

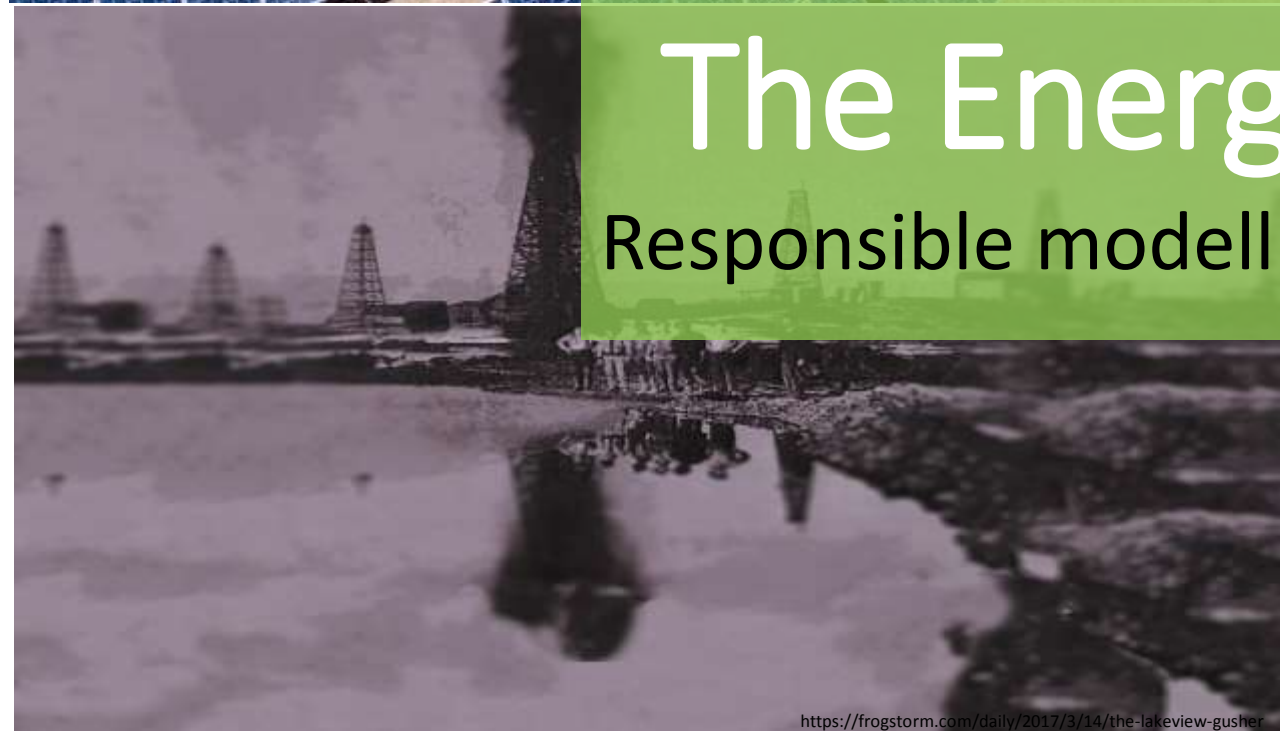


SDG 207

Feukeng, 2019

The Energy Transition

Responsible modelling and forecasting



Andrea Saltelli



- Lecture topics
 - Sociology and ethics of quantification, responsible modelling
- Main competence area
 - Sensitivity analysis, sensitivity auditing, ethics of quantification, science and technology studies
- Background
 - MSc in inorganic chemistry
 - 2005-2015 Head of Econometrics at the European Commission
 - 2016-2020 Professor 2 at UIB-SVT
 - Open Evidence Research, Barcelona



Responsible modelling and forecasting

Andrea Saltelli

Open Evidence Research, Open University of Catalonia



SDG 207, Thursday August 26 2021 at 14.15
(Auditorium 2, Realfagbygget, Allegaten 41)

Where to find this talk: www.andreasaltelli.eu

The logo for Andrea Saltelli, featuring the name "Andrea Saltelli" in white text on a teal square background.[HOME](#)[ABOUT ME](#)[PUBLICATIONS](#)[NEWS & VIDEOS](#)[RESOURCES](#)A scenic photograph of terraced rice fields in a valley, with mountains in the background under a hazy sky. The text "CAETERIS ARE NEVER PARIBUS" is overlaid on the left side of the image.

CAETERIS ARE
NEVER PARIBUS

Tweets by @AndreaSaltelli

andrea saltelli Retweeted

 **I-site ULNE**
@isiteULNE

#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



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

Embed

[View on Twitter](#)

Quantifications and the roots 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)

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 mathématique 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 surgeries; The increasing of strength and activity; The increasing of ability to suffer torture or pain; The altering of complexions, and fashions of dresses; The altering of features; The exalting of the intellectual parts; Versions of species; Making of new instruments of husbandry; Transplantation of trees, and putting of new seeds into them; The destruction of noxious animals, and putting of new ones upon another; The acceleration of maturation; The retardation of putrefaction; The acceleration of germination; Making rich composts for the use of husbandry; The alteration of the winds of the air, and raising of tempests; Great alteration of the constitution of the body, by emolliation, &c; Turning crude and watery substances into soft 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.

**MISSION:
ACCOMPLISHED**

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)

“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)



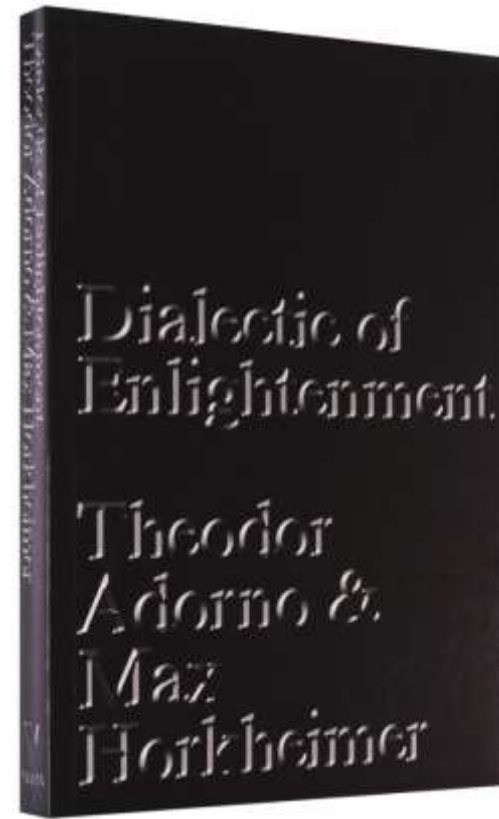
Nicolas de Caritat, marquis de Condorcet
(1743– 1794)

‘Sketch for a Historical Picture of the
Progress of the Human Spirit’

“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 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



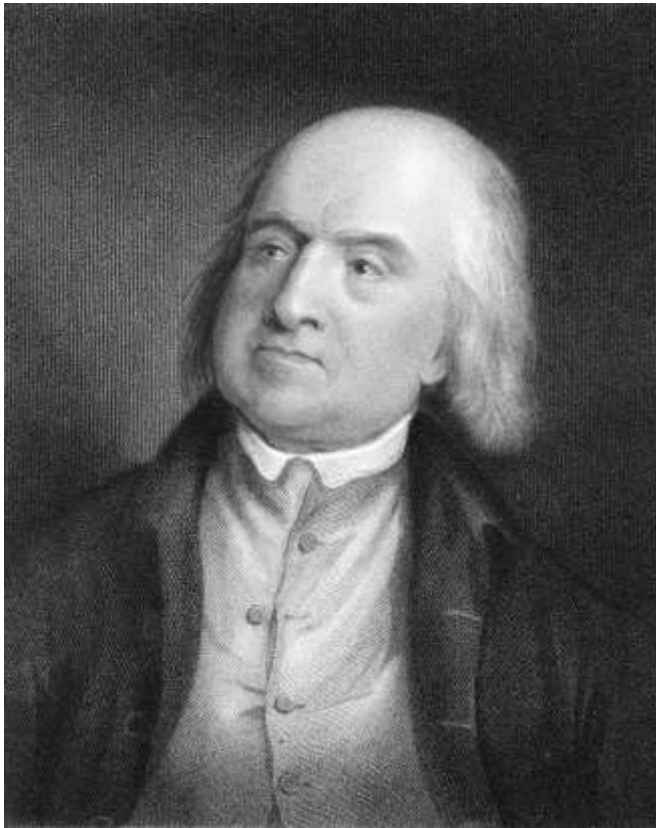
Condorcet's
algorithms and
Descartes'
Geometry: the
dream always had a
quantification
agenda



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

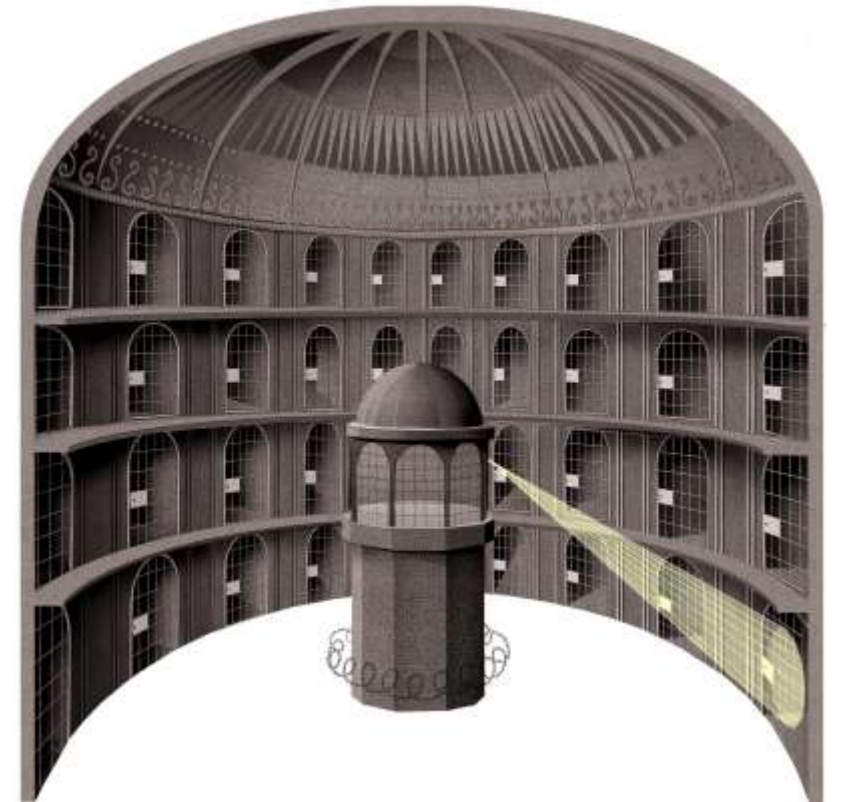


Marquis de
Condorcet
(1743– 1794)



Jeremy Bentham
(1748–1832)

Panopticon

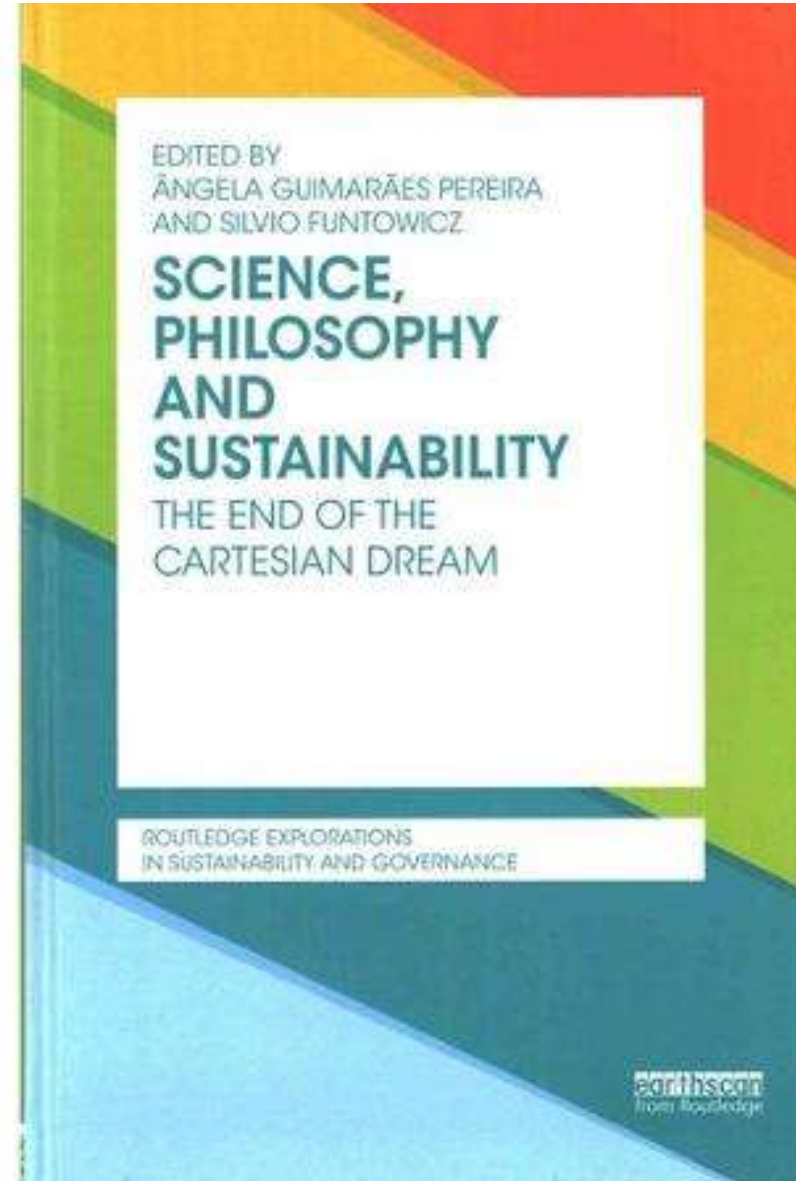


Artwork: Adam Simpson, New York Times

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



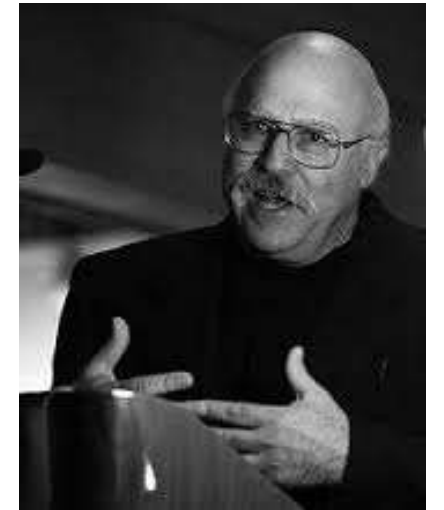
February 18, 2021, Landing of Perseverance on Mars

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

Numbers, visible and invisible...

Blurring lines:

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

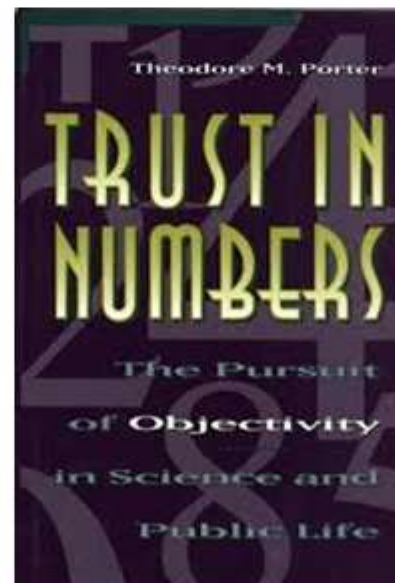
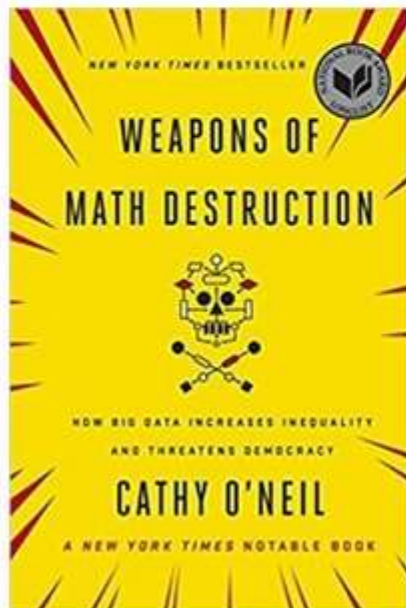
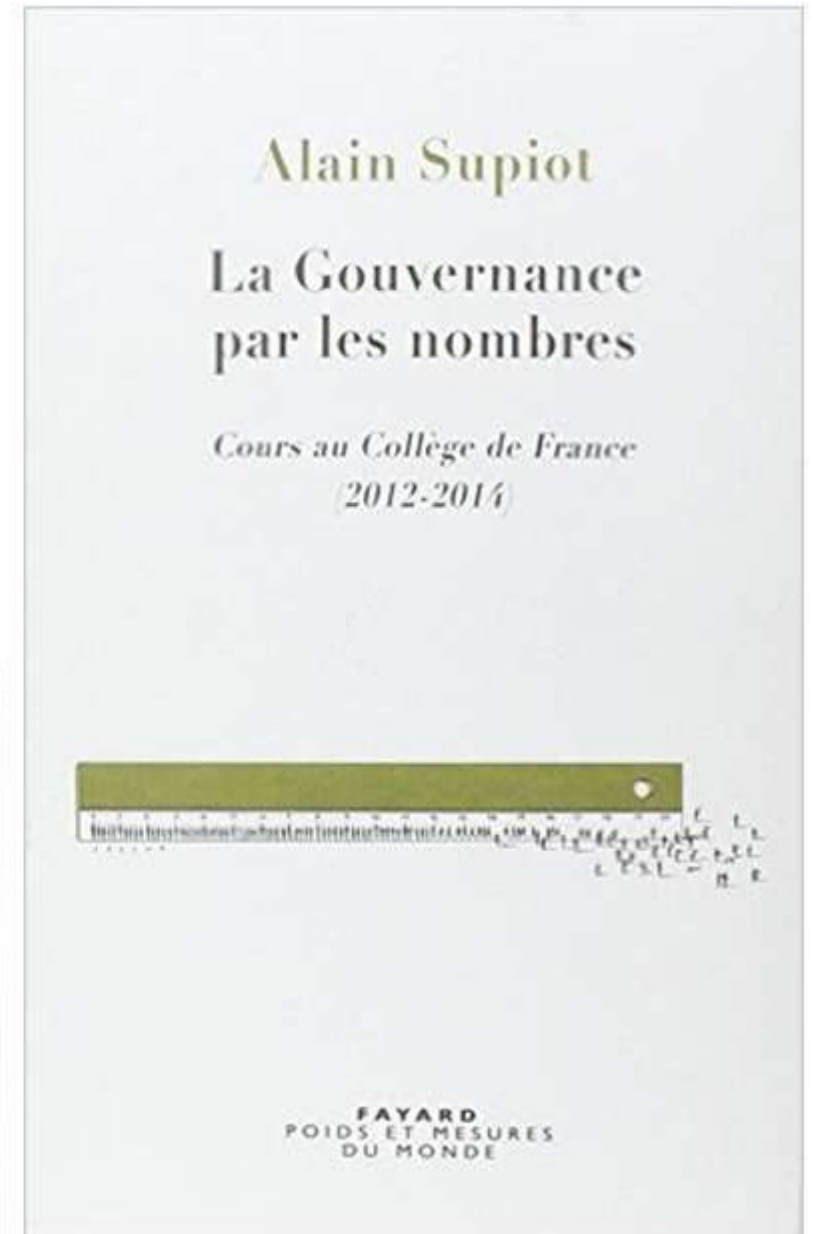
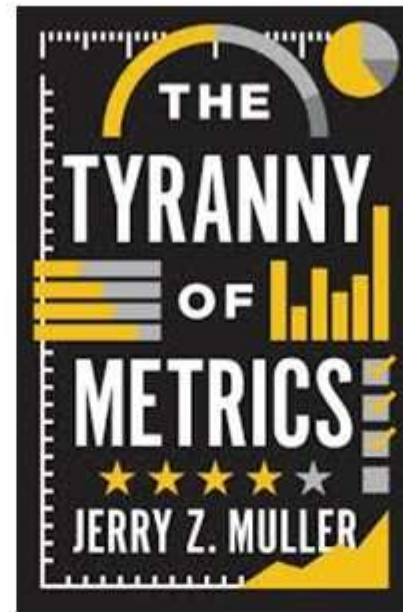
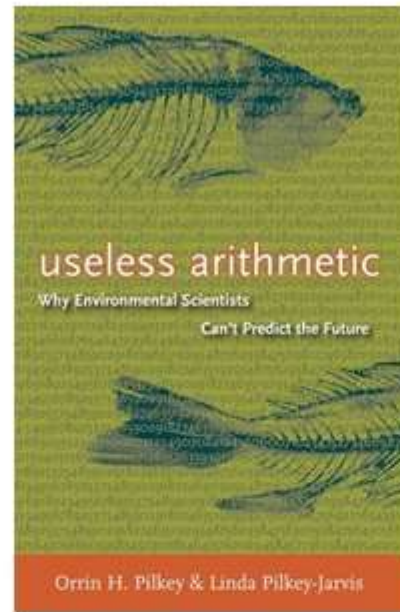
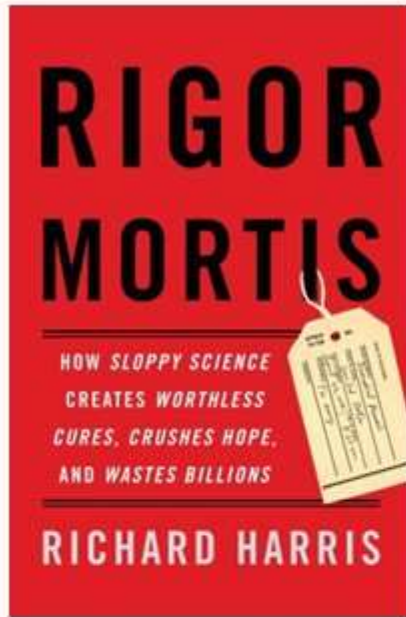


Elizabeth
Popp Berman

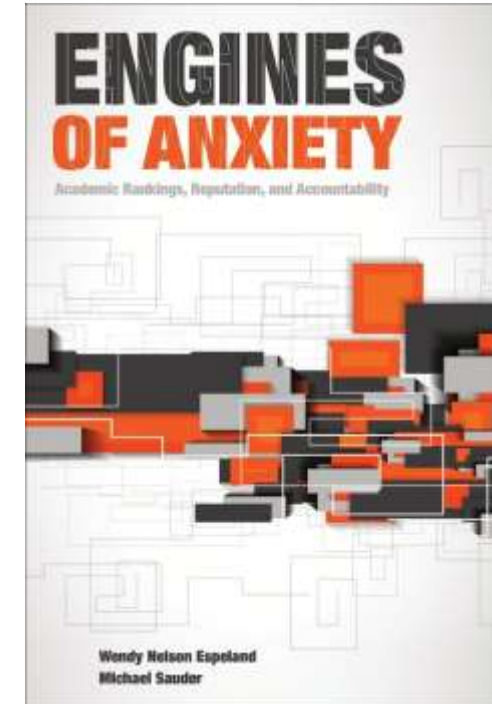
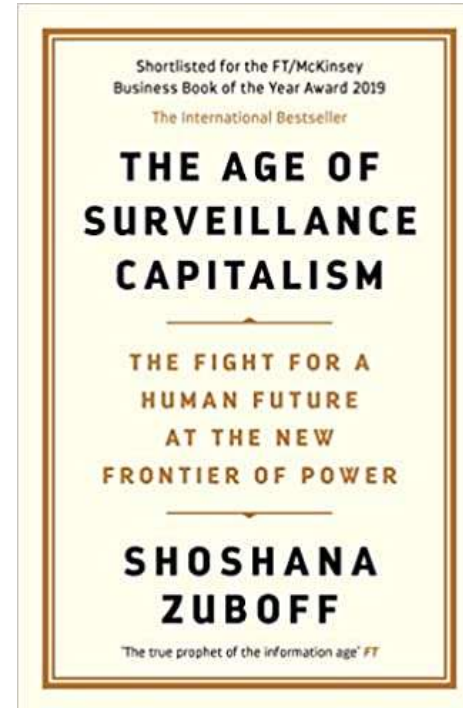
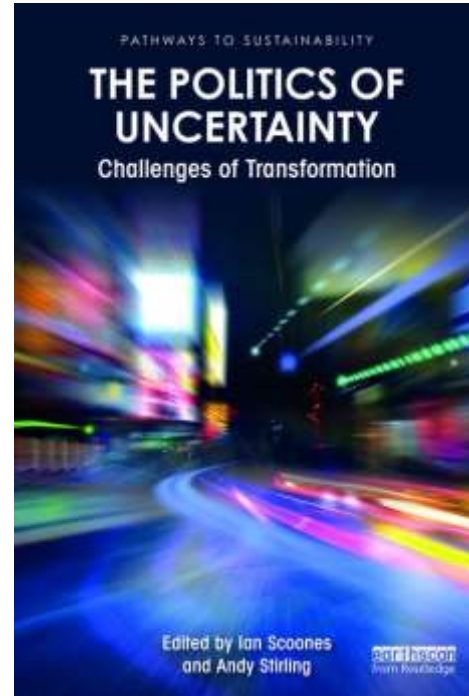
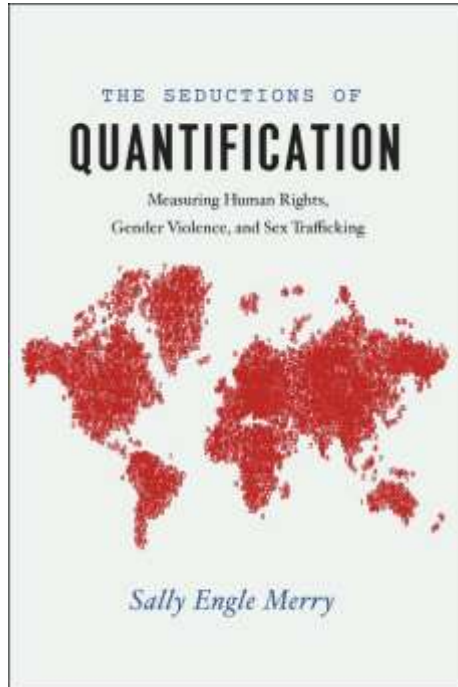
E. Popp Berman and D. Hirschman, **The Sociology of Quantification**: Where Are We Now?, *Contemp. Sociol.*, vol. in press, 2017.

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

Algorithms, models, metrics, statistics...



Algorithms, models, metrics, statistics...



Numbers and their ‘reactivity’
(Espeland and Sauder, 2016)

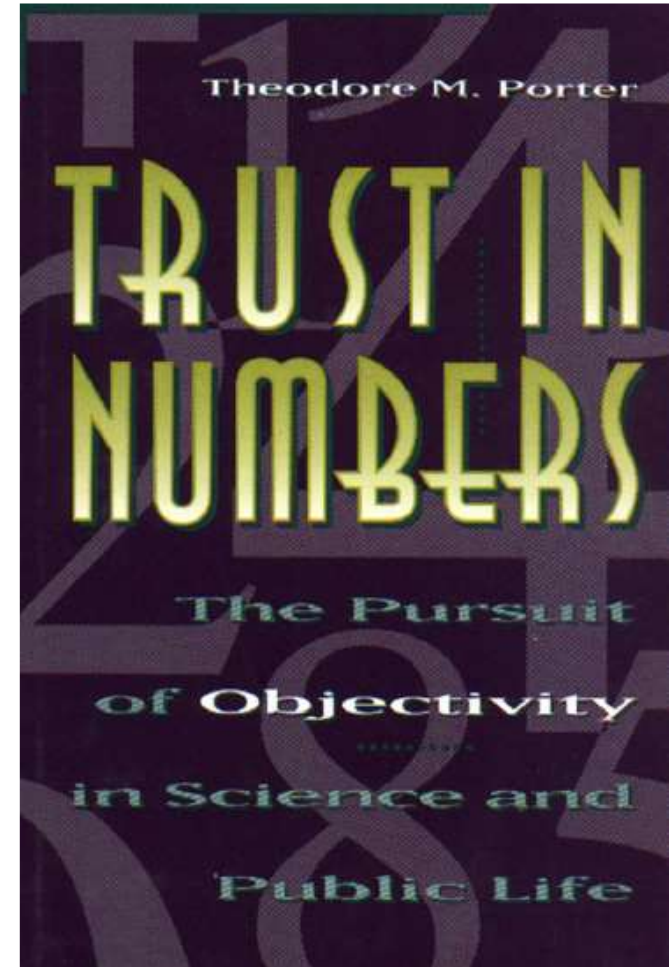
Incumbent numbers affect what society will
measure in the future (Merry 2016)

Numbers “create the environment that
justifies their assumptions”
(O’Neil, 2016)

Numbers and trust



Theodor
M. Porter



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

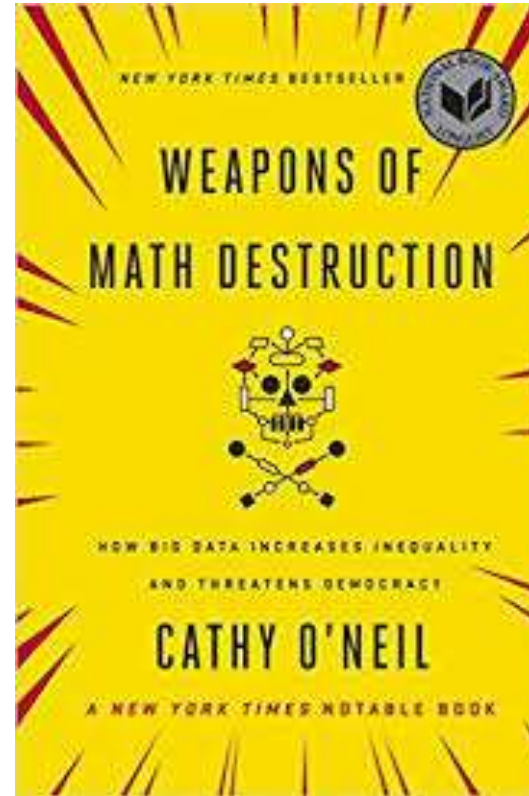
Porter's story: Quantification needs judgment which in turn needs trust ...without trust quantification becomes mechanical, a system, and 'systems can be played'.



Alarm for Weapons of Math Destruction



Cathy O'Neil

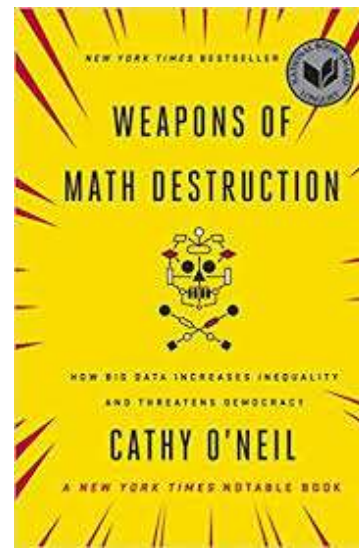


O'Neil, C. (2016). Weapons of math destruction : how big data increases inequality and threatens democracy. Random House Publishing Group.

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...

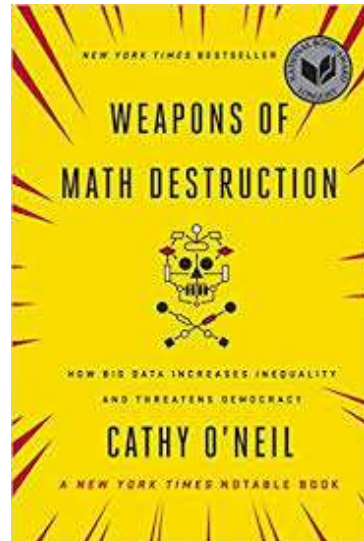
O'Neil, C. (2016). Weapons of math destruction : how big data increases inequality and threatens democracy. Random House Publishing Group.

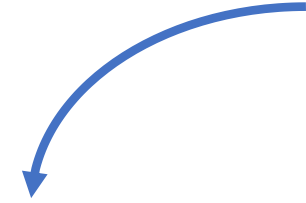
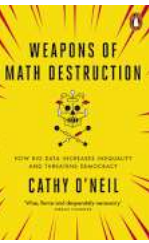
Brauneis, R., & Goodman, E. P. (2018). Algorithmic Transparency for the Smart City. Yale Journal of Law & Technology, 20, 103–176. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3012499



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>





NETFLIX

UNLIMITED TV SHOWS & MOVIES

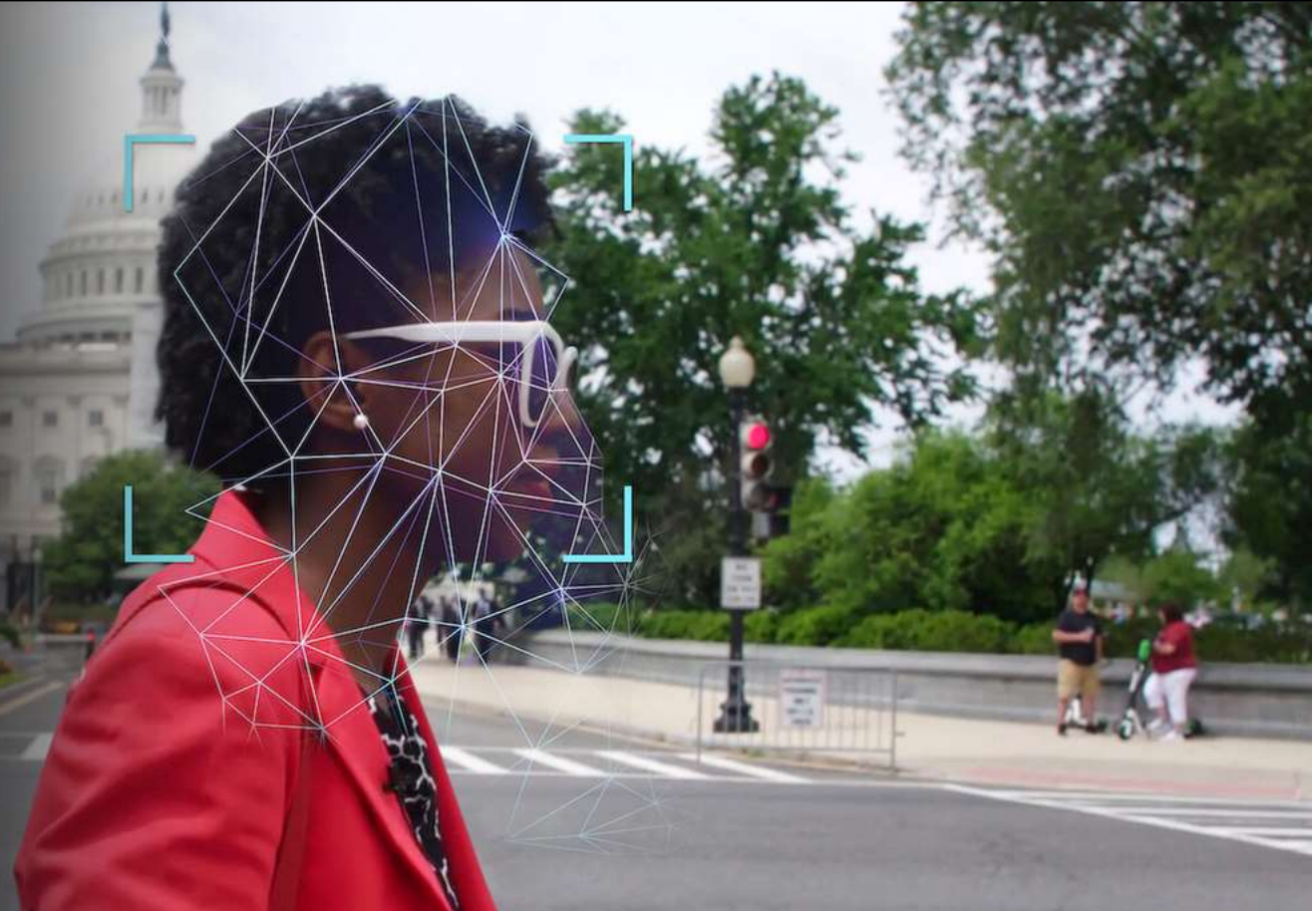
JOIN NOW

C O D E D B I A S

Coded Bias

2020 | 12+ | 1h 25m | Science & Nature Docs

This documentary investigates the bias in algorithms after M.I.T. Media Lab researcher Joy Buolamwini uncovered flaws in facial recognition technology.





Algorithmic Justice League

<https://www.ajl.org/>

The New York Times

Bloomberg
Business

Forbes

TIME

FORTUNE

TED

WIRED

The Telegraph



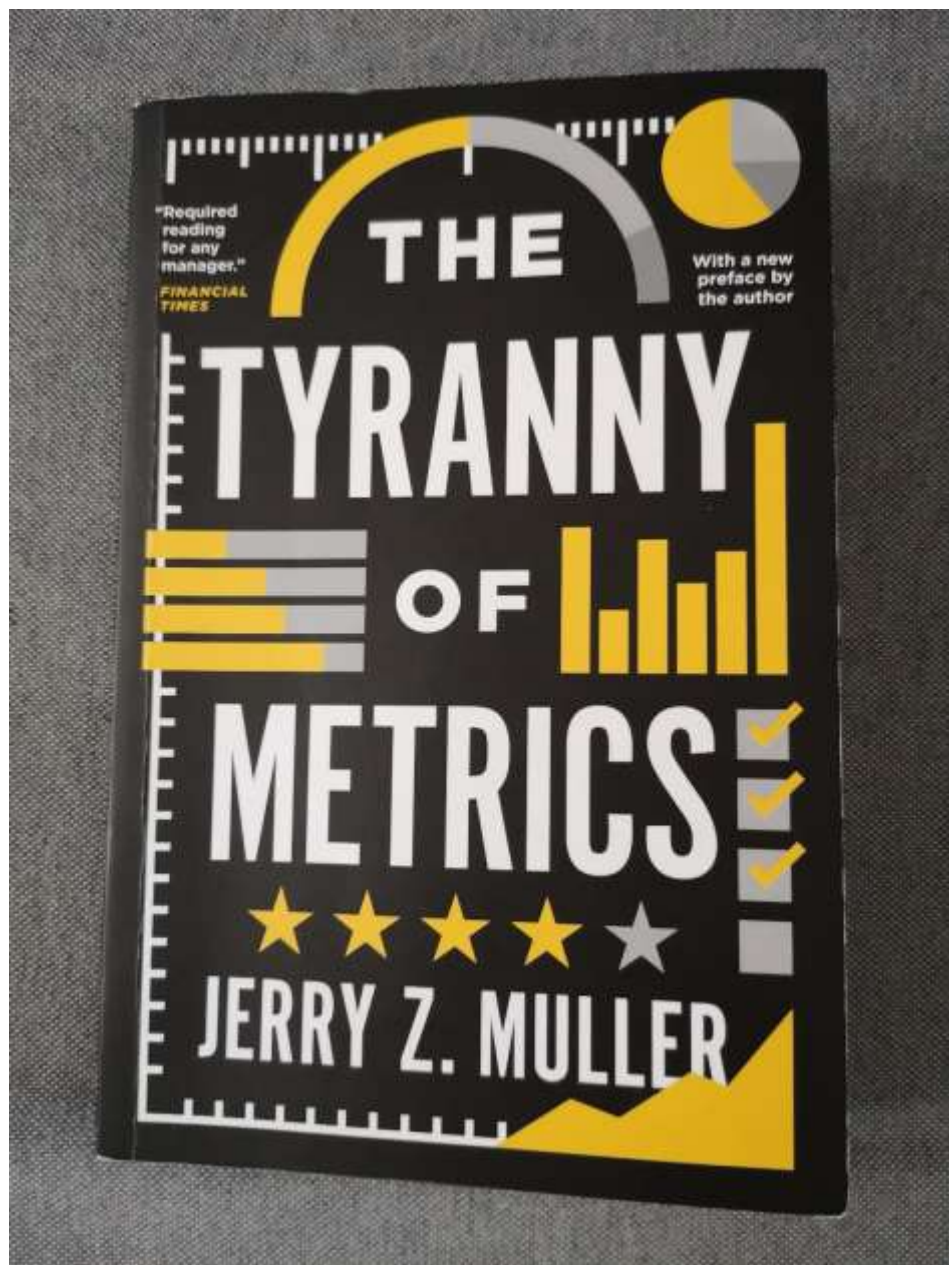
Charles Goodhart

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

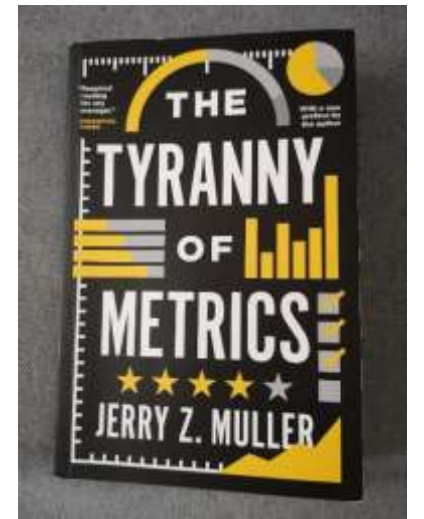


J. Z. Muller, The tyranny
of metrics. Princeton
University Press , 2018.

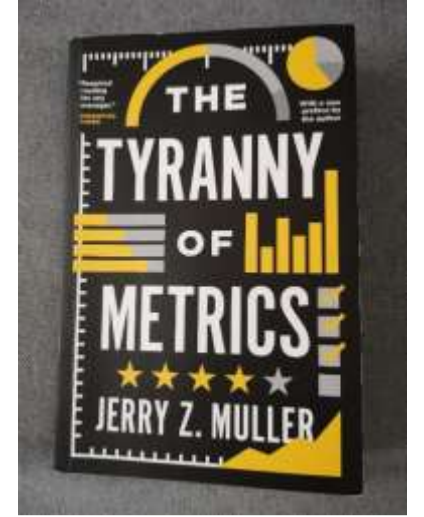
Metric fixation, or the irresistible pressure to measure performance

Gaming of metrics (recall Goodhart law)

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



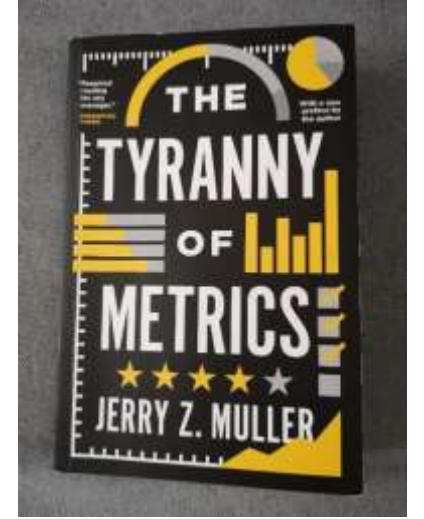
Unintended consequences



- 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

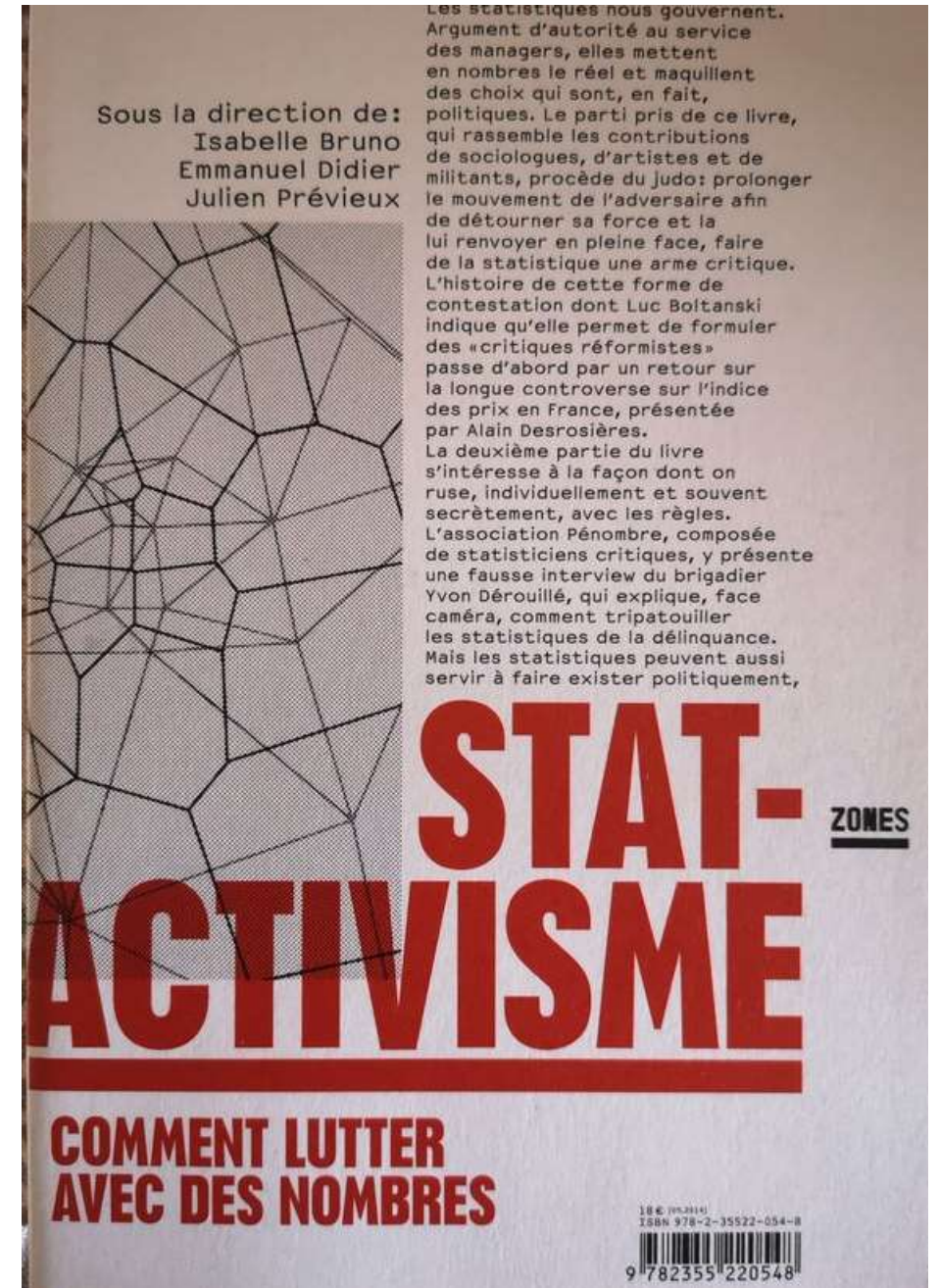
A concluding remark of Muller

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”



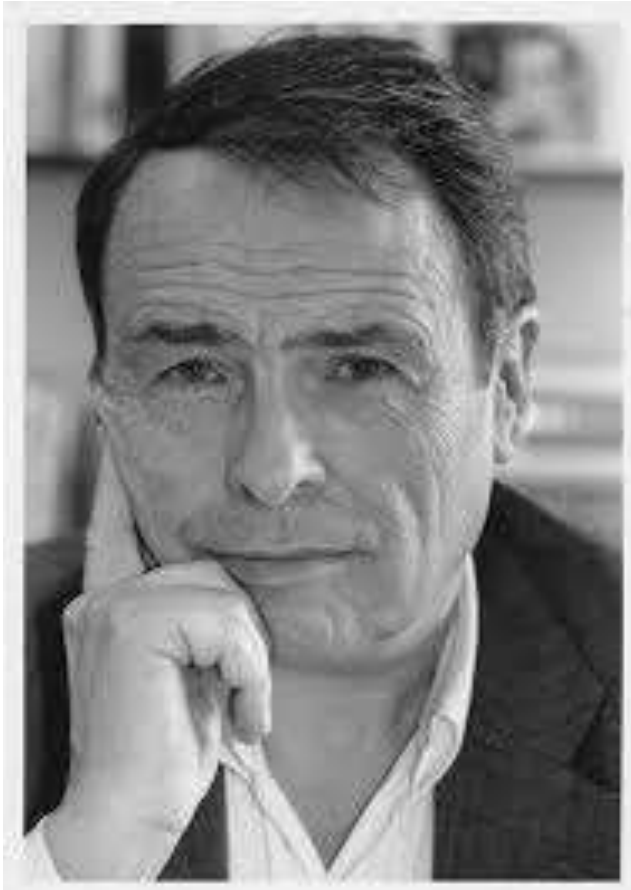
Do we need a movement of resistance?

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

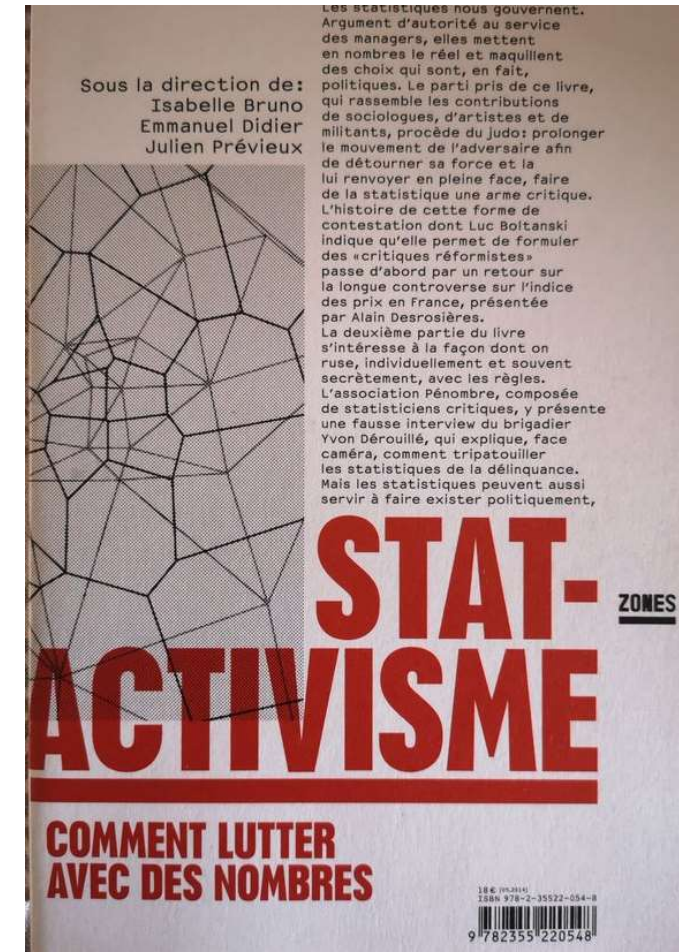
(Sociology must be fun)



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



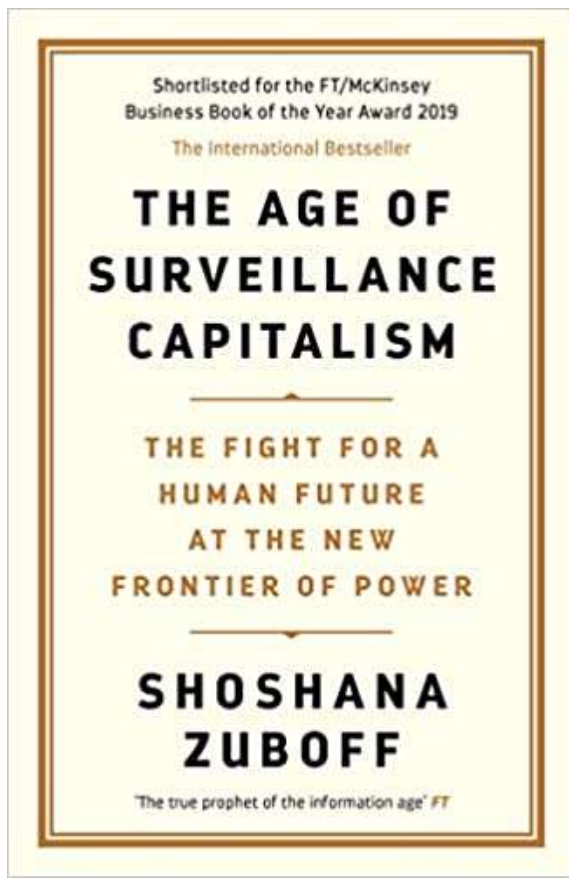
Important:

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

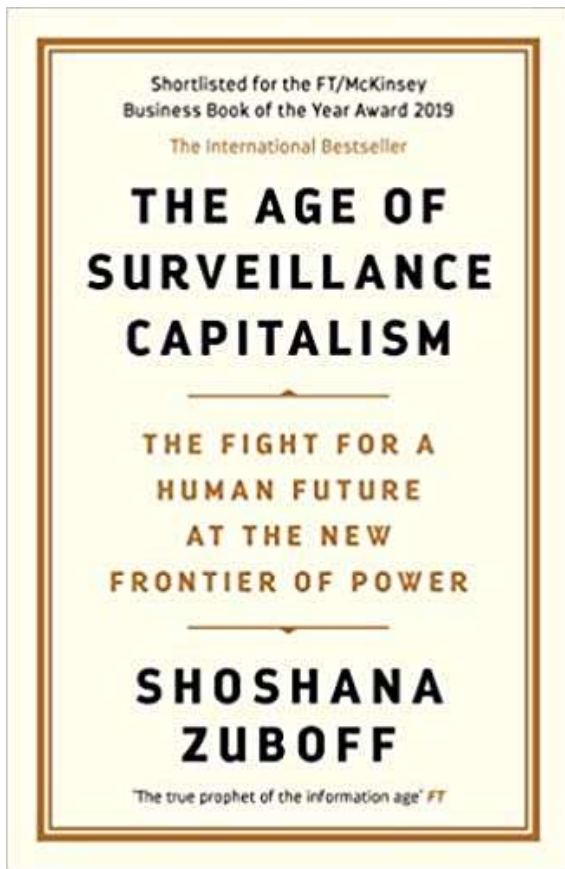




A project of domination of consumers and voters is made possible by artificial intelligence, big data & cognitive psychology



Inequality, power asymmetries and the world of surveillance capitalism



Chapters 11 & 12

Instrumentarian
power



Chapter 10

Néorationalism d'importation

*La trollisation de l'espace
public*

Cognitive psychology
and evolutionary
psychology

A project of domination?



Making algorithms
'good' or 'transparent'
is beyond the point.
Algorithms create new
norms of good or bad.

Algorithm =
ethicopolitical
arrangement of
values, assumptions,
and propositions about
the world



Louise Amoore



THE LONDON SCHOOL
OF ECONOMICS AND
POLITICAL SCIENCE ■

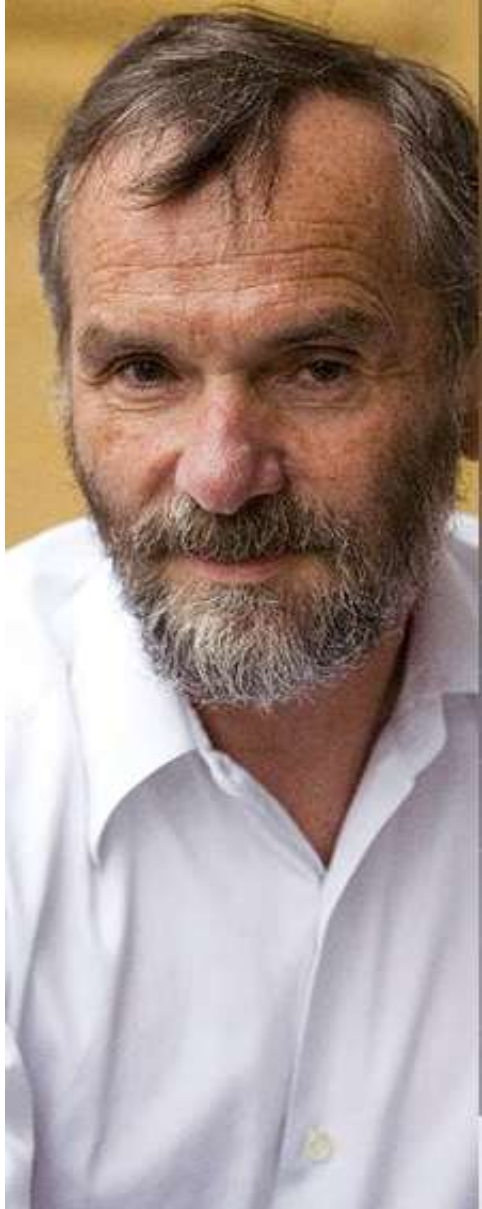
LSE Research Online

[Nick Couldry](#) and Ulises Mejias

Data colonialism: rethinking big data's relation to the contemporary subject

Couldry, Nick and Mejias, Ulises (2018) Data colonialism: rethinking big data's relation to the contemporary subject. *Television and New Media*, vol. 20, 4: pp. 336-349.

Alain Supiot

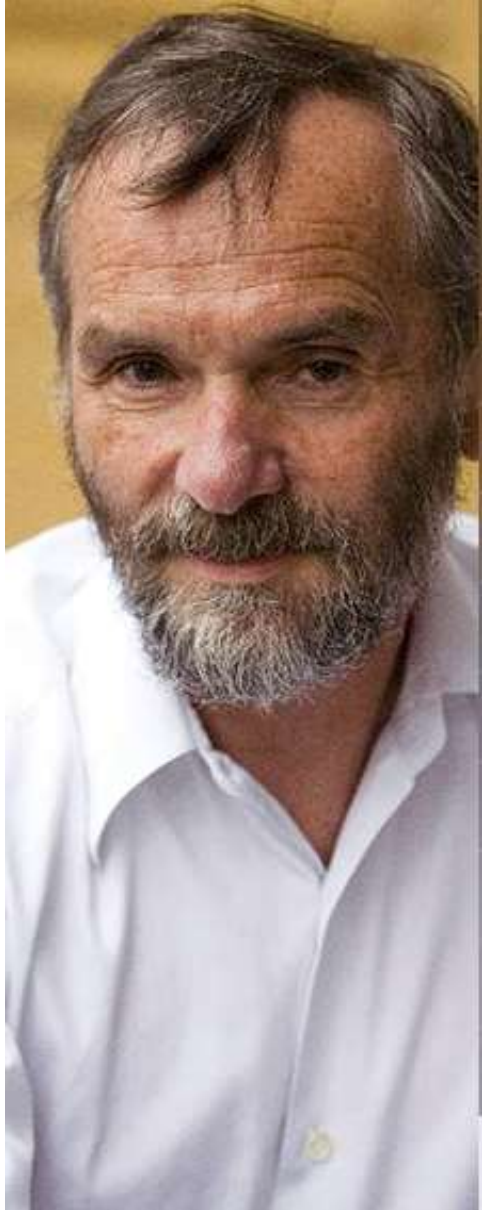


An indictment of the
Total Market and the
normative uses of
economic quantification

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



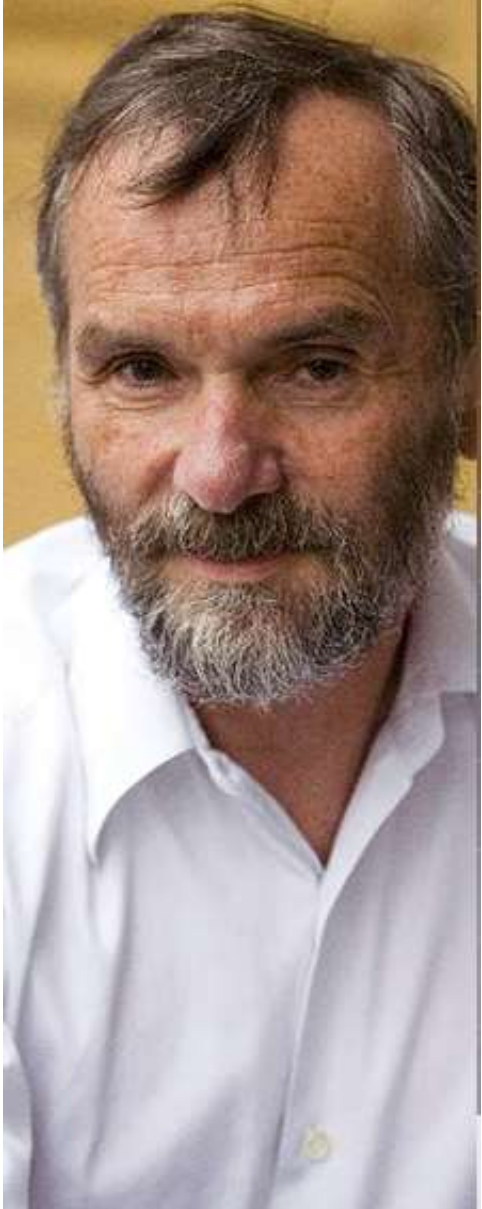
Alain Supiot



...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

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

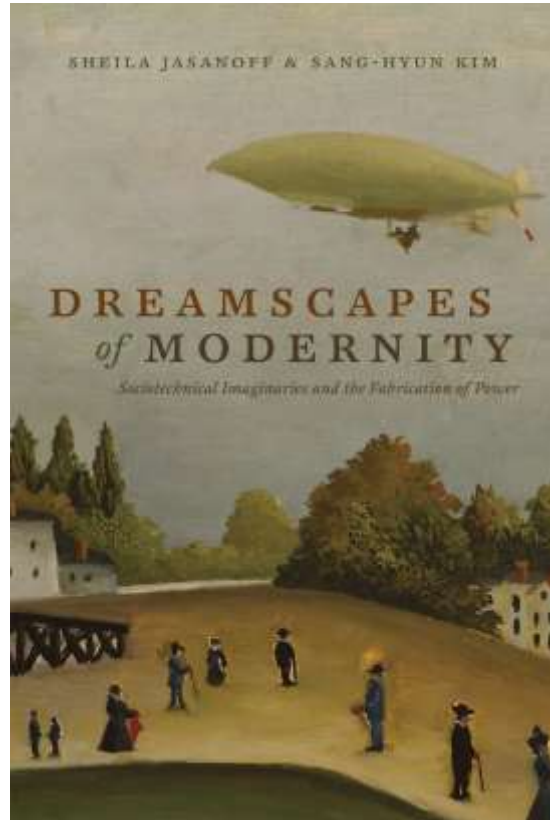
Open Evidence Research, Universitat Oberta de Catalunya (UOC)

Jerome R. Ravetz

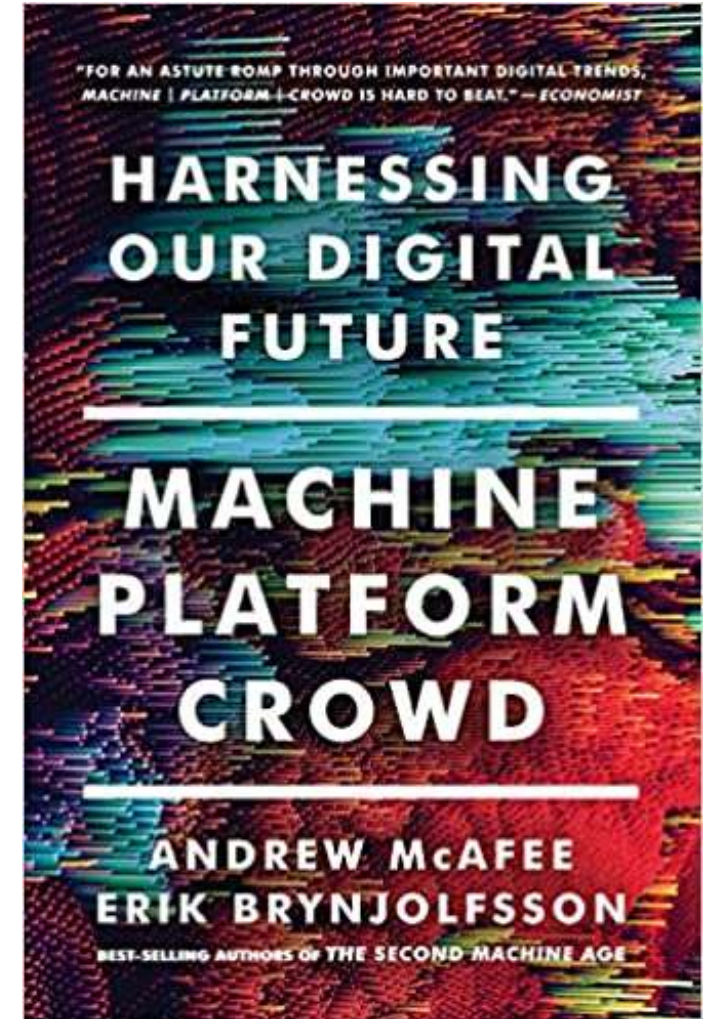
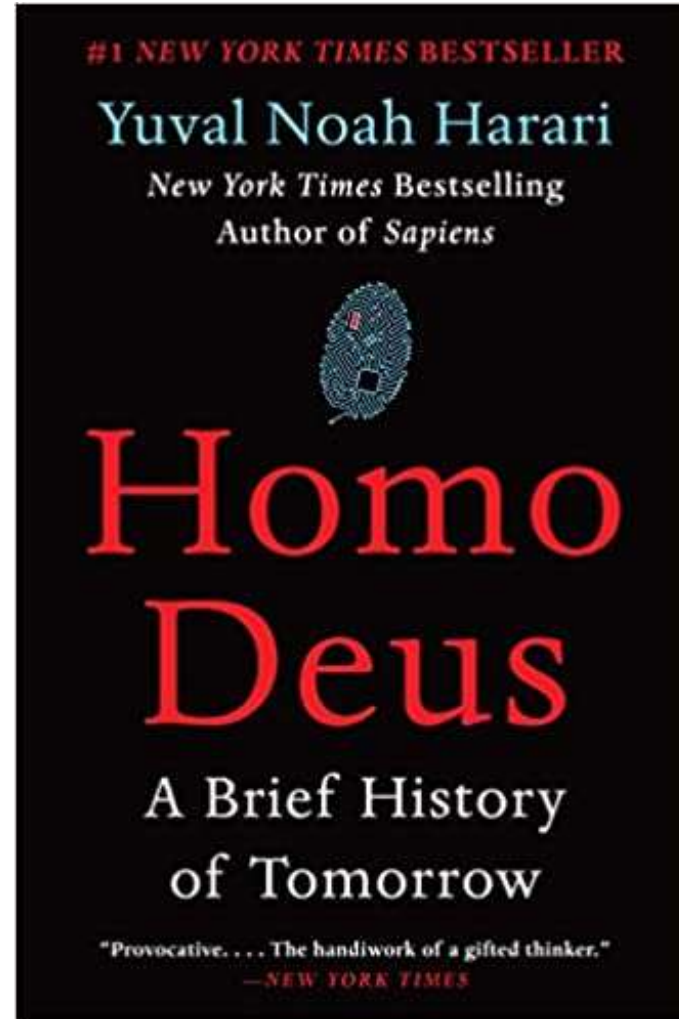
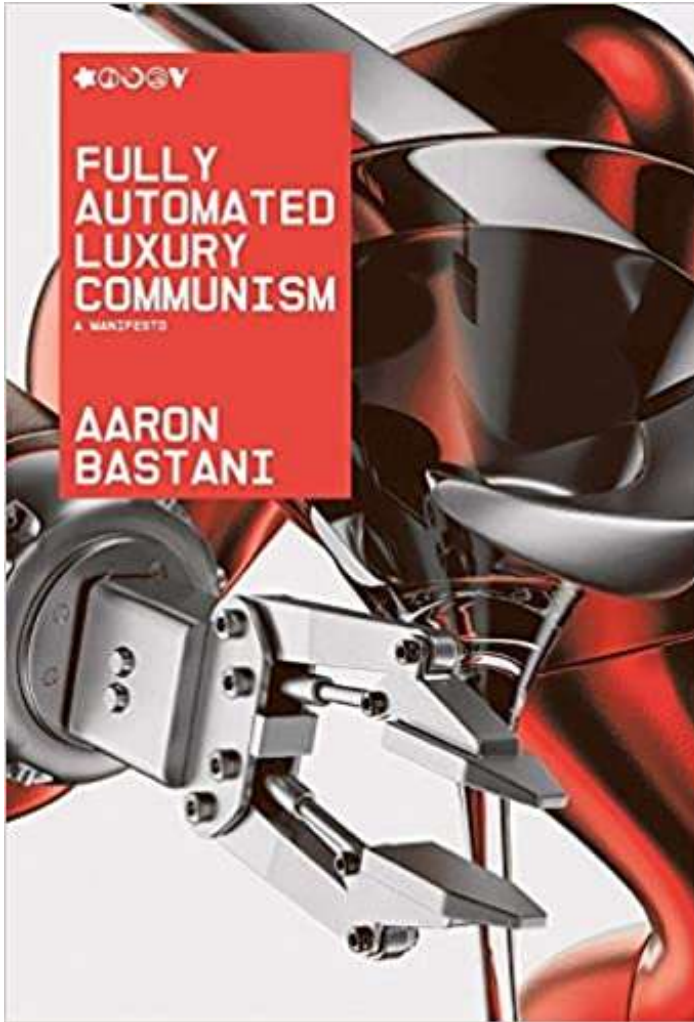
Institute for Science, Innovation and Society, University of Oxford

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



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)

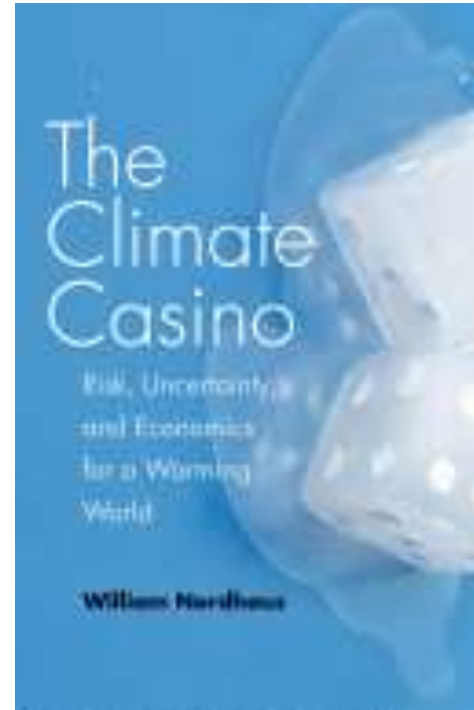


Cass Sunstein, winner of
the 2018 Holberg Prize

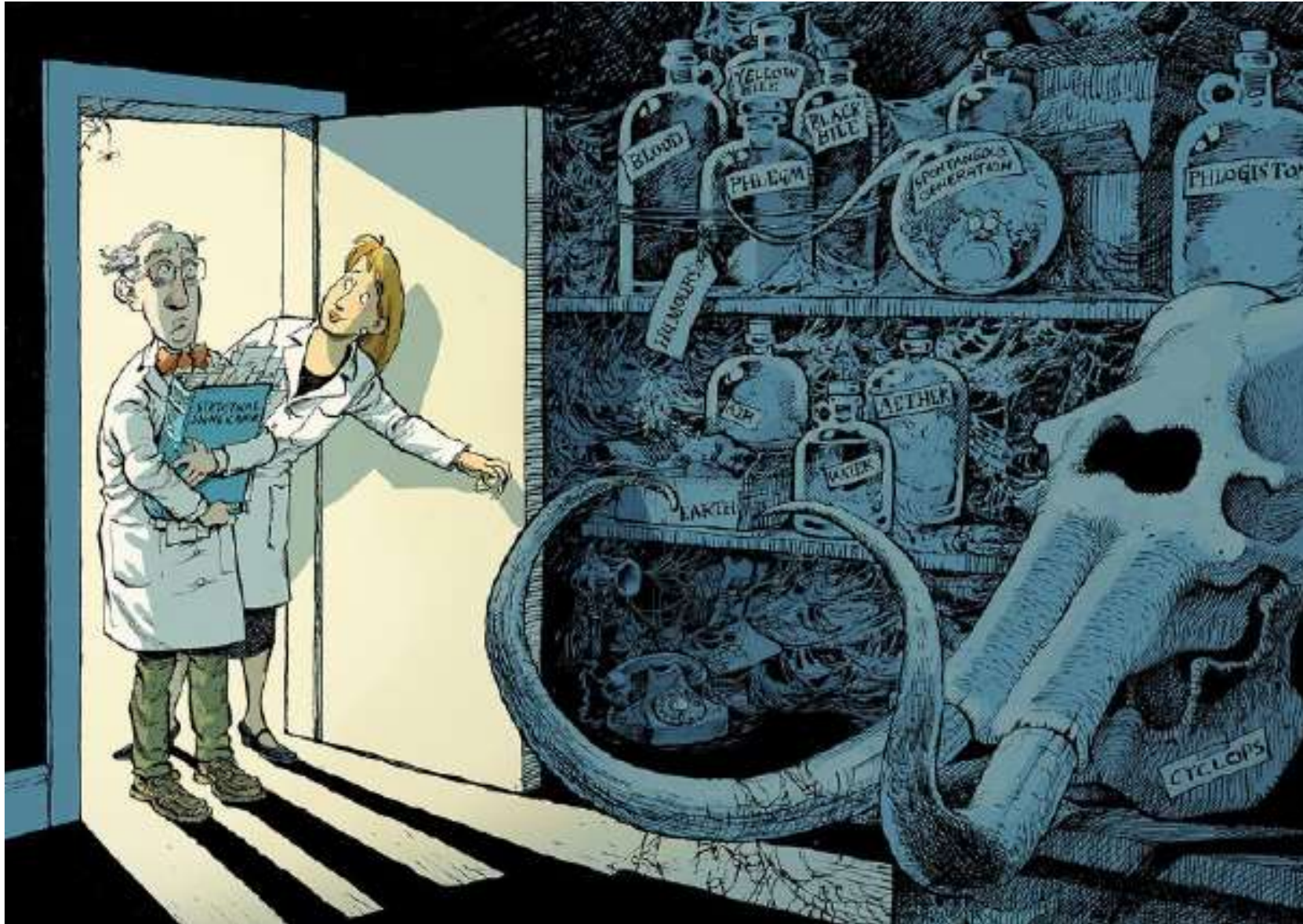


One of the winner of Nobel prize for economics 2018 was Willem Nordhaus, for his work on the economics of climate change.

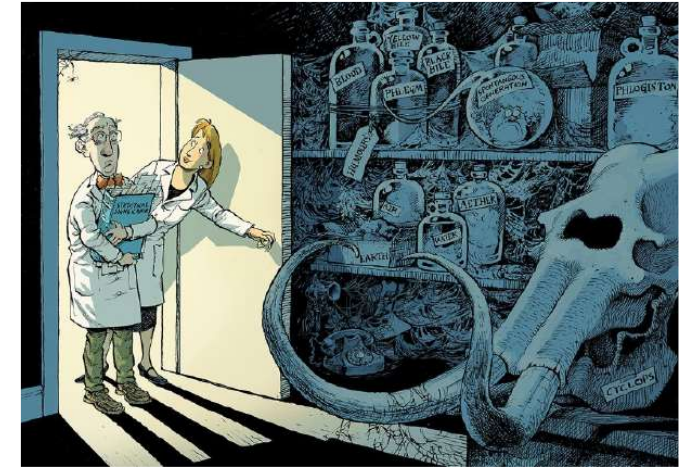
Cost benefit analysis to the year 2100?



Statistical and mathematical modelling



Throw away
the concept of
statistical
significance?



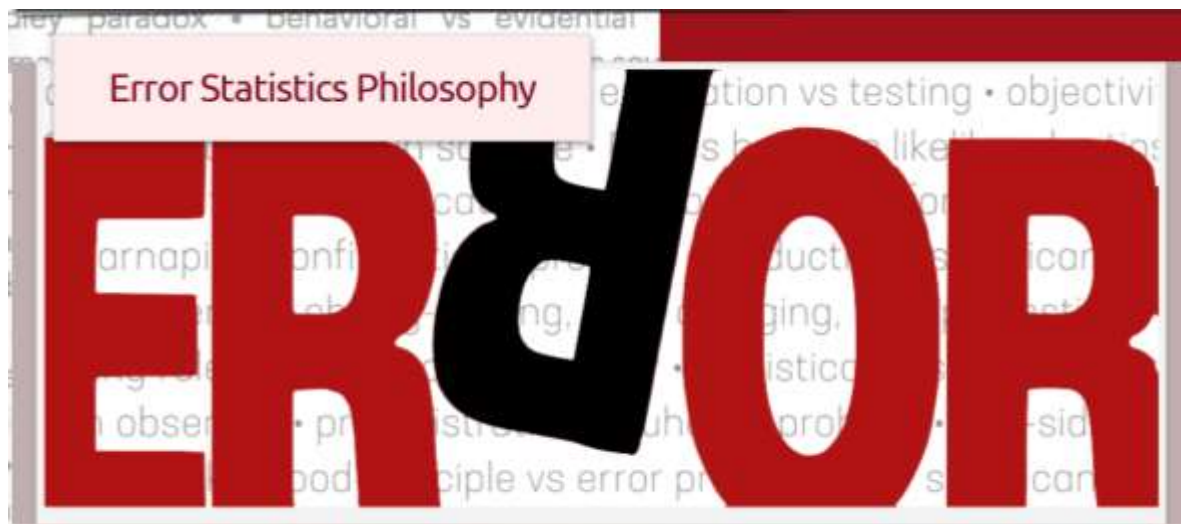
COMMENT • 20 MARCH 2019

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/>





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?

Is mathematical modelling affected?



[Comment](#)

[Open Access](#)

[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.

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.

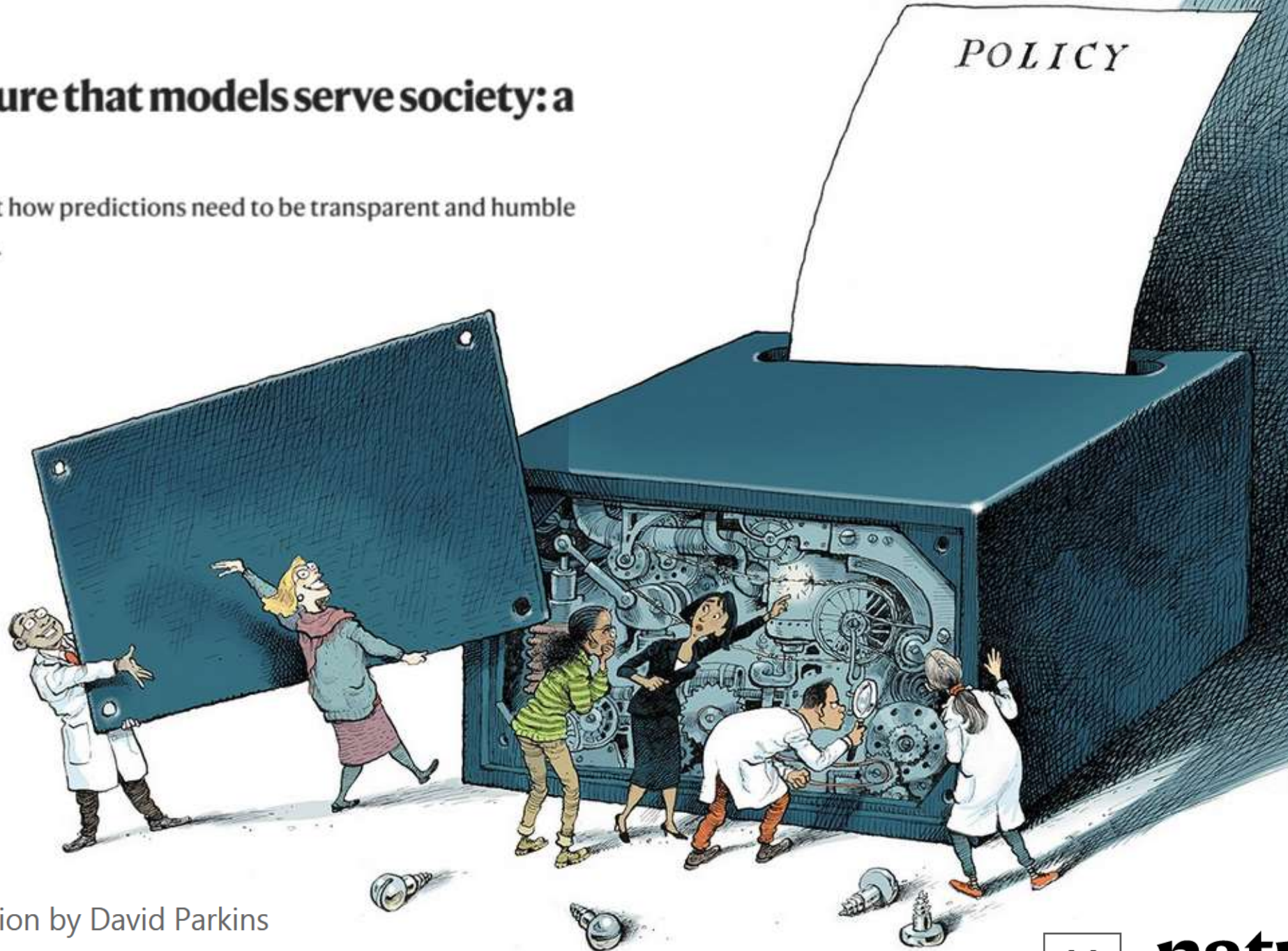


Illustration by David Parkins



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

2 experts models and society

3 statisticians

2 *statactivistes*

2 economists

1 epidemiologist

2 sociologists of quantification

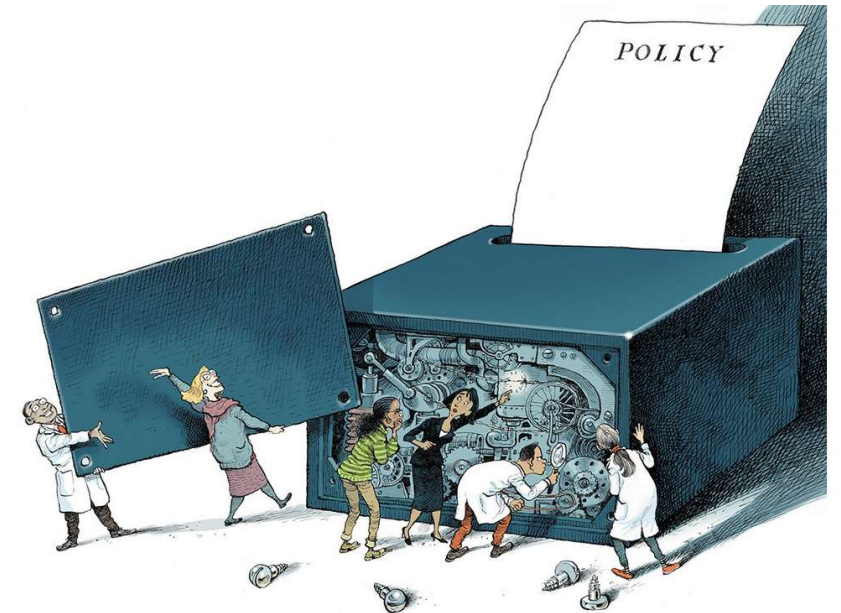
3 STS scholars

1 philosopher

1 historian

1 political scientists

1 expert RRI - Open Science



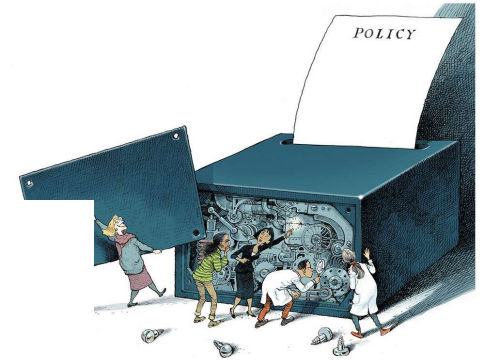
Power

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.

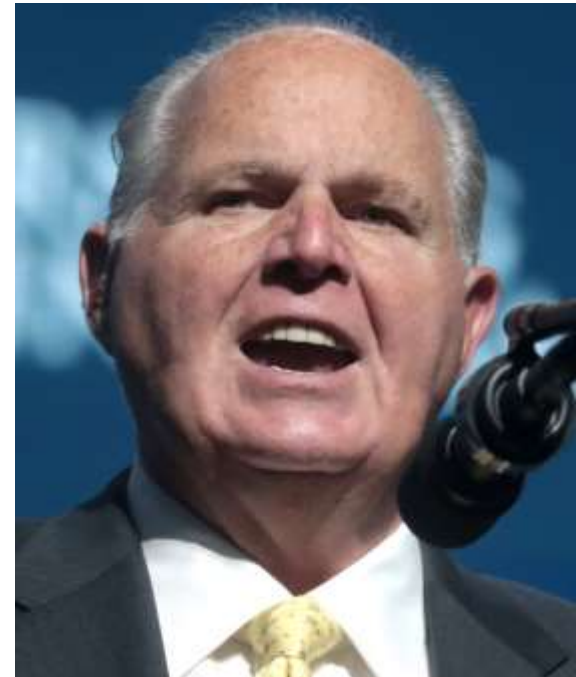


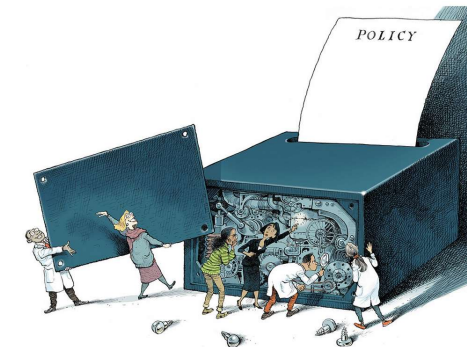
Conflicts, when questions of urgency, stakes, values and uncertainty collide

“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

Rush Limbaugh



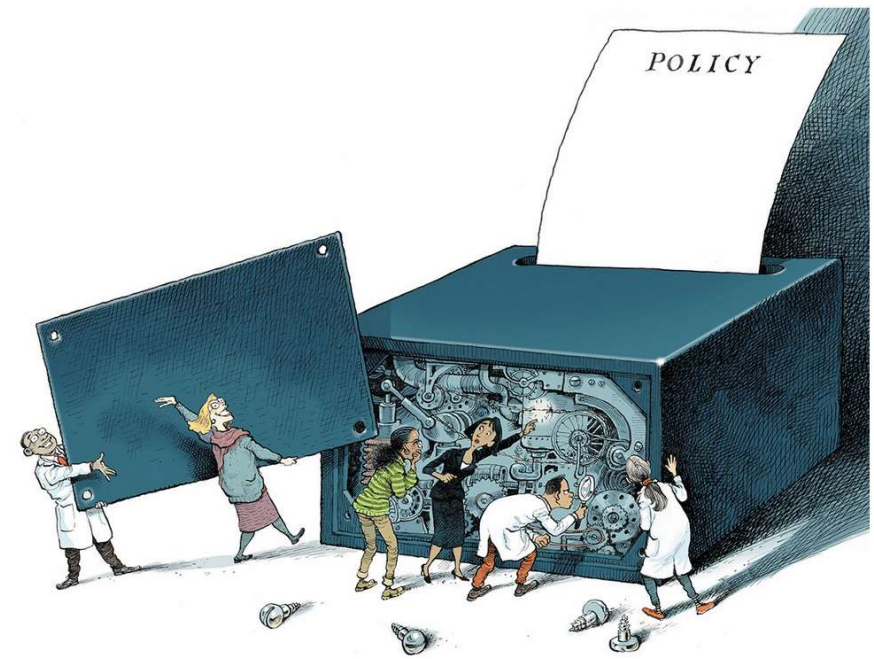


“Modellers must not be permitted to project more certainty than their models deserve;

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

Mind the assumptions

Assess uncertainty and sensitivity



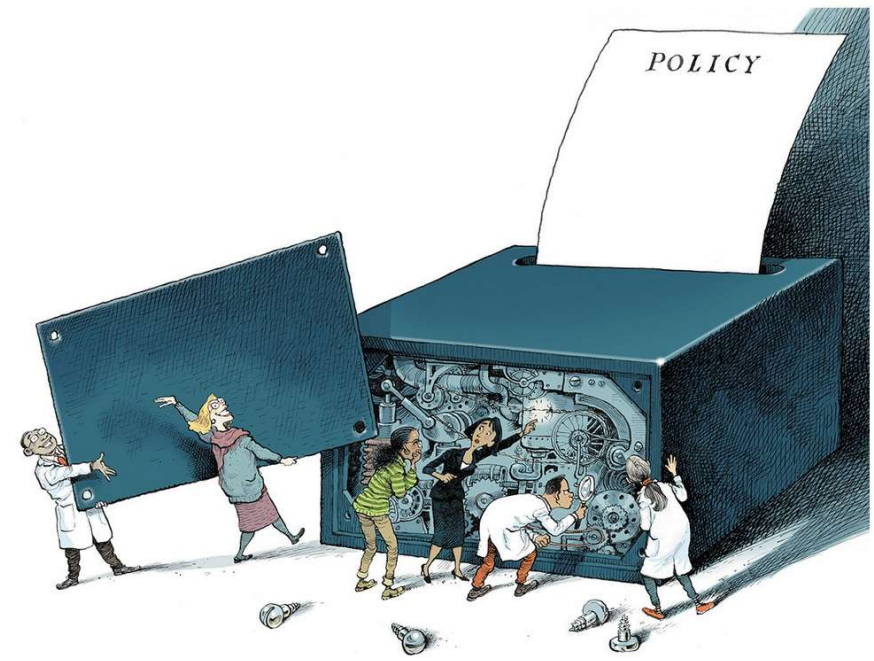
...global uncertainty and sensitivity analyses are often not done. Anyone turning to a model for insight should demand them ...

SUPPLEMENTARY INFORMATION

1. Additional information and references >260 references

Mind the hubris

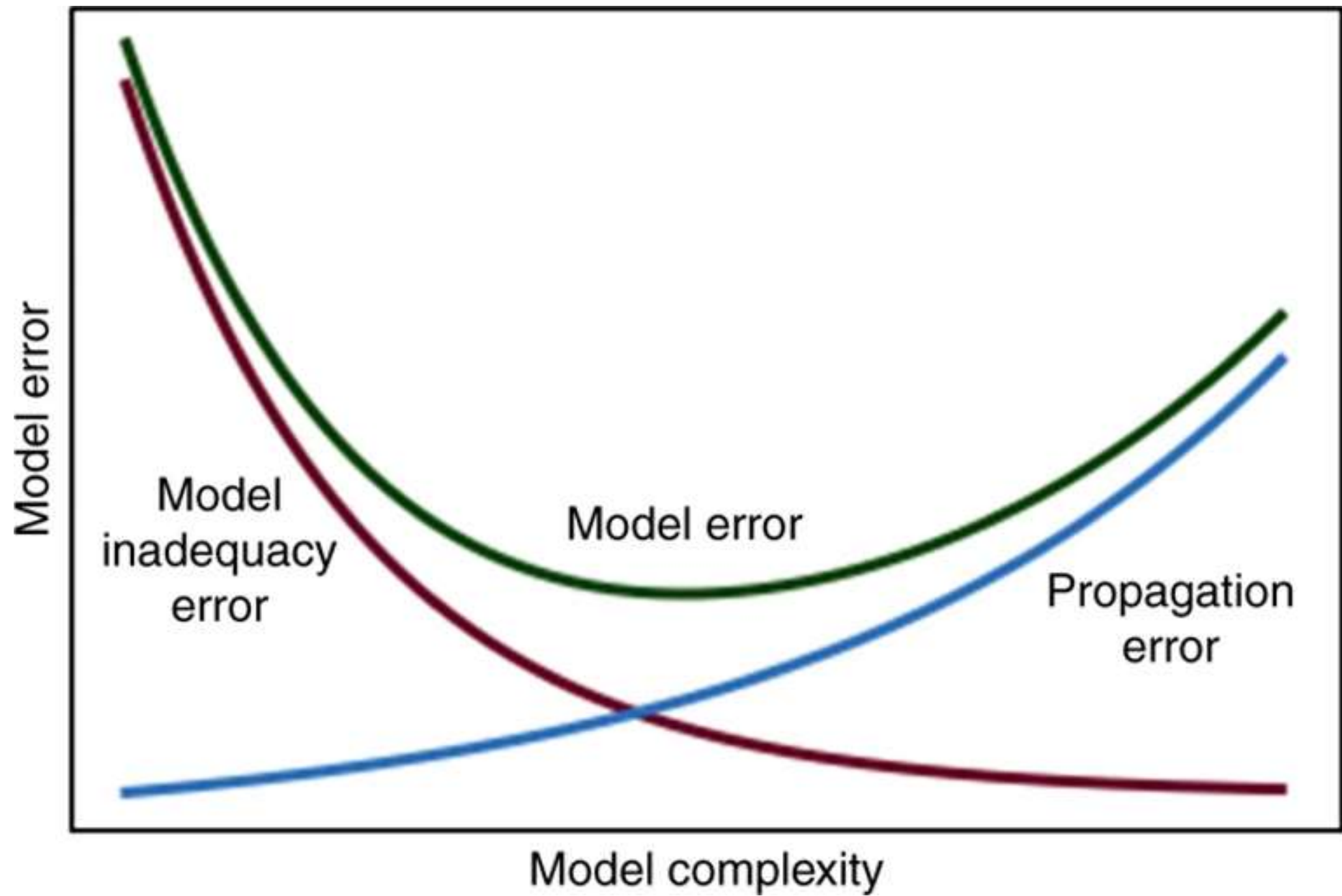
Complexity can be the enemy of relevance



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

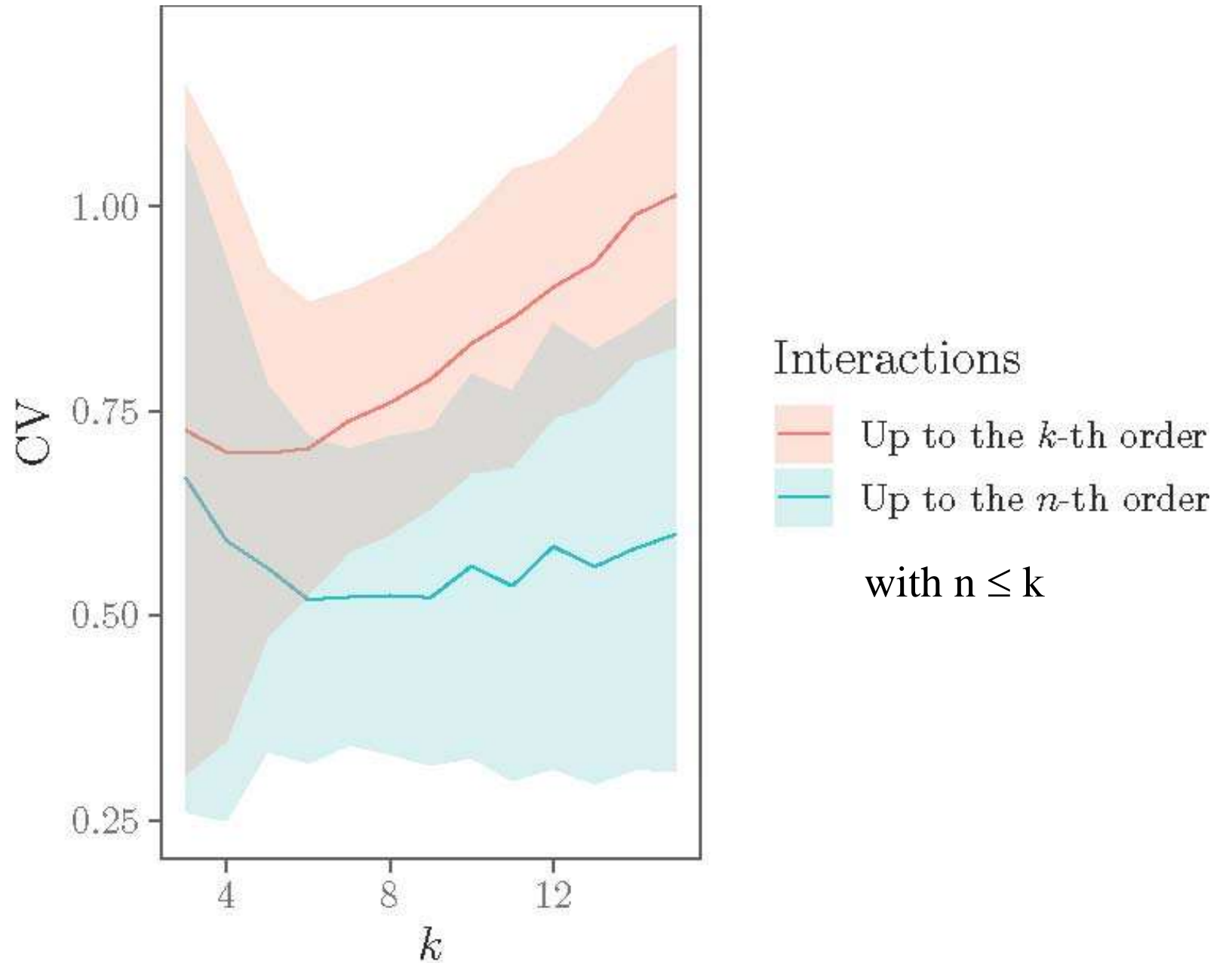
SUPPLEMENTARY INFORMATION

1. Additional information and references >260 references



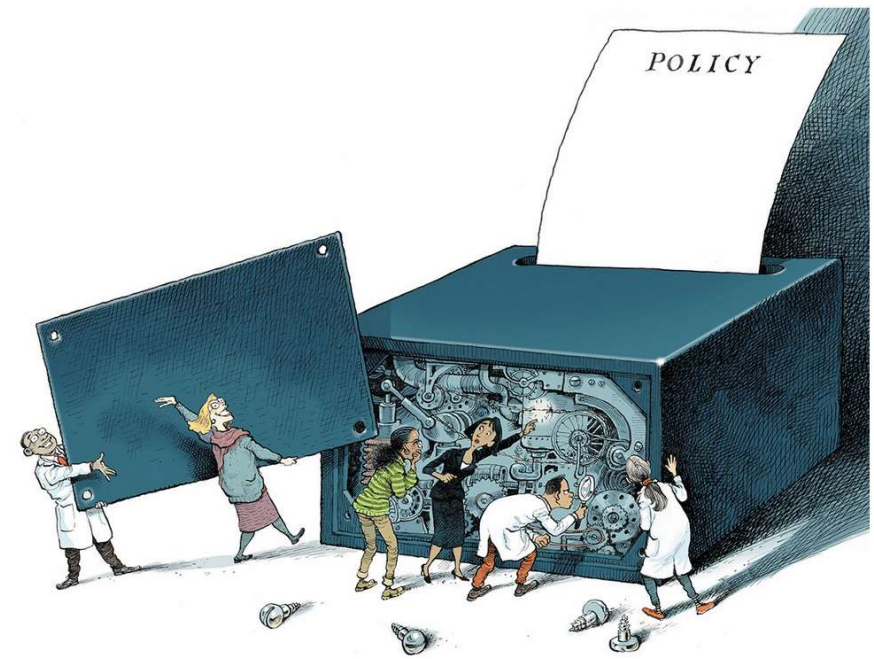
O’Neil
conjecture,
uncertainty
cascade ...
several names
in the literature

From A. Puy et al.,
“O’Neil conjecture
tested”, **paper in
progress**



Mind the framing

Match purpose and context



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

SUPPLEMENTARY INFORMATION

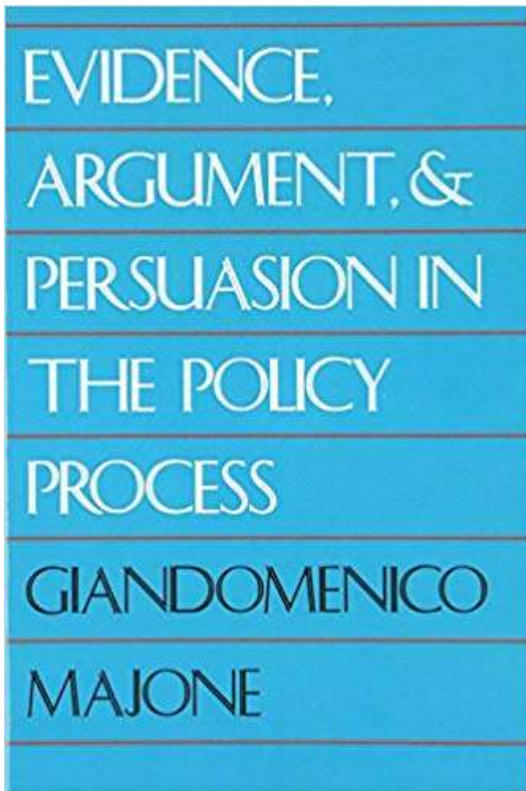
1. Additional information and references

>260 references

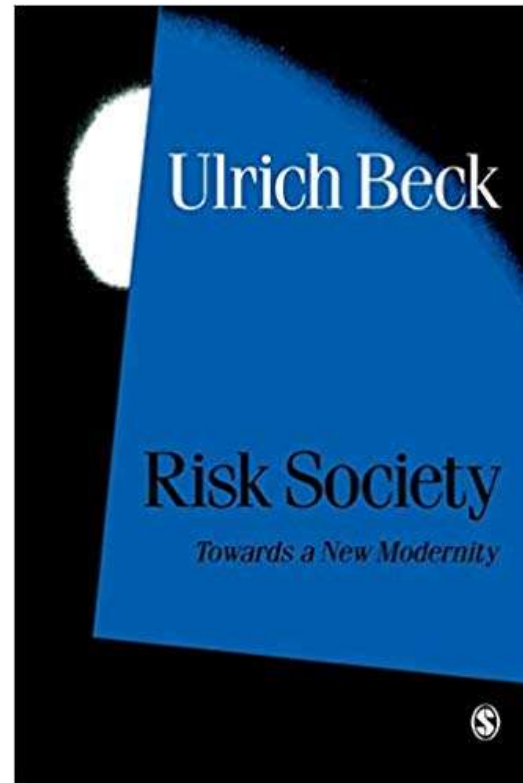
From Ulrich Beck to Giandomenico Majone: the technique is never neutral



Ulrich Beck
(1944 –2015)



1989



1992 (1986)



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}

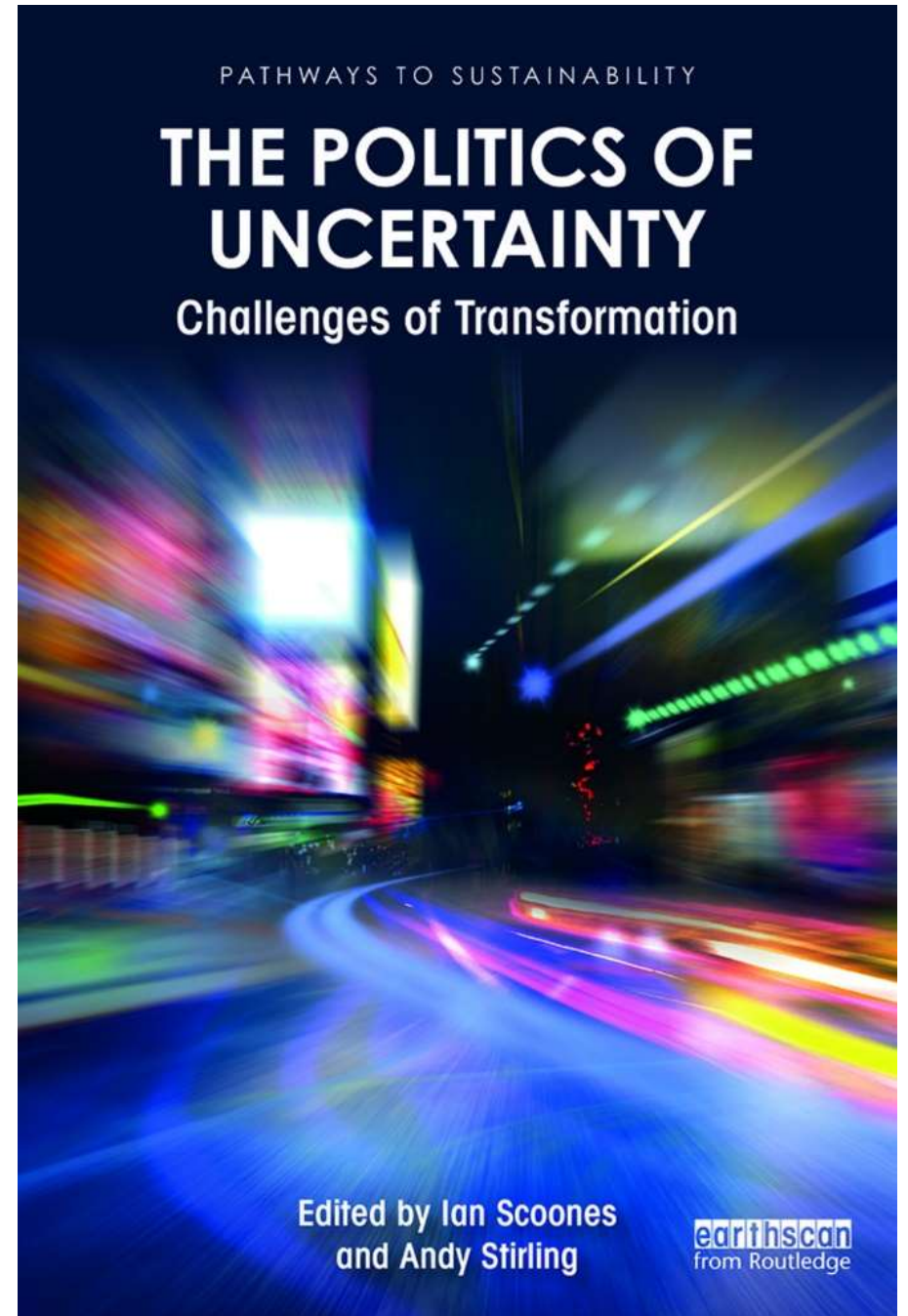
A recent critique of reductionism

4

THE UNRAVELLING OF TECHNOCRATIC ORTHODOXY?

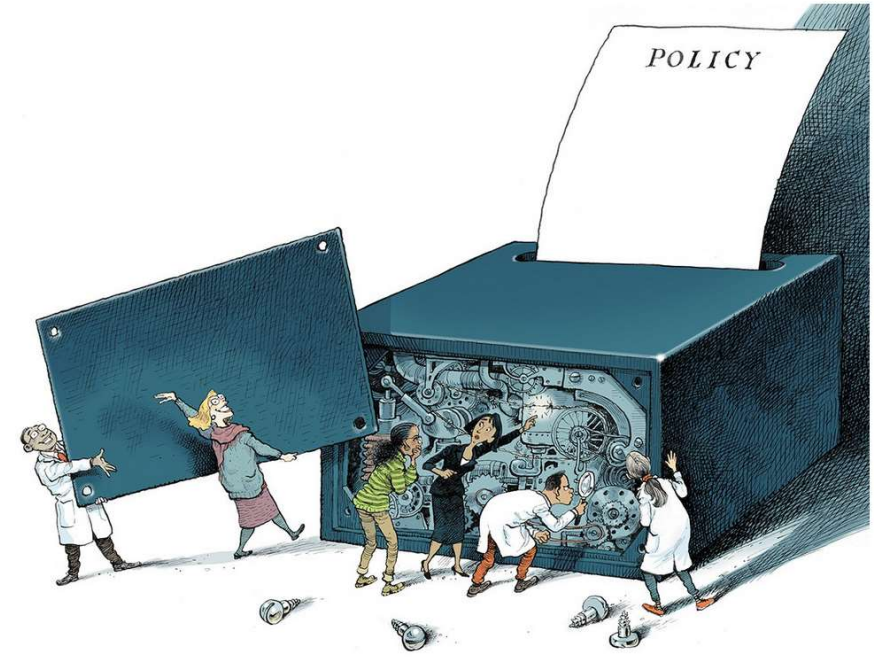
Contemporary knowledge politics
in technology regulation

Patrick van Zwanenberg



Mind the consequences

Quantification can backfire



From the risk of financial products to the management of coastal zones bad modelling may lead to wrong decisions

SUPPLEMENTARY INFORMATION

1. Additional information and references >260 references

Why ethics of quantification is needed now

Andrea Saltelli

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

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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;
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Jayati Ghosh

University of Massachusetts Amherst, United States;
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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



**UCL Institute for
Innovation and
Public Purpose**

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

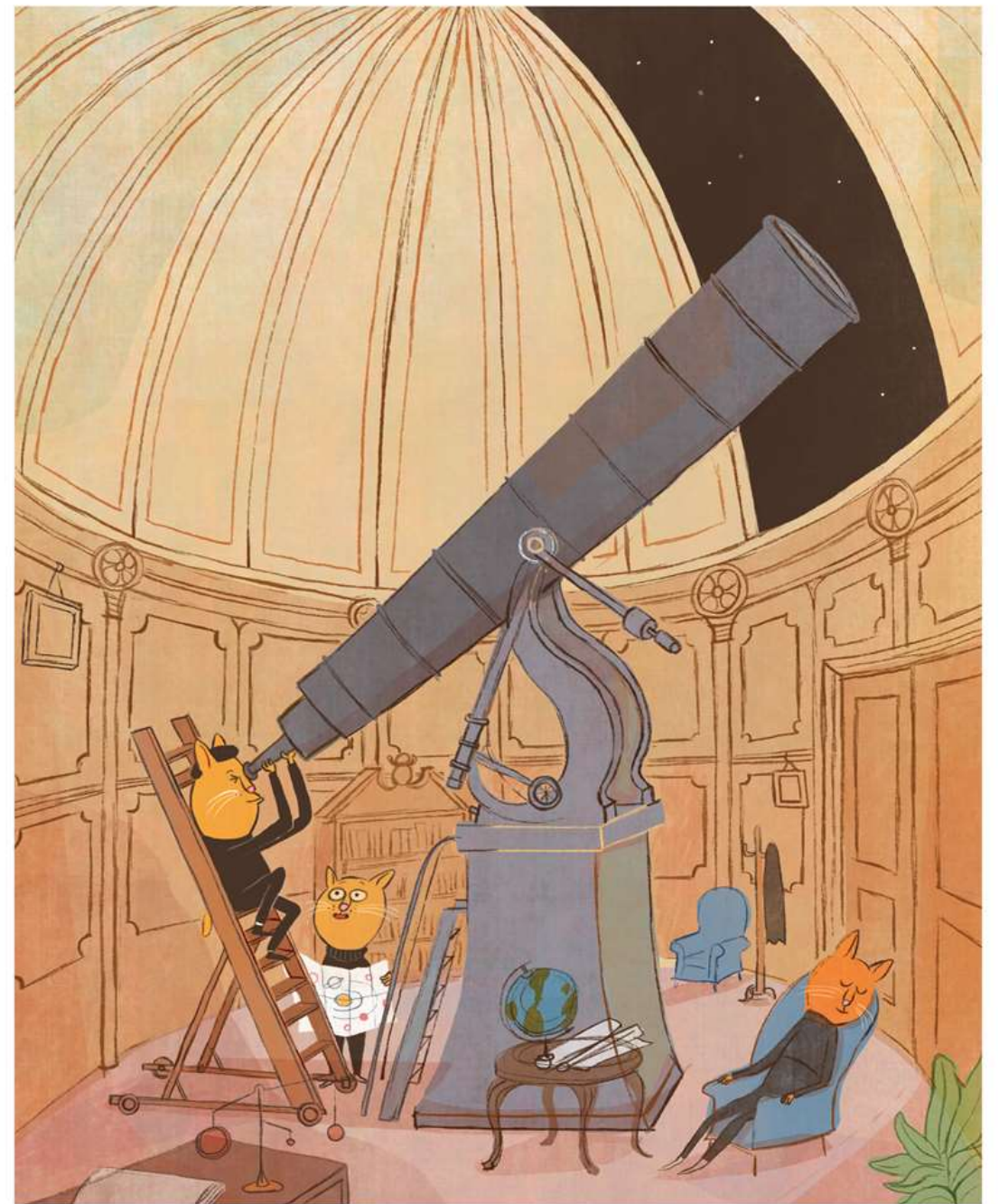
Numbers are the prevalent means to express value in our societies
... Access & production of numbers reflect and reinforce power imbalances



**UCL Institute for
Innovation and
Public Purpose**

WORKING PAPER
WP 2021/05

An observatory?



Source: Tor Freeman, <http://tormalore.blogspot.com/>

The End



@andreasaltelli