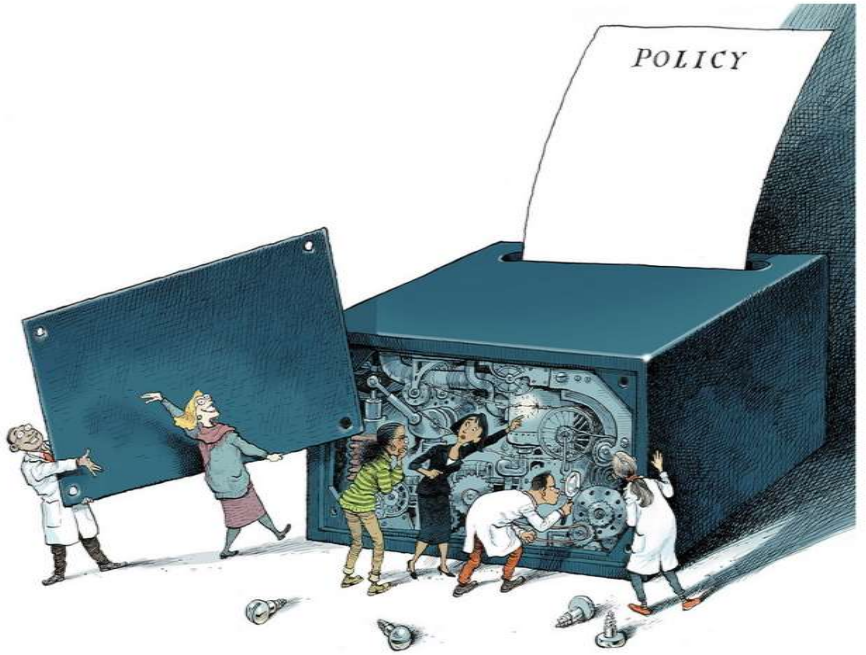
Mind the unknowns

Acknowledge ignorance



Mind the assumptions

Assess uncertainty and sensitivity

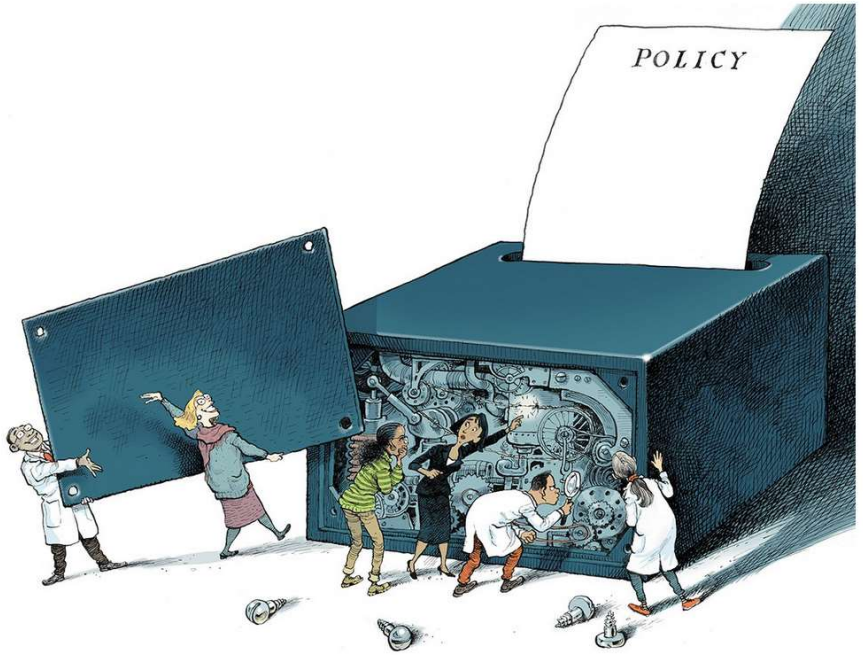


… models require input values for which there is no reliable information…

…global uncertainty and sensitivity analyses are often not done. Anyone turning to a model for insight should demand them …

Mind the assumptions

Assess uncertainty and sensitivity



… this may lead to interesting discoveries …

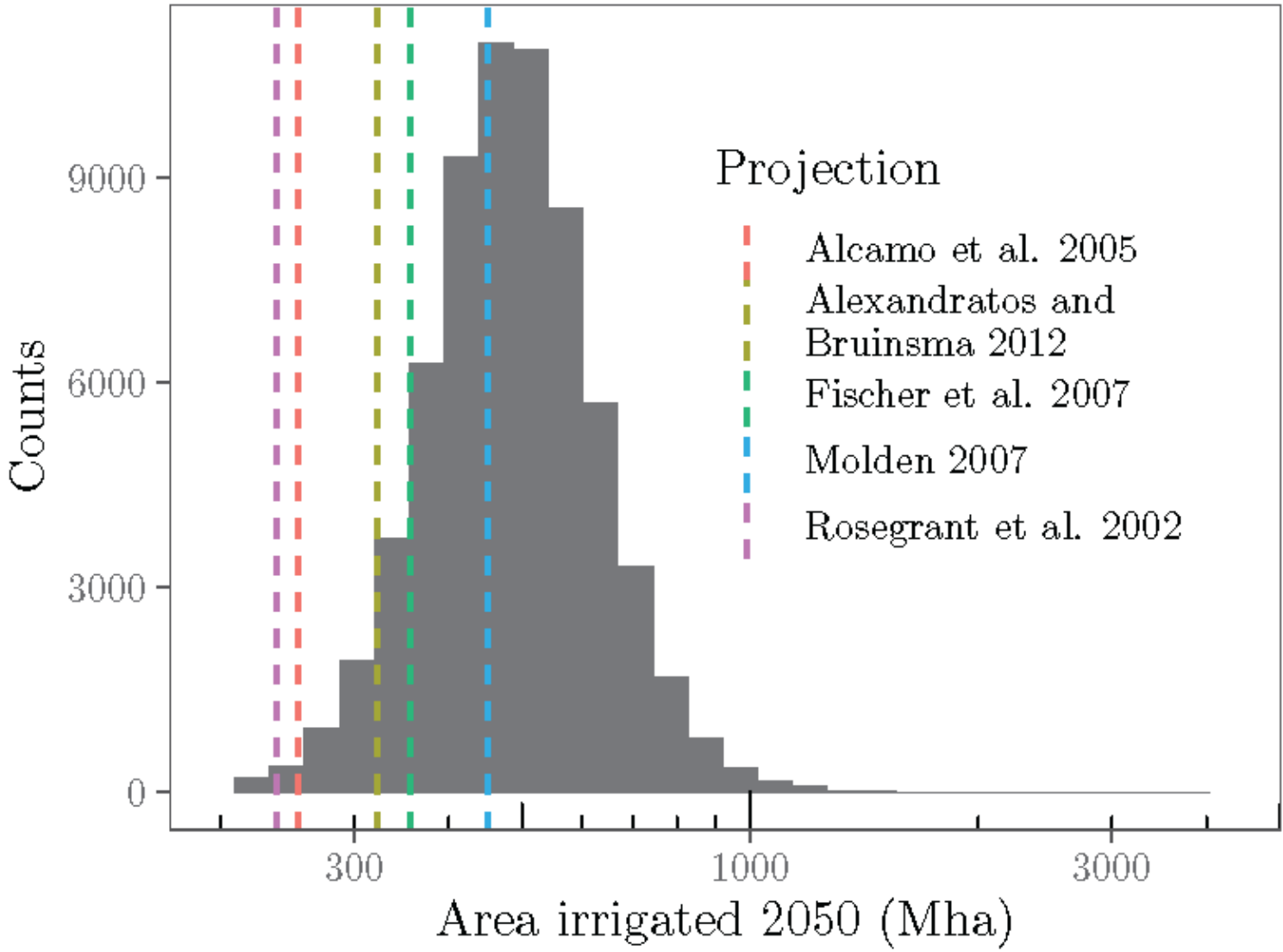
Current Models Underestimate Future Irrigated Areas

Geophysical Research Letters

A. Puy ✉, S. Lo Piano, A. Saltelli

First published: 17 April 2020

An uncertainty analysis (grey histogram) reveals that the range of possible outcomes is larger and less conservative than official estimates (dashed lines)



Results confirmed by more recent work (June 2022)

nature communications

Explore content ⌄ About the journal ⌄ Publish with us ⌄

nature › nature communications › comment › article

Comment | Open Access | Published: 08 June 2022

The delusive accuracy of global irrigation water withdrawal estimates

Arnald Puy ✉, Razi Sheikholeslami, Hoshin V. Gupta, Jim W. Hall, Bruce Lankford, Samuele Lo Piano, Jonas Meier, Florian Pappenberger, Amilcare Porporato, Giulia Vico & Andrea Saltelli

Nature Communications **13**, Article number: 3183 (2022) | Cite this article

Metrics

Models ask as input information which we don't have – The case of WEBTAG

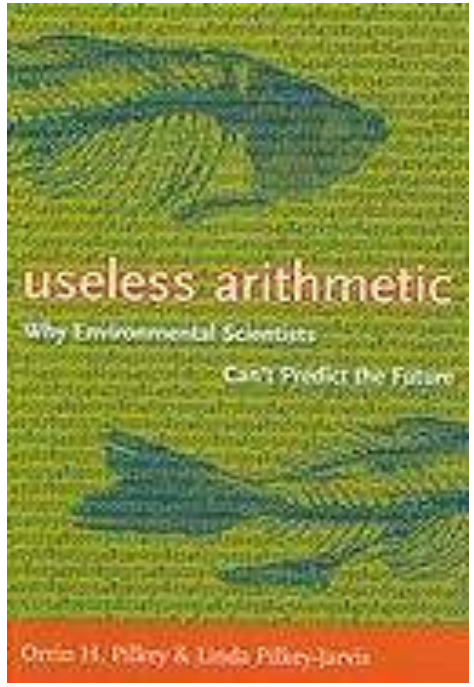
John Kay

J. A. Kay, "Knowing when we don't know," 2012, https://www.ifs.org.uk/docs/john_kay_feb2012.pdf

WebTAG: Annual Percentage Change in Car Occupancy (% pa) up to 2036

Journey Purpose	Weekday					Weekend	All Week
	7am-10am	10am-4pm	4pm-7pm	7pm-7am	Weekday Average		
Work	-0.48	-0.4	-0.62	-0.5	-0.44	-0.48	-0.45
Non - Work (commuting and other)	-0.67	-0.65	-0.53	-0.47	-0.59	-0.52	-0.56

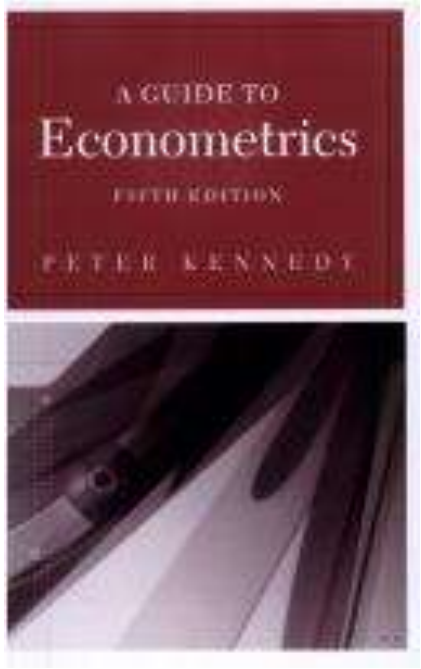
Orrin H. Pilkey



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

Peter Kennedy, A Guide to Econometrics.

One of the ten commandments of applied econometrics according to Peter Kennedy:



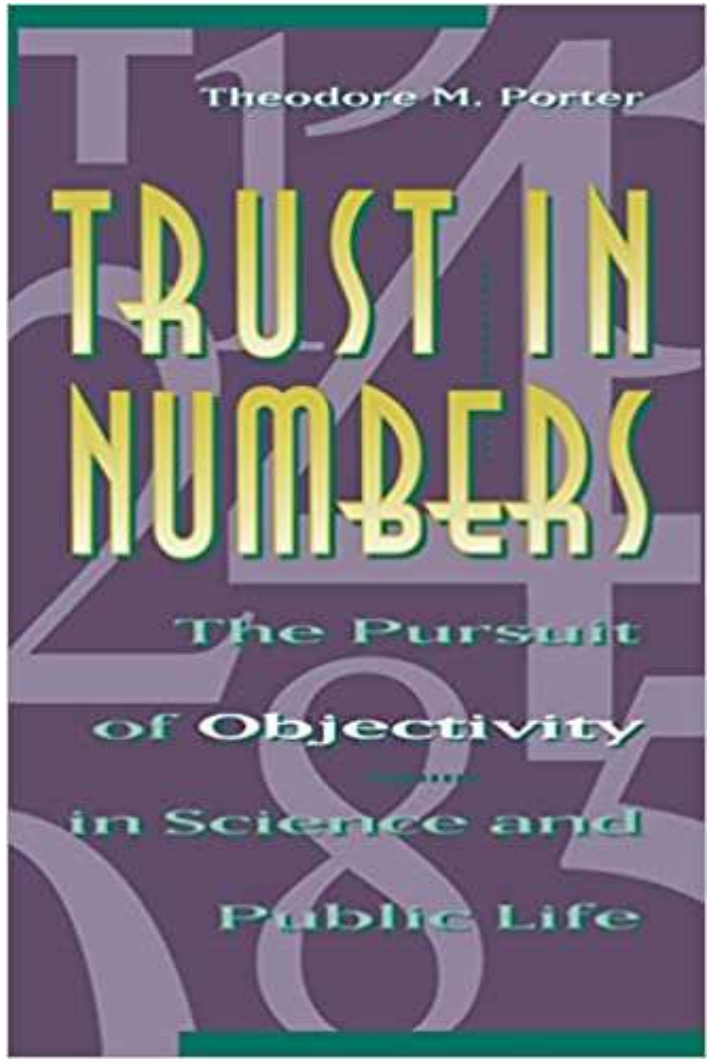
Peter Kennedy

“Thou shall confess in the presence of sensitivity. Corollary: Thou shall anticipate criticism “

"One reason these methods [global sensitivity analysis] are rarely used is their honesty seems destructive;"

"or, to put it another way, a fanatical commitment to fanciful formal models is often needed to create the appearance of progress"

Tantalus on the Road to Asymptopia, Edward E. Leamer, 2010 *Journal of Economic Perspectives*, **24**, (2), 31–46.



Cost benefit analysis: chapter 7 in Porter's book Trust in Numbers", Princeton, 1995

Theodor Porter

A cost benefit analysis can be deconstructed

Global Environmental Change 20 (2010) 298–302

Contents lists available at ScienceDirect

Global Environmental Change

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

Sensitivity analysis didn't help. A practitioner's critique of the Stern review

Andrea Saltelli *, Beatrice D'Hombres

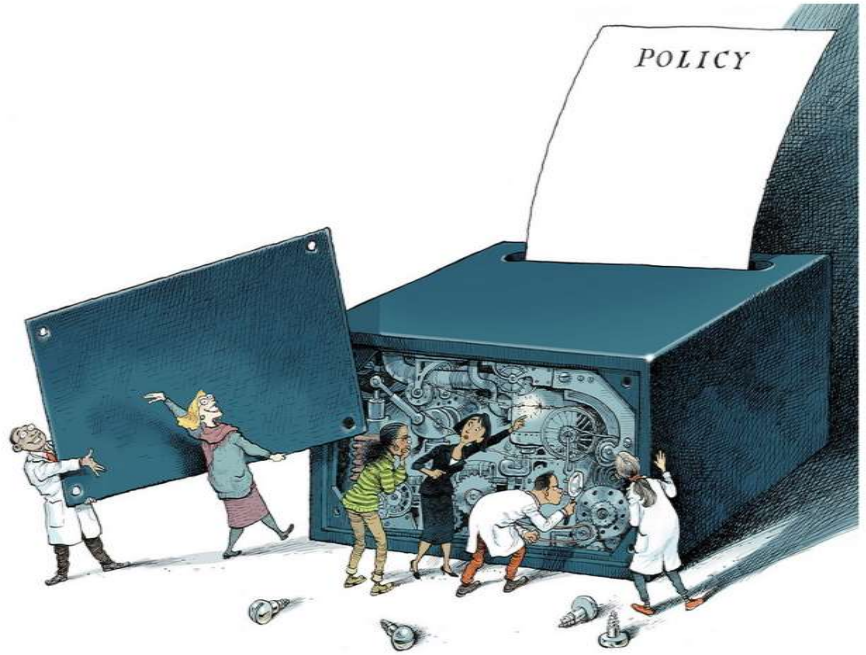
Joint Research Centre, Institute for the Protection and Security of the Citizen, Ispra, Italy

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

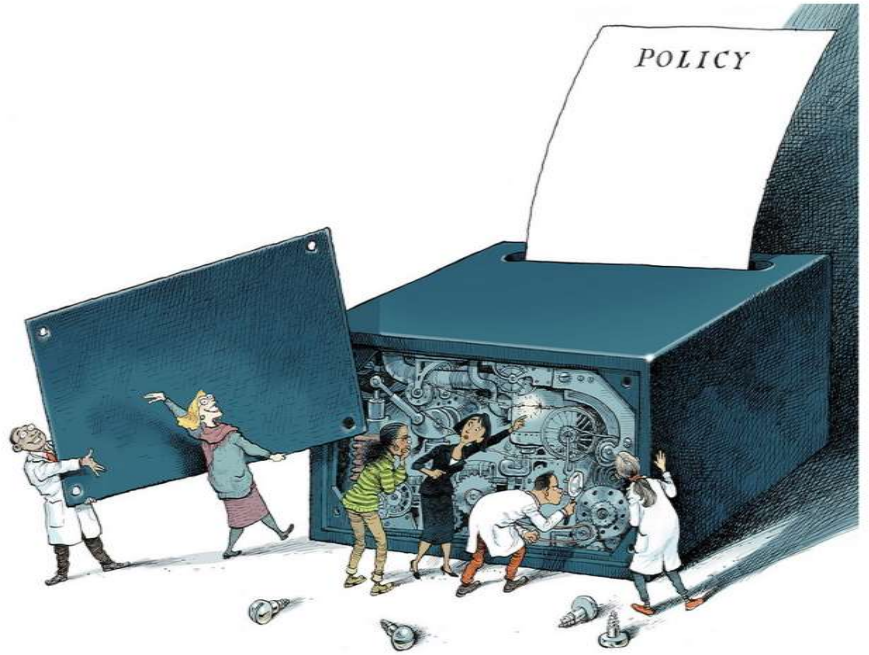
Quantification can backfire

Mind the unknowns

Acknowledge ignorance

Mind the hubris

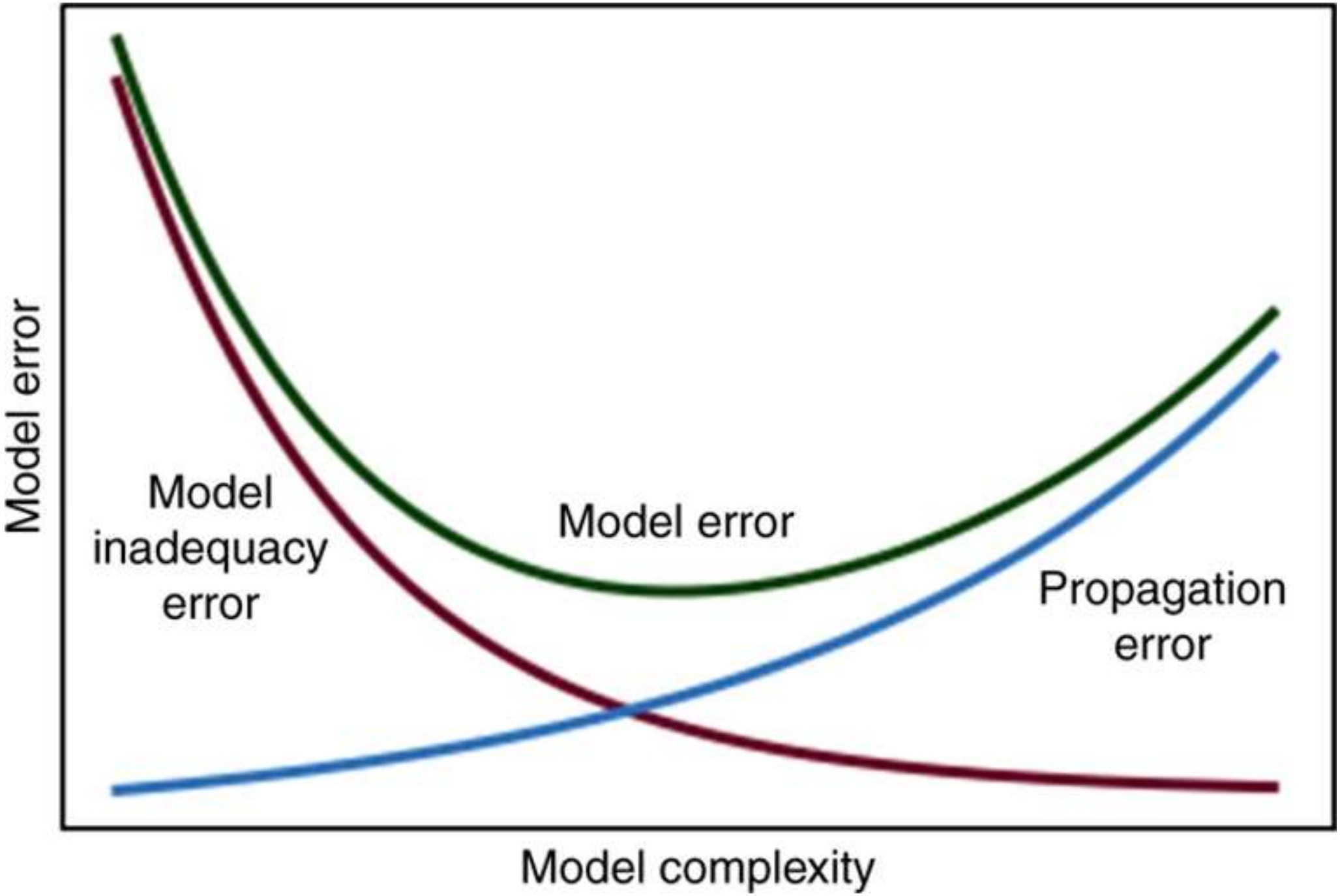
Complexity can be the enemy of relevance

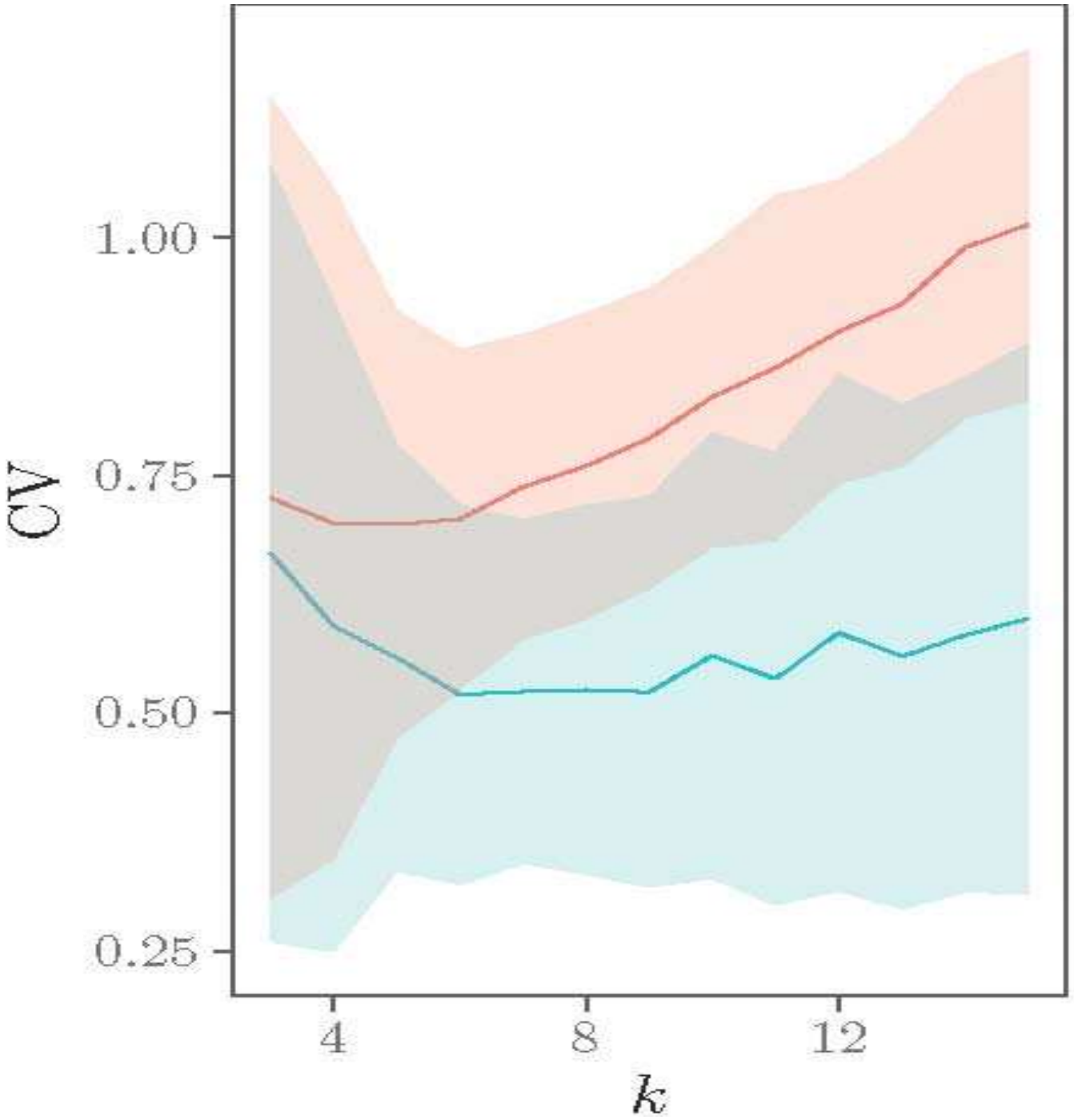


… many are seduced by the idea of adding complexity in an attempt to capture reality more accurately, but…

SUPPLEMENTARY INFORMATION

1. Additional information and references >260 references


Model error
Model inadequacy error
Model error
Propagation error
Model complexity



O'Neil conjecture

CV=coeff. of variation=
STD/mean
k model dimensionality

Interactions

Up to the k-th order

Up to the n-th order

with $n \leq k$

From A. Puy et al, "Effective dimension and model uncertainty", **paper in progress**

Mind the assumptions

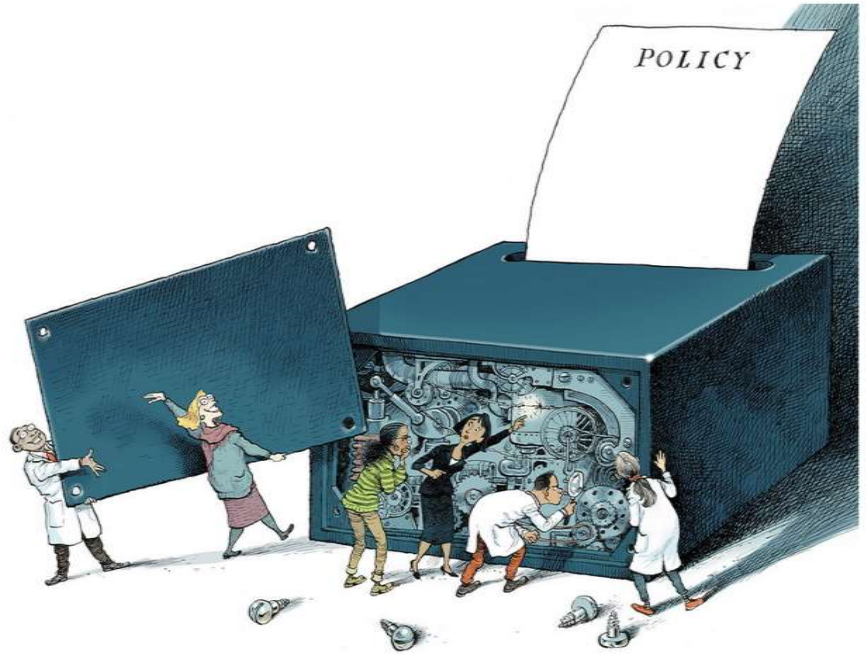
Assess uncertainty and sensitivity

Mind the hubris

Complexity can be the enemy of relevance

Mind the framing

Match purpose and context



Mind the consequences

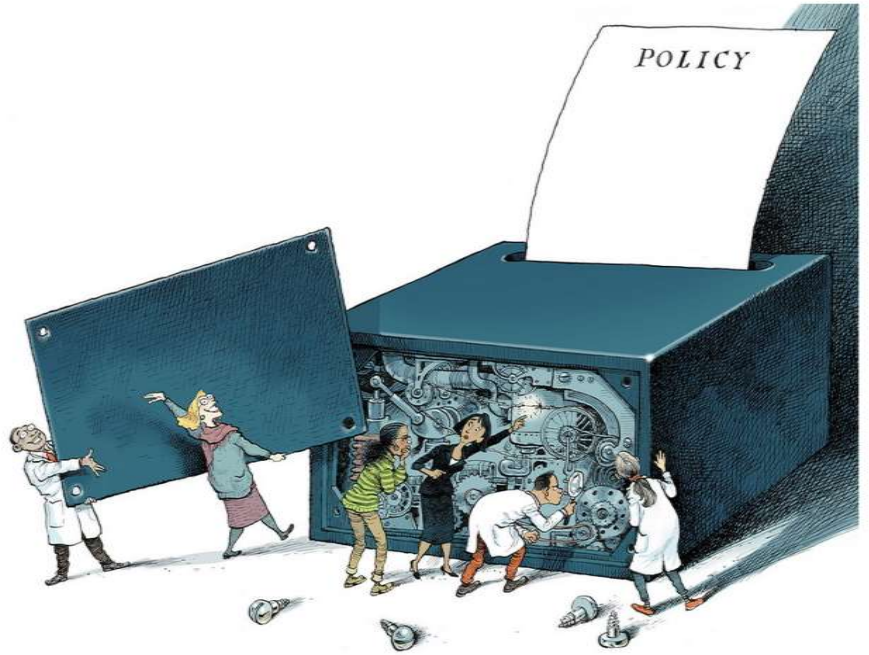
Quantification can backfire

Mind the unknowns

Acknowledge ignorance

Mind the framing

Match purpose and context



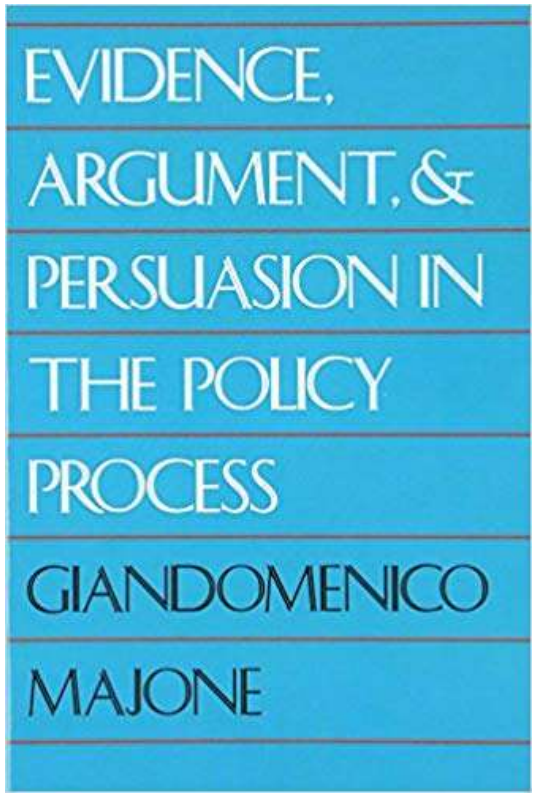
… models will reflect the interests, disciplinary orientations and biases of the developers…

SUPPLEMENTARY INFORMATION

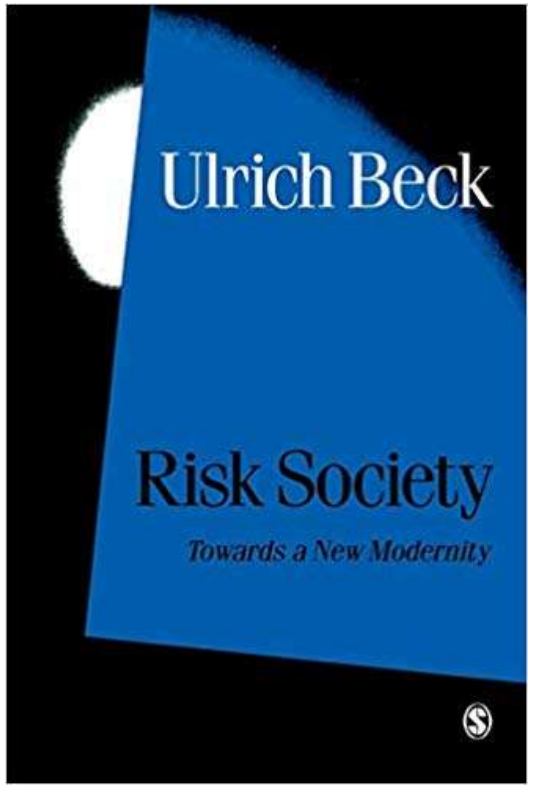
1. Additional information and references >260 references

From Ulrich Beck to Giandomenico Majone: the technique is never neutral

Ulrich Beck
(1944 –2015)



1989



1992 (1986)

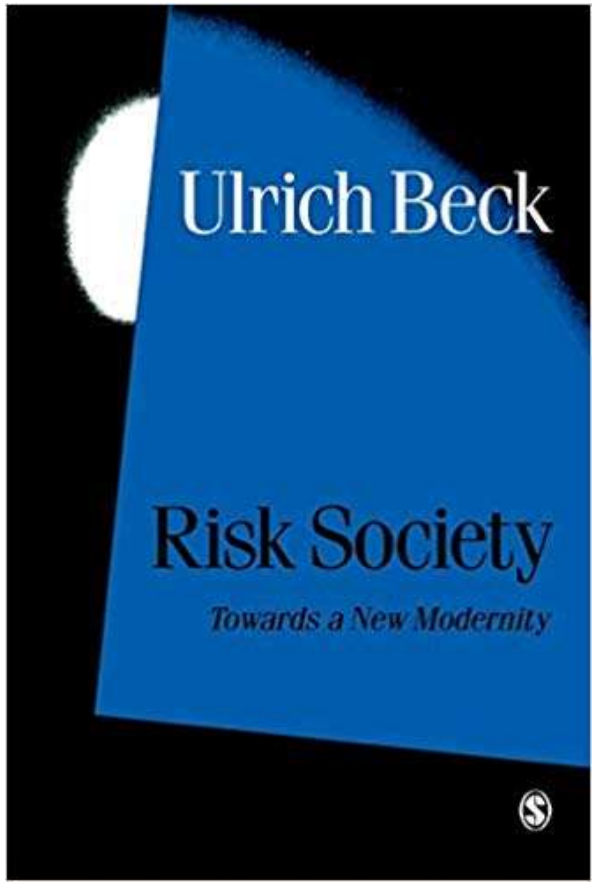
ELSEVIER

Environmental Science & Policy
Volume 106, April 2020, Pages 87-98

The technique is never neutral. How methodological choices condition the generation of narratives for sustainability

Andrea Saltelli [a, b], Lorenzo Benini [c], Silvio Funtowicz [a], Mario Giampietro [d, e], Matthias Kaiser [a], Erik Reinert [a, f], Jeroen P. van der Sluijs [a, g, h]

“It is not uncommon for political programs to be decided in advance simply by the choice of what expert representatives are included in the circle of advisers.”



1992 (1986)

Ulrich Beck
(1944 –2015)

The technique is never neutral. How methodological choices condition the generation of narratives for sustainability

Environmental Science & Policy
Volume 106, April 2020, Pages 87-98

Andrea Saltelli [a, b], Lorenzo Benini [c], Silvio Funtowicz [a], Mario Giampietro [d, e], Matthias Kaiser [a], Erik Reinert [a, f], Jeroen P. van der Sluijs [a, g, h]

Combine more lenses, including Post-normal science (PNS), Bioeconomics, and Non-Ricardian economics

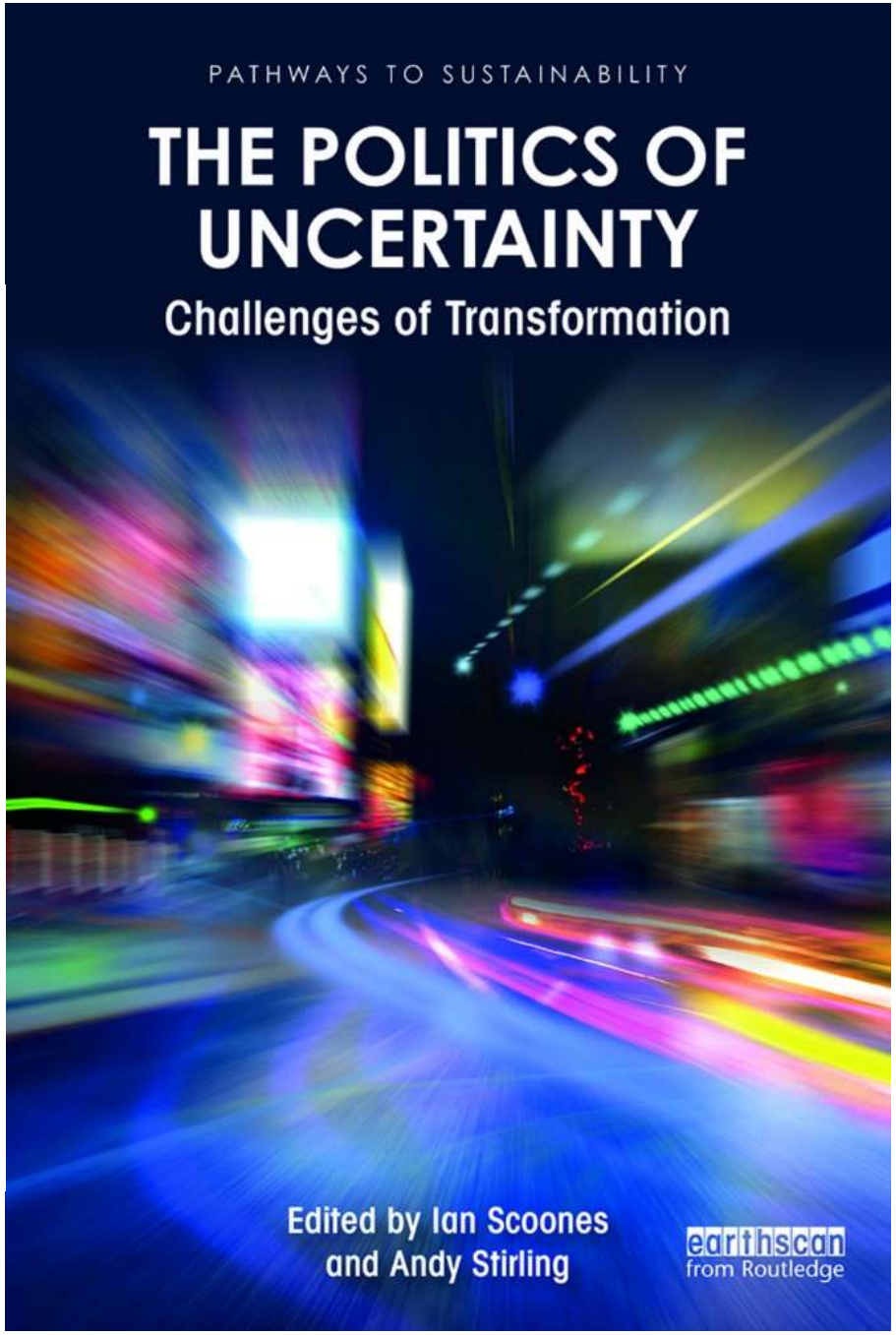
On reductionism

4

THE UNRAVELLING OF TECHNOCRATIC ORTHODOXY?

Contemporary knowledge politics in technology regulation

Patrick van Zwanenberg



Frames as hypocognition & Socially constructed ignorance

Steve Rayner

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

Rayner's (2012) strategies to deal with "uncomfortable knowledge".

Denial, Dismissal, Diversion, Displacement

Model based

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

Displacement: “The model we have developed tells us that real progress is being achieved” (The focus in now the model not the problem).

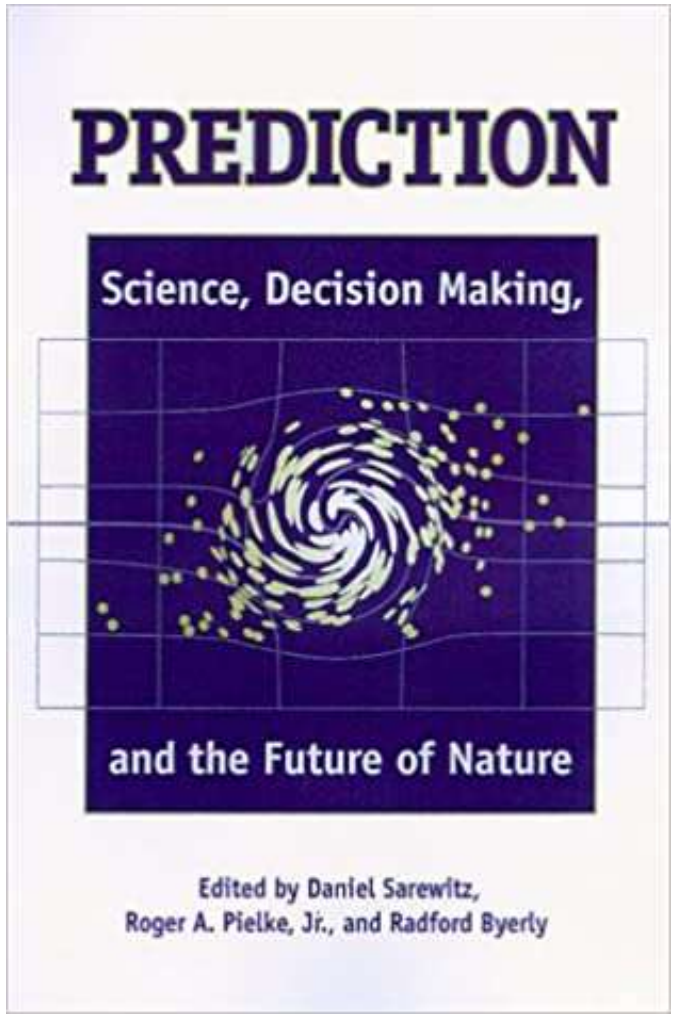
Rayner, S., 2012, Uncomfortable knowledge: the social construction of ignorance in science and environmental policy discourses, Economy and Society, 41:1, 107-125.

Example of displacement: Chesapeake Bay Program (CBP) modelling work

"Bay models are used to track nutrient loads to ensure the cap is not exceeded"

➔The model results – rather than the actual measurements, become the substance of use

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



Model GENESIS for beach erosion

US Army Corps of Engineers ®

Manipulated to support coastal-engineering projects

It neglected the role of extreme event

Sarewitz, D., Pielke, R. A. & Byerly, R. *Prediction: Science, Decision Making, and the Future of Nature* (Island Press, 2000).

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

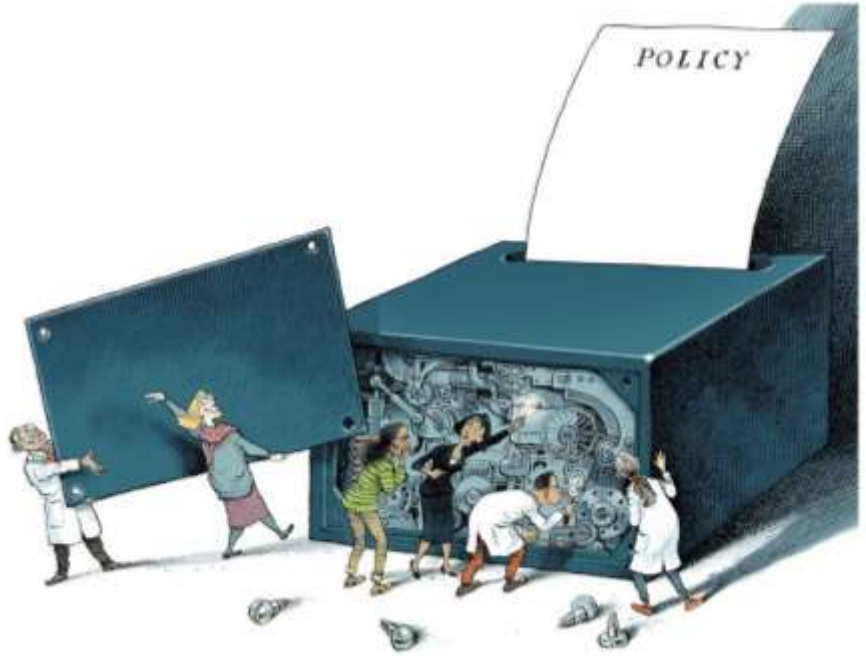
Quantification can backfire

Mind the unknowns

Acknowledge ignorance

Mind the consequences

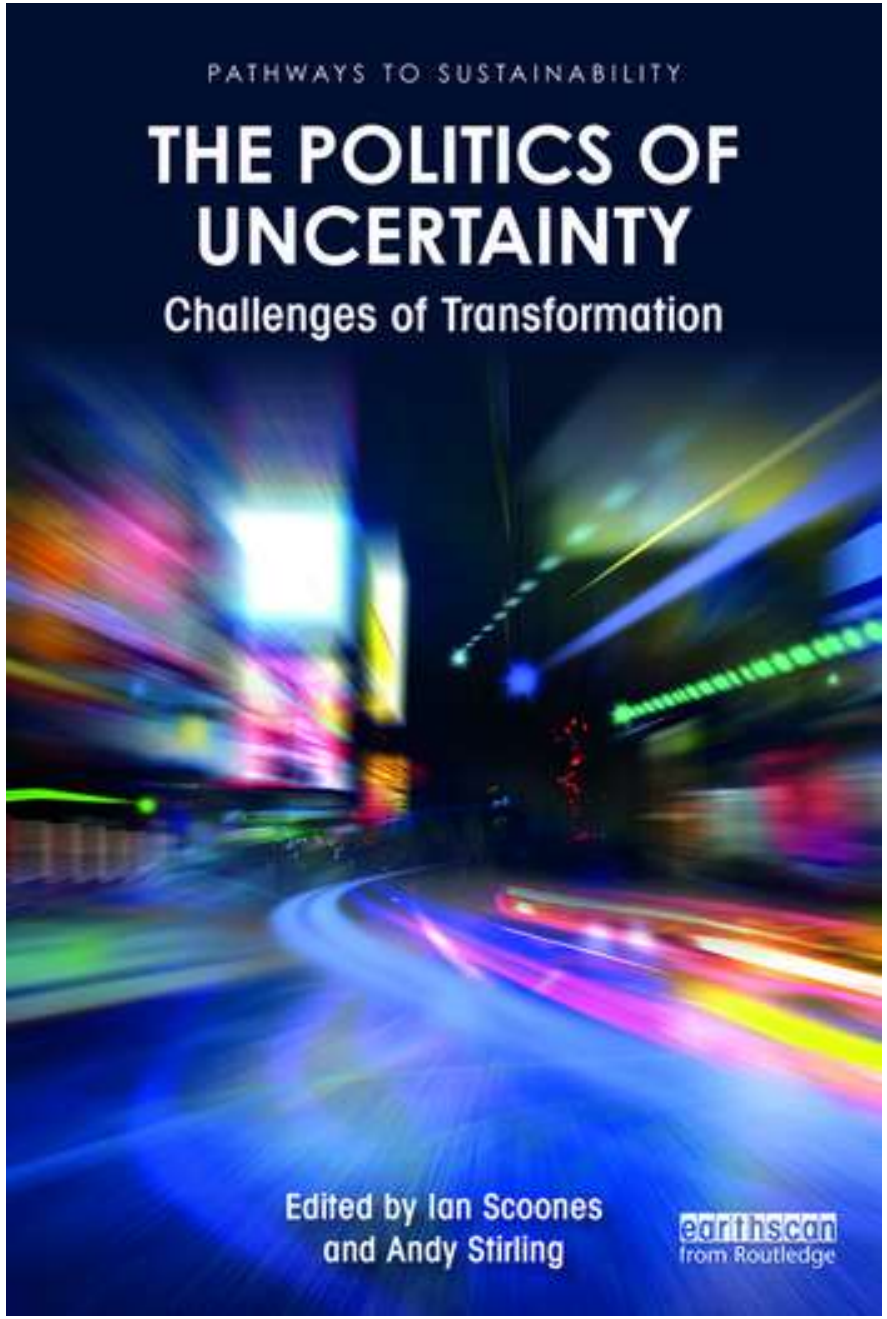
Quantification can backfire



From the risk of financial products to the management of costal zones to the models for disaster insurance bad modelling may lead to wrong decisions

SUPPLEMENTARY INFORMATION

1. Additional information and references >260 references



3

SHARING RISKS OR PROLIFERATING UNCERTAINTIES?

Insurance, disaster and development

Leigh Johnson

Model-based parametric insurance led to dramatic consequences for developing countries experiencing draughts

Open access: https://www.taylorfrancis.com/books/politics-uncertainty-ian-scoones-andy-stirling/e/10.4324/9781003023845

New WHO estimates: Up to 190 000 people could die of COVID-19 in Africa if not controlled

07 May 2020

Brazzaville – Eighty-three thousand to 190 000 people in Africa could die of COVID-19 and 29 million to 44 million could get infected in the first year of the pandemic if containment measures fail, a new study by the World Health Organization (WHO) Regional Office for Africa finds. The research, which is based on prediction modelling, looks at 47 countries in the

Speculative scenario in which ten uncertain input probabilities are increased by an arbitrary 10% — as if they were truly equally uncertain — with no theoretical or empirical basis for such a choice

World Health Organization
REGIONAL OFFICE FOR Africa

Mind the assumptions

Assess uncertainty and sensitivity

Mind the hubris

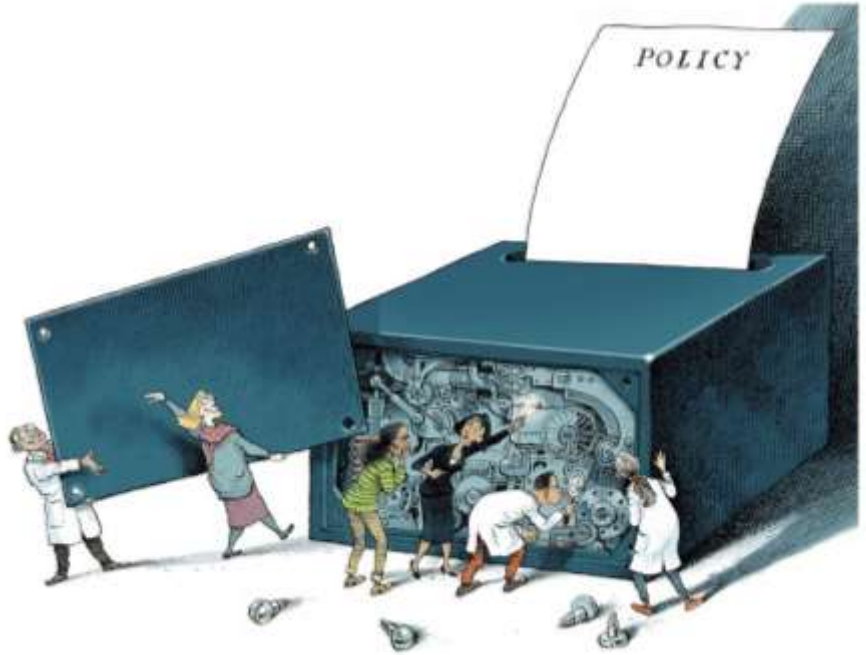
Complexity can be the enemy of relevance

Mind the framing

Match purpose and context

Mind the consequences

Quantification can backfire

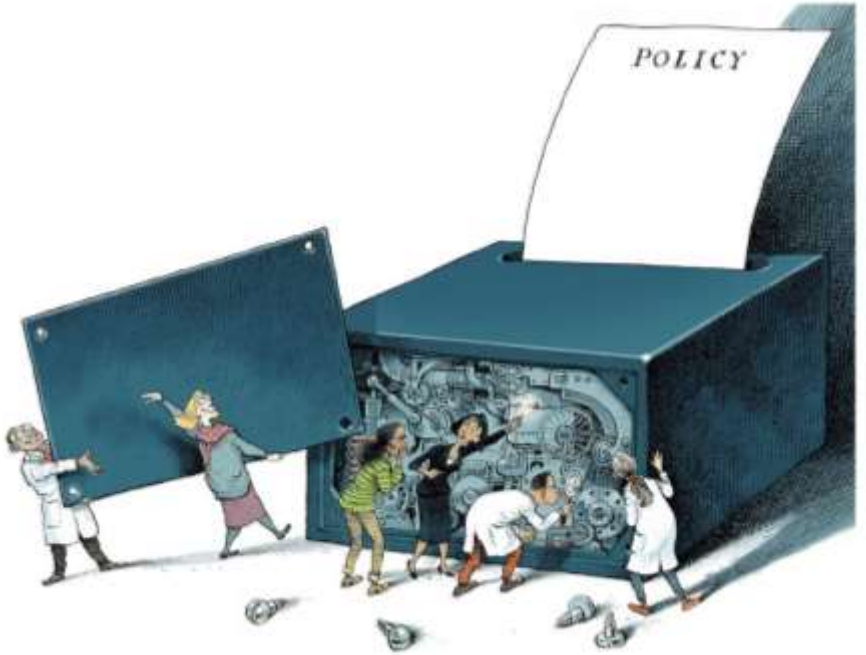


Mind the unknowns

Acknowledge ignorance

Mind the unknowns

Acknowledge ignorance



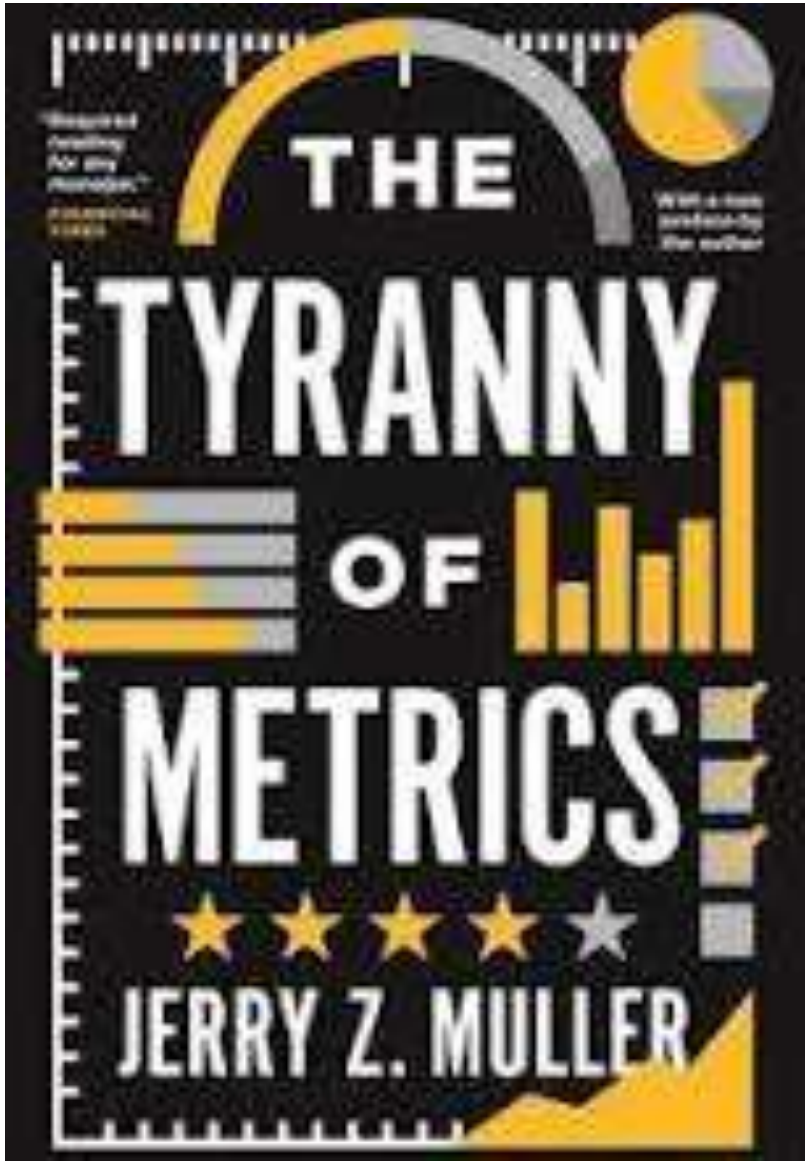
"there is no number-answer to your question"

Anthony Fauci

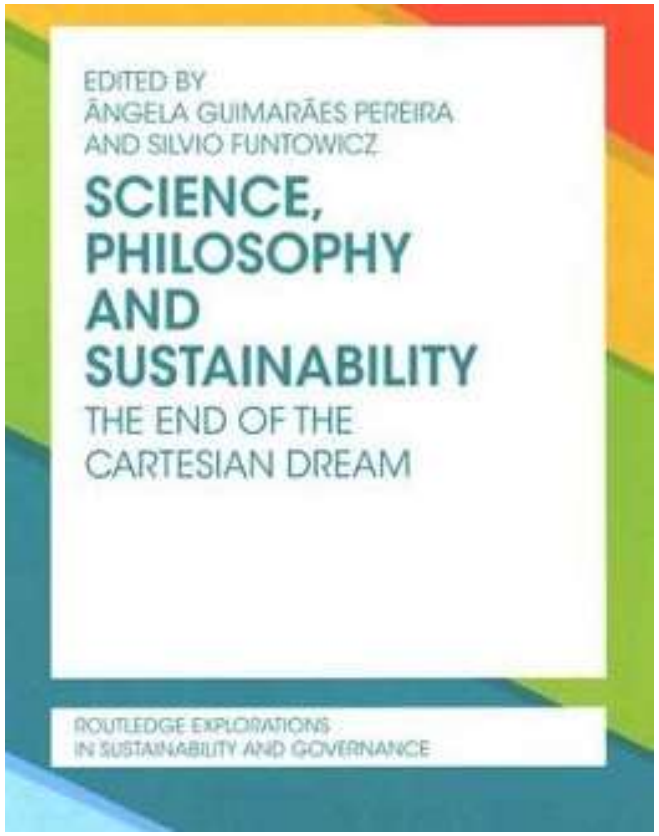
SUPPLEMENTARY INFORMATION

1. Additional information and references

>260 references



"keep in mind at every step that the best use of metrics may be not to use it at all"



Jerome R. Ravetz

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.

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

ELSEVIER

Futures

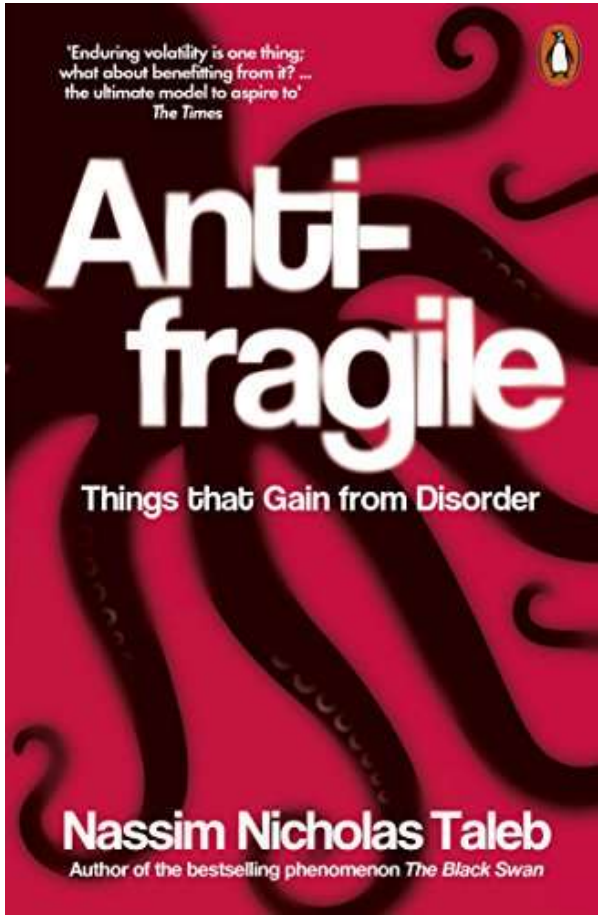
Volume 91, August 2017, Pages 62-71

Original research article

What is wrong with evidence based policy, and how can it be improved?

Andrea Saltelli [a, b, c] ✉, Mario Giampietro [a, c, d]

Responsible use of quantitative information; try via negativa (N. Taleb); instead of proving policy options try to falsify them



ELSEVIER

Futures

Volume 91, August 2017, Pages 62-71

Original research article

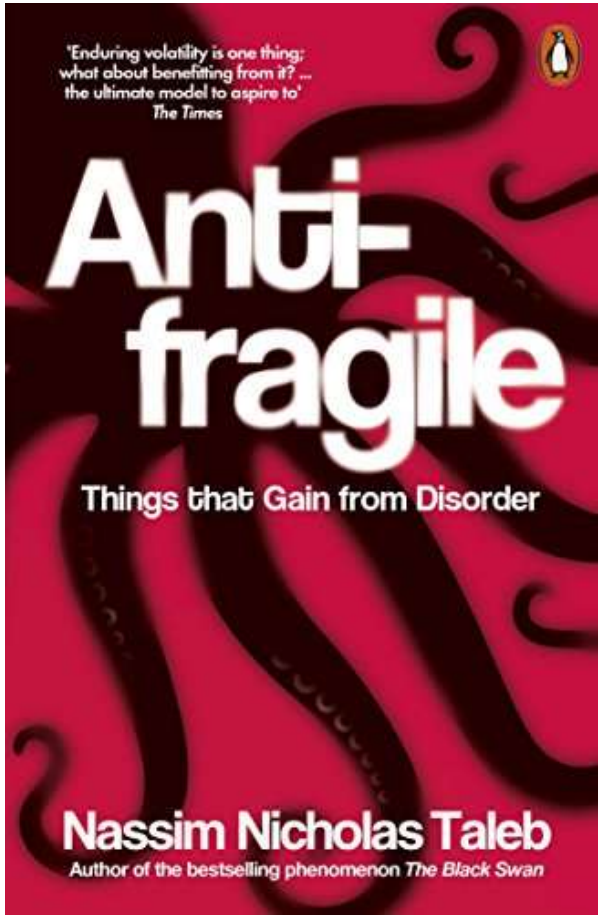
What is wrong with evidence based policy, and how can it be improved?

Andrea Saltelli [a, b, c], Mario Giampietro [a, c, d]

"…we know what is wrong with more clarity than what is right, and that knowledge grows by subtraction

… easier to know that something is wrong than to find the fix …

Actions that remove are more robust than those that add because addition may have unseen, complicated feedback loops"



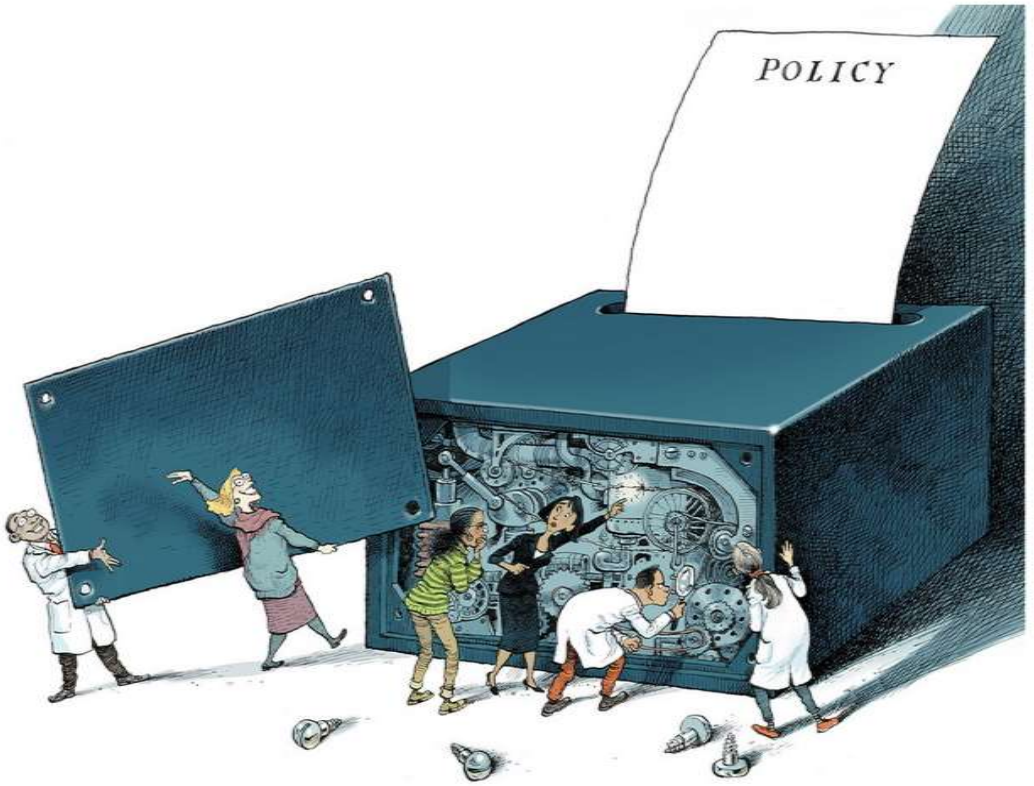
Falsification of the available options based on:

- Feasibility (compatibility with external constraints),
- Viability (compatibility with internal constraints), and
- Desirability (compatibility with normative values adopted in the given society)

nature

Explore content ⌄ Journal information ⌄ Publish with us ⌄

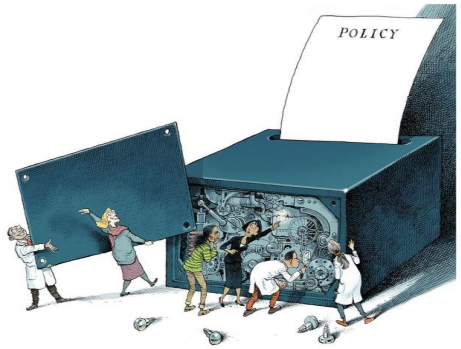
nature › comment › article



COMMENT | 24 June 2020

Five ways to ensure that models serve society: a manifesto

➔ Responsible modelling; reciprocal domestication between models and society



“Modellers must not be permitted to project more certainty than their models deserve;

and politicians must not be allowed to offload accountability to models of their choosing”

The End

@andreasaltelli