

Ethics of quantification or quantification of ethics?

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

Annual symposium of the Centre for the Study of the Sciences and the Humanities (SVT): Ethics of quantification, Bergen, December 6, 2019.



Where to find this talk: www.andreasaltelli.eu

Andrea
Saltelli

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CAETERIS ARE
NEVER PARIBUS

Tweets by @AndreaSaltelli



andrea saltelli
@AndreaSaltelli

Replying to @AndreaSaltelli @merionwest
... and these are 6 m worth watching from Slavoj
Žižek [youtube.com/watch?v=TVwKjG...](https://www.youtube.com/watch?v=TVwKjG...)

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Jul 26, 2019



andrea saltelli
@AndreaSaltelli

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Crisis of science



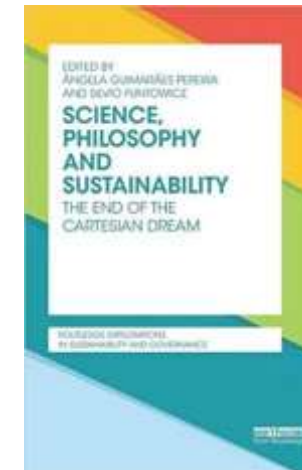
Reflexes on the
use of science to
inform human
affairs



Reflexes on our
understanding of
technoscience



What role does
quantification play
in all that



Ethics of
quantification



Crisis of science



Futures

Volume 91, August 2017, Pages 5-11



What is science's crisis really about?

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

Reflexes on the use of science to inform human affairs



Futures

Volume 91, August 2017, Pages 62-71



Futures

Volume 104, December 2018, Pages 85-90



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}

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

Andrea, Saltelli 

Reflexes on our understanding of technoscience

ANDREA SALTELLI

Save science from itself

COMMENT • 21 MAY 2019



Views from a continent in flux

Carlos Moedas, Isabelle Vernos[✉], Stephan Kuster[✉], Helga Nowotny[✉], Andrea Saltelli[✉], Alina Mungiu-Pippidi[✉],
Jan Wouter Vasbinder[✉], Daniel R. Brooks & Patrick Cunningham[✉]

Journal Pre-proof

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

PII: S0016-3287(19)30353-2

DOI: <https://doi.org/10.1016/j.futures.2019.102491>

Reference: JFTR 102491



What role does quantification play in all that



Environmental Modelling & Software

Volume 114, April 2019, Pages 29-39



Why so many published sensitivity analyses are false: A systematic review of sensitivity analysis practices

Andrea Saltelli ^{a, b} ✉, Ksenia Aleksankina ^c, William Becker ^d, Pamela Fennell ^e, Federico Ferretti ^d, Niels Holst ^f, Sushan Li ^g, Qiongli Wu ^h



nature
COMMUNICATIONS

Comment

Open Access

Published: 27 August 2019

A short comment on statistical versus mathematical modelling

Andrea Saltelli ✉



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

Posted on November 22, 2018 by Mervi



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

SIGNIFICANCE

Business

Culture

Politics



IN PRACTICE

Cargo-cult statistics
and scientific crisis

Ethics of quantification

Ethics of quantification
or quantification of
ethics?

Andrea Saltelli, 2020?



#1

Crisis in science?
Surely you must be
joking



Futures

Volume 91, August 2017, Pages 5-11



What is science's crisis really about?

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



Futures

Volume 104, December 2018, Pages 85-90



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

Andrea, Saltelli 



Silvio Funtowicz

Failed replications, entire subfields going bad,
fraudulent peer reviews, predatory publishers,
perverse metrics, statistics on trial ...




Brow

 OPEN ACCESS

ESSAY

June 21, 2017

Why Most Clinical Research Is Not Useful

John P. A. Ioannidis 

Published: June 21, 2016 • <https://doi.org/10.1371/journal.pmed.1002049>

THE
ECONOMIC
JOURNAL



The Economic Journal, 127 (October), F236–F265. Doi: 10.1111/eoj.12461 © 2017 Royal Economic Society. Published by John Wiley & Sons, 9600 Garsington Road, Oxford OX4 2DQ, UK and 350 Main Street, Malden, MA 02148, USA.

THE POWER OF BIAS IN ECONOMICS RESEARCH*

John P. A. Ioannidis, T. D. Stanley and Hristos Doucouliagos

October 27, 2017

… misleading science advice, institutions on denial, a new breed of science wars

Opinion: Is science really facing a reproducibility crisis, and do we need it to?

Daniele Fanelli

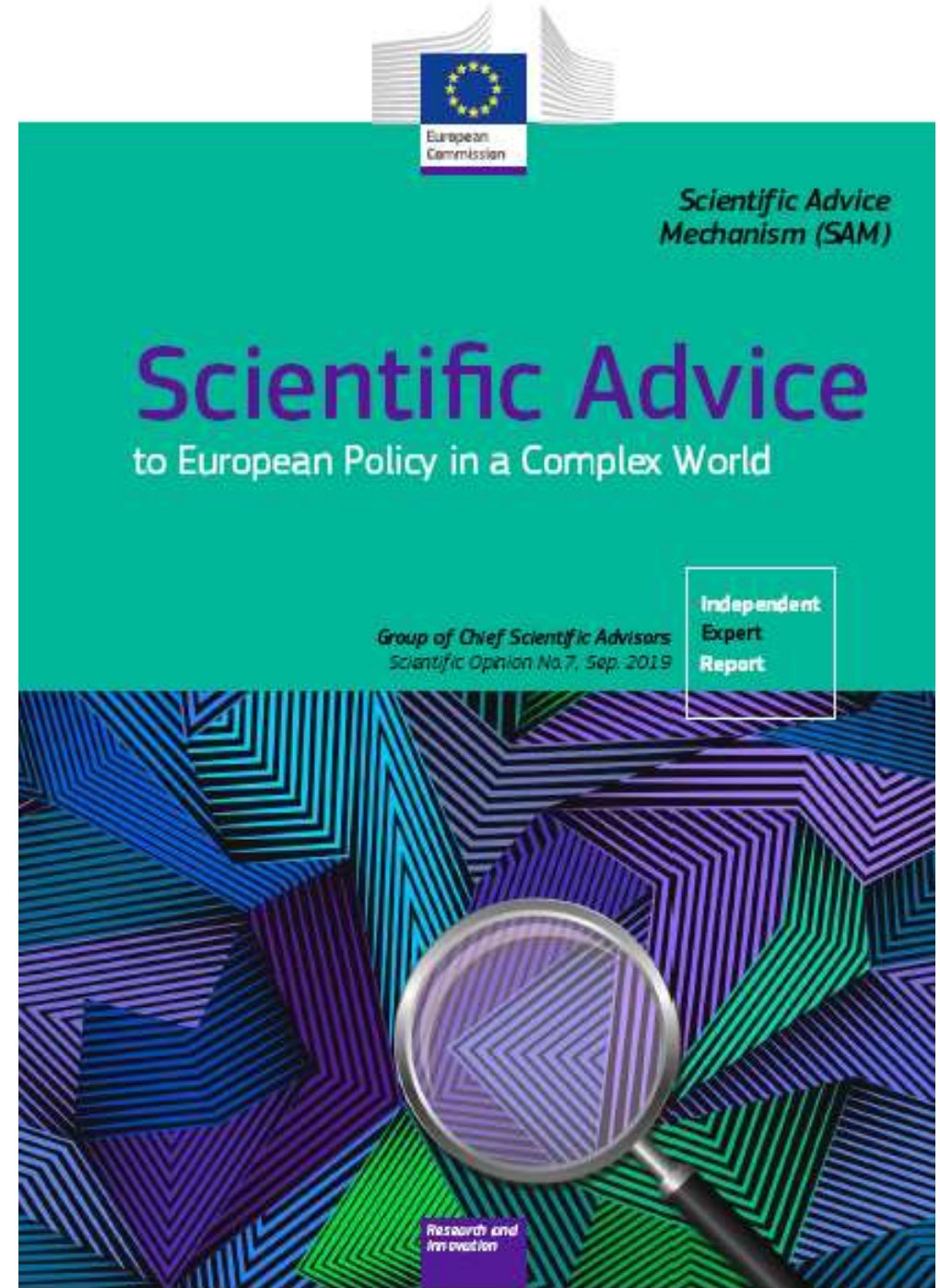
PNAS March 12, 2018. 201708272; published ahead of print March 12, 2018. <https://doi.org/10.1073/pnas.1708272114>



“The new “science is in crisis” narrative is not only empirically unsupported, but also quite obviously counterproductive”



Lost in translation



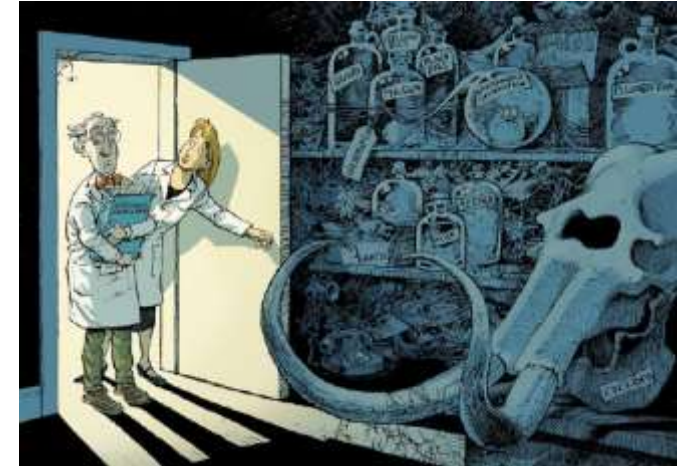
The crisis is methodological,
epistemological, ethical and
metaphysical

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



nature

International journal of science

Statistical wars?

See the discussion on the
blogs of Deborah Mayo

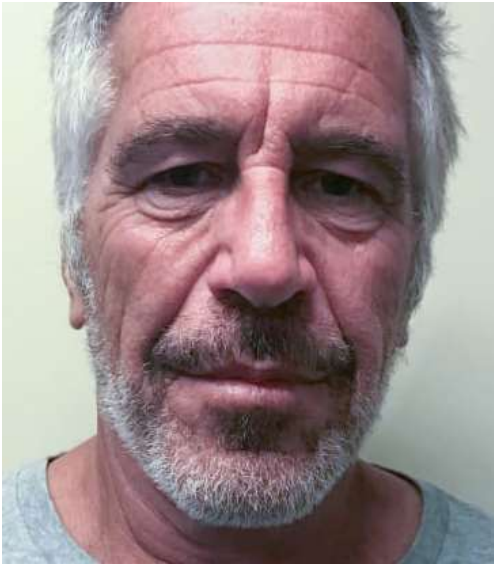
<https://errorstatistics.com/>

and

Andrew Gelman

<https://statmodeling.stat.columbia.edu/>





Jeffrey Epstein
& paedophilia



Sackler family
& opioids



Koch brothers
& climate

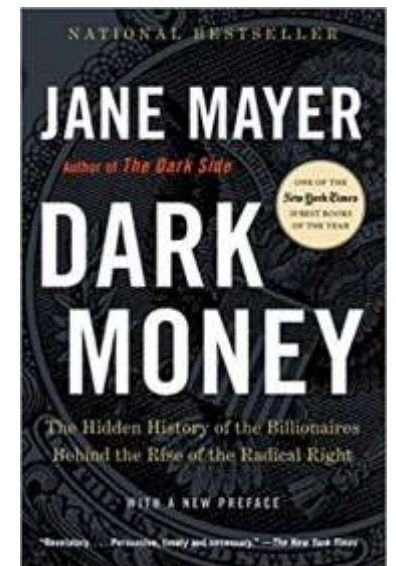
How Rich Donors Like Epstein (and Others) Undermine Science

ADAM ROGERS

SCIENCE

09.15.2019 07:00 AM

WIRED



Powerful drivers, the crisis will be worse before it can be better

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

ROYAL SOCIETY
OPEN SCIENCE

rsos.royalsocietypublishing.org

Research



Cite this article: Smaldino PE, McElreath R.

2016 The natural selection of bad science.

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

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

Received: 1 June 2016

Accepted: 17 August 2016

The natural selection of bad science

Paul E. Smaldino¹ and Richard McElreath²

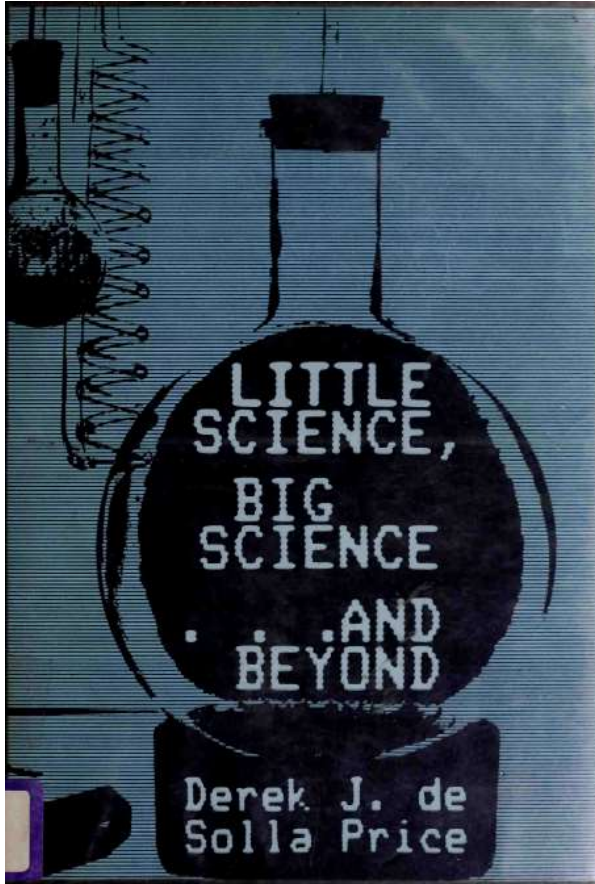
¹Cognitive and Information Sciences, University of California, Merced, CA 95343, USA

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

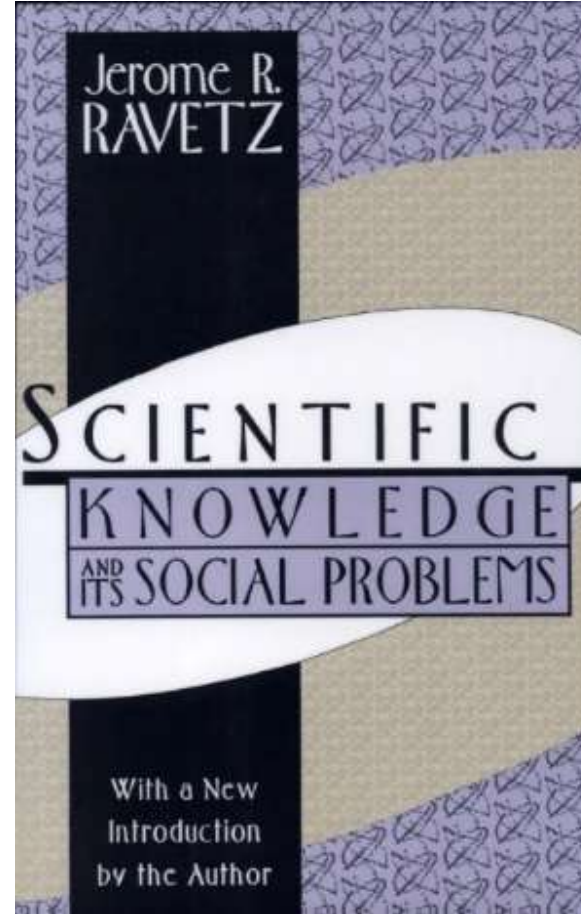
 PES, 0000-0002-7133-5620; RME, 0000-0002-0387-5377

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

The crisis was predicted



Derek J. de
Solla Price



Jerome R.
Ravetz

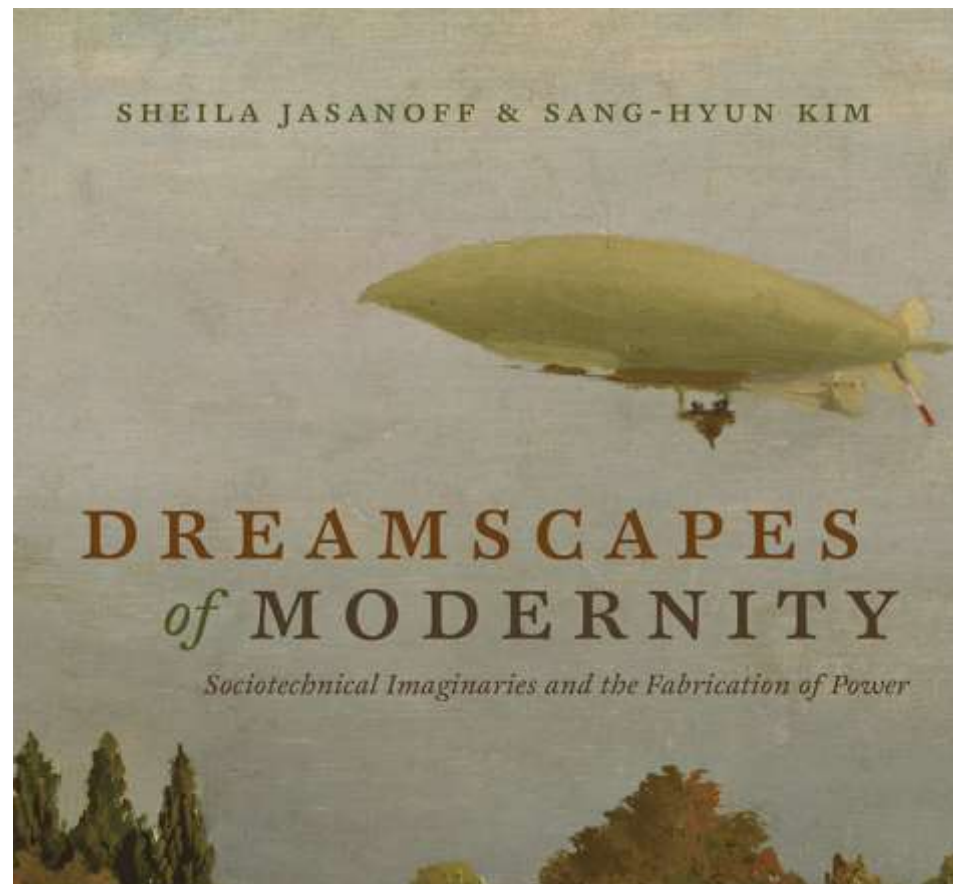
de Solla Price, D.J., 1963, Little science big science, Columbia University Press;
Ravetz, J., 1971, Scientific Knowledge and its Social Problems, Oxford University Press.

#2

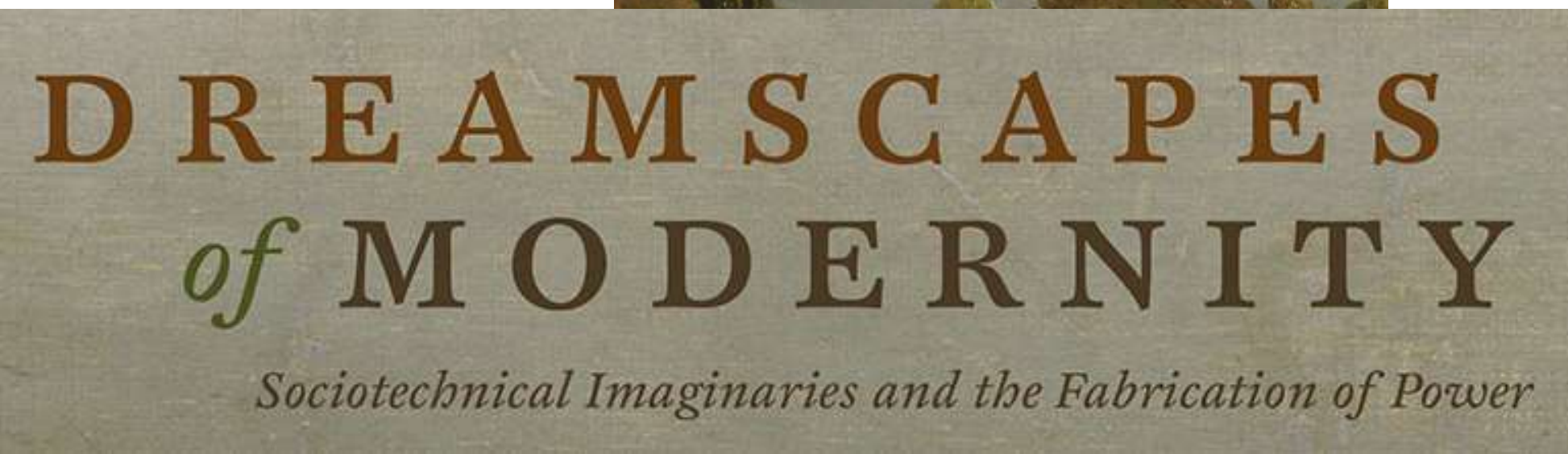
Reflexes on the use
of science in policy

Evidence-based policy:
received wisdom

Sociotechnical Imaginaries



Sheila Jasanoff

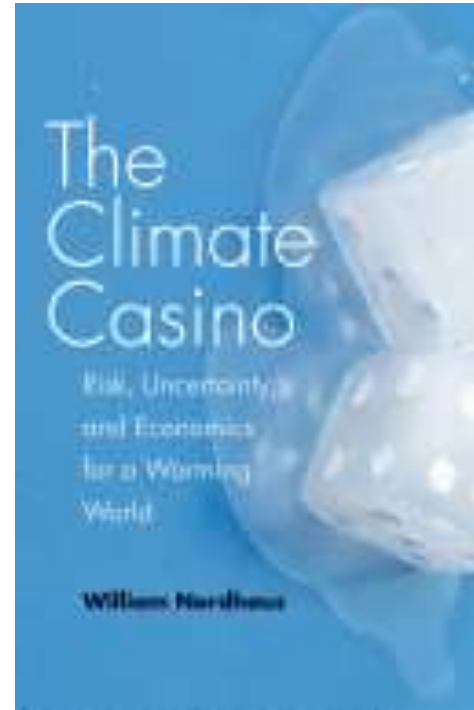


“Often, immersion in the facts makes value disagreements feel much less relevant” (Cass Sunstein, winner of the 2018 Holberg Prize)



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

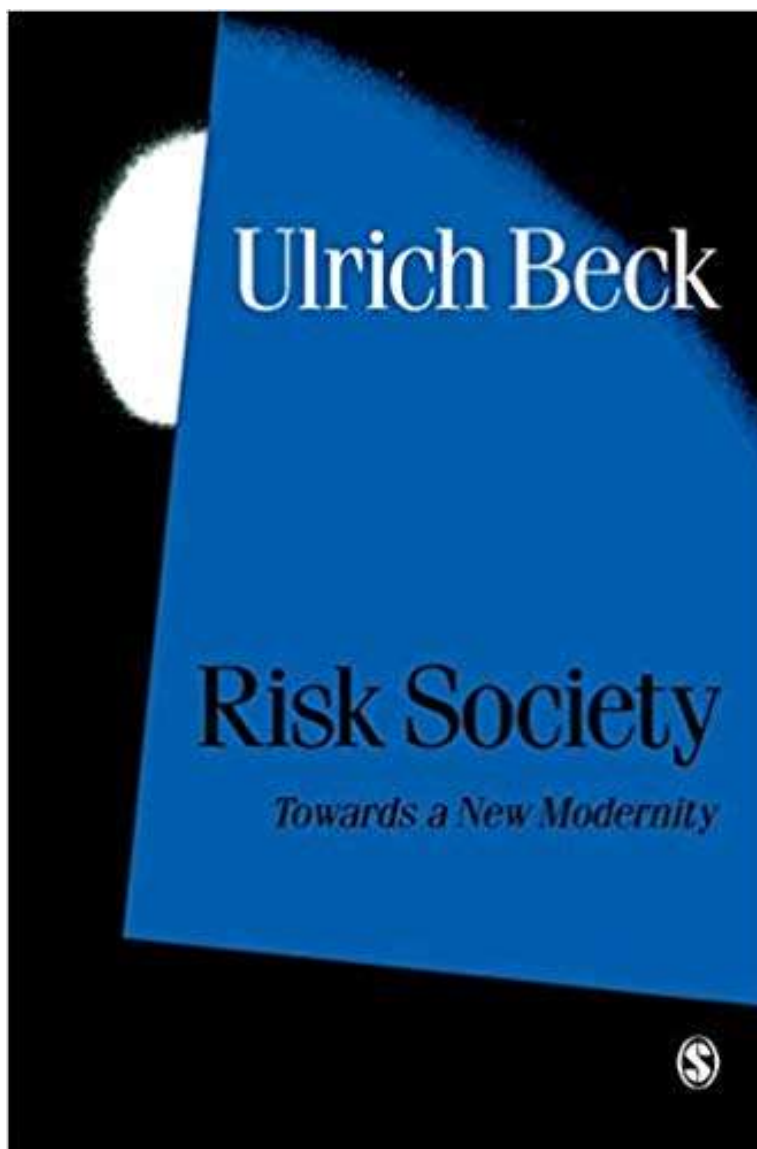
Cost benefit analysis to the year 2100



Critical voices



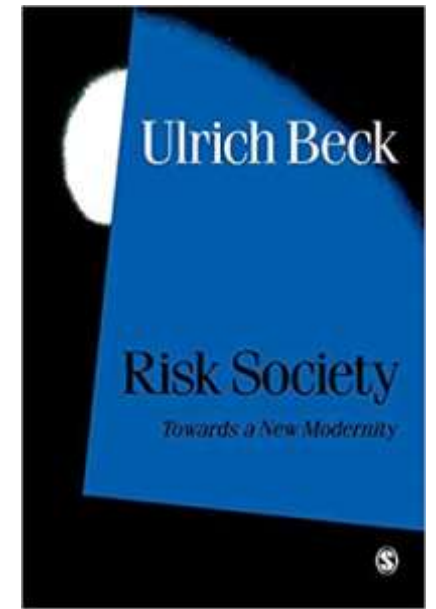
Ulrich Beck
(1944 –2015)



1992 (1986)

Chapter 7 Science beyond truth and enlightenment

- “The differentiation and complexification of the sciences transforms it into a “self service shops for financially well endowed customers in need of arguments.”
- “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.”
 - ➔ The technique is never neutral



EVIDENCE,
ARGUMENT, &
PERSUASION IN
THE POLICY
PROCESS
GIANDOMENICO
MAJONE

“The technique is never neutral”

<https://arxiv.org/ftp/arxiv/papers/1712/1712.06457.pdf>

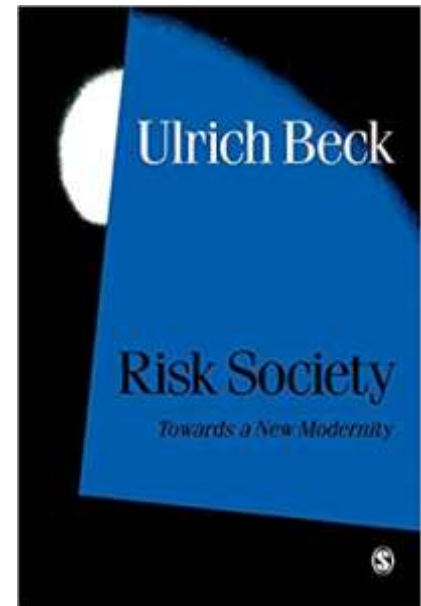
Majone: “In any area of public policy the choice of instruments, far from being a technical exercise that can be safely delegated to the experts, reflects as in a microcosm all the political, moral, and cultural dimensions of policy-making”

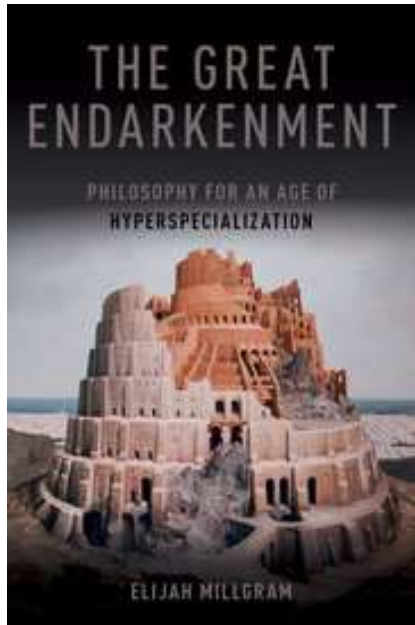
Chapter 7 Science beyond truth and enlightenment

- Feudalization of cognitive practices

“In developed civilizations, scientific cognitive practice becomes an *implicit, objectivized manipulation of latently political variables, hidden behind the pretence of elective decision not subject to justification.*”

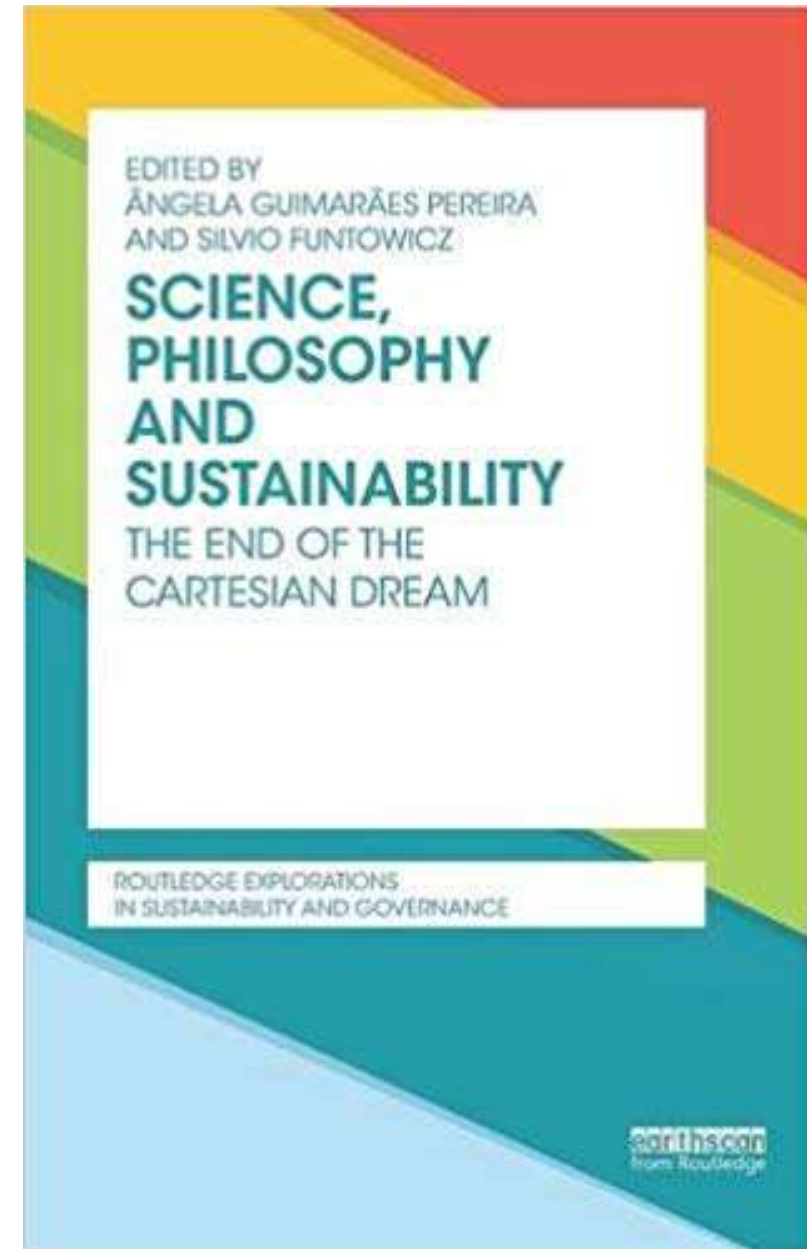
➔ On transforming a political problem into a technical one





Elijah Millgram: warns against “procedural utopia”, a machinery to take the right decision based on a set of logical rules and methods.

A Cartesian dream?



<<[...] rhetoric clamour [surrounds]
'expected utility', 'decision theory',
'life cycle assessment', 'ecosystem
services' 'sound scientific decisions'
and 'evidence-based policy'



Andrew Stirling

Each technique routinely delivers its
answers with formidable levels of
precision. Yet the resulting impression
of accuracy is deeply misplaced >>

<https://steps-centre.org/blog/how-politics-closes-down-uncertainty/>



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}

Highlights

- The closure of any issue in a pre-established frame used for quantification may correspond to normative and political stances.
- The use of mathematical modelling and indicators conveys a spurious impression of precision, prediction and control.
- Better styles of evidence based policy should flag the existence of 'uncomfortable knowledge' usually avoided in policy discussions.

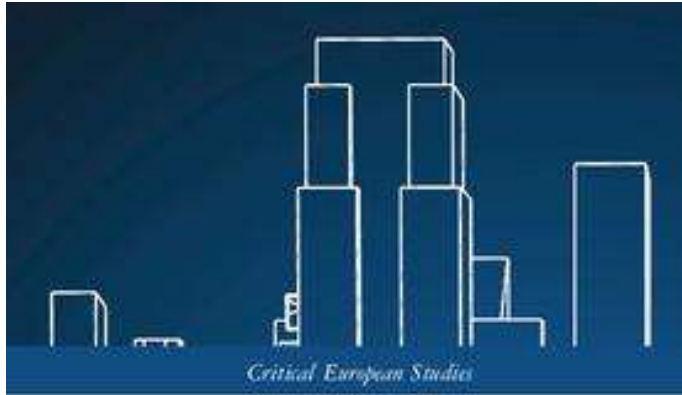
“Uncomfortable knowledge” can be used as a gauge of an institution’s health (Silvio Funtowicz and Jerome R. Ravetz, EMERGENT COMPLEX SYSTEMS, Futures 1994 26(6) 568–582)



Science and lobbying

Power asymmetries in the framing of issues:
those who have the deepest pockets marshal
the best evidence → Instrumental use of
quantification to obfuscate

Sylvain Laurens

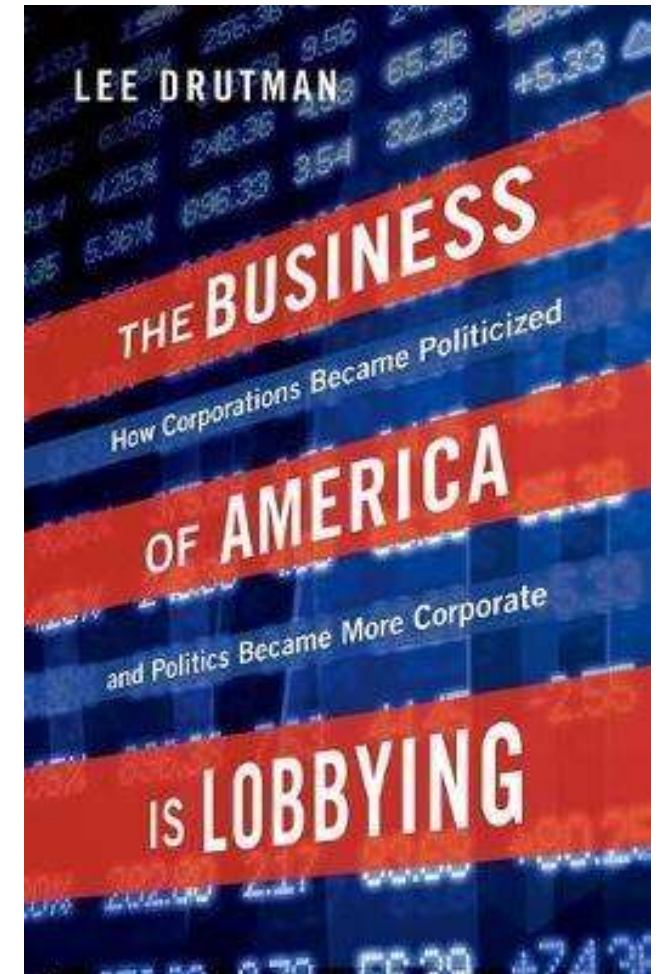


LOBBYISTS AND BUREAUCRATS IN BRUSSELS CAPITALISM'S BROKERS

Sylvain Laurens



Lee Drutman



For both scholars a salient aspect of this power is lobbyists' access to more and better disseminated knowledge/science:

“They have the data”



#3

Reflexes on science
and technoscience

Luhmann to interpret the present: new or old?

<https://doi.org/10.1016/j.futures.2019.102491>



Andrea Saltelli and Paul-Marie
Boulanger, Technoscience,
policy and the new
media. Nexus or vortex?,
Futures, 2020,



Paul-Marie Boulanger

Science is mediatized, commoditized and politicized; what happened?

- the structural coupling between different systems
- the capacity of these systems to ‘irritate’ and ‘resonate with’ one another,
- the capacity of one system to grow at the expenses of others



Niklas Luhmann

Moeller, H. G. Luhmann explained. Open Court Publishing Company, 2006.

Luhmann: Humans as compulsive communicators

Mumford: Human as compulsive adopters
of technology



Niklas Luhmann



Lewis Mumford



Could this be avoided?

Courtesy of Mario Giampietro



nature

ANDREA SALTELLI

Save science
from itself

COMMENT • 21 MAY 2019

Views from a continent in flux

Nature asked nine leading Europeans to pick their top priority for science at this pivotal point. Love, money, and trust got most votes.

Carlos Moedas, Isabelle Vernos , Stephan Kuster , Helga Nowotny , Andrea Saltelli , Alina Mungiu-Pippidi ,
Jan Wouter Vasbinder , Daniel R. Brooks & Patrick Cunningham 

ANDREA SALTELLI

**Save science
from itself**

All that matters operates
simultaneously in science,
technology, economics, law and
policy

Battles are fought where science,
ideology and special interests
collide

Social media imprint unprecedented
reach and acceleration

ANDREA SALTELLI
**Save science
from itself**

Science to inform policy decisions
versus science lending a veil of
rationality to the same decisions

Science as a source of emancipation
versus science as the currency of
lobbies

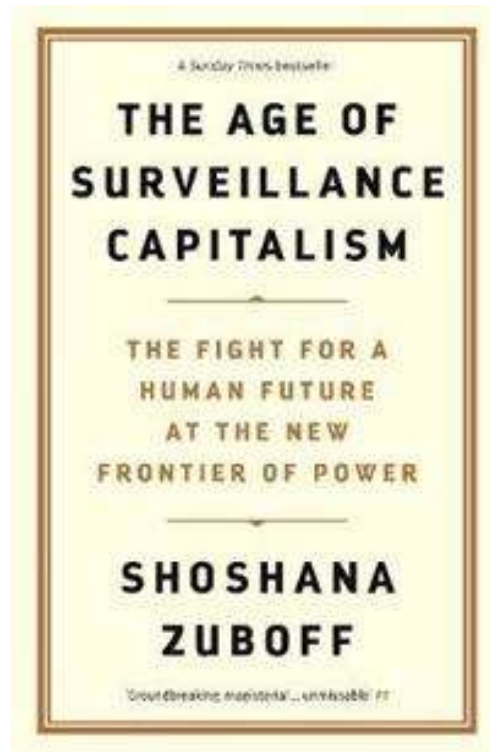
Prudent science and technology are at
odds with their use for corporate or
military interests.

ANDREA SALTELLI
**Save science
from itself**

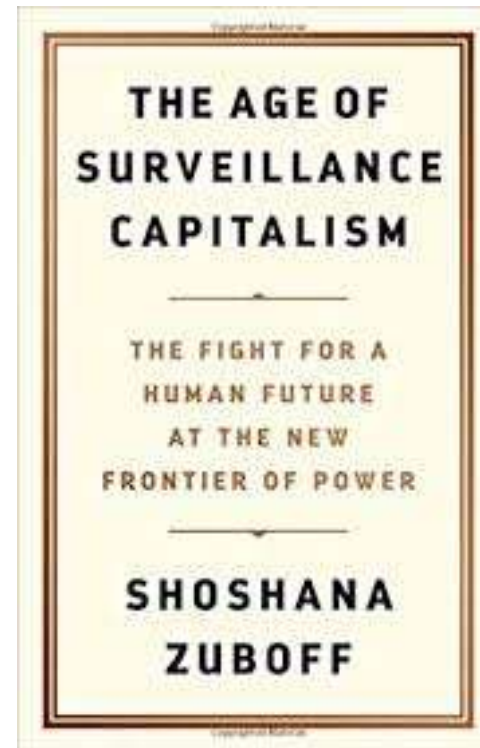
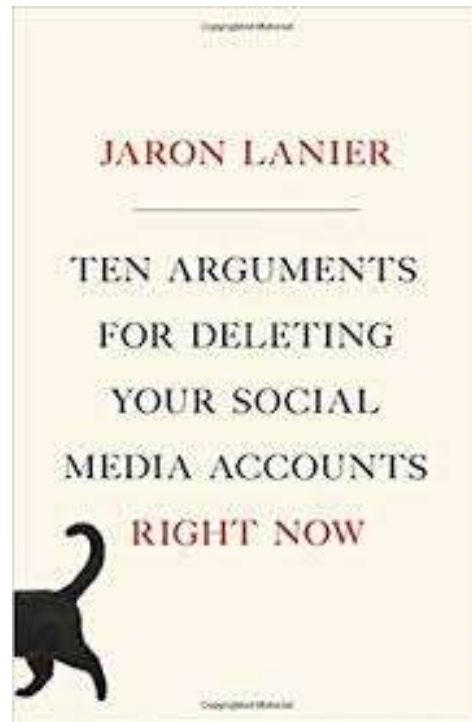
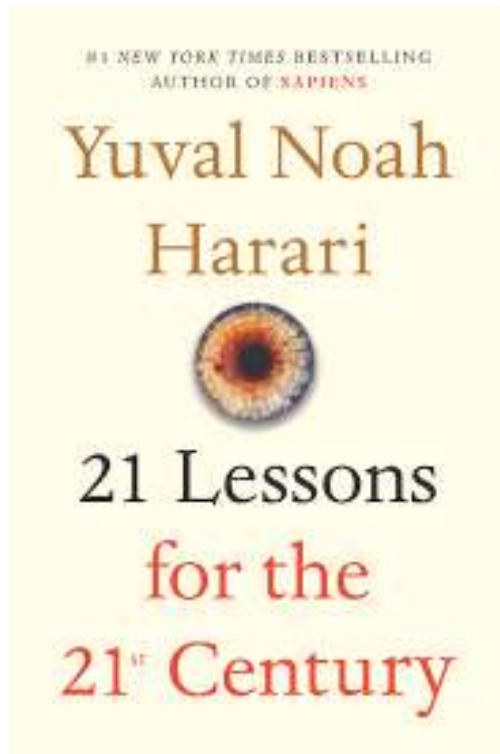
Artificial intelligence & big data foster inequality and power asymmetries in platform and surveillance capitalism



Shoshana Zuboff



Fake news and post truth are the result of an *apprenti sorcier* technoscience escaped to our control



...

The powerful agents of post-truth

Jaron Lanier



Poisonous algorithms to stoke hatred and division

Yuval Noah Harari, Homo Deus 2015 & 21 Lessons for the 21st Century, 2018.

Jaron Lanier, 2018 Ten Arguments for Deleting Your Social Media Accounts Right Now

<https://www.theguardian.com/society/2018/aug/23/russian-trolls-spread-vaccine-misinformation-on-twitter>

"Have you seen those zombies who roam the streets with their faces glued to their smartphones? Do you think they control the technology, or does the technology control them?"

Yuval Noah
Harari



Yuval Harari, 21 Lessons for the 21st Century, 2018, Jonathan Cape publisher; for autopoietic technology see also W. Brian Arthur, 2010, The Nature of Technology, Free Press.



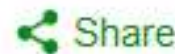
From deepfake to Cambridge Analytica, to algorithmic abuse the scope for damage has expanded

Deepfake videos 'double in nine months'



Rory Cellan-Jones
Technology correspondent
@BBCRoryCJ

🕒 7 October 2019



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NEWS

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Donald J. Trump 
@realDonaldTrump

Trump & the Russian intelligence excel at exploiting the new technologies for soft warfare

Twitter released 9 million tweets from one Russian troll farm. Here's what we learned.

The massive data dump reveals how trolls disrupt and destabilize local and global politics.

By Aja Romano | @ajaromano | Oct 19, 2018, 12:40pm EDT

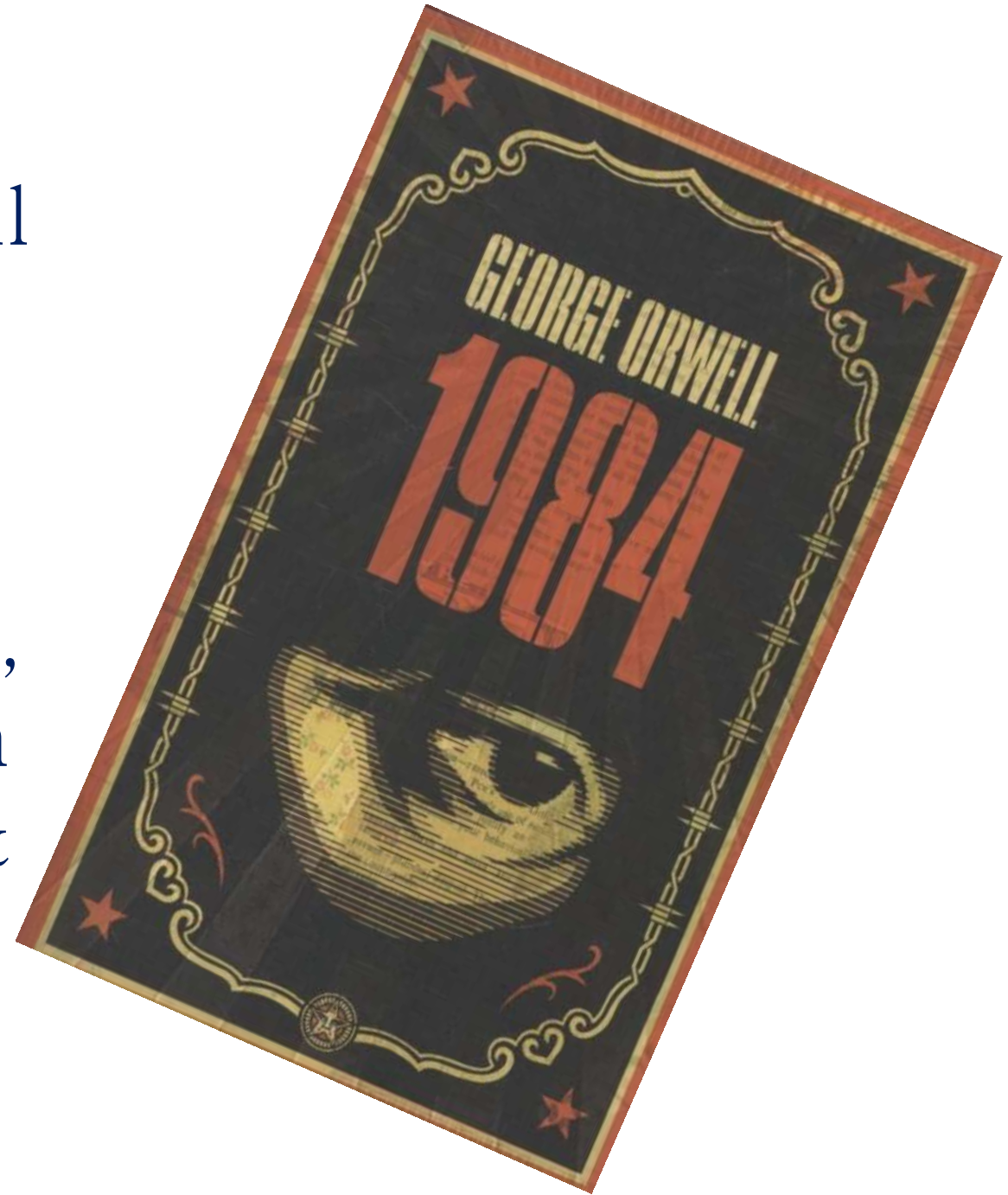
The Vox logo, featuring the word "Vox" in a stylized, black, serif font, centered on a bright yellow rectangular background.

Whose dystopia:
Huxley or Orwell?



George Orwell

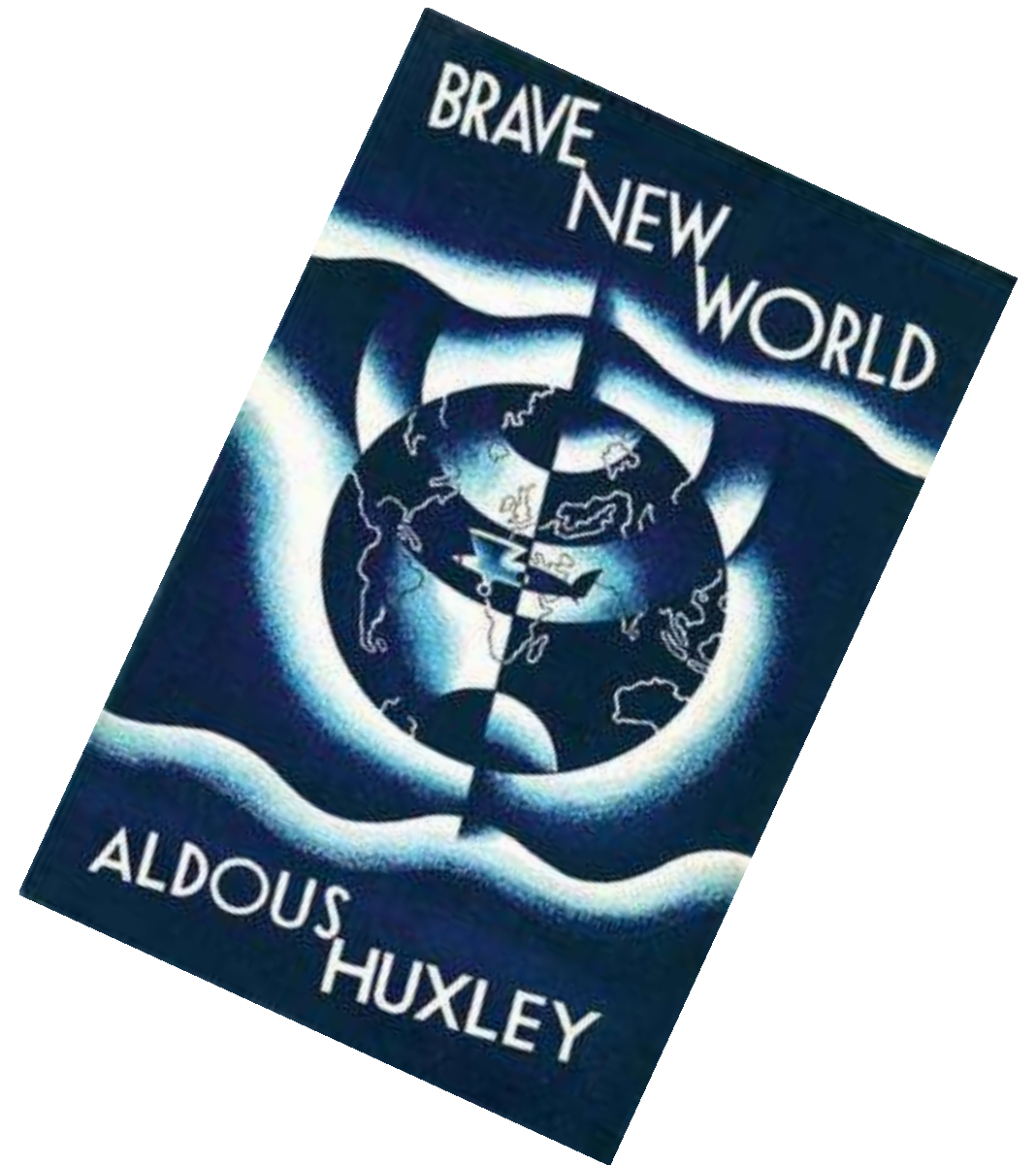
1949; a regimented society,
Big Brother in charge of an
omnipresent surveillance &
propaganda machine





Aldous Huxley

1932; a regimented
world where drug takes
care of consent



What shall thus happen now?

Collapse of trust?

‘System trust’, is social system theory:

“The reduction of complexity
[made possible by generalized media of
communication as money, power and truth]
assumes trust on the part of those
who are expecting such reduction
and of those who are supposed to
accept it once it is accomplished”



Niklas Luhmann

N. Luhmann, Trust and Power. Polity Press, 2017.

“[System trust thus permits] the bank to lend more money than it possess,
the state to issue more commands than it can enforce using the police,
that more information is divulged in professional advice than could be backed up empirically or logically”

N. Luhmann, Trust and Power. Polity Press, 2017.



Niklas Luhmann

‘The essential fiduciary status’ of science:

- 1) Trust in science is necessary for the general society to support it
- 2) Mutual trust within science for it to function



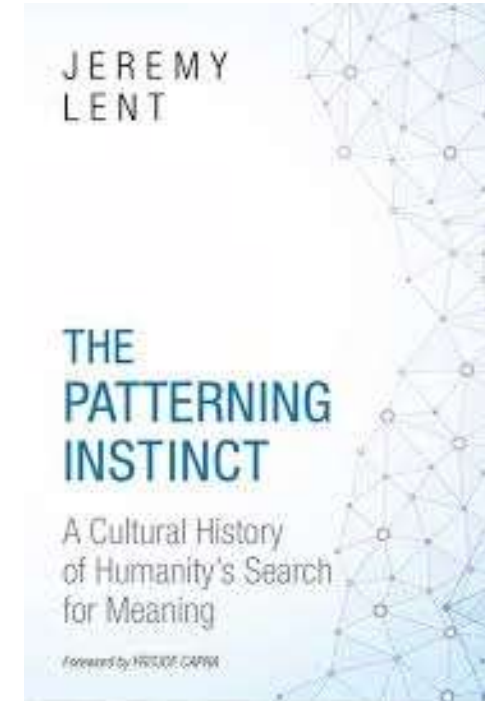
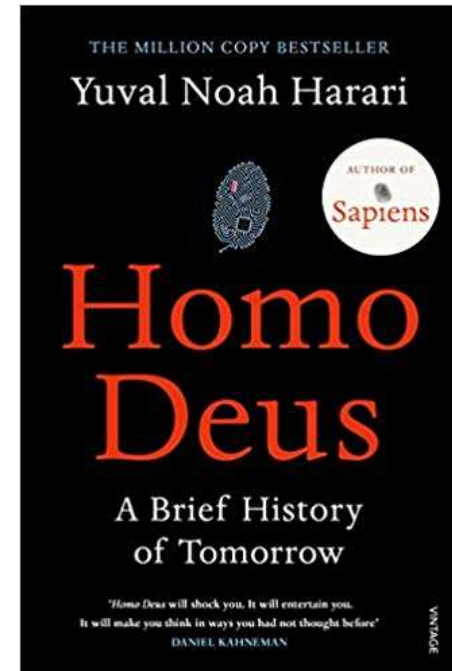
Jerome R.
Ravetz

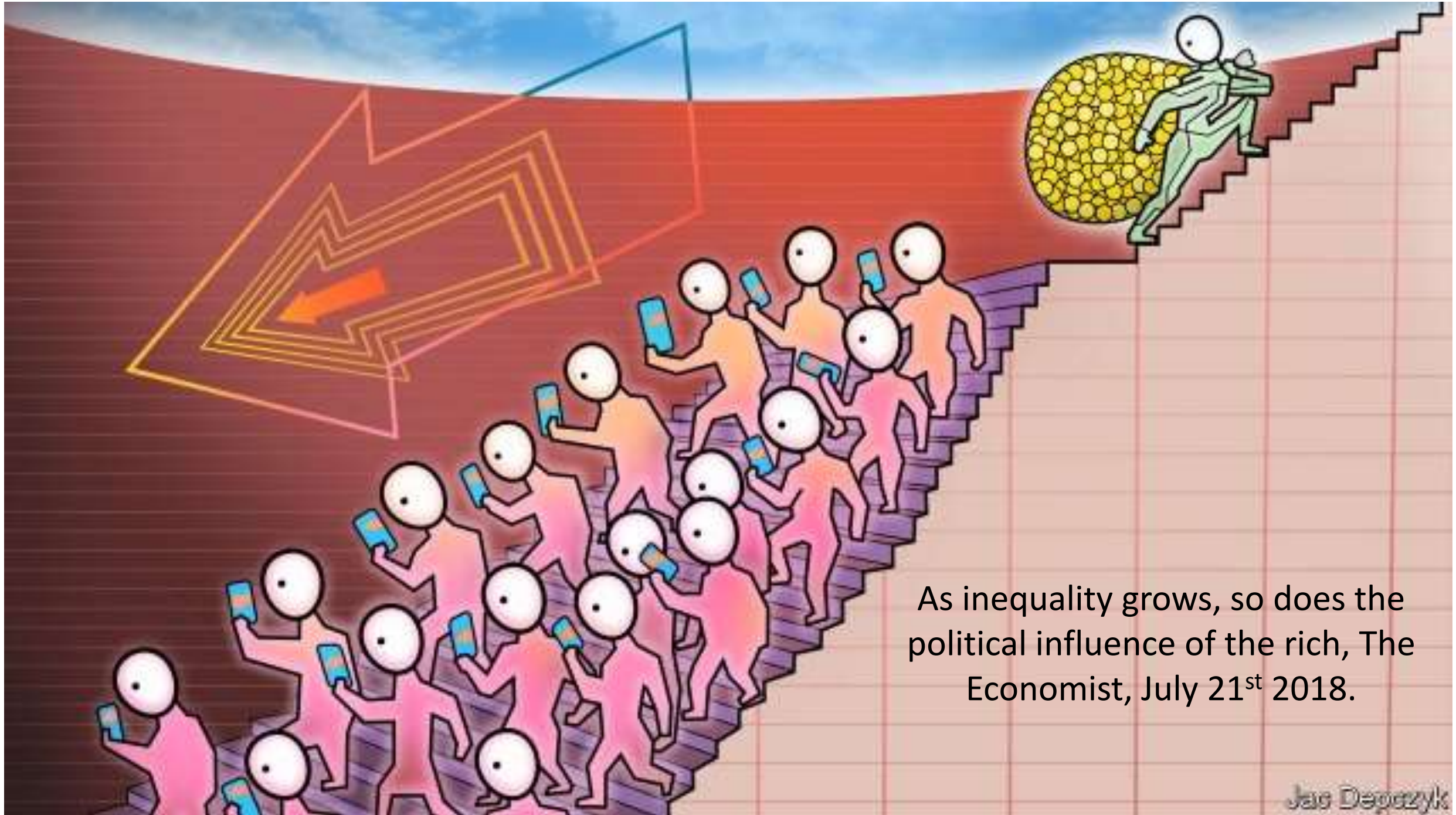
Techno-spit scenario?

An affluent super-technological and possibly trans-human/immortal minority, versus a useless and distracted majority left glued to its mobile phones and tablets

Y. N. Harari, Homo Deus : a brief history of tomorrow. Harvill Secker , 2016.

J. R. Lent, The patterning instinct : a cultural history of humanity's search for meaning. Prometheus Books, 2017.





As inequality grows, so does the political influence of the rich, The Economist, July 21st 2018.

#4

What is the role of
quantification?

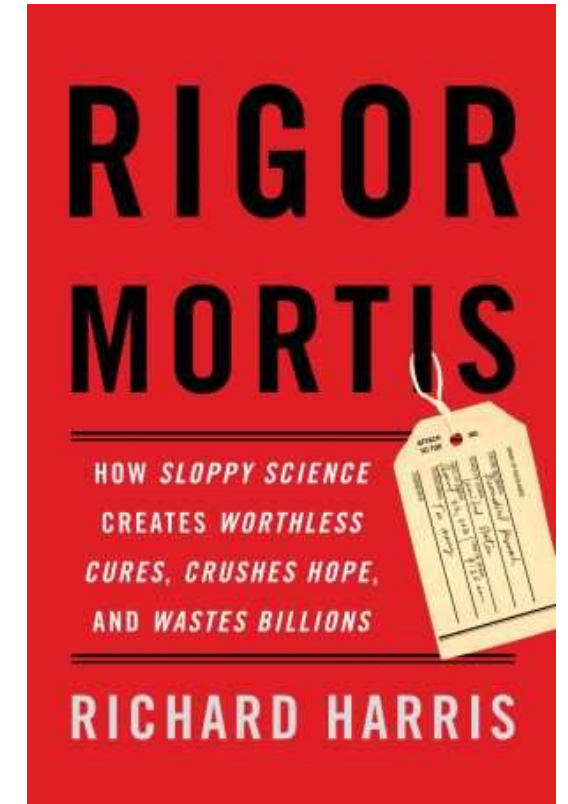
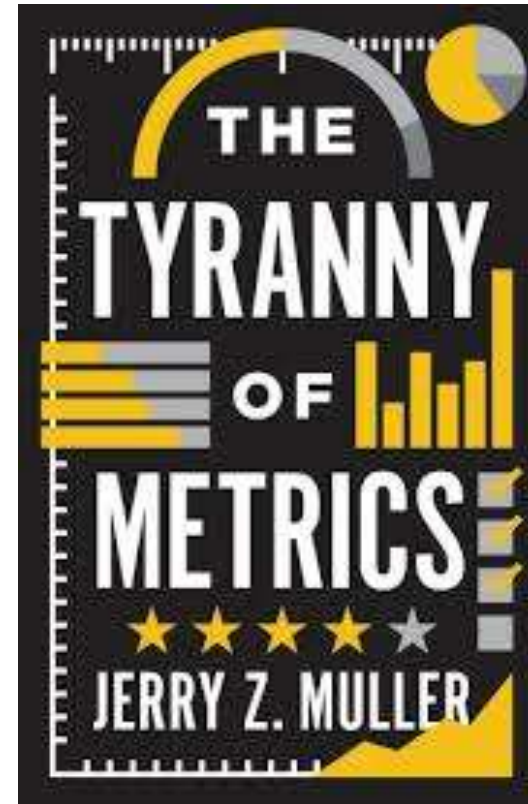
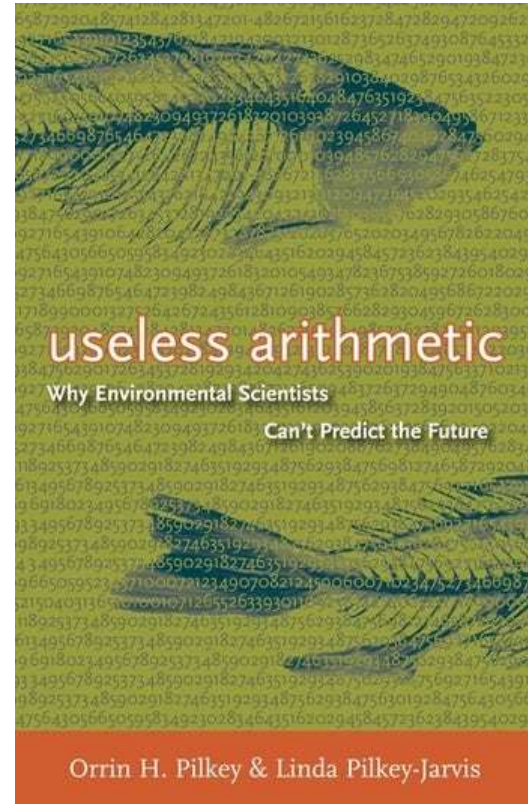
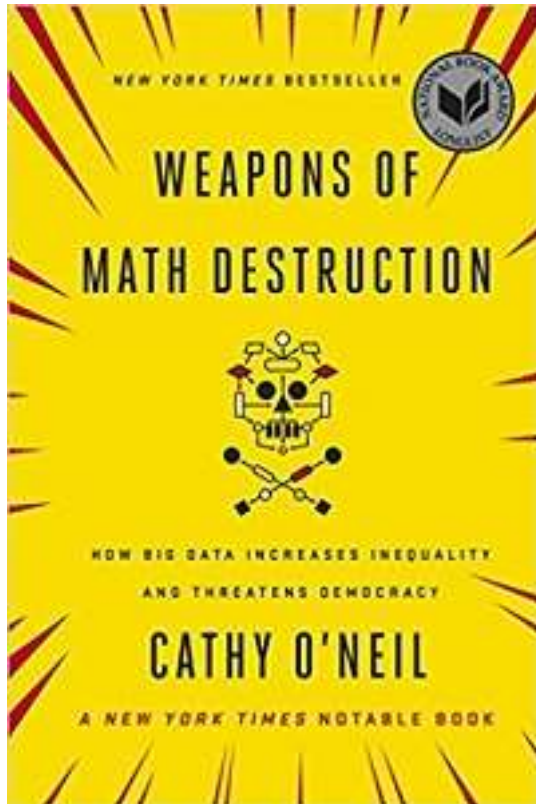
“What qualities are specific to rankings, or indicators, or models, or algorithms?”



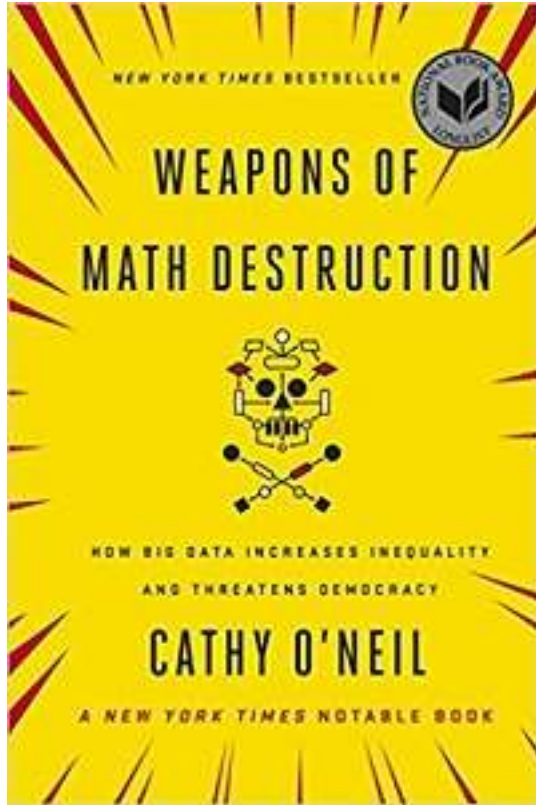
E. Popp Berman

Popp Berman, E. & Hirschman, D. The Sociology of Quantification: Where Are We Now? *Contemp. Sociol.* 47, 257–266 (2018).

Algorithms, models, metrics, statistics

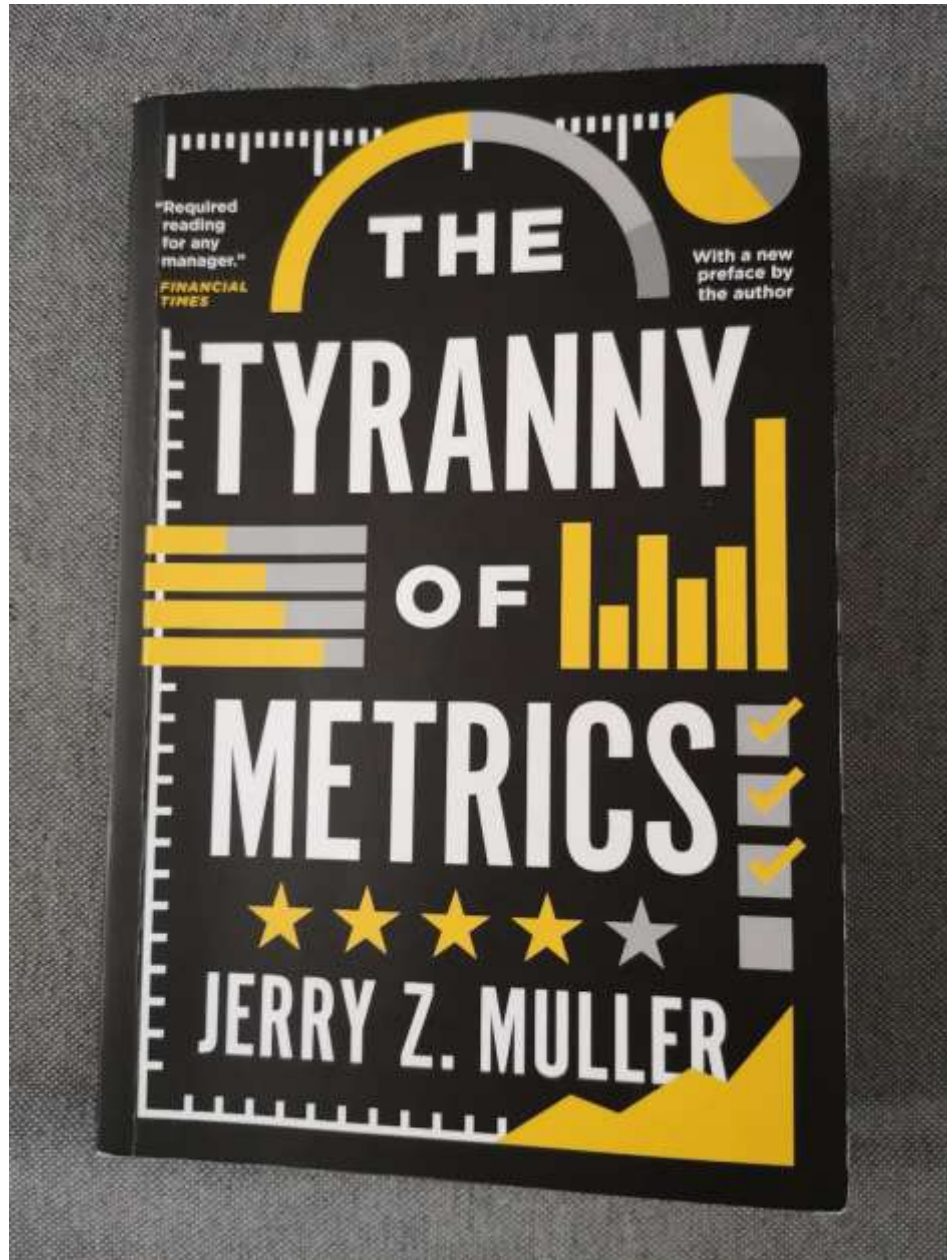


Common root causes?



Cathy O'Neil

Algorithms taking decisions about hiring and careers; adjudicating the custody of minors; approving or denying credits; choosing which neighbourhoods to patrol; whom to free on parole, and more

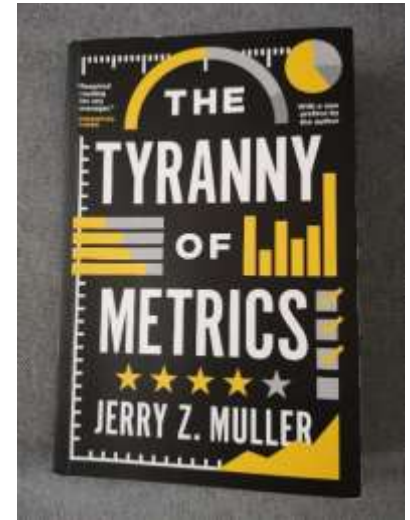


The case against metrics

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

Metric fixation, or the irresistible pressure to measure performance

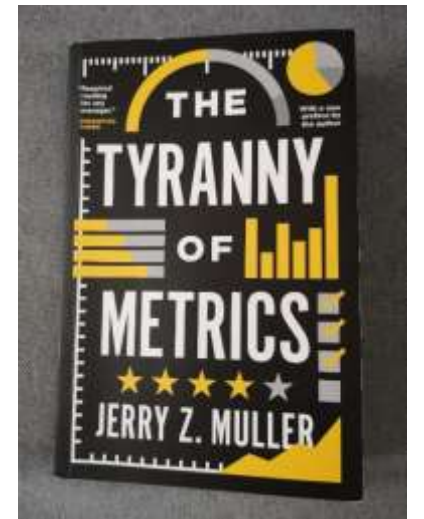
A wealth of case studies from education to war to medicine to foreign aid..



Critiques of metrics

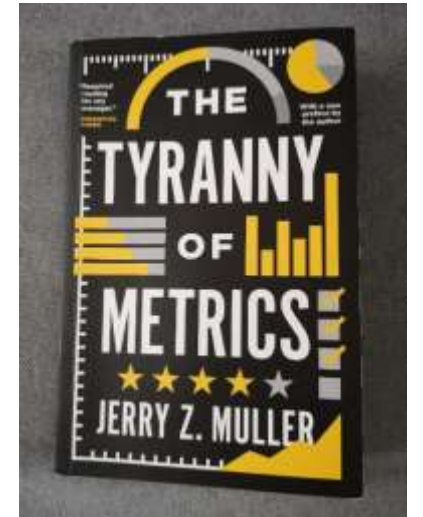
From the left: metric fixation promotes deskilling; “The calculative is the enemy of the imaginative”

From the right (Friedrich Hayek):
metric fixation reproduces features of
the soviet system (See Alain Supiot)



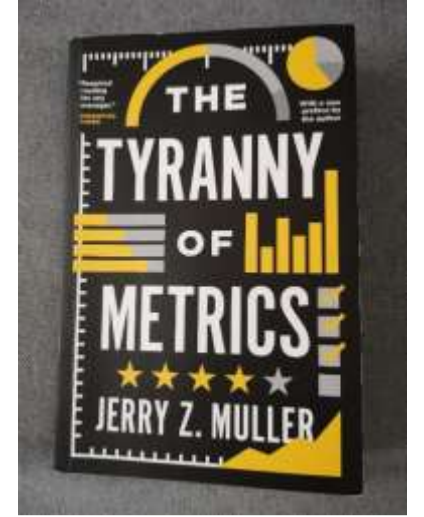
Critiques of metrics

An epistemological critique: metrics privilege abstract and formulaic knowledge against practical and tacit knowledge (Michael Polanyi)



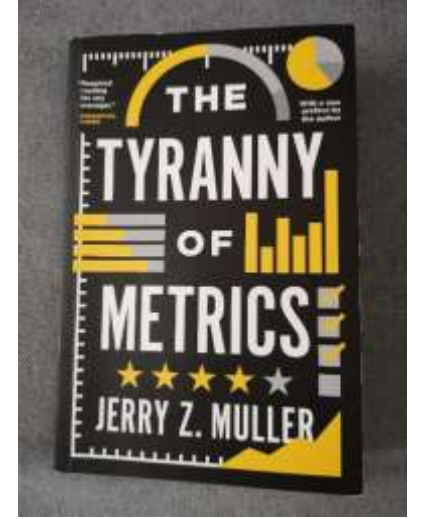
(Greek concept of metis)

Unintended consequences: a litany (1)



- Goal displacement
- Short termism
- Diminishing utility
- Rewarding luck
- Discouraging cooperation and common purpose

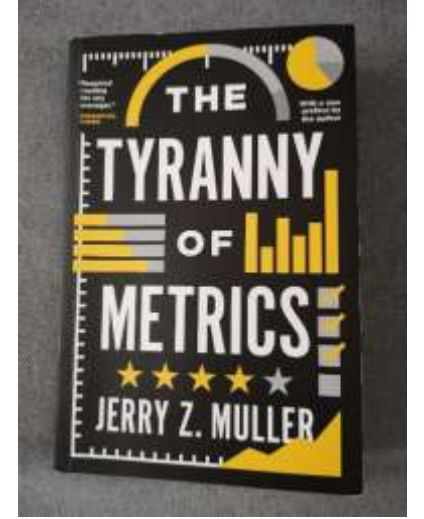
Unintended consequences: a litany (2)



- Rule cascade
- Discouraging risk taking
- Discouraging innovation
- Degrading work
- Time waste
- Loss of productivity

A concluding remark

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”



#5

Ethics of quantification
or quantification of
ethics?

Ethics of quantification or quantification of ethics?

Andrea Saltelli, 2020?



Theodore M. Porter

TRUST IN NUMBERS

The Pursuit
of Objectivity
in Science and
Public Life

Alain Supiot

La Gouvernance
par les nombres

*Cours au Collège de France
(2012-2014)*



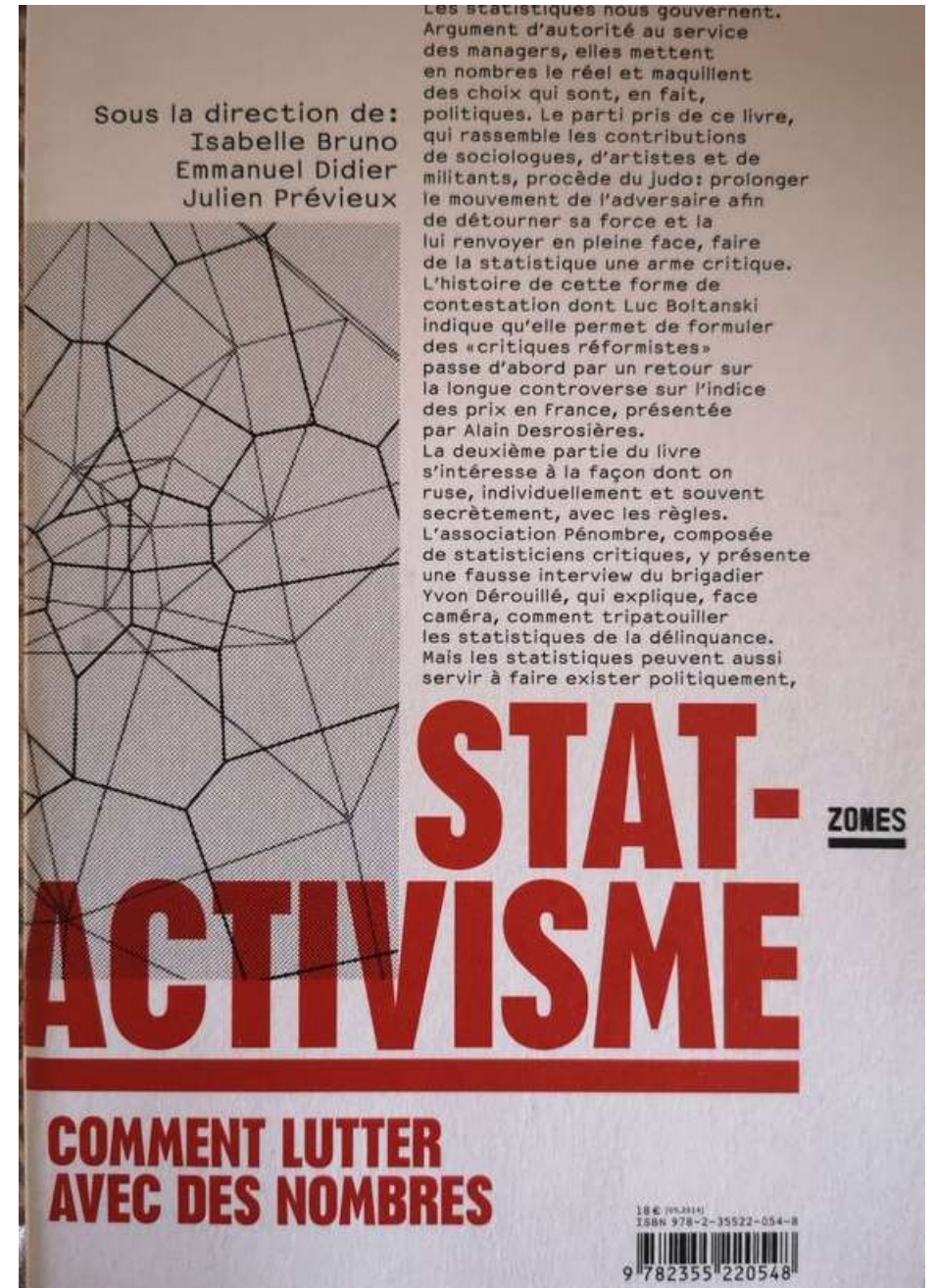
FAYARD
POIDS ET MESURES
DU MONDE

Can we learn
something from
sociology of
numbers?

From law?

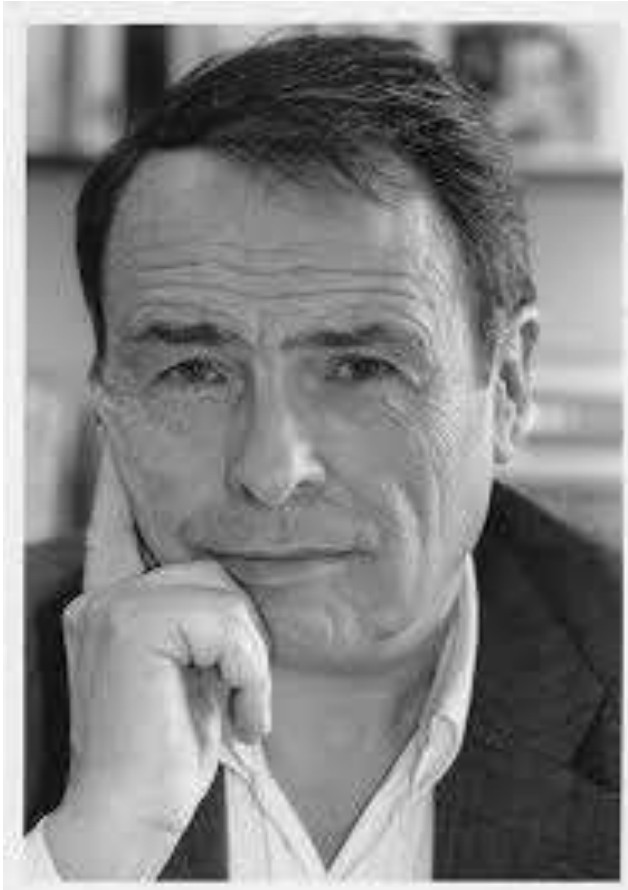
Do we need a movement of resistance?

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

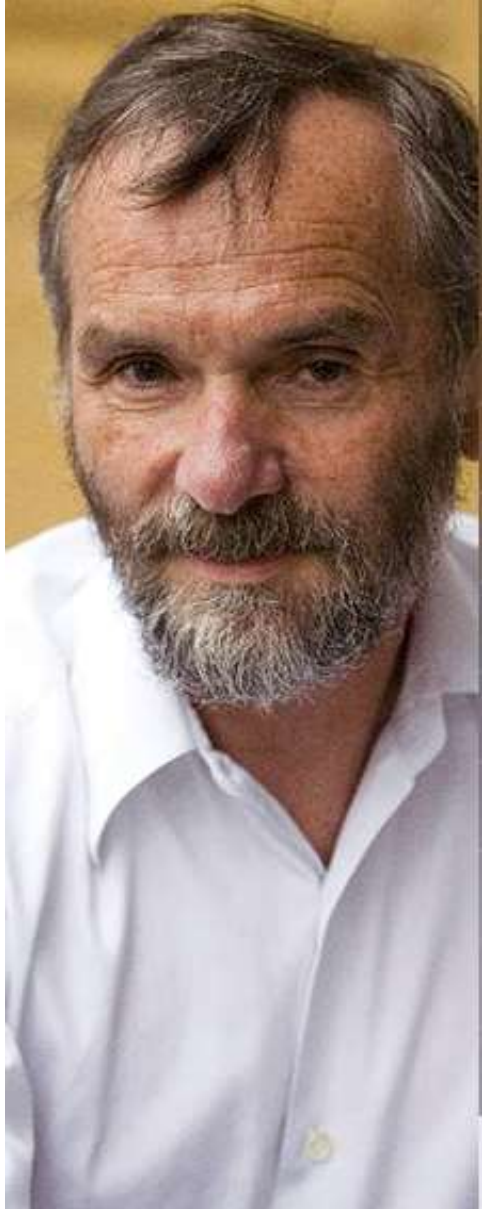


Important:

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



Alain Supiot

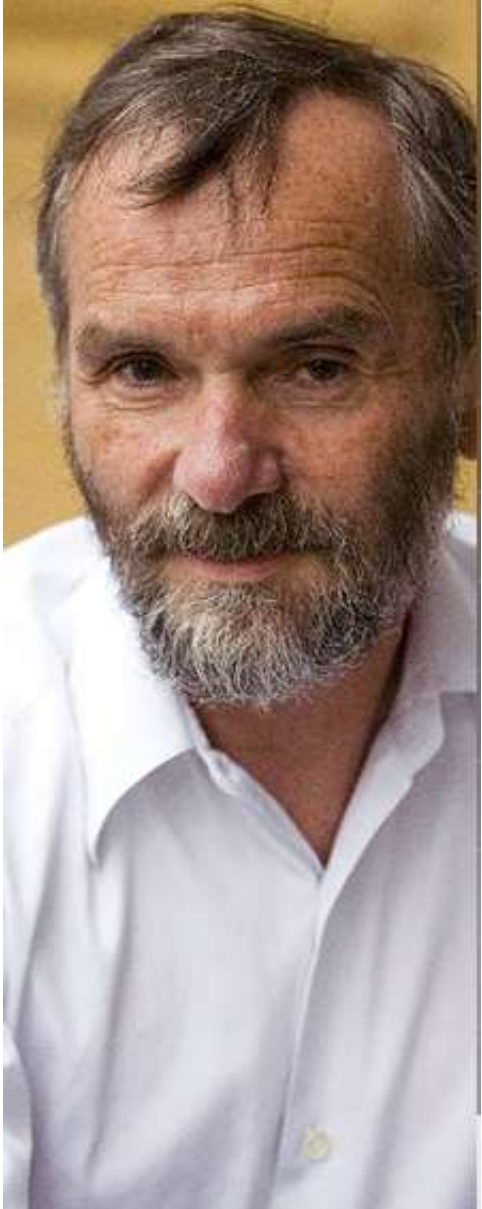


An indictment of
the Total Market
and the normative
uses of economic
quantification

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

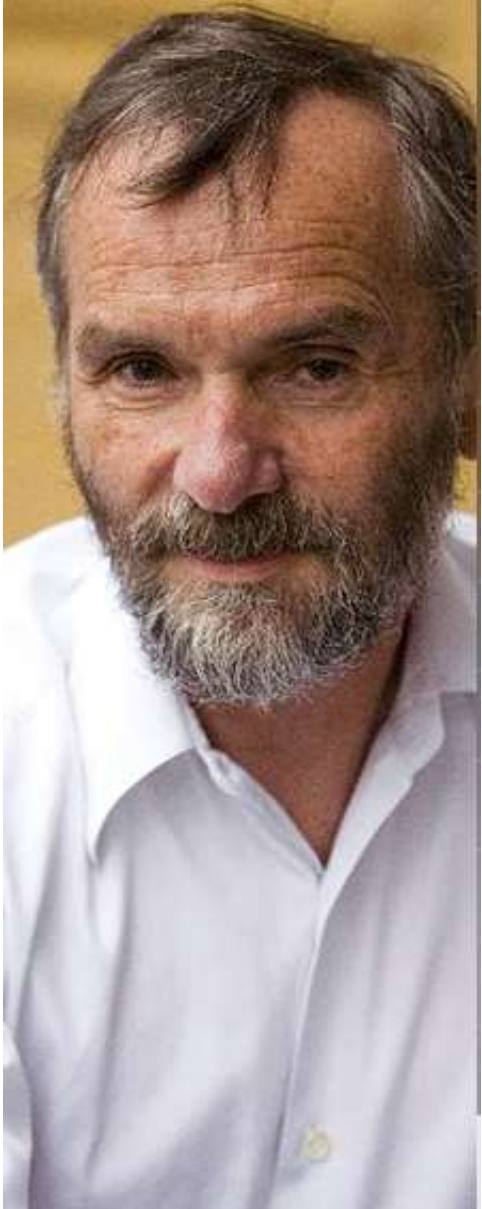


Alain Supiot



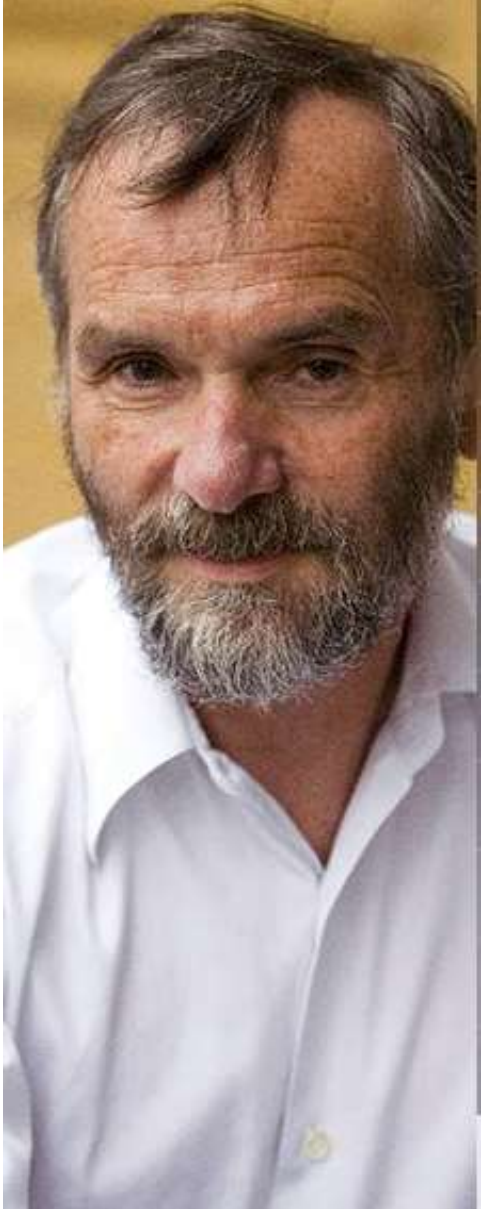
...we have entered the era of the cybernetic imaginary, which revives the West's age-old dream of grounding social harmony in calculations

Alain Supiot



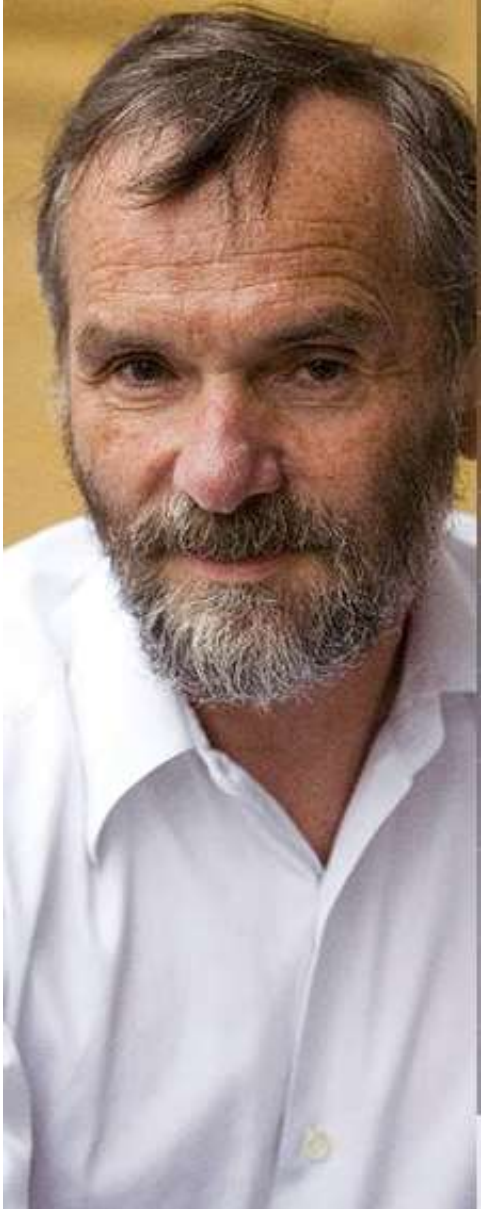
...In this passage from the mechanical (Taylorian) imaginary to the cybernetic lies the origin of multiple interconnected crises

Alain Supiot



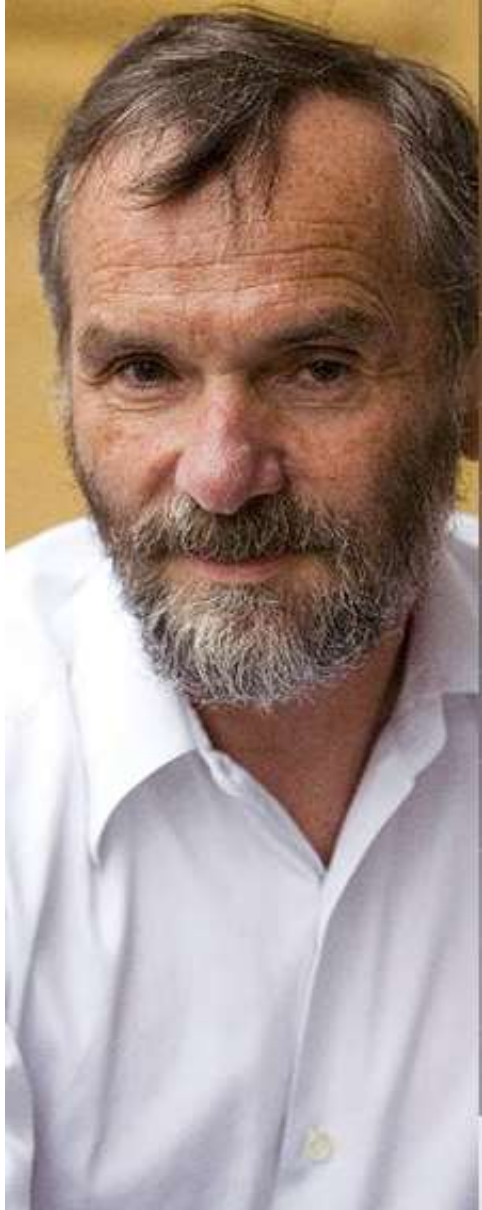
Repudiating the goal of governing by just laws, this new discourse advocates in its stead the attainment of measurable objectives ...

Alain Supiot

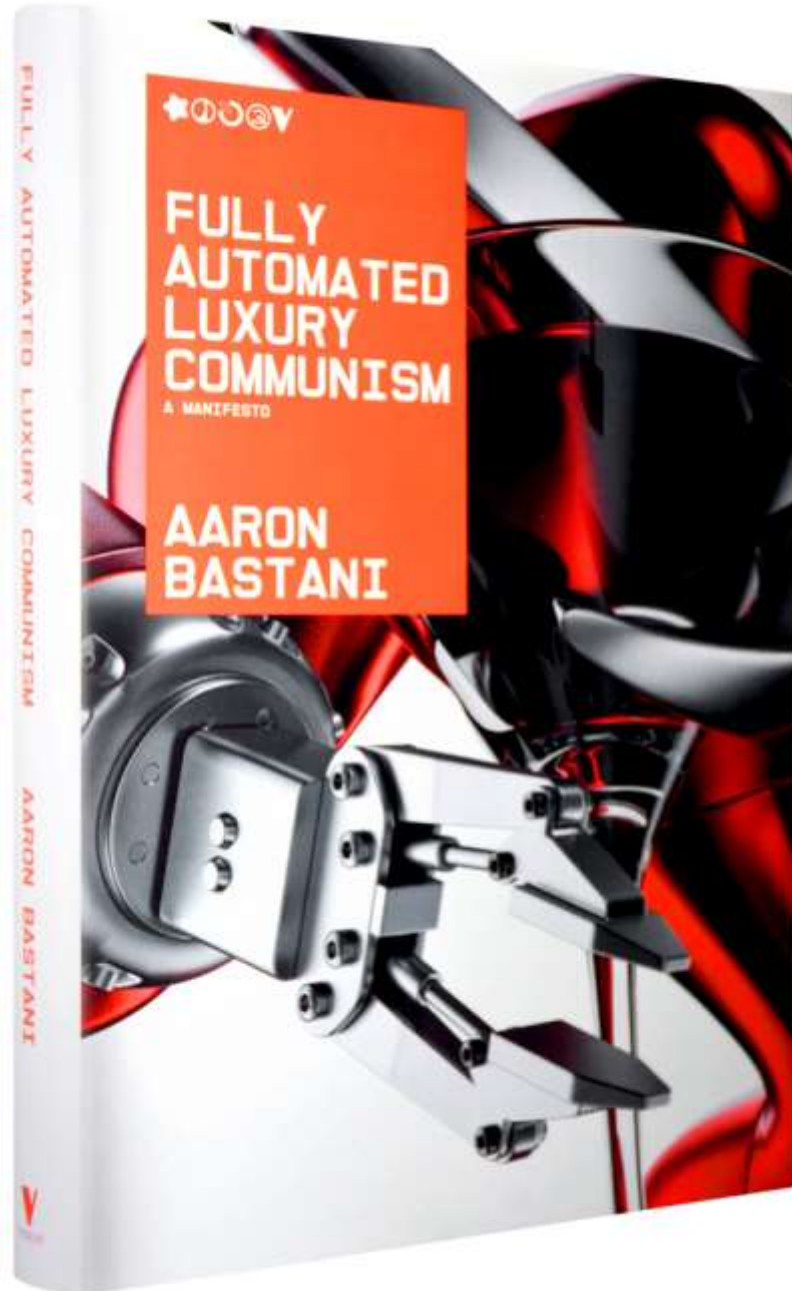


... law is subjugated to a
computation of utility

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



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EVGENY MOROZOV

DIGITAL SOCIALISM?

The Calculation Debate in the Age of Big Data

The debate rages on ...

Ethics of quantification or
quantification of ethics?



Also in the paper:

What issues for an ethics of quantification?

- Trust (Porter, legitimacy, the OECD PISA example)



Ethics of
quantification or
quantification of
ethics?

Andrea Saltelli, 2020?



What issues for an ethics of quantification?

–Defence against abuse (statactivism)



Ethics of
quantification or
quantification of
ethics?

Andrea Saltelli, 2020?



What issues for an ethics of quantification?

- Consequentialism (Ecological Footprint)



Mathis Wackernagel



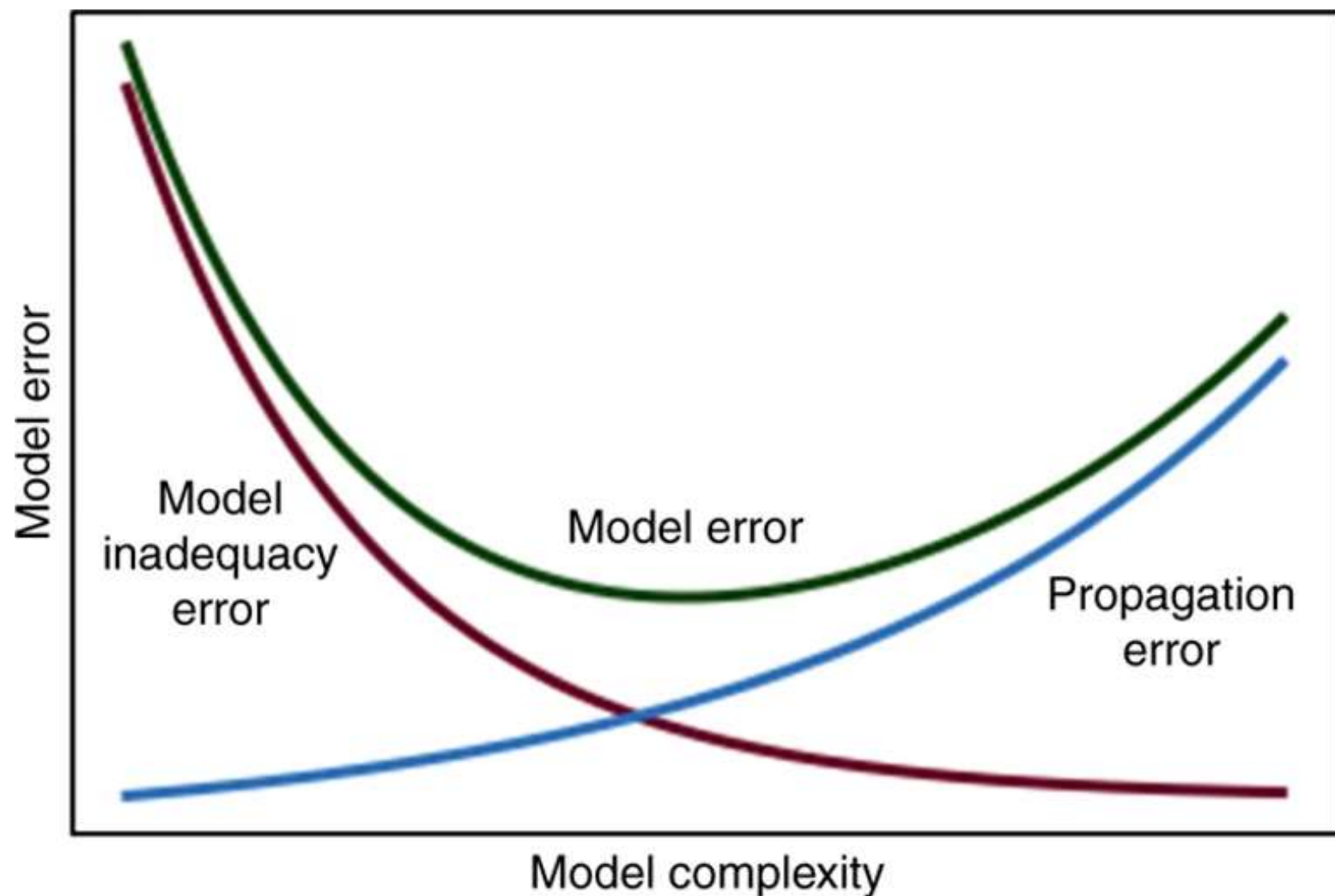
Ethics of
quantification or
quantification of
ethics?

Andrea Saltelli, 2020?



What issues for an ethics of quantification?

–Optimism/Hubris



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What issues for an ethics of quantification?

–Purported neutrality of the technique
(Beck, Majone, Funtowicz and Ravetz;
Romer, Reinert...)

Ethics of
quantification or
quantification of
ethics?

Andrea Saltelli, 2020?



What issues for an ethics of quantification?

- Quality of a quantitative research → “relational validity”, how it corresponds to its **context and purpose**



Issues ▾

For authors ▾

Statistics ▾

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Different Modelling Purposes



Bruce Edmonds^a, Christophe Le Page^b, Mike Bithell^c, Edmund Chattoe-Brown^d, Volker Grimm^e, Ruth Meyer^f,
Sales^g, Paul Ormerod^h, Hilton Rootⁱ and Flaminio Squazzoni^j

Ethics of
quantification or
quantification of
ethics?

Andrea Saltelli, 2020?



What recipes for an ethics of quantification?

- Use tools such as NUSAP and sensitivity auditing to tame hubris, to make quantifications interpretable, conveyable in plain English, and context/purpose specific

NUSAP

Numeral, Unit, Spread

+

Assessment (qualitative judgement on quantification)

Pedigree (qualitative assessment of mode of production and anticipated use)

THEORY AND DECISION LIBRARY

SERIES A: PHILOSOPHY AND METHODOLOGY
OF THE SOCIAL SCIENCES

SILVIO O. FUNTOWICZ AND JEROME R. RAVETZ

UNCERTAINTY AND QUALITY
IN
SCIENCE FOR POLICY

KLUWER ACADEMIC PUBLISHERS



Jeroen
van der Sluijs

Example Pedigree matrix parameter strength

Code	Proxy	Empirical	Theoretical basis	Method	Validation
4	Exact measure	Large sample direct mmts	Well established theory	Best available practice	Compared with indep. mmts of same variable
3	Good fit or measure	Small sample direct mmts	Accepted theory partial in nature	Reliable method commonly accepted	Compared with indep. mmts of closely related variable
2	Well correlated	Modeled/derived data	Partial theory limited consensus on reliability	Acceptable method limited consensus on reliability	Compared with mmts not independent
1	Weak correlation	Educated guesses / rule of thumb est	Preliminary theory	Preliminary methods unknown reliability	Weak / indirect validation
0	Not clearly related	Crude speculation	Crude speculation	No discernible rigour	No validation

<http://www.nusap.net/>



Sensitivity Auditing

What do I make of your latinorum? Sensitivity auditing of mathematical modelling

Saltelli, A., Guimarães Pereira, Â.,
Van der Sluijs, J.P. and Funtowicz, S.



Ângela Guimarães Pereira

The rules of sensitivity auditing

1. Check against rhetorical use of mathematical modelling;
2. Adopt an “assumption hunting” attitude; focus on unearthing possibly implicit assumptions;
3. Check if uncertainty been instrumentally inflated or deflated.

4. Find sensitive assumptions before these find you; do your SA before publishing;
5. Aim for transparency; Show all the data;
6. Do the right sums, not just the sums right;
7. Perform a proper global sensitivity analysis.

What recipes for an ethics of quantification?

–Improve existing disciplinary arrangements



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.

What recipes would be offered by an ethics of quantification?

–Conquer a license not-to-quantify



The End



@andreasaltelli