THE SISYPHEAN QUEST FOR SCIENTIFIC CERTAINTY- A REVIEW OF "PROOF: THE UNCERTAIN SCIENCE OF CERTAINTY" BY ADAM KUCHARSKI. PROFILE BOOKS, 2025, 368 PP., ISBN: 978-1788169080

By: Sorin M.S. Krammer (*University of Southampton Business School*, UK, Email: s.krammer@soton.ac.uk)

Adam Kucharski's latest book (*Proof: The Uncertain Science of Certainty*) offers an expansive, investigative exploration of the scaffolding of certainty in science, from geometry and jurisprudence to randomized trials and neural networks. Across eight sections, the book examines how humans seek and find truth, often conflating confidence with correctness in the process. This conflation, in turn, seems to undermine science's reputation in tackling some of the world's most pressing problems. In an era grappling with algorithmic bias, scientific misinformation, and post-pandemic epistemic aftershocks, *Proof*'s objective is to critically dissect and examine the scaffolding of scientific research rather than reassure us of its superiority.

Kucharski, an epidemiologist at the London School of Hygiene and Tropical Medicine who gained prominence during the COVID-19 pandemic, argues that our methods of establishing truth are as fallible as the institutions wielding them. His thesis cuts against the grain of both scientific triumphalism *(1)* and postmodern relativism *(2)* by suggesting that the tools we've built to pursue certainty—logic, statistics, experimentation, and artificial intelligence—systematically embed the very biases and constraints they originally sought to transcend.

The book opens with an evocative story of the 2010 Icelandic volcanic eruption and the conflicting demands for "proof" from governments and airlines. This serves as an apt metaphor for the book's broader motif: in today's world, proof is often not a static, well-defined ideal, but rather a socio-political negotiation between stakeholders with different incentives. Through vivid case studies like the Monty Hall problem, Gödel's incompleteness theorems, and Lincoln's geometric reasoning for political arguments, Kucharski demonstrates that even mathematics, often seen as the bastion of certainty, harbours philosophical fault lines.

Kucharski discusses several particularly timely themes in the book. First, he problematizes the increasing reliance on automated inference, from risk algorithms in criminal justice to black-box AI models in healthcare and science. These systems, he argues, embed existing societal biases under a veneer of objectivity. Fairness, as he puts it, is often

mathematically incompatible: an algorithm calibrated equally across racial groups may still yield disproportionate outcomes when structural inequalities persist. Thus, while Kucharski is sympathetic to algorithmic advances, he warns of their seductive opacity. Nevertheless, defenders of this approach may contend that algorithmic systems, when paired with careful auditing and transparent objectives, can outperform human judgment in both consistency and scale. Moreover, the standards Kucharski demands, e.g., near-perfect calibration or complex ethical constraints, are virtually unattainable in current human-centric systems as well. Therefore, critics may see these current deficiencies as part of a transitional learning curve rather than grounds for permanently dismissing algorithmic systems *(3)*.

A second major thread is the fragility of public trust in scientific evidence, particularly in the wake of COVID-19. Here, the book becomes strikingly personal as Kucharski revisits early pandemic communication failures, including his own hesitancy to cite internal death toll projections before they were public. Despite superior models and data, scientific persuasion faltered during the pandemic not due to lack of information, but because truth had become politically fractured. Subsequently, Kucharski contends that transparent and timely evidence is no longer enough; proof must engage with the cognitive and social lenses people employ to arrive at belief. This insight is powerful but perhaps underdeveloped in terms of institutional critique. Kucharski diagnoses the well-known academic communication failures of science (i.e., the ivory tower syndrome) but offers less on how to tackle them successfully, particularly in the current environment characterized by media sensationalism, political polarization, and increasing international competition that amplifies them (*4,5*). For policy and practical readership, the book might invite a more prescriptive approach on how to rethink and restructure the scientific pipeline from data to public trust.

Finally, the book's most valuable insight is its treatment of epistemic humility. Through recurring examples—from Janet Lane-Claypon's breast-feeding trials to the AlphaFold protein predictions—Kucharski illustrates that actionable certainty rarely comes with absolute proof. Instead, good science accepts uncertainty, triangulates methods, and builds slowly from provisional belief. He draws an elegant contrast between "proof beyond reasonable doubt" and "proof beyond delay," urging action without the paralyzing demand for perfection (*6*). In turn, a contrary view might suggest that some of today's science communication failures stem not from excessive certainty but from excessive caveating. For instance, in the case of vaccine advocacy or climate change, overly cautious hedging coupled with social media's impact as an information source has sometimes allowed denialism to flourish unchallenged. This suggests

that, besides epistemic responsibility and humility, more interventionist approaches may be needed for high-stakes decisions.

Kucharski concludes with a call to embrace methodological pluralism and to acknowledge that proof is a social, dynamic, and often contested act. Rather than searching for single, irrefutable arguments, *Proof* advocates for triangulation: the use of independent, sometimes imperfect methods to converge on truth. This insight, i.e., strategic redundancy in an age of noisy complexity, could be the book's most enduring contribution.

Proof arrives at a moment when faith in expertise faces unprecedented strain worldwide. Can science maintain authority while acknowledging its limitations? Should algorithms be trusted more than human judgment, or does their opacity make them more dangerous? Kucharski's answer is characteristically nuanced: proof is not a static achievement but a dynamic, social process of negotiation, and one that requires both intellectual rigor and social awareness to navigate our fractured epistemic landscape.

References and Notes

1. J.D. Trout, *Wondrous truths: The improbable triumph of modern science* (Oxford University Press, 2016).
2. G. Andrade, Standing up for science against postmodernism and relativism. *Philosophia: International Journal of Philosophy* **20**, 197-211 (2019).
3. F. Mohr, J. N. van Rijn, Learning curves for decision making in supervised machine learning: a survey. *Machine Learning* **113**, 8371-8425 (2024).
4. B. Huber, M. Barnidge, H. Gil de Zúñiga, J. Liu, Fostering public trust in science: The role of social media. *Public Understanding of Science* **28**, 759-777 (2019).
5. V. Cologna, N. G. Mede, S. Berger, J. Besley, C. Brick, M. Joubert, J. Metag, Trust in scientists and their role in society across 68 countries. *Nature Human Behaviour*, 1-18 (2025).
6. R. Hoekstra, S. Vazire, Aspiring to greater intellectual humility in science. *Nature Human Behaviour* **5**, 1602-1607 (2021).