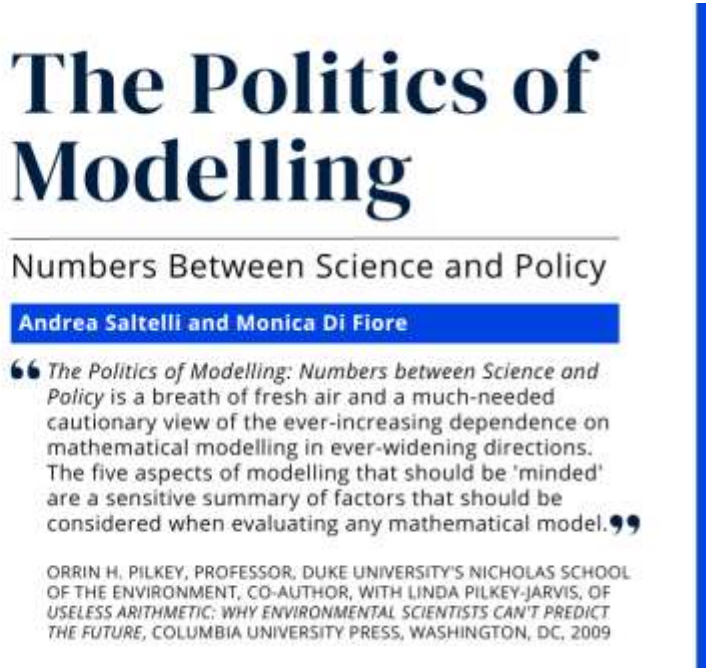
Responsible Modelling and Forecasting

Course SGD 207, Bergen, September 25, 2025

Andrea Saltelli

upf. BARCELONA SCHOOL OF MANAGEMENT

UNIVERSITAS BERGENSIS



Andrea Saltelli

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Latest papers

Models and the common good

A short analysis of norms and counter-norms in modelling, discussing how models may misuse their epistemic authority for reasons of occasion, opportunity and interest.

Outline:
Narratives and counter-narratives,
State of exception,
Seeking Cinderella,
Reformation

Ranking the Rankers

Ranking the Rankers? We investigate using global sensitivity analysis the properties of the science-wide author databases' standardised citation indicators produced since 2015 by a team of researchers led by John P. A. Ioannidis.

Digital twins

We reflect on the development of digital twins of

Where to find this talk:

www.andreasaltelli.eu

Do we live immersed in fantastic numbers?

OPINION

PETER COY

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

Sept. 17, 2021

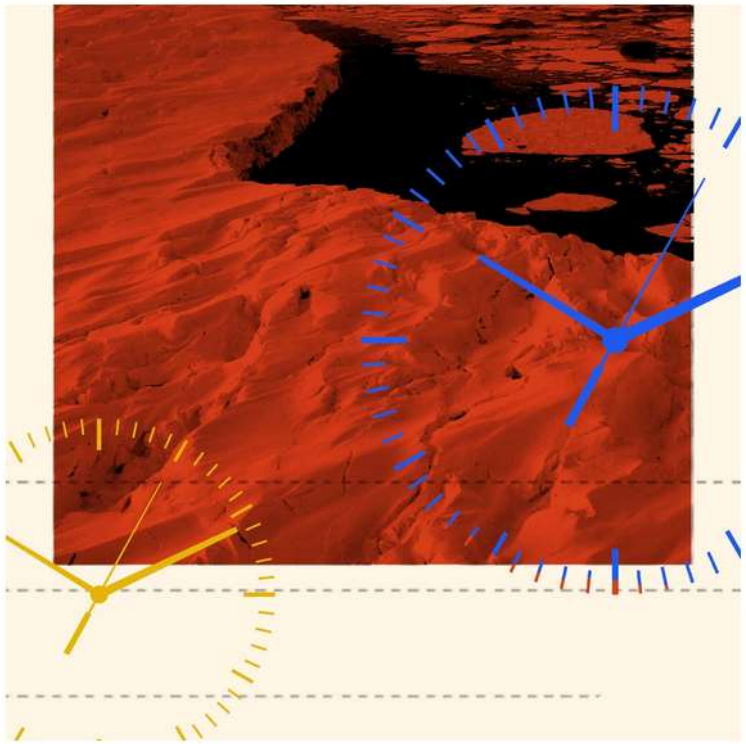


Illustration by Arsh Raziuddin, The New York Times

“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

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

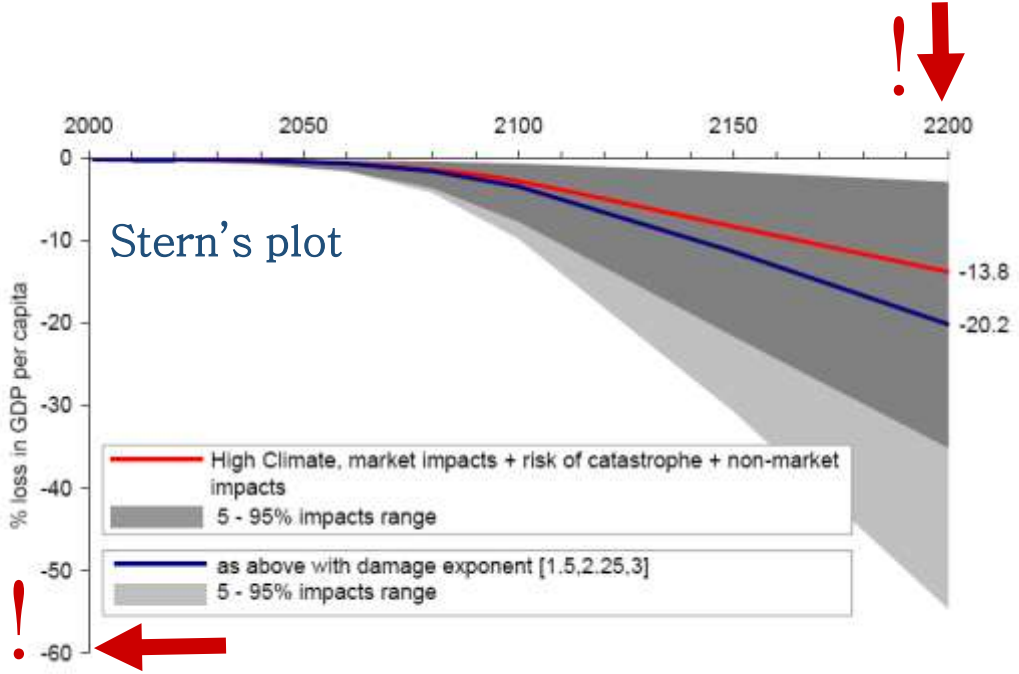
RESOURCES for the FUTURE

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

Working Paper 21-28
October 2021

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



Global Environmental Change 20 (2010) 298–302

Contents lists available at ScienceDirect

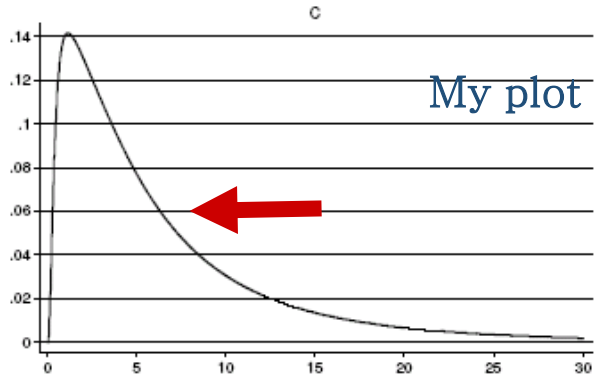
Global Environmental Change

journal homepage: www.elsevier.com/locate/gloenvcha

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

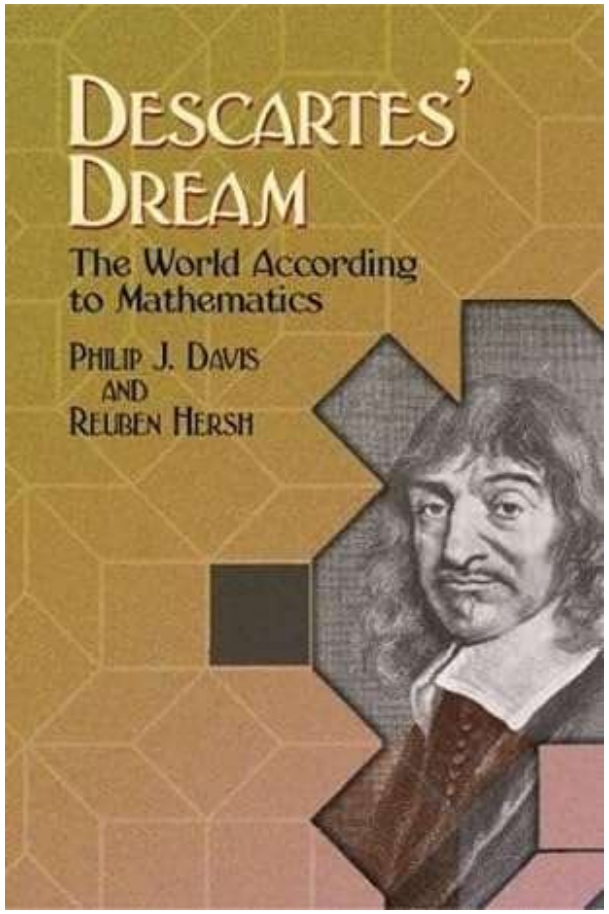
Andrea Saltelli *, Beatrice D'Hombres

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



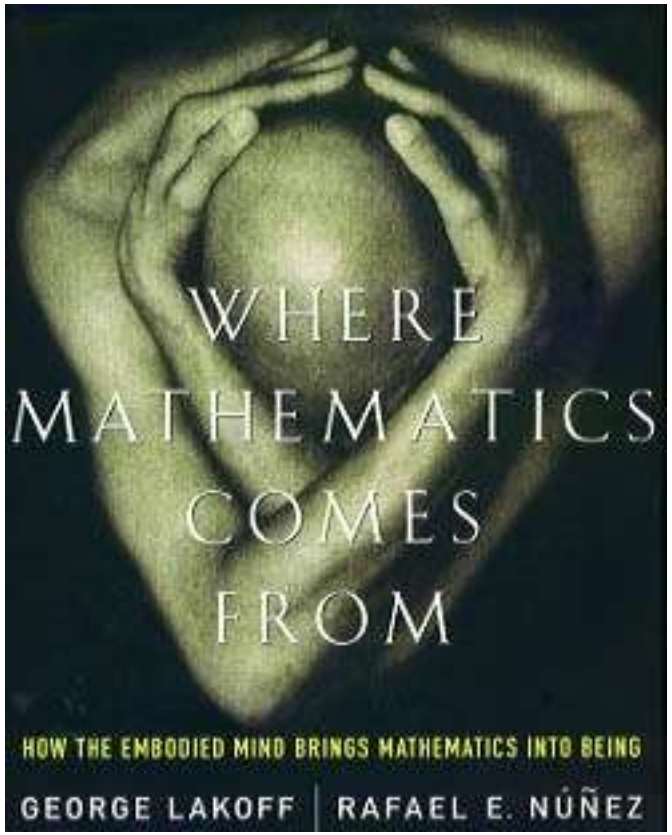
% loss in GDP per capita

Why models live in a state of exception



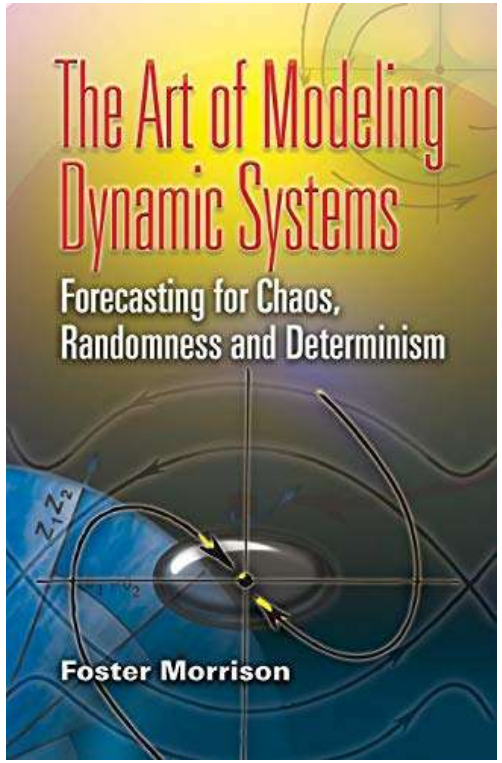
Unparalleled palette of methods / epistemic authority

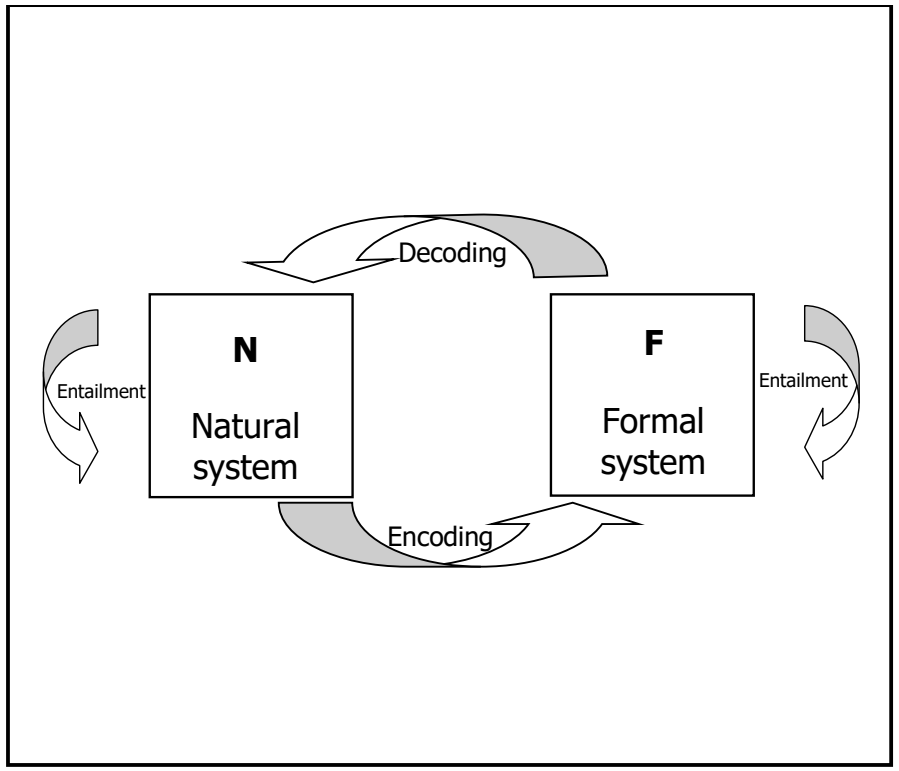
Models dispose of a unique repertoire of methods. Are endowed with unparallel epistemic authority that originates from mathematics, the highest ranked among scientific disciplines (Davies & Hersh, 1986), considered by the fathers of the scientific revolution the language of God himself, up to the point that reconnecting it to human experience is up today an unfinished project (Lakoff & Núñez, 2001).

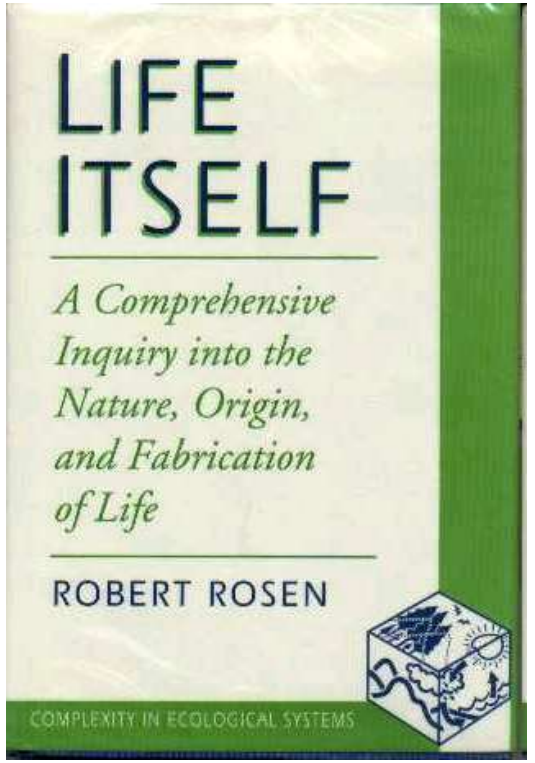


Why models live in a state of exception

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

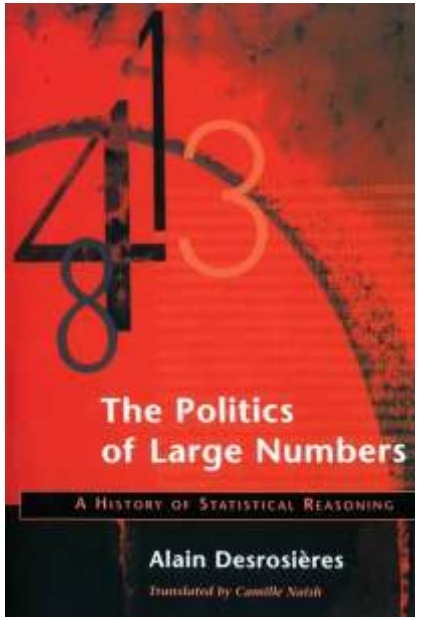






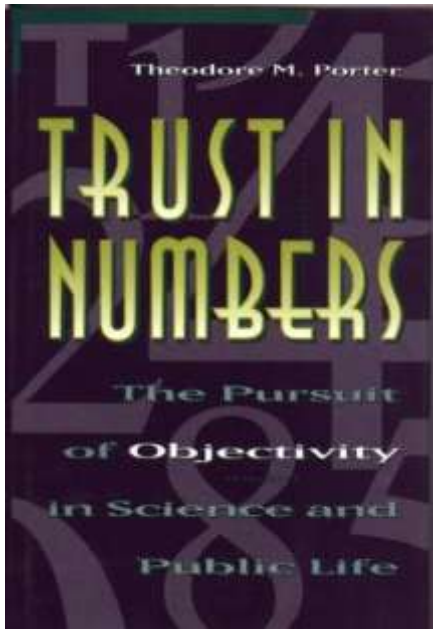
Louie, A.H. 2010. "Robert Rosen's Anticipatory Systems." Foresight 12 (3): 18–29.
Padilla, J. J., Diallo, S. Y., Lynch, C. J., & Gore, R. (2018). Observations on the practice and profession of modeling and simulation: A survey approach. SIMULATION, 94(6), 493–506.

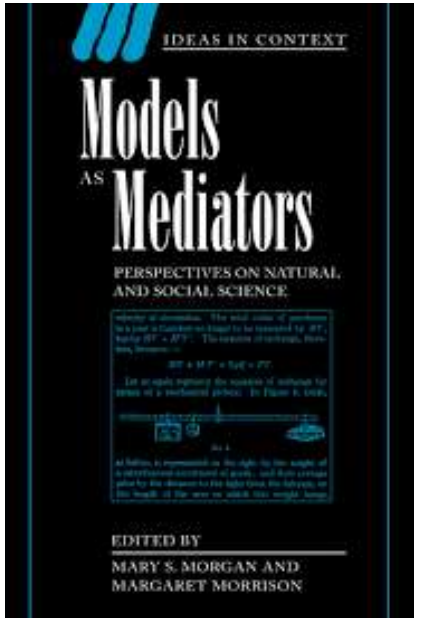
Why models live in a state of exception

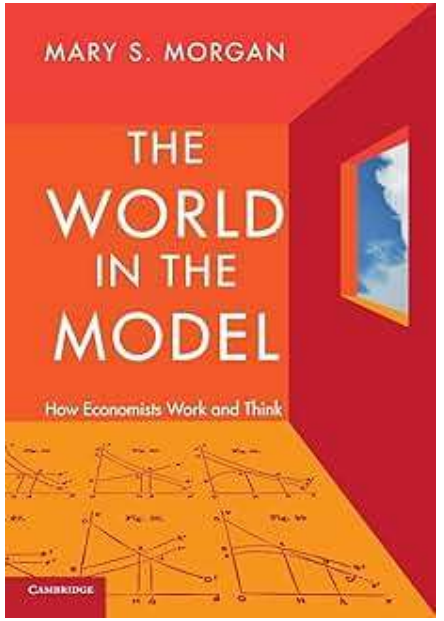


Mathematical models escape sociology of quantification

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). Less on modelling, see exceptions: (Morgan, 2012, Morgan & Morrison, 1999).





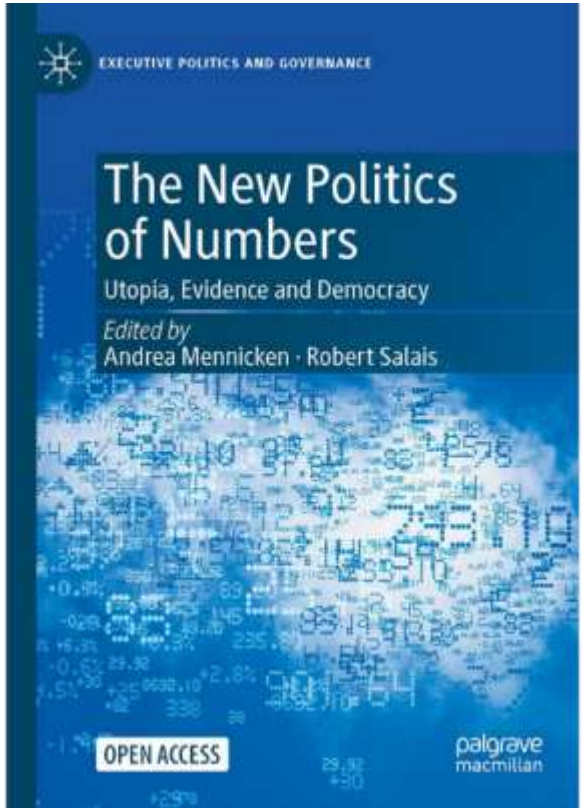


Models have a better pretence to neutrality than other instances of quantification

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

Technical Quality

Normative quality



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.

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

Why models live in a state of exception

Mathematical models are extremely malleable

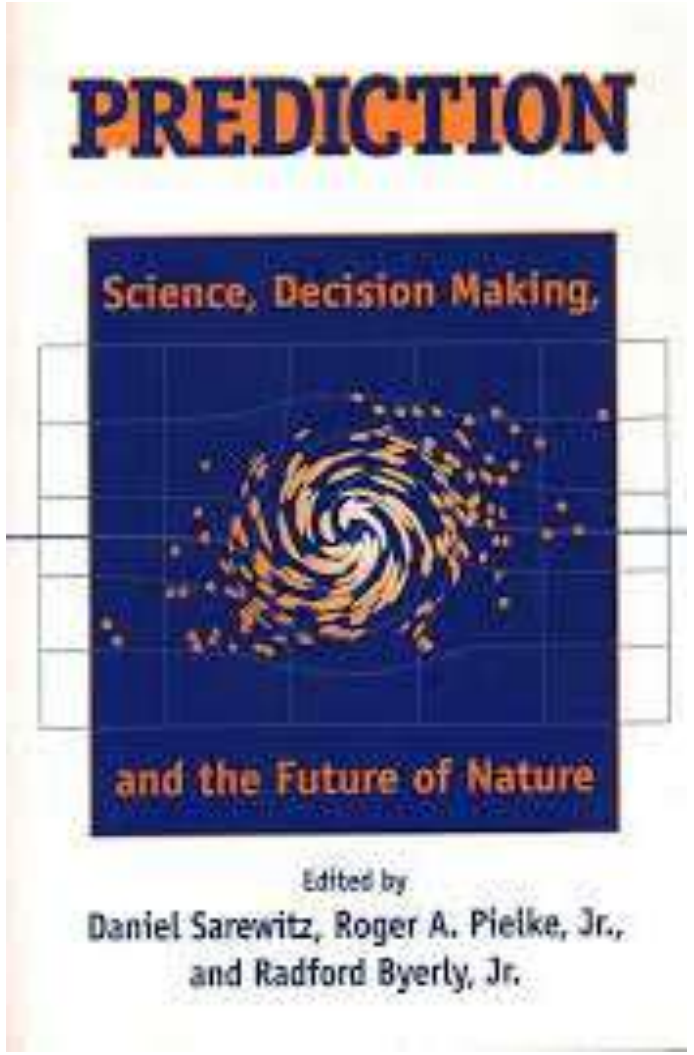
Models lend themselves very naturally to evidence based policy. In statistics you have to reverse the statistical pyramid to achieve the same result – this goes much faster with models

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)

Why models live in a state of exception

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).

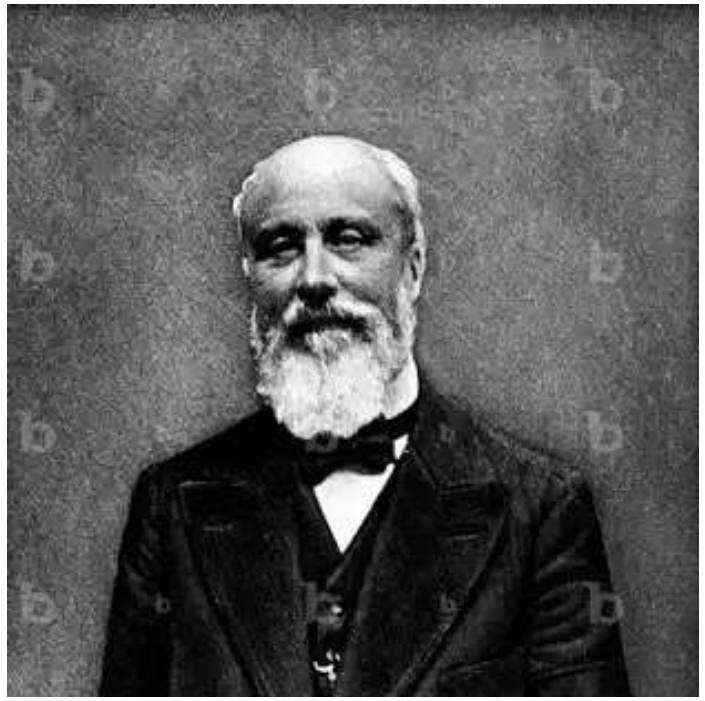


Edwards, P.N. 1999. 'Global Climate Science, Uncertainty and Politics: Data-laden Models, Model-filtered Data'. Science as Culture 8 (4): 437–72.

Models are fragile

"… inferences from mathematical models of phenomena to real physical applications must also be demonstrated to be approximately correct when the assumptions of the model are only approximately true" [1]

Pierre Duhem (1861–1916) and his 'Principle of stability'



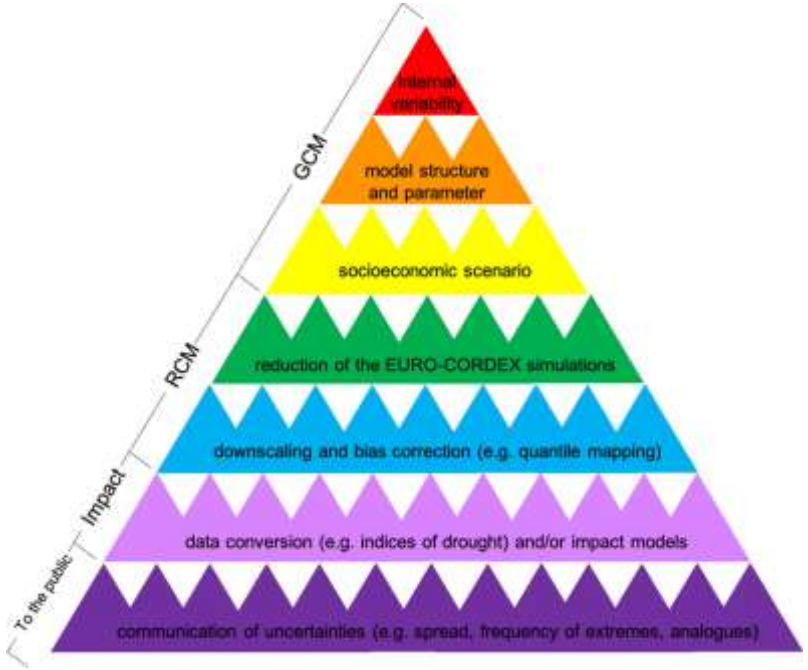
[1] S. C. Fletcher, 'The Principle of Stability', Philosopher's Imprint, vol. 20, no. 3, 2020, Accessed: Sep. 08, 2024. [Online].

Why models live in a state of exception

Models are fragile

Duhem's principle of stability [1], and the occurrence of either Butterfly [2] or Hawkmoth effects [3]. The accumulation of parametric error in a model, the so called uncertainty cascade [4], that is the subject of global sensitivity analysis studies [5].

[1] S. C. Fletcher, 'The Principle of Stability', Philosopher's Imprint, vol. 20, no. 3, 2020, Accessed: Sep. 08, 2024. [Online].
[2] H. G. Schuster, Deterministic Chaos: An Introduction, 2nd Rev edition. Weinheim: Vch Pub, 1998.
[3] E. Winsberg, 'Appendix: Structural Stability and the "Hawkmoth Effect"', in Philosophy and Climate Science, Cambridge: Cambridge University Press, 2018, pp. 232–246. doi: 10.1017/9781108164290.016.
[4] M. Christie, A. Cliffe, P. Dawid, and S. S. Senn, Simplicity, Complexity and Modelling. Wiley, 2011.
[5] A. Saltelli et al., 'Five ways to ensure that models serve society: a manifesto', Nature, vol. 582, pp. 482–484, 2020.



Why models live in a state of exception

Models are fragile

And still one is surprised to find this out

PNAS RESEARCH ARTICLE | SOCIAL SCIENCES OPEN

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

Edited by Douglas Massey, Princeton University, Princeton, NJ; received March 6, 2022; accepted August 22, 2022

"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"
(Massey et al. 2022)

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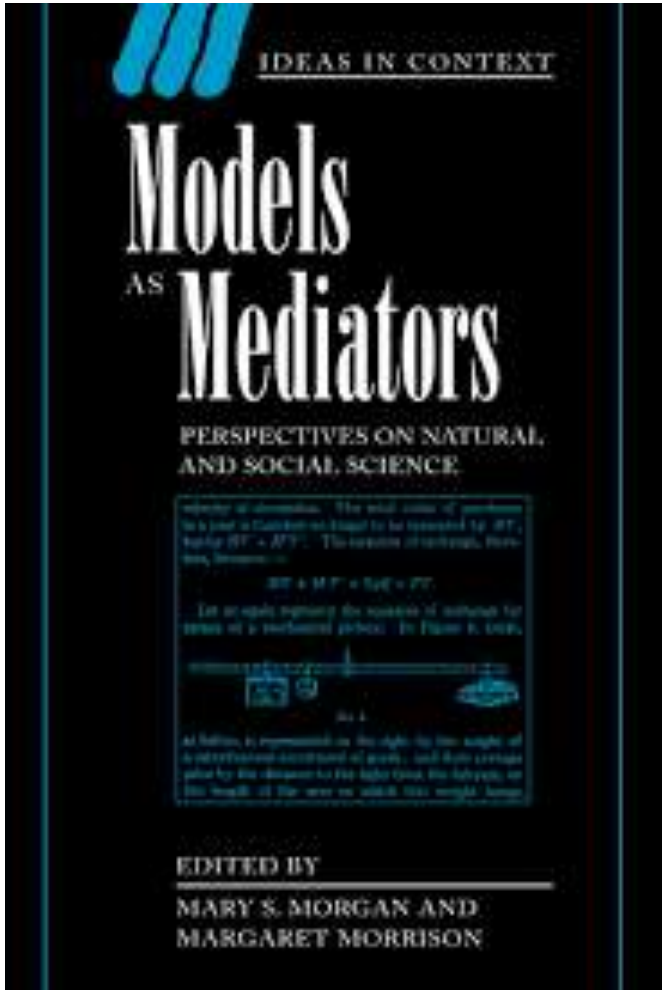
Global sensitivity analysis unveils the hidden universe of uncertainty in multiverse studies

AUTHORS
Andrea Saltelli, Arnald Puy, Alessio Lachi, and Nate Breznau

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).



Consequences descending from state of exception

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.

Jakeman, A.J., R.A. Letcher, and J.P. Norton. 2006. 'Ten Iterative Steps in Development and Evaluation of Environmental Models'. Environmental Modelling & Software 21 (5): 602–14.

Consequences descending from state of exception

Ritual use

An 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

Gigerenzer, Gerd. 2018. 'Statistical Rituals: The Replication Delusion and How We Got There'. Advances in Methods and Practices in Psychological Science 1 (2): 198–218.

Mathematical models: a state of exception?

nature

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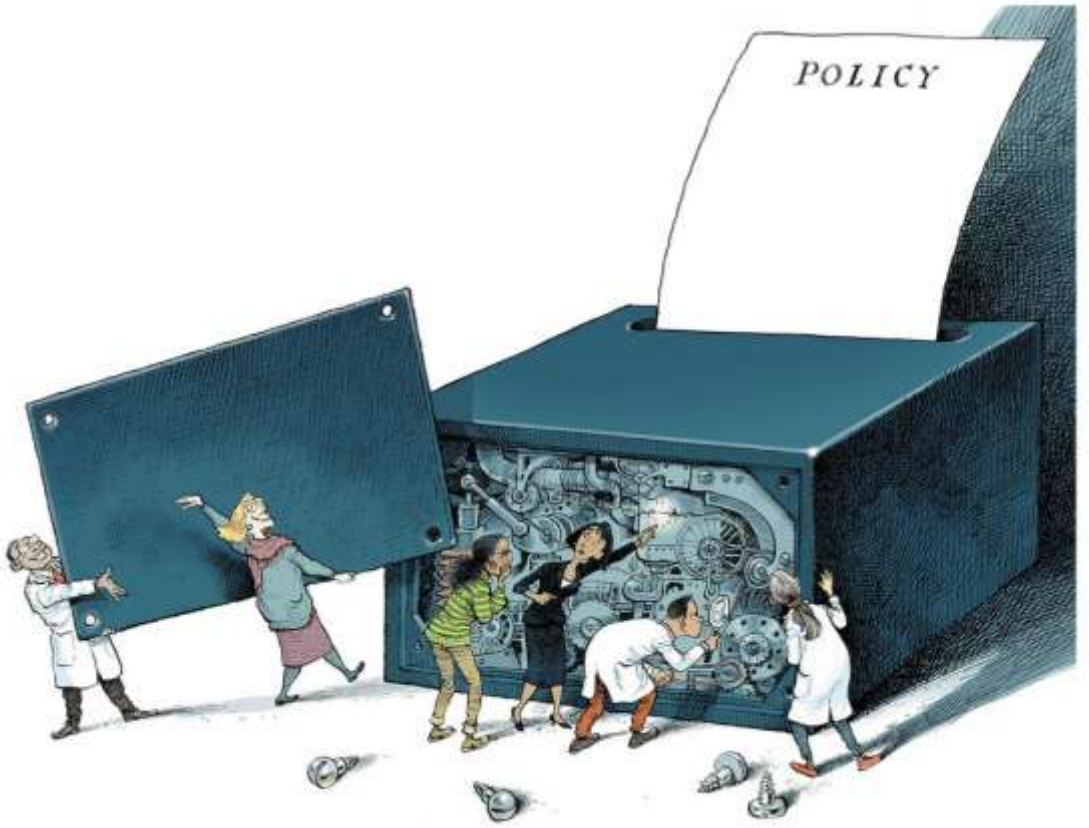
COMMENT | 24 June 2020

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.

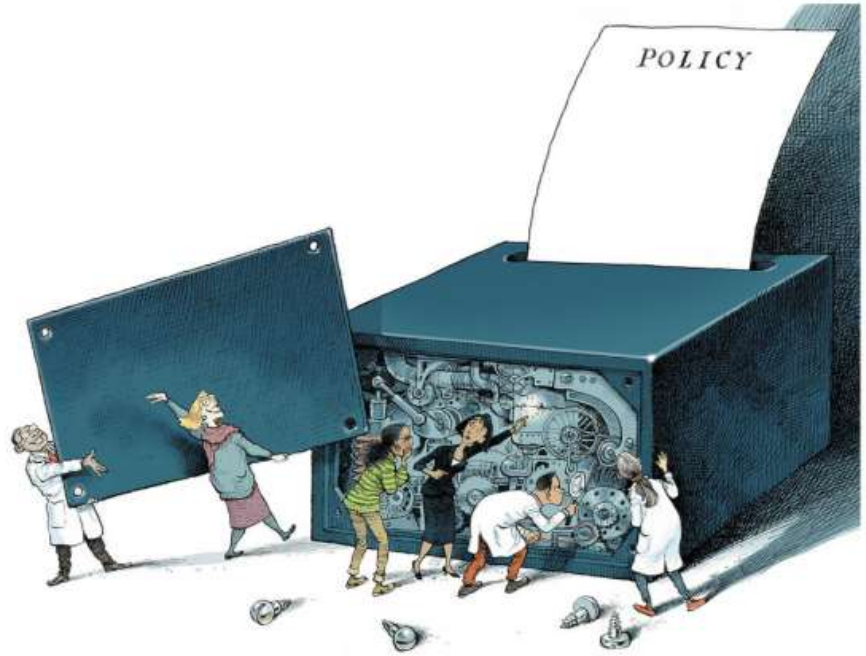


Mind the assumptions

Assess uncertainty and sensitivity

Mind the hubris

Complexity can be the enemy of relevance



Mind the framing

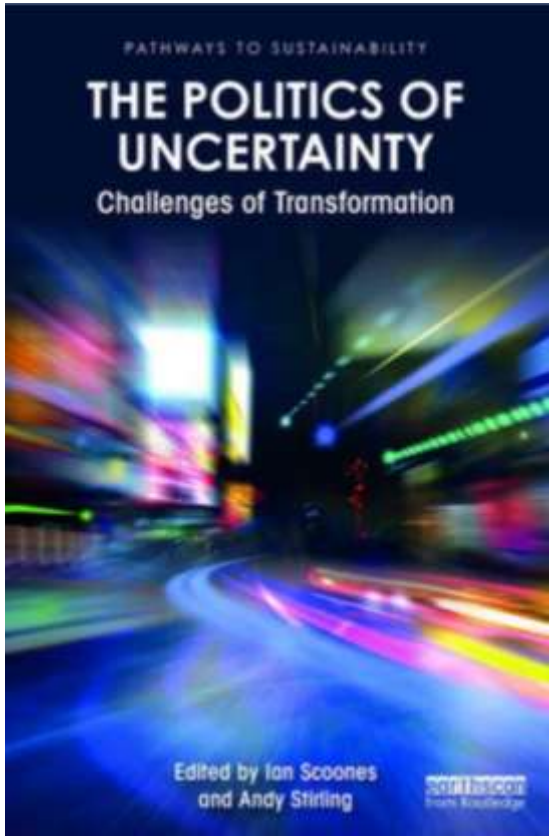
Match purpose and context

Mind the consequences

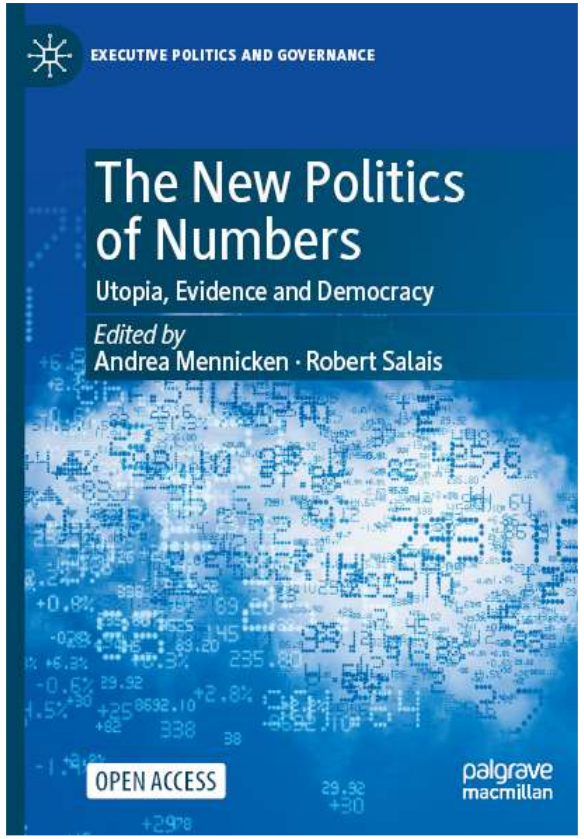
Quantification can backfire

Mind the unknowns

Acknowledge ignorance



2020



2022

2023

Reveal the policy of the numbers

Consequences descending from state of exception

Models and trans-science

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

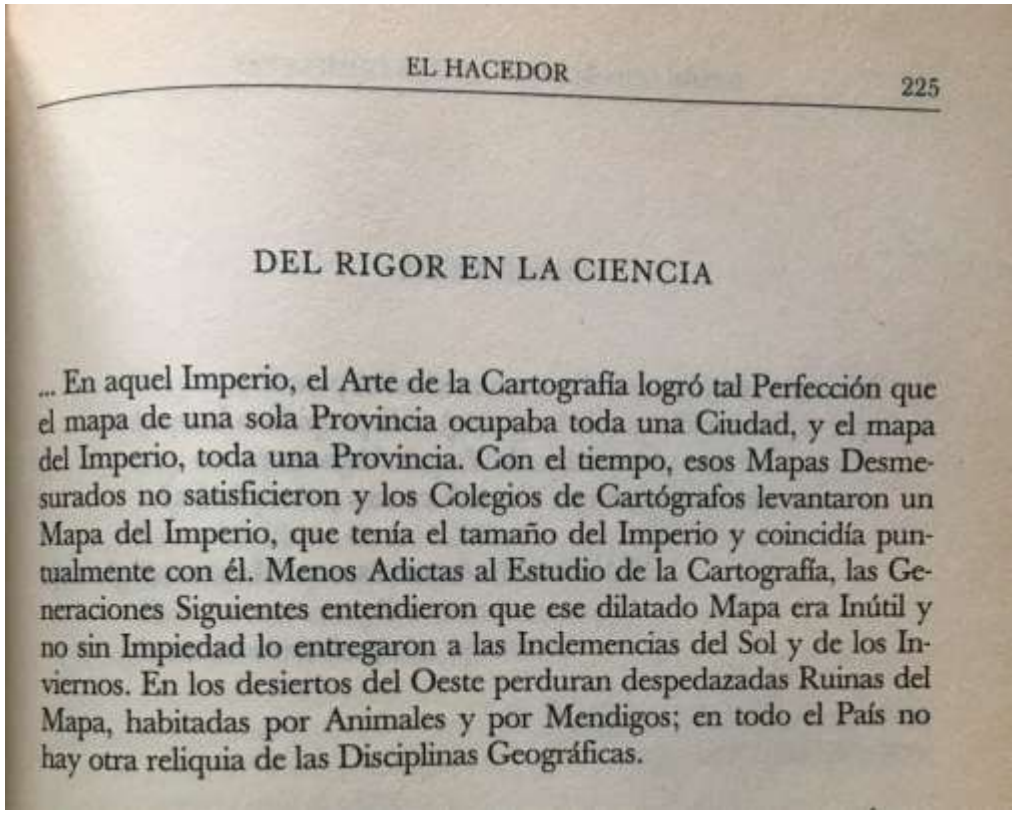
- How many people will sit in autonomous cars by 2050
- How will the spread of malaria change if global temperature increases by 1.5ºC
- What will be the cost of CO2 averaged over the next three centuries

Weinberg, AM. 1972. 'Science and Trans-Science'. *Minerva* 10:209–22.

Consequences descending from state of exception

Models and trans-science

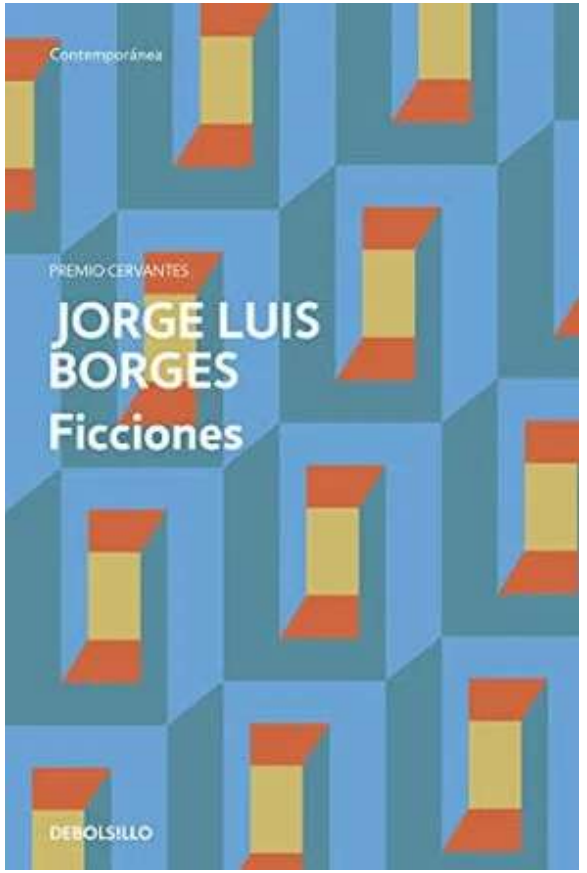
Model as Jorge Luis Borges' (1946) one-to-one map of the empire



EL HACEDOR 225

DEL RIGOR EN LA CIENCIA

... En aquel Imperio, el Arte de la Cartografía logró tal Perfección que el mapa de una sola Provincia ocupaba toda una Ciudad, y el mapa del Imperio, toda una Provincia. Con el tiempo, esos Mapas Desmesurados no satisficieron y los Colegios de Cartógrafos levantaron un Mapa del Imperio, que tenía el tamaño del Imperio y coincidía puntualmente con él. Menos Adictas al Estudio de la Cartografía, las Generaciones Siguientes entendieron que ese dilatado Mapa era Inútil y no sin Impiedad lo entregaron a las Inclemencias del Sol y de los Inviernos. En los desiertos del Oeste perduran despedazadas Ruinas del Mapa, habitadas por Animales y por Mendigos; en todo el País no hay otra reliquia de las Disciplinas Geográficas.



Digital Twins of the Earth

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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 aim 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: GreenData4All[2] and Destination Earth[3]. 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 programme[4], 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

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Review Article | Published: 02 May 2023

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

Xin Li, Min Feng, 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

3576 Accesses | 3 Citations | 27 Altmetric | Metrics

Cornell University

arXiv > physics > arXiv:2306.11175

Physics > Physics and Society

[Submitted on 19 Jun 2023]

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

Yuhan Rao, Rob Redmon, Kirstine Dale, 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 complex 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 AI 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 that 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 of interoperability for DT4ES, trust-oriented co-development, and developing a community of practice.

Digital Twins of th Earth - in the EU Destination Earth

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

By Rosie Frost & Angela Symons

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

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

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

By Rosie Frost & Angela Symons

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

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

- Margrethe Vestager -

"The launch of the initial Destination Earth (DestinE) is a true game changer in our fight against climate change," says Margrethe Vestager, Executive Vice-President for a Europe Fit for the Digital Age. "It means that we can observe environmental challenges which can help us predict future scenarios - like we have never done before... Today, the future is literally at our fingertips."

Margrethe Vestager

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Bring digital twins back to Earth

Andrea Saltelli, Gerd Gigerenzer, Mike Hulme, Konstantinos V. Katsikopoulos, Lieke A. Melsen, Glen P. Peters, Roger Pielke Jr, Simon Robertson ... See all authors

First published: 26 August 2024 | https://doi.org/10.1002/w

The Honest Broker

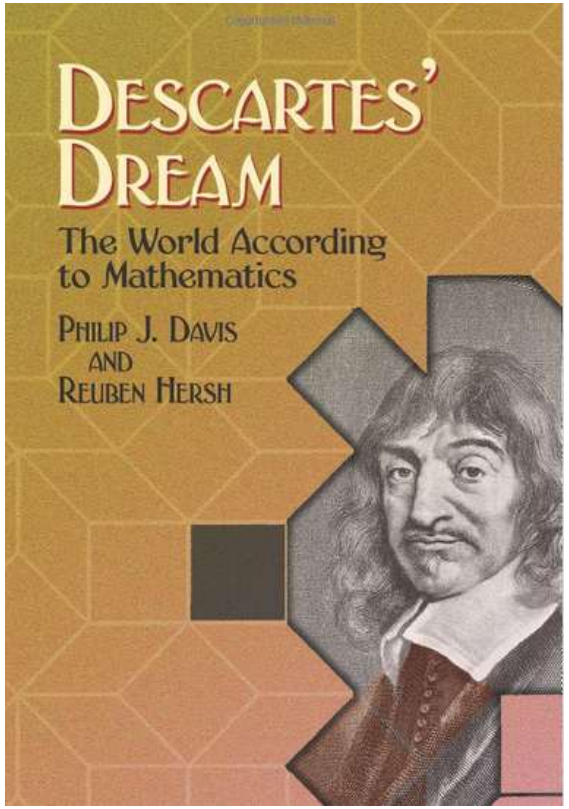
Digital Twins of the Earth: Science or Pseudoscience?

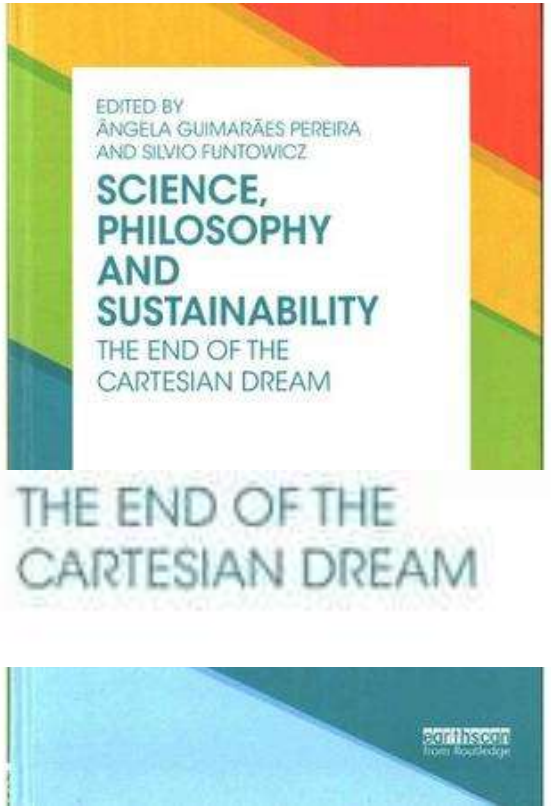
A guest post by Andrea Saltelli

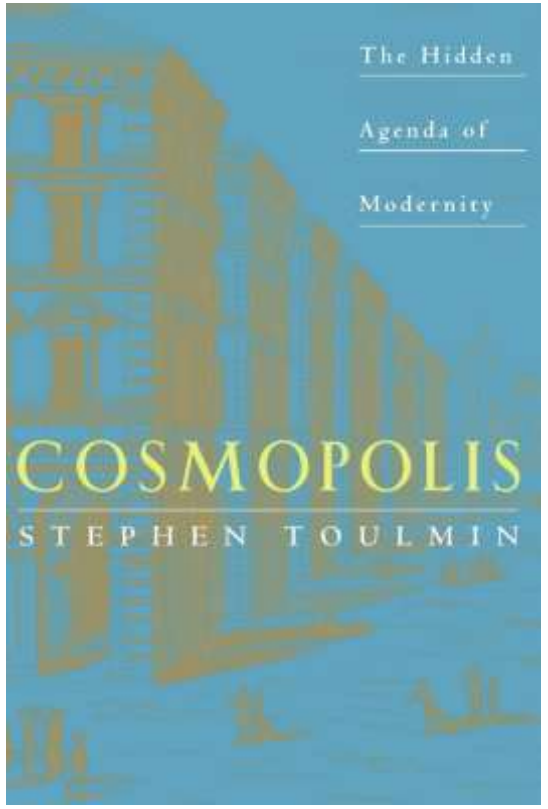
ROGER PIELKE JR.
SEP 09, 2024

Looking good!

Digital Twins: The planet as a manufact; the ultimate Cartesian Dream



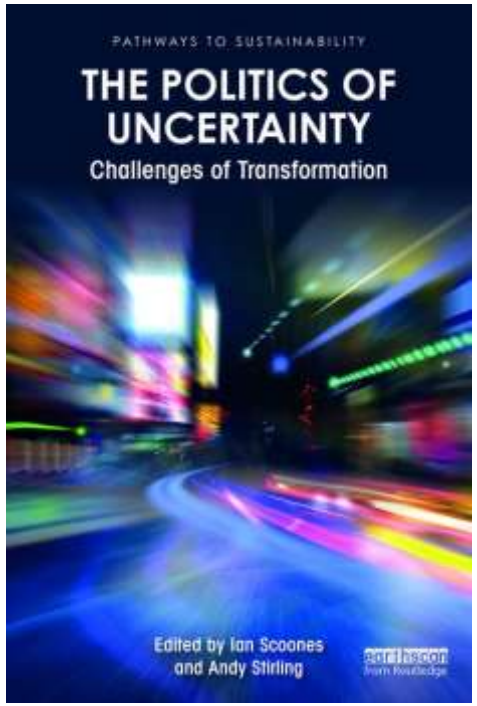




Problems with DestinE: A-la-Zuckerberg approach to introducing new technologies: first it is done, then one worries about “How to embed the ethical, legal, and social considerations in the Digital Twin of the Earth and its interface, such as privacy, equity, accessibility …”

Problems with DestinE

The EC leans toward technology as a conduit to solve policy problems ➔ European institutions are vulnerable to projects oriented to technological solutions and technological optimism

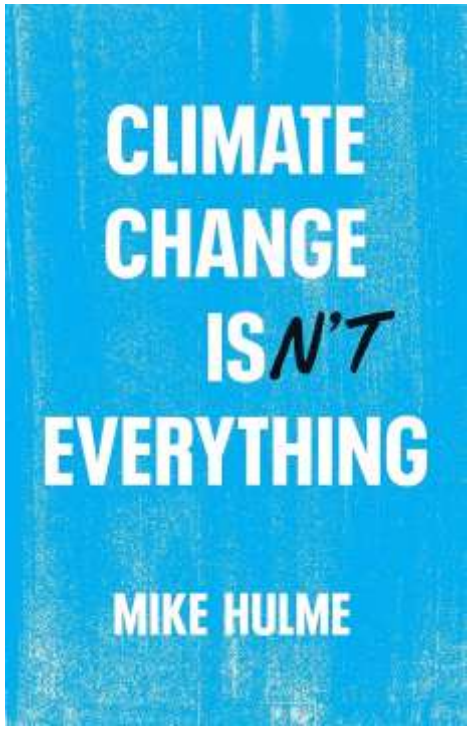


4

THE UNRAVELLING OF TECHNOCRATIC ORTHODOXY?

Contemporary knowledge politics in technology regulation

Patrick van Zwanenberg



Climate change cannot be the lens through which to look at the world's problems. The war in Syria is not a result of climate change

Rejecting climatic determinism is not a refutation of climate change but of its instrumental use

DT's are marketed as a source of 'climate intelligence' but if it is true that "Financial markets and private companies, are in an "arms race" for climate intelligence" [*], should this race be met with public funds?

Rise of the Climate Rating Agencies

Government and the private sector rely increasingly on risk-modeling firms that claim they can zero in on exposure to climate change.

BY LEE HARRIS APRIL 12, 2023

2.4k

ILLUSTRATION BY ROB DOBI

[*] L. Harris, "Rise of the Climate Rating Agencies," *The American Prospect*, Apr. 12, 2023. Accessed: Jun. 07, 2023. [Online]. Available: https://prospect.org/api/content/6015e258-d87d-11ed-bd1d-12163087a831/

"… researchers might be led by their quest for funds to promote "digital twins" of everything—DTs of biodiversity (BioDT) and of extreme events (DT-GEO) are already in progress—thus overstretching the metaphor …

…we note that societal concern with pollinator decline is attentive to phenomena of regulatory capture, seen as one of the causes of pesticide-friendly legislation" (not in BioDT)

WIREs CLIMATE CHANGE RMetS

Perspective | Open Access

Bring digital twins back to Earth

Andrea Saltelli, Gerd Gigerenzer, Mike Hulme, Konstantinos V. Katsikopoulos, Lieke A. Melsen, Glen P. Peters, Roger Pielke Jr, Simon Robertson … See all authors

First published: 26 August 2024 | https://doi.org/10.1002/wcc.915

Edited by Matthias Heymann, Domain Editor and Maria Carmen Lemos, Editor-in-Chief

Pollinator conservation requires a stronger and broader application of the precautionary principle ☆

Laura Drivdal [1], Jeroen P van der Sluijs [1 2] ✉

Science, the endless frontier of regulatory capture

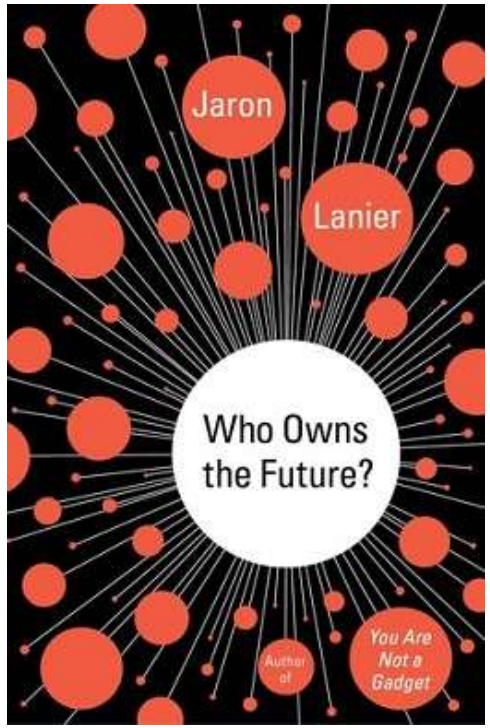
Andrea Saltelli [a] ✉, Dorothy J. Dankel [b c], Monica Di Fiore [d], Nina Holland [e], Martin Pigeon [e]

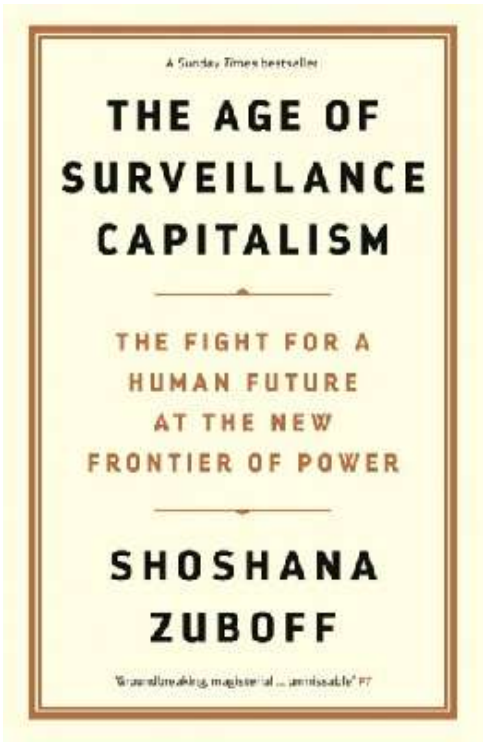
Destination Earth's nature-based metaphors: "Digital ecosystems", "evolutionary development", "data lakes" and "digital species" … and yet we will need AI to read the output of Digital Twins (Bauer et al, 2024)

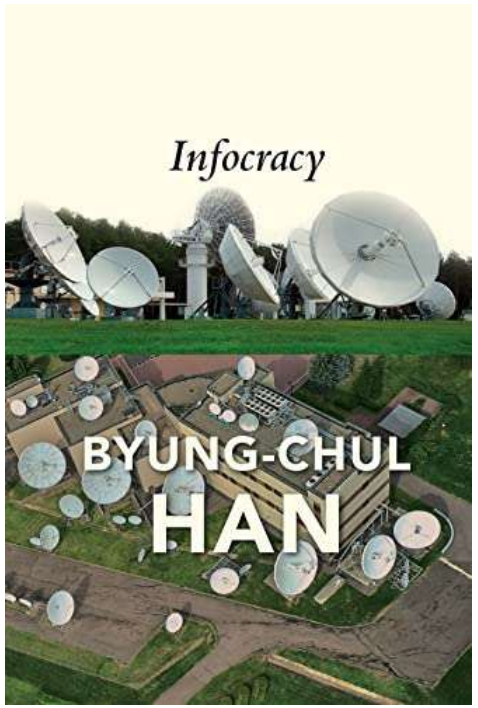
Bauer, Peter, Torsten Hoefler, Bjorn Stevens, and Wilco Hazeleger. 2024. 'Digital Twins of Earth and the Computing Challenge of Human Interaction'. Nature Computational Science 4 (3): 154–57. https://doi.org/10.1038/s43588-024-00599-3.

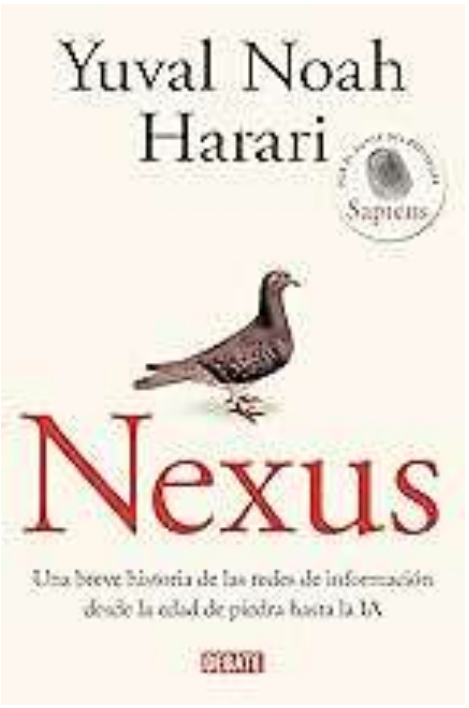
Problems with DestinE

The epistemic community around DestinE unexposed to the concerns about the digitalization of the real









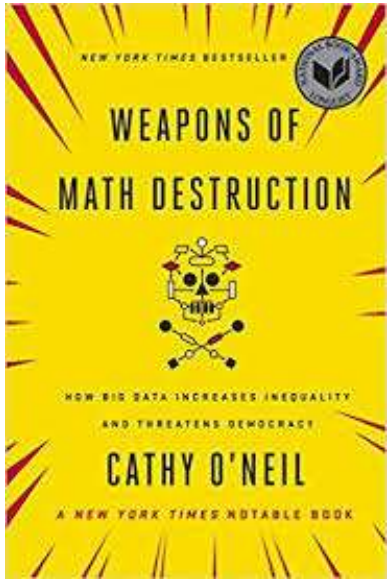
Harari quoque 😮

...

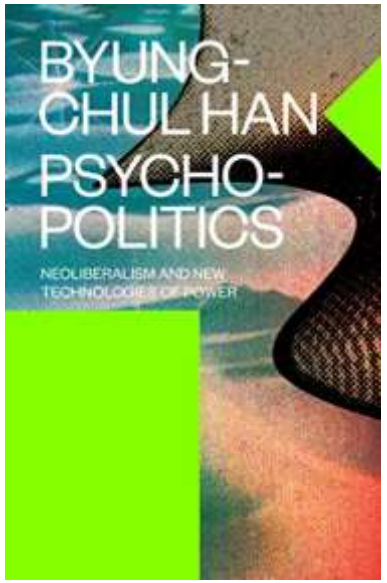
Powered by algorithms, governance by (visible and invisible) numbers contributes to a loss of democratic agency (a-democracy for Salais, fascism for Mc Quillan, refeudalization for Supiot…)

2015
(jurist)

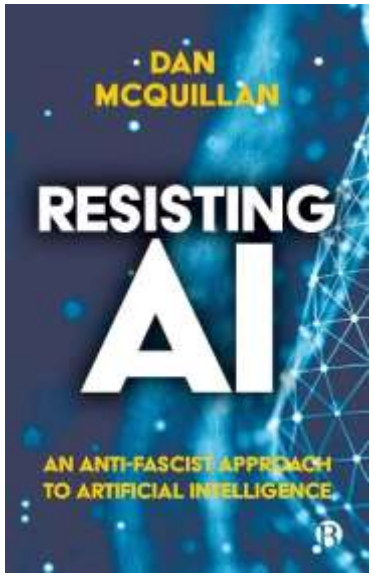
2016
(data scientist)



2017
(philosopher)



2022
(physicist/sociologist)



The New York Review of Books

The Coming Tech Autocracy

Sue Halpern
November 7, 2024 issue

A functional government, committed to safeguarding its citizens, might be keen to create a regulatory agency for AI or pass comprehensive legislation, but we in the United States do not have such a government.

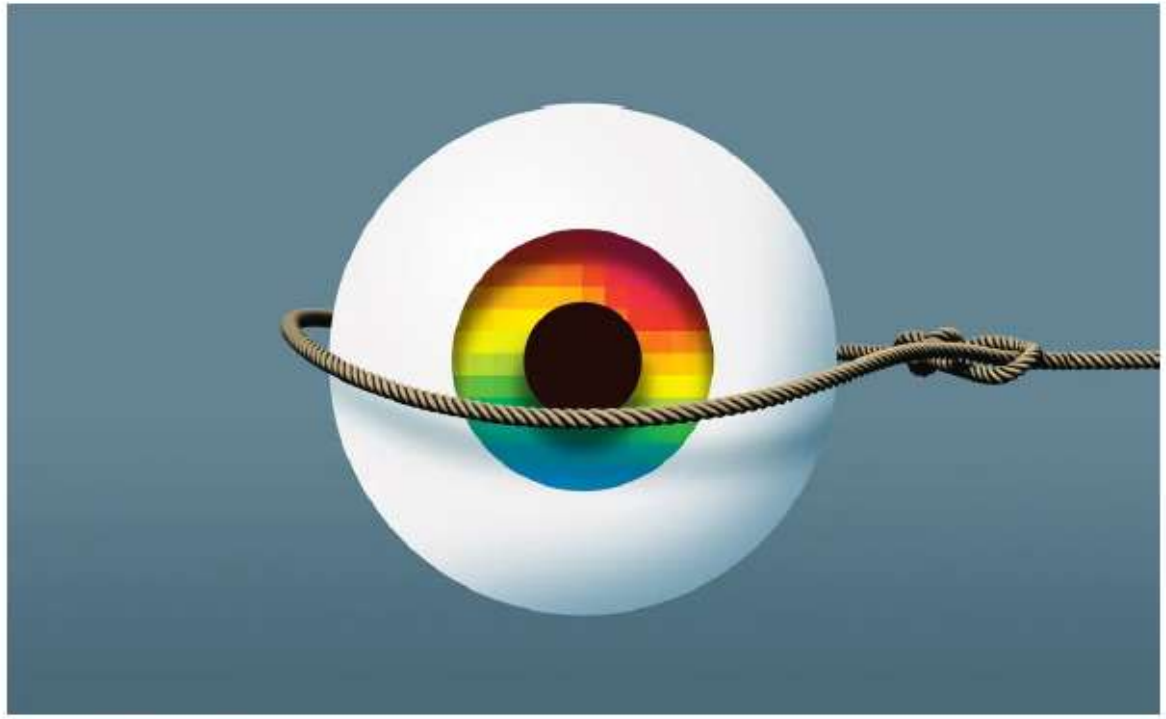


Illustration by Matt Dorfman

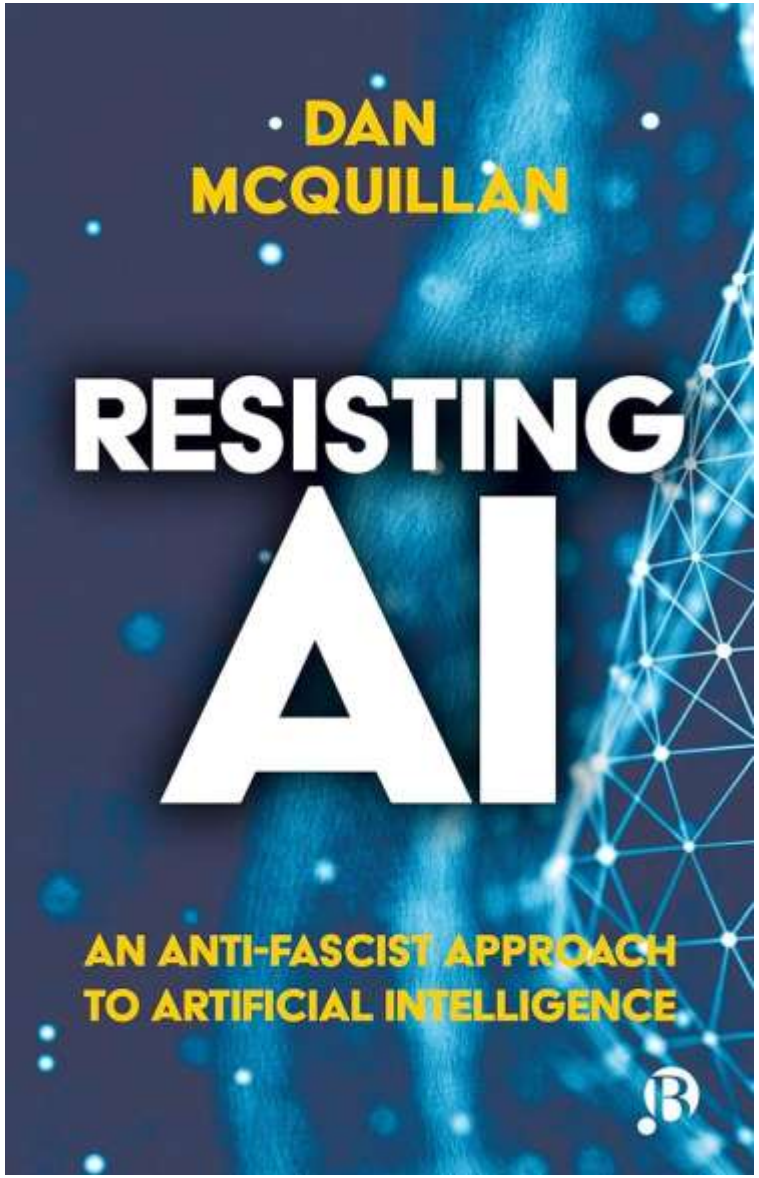
One new book on this topic every second day

AI Needs You: How We Can Change AI's Future and Save Our Own
by Verity Harding

Taming Silicon Valley: How We Can Ensure That AI Works for Us
by Gary Marcus

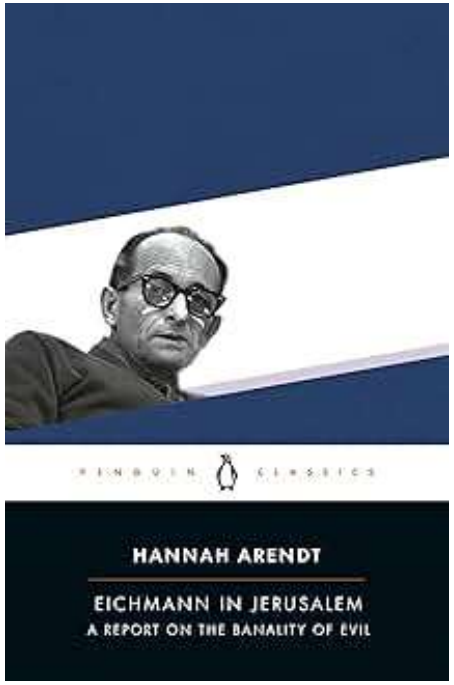
The Mind's Mirror: Risk and Reward in the Age of AI
by Daniela Rus and Gregory Mone

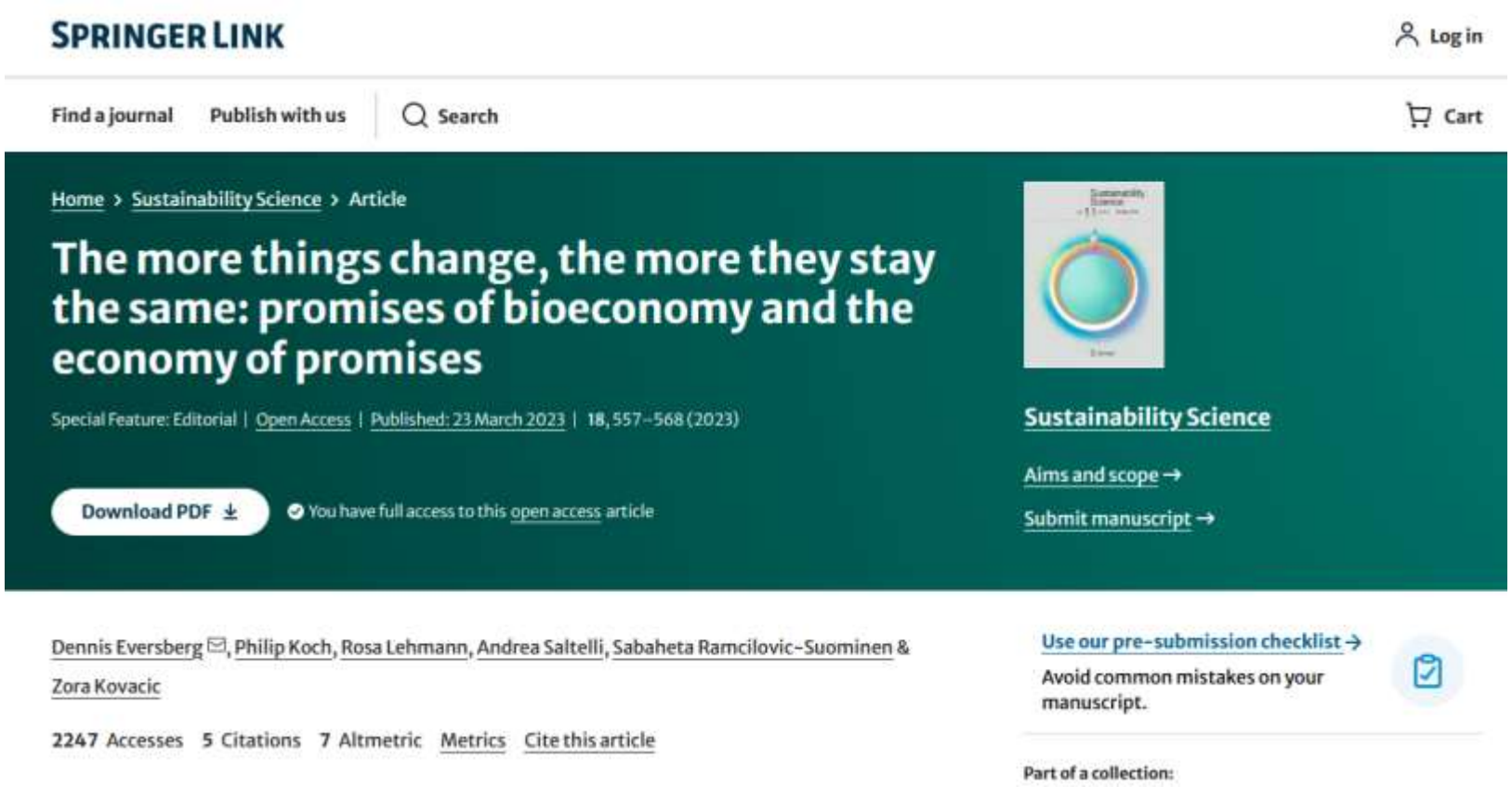
Code Dependent: Living in the Shadow of AI
by Madhumita Murgia



AI may as a continuation and reinforcement of bureaucratic forms of discrimination and violence, ultimately fostering authoritarian outcomes; an ‘impersonal Eichmann’

AI's promise of objective calculability is antithetical to an egalitarian and just society





More critical work

Debunking promises of circular economy, energy transitions, …

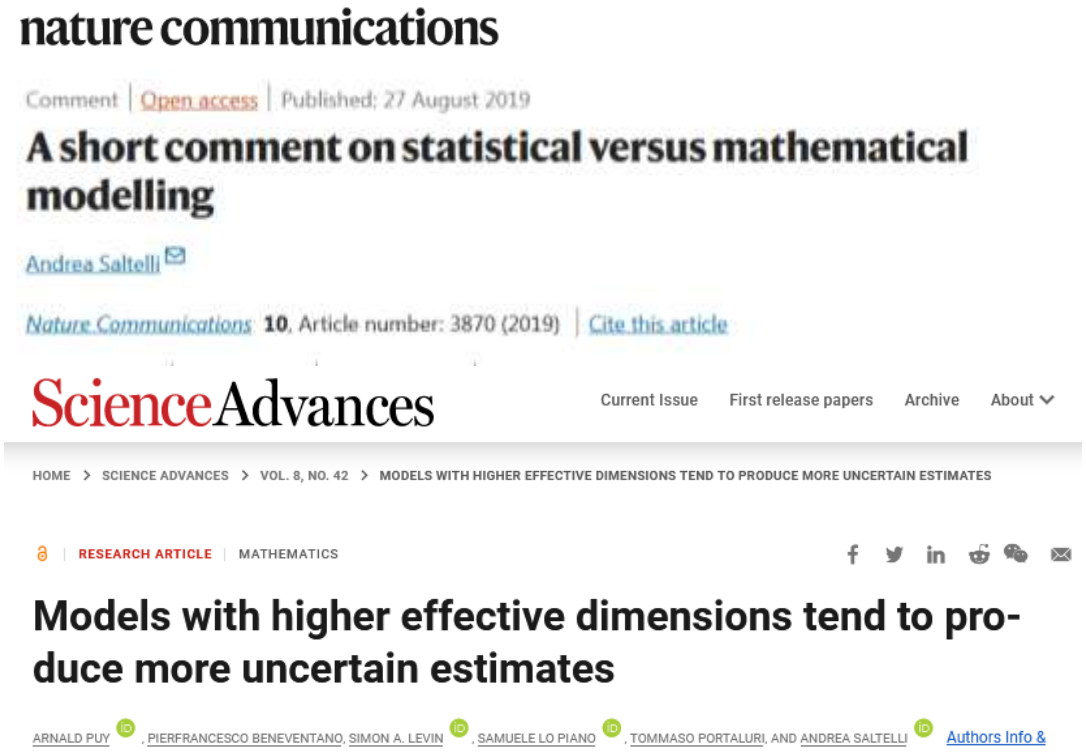
Models for techno-promises

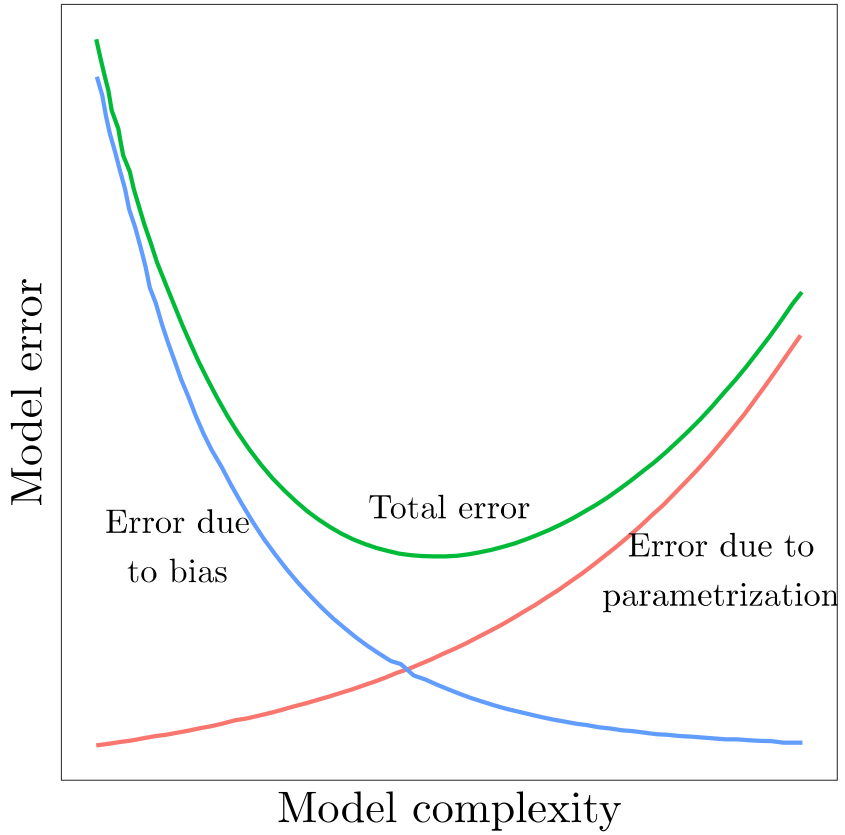
Economics of Techno-scientific Promises' (ETP)= The promise of 'transformation without transformation'

Consequences descending from state of exception

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.





O'Neill, R. V. 1971. 'Error Analysis of Ecological Models'. In Radionuclides in Ecosystems, Proceedings of the Third National Symposium in Radioecology, edited by D. J. Nelson, 898–907. Oak Ridge - Tenn.

Turner, Monica G., and Robert H. Gardner. 2015. 'Introduction to Models'. In Landscape Ecology in Theory and Practice, 63–95. New York, NY: Springer New York.

Consequences descending from state of exception

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

Chalmers, Iain, and Paul Glasziou. 2009. 'Avoidable Waste in the Production and Reporting of Research Evidence'. The Lancet 374 (9683): 86–89.

Pfleiderer, Paul. 2020. 'Chameleons: The Misuse of Theoretical Models in Finance and Economics'. Economica 87 (345): 81–107.

Stirling, Andy. 2023. 'Against Misleading Technocratic Precision in Research Evaluation and Wider Policy – A Response to Franzoni and Stephan (2023), "Uncertainty and Risk-Taking in Science"'. Research Policy 52 (3): 104709.

van Beek, Lisette, Jeroen Oomen, Maarten Hajer, Peter Pelzer, and Detlef van Vuuren. 2022. 'Navigating the Political: An Analysis of Political Calibration of Integrated Assessment Modelling in Light of the 1.5 °C Goal'. Environmental Science & Policy 133 (July):193–202.

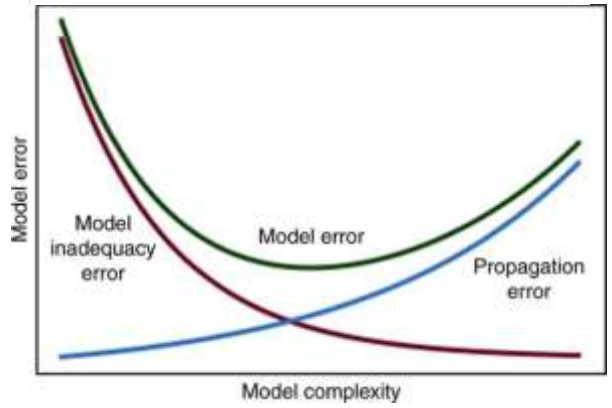
Solutions to resolve the state of exception

Modelling of the modelling process (Sensitivity analysis, sensitivity auditing for de- and re-construction, on the example of statactivism)

➔ retrace what was assumed

➔ check the level of complexity

…



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

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

Science

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: adopt more lenses

Environmental Science and Policy 142 (2023) 99–111

Contents lists available at ScienceDirect

Environmental Science and Policy

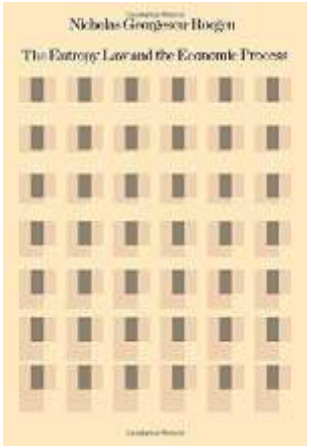
journal homepage: www.elsevier.com/locate/envsci

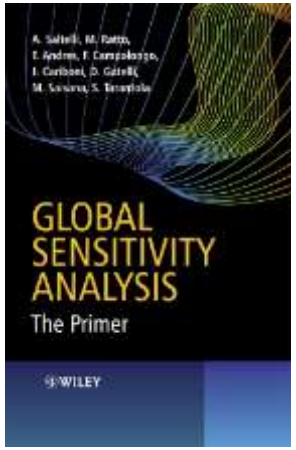
Impact assessment culture in the European Union. Time for something new?

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

Proposed lenses

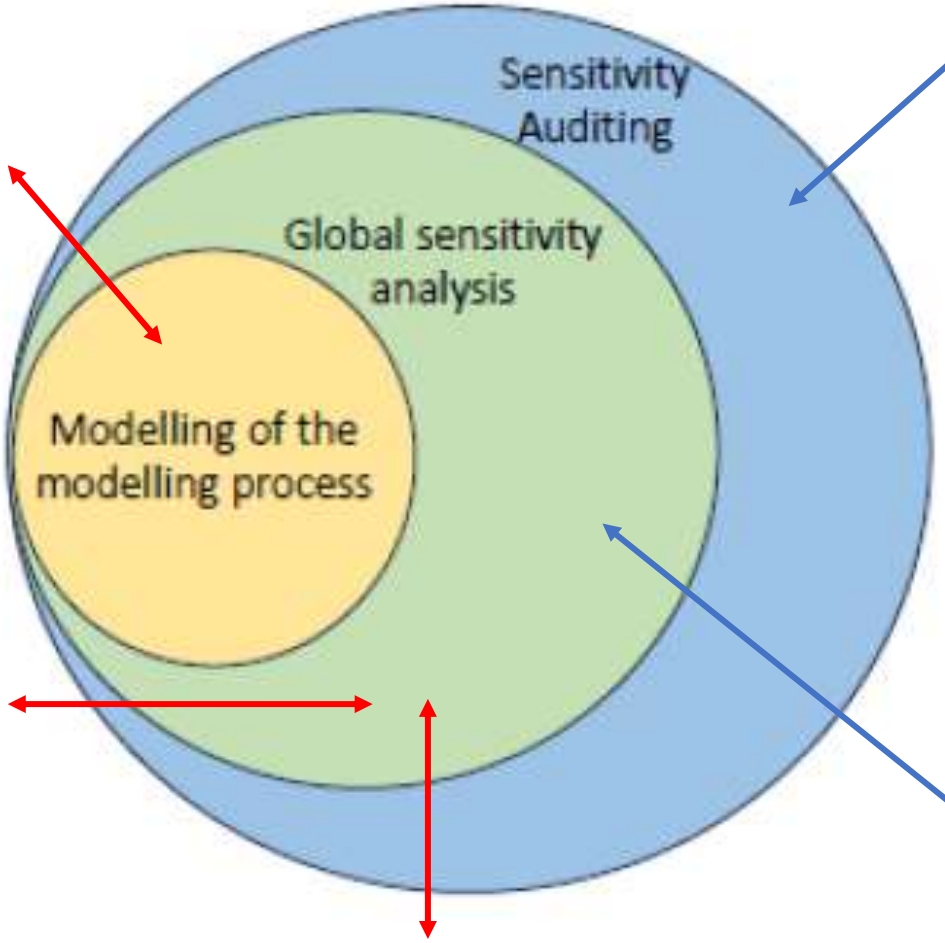
- Non-Ricardian economics
- Bioeconomics (in the sense of Nicholas Georgescu-Roegen)
- Approaches originated in the context of post-normal science
  - global uncertainty and sensitivity analysis
  - sensitivity auditing
  - NUSAP
  - quantitative storytelling





Normative quality

Multiverse analysis



Perturbed Physics Ensemble

Technical Quality

Exploratory modelling analysis (EMA)

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?

Journal of Evaluation in Clinical Practice
International Journal of Public Health Policy and Health Services Research

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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

Conclusions

Home › Policy Sciences › Article

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

Published: September 1984

Volume 17, pages 277–320, (1984) Cite this article

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

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

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

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

See a summary here

Risk Analysis
AN INTERNATIONAL JOURNAL
An Official Publication of the Society for Risk Analysis

PERSPECTIVE | Open Access

Unpacking the modeling process for energy policy making

Samuele Lo Piano, Máté János Lőrincz, Arnald Puy, Steve Pye, Andrea Saltelli, Stefán Thor Smith, Jeroen van der Sluijs

First published: 14 November 2023 | https://doi.org/10.1111/risa.14248

END

upf. BARCELONA SCHOOL OF MANAGEMENT

UNIVERSITAS BERGENSIS

Could climate intelligence backfire? Consider the effects of mortgage securitization on the the last housing bubble recession started in 2007

THE BREAKTHROUGH INSTITUTE

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Performing Climate Risks to Financial Stability

Are climate change models the source of our next financial crisis?

MAY 17, 2024 PRINT SHARE

As the dust of the global financial crisis of 2007—08 settled, many of those looking for someone to blame for the economic disaster zeroed in on something called the Gaussian copula model, a family of mathematical functions used to estimate the probability distribution of investment losses. In a lament on Wired, for example, the journalist Felix Salmon wrote that the model had become "so deeply entrenched—and was making people so much money—that warnings about

Jessica Weinkle

Why models live in a state of exception

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

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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.

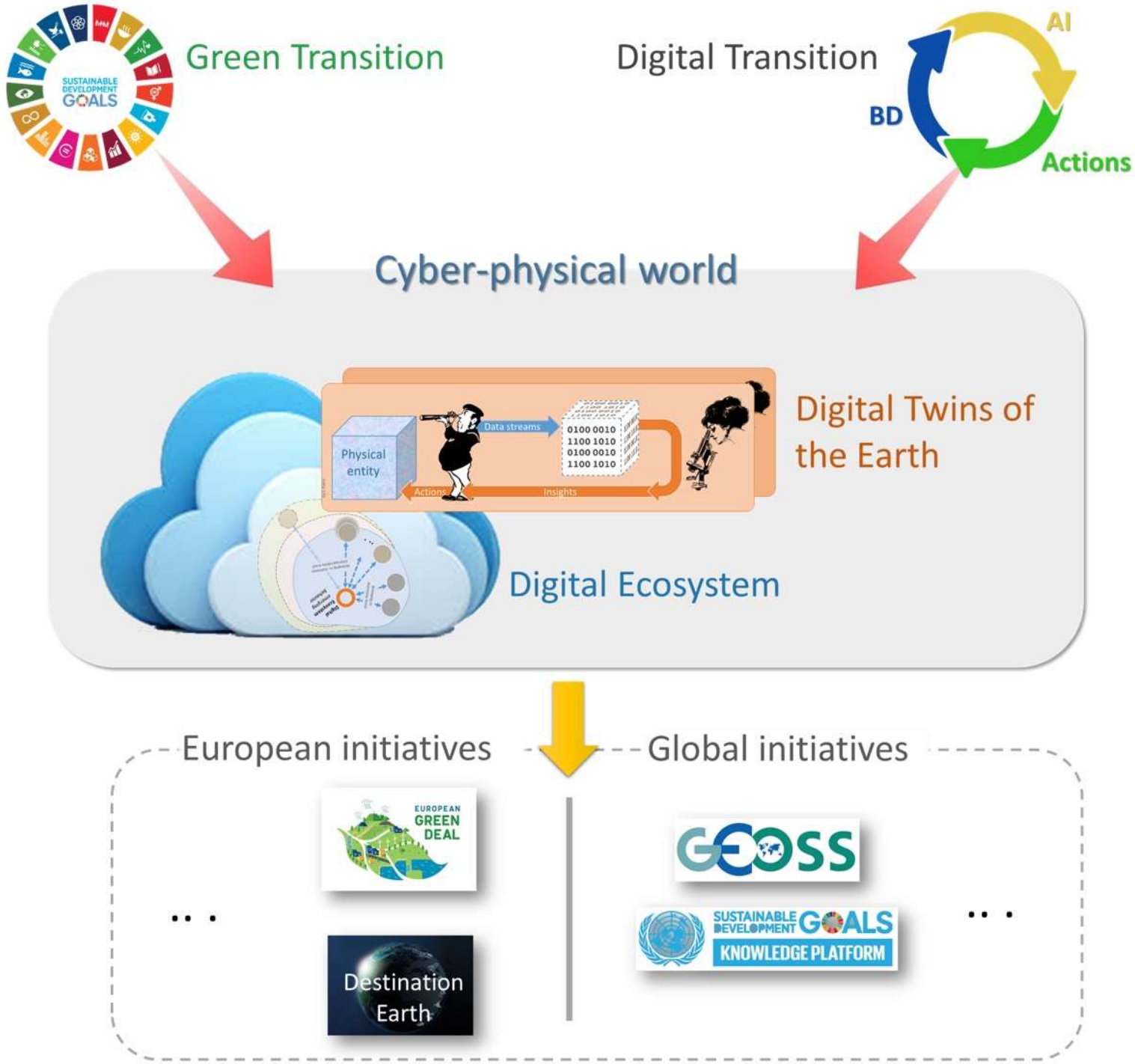
Dont't forget 2013 EC's Human Brain Project

"the European Commission awarded ... a staggering 1 billion euro grant ... the people I contacted struggled to name a major contribution that the HBP has made in the past decade" (Yong, 2019)

DT's assumes that climate change needs more evidence to promote political agency, and that said evidence comes in the form of DT's

[...] with the advent of the Digital Transformation, the interconnection between the physical and the digital world has become almost complete: economic, industrial, and social relationships have been moved to the "cyber-physical" world …

Source: S. Nativi, P. Mazzetti, and M. Craglia, 'Digital Ecosystems for Developing Digital Twins of the Earth: The Destination Earth Case', Remote Sensing, vol. 13, no. 11, Art. no. 11, Jan. 2021, doi: 10.3390/rs13112119



➔Avoid “quantifying at all costs”, expose ‘funny numbers’

Culture Unbound
Journal of Current Cultural Research

Funny Numbers

By Theodore M. Porter

Journal of Evaluation in Clinical Practice
International Journal of Public Health Policy and Health Services Research

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COMMENTARY | Open Access

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

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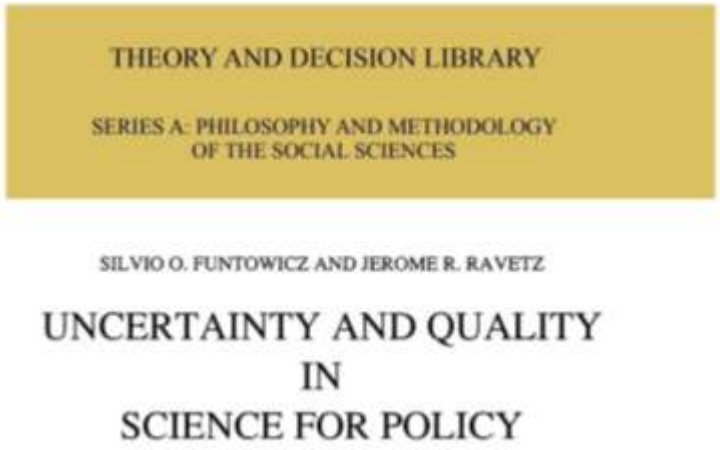
"COVID-19 policies allocated sacrifice, privation and suffering across all walks of society [but] radically different responses from nation to nation—from draconian lockdowns, to relatively permissive and flexible pandemic regimes—made obvious to all that the value of scientific evidence was to support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

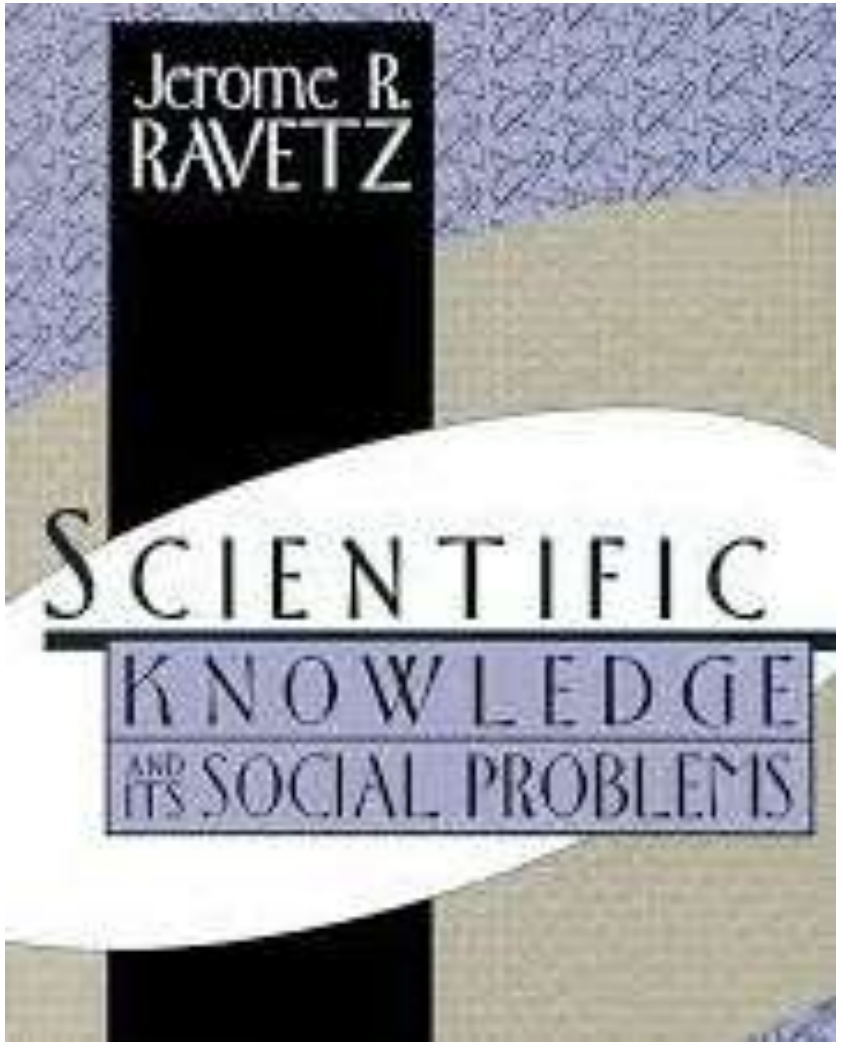
Mostly provided by models

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.





Problems with DestinE

The engagement of social science and humanities that gets accepted in journals seems to be of a confirmatory nature – to help the actors of DestinE to receive societal consensus

For example:
Purportedly this is a critique but … a rather sedated one

communications earth & environment

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Digital twins of the Earth with and for humans

W. Hazeleger, J. P. M. Aerts, P. Bauer, M. F. P. Bierkens, G. Camps-Valls, M. M. Dekker, F. J. Doblas-Reyes, V. Eyring, C. Finkenauer, A. Grundner, S. Hachinger, D. M. Hall, T. Hartmann, F. Iglesias-Suarez, M. Janssens, E. R. Jones, T. Kölling, M. Lees, S. Lhermitte, R. V. van Nieuwpoort, A.-K. Pahker, O. J. Pellicer-Valero, F. P. Pijpers, A. Siibak, … F. C. Vossepoel + Show authors

Communications Earth & Environment **5**, Article number: 463 (2024) | Cite this article

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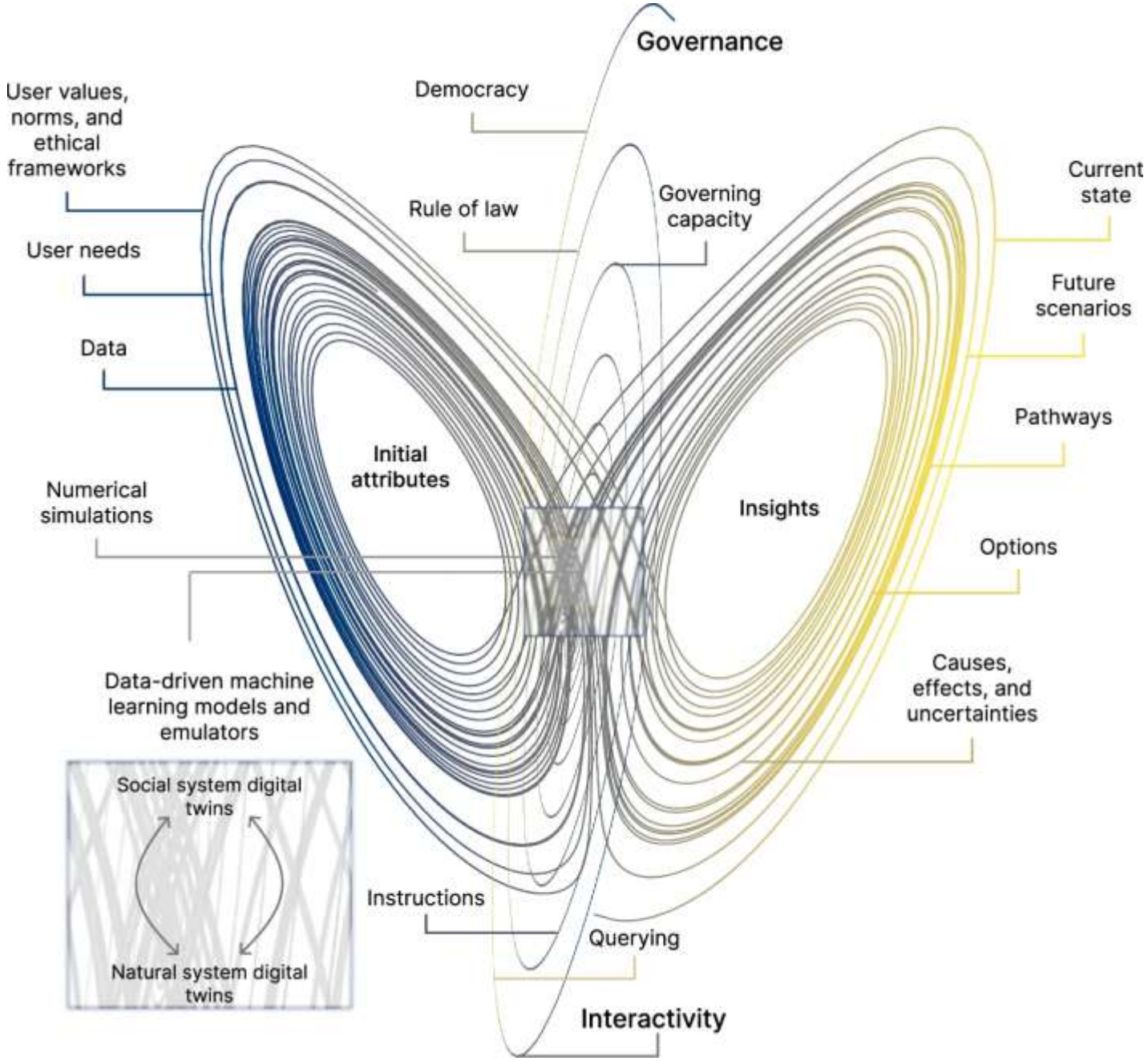

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"Incorporating human interactions in digital twins of the Earth represents a transformative frontier, promising unparalleled insights into Earth system dynamics and empower humans for action."

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

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

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