

# Ethics of quantification

Andrea Saltelli  
June 2023

## Statistical Data Analysis Module A

&

## Project i4Driving



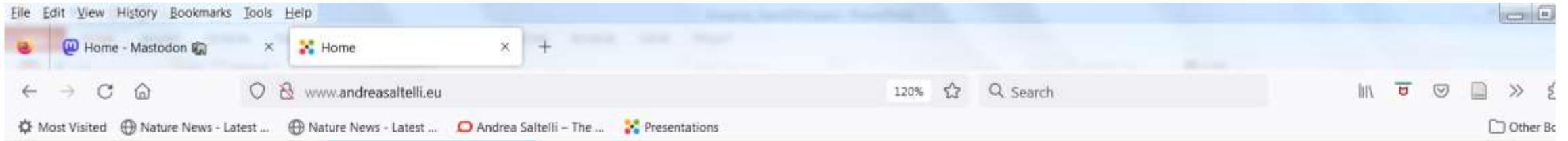
**Integrated 4D driver  
modelling under  
uncertainty**

Project started on October 1st, 2022

**i4Driving**

a EU Horizon Europe R&I project

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



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## Coming Out Soon: The politics of modelling



### Praise for the volume

*"A long awaited examination of the role —and obligation —of modeling."*

**Nassim Nicholas Taleb**, Distinguished Professor of Risk Engineering, NYU Tandon School of Engineering. Author, of the 5 -volume series *Incerto*.

\*\*\*

*"A breath of fresh air and a much needed*

### Mastodon Toots by

@AndreaSaltelli

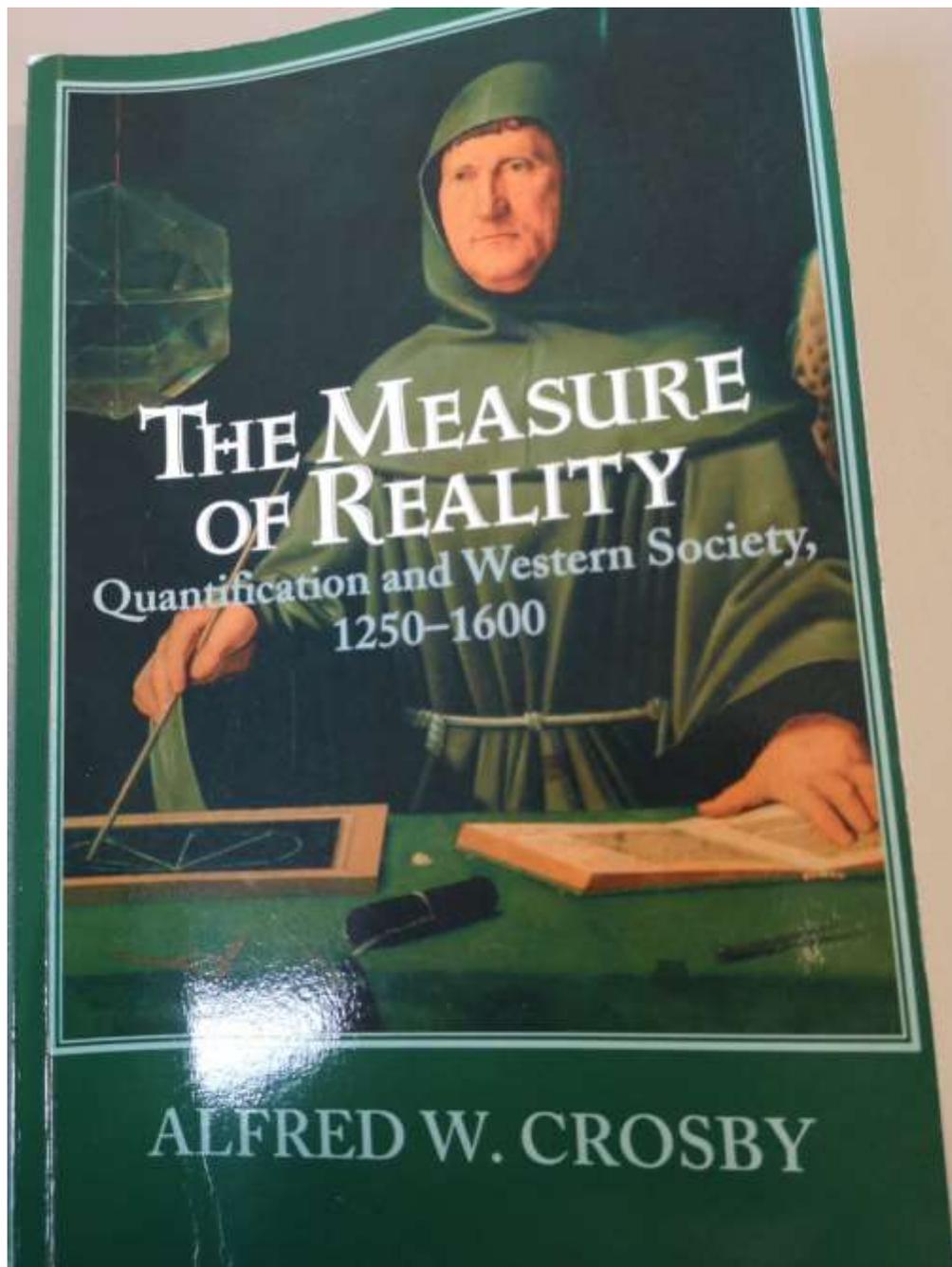


AndreaSaltelli

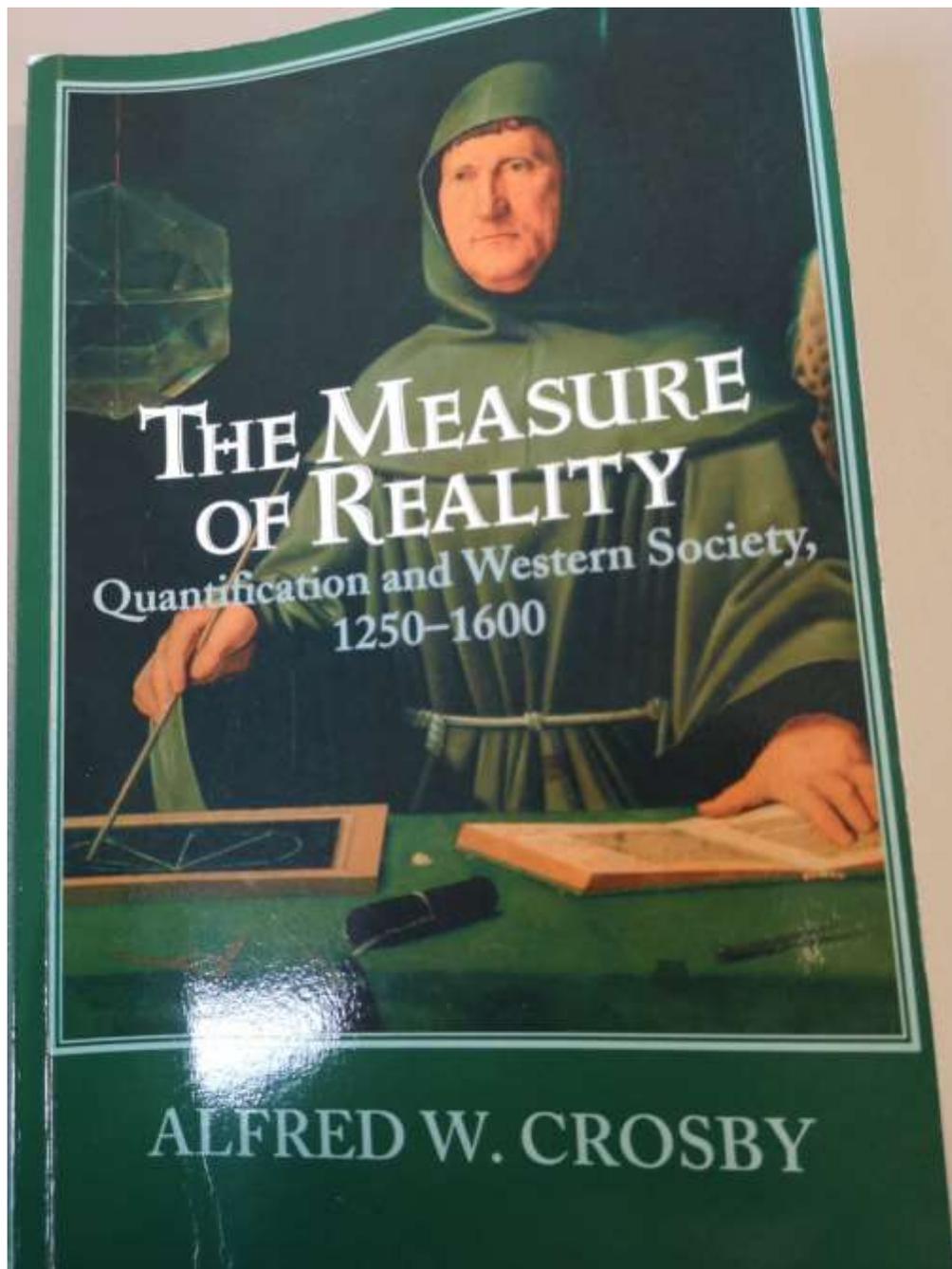
2023/4/18 17:24

"Kaufman, who was until recently a senior climate economist in the White House, questioned the need for the government to set a single price. Regulators should stop "pretending we

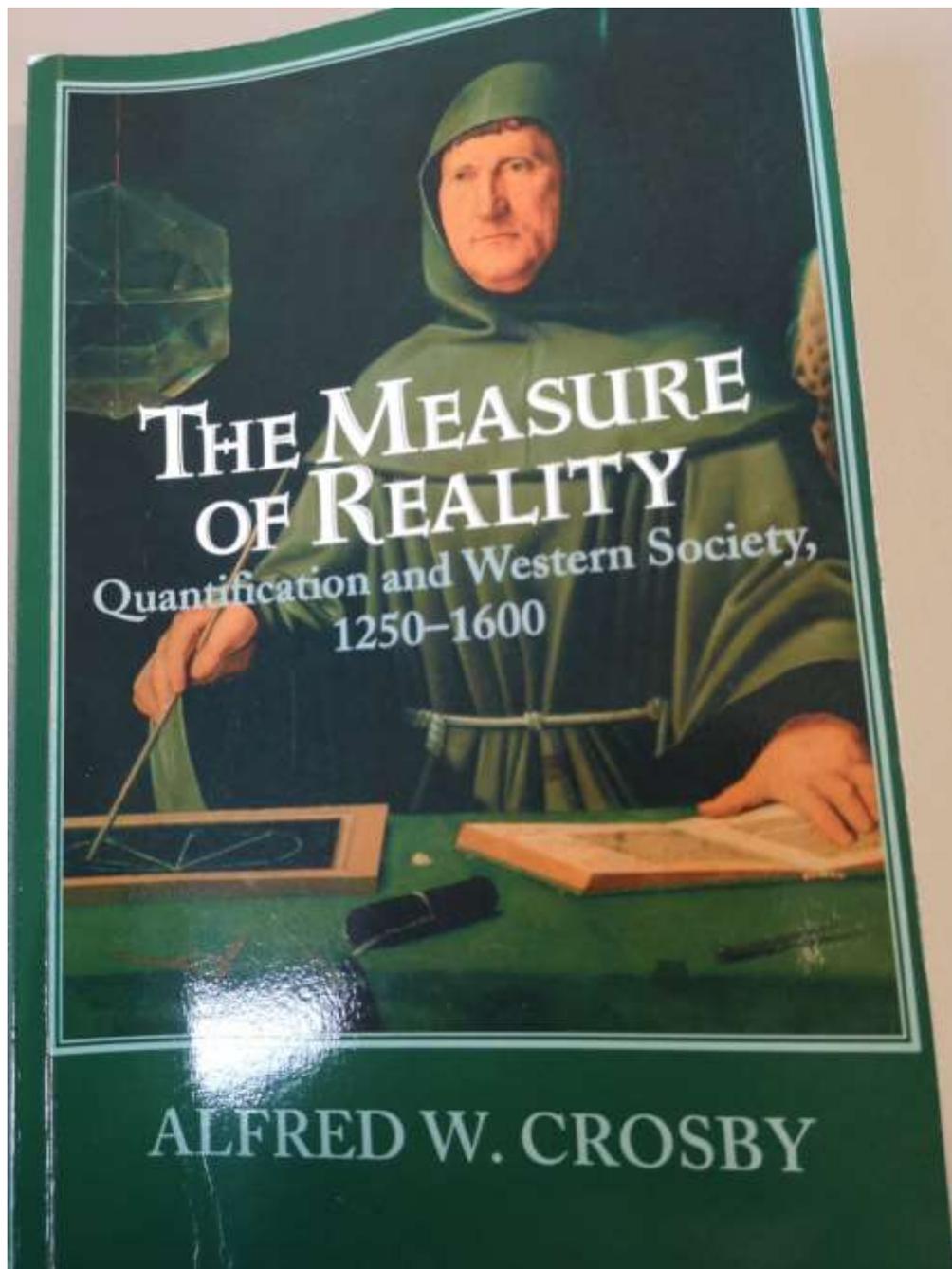
Is quantification important?  
Or all-important?



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 earth and  
skies, dispute on a  
printed bible,  
learning, accounting,  
perspective,  
polyphonic music, the  
windmill, the watch ...



VIDENDVM, VT NEC VOLVPTATI DEDITI PRODIGI ET LVXVRIOSI  
APPAREAMVS, NEC AVARA TENACITATI SORDIDI AVT OBCVRI EXISTAMVS



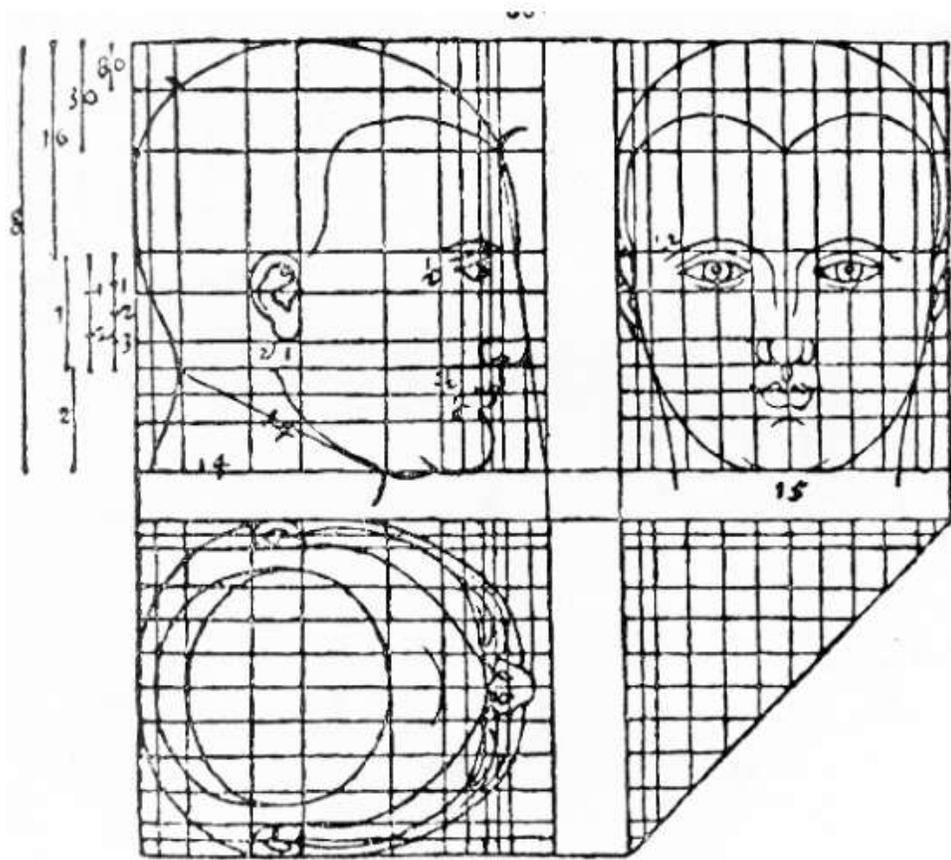
From the abacus  
to Arabic  
numerals



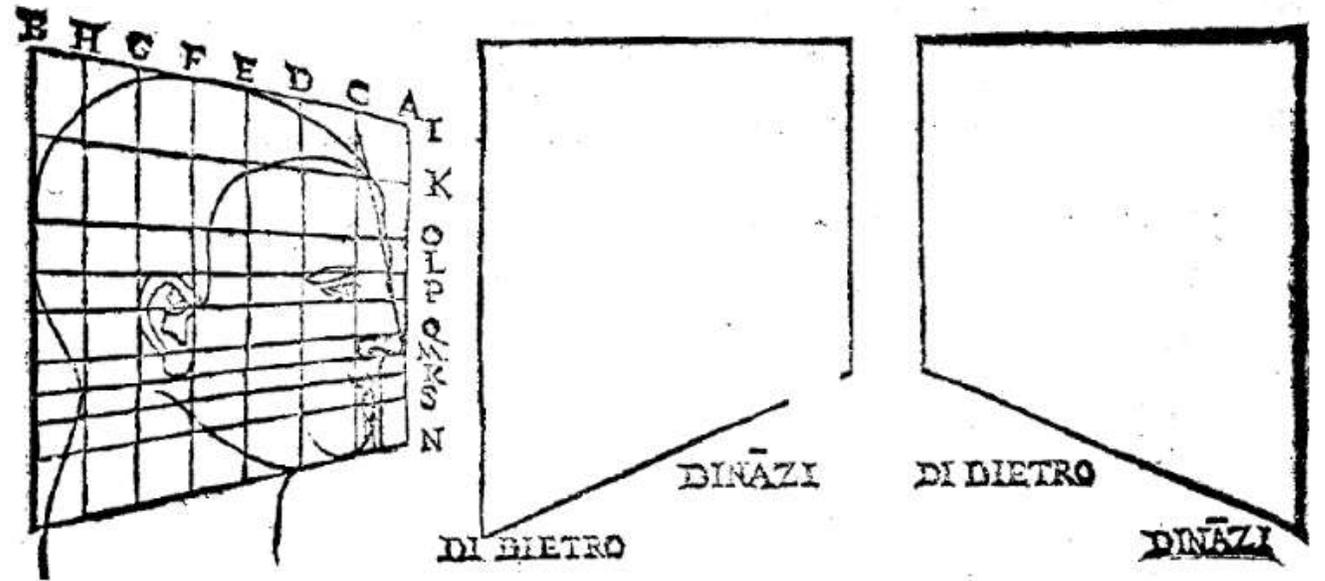
The Annunciation,  
Carlo Crivelli  
(1435, 1495)



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



## DELLA SIMMETRIA



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

# Problematic quantification

Blurring lines:

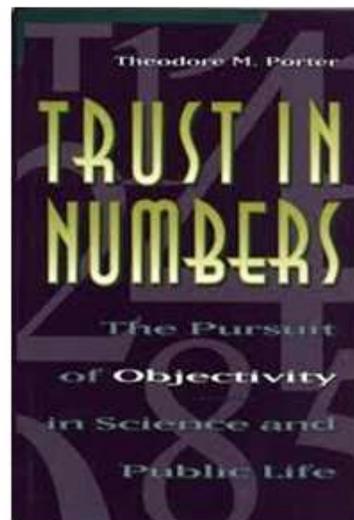
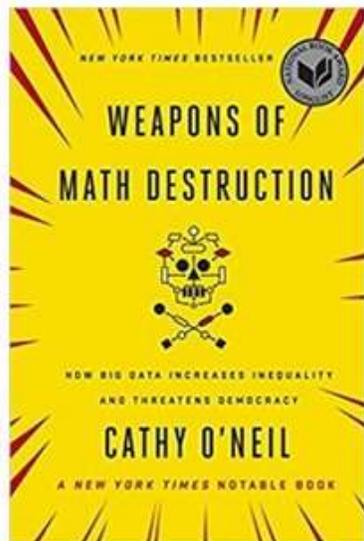
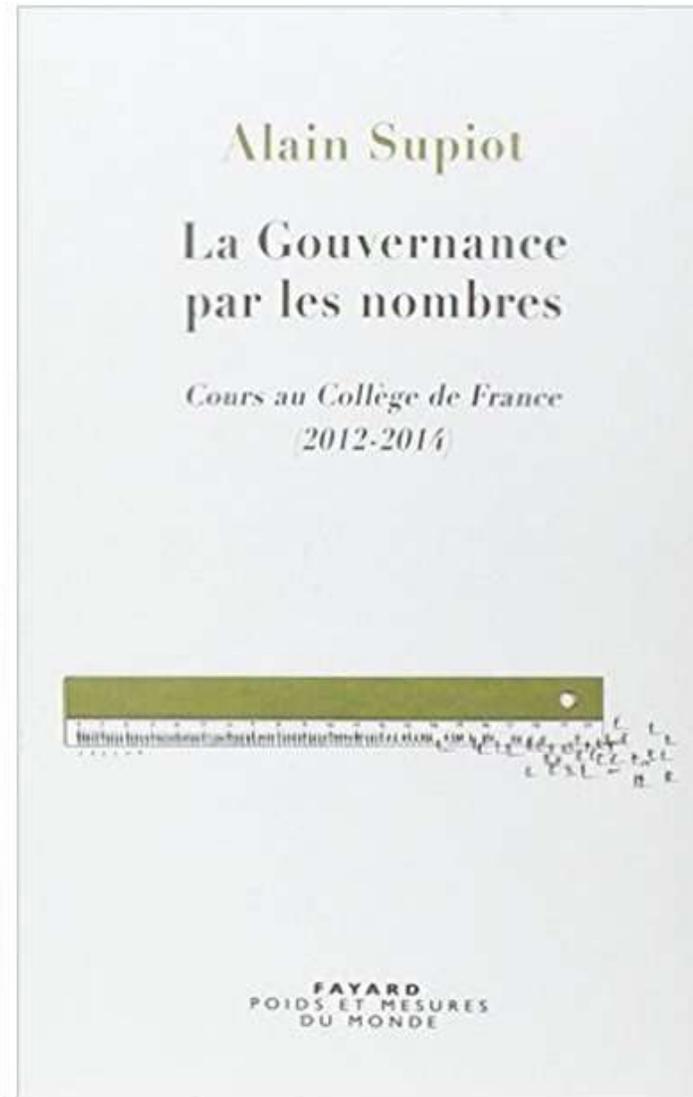
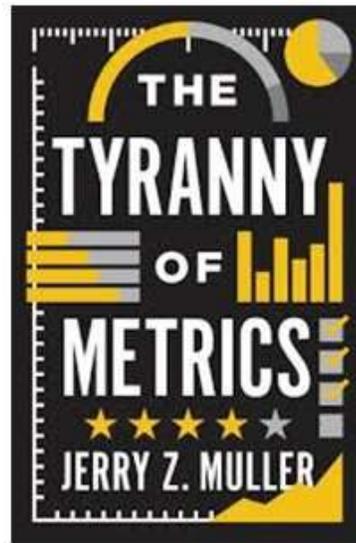
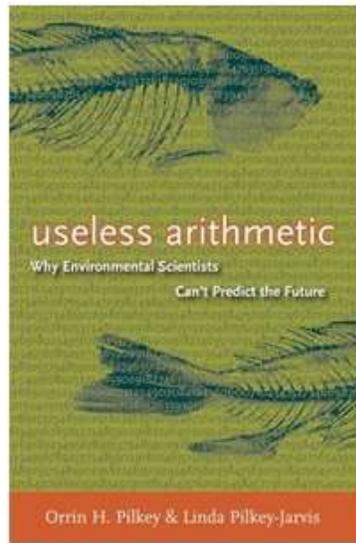
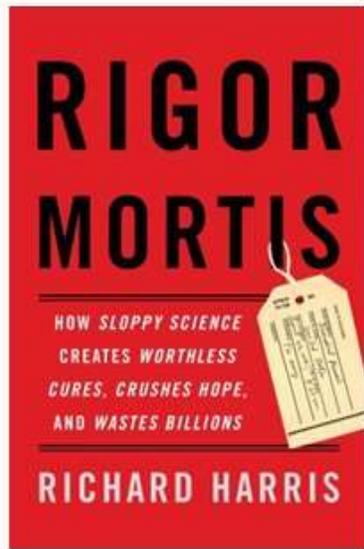
“what qualities are specific to rankings, or indicators, or models, or algorithms?”



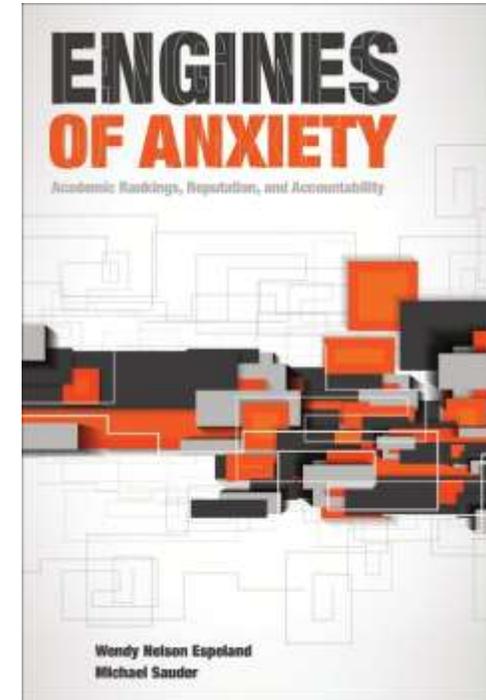
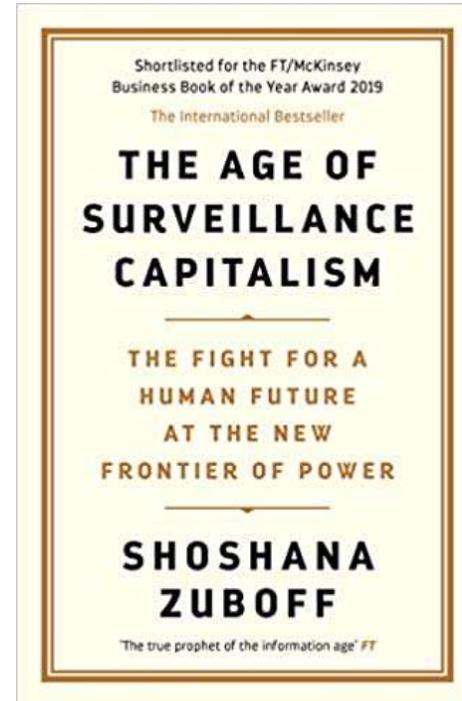
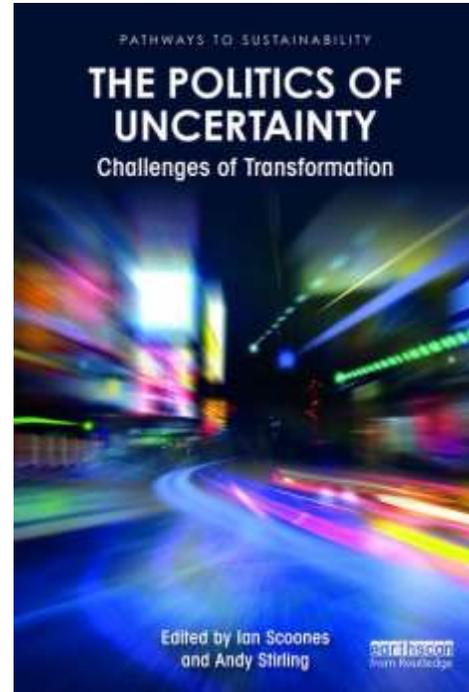
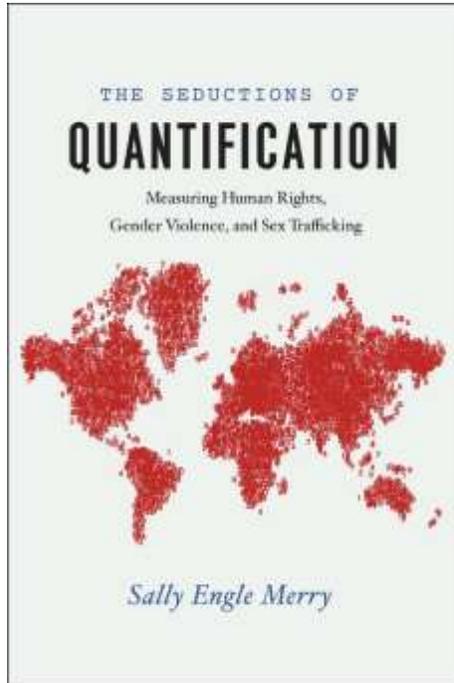
Elizabeth  
Popp Berman

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

# Algorithms, models, metrics, statistics...



# Algorithms, models, metrics, statistics...



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

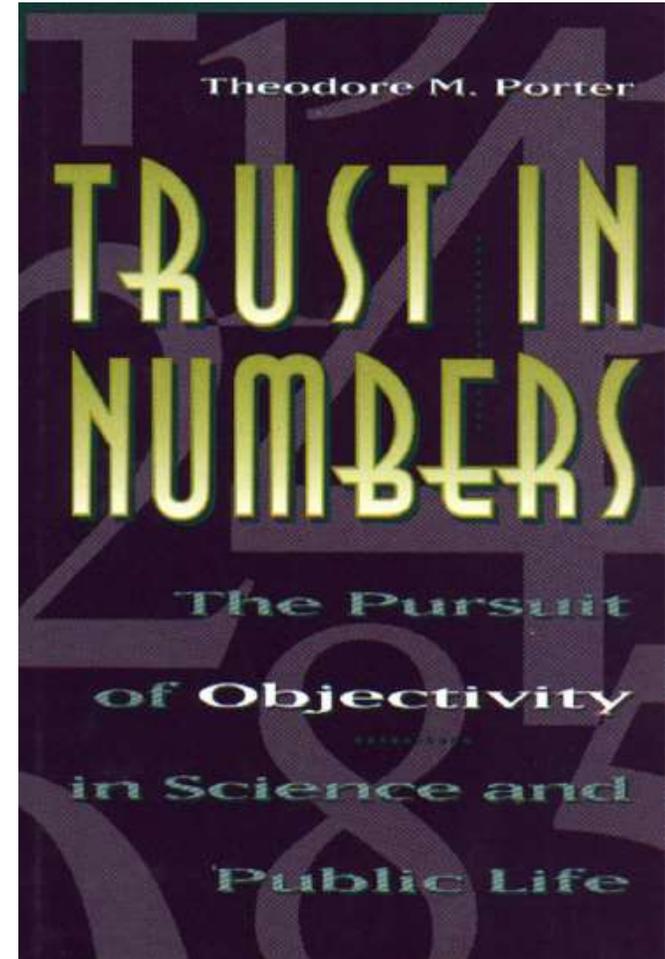
Incumbent numbers affect what society will  
measure in the future (Merry 2016)

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

# Numbers and trust

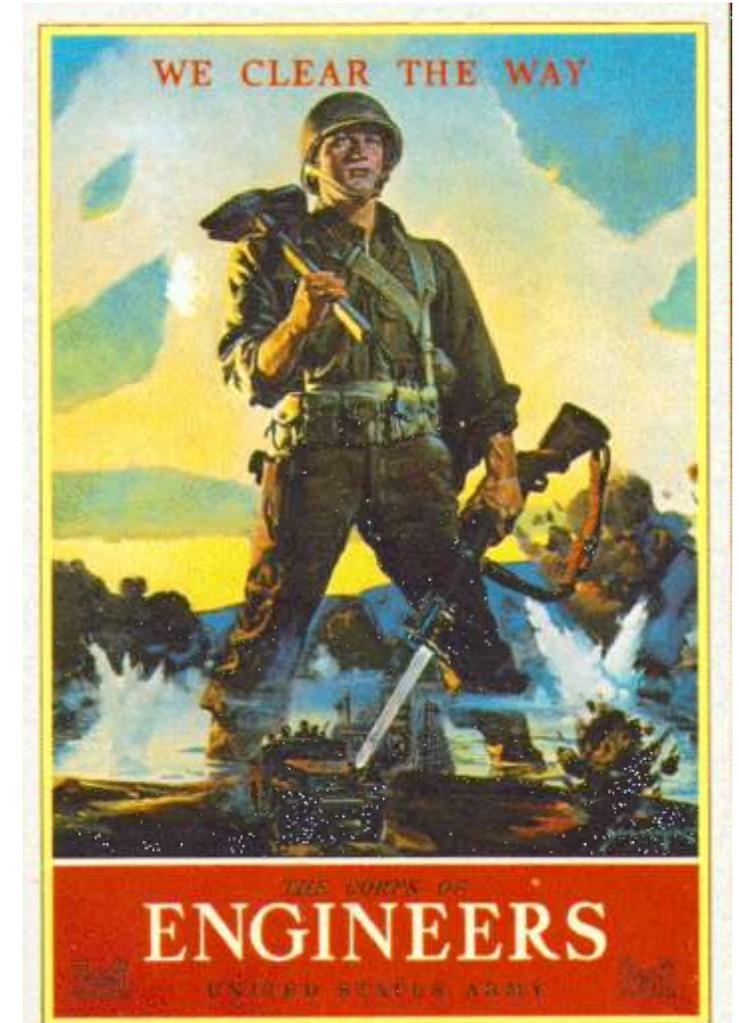


Theodor  
M. Porter



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'.





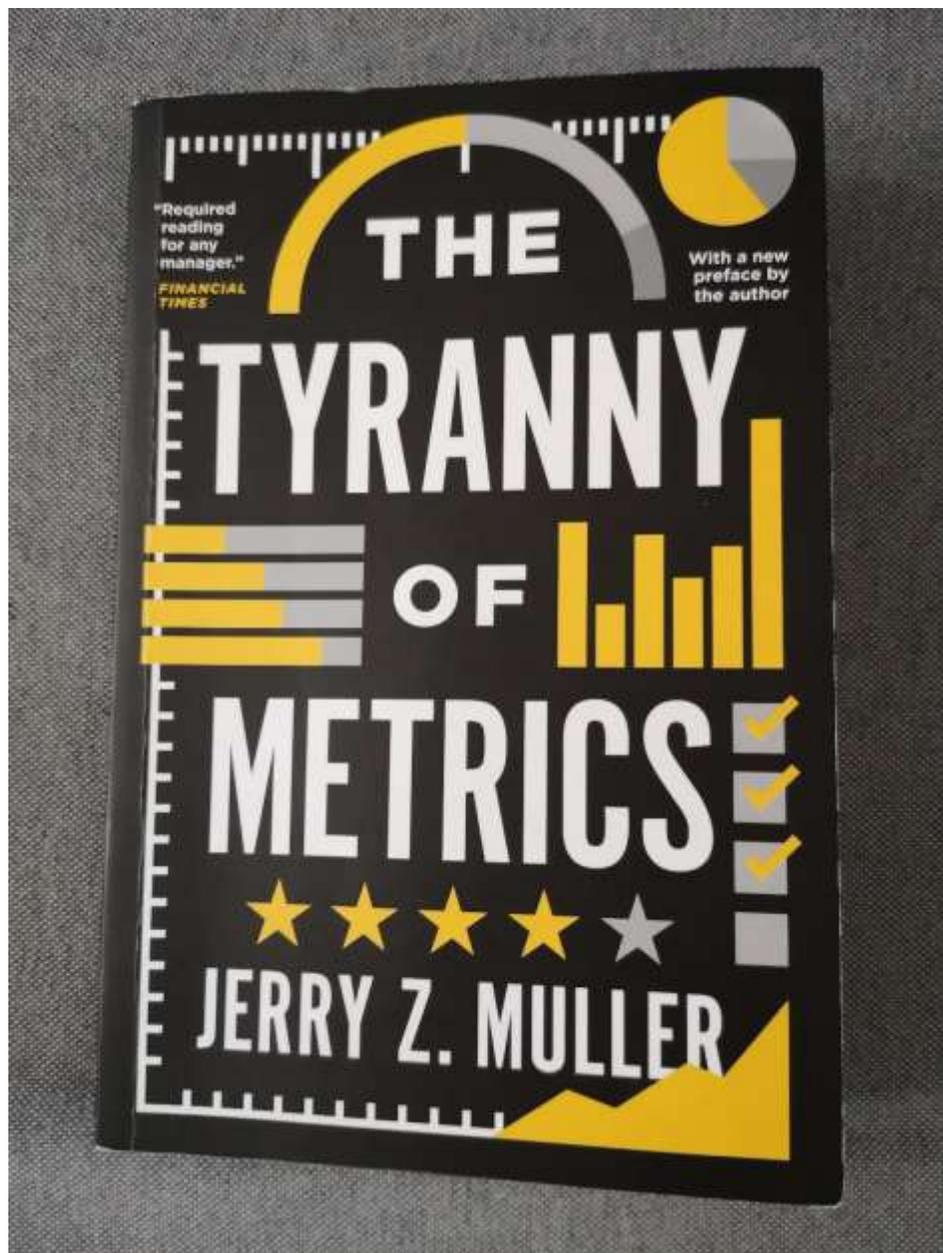
Charles Goodhart

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

This is what we normally call Goodhart’s law, from Charles Goodhart. “When a measure becomes a target, it ceases to be a good measure.”

Also known as Campbell's law (1976);

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

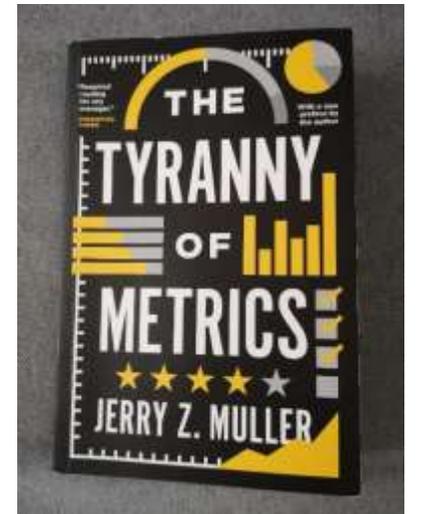


J. Z. Muller, *The tyranny of metrics*. Princeton University Press , 2018.

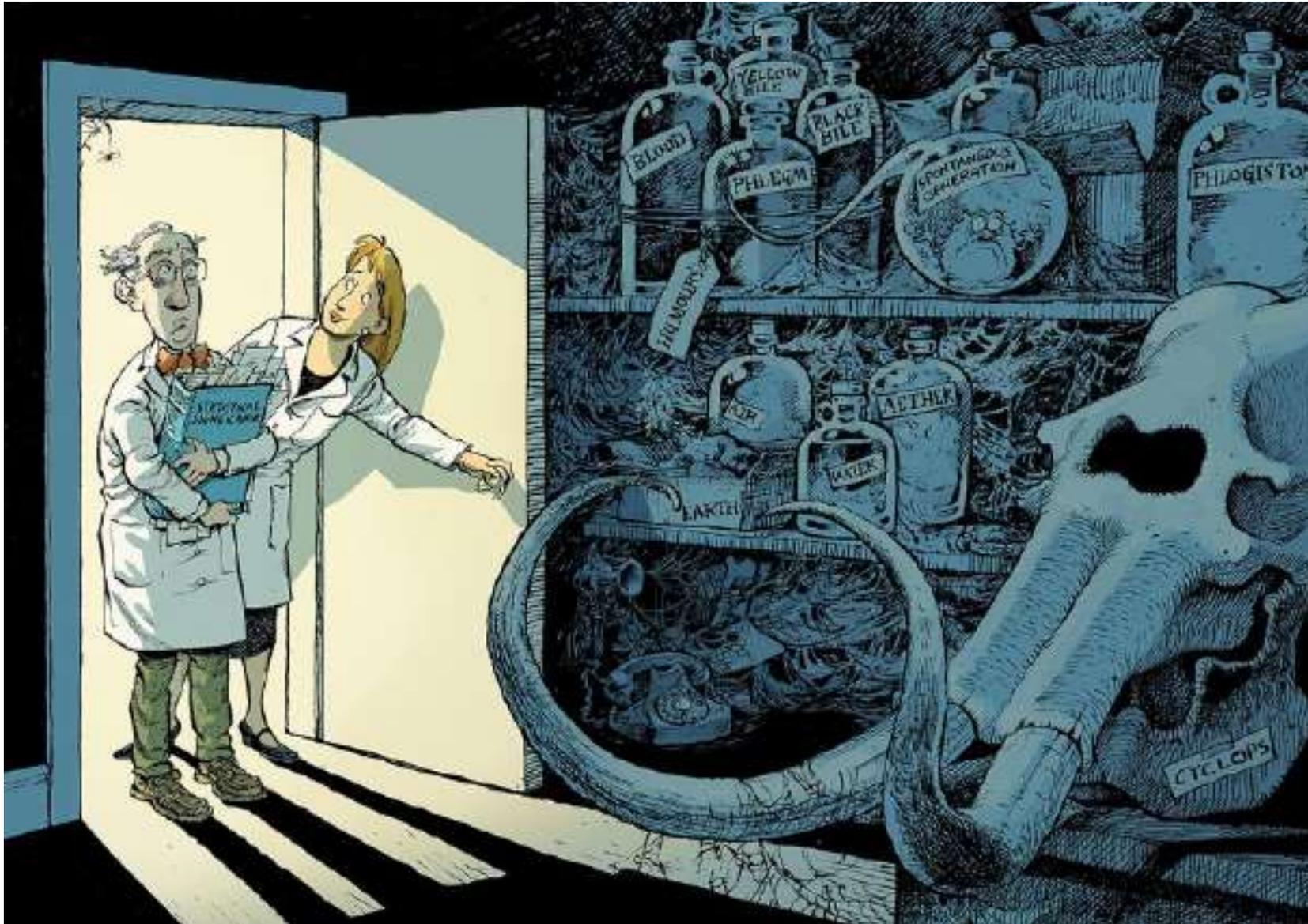
Metric fixation, or the irresistible pressure to measure performance

Gaming of metrics (recall Goodhart law)

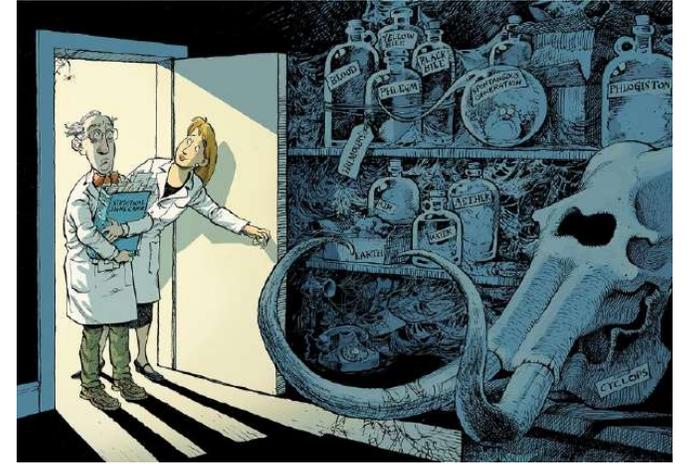
A wealth of case studies from education to war to medicine to foreign aid..



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.*

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Valentin Amrhein , Sander Greenland & Blake McShane

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

Duhem's problem - one-sided vs two-sided - p-values  
H0 - null hypothesis - significance tests as confirmation bias  
H1 - alternative hypothesis - shift  
H2 - hypothesis - null vs alt  
H3 - hypothesis - null vs alt  
H4 - hypothesis - null vs alt  
H5 - hypothesis - null vs alt  
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H100 - hypothesis - null vs alt

**STATISTICAL  
INFERENCE**

**OS**

**SEVERE  
TESTING**

How to Get Beyond  
the Statistics Wars

**DEBORAH G. MAYO**



## 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.

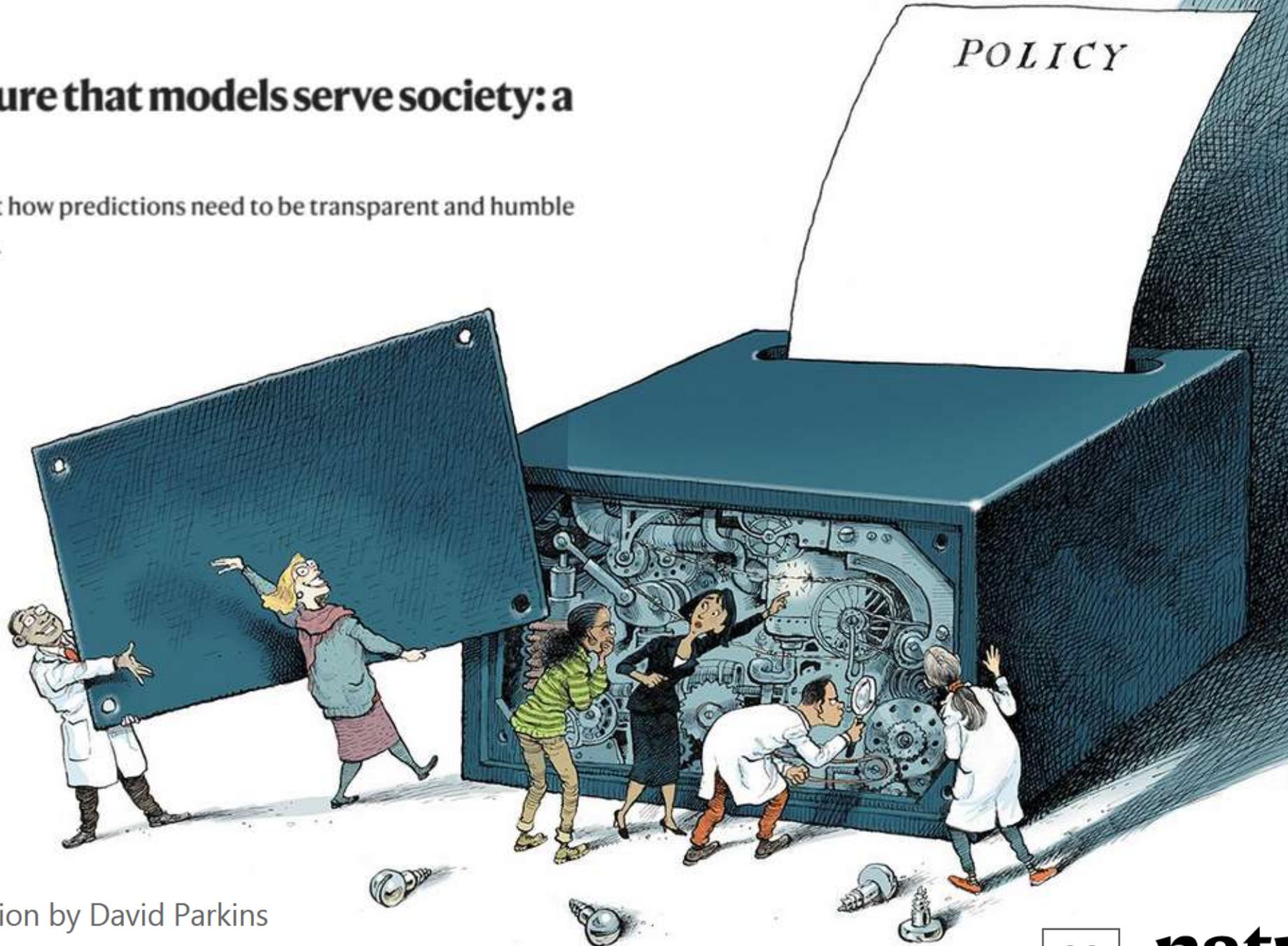


Illustration by David Parkins



# Mind the assumptions

Assess uncertainty and sensitivity

# Mind the hubris

Complexity can be the enemy of relevance

# Mind the framing

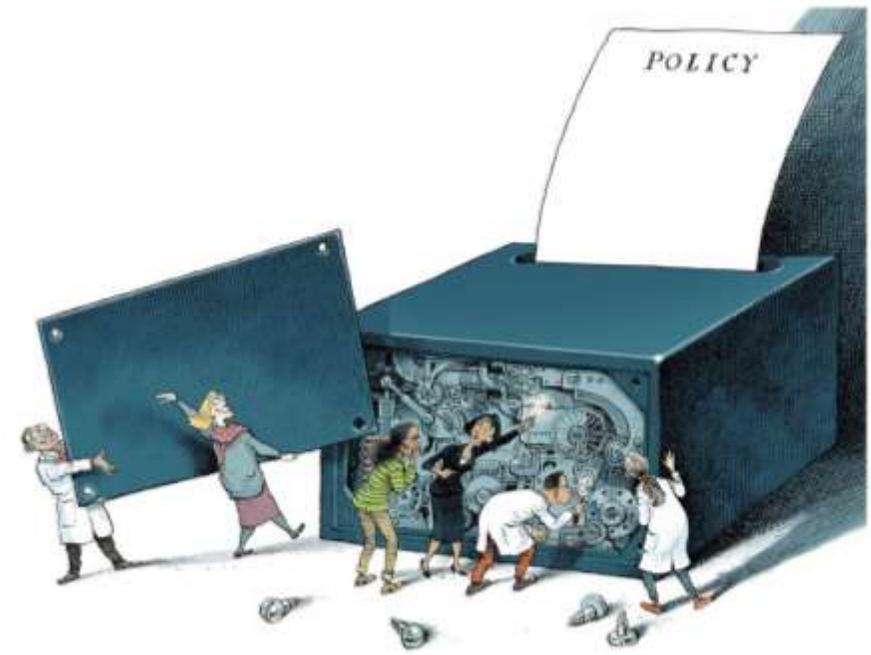
Match purpose and context

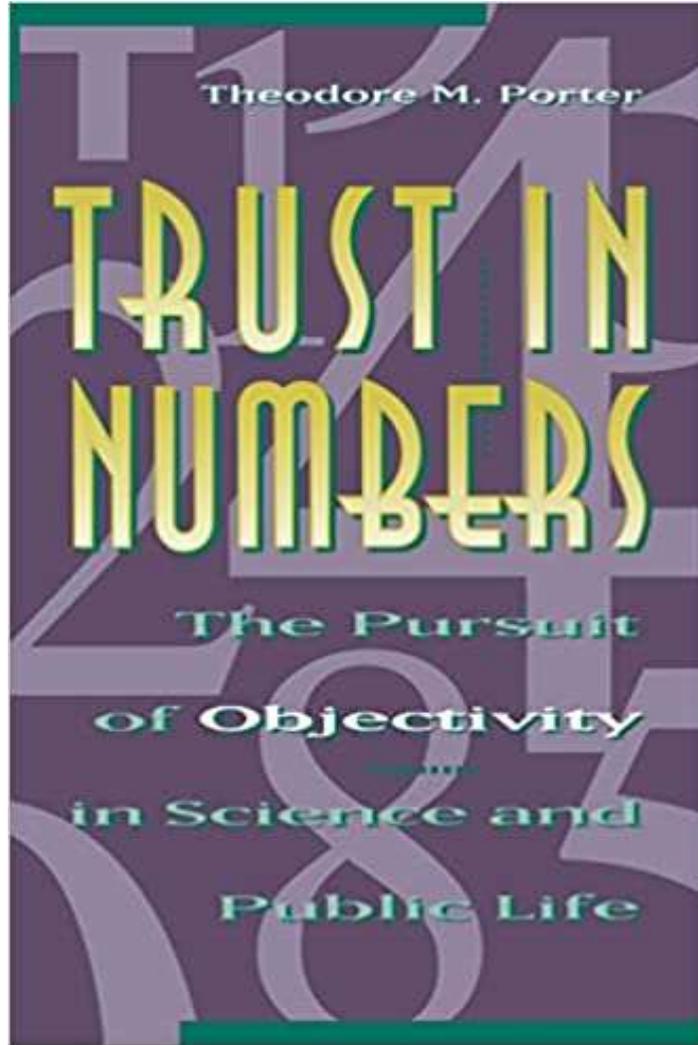
# Mind the consequences

Quantification can backfire.

# Mind the unknowns

Acknowledge ignorance





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



Theodor Porter

# Mind the assumptions

Assess uncertainty and sensitivity

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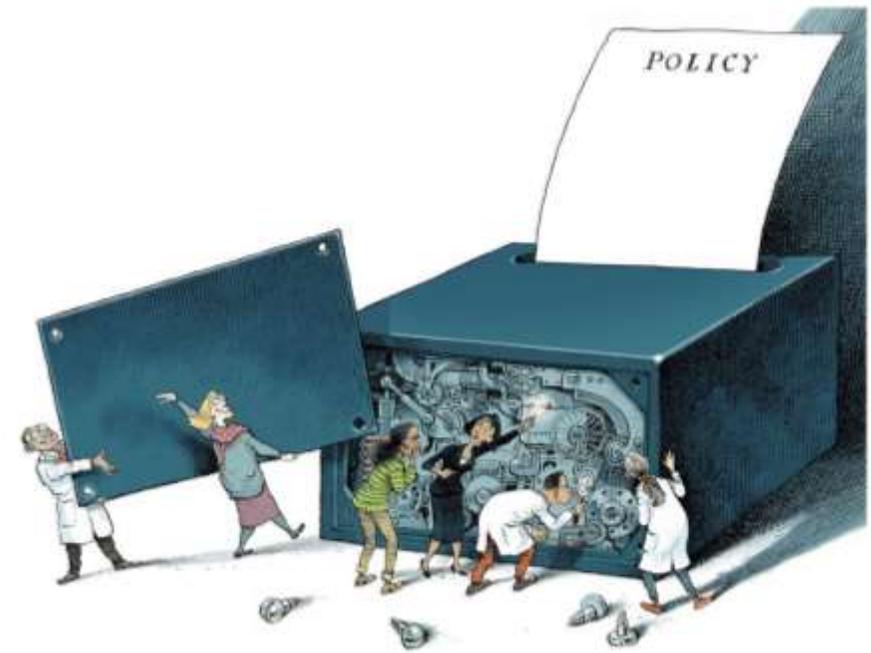
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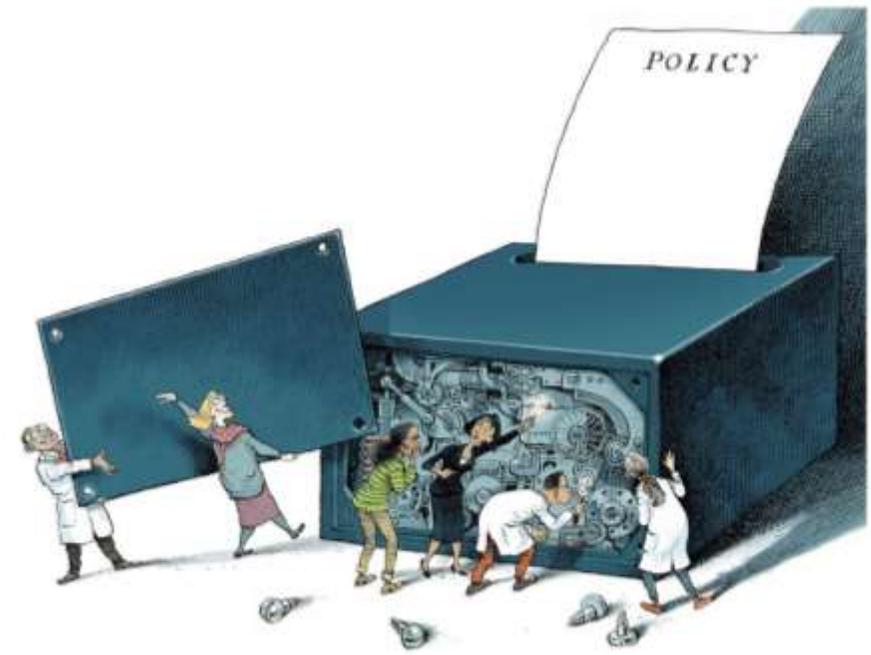
# Mind the unknowns

Acknowledge ignorance



# Mind the framing

Match purpose and context



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

## SUPPLEMENTARY INFORMATION

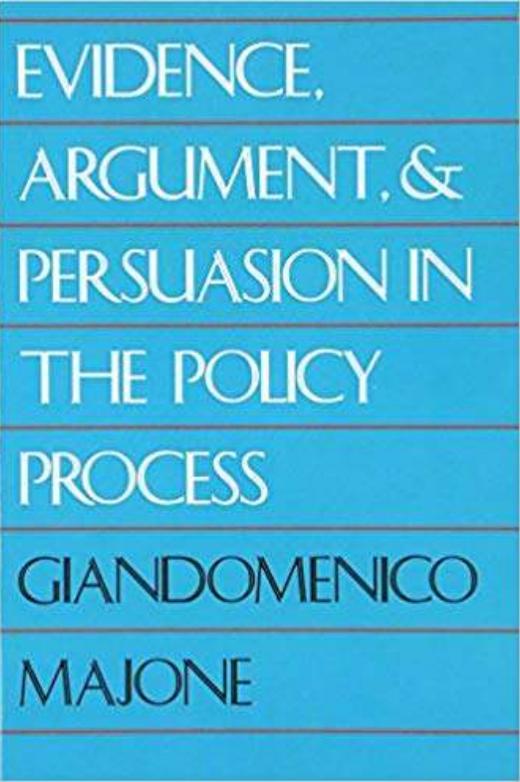
### 1. Additional information and references

>260 references

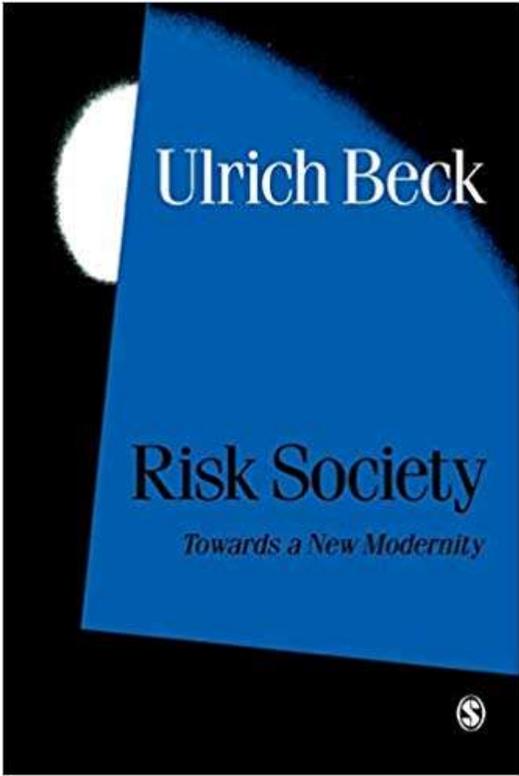
# From Ulrich Beck to Giandomenico Majone: the technique is never neutral



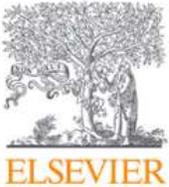
Ulrich Beck  
(1944 –2015)



1989



1992 (1986)



Environmental Science & Policy

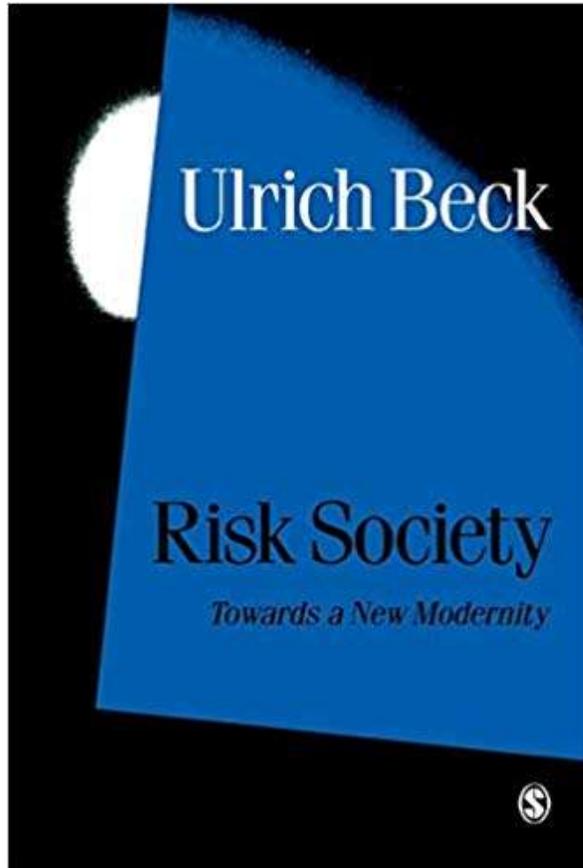
Volume 106, April 2020, Pages 87-98



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

Andrea Saltelli <sup>a, b</sup> ✉, Lorenzo Benini <sup>c</sup>, Silvio Funtowicz <sup>a</sup>, Mario Giampietro <sup>d, e</sup>, Matthias Kaiser <sup>a</sup>, Erik Reinert <sup>a, f</sup>, Jeroen P. van der Sluijs <sup>a, g, h</sup>

“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)

# Mind the assumptions

Assess uncertainty and sensitivity

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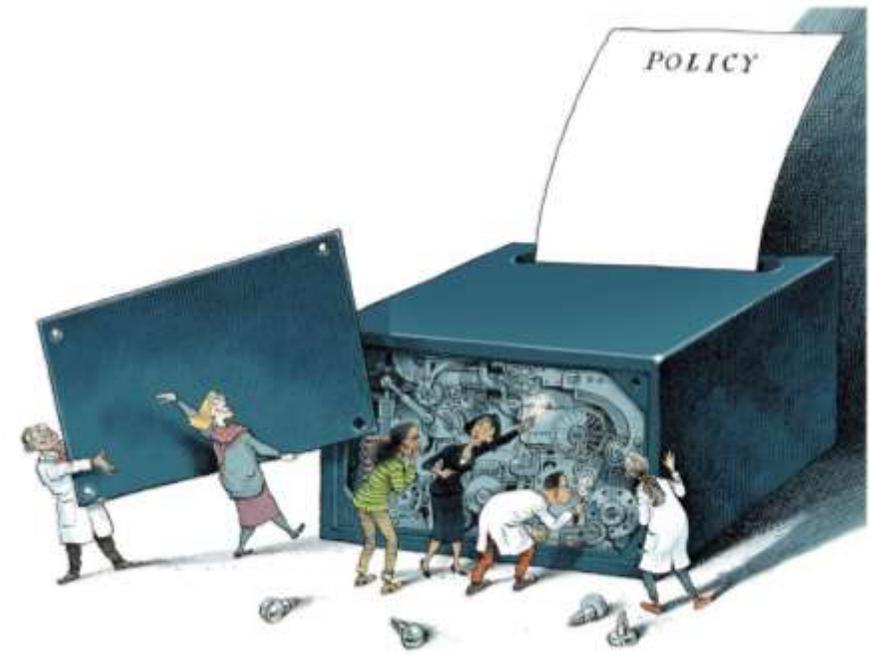


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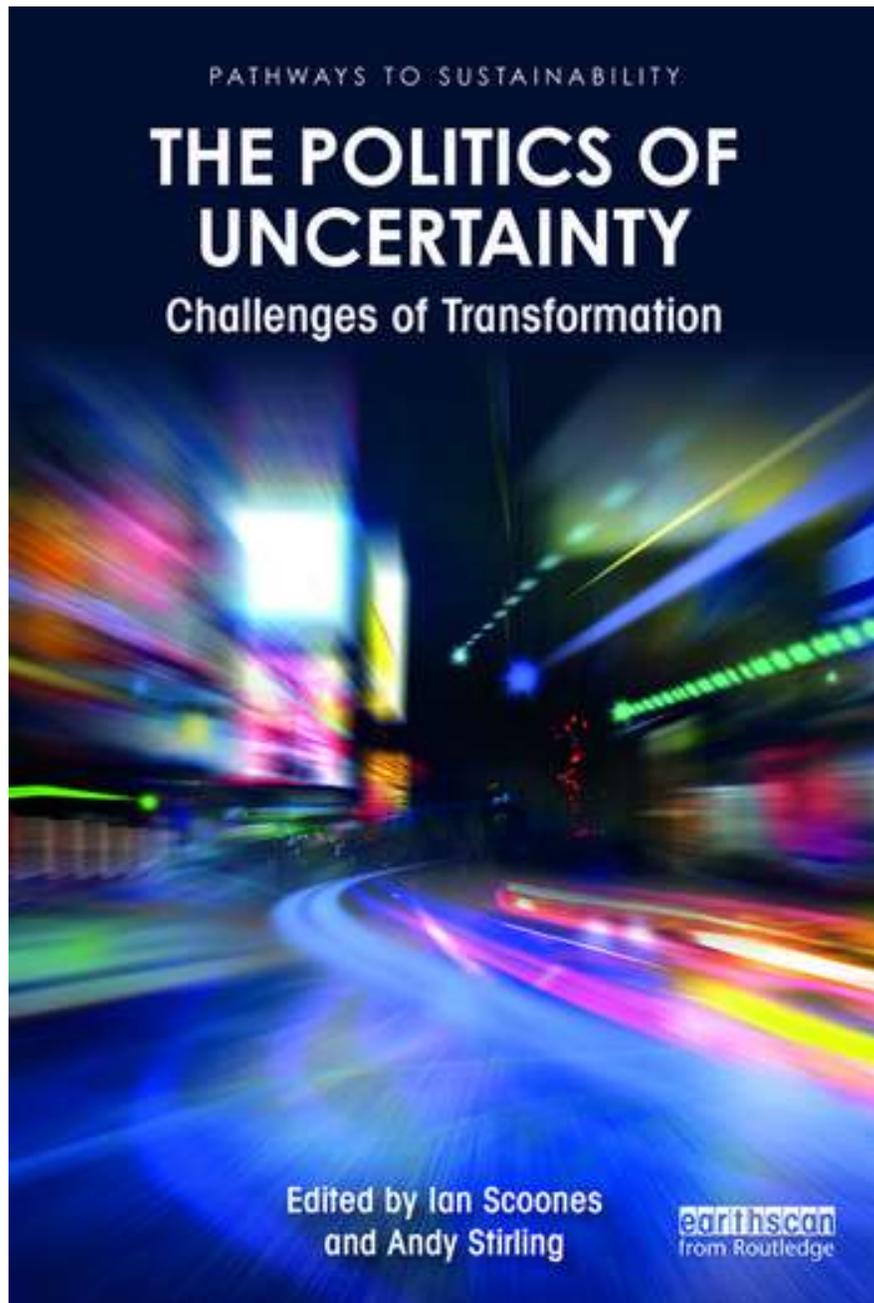


From the risk of financial products to the management of coastal zones to the models for disaster insurance bad modelling may lead to wrong decisions

## SUPPLEMENTARY INFORMATION

### 1. Additional information and references

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# 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>

Beyond models

**Why ethics of quantification  
is needed now**

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**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

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**Wolfgang Drechsler**

Tallinn University of Technology, Estonia;  
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**Jayati Ghosh**

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States;  
UCL Institute for Innovation and Public Purpose

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**Rainer Kattel**

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**Ingrid H. Kvangraven**

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**Andy Stirling**

Science Policy Research Unit, University of  
Sussex

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**Ting Xu**

School of Law at the University of Essex

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**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

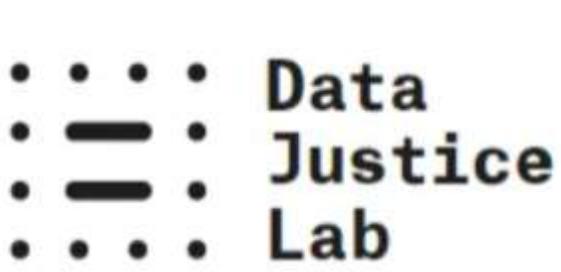
Governing the modern state, or even contesting it, without numbers is impossible

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

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.

# Existing initiatives looking at quantification



## Radical Statistics Group

Using statistics to support progressive social change



**THE ALGORITHMIC JUSTICE LEAGUE**

# Reading material

Di Fiore, Monica, Marta Kuc Czarnecka, Samuele Lo Piano, Arnald Puy, and Andrea Saltelli. 2022. “The Challenge of Quantification: An Interdisciplinary Reading.” *Minerva* 61 (December): 53–70. <https://doi.org/10.1007/s11024-022-09481-w>.

Mennicken, Andrea, and Wendy Nelson Espeland. 2019. “What’s New with Numbers? Sociological Approaches to the Study of Quantification.” *Annual Review of Sociology* 45 (1): 223–45. <https://doi.org/10.1146/annurev-soc-073117-041343>.

Mennicken, Andrea, and Robert Salais. 2022. “The New Politics of Numbers: An Introduction.” In *The New Politics of Numbers. Utopia, Evidence and Democracy*, Andrea Mennicken and Robert Salais, 1–44. Palgrave Macmillan.

Porter, Theodore M. 1995. *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life*. Princeton University Press. <https://books.google.es/books?id=oKOQpgVfINOC>.

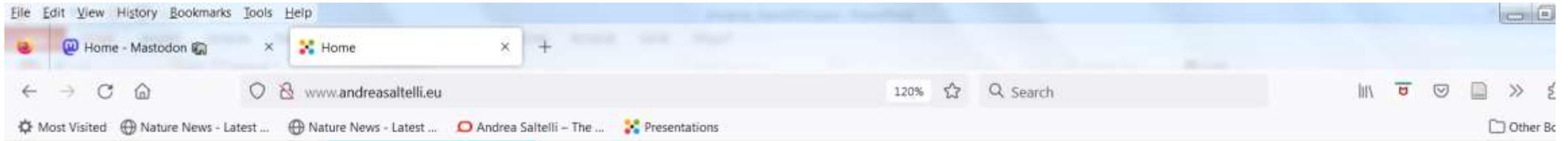
Porter, Theodore M. 2012. “Funny Numbers.” *Culture Unbound* 4: 585–98.

Saltelli, Andrea, A. Andreoni, Wolfgang Drechsler, J. Ghosh, Rainer Kattel, I. H. Kvangraven, Ismael Rafols, Erik S. Reinert, A. Stirling, and T. Xu. 2021. “Why Ethics of Quantification Is Needed Now. UCL Institute for Innovation and Public Purpose.” WP 2021/05. London: UCL Institute for Innovation and Public Purpose.

Saltelli, Andrea, and Monica Di Fiore, eds. 2023. *The Politics of Modelling. Numbers between Science and Policy*. Oxford: Oxford University Press.

Saltelli, Andrea, and Arnald Puy. 2023. “What Can Mathematical Modelling Contribute to a Sociology of Quantification?” *Humanities and Social Sciences Communications* 10 (213). <https://doi.org/10.2139/ssrn.4212453>.

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## Coming Out Soon: The politics of modelling



### Praise for the volume

*"A long awaited examination of the role —and obligation —of modeling."*

**Nassim Nicholas Taleb**, Distinguished Professor of Risk Engineering, NYU Tandon School of Engineering. Author, of the 5 -volume series *Incerto*.

\*\*\*

*"A breath of fresh air and a much needed*

### Mastodon Toots by

@AndreaSaltelli



AndreaSaltelli

2023/4/18 17:24

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