

Ethics of quantification

Andrea Saltelli

Course NANO 310, September 1st, 2022





CAETERIS ARE
NEVER PARIBUS

Tweets from @AndreaSaltelli

andrea saltelli Retweeted



Jeroen van der Sluijs

@Jeroen_v... · Aug 30



International Seminar: Science, lobbies and the environment: marking the 60th anniversary of Rachel Carson's Silent Spring. [@vitenskapsteori](#) [@UiB](#) [@UiB_HF](#) [@corporateeurope](#) [@AndreaSaltelli](#) [@NaomiOreskes](#) [@sfoucart](#) 6 October 2022, Norway-house Brussels. [uib.no/en/svt/155738/...](https://uib.no/en/svt/155738/)



Do we live immersed in
fantastic numbers?

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

Sept. 17, 2021

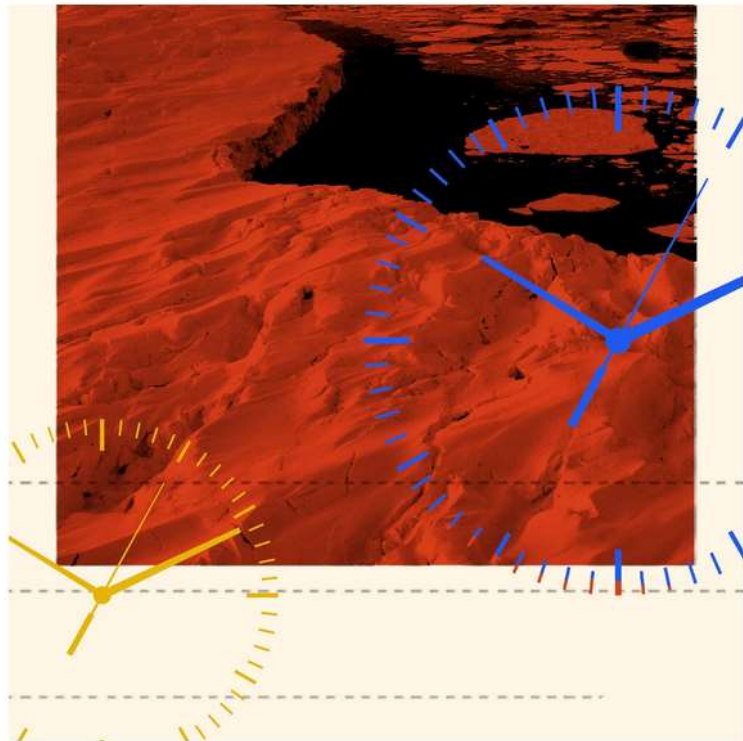


Illustration by Arsh Raziuddin, The New York Times

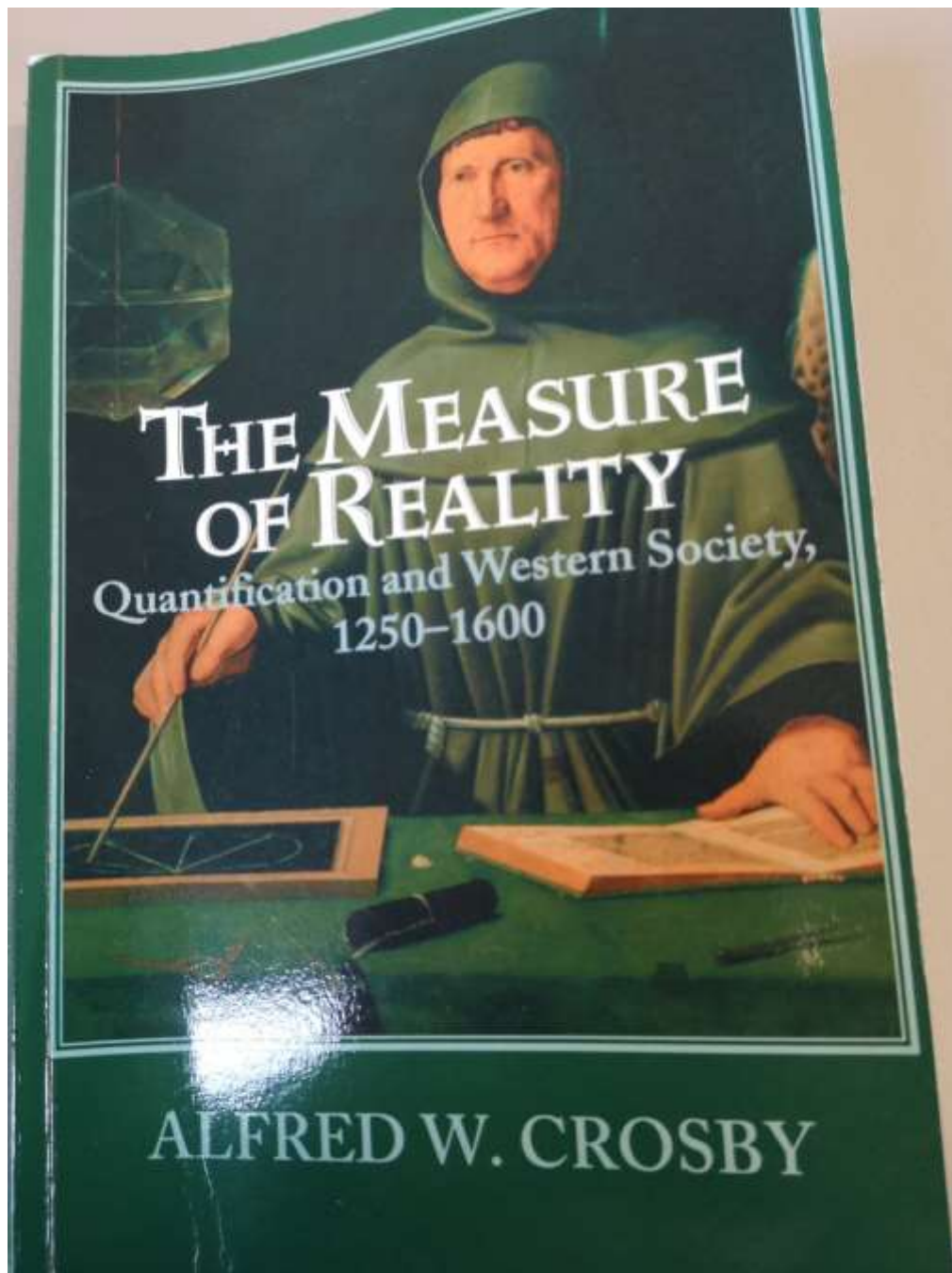
“social cost of carbon:

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

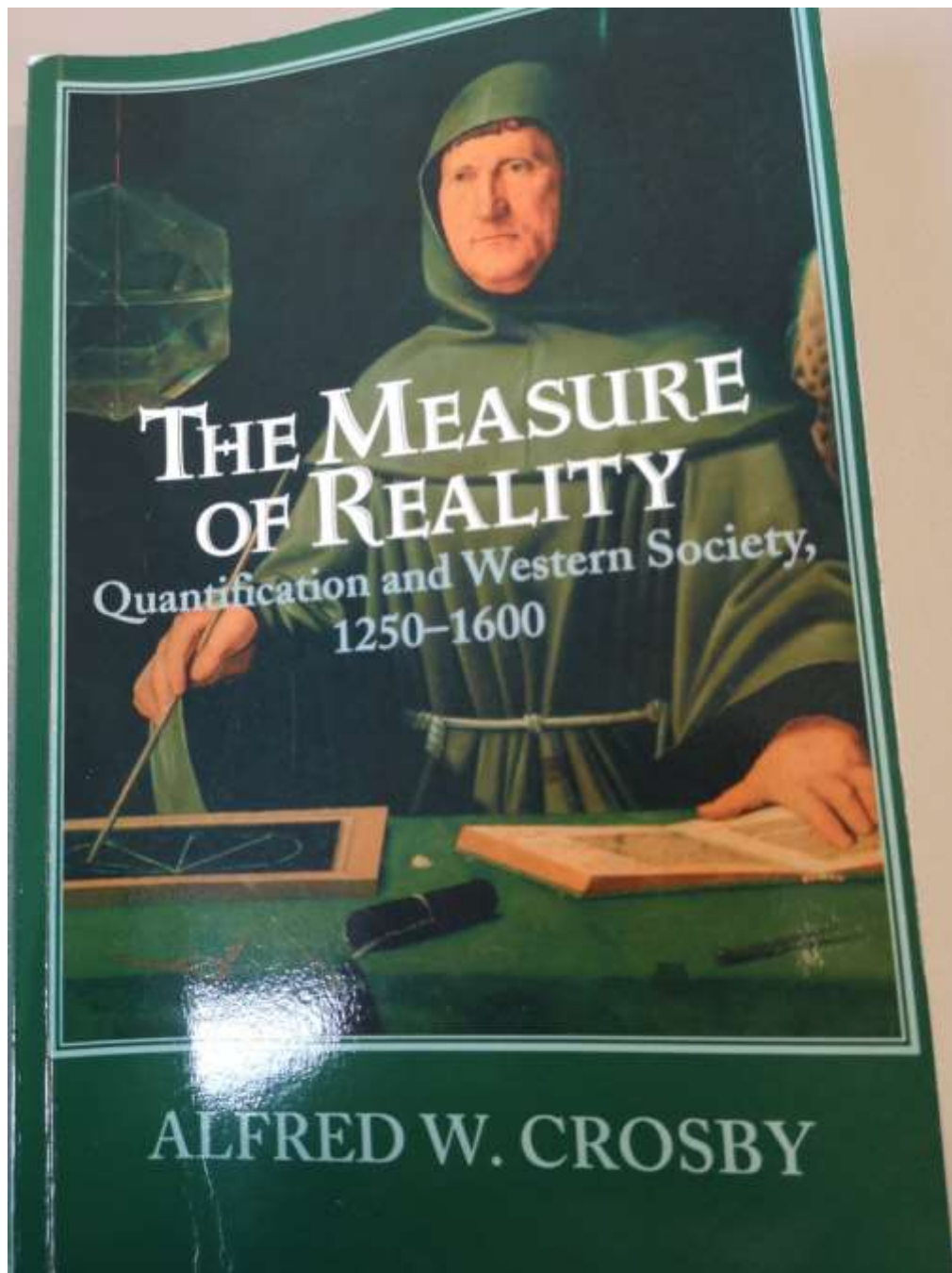
=\$171 a ton on average at a 2 percent discount rate”

The New York Times

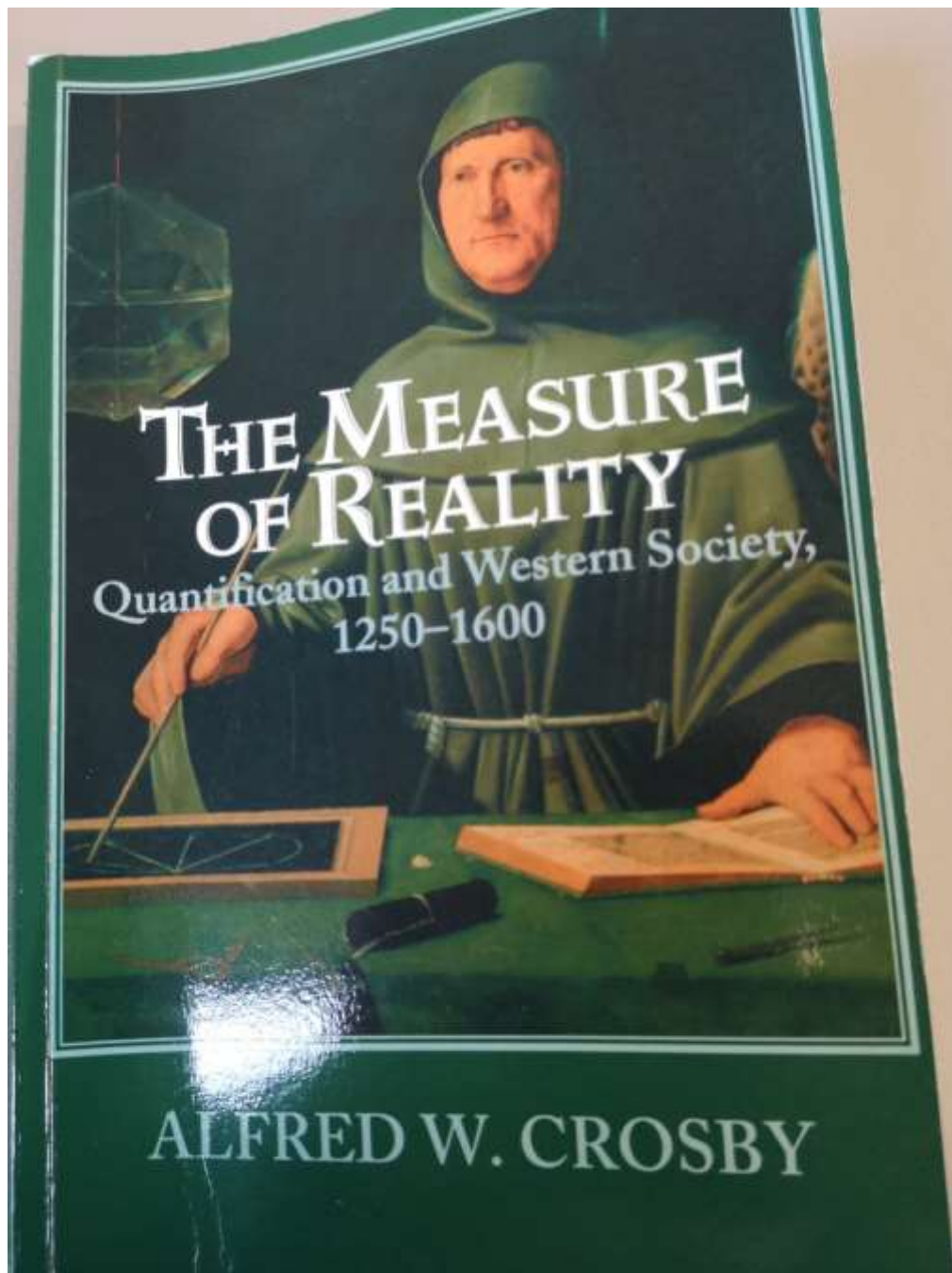
How did we get there?



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 ...

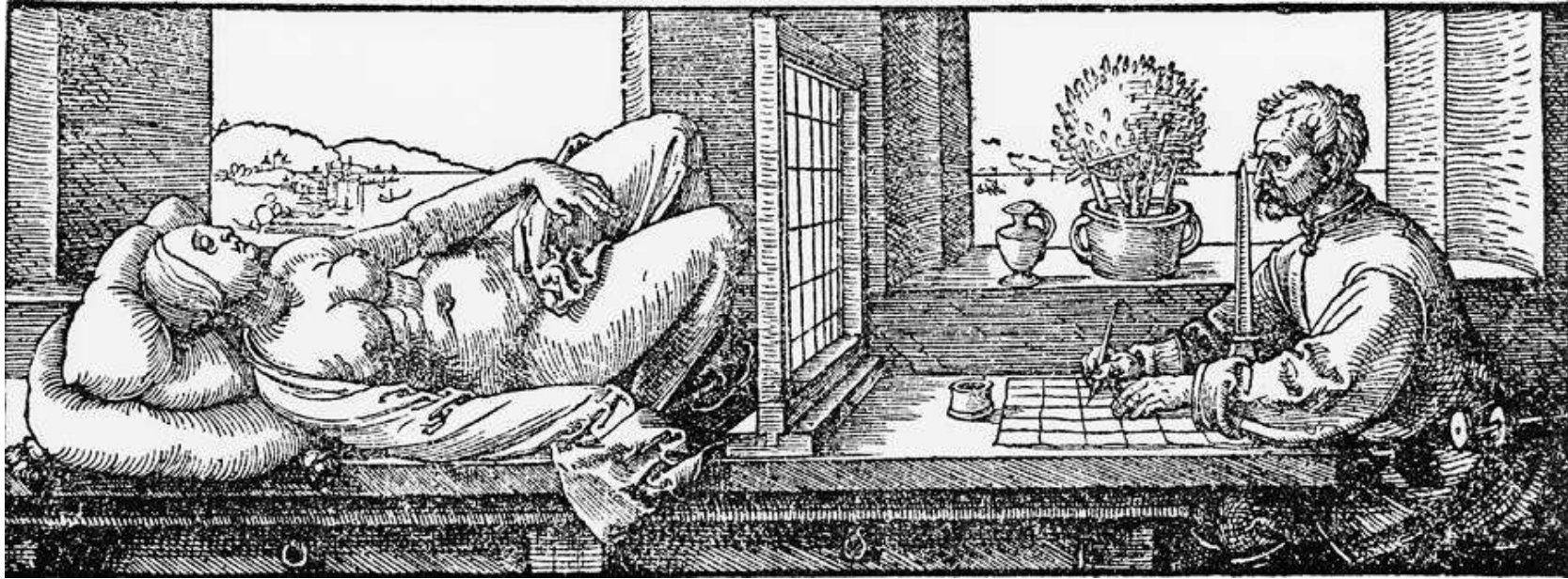




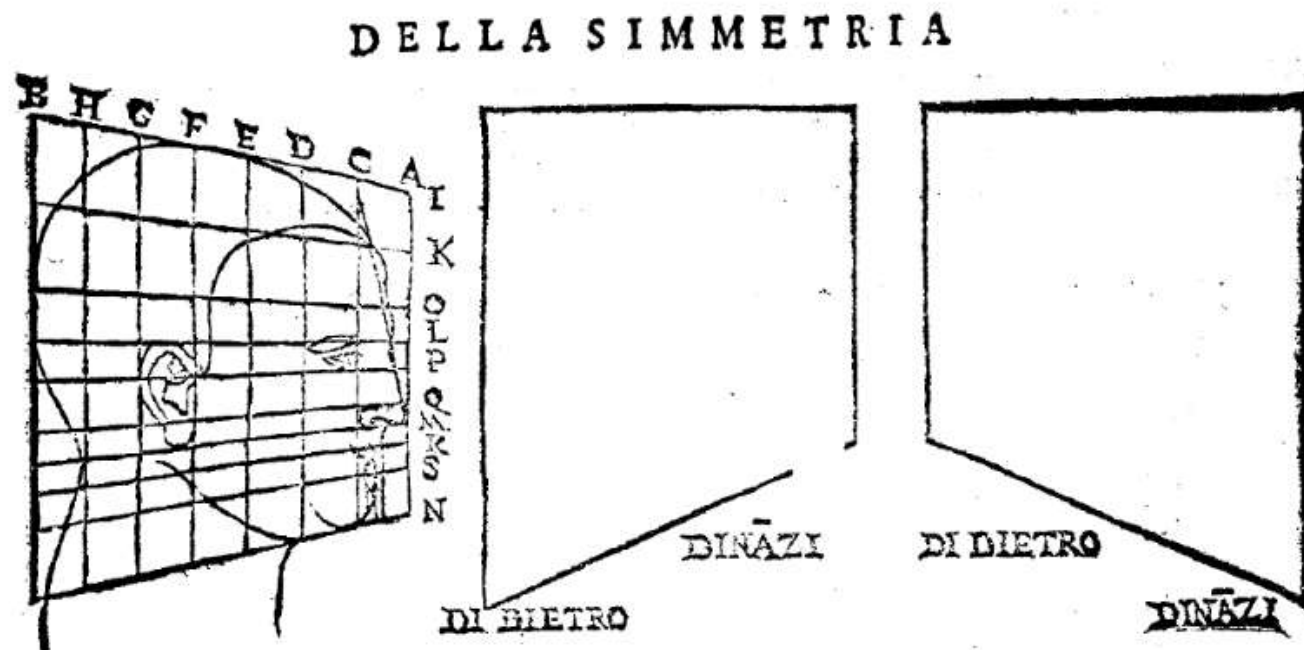
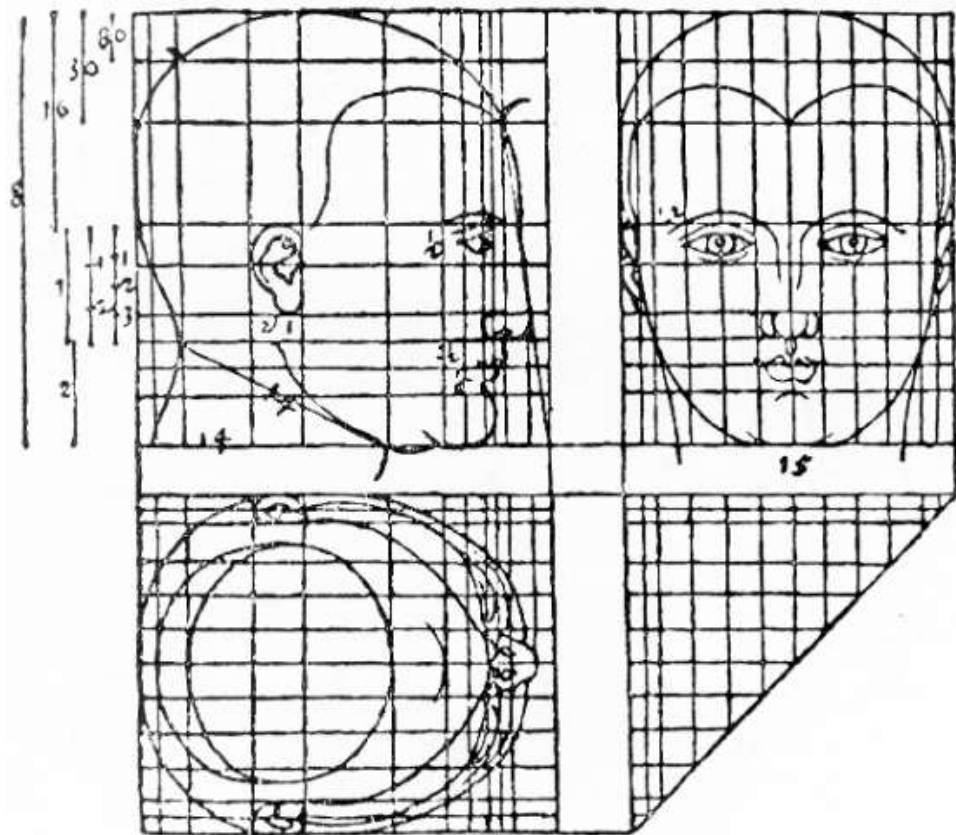
From the abacus
to Arabic
numerals



The Annunciation,
Carlo Crivelli
(1435, 1495)

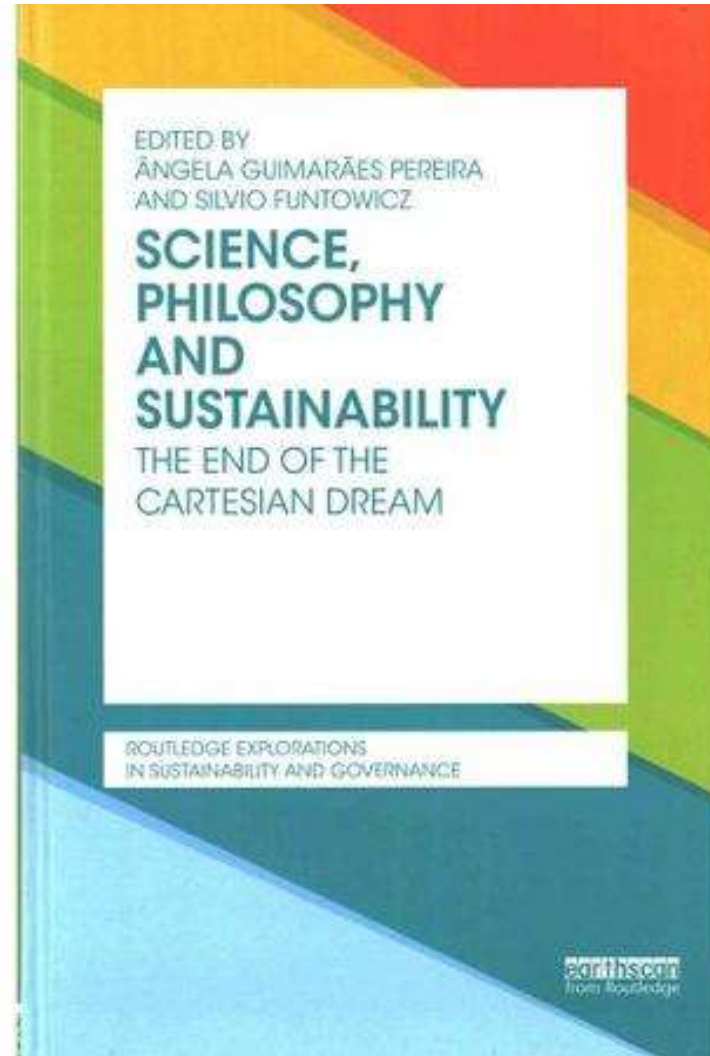
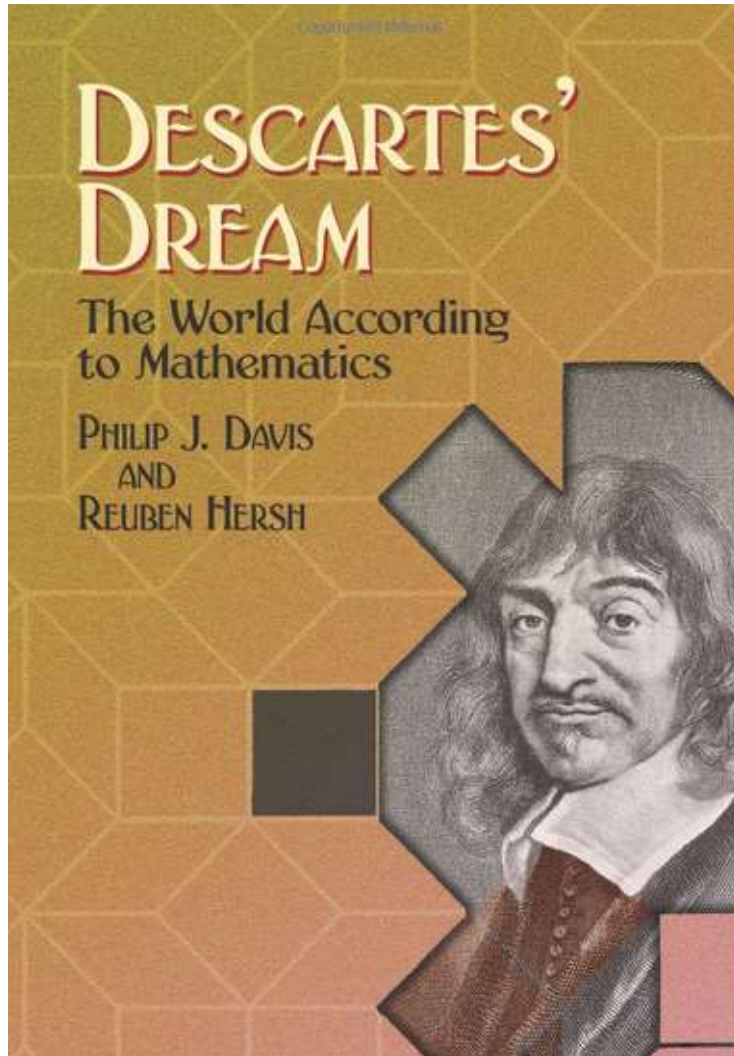


Draftsman Drawing a Reclining Nude
Albrecht Dürer (1471–1528)



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

Quantification as a key element of the Cartesian Dream



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 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
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easy and less loathsome purgings;
...

Natural divinations; Deceptions of the
senses; Greater pleasures of the senses;
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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 statures; The altering of features; The exalting of the intellectual parts; Version of species; Transplantation of members; Making of new instruments of arts, and putting them upon another use; Acceleration of maturation; Acceleration of putrefaction; Acceleration of germination; Making rich composts for the nourishment of plants; Alterations of the air, and raising of tempests; Great alteration of humors, emollition, &c; Turning crude and watery substances into clear 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)



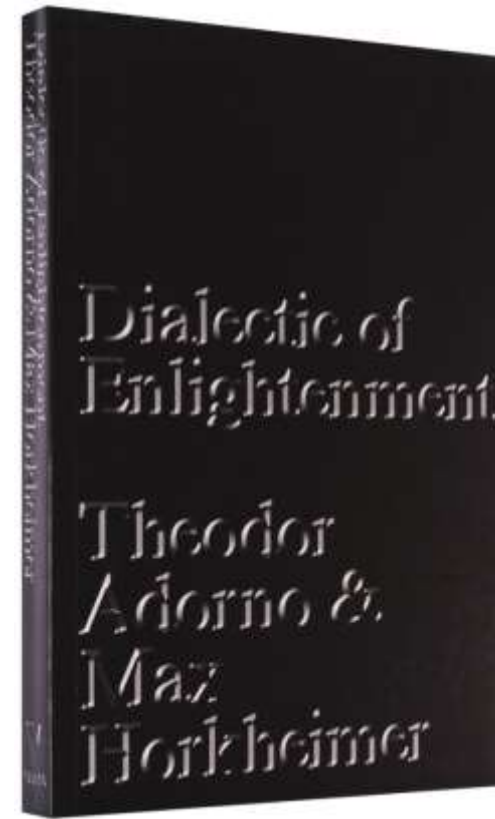
Nicolas de Caritat, marquis de Condorcet
(1743– 1794)

‘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



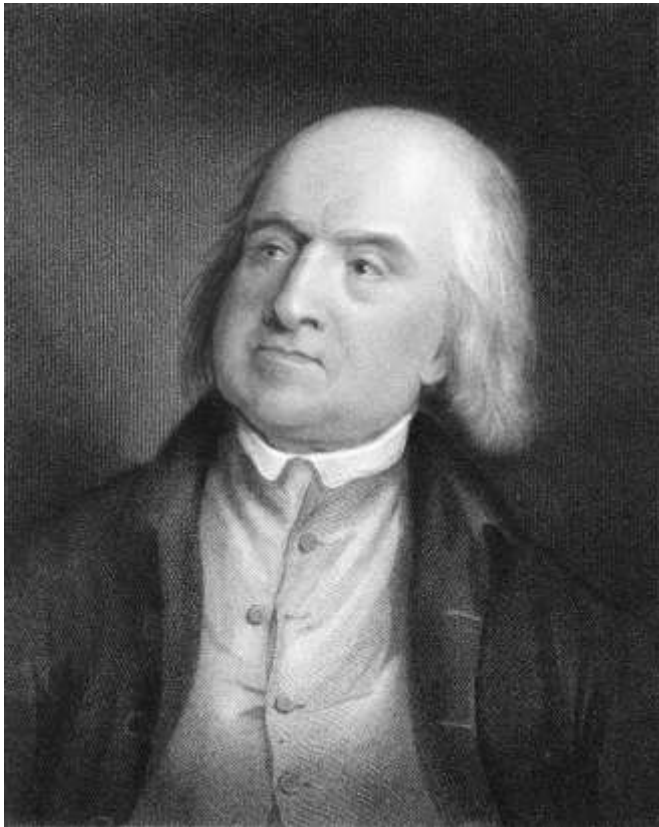
Condorcet's
algorithms and
Descartes'
Geometry: the
dream always had a
quantification
agenda



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



Marquis de
Condorcet
(1743– 1794)



Felicific calculus: 'The greatest
good for the greatest number'
(utility or hedonistic calculus)

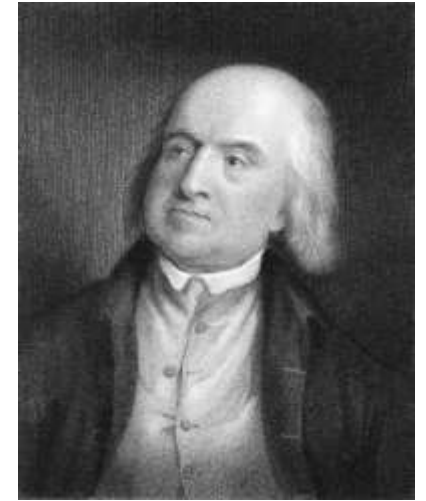
Jeremy Bentham
(1748–1832)

- 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

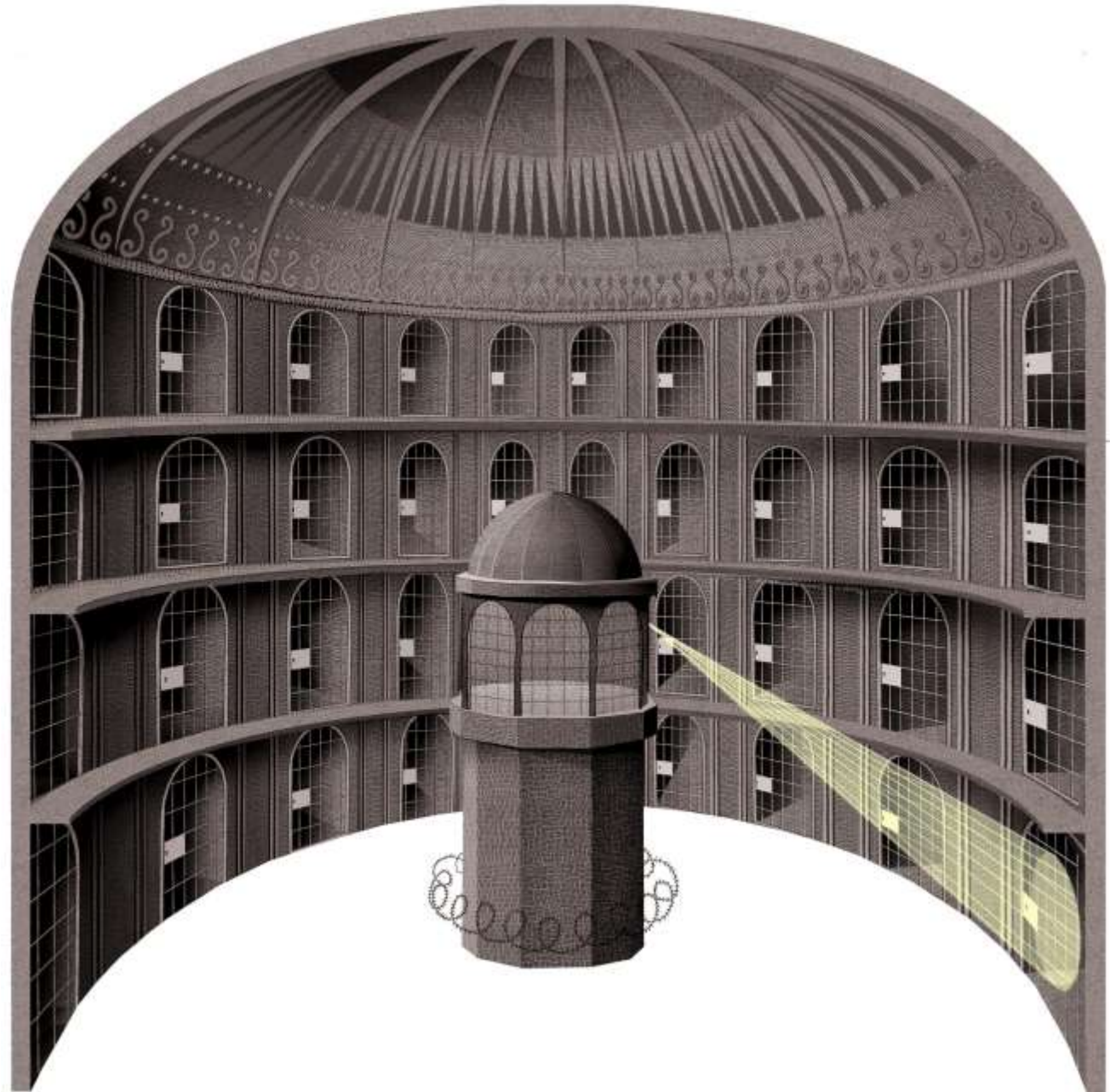


- Intensity: How strong is the pleasure?
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- Propinquity or remoteness: How soon will the pleasure occur?
- Fecundity: The probability that the action will be followed by sensations of the same kind.
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- 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

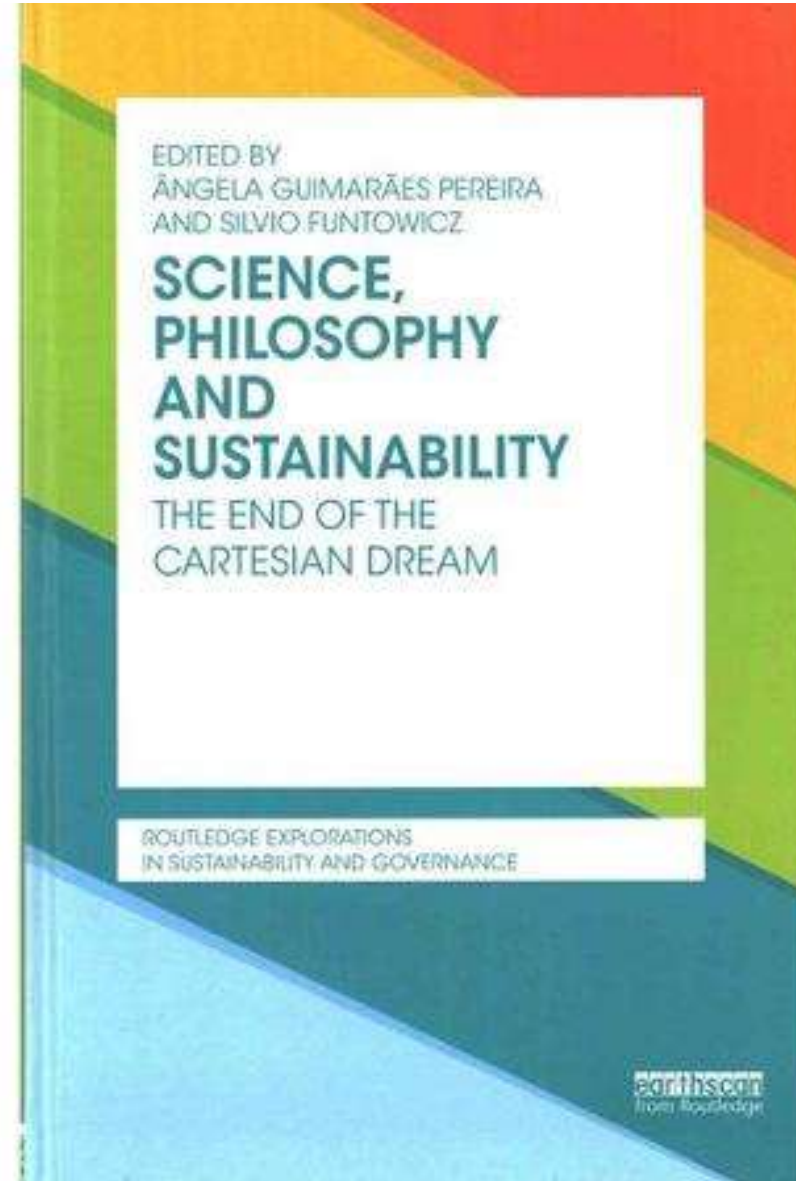


Artwork: Adam Simpson, New York Times

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



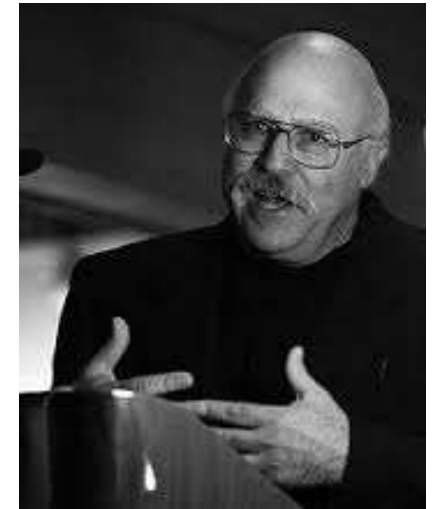
February 18, 2021, Landing of Perseverance on Mars

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?”

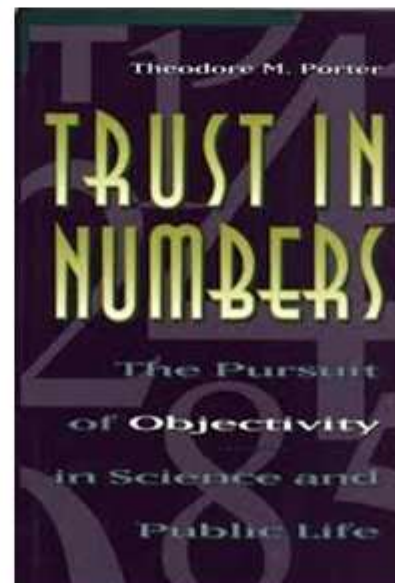
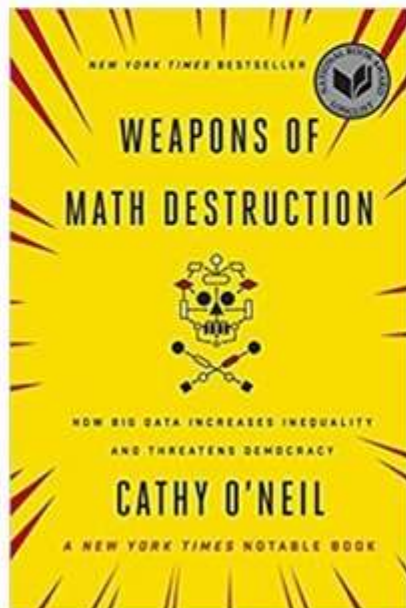
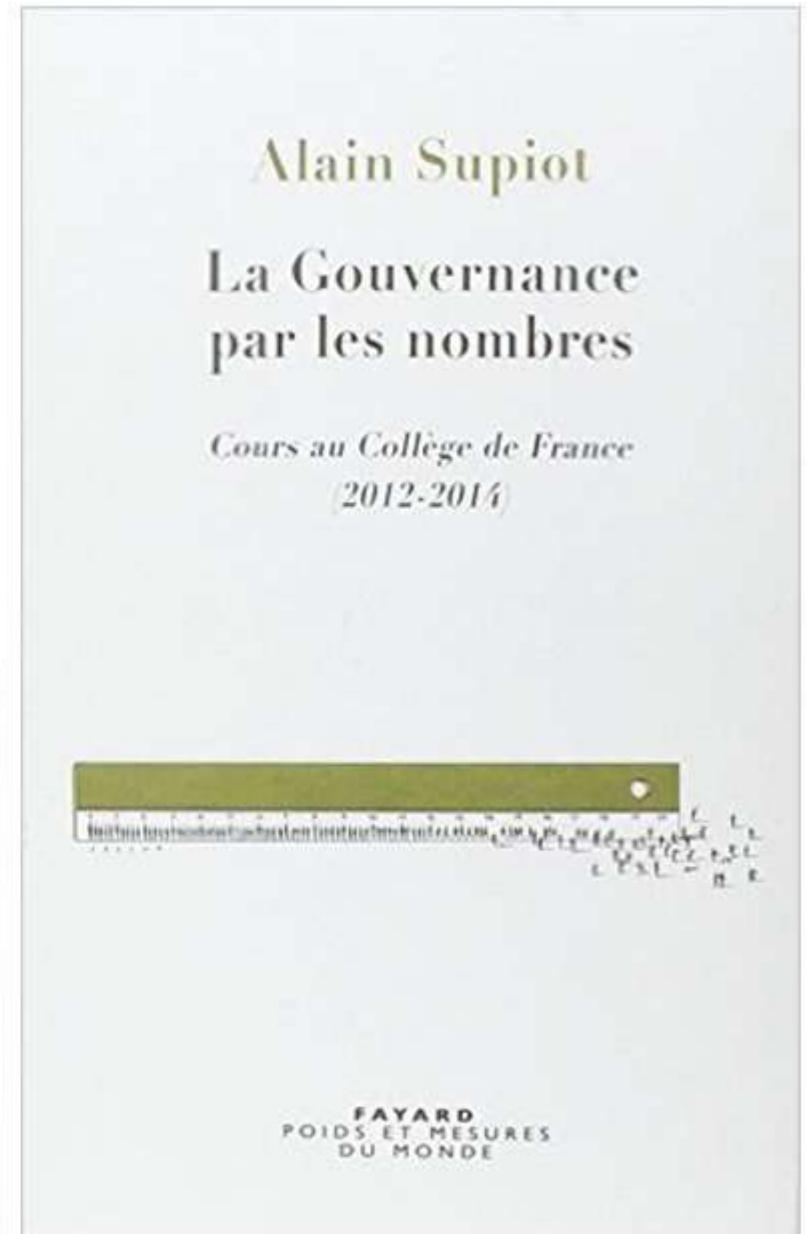
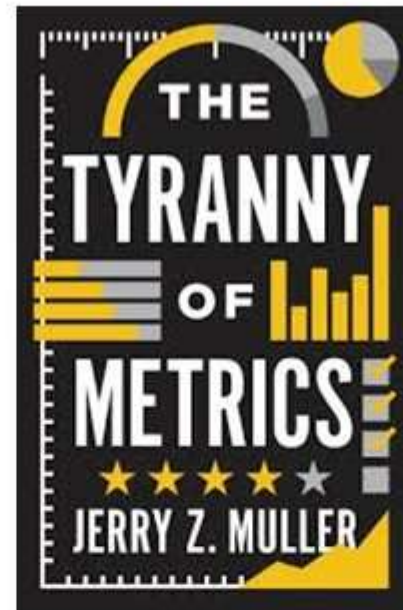
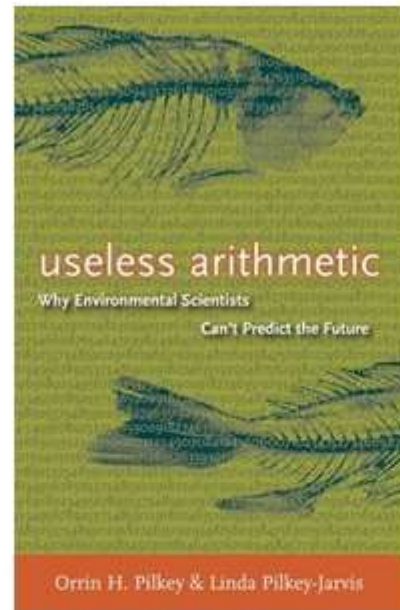
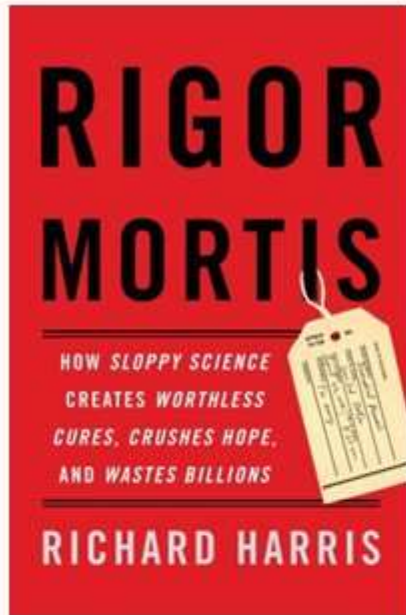


Elizabeth
Popp Berman

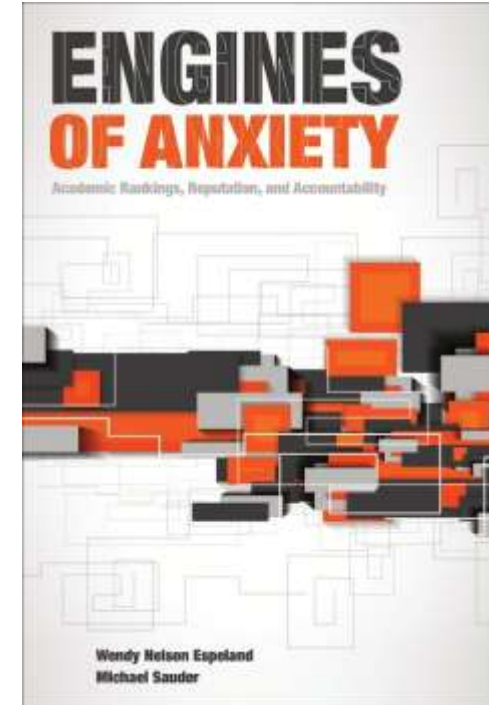
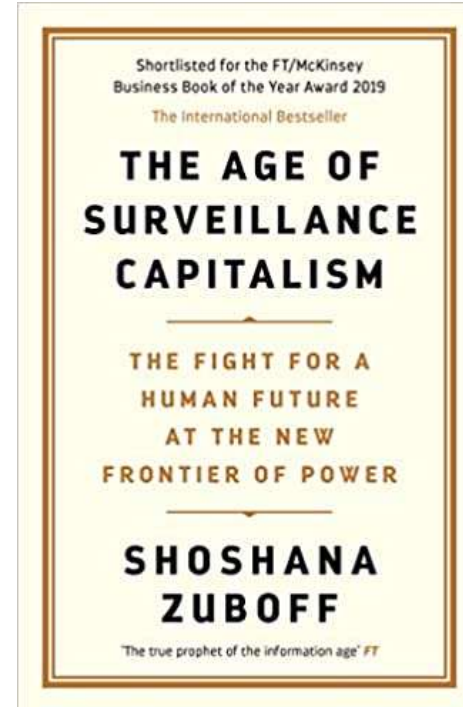
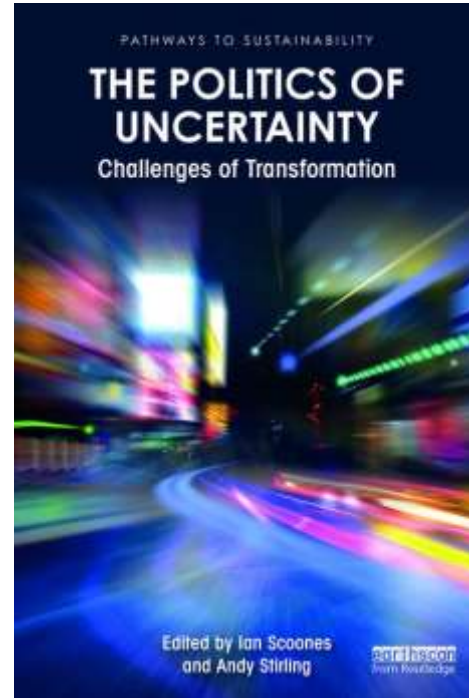
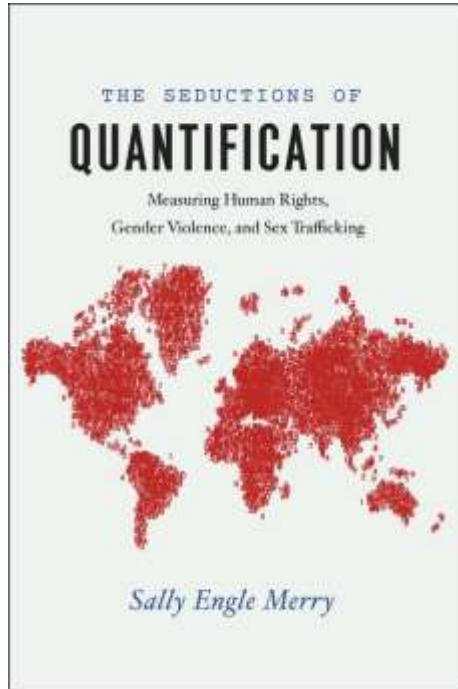
E. Popp Berman and D. Hirschman, **The Sociology of Quantification**: Where Are We Now?, *Contemp. Sociol.*, vol. in press, 2017.

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)

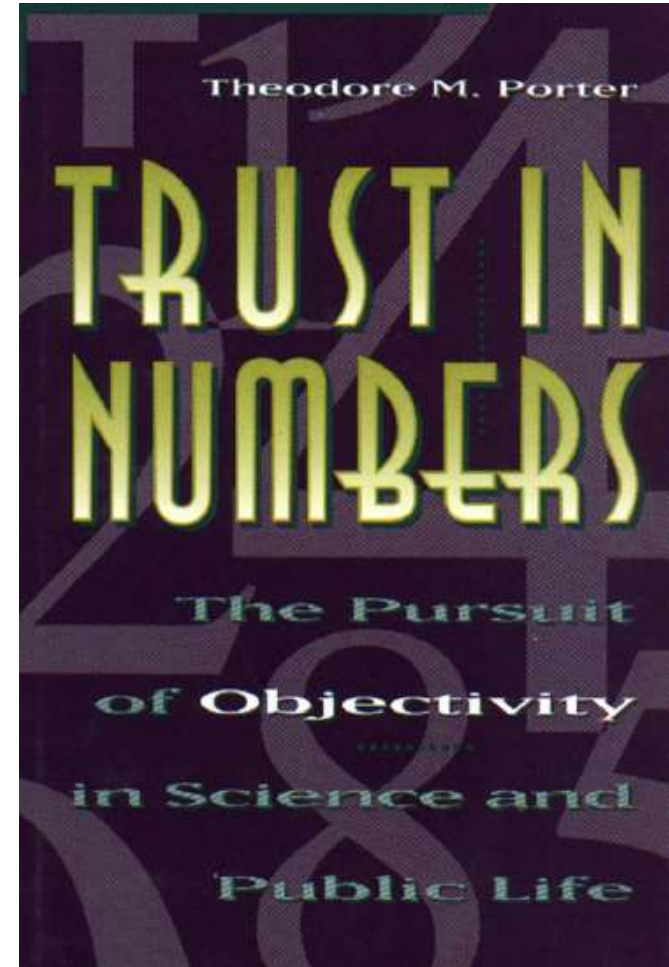
Incumbent numbers affect what society will
measure in the future (Merry 2016)

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

Numbers and trust

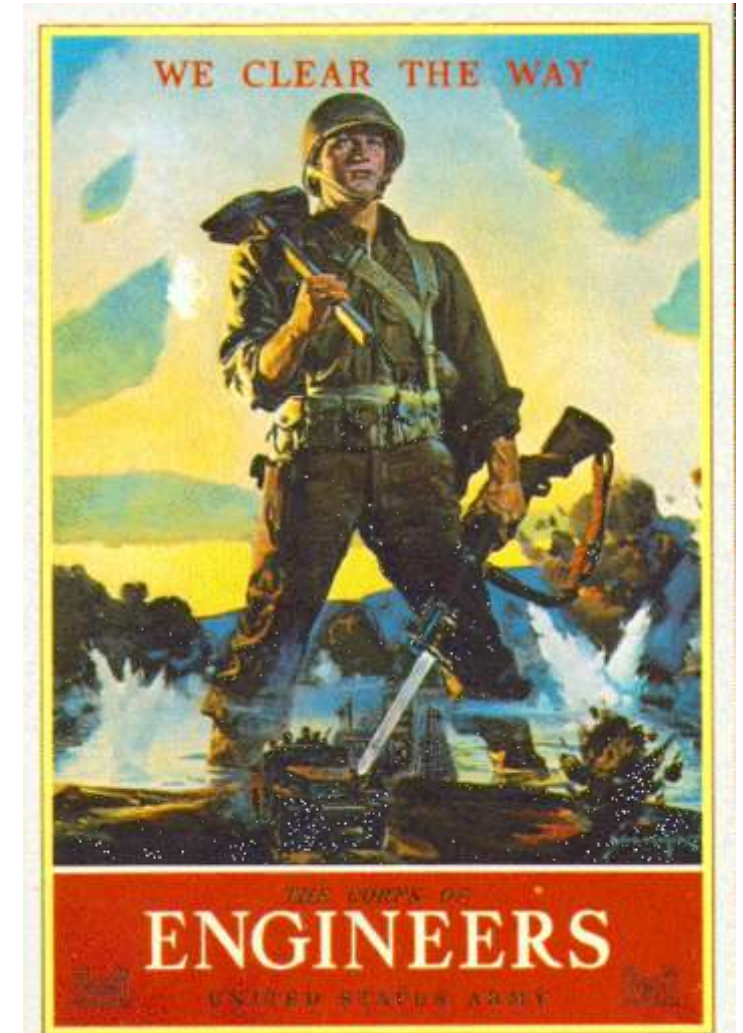


Theodor
M. Porter



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

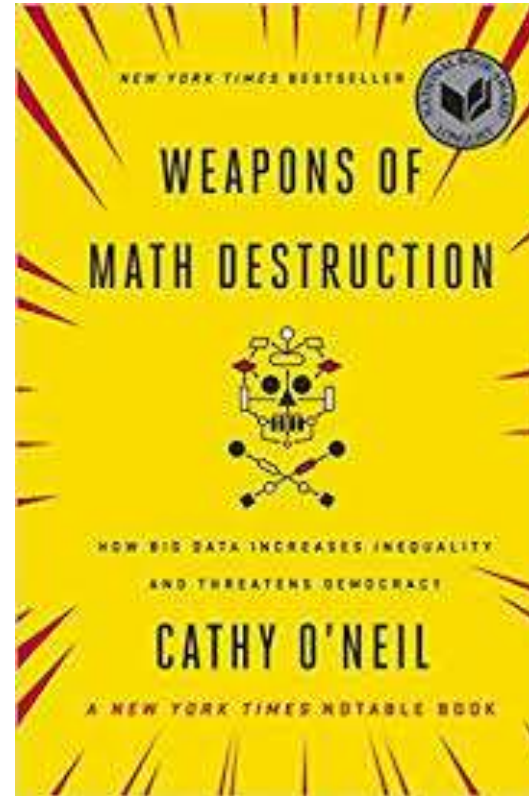
Porter's story: Quantification needs judgment which in turn needs trust ...without trust quantification becomes mechanical, a system, and 'systems can be played'.



Alarm for Weapons of Math Destruction



Cathy O'Neil

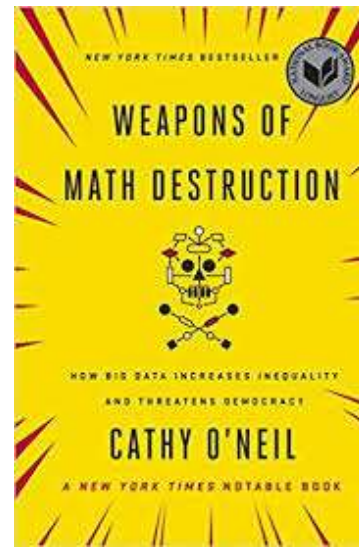


O'Neil, C. (2016). Weapons of math destruction : how big data increases inequality and threatens democracy. Random House Publishing Group.

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...

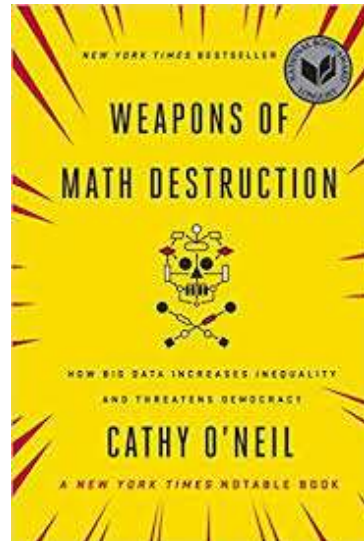
O'Neil, C. (2016). Weapons of math destruction : how big data increases inequality and threatens democracy. Random House Publishing Group.

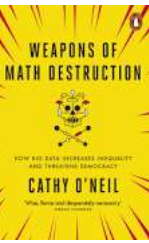
Brauneis, R., & Goodman, E. P. (2018). Algorithmic Transparency for the Smart City. Yale Journal of Law & Technology, 20, 103–176. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3012499



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

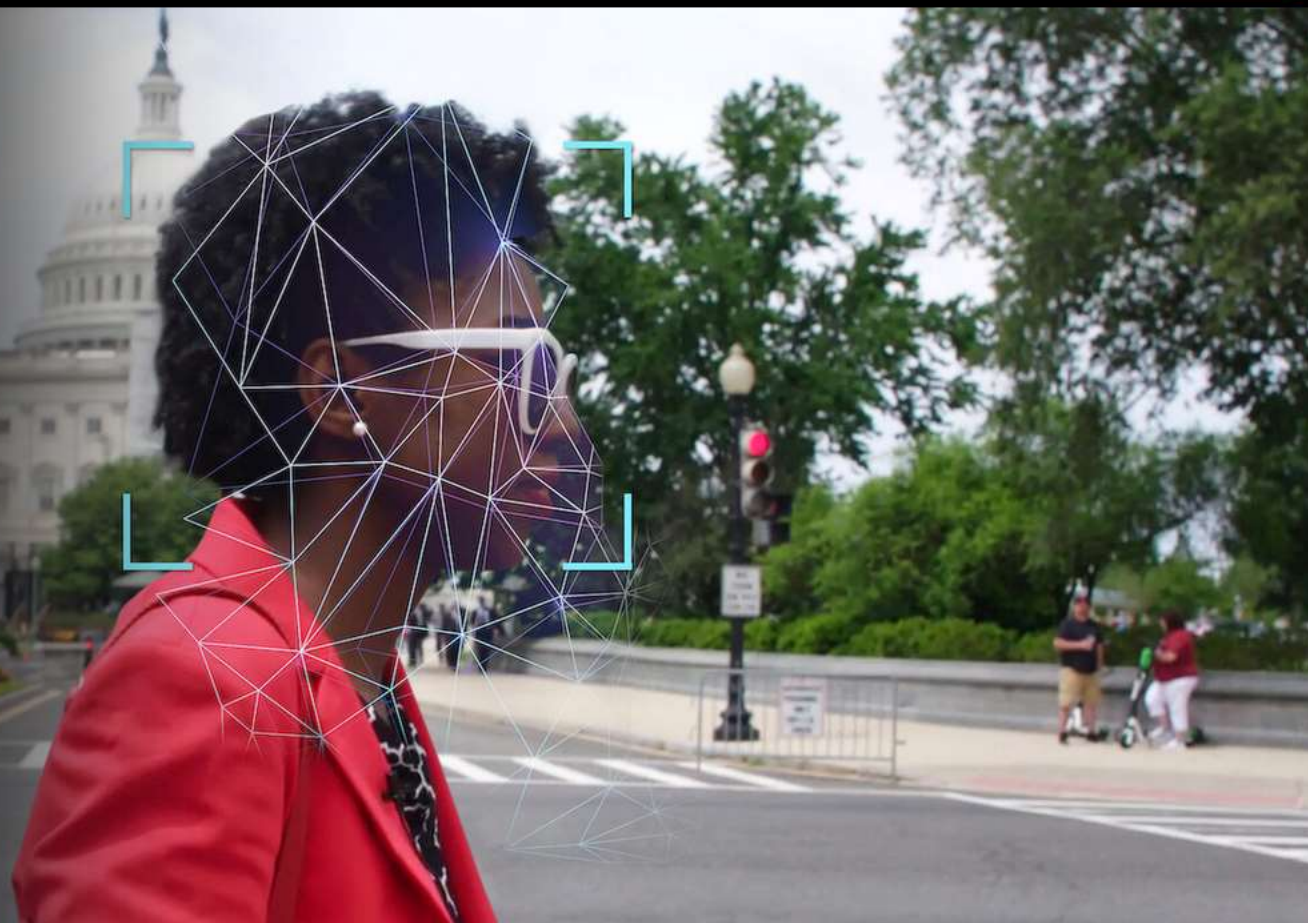
JOIN NOW

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



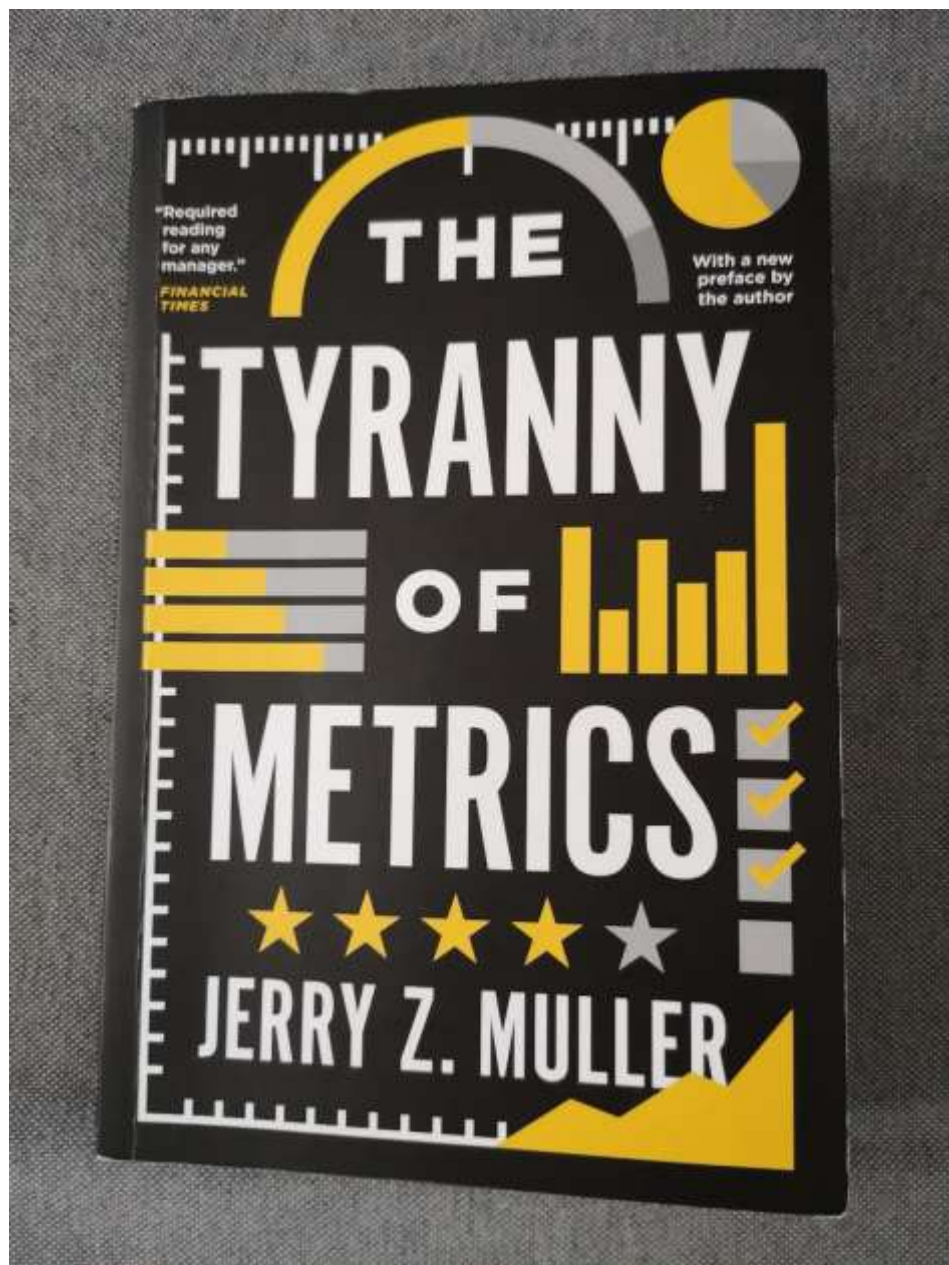
Charles Goodhart

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

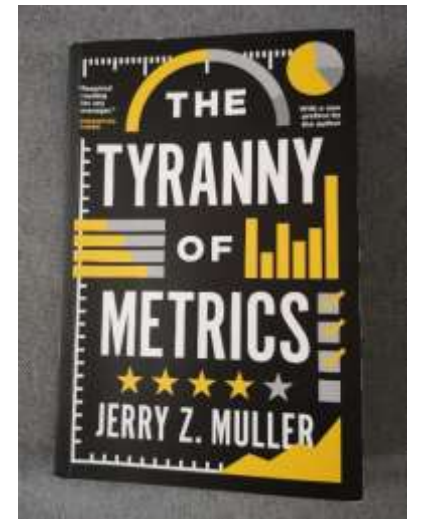


J. Z. Muller, The tyranny of metrics. Princeton University Press , 2018.

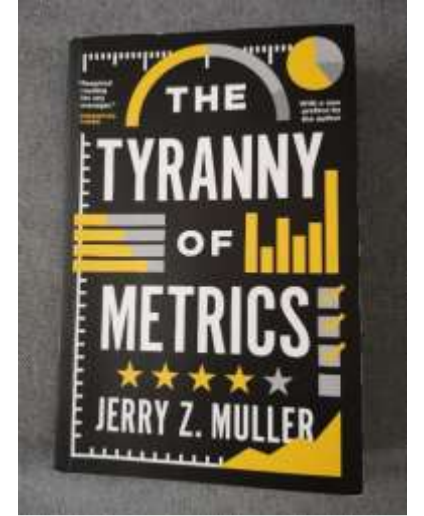
Metric fixation, or the irresistible pressure to measure performance

Gaming of metrics (recall Goodhart law)

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



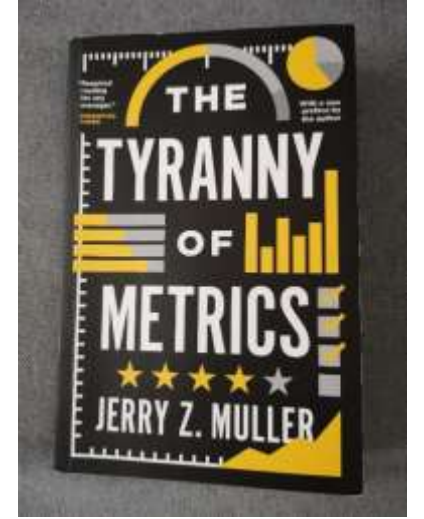
Unintended consequences



- 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

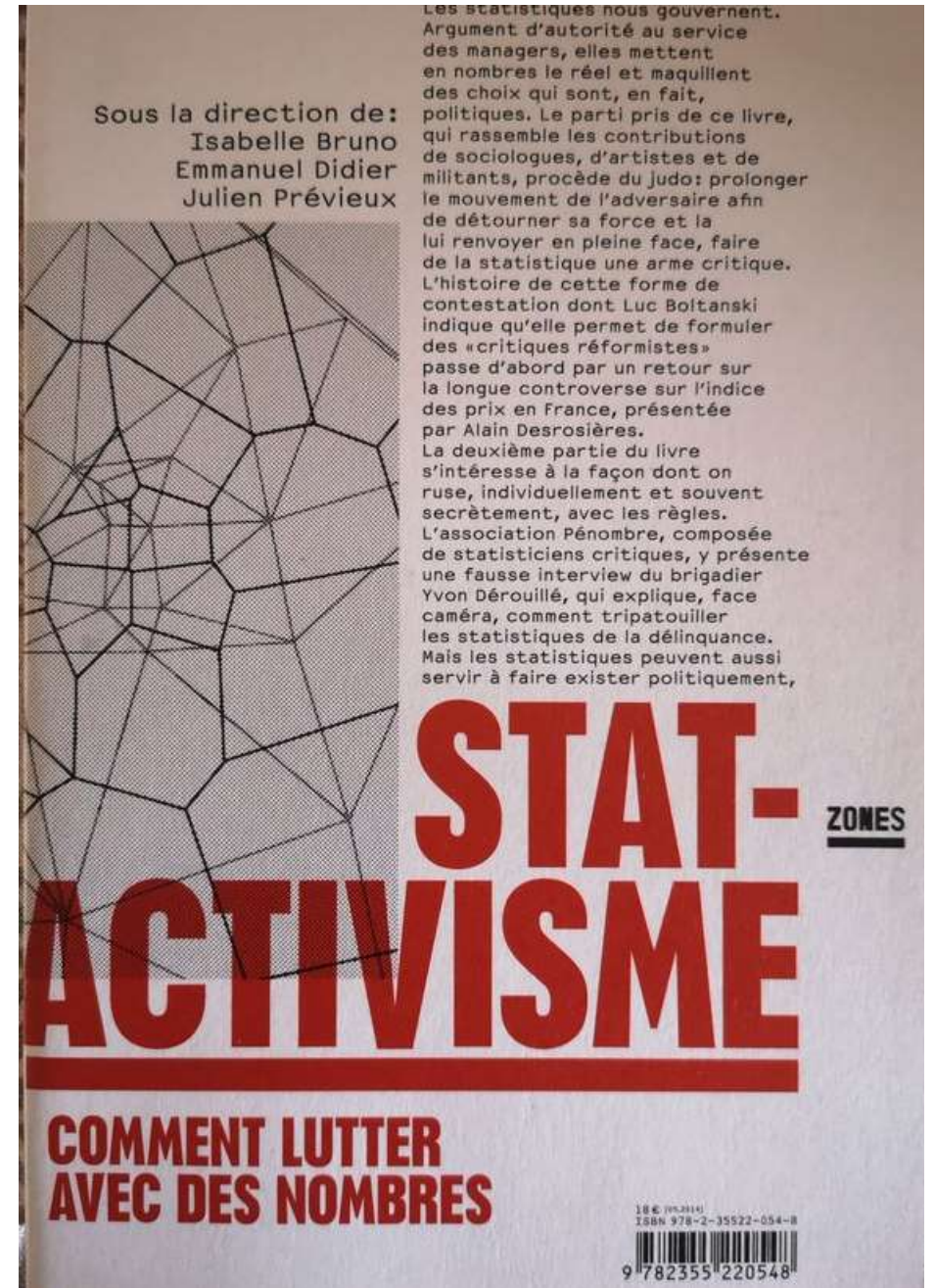
A concluding remark of Muller

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”



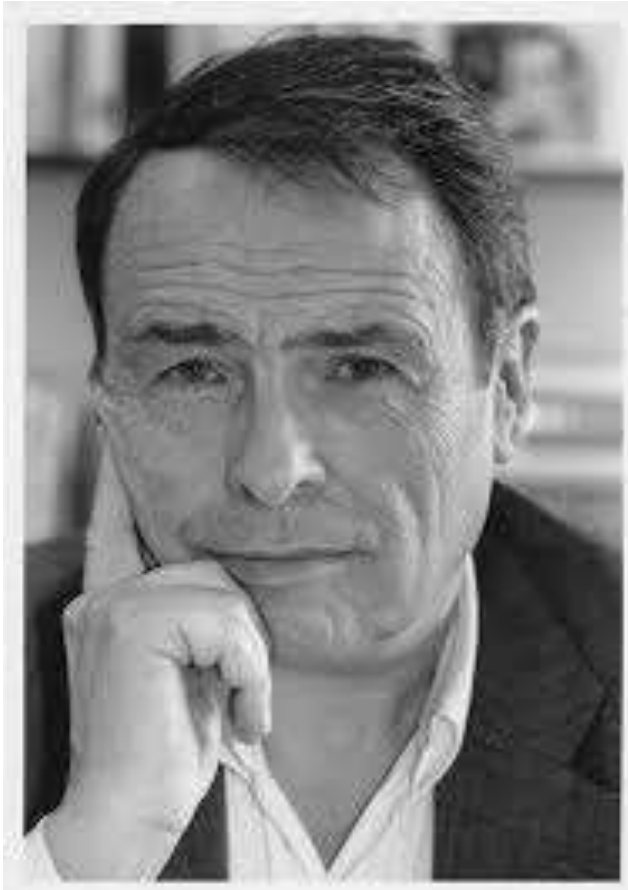
Do we need a movement of resistance?

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



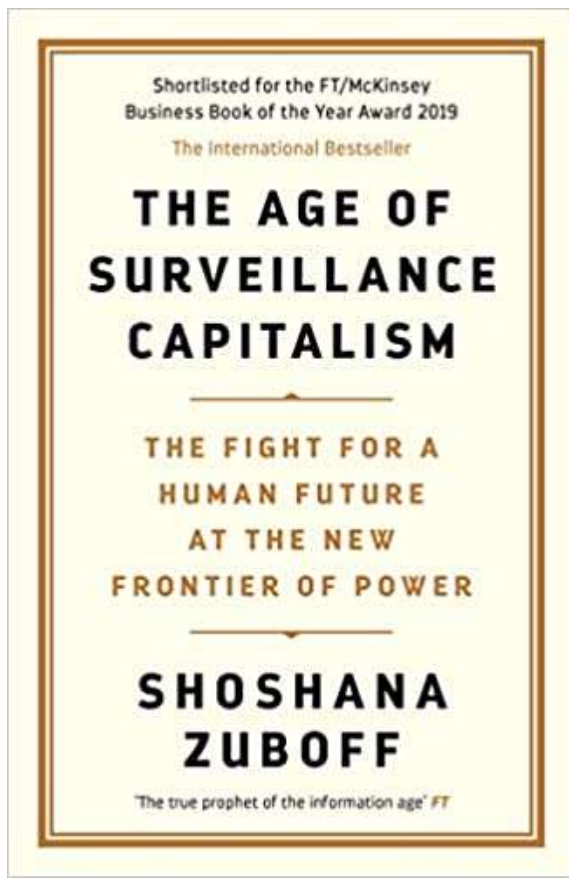
Important:

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

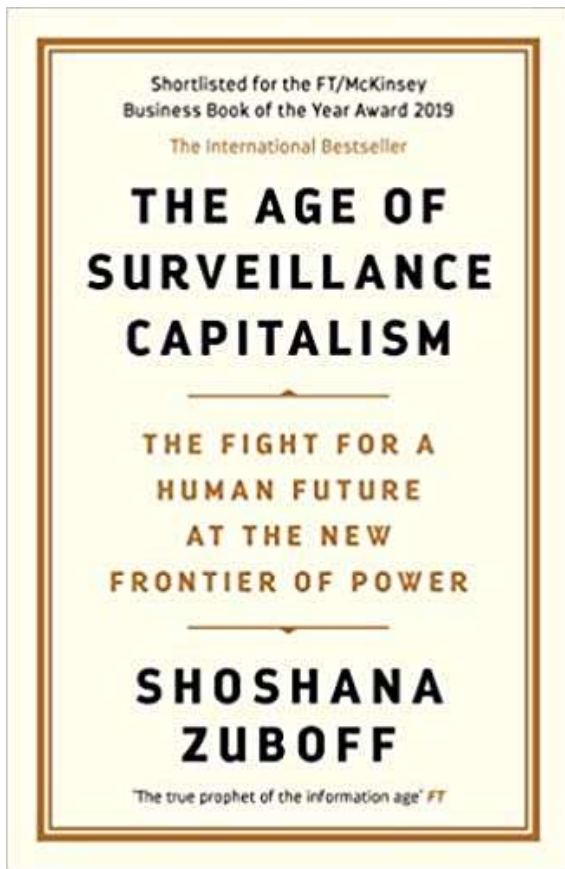




A project of domination of consumers and voters is made possible by artificial intelligence, big data & cognitive psychology



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.

A useful illustration of strategies of capture, starring O'Neil, Zuboff, Lanier, and GAFA technologists...

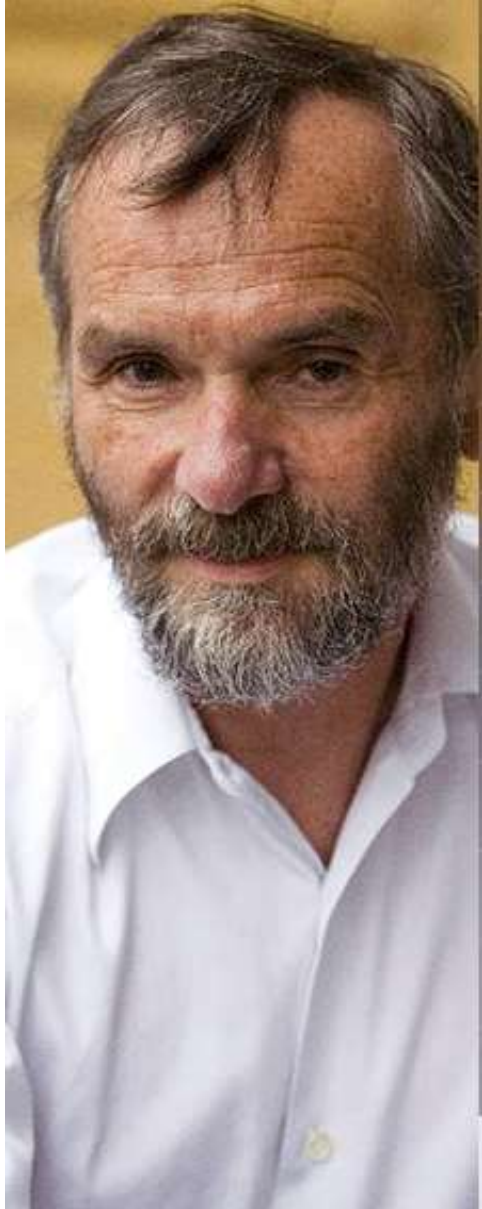


... such as Tristan Harris, former design ethicist at Google, explaining from inside how social media pursue addiction to maximize profit and manipulates people's behaviour



The vision of a
jurist

Alain Supiot

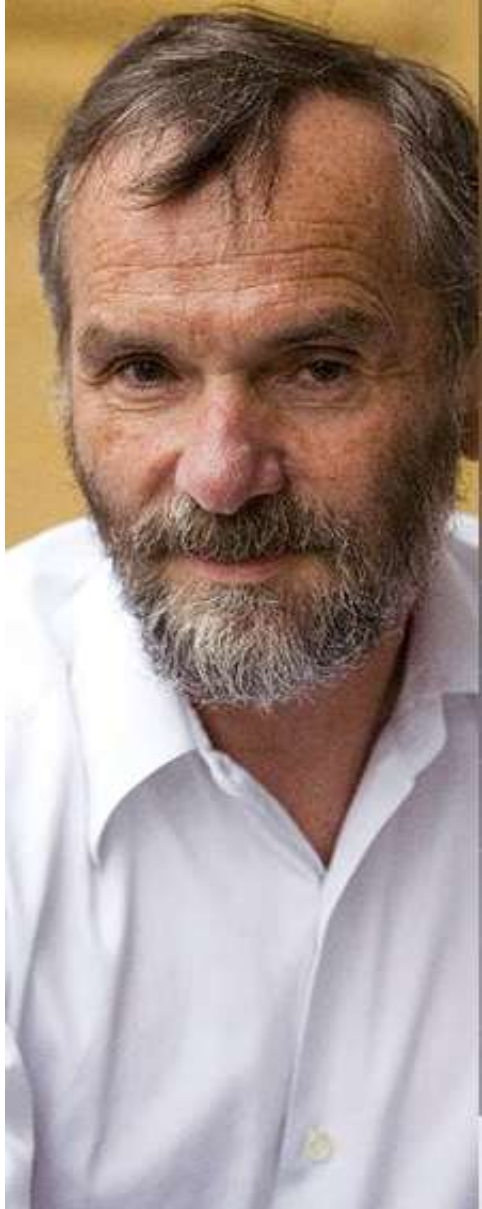


An indictment of the
Total Market and the
normative uses of
economic quantification

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



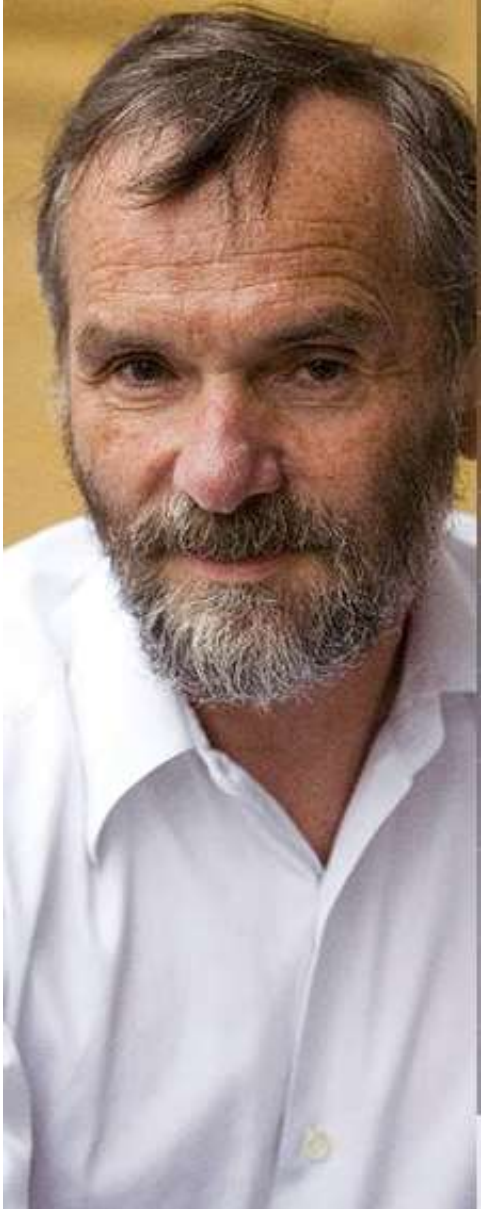
Alain Supiot



...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

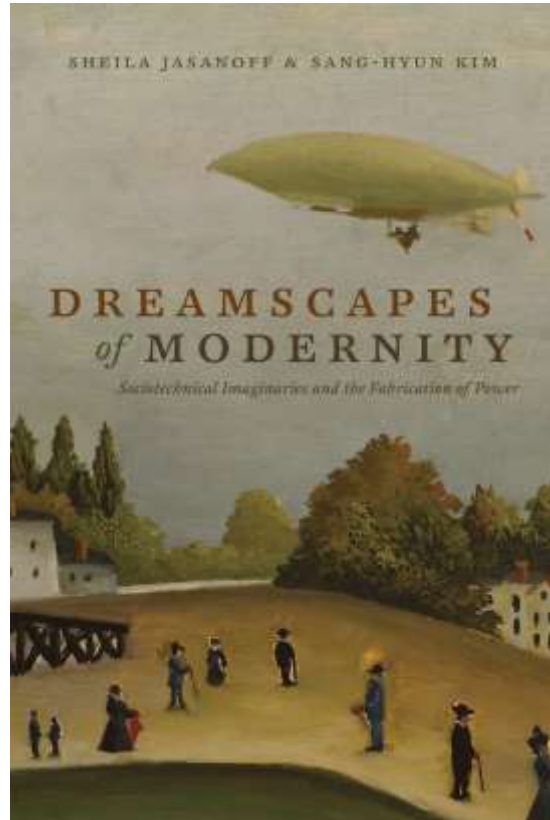
Open Evidence Research, Universitat Oberta de Catalunya (UOC)

Jerome R. Ravetz

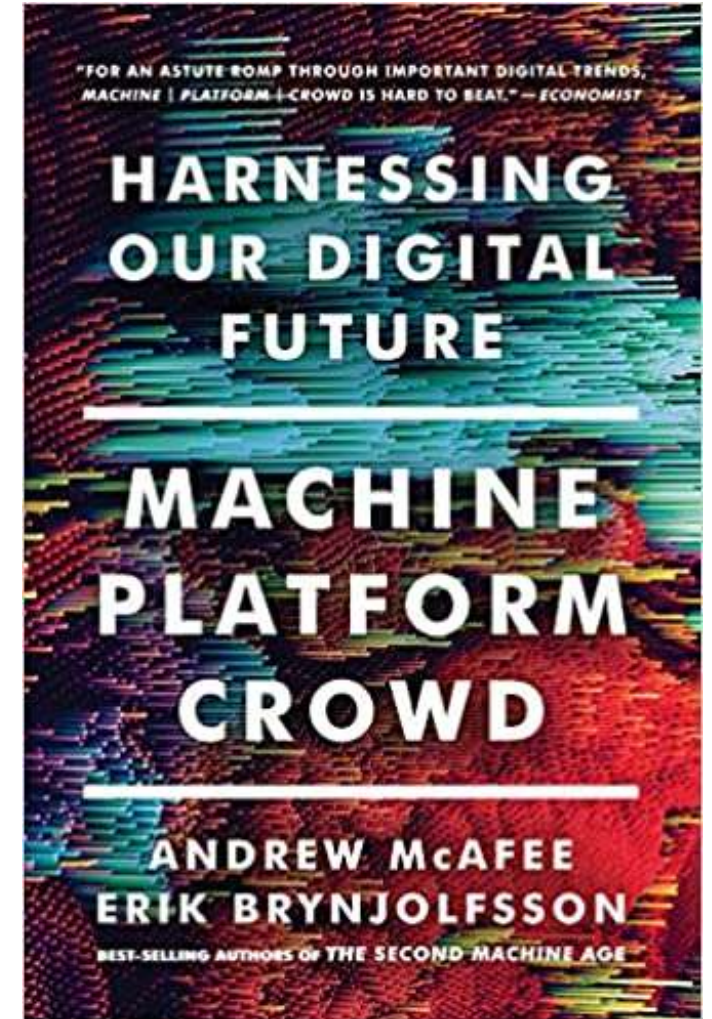
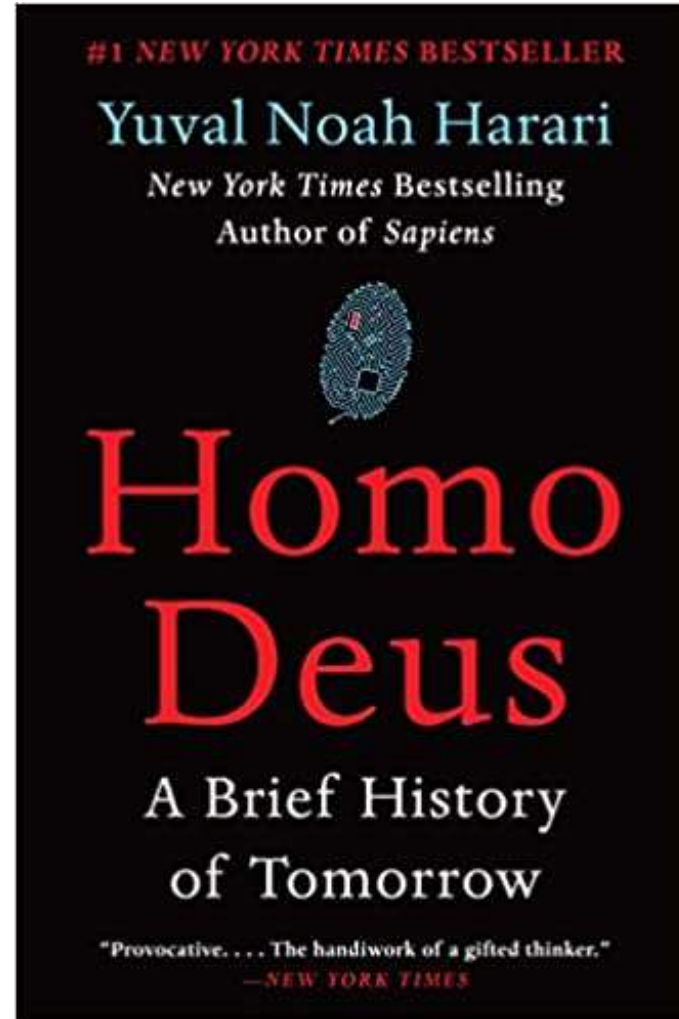
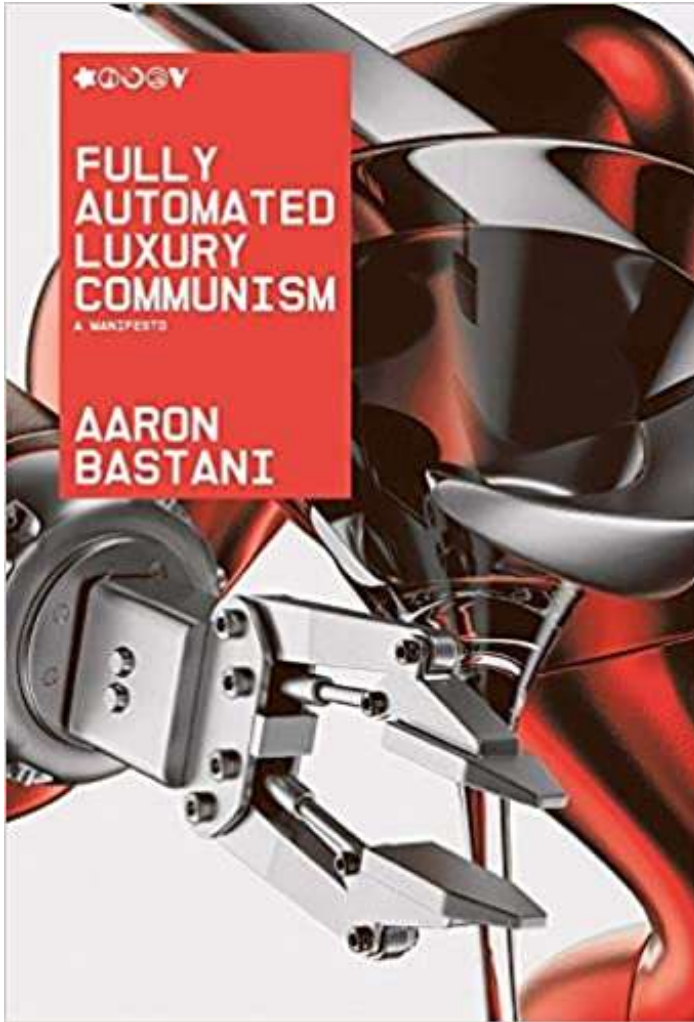
Institute for Science, Innovation and Society, University of Oxford

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)

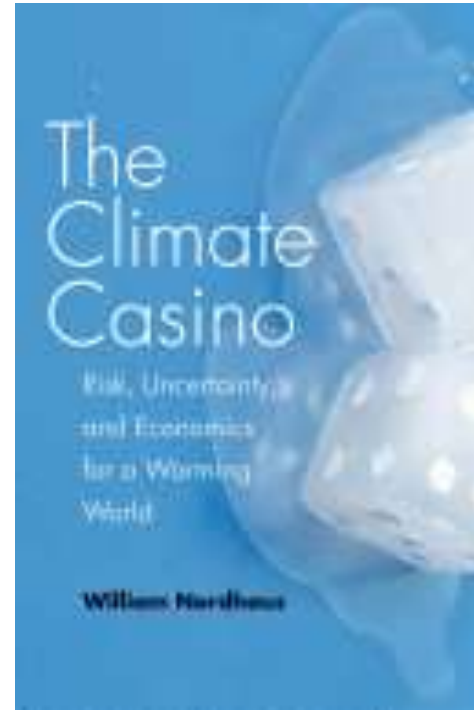


Cass Sunstein, winner of
the 2018 Holberg Prize

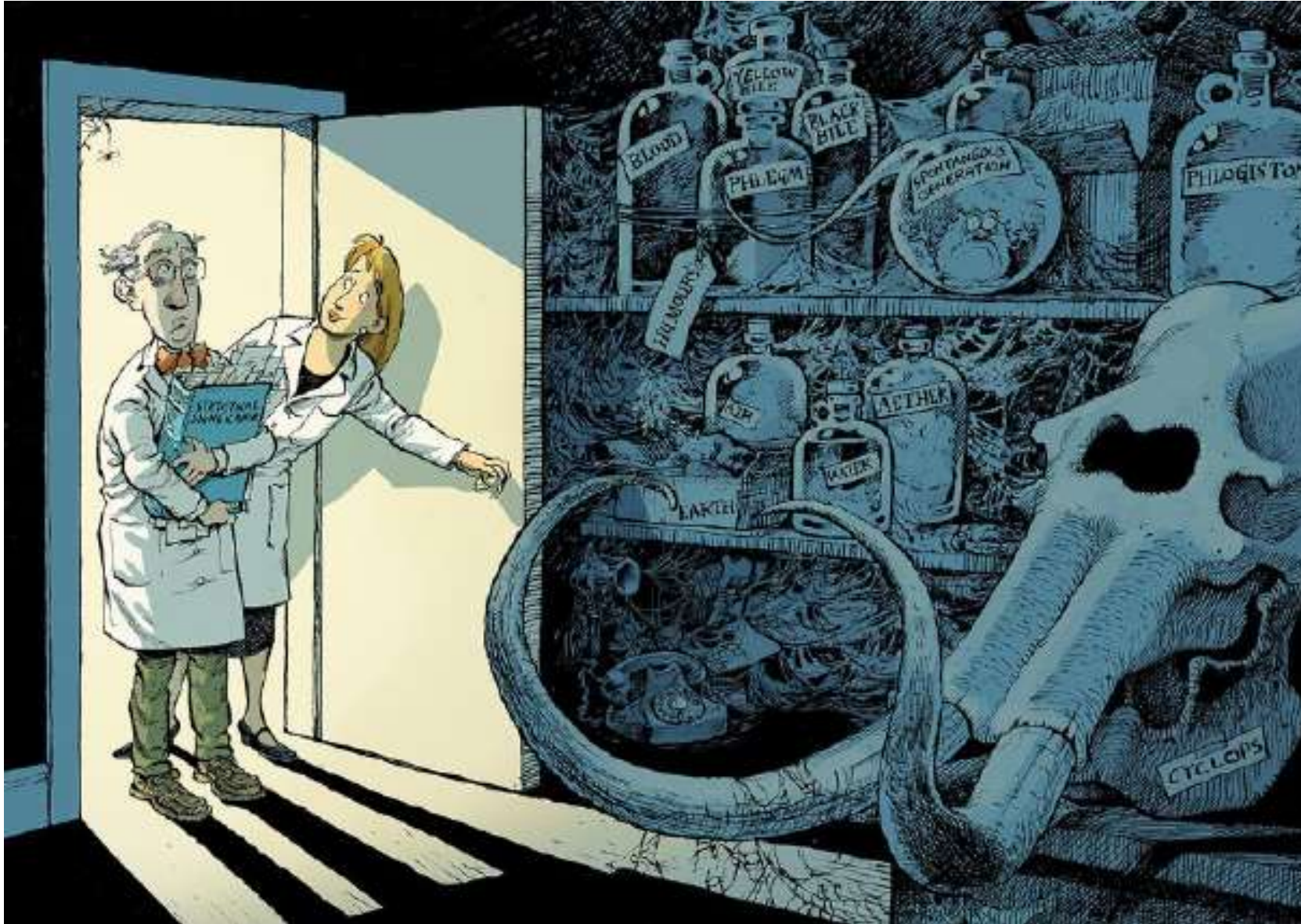


One of the winner of Nobel prize for economics 2018 was Willem Nordhaus, for his work on the economics of climate change.

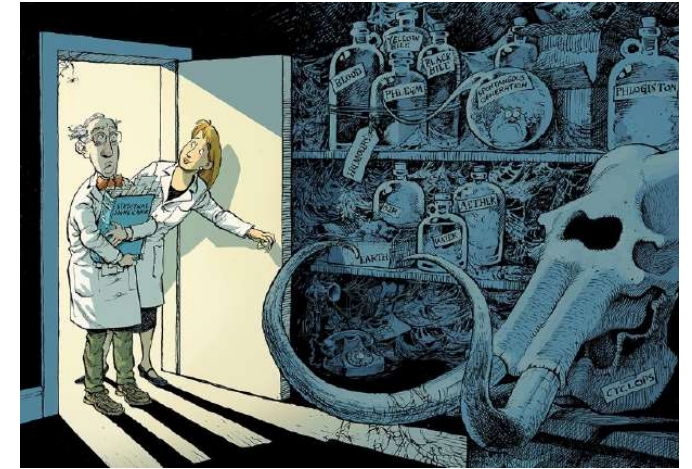
Cost benefit analysis to the year 2100?



Statistical and mathematical modelling



Throw away
the concept of
statistical
significance?



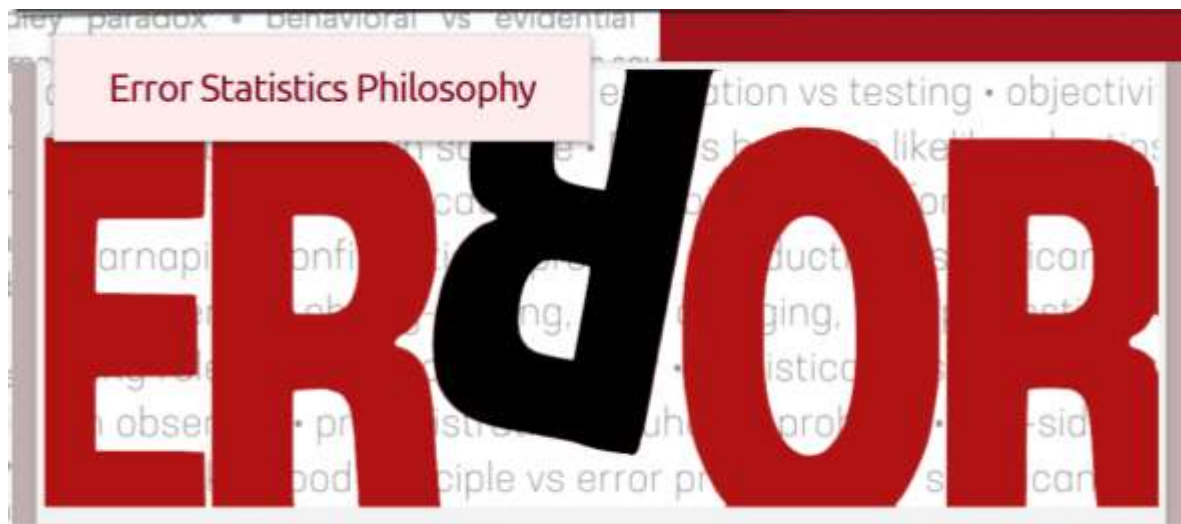
COMMENT • 20 MARCH 2019

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?

Mathematical models

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.

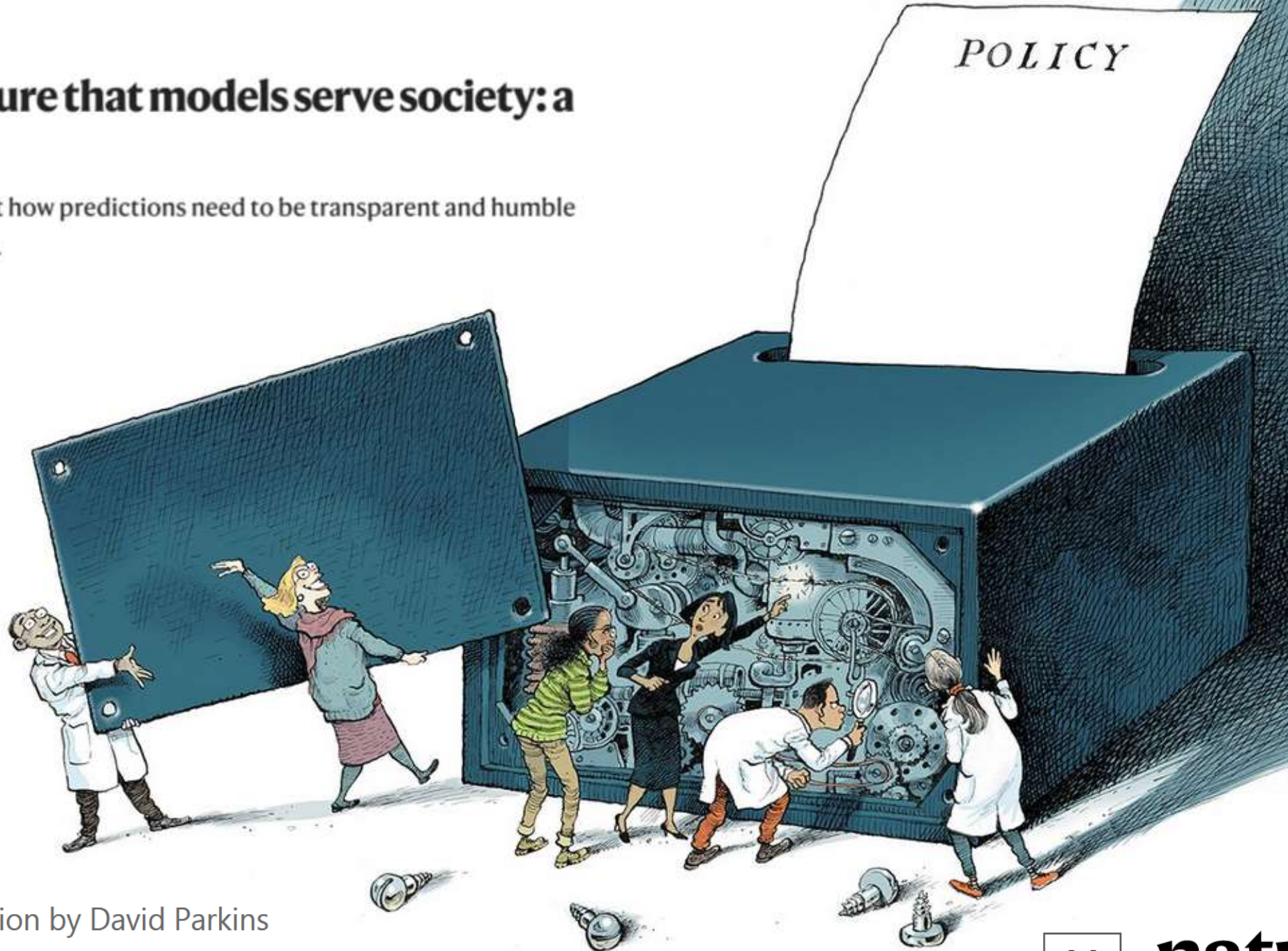


Illustration by David Parkins



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

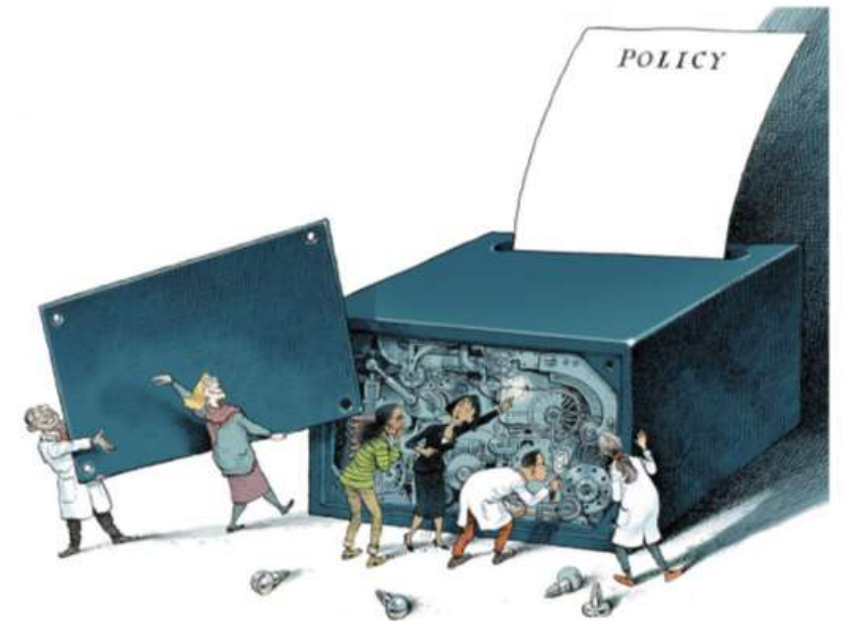
3 STS scholars Bammer, Sarewitz, Stirling

1 philosopher Ravetz

1 historian Charters

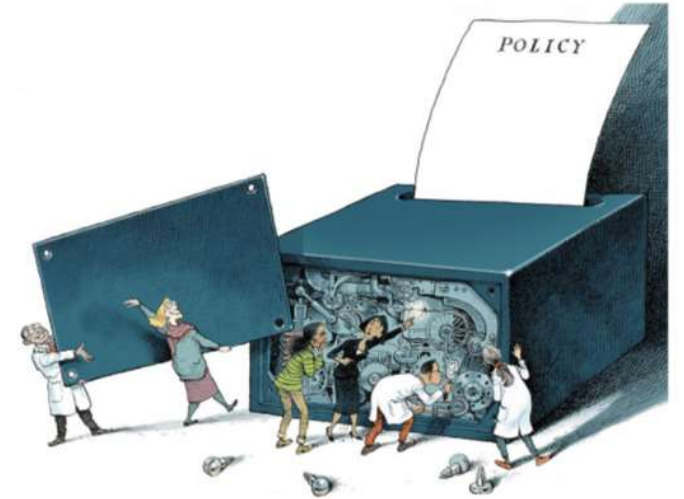
1 political scientists Di Fiore

1 expert RRI - Open Science Rafols



COVID has put mathematical models in the limelight

→ Power & controversy



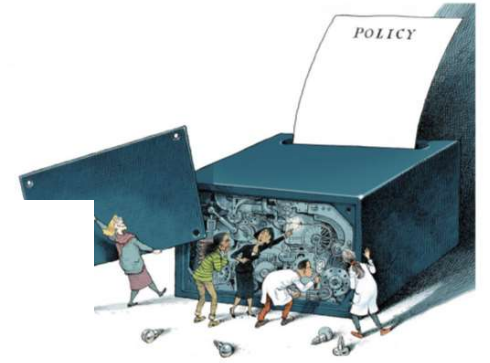
Power

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

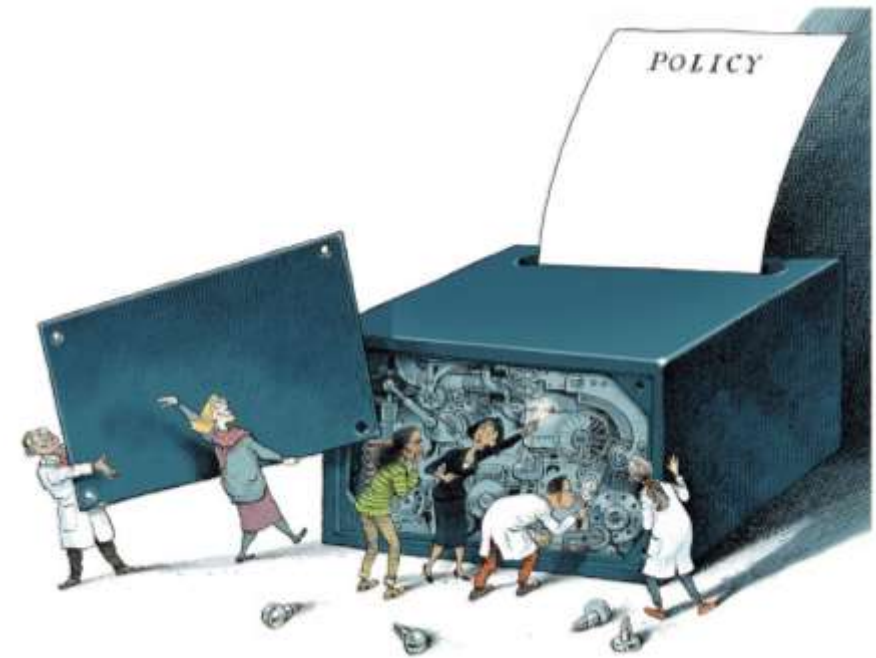
Match purpose and context

Mind the consequences

Quantification can backfire.

Mind the unknowns

Acknowledge ignorance



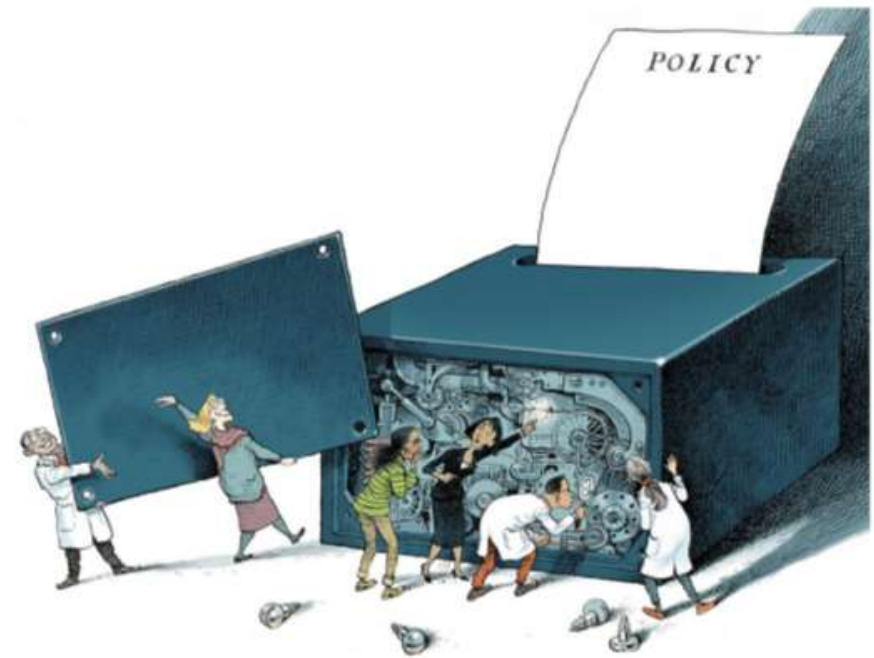
Mind the assumptions

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 ...

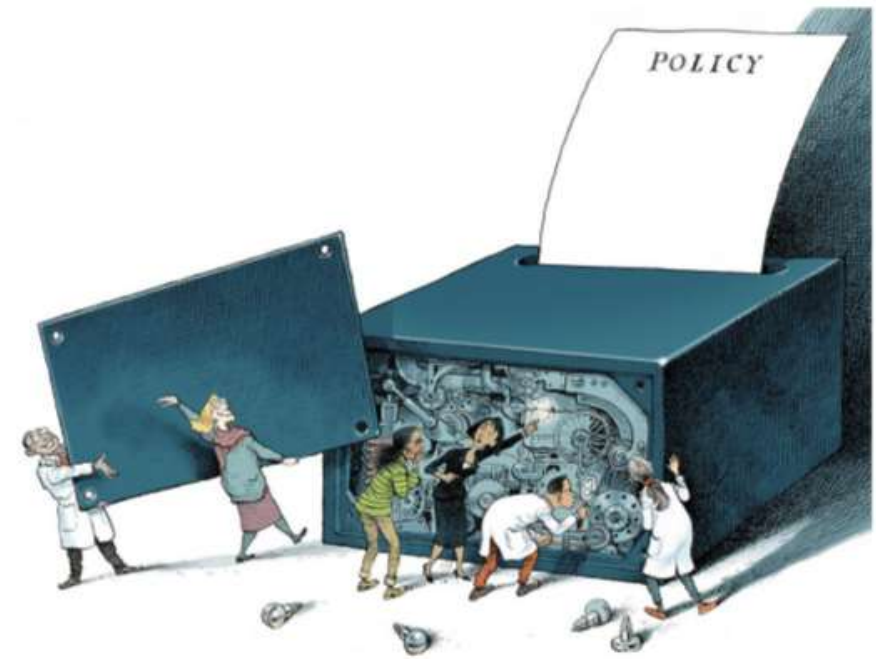


Mind the assumptions

Assess uncertainty and sensitivity



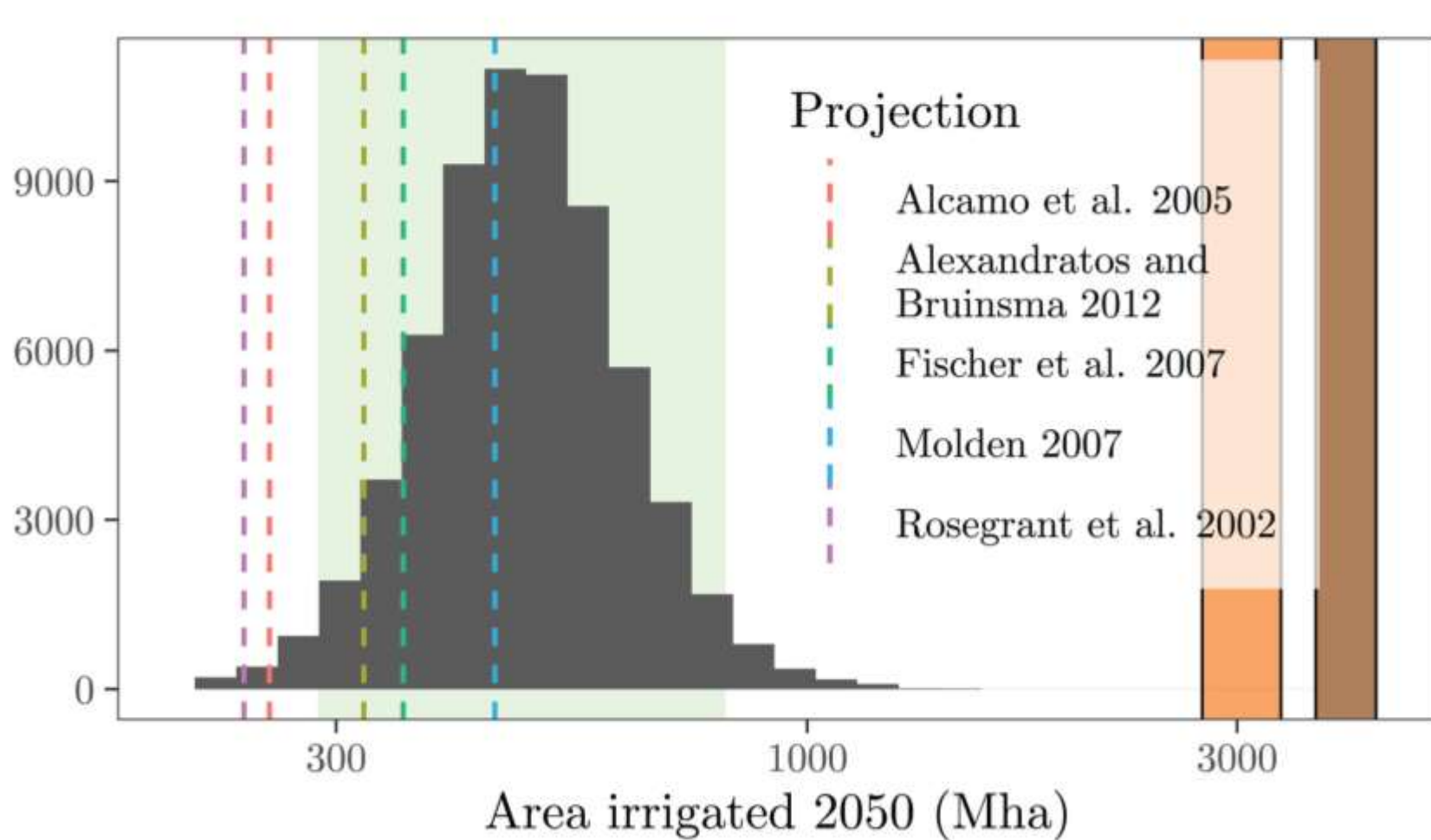
... this may lead to interesting discoveries ...



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> |



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



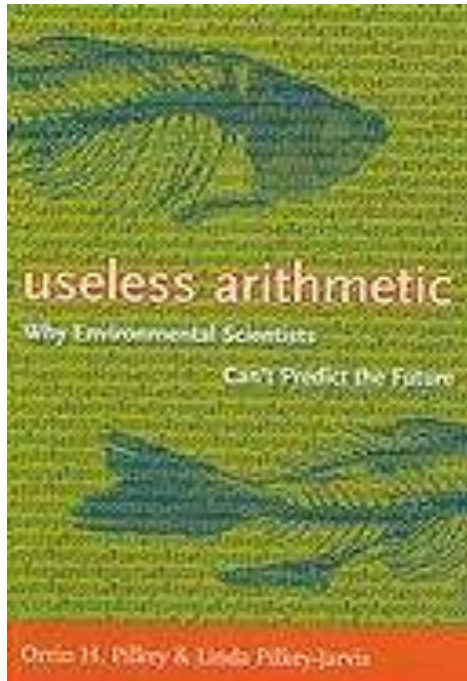
WebTAG: Annual Percentage Change in Car Occupancy (% pa) up to 2036

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



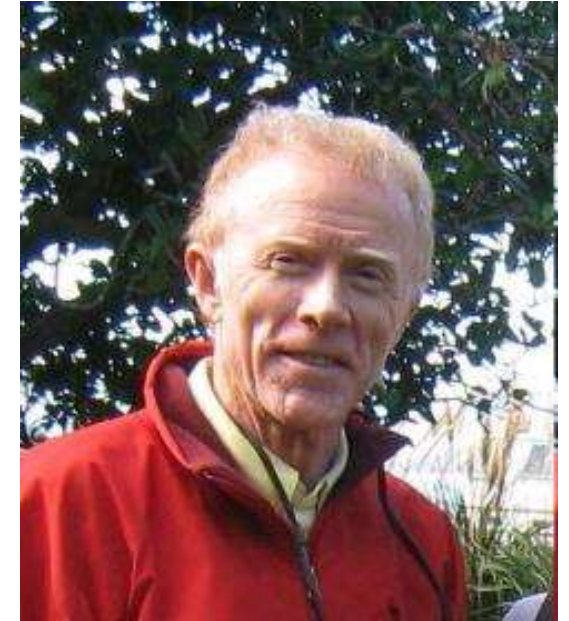
Orrin H. Pilkey

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

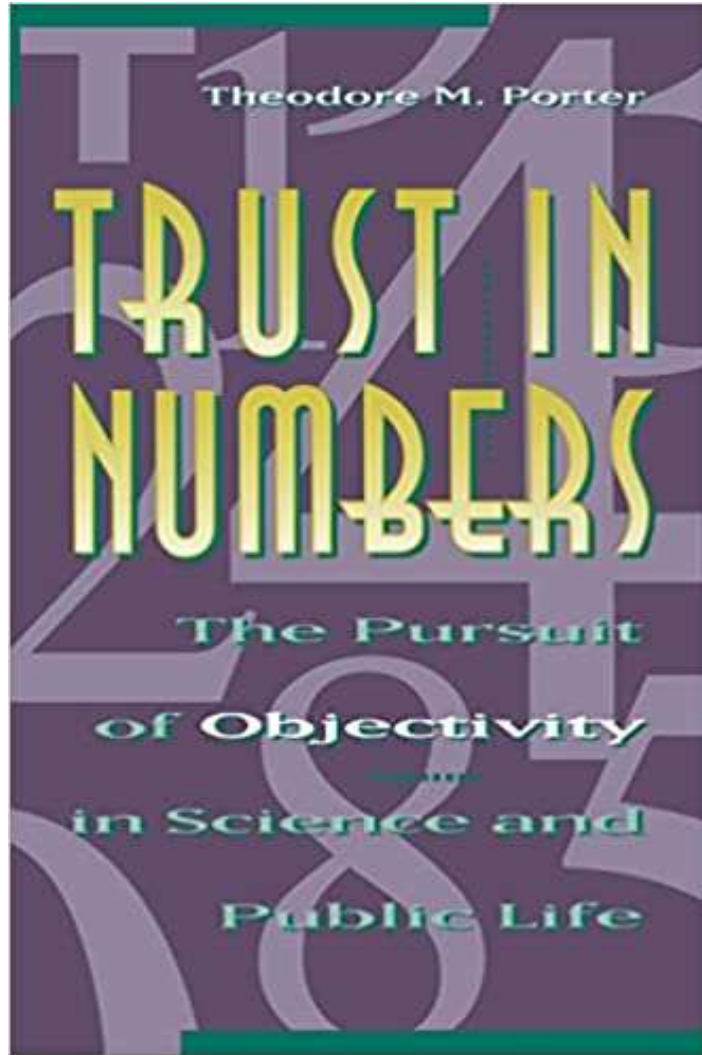
“Thou shall confess in the presence of sensitivity.
Corollary: Thou shall anticipate criticism “



“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

Mind the assumptions

Assess uncertainty and sensitivity

Mind the hubris

Complexity can be the enemy of relevance

Mind the framing

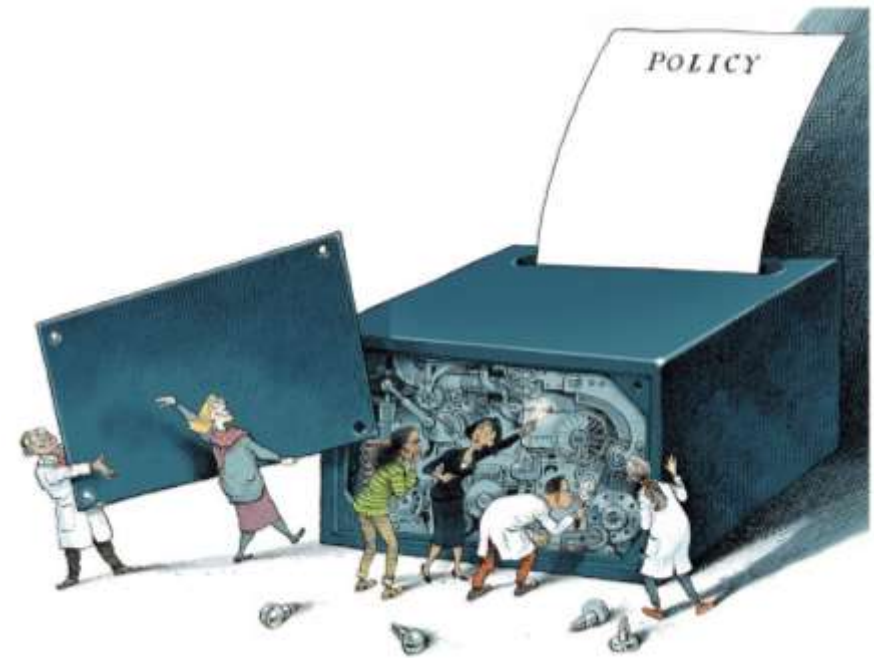
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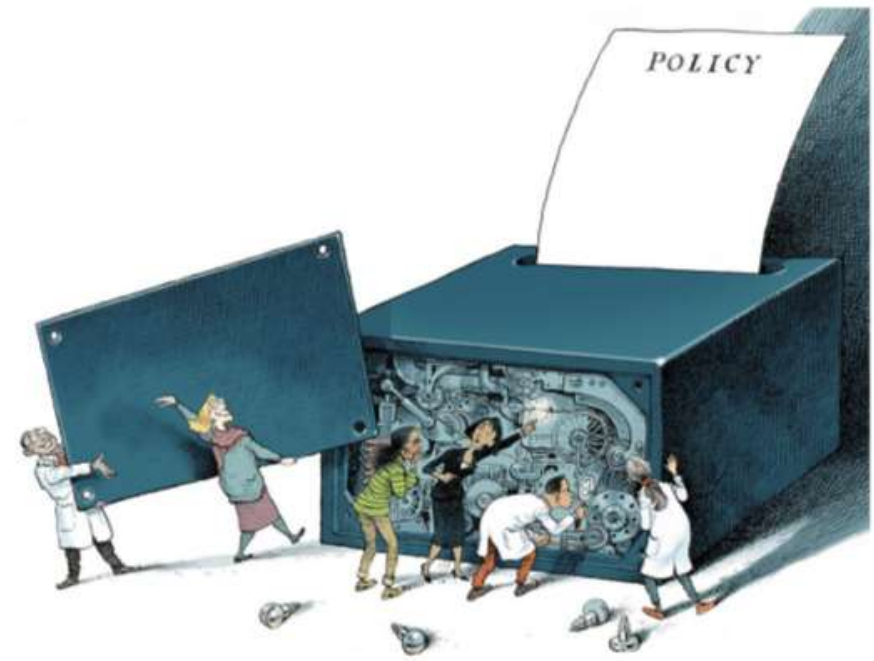
Mind the unknowns

Acknowledge ignorance



Mind the hubris

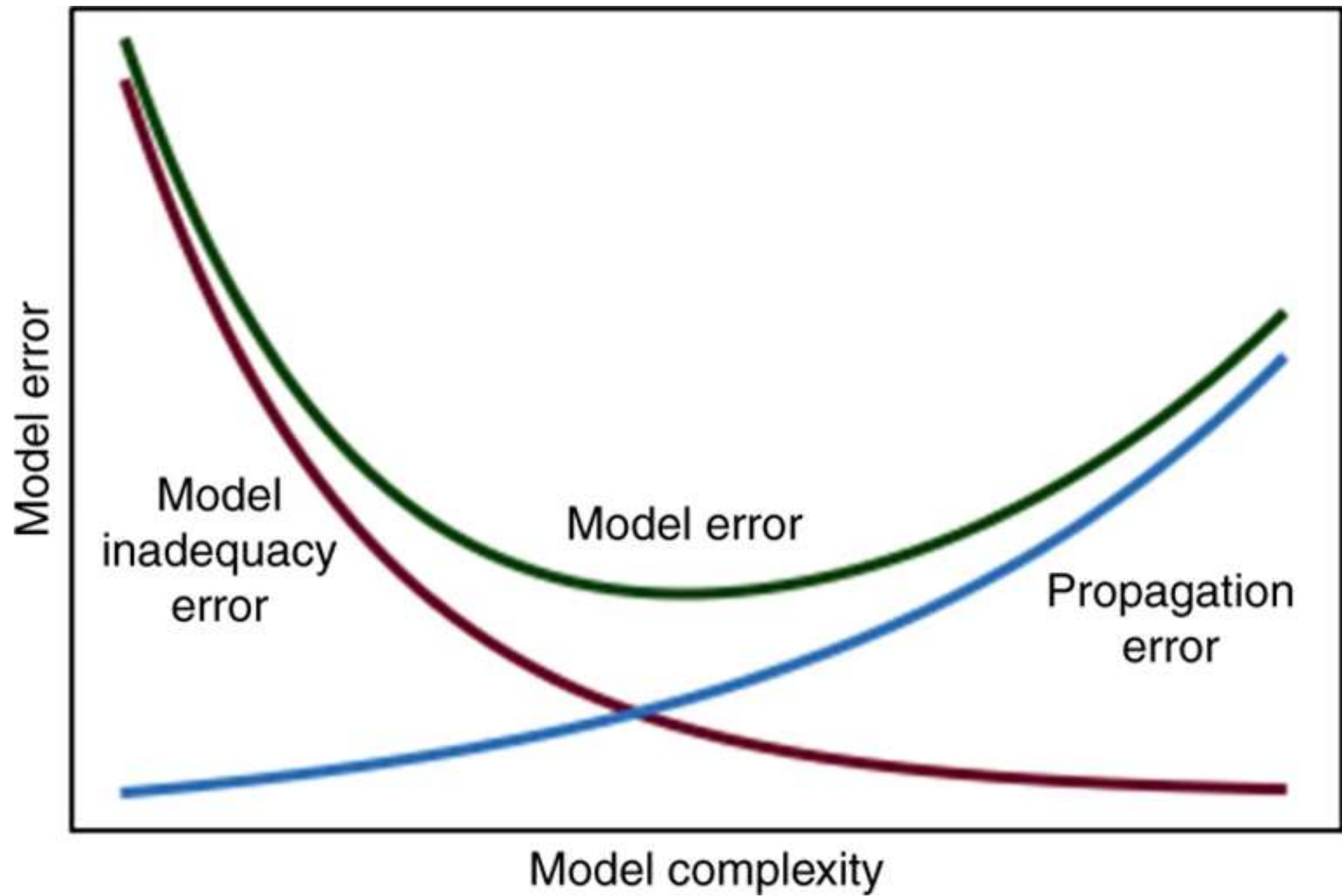
Complexity can be the enemy of relevance



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

SUPPLEMENTARY INFORMATION

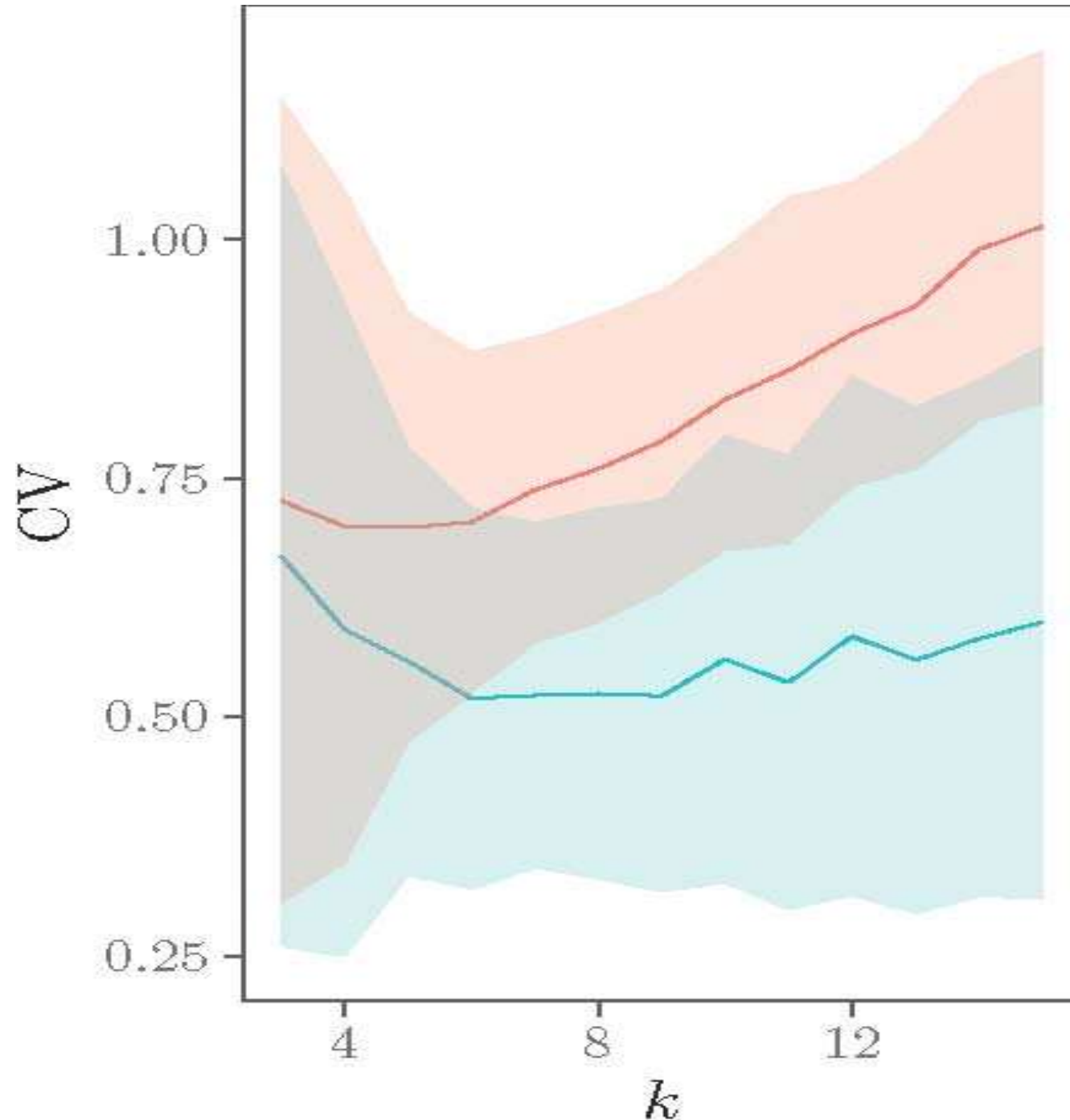
1. Additional information and references >260 references



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**

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Mind the framing

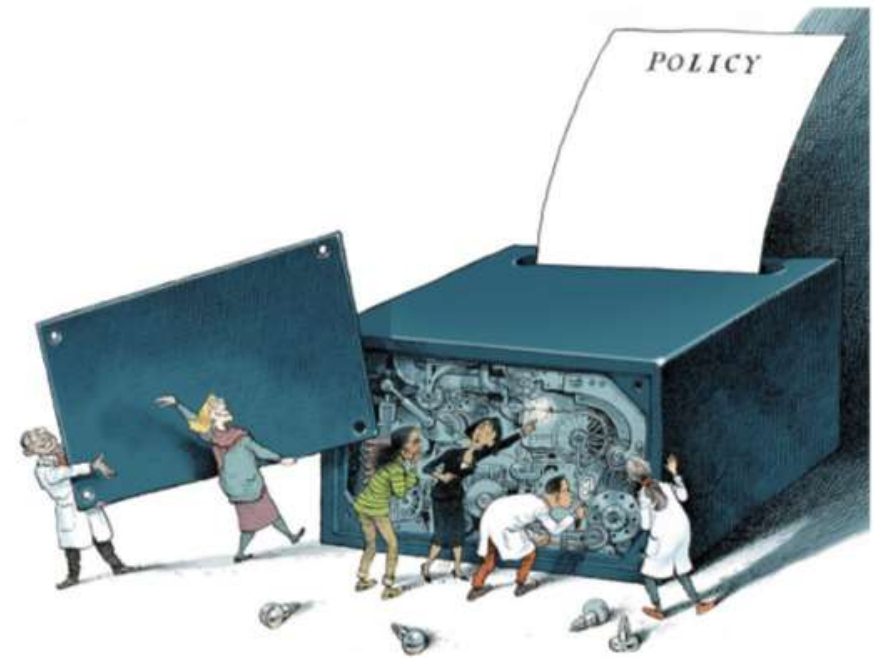
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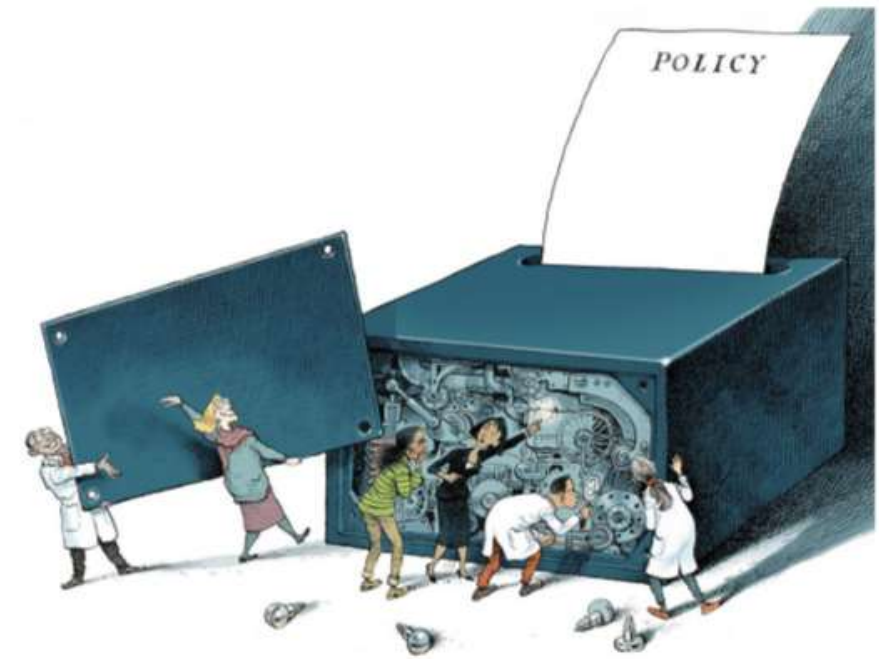
Mind the unknowns

Acknowledge ignorance



Mind the framing

Match purpose and context



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

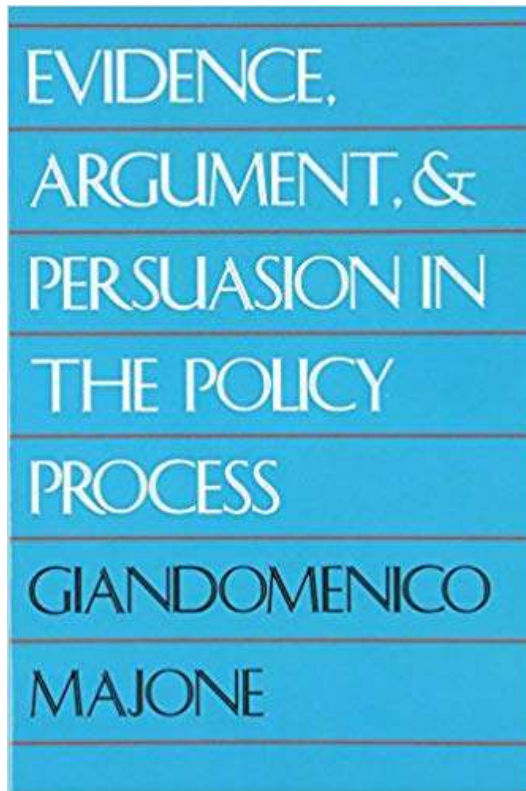
SUPPLEMENTARY INFORMATION

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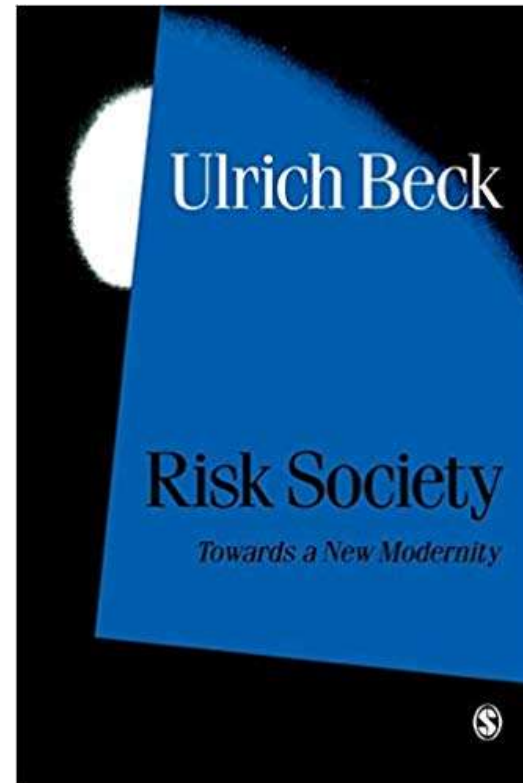
From Ulrich Beck to Giandomenico Majone: the technique is never neutral



Ulrich Beck
(1944 –2015)



1989



1992 (1986)



Environmental Science & Policy

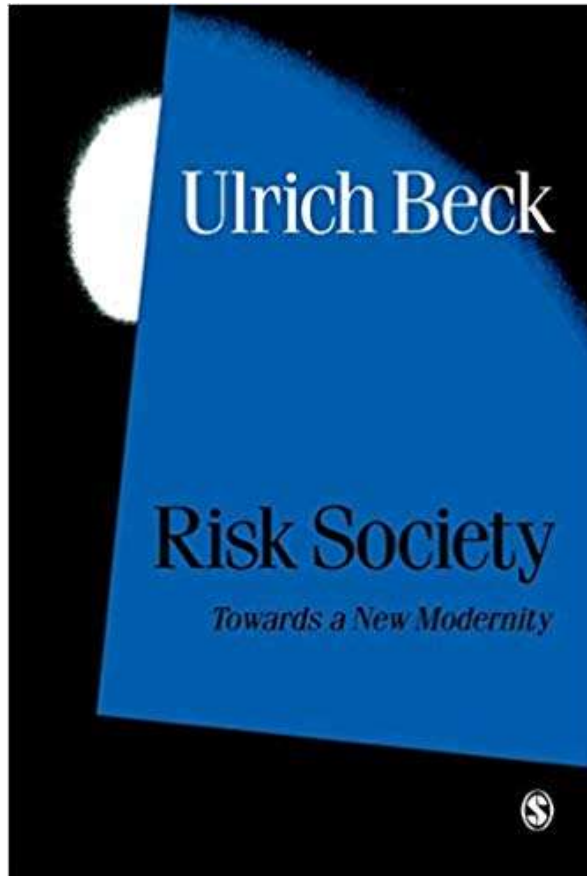
Volume 106, April 2020, Pages 87-98



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}

“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

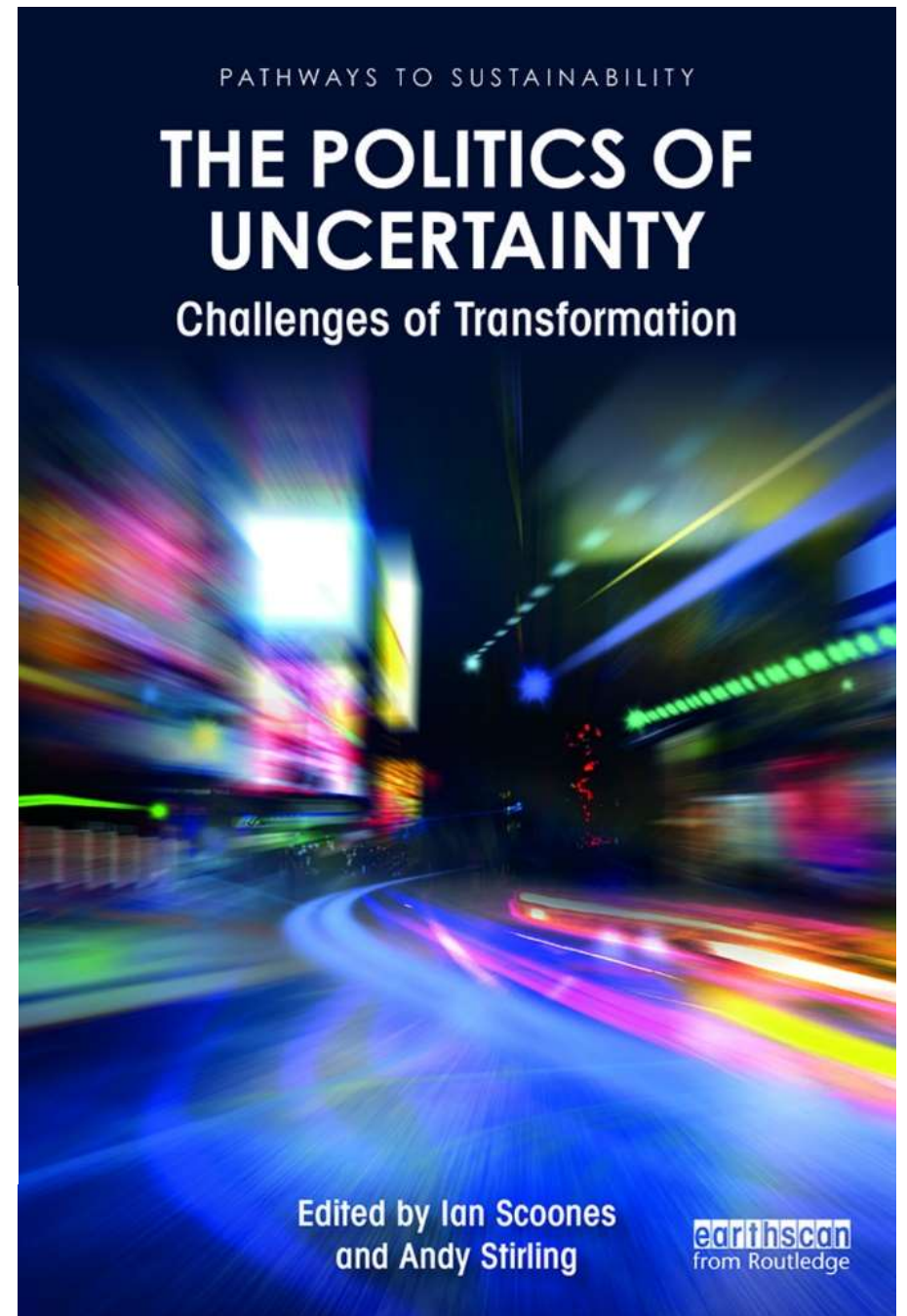
On reductionism

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 is 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

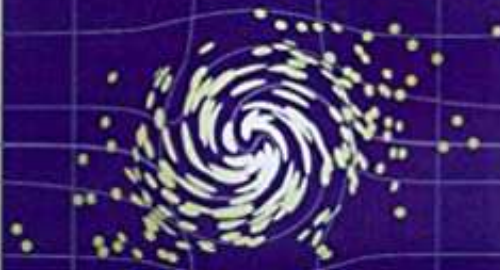
“Bay models are used to track nutrient loads to ensure the cap is not exceeded”

➔ 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.

PREDICTION

Science, Decision Making,



and the Future of Nature

Edited by Daniel Sarewitz,
Roger A. Pielke, Jr., and Radford Byerly

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

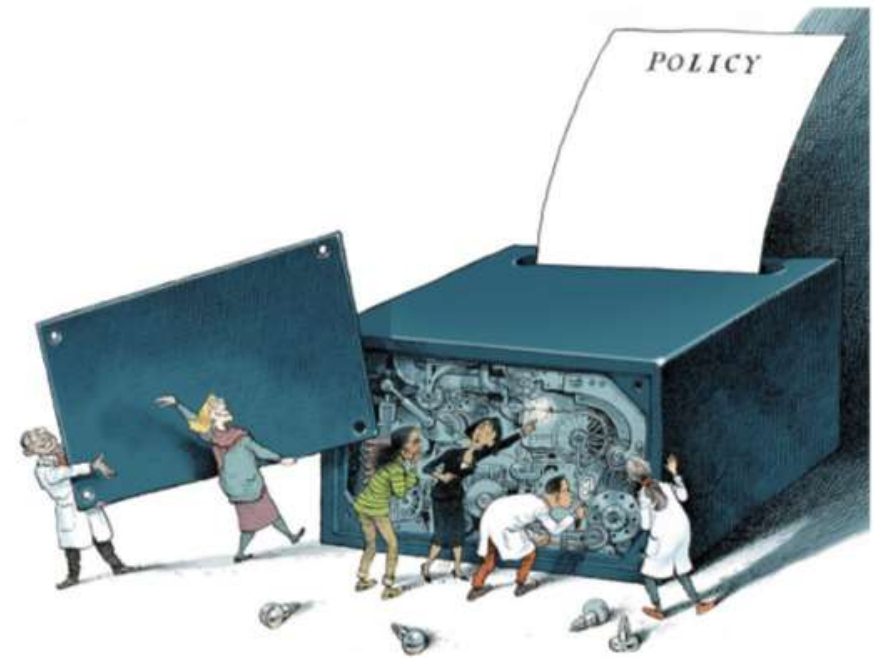


Mind the consequences

Quantification can backfire.

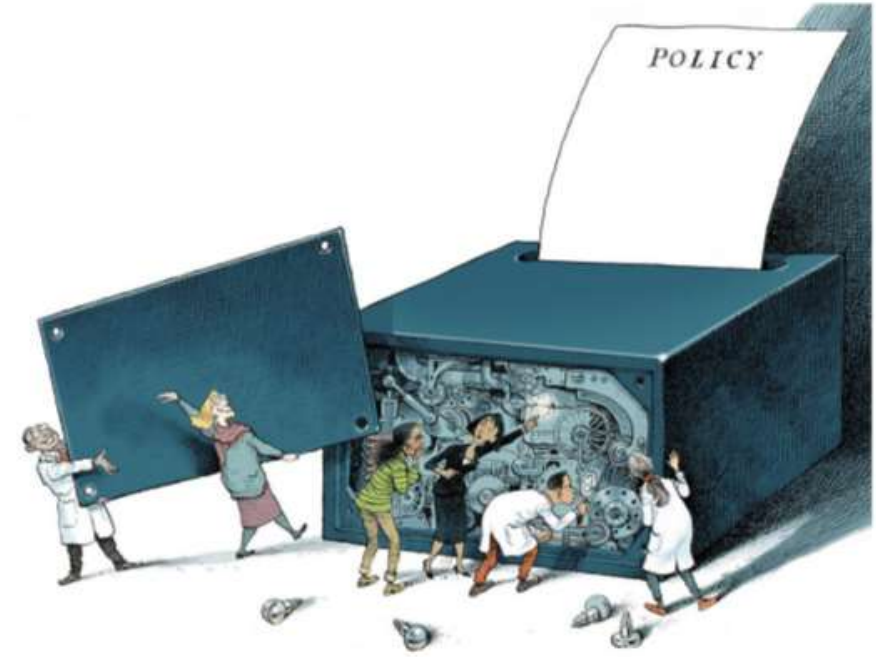
Mind the unknowns

Acknowledge ignorance



Mind the consequences

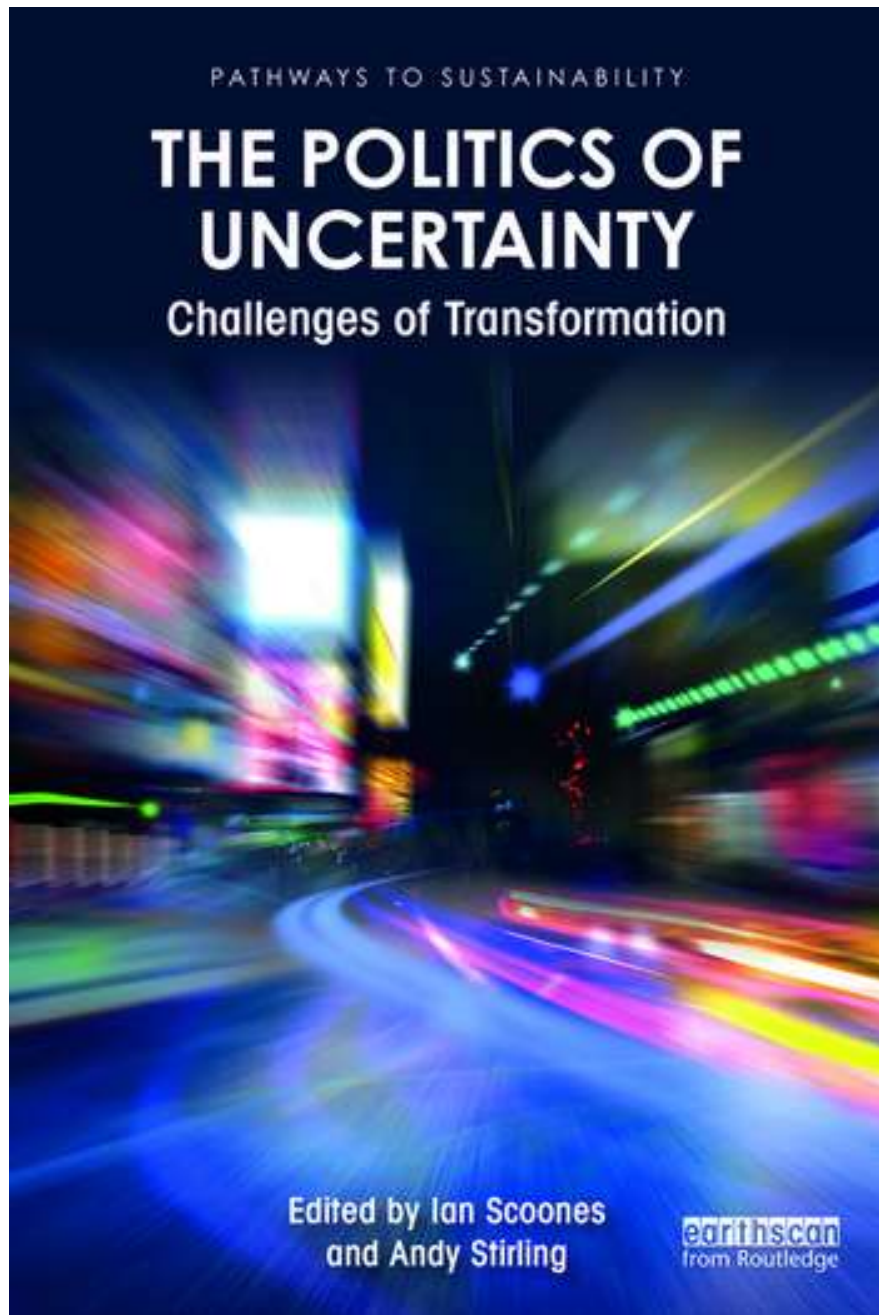
Quantification can backfire



From the risk of financial products to the management of 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>

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



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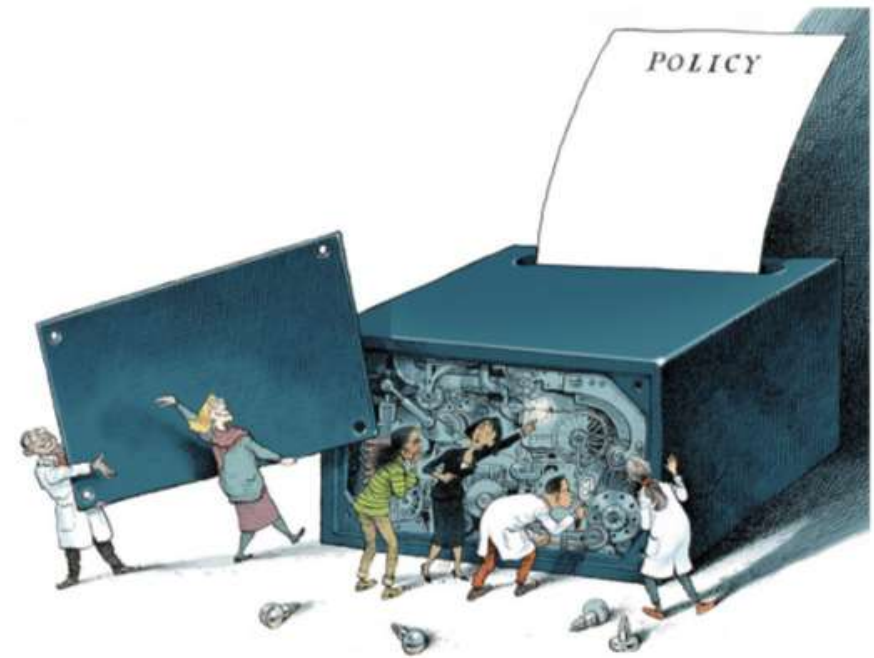
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Mind the unknowns

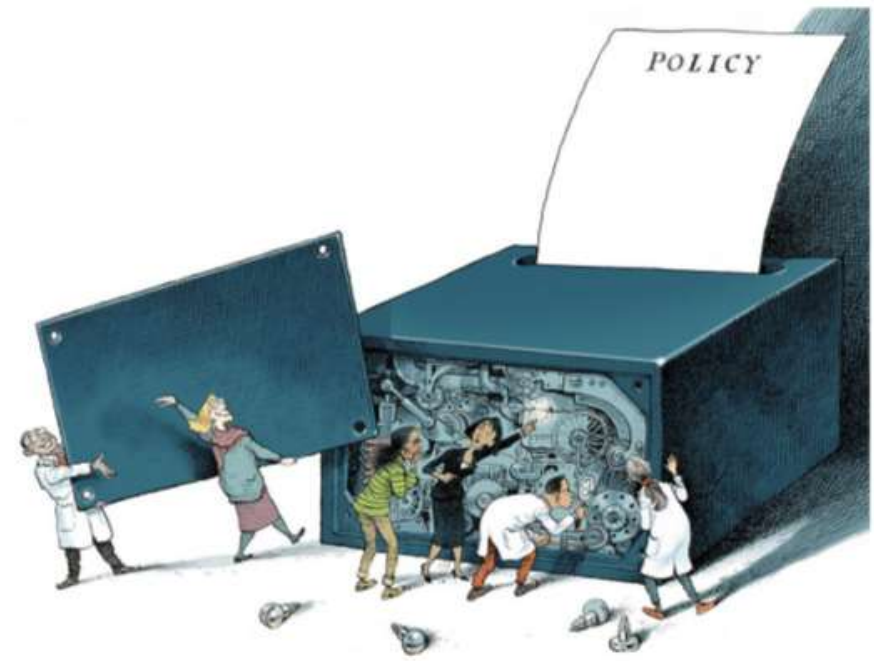
Acknowledge ignorance



Mind the unknowns

Acknowledge ignorance

“there is no
number-answer to
your question”

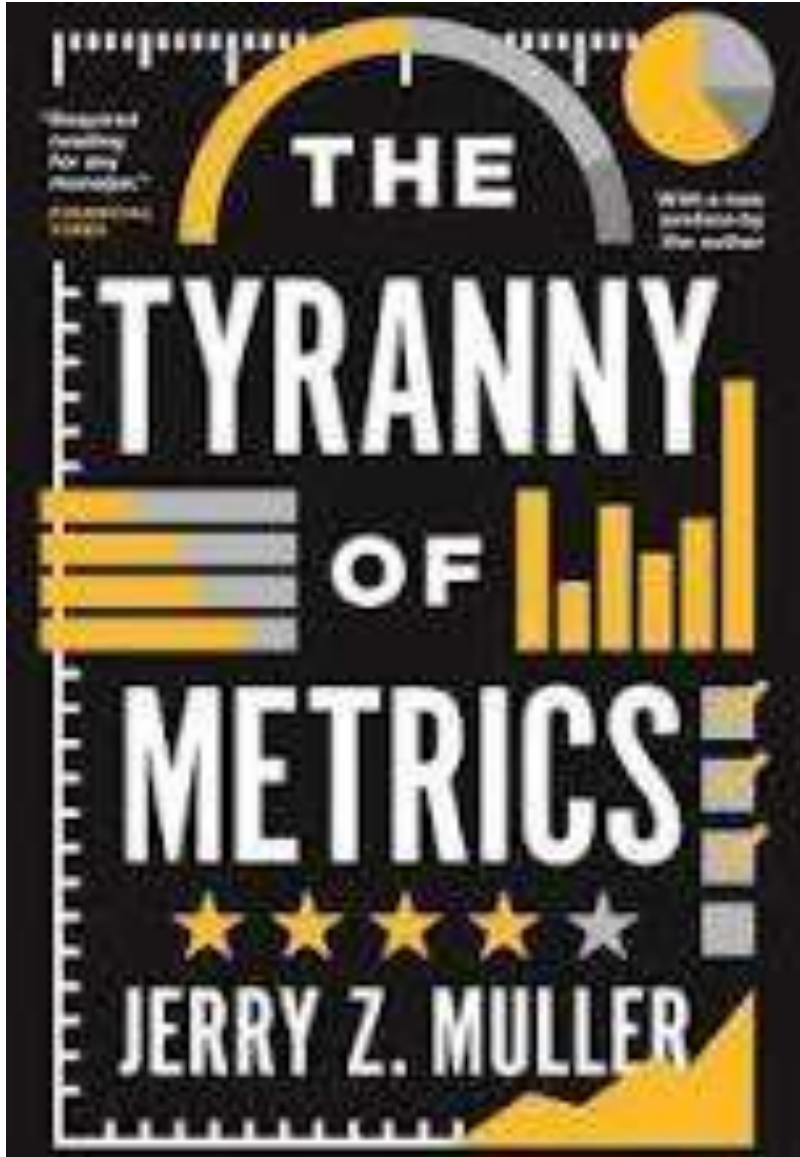


SUPPLEMENTARY INFORMATION

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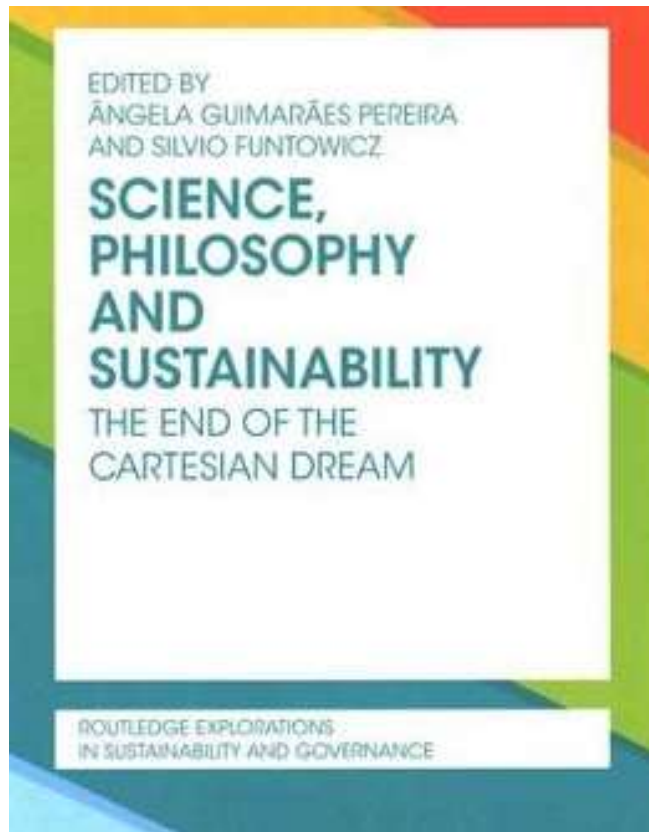
>260 references

Anthony Fauci



As already mentioned:

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



Jerry 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.



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

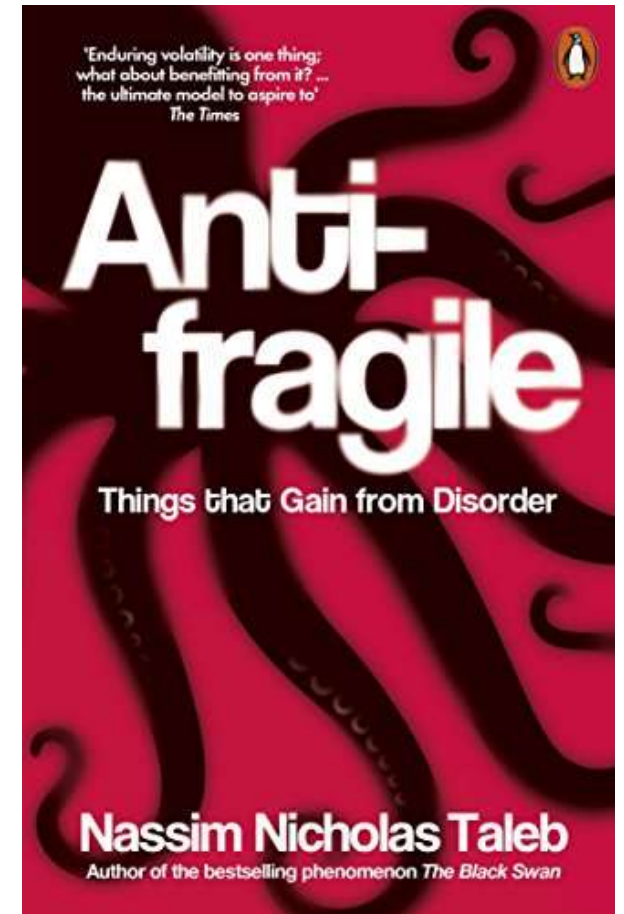
Volume 91, August 2017, Pages 62-71



Original research article

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

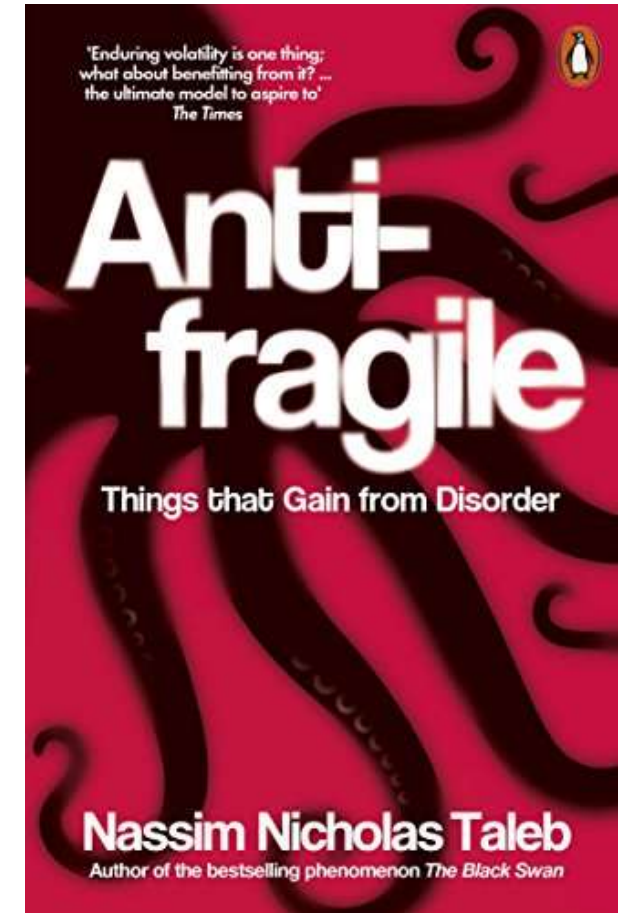
Andrea Saltelli ^{a, b, c}  , Mario Giampietro ^{a, c, d}



“...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)



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, d, e}, Mario Giampietro ^{a, c, d}

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”

Beyond models

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 fatally push those parts into the background which come without the clothing of ...

... 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.



**UCL Institute for
Innovation and
Public Purpose**

WORKING PAPER
WP 2021/05

Scope for harm from ‘wrong numbers’ e.g. in :

- Medical research
- Higher education
- Governance of science
- Finance
- Numbers from international organizations
 - Food and Agriculture Organization
 - The World Bank
 - OECD
 - ...
- ...

‘Trendy’ methods may also harm

- Randomized control trials) may be misused to suggest more general conclusions that may not be valid
- Sophisticated statistical/econometric techniques that can be designed in ways that promote particular policy conclusions reflecting researchers’ biases

A global observatory for gene editing

Sheila Jasanoff and J. Benjamin Hurlbut call for an international network of scholars and organizations to support a new kind of conversation.

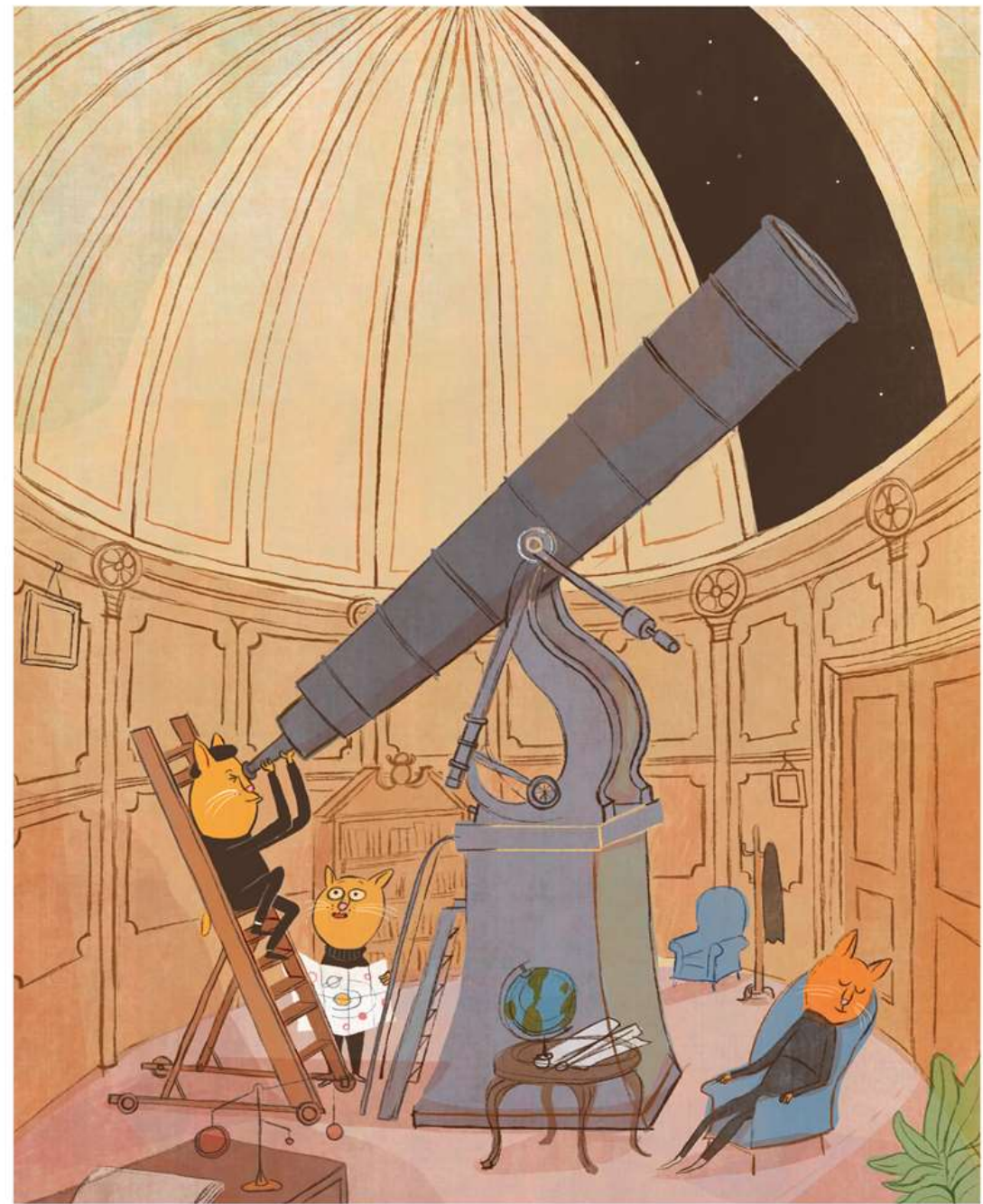
Sheila Jasanoff & J. Benjamin Hurlbut



Illustration by Marina Muun

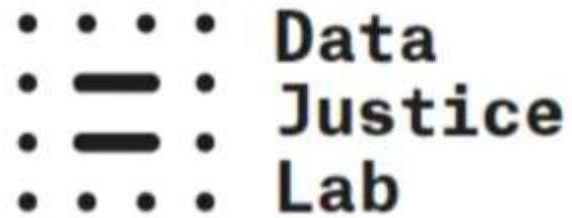
... the potential of numbers to inflict harm is on par or superior to those of biotechnologies

... then how about an observatory for visible and invisible numbers ?



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

Existing initiatives looking at quantification



Radical Statistics Group

Using statistics to support progressive social change



THE ALGORITHMIC JUSTICE LEAGUE

The End



@andreasaltelli