

Science, ethics and quantification

Andrea Saltelli

Series: PHILOSOPHY OF
MEDICAL CORONA SCIENCE

Friday 4th November 2022, virtual
Bertalanffy Center for the Study of Systems Science



Do we live immersed in
fantastic numbers?

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

Sept. 17, 2021

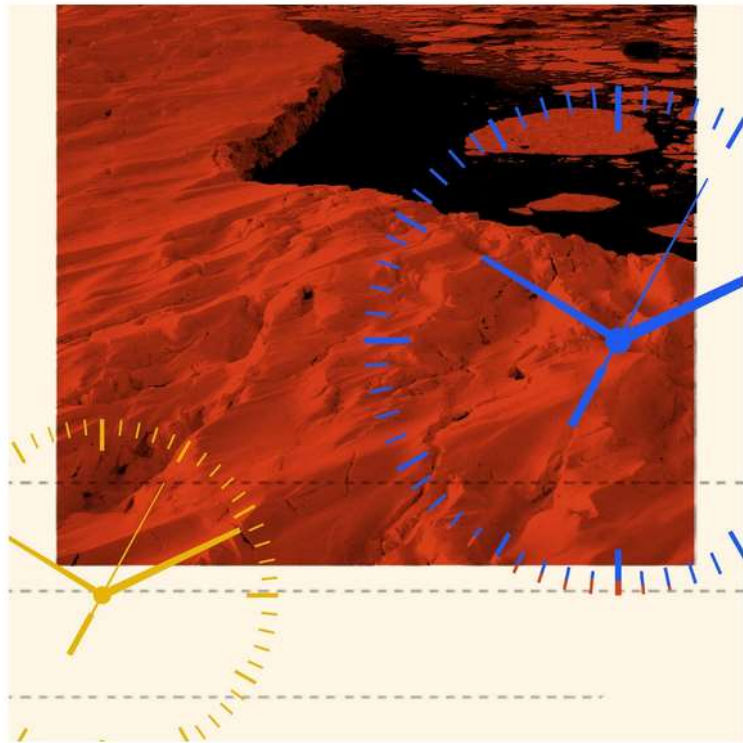


Illustration by Arsh Raziuddin, The New York Times

“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



The Social Cost of Carbon: Advances in Long-Term Probabilistic Projections of Population, GDP, Emissions, and Discount Rates

Kevin Rennert, Brian C. Prest, William A. Pizer, Richard G. Newell, David Anthoff,
Cora Kingdon, Lisa Rennels, Roger Cooke, Adrian E. Raftery, Hana Ševčíková,
and Frank Errickson

Working Paper 21-28
October 2021

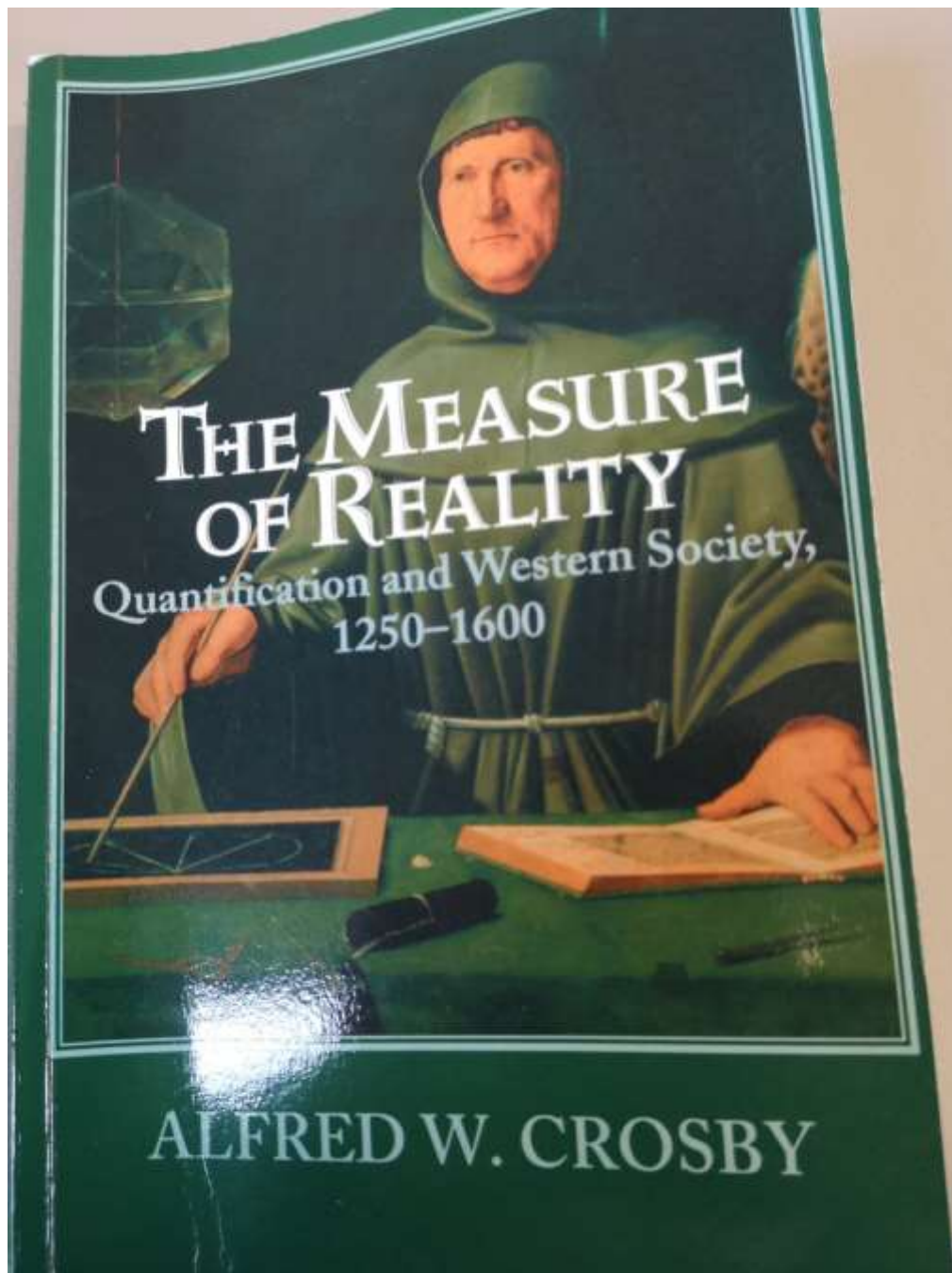
Averaged till year 2300
Feeds into policy design

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

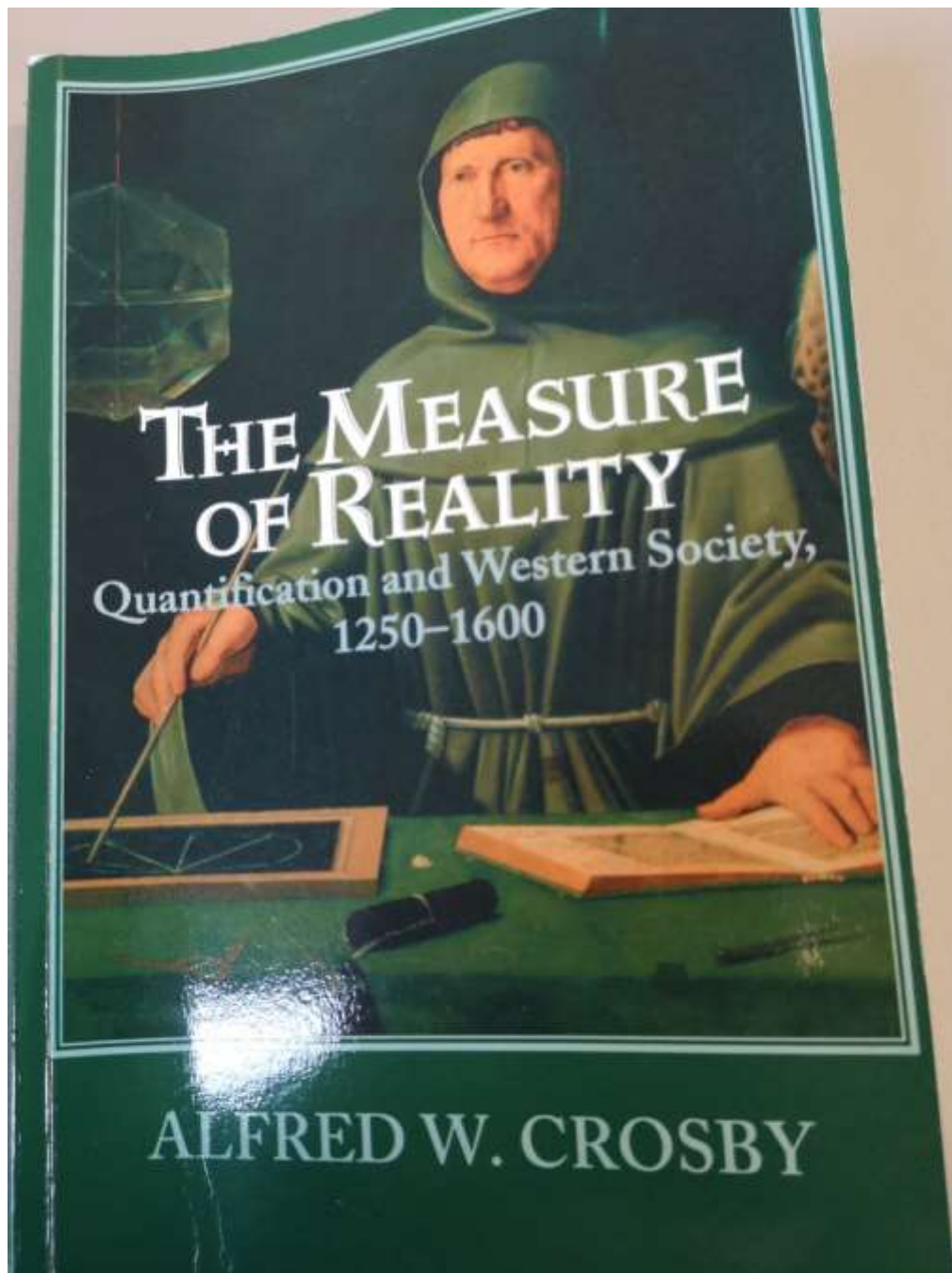


Jerome R. Ravetz

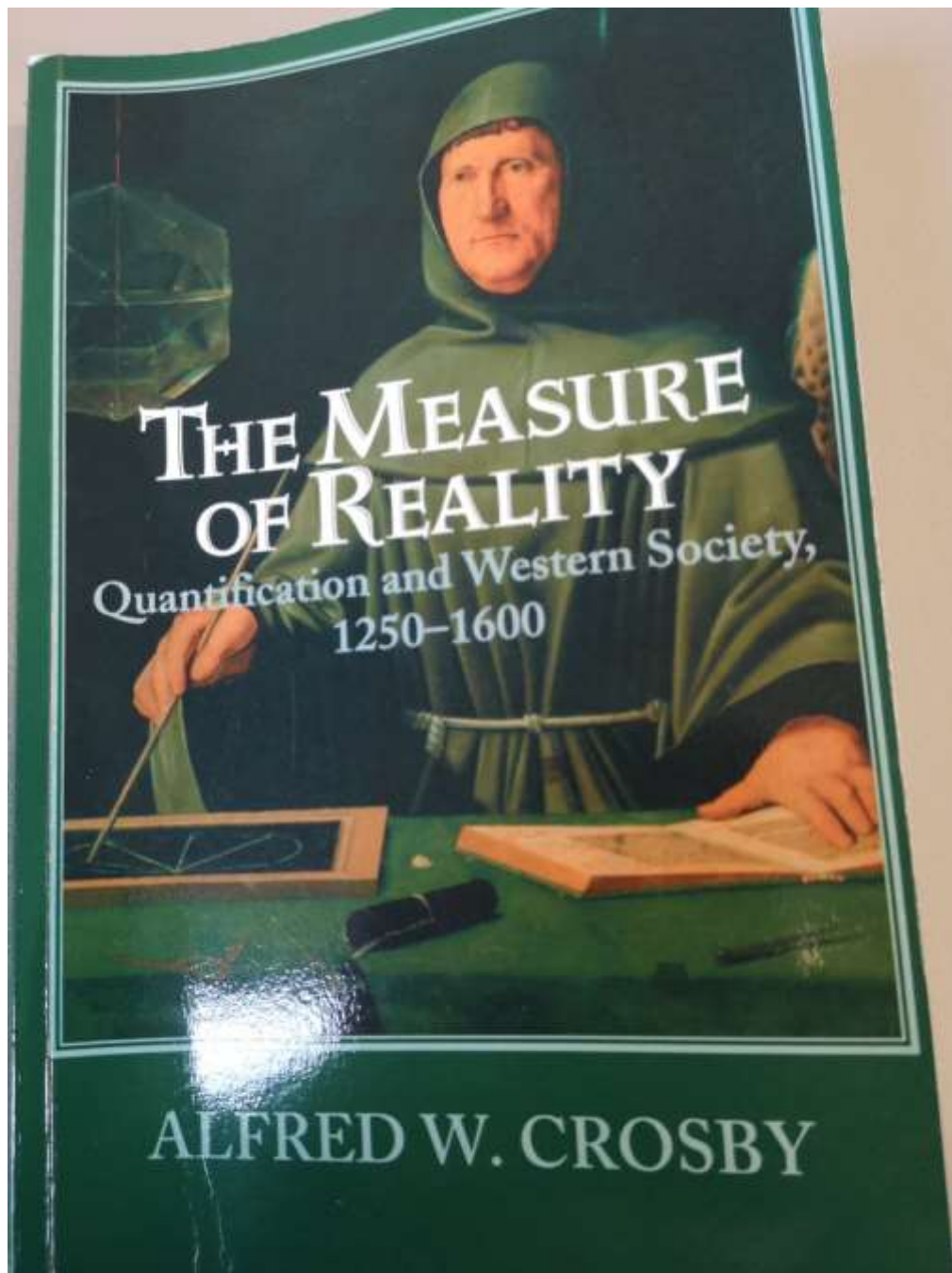
How did we get there?



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



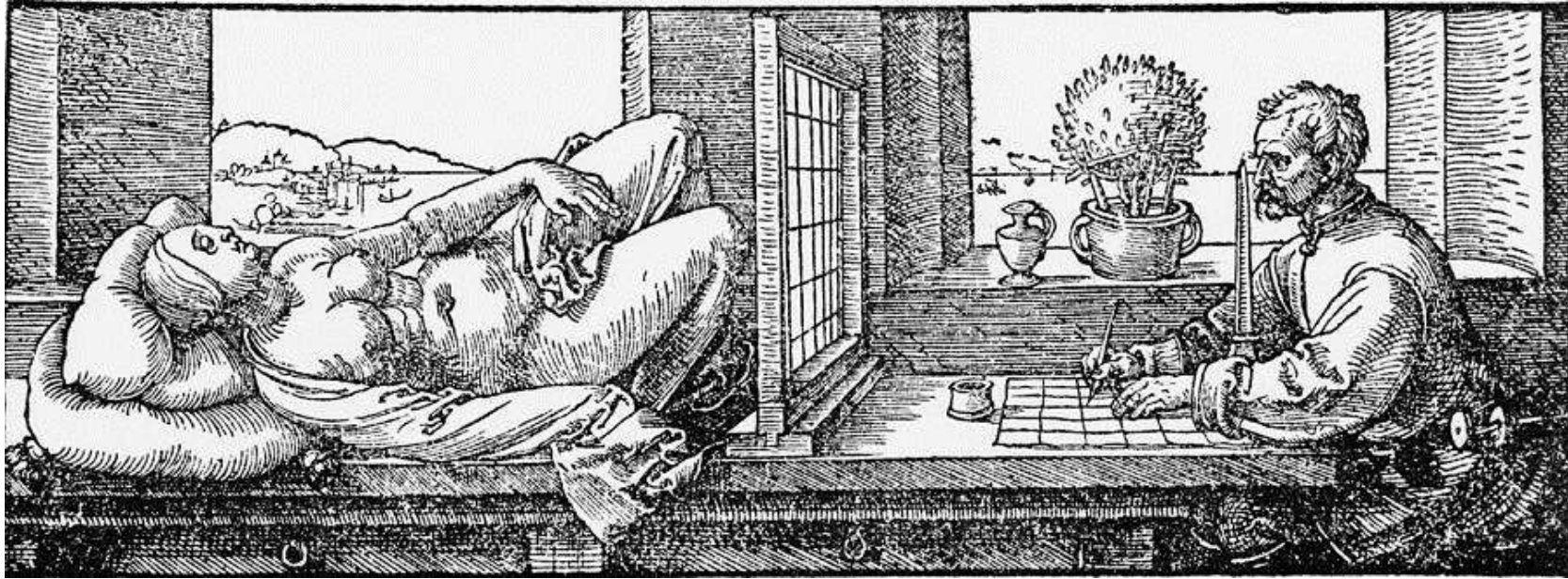
Quantification and visualization of space and time gave rise in the XIV century to a true revolution, in music, painting, accounting, cartography, astronomy ...



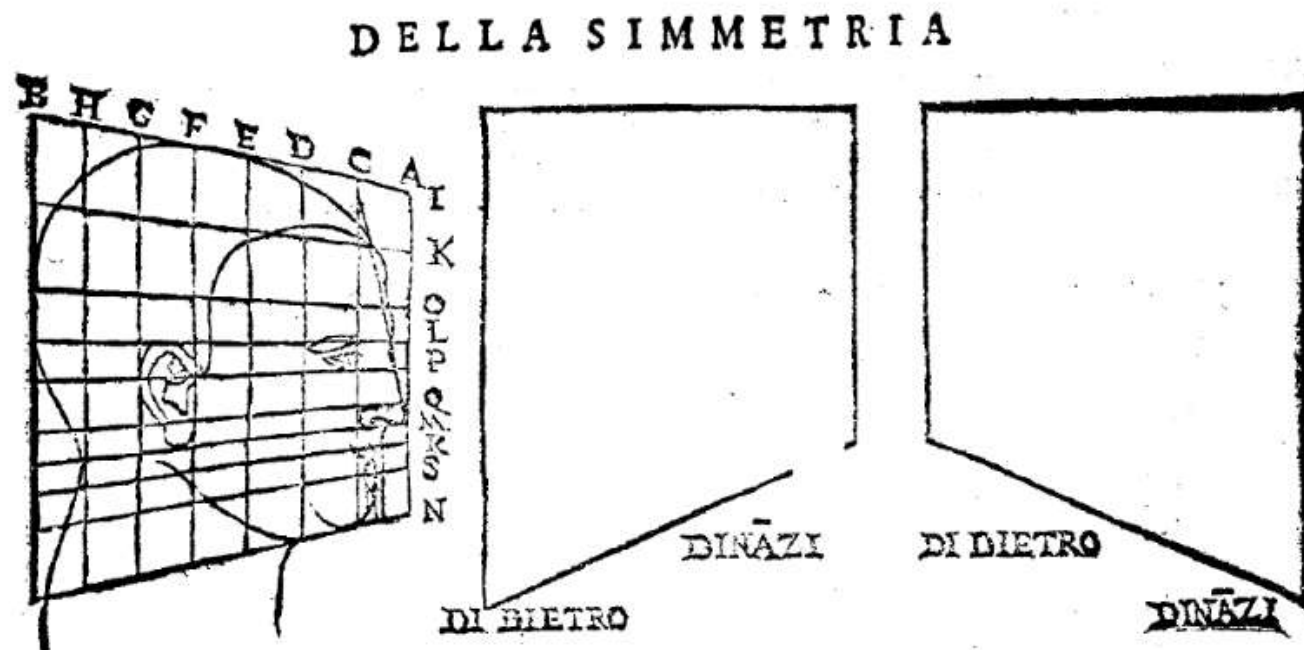
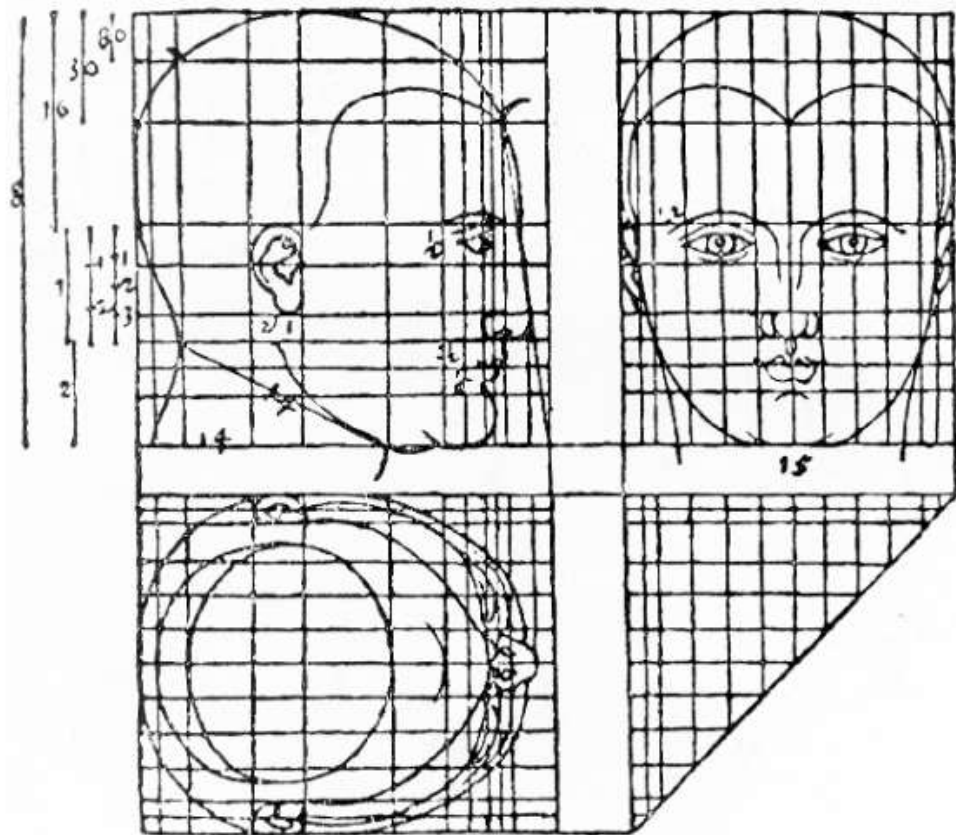
... a revolution that in the following two centuries XV–XVI ensured the epochal success of the West and its domination over the rest of the world



The Annunciation,
Carlo Crivelli
(1435, 1495)

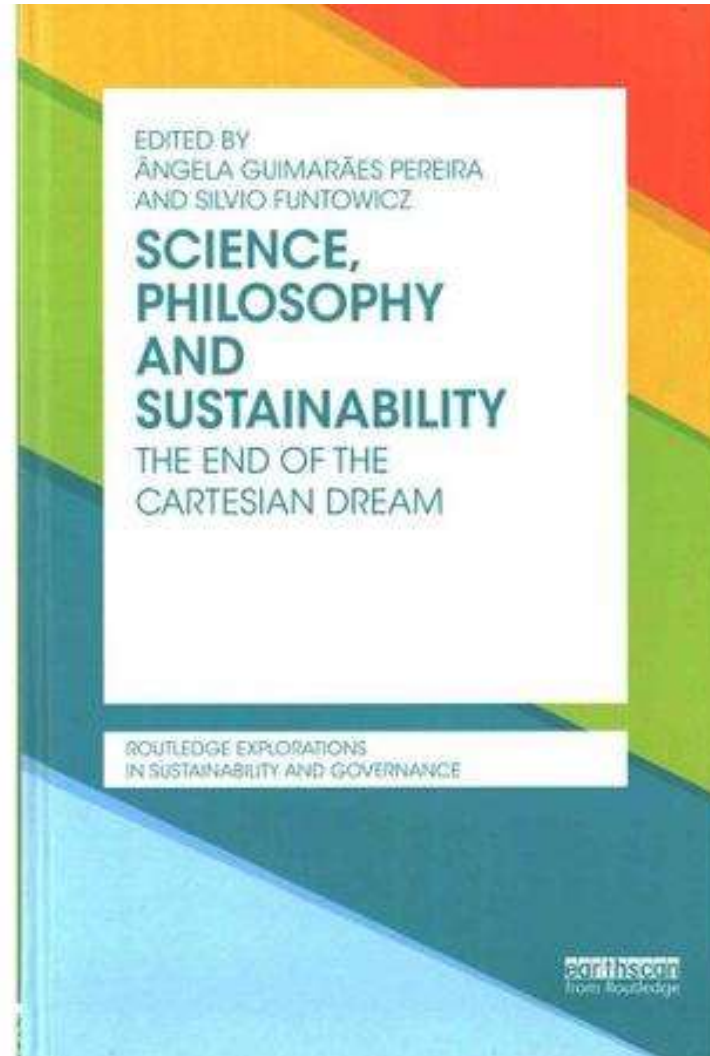
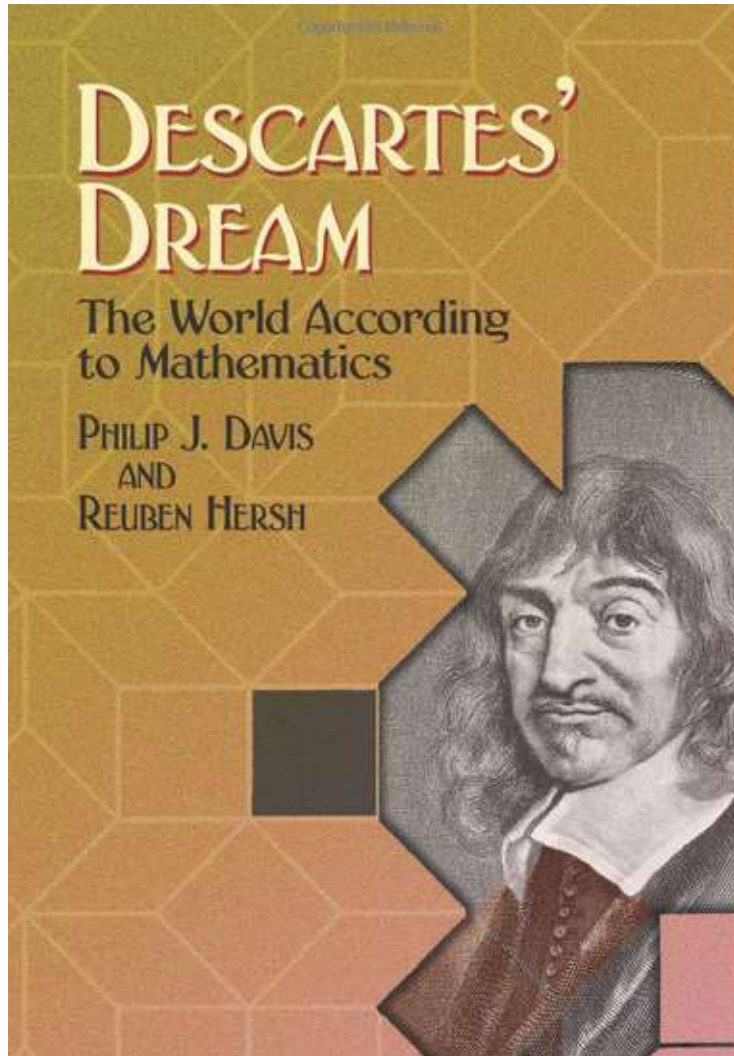


Draftsman Drawing a Reclining Nude
Albrecht Dürer (1471–1528)



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

Quantification as a key element of the Cartesian Dream



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)

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)

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’

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



Marquis de Condorcet

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

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



Science's crisis: the end
of the Cartesian dream



Futures

Volume 91, August 2017, Pages 5-11



What is science's crisis really about?

Andrea Saltelli ^{a, b}  , Silvio Funtowicz ^a



Futures

Volume 104, December 2018, Pages 85-90



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

Andrea, Saltelli 



THE RIGHTFUL PLACE OF SCIENCE: **SCIENCE ON THE VERGE**

CONTRIBUTORS

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



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

The crisis is methodological, epistemological, ethical and metaphysical

Downloaded from <http://rsos.royalsocietypublishing.org/> on September 23, 2016

ROYAL SOCIETY
OPEN SCIENCE

rsos.royalsocietypublishing.org

Research



Cite this article: Smaldino PE, McElreath R.

2016 The natural selection of bad science.

R. Soc. open sci. **3**: 160384.

<http://dx.doi.org/10.1098/rsos.160384>

Received: 1 June 2016

Accepted: 17 August 2016

The natural selection of bad science

Paul E. Smaldino¹ and Richard McElreath²

¹Cognitive and Information Sciences, University of California, Merced, CA 95343, USA

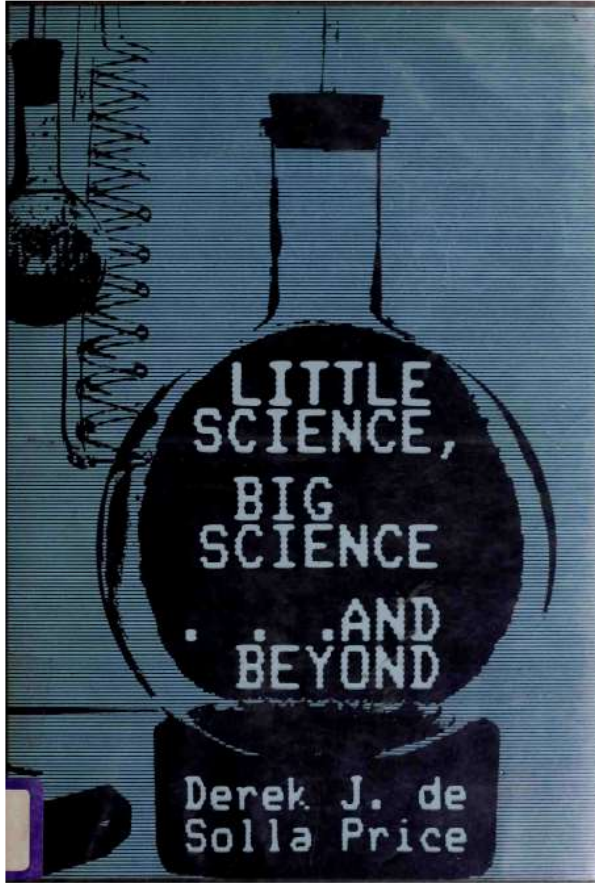
²Department of Human Behavior, Ecology, and Culture, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany

PES, 0000-0002-7133-5620; RME, 0000-0002-0387-5377

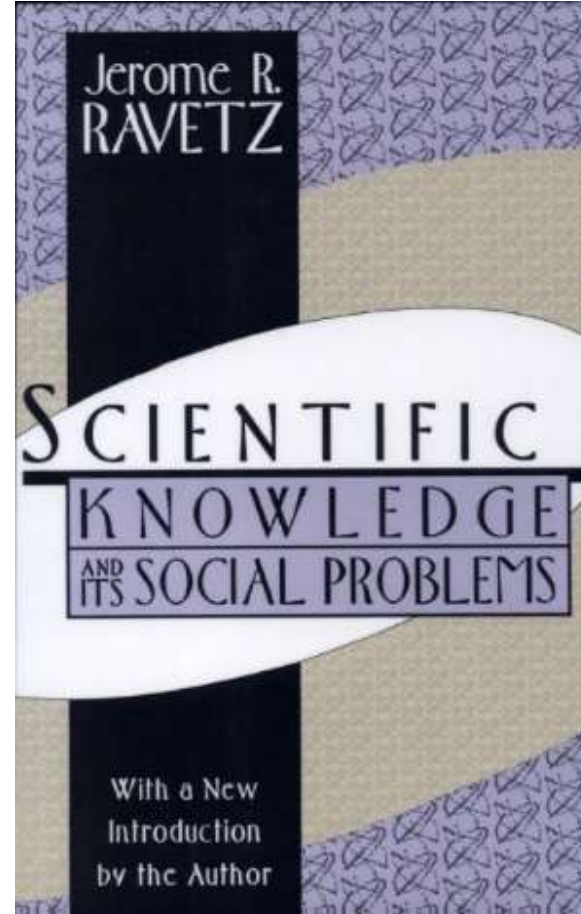
Poor research design and data analysis encourage false-positive findings. Such poor methods persist despite perennial calls for improvement, suggesting that they result from something more than just misunderstanding. The persistence of poor methods results partly from incentives that favour them, leading to the natural selection of bad science. This dynamic requires no conscious strategizing—no deliberate cheating nor loafing—by scientists, only that publication is a principal factor for

... it will
become
worse
before it can
become
better

The crisis was predicted



Derek J. de
Solla Price



Jerome R.
Ravetz

de Solla Price, D.J., 1963, Little science big science, Columbia University Press;
Ravetz, J., 1971, Scientific Knowledge and its Social Problems, Oxford University Press.

Science, the
endless frontier of
lobbying





Futures

Available online 26 October 2021

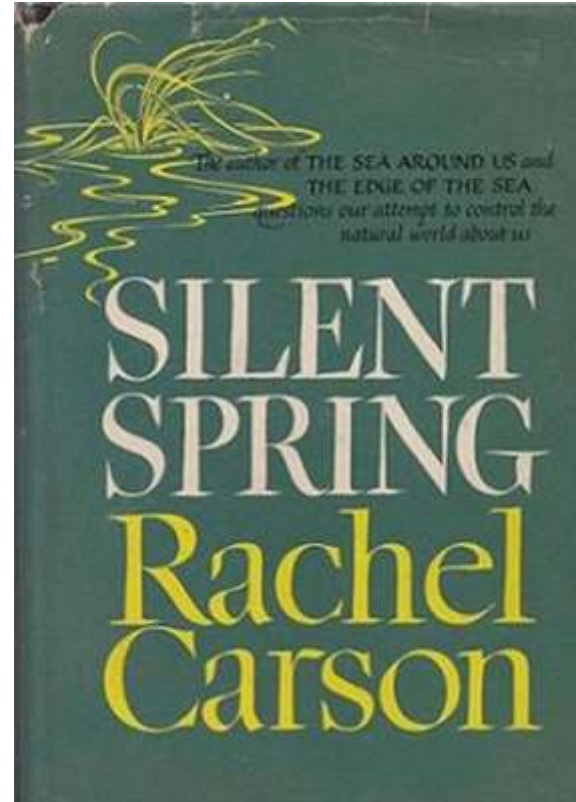
In Press, Journal Pre-proof ?



Science, the endless frontier of regulatory capture

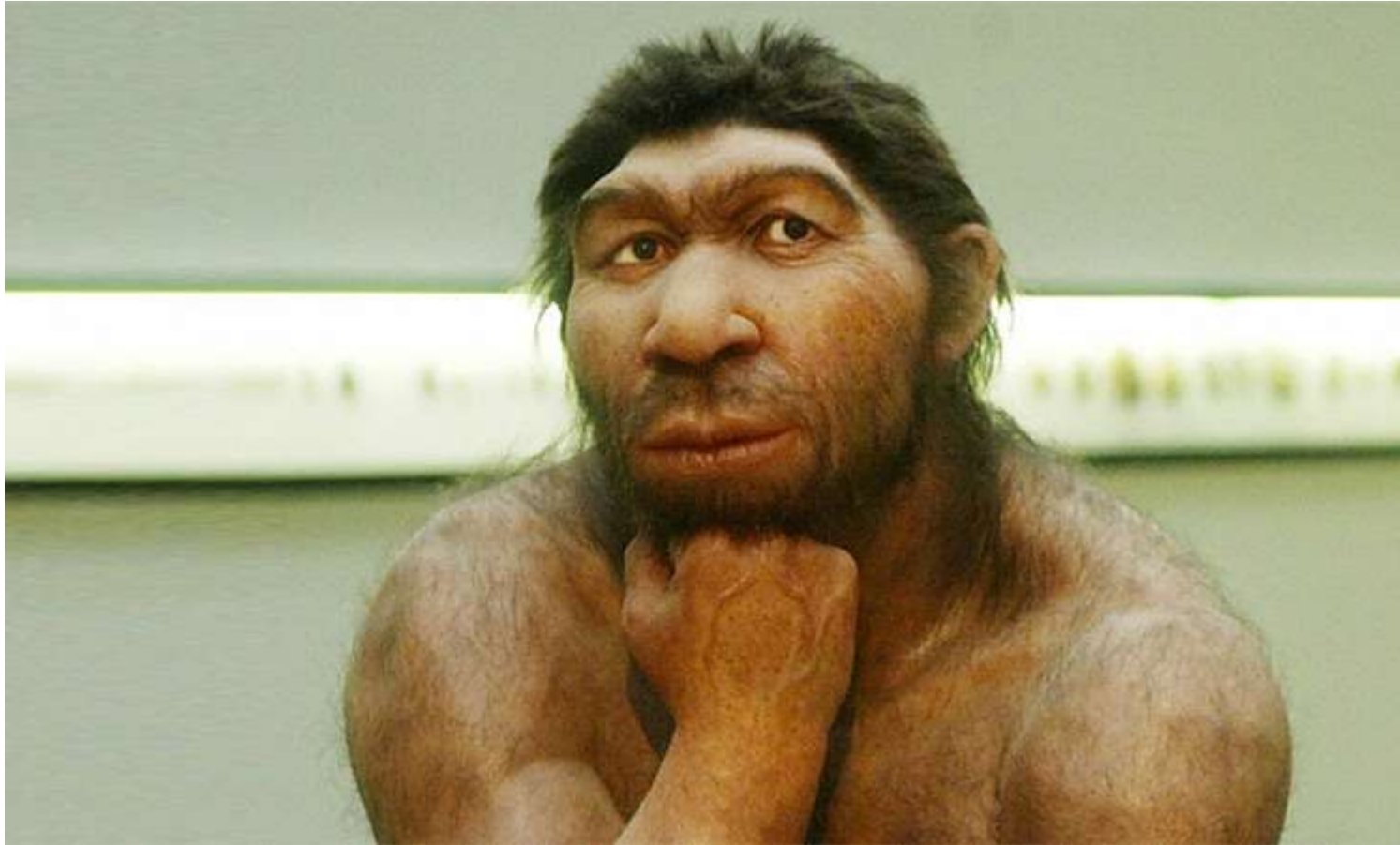
Andrea Saltelli ^a  , Dorothy J. Dankel ^{b, c}, Monica Di Fiore ^d, Nina Holland ^e, Martin Pigeon ^e

“... the Neanderthal age of biology and philosophy, when it was supposed that nature exists for the convenience of man”



Science, lobbies and the environment: marking the 60th anniversary of Rachel Carson's *Silent Spring*, Norway House, October 6, 2022, Brussels
VIDEO <https://www.youtube.com/watch?v=jWlxNOXJkns>

Are we past this age of Neanderthal?



Are we past this age of Neanderthal? If not, why?

Science, the endless frontier of regulatory capture

Andrea Saltelli ^a  , Dorothy J. Dankel ^{b, c}, Monica Di Fiore ^d, Nina Holland ^e, Martin Pigeon ^e

... a form of corporate penetration which is based on a strategic use of the image and legitimacy of science

...cases where lobbyists present themselves as upholders of the values of the evidence-based policy, and interested in the methodological and ethical aspect of science for policy

An epistemic ladder for regulatory capture

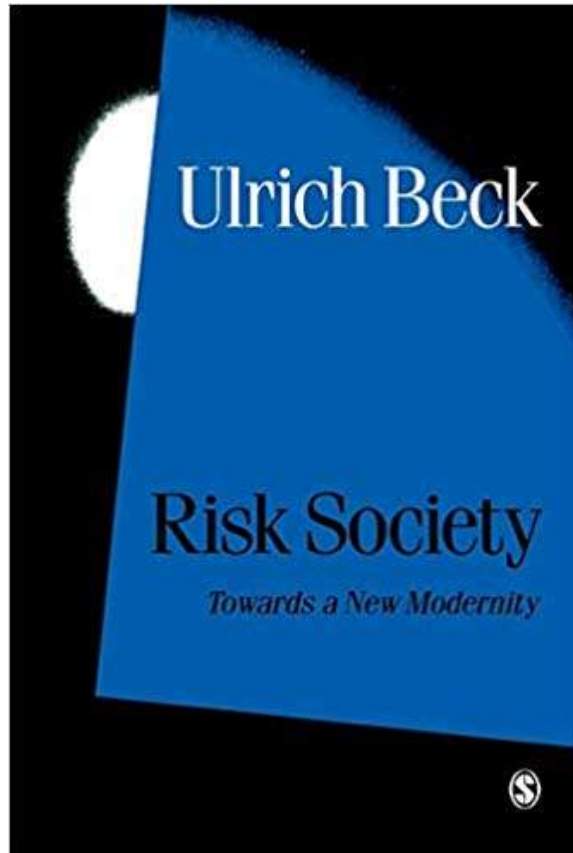
- Epistemic. Invalidating the inference or the methods
- Institutional. Delegitimising and/or 'colonising' institutions
- Political. Promoting a worldview where the very idea of regulation is undesirable

Science, the endless frontier of regulatory capture



Credits: <https://www.subpng.com/>

Science as a self-service shop for financially well-endowed customers in need of arguments (Beck 1992)



1992 (1986)

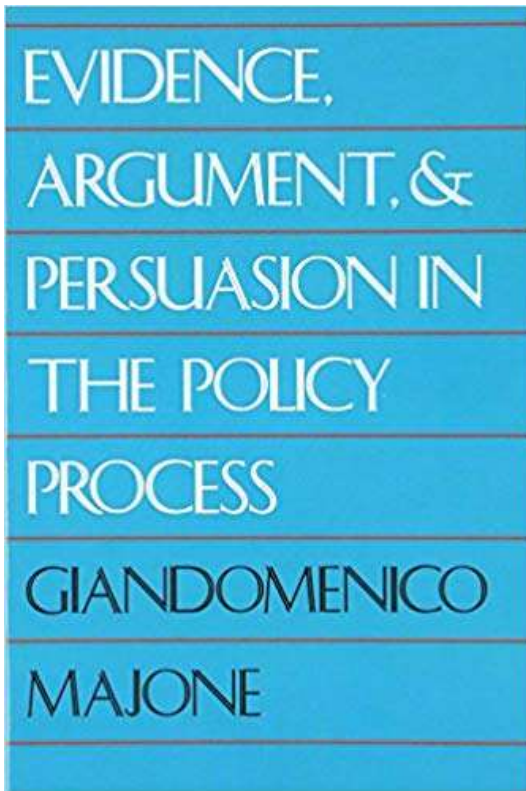


Ulrich Beck
(1944 –2015)

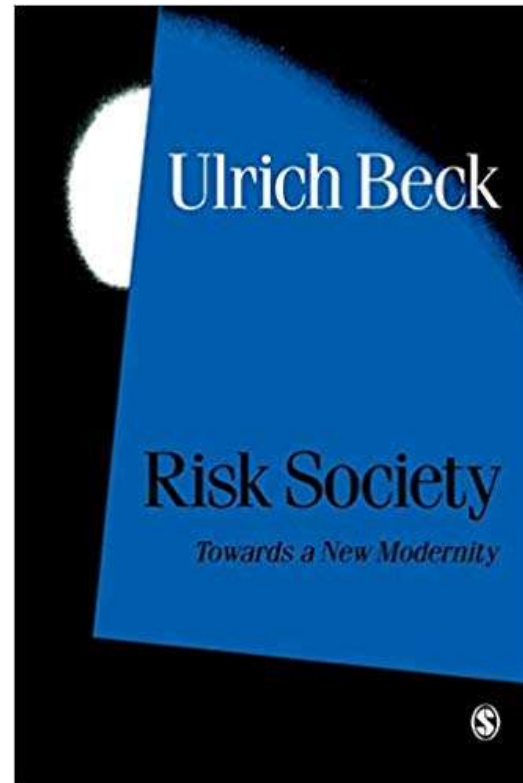
From Ulrich Beck to Giandomenico Majone: the technique is never neutral



Ulrich Beck
(1944 –2015)



1989



1992 (1986)



Environmental Science & Policy

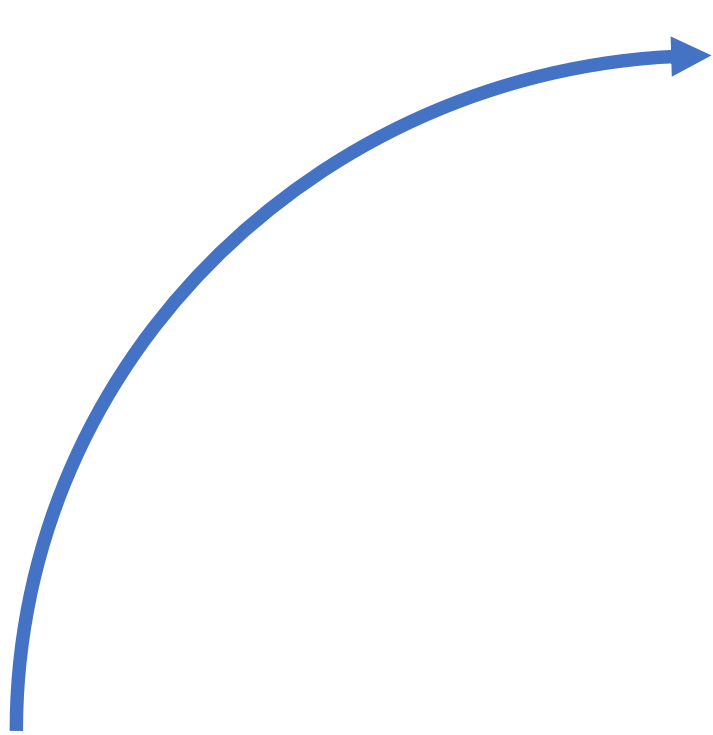
Volume 106, April 2020, Pages 87-98



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}

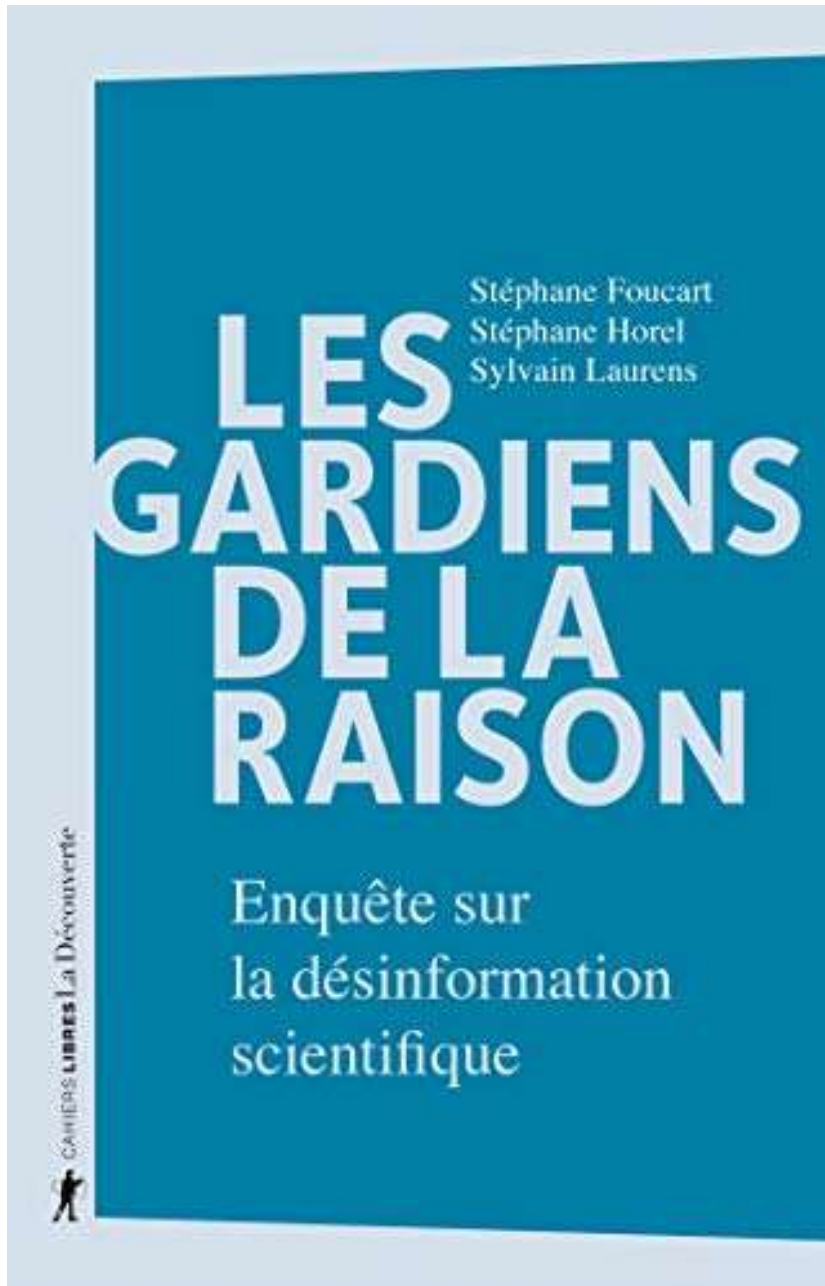
Guardians of sound science



Guardians of reason

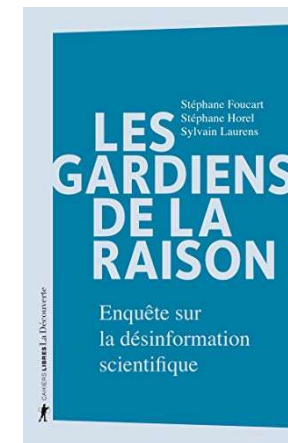


shutterstock.com · 408560539

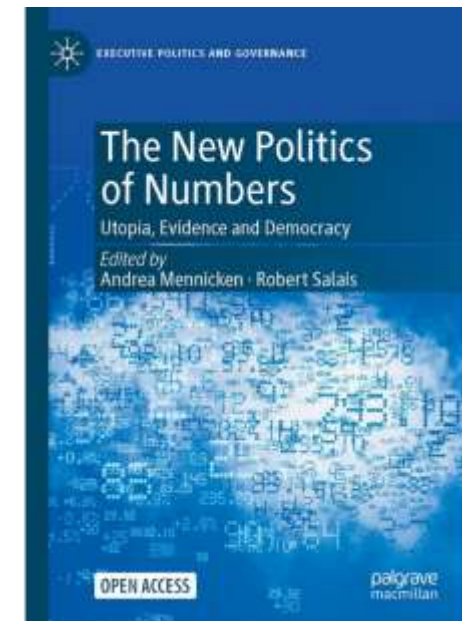
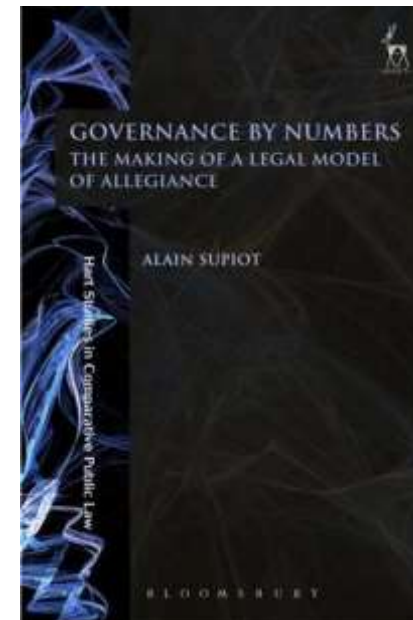
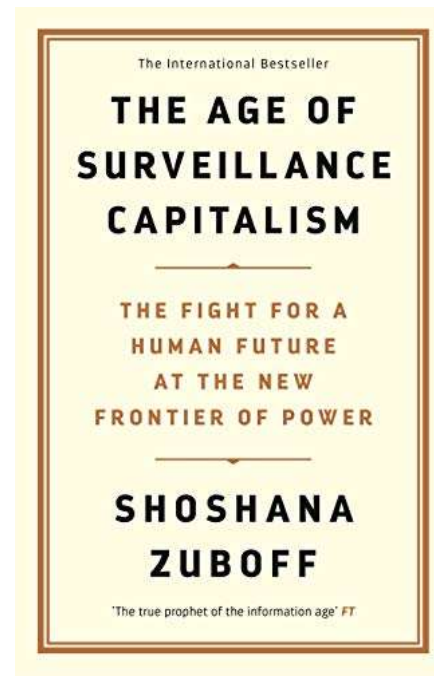


An army of self-proclaimed ‘fact checkers’ becomes mobilized in the defence of a neoliberal and conservative credo, posing as victims of an assault on science perpetrated by the purported enemies of reason

Strategies so *rapides et inédites*



New powerful instruments such as the use of AI and algorithms in combination with cognitive psychology and the new social media to influence the behaviour of consumers / voters



What integrity for
science



- 1→ corrupting political economy of science
- 2→ unsound quality assurance and reward systems
- 3→ disciplines divided by their insularity

Definition of *integrity*

1 : firm adherence to a code of especially moral or artistic values : incorruptibility

2 : an unimpaired condition : soundness

3 : the quality or state of being complete or undivided : completeness

From: Reformation in the Church of Science. How the truth monopoly was broken up

Saving the Real

Andrea Saltelli & Daniel Sarewitz on why the 95 THESES are back



THE NEW ATLANTIS

A JOURNAL OF TECHNOLOGY & SOCIETY

REALITY: A POST-MORTEM

♦ Whither Consensus? ♦ Life in an Alternate Reality Game ♦

A new essay series by Jon Askonas

Saving the Real

Andrea Saltelli & Daniel Sarewitz on why the 95 THESES are back

Alan Jacobs on DEMONS and why we're all going nuts

David Bentley Hart on minds in SIMULATED WORLDS

James Mumford on THERAPY beyond good and evil

Kit Wilson on READING ourselves to death

Laurence Scott on why hell is OURSELVES

Alan Rome ~ Star Trek into sadness

Gabrielle Bauer ~ Precautionary peril

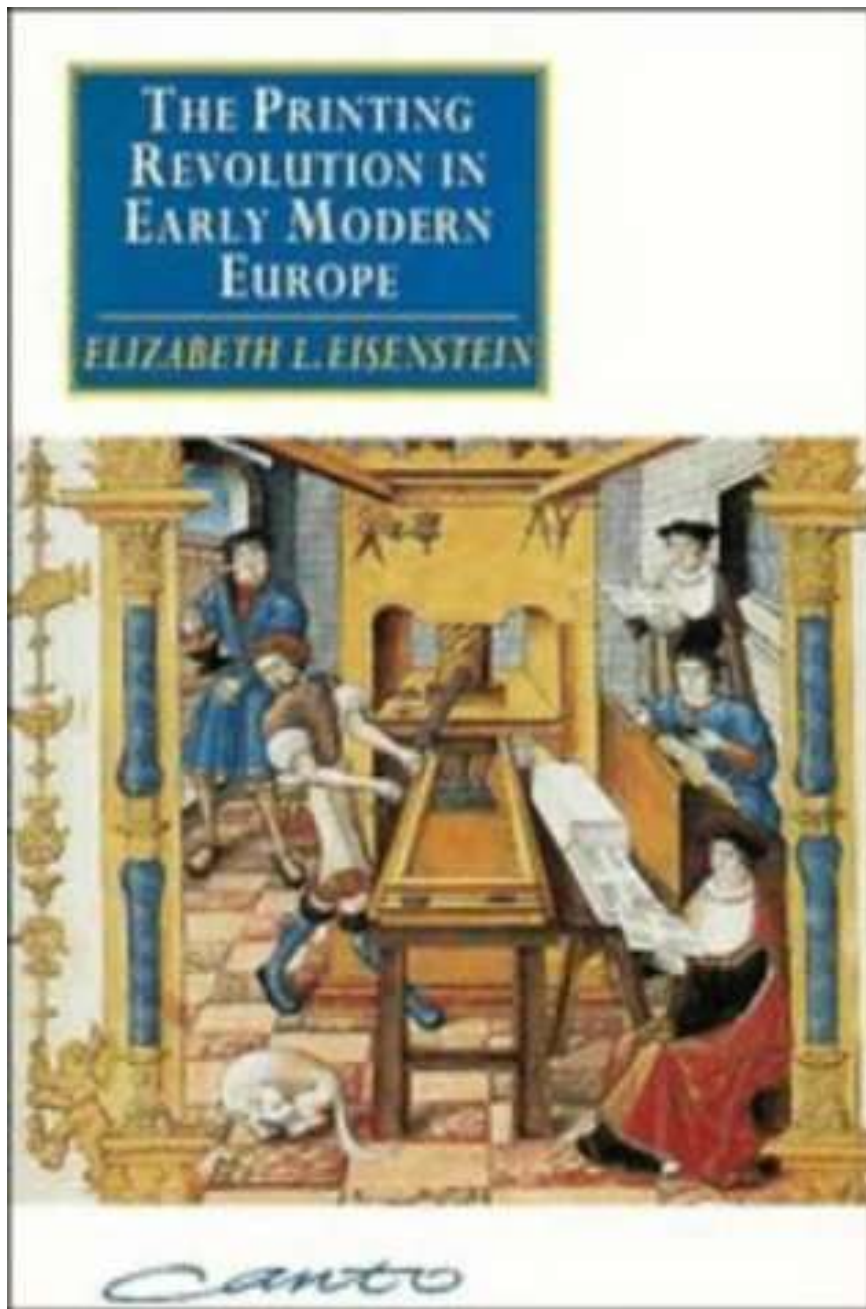
Paul Dicken ~ AI & HR's unholy union

John Konicki & James Pethokoukis ~ Do Americans care about space?

NUMBER 68 — SPRING 2022 — \$10.00

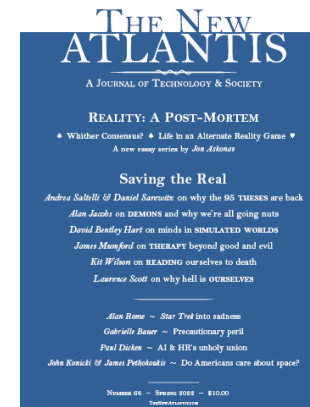
TheNewAtlantis.com





Post-truth as the loss of monopoly of who produces the fake news

Church – science
Printing press – new media





Futures

Volume 115, January 2020, 102491



Technoscience, policy and the new media. Nexus or vortex?

Andrea Saltelli ^{a, b}  , Paul-Marie Boulanger ^c 



THE NEW ATLANTIS

A JOURNAL OF TECHNOLOGY & SOCIETY

REALITY: A POST-MORTEM

♦ Whither Consensus? ♦ Life in an Alternate Reality Game ♥

A new essay series by *Jon Askonas*

Saving the Real

Andrea Saltelli & Daniel Sarewitz on why the 95 THESES are back

Alan Jacobs on DEMONS and why we're all going nuts

David Bentley Hart on minds in SIMULATED WORLDS

James Mumford on THERAPY beyond good and evil

Kit Wilson on READING ourselves to death

Laurence Scott on why hell is OURSELVES

Alan Rome ~ *Star Trek* into sadness

Gabrielle Bauer ~ Precautionary peril

Paul Dicken ~ AI & HR's unholy union

John Konicki & James Pethokoukis ~ Do Americans care about space?

NUMBER 68 - SPRING 2022 - \$10.00

THENEWATLANTIS.COM

Statistical and mathematical modelling

[nature](#) > [nature communications](#) > [comment](#) > article

[Andrea Saltelli](#) 

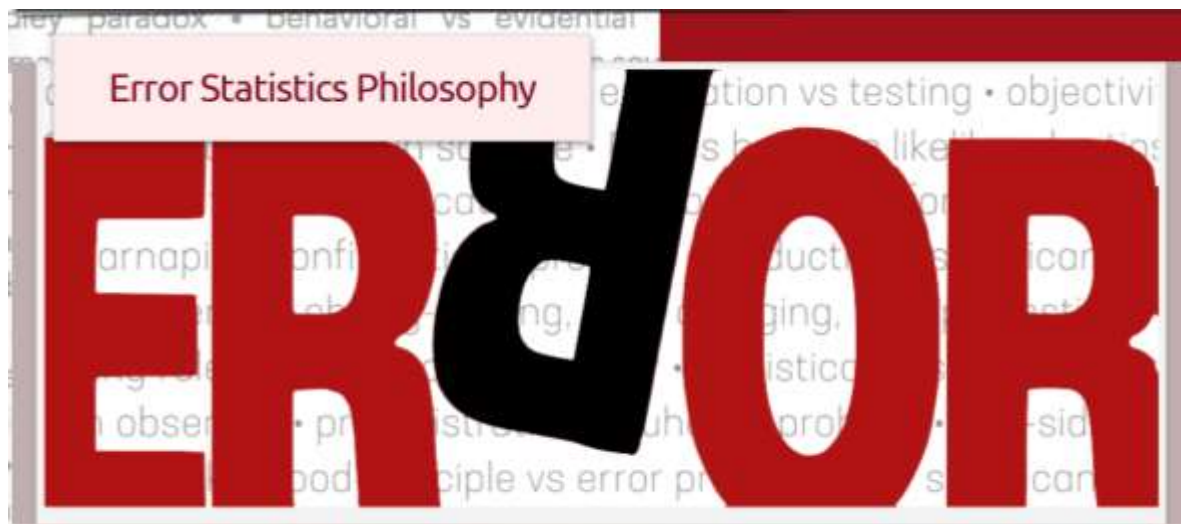
[Nature Communications](#) **10**, Article number: 3870 (2019)

[Comment](#) | [Open Access](#) | [Published: 27 August 2019](#)

39k Accesses | **43** Citations | **386** Altmetric | [Metrics](#)

A short comment on statistical versus mathematical modelling

While the crisis of statistics has made it to the headlines, that of mathematical modelling hasn't. Something can be learned comparing the two, and looking at other instances of production of numbers. Sociology of quantification and post-normal science can help.





A. Saltelli (Guest post): What can we learn from the debate on statistical significance?

Posted on November 22, 2019 by Mayo



Professor Andrea Saltelli
Centre for the Study of the Sciences and the Humanities (SVT), University of Bergen (UIB, Norway),
&
Open Evidence Research, Universitat Oberta de Catalunya (UOC), Barcelona

What can we learn from the debate on statistical significance?

Recent Comments:



Cargo-cult statistics and scientific crisis

Written by Philip B. Stark and Andrea Saltelli on 05 July 2018. Posted in [Science](#)



Statistics in the
wake of the
reproducibility
crisis

Statistical wars?

Science's ethics



quantification

Example: Choosing the significance level in inference testing e.g. with p-test (1%, 5%, 10%, ...)?

Philosophy of Science

VOL. 20

January, 1953

NO. 1

THE SCIENTIST *QUA* SCIENTIST MAKES VALUE JUDGMENTS*

RICHARD RUDNER

“How sure we need to be before we accept a hypothesis will depend on how serious a mistake would be”

THE SCIENTIST *QUA* SCIENTIST MAKES VALUE JUDGMENTS*

RICHARD RUDNER

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.

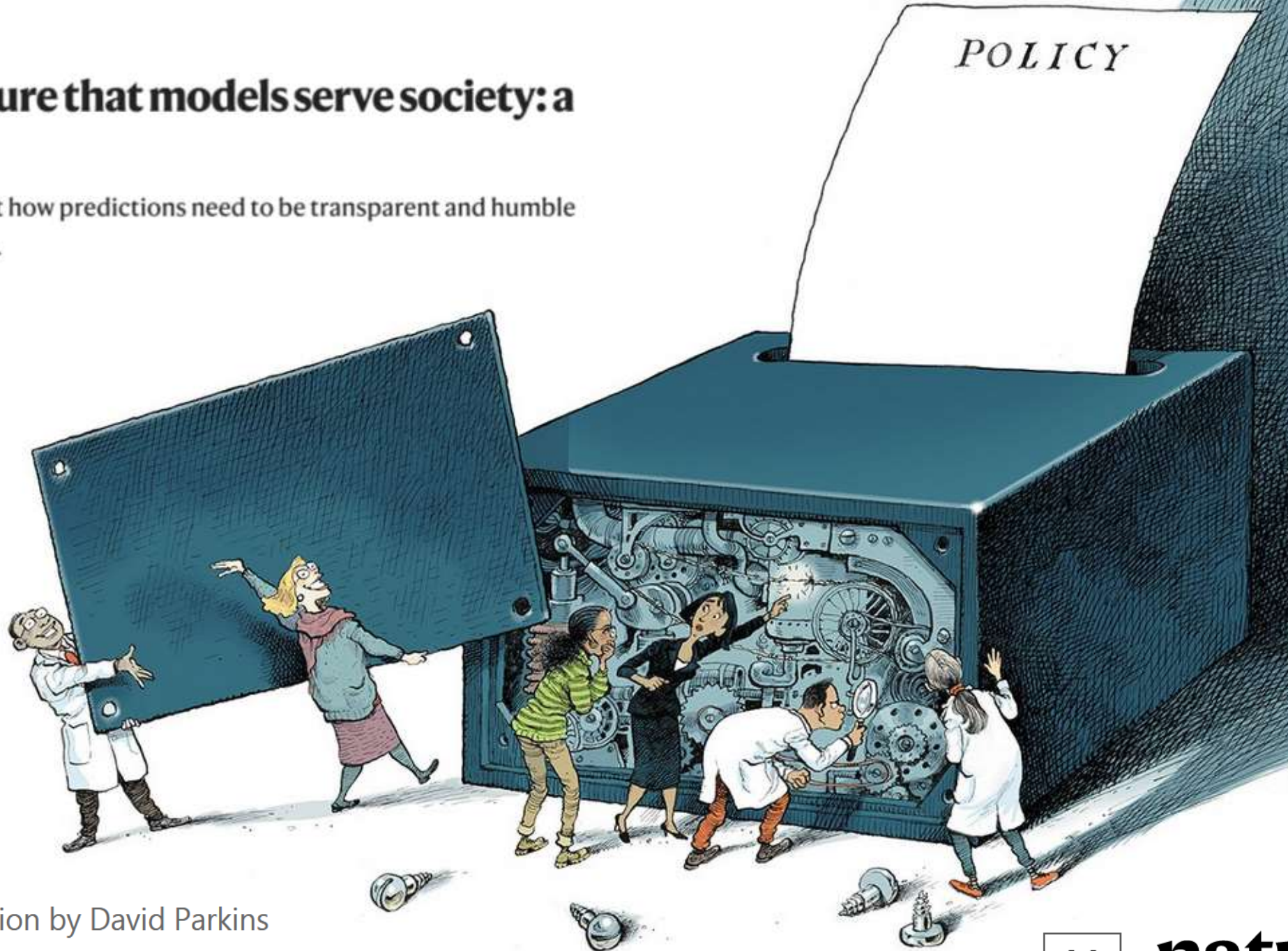


Illustration by David Parkins



nature



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

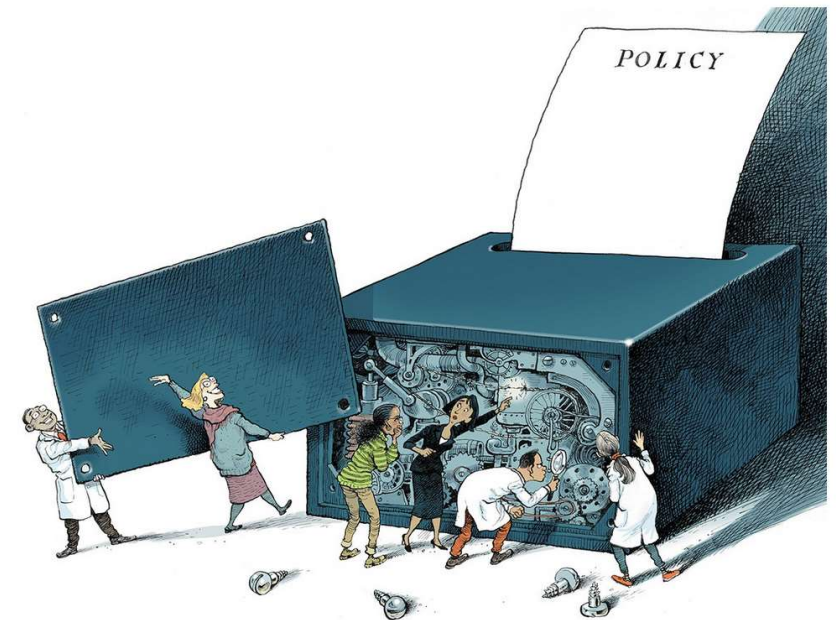
3 STS scholars Bammer, Sarewitz, Stirling

1 philosopher Ravetz

1 historian Charters

1 political scientists Di Fiore

1 expert RRI - Open Science Rafols



Mind the assumptions

Assess uncertainty and sensitivity

Mind the hubris

Complexity can be the enemy of relevance

Mind the framing

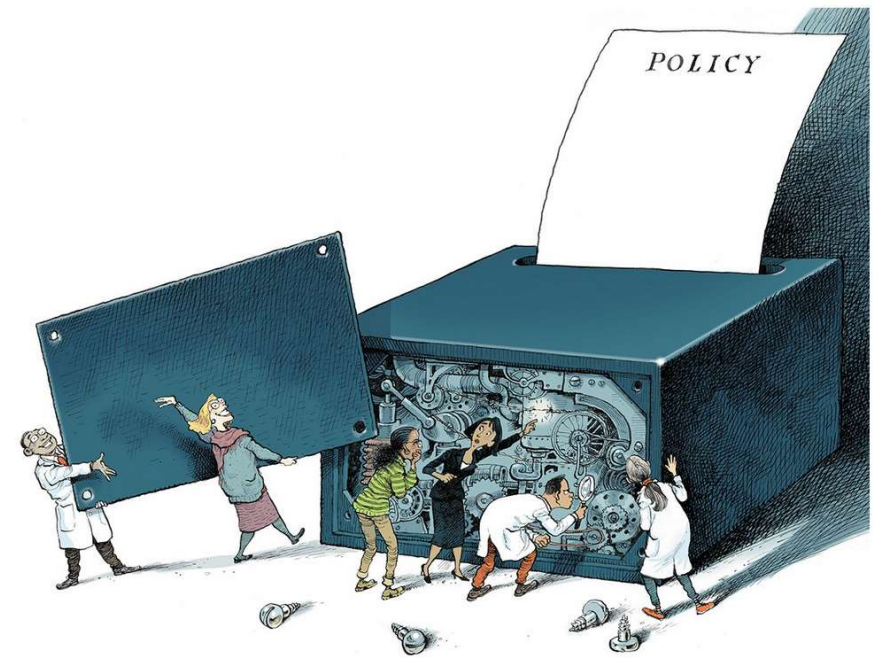
Match purpose and context

Mind the consequences

Quantification can backfire.

Mind the unknowns

Acknowledge ignorance



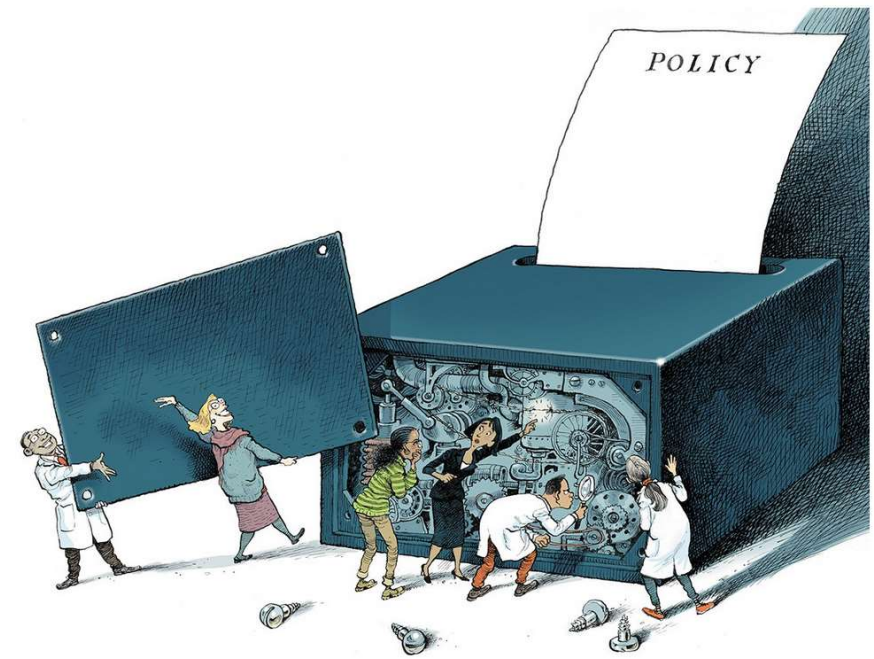
Mind the assumptions

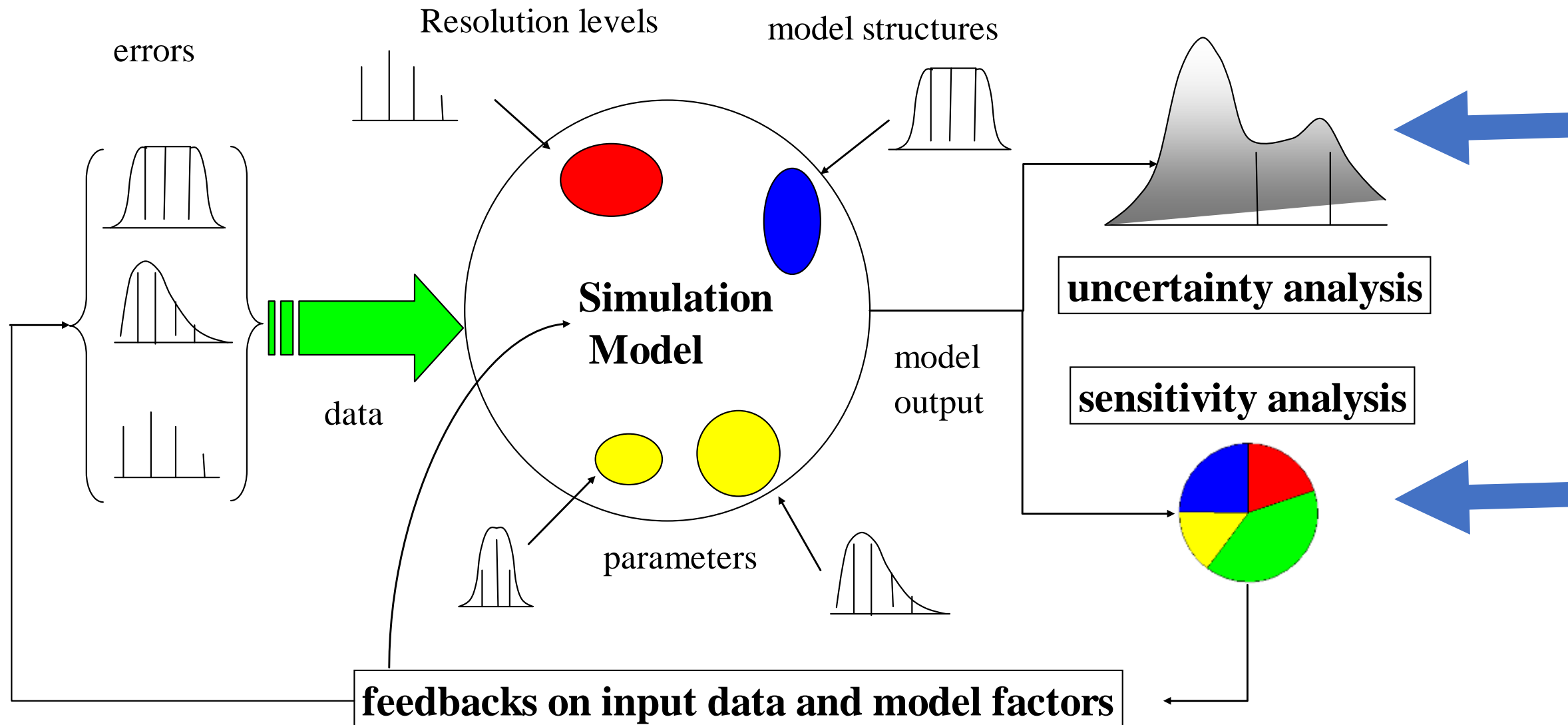
Assess uncertainty and sensitivity



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

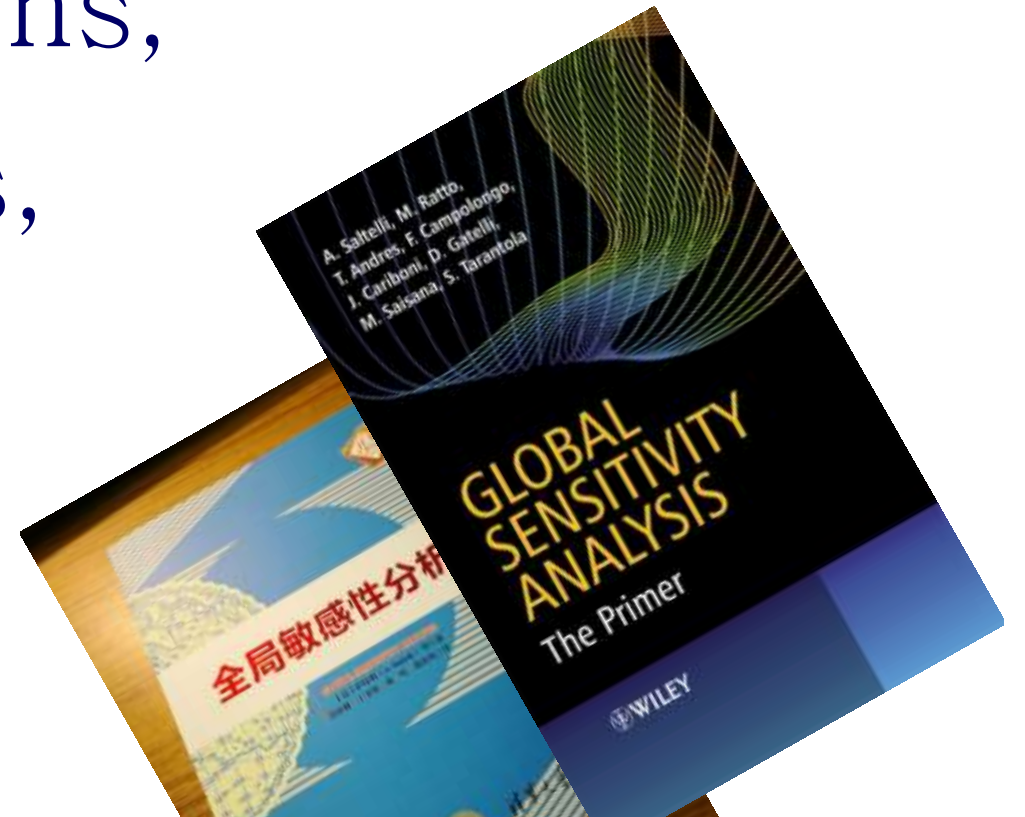
...global uncertainty and sensitivity analyses are often not done. Anyone turning to a model for insight should demand them ...





One can sample more than just factors:

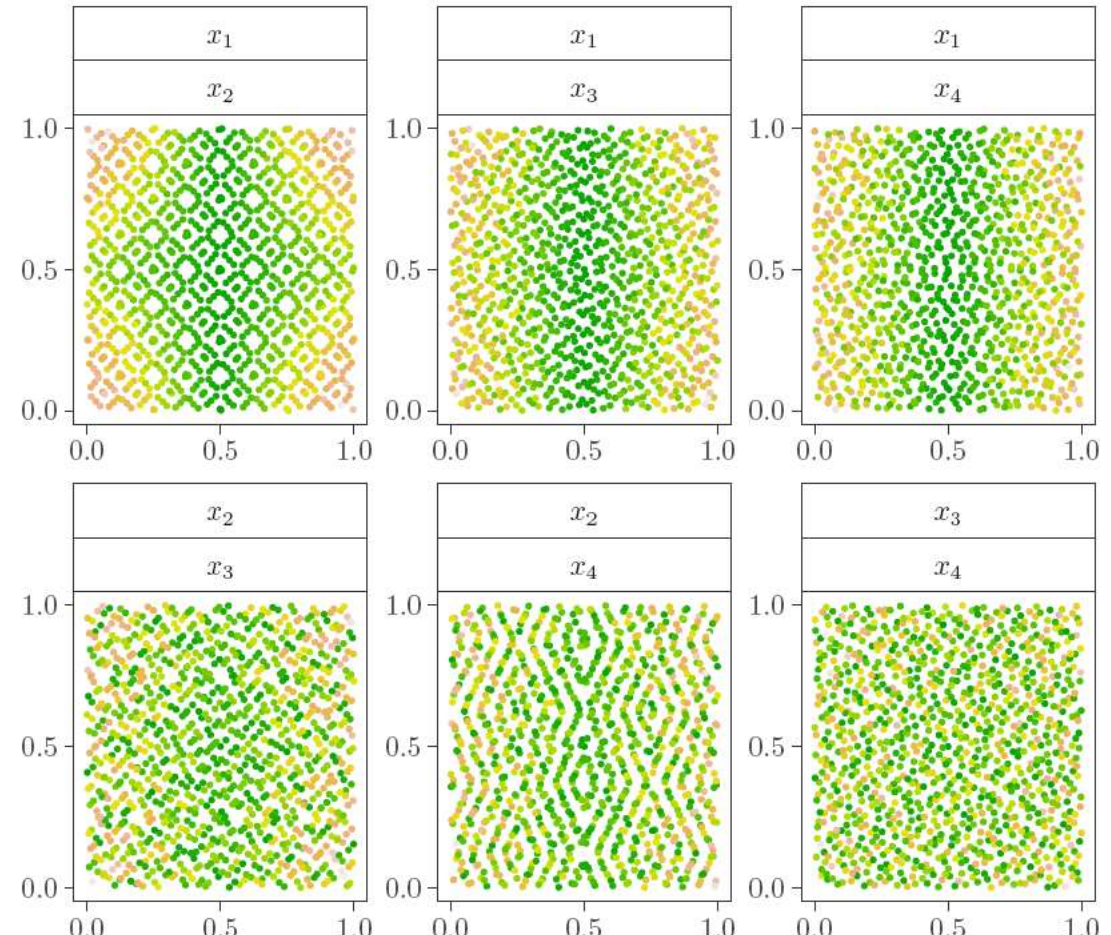
- modelling assumptions,
- alternative data sets,
- resolution levels,
- scenarios ...



→ Modelling of the modelling process

sensobol: An R Package to Compute Variance-Based Sensitivity Indices

Arnald Puy , Samuele Lo Piano , Andrea Saltelli , Simon A. Levin 

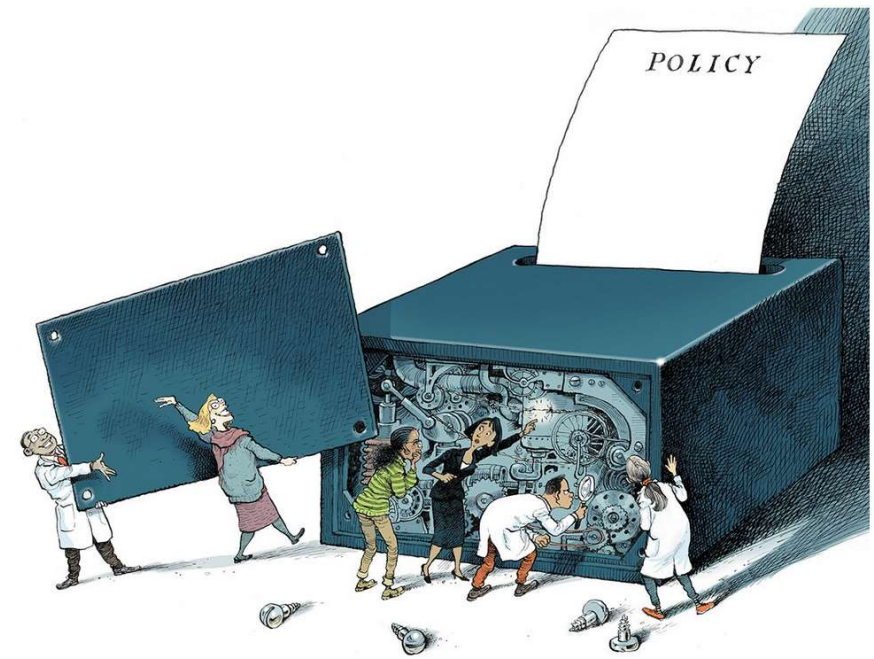


Mind the assumptions

Assess uncertainty and sensitivity



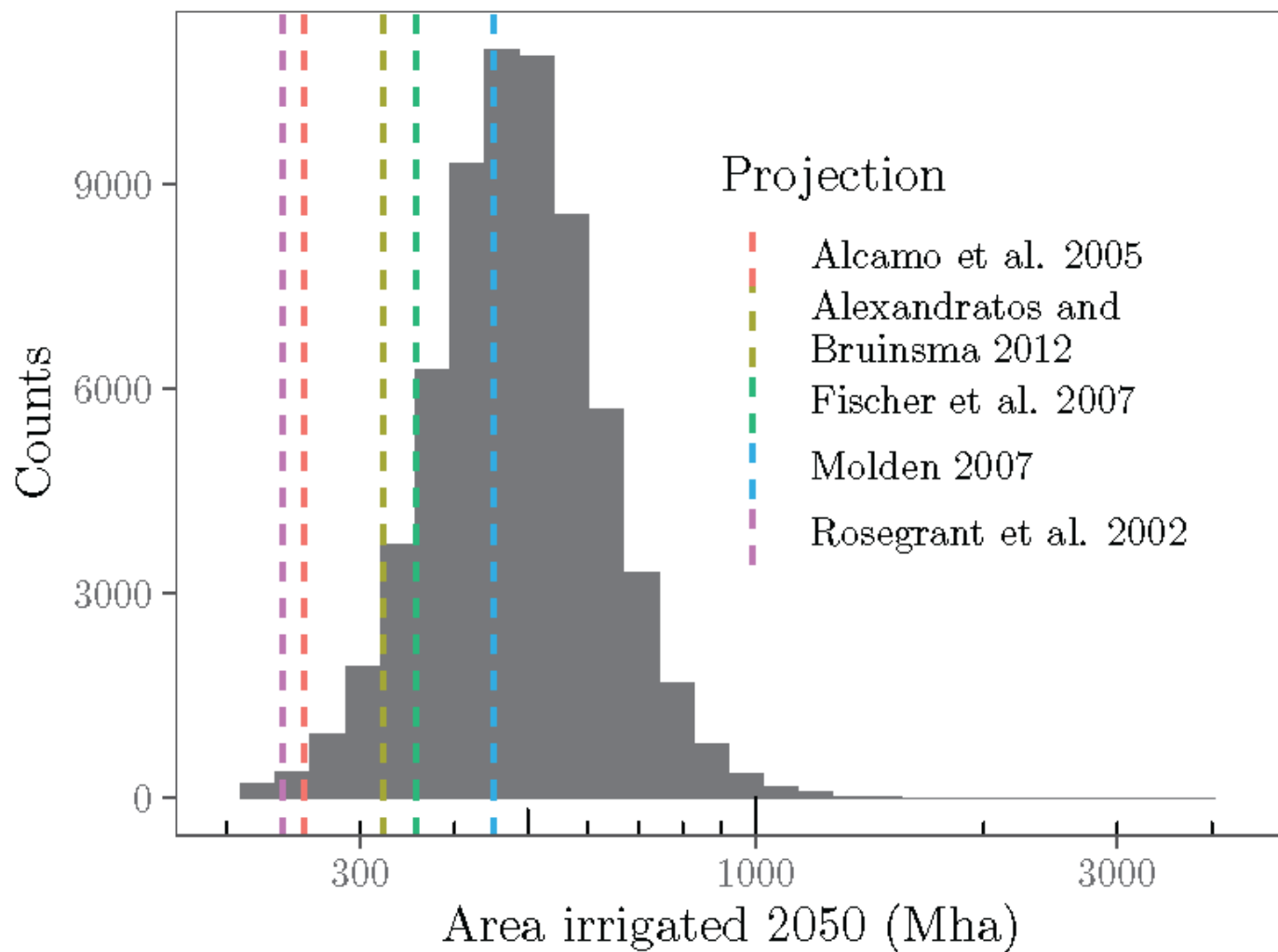
... this may lead to interesting discoveries ...



Geophysical Research Letters

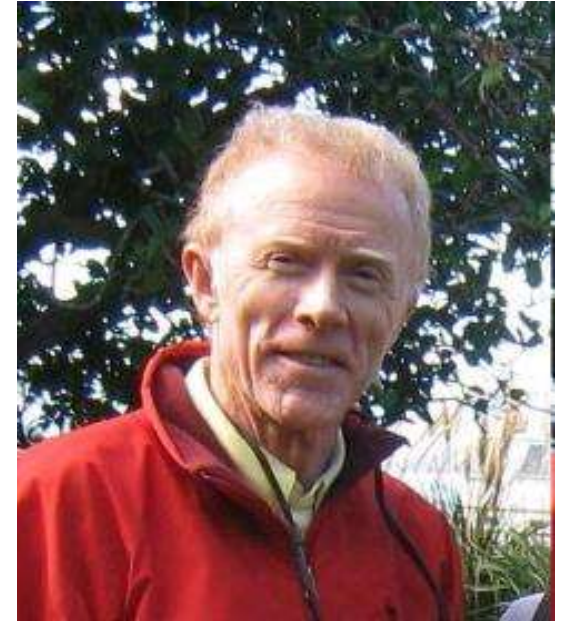
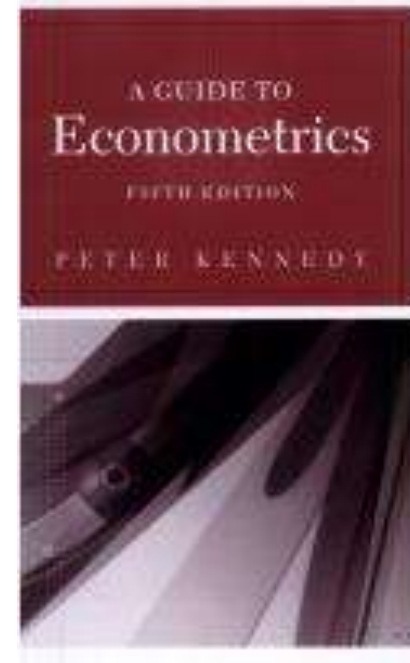
Current Models Underestimate Future Irrigated Areas

A. Puy✉, S. Lo Piano, A. Saltelli First published: 17 April 2020 <https://doi.org/10.1029/2020GL087360> |



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.

Mind the assumptions

Assess uncertainty and sensitivity

Mind the hubris

Complexity can be the enemy of relevance

Mind the framing

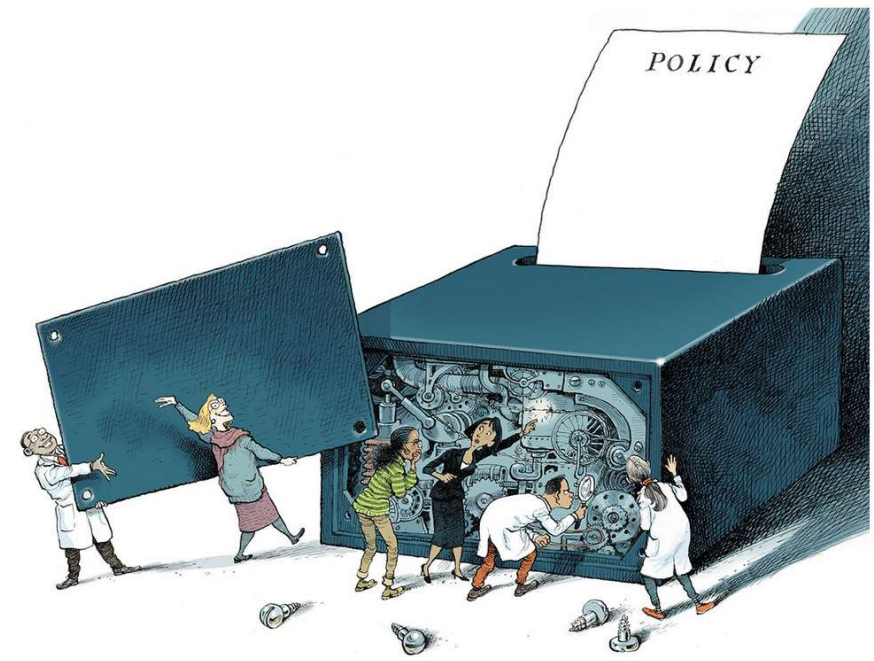
Match purpose and context

Mind the consequences

Quantification can backfire.

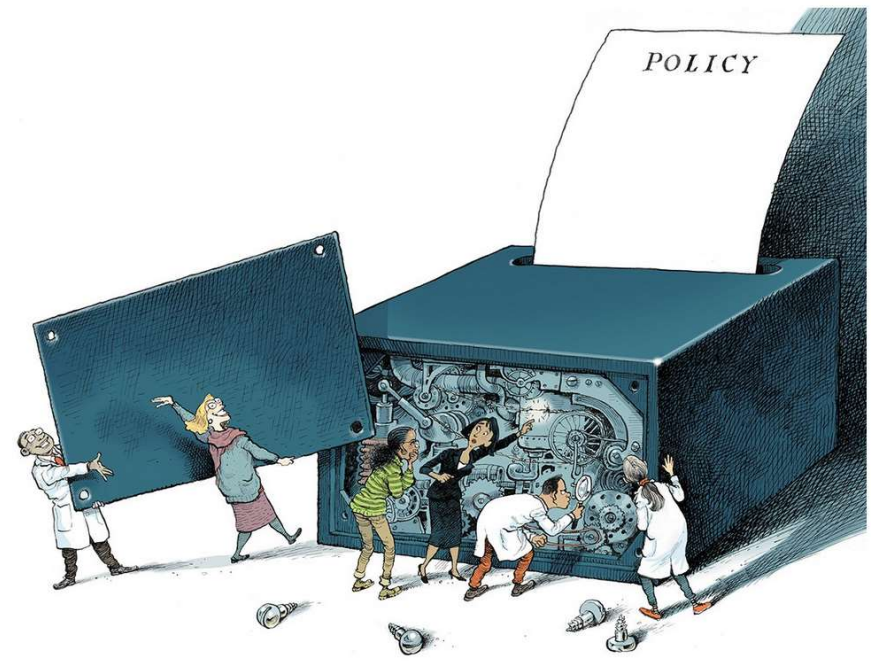
Mind the unknowns

Acknowledge ignorance



Mind the hubris

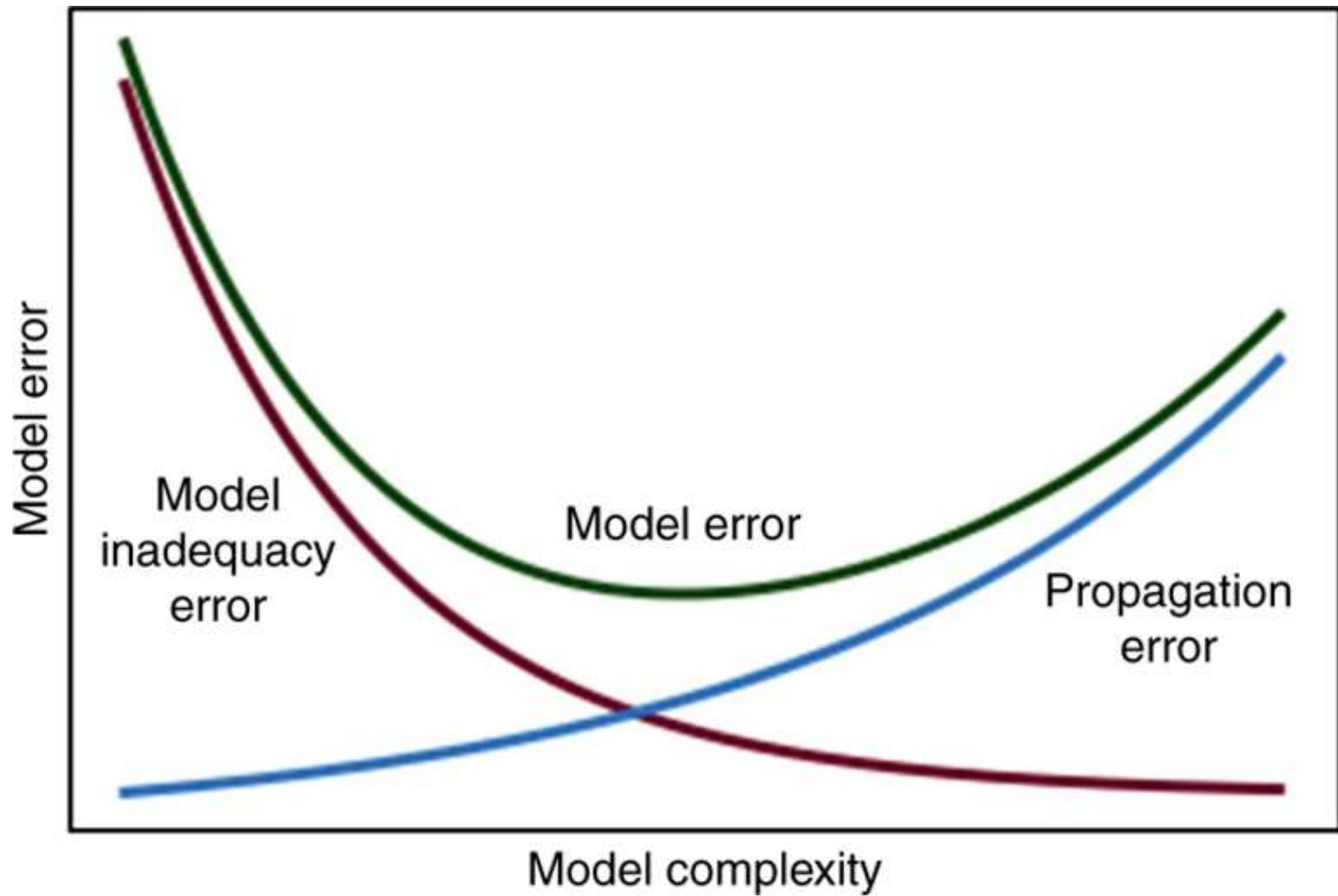
Complexity can be the enemy of relevance



… 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

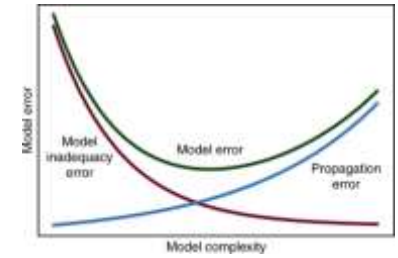
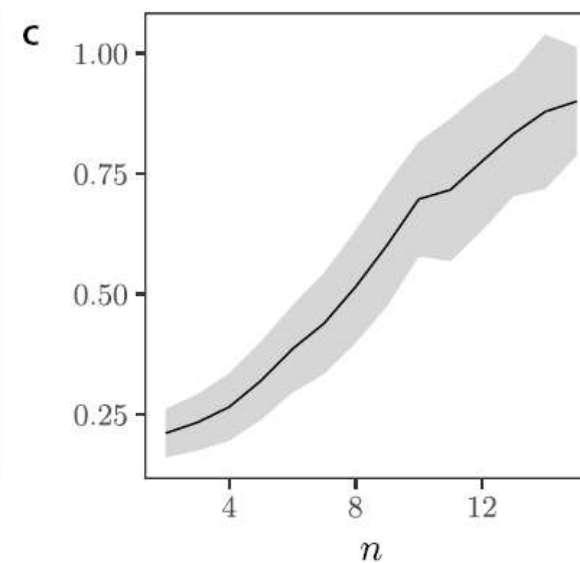
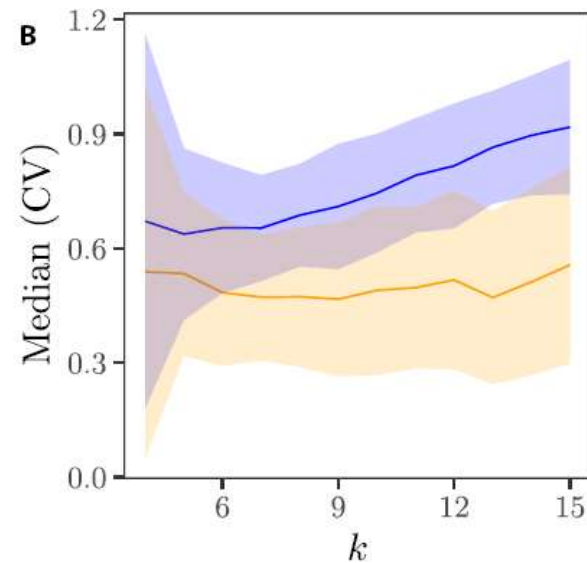


Models with higher effective dimensions tend to produce more uncertain estimates

ARNALD PUY, PIERFRANCESCO BENEVENTANO, SIMON A. LEVIN, SAMUELE LO PIANO, TOMMASO PORTALURI, AND ANDREA SALTIELLI

SCIENCE ADVANCES • 19 Oct 2022 • Vol 8, Issue 42 • DOI: 10.1126/sciadv.abn9450

Interactions — Up to the k th order — Up to the n th order for $k = 15$



Empirical test
using the SA-
based concept of
effective
dimension

Mind the assumptions

Assess uncertainty and sensitivity

Mind the hubris

Complexity can be the enemy of relevance



Mind the framing

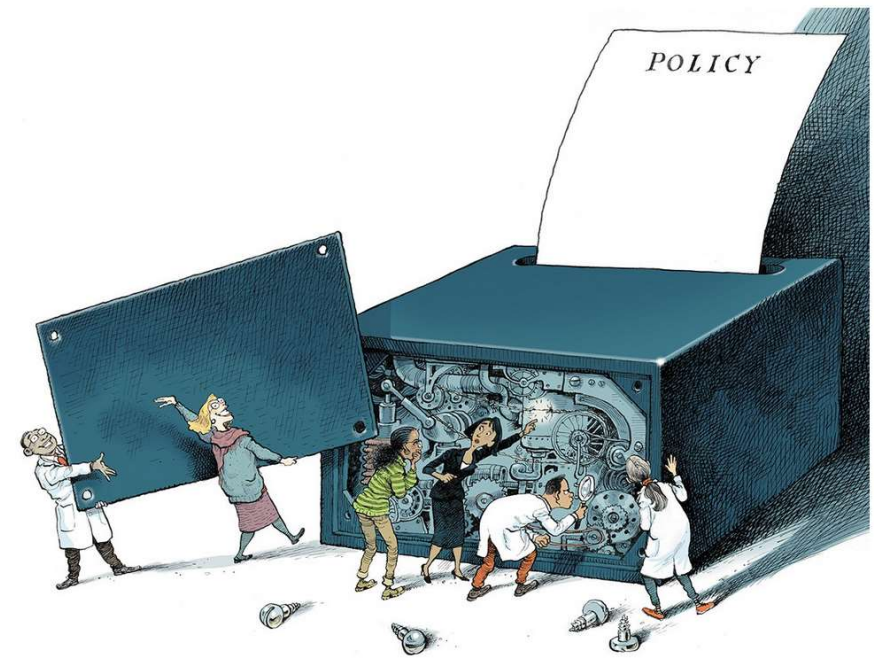
Match purpose and context

Mind the consequences

Quantification can backfire.

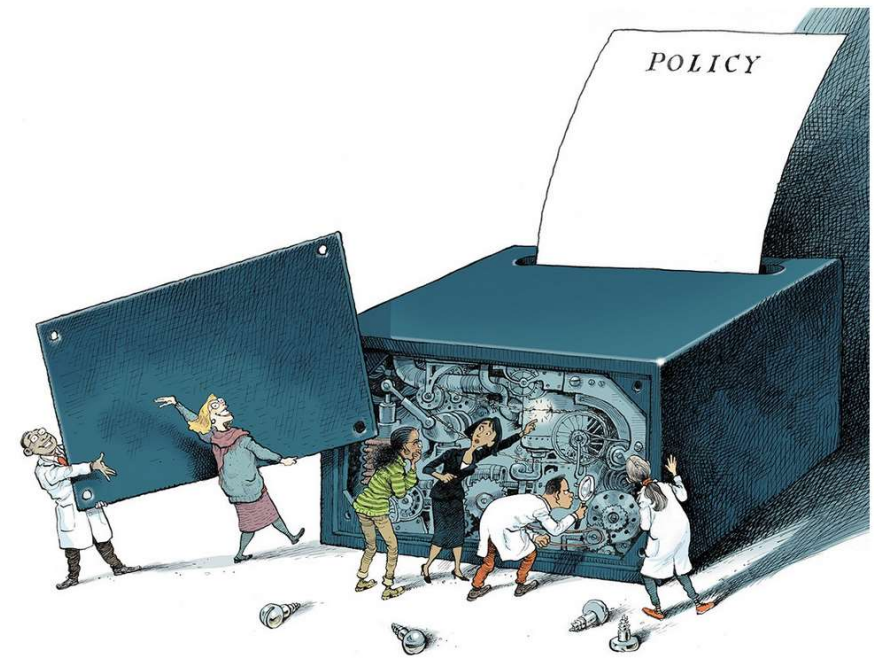
Mind the unknowns

Acknowledge ignorance



Mind the framing

Match purpose and context



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

SUPPLEMENTARY INFORMATION

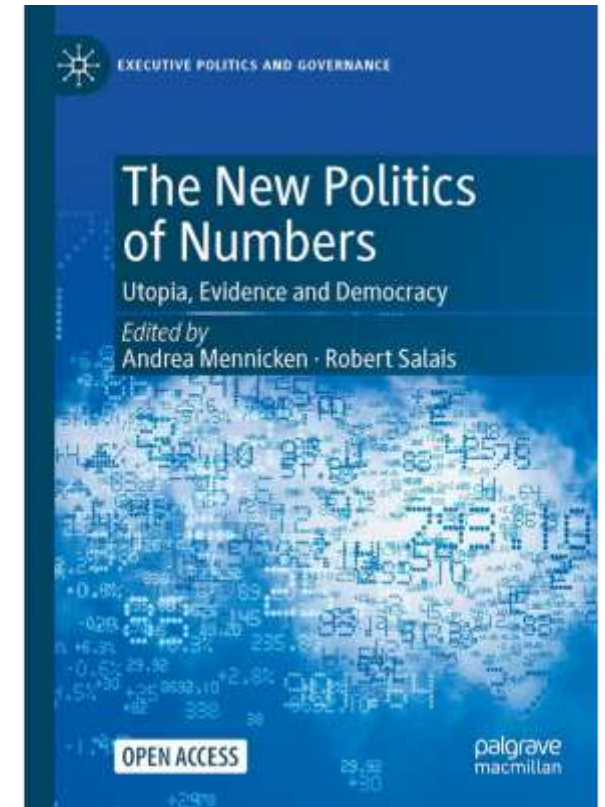
1. Additional information and references >260 references

Since the technique is never neutral a technical proof of quality is illusory without a parallel investigation of normative quality

Technical Quality

Normative quality

How the numbers of neoliberalism (New Public Management) constitute a regime of a-democracy; the example of indicators of employment



Salais, R. (2022). “La donnée n’est pas un donné”: Statistics, Quantification and Democratic Choice. In *The New Politics of Numbers: Utopia, Evidence and Democracy*, Andrea Mennicken and Robert Salais, Palgrave Macmillan, pp. 379–415.

Mind the assumptions

Assess uncertainty and sensitivity

Mind the hubris

Complexity can be the enemy of relevance

Mind the framing

Match purpose and context

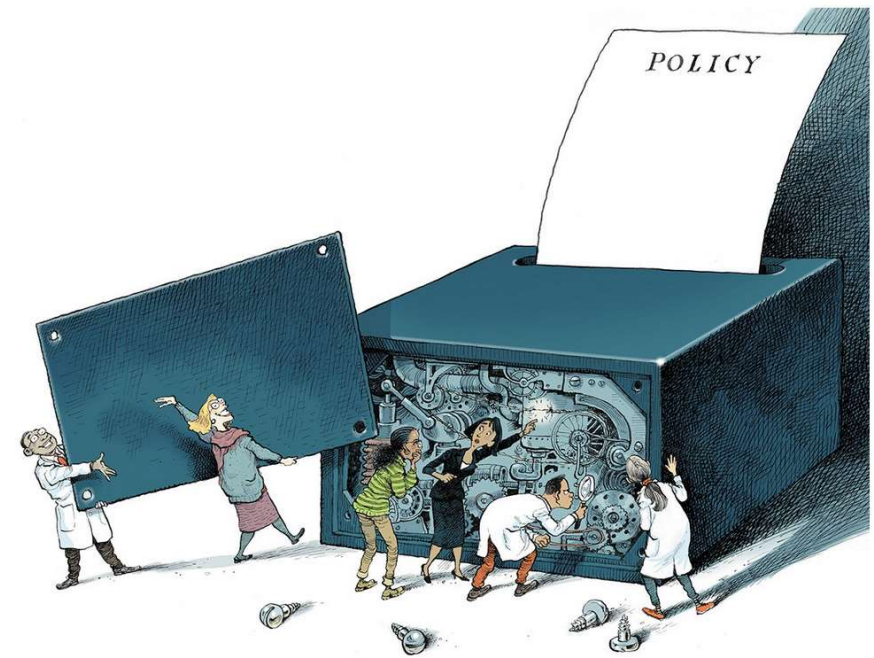


Mind the consequences

Quantification can backfire.

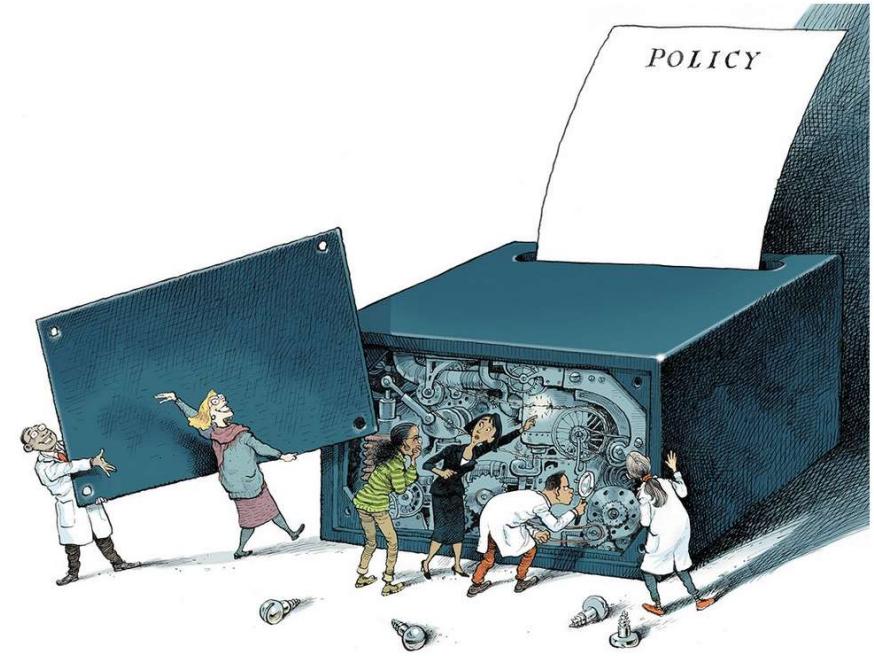
Mind the unknowns

Acknowledge ignorance



Mind the consequences

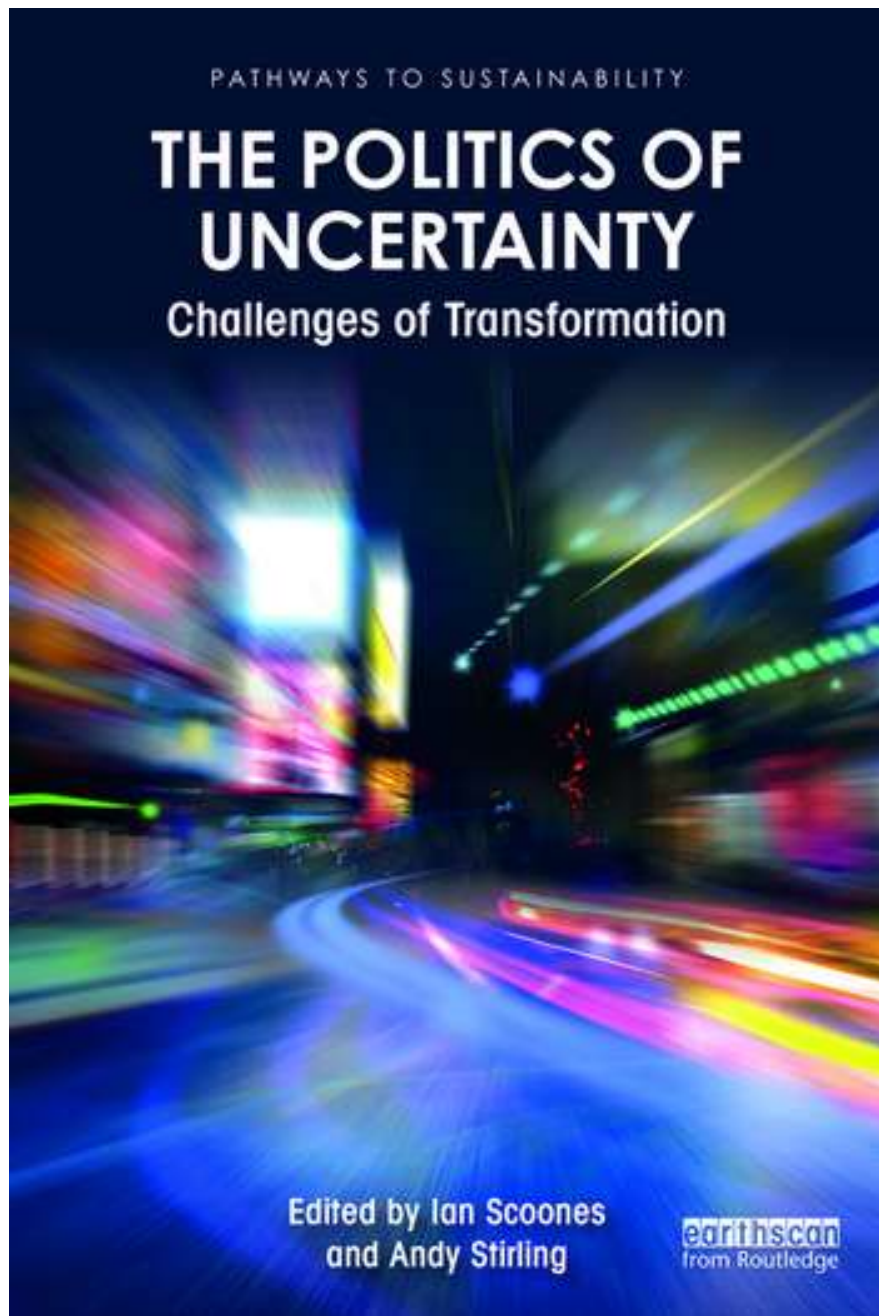
Quantification can backfire



From the risk of financial products to the management of coastal 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>

Mind the assumptions

Assess uncertainty and sensitivity

Mind the hubris

Complexity can be the enemy of relevance

Mind the framing

Match purpose and context

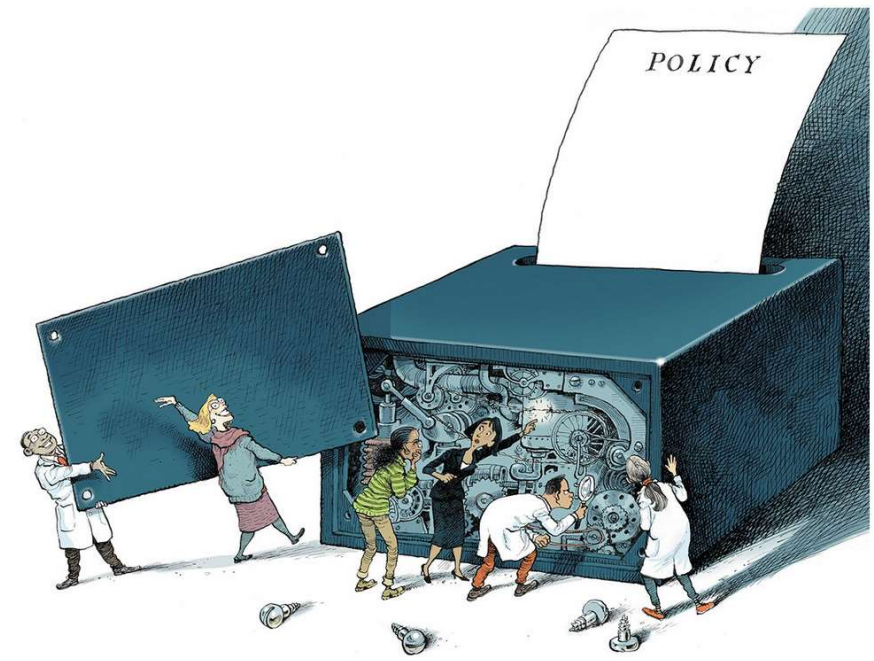
Mind the consequences

Quantification can backfire.



Mind the unknowns

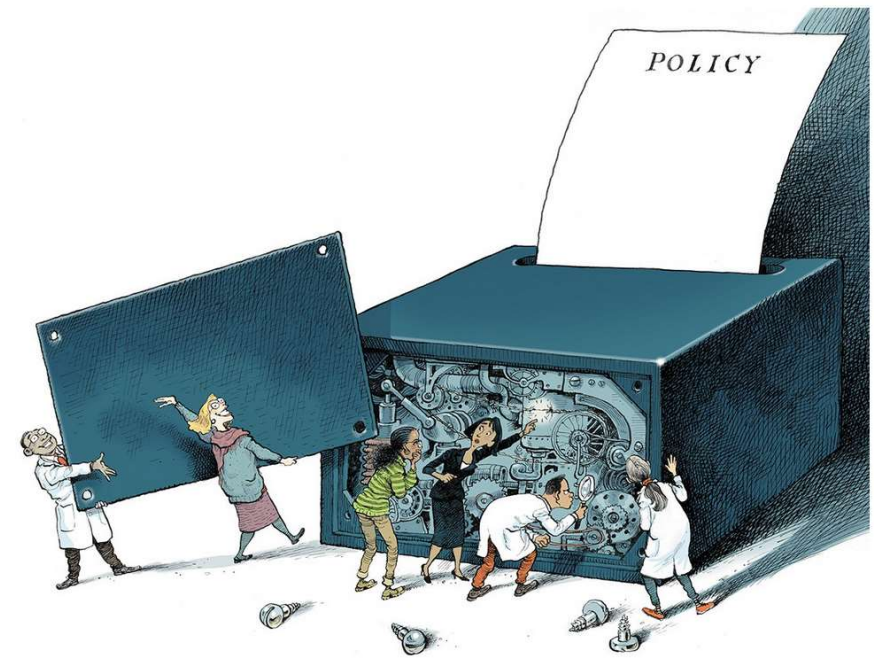
Acknowledge ignorance



Mind the unknowns

Acknowledge ignorance

“there is no
number-answer to
your question”



SUPPLEMENTARY INFORMATION

1. Additional information and references

>260 references

Anthony Fauci



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



Futures

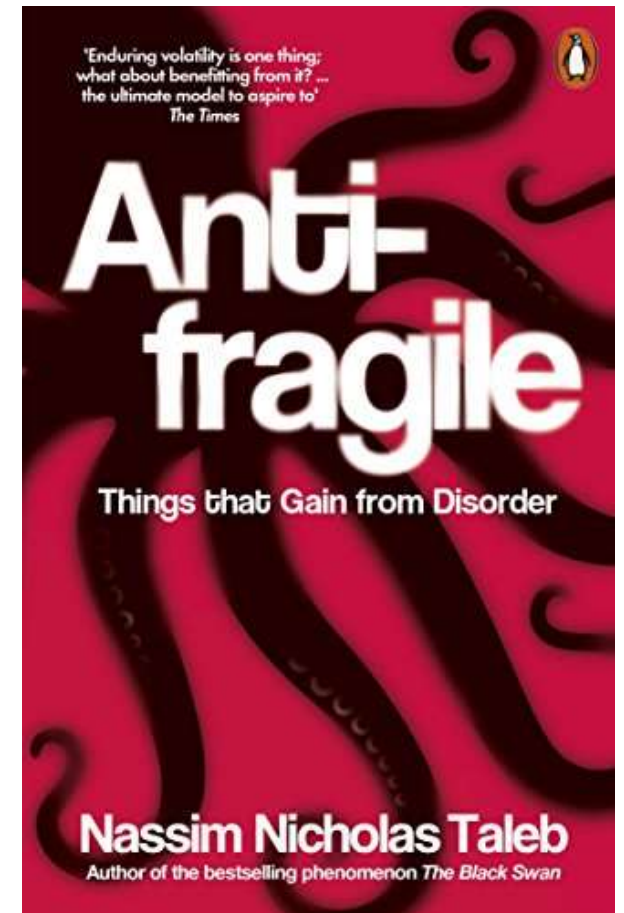
Volume 91, August 2017, Pages 62-71



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}



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)



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}

Numbers, visible and invisible...

Blurring lines:

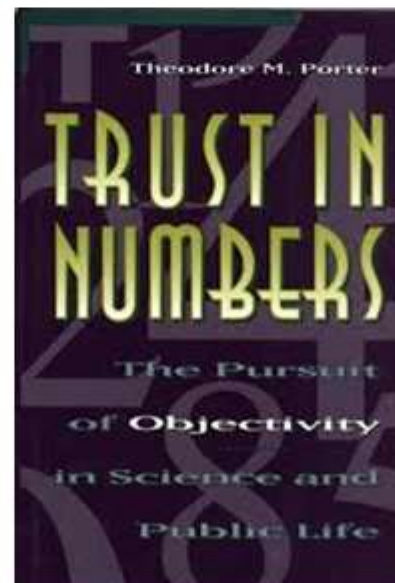
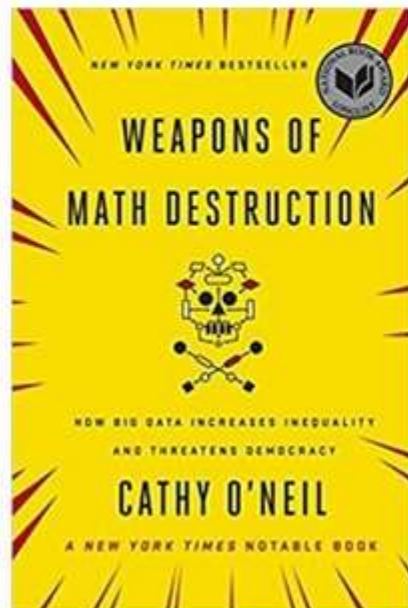
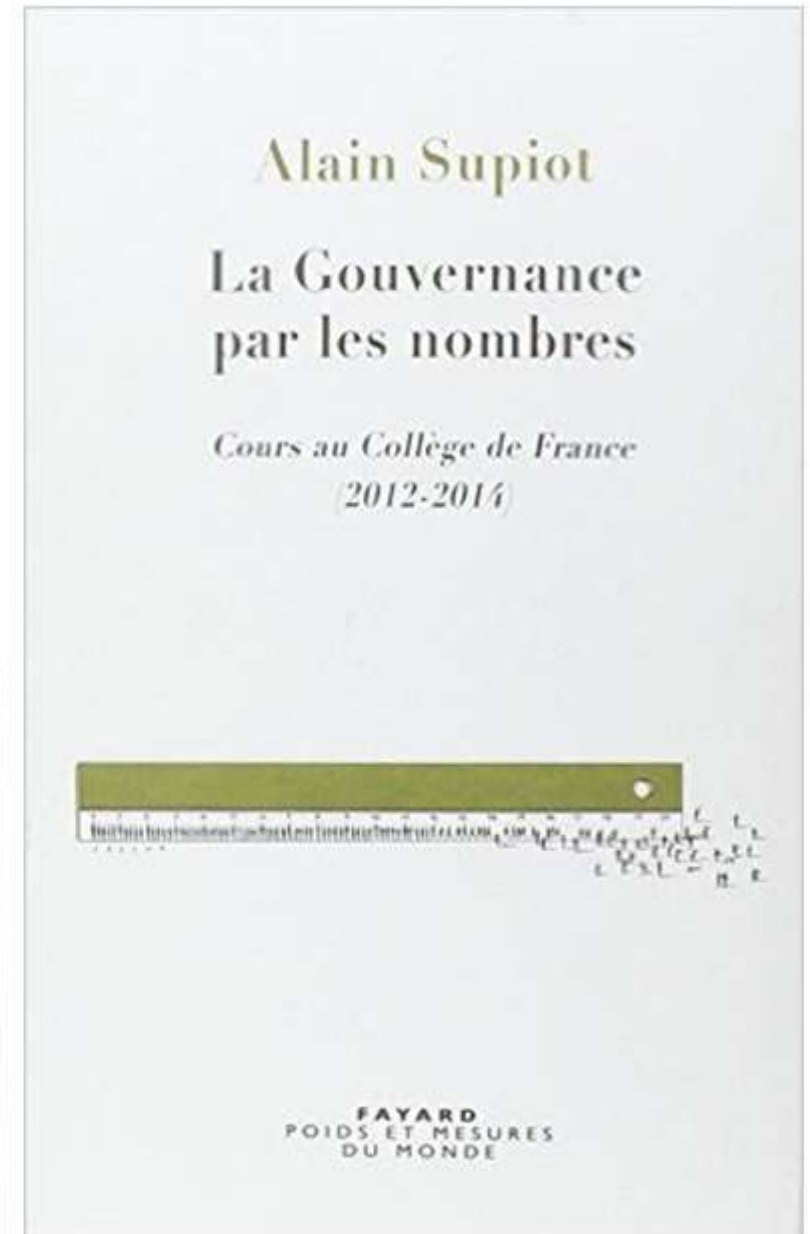
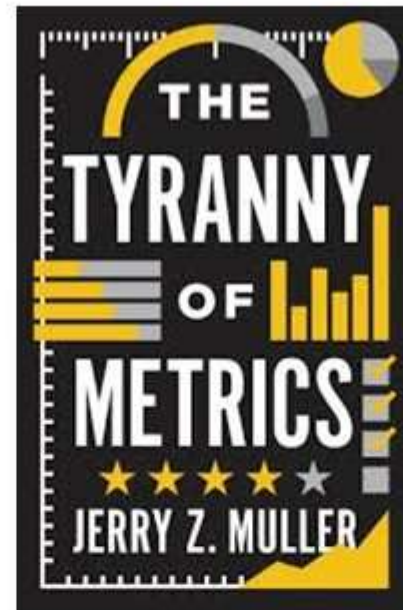
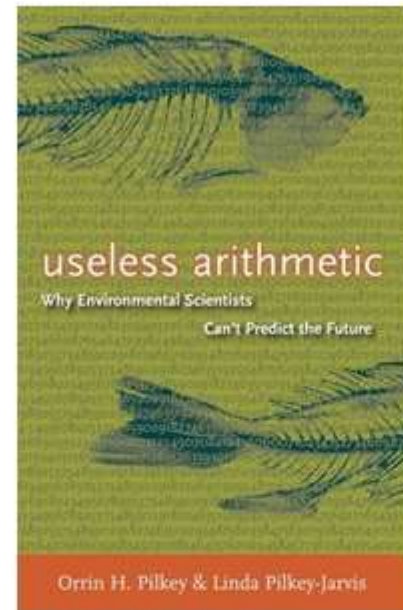
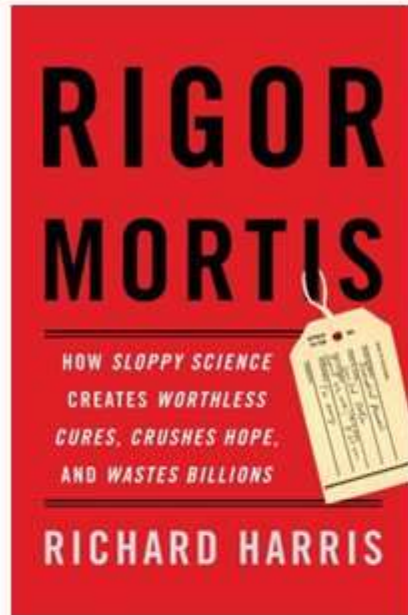
“what qualities are specific to rankings, or indicators, or models, or algorithms?”



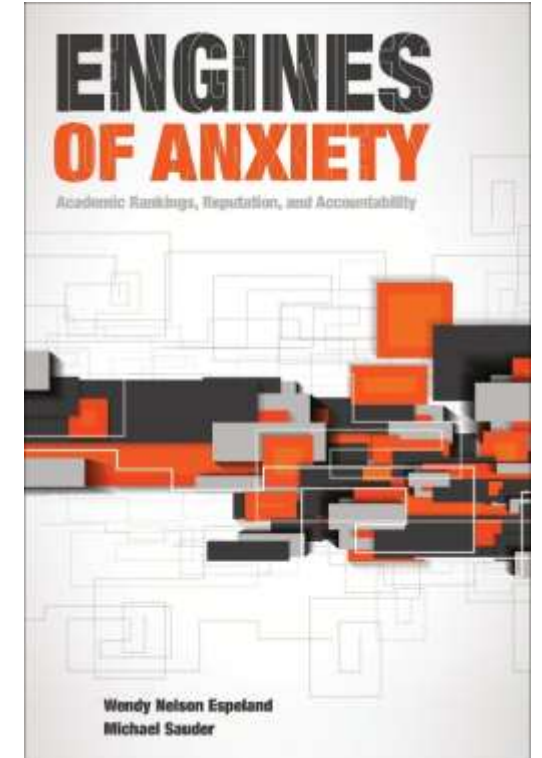
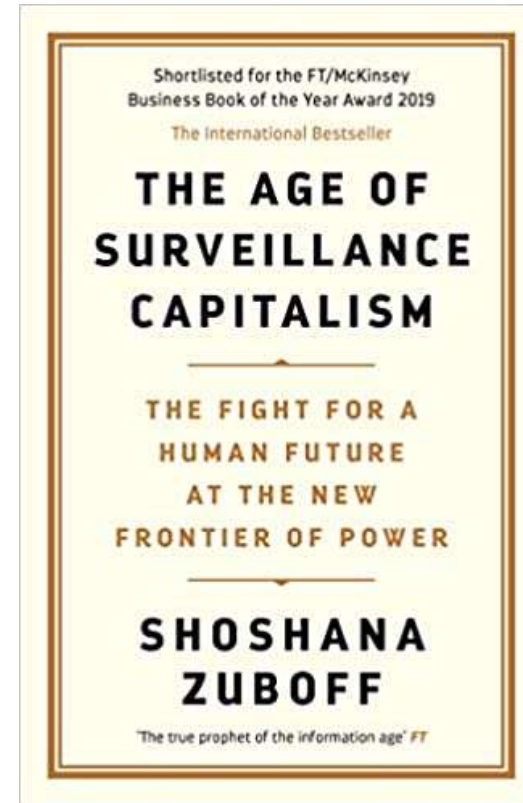
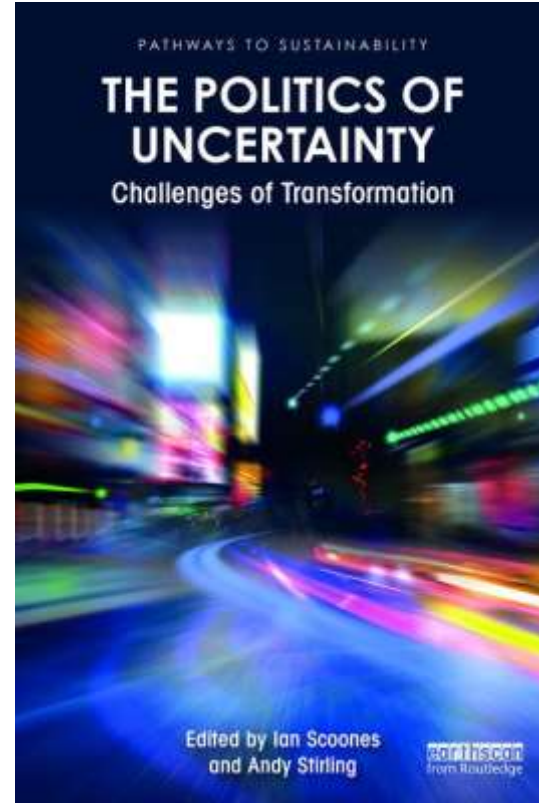
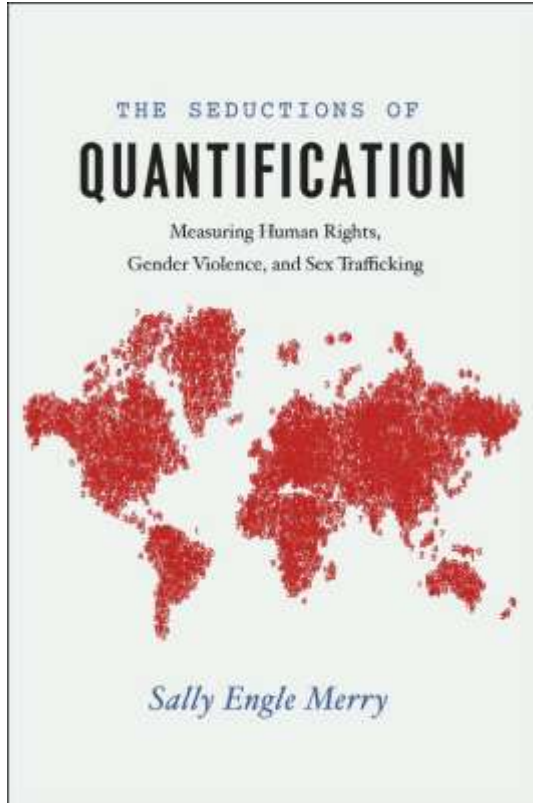
Elizabeth
Popp Berman

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

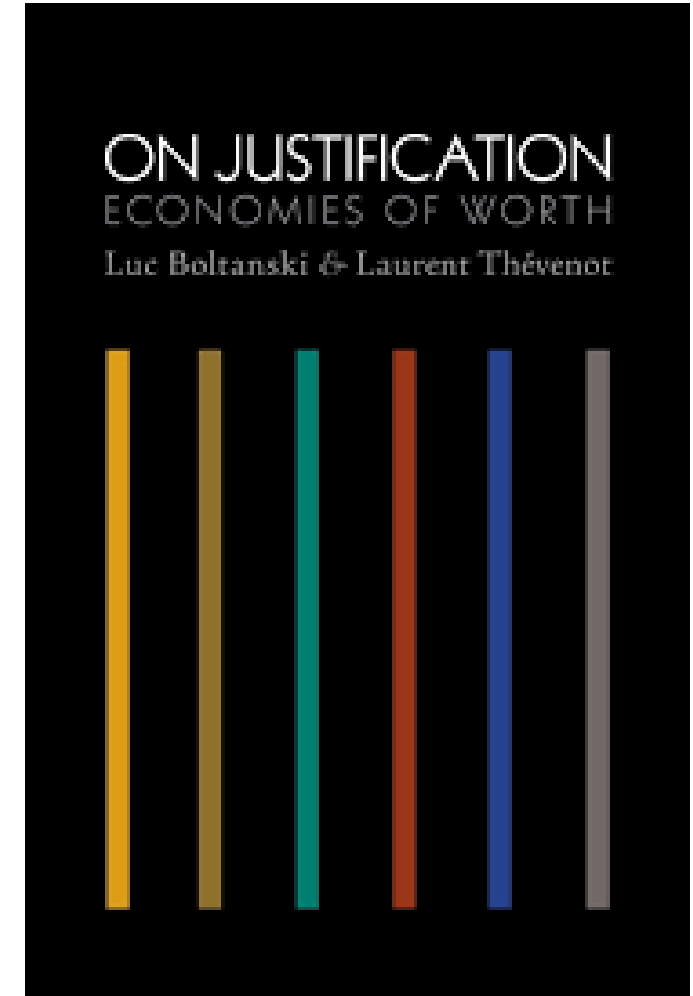
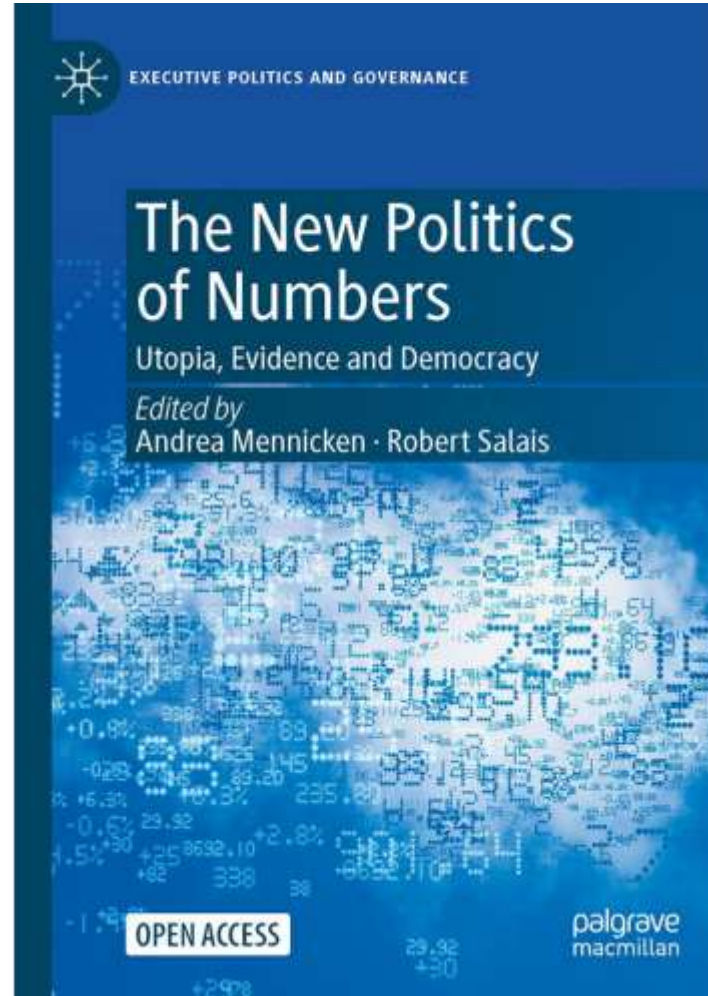
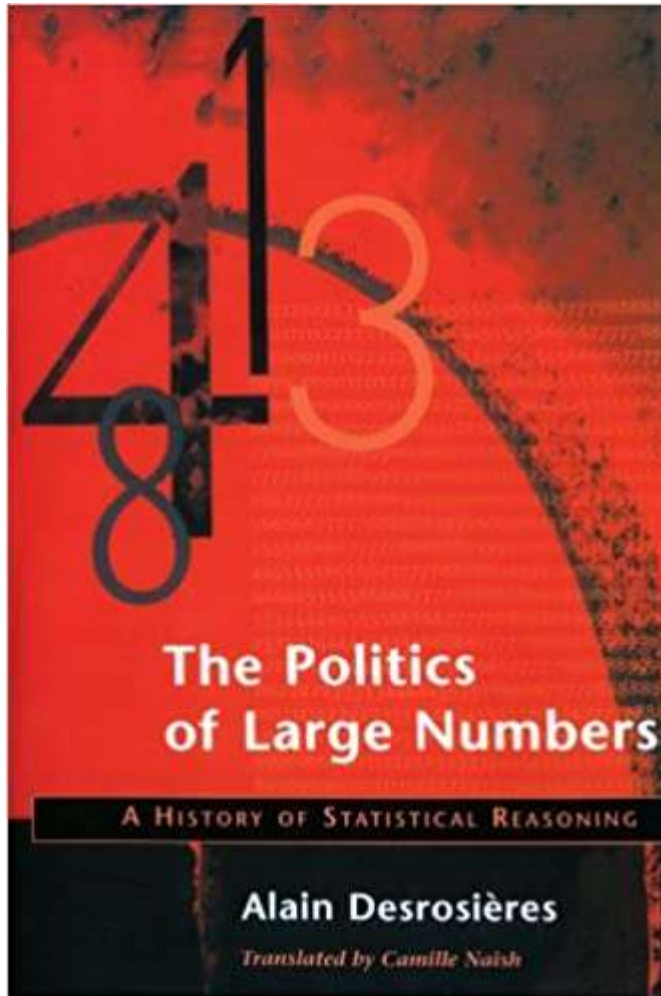
Algorithms, models, metrics, statistics...



Algorithms, models, metrics, statistics...



Algorithms, models, metrics, statistics...



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.



UCL Institute for
Innovation and
Public Purpose



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

Ethics of
quantification?



Futures

Volume 116, February 2020, 102509



Essays

Ethics of quantification or quantification of ethics?

Andrea Saltelli

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

Humanities & Social Sciences
Communications

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](#)

4091 Accesses | **8** Citations | **30** Altmetric | [Metrics](#)

Why ethics of quantification is needed now



**UCL Institute for
Innovation and
Public Purpose**

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

WORKING PAPER
WP 2021/05



... our world is structured by numbers, visible and invisible, where truth is conveyed and reality constructed

Numbers are seductive, performative, confer to their masters' epistemic power and legitimacy

Governing the modern state, or even contesting it, without numbers is impossible

Numbers are the prevalent means to express value in our societies
... Access & production of numbers reflect and reinforce power imbalances



**UCL Institute for
Innovation and
Public Purpose**

WORKING PAPER
WP 2021/05

Numbers capture our attention; they illuminate the part of reality which is being numerified, and hide that which is not

... numbers are so deeply entrenched in our existence that we barely reflect on them critically them anymore ...

... too close to us, they have become part of the very lens through which we attend to and comprehend the world

Harm from 'wrong numbers'

- Medical research
- Higher education
- Governance of science
- Finance
- International organizations
 - FAO
 - World Bank
 - OECD ...

**The Undoing of Doing
Business** **Project Syndicate**



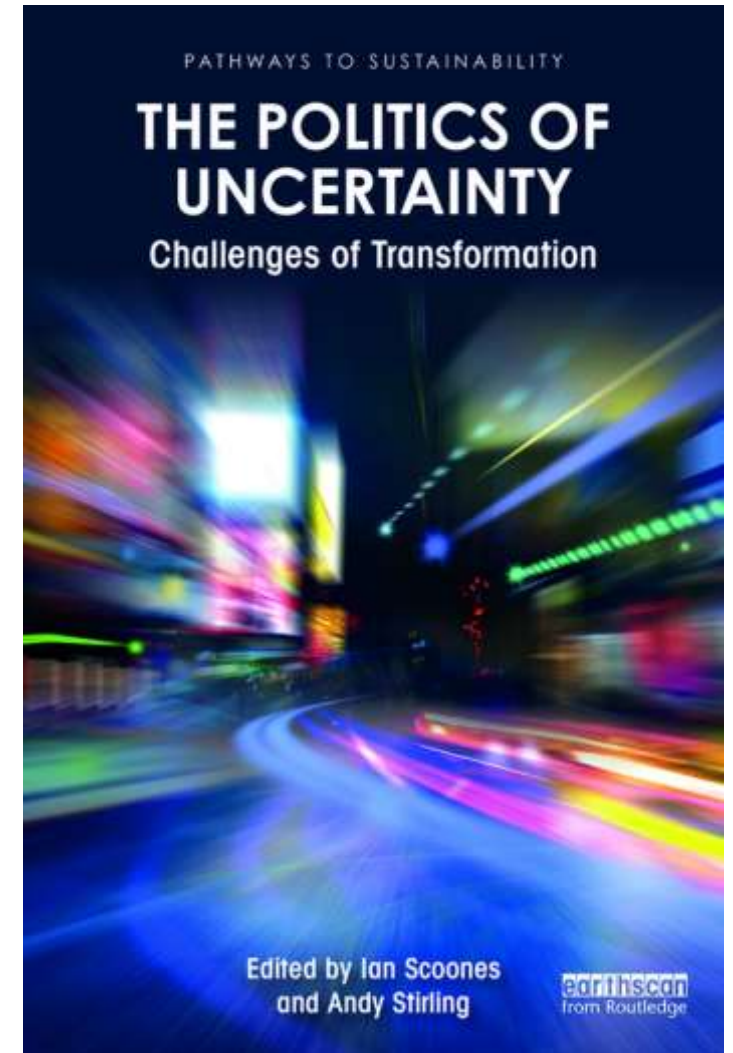
‘Trendy’ methods may also harm

- Randomized control trials misused to suggest more general conclusions that may not be valid
- Statistical/econometric techniques designed to promote particular policy conclusions reflecting researchers’ biases



**UCL Institute for
Innovation and
Public Purpose**

WORKING PAPER
WP 2021/05



The End



@andreasaltelli