The politics of modelling: numbers between science and policy

Andrea Saltelli

European University Institute (Fiesole, IT) Interdisciplinary Research Clusters, Virtual, July 04, 13:30 - 15:00



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August 25 2023: The politics of modelling is out!



the politics of modelling numbers between

edited by Andrea Saltelli & Monica Di Fiore science and policy

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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 cautionary view of the ever-widening dependence on mathematical modeling." Orrin H. Pilkey, Professor at Duke University's Nicholas School of the Environment, co-author with Linda Pilkey-Jarvis of Useless Arithmetic: Why Environmental Scientists Can't Predict the Future, Columbia University Press 2009.

Mastodon Toots by

August 26 Podcast (16m) - interview for ABC NET RADIO, AUS: Assumptions and consequences: the politics of modelling, Guests: Ehsan Nabavi and Andrea Saltelli, Producer - Chris Bullock.

View on mstdn.social

"The methods by which power insinuates itself

Do we live immersed in fantastic numbers?

OPINION PETER COY

"social cost of carbon:

'The Most Important Number You've Never Heard Of'

Sept. 17, 2021



=\$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

Illustration by Arsh Raziuddin, The New York Times

nature climate change

Article

https://doi.org/10.1038/s41558-023-01680-x

Social cost of carbon estimates have increased over time

Richard S. J. Tol

Received: 3 August 2022

Accepted: 23 April 2023

Published online: 15 May 2023

Check for updates

Mathematical models predicting the damage in dollars from hurricanes and draughts up to the year 2300



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

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



The Stern-Nordhaus controversy;
a reverse engineering the model:
→ uncertainty is too large to take decisions → both Stern and Nordhaus are wrong



Slobal Environmental Chang

Global Environmental Change 20 (2010) 298–302



Sensitivity analysis didn't help. A practitioner's critique of the Stern review



Andrea Saltelli*, Beatrice D'Hombres

Joint Research Centre, Institute for the Protection and Security of the Citizen, Ispra, Italy



The Politics of Modelling

Numbers Between Science and Policy

Foreword

Mathematical modelling as a critical cultural enterprise

Wendy Nelson Espeland¹

Preface

The sciences of modelling throug

Daniel Sarewitz



Wendy Nelson Espeland



Daniel Sarewitz





The Politics of Modelling

PART I. MEETING MODELS

- Introduction Monica Di Fiore and Andrea Saltelli
- Pay no attention to the model behind the curtain *Philip B. Stark*





Monica Di Fiore

Philip Stark







The Politics of Modelling

PART II. THE RULES

- Mind the framings: Match purpose and context Monica Di Fiore, Marta Kuc-Czarnecka, Samuele Lo Piano, Arnald Puy, and Andrea Saltelli
- Mind the hubris: Complexity can misfire Arnald Puy and Andrea Saltelli
- Mind the assumptions: Quantify uncertainty and assess sensitivity Emanuele Borgonovo
- Mind the consequences: Quantification in economic and public policy Wolfgang Drechsler and Lukas Fuchs
- Mind the unknowns: Exploring the politics of ignorance in mathematical models Andy Stirling

Wolfgang Drechsler Arnald Puy







Andy Stirling

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The Politics of Modelling

PART III. THE RULES IN PRACTICE

- 8. Sensitivity auditing: A practical checklist for auditing decision-relevant models Samuele Lo Piano, Razi Sheikholeslami, Arnald Puy, and Andrea Saltelli
- 9. Mathematical modelling: Lessons from composite indicators Marta Kuc-Czarnecka and Andrea Saltelli
- 10. Mathematical modelling, rule-making, and the COVID-19 Paolo Vineis pandemic Ting Xu
- 11. In the twilight of probability: COVID-19 and the dilemma of the decision maker Paolo Vineis and Luca Savarino
- 12. Models as metaphors Jerry R. Ravetz

Epilogue: Those special models: A political economy of mathematical modelling Andrea Saltelli and Monica Di Fiore



Samuele Lo Piano

Czarnecka







Ting Xu

Pay no attention to the model behind

2

the curtain

Philip B. Stark



Philip Stark

4 Mind the hubris Complexity can misfire Arnald Puy and Andrea Saltelli



Arnald Puy

8 Sensitivity auditing

A practical checklist for auditing decision-relevant models Samuele Lo Piano, Razi Sheikholeslami, Arnald Puy, and Andrea Saltelli



Samuele Lo Piano

Razi Sheikholeslami

Open access chapters



Research Policy Volume 52, Issue 3, April 2023, 104709

Discussion

Against misleading technocratic precision in research evaluation and wider policy – A response to Franzoni and Stephan (2023), 'uncertainty and risk-taking in science'

Andy Stirling 😂

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 Exploring the politics of ignorance in mathematical models

Andy Stirling

10

Mathematical modelling, rule-making, and the COVID-19 pandemic

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BOOKS ET AL. MODELING

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The responsibility turn

Lessons from the COVID-19 pandemic inspire a guide to recognizing the politics of modeling





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The Politics Behind Overinterpreted and Underexplored Models: A Review of Andrea Saltelli and Monica Di Fiore (eds.), *The Politics* of Modelling - Numbers between Science and Policy

 Oxford, UK: Oxford University Press, 2023
 Minerva

 Book Review | Published: 17 February 2024
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 Volume 62, pages 141–144, (2024)
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Lieke A. Melsen

1.Campbell, P. J. (14 March 2024). "Reviews: Saltelli, Andrea, and Monica Di Fiore (eds.), The Politics of Modelling: Numbers Between Science and Policy, Oxford University Press". Mathematics Magazine. **97** (2). Taylor & Francis: 234–235. <u>doi:10.1080/0025570X.2024.2313390</u>. <u>ISSN 0025-570X</u>. 2.Elsawah, S. (2024). "A Review of Andrea Saltelli and Monica Di Fiore (eds.), The Politics of Modelling - Numbers between Science and Policy". Environmental Modelling and Software. <u>doi:10.1016/j.envsoft.2024.106023</u>.

3.Nabavi, E., Razavi, S. (17 November 2023). "The responsibility turnThe Politics of Modelling: Numbers Between Science and Policy Andrea Saltelli and Monica Di Fiore, Eds. Oxford University Press, 2023. 272 pp". Science (New York, N.Y.). 382 (6672): 775. doi:10.1126/science.adl3473. ISSN 1095-9203.
4. Melsen, L. A. (17 February 2024). "The Politics Behind Overinterpreted and Underexplored Models: A Review of Andrea Saltelli and Monica Di Fiore (eds.), The Politics of Modelling - Numbers between Science and Policy". Minerva. doi:10.1007/s11024-024-09524-4. ISSN 1573-1871.



The Politics of Modelling, Numbers Between
Science and Policy
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Occasion for the book: 2020 manifesto

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COMMENT 24 June 2020

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.



By 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

 \frown



2020

of Numbers Utopia, Evidence and Democracy *Edited by* Andrea Mennicken · Robert Salais

The New Politics

来 executive politics and governance

the politics of modelling

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adired by Andrea Saltelli & Monica Di Fiore

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2023

Goal: Reveal the policy of (mathematical modelling's) numbers

2022

OPEN ACCESS



Conversel Material

Numbers are not neutral but their purported neutrality is a large part of their appeal: being performative without appearing to be so

http://ereserve.library.utah .edu/Annual/WRTG/3705/M athison/objectivity.pdf in

Objectivity as Standardization: The Rhetoric of Impersonality in Measurement, Statistics, and Cost-Benefit Analysis

THEODORE M. PORTER

1. Quantification makes knowledge impersonal, hence objective.



Numbers, visible and invisible…



Andrea Mennicken¹, and Wendy Nelson Espeland² • View Affiliations

Vol. 45:223-245 (Volume publication date July 2019) https://doi.org/10.1146/annurev-soc-073117-041343

First published as a Review in Advance on May 13, 2019

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.

Powered by algorithms, governance by (visible and invisible) numbers contributes to a loss of democratic agency (a-democracy)



From loss of political agency to identity politics

The Clash Of Civilizations *Is* The Politics Of The End of History

Reflections by the philosopher Slavoj Žižek on universality and "worldless places."

ESSAY GEOPOLITICS & GLOBALIZATION

BY NATHAN GARDELS MAY 3, 2024

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"The only remaining legitimate source of conflicts are cultural (ethnic, religious) tensions → rise of 'irrational' populism result from the disappearance of the proper political dimension" (Slavoj Žižek)



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Societies in Transition. Crises of Earth https://www.noemamag.com/the-clash-ofcivilizations-is-the-politics-of-the-end-of-history/

Relevant to EUI clusters



Unparalleled palette of methods / epistemic authority

Models dispose of a unique repertoire of

methods. Are endowed with unparallel epistemic

authority that originates from mathematics, the highest ranked among scientific disciplines (Davies & Hersh, 1986), considered by the fathers of the scientific revolution the language of God himself, up to the point that reconnecting it to human experience is up today an unfinished project (Lakoff & Núñez, 2001).



Lack of agreed standards. Modelling as art/craft (Rosen).



Louie, A.H. 2010. "Robert Rosen's Anticipatory Systems." Foresight 12 (3): 18–29. Padilla, J. J., Diallo, S. Y., Lynch, C. J., & Gore, R. (2018). Observations on the practice and profession of modeling and simulation: A survey approach. SIMULATION, 94(6), 493–506.





Statistics has a much deeper connection to sociology, and to sociology of quantification in particular (Desrosières, 1998; Mennicken & Espeland, 2019; Mennicken & Salais, 2022) than mathematical modelling. Sociology of quantification treats impact assessment tools such as cost benefit analysis (Porter, 1995). Little on modelling, see an exception in

(Morgan & Morrison, 1999).





Mathematical models escape sociology of quantification

Article Open access Published: 06 May 2023

What can mathematical modelling contribute to a sociology of quantification?

<u>Andrea Saltelli</u> [™] & <u>Arnald Puy</u>

Humanities and Social Sciences Communications 10, Article number: 213 (2023) Cite this article

1356 Accesses | 1 Citations | 4 Altmetric | Metrics

Model have a better pretense to neutrality than other instances of quantification

A technical proof of quality is illusory without a parallel investigation of normative quality; the example of indicators of employment

Technical Quality

Normative quality

Justice: Means versus Freedoms Author(s): Amartya Sen Source: Philosophy & Public Affairs, Vol. 19, No. 2 (Spring, 1990), pp. 111-121 Published by: <u>Wiley</u> Stable URL: <u>http://www.jstor.org/stable/2265406</u> Accessed: 28/10/2014 14:48



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

Mathematical models are extremely malleable

Models lend themselves very naturally to evidence based policy. In statistics you have to reverse the statistical pyramid to achieve the same result – this goes much faster with models

| Evidence based policy | Statistics (creating things that hold together for the solution of practical problems) |
|-----------------------|---|
| Policy based evidence | Governance driven quantification (a reversal of the statistical pyramid) |

Models cannot be falsified

Models do not meet classic (Popperian) criteria of Scientificity. Oreskes (2000) has observed that model-based predictions tend to be treated like logical inferences in a classic hypothetic-deductive model. The relation between models and data is often more symbiotic than adversarial. In climate studies this relation has been defined as '**incestuous**', exactly to make the point that in modelling studies using data to prove a model wrong may not be straightforward (Edwards, 1999).



"models are most useful when they are used to challenge existing formulations, rather than to validate or verify them"



Naomi Oreskes

N. Oreskes, K. Shrader-Frechette, and K. Belitz, "Verification, Validation, and Confirmation of Numerical Models in the Earth Sciences," Science, 263, no. 5147, 1994.

Models are not physical laws



Oreskes, N., 2000, Why predict? Historical perspectives on prediction in Earth Science, in Prediction, Science, Decision Making and the future of Nature, Sarewitz et al., Eds., Island Press, Washington DC "When a model generates a prediction, of what precisely is the prediction a test? The laws? The input data? The conceptualization?

Any part (or several parts) of the model might be in error, and there is no simple way to determine which one it is" (Oreskes, 2000)

→ Duhem-Quine critique

Why models live in a state of exception Models as the most effective mediators between theory and reality Due to their independence from both theory and the world, models act as "mediators", instruments that advance understanding thanks to the tacit craftsmanship of scientists (Morgan & Morrison 1999).



Models as the most effective mediators between theory and reality

Models are metaphors that express "in an indirect form our

presuppositions about the problem and its possible solutions", and can

thus assist in an **extended community of peers** to deliberate about

social or ecological problems (Ravetz 2023).



| Extended peer community | | 文A Add languages ~ | | | |
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From Wikipedia, the free encyclopedia

The concept of **Extended peer community** belongs to the field of Sociology of science, and in particular the use of science in the solution of social, political or ecological problems. It was first introduced by in the 1990s by Silvio Funtowicz and Jerome R. Ravetz.^[1] in the context of what would become Post-normal science. An **Extended peer community** is intended by these authors as a space where both credentialed experts from different disciplines and lay stakeholders can discuss and deliberate.

Gross asymmetry developers/ users

Models operate in a context of asymmetry of knowledge between developers and users (Jakeman et al., 2006). There are 'black boxes' also in other families of quantification, typically algorithms or statistics. Yet this asymmetry may be larger for mathematical models.



the politics of modelling numbers between science and policy

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Ritual use

An important analogy between statistical and mathematical modelling is in the 'ritual' use of methods. Rituals in statistics are described in Gigerenzer (Gigerenzer, 2018; Gigerenzer & Marewski, 2015). For models here an anecdote by Kenneth Arrow: producing one month-ahead weather forecasts

"... The commanding general is well aware that the forecasts are no

good. However, he needs them for planning purposes"

See also Niklas Luhmann 'deparadoxification'

(Moeller, 2006); See also politicians' claim:

'We follow the science' during COVID-19



Kenneth Arrow

Models and trans-science

Models lend themselves to trans-science (Weinberg, 1972).

- How many people will sit in autonomous cars by 2050
- How will the spread of malaria change if global temperature increases by 1.5°C
- What will be the cost of CO2 averaged over the next three centuries



Alvin Weinberg





Why ethics of quantification is needed now



UCL Institute for Innovation and Public Purpose

WORKING PAPER WP 2021/05

Scope for harm from 'wrong numbers' e.g.:

- ••

- Numbers from international organizations
 - Food and Agriculture Organization
 - The World Bank
 - OECD (see PISA!)



'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



Mind the assumptions

Assess uncertainty and sensitivity

Mind the hubris

Complexity can be the enemy of relevance

Mind the framing

Match purpose and context

nature

siture & comment & address

COMMENT 24 June 2021

serve society: a manifesto

Mind the consequences

Quantification can backfire.

More example of good and bad models in the Manifesto, it supplementary material, and in the book

Mind the unknowns

Acknowledge ignorance







One to one map of the empire

Model as Jorge LuisBorges' (1946) oneto-one map of the empire



The Politics of Modelling

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comment R Check for updates

A digital twin of Earth for the green transition

For its green transition, the EU plans to fund the development of digital twins of Earth. For these twins to be more than big data atlases, they must create a qualitatively new Earth system simulation and observation capability using a methodological framework responsible for exceptional advances in numerical weather prediction.

Peter Bauer, Bjorn Stevens and Wilco Hazeleger

The European Union (EU) Intends to become climate neutral by 2050, and the set of policies designed to bring about this green transition — the European Green Deal — was announced in December 2019 (ref. ¹). Accompanied by €1 trillion of planned investment, Green Deal policies atm to help the world's second-largest economy sustainably produce energy, develop carbon-neutral fuels and advance circular products in energy-intensive industrial sectors with zero waste and zero pollution.

A key element of the Green Deal is its dependence on the 'digital transformation' - an openly accessible and interoperable European dataspace as a central hub for informed decision making. The EU identified two landmark actions to support the necessary information systems: GreenData4AlP and Destination Earth¹. Whereas GreenData4All will develop the European approach to discover, manage and exploit geospatial information, Destination Earth aims to construct highly accurate models, or 'digital twins', of the Earth to monitor and predict environmental change and human impact in support of sustainable development. Aligned with the new Digital Europe funding programme⁴, Destination Earth is expected to start in 2021, and the first, high-priority digital twins serving extremes prediction and climate change adaptation will

Credit: Map of Layerace / Freepik

Digital Twins of th Earth in the EU Destination Earth

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Review Article Published: 02 May 2023

Big Data in Earth system science and progress towards a digital twin

Xin Li ^{CC}, Min Feng ^{CC}, Youhua Ran, Yang Su, Feng Liu, Chunlin Huang, Huanfeng Shen, Qing Xiao, Jianbin Su, Shiwei Yuan & Huadong Guo

Nature Reviews Earth & Environment 4, 319-332 (2023) Cite this article

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| Cornell University | We gratehelity acknowledge so |
|------------------------------------|-------------------------------|
| arXiv > physics > arXiv:2306.11175 | Search Help (Adva |
| Physics > Physics and Society | |

[Submitted on 19 Jun 2023]

Developing Digital Twins for Earth Systems: Purpose, Requisites, and Benefits

Yuhan Rao, Rob Redmon, Kirstine Date, Sue E. Haupt, Aaron Hopkinson, Ann Bostrom, Sid Boukabara, Thomas Geenen, David M. Hall, Benjamin D. Smith, Dev Niyogi, V. Ramaswamy, Eric A. Kihn

The accelerated change in our planet due to human activities has led to grand societal challenges including health crises, intensified extreme weather events, food security, environmental injustice, etc. Digital twin systems combined with emerging technologies such as artificial intelligence and edge computing provide opportunities to support planning and decision-making to address these challenges. Digital twins for Earth systems (DT4ESs) are defined as the digital representation of the comptex integrated Earth system including both natural processes and human activities. They have the potential to enable a diverse range of users to explore what if scenarios across spatial and temporal scales to improve our understanding, prediction, mitigation, and adaptation to grand societal challenges. The 4th NOAA Al Workshop convened around 100 members who are developing or interested in participating in the development of DT4ES to discuss a shared community vision and path forward on fostering a future ecosystem of interoperable DT4ES. This paper summarizes the workshop discussions around DT4ES. We first defined the foundational features of a viable digital twins for Earth system last can be used to guide the development of various use cases of DT4ES. Finally, we made practical recommendations for the community on different aspects of collaboration in order to enable a future ecosystem of interoperable DT4ES, including equity-centered use case development, community-driven investigation or interoperability for DT4ES, trust-oriented co-development, and developing a community of practice.

Scientists have built a 'digital twin' of Earth to predict the future of climate change

The complex computer model takes into account weather and climate systems as well as our impact on the planet.

DestinE is true game changer in our fight against climate change.

- Margrethe Vestager -

Today, the future is literally at our fingertips 🔊

- Margrethe Vestager -

By Rosie Frost & Angela Symons

Published on 11/06/2024 - 16:00 GMT+2 • Updated 16:00

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Models for techno-promises

Economics of Techno-scientific Promises' (ETP) = The promise of 'transformation without transformation'

Have the strongest grip in policy Models have their own political economy economicism, solutionism, reductionism, transforming of the qualitative into quantitative (Stirling, 2023a, 2023b).

The percentage of non-reproducible studies in the field of clinical medical research could reach 85% (Chalmers and Glasziou, 2009). Nobody can provide a similar figure for mathematical modelling.

'Navigating the political' (van Beek *et al.* 2022)

Acting as chameleons, jumping across contexts, Pfleiderer (2020).

Source: National Geographic

Models are vulnerable to modelling hubris

The conjecture of O'Neill (1971), see also Turner & Gardner (2015), posits that too simple a model may miss important features of the system, and thus lead to systematic error, while a too complex one – burdened by an excessive number of estimated parameters, may lead to a greater imprecision due the error propagation.

Solutions to resolve the state of exception Modelling of the modelling process [→ multiverse analysis (Steegen et al 2016)], sensitivity analysis, sensitivity auditing for de- and re-construction, on the example of statactivism

retrace what was assumed
check the level of complexity

→Avoid "quantifying at all costs", expose 'funny numbers'

Culture Unbound Journal of Current Cultural Research

Funny Numbers

By Theodore M. Porter

Solutions to resolve the state of exception

Complexity of interpretation rather than complexity of construction

The I=PAT model, whereby the human impact on the environment is driven by population (P) times affluence (A) and technology (T). In the seventies, this model allowed a debate on the limit of growth that continues to the present day (Ehrlich & Holdren, 1971).

Impact of Population Growth: Complacency concerning this component

of man's predicament is unjustified and counterproductive

Science

PAUL R. EHRLICH AND JOHN P. HOLDREN Authors Info & Affiliations

SCIENCE · 26 Mar 1971 · Vol 171, Issue 3977 · pp. 1212-1217 · DOI: 10.1126/science.171.3977.1212

Solutions to resolve the state of exception

Reciprocal domestication between models and society

The COVID pandemic of 2020 has dramatically increased the visibility of mathematical modelling, accompanied by a considerable level of controversy, either for the deficiencies of the model, or because of disagreement about the policies (Pielke, 2020; Rhodes & Lancaster, 2020). From 'Flattening the curve' to ... distrust?

COMMENTARY 🔂 Open Access 💿 🛈

What did COVID-19 really teach us about science, evidence and society?

Andrea Saltelli 🔀, Joachim P. Sturmberg, Daniel Sarewitz, John P. A. Ioannidis

First published: 06 June 2023 | https://doi.org/10.1111/jep.13876

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"COVID-19 policies allocated sacrifice, privation and suffering across all walks of society [but] radically different responses from nation to nation from draconian lockdowns, to relatively permissive and flexible pandemic regimes—made obvious to all that the value of scientific evidence was to support what was politically desirable and possible in different contexts

Mostly provided by models

Solutions to resolve the state of exception

Defog the mathematics of uncertainty

An important issue in mathematical modelling is the management of

uncertainty. Uncertainty quantification at the heart of the scientific method, and *a fortiori* in the use of science for policy.

Solutions to resolve the state of exception: adopt more lenses

Environmental Science and Policy 142 (2023) 99-111

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Impact assessment culture in the European Union. Time for something new?

Check for updates

Andrea Saltelli^{a,b,*}, Marta Kuc-Czarnecka^c, Samuele Lo Piano^d, Máté János Lőrincz^d, Magdalena Olczyk^c, Arnald Puy^e, Erik Reinert^{f,g}, Stefán Thor Smith^d, Jeroen P. van der Sluijs^{b,h}

Proposed lenses

- Non-Ricardian economics
- Bioeconomics (in the sense of Nicholas Georgescu-Roegen)
- Approaches originated in the context of post-normal science
 - global uncertainty and sensitivity analysis
 - sensitivity auditing
 - NUSAP
 - quantitative storytelling

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Impact assessment culture in the European Union. Time for something new?

Andrea Saltelli ^{a,b,*}, Marta Kuc-Czarnecka⁶, Samuele Lo Piano^d, Máté János Lőrincz^d, Magdalena Olczyk⁷, Arnald Puy⁸, Erik Reinert^{1,6}, Stefán Thor Smith⁴, Jøreon P. van der Sluijs^{b,10},

Contrasting invisibilities

Non-Ricardian economics: invisibility of qualities, whereby all hours of work are taken to have the same value

Bioeconomics: invisibility of nature, whereby natural resources are considered as infinite or infinitely substitutable

Post-normal science: invisibility of values, obfuscated by the purported neutrality of quantification

Nicholas Georgescu-Roegen

Environmental Science and Policy

Impact assessment culture in the European Union. Time for something new?

Andrea Saltelli^{a,b,*}, Marta Kuc-Czarnecka^c, Samuele Lo Piano^d, Máté János Lőrincz^d, Magdalena Olczyk^{*}, Arnald Puy⁶, Erik Reinert^{4,g}, Stefán Thor Smith^d, Jereen P. van der Sluig^{*}bard

Erik S. Reinert

Jerome Ravetz and Silvio Funtowicz

Conclusions

The institutional context of science, models, and policy: The IIASA energy study

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The same way Digital Twins of the planet are 'scientifically prescribed' today ...

"models are more symbolic vehicles for gaining authority than objective technical framework" (1984)

Brian Wynne (and others such as William Keepin) debunked in the early 80's a totally offthe-mark model-based energy future, declared as 'scientifically prescribed' by analysts at IIASA …

See a summary here

A fast breeder reactor in the Netherlands, today an amusement park Risk Analysis

An Official Publication of the Society for East And

PERSPECTIVE C Open Access

Unpacking the modeling process for energy policy making

Samuele Lo Plano (), Mahi János Lörincz, Amuld Puy, Steve Pye, Andrea Sattelli, Stefan Thor Smith Jeroen van der Stuljs

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END

Summary, extra slides and references below

Abstract: Models live in a state of exception. Their versatility, the variety of methods, the impossibility of their falsification and their epistemic authority permit mathematical models to escape, better than other instances of quantification, the lenses of sociology and other humanistic disciplines. This endows models with a pretence of neutrality that perpetuates the asymmetry between developers and users. Models are thus underexplored and overinterpreted. While retaining a firm grip on policy, they reinforce entrenched cultures of transforming political issues into technical ones. To combat this state of exception one should start discussing the reproducibility of models, foster complexity of interpretation rather than complexity of construction, and encourage forms of activism following the French statactivists, aimed to achieve a reciprocal domestication between models and society. To breach the solitude of modellers, more actors should engage in practices such as assumption hunting / modelling of the modelling process / sensitivity analysis and auditing.

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Why is modelling of the global sensitivity analysis important? Fishing expeditions and forking paths …

The garden of forking paths: Why multiple comparisons can be a problem, even when there is no "fishing expedition" or "p-hacking" and the research hypothesis was posited ahead of time^{*}

> Andrew Gelman[†] and Eric Loken[‡] 14 Nov 2013

The garden of forking paths: Why multiple comparisons can be a problem, even when there is no "fishing expedition" or "p-hacking" and the research hypothesis was posited ahead of time^{*}

> And rew Gelman[†] and Eric Loken[‡]

> > $14 \ \mathrm{Nov} \ 2013$

Why this matters?

RESEARCH ARTICLE

SOCIAL SCIENCES

Observing many researchers using the same data and hypothesis reveals a hidden universe of uncertainty

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"Will different researchers [73 teams] converge on similar findings when analyzing the same data?

…teams' results
varied greatly,
ranging from large
negative to large
positive effects"
(Breznau et al. 2022)

Ongoing work: reproduce Breznau et al.'s results using modelling of the modelling process / global sensitivity analysis - one team instead of 73