

Entanglements in World Politics

The Power of Uncertainty

CAMBRIDGE STUDIES IN INTERNATIONAL RELATIONS

Peter J. Katzenstein



Entanglements in World Politics

In this seminal study, Peter J. Katzenstein drags the analysis of world politics from the Newtonian humanism and para-humanism of the nineteenth century into a new post-Newtonianism of the twenty-first. The key concept is entanglement. By examining differences in context, process, and language, Katzenstein specifies how risk and uncertainty intertwine. Three deeply researched case studies – finance and political economy, nuclear crisis politics and war, and global warming and AI – support his original arguments. A chapter on power further illustrates the risk-uncertainty conundrum. *Entanglements in World Politics* calls for humility and eclectic pragmatism, emphasizing the unity of knowledge of the natural and humanistic sciences and the complementarities of science and religion. Katzenstein's engaging writing and innovative approach make this a must-read for anyone interested in the complexities of global politics. This book is also available as Open Access on Cambridge Core.

Peter J. Katzenstein is the Walter S. Carpenter, Jr. Professor of International Studies at Cornell University. His work addresses issues of political economy, security, and culture in world politics. In 2020 he was named the 26th recipient of the Johan Skytte Prize. He is the author, co-author, editor, and co-editor of more than forty books, edited volumes, or monographs and over 100 articles or book chapters. Recent books include *Uncertainty and Its Discontents: Worldviews in World Politics* (2022), *Downfall: The End of the American Order* (co-edited with Jonathan Kirshner, 2022), and *Protean Power: Exploring the Uncertain and Unexpected in World Politics* (co-edited with the late Lucia Seybert, 2018). Katzenstein served as President of the American Political Science Association from 2008 to 2009, was elected to the American Academy of Arts and Science in 1987, the American Philosophical Society in 2009, and the British Academy in 2015. He holds six honorary degrees.

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“International Relations has found its Tolstoy! The hard problem of uncertainty in world politics has found its match. Dancing nimbly on the cutting edge of the sciences and humanities, jumping deftly from the subatomic to the geopolitical, Katzenstein constructs a protean world view for navigating the political, financial and environmental uncertainties and risks of the twenty-first century. He does so with a humility and humour uncommon in academic treatises. If you are looking for a ray of hope in a time of dark fears and creeping nihilism, read this wickedly smart book.”

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“This important book about ubiquitous uncertainty and interpretation of risk in international relations demonstrates that Katzenstein remains among the most creative and erudite scholars in political science. Who else can illuminate current and historical crises in political economy, security studies, and climate change with equal depth and insight? This plea for empathy for others and humility about ourselves should be widely read and debated.”

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“Katzenstein’s highly readable tour de force calls out the overwhelming tendency of social scientists to conflate calculable risk and incalculable uncertainty. Invoking Tolstoy’s warning against the false lure of ‘an imaginary knowledge of the perfect truth’, his penetrating insights on theories and myths of political economy are essential to understanding the crises of our times. He calls for a philosophically self-aware pragmatism treating theories as stories in a distinctive merger of science and humanistic thought.”

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“Katzenstein is political science’s great re-framer of problems. He once turned a world of empire into a world of regions. Now he turns worlds of risk and uncertainty into worlds of mutual entanglement where the certain and the unexpected uneasily cohabit. Rather than treat worlds of finance and security as separate and fully knowable, Katzenstein shows us how they mutually imbricate, reinforcing and fracturing as they move forward.

Keynes sought to show us how the once general theory of competitive equilibrium was but a special case of a more general class of possible states of the world where calculability and risk were but fleeting companions. Taking up Keynes’ concern with the structuring role of conventions in a world that is both risky and uncertain, Katzenstein rethinks what power is and how it is exercised in such a fleeting world.”

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“Katzenstein contrasts risk – where probabilities can be calculated – with uncertainty, where such calculations are impossible. For issue after issue, he shows that uncertainty is pervasive: worldviews and theories that deny or overlook ‘the risk-uncertainty conundrum’ fail. Erudite and challenging, *Entanglements in World Politics* will profoundly affect its readers’ worldviews.”

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“Whereas uncertainty is an enduring condition of world politics, Katzenstein’s book is groundbreaking for embracing it, contra the social scientific impulse to mitigate or control it. As he reminds us, ‘there is no simple ... path through the complexities of contemporary crisis.’ By creating conceptual space for a social science that accounts for *both* (knowable) risk and (unknowable) uncertainty, this book provides not a compass, but a pragmatic and sagacious guide.”

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The Power of Uncertainty

Peter J. Katzenstein

Cornell University, New York



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Shaftesbury Road, Cambridge CB2 8EA, United Kingdom

One Liberty Plaza, 20th Floor, New York, NY 10006, USA

477 Williamstown Road, Port Melbourne, VIC 3207, Australia

314–321, 3rd Floor, Plot 3, Splendor Forum, Jasola District Centre,
New Delhi – 110025, India

103 Penang Road, #05–06/07, Visioncrest Commercial, Singapore 238467

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a department of the University of Cambridge.

We share the University's mission to contribute to society through the pursuit of
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www.cambridge.org

Information on this title: www.cambridge.org/9781009675802

DOI: [10.1017/9781009675819](https://doi.org/10.1017/9781009675819)

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When citing this work, please include a reference to the
DOI [10.1017/9781009675819](https://doi.org/10.1017/9781009675819)

First published 2026

A catalogue record for this publication is available from the British Library

*A Cataloging-in-Publication data record for this book is available from
the Library of Congress*

ISBN 978-1-009-67580-2 Hardback

ISBN 978-1-009-67577-2 Paperback

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Contents

<i>List of Figures</i>	<i>page ix</i>
<i>List of Tables</i>	<i>x</i>
<i>Preface</i>	<i>xi</i>
Introduction: “An Imaginary Knowledge of the Perfect Truth” Meets the Risk-Uncertainty Conundrum	1
1. Why This Book? (5). 2. The Risk-Uncertainty Conundrum (13). 3. Newtonianism and Humanism as Sweet Common Sense (21)	
1 Worldviews and Small and Large Worlds	31
1. Dilthey and Weber (32). 2. Worldviews (42). 3. Objective and Subjective Probabilities in Small and Large Worlds (48). 4. Conclusion (60)	
2 Small and Large Worlds, Post-Newtonianism and Para-Humanism	63
1. From Small to Large Worlds: Context, Process, Language (64). 2. Post-Newtonianism (78). 3. Para-Humanism (89). 4. Conclusion (100)	
3 Theories, Models, and Methods	103
1. The Narrative Turn (105). 2. Theories and Models as Stories (108). 3. Methods: Experiments and Experimentation (115). 4. Simplicity, Complexity, and the Risk-Uncertainty Conundrum (126)	
4 Risk and Uncertainty in Finance	133
1. Risk and Rationalism (137). 2. Uncertainty and Convention (145). 3. The Hybrid World of Risk and Uncertainty (156). 4. Central Bankers Talking to Markets (161). 5. Extensions and Reflections (167)	
5 The Missiles of 1962	175
1. October Crisis.1: Brinkmanship, Emotions, and Fear in a Small World (178). 2. October Crisis.2: Organizational Malfunctioning (188). 3. October Crisis.3: Post-Newtonianism and Nuclear Politics (193). 4. Jargon Anesthetizing Awful Possibilities: Language and the October Crisis (202). 5. The Bargaining Model of War (208). 6. The Fragility of a Crazy Politics (214)	

6	Global Warming and Artificial Intelligence	222
	1. The Small World of Climate Change: Geoengineering (229). 2. The Large World of the Biosphere: Anthropocene and Time (246). 3. Technosphere, Consciousness, and Language in the Era of AI (255). 4. Conclusion (269)	
7	Control and Protean Power in Small and Large Worlds	272
	1. Control and Protean Power (275). 2. Power in Small and Large Worlds: Ten Case Studies (287). 3. Language and Power (296). 4. Protean Power and <i>Fortuna</i> (304)	
	Conclusion: Re-sizing Worlds	309
	1. Recapitulation (311). 2. Arts and Sciences: The Unity of Knowledge (317). 3. Eclecticism and Experimentalism (329). 4. Peering into the Future (333). 5. Moral Luck, Policy, and Pragmatism (340). 6. Uncertainty in Religion and Science (350)	
	<i>References</i>	358
	<i>Index</i>	447

Figures

1.1 N-grams: Worldview, Model, Theory Updated from Figure 1.1 in Katzenstein 2022a: 7	<i>page</i> 44
2.1 Context, Process, and Language in Small and Large Worlds	65
7.1 Context, Experience, and Power Adapted from Figure 1.1 in Seybert and Katzenstein 2018: 13	285

Tables

7.1 Control and Protean Power Reproduced Table 1.1 in Seybert and Katzenstein 2018: 10	<i>page</i> 276
7.2 Control and Protean Power in Selected Issue Areas Adapted from Table 1 in Katzenstein 2020: 483–84	293

Preface

In separating me from others, the pandemic taught me the importance of entanglement. Enticed to read more broadly in solitude, I learned about nature as an “entangled bank” of webs of affinities.¹ For entomologist Rick Karban, research about plant awareness and experience has not presented radically different facts. New is “the change in worldview” through which the facts are interpreted.² “Biological life,” writes science writer Zoë Schlanger, “is a spiraling diffusion of possibilities.”³ Quantum physicists have come to a similar conclusion. While it is nice to simplify, the physical world is not simple. At the subatomic level, particles and waves point to a relational world filled with potentialities. The cosmos is a set of entangled processes that does not know its own future. Interested in the relation between risk and uncertainty, I am following the lead twentieth-century sciences provide.

Reading broadly has made me a firm believer in a *bon mot* attributed to Max Weber: “I do not have a field – I am not a donkey.” But with risk and uncertainty as my chosen subject I have learned to accept another *bon mot* attributed to art collector and writer Leo Stein: “It’s hard to be so smart that the next minute can’t fool you.”⁴ The entangling of chance with fate poses the conundrum I discuss in this book.⁵ After many years of trying, I continue to struggle with the deep truth the Athenians expressed in the *Melian Dialogue* when they called “hope danger’s comforter.”⁶ With this book I want to tell my reader not what to think but what to think about. A serious reading is for me the highest compliment any author can hope for.

Not predisposed to any tribe’s uniting call, I resist the pull of any one worldview, paradigm, theoretical approach, modeling tradition, or method. I admire, sometimes, the courage of the convictions of those who rally around their chosen flag while I flap around aimlessly.

¹ Charles Darwin quoted in Schlanger 2024: 148. ² Schlanger 2024: 73.

³ Schlanger 2024: 21. ⁴ Leo Stein quoted in Christian 2020: 137. ⁵ Rorty 1989: 22.

⁶ Strauss 2008: 353 (5.103).

And I envy, sometimes, the companionship the like-minded so evidently enjoy as I bushwhack my way through the jungle alone. Born in Germany at the end of World War II, it is a quirk of my biography that I abhor collectives celebrating companionship. I prefer practices and conversations that open up new terrain to those that fence it in and close it down. I am deeply skeptical of political engineering, big leaps, and final solutions.

I like to celebrate and thank the many people who taught and tutored me in different ways and at different stages, as I was writing this book. Their help made me acutely aware, once again, of the collegiality and camaraderie that define communities of scholars and that include the invisible college of those who came before and those who will come after. Learning is collective and shared, writing is individual and lonely.

Steve Nelson was a collaborator on a set of papers that dealt with the financial crisis of 2008. That event shocked me more than any of my colleagues. Much of what I learned from and with him is part of [Chapter 4](#) in this book. Rudra Sil helped me understand eclecticism and pragmatism, which we explored in *Beyond Paradigms: Analytic Eclecticism in World Politics* (2010) and several articles. Our collaborative writing informs the spirit of this book and appears explicitly in its concluding chapter. Living the last stages of her life with enormous courage and grace as illness drained her strength, the late Lucia Seybert taught me a deep truth about the power of hope. The gist of our collaboration in *Protean Power* (2018) and the important empirical work of our collaborators who put flesh on the bones of our theoretical arguments – Rawi Abdelal, Peter Andreas, Philip Ayoub, Noelle Brigden, Jennifer Erickson, Jessica Green, Erin Lockwood, Barak Mendelsohn, Stephen Nelson, and Christian Reus-Smit – are reported in [Chapter 7](#). Jacques Hymans organized and introduced a special issue of *International Theory* (2020). I learned a great deal from the insightful papers of Emanuel Adler, George DeMartino and Ilene Grabel, Stefano Guzzini, Benoît Pelopidas, and Michael Zürn. Much of what I learned about worldviews came from *Uncertainty and Its Discontent* (2022), a project made possible by the full intellectual engagement of Bentley Allan, Michael Barnett, Timothy Byrnes, Prasenjit Duara, Jairus Grove, Mark Haas, Milja Kurki, and Henry Nau. Some snippets are reported in portions of [Chapters 1](#) and [2](#). Where relevant, I have referred in various parts of this book to some of my prior publications.⁷

⁷ Katzenstein 2006. Nelson and Katzenstein [2014](#). Katzenstein [2018](#). Katzenstein and Seybert [2018a](#), 2018b, 2018c. Seybert and Katzenstein [2018](#). Katzenstein [2020](#), [2022a](#), [2022b](#), [2022c](#), [2022d](#), [2024](#).

This is only the beginning of a long list of colleagues who helped me with this book. I have received invaluable comments on chapter segments, chapters, and different versions of the whole manuscript from Rawi Abdelal, Uriel Abulof, Emanuel Adler, Mathias Albert, Bentley Allan, Amelia Arsenault, Phil Ayoub, Michael Barnett, Kaushik Basu, David Bateman, Alexandra Blackman, Brett de Bary, Steven Bernstein, Noelle Brigden, Timothy Byrnes, Alexandra Cirone, James Davis, Tim Devoogd, Donna Dickenson, Prasenjit Duara, Peter Enns, Jennifer Erickson, Matthew Evangelista, Anna-Katharina Ferl, Rainer Forst, Jill Frank, Peter Gourevitch, Ilene Grabel, Jessica Green, Jairus Grove, Stefano Guzzini, Mark Haas, Peter Haas, Gunther Hellmann, Douglas Holmes, Aida Hozic, Steffen Huck, Macartan Humphreys, Patrick Jackson, Bruce Jentleson, Stephen Kalberg, Sabrina Karim, Mary Katzenstein, Robert Keohane, Jonathan Kirshner, Sarah Kreps, Douglas Kriner, Milja Kurki, David Lake, David Laitin, Adam Lerner, Adam Levine, Phil Lewis, Erin Lockwood, Patchen Markell, Michael Marks, Sally McConnell-Ginet, Barak Mendelsohn, Cheryl Misak, Franziska Müller, Henry Nau, Joseph Nye, Lou Pauly, Reid Pauly, Benoît Pelopidas, Kai Quek, Christian Rauh, Judith Reppy, Bryn Rosenfeld, Christian Reus-Smit, Scott Sagan, Wayne Sandholtz, Fritz Scharpf, Rebecca Slayton, Hendrik Schopmans, Rudra Sil, Janice Stein, Wolfgang Streeck, Sidney Tarrow, Geoffrey Wallace, Jeremy Wallace, Christopher Way, Zellman Warhaft, David Welch, and Anna Wojciuk. I thank them for their helpful conversations, insightful comments, sharp criticisms, and extensive reviews. I apologize to those whose names I failed to record properly and list here.

I also thank the participants of workshops convened by Cornell's Government Department, Duke University, the European University Institute, the Hertie School of Berlin, the Universities of Frankfurt and Toronto, the Max-Planck Institute for the Study of Societies at Cologne, and the WZB Berlin Social Science Center for their engaged participation and critical comments on different chapters of this book. Two anonymous readers for Cambridge University Press gave the manuscript an engaged reading that proved very helpful in the final revisions of the manuscript.

In the writing of this book I have gratefully relied on Wikipedia for initial orientations or verifications. I have refrained from seeking assistance from any version of AI or Chatbot.

Naomi Egel, Jordan Ecker, and Muskaan Chauhaan served as extremely resourceful and helpful research assistants at different stages of the project. Junyang Hu and Jake Swanson became indispensable colleagues. For several years Junyang Hu helped me with unfailing

efficiency to master all kinds of tasks, small and large, that reminded me of the advertisement I once saw in a small shop: “the impossible we do right away; miracles take a little longer.” Jake covered an enormously wide field of topics which, falling woefully short of full mastery, I needed to get to know. Over several years we talked as he tutored me how language should and could be integrated as a crucial part of the book’s argument. Both Junyang and Jake commanded a preternatural reservoir of empathy that made them strike the proper balance of criticism and encouragement as I was struggling with the material and putting pen to paper. Patrick Jackson taught me that it takes repetition to fully internalize rather than merely hear the simple, big point. Although our destinations differed, we have traveled on adjacent roads. At a crucial point toward the end of the project, with my spirit flagging, Janice Stein appeared like a Saint, sounding the trumpet and pointing out some of my discordant notes. Her support went far beyond assent and criticism and helped propel me across the finish line. After more than forty years of collaborative work with one of the best social science editors of the past generation, I have admired, once again, what Roger Haydon can do with the English language. He was entirely correct when he wrote at the end “I have read every word of this,” which was his way of saying “this book is too long,” while also understanding fully why it could not be shorter.

I have once again been the beneficiary of the superb editorial staff at Cambridge University Press. John Haslam was totally supportive of this conclusion to a trilogy comprising also *Protean Power* (2018) and *Uncertainty and Its Discontents* (2022). Carrie Parkinson and Claire Sissen made sure that the train was always on the right track and running on time. And the incomparable Julene Knox demonstrated time and again that computer-assisted copy-editing remains both craft and art. I thank them all for making the production of this book such an unproblematic venture.

I thank Mary for our life that is deeply entangled with this book.

Finally, I dedicate this book to Almut, beloved sister, and to the cherished memory of Bernd, top of my alphabet.

Ithaca, July 2025

Introduction: “An Imaginary Knowledge of the Perfect Truth” Meets the Risk-Uncertainty Conundrum

“An imaginary knowledge of the perfect truth” is how in *War and Peace* Tolstoy characterizes General Pfuell’s belief in science.¹ For Pfuell the idea of war guides the conduct of war; and when war does not conform to the idea, it is war and not the idea that is to blame. “He did not see in the outcome of that war the least proof of the incorrectness of his theory. On the contrary, to his mind the departures from his theory were the only cause of the whole failure.”² Pfuell’s foolishness is part of something much larger that affects us all.

We talk of “risk” when events are well known or can be confidently judged and probabilities can be calculated. Death is more certain than taxes. Actuarial risks are more accurate than political risks. But both are calculable. Indeed, we meet risk in much of our daily life. Catching a cold while going to a show is a risk that we consider normal and manageable. As I sit at my desk writing this sentence, I am not fretting about the possibility of the roof collapsing on me. At the same time, and quite regularly, we experience baffling uncertainties. We talk of “uncertainty” when the events are known but probabilities cannot be calculated, as is true for example of acts of terrorism. But uncertainty exists also when neither the event nor the probabilities are known, as with the effects of not yet invented technologies. Risk and uncertainty are complementary, and that creates an inescapable conundrum. A widespread inclination in the analysis of politics and world politics and modern life in general is to silence or eliminate uncertainty by converting it into risk – a fruitless quest, as I shall argue.

I experienced the financial crisis of 2008 as uncontrollable uncertainty. It left me totally disoriented. Walking into my first class after the news broke, I told my students that I had not expected, ever, to see the repeat of another 1929-style Black Monday. Bad things surely would follow, as they did in my native Germany after the Great Crash. But then America elected Barack Obama as its first African-American President. I have not

¹ Tolstoy 2008: 639. ² Tolstoy 2008: 640.

forgotten how wrong I was in 2008. That has not stopped me from being wrong time and time again since then. I was unsure, for example, about the outcome of the 2024 Presidential election. Anything, I believed, was possible – a sweep for either candidate in all swing states or stalemate. But the one thing I was pretty sure about was that the final decision would occur not on the evening of November 5 but two months later, most likely at the hands of nine Supreme Court Justices. I was wrong again. Living with uncertainty, thinking about it, confronting the fear it instills, embracing the opportunities it creates, and accepting its mystery have broadened my horizons and spurred me to write a trilogy on world politics which concludes with this book.³

When the coronavirus shut down the world in the spring of 2020 I was dumbfounded, like everyone else I knew. Specialists had warned for years that globalization was increasing the risk of pandemics. The SARS virus served as a warning I had experienced first-hand while traveling to China and observing its safety protocols. But that experience did not prepare me for COVID. Until the first vaccines became available, uncertainty reigned in my personal and professional life; a sense of learned helplessness spread uncontrollably. But the uncertainty induced by COVID was not unprecedented. I was also ill-prepared for many of the seismic events of the last generation: the dismantling of the Berlin Wall and the collapse of the Soviet Union in 1989–91; the financial crisis of 1997; the 9/11 attacks; the 2011 Arab Spring; the sudden collapse of the Afghan government in 2021; the Russian attacks on Ukraine in 2014 and 2022; the collapse of Assad’s regime in Syria in December 2024; and the rapidity of global warming.⁴

Most scholars of world politics stick, as did I for many years, to their habituated sense of living in a world of risk and their ingrained sense of politics as evolving in a knowable and controllable world. But as these various events show, risk is always coupled with uncertainty. Together, risk and uncertainty pose a conundrum that lies at the very center of political analysis.⁵ Risk lies in plain sight; uncertainty is what Michael Blastland calls “the hidden half” of the conundrum. It is a stubborn reminder that our incessant ingenuity is tied tightly together with inescapable ignorance.⁶ The complementarity of risk and uncertainty is not how we normally think or talk about the world of politics and world politics. We typically prefer to silence uncertainty so as to more easily sidestep the conundrum it creates.

³ Katzenstein and Seybert 2018a. Katzenstein 2022a.

⁴ Avishai 2020. Matejova and Shesterinina 2024b: 1–2.

⁵ Kasperson and Moser 2017: 3. ⁶ Blastland 2019. Lilla 2024.

In classrooms, conferences, journals, social media, newspapers, books, and public discourse, our conventional focus is on what statistician Leonard Savage called, metaphorically, risky “small worlds” that differ from uncertain “large” ones.⁷ Savage’s metaphor is apt. I will rely on it throughout this book. He insists that uncertainty is not an error that can be corrected by recalculating risks. And he is clear that the two worlds are not empirical, corresponding, more or less, to the “real” world. But Savage is mistaken in speaking of small and large worlds as only different, like risk and uncertainty. He fails to insist, as I am doing here, that they are also complementary. Choosing between them is making a wrong choice. Small worlds shun incalculable uncertainties and are reinforced powerfully by the popular expectation that the social sciences must deliver what the public and politicians crave – predictability and control. Tended to with craft and care, small worlds are like well-pruned gardens. Defying control, large worlds are like jungles. Where gardens and jungles meet, we find ourselves in parks, the home of the risk-uncertainty conundrum.⁸ Inhabiting parks requires us to accept the mysteries of uncertainty when they cannot be reformulated as problems. Since the passing of the age of religion, disenchantment (*Entzauberung*) has taken three turns Max Weber did not anticipate. We can reject science and insist on the unknowability of the world, the preferred solution of anti-intellectual authoritarians everywhere who feel threatened by science. We can embrace science and limit it to the small world of risk, the preferred solution of most scientists, including students of politics and many social sciences. Or we can accept the mysteries of uncertainty when we meet them, as I do here, navigating them pragmatically, and learning how to live on the sharp edge of the knife, resisting the urge to cut, simplify, and be proven wrong time and again. Doing so has the benefit of engaging in far-reaching conversations with the sciences and the humanities about the tacit knowledge our worldviews provide as the invisible foundations of our theories, models, and methods. Since uncertainty disrupts, we are not subject to a predetermined future. And those disruptions are the source of both challenges and opportunities, anguish and hope.

The preoccupation with controllable risk can trip up even the most prominent scholars who seek to make sense of the world. Thinking about world politics as a casino, one prominent theorist considered the end of the Cold War “a mere data point” in a bell-shaped statistical distribution.⁹ Partial to a mechanical view of history, another theorist argued a year after the Berlin Wall had fallen that with instability

⁷ Savage 1972 [1954]. Daston 2022: 5. ⁸ Katzenstein 2022c.

⁹ Quoted anonymously in Lebow and Risse-Kappen 1995: ix.

spreading in Europe, we would soon miss the Cold War.¹⁰ For the statistically inclined, 1989 was nothing special in a risk-based approach to world politics. The mechanically minded agreed because for them world history is one sad repeated story of great power rivalries leading to war. Indeed, in confronting big events, students of world politics have done poorly. In the late 1970s and early 1980s Kenneth Waltz, one of the leading realists of the last generation, bet that the Soviet Union would last another century; Robert Keohane, a leading liberal, that the era of American hegemony had ended.¹¹

The stories I tell in this book fill in some of the blanks. Here is a thumbnail sketch. Like a puppy playing with the long stick which is the risk-uncertainty conundrum, we chew energetically on the risk end, letting the uncertainty end drag in the dust. The stick is shaped, I argue, by Newtonian humanism. It combines the scientific and humanist stances that have co-evolved in modern times, constituting a commonsensical, internally inconsistent, worldview. And that view bends the analysis of the political world toward controllable risk, sidestepping or silencing unruly uncertainty. Drawing on the natural sciences and humanities, I suggest two alternative worldviews: post-Newtonianism and para-humanism.¹² Both highlight uncertainty rather than push it out of sight. Conventional theories and models of world politics tell stories that are informed by statistical regularities or the assumption that humans are rational or reasonable. Relying on unconvincing arguments and dubious assumptions about objective and subjective probabilities, both routes end up making us focus only on small, risky worlds. And that leaves us stunned, time and again, when the real world does not meet our expectations. Instead, I find it more helpful to distinguish more precisely between the two worlds that contain the risk-uncertainty conundrum. The theories, models, and methods that evolve within internally inconsistent worldviews focus on contexts, processes, and language that distinguish analytically between small, risky and large, uncertain worlds. Relying on this conceptual tool kit, I analyze finance, security, and climate change/AI in world politics. The different strands of the argument converge in the

¹⁰ Mearsheimer 1990a, 1990b, 2001. Mearsheimer's main prediction could not be tested as the withdrawal of the US security guarantee did not materialize after the end of the Cold War; it may be in the offing now, as this book goes to press in 2025. But Mearsheimer was wrong in predicting that the NATO alliance would "soon" become irrelevant. Thirty-five years later NATO continues to have great military and political relevance for a much larger number of states than it did in 1990.

¹¹ Waltz 1979: 95. Keohane 1984: 244.

¹² In a prior publication (Katzenstein 2022a) I wrote hyper-humanism rather than para-humanism. Since "hyper" means not only "beyond" but also "excessive" it can be misleading.

analysis of two different concepts of power: control power governs the world of risk; protean power the world of uncertainty. As in the risk-uncertainty conundrum both kinds of power are complementary. The concluding chapter opens with a discussion of the unity of knowledge encompassed by the humanities and the natural sciences, elaborates on several topics that are germane to the complementarity of risk and uncertainty (eclecticism and experimentalism; punditry, forecasts, and scenarios; moral luck, policy, and pragmatism) and concludes with a discussion of science and religion.

1. Why This Book?

Adapting the “where’s the beef” slogan of the 1980s fast food industry, a reader of this book may well ask why does the risk-uncertainty conundrum matter? Are not the books and articles we read and write focusing self-consciously on a small part of the world for better understanding and thoughtful practice? Do they not deliberately omit the rest of the world, placing it outside the focus of theoretical and practical concerns, or include it in the error term of statistical equations like the distracting “noise” that obscures life’s main “signal”?¹³ A resoundingly positive answer, I argue, is a major source of weakness for how we think about and act in the political world.

Entanglement

In my story of entanglement “both-and” beats “either-or.” Complementarity is a specific form of entanglement. The risk-uncertainty conundrum unfolds in constantly moving, momentarily interlacing, always fleeting constellations of political entities and processes – the grist of the stories we tell about small and large worlds with theories and models, words and numbers, images and sounds. The large world does not encircle the small one. The small world does not encapsulate the large one. And the two worlds do not exist in parallel universes or cohabitate in one multiverse. They are, in a word, entangled, a process that the Austrian quantum physicist Erwin Schrödinger called *Verschränkung*. Entanglement is a combination of the spaghetti served by Italian and German waiters, both tangled and neat.¹⁴ The stories we tell and the conversations we have should reflect this combination. Pretending that there is only one kind of waiter is wishful thinking. Ours is not a world of pure-breeds but of mutts. Some stories and conversations can forget one or the other waiter or doggie, but for the most part both are necessary.

¹³ Klaas 2024: 214. ¹⁴ Katzenstein 2022d.

Entanglement conveys an idea that is quite similar to what the American-Brazilian-British physicist David Bohm characterizes as the deep orders that are somehow related to the surface order of things. He points to orders in which “time and space are no longer the dominant factors determining relations of dependence and independence of different elements.”¹⁵ Bohm’s idea resonates with Martin Buber’s central message in *I and Thou*, the fluidity between being and becoming. Buber might well have been critical of humanism and all other “isms” that threaten to destroy the human. But he might also have agreed with Bohm that in religion, as in science, variants and combinations of persons, things, and relations constitute unceasing, vibrant, and fleeting entanglements. They are at the center, as this book’s title claims, of world politics. In his famous essay Isaiah Berlin praises the hedgehog as knowing one thing very thoroughly while the fox knows many things only superficially. Pace Bohm and Buber, Berlin is wrong. The hedgehog cannot know one thing deeply precisely because he is bound by the narrowness of his outlook. Wrong about the one thing he claims to know well, this raises the troubling question whether hedgehogs know anything about anything.

“Both-and” encapsulate this book’s analysis of entanglements in both the political world and in world politics. My argument is driven by a specific kind of entanglement, the complementarity of risk *and* uncertainty; by worldviews *and* theories or models applied to finance, security, and the environment; by the effects of Hobbes’s control power *and* Machiavelli’s protean power; and by the humanities *and* the sciences as different ways of knowing the world. This book also bears the mark, to quote Dostoevsky, of the “impotent and infinitely small Euclidian mind of man” *and* its far-reaching engagement with broader sensibilities all too often left unacknowledged.¹⁶ Admittedly not the smartest of bears, but amply equipped with good intentions and unerring instincts, Winnie the Pooh was once asked whether he wanted honey or butter. Winnie had no trouble grasping the idea of entanglement. He liked “both-and” better than “either-or.”¹⁷

Both complementarity and entanglement are central to quantum theory and the post-Newtonian worldview it expresses. It depicts a universe that is both holistic and atomistic. At the subatomic level particles and waves illustrate a world of uncertainties and potentialities. For physicist Carlo Rovelli *Reality Is not What It Seems*. The key is “the

¹⁵ Bohm 1980: xviii. Fierke 2022: 16, 202–03.

¹⁶ Dostoevsky 1970: 244. Galileo Commission 2019: 79–80. ¹⁷ Milne 1926: 24.

relational aspect of things.”¹⁸ For Rovelli “this was an abrupt awakening from the pleasant sleep in which we had been cradled by the illusions of Newton’s success.”¹⁹ What Einstein once called dismissively “spooky action at a distance” has become an experimentally confirmed fact and a strangely compelling example of entanglement.²⁰ The joint properties of two entities correlating with one another while operating at a distance exist only in relation to a third entity.²¹ Conceptualizing the cosmos as an evolving set of entangled processes that does not know its own future has become common not only in physics but also in biology, chemistry, and geology.²² Research in quantum biology suggests that processes such as photosynthesis, bird navigation, and sense of smell are better understood as being quantum rather than classical.²³ Built on the concept of entanglement, quantum decision-making theory has produced strong experimental results that challenge behavioral economics and psychological theories that try to explain deviations from the rationality assumption.²⁴ In general, entanglement suggests a world filled with infinite, unknown potentialities. The world is a complex system not a complicated one. Rather than seek to discover theories with immutable laws, science aims to formulate models to help us navigate an entangled world that escapes full knowledge and control.²⁵ In the words of philosopher Nicholas Rescher, “at the microlevel, what was usually deemed a physical *thing*, a stably perduring object, is itself no more than a statistical pattern – a stability wave in a surging sea of process.”²⁶

Surprisingly, this shift in our understanding of the natural world has had virtually no effect on our understanding of the political world. For the most part we continue to think of the world as constituted by self-contained actors who are the object of inquiry by dispassionate scientists, operating at a distance from the world. Quantum theory, by contrast, describes “the way in which one part of nature manifests itself to any other single part of nature.”²⁷ Theoretical physicist Lee Smolin goes so far as calling “the 20th-century revolution in physics the relational revolution . . . in full swing in the rest of science.”²⁸ Such entanglements point to the limits of conventional anthropocentrism. If humans are integral parts of the natural world, rather than standing apart from or above it, like physical objects they are entities that are entangled with

¹⁸ Rovelli 2017: 119. ¹⁹ Rovelli 2021: 73. ²⁰ Rovelli 2021: 89–97.

²¹ Rovelli 2021: 98–100. ²² Kauffman 2008. ²³ O’Brien 2016: 3.

²⁴ Wendt 2015: 154–73. ²⁵ Frank and Gleiser 2023. ²⁶ Rescher 1996: 98.

²⁷ Rovelli 2021: 75.

²⁸ Smolin 2013: xxviii. See also Smolin 2000: 49–65; 1997: 276–84.

other entities.²⁹ Stressing the primacy of these entanglements, Karen Barad calls all interactions “intra-actions” – a useful reminder that entities do not exist prior to their entanglements but emerge from them.³⁰ Post-Newtonianism and para-humanism suggest a world of entanglements which incorporate humans, endowed with their senses, language, and capacities and imaginations to access past and future.³¹

In our understanding of entanglement the shift from substantialism to relationalism in the analysis of the social world is analogous to the shift from atom to particle in the understanding of the physical one. As in a rope made of twisted threads, entanglements can be “thicker” (in their quantum and philosophical versions) and “thinner” (in their Newtonian and sociological variants).³² Entanglements among specific actors in small, risky worlds are “thin.” Actors are distinguishable from the relations that constitute them. This differs from the “thick,” entangled and distributed agency in large, uncertain worlds.³³ Contra Newton, philosophers like Henri Bergson and Alfred North Whitehead insisted that all things are continuous rather than discrete. Processes replace structures and causality.³⁴ Terms like “coherent and logical” are replaced by “applicable and adequate.”³⁵ Without entanglement, entities lack properties. This entangled world is finely textured, fragile, and made up of discontinuous events lacking permanence. In the twenty-first century it increasingly joins technological and ecological communities with human ones – constituting a multiplicity of layered entanglements of an evolving planetary politics.³⁶ In the warp and weft of the world’s weaving, every event adds a thread.

Most mainstream scholars of world politics follow convention and, they believe, imitate the natural sciences. Neglecting uncertainty, for them world politics unfolds in the domain of risk. At the margins of the mainstream, “critical” scholars highlight uncertainty. My arguments speak to the concerns of both groups. The first evokes the story of Icarus. Seeking control over nature, he learned how to fly. Today, the power of reason has pushed humanity’s vision to the edge of the cosmos and the beginning of time. Unable to control ambition, like Icarus, we are risking catastrophe by soaring ever closer to the sun. The second group exhibits the diffidence of the critical bystander who has the world in clear sight but deems it permanently out of reach. That group understands ideas not as tools that operate in an external reality but as vital parts of the

²⁹ Rovelli 2021: 182. ³⁰ Barad 2007. ³¹ Rovelli 2021: xvi, xviii, 45, 56, 128, 142–45.

³² Rescher 1996: 42, 83–103. Adler 2019: 45–76.

³³ Gilpin 1981: ix–xiv. Jackson and Nexon 2013: 553, 555. Nexon 2010.

³⁴ Grove 2022a: 71–72. Arfi 2022. ³⁵ Grove 2022a: 74.

³⁶ Kurki 2020: 560–61, 562–73.

world. I see no obvious common ground for these two groups. The tattered promise of knowledge eventually producing a Newtonian “science” of world politics leaves me cold. And I am not warmed by the prospect that such knowledge is unobtainable.

The distinction between independent and dependent variables is for me an artifact the analyst imposes on entangled processes constituting reality. Although they are stumped in their understanding of how and why this works, physicists agree that linear, additive causal models do not work. International relations (IR) scholar Laura Zannotti makes this the center of her analysis. She argues that the fundamental uncertainty in the world is grounded in deep entanglements that can be resolved only contingently.³⁷ Entanglement stretches across levels, sectors, and scales. Committed to “doing IR differently,” a number of scholars have begun to take their cues from the natural sciences.³⁸ For them vulnerabilities do not only generate clashes between competing actors. They also create exposures to vulnerabilities with others in entangled relations that can set free unexpected cooperation. And an entangled world dissolves the conventional “level of analysis problem” that has bedeviled students of world politics for more than half a century.³⁹

With this book I seek to create a conceptual space for incessant conversations, not a research program dragging political and social analysis into the world of twenty-first century science. For me conversations are foundational, cutting to the core of the social scientific enterprise. But they fall short of being Foundational; they do not provide our efforts with a definitive philosophical basis. Such conversations create a humility derived from our unavoidable, remediable ignorance and our inescapable, pragmatic engagement with the complementarity of risk and uncertainty. The journey is its own destination. Soccer players have a *Standbein*, the leg that supports them, and a *Spielbein*, the leg with which they move the ball around and kick it.⁴⁰ This book is a reminder that both legs matter – as does the risk-uncertainty conundrum. Forgetting this elementary lesson of soccer leaves many political scientists and actors, to quote the late investor-legend Charlie Munger, in the position of “a one-legged man in an ass-kicking contest.”⁴¹

³⁷ Zannotti 2018: 4, 57–58. See also Barad 2007. ³⁸ Trownsell et al. 2021: 27.

³⁹ Singer 1961.

⁴⁰ Berenskoetter (2011: 653) completes this soccer metaphor with a discussion of Heidegger’s concept of *Spielraum*.

⁴¹ Tetlock and Gardner 2015: 146. See also Best 2008: 358–59.

Preview: Worldviews, Theories, and Models – Finance, Security, Environment

The opening chapters set forth three worldviews that inform our theories and models of world politics. Traditional Newtonian humanism expresses our common sense, dating back to the scientific revolution and the Enlightenment. Newtonianism seeks laws or law-like generalizations, sidelining the unpredictability of humans. Post-Newtonianism and para-humanism offer alternatives that emerged with scientific advances made in the twentieth century. They shed new light on uncertainty. These three worldviews are not well-bounded, coherent wholes. Post-Newtonianism contains Newtonianism as a practical but inaccurate view of the world. Para-humanism includes the human but goes around and beyond it. Internal tensions are common to each of these views, providing the intellectual space for different theories, models, and methods to flourish. These chapters also focus on the factors that shape the complementarity of risk and uncertainty. Different theories and models conceptualize small risky worlds and large uncertain ones. Conventional approaches to world politics operate in small worlds, shunning uncertainty. They do so by telling stories based on the calculation of frequencies and objective statistics or by calculating subjective statistics based on the assumption that humans are rational and reasonable. On their merits, these stories make us focus only on risk, simply assume away the risk-uncertainty conundrum, push aside the seemingly infinite store of surprises in world politics, and leave us to be totally surprised again, and again, and again.

In seeking to understand the world and finding a way to engage with it, how should we think about the risk-uncertainty conundrum in a world of entanglements? A risky world resembles a causal machine, an uncertain one, a creative generator of unfolding potentialities. Context, process, and language offer three simple checks that distinguish the two worlds. In a small world of risk, political contexts are homogeneous, processes are invariant, and language is passive and “represents” reality. In a large world of uncertainty, contexts are heterogeneous, processes are variable, and language is active and “re-presents” reality. Looking for their keys under the light cast by the metaphorical small world lamp does not lift the burden of proof from those who insist that the risk-uncertainty conundrum does not exist or does not matter. Previewed below, my empirical studies make the case for the conundrum’s salience in the politics of finance, security, and the environment. What Graham Allison and Philip Zelikow write about the Cuban missile crisis holds also for recurrent financial upheavals and the unfolding catastrophes caused by global

warming: the probable and the possible and the improbable and the impossible are entangled. Because of the conundrum that risk and uncertainty pose, the twinned tensions they create need to be understood and tolerated, not resolved.⁴²

In finance the link between the unfathomable and the inevitable is evident for all to see. Financial crises are mostly unpredictable, like earthquakes. Fueled by human greed and marked by human suffering, their recurrence is also almost normal. [Chapter 4](#) explores the small, large, and hybrid financial worlds of risk and uncertainty. Rational expectation theory evolved in the small world and came to dominate Wall Street with an ingenious simplification that reduced uncertainty to risk. The crisis of 2008 proved that theory to be disastrously wrong. Social conventions can compensate to some extent for our inadequate foresight. Widely shared stories about financial markets express realistic rather than rational expectations. In the years leading up to the crisis, risk-management models became powerful conventions that also proved to be useless once the crisis hit. Conventions can stabilize uncertainty for a while. But they cannot eliminate it. Often risk and uncertainty co-evolve, especially when markets move from the stability of statistical regularities to reflexive human practice marked by euphoria and panic. Complementing their traditional policy instruments, central bankers honed their skills of talking to markets, a useful tool for nudging markets away from uncertainty to risk, especially in the midst of a major crisis.

Discussed in [Chapter 5](#), the Cuban missile crisis illustrates the importance of post-Newtonianism for the risk-uncertainty conundrum. Thomas Schelling and other theorists of deterrence argued that nuclear crisis politics would be shaped by rational decisions made by rational decision makers: the closer the abyss, the greater the caution. The Cuban missile crisis tells a different story. The history of that crisis documents how the small world of risk and the large world of uncertainty were indelibly fused in the high noon of the nuclear era. Famously, Schelling himself developed rational models of nuclear deterrence that included the “threat that leaves something to chance.” This “something” removes full control over outcomes from the threatener’s calculation of the odds of different choices. Without uncertainty deterrence loses its teeth. Going beyond rational theory other explanations highlight the importance of organizational routines and dispersed bureaucratic agents. Both undermine predictability and the confidence of human control over events. Expressing post-Newtonian and para-humanist views, recent analyses offer new insights that foreground uncertainty. Profoundly relational, they

⁴² Allison and Zelikow 1999: xii. Avant 2024: 2.

incorporate explicitly the assemblages of technical objects and human beings. In such crisscrossing entanglements human choice still matters. But these studies point to many unforeseeable and unforeseen events that create the risk-uncertainty conundrum. Language also mattered in the fall of 1962. The “crisis” was given different labels in Washington D.C., Moscow, and Havana. This underlines the importance of the discursive construction of the national interests defined by the different protagonists.

Global warming and AI, discussed in [Chapter 6](#), raise a host of issues involving the complementarity of risk and uncertainty that para-humanism and post-Newtonianism illuminate. Humans have become geological agents in creating global warming in their material environment and Artificial Intelligence (AI) in their symbolic one. Geoengineering focuses on ecosystems that lend themselves to risk calculations that may prove helpful in mitigating some of the adverse consequences of global warming. But geothermal and marine engineering remain hotly contested politically, especially when the discussion focuses on their implementation at scale. Informed by para-humanism and conceptions of geological time, the concept of the Anthropocene confronts uncertainty even more directly. Humans have become geological agents with profound effects on the earth’s basic physical processes. The ecosystems of the world are not external constraints for human action. Instead, they are endogenous to the world’s evolution. The same holds for humanity’s symbolic environment, including language as its central cultural technology.

Going beyond the specific issues of finance, nuclear crisis, and global warming/AI, power dynamics discussed in [Chapter 7](#) also differ in small and large worlds. For centuries, the control power of Hobbes’s Leviathan has captured the imagination of students of world politics. Newtonian laws offer a partial and practical explanation of the world that denies the uncertainties with which its successor, quantum theory, has grappled for more than a century. Today most analyses of world politics still focus on control and operate in the small world of risk. Overlooked is a post-Newtonian concept of shape-shifting, protean power that highlights potentialities. It illuminates the large world of uncertainty that leaves us all too often stunned when the unexpected generates new possibilities. Typically, control and protean power coexist and co-evolve in entangled relations that [Chapter 7](#) explores in ten brief case studies. The difference between the two kinds of power extends to the domain of language. The Newtonian Leviathan must be the ultimate enforcer over meaning. Post-Newtonianism focuses its analysis on the concept of complementarity of plural insights waiting

to be reconciled at some future time. The [concluding chapter](#), finally, spells out some of the broader implications of this book's central arguments.

2. The Risk-Uncertainty Conundrum

Blurred edges are a mark of the complementarity of risk and uncertainty.⁴³ Uncertainty feeds an unending stream of public commentary serving an insatiable demand for information. Sport is a daily reminder of the importance of statistical metrics and imponderable uncertainties. In basketball “nothing is inevitable. Everything is uncertain.”⁴⁴ Baseball’s beloved philosopher-king Yogi Berra did not opine “sports is for losers.” Had he done so, he surely would have been right.⁴⁵ One thing is certain: At the end of the year’s competition only one team will be champion. Which team will win the crown is uncertain. Every year hundreds of sports analysts create betting models for different sports that run simulations of games based on past empirics attempting to predict the next champion. And yet, no model can ever be correct in all of its predictions. Injuries, a surge of good luck, and sheer willpower can produce outcomes that simply defy accurate prediction. Or so it seemed until data science transformed baseball by reducing uncertainty so much that the game became simply boring. Uncertainty diminished together with attendance. Fans were missing the exciting action on the field that had drawn them to the stadium in the first place.⁴⁶ Hoping to reignite interest, in 2023 the clubs changed some of the rules. For the first time in more than a decade, attendance rose in the following year. This is a useful reminder that people do not only dread an uncertain future but welcome uncertainty’s opportunity and excitement. We can live in both small and large worlds at the same time without the felt need to reduce one to the other. The entangled messiness of political life is also marked by the risk-uncertainty conundrum. In 2022, executives in the high-tech world were torn about the future. “No one knows anything.” Pessimists and optimists “lived in two separate realities. And maybe they do.”⁴⁷

Imitating the prediction industry developed around sports, the summer of 2023 found the recruitment drive for staffing a political science prediction market in full swing.⁴⁸ As former Deputy Assistant Secretary of Defense Linton Wells II might say, good luck to that! As part of the 2001 Quadrennial Defense Report, he briefly surveyed, decade by

⁴³ Kasperson 2017. Hacking 1990, 2002. ⁴⁴ Cacciola 2019.

⁴⁵ I am indebted to Janice Stein for creating this Yogi Berra quote out of thin air.

⁴⁶ Klaas 2024: 259. ⁴⁷ Ovide 2022.

⁴⁸ Unsolicited email invitation from Anurag Dutt of the Penn State SCORE team, 04/05/23. Roose 2023.

decade, the astonishing changes during the twentieth century. With an admirable sense of irony, he captured succinctly the challenge of trying to forecast the events of the next decade: “I’m not sure what 2010 will look like, but I’m sure that it will be very little like we expect, so we should plan accordingly.”⁴⁹ Specialists in the quantification of uncertainty were asked during one conference to jot down their preferred definition of this complex concept on Post-it notes and stick them to the wall. One favorite read “anything and everything that can **** up a decision [insert descriptor of your choice].”⁵⁰

The notion that uncertainty is an inevitable part of doing and analyzing politics is an insight that seems to evade analysts all too often. After 1991, for example, 10 million Russians went missing.⁵¹ Within three years, between 1991 and 1994, life expectancy of Russian males dropped from 64 to 57. The 10 million missing men accounted for 6.7 percent of Russia’s total population. It was a catastrophe of unimaginable magnitude. The global death rate due to COVID-19, for example, was about 5 million or 0.6 percent of the world’s population. The flu pandemic of 1918–20 killed about 2.8 percent of the world’s population. And the total number of all Americans who died in all wars during the last 250 years was 2.9 million. By all measures and comparisons, Russia’s loss was staggering. The proximate causes of death included alcohol poisoning, suicide, homicide, injury, heart attack, and the loss of social networks.

The cause of this calamity was a massive economic experiment that Russia had conducted in the early 1990s. Russian policy was guided by a group of prominent American economists, including Jeffrey Sachs, Lawrence Summers, and Andrei Shleifer. They were convinced that “shock therapy” was needed to effect the transition from state socialism to a market economy and to undercut the mass opposition a radical shift in policy would surely generate. And so subsidies and price controls on which the economy and living standards depended were suspended. State-owned enterprises shuttered their doors. In less than two years 120,000 firms were privatized. The new owners laid off workers by the millions and stripped the firms’ assets. Subsequently they acquired the remaining state-owned firms in rigged auctions that created a new class of billionaires. The collapse of the economy came in short order. The share of the population living below the poverty line increased from 2 percent in 1988 to 25–40 percent in 1995. Unemployment soared above 20 percent.⁵²

⁴⁹ Rumsfeld 2001. ⁵⁰ Roberts 2020: A4.

⁵¹ Stuckler and Basu 2013: 21–34. DeMartino 2022: 21–24.

⁵² Stuckler and Basu 2013: 21–34. DeMartino 2022: 21–24.

Trusting their best models, ambitious and influential American economists instituted policies they believed would bring about a rapid transition to a functioning market economy based on the principle of private property. Things did not work out as planned. One of the reasons for this failure was their reliance on models that only considered risks. Moving with great confidence, they had been blind to the uncertainties created by their unprecedented experiment. With explicit reference to Bolivia, but very apposite to the disastrous policy advice he had given the Russian government fifteen years earlier, Jeffrey Sachs remarked ruefully that “it bothered me greatly that the most basic and central features of economic reality could be overlooked by academic economists spinning their theories from thousands of miles away.”⁵³ The risk-uncertainty conundrum thus reflects and creates “irreparable ignorance” of the unknown and unknowable.⁵⁴

The idea of the unknown and unknowable made headlines in remarks on the global war on terror that US Secretary of Defense Donald Rumsfeld made in a press conference he held in Brussels on June 6, 2002.⁵⁵ Under conditions of risk, Rumsfeld stated, decisions are made in the world of “known knowns”; the consequences of the options are known and so are the probabilities for calculating their odds. Lacking calculable probabilities among the consequences of known options moves the decision maker into the domain of uncertainty, situations of “known unknowns.” Under conditions of radical uncertainty neither the options nor their consequences are known, a state of “unknown unknowns” or “unknowable unknowns.” Uncertainty and radical uncertainty are vexing conditions bedeviling many aspects of world politics that often are also marked by some elements of risk. The risk-uncertainty conundrum exists when we do not know (or are not aware of) whether we are in the world of risk or in the world of uncertainty.⁵⁶ Absent that knowledge, there is no way to calculate (or think about) the trade-offs between managing risks and creating uncertainties. Since this can be disconcerting, even upsetting, political psychologist Brian Rathbun argues that “we tend to discount how profoundly unknowable the world is and substitute the certainty provided for in the form of theories for uncertainty. We know

⁵³ Sachs 2005: 105. ⁵⁴ DeMartino 2022: 4.

⁵⁵ Rifkin 2022: 88–89. Matejova and Shesterinina 2024b: 2–6, 8. Diebold, Doherty, and Herring 2010: 2–4. Granger 2010. Gomory 1995. Iida 1993.

⁵⁶ Luhmann (1993: 28) argues instead that the more we know, the better we know what we do not know, and the more elaborate our awareness of risk and uncertainty. This strikes me as wrong. It assumes that our ignorance diminishes as our knowledge increases. However, pushing the frontiers of knowledge removes a patch of ignorance while opening up new continents to be explored.

this empirically because profound uncertainty is *rarely acknowledged* by decision-makers themselves.”⁵⁷

The conundrum is concealed also because in common parlance terms like “chance” and “likelihood” are often assumed to be synonyms for probability.⁵⁸ They are not. Chance can refer to both probabilistic risk and possibilistic uncertainty. While translating Max Weber into English, Talcott Parsons insisted that the German concept of *Chance* should be stripped of all mathematical or statistical connotations suggesting that “chance” could be measured numerically.⁵⁹ In Weber’s later writings the concept of “chance” evolved from historical to analytic contingency, that is, toward the concept of “uncertainty.”⁶⁰ Likelihood and chance are less precise than the numerical value expressed by probabilities. The quantification of risk is indispensable and useful in many instances, for example in calculating life expectancies or making short-term weather forecasts.⁶¹ Technically challenging, risk poses “tame problems.” They differ from the “wicked problems” posed by uncertainty.

The Merriam Webster’s dictionary, for example, defines risk in terms of chance of loss or the degree of probability of such a loss.⁶² Ordinary language complicates matters when it uses the concepts of risk and uncertainty as synonyms.⁶³ In conventional language “risk” means danger; “high risk” means a lot of danger and misfortune.⁶⁴ This change in meaning adds a misleading undertone of precise calculation to the domain of incalculable uncertainty. Conventional language overlooks categorical differences. It treats different things as if they were the same.⁶⁵ The lack of information creates epistemological risk (of known or knowable unknowns) and makes actors doubt the truthfulness of the knowledge they have about the context they experience, the processes they are exposed to, and the language they rely on. Ontological uncertainty (of unknown or unknowable unknowns) is irremediable because of life’s emerging processes and contingencies that are shaped by the unintended or unanticipated consequences of human choices. Gathering objective statistics and updating subjective beliefs with more recent information is often insufficient to meet the creativity of life itself and its incessant motion and change. Undeterred by the complementarity of risk and uncertainty, the World Economic Forum has issued a global risk report for many years. The eighteenth report’s Executive Summary

⁵⁷ Rathbun 2024: 4. ⁵⁸ Maechler and Graz 2022.

⁵⁹ Seybert and Katzenstein 2018: 11. ⁶⁰ Tribe 2022: 306. ⁶¹ Blum 2023.

⁶² See at www.merriam-webster.com/dictionary/risk, accessed 04/03/23.

⁶³ Douglas 1990: 12. Kay and King 2020: 97, 99.

⁶⁴ Dake 1991: 62. Wildavsky and Dake 1990: 51. Luhmann 1993: 11.

⁶⁵ Galileo Commission 2019: 45.

opines “as 2023 begins, the world is facing a set of risks that feel both wholly new and eerily familiar . . . together these [challenges] are converging to shape a unique, uncertain and turbulent decade to come.”⁶⁶ In a similar vein German researcher Rainer Sachs writes that “with the term ‘risk’ we mean uncertain negative outcomes.”⁶⁷ Public intellectual Robert Kaplan describes various developments signaling the coming chaos in Eurasia as “not probable” but “increasingly possible.”⁶⁸ Bestselling sociologist Ulrich Beck’s core idea of the manufacturing of uncertainty by modern risk societies also illustrates the misleading slip-slide between the two concepts.⁶⁹

Furthermore, risk and uncertainty are often used as transhistorical concepts. This overlooks that terms such as “certainty” and “uncertainty,” “predictability” and “unpredictability,” “chance” and “probability” are historical concepts that acquired different meanings at different points of time.⁷⁰ This is true of concepts like “Fortuna” (fifteenth century), “probability” (after about 1650), and “risk” (twentieth century).⁷¹ A voluminous literature has probed different time periods, such as “modernity” (1930–1970s) and “late modernity” (1970s–), for the pervasiveness and intensity of the experience of risk and uncertainty.⁷² For example, with specific reference to the United States, Greta Krippner shows how over the course of more than a century the perception of risk has moved from a collective to an individual affair. The community of fate that was the foundation of the insurance industry and the epidemiology of infectious diseases has been transformed in the era of neoliberalism to a matter of personal decision.⁷³ During the COVID epidemic “to mask or not to mask” illustrated the risk-uncertainty conundrum operating as a clash between individualist and collective moralities.

Besides being conflated with “risk,” the concept of “uncertainty” is often overlooked altogether. Captain E. J. Smith reportedly said in 1907 “in all my experience, I have never been in any accident . . . of any sort worth speaking about.”⁷⁴ Five years later he drowned in the icy waters of the North Atlantic – in the “unthinkable” accident of the “unsinkable” *Titanic*. An iceberg did to the watertight compartments, designed to keep the *Titanic* afloat, what a can-opener does to a can. That iceberg was not white. Melting icebergs become top-heavy, capsize, and turn dark blue until the water runs out of them. At night they are exceptionally hard to

⁶⁶ World Economic Forum 2023: 6. ⁶⁷ Sachs 2023: 537. ⁶⁸ Kaplan 2016: 39.

⁶⁹ Beck 1992: 157, 173, 215; 1999: 5, 61, 93, 126. Aradau and van Munster (2011: 21) note correctly that Beck fails to distinguish clearly between risk and uncertainty. See also Maechler and Graz 2022: 631 and Whittington 2018: 6, 9.

⁷⁰ Klinker 2025. ⁷¹ Haldén 2024: 11. ⁷² Beck 1992, 1999. ⁷³ Krippner 2023.

⁷⁴ Taleb 2007: 42.

see. The *Titanic* probably struck one of those “black” icebergs, a close cousin of Nassim Taleb’s “black” swans, both inhabiting fat tails in the small world of risk.⁷⁵ After the tragedy George Bernard Shaw wrote that Captain Smith’s many admirers of his composure in the face of disaster were mistaking “sensational misfortune for inspiring achievement.”⁷⁶

The middle of the seventeenth century witnessed an amazing intellectual feat. That a chance of loss can become an opportunity for gain is a stupendous insight.⁷⁷ The capricious tides of the high sea threatening long-distance maritime trade were a perpetual source of anxiety and a powerful spur for commodifying off-shore risks as “acts of God.” On-shore dangers such as disease, fire, bad harvests, and premature death remained instead uninsurable biblical events.⁷⁸ In the nineteenth century the invention of statistical laws consolidated the notion that predictable risk was preferable to capricious chaos. This brought a sense of controlled, insured order to society. For political scientist Lou Pauly the global spread of risk has become a widely accepted fact of life.⁷⁹ Yet, uncertainty is increasing in some domains such as the insurance industry.

The fires consuming parts of Los Angeles in 2025 created losses estimated at \$50 billion; only \$20 billion were insured.⁸⁰ Broadly speaking, calculable risk is a defining aspect of late modernity and characteristic of modern forms of governmental power favoring the logic of calculation. Rational economic models express that stance by brushing aside unpredictable events as exogenous shocks. Under the label of risk management, capitalism came to commodify them as well. Disciplining or eliminating uncertainty is a hallmark of modern risk societies.⁸¹ We are ruled by the confidence-instilling institutionalization of risk management.⁸² The Latin root of confidence, *fides*, means faith – a reminder of the religious grounding of deeply held secular belief. Risk-management techniques are not eliminating uncertainty. Like water running down the mountain, uncertainty is not to be denied. It may be pushed underground and out of sight for a while, but it has the nasty habit of gushing forth unexpectedly at new places. Czech novelist Milan Kundera confronted squarely what students of politics sidestep: “the truth of uncertainty.”⁸³

One way of conflating uncertainty with risk, or of neglecting it altogether, is to focus only on known rare events. “The very nature of randomness,” Nassim Taleb writes, “lies in its abstraction.”⁸⁴ But for many the old adage still holds: “If you have seen one kind of randomness,

⁷⁵ Cox 1997: 13, 19. Taleb 2007. ⁷⁶ Cox 1997: 26.

⁷⁷ Nacol 2016. Bernstein 1996: 1, 337. Haldén 2024: 273.

⁷⁹ Pauly 2025. ⁸⁰ Ip 2025. ⁸¹ Beck 1992, 2005, 2006.

⁸³ Lewis 2023: A20.

⁸⁴ Taleb 2007: 78.

⁷⁸ Levy 2012: 3–4.

⁸² Eidinow 2011: 158.

you have seen them all.”⁸⁵ Not really. Randomness exists only in the small world of risk. Another way is to focus on risk as a fictional expectation. Humans rely on utopian and dystopian visions of a meaningful future that give them a sense of direction and control over different possibilities of being.⁸⁶ At what she calls a dystopian moment, security scholar Deborah Avant recognized risk and uncertainty as being categorically different. She pleads the case for holding in tension, rather than resolving *a priori*, particularity and generalization, description and theorization, and complexity and simplicity. Exploring the space between probability and possibility, she argues, recognizes the ubiquity of uncertainty and the risk-uncertainty conundrum and embraces the possibilities for making scholarship relevant for human betterment.⁸⁷ Beyond the world of scholarship, uncertainty is welcomed by many who have little control over their lives. Their agility in the face of contingency reveals the protean power I discuss in [Chapter 7](#). On financial matters uncertainty exists as an objective fact and is experienced as such subjectively.⁸⁸ Yet many are convinced that they live only in a world of risk and have thus been enslaved, in the words of Peter Bernstein, by “a new religion, a creed that is just as implacable, confining, and arbitrary” as the old one of uncertainty and inescapable fate.⁸⁹ A splendid characterization, this, of our everyday encounter with the risk-uncertainty conundrum!

The incomparable Yogi Berra reportedly remarked that “the future is not what it used to be.” Yet, we cannot help but plan for it. In the words of author Malcolm Bradbury “the future is just what we invent in the present to put an order over the past.”⁹⁰ In the domain of known unknowns, or operational uncertainty, risk calculations may be difficult but are in principle possible. In the domain of unknown and unknowable unknowns, or radical uncertainty, they are not. This creates the conundrum. Emotions can create a sense of both uncertainty and certainty. Terrorism is about the creation of fear and uncertainty. But suicide bombers yearn for certainty to justify their heroic self-sacrifice by criminally murdering others. More generally, faith is a plausible response to existential uncertainty. In science, statistical regularities are reported as holding within specified confidence intervals. Similarly, religions offer confidence-inspiring language and rituals that provide a normative orientation to the uncertainty of life and the certainty of death. Only after the moment has passed, and the world has moved on, can we know with some confidence whether we were in the domain of risk or uncertainty. “The

⁸⁵ Taleb 2007: 198. Matejova and Shesterinina 2024a.

⁸⁶ Beckert 2016. Berenskoetter 2011: 648, 652–53.

⁸⁷ President of the International Studies Association, Avant 2024. ⁸⁸ Zeckhauser 2010.

⁸⁹ Bernstein 1996: 7. ⁹⁰ Bradbury 1992: 328.

very ability we have to map our world,” writes literary scholar and philosopher William Egginton, “and hence to see our way through the dark also treats that map as though it were the world, and hence drapes a new veil over our enlightened eyes.”⁹¹

There is no simple way of finding a path through the complexities of contemporary crises. To be sure, the oracle of contemporary social science gives us a tidy, storybook version of reality. It dismisses as mere “noise” the important flukes of life. Linear cause and effect relations are presumed to be stable across time and space.⁹² But for sociologist Renate Mayntz the years since the financial crisis of 2008 have signaled a shift to a subjectively experienced and objectively existing loss of control: of individuals over their lives and of states and societies over their encounters with social, economic, and environmental change.⁹³ “Polycrisis” describes this new condition, a proliferation of crises cropping up in different sectors and locales “blurring together, overlapping and interacting in powerful, unexpected ways . . . marked by feedback loops and reflexivity, amplification and acceleration, all combining to let loose forces and processes we can only be dimly aware of.”⁹⁴ We must, it seems, acknowledge frankly the fragility and limitations of all attempts to exercise control over a polycrisis of immense scale covering the major issue areas of world politics.

The risk-uncertainty conundrum means for some that we are condemned to grope in a scary dark. But it would be wrong to think of uncertainty simply as a threat. Einstein and Picasso taught us that our understanding of the world is relative to where we stand and what we see. Uncertainty exists both in the world and in our minds. At the grandest of all levels, the cosmos once was thought to be fixed. It has now been found to be expanding into uncertain space and time. And at the smallest of all levels, quantum physics charts ever-shifting possibilities in a world of impermanence and unpredictability. Across all scales much of the world we live in is provisional, messed up, and unsettled⁹⁵ – this a fair description of the political world and of world politics. Unsurprisingly, humans share therefore in a deep sense of vulnerability.

For sure, these days powerful algorithms promise to end our erratic encounters with the uncertain. Are miracles of calculation the contemporary manifestation of John Dewey’s *Quest for Certainty*?⁹⁶ It turns out that Promethean feats of calculation do not eliminate Sisyphean anguish and joy. Frustration and despair, yes. But also surprise, serendipity,

⁹¹ Egginton 2023: 281. ⁹² Klaas 2024: 196. ⁹³ Mayntz 2023: 7, 13–14.

⁹⁴ Hobson 2022a, 2022b. See also Helleiner 2024.

⁹⁵ Jackson 2024: xxiv. Schweller 2014: ix. ⁹⁶ Dewey 1929.

wonder, awe, and curiosity.⁹⁷ Charlie Chaplin's *Modern Times* visualized the dehumanizing brutality of the modern mechanical world exerting predictable control. In the electronic age the assumption that everything needs to be controlled and predictable is no less pernicious. Life can become nothing but dull, solitary chores to be endured, such as coping with the overflowing inbox of one's email account or the unending invites of one's favored social network – raising the half-jocular question whether there exists any meaningful life before death. For psychologist Oliver Burkeman the answer is a resounding yes, as long as humans practice “imperfectionism,” by letting go of the illusory notion of full control so as to better absorb the punches of the unpredictable.⁹⁸

Often mislabeled as uncertainty, the lack of information creates epistemological risk that makes actors doubt the truthfulness of the knowledge they have about the context they experience. There is wisdom in not being too sure, in avoiding cognitive shortcuts, and in resisting the comforts of repeating what has worked in the past. Incessant ingenuity is part of uncertainty experienced not as threat but as opportunity. Thinking anew is accompanied by the frightful sense of recurrent failure and the exhilarating prospect of exploring unknown possibilities. “Uncertainty,” writes researcher Maggie Jackson, “plays an essential role in higher-order thinking . . . the mindset most needed in times of flux.”⁹⁹ The updating of information, however, is often insufficient to meet the unpredictable creativity of life itself. Spurious precision must give way to the acknowledgment of nuance and the tolerance of ambiguity.¹⁰⁰ Furthermore, ontological uncertainty of context is irremediable because of life's emerging processes and contingencies that are shaped by the unintended and unanticipated consequences of human choices. The biggest ship on Lake Zurich is suitably named *Pantarei*, “everything flows,” invoking Heraclitus's idea of reality as incessant motion and change. In the end, the risk-uncertainty conundrum fuses epistemology and ontology into epi-ontology.¹⁰¹ We cannot be without knowing and we cannot know without being.

3. Newtonianism and Humanism as Sweet Common Sense

Newtonian humanism provides us with the conventional intellectual armor for coping with the complementarity of risk and uncertainty that Isaac Newton's life personified. Inscribed on his tomb, Alexander Pope's epitaph reads “Nature and Nature's laws lay hid in night: God said, Let

⁹⁷ Klaas 2024: 125.

¹⁰⁰ Jackson 2024: xiv.

⁹⁸ Burkeman 2024: xv–xxvi.

¹⁰¹ Fierke 2022: 43.

⁹⁹ Jackson 2024: xiii.

Newton be! and all was light.” Scientific truth, Newton insisted, was to be found “in the simplicity, and not in the multiplicity and confusion of things.”¹⁰² Newton transformed the structure of the cosmos, according to the historian Ernst Cassirer, from something “to be merely looked at” to something which could be “penetrated” by the human mind.¹⁰³ After Newton History became a story of the progressive power of the human mind to discover the laws of nature.¹⁰⁴

Newton’s life, however, tells a second story. He did not manage to avoid “multiplicity and confusion” in his personal affairs. A very wealthy man, Newton owned shares in the South Sea Company, which he sold in the spring of 1720, earning a hefty, seven thousand pound sterling profit on his original investment. It turned out that he had sold too early. Share prices continued to climb. Since Newton did not want to lose out in this bull market, he bought shares back at three times the price of his original investment. The bubble burst a few months later, decimating Newton’s savings. He reportedly lost the equivalent of 3 million dollars in today’s money.¹⁰⁵ Newton subsequently remarked mournfully that “I can calculate the motion of heavenly bodies but not the madness of people.”¹⁰⁶ The multiplicity and confusion of things and the madness of people that Newton experienced as an investor stand in stark contrast to his scientific work.

Accounting for the movements of planets, Newton formulated the laws of motion as a universal set of principles. “The prototype for the order of universal natural law,” Lorraine Daston writes, “is universal gravitation, set forth in all its magisterial generality by Isaac Newton in his *Mathematical Principles of Natural Philosophy*.”¹⁰⁷ That book’s reputation for unreadability was reflected in its hundreds of equations and Latin text laden with obscure references. As the author walked by, one student at Cambridge University reportedly whispered “there goes the man that writt a book that neither he nor anybody understands.”¹⁰⁸ This does not seem to have hurt sales. Newton’s masterwork enjoyed a wide distribution throughout the educated world and had a profound impact on Enlightenment science. It offered a “cosmological formula so

¹⁰² Snobelen 2005: 273; fn 154. ¹⁰³ Cassirer 2009: 11.

¹⁰⁴ Fierke (2022: 46–47) reminds us that Newton produced an enormous corpus of unpublished work on alchemy and the transformation of matter. He thus explored large world possibilities that lie outside of the small world closure of classical physics.

¹⁰⁵ Kessler 2020.

¹⁰⁶ Odlyzko 2020. Lehrer 2007: 27. Chancellor 1999: 14–20. Christianson 1984: 571. Westfall 1980: 861. Dale 2004.

¹⁰⁷ Daston 2019: 23. ¹⁰⁸ Broad 2020.

powerful that Newton became not so much the name of a man as of an infallible world outlook.”¹⁰⁹

Newton assumed that movement occurs in relation to absolute space and time. He imagined space to be a large, empty container. God invented matter and created the moving objects that fill this space. Indeed, God might be space itself.¹¹⁰ All motion and change in nature are orderly and proceed according to knowable laws. And the laws of motion and universal gravitation are time reversible.¹¹¹ Thus, Newton arrived at the view of a clock-like universe: a consistently working machine that reflects a hidden order, captured by the laws of motion and accessible to human observation and reason.¹¹² “Newton, more than any other man,” writes Jonathan Louth, “had banished mystery from the world by discovering a ‘universal law of nature,’ thus demonstrating what others had only asserted: that the universe was rational and intelligible through and through, and capable, therefore, of being subdued to the uses of men.”¹¹³

In a Newtonian worldview society and politics are problems to be solved.¹¹⁴ Thus the world feels “less anarchic and more predictable” strengthening “the commonsense belief in a world designed by a higher intelligence and a superior force” – be it God or the Laws of Nature.¹¹⁵ The presumed order contains the promise of control, a suggestion “with a quasi-poetic function” to counterbalance irrational elements.¹¹⁶ Newton’s image of an orderly universe has branded important strands of political thought. The progressive imagination of the American Founding Fathers and the conservative theories of a recurrent international balance of power are both marked by the mechanical foundations of Newtonian thought.¹¹⁷ Today, in their analyses of world politics many liberals and realists share a Newtonian view of the political universe as self-sustaining and self-regulating sets of objects and actors. And many members of both groups view the flux of events as subject to statistical regularities or fixed laws. Entities are knowable and are subject to control by humans, who are set apart from the rest of nature by the power of their reason.¹¹⁸ Newton’s work helped usher in a sense that an unstoppable process of transformation had begun. Historian of science David Wootton writes, “the triumph of Newtonianism marks the end of the beginning.”¹¹⁹

Meanwhile, the insights to be gleaned from Newton’s life as an investor have been forgotten. Although students of world politics share Newton’s

¹⁰⁹ Landauer 1961: 338, quoted in Waters 2022a: 64. ¹¹⁰ Koyré 1957, 1965.

¹¹¹ Rifkin 2022: 29. ¹¹² Maudlin 2012. Smolin 1997: 141–42. ¹¹³ Louth 2011: 68.

¹¹⁴ Louth 2011: 73. ¹¹⁵ Hage and Kowal 2011: 7. ¹¹⁶ Hage and Kowal 2011: 9.

¹¹⁷ Foley 1990. Allan 2018: 22, 117–35.

¹¹⁸ Kurki 2020: 131–32. Grove and Chandler 2017: 79. ¹¹⁹ Wootton 2015: 5.

befuddlement about the unexpected in their personal lives, they continue to hold fast to his orderly worldview. The typical response to the all-too-frequent explanatory and predictive failures of our preferred constructs has been to re-examine and improve theories, models, and methods with the hope that, eventually, the Newtonian strategy of simplification will lead to the discovery of valid laws and causal mechanisms that generate parsimonious explanations and accurate predictions.

Philosopher John Searle dismisses this as a hopeless quest for a Newtonian social physics.¹²⁰ The classical model, to be sure, remains a convenient computational tool for many practical problems. But Newtonianism is misleading. Nature is not a simple, ordered system of laws. All too often it is disorderly and not readily accessible to neutral observers. In fact, the subatomic world escapes the classical model altogether, which thus falls short of providing a general, unified, explanatory framework.¹²¹ More than four centuries after Newton, quantum physics continues the same, still unsuccessful quest. This is not to deny that it made revolutionary discoveries with profound effects on our daily lives and world politics. During the twentieth century most physicists have shed Newtonianism and adopted an empirically rich, theoretically confounding post-Newtonian worldview that “even physicists don’t understand.”¹²²

Can we rely on the past to make us speak confidently about the future? Jonathan Kirshner’s to me reasonable insistence on contingency and uncertainty as the defining features of world politics pleads for “anticipation” and against “prediction.”¹²³ His critics charge Kirshner with being “anti-scientific” and lacking in “discipline.” For them the logic of prediction is central to the testing of all arguments. Without testable predictions there is no usable theory and no roadmap for the future.¹²⁴ This is sweet common sense for most students of world politics, meriting no further reflection. But why, one may ask, do we continue to stumble along tapping our cane against the pavement as we meet pestilence, fires, and floods of biblical proportions? As art and artifice scientific prediction is like a ghost, present everywhere and nowhere. “Perhaps no element of public life,” writes media scholar Benjamin Peters, “has become at once as ubiquitous, poorly understood, and totemic of modern-day unease as the scientific prediction – and its step-siblings, risk and rationality. Together the three blur the lines between the description and projection of what *was* and *is* into what *might* and even *ought (not) to be* . . . Every

¹²⁰ Searle 1984: 75.

¹²¹ Barad 2007: 24, 134, 440 fn 6. Unger and Smolin 2015: 373–84, 391–92. Smolin 1997: 125.

¹²² Carroll 2019. ¹²³ Kirshner 2024. ¹²⁴ Grinberg 2024. Posen 2024.

model becomes a model *both of and for* the future.”¹²⁵ Prediction is an exercise of meaning making that self-reflexively aligns the future to present needs. With prediction blurring into performance, meaning rarely arrives on time. For Eglė Rindzevičiūtė scientific predictions are knowledge cogs rather than complete devices. “Cog-like scientific predictions in effect moderate the modern cultural desire to obtain a perfect – or actionable – knowledge about the future.” All too often they are “pedantic” exercises of checking on “reality” rather than “free visioning.” As a consequence, Rindzevičiūtė argues, the failure of knowledge to create certainty makes scientific predictions and science in general politically vulnerable. “The performative power of scientific predictions as well as the nature of the will to predict, ... is expressed through the entangled strategies of ad hoc behaviors. ... Predictive capacity cannot be completely separated from the phenomena observed. ... The predictor and the predicted are coupled in the same system (or entangled in a form of chaos, depending on the level of complexity).”¹²⁶ Thus in 2012 the Italian government convicted six of its own scientists of multiple manslaughter charges for their failure to predict the 2009 earthquake at L’Aquila in the Abruzzo. For Teresa Ashe, in a post-Newtonian era the stakes in the prediction sweepstake could not be higher. It is “the nature of knowledge and power in a world that is no longer imagined as mechanistic and rule-governed.”¹²⁷ We no longer live today with the confidence instilled by taking Lab 101. Instead, we share in a pervasive sense of the inadequacy of human knowledge to face the existential insecurities of our futures. On this point, a doyen of American foreign policy, George Kennan, did not mince words: “the greatest law of human history is its unpredictability.”¹²⁸

Complementing Newtonianism is the contested concept of humanism. It describes a set of beliefs that makes humans the center of concern. Different kinds of humanisms characterize different periods in world history, spanning in the West from Greco-Roman antiquity to the Renaissance, the Enlightenment, the Romantic reaction, and a wide range of positions in the twentieth century. Humans are all of their own, sharing affinities with fallen angels and rising apes.¹²⁹ And humans are on their own, the only source of meaningful agency. Humanism expresses a secular cosmology. Bereft of gods, the world is held “in human hands.” The universe is understood from a human perspective. Non-human forces can make things happen. But humans are the only beings that

¹²⁵ Peters 2024. ¹²⁶ Rindzevičiūtė 2024; 2023: 1–3, 5, 154–56. ¹²⁷ Ashe 2024.

¹²⁸ Quoted in Kirshner 2022: 55.

¹²⁹ Marsh 2022: 150 quoting the renowned zoologist J. Z. Young.

can intervene in the trajectories of events to alter the conditions of human existence. This makes humans the sole shining light that illuminates an otherwise dark and blank universe. Humans are the ultimate arbiters of life's meaning and guarantors of the universe's order.¹³⁰

Humanists insist that humans differ fundamentally from other sentient beings. In Descartes' view, for example, humans were set apart by their reasoning capacity. This insight became the bedrock of many versions of humanism that followed.¹³¹ No longer artificial, machine intelligence is beginning to put that assumption to the test. "Human beings are soon going to be eclipsed" headlines the column of one chastened journalist.¹³² Yet, more than ever technological progress and prowess require an alignment of machines with human purposes and values. Sarah Bakewell's humanism experiences life between the entirely physical and the entirely spiritual, building worlds of happiness and sadness, here and now. Containing multitudes, humanism promises making connections with others.¹³³ The strength of human beings is "to take charge," consciously altering the conditions of their own lives. Their weakness lies in being "only human," unable to alter things that are "out of their hands."¹³⁴ Laden by positive and negative connotations throughout history, humanism has often been fought over in recurrent culture wars.¹³⁵

Through all these fights, the links of some variant of humanism to Newtonianism have been profound and not only in eighteenth century Victorian literature.¹³⁶ Like Newtonianism, various humanisms conveyed a triumphant sense of what was possible for humans. Even though he almost certainly never read any of Newton's work, Thomas Paine offers a striking illustration. Imprisoned in pre-revolutionary France and the target of a failed assassination attempt in post-revolutionary America, in his *Age of Reason* Paine views the world as an orderly and predictable space that invites mastery. And in *Common Sense* he declared that his generation had the power to make the world over again, listening to the "simple voice of nature and of reason."¹³⁷ The human capacity to understand and master the world was practically unlimited. Congealed into tradition and habit, only prejudice impaired the human capacity to see the world rightly and simply. Once prejudice was overthrown and the dictate of common sense heard, the abolition of monarchy and the establishment of democracy were sure to follow. Paine believed in the capacity of everyday people to understand and govern the world.¹³⁸ His humanism shares a deep affinity with a Newtonian worldview.

¹³⁰ Mitchell 2014a; 2014b: 1–2. ¹³¹ Schmidt 2018. ¹³² Brooks 2023.

¹³³ Bakewell 2023: 1–23. ¹³⁴ Mitchell 2014b: 2. ¹³⁵ Davies 1997: 5–6.

¹³⁶ Brown 2023: 47–70. ¹³⁷ Paine 1995: 49. ¹³⁸ Rosenfeld 2011.

For Paine politics is occasioned by little more than the need to overturn the prejudices of the past. Once that task has been accomplished nothing will stop humans from mastering the social and political world. Paine's optimism extends to the power of science to demystify the world by eliminating superstition so that science can guide humanity to a better future. Paine's humanism is triumphalist. God made the world and gave man reason to understand it: "The Almighty hath implanted in us these inextinguishable feelings for good and wise purposes . . . They distinguish us from the herd of common animals."¹³⁹ For Paine the world is organized by simple natural laws that are knowable by man. Humans are intrinsically reasonable creatures who only need to overcome their prejudicial *unreasonableness* to engineer the world as they and God see fit. Democratic government is all that is necessary to provide for security and freedom. Once it is achieved, political practice will fade away. None of this is complicated: "the simple voice of nature and of reason will say, it is right."¹⁴⁰

Not so for Nietzsche, who must have been drawn to the Jewish proverb "Man thinks, God laughs." His attack on God and reason links Nietzsche to the very tradition he seeks to overturn.¹⁴¹ For Nietzsche Paine's Christian God is no more than a product of "*ressentiment*," an idea invented by the weak to gain moral authority over the strong.¹⁴² There is no God and no God's eye watching the world at a distance. Lacking God's assistance humans invent reason for themselves. Knowledge is offering us not a firm grasp of the way the world is but a useful way of organizing our experience.¹⁴³ Reason is an accretion of conventions and a product of language. Reason and language give us the capacity to establish apparent equivalences between things that are not actual.¹⁴⁴ Instead, humans experience the world through sensations. A word is no more than a "copy of a nervous stimulation in sounds."¹⁴⁵ Nature "remains silent" about the truth of both reality and human beings themselves. In Nietzsche's own words it is "banishing and enclosing us within a proud, illusory consciousness" while throwing away the key.¹⁴⁶ Language is a product of this illusory consciousness. It does not touch reality itself but merely yields metaphors that approximate, more or less successfully, some aspects of human experience.¹⁴⁷ Truth is no more than a "mobile army of metaphors, metonymies, and anthropomorphisms"; after extended use they "strike a people as firmly established, canonical,

¹³⁹ Paine 1995: 35. ¹⁴⁰ Paine 1995: 9.

¹⁴¹ Deleuze 2006. Gooding-Williams 1987. Pippin 1999.

¹⁴² Nietzsche 2021: 173; 2014. ¹⁴³ Jackson 2016: 134.

¹⁴⁴ Nietzsche 2021: 60–61; 2007: 143–45. ¹⁴⁵ Nietzsche 2007: 144.

¹⁴⁶ Nietzsche 2007: 142. ¹⁴⁷ Nietzsche 2007: 144.

and binding.”¹⁴⁸ Truth is an illusion grounded in human amnesia of its entirely arbitrary history.¹⁴⁹ Our sense of stability, of an orderly natural world, and, indeed, of time and space are mere metaphorical contraptions.¹⁵⁰

Hiding behind reason and rationality, for Nietzsche, lies not irrationality but a-rationality and a-reason, with the “a” marking simple absence.¹⁵¹ Unlike irrationality, a-rationality and a-reason have little relationship with rationality. Nietzsche’s argument constitutes the end of the humanist project that relied on reason to create a bridge between humans and the world. Humans cannot know the world or themselves. And they cannot trust their reason. For they cannot secure the ground on which to do so. The result is a view of mastery entirely different from Paine’s divinely installed reason. For Nietzsche, mastery describes instead the battle of instinct against instinct, the will-to-power of life itself. This is played out in the a-rational actions of human beings. Humanity is no more important than a “midge,” which also “floats through the air with the very same pathos, feeling that it too contains within itself the flying centre of this world.”¹⁵² A faith in reason underwrites Paine’s firm belief in human exceptionalism. Nietzsche’s attack on reason underwrites a deep skepticism of all forms of anthropocentrism that make human beings appear to be unique.

Changes in nineteenth- and twentieth-century natural science prompted new developments in philosophical and methodological arguments in the humanities that were critical of the unthinking application of positivist and empirical science to humans and society. John Dewey argued that an operational and relational definition of scientific conceptions had replaced discrete and sensory ones and thus destroyed the foundations of Newtonian science. For Newton, objects of the world could be known with certainty only if they were reducible to original, unchanging essences. Heisenberg’s principle of indeterminacy established instead that acts of observation are indispensable for creating nature’s objects in a non-deterministic world. The old spectator theory of knowledge is thus replaced by an active intelligence that seeks control of changeable events. Indeterminacy has replaced “a fixed and closed world.”¹⁵³ And in an open world, human acts of interpretation and practical intelligence rather than theoretical reason intervene creatively in shaping the course of events.¹⁵⁴ This has been the task for the interpretive turn that started with Dilthey and Weber, discussed in [Chapter 1](#),

¹⁴⁸ Nietzsche 2007: 146. ¹⁴⁹ Nietzsche 2007: 146. ¹⁵⁰ Nietzsche 2007: 150.

¹⁵¹ Jackson 2016: 132–36. ¹⁵² Nietzsche 2007: 141.

¹⁵³ Dewey 1929: 200, 111–18, 192–200. ¹⁵⁴ Dewey 1929: 203–04.

and extends in the second half of the twentieth century to scholars such as Said, Foucault, Derrida, Butler, and many others who have argued against the slavish imitation of the successful natural science model.¹⁵⁵ Nobel Prize winning economist Kenneth Arrow concurs when he evokes “the tentative, creative nature of the human mind in the face of the unknown.”¹⁵⁶

Another twentieth century political theorist, Hannah Arendt, also lamented the conquest of the humanities and humanism by modern science and the scientific search for certainty in an uncertain universe.¹⁵⁷ For her, modern physics and science more generally have displaced humans as the center of a cosmic perspective on life. As the capacity for action became a prerogative of the sciences, the line separating the natural from the human world has been discarded. Science acts on nature from the standpoint of the universe rather than from within the web of human relations. It cannot tell stories that illuminate the human condition and distinguish the realm of “who” from the realm of “what.” For Arendt this loss of human exceptionalism is an unmitigated catastrophe. It left her wrestling with the problem of how to locate humanity as integrated into rather than set apart from a cosmic order consisting of human and non-human forms of life.¹⁵⁸

Like Arendt, Hans Morgenthau, the leader of mid-twentieth-century international relations, also attacked scientism and its search for certainty in an uncertain world.¹⁵⁹ But contra Arendt, for Morgenthau quantum mechanics affirms rather than negates the centrality of human reason. Modern physics offers decisive proof that Newtonianism has to be discarded not only in the natural but also in the social sciences. Newton learned that he could make sense of what moves objects. And he learned also that he could not make sense of what moves humans. As matters turned out, he was wrong about the first and right about the second. For Morgenthau it is sheer folly for the social sciences to emulate an out-moded Newtonianism. In Morgenthau’s vision, reason is surrounded and underlaid by unreason, “an island precariously placed in the midst of an obscure and stormy ocean.”¹⁶⁰

Because it aimed for the unobtainable, Tolstoy mocked Pfuel’s “imaginary knowledge of the perfect truth.” The pairing of Newtonianism with humanism remains a source of infinite, interesting conversations that illuminate the islands and oceans of the risk-uncertainty conundrum as the source of the messiness of the world of

¹⁵⁵ Blakely 2020: 125–27. ¹⁵⁶ Bernstein 1996: 220.

¹⁵⁷ Arendt 1958: 270, 322–24. Waters 2022a: 65. ¹⁵⁸ Ephraim 2018.

¹⁵⁹ Morgenthau 1946: 132, 136–37. Katzenstein 2022b: 29–30. Waters 2022a: 62–64.

¹⁶⁰ Morgenthau 1946: 145.

politics and of world politics. Why should you care to read this book? You can discover that grasping the post-Newtonian along with the Newtonian, and the para-human along with the human can lead to broader and deeper understandings of the world of politics and world politics – and greater modesty in the claims about the role we play in them. What can you do with this book? You can use it as a kaleidoscope for recognizing the complementarity of risk and uncertainty operating in a world of entanglements, and, on a very clear day, as a source for understanding some of those connections. Whatever the problem – finance, war, the environment, and all three together – you do not have to be stuck in one world for all problems and all times. Depending on the question at hand you can move around the world of risk in the morning, the world of uncertainty in the afternoon, and seek out the connections among both worlds in the evening. This book frees one's feet from being encased in cement and invites them to tap-dance. By opening windows, it lets a fresh breeze get rid of stale air and enhances our capacity to shift perspective. This can be an unsettling experience and not only for the foolish Pfuels that inhabit some part of all of us. Robert Oppenheimer once said that “it is a profound and necessary truth that the deep things in science are not found because they are useful; they are found because it was possible to find them.”¹⁶¹ But there is another truth, equally necessary and equally deep. With sufficient courage to look for this truth within us, we will also find it in the world: the search for an imaginary knowledge and the perfect truth is magnificently futile.¹⁶²

¹⁶¹ Quoted in Silver 2024: 407. ¹⁶² Lilla 2024.

1 Worldviews and Small and Large Worlds

On election day November 8, 2016 America was on edge at the end of a Presidential campaign of vitriol and lies unusual even by the forgiving standards of American politics. The two Nates and most pollsters agreed that in a tight race Hillary Clinton would become the next President of the United States. Nate Cohn of the *New York Times* thought the odds were 85 percent in Clinton's favor. Nate Silver's *FiveThirtyEight* poll predicted the same outcome with more than 70 percent confidence and gave Clinton more than 300 votes in the electoral college. The Princeton Election Consortium put Clinton's odds at around 98 to 99 percent. Its president promised to eat a bug if Trump were to win more than 240 votes of the electoral college. Elite opinion, inside and outside the Beltway, concurred with the pollsters. But between afternoon and nightfall on that November day, within a few hours Nate Cohn's updated estimate gave Donald Trump a 95 percent chance to win the election. Rarely in the history of American elections have so many been so wrong.¹

Worldviews provide horizons for the risk-uncertainty conundrum. A world without horizons is disorienting and bereft of hope. Conspicuous "failures of worldview" sap confidence in leaders who do not know what is coming next.² Such failures can undermine the self-confidence of individuals, groups, and states who do not like the unexpected to undermine the sense of control they enjoy over others. Where you stand, students of bureaucracy quip, depends on where you sit. The powerless do not indulge in the fantasy of being in control. Assigned seats at the children's table, or denied seats altogether, they often understand life's uncontrollable uncertainties better than those seated comfortably at the high table. Precarity and marginality often make them face risk and uncertainty with dread, sometimes with hope. Worldviews and the horizons they provide are always relative to the position from which the world is viewed.

¹ Blakely 2020: xi–xii. ² Authors 2017. Phillips 2020: B4.

Before proceeding any further, I should put my cards on the table. My own worldview is reasonably well summarized by the title of a short article I once wrote: “Mid-Atlantic: Sitting on the Knife’s Sharp Edge.”³ Living between American and European social science I have found myself caught, following Michael Adams’s metaphor, between “fire and ice.”⁴ This captures my stance toward worldviews – both conventional Newtonian humanism and its post-Newtonian and para-humanist alternatives. Although the sharp edge of the knife is not a comfortable resting place, the geography of my thinking does not lack a firm anchor. Interested in understanding better the complementarity of risk and uncertainty, I look for promising alternatives to sweet common sense, difficult as they may be to understand. I find intuitively plausible a problem-focused approach of being in the world. Trespassing is for me the main advantage of scholarship.⁵ Eschewing the cozy cocoon of the like-minded, in the stiff breeze of the imagined mid-Atlantic I am drawn to Samuel Beckett’s preference for hues of grey over black and white.⁶ Like Winnie the Pooh, I lean toward “both-and” rather than “either-or” styles of analysis. Contentedly, I rest uncomfortably on the knife’s sharp edge. For “truth is one.”⁷ People simply call it by different names. When all is said and done, for me it is the place “where the individual mind comes to rest.”⁸

Worldviews ground different theories and models in their encounters with the risk-uncertainty conundrum. This chapter introduces the concept of worldview as elaborated by its two pre-eminent theorists, Wilhelm Dilthey and Max Weber (section 1). It then discusses worldviews in general, alluding briefly to two alternatives to Newtonian humanism (section 2). Elaborating on the metaphor of small and large worlds the chapter finally shows how objective and subjective probabilities are seeking to sidestep, unsuccessfully, the risk-uncertainty conundrum and how both are, implausibly, reinforcing the sweet common sense we call Newtonian humanism. That “common sense” predisposes us to focus on risk while neglecting uncertainty (section 3).

1. Dilthey and Weber

The concept of worldview is intimately tied to the names of two nineteenth-century social theorists, Wilhelm Dilthey and Max Weber. Both were committed to empirical investigations of intellectual and social history as an avenue to elucidate different worldviews. Both tried to find regularities

³ Katzenstein 2009. ⁴ Adams 2004. ⁵ Hirschmann 1981. ⁶ Beckett 1958: 17.

⁷ Fierke 2022: 3, 53 quoting the Rig Veda. ⁸ Katzenstein 1976: xiii.

in human affairs. Dilthey focused his attention on religious, artistic, and philosophical worldviews.⁹ Weber inquired into the tensions modern capitalism had introduced into the civilizational legacies of the past, specifically the relationship between ideas and social action. Dilthey looked to the present and future as he sought to define the scope of an interpretive science and defend it against the rising importance of the natural sciences. Weber examined the past for the religious roots of contemporary secular beliefs and practices. For both, worldviews express values. In contrast to positivists who believe that social inquiry can be value-free, for Dilthey such inquiry is historical and inescapably value-laden.¹⁰ Weber disagreed. He emphasized the importance of values in the selection of all objects of inquiry. But he also argued for the possibility of a value-free social science.

Dilthey

Much of Wilhelm Dilthey's voluminous work remained fragmentary and was published posthumously. Only a small amount has been translated into English.¹¹ Like Kant, Dilthey was committed to the creation of a secure epistemological foundation for knowledge. As a humanist, he focused on the cultural rather than the natural sciences. In contrast to some of Kant's writings, for Dilthey experience and knowledge are not activities that belong solely to the realm of reason. In developing a culture-bound concept of worldview, Dilthey's work thus departs from the transcendental tradition of German idealist philosophy. Instead, for Dilthey the concept of worldview rests on the bedrock of human experience. Life itself and the human capacity to will, feel, and think are the foundation of all knowledge.¹² Dilthey thus shifted the problem of history and philosophy from the universalism of abstract concepts to inherently partial and plural notions of worldview.¹³

Worldviews touch on the deepest beliefs of an individual's inner experience about the meaning of life in the face of death, thus speaking to both

⁹ Dilthey 1931: 3–42. ¹⁰ Jackson (2002: 72) calls this “historical hermeneutics.”

¹¹ Dilthey's work and Dilthey scholarship are difficult and voluminous. My cursory remarks barely scratch the surface of difficult ontological, epistemological, and methodological issues rarely discussed by scholars of world politics. Most relevant for this section are a few of Dilthey's books (1922, 1924, 1927, 1931). For English translations see Makkreel and Rodi (1989a, 2010, 2002, 1996, 1985) including their lucid introductions to each volume; Kluback and Weinbaum 1957: 17–74; Rickman 1976: 133–54; and Owensby 1994: 15–20. For clear and concise overviews in English see Masur 1952 and Hodges 1944.

¹² Holborn 1950: 98–100. Makkreel 1975: 77–202. ¹³ Ermarth 1978: 323.

risk and uncertainty.¹⁴ They contain fundamental religious, philosophical, and esthetic beliefs that are accepted as self-evidently true.¹⁵ Each of these three endeavors makes different demands on human capacities. Religion mobilizes will, philosophy thought, art feeling. In the history of humankind, religion preceded the other two. Like prophets, philosophers and poets seek answers to the basic riddles of human life – its purpose and meaning, its transitory nature, its beginning and end. As macroscopic disclosures of human experiences, worldviews embed individual understandings and lived experiences in the socio-cultural world.¹⁶

Worldviews are accessible through the analysis of historical artifacts such as books, symbols, official records, painting, architecture, music, philosophy, and religion.¹⁷ Private experience is the starting point for an individual's expansion through re-experiencing the historical world. Historical knowledge is always also a mode of gaining more self-knowledge.¹⁸ As collectively shared interpretations, such as Newtonian humanism, worldviews mark major historical epochs.¹⁹ In a nutshell, Dilthey distinguishes three phases of history that are expressed in the worldviews of priestly, monotheistic Hebrew, Islamic, and Christian religions seeking salvation through communion with a living God; in the philosophies of Greece and Rome articulating universally valid patterns of thought and developing rules, law, and obligation; and in the modern era of science, epitomized by Newton and the inventions of concepts such as risk. The confluence of all three has formed the modern European worldview.²⁰

Dilthey's vision was both European and universal. To be sure, his humanism focuses on the three Abrahamic religions as well as a tripartite West consisting of Greece, Rome, and the Renaissance. Yet Dilthey's humanism resonates also with less Euro-centric sensibilities. For him all cultures embody different human interpretations of reality.²¹ Once they are subjected to an interpretive approach, a Shakespearean sonnet, an African mask, and a Chinese relic cease being an It. They become a Thou to which the I of the investigator relates as she probes their different meanings. Contra the nineteenth-century view that non-European civilizations were inferior, Dilthey insisted that they, too, inform and instruct just as much as Europe does. Foreign and distant

¹⁴ Dilthey 1924: 378–416; 1931: 75–118. Tuttle 1969: 55. Makkreel 1975: 345–64. Koltko-Rivera 2004: 6.

¹⁵ Dilthey 1931: 26–42. Mul 2004: 269–83.

¹⁶ Dilthey 1927: 151, 181, 191, 262–64; 1931: 207. Tuttle 1969: 46, 49–50.

¹⁷ Tuttle 1969: 58. Owensby 1994: 162–64. ¹⁸ Chakrabarty 2009: 220.

¹⁹ Plantinga 1980: 81–82. Bulhof 1980: 4, 82–83. Ermarth 1978: 325–26.

²⁰ Masur 1952: 98–100. ²¹ Bulhof 1980: 105–07.

experiences open windows onto an infinitely rich reality that lies beyond any individual's limited personal and cultural grasp. Dilthey was interested in discovering ways to transcend human limits and enable encompassing, shared human understandings.²² Unlike Weber's more Euro-centric sociology of religion, Dilthey's humanism points the way toward a cross-cultural and trans-civilizational universalism.²³ He thus anticipated twenty-first-century humanists' emphasis on the primary unifying identity of one encompassing humanity and the subordination of secondary divisions such as nationality, ethnicity, race, gender, and sexual orientation.

Newtonian humanism and other worldviews are holistic interpretive frameworks that differ from question-specific theories and models.²⁴ For Dilthey such worldviews try to understand the world synthetically by alerting us to meanings broader than scientific explanations. Worldviews incorporate ideals and purposes, offering insights into what is and postulates about what ought to be. Dilthey's science of worldviews was to operate at an even higher level of abstraction than do worldviews themselves. That science could not be transhistorical, resting on stable observations outside of history. It had to be heuristic and provisional. Going beyond the atomistic empiricism and mono-causal explanation characteristic of Newtonianism, an interpretive science sought to describe major systems of thought, deepen conceptual knowledge, and offer circumscribed generalizations.²⁵ For worldviews such as Newtonian humanism have an inner dialectic rooted in their contradictions, are always open to immanent critiques, and thus always remain subject to change. And that changeability takes some of the sharp edges off the unavoidable intellectual conflicts that exist between them.²⁶ Early on in his career, Dilthey thought of his typology of worldviews as explanatory. Later in life he regarded it as no more than a possibly helpful heuristic.²⁷

Resonating with scientific models and American pragmatism Dilthey's exploration of worldviews has a practical bent. For Dilthey the purpose of philosophy is to serve living in the world.²⁸ This underlines his disagreement with empiricists who rely, in his way of thinking, on a leap of faith to bridge the gap separating the reception of sensory data and human experience. For him, reality is not mute and inert, as in Newtonianism.

²² Marom 2014. ²³ Rickman 1979: 173–74. ²⁴ Mul 2004: 272.

²⁵ Dilthey 1924: 378–404.

²⁶ Ermarth 1978: 326–27, 334, 336. Orth 1985: 16–17. Plantinga 1980: 82, 139. Bulhof 1980: 89.

²⁷ Ermarth 1978: 329–32. Plantinga 1980: 139–43. Bulhof 1980: 91–92. Bianco 1985: 221–22, 224. Young 1979.

²⁸ Rickman 1988: xii–xiii; 1979: 3. Holborn 1950: 96–97.

It discloses itself in and through language and other communicative practices.²⁹ Humans are actors not spectators in the evolution of the world. In the end, “the humility and profundity” of Dilthey’s articulation of the concept of worldview, Young argues, stays true to the “concrete many-sidedness of divergent human interests and interpretations of reality.”³⁰

Weber

Max Weber’s towering intellectual achievements as a social scientist lacked Dilthey’s self-reflexivity and humility. Yet in some ways Dilthey helped point the way for Weber’s cross-civilizational sociology of religion.³¹ Weber’s interest in worldviews was empirical: identifying distinctive sources of Western rationalism. Weber’s foremost interest was a better understanding of the distinctive religious and secular traditions of the West and, specifically, Western notions of rationality. To make sense of life’s chaotic confusions humans create meaningful parts of their existence. Although it is haphazard, that process is not experienced as such. Individuals and groups tend to believe in the necessity and sanctity of some of their most basic beliefs and cherished values.³²

For Weber worldviews offer answers to some of the most profound questions that shape human practice. Scattered throughout his writings, Weber’s ideas about worldviews are difficult to track. The comprehensive and highly regarded *Max Weber Dictionary*, for example, does not contain a single entry under this subject heading.³³ My account relies on Stephen Kalberg’s authoritative summary guide and interpretation.³⁴ For Weber worldviews are grounded in closely connected supernatural and worldly realms. In his famous formulation,

not ideas, but material and ideal interests directly govern men’s conduct. Yet, very frequently the “world images” that have been created by “ideas” have, like switchmen, determined the tracks along which action has been pushed by the dynamic of interest. “From what” and “for what” one wished to be redeemed and, let us not forget “could be” redeemed, depended upon one’s image of the world.³⁵

In this arresting image of track and switchman, worldviews operate both directly and indirectly. They are filters that shape politics by defining actor identities and molding the political structures and processes that

²⁹ Bulhof 1980: 1–2. ³⁰ Young 1983: 138.

³¹ Rickman 1979: 173–74. Byrnes 2022: 266–69. ³² Kalberg 2017. Poggi 2006.

³³ Swedberg 2005.

³⁴ Kalberg 2012: 73–91; 2021: 154, 313, 397–400, 412–14, 425–34, 441–45, 483–85.

³⁵ Weber 1946: 280; 1920: 252.

influence practices.³⁶ And they also embody values that inform the interests of actors.³⁷ Operating directly or indirectly, worldviews contain different configurations of values that become objects of political conflict, creators of groups and movements, and shapers of practices and policies. Worldviews are contingent and permit the unexpected to happen; in Leonard Seabrooke's words "trains can be robbed, derailed, delinked, or run out of steam."³⁸

In Weber's writings on religion, the main carriers of worldviews are prophets.³⁹ They make available to their followers "a unified view of the world derived from a consciously integrated meaningful attitude toward life."⁴⁰ In Weber's analysis prophets and the prophetic age are the central events in the evolution of religion, turning points between many thousands of years of "magical" religion and the new era of post-magical "salvation" religions.⁴¹ Prophets gave social and cosmic events a systematic and coherent meaning that should govern man's conduct if he aspires to salvation. It requires a prophet's sustained effort to bring order into life's variegated manifestations and to organize man's ordinary practices. As legacies of prophetic visions, worldviews offer practical evaluation, not logical consistency. The discrepancy between a coherent, religiously infused view of the world and empirical reality is the source of the strongest tensions between inner life and external relationships. Prophecy, priestly guidance, and subsequently secular philosophy are all concerned with alleviating those tensions.⁴²

Weber developed this general approach in his seminal *Protestant Ethic and the Spirit of Capitalism*.⁴³ For Weber the economic ethic – which he called "the spirit of capitalism" – was of central importance. It required a cultural analysis of sixteenth- and seventeenth-century ascetic Protestant sects and churches, mainly Reform Calvinism. The Protestant ethic furthered rationalization, especially in economic life but also in other spheres. It set a standard that all other religions, including Catholicism, did not match. The economic practices of Protestant believers, Weber argued, were shaped by answers given to the question of salvation rather than by utilitarian considerations. The faithful came to believe that their capacity for methodical and profitable work and their success in accumulating wealth in this world served as evidence of their salvation in the next. With work acquiring religious meaning, they could create the conditions of their own salvation. Methodical work became sanctified as a religious calling. Looking for signs of redemption sent by God, Protestants saw in

³⁶ Anderson 1978: 23. ³⁷ Haukkala 2011: 34. ³⁸ Seabrooke 2006: 11.

³⁹ Weber 1978, I: 439–51. Joas 2012: 17–20, 27, fn 34. ⁴⁰ Weber 1978, I: 450.

⁴¹ Joas 2012: 17. Weber 1946: 267–359; 1978, I: 430–31. ⁴² Weber 1978, I: 450–51.

⁴³ Weber 2009.

worldly economic success one such sign. Weber shows how in creating their religious world and a subjectively meaningful life, believers arrived at their conclusions. Over time, the religious ethic of groups of believers transformed itself into its secular successor, the spirit of capitalism. Thus, asceticism in this world gave the capitalist economy of the West a vital push to great dynamism and efficiency compared to non-Western societies. This provocative and highly original argument led Weber to eventually write a massive comparative sociology of religion that included book-length studies of China, India, ancient Judaism, and antiquity.⁴⁴

Comprehensive and coherent value configurations of worldviews can be grounded also in secular realms. Chinese literati, Hindu Brahmins, and the intellectual leaders of secular movements such as Liberalism and Marxism ponder life's meaning and develop an integrated worldview.⁴⁵ What matters is the crystallization of a message of the ordered meaningfulness of life. In modern times worldviews thus can express inclusive-universalistic values of the world's major religions, cosmopolitan secular ideologies, exclusive-particularistic values of ethno-nationalist movements, and the values of scientific inquiry itself.

Distinct forms of rationalism became the eventual destination not only of the three Abrahamic religions but also of Hinduism and Confucianism. In those Eastern religions Weber also located rational and commercial elements. The eventual disenchantment of traditional religious and philosophical life forms could not be stopped as science and technology gradually weakened and eventually destroyed deeply held traditional convictions and values in both West and East. The scientific revolution of the sixteenth and seventeenth century was particularly impactful. In Weber's view Chinese science, for example, remained little more than concealed empiricism and had little to do with the rigors of the mathematical universe that Newton had constructed. And while India had a very strong mathematical tradition, according to Weber it simply could not compete with the advanced mathematics developed by Western intellectuals.⁴⁶

As religious beliefs were increasingly replaced by beliefs in science and technology, religiously infused worldviews were replaced by the thin veneer of custom and rational self-interest as the main motivation for individual and group practices. As Kalberg writes, orientation to the ethical universe of worldviews involves "an uprooting of action from its common random, pragmatic, and utilitarian flux and flow, and its guidance by a constellation of values."⁴⁷ Values clustered in the ethos of

⁴⁴ Weber 1951, 1952, 1958, 1976. Wittrock 2012: 103. ⁴⁵ Weber 1978, I: 506.

⁴⁶ Love 2000: 184, 187. Kalberg 2021: 402–04. ⁴⁷ Kalberg 2012: 76.

secular organizations and status groups normally do not reach the level of comprehensive worldviews. Typically, they do not offer answers to life's broad questions about meaning, purpose, injustice, and suffering. For example, "unsentimental economic brotherhoods" practiced for the benefit of individual households possess concrete, transitory purposes and do not address basic religious, moral, and philosophical questions of life.⁴⁸ The same is true of the bureaucratic ethos of civil servants with its typical this-worldly value configuration centered around duty, discipline, respect for hierarchy, orderly work habits, security, reliability, and impartiality.⁴⁹

In Weber's view the ascent of formal and practical rationality in modernity caused a decline in the importance of the supernatural, especially in Europe and the Americas. These two forms of rationality rule daily life in modern societies. Untethered from religious values, they follow the logic of state and market. The effect of the Judeo-Christian worldview is weakening and with it the grounds for practical-ethical action-orientations. This modern world is, like the ancient one, once again polytheistic: abstract entities now hold center stage, among them GDP growth, star-status in the social media world, and good looks. None can mobilize compassion, feelings of brotherhood, and ethical action. Custom and convention are replacing ethical values that were once given legitimacy by a shared worldview. And for Weber, when customs and conventions weaken, action will in the end be driven only by the cognitive thrusts of means-ends rational action. Quasi-religious social reform movements also fail to create configurations of binding values. They fall prey to merely utilitarian calculations. Worldviews do not disappear. But they become relics from a distant past.

Weber's argument turned out to be flawed on two counts. The inevitable loss of religion in a disenchanted modernity failed to fully materialize. As legacies from the past and adaptations to the present, religions continue to shape contemporary worldviews and world politics. In all corners of the world different religious traditions have shown a great capacity to reinvent and reinvigorate themselves – even in Europe, the most secular region in the world. The enlargement of the European Union toward South and East and a growing stream of illegal migration, for example, have made religion once again a vigorous European concern.⁵⁰ And in America's social and political life religion remains a vital force.

Weber also failed to consider fully the implications of different scientific worldviews in the era of disenchantment he bore witness to.⁵¹ We live

⁴⁸ Weber 1978, I: 361–63. ⁴⁹ Weber 1978, I: 217–26; 1978, II: 956–58, 998–1003.

⁵⁰ Katzenstein 2006. ⁵¹ Allan 2018: 36, fn 28.

with the conviction, he wrote, that in this disenchanted world “one can, in principle, control everything by means of calculation.”⁵² This scientific credo creates “specialists without spirit, sensualists without heart; this nullity imagines that it has attained a level of civilization never before achieved.”⁵³ This assessment seems to be off the mark. Newton’s life work expressed the impetus of seeking divine will in the laws of nature, thus proving His superior intelligence. And in the twentieth century quantum mechanics has generated miraculously precise predictions and innumerable practical applications. But the meaning and nature of quantum mechanics, most physicists agree, has remained a mystery. This may be one reason why Newtonianism retains its iron grip over the social sciences and the analysis of world politics – despite the fact that in their normal research practices these disciplines rely heavily on the everyday technological products of the quantum revolution. Furthermore, besides quantum mechanics a second development in the humanities unfolded fully only after Weber’s death: post-modern writings expressed a loss of faith in meaning itself.

Conclusion

Both Dilthey and Weber grappled with the issue of historical relativism – Dilthey retrospectively, Weber prospectively.⁵⁴ While Weber made his own noteworthy methodological contributions, it was Dilthey who insisted that the humanistic sciences (*Geisteswissenschaften*) required hermeneutics, a methodology that differs from the positivism of the natural sciences. Building on the writings of the theologian Schleiermacher, Dilthey insisted that the humanistic sciences must shoulder the burden of self-interpretation and take account of the historical horizons of their times. Framing both self-interpretations and historical horizons, at a higher level of abstraction worldviews themselves are also a form of self-interpretation. They picture who we are, and how we fit into the world. This insight became a cornerstone of the writings of philosophers and historians of science in the twentieth century.

Martin Heidegger and Thomas Kuhn have built on Dilthey’s and Weber’s insights. Heidegger radicalized and broadened Dilthey’s self-interpretive method. He interrogated the experience of the everyday as a way of uncovering the ontological foundations of life. And he stripped away traditional metaphysical assumptions and applied interpretive methods to modern science.⁵⁵ In 1938 Heidegger gave a lecture, first

⁵² Weber 1975: 139. ⁵³ Weber 1958: 182. ⁵⁴ Bergstraesser 1947: 92, 95, 108–10.

⁵⁵ Heidegger 2008.

published in 1950 without the unabashedly positive references to Germany's Nazi government. His political culpability aside, Heidegger sought to understand modernity. He did so by focusing on the presuppositions of modern science as a way to uncover the elusive, yet unavoidably historical, foundation of modernity.⁵⁶ Heidegger argues that each scientific era has its own worldview. And that view is incommensurable with any other.⁵⁷ Linked through a historically grounded, dialectical process of critique, discovery, and interpretive innovation the Greeks' and Galileo's understanding of the universe differed radically from that of modern science. What was considered true in one era was deemed to be wrong in another. Different scientific worldviews pose different questions and accept different answers. Modern science has given free rein to conceiving and creating a world of controllable objects. "Calculability" has become a central characteristic of modernity without eliminating the unknowable uncertainties at the core of Being.⁵⁸ This is Heidegger's formulation of what I call the risk-uncertainty conundrum.

A few decades after Heidegger, the American historian of science Thomas Kuhn fashioned the concept of paradigm to describe the foundational assumptions of scientific theories.⁵⁹ Paradigms are the foundations of all theories. Some scientific claims about the world are incommensurable with others, especially ancient, religious, and contemporary commonsensical ones; others are not. Progress in science is not continuous and cumulative. It consists instead of periods of normal science interrupted by brief periods of revolutionary science that create a paradigm shift. Normal science is marked by the ascendance of a single paradigm that determines central research questions, theoretical vocabulary, plausible models, acceptable methods, and criteria for assessing how well a given question has been answered. When paradigms become dominant, their weak parts are no longer recognized, foundational assumptions are no longer questioned, and anomalies are consistently overlooked. Expressed as a pre-paradigmatic worldview shared by all of the main paradigms of international relations, Newtonian and humanist presuppositions fit that description to a T.

Controversially, like Heidegger, Kuhn argued initially that across different historical eras scientific paradigms are incommensurable with one another. If true, that would make it impossible to integrate or compare theories developed in different paradigms. In some of his later writings, however, unlike Heidegger, Kuhn backed away from this claim. Instead, he sometimes likened revolutionary, paradigm-shifting scientific progress

⁵⁶ Heidegger 2002: 57–60. ⁵⁷ Lafont 2014: 393. ⁵⁸ Heidegger 2002: 67–71.

⁵⁹ Kuhn 2000, 2012.

to the process of Darwinian evolution: non-directional improvement with no specific purpose. By contrast, change during normal times, within well-understood paradigms, is directional.⁶⁰ While there are multiple truths in all scientific endeavors, on the record of the last several centuries, natural scientists have ruled out many things previously thought to be true. There is thus justified hope of movement in the direction of greater truth. That hope is much weaker in the social sciences, including the analysis of the political world and world politics. Kuhn dismissed them as inconclusively fumbling around in a pre-paradigmatic state, unable to address, let alone escape, the risk-uncertainty conundrum.⁶¹

2. Worldviews

We navigate our way through life guided by different worldviews.⁶² “Our views of the world,” writes political psychologist Brian Rathbun, “provide comfort in an uncertain environment.”⁶³ I refer to “we” in the encompassing sense – “we the people,” decision makers, and students of world politics. Stabilizing our fraught experiences is one of the great accomplishments of worldviews. Individually experienced yet irreducibly social, they touch deep emotions. In the words of Martha Nussbaum “they reside at the core of one’s being, the part of it with which one makes sense of the world.”⁶⁴ Worldviews can have both sustaining and disruptive qualities.⁶⁵ Incorporating at times contradictory components, fixed or fluid worldviews compete, co-exist, and co-evolve with one another. Worldviews can endure for centuries.⁶⁶ They acquire force by being believed in – strongly and frequently unconsciously.⁶⁷ They are taken for granted and offer meaning in an often meaningless world. Informing theories and models they help tell stories about the world. Ideas come and go; stories stay.⁶⁸ Worldviews lead us to pose our questions, and they shape our answers. And the correctness of those answers is not always supported by facts. The real world changes, yet all too often our mental frameworks don’t. “Sometimes in life you should stick to your worldview and defend it against criticism,” writes journalist David Brooks in a self-critical column titled “I Was Wrong about Capitalism.” But when the

⁶⁰ Weinberg 1998: 14. ⁶¹ Wight 1996: 292, fn 7.

⁶² Nordin and Smith 2019. Jackson (2016) speaks of philosophical wagers, specifically mind-world dualism and mind-world monism.

⁶³ Rathbun 2024: 2.

⁶⁴ Nussbaum 1995: 375. In Latin, emotion means to “move out” – from the individual toward the world, be it small or large.

⁶⁵ Kalberg 2012: 76–81. Katzenstein 2022a. ⁶⁶ Toulmin 1992. Haldén 2024.

⁶⁷ Kalberg 2012: 75. ⁶⁸ Taleb 2007: xxvii.

world is genuinely different “the crucial skills are the ones nobody teaches you: how to reorganize your mind, how to see with new eyes.”⁶⁹

In comparison to the concepts of “theory” and “model,” as Figure 1.1 shows, the concept of “worldview” is rarely used, as the flat line close to the x-axis demonstrates.⁷⁰ This is unfortunate. The concept of worldview plays a vital role as the unacknowledged foundation for common-sense, conventional understandings of concepts such as “theory” and “model.” Collective patterns of thought, Nathan Leites argued long ago, matter in world politics. During the Cold War, for example, Soviet decision makers adhered to an “operational code” that shaped their views of cooperation and conflict in world politics.⁷¹ Vying for the position of favored crown-prince in the second Trump Presidency, in 2024 J. D. Vance and Elon Musk have partly rival and partly overlapping worldviews about the future of America.⁷² In the sciences, meta- and pre-theoretical constructs such as “worldview” go by the name of “paradigm.” Kuhn’s paradigms have been reinterpreted by students of world politics, who refer to paradigms as normatively infused, analytically compelling, and politically salient schools of thought.⁷³ Realism, Liberalism, and Marxism, for example, are battling over how to explain or interpret past and present, and how to act in world politics. Their sharp disagreements rest on the invisible, shared foundation of Newtonian humanism. Newtonians strive for a social physics that humanists decry as futile. With interpretivists persisting in their critique, the American study of world politics, John Ruggie observed three decades ago, “is reposed in deep Newtonian slumber wherein method rules.”⁷⁴

That said, the eminent historian of science Alexandre Koyré’s assessment from 1965 still rings true. All or nearly all have accepted “the idea of the Newtonian world machine as the expression of the true picture of the universe and the embodiment of scientific truth.”⁷⁵ Applied to the analysis of world politics, Newtonianism searches for law-like correlational statements and causal mechanisms.⁷⁶ Built on Newtonian foundations, these analyses hold that the world is external, static, and fully knowable; that it is independent of the observer; and that the temporal and spatial coordinates of the world are independent from one another. The simple billiard ball

⁶⁹ Brooks 2022.

⁷⁰ Google Books *Ngram Viewer* is a research tool for “quick-and-dirty heuristic analysis” (Chumtong and Kaldewey 2017: 8). It is worth remembering that this tool does not measure what people are talking but what they are publishing about, only in English, and only in texts that Google has digitalized. See also Clapp and Dauvergne 2011: 1–18. Braumoeller 2012: 86–89.

⁷¹ Leites 2007 [1951]. ⁷² Douthat 2024a. ⁷³ Kuhn 2000, 2012.

⁷⁴ Spruyt 2020: 30–31, 333. Ruggie 1993: 170. ⁷⁵ Koyré 1965: 4.

⁷⁶ Jackson and Nexon 2013: 549. Wæver 1997.

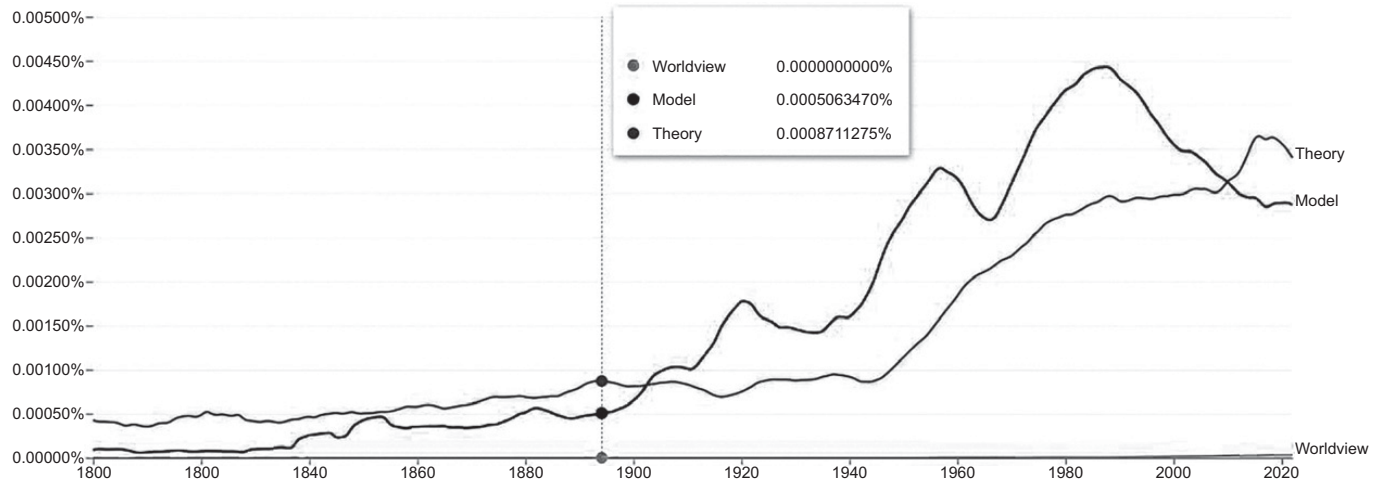


Figure 1.1 N-grams: Worldview, Model, Theory
Updated from Figure 1.1 in Katzenstein [2022a](#): 7

model of international relations, conventionally taught to first-year college students, is a good example of cause and effect reasoning that is mechanistic. Indeed, many scholars of world politics emulate economics which was deeply affected by nineteenth-century mechanics.⁷⁷ More generally, much of American political science has imitated or adapted theoretical developments in the more mature disciplines of economics and sociology.⁷⁸ Just as atoms are the smallest entities that constitute the physical world, for many political scientists independent social entities – individuals, groups, states, or “things” – are the building blocks of the social and political world.⁷⁹ The analysis of world politics tries to get hold of an always-in-flux and elusive world based on three unacknowledged assumptions: the context of world politics is relatively homogeneous; social and political processes are stable; language is a mirror of the world.⁸⁰

Many students of world politics are also humanists, in the sense of putting humans at the center of their stories. A humanistic worldview dates back to the Renaissance, the scientific revolution of the seventeenth century, and the eighteenth-century Enlightenment. Common to these lineages is a central claim: human beings are distinct from the rest of the world. The natural world is knowable and governed by laws that humans can identify and manipulate to their own advantage. Human beings thus possess a unique status. They can explain *and* change the design of the natural and social world. As masters of the world, they stand apart from and above it. Reason and language can fire human imagination to explore unknown possibilities. This idea has waxed and waned over time. In the early nineteenth century in Germany the idea of a humanistic education was narrowed to a Western tradition dating back to Greco-Roman antiquity. A hundred years later Nietzsche argued that humans were a-rational and irrational, and humanist talk was nothing more than a bladder full of hot air.⁸¹

Worldviews offering alternatives to Newtonian humanism do exist. They merit attention not because we should start everything over anew but because unconventional worldviews can offer fresh insights into the complementarity of risk and uncertainty. Like Newtonian humanism, they are constructs of the human imagination, open to different ways of building theories and models, and subject to intellectual and political controversy. But unlike the Newtonian part of Newtonian humanism, they are more comfortable engaging issues of uncertainty. In the words of David Dequech, they help define a natural and social reality “subject to non-predetermined structural change” and “inhabited by individuals

⁷⁷ Mirowski 1989. ⁷⁸ Harrington 2022: 29–31. ⁷⁹ Jackson and Nexon 1999, 2013.

⁸⁰ See Chapter 2, section 1. ⁸¹ Quoted in Davies 1997: 37.

who have . . . the potential for creative thoughts and acts.”⁸² This should make it impossible to push uncertainty aside. But it does not. Conventional arguments often bypass the distinction between the risk of known unknowns and the uncertainty of unknown or unknowable unknowns, and they gloss over the difference between the unintended (by humans) and unanticipated (in systems) consequences of actions.⁸³ In short, they do not acknowledge the risk-uncertainty conundrum.

In the late nineteenth century, experimental physics began to probe the subatomic structure of matter. Electrons, quarks, photons, gluons, neutrinos, and a few “Higgs bosons” are the elementary particles studied by quantum mechanics.⁸⁴ They are not real, like little pebbles. “They are the elementary excitations of a moving substratum . . . minuscule moving wavelets.”⁸⁵ Einstein’s special relativity theory of time and space, and relativistic quantum field theory more generally, opened up an invisible world of energy governed by randomness. Time and space are related and fluid. Nineteenth-century philosophical relationalism inspired the first generation of quantum physicists to think relationally about many of the new phenomena they were discovering with ingenious experiments. Although the weirdness of the quantum world has defied all attempts at explanation since then, the new theory became a marvel of predictive accuracy. It has generated technological innovations and applications that continue to revolutionize world politics. Filled with many baffling aspects, the subatomic world is indeterminate and cannot be visualized. Electrons moving in an atom are ruled by quantum uncertainties.⁸⁶ The world is not a causal machine driven by the past but a creative generator of unfolding propensities and future potentialities.⁸⁷ For many purposes the classical model is practical; but it conveys a truncated view of the world. The inventors of quantum theory discovered the observer-created reality that flies in the face of conventional notions of objectivity.⁸⁸ Quantum mechanics also directs our attention to apparatuses of measurement and the linguistic practices and performances they entail.⁸⁹ This highlights relational aspects of difference; the boundary-producing effects of measurement; and the entanglements between objects and subjects, of matter and meaning, and of the natural and the social world.⁹⁰

Para-humanism goes “around” and “beyond” humanism without excluding it. It describes “the ‘more-than-human’ character of human

⁸² Dequech 2011: 637.

⁸³ Merton 1936. Boudon 1982. Rifkin 2022: 88–89. Latour 2017: 105.

⁸⁴ Physicists refer to quantum theory, quantum mechanics, quantum physics or particle physics. In this discussion I use these terms interchangeably.

⁸⁵ Rovelli 2016: 32. ⁸⁶ Pagels 1982: 90. ⁸⁷ Popper 1990: 17–21.

⁸⁸ Pagels 1982: 64–66, 72. ⁸⁹ Barad 2007: 29–30. ⁹⁰ Barad 2007: 26, 72, 75–88, 93.

existence.”⁹¹ It has generated its own paradox in modern times. The more modern humans succeeded in knowing and controlling nature, the more they came to realize that they are neither so different from animals nor superior to machines. Call it the human dog-cog paradox. The headlines of our daily sources of news scream that humans no longer fully control nature and no longer can use it with impunity for their own purposes.⁹² Humanity is deeply entangled with everything and everybody.⁹³ The human species is not unique and cannot observe nature at a distance.⁹⁴ Para-humanism thus rejects anthropocentrism because it blinds us to humans’ deep implication with rather than domination of the natural world. For Donna Haraway, for example, the world is populated by collectively produced systems. Such systems do not have clear boundaries. Systems of distributed information and meaning link symbiotic components in complex relationships. Self-regulation is a chimera.⁹⁵ Human beings are an inseparable part of others. Furthermore, relationships connect beings with things. Things are not passive props but participants in a collective process of becoming.⁹⁶ Para-humanism occurs at all scales. At a macro-scale, it conceptualizes the cosmos as an evolving set of processes and relations and thus is foundational for the field of scientific cosmology. It suggests that our scientific theories and models are not intellectual representations of the universe but integral parts of its evolution.⁹⁷ The universe is an open system that continuously interrogates all of its basic assumptions. Cosmology is “a human intellectual creation, not merely a collection of facts.”⁹⁸ It incorporates new data and speculations as the cosmos pushes back against the always imperfect and incomplete facts and beliefs humans hold about it. For humanist Newtonianism critical junctures or inflection points in history are exogenous ruptures in a human-engineered future.⁹⁹ Para-humanism hears instead the thunderclaps of the uncontrollable in the endogenous workings of an evolving world that does not know its own future.

For the most part students of the political world and world politics are unaware of the tacit knowledge their foundational worldview provides. Anchored in the mechanical world of the nineteenth century and infused by anthropocentrism, the Newtonian humanism that informs most analyses of world politics is simply taken for granted. Trying to grasp

⁹¹ Kurki 2020: 115–16, 124–26, 134–35. Bridle 2022: 11. ⁹² Kauffman 2008.

⁹³ Kavalski *et al.* 2018. Kurki 2020.

⁹⁴ Cudworth and Hobden 2018a: 8. Cudworth *et al.* 2018. Smith 1991.

⁹⁵ Haraway 2016: 33; Kurki 2020: 120–22. ⁹⁶ Bridle 2022: 12, 18.

⁹⁷ Kurki 2020: 2–3, 14–16, 41–42. ⁹⁸ Hetherington 1993: 6.

⁹⁹ Widmaier *et al.* 2007. Drezner 2020.

an always-in-flux entangled world,¹⁰⁰ conventional analyses see a disentangled social atomism as its defining feature.¹⁰¹ Newtonian humanism is both serviceable and misleading. It is serviceable because of its simplicity. It is misleading because it suggests that, like God, humans are observing the political world and world politics at a distance and can figure out how to control it. All too often, the risk-uncertainty conundrum defeats that effort.

Vaccine skepticism during the COVID pandemic offers a vivid example of the richness of unacknowledged worldviews. American public health professionals learned that the public skepticism they encountered was not a knowledge problem that could be solved by providing people with better information. Lack of health insurance and distrust of America's sorry health care system helped create a vaccine resistance that was much greater among younger Americans than older ones who were covered by Medicare.¹⁰² Moreover, "follow the science" efforts at education ran into deeply held beliefs. About one third of the American population, and a much larger proportion of Republicans, resisted vaccines because they believe that rights exist without obligations. Vaccine skeptics value individual liberty and individual rights above all; show less deference to elites in general and the government and medical establishment in particular; are concerned about the "purity" of their minds and bodies; and are open to conspiratorial thinking. At the root of vaccine skepticism lie moral intuitions and gut feelings that are largely impervious to information.¹⁰³ This is a good illustration of worldviews that are always present as typically invisible foundations for how we describe and explain what happens in the world. They place us in the world and tell us how that world does or should work. A typically unacknowledged Newtonian humanism that informs our conventional theories and models denies the risk-uncertainty conundrum and points to a small world of risk – an inadequate way to get a full grip on the political world and world politics.

3. Objective and Subjective Probabilities in Small and Large Worlds

One of the leading statisticians of the twentieth century, Leonard Savage, merged the concepts of utility and personal probability, under conditions of uncertainty, into "a highly idealized theory of the behavior of a 'rational' person."¹⁰⁴ Savage insisted that his formalization of decision

¹⁰⁰ Spruyt 2020: 30–31, 333. Welch 2022: 13–15. ¹⁰¹ Camilleri 2011.

¹⁰² Tufekci 2021. ¹⁰³ Tavernise 2021. Mlodinow 2022: 48–52.

¹⁰⁴ Savage 1972 [1954]: 9. He was not the only one. Immanuel Kant distinguished between the contingent and uncertain world of the senses and the determinative world of ideas

theory made it possible to calculate probabilities only in a metaphorically small world; the large world does not lend itself to precise calculation. “The use of modest little worlds, tailored to particular contexts,” writes Savage, “is often a simplification, the advantage of which is justified by a considerable body of mathematical experience.”¹⁰⁵ “Look before you leap” and “he who hesitates is lost” are two proverbs that capture the difference between the two worlds. When proverbs conflict there is truth in both of them. In a small world it is feasible to look before you leap. An actor can reckon with all the effects of her action and all conceivable future pieces of information would have on the model that determines her subjective beliefs. Consistency is an unqualified virtue.¹⁰⁶ But “when the world in which we are making decisions is large and complex, there is no way that such a process [of reflection and introspection] could be carried through successfully,” writes Ken Binmore. “Savage restricted the sensible application of his theory to small worlds . . . The worlds about which real people learn are almost always large . . . The problem of how best to learn in a large world is unsolved.”¹⁰⁷ Strict adherence to consistency in a large world where “he who hesitates is lost” refuses to admit the possibility of error.¹⁰⁸ Savage was very explicit about claiming that his analysis would work only in the confines of small worlds. His caution has often been overlooked. Many economists have embraced the notion that personal subjective probabilities are of great importance for individuals maximizing utilities. The two leaders of the Chicago School of economics, Milton Friedman and Gary Becker, went so far as to assert that their models had direct application to policies appropriate in large, uncertain worlds.¹⁰⁹

Conventional analyses of world politics are attracted to the siren call of economics, which is inclined toward puzzles with well-defined rules and single solutions. Puzzles can be solved even though the solution may be difficult. And when puzzles cannot be solved, there is a realistic hope that a correct answer will be found in the future. By contrast, mysteries lack clear definition and objectively correct solutions. They are marked by vagueness and indeterminacy. Mysteries elicit John Kay’s and Mervyn King’s central question in their book *Radical Uncertainty*: “What is going on here?” Coping with the complementarity of risk and uncertainty means being willing to accept mysteries. It requires judgment, experience, imagination, and the capacity to tolerate ambiguity. One of the hard

(Egginton 2023: 106–16). See also Gigerenzer 2021. Slovic and Lichtenstein 1971: 665. Seth 2021: 101–11.

¹⁰⁵ Savage 1972 [1954]: 9. ¹⁰⁶ Binmore 2009: 117.

¹⁰⁷ Binmore 2009: 130, 132, 133. ¹⁰⁸ Savage 1972 [1954]: 16. Binmore 2009: 117.

¹⁰⁹ Kay and King 2020: 111–23, 443–44.

questions is always which of the mysteries of the uncertain can be treated as puzzles of risk-based analysis and which cannot?¹¹⁰

Identifying some traits that distinguish small from large worlds helps. In small worlds the relevant entities are known, and their configurations are stable. Small worlds have sufficient data for the calculation of objective probabilities that offer reasonably reliable guides for private beliefs. And the consistency requirement for good decisions can be met. In large worlds all relevant entities are not known, and their configurations are not stable. Large worlds lack sufficient data to calculate objective probabilities and thus do not offer reliable guides for forming private beliefs. And the consistency requirement for good decisions cannot be met. In small worlds decision makers know that “normal,” calculable surprises may happen. But in large, uncertain worlds decision makers can rely only on their unchecked private beliefs and thus set themselves up for “nasty,” incalculable surprises. The risk-uncertainty conundrum makes incalculable surprises normal.

The concept of probability is Janus-faced. It gives the concept of chance two different meanings. Believing that probability inheres in the world, “frequentists” concern themselves with numerical calculations of random variations that are connected to the existence of some chance process producing stable frequencies. This creates the conditions favoring an “inferential” rationality of learning about the world through probabilistic calculations. Some well-controlled situations fit the frequentist paradigm by producing probability distributions with predictable, long-run properties: large collections of gas molecules and genetics in the natural world, mortality tables and the tools of the casino (such as shuffled cards, roulette wheels, and spinning coins) in the social world.

Often, however, numerical probability “is not an objective property of the world, but a construction based on personal or collective judgements and assumptions.”¹¹¹ In contrast to “frequentists,” “personalists” (also called “subjectivists” or “Bayesians”) focus on coherent degrees of subjective beliefs about the world. They rely on “understanding” the rationality of how humans learn under conditions of uncertainty.¹¹² Here the laws of probability are preferences for specific gambles measured in expected utility expressing partial beliefs that constitute our personal probabilities. Generally speaking, for the world of politics it does not

¹¹⁰ Kay and King 2020: 20–21, 34, 40, 46. ¹¹¹ Spiegelhalter 2024: 560.

¹¹² Kay and King 2020: 111–14. Hacking 2006: 1, 12–17. Popper 1990: 8, 12, 17, 20–21. There is some technical work that tries to think about the connection between both kinds of rationalities. See, for example, Blume 2010; Gintis 2010; Binmore 2007: 29; 2017: 260–61, 263–64.

make much sense to think of our judgments as estimates of “true” probabilities.¹¹³

The complementarity of risk and uncertainty requires analysts of world politics to pay attention to both aspects of the concept of probability. It is confusing that the class of repeated, similar observations of the world and the class of repeated, similar judgments about the world sound so similar. They are not. And it is also confusing that numerical probability is useful for thinking about both the “aleatory” uncertainty of an unknowable future and the “epistemic” risk about what we currently do not know.¹¹⁴ Risk can be resolved by checking facts. It can be mapped by frequencies and known probability distributions conventionally, and unreasonably, assumed to look like the familiar, bell-shaped curve of Gaussian statistics. Overlooked in the analysis of politics and world politics are the infrequent occurrences mapped by power laws that are hidden in the “fat tails” of distributions hiding “black swan” events that are fiendishly difficult to anticipate until they happen. Uncertainty cannot be resolved by checking facts. It results from a host of factors including lack of information or knowledge, vagueness of problem specification, and irremediable ambiguity. Beyond unforeseeable, unknown events located in the world of risk lie the possibilities of the unknowable, unimagined, and unimaginable of the uncertain. Irresolvable disagreements, speculation, and, most important, silence are its hallmarks. As a matter of practice, however, conventional analysis of the political world and world politics assumes that the large world of uncertainty can be reduced to the small world of risk that we can analyze with numerical probabilities of repeated similar observations of the world.¹¹⁵ Two prominent theorists of international politics, John Mearsheimer and Sebastian Rosato, thus argue that “there is no meaningful difference in how rational individuals make choices under uncertainty and under risk.”¹¹⁶ Reducing uncertainty to information-deficiency and denying the risk-uncertainty conundrum, for them risk defines “the reality of international politics.”¹¹⁷

Objective Probability

In the 1920s Frank Knight argued that probabilities could not be established outside the realm of known or knowable frequency distributions. For Knight a “measurable uncertainty” (i.e., risk) was qualitatively

¹¹³ Spiegelhalter 2024: 561. Determinist views of the world deny the existence of risk and uncertainty. For them the social world is governed by laws akin to Newton’s law of gravity. Because such views are rare, I am not considering them here.

¹¹⁴ Spiegelhalter 2024: 562–63. ¹¹⁵ Kay and King 2020: 15, 72, 170, 336, 420, 431.

¹¹⁶ Mearsheimer and Rosato 2023: 84. ¹¹⁷ Mearsheimer and Rosato 2023: 24, 225.

different from an unmeasurable one.¹¹⁸ Knight's goal was to explain a puzzle: why do corporate profits exist in markets that equalize demand with supply. In a world of frictionless markets, new suppliers will enter markets until the marginal price of a good equals the marginal cost of production.¹¹⁹ Knight reasoned that successful entrepreneurs are willing to make investments with calculable future payoffs permitting them to charge a premium. For him "measurable uncertainty," or risk, is the mainspring for entrepreneurial activity and capitalist growth.

Risk calculations are shaped by some curious conventions. For example, time is assumed to be reversible. "Post-dictions" become stand-ins for predictions. "If you predict Denmark's GDP in the year 2000 based on only data through 1910," argues Lant Pritchett, "the prediction is off by like 3%. That's unbelievable. We have a 90- or a 100-year-ahead forecast."¹²⁰ Pritchett avers that there is no difference between past and future. "Post-dictions" are thought to be useful since, as in a casino, the dice of world politics are rolled many times, yielding calculable outcomes in a game that does not change. But for this to hold, the processes generating the political outcomes in question must be stable. Only when that assumption is met does it make sense to use "post-dictions" as guides for "predictions." Over short time spans, a few months or years, that assumption is often plausible. Over long periods, as in the example of Denmark's twentieth-century GDP, it is not. Furthermore, the outcome in question is an ordinary event of little consequence in and of itself. Focusing only on a single or a small number of events is cherry-picking. Doing so commits the political scientist's cardinal sin: "selecting on the dependent variable." But it is easy to forget that statistical distributions are always simplifications that replace the fuzziness of the risk-uncertainty conundrum with the precision possible with the concept of risk.

In the world of risk, the social scientific concern with numerical frequencies and stochastic processes looks at events as tiny specks of large ensembles that fit the normal, bell-shaped distribution of Gaussian statistics with thin tails. In the teaching of graduate political science programs in the US only Gaussian statistics are taught.¹²¹ This makes abnormal

¹¹⁸ Knight 1921: 20. Jarvis 2011. Kay and King 2020: 13–14. Bylund 2021. Maechler and Graz 2022: 633–34.

¹¹⁹ Beckert 1996, 2002; Blyth 2002: 31–34. ¹²⁰ [Mercatus Original Podcasts 2022](#).

¹²¹ Calculation of topic coverage of syllabi covering the years 2016–24 in first-year, two-semester graduate statistics seminars of ten of the strongest IR departments in the US show that 63% of the weeks were spent on teaching Gaussian statistics, 36% on other topics, and 1% on power laws. Put differently, out of 231 weeks of instruction 143 were spent on Gaussian statistics, 85 weeks on other statistics and 2 weeks on power laws (Michigan 2023 two half weeks; MIT 2024 one week). I thank Junyang Hu for the tedious work of gathering, coding, and summarizing the data.

events look vanishingly rare. Even though they can have profound effects, understood as causes rare events such as large wars, great depressions, and global pandemics appear not to matter. Single cases are crumbs left for historians who analyze “one damned thing after another.” Submitted to statistical analysis, however, such rare events are best captured by power laws, a statistic that does not look at all like a bell-shaped curve with thin tails. Marked by fat tails, in a power-law distribution the top 20 percent of entities typically hold 80 percent of the value or power. It is often more suitable to deal with risk than Gaussian statistics. Abnormal events falling into fat tails are not all that rare. In fact, many human-made rare events follow the logic of power laws. They capture the jumps and discontinuities in the statistical distribution of events that elude Gaussian statistics.

Power laws make us look at the exceptional first because it is so important and only then move to the ordinary and less consequential.¹²² The casino view of world politics produces the “mild” randomness of normal statistical distributions with thin tails and the small effects of outliers. Human height and weight, car accidents, deaths by heart attack, and gambling in a casino are examples for which the law of large numbers works very well. Randomness disappears with averaging. However, this does not capture the “wild” randomness of power-law distributions with their fat tails and the higher probability that extreme values can have on the total distribution. Book sales are a good example. The widely read author of the Harry Potter series, J. K. Rowling, sold more than 600 million copies, a number that is about six orders of magnitudes larger than the 600 or so copies this book may sell. Power-law distributions capture many politically more salient issues than book sales, including wealth, income, market returns, stock market crashes, deaths in wars, and casualties of terrorist attacks. In world politics it is often the outliers that we need to understand. Market crashes provide powerful illustrations. For example, “just ten trading days represent 63 per cent of the stock market returns of the past 50 years.”¹²³ As Central and Latin American countries all defaulted at the same time in the summer of 1982, America’s large banks lost close to all of their past earnings, everything they had ever made in the history of American banking.¹²⁴ And during the crash of 1987, on October 19 the Dow Jones index fell “three times as much in a little over an hour as it had in any other full trading day in history.”¹²⁵ Power laws encapsulate the tyranny of the accidental, underline the difficulty of

¹²² Mandelbrot and Taleb 2010. Taleb 2007: 127–28, 229–34, 236, 244–50, 252. Kay and King 2020: 236–39. Patterson 2023: 72–77, 104–07.

¹²³ Mandelbrot and Taleb 2010: 50. ¹²⁴ Taleb 2007: 43. ¹²⁵ Bookstaber 2017: 87.

predicting the future based on the past, and remind us that history does not always crawl but also jumps. In short, there are different ways of dealing with chance events and processes in the small world of risk. Because many features of politics shaped by humans are wild, it is often misleading to rely on the standard deviation of the normal distribution as the measure of randomness. Compared to the casino view of risk, power laws “have become an alternative way to view the world, and a methodology where large deviation and stressful events dominate the analysis.”¹²⁶ Students of the political world and of world politics who are strongly committed to the analysis of risks based on frequency statistics have exciting and important work to do once they trade in Gaussian for power-law statistics.

Subjective Probability

In contrast to Knight, for Keynes “radical uncertainty” refers to matters about which there are no scientific ways to calculate any probabilities, such as major scientific discoveries and major nuclear war.¹²⁷ This kind of uncertainty is rooted in our unavoidably incomplete knowledge of the world. Keynes argued that decision makers find themselves occasionally in situations in which there are measurable, objective probabilities for risky events. For the most part, however, he insisted, our tools and evidence are “too limited to make probability calculations: there may be no way of calculating, and/or there is no common unit to measure magnitudes.”¹²⁸

Frank Ramsey was an Oxford mathematician, economist, and philosopher whose work in the 1920s proved to be foundational for our thinking about risk and uncertainty. His main contribution was to go beyond Keynes’s logical theory of probability.¹²⁹ He insisted instead that all probabilities are measurable in terms of risk based on degrees of belief. Grounded more in human psychology than logic, probabilistic or partial beliefs could be rational. This insight was the origin of twentieth-century subjective probability and decision theory. In Cheryl Misak’s words Ramsey showed “how to measure partial belief by using a subjective interpretation of probability.”¹³⁰ Probability for Ramsey is multidimensional. Partial beliefs establish connections between inward states of dispositional beliefs and outward states of action. Beliefs are habits

¹²⁶ Mandelbrot and Taleb 2010: 53.

¹²⁷ Keynes 1937: 213–14. Kay and King 2020: 14. Eich 2024b: 11–17.

¹²⁸ Keynes 1948 [1921]: 31, 34.

¹²⁹ Spiegelhalter 2024. Independently from Ramsey, Bruno de Finetti developed a similar approach in the 1930s.

¹³⁰ Misak 2020: 117.

normally tested by experience. For Ramsey, the utilitarian assumption and a definition of rationality as the maximization of utility can offer useful simplifications for particular purposes. But he argued also that such simplifications are wrong for two reasons. Utility maximization is wrong philosophically: It is a moral decision that puts utility before justice and equality. And utility maximization is wrong empirically; humans differ greatly in their initial probability assignments and the strength of their beliefs.¹³¹

The quantification of subjective probabilities pushes back against the idea of a “correct” or “objective” probability, for example in a national security crisis.¹³² Since the standard for what is objectively “correct” is unavailable, only subjective assessments are possible.¹³³ In this view, assessments of the risk-uncertainty conundrum are considered “correct” only in as far as they coherently reflect an actor’s personal beliefs in a specific context. When objective assessments are unobtainable, the ability to give well-structured and coherent assessments of judgment are not. This requires, Jeffrey Friedman argues, that we distinguish clearly between “assessments of probability (which reflect the chances that a statement is true) and assessments of confidence (which reflect the extent to which analysts believe they have a sound basis for drawing conclusions).”¹³⁴ Confidence depends on the range of reasonable opinion surrounding a judgment, and the susceptibility of a judgment to new information that might be forthcoming.¹³⁵ Put simply, as a subject of Bayesian statistics confidence is analytic.¹³⁶

Bayesian models start with “prior beliefs” – subjective probability estimates. Anchoring the analysis, prior beliefs are “updated” in a process that is deemed to be as unproblematic as the newly acquired information.¹³⁷ Updating permits continued disagreement of actors in the short term. In the long term it will lead to a social consensus based on shared information, that is, changing beliefs.¹³⁸ Under conditions of calculable risk this can work. “Overconfidence,” for example, crosses some fuzzy boundary of what is “justifiable” by some conventionally understood or calculated risk metrics. But under conditions of uncertainty this does not work. Objective and subjective probabilities are not closely aligned. Lacking a reliable metric of measurement, actors instead share with others the confidence they have in their personal beliefs by trying to be persuasive. That consensus, for example about the weather

¹³¹ Misak 2020: 263–77. ¹³² Friedman 2019: 51–52. Gillies 2000: 55–58.

¹³³ Stein 2024: 14–15. ¹³⁴ Friedman 2019: 23; see also 51, 57, 62, 63, fn 37.

¹³⁵ Friedman 2019: 61–63.

¹³⁶ Friedman 2019: 14, 58–63. Friedman and Zeckhauser 2018.

¹³⁷ Pinker 1997: 243, 344–45, 349–51. ¹³⁸ Bullock 2009: 1110.

and harvest conditions three months out, will be less durable than one based on objective probability calculations that are based on the accretion of human practices and experiences, for example the inadvisability of leaving your tenth-floor apartment by walking out of the window.

Accuracy is not the only concern that influences a decision maker's choice. In American foreign policy, for example, it is implausible to think that Presidents are simply concerned about predictive accuracy when they confront the risk-uncertainty conundrum in international affairs. Friedman reports that decision makers exhibit a widespread resistance against relying only on probabilistic reasoning.¹³⁹ Logic, cognition, and rigor are surely relevant.¹⁴⁰ Typically, however, they work along with other factors such as individual or group emotions, religious and other beliefs, and social conventions.¹⁴¹ All of these factors buttress the confidence that decision makers have in their subjective beliefs.¹⁴² They create "biases" that distort the process of information updating.

Bayesian theory insists that actors must accept the "correct" Bayesian model of how the world works even when other models work better.¹⁴³ When humans do not optimize, their "bias" makes them deviate from "rational" behavior. But rationality does not exist in thin air. Preferences are not "revealed" in Bayesian updating but are "constructed" and are very sensitive to framing and context effects.¹⁴⁴ Typically, there are many different ways of being rational or at least reasonable. Axiomatic rationality as developed by economists, for example, differs considerably from evolutionary rationality. For Kay and King "many so-called 'biases' are responses to the complex world of radical uncertainty."¹⁴⁵ Indeed, being unreasonable or irrational, one might argue, affirms being human. The application of subjective probabilities to the analysis of world politics all too often forgets Ramsey's insistence that this theory presents a simplified scheme that actual people approximate only very imperfectly. It is a convenient shortcut for Newtonians who remember only Thomas Paine and forget Friedrich Nietzsche.

Furthermore, psychologists have taught us what the eighteenth-century statistician Thomas Bayes did not know. The initial values of

¹³⁹ Friedman 2019: 12, 96–98. ¹⁴⁰ Friedman 2019: 12, 34, 49.

¹⁴¹ This argument assumes that various criticisms of subjective probability can overlap. And it accords greater importance to factors such as values and emotions that Friedman's analysis of analytic confidence excludes. See Friedman 2019: 6–10, 192–95.

¹⁴² Friedman 2019: 12, 14–15. Friedman (2019: 67, 88) concedes that the distinction between "mathematicians" and "poets" may make sense from organizational and cultural perspectives. He thus acknowledges the limits of the analytic confidence that concerns his analysis.

¹⁴³ Slovic and Lichtenstein 1971: 716. ¹⁴⁴ Wendt 2015: 162.

¹⁴⁵ Kay and King 2020: 16.

an estimate of the world systematically distort the estimates and chain of reasoning that follow based on newly acquired information. Because it is context dependent and relies on language, the newly acquired information does not speak for itself. “Priors” and “updates” thus are estimates expressed in the numerical language of risk that conceals hidden uncertainties. As I will argue in [Chapter 2](#), its “diagnostic” is as laden with judgment, experience, and values as that of any doctor. Interpretation is the work of human beings who fit new information into existing beliefs or use it to create new ones. And that work relies on experience, memory, and language, all rich sources of ambiguity and uncertainty, to make sense of and give meaning to the world. In short, Bayesianism gives the misleading appearance of a transparent, episodic process of information updating, unhindered by doubts about the meaning of the information itself.¹⁴⁶ A psychologically realistic description highlights instead an opaque, continuous process of information updating, inflected by the ambiguities that inhere in specific contexts and in reliance on human language.

Trying to tame uncertainty through an extension of the concept of risk, Bayesians all too often work with poor descriptive models of how people actually think.¹⁴⁷ The risk-uncertainty conundrum cannot be resolved by invoking “Bayesian updating” as a “nomological machine” – a fixed arrangement of a target mechanism operating in a relatively stable, repetitive, and predictable way that is not exposed to unrecognized or unforeseen potentialities.¹⁴⁸ Ramsey’s innovative formulation gave subjective beliefs, probability calculations, and rationality their due without insisting, unreasonably, that this was the end of the story. His intuition is supported by the research program that Daniel Kahneman and Amos Tversky developed in behavioral economics during the last several decades. Their psychological studies document both the updating of reference points for the calculation of gains and losses and the persistent biases and “irrational” reasoning of humans, one of the sources of the inescapable complementarity of risk and uncertainty.¹⁴⁹ Too frequently such lessons in human psychology have not been heeded. Before the great financial meltdown of 2008, for example, most economists believed that

¹⁴⁶ Humphreys and Jacobs (2023: 3, 6) write about their ability to characterize uncertainty by calculating p-values and standard errors and about having models of how the world works that permit them to make inferences about observed patterns in the data while also updating the models based on the same data. The book is based on Bayesian network analysis, a probabilistic graphical method, innovatively used to update models. See also the discussion of Bayesian uncertainty in Blair *et al.* 2023: 94–99, 101–04, 107, 113.

¹⁴⁷ Slovic 1999. Slovic *et al.* 2004. ¹⁴⁸ Cartwright 1999; 2019: 67.

¹⁴⁹ Kahneman 2011. Kahneman and Tversky 1979.

data were copious, that rational learning entails always and everywhere the updating of information, and that actors adhered to the rules of consistency. Criticisms that pointed to possible violations of those beliefs were “commonly greeted with incredulity and laughter.”¹⁵⁰

The concept of subjective probability is an important and useful tool. But it does not eliminate the risk-uncertainty conundrum.¹⁵¹ “Irreparable ignorance” is an unavoidable part of the analysis of world politics. By tracking in Newtonian fashion how discrete objects course on predictable paths through the political universe, the study of world politics typically assumes that the world consists mostly of calculable risk. But all too often world politics is also marked by uncertainties and unforeseen potentialities. The ambiguity and creativity human language infuses into the world reinforces the importance of those potentialities. “Simply knowing in principle that the way we think now is the product of historical contingency rather than logical necessity,” Lorraine Daston writes, “is rarely sufficient to lift the blinders imposed by history and habit. The mental world we happen to inhabit contracts the imagination to its own cramped dimensions.”¹⁵²

If everyone’s imagination is shrunk the same way, then everyone shares the same model of how the real world works: small and risky. The problem that Bayesianism tries to solve with information updating is thus solved by fiat. This is what the common knowledge assumption does in game theory.¹⁵³ It stipulates that all players share continuously updated beliefs about the game’s structure and one another’s identity and rationality.¹⁵⁴ Common knowledge is necessary to ensure consistency and convergence of beliefs among rational agents.¹⁵⁵ In the absence of common knowledge, player expectation, choice, and coordination are compromised and the accuracy of the game’s predicted outcome is significantly impaired.¹⁵⁶ Put differently, in game theory the cramped dimensions of our mental world must take the same form for all players.¹⁵⁷

Some scholars have tested the role of common knowledge in signaling and bargaining under conditions of uncertainty and looming war. Smith

¹⁵⁰ Binmore 2007: 26. ¹⁵¹ Ananthaswamy 2024: 99–101. ¹⁵² Daston 2022: 22.

¹⁵³ Amadae 2016.

¹⁵⁴ Lewis 1969: 3, 13–14, 35 credits Schelling’s (1960: 83–118, 291–303) work as foundational for games of coordination without communication, supported by shared tacit knowledge.

¹⁵⁵ Aumann 1976, 1998. Brandenburger and Dekel 1989.

¹⁵⁶ Geanakoplos 1992, 1994. Clancy 2024.

¹⁵⁷ For further discussion of the common knowledge assumption see Gul 1998. Niou, Ordeshook, and Rose 1989; Fearon 1995; Fey and Ramsay 2007. Yildiz 2003. Culpepper 2008.

and Stam, for example, have found, unsurprisingly, that the common knowledge assumption all too often does not hold in real-world political contexts. Games supposedly are mapping the territory. But their ubiquity, argues philosopher Jean Baudrillard, has reversed the traditional relation between map and territory. In olden times, useless maps were rotting across the countryside. Now the situation is reversed. Since all too often maps are mistaken for the territory, it is “the territory whose shreds are slowly rotting across the map.”¹⁵⁸ The unpredictability and complexity of international relations undercut the assumption that all actors share prior and common knowledge.¹⁵⁹ On questions of war and peace, states often come to blows because they hold fundamentally different views of their relative strengths and resolve. War updates divergent beliefs that ultimately can lead to a convergence and a negotiated settlement. But James Fearon also argues that the lack of mutual knowledge and the inability to commit can lead to prolonged war. Even with shared beliefs about capabilities, uncertainty about future actions can prevent serious bargaining.¹⁶⁰ In a similar vein, Harvey Lederman holds that the assumption of common priors is insufficient to prevent disagreement as long as additional assumptions about the updating of common knowledge and the truthfulness of the updates are not met.¹⁶¹ And higher-order uncertainties are often encased in tacit beliefs, that is, worldviews actors are not even aware of.¹⁶²

Put briefly, the risk-uncertainty conundrum in small and large worlds cannot be avoided by trying to circumvent uncertainty either through the practice of Bayesian updating or through reliance on the common knowledge assumption. This does not create an insurmountable obstacle for a scientific study of the political world and of world politics. Far from it. Philosopher of science Nancy Cartwright speaks for a science of localized practices gleaned from a world that can be imitated. She warns against tracing the consequences of scientific laws in the hope of controlling the world. For her, nature is an artful modeler. In this, nature gives a hint how to make sense of and cope with risks and uncertainties. The impressive scientific successes scored over centuries do not speak, in Cartwright’s captivating words, for a “unified world of universal order, but rather for a dappled world of mottled objects.”¹⁶³ Recouping Nature we should focus not on general principles but on specific practices. Artful modeling avoids flights of fancy and leaps of faith. It locates instead pockets of predictable order. Cartwright pleads the case for pluralism, particularism,

¹⁵⁸ Quoted in Clancy 2024: 301.

¹⁵⁹ Smith and Stam 2004, 2006. Fey and Ramsay (2006) disagree. ¹⁶⁰ Fearon 2013.

¹⁶¹ Lederman 2015. ¹⁶² Chadeaux 2020. ¹⁶³ Cartwright 1999: 10.

and practice.¹⁶⁴ So did Albert Hirschman, who noted half a century ago that the inferiority economists felt vis-à-vis physicists was rivaled by the inferiority political scientists felt vis-à-vis economists, with both disciplines showing a surprising eagerness to be colonized and join the invaders.¹⁶⁵ Skeptical of heroic generalizations, Cartwright and Hirschman favor humble over lofty arguments. We should take their advice as a warning of the intellectual imperialism of swashbuckling pirates, armed with strong assumptions, satisfying their predatory instincts while searching for bounty on the vast ocean of human inquiry.

4. Conclusion

Many scholars of world politics discuss their most basic beliefs in the language of “paradigms” such as Realism, Liberalism, Marxism, Constructivism, Feminism, and Post-colonialism.¹⁶⁶ Paradigms express what their adherents consider the foundational understandings of world politics.¹⁶⁷ With none of these paradigms able to claim final victory, each asserts its particular view as sacrosanct and seeks to “convey a world view more basic than theory.”¹⁶⁸ Their sharp intellectual and political disagreements occur on the shared ground of Newtonian humanism. Friedrich Hayek would not have been surprised by the existence of this unobtrusive collective mind set. Hayek argued that all knowledge is built on and reinforced by tacit, commonsensical understandings.¹⁶⁹ Newtonianism assures most students of world politics that the world is real, stable, singular, and subject to law-like generalizations relying either on variable- or on mechanism-based analysis. Humanism shows humans as gyrating between Paine’s predictable reasonableness and Nietzsche’s unpredictable unreasonableness, thus helping create the risk-uncertainty conundrum.

It is the internal tensions and contradictions of Newtonian humanism that have generated a series of debates about the foundations of the

¹⁶⁴ Cartwright 2019: ix, 4–5, 20, 22–23, 26, 49–50, 91–92. See also Hartmann *et al.* 2008.

¹⁶⁵ Quoted in Jackson 2016: 21.

¹⁶⁶ Gilpin 1975: 215–62. Rosenau and Durfee 1995: 9–69. Lichbach and Zuckerman 2009. Marks 2018: 140–69. Generally speaking, critical variants of Constructivism, Feminism, and post-Colonialism do not accept Newtonianism’s mind-world dualism and thus have an affinity with post-Newtonianism and para-humanism.

¹⁶⁷ Hamilton, S. 2017: 153. James 2002: 215–21. Paradigms offer communities of shared purpose and value and focus on problems of alternative causes and alternative consequences. In contrast to explicitly political paradigms, perspectives such as rationalism or constructivism are purely analytical.

¹⁶⁸ Little 1984: 7. Banks 1984: 15.

¹⁶⁹ Hayek 1945. Polanyi 1966. Hopf 2010. Duguid 2005: 111. Collins 2010: 7–9.

study of world politics.¹⁷⁰ Realism-liberalism-Marxism, idealism-realism, traditionalism-positivism, and rationalism-constructivism-reflectivism are some of the headlines under which these debates were conducted during the last half century. They have always remained inconclusive. Their value was to clarify positions more than to change research practices. They may have been “great debates” when they were waged in North America and across the Atlantic. But the globalization of the study of world politics and the passage of time have shrunk their importance.¹⁷¹ A younger cohort of scholars and some new schools of thought have moved to the fore, among them subaltern, indigenous, critical race, and post-colonial studies. They detract from some arguments and augment others. But they do not resolve the tensions that inhere in Newtonian humanism and the persistence of the risk-uncertainty conundrum.

Nothing speaks against the signal importance of all sciences, including the science of international relations, operating successfully in small worlds. Everything speaks against defending small world thinking by adopting the Peter Pan principle – closing one’s eyes and wishing really hard. Together small and large worlds create the risk-uncertainty conundrum. The economist John Maynard Keynes was both a plumber and a poet. As plumber he specified the relations between economic aggregates such as consumption, investment, savings, government spending, exports, and imports. As poet he was keenly aware of the ferocity of speculative “animal spirits” and the importance of social conventions. Keynes understood that “expectations can literally drive reality,” as in self-fulfilling prophecies.¹⁷² Answering precise questions in carefully specified field experiments can lead to interesting and useful knowledge in small worlds. Neglecting, as Keynes did not, the insight that controllable small world risk is all too often hitched to uncontrollable large world uncertainty is to mistake the proverbial tree for the entire forest. Sharpening our analytical tools for the small world of risk, as Hans Morgenthau is reported to have remarked ruefully, should not be mistaken for cutting something worthwhile in the large world of uncertainty.

An unthinking acceptance of Newtonianism tempts some students of world politics to differentiate conventional “modern” approaches from unconventional “post-modern” ones. Often the conventional modern actually is “early-modern,” rooted in nineteenth-century mechanics. And the unconventional post-modern is actually “late-modern,” reflecting intellectual currents in the second half of the twentieth century.

¹⁷⁰ Lapid 1989. Wæver 1996. Adler 1997. Price and Reus-Smit 1998. Kratochwil 2006. Hamchi 2011. Lake 2013.

¹⁷¹ Acharya and Buzan 2007, 2010, 2017. ¹⁷² Moss 2014: 143.

According to Stuart Kauffman “scientists tend to live with philosophies of science that are decades out of date.”¹⁷³ The effect of Newtonian humanism on the study of world politics has been a powerful force for more than a century. Early modelers in political science were drawn to nineteenth-century views of scientific theories. “The Received View, with its origins in classical mechanics, seemed a natural fit for scholars looking to put their young discipline on an equal footing with the ‘hard’ sciences,” write Kevin Clarke and David Primo. “Soon after, philosophers abandoned the Received View as a description of scientific theories.”¹⁷⁴

But most students of the political world and world politics have stuck with the Received View, foregoing the opportunity to learn from other worldviews how to engage the complementarity of risk and uncertainty. As a result, they tend to shy away from discussing uncertainty.¹⁷⁵ For example, in their outstanding and widely used textbook Gary King, Robert Keohane, and Sidney Verba distinguish between a probabilistic and a deterministic world.¹⁷⁶ Barely brushing up against the risk-uncertainty conundrum they advise that “the perceived complexity of a situation depends in part on how well we can simplify reality.”¹⁷⁷ This is surely correct. But what about the “other part” they put aside? In Newtonianism the world exists as a place “out there,” separate from us as a series of probabilities. In other worldviews it exists “in here,” as not yet determined conditions of possibility. In its self-organizing the real world does not know its own future. Putting uncertainty and its possibilities simply aside, however, denies the existence of the risk-uncertainty conundrum and thus limits political analysis unnecessarily.

¹⁷³ Kauffman 2008: 293. ¹⁷⁴ Clarke and Primo 2012: 65–66.

¹⁷⁵ Haggard 2018: 91, quoted in Ang 2022: 2.

¹⁷⁶ King *et al.* 1994: 59–60. Lerner (2021: 364–65) criticizes their argument about the observational equivalence of these two worlds.

¹⁷⁷ King *et al.* 1994: 10, 59–60.

2 Small and Large Worlds, Post-Newtonianism and Para-Humanism

The experience of a world out of control is all-pervasive: a pandemic with unknown long-term consequences, a threat of mass starvation in the Global South because of Russia's war of aggression against Ukraine, Israel's war of retribution in response to Hamas's brutal terrorist attack, increasing numbers of extreme weather events occurring in all parts of the world in the era of global warming – these are a few of the events capturing current world politics. At the same time advances in science and technology yield astonishing results: vaccines developed in a matter of months, a new capacity to peer into the distant past of the universe, and advances in Artificial Intelligence (AI) that question the very meaning of being human. No wonder that pervasive uncertainty intrudes deeply into our personal and political lives. The centennial issue of *Foreign Affairs*, a widely circulated and read journal of international relations, is quite appropriately titled “The Age of Uncertainty.”¹

The lead essay of that issue speaks not of uncertainty but of catastrophic risk; no other essay puts the concept of uncertainty in its title. This conflation of risk with uncertainty is common. The relation between risk and uncertainty is complementary and fluid and creates a conundrum.² Predictable normalcy occurs in the small world of risk; unpredictable crisis in the large world of uncertainty. Writing about international relations, Henry Kissinger argued that risk and uncertainty require different types of leaders. Periods of predictable normalcy ask for the day-to-day stewardship of managerial leaders. Periods of unpredictable crisis demand farsighted statesmen who know how to temper their vision with a wariness that accepts the limits of their actions.³ Islands of stability and predictability in a tumultuous world are fragile accomplishments easily overwhelmed at any moment. Plotting routes in the domain of risk differs from doing so in the domain of uncertainty. Adding a wrinkle to the old story of the blind men and the elephant, my story is about seeing only one elephant where there are two, risk and uncertainty. It resonates with everyday experience.

¹ *Foreign Affairs* 2022. ² Mandavilli 2021. ³ Kissinger 2022: xxiii–xxiv.

Before they happen, many events are unfathomable; after they have happened, many appear to have been inevitable. *A priori* underdetermination and a *posteriori* overdetermination are two halves of the same nut, reflecting the risk-uncertainty conundrum.

This chapter sorts out how we can distinguish small worlds and conditions of risk from large worlds and conditions of uncertainty along three dimensions (section 1). Unnoticed by students of world politics, in many domains of knowledge the twentieth century saw an important collective shift in terminological resources from Newtonian humanism to post-Newtonianism and para-humanism. These two worldviews are therefore discussed (in sections 2 and 3). Both engage uncertainty more openly than Newtonian humanism does. In any field of study, including world politics, “speaking differently” in a new conceptual language can make distinct contributions to understanding – contributions that can be as important as “arguing well” by relying on conventional terminology. In this case, speaking differently helps us rethink the risk-uncertainty conundrum.

1. From Small to Large Worlds: Context, Process, Language

In our quest for knowledge, Joan Didion writes, we freeze into fixed story lines “the shifting phantasmagoria which is our actual experience.”⁴ And that experience, filtered through the views of small and large worlds, feeds our individual imaginations and the imaginaries of our theories and models. The small world of risk expands along three dimensions to the large world of uncertainty. The first dimension moves from homogeneous to heterogeneous contexts, the second from invariant to variable processes, and the third from “representational,” world-mapping models of language to “re-presenting” and world-making ones. These dimensions are continua offering “more-and-less” distinctions rather than “either-or” categorical divisions. Moving along them opens intellectual spaces to better understanding, navigating and reimagining the risk-uncertainty conundrum. Downplaying or ignoring altogether the domain of incalculable uncertainties makes the presuppositions of unreflective Newtonians as non-discussable as the water that fish swim in. “Water?” asks the fish, “what’s water?”⁵

For heuristic purposes the cube depicted in Figure 2.1 maps small and large worlds along these three dimensions. The upper left and the lower right corners of the cube capture the conditions that differentiate the two worlds most clearly. Those predisposed to acknowledge uncertainty

⁴ Quoted in Kakutani 2021. ⁵ Kripal 2019: 33. Galileo Commission 2019: 20.

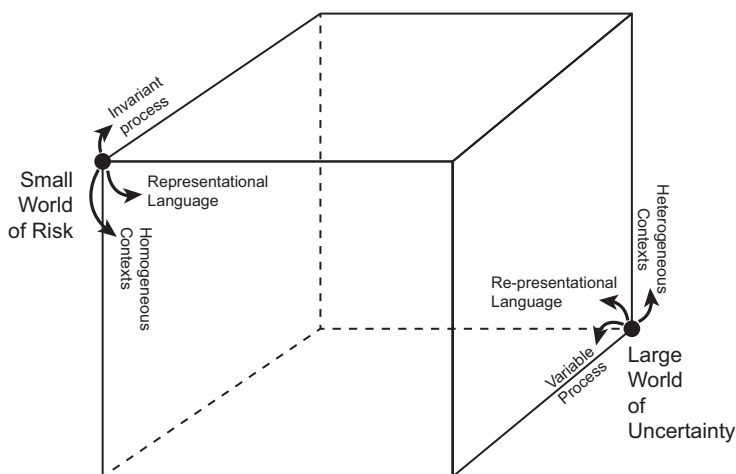


Figure 2.1 Context, Process, and Language in Small and Large Worlds

often fail to recognize elements of risks introduced by homogeneous contexts, invariant processes, and the representational role of language (the upper left corner). Those prone to focusing on risk often fail to acknowledge elements of uncertainty introduced by heterogeneous contexts, variable processes, and the re-presentational character of language (the lower right corner). The arrows symbolize the feedback effects that small and large worlds have on context, process, and language. The entanglements of both worlds are depicted by the absence of clearly demarcated cells inside the cube. Small and large worlds continually bump into each other, becoming entangled, disentangled, and re-entangled in ways that our stories often fail to capture.

Context

As he prepared himself for writing a regular column for the *Wall Street Journal*, author Walter Russell Mead asked Henry Kissinger for general advice of what he should do.⁶ “Provide context” was Kissinger’s pithy counsel. Kissinger and other classical realists ground their analysis in the contradictions and messiness of the real world rather than reasoning from

⁶ I am not concerned here either with the epistemological contextualism discussed by philosophers or the contextualism in the field of the history of ideas (Mjøset 2009: 51, 64–65).

first principles and lofty assumptions.⁷ Contextualism insists that our knowledge of the world is not coherent; that it resists uniform theoretical analysis; that global criteria of assigning epistemic priority to specific beliefs or principles of inference are wrong-headed; that conceptual analysis specifying necessary and sufficient conditions is useful only for some parts of empirical analysis; that justifications can be proffered only with regard to specific questions posed in specific contexts; and that the relevant background knowledge cannot be simply taken for granted. “All evaluation is local and empirical.”⁸ Operating free of context, a deductive, Newtonian approach aims instead for universal insight and unproblematic application. But our lives evolve in the particular even when our thoughts move in the general. What influences us when we “make up our minds” in specific contexts is often not enduring. It is part of the normal noise of life, rather than the singular signal we strain to discern. Facing up to the mysterious and unexpected prepares us better than dreams of laws and regularity for the patchwork of unexpected anomalies.⁹

Drawing on his knowledge of quantum mechanics, more than half a century ago celebrated physicist J. Robert Oppenheimer warned social scientists not to identify science with the classical model of physics which, in his words, “has been quite outdated.”¹⁰ He advocated instead trusting common sense and accepting the indeterminacy of the world. Twentieth-century physics has sharpened our understanding of the importance of context.¹¹ Our knowledge of the quantum world is relational. It is not knowledge of the quantum object itself but of experimental phenomena interacting with the observing instrument.¹² A theory should be asked to make statements only about those variables or processes for which humans take measurements. The discoveries of quantum physics thus brought new insights into how human beings go about making claims about themselves and their contexts.¹³ This requires letting go of the classical idea of a pre-existing “real” world with observable variables possessing values even when they are not measured. The world is constituted not in and by itself but by the measurements that join the engaged observer with the world. Humans share with electrons that neither has intrinsic determination. Both depend for their actualization on the context in which they operate. The articulation of theories and models and the construction of experiments inform what we seek to explain and

⁷ Mead 2018. Kirshner 2024. Structural realism disagrees on both counts with Kissinger’s version of realism.

⁸ Kincaid 2004a: 201–02. Leon 2010. ⁹ Blastland 2019: 11, 13–15, 42, 44, 59–60.

¹⁰ Oppenheimer 1956: 134. ¹¹ Ghose 2022. ¹² Harrington 2023: 117, 126.

¹³ Barad 2007: 292–94.

observe. The context shaping the measurer matters, and so do the contextual factors shaping what is being measured.¹⁴

Physics is not merely about measurements taken in carefully controlled laboratory settings. Like world politics it is also about experiences in the world. All of the variable properties of physical entities exist in relation to other entities. “Things exist in context . . . The contextuality that permeates the world reaches this elementary grammar. There are no elementary entities that we can describe except in the context of their interaction with something else.”¹⁵ If things exist only in context, making claims about them invariably involves a consideration of the context shaping them. How else could we distinguish twitch from wink? In quantum mechanics a reliance on conventional language that captures sensory experiences makes description difficult, if not impossible. Bohr’s principle of complementarity, for example, can be grasped only imprecisely through metaphoric and poetic language. Precision is possible only in mathematical language.¹⁶ Similarly, Kenneth Waltz’s foundational book on international relations relies on conventional language representing reality, which, he concedes, is not adequate to convey accurately his theory. For author and readers this leads to numerous inconsistencies and confusions.¹⁷

Science does not teach the world how to be or become. It thus makes little sense to claim a position of observation *outside* of the natural and social world, taking a God’s-eye view. Instead, we listen to and observe the world and learn from our actions how to think about and act in it. Humans and the knowledge they gain are part of the natural and social world with which they are entangled. The world can be studied as such without resorting to philosophical or religious claims. That has been the task of science, with stupendous success over many centuries. Scientific knowledge encompasses inert matter – the world of stones – as well as consciousness – the world of experience. Both physical and mental phenomena are natural, and as such integral parts of the physical world. And both are proper subjects of scientific investigation. The insistence on science is perfectly compatible with the acknowledgment of the importance of different methods. But all scientific descriptions and explanations of the world are constructed from within that world, by some of its parts, be it humans or their surrogates. No external perspective or experience of the world exists. It is philosophy that must learn from science at least as much as science must learn from

¹⁴ This characterization is based on the reigning Copenhagen interpretation of quantum physics. Einstein never accepted it, insisting that eventually a larger theoretical construct would replace it. See Kumar 2009.

¹⁵ Rovelli 2021: 141, 147–48. ¹⁶ Heisenberg 1960: 50–51. Fierke 2022.

¹⁷ Waltz 1979. LaRoche and Pratt 2018: 154, 160–62. Jackson 2016: 123–24.

philosophy.¹⁸ Long considered a domain of “pure” thought, even conceptualizations of logic, Badredine Arfi argues, now start with what is “local” and “contextual” rather than what is “global” and “universal.”¹⁹ Context-sensitivity has therefore become important in many scientific domains. It refers to many factors, including socio-historical and cultural milieus of meanings and relationships. Humans act in the context of an “open, indeterminate and changing world” that both invites and blocks human plans and purposes.²⁰

Process

At the beginning of 2010 the theory of authoritarian durability was widely accepted among Mideastern specialists who were writing compelling analyses of Muammar Gaddafi’s Libya, Ben Ali’s Tunisia, and Hosni Mubarak’s Egypt. In late 2010 an exasperated Tunisian vegetable vendor, Mohamed Bouazizi, set himself and the entire Mideast on fire. The unpredicted Arab Spring washed away these three autocrats and the theory of authoritarian durability with a regionwide revolutionary upheaval. But perhaps the theory was not wrong. Instead, the world had changed by processes that had remained unobserved. We simply do not know.²¹ Heraclitus was right when he insisted that one cannot step in the same river twice. Are processes invariant or variable?

World politics consists of forever-changing events and relations and never-ending, indeterminate processes of becoming that cannot be reduced easily to static qualities.²² This characteristic it shares with the field of cognitive psychology, which is often counted as one of the “hard” social sciences.²³ Past events are alive in the present as more or less variable processes. Events are a series of dynamic developmental moments of a continuously changing reality in a world marked by the complementarities of risk and uncertainty that both invite and block human plans and purposes.²⁴ Processes are often deeply entangled with context and cannot be separated easily. Forever-changing events thus create a reality of never-ending process that is often inherently unpredictable. The open-ended nature of processes conceived of as ongoing events makes the investigator an active participant rather than a detached observer.²⁵ Many sciences are about intervention, participation, and learning rather than representation. We should be skeptical about

¹⁸ Rovelli 2021: 135–38. Hanson 1961. ¹⁹ Arfi 2022: 217.

²⁰ Jaeger and Rosnow 1988: 65. ²¹ Klaas 2024: 206–07. ²² Kincaid 2004a: 210–11.

²³ Jaeger and Rosnow 1988: 64–67. Rosnow and Georgoudi 1986. See also Pepper 1942: 232. Black 1962: 239–41. Marks 2011.

²⁴ Jaeger and Rosnow 1988: 65. ²⁵ Mjøsset 2009: 47–48.

generalizations concerning the “deep structures” of the cultural world that are informed by analogies with the “driving forces” of the physical world.²⁶ Why not pay attention instead to generalizing statements that are linked to participatory, interventionist, or learning purposes in a world of emergent processes?

Many political and social processes stress “path dependency, temporally heterogeneous causalities and global contingency.”²⁷ Historically conditioned patterns often result from highly variable processes.²⁸ Causation consists of a concatenation of causal factors. Often it cannot be reduced to the notion of a single, efficient cause. Causal conditions have different effects at different stages of historical processes unfolding in different locales. In this view the time and place in which processes unfold make a difference to their character.²⁹ Unaccounted-for cases or observations are resolved through the introduction of more complex constellations of processes. In the stories they tell, complex theories and models thus seek to cope with the specificity of historical processes, the intricacy of causal configurations, and the ambiguity of language.³⁰

Needless to say, not everybody agrees with this characterization. Larry Summers – former chief economist of the World Bank, former Treasury Secretary, former President of Harvard, and former economic advisor to President Obama – has gone on record proclaiming that “the laws of economics, it’s often forgotten, are like the laws of engineering . . . There’s only one set of laws and they work everywhere. One of the things I’ve learnt in my short time at the World Bank is that whenever anybody says, ‘but economics works differently here,’ they are about to say something dumb.”³¹ Summers’ claim reflects a small world perspective. Processes are assumed to be invariant, contexts homogeneous and general, and language a passive mirror of the world. Just like Newton’s law of gravity, for Summers economic laws work everywhere and at all times. For John Searle this insistence on a Newtonian social physics is hopeless. It assumes human behavior to be predictable to a degree that it simply is not.³²

Language

Language matters in politics. For example, what in Washington in 1997 was called “the Asian Financial Crisis” was a calamity that did great economic harm and had enormous political consequences in Southeast

²⁶ Mjøset 2009: 49. ²⁷ Sewell 1996: 264. Western 2001: 355.

²⁸ Bernstein 1976: 106. ²⁹ Tilly 1984: 79. ³⁰ Western 2001: 356–58.

³¹ DeMartino 2022: 6, citing Hardy 2019: 18.

³² Searle 1984: 75. DeMartino 2022: 32. Hardy 2019: 18.

and East Asia. In South Korea it was called “the IMF crisis” (*aiem-epeu wigi*). “The name accorded with specific local truths.”³³ Many South Koreans were deeply angered by what they saw as the IMF’s economic imperialism. The conditionalities the IMF imposed so that the South Korean government could receive badly needed stand-by credits – the elimination of protective tariffs, the liberalization of labor markets, pension reforms – clashed with long-standing South Korean practices and policies.

Conventional wisdom and common sense express the belief that a real world exists “out there” which humans access through language.³⁴ Language is the conveyor of information about facts and the creator of imaginations expressed as fiction. These two domains of language use are conventionally understood to mark off the social sciences from the humanities. But often the distinction breaks down. For example, like theories and models, metaphors have analytical power, and like metaphors theories and models are telling stories. Words are symbols that express meanings humans assign to things in the world. And humans rely on symbols to name and talk about the world. Without language, two different humans would look at that world without being able to join in telling their stories about it. This is not to deny that some things in life – laughter, music, paintings – are difficult or impossible to capture in words.³⁵

Sally McConnell-Ginet writes “Audre Lorde famously quipped, ‘the master’s tools will never dismantle the master’s house.’ Language is not fully under the master’s control. Resisters can launch new ways of understanding familiar words, and they/we can create new words and arrangements of words – and, maybe, eventually new worlds.”³⁶ Understood as a cultural technology, language is historically emergent and inherently creative.³⁷ It can move people, open up new conceptual and artistic spaces, and create ambiguities and indeterminacies. Often relying on metaphors, language makes us tell stories that theorize and model the world. Put differently, language “performs” and has effects. Chief Justice Roberts knew this when he spoke about his job as a Supreme Court Justice: “Judges are like umpires. Umpires don’t make the rules, they apply them . . . Nobody ever went to a ball game to see the umpire.”³⁸

³³ Ferguson 2022: 10.

³⁴ In contrast to context and process, which are quite familiar to students of politics, I discuss language at greater length. The assumption that language is about information sharing and acts as a mirror of the world is widely shared among empirically oriented students of the political world and world politics. For a general overview of an enormous, complex field of scholarship see *Stanford Encyclopedia of Philosophy*, “Mental Representations,” <https://plato.stanford.edu/entries/mental-representation/>. Accessed 10/09/23.

³⁵ Wootton 2015: 18, 45–48. ³⁶ McConnell-Ginet 2020: 283. ³⁷ Patomäki 2020.

³⁸ U.S. Courts 2005.

Roberts's modesty was disarming as he suggested that he was Umpire 1 ("I call it as it is"). But Roberts is a smart man and surely knew about the importance of Umpire 2 ("I call it as I see it") and the power of Umpire 3 ("It is the way I call it"). Roberts could fool some people some of the time, but he did not fool all of the people all of the time. Public trust in and approval of the Supreme Court has declined sharply for many reasons since he was appointed as Chief Justice in 2005. Taking the American public for a ride about the nature of officiating in sports and politics may be one of them.

Theories of language diverge on whether language is fixed or fluid.³⁹ Noam Chomsky's work on a universal grammar and the fact that children everywhere acquire language effortlessly in the same way suggests that humans are born hard-wired with the basics implanted in their brains. Chomsky's early work in the 1960s developed the ground-breaking claim that language could be studied like other biological or chemical systems of the human body. He followed an axiomatic-deductive approach to develop propositions about language structure which could be tested empirically and then be refined or rejected. Later on, Chomsky elaborated a set of principles and parameters believed to be universal for all languages. Eventually he postulated computational recursion as the only universal principle; the brain embeds meaningful phrases in multiple forms into multiple sentence structures, limited only by memory.⁴⁰ Chomsky argues against language as a socio-cultural product. He posits language as an innate, "essential" capacity not an "emergent" product of social conditions.⁴¹ Even though Chomsky does not endorse the idea that words denote stuff in the world, he holds that words can express truths and falsehoods.

Steven Pinker links the idea of a universal grammar to evolutionary biology.⁴² Language is, to quote Wilhelm von Humboldt, "the infinite use of finite media."⁴³ Humans evolved to have an innate language capacity that makes them a unique species. Language is not an artifact of culture. Placing himself in a tradition that reaches from Aristotle to Darwin, Pinker argues that language is a human instinct, wired into our brains by evolution like web-spinning in spiders or sonar in bats.⁴⁴ Agreeing with Chomsky's focus on syntax and grammar, he points to the biological evolution of language understood as instinct. Computation and evolution

³⁹ Fierke 2022: 43–45.

⁴⁰ Tomalin (2006) gives a detailed history of the different phases and understandings of Chomsky's work as well as different schools of thought connected to it.

⁴¹ Scholz *et al.* 2022. Ibbotson and Tomasello 2016.

⁴² Pinker 1994: 18, 19, 21–24, 333, 355–69. Berwick and Chomsky 2017.

⁴³ Quoted in Pinker 1999: 10. ⁴⁴ Pinker 1994: 18.

are the two big ideas that help us understand how the mind works.⁴⁵ For both Chomsky and Pinker the meaning of the whole – sentence, paragraph, text – depends on how the meanings of its constituent parts, words, are combined. In this view, the meaning of the word derives from the representation of the specific object. Sentences combine words into larger units of meaning. Language is stable and fixed. Similarly, for many students of world politics language is an unproblematic, neutral conveyor belt for information about the world.

Pinker defines culture as a process by which learning spreads in a community and minds become coordinated into shared patterns, akin to the relation between language and dialect.⁴⁶ He acknowledges the amazing diversity in languages rooted in Chomsky's Universal Grammar. And he polemicizes against anthropologists' fetishism of cultural diversity and their ignorance or denial of abstract human experience grounded in evolutionary processes.⁴⁷ As an imaginative theorist, in his many books Pinker's plea for the computational theory of the mind is based on a metaphorical move. Our pinkish-grey brain is the hardware of chemical processes and the software of information processing. And neurobiology and evolutionary psychology are powerful tools furthering our understanding of brain and language.⁴⁸ This is a compelling set of scientific postulates coupled with a powerful metaphor enjoying broad appeal.

Pinker mentions metaphors only once in his book about the language instinct.⁴⁹ But he gives them a central place in one of his subsequent books.⁵⁰ He writes "language is saturated with implicit metaphors."⁵¹ Besides the combinatorial power of language shown by its Universal Grammar, conceptual metaphors are the second way of escaping at least partway from Plato's cave. "Humans take their concepts of space, time, causality and substance, etch away the leaden physical contents they were designed for, and apply the residual framework to airier subject matters."⁵² Newtonian physics and Shakespearean sonnets are made of conceptual metaphors. Pinker thus builds a bridge between language as "representation" and language as "re-presentation." "When you combine these two aptitudes – metaphor and compositionality – the language of thought can be pressed into service to conceive and express a ceaseless geyser of ideas."⁵³ He argues that "if all abstract thought is metaphorical, and all metaphors are assembled out of biologically basic concepts,

⁴⁵ Pinker 1997: ix–x. ⁴⁶ Pinker 1994: 411. ⁴⁷ Pinker 1994: 409–11, 413.

⁴⁸ Pinker 1997. ⁴⁹ Pinker 1994: 230.

⁵⁰ Pinker 2007: 235–78. See also Pinker 1997: 352–60. Lakoff and Johnson 1980. Lakoff 1987, 1993. Blanchard 2012.

⁵¹ Pinker 2007: 6. ⁵² Pinker 2007: 435. ⁵³ Pinker 2007: 437.

then we would have an explanation for the evolution of human intelligence. Human intelligence would be a product of metaphor and combinatorics.”⁵⁴ But unlike the evolutionary biologist E. O. Wilson’s argument about the consilience of knowledge, which I discuss in the [concluding chapter](#), Pinker’s trilogy of books on language and mind do not mention, let alone discuss, the slackening of the epigenetic leash during the last 100,000 years of evolutionary history, and the explosion of cultural autonomy from its biological roots.⁵⁵

A world exists “out there” that is not of human creation.⁵⁶ Many things in that world are the effects of causes which do not include human mental states. And sometimes descriptions of the world and claims about the veracity of those descriptions can be checked for their truth content. Directions and warnings generally work well among those sharing linguistic resources. It does not follow, however, that all descriptions of the world are truth-evaluable. For example, concepts such as “God” or “Truth” are not. Language is not “out there” in the world. Words, concepts, and metaphors are products of human language, creations made possible by instinct and the effect of genetic slack. The difference between world and language becomes clearer when we focus on vocabularies or discourses rather than words or sentences. The language of Aristotle’s physics differs from Newton’s and Einstein’s, but not because the world decides between them. The vocabulary or discourse for our descriptions is a human invention. As Richard Rorty writes: “The fact that Newton’s vocabulary lets us predict the world more easily than Aristotle’s does not mean that the world speaks Newtonian. The world does not speak. Only we do.”⁵⁷ Programmed by a vocabulary we choose, a process that can take decades or centuries, the world can cause us to hold beliefs. But it is humans not the world that choose the language in which we express our beliefs. The shift from one set of vocabularies or discourses to another is less an act of will or the result of argumentation and more a matter of changing habits. The shift reflects changes in the social practice of language use. Speaking differently rather than arguing well is the chief instrument of culture change: we replace an entrenched vocabulary or discourse that has outlived its usefulness. Although a new vocabulary or discourse at first may be inchoate, it holds the promise of being productive. Such change does not lie either within us as individuals or in the external world. It emerges in cultural communities existing in the material world. The shift from Aristotelian to Newtonian vocabulary, for example, was hugely important because it enabled new scientific inquiries

⁵⁴ Pinker 2007: 242–43. ⁵⁵ Wilson 1998. Pinker 1995, 1999, 2007.

⁵⁶ Rorty 1989: 3–8; 1979. ⁵⁷ Rorty 1989: 6.

and technological developments whose success was measured by their predictive accuracy. So might a shift away from theories and models that are based on the tacit knowledge provided by Newtonian humanism.

Looking at language use and language games also was central to Wittgenstein's theory of language. He sought to understand the formal, logical limits of language. And when he succeeded in doing so, he thought he would uncover everything that can be said truthfully. However, during the second half of his life, after about 1930, Wittgenstein came to develop an agentic view of language as "re-presenting" the world.⁵⁸ Combinations of concepts and sentences often are not computationally recursive. Words do not have innate meanings or referents. Language has no inner logical essence. It unfolds through a multiplicity of human practices. We must study the everyday uses of the language that constitutes and embeds us. Language is a kind of practice that is as varied as all other human practices.

Meaning is created in speech or text. Word use is created by word-users. Human agency, specifically language practice, is an indelible part of the experience of being in the world. As Wittgenstein writes famously "the limits of my language mean the limits of my world."⁵⁹ Language is not a camera taking still photos. And the pragmatics of word use are not reducible to semantics in determining linguistic meaning. Pragmatic considerations span from macroscopic cultural and institutional factors to the micro-level interactional exchange of shared knowledge claims. Jorge Luis Borges' marvelous parable of the fictional author Pierre Menard makes this point.⁶⁰ Menard studied all the nuances of Cervantes' masterpiece with such care that he ended up writing a new book hundreds of years after the publication of *Don Quixote*. All the sentences and words in his book were identical with those of the original. But the intervening centuries had given them very different meanings.

Language is a foundational way of being in the world. The nature of things is the product of particular language use that can become "second-nature."⁶¹ As such it has been the subject of intensive study and important debate by specialists in linguistics, literature, history, and the humanities more generally who have followed Dilthey's lead. I disregard it here only because that debate would lead me far afield from my purpose. What matters to my argument about language is this. Without in any way belittling the importance of information, language is more than an information-conveying instrument. It makes intelligible and accessible the possibility of novel ends.⁶² Expressed in language, our worldviews are not acquired

⁵⁸ Misak 2020: 358–67. ⁵⁹ Wittgenstein 2001: 69. Misak 2020: 134–35.

⁶⁰ Borges 1999: 88–95. Egginton 2023: 147–49. ⁶¹ Wittgenstein 1968: 103.

⁶² Brandom 2011: 79–80.

because of their correctness. They are, rather, the background against which we distinguish between truth and falsehood.⁶³ “The propositions describing this world-picture might be part of a kind of mythology. And their role is like that of rules of a game; and the game can be learned purely practically, without learning any explicit rules.”⁶⁴ Since the relation between rules and experiences expressed in language can change, we should not think of rules as existing outside language.

Whether a rule is good or bad, however, is not a product of language. That depends on its context, on how the rule works in the world. Language is shaped by its practice and how we experience the world.⁶⁵ Practice and experience will change and with them the meaning of words. Take the practice of slavery or foot-binding. What is considered natural and reasonable at one point in history can be considered unnatural and unreasonable at another. But what is reasonable does not change. For slavery and foot-binding were challenged even in their time and place. Philosophy can ponder what is right and what is wrong.⁶⁶ But it cannot determine language practice. That is something that only experience and shifting meanings can do.

Like Wittgenstein Donald Davidson views language as a tool not as a medium of representing the world or expressing individual beliefs.⁶⁷ Tools are more or less effective. They help or get in the way of doing a job. Elaborating on Davidson, Richard Rorty thus argues that vocabularies can help or hinder our understanding by comporting or not comporting well with other vocabularies.⁶⁸ Traditional Aristotelian vocabulary hindered the deployment of the mathematized vocabulary that students of mechanics developed in the sixteenth century. In the sciences, philosophy, poetry, and all the other domains of human endeavor, language and vocabularies understood as tools evolve by trial and error. Language is a coping mechanism to help us find our way in the world. It is more than a mere medium representing the world. Unpredictably, a new language makes possible the articulation of a new purpose rendered in new descriptions that “re-present” the world.

If language is fixed, humans have a lexicon of meaningful words stored in their brains; intersubjective understandings result from the logical structure of all mental representations, including linguistic ones. Humans may be trapped in their heads but all those heads are structurally alike. If language is fluid, however, words and their meanings are stored but those meanings change in different settings and over time when used

⁶³ Wittgenstein 1972: No. 94 [15e]. No. 162 [23e–24e].

⁶⁴ Wittgenstein 1972: No 95 [15e].

⁶⁵ Wittgenstein 1968: 74–88 on rule-following and the possibility of a private language.

⁶⁶ Wittgenstein 1968: 5. ⁶⁷ Davidson 1978, 1984. ⁶⁸ Rorty 1989: 9–18.

by different actors. The entangled relation between what is fixed (language-as-innate) and what is fluid (language-as-contingent) is changeable through the creative use of metaphors.⁶⁹ Metaphors offer a helpful tool that makes it possible for us to oscillate back and forth, building bridges and repairing fences.⁷⁰

Metaphors resemble the growth and death of coral reefs.⁷¹ They are interruptions in the unthinking flow of language. For example, in the 1920s Soviet physicists developed methods to describe the collective behavior of particles dubbed quasiparticles. Today they are a basic concept of physics that scientists normally working for business rather than left-wing political movements use unthinkingly.⁷² The use of familiar words in unfamiliar ways is an indication of the unsuitability of familiar language for one's purpose. Scientific revolutions are metaphoric re-descriptions. If the new description proves useful for other speakers, repetition will make it habitual and thus help shape an evolving vocabulary. Metaphoric language changes step by step and leaves behind a pile of dead metaphors. Without accomplishing a higher purpose and akin to biological evolution metaphoric language change brings about new forms of life, blindly killing off old ones. In his discoveries Newton did not come up with the words needed to fit the world properly, words that others before him had missed. Instead, Newton happened to hit upon a language tool that worked better for certain purposes than any previous tool. Once people realized what could be accomplished with this new tool, interest in the old Aristotelian tool evaporated. This process is the same in science, the arts and philosophy, and all spheres of life, including politics. It dissolves inherited problems rather than solving them. The contingent process of making new words thus can make new worlds filled with looming, fresh uncertainties.

Metaphorizing something conceptually as religious, as in the "Bomb as God," is a cultural sedimentation of language that is so deep as to move the metaphor out of the realm of secular politics. Nuclear renunciation, Jacques Hymans argues, thus becomes impossible.⁷³ Deliberative metaphors are used purposefully to persuade others to think or act in a specific way. The metaphor "our nation's life is a journey" originates in the sensory experience of human movement toward a desired goal in the future. It can be used as a deliberative metaphor in politics.⁷⁴ In adopting Savage's small and large world metaphor I rely on both kinds of metaphors in trying to convince you, the reader of this book's arguments.

⁶⁹ Brown 2003. ⁷⁰ Zvirzdin 2024. ⁷¹ Rorty 1989: 16. Pinker 1997: 352–62.

⁷² Kojevnikov 1999: 296. ⁷³ Hymans 2023.

⁷⁴ Steen 2013. Onuf 2024. I thank Michael Marks for his comment on this point.

“Metaphors are integral to how IR scholars conceptualize their field,” writes political scientist Michael Marks. “They provide the narrative structure through which facts are sorted into categories, assumptions are made, hypotheses are derived, and theories are formulated.”⁷⁵ Metaphorical language does not seek to “represent” the real world. Instead, it approximates some elements of the world by means of comparison.⁷⁶ That is, it “re-presents” the world. In the words of Hayden White “metaphor does not *image* the thing it seeks to characterize, it *gives direction* for finding the set of images that are intended to be associated with that thing. It functions as a symbol rather than as a sign.”⁷⁷ Persuasiveness rather than veracity is metaphor’s preferred coinage.

Metaphors that give direction leave space for creativity, for seeing things anew, thus undercutting conventional notions of representation. For some, metaphors arise from the contextual use of words. What might be a good metaphor in one context could fail in a different one. What matters is the effect metaphors have on their audience rather than their inherent linguistic properties.⁷⁸ As it does not image the world directly, the same metaphor, used differently, highlights different aspects of the world. A stronger version of the same argument holds that language is itself metaphorical. The now dominant “conceptual” approach to metaphor holds that all thought and language are metaphorical. Metaphors “happen” mostly at a sub-conscious level. This does not preclude, however, the deployment of “conscious” metaphors as instruments of control of how people, such as the readers of this book, view aspects of the world, for example the complementarity of risk and uncertainty in small and large worlds.⁷⁹ For Nietzsche humans and nature merge therefore in an always-in-flux form of life. Language offers an endless series of perspectival, partial descriptions of reality. For him “there is no real knowing apart from metaphor.”⁸⁰ Aided by metaphors, speaker and audience who are taking different perspectives are engaged in a power struggle over the definition of reality.

Metaphors are “re-presenting” the world in a new light. They do not have to be verbal. Sometimes they are gestural and more telling than language. In many seminar rooms and lecture halls, for example, speakers use air quotes as they refer to “independent” and “dependent” variables. In doing so, they indicate that the distinction between different kinds of variables is to be understood metaphorically, as in “so-called independent and dependent variables,” since such variables are artifacts the analyst imposes on deeply entangled processes. More generally, up-and-down

⁷⁵ Marks 2018: 3. ⁷⁶ Marks 2011: 10. ⁷⁷ White 1978: 91. ⁷⁸ Davidson 1978.

⁷⁹ Steen 2013: 55–59. ⁸⁰ Cantor 1982: 78.

metaphorical concepts convey strong emotions, as in “thumbs-up” and “thumbs-down.” And the “deep state” sounds like a Hades-like sinister space. Generally downward movements are associated with experiences such as falling or being defeated in battle or just “feeling down.” Many metaphors associate upward movement with positive feelings as in “things are looking up” or “the sky is the limit.”⁸¹

Metaphors can also be pictorial. The choice of fonts and the numbering of headings and subheadings of academic papers send a signal to the audience about an author’s basic stance on matters of theory and method. In economics demand and supply curves are metaphors for markets. The mathematics that leads to graphs is a metaphor often with considerable predictive capacity. For Deirdre McCloskey “models are metaphors that is all ... when we use math or metaphors, we are talking.”⁸² This is different from art, but not all that much. Artistic truth does not lie in a correspondence with the facts of the world that is being “represented,” as in acts of world-mapping. It lies instead with world-making acts of “re-presentation.” Artistic truth rests on the imagination and authenticity of a world-creating vision that “re-presents” the world.⁸³ Language and metaphors do the same thing. They can be productive in actualizing a world from the many possibilities that exist. “Language by naming beings for the first time,” writes Martin Heidegger, “first brings beings to word and appearance.”⁸⁴ On a larger scale we call that the creation of self-fulfilling prophecies. And not always for the better. The economic metaphor of self-regulating markets, for example, led in 2008 to a market-driven disaster.⁸⁵

2. Post-Newtonianism

Post-Newtonianism highlights the entangled nature of the world. Entities in the world exist not as separate objects but in the specific contexts provided by their entanglements with other entities. The language which describes these relations is mathematical and metaphorical. Like Newtonian humanism, a post-Newtonian worldview has its share of intellectual tensions and contradictions that leave plenty of space for different theories and models. Based on strong scientific principles and practices it does not seek to restrict

⁸¹ I am very much indebted to an extended e-mail correspondence with Michael Marks which introduced me to the richness and intricacies of metaphorical language. See also Marks 2004, 2011, 2018.

⁸² McCloskey 1994: 42, 183.

⁸³ The same holds for cognitive linguistics and theories of human thought as metaphorical, experimental, and thus indeterminate. See Marks 2011: 12–13, 15–18.

⁸⁴ Heidegger 2002: 46. ⁸⁵ Blakely 2020: 14–18.

the hardness of its science to the calculation of risk. And in sharp contrast to how students of world politics typically go about their business, post-Newtonianism highlights instead the importance of uncertainty. It holds that measuring the world is an entangling practice that occurs internal to the world; there is no world that exists external to the observer. Post-Newtonianism's conception of spacetime flies in the face of Newtonianism's linguistic representations, which are organized by conventional understandings of separate dimensions of time and space. And in contrast to Newtonianism, for post-Newtonianism novelty is not recombinatorial, based on law-like generalizations and identifiable causal mechanisms operating in closed systems.⁸⁶ It insists instead on the existence of open systems filled with infinite potentialities and possibilities. In brief, for scholars of world politics who focus only on risk post-Newtonianism is an intrusive, alien spaceship.⁸⁷

Newton believed that both God and Nature made the universe simple. Einstein agreed. He stripped away Newton's metaphysics and argued that the subatomic level possesses a symmetry that invites simple explanations. For example, with time and space conceptualized as distinct dimensions, Maxwell's eight field equations as the basis of classical electrodynamics were clunky and opaque. Once Einstein had developed his theory of spacetime as a fourth dimension, rotating these equations across a higher dimension collapsed them into one simple equation, reflecting Einstein's brilliant insight of the symmetry of time and space as equivalent observations.⁸⁸ Could gravity change time? Could speed and position alter the nature of space? Backed by compelling experimental evidence, Einstein's affirmative answers to both questions established that reality could not be grasped intuitively. The concepts of spacetime and the relative nature of reality should have shocked conventional theories of world politics holding to the notion of a clock-like universe. The fact that they did not is testimony to humanist Newtonianism's firm grip on the study of the political world and world politics.⁸⁹

Over the last century, quantum physics has generated hypotheses with great predictive accuracy about the natural world that are superior to

⁸⁶ Wiener 1948: 42. ⁸⁷ Mirowski 1989: 4–5, 357, 366, 374–95.

⁸⁸ Gunitsky 2019: 709, fn 8.

⁸⁹ In the form of nuclear weapons, quantum mechanics did have a profound influence on international relations, but “the discipline remained largely wedded to the Cartesian-Newtonian paradigm, and few considered the deeper connections between quantum mechanics and IR” (Waters 2022b: 57). For recent, notable exceptions see Wendt 2015; Zanotti 2018; the collection of papers in a special issue of *Security Dialogue* (2020) fully referenced in Waters 2022a: 27, fn 3; Murphy 2021, 2022; Waters 2022a; Fierke 2022; and Der Derian and Wendt 2022. James Der Derian's Project Q housed at the University of Sidney and Wendt's summer school at Ohio State University have acted as catalysts.

those derived from the classical model. Yet, for the most part, following the lead of economics, students of world politics continue to adhere to Newtonian humanism.⁹⁰ Even though nuclear weapons became a central concern for students of world politics, post-Newtonianism as a worldview remains virtually unacknowledged. In the late nineteenth century Newtonian physics became the model for economics, anointed royalty of the social sciences in the second half of the twentieth century. The quantum discovery of discrete and discontinuous packages of energy in 1900 and the development of quantum mechanics in the 1920s set the stage for quantum technologies in the second half of the twentieth century such as nuclear weapons, lasers, transistors, fiber optics, computers, mobile phones, drones, and the world wide web. At the dawn of the era of AI we now discern quantum computing, quantum cosmology (a unified theory of the beginning, evolution, and end of one universe or an infinity of universes), and quantum consciousness (human and artificial).⁹¹

Quantum mechanics differs from the classical model.⁹² Matter is not dead stuff but a form of energy operating at many scales, from particles to galaxies. The elementary parts of the natural world are entangled and not fully separable. A century of research has generated powerful results establishing particle entanglement without any observable mechanisms, creating what Einstein called “spooky action at a distance.” This action has been confirmed strongly by experiments reported in recent years.⁹³

In this post-Newtonian view life does not evolve as points in space existing in an empty container; and it is not organized by time as a linear, universal referent. Following Einstein, life is instead an iterative evolution of four-dimensional spacetime that teems with possibilities.⁹⁴ The world is made of fields that are subject to tiny fluctuations. Basic particles are continually created and destroyed.⁹⁵ “The world is a continuous, restless swarming of things, a continuous coming to light and disappearance of ephemeral entities” writes physicist Carlo Rovelli, “a world of happenings, not of things.”⁹⁶ The future is uncertain or indeterminate and open.

⁹⁰ Blakely 2020. ⁹¹ Der Derian 2019: 7–11.

⁹² Mermin 1990: 175, 195. Baeyer 2016: 185, 192, 195. Waters 2022a: 90, 142. For a general overview see Kumar 2009; Lewis 2016; and Waters 2022a: 98–159. I justify my radical simplifications of an exceedingly difficult analytical terrain because I wish to distinguish different worldviews (Baeyer 2016: 140). On the widespread agreement on the Copenhagen interpretation see, among others, Barad 2007: 249–52, 414–15, fn 48; Cushing 1994; Healey 2017; Freire 2015; Becker 2018: 49–50, 84, 271; Ney and Albert 2013; Weinberg 2017: 5–8.

⁹³ Markoff 2015: A13. Hanson and Shalm 2018.

⁹⁴ Rovelli 2017: 69–91. Barad 2007: 92, 141. ⁹⁵ Rovelli 2016: 33.

⁹⁶ Rovelli 2016: 33; 2017: 79–84.

Possibilities are always being reconfigured with new ones opening up as others close down.⁹⁷ The concept of a probability wave, Heisenberg argued, is a quantitative restatement of the old concept of potentiality, a strange kind of physical reality between possibility and reality.⁹⁸ The world's presentation of an infinitude of relational possibilities cannot be controlled; but it can be captured by smart experiments and isolated cause and effect chains. In this view, uncontrollable surprises, accidents, and unintended consequences are normal.⁹⁹ Rather than being focused on Newtonian constraint and necessity, post-Newtonianism centers on uncertainty, indeterminacy, potentiality, and possibility.

Defying common sense, quantum mechanics has established or fortified concepts such as uncertainty, complementarity, entanglement, non-locality, and superposition. The elementary entities in quantum mechanics are entangled. Conceived of as particles and as waves they are ruled by the principle of uncertainty. Their functions represent the probability of finding particles at a specific location only if we choose to look there. The question of probability goes to the heart of physics, where before “everything had seemed to be regulated by firm laws that were universal and irrevocable.”¹⁰⁰ Quantum entities exist in both particle and wave form, until they collapse at the moment of observation. Their velocity and position cannot be measured simultaneously. They correlate across enormous distances. They can pass through impermeable barriers. And, in thought experiments, they can produce contradictory states. Quantum mechanics strains to discuss these phenomena in non-mathematical language. It yields a picture of an entangled universe that is both holistic and atomistic.¹⁰¹ In the words of James Der Derian and Alexander Wendt “as a fundamental worldview, theory of reality and enabler of new technologies, quantum touches everything, in theory and increasingly in practice.”¹⁰²

Although they shared in the same worldview, the inventors of twentieth-century quantum mechanics differed widely on questions of theory, and those disagreements were reflected in public debates. In Weimar Germany, for example, Einstein's theory generated fierce public controversy. A pacifist and a Jew, he was a ready target of conservatives and ultra-nationalists. Like Newton before him, Einstein mused “this world is a strange madhouse. Currently every coachman and every waiter is debating whether relativity theory is correct. Belief in this matter depends on political party affiliation.”¹⁰³ The political salience of

⁹⁷ Barad 2007: 234–35. ⁹⁸ De Ronde *et al.* 2016: 3. ⁹⁹ Barad 2007: 354.

¹⁰⁰ Rovelli 2016: 18.

¹⁰¹ Murphy 2022: 252. Der Derian and Wendt 2022: 11. Patomäki 2017a, 2017b.

¹⁰² Der Derian and Wendt 2022: 18. ¹⁰³ Quoted in Hamilton 2013b: 97.

quantum physics declined as its practical significance increased. Empirical applications of quantum mechanics have made stunning progress in many different fields of technology touching many aspects of world politics.

This, however, has not resolved deep-seated disagreements about the meaning of quantum mechanics. Niels Bohr's principle of complementarity is a good example. In Bohr's analysis of the Planck constant, the collapse of the wave function can be described only as an interaction between the measurement apparatus and the light being measured. Reality is not a set of more or less contingent cause and effect relations. This is irreconcilable with the very idea of causality. It challenges commonsensical understandings of reality as much as did Einstein's theories of relativity. Complementarity holds that mutually exclusive pictures are the necessary constituent parts of a more complete description of the phenomenon being investigated. For example, for Bohr Schrödinger's wave function and Heisenberg's matrices, the wave-particle duality, were both valid. The contradiction between the two approaches could not be resolved. No single frame of reference was sufficient to capture a contradictory reality. Measured in one set of experiments observations would yield waves, and in another particles. "Neither was a perfect reflection," writes Benjamín Labatut, "and both were models of the world."¹⁰⁴ Although physics encountered this paradox in the study of the interaction between light and material bodies, the principle of complementarity, Bohr argued, should be adopted in any field of science in which complex phenomena are analyzed by relying on simple concepts.¹⁰⁵ His colleagues and associates, Wolfgang Pauli and Max Born, developed similar arguments about the relevance and applicability of the principle of complementarity to the human sciences in general and psychology in particular.

Disagreements about some of the theory's deeply paradoxical features have continued among successive generations of physicists.¹⁰⁶ One disagreement concerns the very meaning of the term "measurement." Does it refer to an apparatus in the lab or also to language? For some, like Karen Barad, Bohr and the Copenhagen interpretation insist that when humans measure they affect both the material and the symbolic world. What Bohr "really" meant in his many and often opaque commentaries remains unresolved, as do differences of opinion over how one should think about the physical world with or without language and human experience – a debate powerfully revived by recent advances in AI. But Slobodan

¹⁰⁴ Labatut 2020: 152. Chen 2023. Päs 2023. ¹⁰⁵ Harrington 2023: 26–31.

¹⁰⁶ Baggott 2024. Weinberg 2017: 3.

Perović argues convincingly that throughout his career Bohr grounded his philosophical arguments in experimental data. His general principle of complementarity was the end-result of painstaking work developing and testing hypotheses and developing middle-range theoretical constructs. Everyday language and classical terminology were needed to report the experimental results in the first stage of induction.¹⁰⁷ The second quantum stage reports performed experiments, the nature of the apparatus, the observer, and other quantum concepts in tentatively intermediary and general hypotheses that, eventually, may produce a master hypothesis that grasps the overall experimental context. Such hypotheses can introduce metaphysical ideas and models that do not agree with the classical view of the material world, such as the entanglement of observed objects and the instruments used to interpret them. The limitations of language were a great obstacle to dealing with the quantum weirdness that Bohr addressed as a practicing physicist.¹⁰⁸ Heisenberg agreed about language as “re-presentation” and world-making. He conceded that Bohr’s concept of complementarity forced physicists to rely on ambiguous language.¹⁰⁹ “When it comes to atoms, language can be used only as in poetry,” Heisenberg wrote. “The poet, too, is not nearly so concerned with describing facts as with creating images and establishing mental connections.”¹¹⁰

A post-Newtonian worldview tolerates widely diverging theories of Quantum Realists and Quantum Instrumentalists. Their different positions recall debates between “frequentists” and “subjectivists” in the discussion of probability discussed in [Chapter 1](#). “Quantum Realists” believe that the history of the world is a history of endless splits, which occur every time a macroscopic body is tied to a choice of quantum states. They stipulate an inconceivably large number of uncorrelated multiverses, for David Mermin “the *reductio ad absurdum* of reifying the quantum state.”¹¹¹ Realists are waiting for a post-quantum revolution that will make quantum mechanics a special case of a more general theory not yet invented. Such a revolution might thus start a new cycle in which quantum physics would be subsumed, just as it subsumed Newtonian physics in the early twentieth century. Physics Nobel Prize winner Steven Weinberg characterized that quest as interesting but also as “whistling in the dark.”¹¹² For now, from the perspective of Quantum Realists, uncertainty and entanglement are viewed as constitutive elements of the world and, by extension, of world politics.¹¹³

¹⁰⁷ Harrington 2022: 31–32. Fierke 2022: 31, 43, 45.

¹⁰⁸ Perović 2021: 48, 51–52, 191–93, 198. ¹⁰⁹ De Ronde *et al.* 2016: 8–9.

¹¹⁰ Quoted in Egginton 2023: 62. ¹¹¹ Mermin 2019: 6, fn 15. Kauffman 2008: 27–30.

¹¹² Henderson, B. 2020: 39. Chen 2023. ¹¹³ Kurki 2015: 788.

“Quantum Instrumentalists” believe that when human beings measure the world, they produce that world at some fundamental level. The natural world is not governed by impersonal physical laws that control everything. Quantum Bayesianism (or QBism) offers instead a radically subjective interpretation of quantum mechanics that provides an unconventional answer to the mysterious meaning of the subatomic world.¹¹⁴ For Mermin “QBism is as big a break with 20th-century ways of thinking about science as cubism was with 19th-century ways of thinking about art.”¹¹⁵ QBism grapples with the “weirdness” of central aspects of quantum physics, specifically the interpretation of quantum probabilities.¹¹⁶ It stipulates that each actor makes bets and updates odds.¹¹⁷ Based on evolving experience and new information, and following the rules of Bayesian probabilities, agents update their prior beliefs to improve their predictions of future events. In QBist interpretations, all probabilities are interpreted as exclusively private beliefs of individuals. Information is intrinsically private and inaccessible to others. Information updating does not produce intersubjectively shared, consensual beliefs about the world in the medium- or long-term. QBism does not allow for social or interpersonal relations. The updating process involves *only* the agent’s evolving experiences and beliefs. Einstein would not have any of this: if God had wanted to play dice, he argued, “then he would have done it quite thoroughly and not stopped with a plan for his gambling. In for a penny, in for a pound [*Wenn schon, denn schon*]. Then we wouldn’t have to search for laws at all.” Rüdiger Schack answers Einstein: “God *has* done it thoroughly. That’s the message of QBism. It is not a plan for *his* gambling, but for *ours*.”¹¹⁸ And the “our” is a collection of isolated individuals existing without society. In the words of Christopher Fuchs, QBism postulates that “nature and its parts do what they want, and we as free-willed agents do what we can get away with. Quantum theory, on this account, is our best means for hitching a ride with the universe’s pervasive creativity and doing what we can to contribute to it.”¹¹⁹

¹¹⁴ Mermin 2016: 232–48 and 2019: 2–4, 6. Fuchs *et al.* 2014. Fierke 2017: 151. Wendt 2015: 207–21. Mermin (2019: 2, 13–15) argues that the insights of QBism are relevant also for puzzling, though less vexing, aspects of the classical world such as the problem of “Now.” For two sharply differing views on QBism see Becker 2018: 289–94 and Baeyer 2016: 235–39. Mohrhoff (2014a, 2014b and 2019a, 2019b) offers an informative critical engagement.

¹¹⁵ Mermin 2016: 233. ¹¹⁶ Mermin 1998. Fuchs and Schack 2009: 48.

¹¹⁷ Caves *et al.* 2002a, 2002b. Fuchs 2017. Mermin 2016: 232–48.

¹¹⁸ Fuchs 2017: 20. For the most up-to-date and comprehensive version of QBism see Fuchs 2024.

¹¹⁹ Fuchs 2017: 20.

For QBism humans are part of a participatory rather than an inert universe.¹²⁰ Many trillions of elementary observer-participatory acts help constitute the shape of the universe, without determining it.¹²¹ Every action by the self can be met by uncontrollable and unforeseen consequences from the world. “The objective world asserts itself unmistakably, unpredictably and uncontrollably in its immediate response to any of our interventions.”¹²² When actors prod the external world, the world can and often does generate something new that no agent could have predicted. The core of QBism is about something that is profoundly personal, relational, and unpredictable. Confirmed by the private experiences of individuals, the laws of nature eventually crystallize into conventional wisdom.¹²³ For QBism quantum mechanics is a technique for navigating the world. It is not human experience that yields to the world, as in the classical model. It is the world that yields to human experience – until the cumulation of experience changes.

QBism holds that self’s understanding of the world rests entirely on individual experience. “When I sleep or die” writes Oswald Spengler, “my world ends with me, but the world of the others remains. With every newborn child awakens also its world.”¹²⁴ It is self’s uncommunicable experience that matters – the individual “I” not the intersubjective “we.” It is “each of us” as a singular entity and not a collective “us.”¹²⁵ This is *not* to argue that the world exists only in the head of self.¹²⁶ The material from which self constructs a picture of the external world includes the effects that the world has on self’s experience of other. It leads self to reason that other is very much like self, with its own private experiences. This is as firm a belief as any that self has. Self could not function in the world without it. Asked to assign a probability to this statement, self would choose $p=1$. The source of that confidence remains outside of the scope of the theory, surely a source of bafflement to social constructivists and other social scientists.¹²⁷ QBism is not a solipsistic theory that holds that each of us is free to make up our own private world. There exists a world external to each agent.¹²⁸ This empirical proposition is

¹²⁰ Baeyer 2016: 202–10. ¹²¹ Fuchs 2017: 5–6. ¹²² Mermin 2019: 8.

¹²³ Baeyer 2016: 196–201. ¹²⁴ Spengler 1965: 54. Author’s translation.

¹²⁵ Mermin 2016: 233, fn 1, 238; 2019: 5–6.

¹²⁶ Becker 2018: 25–27, 29–30, 48, 168, 234.

¹²⁷ “Probability-1 measures the intensity of a belief: supreme confidence: It does not imply a deterministic mechanism . . . That probability-1 assignments are personal judgements, like any other probability assignments, is essential to the coherence of QBism” (Mermin 2016: 244, 245, and 219–26). I asked my physics colleague, David Mermin, about any writings by physicists about the origin of confidence and he writes “I don’t believe any physicists have ever asked this question before you raised it, and I’ve received no answers.” Personal communication 02/27/23.

¹²⁸ Fuchs and Schack 2009: 48–55.

more useful and strongly confirmed by experience than any other. An important part of self's private experience is the impact on self by other's effort to communicate in speech or writing other's personal experience.

QBism differs from Wendt's book on quantum consciousness.¹²⁹ Wendt's argument seeks to ground human consciousness in the materiality of the world. He hopes to create a consistent, coherent, and complete system of knowledge. QBism is different. It is pragmatic. It takes experience (or Wendt's consciousness) as given. Knowledge is not a set of securely anchored systematic propositions. It is, rather, a set of successive attempts to cope with problematic situations that are more or less successful in specific contexts.¹³⁰ Like all of physics, QBism is a product of human thought and culture. There is no "reality" out there. It is all in our heads and the world is created through individual experience, beliefs, and information updating. For QBism, human experience (Wendt's consciousness) is foundational and creates the quantum world. For Wendt, quantum physics is the foundation on which he grounds his far-ranging search for consciousness (QBism's experience). For QBism, the move is from individual experience (or consciousness) to the world; for Wendt, the move is from the world to individual consciousness (or experience). For QBism, worldviews are epistemologically grounded. For Wendt, individuals are ontologically walking wave functions. These arguments are different though not necessarily antithetical. In fact, they may be complementary, just as Russell's and Whitehead's philosophical arguments connecting materialism and idealism.¹³¹ In the words of Jairus Grove "much like a magnet can have two opposing forces, positive and negative, in one object so can matter have conscious and nonconscious properties."¹³²

Within a post-Newtonian worldview theoretical disagreement extended also to the broader application of quantum mechanics. Albert Einstein, John von Neumann, and Erwin Schrödinger, for example, saw little value in quantum mechanics for the humanities and social sciences. Other physicists insisted on the theory's relevance while disagreeing on its precise contribution. Formalists like Max Born thought that the relations between human and social phenomena could be expressed mathematically, and that this might generate novel explanations and probabilistic predictions. Niels Bohr, Werner Heisenberg, and others were similarly convinced of the theory's contribution to our understanding of the construction and sharing of human knowledge beyond the material world. Students of world politics and the social sciences more generally,

¹²⁹ Wendt 2015. ¹³⁰ Guess 2020: xii, 17–22, 28–30. ¹³¹ Waters 2022a: 56.

¹³² Grove 2022a: 78.

however, have resisted exploring such avenues. They have sidelined uncertainty and struggled unsuccessfully with the risk-uncertainty conundrum.

That is not to argue that Bohr and Heisenberg agreed on the meaning of uncertainty and indeterminacy.¹³³ Heisenberg thought of uncertainty as the unavoidable trade-off in the knowledge of quantum systems such as the relation between the position and momentum of a particle; more certainty about one meant less certainty about the other. Uncertainty was for him a quantitative and measurable concept. Bohr understood indeterminacy as a qualitative phenomenon rather than a measurable probability. Indeterminacy was not the same as Heisenberg's "principle" governing objective experimental observation. It was part of complementary "relations" due to the inseparability of subject, object, and instrument in quantum experiments. Heisenberg focused on measurability and how things "are," Bohr on knowability and how things "appear." This distinction points to a split in the community of quantum physicists that emerged in the mid-1920s. One group focused on mathematics (such as Einstein, Born, Schrödinger, Dirac, and Heisenberg), the other on philosophy (Bohr and Pauli in particular). Despite these disagreements on fundamental issues of ontology and epistemology, all agreed that quantum mechanics revealed something profoundly novel about the constitution of the world.¹³⁴

Early on, some political scientists agreed.¹³⁵ For example, in 1927 William Bennett Munro, then president of the American Political Science Association, delivered his address on the topic of "physics and politics," regretting that the study of government was "still in bondage to the eighteenth-century deification of the abstract, individual man."¹³⁶ Twenty years later, in *Scientific Man vs. Power Politics*, Hans Morgenthau acknowledged the importance of changes in physics for the analysis of world politics.¹³⁷ For Morgenthau Newtonian physics was "a ghost from which life has long since departed."¹³⁸ Since the classical model had been disproved and rejected by physicists, Morgenthau argued, it should no longer serve as a guide for the social sciences. Students of world politics should accept the complex worldview underlying quantum mechanics. Scientific studies of world politics would therefore have to settle for a disquieting mixture of the knowable and the unknowable.¹³⁹ By

¹³³ Harrington 2023: 112–13, 120–22, 142–46. ¹³⁴ Harrington 2022. Welch 2022: 15.

¹³⁵ Rummel's 1960s and 1970s quantum social field theory and the 1980s quantum politics study group at the University of Hawaii are discussed in Waters 2022a: 71–75. See also Becker 1991 and Uphoff 1992.

¹³⁶ Munro 1928: 3. ¹³⁷ Frei 2001: 206. ¹³⁸ Morgenthau 1946: 132.

¹³⁹ Uncertainty was central to the work of economist Frank Knight, Morgenthau's colleague at Chicago, whom he singles out for special thanks in the preface to his 1946 book.

introducing the concepts of uncertainty and indeterminacy, quantum mechanics had radically transformed the calculable, determinist universe of the classical model.¹⁴⁰ “The next quantum jump of an atom is as uncertain as your life and mine.”¹⁴¹ Although probabilistic predictions and scientific laws can provide insights into the modal tendencies of statistical aggregates, like quantum physics they cannot provide any insight into individual units of observation. Morgenthau thus called for a thorough revision of simplified social science modeling.¹⁴² And he insisted that modern science should re-establish “the unity of the physical and social world, to which the modern age aspired in vain” making “man aware of his ignorance in the face of the unknown and unknowable and of his impotence in the face of the superior and insuperable.” Morgenthau argued that when we take quantum mechanics rather than the classical model as our guide, “the structure of the natural world finds its exact counterpart in the social world.”¹⁴³ Toward the end of his life he criticized rational scientism as a cover for emotional commitment rather than an instrument for understanding how the world works. “The pervasive flaw,” Morgenthau writes about Herman Kahn’s soothing theorizing about nuclear war, “is the discrepancy between his optimistic conclusions and the allegedly unemotional, factual, quantitative, objective, scientific assumptions from which the conclusions are supposed to derive with logical necessity . . . His argument is propelled forward by an emotion as strong as any ever to ruin scientific intent: to prove that we can live with nuclear war.”¹⁴⁴ Though they are largely forgotten, half a century later, Morgenthau’s theoretical and moral arguments still ring true.

A post-Newtonian worldview provides an intellectual foundation for addressing the complementarities of risk and uncertainty, recognizing the importance of entanglements, and tracking the technological revolutions that have transformed world politics. Uncertainty is an important part of those revolutions, illustrated at the dawn of the nuclear era. In the race to build a nuclear bomb, the German team, led by Werner Heisenberg, invested in what turned out to be an unworkable technology. The American team did not. An instance of “contingency on steroids,” this had enormous consequences for the eventual end of World War II and the Cold War that followed.¹⁴⁵ Decades later, senior diplomats like former US Secretary of State George Shultz and former Armenian President Armen Sarkissian, a theoretical physicist turned politician, spoke of “quantum diplomacy” and “quantum politics.”¹⁴⁶ Governments and corporations

¹⁴⁰ Morgenthau 1946: 132. ¹⁴¹ Morgenthau 1946: 136.

¹⁴² Morgenthau 1946: 144–45. ¹⁴³ Morgenthau 1946: 136.

¹⁴⁴ Morgenthau 1972: 125. ¹⁴⁵ Bendor and Shapiro 2019: 148.

¹⁴⁶ Der Derian and Wendt 2022: 9.

are in the process of investing hundreds of billions of dollars in developing new technologies, such as quantum computers and AI, that will touch world politics profoundly in the coming decades. The mobilization of quantum mechanics is driven not by fads but necessities. “To ‘quantize’ IR,” Jayson Waters argues, “is merely an attempt to better understand our world and ourselves in line with our best physical theories.”¹⁴⁷

In their foundational treatments of realism and liberalism, Kenneth Waltz and Robert Keohane neglect the risk-uncertainty conundrum.¹⁴⁸ The index of Waltz’s book has no entries for either risk or uncertainty. Applying the insights of micro-economics to international relations, Waltz overlooked that indeterminacy is central to the oligopolistic markets that most closely approximate great power balancing. As Jonathan Kirshner writes, “the implications of systemic forces are inherently and irretrievably indeterminate . . . theories of imperfect competition tell us that oligopolists and duopolists have *more* to gain from colluding with each other than they do by competing with each other . . . it remains shattering that the central analytical analogy of *Theory of International Politics* is fundamentally misapplied.”¹⁴⁹ While the index of Keohane’s book has no entry for the concept of risk, it lists the concept of uncertainty eighteen times. But all of those entries refer to the quality of information, as discussed in the field of transaction economics. None refers to power laws or Bayesian subjective probabilities as admittedly problematic ways of dealing with the risk-uncertainty conundrum. Almost forty years later, John Mearsheimer and Sebastian Rosato agree with Keohane. International politics operates in an information-deficient, that is for them, uncertain environment.¹⁵⁰ These scholars say different things while speaking the same language. Post-Newtonianism differs. It highlights, as Waltz and Keohane, Mearsheimer and Rosato fail to do, deep uncertainty and unpredictability in an entangled universe.¹⁵¹

3. Para-Humanism

Since there exists a multiplicity of ways of knowing nature and the universe, the concept of para-humanism has multiple meanings.¹⁵² Applied to different human and non-human contexts, and open to

¹⁴⁷ Waters 2022a: 94. ¹⁴⁸ Waltz 1979. Keohane 1984. ¹⁴⁹ Kirshner 2022: 46–48.

¹⁵⁰ Mearsheimer and Rosato 2023: 4, 23–26, 35, 82.

¹⁵¹ In the field of international relations Wendt (1999) provides an ambitious and widely known theoretical statement of post-Newtonian theory that Keohane (1984) could not have and Mearsheimer and Rosato (2023) did not cite.

¹⁵² Wolfe (2010), Cudworth and Hobden (2013a: 651–54; 2018b: 5, 7), and Kurki (2020: 4) invoke the label “posthumanism” to describe this worldview. This connotes,

different languages and types of communication, para-humanism holds that the world generates a heap of deeply entangled life forms. Enriched by a growing appreciation and understanding of non-Western systems of knowledge, decades of careful work in the biological and behavioral sciences point the way to different forms and types of intelligence. “The non-human world seems suddenly alive with intelligence and agency . . . This idea of forming new relationships with non-human intelligences . . . emanates from a wider and deeper dawning: the increasingly evident and pressing reality of our utter entanglement with *the more-than-human world*.”¹⁵³ Although it may seem esoteric for political scientists and scholars of international relations, this view is quite common in the natural sciences including in biology, chemistry, and computational science.¹⁵⁴

Para-humanism differs from anthropocentric versions of humanism. Strong versions of anthropocentrism hold that humans are at the center of all things, are the only beings with intrinsic value, and are the most important part of reality.¹⁵⁵ The precise meaning of such claims remains a matter of debate. In a basic sense humans cannot help but be anthropocentric. They can know their world only from a human point of view. A view “from nobody” is not an option. Strong versions of anthropocentrism view humans as superior to other beings, combining a kind of human chauvinism with a belief in the moral superiority of the human species. Weak versions of anthropocentrism agree that humans can know the world only from a human point of view. But they do not believe that the human species is morally superior to others.¹⁵⁶

Para-humanism does not replace humanism. But generally speaking, para-humanism “is critical of traditional humanism and associated theories about the superiority of humanity.”¹⁵⁷ Marcy Norton, for example,

at least to me, a misleading temporal dimension. Ferrando (2013) discusses the many overlapping and contradictory strands and meanings of transhumanism, anti-humanism, metahumanism, and new materialism. Kripal’s (2022) “superhumanism” suggests a distorting intensification of humanism. Facing a plethora of choice I have settled on para-humanism (“beyond” and “around” humanism but not excluding it) for the purpose of this discussion. It shares with many of the other concepts the insistence on dismantling dualisms between humans, animals, and technology and with Kavalski, Hobden, and Cudworth (2018: 279–80) the aim to free the analysis of world politics from the straitjacket of an anthropocentrism that affirms the superiority of humans over the diversity of different life forms inhabiting the world. See also Haraway 1991. Cudworth and Hobden 2011: 184–85; 2013a: 651–59; 2013b: 430, 443–44. Mitchell 2014a, 2014b. Hulme 2014. Banerji and Paranjape 2016. Plessis 2018: 395. Hobden 2018: 109–11. Cudworth *et al.* 2018. Chandler and Chipato 2024.

¹⁵³ Bridle 2022: 11. ¹⁵⁴ Kauffman 2008. Valiant 2024.

¹⁵⁵ Hayward 2014: 18. Kopnina 2019: 1.

¹⁵⁶ Kopnina *et al.* 2018. Mylius 2018: 167. Hayward 1997: 50. Thompson 2017: 78–79.

¹⁵⁷ Kopnina 2019: 1–2.

rejects the biblical separation of “humans” from “animals” and prefers instead “wild” and “tame” beings. For Norton humans and animals are defined by their entangled relations not by the resources they control.¹⁵⁸ Para-humanism invites the humanities and social sciences to engage with natural sciences such as biology, geology, and cosmology. It focuses on environmental and ethical questions as it probes the relations of humans with non-human subjects.¹⁵⁹ It reaches beyond human language to incorporate other articulative practices. A multispecies and more-than-human ethics thus is attentive to the entanglement of different beings and material objects with one another without a shared sense of time and space.¹⁶⁰ Testing the boundaries of good taste and offending deeply humanist sensibilities Edward Albee grapples with some of these issues in his play *The Goat or, Who Is Sylvia?* The deep love and sexual attraction a prize-winning architect develops for a goat explodes his tight-knit family and with it the entire humanist cosmos. Para-humanism points to Christianity’s anthropocentric idea that God created the world for humankind as one important source of modernity’s ecological crisis. It emphasizes instead a more encompassing ecological ethics of care less beholden to the self-possessed and self-obsessed ego-centrism of humanity.¹⁶¹

In its eco-, cosmo-, and machine-centered forms, para-humanism goes “around” and “beyond” humanism, choosing a stance that is critical of traditional humanist tenets. In an eco-centered version nature and society are conceived as complex, overlapping, entangled, open systems. As in post-Newtonianism, the human species is not “above” but “inside” nature. In contrast to closed systems, open ones require an understanding not only of their different components, as in the mechanical worldview of the classical model, but also of their adaptive capacities and the evolving environment of which they are a part. Such systems are always in flux and through positive feedback loops can move toward, away from, or around different equilibria. Global warming, for example, leads to the thawing of the Arctic tundra, the release of more greenhouse gases, and further global warming. In contrast to Newtonian physics, such feedbacks are contingent not deterministic, and they are time-irreversible. Interactions in complex systems generate non-linear emergent properties at the system level that are “superadditive”; they are more than the sum of their parts. Guesswork and conjecture often replace prediction when one seeks to gauge the effects of human action on complex climate systems. And as in

¹⁵⁸ Norton 2024. ¹⁵⁹ Kopnina 2019: 4–6. Thompson 2017. Mylius 2018.

¹⁶⁰ Tazudeen 2024: 11–12. Barad 2007. Latour 1988, 1993. Haraway 2016.

¹⁶¹ Thompson 2017. White 1967.

quantum physics, “within and between complex systems, cause and effect are understood to be potentially non-local and simultaneous.”¹⁶² In Bohm’s terminology quoted in the Introduction of this book, “implication” hints at an entanglement not fully captured by causal language.¹⁶³

Human evolution establishes humanity’s relation with a rich multi-microbial ancestry. Humans host billions of organisms that are vital to their well-being.¹⁶⁴ Humanity’s incomplete control over nature has been accompanied by its unprecedented disconnection from nature. This has altered relentlessly the web of ecological connections. Rob Dunn argues that it is in humans’ narrowly conceived self-interest as a species to reclaim some bodily wildness, avoiding the wilderness of deadly diseases and “large carnivores eating our loved ones.”¹⁶⁵ This restates an often misquoted Thoreau, who wrote that wildness, not wilderness, “is the preservation of the world.”¹⁶⁶ The human body is not a self-contained Leviathan but a vessel of co-evolved messmates enmeshed in complex relationships.¹⁶⁷ A microbial perspective locates world politics in biocentric rather than anthropocentric coordinates. Planetary politics is entangled with a biosphere that is increasingly unable to support many life forms. Today natural rates of species extinction exceed prior rates by a factor of 100 to 1,000.¹⁶⁸

In an eco-centered perspective para-humanism transcends the dualism that in recent times has set humans apart from nature. As recently as the tenth to eighteenth centuries the non-human sphere was not clearly demarcated from the human one. In almost 200 documented cases, ecclesiastical courts held pigs, bulls, horses, and other animals criminally accountable for their actions. When found guilty, animals were executed, hanged, or burned. Occasionally they were acquitted. Plagues of rodents, locusts, and other small animals created more complications for legal proceedings. In one sixteenth-century case some rats were exonerated by the smart lawyerly argument that they could not reasonably be expected to show up in court; too many cats were waiting for them en route. In other cases animals were issued written orders to leave particular properties on a specific day or hour. Subject of the 1993 movie *The Hour of the Pig* (a.k.a. *The Advocate*), the medieval perspective on animal mind and consciousness differed sharply from the Cartesian distinction between humans and animals.¹⁶⁹

Para-humanism includes the natural world in its manifold life forms. The human is a messy medley and the non-human is more than

¹⁶² Hobden 2018: 111. ¹⁶³ Introduction, section 1.

¹⁶⁴ Margulis and Sagan 1997: 32–33. *The Economist* 2023b. See also Yong 2017.

¹⁶⁵ Dunn 2011: xiii. ¹⁶⁶ Quoted in Dyson 1997: 228. ¹⁶⁷ Fishel 2017: x–xi, 2–3.

¹⁶⁸ Kolbert 2014. ¹⁶⁹ Seth 2021: 235–37.

background.¹⁷⁰ This worldview does not reject humanism.¹⁷¹ Instead, it places humanism within a broader context.¹⁷² It does reject those elements of humanism that regard the human species as somehow exceptional or unique and set apart from the rest of nature.¹⁷³ Political theorist William Connolly is not the only one who argues that treating humanity as independent and unique has led to planetary and ecological crises that reveal the extent to which the human species is in fact deeply involved with the rest of nature.¹⁷⁴ Similarly, Jane Bennett points to the active participation of non-human forces in the world. Going beyond Newtonian humanism, they open up vistas for recognizing the deep entanglement between the human and the non-human and, perhaps, also new avenues for an environmentally less destructive politics.¹⁷⁵

As active participants, all humans exist inside the world. They are not self-contained actors existing outside, looking at the world from a distance. Eduardo Kohn, among others, advocates for an anthropology that stretches “beyond the human” and explores representational forms that go beyond conventional linguistic and symbolic ones. Humans share with other living organisms semiotic modalities that pervade what he calls “the open whole.”¹⁷⁶ Humanistic forms of representation cast humans as players on the stage of nature. Para-humanistic representational forms consider how the players and stage shape one another. Tim Ingold puts forward a conception of “the human being as a singular nexus of creative growth within a continually unfolding field,” of broader and more-than-human relationships and meshworks.¹⁷⁷

What is true of humans also holds for forests and trees. The “greening” of the Arctic is a reminder of the reduced ability of the tundra to reflect solar radiation, another indicator of the extent of global warming that is transforming the world.¹⁷⁸ The “wood-wide-web” is driven by the discovery of networks of fungal filaments shuttling nutrients and information. Forests live relationally. German forester and global bestselling author Peter Wohlleben describes forests as systems of complex interdependence among trees that share a resilient, communal life.¹⁷⁹ For him the forest is a site for the comfort offered by slow evolutionary change. No apocalyptic news disturbs Wohlleben’s forest. Soft-floor fungal bodies feed trees and extend themselves in skeins that bind roots, nurture

¹⁷⁰ Latour 1993. Kurki 2020, 2022. ¹⁷¹ Kauffman 2008.

¹⁷² Bakewell 2023: 364–65. Chandler 2014: 181–201.

¹⁷³ Cudworth and Hobden 2018a: 8. Smith 1991.

¹⁷⁴ Connolly 2013: 20–42 and 2017. See also Fierke 2022: 48. Schmidt 2018.

¹⁷⁵ Bennett 2010. ¹⁷⁶ Kohn 2013: 8–10, 27–68, 224–25. Smith 1991.

¹⁷⁷ Ingold 2000; 2011: xii. See also Abram 1996. Kimmerer 2013. Tully 2020.

¹⁷⁸ Rawlence 2022. ¹⁷⁹ Wohlleben 2017. Weidemann 2018.

organisms, and offer a collaborative meshed net.¹⁸⁰ Suzanne Simard's hard-science experimental work has been an important driver of this research agenda that for now poses, yet leaves unresolved, the notion that plants possess some kind of sentience that might form the basis for both collaboration and exploitation.¹⁸¹ Even though it has attracted much popular interest, this vibrant research program remains deeply contested.¹⁸² But there is widespread agreement that underground mycorrhizal fungal networks offer trees vital nutrients while fungi gobble up the carbon trees provide. One estimate suggests that 5 billion tons of carbon, or more than 10 percent of the world's total, flow from plants and trees to fungi each year.¹⁸³ Generalizing this point to the communicative practices of plants is very controversial. Yet the complex adaptive capacities of plants to their environment are widely acknowledged. Ted Farmer, a Lausanne botanist, resists the idea that plants have "intelligence" or "consciousness." Yet, he backs the idea of interplant communication.¹⁸⁴

Para-humanists acknowledge human agency but put it in relationship to the agency that inheres in animals, plants, objects, earth, and the entire cosmos. Since the 1920s cosmologists have probed matter, energy, and the cosmos at large with different theories and models that they test against an ever-increasing body of data made available by new technologies.¹⁸⁵ Scientific cosmology embraces the sciences (in the plural) as an engaged human enterprise that places humans in a vast, non-human spatial and temporal context. It all started, the Standard Model tells us, with the "big bang," a moment of infinitely dense matter and energy about 13.6 billion years ago. This explosion created an expanding universe marked by smoothness and homogeneity in the distribution of matter and energy, with life emerging about 10 billion years later. Today, its early life forms are gradually becoming known. Deep life differs from surface life. It is based on residual chemical and radioactive sources of energy and makes up a significant fraction of earth's biomass that exists in deep, high-pressure environments formerly thought to be sterile.¹⁸⁶ Stars and galaxies evolved from the universe's physical and chemical elements and created the atomic level and everything beyond and below it. Alternative theories – among them multiverse models, string theory, and variable law models – seek to address puzzles that the Standard Model cannot explain in its original form.¹⁸⁷ At the beginning of the

¹⁸⁰ Tsing 2015: viii, 4. ¹⁸¹ Simard 2021. Farmer 2022. Jabr 2020.

¹⁸² Popkin 2022. Calvo and Lawrence 2023. Grandin 2023.

¹⁸³ Sengupta and Munita 2022. ¹⁸⁴ Shechet 2019: D2.

¹⁸⁵ Kragh 2011: 87–116; 2012; 2013. Katzenstein 2022a: 40–44.

¹⁸⁶ Sol M. Gruner, Henri Sack Memorial Lecture, Cornell University, November 1, 2023.

¹⁸⁷ Smolin 2000: 3–5.

universe, the very big and the very small, cosmology and quantum, were one. At the macro level of relativity theory, spacetime is curved and smooth; at the micro level of quantized spacetime, that smoothness disappears as discrete quanta jump over a flat spacetime governed by global symmetries. The two theories are partial and in contradiction with each other, supporting the notion that worldviews can be incoherent and provide space for the articulation of different theories and models.¹⁸⁸ Despite this, like the Copenhagen interpretation, most cosmologists accept the Standard Model as the most accurate and plausible story we have today.

Disconfirming evidence, however, has accumulated in recent years, enhancing the sense that cosmology's understanding of the origins of the universe may be less solid than had been assumed during the last half century.¹⁸⁹ Fully formed galaxies appear to have existed much earlier than the Standard Model can explain. For decades different ways of measuring the expansion of the universe have yielded incommensurate results. And normal matter makes up only 4 percent of the universe; the rest is made of invisible dark matter and dark energy. It is possible that the incremental ways of "normal science" can resolve these and other anomalies. If so, eventually general relativity and quantum mechanics will be brought together and provide, writes Heinz Pagels, "the basis for cosmology, the study of the entire universe."¹⁹⁰ But it is also possible that cosmology is heading toward a revolutionary moment requiring fresh reconceptualizations of the nature of time, space, law-like regularities, and observation. Copernicus, Darwin, and Einstein developed theories that had broad cultural impacts challenging the notions that humans held a special place in the universe, that humans were fundamentally different from animals, and that common-sense ideas about the flow of time were true. Astrophysicists Adam Frank and Marcelo Gleiser speculate that "we may need not just a new story of the universe but also a new way to tell stories about it" – and perhaps about ourselves as well.¹⁹¹

Lee Smolin's entangled cosmological story gives us a glimpse of a para-humanist perspective that rethinks science, knowledge, meaning, and humanity's position in an evolving universe.¹⁹² Smolin suspects that many scientists still hope to gain access to eternally valid laws of the universe. They may have lost confidence in Newton's laws but not in the idea of the laws of nature. Mathematics is for them a powerful tool in the endeavor of finding the universal and eternal. But for Smolin the

¹⁸⁸ Rovelli 2016: 40–41. ¹⁸⁹ *The Economist* 2024a, 2024b.

¹⁹⁰ Pagels 1982: 54–55, 127–34, 154. ¹⁹¹ Frank and Gleiser 2023.

¹⁹² Smolin 1997, 2000. Unger and Smolin 2015.

problem with mathematics is that it looks at things in the universe from the outside, as if things were moving against a neutral background. Relational cosmology breaks with this implicit Newtonianism.¹⁹³ Although astronomers have developed many theories in recent decades, the cosmos itself existed for billions of years before the discipline of astronomy was “invented” or “evoked.”¹⁹⁴ Smolin argues that a single, open, and causally highly complex cosmos comprises the universe. Nothing exists beyond it.¹⁹⁵ The universe is what it has evolved into being, specifically networks of entanglements in time. They cannot be explained by scientific laws any more than they can be explained by religious entities.¹⁹⁶ We are all in and of the universe – and not in or of anything else. Scientific cosmology insists on the “simple fact that all possible observers are inside the system they study.”¹⁹⁷ And, in real time, that system is teeming with mini matters that are forever opening up and closing down new possibilities and thus constitute the universe as a history of its entangled relationships.¹⁹⁸ Time, in this view, is a measure of change in the evolution of the universe’s entanglements. Everything changes in this relational universe, including change, that is, time itself. It is not only the phenomena that change but also the observed regularities, the supposed laws and the constants of nature.¹⁹⁹ Denying an external “God eye’s” view to all, the universe incorporates everything and everybody. Escher’s picture “Drawing Hands” depicts two hands drawing each other without giving the viewer God’s absolute vantage point.²⁰⁰ There exists no view from nowhere which could ground who we are and what we do. At both the micro and the macro level and in both space and time, the evolution of the universe is entangled.

The world is not inert matter moved by predictable, physical laws. It is active with often unpredictable effects. Non-human devices can alter natural and human possibilities.²⁰¹ Over four decades the late Bruno Latour developed this perspective more fully than any other scholar. Latour’s theory became known as actor-network theory.²⁰² Less theory than method, it eliminates the distinction between subject and object, central to Newtonianism, and between things and persons, central to humanism. Latour rejects the certainties of those who imagine “a social world without objects” and “a natural world without humans.” The

¹⁹³ Smolin 2000: 106–24. ¹⁹⁴ Unger and Smolin 2015: 422–23.

¹⁹⁵ Smolin 2000: 17. Unger and Smolin 2015: 355, 371.

¹⁹⁶ Smolin 1997: 207–08. See also Kragh 2011: 224–25. Taleb 2007: 117–18.

¹⁹⁷ Smolin 2000: 3. ¹⁹⁸ Unger and Smolin 2015: 385–89. Smolin 2000: 25.

¹⁹⁹ Unger and Smolin 2015: 8, 356. ²⁰⁰ Galileo Commission 2019: 20–21, 30.

²⁰¹ Latour 2014: 11–13. Harrington 2016: 490–91.

²⁰² Latour 1993. Cudworth and Hobden 2018b: 55–71.

inanimate objects of scientific study, so-called “actans,” are simply less familiar to us than the anthropomorphic “actors” whom we believe we know better. There exists no easy distinction between the “objects of the natural world,” deanimated, inert, stripped of all action, and the “subjects of the human world,” overanimated, endowed with souls or consciousness, and free.²⁰³ Latour offers a vivid example. When Alexander Fleming, a Scottish doctor, returned from a vacation in 1928 he found in his laboratory a petri dish covered in mold that inhibited the growth of bacteria. In the discovery of penicillin, Latour asks, was Fleming the more important actor or was it the mold? In his answer, Latour describes a world that is co-produced by both.²⁰⁴ For Latour ecologies are about beings and things. Human and non-human actans are meshed together in networks, forming distinctive political ecologies. The nineteenth-century Scottish-American naturalist John Muir described such ecologies very simply. “When we try to pick out anything by itself, we find it hitched to everything else in the Universe.”²⁰⁵

In a similar vein, Donna Haraway argues that in the evolving world of machines cyborgs consist of collectively produced systems rather than self-regulating ones.²⁰⁶ Such systems lack spatial and temporal boundaries. They rely on information and control provided by distributed components, linked symbiotically in complex entanglements. More broadly, conceptions of “self-regulating” systems like the free market rest on a humanistic worldview in which economic systems do not interact meaningfully with or impact on other climatological, biological, or social systems.²⁰⁷ This flies in the face of experience. The coronavirus is the latest reminder that humans are not self-contained but inseparable parts of others existing within them (bacteria and viruses) and around them (plants, animals, other humans, and possibly even extra-terrestrial beings). The entanglement of humans with others sets the stage for the outbreak of global pandemics. The avian flu, for example, could infect up to 32 billion chickens raised worldwide. Were it to mutate and evolve from birds to humans, this could have devastating consequences for human life.²⁰⁸

Para-humanists hold different beliefs and entertain different theories and models, just like post-Newtonians and Newtonian humanists. Some believe that humanity is malleable and can flourish in different cosmic environments especially when assisted by machine intelligence. This appears to be the position of Elon Musk, the world’s richest man and

²⁰³ Latour 2017: 3, 49–50, 57–58, 85, 97. ²⁰⁴ Muecke 2022: 12. Latour 1988.

²⁰⁵ Quoted in Bridle 2022: 12. ²⁰⁶ Haraway 2016: 33.

²⁰⁷ Connolly 2013: 1–19; 52–80. ²⁰⁸ Quammen 2023.

the founder, CEO, and chief engineer of, among other companies, SpaceX. In his youth Musk read a lot of science fiction. He is deeply committed to seeding space and relies on reusable rockets to bring down costs. Firmly believing that most of human effort should be concentrated on remedying conditions on earth through investments in corporations such as his own Tesla and Solar City, he believes that a small fraction of global capital should be invested in building a self-sustaining city on Mars. This would make humanity a multiplanetary species and thus diminish the odds of a cosmic catastrophe, perhaps an asteroid, eliminating humans as it did dinosaurs 60 million years ago. His argument is both defensive and inspirational. “The idea of us being a space-faring civilization,” Musk argues, “and being out there among the stars is incredibly inspiring and exciting and something to look forward to.”²⁰⁹ Like other tech billionaires smitten by the ideology of space spectacles as the ultimate imperial ambition of the super-rich, Musk argues that we are a knowledge-seeking and frontier-busting species.²¹⁰ Why wait?

A strong humanist taboo, rooted in anthropocentrism, prohibits acknowledging the possibility of extra-terrestrial life. To be sure the US Defense Department issues an annual report about unidentified aerial phenomena (UAPs) commonly still referred to as UFOs. And because of public interest and controversy among astrophysicists, UFOs were the subject of a 2022 Congressional hearing. Alexander Wendt asks whether states will be able to mobilize and unify their citizens against non-human forms of intelligence that may have no interest in terrestrial politics. And if they do not, he asks, what will be the consequences – fear, worship, awe – which could delegitimize the entire international and global political order?²¹¹ Extra-terrestrial beings are featured in Spielberg’s enchanting movie *ET* and in the unsettling movie *Arrival*, which is based on Ted Chiang’s short story. But as Wendt and Raymond Duvall have shown persuasively, these movies have not received any attention from students of world politics.²¹² Astrophysicist Milan Ćirković compares the adherents of anthropocentric arguments to an overwhelmingly strong cartel with a vested interest in human exceptionalism, geo-centrism, and other parochial forms of opposition to human bio-enhancement and the exploration and colonization of the universe. The possible discovery of extra-terrestrial intelligence, likely much more advanced than human intelligence, reveals for Ćirković a medieval anthropocentrism hiding underneath modernity’s thin veneer. For him anthropocentrism is the doctrine of eternal infantilism, fortified by a powerful close-mindedness

²⁰⁹ Sorkin 2023: F2. Biello 2016: 243–45, 261. Isaacson 2023: 93–94.

²¹⁰ Crawford 2021: 229–37. ²¹¹ Wendt n.d. ²¹² Wendt and Duvall 2008.

that prevents thinking and acting in the face of potential earthly catastrophes. Ćirković indicts contemporary anthropocentrism as a “deep and insidious form of anti-humanism.”²¹³

Science writers, literary scholars, novelists, and visionary businesspeople have also contributed to the corpus of para-humanist writings and understandings of deeply relational life forms. Monica Gagliano’s memoir *Thus Spoke the Plant* insists that humans have to understand themselves to be an integral part of the world rather than sitting apart from it.²¹⁴ One scholar of eighteenth-century English literature, Laura Brown, draws on ecocriticism and the new materialism in writing about *The Counterhuman Imaginary*, a realm of human imagination that exceeds human understandings of order.²¹⁵ Diana Beresford-Kroeger is a real-life scholar, a pioneering scientist who regards deforestation as a suicidal, even homicidal, act. She appears as a central character in Richard Powers’ *The Overstory*, which traces life through the lens of trees.²¹⁶ Her bio-conservative stance is earth-bound and understands humanity as linked inseparably to the earth system.

Worldviews are informing all human efforts to explain, understand, engage, and navigate the world. These views are gigantic cocoons hanging from the branches “of a cosmic tree” as Nobel Prize winning poet Czesław Miłosz has written.²¹⁷ They have a performative side to them that creates meaning. Worldviews and their offshoots differ in their scope, scale, and depth of institutionalization.²¹⁸ Widely accepted worldviews, such as Newtonian humanism, post-Newtonianism, and para-humanism, accomplish the demanding task of stabilizing an unfathomable world. Internally incoherent, as all worldviews are, they provide space for the development of different theories, models, and methods to explore how the world works and what the world means. At the cost of blending out the uncertainties that create the risk-uncertainty conundrum, as sweet common sense this is true of Newtonian humanism. Although not sweet common sense, post-Newtonianism and para-humanism are widely accepted in the sciences and humanities. Like Newtonian humanism they are beset by internal inconsistencies and contradictions, reflected in a bounty of theories, models, and methods. What sets them apart from Newtonian humanism is their forthright acknowledgment of uncertainty, an indispensable step toward full engagement with the complementarities of risk and uncertainty – and their minuscule impact on the social sciences.

²¹³ Ćirković 2020: 276. Deutsch 2011. ²¹⁴ Gagliano 2018. ²¹⁵ Brown 2023.

²¹⁶ Powers 2019. ²¹⁷ Quoted in Blakely 2020: 124.

²¹⁸ The claim not to have a worldview is itself a worldview – a kind of “anti-worldviewism.” See Guess 2020.

4. Conclusion

The concepts of risk and uncertainty point to different philosophical traditions informing the analysis of world politics in America and beyond: neo-positivism, critical realism, and social constructivism.²¹⁹ Neo-positivism sees uncertainty arising in a closed universe as the result of a combination of incomplete data and models as well as the inherent vagaries of a probabilistic world. Uncertainty is a problem of inference. For many positivists with strong commitments to a unified science the “faith that our world must be rational and well-ordered through and through” retains great attraction.²²⁰ The call of neo-positivists is simple: one science for a real world. The call is loudly proclaimed and widely heard, but not everybody heeds it. For it is not self-evident that the social and political world is closed. Unlike closed material and biological systems, human communication and creativity leave the social and political world open. Furthermore, all causal arguments depend on counterfactuals. Critical realists thus point to the difference that exists between the observable, empirical world and the real world that includes unobservable phenomena, some of which are causally relevant. For critical realists uncertainty is rooted in the world of not-actualized causal potentials. Conventional and critical social constructivists draw on positivist and critical realist arguments. They hold that all knowledge is unavoidably shaped by partial, subjective and intersubjective beliefs. Risk and uncertainty, one might quip, are what we make of them. Cast into theories and models, these beliefs feed social processes of knowledge creation.

Ardent believers in any one of these traditions are convinced that they get to ride a white horse on the king’s highway toward a secure knowledge about the world. In fact, translating and debating plural knowledge claims about the world is normal business in the analysis of world politics.²²¹ Knowledge is built on a matrix of competitive and complementary insights. Adam Mastroianni’s research into the inconclusive results of the effectiveness of flossing confirms skepticism about white horses and royal highways – and perhaps also about the benefits of flossing.²²² A meta-study of thirty-five randomized-controlled trials with 3,929 participants generated the dismal finding that flossing “may” reduce gingivitis; but the effects were uncertain and barely significant statistically. Mastroianni’s humble optimism seems apposite in the face of our ignorance that is profound, forgivable, and temporary. The two mistakes we should avoid are believing that we have no more errors to make, and that our errors are permanent and irreversible. Everyman is of course free

²¹⁹ Jackson 2016: 58–122, 222–29. Patomäki 2020. Lerner 2021: 364–67.

²²⁰ Cartwright 1999: 17. ²²¹ Jackson 2016: 18–21, 35. ²²² Mastroianni 2023.

to fall asleep with this nursery rhyme: “If wishes were horses, then beggars would ride. If horse turds were biscuits, they’d eat ’til they died.” But during the day, night dreams turn to pipe dreams. In world politics there is no white horse and no king’s highway. Instead, there are muddy trails walked by multitudes wondering where they and the world may stumble next.

The same is true of the growing importance of Chinese theories of world politics.²²³ In Chinese writings realist concepts of power, liberal notions of cosmopolitanism, and constructivist ideas of relationality resonate with established paradigms and American and European concepts and approaches. It is noteworthy that Chinese scholars have shown surprisingly little interest in a broad range of critical theories of IR, including Marxism. Anathema to China’s reigning state capitalist ideology, Marxism may not have a chance, for now, of establishing itself as a legitimate part of the Chinese School of IR. While negotiating the difficulties of working under an authoritarian system, Chinese scholars are bound to open up new avenues of investigation. They may do so, Malaysian scholar Bo Yuan suggests, if they turned to the indigenous “anthropocosmic worldview of Oneness between Heaven and Humanity.”²²⁴ It resonates with post-Newtonianism and para-humanism and is more encompassing than the worn-out cultural exceptionalism currently favored by many Chinese politicians and scholars. For now, adhering to Newtonian humanism Chinese scholars remain caught up by its tensions and contradictions and the risk-uncertainty conundrum.

There exist other options to deal with the risk-uncertainty conundrum. Here I mention only two. One is to reduce our aspirations and set aside the search for robust and valid generalizations. In current research practice, the specification of scope conditions in your typical seminar on world politics is a ritual that is treated with the kind of indifference that your average airline passenger gives to the “fasten your seat-belt sign” before take-off and landing. In fact, scope conditions are of enormous relevance for any piece of research. Are they a step toward establishing valid generalizations or are they an articulation of a specific context, in time and space? Observed regularities reflect temporary, local stabilities in a highly selective subset of factors. This may generate a specific small world theory or model which might be able to explain specific patterns of events or outcomes. Exposed to endogenous change and large world exogenous shock, their truth content and usefulness are unavoidably “only-here-and-for-a-short-time.” Transportability depends on comparable conditions. Reminiscent of Weber’s ideal type, this addresses

²²³ Katzenstein 2018, 2024. ²²⁴ Bo Yuan Chang, email conversation, 06/10/24.

the risk-uncertainty conundrum spanning small and large worlds. A second option is to fully historicize the analysis of world politics and view it as one eventful moment or an unfolding series of events. This would follow astrophysicist Lee Smolin, who argues that in the relational universe everything changes, including the observed regularities, the laws of nature, and change itself.²²⁵ The French revolution was not known to its participants by that name. It was created after 1789, combining a series of effect-full events that seemed to order-seeking historians to hang together. A theory of world politics could thus be a historical analysis of different small and large world developments that fully acknowledges the complementarity of risk and uncertainty. Or it could continue on as before, grounding itself in Newtonian humanism and shouting “Surprise, surprise!” when the world takes still another of its familiar turns to the unknown.

²²⁵ Unger and Smolin 2015: 8, 356, 385–89. Smolin 2000: 25.

3 Theories, Models, and Methods

Attended by a large number of bigshot celebrities, the *New York Times* 2023 DealBook conference marks today's uncertainty as "a palpable feeling that seems to be affecting virtually every major figure at the top of the leadership complex across the world."¹ Political instabilities, wars, recessions, and technological disruptions are among the factors that feed a sense of unfathomable uncertainty – a sense expressed all too often in the familiar and acceptable language of risk. P(doom) is Silicon Valley's math-speak for the probability of doom following from AI as a threat to human survival. Often referred to as the "godfather of AI" and a co-recipient of the 2024 Nobel Prize in Physics, Geoffrey Hinton believes that an unregulated AI industry will have a 10 percent chance of leading humanity to its extinction in the next thirty years. Yann LeCun, who helped to give birth to the AI boom, thinks that AI is dumber than a cat.² Nobody knows. The point of p(doom) is to express the unsettling fear of the uncertain in the familiar language of calculable risk. "Admitting that one does not know," Janice Gross Stein writes, "is psychologically uncomfortable. It seems to convey either a lack of knowledge or an absence of confidence or both."³

Hamas's terrorist attack on Israel in October 2023 and the subsequent war in Gaza illustrates the pervasiveness of uncertainty in world politics. Little more than a month before the Hamas attack, China's Foreign Minister Wang Yi hailed a "wave of reconciliation" sweeping the Middle East. He credited China's pragmatic diplomacy for brokering a deal between two great sectarian rivals, Saudi Arabia and Iran, and helping the broader region to achieve "good neighbourliness and friendship."⁴ Not to be outdone by the perspicacity of his Chinese colleague, in an essay written before the October 7 attack and published in *Foreign Affairs* two weeks later, President Biden's National Security Advisor, Jake Sullivan, wrote "although the Middle East remains beset

¹ Sorkin 2023: F1–2. ² Taylor *et al.* 2024. Mims 2024. ³ Stein 2024: 4.

⁴ *The Economist* 2023e: 42.

with perennial challenges, the region is quieter than it has been for decades.”⁵ Yi’s and Sullivan’s global audience may be permitted one simple question: Really?

This chapter looks at theories, models, and methods as tools for dealing with the complementarities of risk and uncertainty. They embody the tacit knowledge provided by encompassing worldviews with an unavoidable intellectual incoherence that is concealed by the depth of their institutionalization in thought and practice. And it is that incoherence which provides the space for the articulation and deployment of different theories, models, and methods of analysis.

Like language, discussed at length in [Chapter 2](#), theories, models, and methods are telling Janus-faced stories. They represent the world. And they also re-present the world, performing in and for the world and thus creating or magnifying the very effects they predict or highlight. This is Deirdre McCloskey’s central point. Science is a way of talking.⁶ Stories are important drivers of all human inquiry, including in all of the sciences. The risk-uncertainty conundrum is the subject of one of the most enduring and important of all stories. The findings of every scientific theory or model are expressed in language that seeks to persuade. The greater prestige of the natural sciences compared to the social sciences and humanities may be traced to the idea that stories reporting the results of experiments are more compelling than stories based on backward-looking history or counterfactuals.⁷ Some stories are linear and are told as if all variables are known, all mechanisms identified, and all causes clearly specified. Others are non-linear and involve feedback effects, opaque mechanisms, and configurations of causes. Captured best by differential equations, they can tell stories about very large effects of very small changes, such as catastrophic accidents. For McCloskey there is no “actual,” “real,” or “true” account of the world.⁸ Often relying on metaphorical language, for her there are various attempts, some more successful than others, by individuals or groups to persuade others about something. Facts are a very important part of being persuasive though not the only one.⁹ Science occurs through language, and language use is a social act. It requires paying attention to others. Adhering to a pragmatist stance, McCloskey is not interested in the philosophical foundations or implications of her argument.¹⁰ For her all theories and models are more or less persuasive forays into the world, including metaphorically small and large ones.

⁵ Rogers 2023. ⁶ McCloskey 1985: 21. See also Kay and King 2020: 215–20.

⁷ Taleb 2007: 120. McCloskey 1990: 92–93. ⁸ McCloskey 1994: 188.

⁹ McCloskey 1994: 38–52; 1985. ¹⁰ McCloskey 1994: 270; 1985: 30.

In this chapter I explore theories, models, and methods. The narrative turn in the social sciences and in the analysis of world politics has been fostered by and drawn attention to McCloskey's work and the importance of story-telling (section 1). Theories and models tell stories that are created by acts of individual imagination and that exist as collective imaginaries (section 2). Experiments and experimentation are different ways of testing and test-driving scientific theories and models in a world that is both risky and uncertain (section 3). And the simplicity or complexity of the stories told by theories and models always grapples with the risk-uncertainty conundrum (section 4).

1. The Narrative Turn

Humans are a story-telling lot. They rely on metaphors and language in its "representational" and "re-presentational" metaphorical forms. Differing in form and function, narration is ubiquitous and remains "intuitively attractive, capturing commonsense understandings."¹¹ E. M. Forster once wrote "'The king died and then the queen died' is a story. 'The king died and then the queen died of grief' evokes causation." Narrative bias is causal.¹² Linking narrator and audience, stories create or convey meaning.¹³ Physics relies on math to narrate the epic tale of the universe with great precision and in concrete detail. But it also relies on stories and metaphors for doing science. At its core, researcher Jamie Zvirzdin holds, "physics is fundamentally a word problem. A story problem."¹⁴ Einstein's relativity theory was told first as a story of traveling clocks and later, for bigger impact, as a story of the traveling twin returning to his brother but now of a different age. Dead or alive, Schrödinger's cat is a thought experiment, straight science fiction. For Ernst Mach thought experiments are a necessary precondition for physical experiments.

Because of growing interest in and concern with self-fulfilling prophecies, story-telling is no longer the laughing stock of the social sciences. Consumer surveys affect consumer confidence and the real economy. Political conspiracies feed off and are magnified by social media. How issues are framed is vitally important for the meaning making and success or failure of social movements.¹⁵ And in the field of foreign policy, moral stories lead to intransigence and impede pragmatic bargains.¹⁶ With words, numbers, and images, theories and models tell stories about politics that can be tested with different methods.¹⁷ Those who belittle

¹¹ Western 2001: 357. ¹² Quoted in Klaas 2024: 73, 136; see also 136–41.

¹³ Mayer 2014: 53–55. ¹⁴ Zvirzdin 2024. ¹⁵ Tarrow 2022: 121–40. ¹⁶ Post 2023.

¹⁷ Goodson and Gill 2011. Berger and Quinney 2005.

“mere story-telling” are missing the ship of theorizing and the fun of the cruise. Narratives, furthermore, set the agenda by defining the parameters of public debate, tell actors who they are and what is in their interest, frame what is possible and impossible in a given situation, and thus shape the actions of states and individuals.¹⁸ The narrative turn has affected not only the humanities and history, but also other disciplines such as psychology, medicine, law, biology, and physics.¹⁹

Three intellectual developments laid the groundwork for the narrative turn in the analysis of world politics. First, structuralist and poststructuralist accounts underlined the performative character of language.²⁰ Language was not merely a mirror of reality that provided a linguistic “representation” for things in the world. Instead, language was productive and evolved with social and historical developments that encased and enacted power through “re-presentation.”²¹ Even as analysts of world politics restrict themselves to small worlds operating in homogeneous contexts and invariant processes that lend themselves to generalization, language retains its capacity for making rather than mirroring the world. The philosophical work of Alasdair MacIntyre and Walter Fisher’s application of literary theory in political science were a second development. Interested in virtue, MacIntyre articulated a philosophy of the good life in small communities. He argued that first and foremost human beings are narrative creatures.²² Narrating their lives to themselves and others, they constitute themselves and meaningful social worlds. Fisher adopted this idea and coined the term *homo narrans*.²³ He also connected it with mid-twentieth-century literary theory that addressed the nature and structure of narrative.²⁴ Cognitive psychologist Jerome Bruner’s work provided a third impetus for the narrative turn. One of Bruner’s most important contributions was the idea of the narrative construction of reality. In two books and an important article Bruner made the case that the social world is a narrative construct.²⁵ The “domain of social beliefs and procedures – what we think people are like and how they must get along with each other” – is organized through narration, cultural products taking shape in and shaping historical context.²⁶ For scholars of world politics like Ron Krebs, Bruner offered a way to recognize how elite consensus and states’ views of each other are shaped by narratives.²⁷

¹⁸ Krebs 2015a: 1–3; 2015b: 811. Lerner and O’Loughlin 2023. See also Sugamani 2008 and Roberts 2006.

¹⁹ Somers 1994: 613. ²⁰ Barthes 1972, 1975. Derrida 1981. Foucault 1984.

²¹ History (White 1973, 1981) and literary studies (Mitchell 1981) turned to such insights even earlier. See Hyvärinen 2010.

²² MacIntyre 1981, 1988, 1999, and 2016. ²³ Fisher 1984.

²⁴ Burke 1969 [1945], 1969 [1950]. ²⁵ Bruner 1986, 1990, 1991.

²⁶ Bruner 1991: 4, 21. ²⁷ See Krebs 2015a: 10 and 2015b: 813.

These developments provided ground for the narrative turn. That turn bridged old dualities that separated discourse from numbers, the non-explanatory from the conditionally propositional, and the non-theoretical from the theoretically driven scientific. The narrative turn makes a claim that supersedes distinctions such as narration and causality. Narration is both an epistemological and an ontological condition of life. Life is a storied condition, an instance of what one might call “epi-ontology.” But scientific convention is not a rule that has to be followed. Stories explain and stories guide action. Including both deepens our understanding and sharpens our analysis.²⁸ Selves/subjects talk and produce discourses, just like states. The ongoing production of stories offers insights about those who speak, their wants, and how power operates within and among them. The production of discourse(s) over time leads to coherence and binding positions at the international level.²⁹ Charlotte Epstein includes the body in the constitution of the modern state. For thinkers like Hobbes, she shows, language and narrative imbue the reality of subjects and states with “order,” rendering them more amenable to scientific investigation and subject to political control.³⁰

Advancing the narrative turn, Ronald Krebs contends that narrative is how human beings order disordered experience.³¹ International actors do not automatically respond to events wholly based on their position in the balance of power. They respond, rather, as a feature of the narratives they and others construct to make sense of events. Competition over the meaning of events results in some narratives becoming dominant, and they structure how elites view foreign policy, what the public does and does not support, and how states behave in particular situations. For Krebs, states do not respond to global events by virtue of their position within an international system. Events must be woven into a narrative that makes sense of them, of what others think and might do, and of how a state should respond.³² In contrast to Epstein, for Krebs narratives are a lens for viewing the world rather than part of a larger claim about the discursive character of reality. Margaret Somers adds usefully that the narrative constitution of identities can imply weak causal connections.³³ A story about how one thing connects to another draws the listener in. But the connections may be weaker than the story suggests. And when the two

²⁸ Somers 1994: 606, 613–16. Epstein 2010: 334–38, 341.

²⁹ Epstein 2010: 342; 2008. Lerner 2022: 72–80.

³⁰ Epstein 2020: 3–12, 28–30, 87–89.

³¹ Krebs (2015a: 2, 16–17, 22) notes similar work by the Copenhagen School. See also Barnett 1998 and Ringmar 1996.

³² Krebs 2015a: 2–3 and 2015b. See also Barnett 1998 and Campbell 1998.

³³ Somers 1994: 613–17.

things are totally unrelated, the story traps us in a “narrative fallacy,” purgatory for “mere” story-tellers.

2. **Theories and Models as Stories**

Because of the astounding successes of the natural sciences over centuries, Newtonianism serves as a model for many students of world politics. It leaves them distrustful of the never-ending debates preoccupying the humanities. Despite many decades of disappointment, the hopeful belief remains unshaken: building many picturesque chapels will in the end create one magnificent cathedral. Nancy Cartwright, a leading philosopher of physics, has placed a different bet.³⁴ In her argument many small orderly worlds sum to one large messy one. If we follow her lead, we see that the generalizations of international relations are never truly general but always situationally and historically specific, shaped by humans’ highly variable capacity for reasoning. We navigate the domain of risk aided by theories and models that test hypotheses and draw implications from them. There are many forms of test. They can be observational, experimental, or counterfactual. Often we navigate the domain of uncertainty by relying on our imagination, cast in story-telling theories and models, and the discernment of broad patterns based on practices of experimentation and learning by doing. All theories and models express the worldviews they implicitly hold. Once human minds are “inhabited with a certain view of the world,” they will consider only those instances that prove them right.³⁵ And on no issue is this claim clearer than the legibility of the world. Speaking metaphorically, small world theories and models hold that the world is fully legible; large world theories and models demur.³⁶

Immanuel Wallerstein has insisted that he is engaged in world systems analysis, not world systems theory. The construction of plausible explanations of complex, large-scale, long-term phenomena, he argued, is helped by relying on theoretical hunches without being bound by them.³⁷ His was an exploratory voyage in large rather than small worlds. Wallerstein’s stance was shaped by listening to a lecture by chemist Ilya Prigogine. Chemists were traditionally chided by physicists for merely describing rather than explaining. Prigogine would have none of that. He received the Nobel Prize for his work on non-equilibrium processes and dissipative structures in chemistry and biology. In his view equilibrium processes are a highly unusual case of the physical world. We may well ask, and what about the social and political world? Central for Wallerstein

³⁴ Cartwright 1999. ³⁵ Taleb 2007: 59. ³⁶ Lennon 2015: 1.

³⁷ Wallerstein 2002: 358.

were three of Prigogine's arguments. First, following the two laws of thermodynamics, energy in the universe is constant and entropic while it changes its form: ordered system states are replaced by chaotic ones.³⁸ The pathways between order and chaos cannot be predicted. Foreknowledge is impossible. Second, the Newtonian idea of time reversibility is absurd. All natural and social systems are historical and thus subject to the forward movement of the arrow of time. Finally, matter and nature are not passive but active and not bound to rest in equilibrium states.³⁹ Global warming is an example of the long, unpredictable entropic tail of short-term economic exchanges, the irreversibility of time, and the non-equilibrium state of the natural world. These arguments pose a challenge for analyses of world politics that take the same approach as conventional economics with its adherence to Newtonianism.⁴⁰ For such analyses equilibria are normal. Time is reversible. And long-term costs are marginal compared to the short-term benefits gained at the moment of exchange or consumption.

Theories and models are driven by real and fictive experience. They are shaped by individual imagination and collective imaginaries.⁴¹ However, "If imagination ... is to fulfill its potential as a driver of social and economic progress," Jens Beckert and Richard Bronk write, "it must be schooled by reason and empirical analysis."⁴² Imagining produces new ways of viewing the world and deploying forever-changing insights cast in the form of theories and models.⁴³ For example, "international relations" conducted among states and "global politics" evolving beyond the confines of states do not exist simply on their own. They are constructs that express and define an imagined domain of social life. They are made observable through repetitive practices. And they point to actors and their relations conceived, respectively, as homogeneous, unified, and coherent states or as an assemblage of heterogeneous, disunited, and incoherent actors.⁴⁴ The first can be expressed as "robust" visions measured by their probability of success; the second as "creative" visions that expand the horizons of possibilities.⁴⁵

Individual imagination and collective imaginaries are not reality-denying fantasies but reality-affirming devices put to use in scientific theories and models. No sharp break separates sensory from fictitious experience.⁴⁶ Imagination and play are not passing stages of child

³⁸ Schweller 2014. ³⁹ Wallerstein 2002: 369–70.

⁴⁰ Schweller 2014. Rifkin 2022: 30–34, 37–38.

⁴¹ Beckert 2016: 283. Gabriel 2021: 17, 21–34. Spruyt 2020: 6, 33. Suckert 2022.

⁴² Beckert and Bronk 2018: 4. ⁴³ Lennon 2015: 12. Connolly 2019: 10–11.

⁴⁴ Reus-Smit 2020: 3. Strauss 2006: 322–23. ⁴⁵ Berenskoetter 2011: 657–62.

⁴⁶ Bottici 2014: 1–11. Castoriadis 1987: 336–37.

development, as Freud and Piaget argued. They are life-long human experiences in the symbolic social world and creative interactions between the experience of the inner and the perception of the outer world.⁴⁷ In science as in art creativity is a basic source of energy.⁴⁸ And as Knight and Keynes both recognized, creativity is inseparable from uncertainty.⁴⁹ Theoretical advances are made by “discovering,” “inventing,” and “giving” explanations. Such advances make us see in familiar things “what no one else has seen before.”⁵⁰ Science consists of both looking at the ground while putting one foot before the other, and of lifting the gaze while scanning the horizon. Einstein’s genius was his capacity to both compute and dream.⁵¹

And as in science, so in politics. All modern states, political scientist Richard Bensele writes, “embody myths, fictions, and abstractions that enlist mass support for the state’s sovereign right to rule. While symbolically indispensable, these fictions are grounded in metaphysical assumptions that cannot be construed or referenced as empirical realities.”⁵² Imagination matters not only at the initial moment of state founding. It suffuses all forms of politics. The security imaginary of a state, for example, provides the cultural raw material for the construction of a state’s basic interests.⁵³ Similarly, like money powerful legal fictions surround the posting of collateral as essential props that make global derivative markets function. Quotidian practices create fictions of calculability in contracts that circumscribe the indeterminacies of financial markets. In fact, collateral is a chain of legal fictions about the rights of parties that appear to be well understood when, in fact, they are not. These fictions are placeholders that communicate a collective commitment among market participants to arrangements that are useful though false. Readily accepted they become reliable creators of market realities.⁵⁴ More generally, capital is coded as law. “With the right legal coding,” writes Katharina Pistor, any asset “can be turned into capital and thereby increase its propensity to create wealth for its holder(s).”⁵⁵

More generally, make-believe imaginaries help stabilize actor expectations. Actors cope with life’s contingencies through imagining an unfathomable future that looks and feels like the familiar present. As in literary fiction, a “present future” creates its very own world. The radical contingency of the world is stabilized by playing pretend games which, in moments of crisis, can suddenly collapse as the abyss of the unfathomable

⁴⁷ Harris 2000: x–xii, 6–7, 26–27, 118, 138, 192–94; 2007: 208, 209, 223–24. Vygotsky 2004: 9–13, 20, 17, 30, 32. Winnicott 2005: 3, 15, 54–55, 67–68, 87–88, 128–39.

⁴⁸ Rubin, Rick 2023. ⁴⁹ Kay and King 2020: 47. ⁵⁰ Hanson 1961: 30, 157.

⁵¹ Lightman 1993. Galison 2000. ⁵² Bensele 2022: 474. ⁵³ Weldes 1999: 10, 13–15.

⁵⁴ Riles 2011. ⁵⁵ Pistor 2019: 2.

comes into full view. Fictional expectations that rely on an inherently open future and contingent expectations make the future an ambiguous screen on which different actors project their hopes and fears.⁵⁶ Discussed further in [Chapter 4](#), the financial crisis of 2008, for example, teaches us that fictional expectations in the large world differ greatly from rational expectations in the small one.

Informed by implicit worldviews and often inconsistent theories and models, imaginaries and imagination are essential for learning how to navigate small and large worlds. With some difficulty, the future is ascertainable in small worlds, but it is unknowable in large ones. And to the delight of historians, the past is not fixed but fluid in both worlds. Forever changeable, humans refashion it to deal with the experiences of the present and expectations of the future. We are driven by history while thinking that we are the drivers.⁵⁷ Furthermore, the counterfactuals we deploy to test theories and models are unavoidably fictitious.⁵⁸ Theories and models thus can express both the “if-then” factual logic of hypothesis-testing in small worlds and the “what-if” fictitious logic of play-acting in large ones.⁵⁹ As long as they meet public standards of accountability, writes Daniel Deudney, both “are integral, not antagonistic, to scientific and technological progress.”⁶⁰ Both are order-seeking. They create a sense of control by generating predictable outcomes in small worlds. And they search for broader patterns in the unpredictable outcomes in large worlds.⁶¹

Theories are fictions that abstract from the world.⁶² One of the preeminent theorists of international relations, Kenneth Waltz, created images that shifted our thinking about international politics.⁶³ Following Newton, for Waltz theories “convey a sense of unobservable relations of things. They will be about connections and causes by which sense is made of things observed.”⁶⁴ Theory is not offering an objective representation of the world. For Waltz it is an abstraction that presents an image of a specific domain of the world. We arrive at a theory by moving away from rather than toward reality.⁶⁵ This is the reason why theories are dangerous things to have. They are fraught instruments for real-world usage.⁶⁶ Waltz’s systemic theory of world politics seeks to account for an ever-recurrent process of balancing behavior throughout history. This is

⁵⁶ Beckert 2016: 9–10, 61–67.

⁵⁷ Lennon 2015: 1–2, 73, 96. Taleb 2007: 211. Castoriadis 1987. ⁵⁸ DeMartino 2021.

⁵⁹ DeMartino: 2022: 92. ⁶⁰ Deudney 2020: 105.

⁶¹ Beckert 2016: 8–12, 61–67. Little and Pepinsky 2016: 435.

⁶² Little and Pepinsky 2016: 439. ⁶³ Waltz 1959, 1979. Wæver 2009: 202, 209.

⁶⁴ Waltz 1979: 9. ⁶⁵ Waltz 1979: 8, 10, 68–69. Corry 2019: 2–5. Toon 2012: 34–83.

⁶⁶ Taleb 2012: 116–17.

profoundly interesting. But Waltz's spare theory tells us nothing about the direction of balancing, for example balancing with or against rising powers – a matter of great importance for political actors who must navigate in the world. This is not Waltz's concern. He is doing "pure theory."

Not so with models. They are "purpose-relative" tools.⁶⁷ Models deliberately misrepresent reality. For Einstein they are as simple as possible, but no simpler.⁶⁸ They are props that offer a helpful view of the world.⁶⁹ The props can be verbal, pictorial, numerical, or physical. Models are simplified representations that get essential parts of the story right. In the study of climate change/AI discussed in [Chapter 6](#), for instance, Earth Systems Science (ESS) models are the current state of the art. Their thousands of equations capture complicated feedback loops, aim for high temporal and spatial specificity, and can cover very short or very long time periods. Compared to these physical models, social ones developed, for example, during COVID, have had a very hard time. Neither the virus nor people behaved as predicted. Citing low reliability, the US Centers for Disease Control thus shut down its case-forecast project. That failure was due to the distance between the model and the phenomena it tried to capture. "Art is the lie that makes us realize the truth," Picasso once said.⁷⁰

Models are imaginative descriptions of things relevant for some aspect of the world. We are test-driving models rather than testing them. The evaluative criterion for models is their pragmatic usefulness.⁷¹ Good models help us act in ways that work in relevant circumstances. In deciding whether a model works, the primary criterion is not logical inference but pragmatic reasoning. Does a model offer an effective means to achieve a valued goal? What matters is that a model is correct (*richtig*) rather than true (*wahr*).⁷² Models as maps can be made to learn as we go along.⁷³ So-called Bayesian neural networks, for example, deal with the risks and uncertainties of the world. Training such models on the world does not rely on set parameters. Therefore, the model does not give the same prediction every time it is used. In the domain of language, for example,

⁶⁷ Clarke and Primo [2012](#): 53. See also Blair *et al.* [2023](#): 8–10, 35–38, 41–51.

⁶⁸ Cartwright and Nakamura [2009](#): 13.

⁶⁹ Corry [2019](#): 8–10. Toon [2012](#): 34–60. Walton [1990](#): 4–5, 12, 21–24, 35–34.

⁷⁰ Rockmore [2024](#). Patterson [2023](#): 59–60.

⁷¹ Clarke and Primo [2012](#): 83–93. Kay and King [2020](#): 393.

⁷² Giere [1999](#): 6–7, 50–53. Corry [2019](#): 2. What is the relation between model and reality? An older, indirect, "syntactic" view differs from a later, direct, "semantic" view of model representation (Morgan and Morrison [1999](#). Giere [1999](#): 97–99. Wæver [2009](#): 202, 206–07. Corry [2019](#): 3, 5–7. Toon [2012](#)).

⁷³ Humphreys and Jacobs [2023](#): 3, 6. Christian [2020](#): 282–88.

ensembles of models tend to agree when they are applied to texts close to the training data, and disagree when applied to texts that are far removed. The variability in predictive accuracy gauges the model's uncertainty about the state of the world. Wild oscillations in the recognition of different verbal or visual cues representing, for example, dogs, sofas, hamburgers, and books give a clue that the model is flawed; stable representations suggest that the model knows what it is talking about. Disagreement thus becomes a proxy for model error. Furthermore, randomly unplugging different parts of the model in successive training sessions reveals which parts of the model are central and which are not, and which can be combined into robust and efficient model subsets and which cannot.

Theories and models operate differently in (metaphorical) small and large worlds.⁷⁴ The small world can be clouded by bias and incomplete information, but with sufficient data it is nonetheless fully knowable. We cull data from the past so that we can “learn the lessons of history” and apply methods that permit us to make probabilistic assessments of the future. As in a casino, the generators of processes and outcomes are visible. Eliminating bias and improving information makes the world fully legible. Theories and models can thus correspond with important aspects of reality. In contrast, the large world is not fully knowable. Bias, misperception, and informational incompleteness remain unchecked. The past may be irrelevant for the world's unpredictable process of emergence. Without knowledge of relevant parameters, conventional statistical calculations are impossible. Large world outcomes are due to unobservable causal generators that can leave the world, for example, in unpredictable financial bubbles and the inscrutable fog of war. Yet, on questions of money, war, and climate, as [Chapters 4–6](#) illustrate, it is common to mistake large worlds for small ones. Newtonian humanism makes small worlds the default option.

In acquiring a causal force of their own, like language, theories and models can reinforce the entanglements of small with large worlds. We make sense of the world, living life forward, aided at times by false, stabilizing backward narratives. Whatever their weaknesses, the narratives that theories and models provide can help in coordinating human behavior and nudge the large world, at least for a while, toward the small one. “Modeling the world as it is,” writes Brian Christian, “is one thing. But as soon as you begin *using* that model you are *changing* the world, in ways large and small.”⁷⁵ In Donald Mackenzie's words, theories and

⁷⁴ Taleb 2007. Blyth 2009: 447–53. Taleb and Blyth 2011. Taleb and Treverton 2015.

⁷⁵ Christian 2020: 49.

models are engines not cameras. They are performances that have causal effects by bringing into being the very conditions they are concerned with, thus narrowing the gap between the two worlds.⁷⁶

Theories and models are closely linked. A theory can spawn a collection of different models, understood as more or less useful objects rather than more or less true linguistic entities.⁷⁷ For Waltz models are neither a construction of truth nor a reproduction of reality.⁷⁸ Instead they provide convenient intellectual elevators. It is models all the way up and all the way down the theoretical-empirical ladder. At the top, families of models are grouped under the heading of a theory. At the bottom “model-data” are offered as descriptions and explanations. All data are theory- and model-laden. For Waltz “we are therefore inclined to see what we are looking for, to find what our sense of the causes of things leads us to believe significant.”⁷⁹ Models provide heuristic images and a common way of talking about the world. Imagination and pragmatism are central. “Robust visions” focus on the probability of success in navigating small worlds, “creative visions” on expanding them toward large ones.⁸⁰ This model-theoretic view works in both small and large worlds.⁸¹

Theories and models as imaginaries are typically formulated with the aim to persuade. All graduate students who have been groomed for the grueling experience of finding a job practice an “elevator pitch” of their dissertation project, a story so condensed that it can be told during a short elevator ride to a senior professor too busy to attend the student’s job talk. Elevator pitches are dotted with attention-grabbing “stylized facts.” The predilection to summarize runs the risk of Taleb’s “narrative fallacy.”⁸² Confronted with a sequence of events humans are predisposed to weave

⁷⁶ Mackenzie 2004, 2006. Blyth 2009: 462.

⁷⁷ Clarke and Primo 2012: 63, 67–74. Giere 1999: 5–6, 91–94. See also Kincaid 1990, 2004b; Roberts 2004.

⁷⁸ Waltz 1979: 7.

⁷⁹ Waltz 1979: 12. For Waltz (1979: 8–9, 13–16, 123–24), model- or theory-testing is extremely difficult if not impossible (LaRoche and Pratt 2018: 154, 160–62). And yet both kinds of tests remain desirable, even necessary (Waltz 2008: 90). This contradiction remains a deep problem not only for a materialist like Waltz but also for idealists and institutionalists (Corry 2019: 1, 4). All face the challenge of how to test hypotheses or the observable implications derived from either theory or model, against a reality that does not exist independently from theory or model. This challenge has never been satisfactorily resolved in the empirical research on world politics (Corry 2019: 2). Since models represent theories rather than reality, falsification is not an appropriate strategy (Waltz 1979: 8). And yet, having shown that it is extremely difficult, if not impossible, Waltz (2008: 92–95) insists on the desirability of testing theories to weed out wrong ones. Even though Waltz was skeptical of falsification, he gave instructions of how to test his theory (Waltz 1979: 13–16). In short, for Waltz theories and models could neither be falsified nor verified but, in an unspecified way, needed to be tested.

⁸⁰ Berenskoetter 2011: 657. ⁸¹ Clarke and Primo 2012: 4–9. Klaas 2024: 65–79.

⁸² Taleb 2007: 63–64.

explanations into them, by forcing logical links or establishing causal connections. We are drawn to what happened – the tangible and the visible. And we ignore what could have happened – the abstract and the hidden. This deeply ingrained predisposition to simplification and order-seeking explanations fosters the strong belief that the world is less random than it actually is.⁸³ Although we often inhabit large worlds, this predisposition tempts us with small world thinking.

3. Methods: Experiments and Experimentation

The natural and the social sciences are based on trial and error. Experiments are events; experimentation is a process. Both are “multifaceted, epistemologically opportunistic” and not dogmatically associated with a particular philosophy.⁸⁴ The small world of risk lends itself to Newtonian humanist thinking. It is made of systems that can be taken apart and tested in laboratory, field, or survey experiments.⁸⁵ Experiments presume that the world is marked by discrete causes and effects that can be captured by probabilistic or deterministic laws. Though often overlooked, experiments also can take the form of experimentation. Experimentalism enriches the limitations that inhere in routine applications of individual experiments. It can help in navigating the large world of uncertainty and intervene in evolving processes that are open to manipulation.⁸⁶

Small world, intervention-centered approaches aim at effects operating in contexts that are homogeneous and generalizable. They identify causal mechanisms often encapsulated in one or a small number of treatment variables, with or without the requisite knowledge of how that variable operates or how that mechanism is put together.⁸⁷ In international relations, mechanisms are often invoked holistically by generic labels such as coercion, coordination, and imitation that compress, conceal, or short-circuit information necessary for understanding what is going on. In an active society that tries things out by exploring possibilities, Donald Campbell argues, “a certain amount of trial-and-error is essential.”⁸⁸ For the large world is filled with many higher-order interactions between variables – interactions that all too often an experimenter looking for main effects is not even aware of. This may be one reason why, in contrast to Newtonian physics, no laws have yet been discovered in the social sciences and why the successful replication of experiments in the social

⁸³ Taleb 2007: 69, 132. ⁸⁴ Wight 2013: 340.

⁸⁵ Green and Gerber 2002: 822–23, 828. ⁸⁶ Campbell 1991: 231.

⁸⁷ Cartwright 1999: 50; 2019: 67. ⁸⁸ Campbell 1991: 224.

sciences is so difficult. Social scientists who design experiments in the small world should be careful, argues Campbell, and act as servants of and not guides for politicians. What the social sciences, including the study of world politics, do offer, however, are technologies of experiments and practices of experimentation that can help explore and navigate small and large worlds.⁸⁹

Experiments

In a Newtonian worldview the world is a complicated, decomposable system that we hope to understand better by testing some of its constituent parts.⁹⁰ Specifically, the testing of large theories is helped by scrutinizing subsidiary propositions or exploring causal mechanisms in controlled environments. Furthermore, experiments are conducted under the presumption that the world is marked by discrete causes and effects that can be captured by probabilistic or deterministic laws.⁹¹ The attempt to control for all but one or, at most, a small number of variables makes laboratory studies and the method of randomization applied to many trials so important.⁹² To conduct field or survey experiments outside the laboratory is tricky because it is difficult to control all or most relevant variables. Even well-designed experiments in the real world can be difficult to replicate. Compared to psychologists, economists focusing on causal identification tend to be quite rigorous in their application of experiments and typically do better in reducing the noise created by uncontrolled variables. Psychologists typically are more relaxed and are less focused on reducing noise. As they develop their own approaches, students of world politics, and politics more generally, have learned from advances in both fields. Everywhere, though, the incentives are strong to report statistically significant findings. This may be misleading when the effects are small, of short duration, and highly unstable over time. What is of interest is the existence of effects as well as their size.⁹³ And assessment of size requires substantive argumentation and agreement among communities of experts. Physicists, for example, do not rely much on standard tests of statistical significance and are wary of replacing judgments with tables of conventionally defined goodness of

⁸⁹ Campbell 1973: 75. Riecken and Boruch 1974.

⁹⁰ Green and Gerber 2002: 822–23, 828.

⁹¹ Druckman *et al.* 2011. Teele 2014. Gerber and Green 2012. Chilton and Tingley 2013. Hyde 2015.

⁹² Hainmueller *et al.* 2014.

⁹³ Gaines *et al.* 2006. McCloskey and Ziliak 2008a. Gerber and Green 2012: 65–66.

fit measures.⁹⁴ As on questions of policy and matters of personal conduct, in experiments there is no substitute for judgments.

It is reassuring to know that survey experiments relying on non-representative online samples have been found to be reasonably reliable in some studies.⁹⁵ But their validity can be suspect on other grounds. For example, asking respondents about their policy choices in an imagined nuclear crisis simply cannot duplicate decision-making dynamics, as in Defense Secretary McNamara's fear at the height of the Cuban missile crisis in October 1962 discussed in [Chapter 5](#). Field experiments, furthermore, are typically considered a neutral mirror of reality, leaving little or no trace in the world. This presumed distancing between observer and objects in the world is a marker of the Newtonian worldview that often does not bear out in the social sciences. With quantum mechanics very much on his mind, as early as 1946 Hans Morgenthau warned against the use of experiments, for both theoretical and practical reasons.⁹⁶ In taking measurements of the world, the social scientist cannot help but change that world. She "does not remain an indifferent observer but intervenes actively as both product and creator of social conditions."⁹⁷ Measurement alters the characteristics of the object that is being measured.⁹⁸ It is thus very difficult, and often impossible, to create the proper set-up for field experiments. On questions of economic development, for example, foreign agencies and their local agents have heavy boots and deep pockets. In the administration of treatments in the field, a lot goes on other than the treatment.⁹⁹ "Experimental regularities should perhaps be interpreted in terms of human skill rather than [of] stable, underlying entities and the functioning of the laws of nature" of society and politics.¹⁰⁰

Understandably, proponents of experiments disagree. Experiments typically focus on individuals making choices. Each subject's access to other subjects is either forbidden (in individual choice experiments) or tightly controlled (in game theory experiments). Tight controls over all plausibly relevant conditions except the treatment establish firm grounds for causal inference. But a philosopher of physics, Nancy Cartwright, and a heterodox economist, George DeMartino, question those very grounds. Cartwright argues that as we shift from controlled small worlds to uncontrolled large worlds, we run into the fact that all "generalizations" in the

⁹⁴ McCloskey and Ziliak 2008a; 2008b: 42–44, 51–52.

⁹⁵ Mullinix *et al.* 2015. Coppock 2019. ⁹⁶ Morgenthau 1946: 125–44.

⁹⁷ Morgenthau 1946: 143. ⁹⁸ Morgenthau 1946: 141, 143–44.

⁹⁹ Deaton and Cartwright 2018: 11. Bédécarrats *et al.* 2020. Rajagopalan and Pritchett 2022. Ravallion 2012, 2020. Reddy 2013. Dehejia 2016.

¹⁰⁰ Porter 1995: 13.

natural and, by extension, social world are *ceteris paribus* laws.¹⁰¹ They are not general; they obtain only under specifically defined circumstances. In a “non-stationary” world marked by change this fact limits greatly the contribution experiments can make in the search for generalizable findings. Furthermore, DeMartino argues, all causal arguments about the past, present, and future depend on counterfactual reasoning.¹⁰² It is not only our knowledge of the future that is fictitious. It is also our knowledge of the past. For we do not and cannot distinguish between contending counterfactuals concerning past events. This difficulty holds for all randomized controlled trials in field and survey experiments.¹⁰³ Whether World War I would have happened in the absence of the assassination of the Archduke is based unavoidably on a constructed historical narrative. Theories are based not only on what is seen but also on what can’t ever be seen. Epistemically insecure, theories “hold to distinct fantasies, generated by their distinct theoretical frameworks, which cannot ever be subjected to knock-out empirical or theoretical tests for assessing who, if anyone, has the uniquely correct counterfactual.”¹⁰⁴ We solve this thorny problem by fiat, adhering to the convention that only one framework is feasible or legitimate. Put differently, we accept without further thought what we purport to test empirically. For the proponents of experiments, that convention is Newtonian humanism and its disregard of uncertainty in politics.

In all experiments randomized controlled trials (RCTs) are the gold standard. In one over-the-top endorsement, the *British Medical Journal* wrote that “Britain has given the world Shakespeare, Newtonian physics, the theory of evolution, parliamentary democracy – and the randomized trial.”¹⁰⁵ Nancy Cartwright is more laconic when she writes that randomized controlled trials are not the gold standard, for the simple reason that there are no gold standard experiments except those held under extremely narrow scope conditions and thus resistant to generalization.¹⁰⁶ Although it may be useful, the average of a treatment effect, for example, does not tell us what percentage of the population is affected positively or negatively or not at all.¹⁰⁷ We need to understand not only the experiment but also its political context, underlying processes, and operative mechanisms before we can evaluate its relevance to our understanding of the world. Without this, the additional knowledge gained from randomized controlled trials is often trivial and oversold.¹⁰⁸ Experiments are good for isolating specific treatment effects. They are narrow by design. Local

¹⁰¹ Cartwright 1999: 25–29. ¹⁰² DeMartino 2018. ¹⁰³ DeMartino 2018: 10.

¹⁰⁴ DeMartino 2018: 13. ¹⁰⁵ Quoted in Deaton 2010: 438.

¹⁰⁶ Cartwright 2007. Deaton 2010: 426. ¹⁰⁷ Deaton 2010: 449.

¹⁰⁸ Deaton and Cartwright 2018: 3, 10. Mercatus Original Podcasts 2022.

average treatment effects apply only to the specific treatment applied to a specific sample. When all is said and done, experiments are useful guides for the world when they are precise and narrow. This is not to deny that when they are done well experiments sometimes can lead to important new insights. In the field of international politics, for example, Michael Tomz's survey experiment of audience costs makes an outstanding contribution.¹⁰⁹

The questions surrounding experiments go beyond the strictly "methodological." To understand "what works," we need a theory of why things work rather than just experiments testing whether things work.¹¹⁰ By themselves, simple extrapolation and generalization from repeated, successful replications are not confirming anything. Many practitioners of experiments agree that well-established results do not necessarily travel across heterogeneous contexts. It takes good reasons to justify making that attempt. And such reasons often do not exist.¹¹¹ Local results must be linked to more general mechanisms. The chicken infers from repeated evidence that when the farmer comes in the morning, it will be fed – a good inference until Christmas morning, when the farmer comes, wrings the chicken's neck, and feeds it to his family. Experiments can run this chicken risk, not because of the method but because of a lack of understanding of the conditions that give rise to the observed relationship. A carefully crafted randomized control trial of chickens turning up in summertime in the farmyard and being fed regularly would have confirmed the chicken's belief.¹¹² For a while, the hapless chicken experiences the world as a stationary rather than as a dynamic process – a common mistake when the results of experiments are reported as generalizable findings.¹¹³

All too often experiments are based on the assumption that "the universe proceeds by causality and so the future that lies ahead of us is as determined as our history."¹¹⁴ But as Blaug mischievously suggests, history repeats itself because "historians repeat each other."¹¹⁵ Learning from experience, knowing which stories travel from the past to the present or future and which do not, is difficult. Extensions beyond the context in which an experience has been made create vulnerabilities. The experience of being disastrously wrong is of course salutary. No student of politics and society should be spared it, insisted John Kenneth Galbraith. "And few are."¹¹⁶ Since for many historians (and some physicists) the past is as open and indeterminate as the future, this is at best an argument

¹⁰⁹ Tomz 2007. See also Kohama *et al.* 2024. ¹¹⁰ Deaton 2010: 442.

¹¹¹ Deaton and Cartwright 2018: 10–12. ¹¹² Blastland 2019: 202–03.

¹¹³ Deaton and Cartwright 2018: 11–14. ¹¹⁴ Basu 2014: 459. ¹¹⁵ Blaug 1963: 152.

¹¹⁶ Quoted in Blastland 2019: 110.

for a world of weak causal effects. Furthermore, long chains of causation cannot be foreseen with “any degree of certainty.”¹¹⁷ At best, randomized controlled trials can establish “circumstantial” rather than generalized causality. Observable effects occur in specific historical contexts. No easy shortcuts get us around the problems raised by differences in contexts, mechanisms, *ceteris paribus* conditions, and counterfactuals – other than the unthinking confidence that Newtonian humanism instills in us as we deal with the complementarities of risk and uncertainty.

That confidence has been shaken in the sciences. One 2011 study referred to as “Begley’s bombshell” replicated only 10 percent of fifty-three studies published in the world’s top science journals such as *Nature* and *Science*. Another study reports that on average replication effects were in the same direction as in the originals but only about half their magnitude.¹¹⁸ In a survey conducted by *Nature* in 2016, 90 percent of the respondents agreed that the natural sciences had a reproducibility crisis.¹¹⁹ That sense extends to the social sciences. The social world is like a little kid. You tell it to sit still while you take a picture. But as you are fastidiously fumbling with your camera, the kid simply will not wait for you. All too often the world’s social and political processes are not static. And this has created problems for the social sciences. The replication crisis was very serious in the field of psychology. As a consequence psychologists have adopted much stricter research protocols in recent years. Political science, the informed consensus view holds, has avoided a serious replication crisis.¹²⁰ That is good news. The bad news is what Alexander Wuttke, a well-informed and sympathetic supporter of experiments in political science, reports in his recent assessment. For a significant portion of political science studies

we cannot be sure to obtain the same results if we re-ran the same analyses on the same data . . . positive findings were forty percentage points (or three times) more likely to be published and sixty percentage points more likely to be written up. In other words, when researchers test a hypothesis and the results do not provide confirming evidence, there is a good chance that the academic community will never know about these results.¹²¹

It is not surprising that in the world of “publish or perish” researchers tailor their research and publication strategies to advance their professional careers. And it is heartening to see journals beginning to adopt submission (pre-registration) and reviewing (result-blindness) protocols to inhibit systematic distortions created by the misaligned incentives researchers face.

¹¹⁷ Morgenthau 1946: 127. ¹¹⁸ Spiegelhalter 2019: 6. ¹¹⁹ Blastland 2019: 111–13.

¹²⁰ Mullinix *et al.* 2015. Coppock 2019.

¹²¹ Wuttke 2019: 7, 9. See also Brodeur *et al.* 2024.

But little can be done about the enduring problem that Wuttke recognizes and that has been a central theme in my argument about uncertainty in world politics. “Most political science findings are context-dependent and, thus, do not necessarily generalize across time and space” unless boundary conditions are clearly specified. Unfortunately, current research practice “does not invest much effort on theoretical discussions of boundary conditions or on empirical replicability tests.” A recent study found that only one third of twenty-one influential social science experiments that were replicated had “significant effects in the same direction as the original study,” larger than similar studies reported in psychology and similar to rates reported in economics. “The insight that the likelihood of replicating a recent and prominent social science experiment is not much larger than the flip of a coin may shake prior beliefs about the predictive power of existing social scientific studies,” Wuttke concludes.¹²² I take this conclusion as support of the argument that, partly constituted by the risk-uncertainty conundrum, a dynamic world all too often slips through the fingers of scholars conducting experiments.

Experimentation

Like a simple model, well-designed experiments are useful instruments that can provide some baseline understandings of the world. Experimentation, in contrast, is a practice that operates without design. It focuses on applied forward reasoning to map possible futures that emerge from human actions and their unintended consequences. This is typical of open, non-linear systems where humans interact to shape their environments. A strike of workers on the London Tube forced commuters to seek out alternatives. After the strike was over, tens of thousands stuck to their new routes. For better or for worse, experimentation, it turned out, had created a lasting effect. Experimentation is well suited to a world filled with contingencies.¹²³ Conventional backward-looking methods that assume the world is stationary do not work well. Analysis-for and prescription differ from analysis-of and explanation. Policy prescription seeks to identify chains of contingency that could shape the future rather than explaining past events in the hope of improving theories or choosing policy interventions to select criteria and predict their effects in single-shot interventions or experiments.¹²⁴ Experimental governance is relevant when traditional, top-down command and control are not feasible or are found wanting.¹²⁵

¹²² Wuttke 2019: 13–14. ¹²³ Klaas 2024: 61–62. ¹²⁴ Levin *et al.* 2012: 130–31.

¹²⁵ Sabel and Victor 2017a, 2017b. Dorf and Sabel 1998. Sabel and Zeitlin 2010.

In principle, experimentation works in both small worlds of calculable risk and large worlds of incalculable uncertainty. In practice, in contrast to experiments, experimentation “disavows the notion . . . that causality and its measurement can be fixed across time and place and that any occurrence can be isolated from its context.”¹²⁶ Contextual specificity and heterogeneity trump homogeneity and generalizability. And experimentation also acknowledges that processes are variable and that language can make rather than mirror worlds. Experimentation assumes that appropriate scientific practice is rooted not in better methods but in a better understanding of the scientific enterprise. It starts with the assumption that a well-designed experiment does not lead to generalization but to insights that another, related experiment can build on. Although they are typically regarded as diametrically opposed, here the nomothetic inclinations of positivist scholars and Weber’s idiographic ideal types sing from the same songbook.

Albert Hirschman spoke up for this social scientific approach. It is attuned to relying on causal rules and generalizations with which we meet the future rather than relying on any one “ism,” or touting any one “killer method.”¹²⁷ Hirschman was a heterodox economist with wide-ranging interests who disliked blueprint economics and its cookie-cutter application to any issue, including development economics. Opposed to any and all orthodoxies, he valued new practices and institutional arrangements. His belief in small-scale experimentation resonates deeply with those who work with well-designed experiments. However, Hirschman rigorously opposed the temptation of arguing that any lesson learned from small-scale experiments could be scaled up readily to larger settings marked by unknown yet surely different contexts. Learning by doing in policy making and listening rather than preaching, his approach had two unusual hallmarks: humility and the capacity to adapt to variable processes and changing circumstances. He favored incoherence over coherence, pragmatism over plans.

Simple approaches to complex problems were anathema to him, and so were overblown grand claims in the name of Science (with a capital S), hallmark of an unreflective Newtonian humanism. Urbinati writes that “in a time in which . . . nothing seemed to work without the pre-defined guidance of a *weltanschauung*, Albert persisted in living outside of and without any *weltanschauung*.”¹²⁸ Not quite. His disposition was post-Newtonian. In a complex world filled with unknowable uncertainties, he opposed reductionist models, epistemic certainty, and the pretense of

¹²⁶ Adams 2020: 360. ¹²⁷ Grabel 2017: 29–54. Meldolesi 1995.

¹²⁸ Urbinati 2015: 268.

scientifically based authority over policy. Hirschman's writings from the late 1950s did much to end the "big push, high development" theory of the 1940s and 1950s.¹²⁹ After half a century of obscurity, development economics has recently been swept up by the excitement of randomized controlled trials, both widely noted and criticized when this research strand was recognized with the 2019 Nobel Prize for Economics. Taken together with the macro approach of large-N statistical studies, this micro approach may undergird a new and better development economics and social science more generally.¹³⁰ But Hirschman would have pointed to both epistemic and ethical grounds for skepticism of the positivist RCT approach. With economist Lant Pritchett he would have challenged RCT's dubious claim that microscopic experiments can lead to actionable knowledge about how to achieve large-scale growth and development.¹³¹ And he would likely have been repulsed by the power disparities between experts and vulnerable populations which, not that rarely, are exposed to ethically dubious experiments. More likely, he would have welcomed the pragmatic learning-by-doing approach to development through an inclusive growth strategy, illustrated by China after 1979.¹³²

Intellectual opportunism is central to experimentation. Searching out uniqueness and novelty requires taking advantage of spaces for innovation rather than relying on preconceived notions and plans. Deep knowledge of local contexts, awareness of sequential and cumulative changes that are not legible from quick visits to research sites made accessible by local gatekeepers, and suspicion of efforts to transplant observed local average treatment effects to unrelated and distant sites – all are hallmarks of an experimentation approach. Most important is faith in and embrace of what is possible.¹³³ An experimentation approach is based on a worldview that acknowledges the existence of uncertainty, and incomplete, dispersed, partial, tacit, and limited knowledge. It is marked by "constructive humility."¹³⁴ Knowledge of the future is irreducibly uncertain and typically cannot be accessed by probabilistic thinking. For Hirschman the need for predictability and the embrace of epistemic certainty and parsimony supporting general paradigms and laws constituted a serious neurosis that afflicted economics and other social sciences, including the analysis of world politics.¹³⁵ His commitment to the world's complexity was as unshakeable as his commitment to strategies of intervention.

¹²⁹ Hirschman 1958. ¹³⁰ Grabel 2017: 32–33.

¹³¹ Mercatus Original Podcasts 2022. ¹³² Ang 2016, 2023. ¹³³ Grabel 2017: 33.

¹³⁴ Bernstein *et al.* 2000: 45. ¹³⁵ Grabel 2017: 37.

Practical intervention always has unknowable effects that are set in motion by contending forces and a totality of circumstances unknown to the researcher or practitioner at the time the intervention is made. Playing off Adam Smith's "invisible hand" operating in small worlds, Hirschman's "hiding hand" operates in large ones.¹³⁶ It recognizes ignorance as a precondition for, rather than obstacle to, progressive change. Ignorance and mistakes are unavoidable and productive. Embarking on a project that seems manageable at the outset, and then turns out to be fiendishly difficult, reveals ignorance as the expert cultivator of unknown capacities for innovation and adaptation. Hirschman's hiding hand beneficially conceals difficulties and thus frees untapped powers of creativity. Without ignorance, we would not start and thus would forego the possibility of learning about beneficial outcomes or effects. In small worlds we plan for progress, in large ones we stumble into it. Failed predictions can breed success. We thus can literally "fall from error into truth."¹³⁷ Hirschman's possibilism sidesteps both the overconfidence that we can fix everything and the fatalism that nothing can be fixed. Instead of epistemic certainty, Hirschman pleads the case for path-dependent change, small steps, local contexts, unintended consequences, and adaptive learning. Above all, he prizes experimentalism and improvisation, along with a slow reform-mongering holding to the possibility for betterment.

For Hirschman the world is an open and complex system that is contingent, adaptive, and unknowable in many of its features. Shorn of the epistemic error of viewing the world as a simple, decomposable, and analytically tractable system, Hirschman's approach expressed the hope of exploiting unforeseen possibilities for improving it.¹³⁸ His "possibilism," Ilene Grabel writes, "is grounded in faith in the demonstrated capacities of individuals, institutions, and societies to develop diverse, creative solutions to unforeseen challenges and development problems. Possibilism encapsulates the enduring bias for hope."¹³⁹ Hirschman regarded an uncertain, open future as a truly inalienable right for every person, group, and state.¹⁴⁰ So did the human rights activist and physicist Andrei Sakharov, who won both the Nobel Prize for Peace and the Stalin Prize for designing the Soviet H-bomb. Sakharov wrote in a letter from his exile in Gorky: "fortunately, the future is unpredictable and also – because of quantum effects – uncertain."¹⁴¹ For both Hirschman and Sakharov uncertainty was filled with hope not fear. As for the social

¹³⁶ Hirschman 1967. Gladwell 2013. Meldolesi 1995: 38, 118–20.

¹³⁷ Hirschman 1967: 13, 20. ¹³⁸ Hirschman 1971. ¹³⁹ Grabel 2017: 46.

¹⁴⁰ Hirschman 1971: 30. ¹⁴¹ Gorelik and Bouis 2005: 358.

sciences, in Hirschman's view, they often "consider it beneath their scientific dignity to deal with possibility until *after* it has become actual and can then at least be redefined as a probability."¹⁴² In Newtonian humanism, implausibly, time is reversible. With nary a blush, many social science "predictions" published in scholarly journals are "postdictions." They are based on the unstated and unexamined assumption that the political process being examined is unchanging.¹⁴³ Convinced of the importance of uncertainty, Hirschman would have none of this. He resolutely refused to cede possibilistic grounds to probabilistic games.

Conclusion

For Donald T. Campbell, who led the social sciences to experiments and experimentation, the small world of experiments and the large world of experimentation are closely related. "The job of the methodologist for the experimenting society is not to say *what is to be done*, but rather to say *what has been done*."¹⁴⁴ Small world social science risks falling into the trap of over-advocacy when it advises what should be done. It should be more modest and admit that we cannot know until we have tried. Occasionally experiments go beyond common-sense understanding, but only because they build on it, not because they are a substitute for it.¹⁴⁵ We learn only by checking things out. For Campbell the experiments of the experimenting society will never be ideal for testing theory. But "they will probably be the best we have, and we should be willing to learn from them even when we have not designed them . . . Measuring the effects of a complex politically designed ameliorative program involves all of the problems of experimental inference found in measuring the effects of a conceptually pure treatment variable – all and more."¹⁴⁶ Since they are scientific by intention and effort but not, at least as of yet, by achievement, social scientists should avoid "cloaking their recommendations in a specious pseudo-scientific certainty, and instead acknowledge their advice as consisting of but wise conjectures that need to be tested in implementation."¹⁴⁷ And in the large world of contingency and uncertainty "the guesses of the experienced administrator and politician are apt to be on the average as wise as those of the social scientist."¹⁴⁸

Campbell's humility is sorely missing in many studies of world politics that combine statistical methods and the "analysis of" world politics aiming at explanations that contribute to theory with experimental

¹⁴² Hirschman 1980: xii. ¹⁴³ Bernstein *et al.* 2000: 48–49.

¹⁴⁴ Campbell 1973: 72; 1991: 228. ¹⁴⁵ Campbell 1991: 263.

¹⁴⁶ Campbell 1973: 72; 1991: 228. ¹⁴⁷ Campbell 1973: 73.

¹⁴⁸ Campbell 1991: 228.

studies and the “analysis for” world politics aiming at intervention that contribute to policy.¹⁴⁹ Newtonianism holds forth the promise of creating predictability in our lives. God after all gave all the easy problems to the physicists.¹⁵⁰ Covering the full range of human reason and unreason, humanism is more attuned to God’s difficult problems. Newtonian humanism thus has the wherewithal to address the risk-uncertainty conundrum. But it fails to deliver on that promise as long as it favors precision over accuracy and experiments over experimentation. It thus creates a bias for “single-shot” interventions based on small world thinking that overlooks chains of contingencies marking large world realities.

Informed by different worldviews, as we make our way we typically are unaware of uncertainty or unwilling to acknowledge its existence. Experiments help us understand the risk-based world we seek to control on the basis of results gleaned either after manipulating conditions in a laboratory or after performing smartly designed field or survey experiments. Experiments share in the hope of studying the effects of treatments and then, implausibly, scaling up local results to offer general solutions to real-world problems. Experimentation has less lofty aspirations. It is based on the notion of learning by doing under always shifting contexts in a dynamically evolving world filled with uncertainties that resist law-like generalizations. Experiments and experimentation are two different methods of dealing with risk and uncertainty. Relying eclectically on quantitative, qualitative, and axiomatic approaches, we may try to fence in uncertainty in the analysis though not in the practice of world politics. But it is a fool’s errand to neglect uncertainty altogether or try to chase it over the horizon, saddling us with unresolved risk-uncertainty conundrums.¹⁵¹

4. **Simplicity, Complexity, and the Risk-Uncertainty Conundrum**

Is the risk-uncertainty conundrum best analyzed with simple or complex theories, models, and methods? In the abstract, there exists no obvious ground for choosing. Simplicity has some undeniable advantages. Reducing the risk-uncertainty conundrum simply to risk can, however, be a perilous shortcut. All too often it leaves students of world politics empty-handed in their frequent encounters with the unpredictable.

¹⁴⁹ Levin *et al.* 2012: 131. ¹⁵⁰ Bernstein *et al.* 2000.

¹⁵¹ Shapiro and Bedi 2007: 16–17.

Simplicity

Following Newton's admonition, most theories and models of world politics aim for simplicity. This has been hugely influential, for example, in economic models and the belief in the beneficial effects of unregulated markets; in Marxist models and the belief in progress brought about by the history of class struggle; in Liberal models and the belief in the possibility of amelioration of both unregulated markets and class struggle; and in Realist models and the belief in the inevitability of war. Simple models aim at useful generalizations and causal propositions about outcomes occurring under a wide variety of different conditions.¹⁵² Simple models can generate strong conclusions especially when they rely on large numbers of observations and are supported by an accumulation of consistent information.¹⁵³ For the most part, simple models are based on strong assumptions. One such assumption holds that social reality consists of discrete, fixed entities endowed with attributes measurable as separate variables and linked in linear relations.¹⁵⁴ Causal influence is monotonic; a given cause is equally relevant at all times.¹⁵⁵ Language "represents" the world. Meanings of terms describing the world are unequivocal. There exists only one meaning for the effect that a given variable exerts on another. In short, in this small world conception, domestic and international politics are composed of fixed entities with constant, uniform, and unambiguous causal influences operating without any meaning ambiguity.¹⁵⁶ According to one of his unnamed students who recounted the episode on Twitter a few years ago, John Mearsheimer put his cards on the table when he told his graduate students "In this world, there are complexifiers and simplifiers, you want to be a simplifier."¹⁵⁷ Swiss philosopher Jacob Burckhardt begged to disagree. He warned of the harm done by "terribles simplificateurs" descending on poor old Europe.¹⁵⁸

Specific methods support Mearsheimer's quest. For example, laboratory experiments strictly control the context so that specific causes can be identified. When laboratory experiments are not possible, quasi-experimental field or survey experiments also seek to isolate causal factors. In quantitative studies statistical controls seek to achieve the same objective by addressing issues such as multi-collinearity, omitted variable bias, and selectivity.¹⁵⁹ Simple models generate behavioral implications

¹⁵² Western 2001: 358–61. Hornstein and Star 1990: 424–25. Little and Pepinsky 2016: 438–41. Kiser and Hechter 1991, 1998. Goldthorpe 1997.

¹⁵³ Western 2001: 359. ¹⁵⁴ Abbott 1988. ¹⁵⁵ Ruffa and Evangelista 2021.

¹⁵⁶ Kincaid 2004a: 211. ¹⁵⁷ Avant 2024: 6. ¹⁵⁸ Dru 1955: 220.

¹⁵⁹ King *et al.* 1994: 104, 119, 196–97.

that can be tested and proved wrong, a welcome contrast to the opaqueness of complex models. Simple models are not easily tinkered with to shield them from disconfirmation. They constrain data-mining, the accidental stumbling into false positives, and imputing the presence of a condition or causal effect that does not exist.¹⁶⁰

In principle, simplification is compelling. In practice, it often runs into trouble mistaking the simplicity of the map as an accurate characterization of the territory of a complex world. Frequently repeated epistemological assumptions about the world morph all too easily into ontological claims about what the world is really like. Maps are not territories. Ken Waltz argues that “a theory, though related to the world about which explanations are wanted, always remains distinct from that world.”¹⁶¹ For Seva Gunitsky epistemological simplification is a “useful capitulation” and an “informed concession to ignorance” of the world’s complexity. Simplification “requires both boldness and humility – the boldness of simplifying assumptions and the humility to recognize them as such.”¹⁶²

Complexity

Many agree that world politics is not simple. But is it complicated or complex? Focusing on only some of its parts can be a practical step toward eventually understanding the whole.¹⁶³ Complicated systems can be disaggregated into their components.¹⁶⁴ With their initial constraints or parameters fixed such systems are often linear and deterministic. As long as underlying processes are stable, historical probabilities in clock-like, complicated systems provide a reasonable guide to a future marked by predetermined regularities under conditions of risk. Complicated weather systems are a good illustration.

However, parameters of self-organizing, non-linear complex systems with emergent properties can shift as they adapt over time. Yuen Yuen Ang’s adaptive political economies highlight whole systems that are not reducible to the relations among their parts.¹⁶⁵ Generalizations do not occur across one homogeneous context but across a variety of heterogeneous ones. Since emergent phenomena cannot be reduced to their constituent parts, explaining specific events with the help of overarching concepts is often misleading.¹⁶⁶ Complex models focus on feedback loops operated by a circular causality without the assignment of specific agency to any one entity.¹⁶⁷ Historical probabilities offer no reliable guide

¹⁶⁰ Ron 2002: 131–32. ¹⁶¹ Waltz 1979: 6. ¹⁶² Gunitsky 2019: 708, 714.

¹⁶³ Lake 2009a, 2009b. ¹⁶⁴ Simon 1962.

¹⁶⁵ Ang 2023. Silberstein and McGeever 1999: 182, 184–85, 190–91. Taleb 2012: 56–60.

¹⁶⁶ Houghton 2009. ¹⁶⁷ Freeman 1999.

to an uncertain future marked by low-probability events and unpredictable contingencies. In cloud-like complex systems the future is open under conditions of uncertainty.¹⁶⁸ The movement and shape of individual clouds, for example, remain mysterious, defying prediction, at least for now.

The complementarity of risk and uncertainty blends the known and the unknown in politics. In complicated political systems uncertainty may be due to methods of generating a sample, the incompleteness or inclusion of an element of randomness in a model or theory, and the partial randomness of human behavior.¹⁶⁹ Predictive capacity is limited by the time it takes a system to run through sufficient repetitions to record how things eventually map out.¹⁷⁰ Complex political systems are governed by dynamically changing processes rather than predetermined laws. System dynamics can be tracked only *ex post*; they are not predictable *ex ante*. The coexistence of serendipitous circumstances with circumstantial craziness, the confluence of the unintended consequences of human action, and the unanticipated consequences of system dynamics are some of the factors that make the risk-uncertainty conundrum so intractable.¹⁷¹

Nobel Prize winner Robert Solow's "gimmick" was to pick a thing that interested him and simplify everything else. What he was aiming for was to understand "a little piece of the puzzle" by building "toy models."¹⁷² Far from being averse to intellectual elegance, Albert Hirschman warns that "parsimony in theory construction can be overdone."¹⁷³ Sometimes our understanding is enhanced by making things more complicated and more complex. Rational choice theories are a case in point. For example, our understanding of preference change can be enriched by incorporating the analysis of meta-preferences. Many actors are internally divided. They have the ability to step back in self-reflection and argue within themselves about the relation between ephemeral tastes and enduring values. This ability to step back is unique to humans, though not present in all of them. Hirschman argues that changes in revealed, first-order preferences are useful guides to validate the concept of meta-preferences. He also argues against the reinterpretation of meta-preferences as ephemeral tastes and against attempts to explain preference change exclusively through price and income changes. Instead, he insists, we must embrace

¹⁶⁸ Lerner 2021: 369–72. Almond and Genco 1977. Kellert 1993. Axelrod and Cohen 1999. Ang 2022: 2–10. Jervis 1997. Byrne and Callaghan 2013. Kiel and Elliott 1996. Harrison 2006. McCloskey 1991. Tetlock and Gardner 2015: 8–10.

¹⁶⁹ Gailmard 2014: 77–79.

¹⁷⁰ Bookstaber 2017. Kay and King 2020. Bousquet and Geyer 2011: 1. Kauffman 2008: 258. Bousquet and Curtis 2011.

¹⁷¹ Blight 1990: 69–70. ¹⁷² Hershey and Weinstein 2023. ¹⁷³ Hirschman 1984: 12.

a style of analysis that does not simply rule out the complicated or complex effects of “autonomous, reflective change in values.”¹⁷⁴ This conception is at odds with Newtonian humanism’s assumption of self-sufficient, rational individuals.

A complex approach can be helpful for capturing an individual’s non-routine activities. They include the striving for “truth, beauty, justice, liberty, community, friendship, love, salvation and so on” rather than only productive labor. Such strivings generate more or less temporary experiences of attainment that go far “in accounting for the existence and importance of non-instrumental activities.”¹⁷⁵ They cannot be elucidated by simple means-ends calculations. Compensation for the uncertainties about the outcome of striving activities lies in their often intrinsic, “intoxicating” quality. Non-instrumental action, furthermore, often has the effect of making the actor feel like a “real person.” As such, it can be interpreted as an investment in individual or group identity, personhood, and sense of belonging. Similarly, morality, benevolence, and civic-mindedness cannot, Hirschman argues, be analyzed sensibly by relying only on the simple scarcity model of economics. An economic approach that seeks insight into a broad class of problems must embrace a view of the world that does justice to “the incredible complexity of human nature” – a view that economic analysis needs to incorporate for gaining greater realism and relevance.¹⁷⁶ Hirschman pleads “let us beware of excessive parsimony.”¹⁷⁷ His insistence on incorporating large world phenomena into economic analysis is a useful reminder of the persistent risk-uncertainty conundrum.

Conclusion

That conundrum looks different in closed, decomposable, complicated systems than in open, holistic, complex ones. The first permits calculations of risk, the second insists on acknowledging the existence of uncertainty. Herbert Simon offered a formulation that encompasses both.¹⁷⁸ For Simon the world is a loosely coupled system consisting of clustered variables. Tight clusters lend themselves to simple modeling more easily than do loosely linked ones. More recently, some scholars have pushed beyond Simon’s logic.¹⁷⁹ They argue that the world is deeply entangled and open and cannot be approximated usefully by conceiving of it as a series of partially closed systems. Joseph Nye states this point graphically. “The social sciences are like inhabitants of islands in a huge swamp. They could measure and predict pretty well on each island, but were inept at building

¹⁷⁴ Hirschman 1984: 15. ¹⁷⁵ Hirschman 1984: 18–192. ¹⁷⁶ Hirschman 1984: 27.

¹⁷⁷ Hirschman 1984: 27. ¹⁷⁸ Simon 1962. ¹⁷⁹ Popper 1990. Adler 2019. Qin 2018.

bridges between them. So, they tried to link the islands with huge leaps of theory and often wound up floating in the swamp of uncertainty.”¹⁸⁰

In many simple models individuals are the only important information-processing, knowledge-producing, and risk-calculating actors.¹⁸¹ And the individual brain looks like and can be modeled as a computer. Complexity theory highlights instead the cultural accumulation of cognitive artifacts that are external to the individual. Information processing is distributed across group members and generations. Cognition is socially distributed. Wilcox surmises that rich cognitive artifacts “were accumulated by increments and innovation across years and indeed millennia.”¹⁸² Groups of people rather than individuals were the main drivers of learning processes revealed in the production of cultural objects and socially distributed, uncertainty-producing mentalities.

A well-specified outcome or “dependent variable” is central to simple models that conceive of explanations in terms of a funnel of causation. Complex events inside the funnel are the result of many prior causes that have multiple effects. What matters most is the “dependent variable” at the end of the funnel, often a specific political act.¹⁸³ The funnel operates not in “real time,” for example following voters through the various stages of a campaign. It occurs instead in “causal time” that moves from big background factors to a number of smaller factors affecting the final outcome. In contrast, complex models focus not on outcomes but on processes. They track the flow of variables through “real” rather than “causal” time.¹⁸⁴ Specific events are conceptualized as ongoing sequences of events that flow through networks. Outcomes are the byproducts of processes that constitute social and political reality. Political process is a “continuous sequence of interim results” rather than a “discontinuous sequence of final results.” Interim or process outcomes can generate trending outcomes and long-run stabilities that are brought about by large numbers of individual events.¹⁸⁵ Simple models isolate efficient causes. Complex models focus instead on the concatenation of different types of causes. The risk-uncertainty conundrum plays out differently in these two conceptions of causal relations. The first is more congenial to risk-based analysis than the second. But often risk and uncertainty blend into one another and cannot be clearly separated out. Put simply, often simplification does not help us unravel the complementarity of risk and uncertainty.

¹⁸⁰ Joseph S. Nye, personal email correspondence, 12/23/23.

¹⁸¹ Wilcox 2008: 523–24. ¹⁸² Wilcox 2008: 524–25, 527–29.

¹⁸³ Abbott 1998: 148–50, 158–59, 161–63, 167–68; 2005: 398; 2016: 170–72. Kurki 2008: 2–13. Ruffa and Evangelista 2021.

¹⁸⁴ Abbott 2016: 167–69, 171–72. ¹⁸⁵ Abbott 2016: 176. Abbott 2005: 400–05.

In line with this chapter's emphasis on stories, one of the fathers of modern macroeconomics and rational expectation theory, University of Chicago economist Robert Lucas, thought of himself and his colleagues as story-tellers operating in the world of make-believe. "We do not find that the realm of imagination and ideas is an alternative to, or retreat from, practical reality. On the contrary, it is the only way we have found to think seriously about reality."¹⁸⁶ In his Presidential Address to the 2003 meeting of the American Economic Association, the Nobel laureate announced that "macroeconomics . . . has succeeded: its central problem of depression prevention has been solved, for all practical purposes, and has in fact been solved for many decades."¹⁸⁷ His story was about rational expectation. It tickled every economist's imagination and convinced most of them. In the make-believe world of rational expectation Lucas made a series of claims. There exists a "true model" of the "real" world. Economists, and everybody else, know what that model is. Everybody has developed expectations that are consistent with everybody else's expectations. And everybody acts on these expectations. In Lucas's story "all agents inside the model, the econometrician, and God share the same model."¹⁸⁸ Five years later the greatest economic crisis since the Great Depression illustrated once more that financial crises, like wars, are the result of dynamically changing processes.¹⁸⁹ Like the captain of the *Titanic*, Lucas had imagined an accident-free world of stationary processes. The Nobel Prize winning story-teller had spun a good yarn that a great many people found compelling. When pressed in Congressional testimony after the crash, Alan Greenspan, then Chairman of the Federal Reserve, remarked ruefully that his view of the world had been shown wanting: "I made a mistake . . . I found a flaw in the model that I perceived is the critical functioning structure that defines how the world works, so to speak. I was shocked, because I have been going for 40 years or more with very considerable evidence that it was working exceptionally well."¹⁹⁰ As *The Economist* wrote in its obituary, Lucas had "built a fantastical new world for wonks to explore."¹⁹¹ But Lucas had omitted to notice the difference between small and large worlds. As the [next chapter](#) argues, the crisis of 2007–08 showed his story to be fatally flawed. Playing the role of pied piper, he had fooled a lot of people. Not all of them were wonks.

¹⁸⁶ Kay and King 2020: 92. ¹⁸⁷ Lucas 2003: 1.

¹⁸⁸ Thomas Sargent quoted in Kay and King 2020: 342.

¹⁸⁹ Kay and King 2020: 193, 338–39, 371–72.

¹⁹⁰ U.S. Congress, House of Representatives 2008: 45–46. Greenspan (2013: 68) reports a different interaction with Congressional committee chair, Henry Waxman, on October 2008.

¹⁹¹ *The Economist* 2023b: 68.

4 Risk and Uncertainty in Finance

Based on reams of data, economic forecasts share one thing: they are almost always wrong. The median Wall Street annual forecast for the period 2000–23 was off by an average of 13.8 percent, more than twice the annual performance of the stock market.¹ At the beginning of each year there existed a strong consensus about the market that proved to be entirely wrong.² It is not only the stock market that is difficult to predict. For January 2023, forecasters had estimated 187,000 new jobs. The actual number, seasonally adjusted, ran almost three times higher.³ In the summer of 2024 the needle pointed the other way. In calendar year 2023 the economy added far fewer jobs than had been reported previously, a shortfall of about 800,000 over the previous twelve months, a downward revision of 28 percent.⁴ Convinced that the next big financial crisis was inevitable because of a global economy awash in tens of trillions of dollars of public debt, the authors of an exhaustive 2017 survey of possible triggers focused on a long list of economic and political causes; but they failed to mention the pandemic that brought the world to the brink of collapse three years later. Complicating matters further, disagreements of economists about what will happen in the future spill over into disputes over what happened in the past.⁵ Undeterred, two German writers predicted in 2019 that the greatest global crash in history would happen by 2023. In their win-win world, should the forecast be wrong, their earnings from writing a bestseller would permit them to celebrate the wrong prediction by “opening a bottle of whiskey.”⁶ My Cornell colleague David Mermin is not surprised by this collective failure in probing the future. After he had listened to a Nobel Prize economics lecture, he remarked sardonically that with its integrals and derivatives, economics was just like physics, “except physics works.”⁷

¹ Sommer 2023: B8; 2024. ² Mackintosh 2023. Smialek and Casselman 2024.

³ Harrison 2023. ⁴ Casselman 2024. ⁵ Peterson 2016.

⁶ *DER SPIEGEL* 2019, 2020. ⁷ Mermin 2016: 132.

Between 1980 and 2005 the world experienced about one noteworthy financial crisis per year.⁸ But the Great Recession of 2007/08 was different. In its impact it was surpassed only by the Great Depression of the 1930s. Some of the lessons of history were learned well, which helps explain a relatively better outcome after 2008. But other lessons were not learned. The question remains – why did the US not do better?⁹ The near-collapse of the American financial system in 2008 wiped out over \$11 trillion in household wealth.¹⁰ Millions lost their homes. Major banks and financial institutions went bankrupt or were rescued by enormous government-financed bailouts. The crisis came out of the blue even though it was the consequence of prior political decisions: the 1980s Republican party's strident renunciation of fiscal responsibility; the 1990s Democratic party's resolute embrace of financial deregulation; and after the 9/11/2001 attack the relative decline of American power drained by two losing wars fought in Afghanistan and Iraq. The financial crisis of 2008 mattered greatly. It created a strong populist backlash and has reinforced illiberal and authoritarian politics in the US and abroad.¹¹

The broader context of the Great Recession of 2008 and other less cataclysmic financial crises lies in the changing structure of the US economy since the 1970s.¹² The American state responded to a variety of economic, social, and political challenges of the 1970s – “stagflation” at home and defeat in Vietnam abroad – with improvisational policies that unburdened the state and shifted the economy toward finance. This was not only a planned transition but also the unintended consequence of policies designed to solve unrelated problems. The outcome was to shift profit making in the economy from productive to financial activities. Three policy changes mattered: deregulation of financial markets, the influx of foreign capital, and a radical change in monetary policy in the early 1980s. Financialization was the fuse and speculation in mortgage became the match for blowing up the entire economy in 2008. Political choices were determinative. The point of this chapter is not to adjudicate among the different causes of the Great Recession but to use that event as a lens to see how the complementarity of risk and uncertainty shapes a vital political domain.

When it comes to money, in common parlance luck is the preferred idiom. In America rich people are believed to have won “the world's lottery,” and life is “a game of chance.” With chance understood as luck, conceptual and deliberative metaphors are mixed; so are probability

⁸ Litzenberger and Modest 2010: 74–75. ⁹ Eichengreen 2015: 378.

¹⁰ Financial Crisis Inquiry Commission 2011: xv.

¹¹ Tooze 2018. Kirshner 2014. Cohen 2022: 87–91. ¹² Krippner 2011.

and possibility. In politics luck often trumps skill, argues one observer as he reflects on the fortunes of various leaders in modern British politics. Labour's lead over the Conservatives in 2023 was due mainly to "damned" luck.¹³ Bill Gross, one of the rock stars of the American bond market, had run Pimco for over forty years, building one of the strongest earning records in the industry. When he joined a rival company, returns in his first year plummeted. Luck had deserted him, it seemed.¹⁴ In finance, as in war and sports, skill and luck are difficult to parse. Napoleon wanted his generals to be smart, but he was partial to the lucky ones. Making the cover of *Sports Illustrated* often leads to the "Sijinx," a decline in the fortunes of the featured star athlete.¹⁵ Underlining luck's vast domain, the secular combines with the religious: the "rise to the top" is followed by the "fall from grace." It seems that the mysterious has no rhyme or reason. Good and bad luck occur in the world's fold where probability meets possibility on the risk-uncertainty conundrum.

All too easily we forget the sensible question Queen Elizabeth II posed to a group of experts after the immediate crisis of 2008 had passed: "Why did no one see it coming?" Six months later a group of eminent economists sent a letter apologizing to the Queen for their "failure of collective imagination."¹⁶ And when Ben Bernanke was asked, after the crisis had passed, what most surprised him about the crisis, he answered "the crisis." Bernanke knew that financial crises recur throughout history. They are the product of human emotions and perceptions and of the evolution of complex, dynamic chains of contingencies generating "poly-crises." For all his formidable, life-long experience writing about and managing financial crises, Bernanke suffered from the same failure of imagination as his British colleagues.¹⁷ This is not to cast blame on smart people. Like the rest of us they can be overconfident, confused, and forgetful of the last crisis. And as with death, so with financial crises: their timing and circumstances are uncertain, their recurrence is not. The Queen might better have kept counsel with her corgis rather than her experts.

Like medical malpractice, negligent financial practice can kill a banker's client prematurely. Stoking the fury of many, in the 2008 crisis some bankers were rewarded handsomely while millions lost their homes. Bankers rely on sophisticated risk models when they place their bets, informed by what they understand to be the rational beliefs they and others hold about the world. In a financial crisis, however, on a moment's notice those beliefs can morph into panics, revealing unacknowledged

¹³ *The Economist* 2023f. ¹⁴ Mackintosh 2015. ¹⁵ Harford 2019.

¹⁶ Eichengreen 2015: 3. ¹⁷ Bernanke *et al.* 2019: 24–25.

uncertainties that had existed all along. This orthodox view imagines the world to be small and marked by risk. Since differences in context do not matter, models of the financial sector can be general and financial processes tend to be invariant. Cleverly, bankers mask uncertainty in the language of risk. Willfully, they ignore uncertainties they do not want to face. But despite their best efforts, in the end, they cannot escape the risk-uncertainty conundrum (section 1).

What bankers, traders, government officials, and many of us do all too rarely is to acknowledge the pervasiveness of an uncertain future that we may intuit but cannot know. As the Austrian poet Rainer Maria Rilke wrote, “the future enters us . . . in order to be transformed in us, long before it happens.”¹⁸ Like Rilke, heterodox people of different persuasions do include uncertainty in their thinking. For them, the difficulty an actor has of fully knowing another person’s thinking and unavoidable social contingencies are tell-tale signs of the impossibility of knowing the future.¹⁹ In the frenzy of speculative bubbles, many financial practitioners are also fully aware of uncertainty. Unlike others whom they believe to be less smart, they plan to sit down before the music stops playing. Some of them do. Many don’t. Without firm knowledge about the future, actors are guided by confidence-instilling conventions. “Nobody knows anything, but everyone knows someone” is a *bon mot* that captures the social element of economic life. The financial crisis of 2008 was not an exogenous event disrupting a world of calculable risk. Social conventions, such as risk-management models, were widely believed in and adopted to control uncertainty. These models were not representing reality but they were productive in generating endogenously a systemic crisis that revealed the risk-uncertainty conundrum (section 2). Often in plain sight, the complementarity of the small world of risk with the large world of uncertainty is reflected in economic practices such as accounting and arbitrage (section 3).

In the world of finance, language matters in different ways. In developing and testing their causal theories or models economists typically assume that language mirrors reality in “representing” the world. But all causal arguments depend on counterfactual reasoning, fictitious, world-making narratives that “re-present” realities that do not exist.²⁰ Based on a very different theory of language, Philip Tetlock’s and Aaron Belkin’s “fictions of what would have been” are the unacknowledged companions of economists interested in causal identification.²¹ Furthermore, the uncertainties in finance make language a very public

¹⁸ Rilke 1993: 94. ¹⁹ Berenskoetter 2011: 650. Iida 1993. ²⁰ DeMartino 2021.

²¹ Tetlock and Belkin 1996: 4.

instrument for “re-presenting” the world and, in so doing, changing it. Unlike most economists, central bankers are very much aware of the power of talk. They do not view language as a passive instrument of communication that mirrors the real world. The Federal Reserve has relied heavily on story-telling to nudge financial markets away from the large world of uncertainty toward the small world of risk (section 4). Going beyond the analysis of finance this chapter ends by discussing the denial of the risk-uncertainty conundrum by the reigning theory in the field of international political economy (section 5).

1. Risk and Rationalism

Despite their many disagreements, at the beginning of the twentieth century Frank Knight and John Maynard Keynes agreed on the difference between risk and uncertainty. Among economists the reaction to Knight’s and Keynes’s work has followed two tracks. The first is to ceremonially invoke the distinction and then ignore it as uninteresting or trivial.²² The second rejects outright the existence of unquantifiable uncertainty and assumes that agents live only in a world of calculable risk. Jack Hirshleifer and John Riley, for example, referred to Knight’s distinction as “sterile.”²³ They were dismissive of critics who catalogued choices that deviate from the postulates of rationality based on subjective probability calculations. For them such anomalies are akin to “mental illusions” which are “only a footnote to the analysis of valid inference.”²⁴ After all, in economies with complete markets, inconsistent beliefs are unsustainably costly. As Mark Blyth puts it: “since being deluded all the time is very expensive, especially when making margin calls,” one would expect agents operating in competitive markets to correct their mistakes.²⁵ Competitive pressures weed out actors who fail to adhere to the axioms that underpin rational decision theory. Most mainstream economists have therefore closed ranks around the assumption that uncertainty is indistinguishable from risk.²⁶

Frank Ramsey and Bruno de Finetti were the first to eliminate uncertainty theoretically by developing a broadened concept of subjective probability. They won the battle with Knight and Keynes over the

²² Hamouda and Smithin 1988: 159. Hirshleifer and Riley 1992. LeRoy and Singell 1987: 395. McKenna 1986. Granger 2010: 32–34, 38, 45. Zeckhauser 2010: 307.

²³ Hirshleifer and Riley 1992: 10. ²⁴ Hirshleifer and Riley 1992: 34, 39.

²⁵ Blyth 2003: 243.

²⁶ Reddy 1996: 229. Maechler and Graz 2022: 625–28. LeRoy and Singell (1987: 398) went as far as reinterpreting Frank Knight posthumously as a Bayesian. Kay and King 2020: 74.

difference between uncertainty and risk. Disregarding Ramsey's insistence that subjective probabilities were only a theoretical idea, putting aside doubts about the possibility of precisely measuring degrees of belief, and neglecting the inconceivable events lurking in the domain of uncertainty, Milton Friedman and other adherents of the Chicago School argued that people could be treated as if they assigned numerical probabilities to all conceivable events.²⁷ This powerful idea was first developed in thinking about consumer choice. It was later extended to cover all decision making under uncertainty.²⁸ Economists thus came to deal with the complementarity of risk and uncertainty by relying on guesses about the future and the formalization of subjective probabilities. Actors' subjective beliefs are based on past experience. As they learn more about the world, actors change their beliefs about the likelihood of different outcomes.²⁹ And as the world evolves, people update their prior probabilities continuously in light of new information.³⁰

Developed and tested in controlled laboratory settings, the idea of subjective probability was applied to the real world. Differences in context were thought to be unimportant.³¹ It turned out that people made obvious errors in calculating opportunities for gain or loss in uncertain situations that differed systematically from how probabilities "should" be updated. Economists and psychologists explained such deviations from theoretical expectations as "biases" or "heuristics" that impair human judgment. Human beings simply lack the "correct" intuition about how to estimate probabilities. The error was "dispositional" and located in the actor's perception of a risky world; it was not "situational" in the state of an uncertain world. For the better part of half a century economists thus have made the concept of uncertainty all but disappear from mainstream analysis. A major reason was the theory of rational expectations that took the economics profession by storm.³²

In its strong form the rational expectations hypothesis holds that an economic agent makes no systematic error in processing information and, writes economist Bill Gerrard, "has a complete information set on the 'true' deterministic component of the relevant economic structure."³³ Lars Peter Hansen and Thomas Sargent stipulate that there exists no difference "between agents' subjective probabilities and the probabilities emerging from the economic model containing those agents" in the

²⁷ Kay and King 2020: 72–74, 84. Buchanan 2013: 112–14. Stein 2024: 4–6. I discuss objective and subjective probabilities in Chapter 1, section 3.

²⁸ Kay and King 2020: 110–14. ²⁹ Dequech 2000.

³⁰ Kay and King 2020: 60–61, 66–68, 117–20.

³¹ Stein 2024: 5–6. Tversky and Kahneman 1992.

³² Muth 1961. Lucas 1972. Sargent and Wallace 1976. ³³ Gerrard 1994: 329.

world.³⁴ Wrapping model and worldview into one, everyone's expectations contained the same view of the world. This hypothesis had profound implications for the pricing of assets in financial markets. If market participants all share the same (correct) model of the economy and information is reasonably well distributed throughout the financial system, "then" writes Mark Blyth, "agents' expectations about possible future states of the economy should converge and promote a stable and self-enforcing equilibrium."³⁵ An investment community composed of rational individuals who share knowledge of the true underlying structure of the economy would not drive asset prices too far away from their fundamental value. As Edward Leamer puts it, "rationality of financial markets is a pretty straightforward consequence of the assumption that financial returns are drawn from a 'data generating process' whose properties are apparent to experienced investors and econometricians."³⁶ Put bluntly, the rational expectations hypothesis offered a "reductive translation" of uncertainty into risk, of large world into small world, and of real world into model world.³⁷

Quantitative finance models and much of decision theory circumvented uncertainty by focusing on volatility as a key indicator of risk. This became the main focus of the important work of Fischer Black, the co-inventor of the Black–Scholes option pricing formula, the heart of modern finance theory. Bridging theory and practice, Robert Rubin, partner and eventual co-chairman of Goldman Sachs, hired Fischer Black. His job was to introduce these new financial techniques into trading and investment banking. Option pricing distinguishes random volatility from directional risk. It succeeded in isolating and pricing directional risk by continuously deriving the value of an unknown asset (the option) from the value of a better-known asset (the stock). "To access and play with the 'upside' of volatility, you have to hedge away, neutralize, or buffer out directional risk."³⁸ Black's success eventually led to the massive growth of deregulated derivative markets. The artificial suppression of volatility in the name of stability turned out to be profoundly destabilizing.³⁹ Attaching precise numerical values drawn from the domain of risk to describe unpredictable swings occurring in the domain of uncertainty concealed a crucial fact: observed changes were shaped in part by unforeseeable and unforeseen uncertainties that escaped the calculation of risk.

³⁴ Hansen and Sargent 2010: 4. See also Dow 2004: 544. ³⁵ Blyth 2003: 243.

³⁶ Leamer 2010: 38. ³⁷ Holzer and Millo 2005: 228. Kirshner 2022: 58–62.

³⁸ Lee 2016: 4–5. ³⁹ Taleb 2007.

The risk-uncertainty conundrum was very much in evidence in the financial crisis of 2008. In a Gaussian distribution – the familiar normal curve – sigma is defined as a single standard deviation away from the average. If returns were Gaussian, we would observe an event that is five sigmas away from the mean about once every 14,000 years. “The waiting period associated with a 20-sigma event is a number, in years,” write Dowd and Hutchinson, “that considerably exceeds recent estimates of the number of particles in the known universe.”⁴⁰ Yet in August 2007 David Viniar, Goldman Sachs’ Chief Financial Officer, declared that his risk-management team was “seeing things that were 25-standard deviation moves, several days in a row.”⁴¹ Such an event is as likely as winning a one-in-a-million lottery jackpot more than twenty times in a row.⁴² The chances of exceeding 22 sigmas are one in a googol – a googol being 1 with 100 zeroes after it.⁴³ Put differently, Viniar’s statement implied that “Goldman Sachs had suffered a once-in-every-fourteen-universes loss on several consecutive days.”⁴⁴ Delegating the work to risk model professionals, this senior executive of Goldman Sachs had run into the risk-uncertainty conundrum by mistaking the small model world in which risks can be calculated for the large world with its unmeasurable uncertainties.⁴⁵

The conventional risk-only view of the world discounted and disregarded contrary evidence and arguments. Experimental evidence about lotteries showed that subjects were not always maximizing expected utilities (as the conventional wisdom held they would).⁴⁶ Daniel Ellsberg, for example, conducted a simple experiment showing that subjects had an aversion to uncertainty, thus violating the postulates of subjective expected utility theory. Adding a small dose of uncertainty in the experimental set-up induces choices that seek to protect subjects from the disliked unknown. People appeared to prefer choosing the sure thing of a known probability, even when doing so violated maximizing subjective expected utility.⁴⁷

The emotional experiences of actors confronting uncertainty also cut against the grain of the rational expectations theory with its emphasis on cool calculation.⁴⁸ Psychologist David Tuckett reports the enormous emotional stress that the top financiers, bankers, and traders he interviewed experienced in confronting uncertainty day in and day out in their

⁴⁰ Dowd and Hutchinson 2010: 89. ⁴¹ Quoted in Chinn and Frieden 2011: 91.

⁴² Buchanan 2013: 78–79. ⁴³ Mandelbrot and Taleb 2010: 50–51.

⁴⁴ Skidelsky 2009: 6. Danielsson 2008. ⁴⁵ Kay and King 2020: 6, 9, 68, 202.

⁴⁶ Kay and King 2020: 134–36.

⁴⁷ Tversky and Kahneman 1992. Zeckhauser 2010: 331–23. Ellsberg 1961.

⁴⁸ Barbalet 1998: 85. Pixley 2004.

working lives. Financial markets, he reports, “create dangerously exciting stories, problematic mental states, and strange group processes in which realistic thinking is fundamentally disturbed.”⁴⁹ His subjects described “trying to decide what they thought were the various uncertain futures that might unfold for the future price of various financial assets . . . the information they had was always *both* too much to be examined exhaustively and never enough to give any certainty about choices.”⁵⁰ This condition can be emotionally and physically very taxing, as is well illustrated by the autobiography of Hank Paulson, which focuses on the crisis of 2007–08. The former Secretary of the Treasury and head of Goldman Sachs gives a head-spinning account of the biggest financial upheaval since the 1930s, charting the spread of a small housing problem to a global financial crisis. What he calls at one point an “economic equivalent to war”⁵¹ took a heavy toll on Paulson’s sleep,⁵² intensified the dry heaves from which he had suffered since his youth,⁵³ and occasionally created fears so strong that Paulson answered them with prayers.⁵⁴ When uncertainty is rampant, actors yearn for unobtainable certainty.⁵⁵

Herbert Simon’s concept of “bounded rationality” nodded its head in that direction.⁵⁶ In an uncertain world not subject to risk calculation people do not follow the axioms of optimization. Rules of thumb and searching for a good-enough outcome trump optimization. Simon called that behavior “satisficing” and found that it worked well in the large world of uncertainty. Economists, however, reinterpreted the concepts of bounded rationality and satisficing to describe the cost of processing information which acts as an additional constraint on optimization. Misusing Simon’s terminology they neglected his core insight. In the world of uncertainty people do not try to optimize. Instead, they rely on practical reasoning and satisfice with the first good-enough choice. Contra the rational choice hypothesis, decision making does not necessarily follow the dictates of subjective expected utility.

The rating industry in financial markets illustrates the failure of the rational expectations hypothesis during the financial crisis of 2008. The three largest rating firms – Moody’s, S&P, and Fitch – are indispensable for contemporary finance.⁵⁷ The ostensible purpose of rating is to mitigate risk. This is the official story. The unofficial one differs.⁵⁸ Rating

⁴⁹ Tuckett 2011: x. See also Widmaier 2009, 2010. ⁵⁰ Tuckett 2011: xvi, 51.

⁵¹ Paulson 2010: 254. ⁵² Paulson 2010: 97, 207, 223, 249, 331, 404–05.

⁵³ Paulson 2010: 242, 290, 313. ⁵⁴ Paulson 2010: 207, 215–16.

⁵⁵ Paulson 2010: 118–20, 130. ⁵⁶ Kay and King 2020: 149–51.

⁵⁷ Carruthers 2011. Dittrich 2007. Hill 2004. White 2010. Caprio *et al.* 2010. Sinclair 2005.

⁵⁸ Abdelal and Blyth 2015.

agencies exist to transform uncertainty into risk. This industry is a child of government regulations. By law, institutional investors can only hold securities that have been rated. In terms of pure smarts, regulators are no match for raters. The same holds for the relation between raters and bankers and traders. Reflecting great differences in training, skills, and reputation, bankers and traders make ten, twenty, or thirty times as much money as agency analysts do. In their rating work, analysts do not come up with new information. They merely codify authoritatively what is already known. But credit rating analysts are not passive recorders of events. They are active participants in markets and help drive market developments. In fact, ratings helped hedge funds game the system. For example, once traders realized that some junk bonds were rated as AAA, they used that information and shorted the stock of banks holding these securities. Rather than stabilizing markets, rating agencies helped trigger market instability.

Based on erroneous assumptions and misleading simplifications, in the financial crisis of 2007–08 ratings proved to be spectacularly wrong in assessing the creditworthiness of various financial products.⁵⁹ The industry had a prior record of similar failings – during the devastating Asian Financial Crisis of 1997 and the collapse of Enron in 2001. Deeply flawed ratings have not diminished the hunger of the industry’s clients and governments for dubious metrics in an uncertain world. For without those metrics markets might cease to function. A history of failures has done next to nothing to undermine the importance of rating agencies in financial markets. If they did not exist, rating agencies would have to be invented. Right or wrong, their main purpose is to turn uncertainty into risk. Rating agencies provide authoritative knowledge on which economic actors rely – most of the time. Converting uncertainty into risk is essential for financial markets to operate. Accuracy is not the issue – authoritative estimates of risk in an uncertain world are.

At their best, rating agencies provide information that enhances rational decision making and makes markets more efficient. At their worst, they pretend to do the impossible – rate uncertainty. Most of the time, they convert uncertainty into risk. Since the middle of the nineteenth century, firms rated the credit of counterparties in financial transactions: bonds, mortgages, and, more recently, a broad range of financial products embodying different kinds of risks. In the case of corporate bonds, the data showed that ratings predicted actual defaults reasonably well.⁶⁰ Unavoidably, however, the rating process required simplified information. The financial crises that have rocked markets in the last

⁵⁹ Silver 2012: 26–30, 45. ⁶⁰ MacKenzie 2011: 1811.

two decades show the industry failing badly in the rating of new financial instruments such as collateralized debt obligations (CDOs).⁶¹

While the technologies of simplification have changed, the upshot has been the same. Large world uncertainties were “domesticated” into manageable small world risks, and thus were believed to have been “conquered.”⁶² Furthermore, by loosening the links between creditors and debtors, since the 1980s financial innovation had changed the context for and processes in finance. Personal relationships were replaced by disembodied ones. This facilitated the marketing of a dizzying array of new, highly liquid and easily traded products. Unfortunately, many of them were obscure and difficult to understand. This change enhanced the importance, size, and profitability of rating agencies.⁶³ The mortgage industry boom before 2008 doubled the profits of the three main rating agencies from \$3 billion in 2002 to \$6 billion in 2006. For five years in a row, Moody’s profit margin was larger than that of any company in the S&P top 500 corporations.⁶⁴ The spread of the securitization of risk across an ever-growing range of products made the information provided by rating agencies a gold mine.⁶⁵

So as to better assess the inherent degree of risk of new, complex products like CDOs, investors were eager to have them rated. Rating agencies applied to the new products the well-known labels with which they had classified corporate and government bonds for decades. New financial products were created by slicing, pooling, and re-packaging, thus creating complex, new, hybrid products. This led to a growing discrepancy between the risk that was being securitized and the quality of the underlying assets. In general, the mixing of different credit risks contained in the different tranches pooled in new products resulted in substantially higher credit ratings than the value of the underlying assets warranted. Reminiscent of radio host Garrison Keillor’s mythical Lake Wobegon, where all the children are above average, by 2007 more than half of the bundled subprime securities were rated AAA rather than just the 10–20 percent of the total package that might have deserved such ratings.⁶⁶ Another study reports that 70 percent of the securitized assets

⁶¹ Securitization produced an array of products. Mortgage-backed securities were created from pools of loans purchased from originators. CDOs involved packaging tranches of the asset-backed securities (ABS) into new instruments that could be sold by the CDO manager to outside investors.

⁶² Carruthers 2011: 4. Hill 2010: 14.

⁶³ The number of analysts employed by Standard and Poor’s, for example, increased fifty-fold between 1986 and 2000 (from 40 to 2,000). Rona-Tas and Hiss 2010: 125.

⁶⁴ Waxman 2008: 2. ⁶⁵ Sinclair 2005.

⁶⁶ Willett 2012: 47. Early on in the crisis, in October 2008, the IMF estimated that of the total loss of \$1.4 trillion more than half (\$770 billion) was in mortgage-backed securities

in the sample studied were rated AAA while 93 percent of the underlying assets had a credit rating of B or lower. The authors of that study use the term “alchemy” to describe the mismatch between the credit ratings of the securitized products and the credit quality of the underlying collateral. They speculate that the mismatch is driven by a boilerplate model that targeted “the highest possible credit rating at the lowest cost.”⁶⁷ The compounding of risks in pricing these new products was exploited by highly knowledgeable investors and disregarded by market players with short memories. This dynamic further enhanced the profits and clout of the rating agencies.⁶⁸ Furthermore, the deregulation movement was driven by the belief that new securitizations and rating technologies made government supervision unnecessary. In 1996, the renegotiation of an international agreement transformed into soft law the conventional belief that risk analysis could be safely left to the models employed by the rating agencies and large banks.⁶⁹ The social context of finance was transnational, bipartisan, and hurdled the constitutional separation of powers in the United States. Thus, straw was spun into gold.⁷⁰

Rating agencies were stymied by the complementarity of risk and uncertainty. After the boom years, subprime mortgages based on CDOs defaulted or were downgraded. The rating of asset-backed securities (ABS) and CDOs showed the futility of all attempts to domesticate uncertainty. In the end, behind a veil of highly technical analysis the agencies were simply part of the conventional view, widely shared among homeowners, bankers, media, government bureaucrats, and politicians of all stripes: house prices could only go up. Everyone thought of their home as a personal ATM machine. Providing high-risk mortgages was deemed safe. With house prices assumed to only increase, within a few years homeowners would acquire considerable equity which would diminish the risk of default. Furthermore, processes were thought to be invariant since the models from which default risk was estimated were based on relatively recent and brief time-series data.⁷¹ The assumption that the structure underlying mortgage markets was stationary and stable was just that, an unexamined assumption lacking supporting evidence. Furthermore, some models had technical flaws introduced for the convenience of making the models behave better rather than become more

and the single largest category (\$290 billion) was in asset-based CDOs. MacKenzie 2011: 1179.

⁶⁷ Benmelech and Dlugosz 2009: 3–4. ⁶⁸ Carruthers 2010: 10.

⁶⁹ Lockwood 2013a, 2013b. ⁷⁰ Porter 2010.

⁷¹ Models did not extend back beyond 1995, the date when personal FICO credit scores became available for most mortgage holders. Thus, the time series only included data from a period in which house prices had increased. See Rona-Tas and Hiss 2010: 130, n 23.

accurate.⁷² Finally, the rating agencies were not cognizant of one aspect of the context they tried to capture – potentially high correlations across different asset classes. When interest rates increased after a prolonged period of easy credit and growing market mania, a cascade of defaults in the subprime market spread quickly. In short order that led to a panic which suppressed lending throughout the economy.⁷³

After the financial crisis of 2008 Lawrence Summers, former chief economist of the World Bank, Secretary of the Treasury during the tenure of President Clinton, and former president of Harvard University, insisted that textbook macroeconomics had stood up very well despite the crisis. “Market breaks are inherently unpredictable” he argued. This claim overlooks the deregulation Summers had himself helped bring about in the 1990s. The changes were not external shocks but endogenous to the world of finance that made the crisis an accident waiting to happen. Heterogeneous contexts mattered, not only in the laboratory tests of the rational expectations hypothesis and its application in the real world but also in different market segments. Underlying processes were not invariant but dynamically changing. And in the development and application of economic models, language played a complex role that went well beyond the conveying of information.⁷⁴ Kay and King conclude that modern finance theory “not only failed to prevent the 2007–08 crisis, but actively contributed to it.”⁷⁵

2. Uncertainty and Convention

Since knowledge of the future is fluctuating, vague, and uncertain Keynes argued that no one can ever know fully the price of future assets.⁷⁶ “Knowing that our own individual judgment is worthless, we endeavor to fall back on the judgment of the rest of the world which is perhaps better informed ... [this] leads to what we may strictly term a conventional judgment.”⁷⁷ As a matter of practice, in Keynes’s view actors have no choice but to rely on “conventions, stories, rules of thumb, habits, traditions in forming our expectations and deciding how to act.”⁷⁸ Rumors, norms, and social life are indispensable for understanding financial markets.⁷⁹ Keynes distrusted rationalism in financial matters. In the words of political economist Jonathan Kirshner, for Keynes rationalism was grounded in a “pseudo-rational view of human nature” and he likened it to skating on thin ice or “skipping on the crust of the lava.”⁸⁰ For Keynes

⁷² Derman 2011. ⁷³ Gorton 2010. ⁷⁴ Kay and King 2020: 252.

⁷⁵ Kay and King 2020: 319. ⁷⁶ Keynes 1937. Gerrard 1994: 331.

⁷⁷ Keynes 1937: 214. ⁷⁸ Skidelsky 2009: 87. Nelson 2015. ⁷⁹ Sinclair 2009: 451.

⁸⁰ Kirshner 2015a: 404, 406.

financial markets operate in a world riddled with uncertainty that can be stabilized only by social processes. Updating rational expectations is simply insufficient to deal with the risk-uncertainty conundrum. Rationalism's failure in encountering the crisis of 2007/08 and other unexpected events is not due to a good theory encountering a black swan. The problem is not black swan events but lame duck theory.

Social processes instill confidence, an essential part of Keynes's view of decision making under uncertainty.⁸¹ According to Bill Gerrard, for Keynes confidence "is not a statement about the future to be checked against actual outcomes . . . [it is] a state of mind, a belief or feeling about the adequacy of the knowledge base from which the forecasts of the future are derived."⁸² Prevailing levels of confidence are a quicksilver social phenomenon. Financial markets are thus unavoidably prone to unpredictable bouts of euphoria and panic. Keynes did not see rational agents maximizing their subjective utility. Instead, he emphasized the role of "animal spirits" – of daring and ambitious entrepreneurs placing bets in an environment characterized by uncertainty.⁸³ Rather than use fixed decision rules, actors rely on social devices as a way of "getting by."⁸⁴ Under conditions of uncertainty confidence-boosting conventions are central.⁸⁵

Over decades of investing, thinking, and writing about financial markets, one of the world's most successful financiers, George Soros, when making a financial bet, always looked for evidence that might prove his initial theory wrong.⁸⁶ And he also grappled with the behavioral consequences of the uncertainty he experienced first-hand.⁸⁷ Most notably in 1992, he succeeded in breaking the Bank of England, forcing a devaluation of the British currency, and making Britain leave the European Exchange Rate Mechanism (ERM).⁸⁸ For Soros, market participants seek to impose some order on an unknowable future. The mental constructs that inform their expectations do not mirror underlying economic fundamentals. Instead, markets are shaped by the partial and distorted views that market participants impose on the world. Such views drive markets, which subsequently shape beliefs and thus can generate far-from-equilibrium outcomes. This social character of financial markets gives actors in markets the power to shape underlying economic fundamentals.⁸⁹ Soros's analysis is harshly critical of the work of conventional economics, which he regards as narrow-minded, devoid of practical reason, and utterly ignorant of the manipulative

⁸¹ Nelson 2017. ⁸² Gerrard 1994: 332. ⁸³ Kirshner 2009: 532.

⁸⁴ Lawson 1985: 916.

⁸⁵ Abdelal *et al.* 2010: 12. Woll 2008: 12. Seabrooke 2006: 12. Beckert 1996. Blyth 2002.

⁸⁶ Taleb 2007: 59. ⁸⁷ Soros 2009, 2008, 1998, 1987. ⁸⁸ Wen 2009.

⁸⁹ Soros 2009: 59, 71.

effects of market participants on the real economy.⁹⁰ Based on investment strategies derived from his model of the world, Soros regards the fortune he amassed to be incontrovertible proof that the rational expectations hypothesis is wrong. It is, he writes, “so far removed from reality that I did not even bother to study” it.⁹¹

Soros’s scorn of economics has been amply returned. Economists have tended to either ignore his ideas altogether or comment on them with a mixture of barely concealed condescension and suppressed envy. As a stand-in for many others, Nobel laureate Robert Solow takes Soros to task for a multiplicity of sins and calls his work “embarrassingly banal.”⁹² Reading Soros’s work and Solow’s review is like watching two proverbial ships of practical and theoretical financial economics passing in the night. Solow’s review glosses over the central point of Soros’s argument. Unlike the rationalist economic models that Solow references, Soros assumes that knowledge in and about financial markets runs up against fundamental uncertainty, “unknowable unknowns.”⁹³ Soros’s central insight is the power of collective beliefs, especially of traders. Justin Fox has shown in great detail how the creation of shared beliefs about the world of risk is a complex historical and deeply social process involving scholars, market players, and policy makers.⁹⁴ It is not captured by models of the small world of risk that are believed to hold in all contexts everywhere, be exposed to invariant processes at all times, and be expressed in language that mirrors reality.

Keynes and Soros agree that under conditions of uncertainty we fall back on robust stories or “reference narratives,” unspoken premises that express realistic rather than rational expectations.⁹⁵ Generally speaking, more or better general information is not central for generic individuals, households, corporations, and political actors. The meaning of risk is specific to each of them and so is the reference story they rely on and seek to protect. Since people assess risk and uncertainty with different reference narratives, they will deal with the same risk differently. Risk is the prospect that a projected story will fail to unfold as envisaged. The difference between expectation and outcome may be narrow or large. But it is not quantifiable. For stories rest on language that “re-presents” the uncertainties of the world we describe, explain, and must act on.⁹⁶ Economists Akerlof and Shiller describe the collective belief that home prices could only increase as “new era stories.”⁹⁷ That belief was shared by homeowners, investors, economists, and policy makers alike. As Nobel

⁹⁰ Soros 2009: 6–9. ⁹¹ Soros 2009: 58. ⁹² Solow 1999: 29. ⁹³ Dequech 2000.

⁹⁴ Fox 2009. ⁹⁵ Kay and King 2020: 122–24. ⁹⁶ Kay and King 2020: 100.

⁹⁷ Akerlof and Shiller 2009: 55.

Prize winning economist Edmund Phelps puts it, financial market actors “appear to have expected that housing prices would go sky-high, so prices took off and then went on climbing in anticipation that those prices were getting closer.”⁹⁸ James Shinn’s analysis of the reference models of traders in the global macro hedge fund world expresses a related view. All traders focus on the same small number of major events and trends, and all of them are ready to change their stories provided others do so as well.⁹⁹

In the run-up to the crisis, banks and credit rating agencies employed sophisticated risk-management techniques. Risk calculation had gradually merged with risk management and thus appeared to have created a systematic operational capacity for a well-organized minimization of risk. In their practical application, however, risk-management models proved to be social conventions offering the dangerous illusion that uncertainty could be transformed into risk.¹⁰⁰ The usefulness of these models was rooted less in their predictive accuracy and more in their provision of clearer communications within trading organizations. The models solved operational challenges for calculating risk-based deposits of traders and providing regulators with greater legitimacy for their decisions.¹⁰¹ Inside banks, risk measurement and risk management reinforced a normative commitment to the notion of shareholder value that had come to define the culture of global finance.¹⁰² But the financial crisis revealed deep flaws in the assumptions upon which risk models were built. On average, they underestimated the actual default rates for collateralized debt obligations (CDOs) of mortgage-backed securities by 20,155 percent.¹⁰³ In light of this yawning gap between the predicted and the actual outcome, the three main agencies (Moody’s, Standard and Poor’s, and Fitch) downgraded huge quantities of the mortgage-backed securities that they had initially regarded as safe.¹⁰⁴ Looking for the best solution turns out to be irrelevant and irrational in large world uncertainty.¹⁰⁵

⁹⁸ Phelps 2009. ⁹⁹ Shinn 2011.

¹⁰⁰ Bernhard and Leblang (2006: 7, 60), for example, build from the assumptions that “market actors engage in economic activity in efficient markets” and “that economic actors have rational expectations.” Armed with those assumptions, the authors build models of investor behavior rooted in portfolio theory. See also Latsis *et al.* 2010 and the criticism of Taleb (2007: 277–79).

¹⁰¹ Millo and MacKenzie 2009: 639. ¹⁰² Power 2009.

¹⁰³ Nelson and Katzenstein (2014: 377) averaged the percent difference between estimated and realized default rates across ten ratings classes (BBB- to AAA) for CDOs issued in 2005–07; the data were supplied by Donald MacKenzie and reported in *The Economist* 2010: 6. Coffee (2011: 232) estimated that 36 percent of all CDOs built from US asset-backed securities had defaulted by July 2008.

¹⁰⁴ Moody’s, for example, downgraded 83 percent of the MBS it had rated AAA in 2006 and 100 percent of BAA tranches (FCIC 2011: 222).

¹⁰⁵ Kay and King 2020: xv, 133–36, 140–44, 147, 149.

Securitization as Convention

Conventions are shared templates of understandings. They illustrate that “behavioral finance” is embedded in “social finance.”¹⁰⁶ Sometimes tacit and sometimes explicit, conventions coordinate actions in predictable ways, serving, in the words of sociologists Nicole Biggart and Thomas Beamish, as “agreed upon, if flexible, guides for economic interpretation and interaction.”¹⁰⁷ Conventions simplify uncertain situations by enabling agents to impose schemas on the world that can serve as a guide.¹⁰⁸ They can also have prescriptive force, telling actors what decisions are reasonable.¹⁰⁹ For economists Michael Storper and Robert Salais conventions are “attempts to order the economic process in a way that allows production and exchange to take place according to expectations which define efficiency.”¹¹⁰

A proximate cause of the financial crisis of 2008 was the excessive risks taken by large, interconnected financial institutions. Why did market actors place such risky bets? Many observers assumed that participants with “skin in the game” had sufficient incentive to try to understand and effectively manage the risks created by the buying and selling of new financial products. The most prominent supporter of financial innovation was Alan Greenspan, long-time Chair of the Federal Reserve. He became convinced that highly profitable but enormously complex bets placed by market actors made the whole financial system safer. “These increasingly complex financial instruments,” he said in 2005, “have contributed to the development of a far more flexible, efficient, and hence resilient financial system than the one that existed just a quarter-century ago.”¹¹¹ The modern risk-management paradigm evolved over decades, developed by leading mathematicians and finance experts. A Nobel Prize was awarded for the pricing model that supported the development of derivative markets. The entire edifice, however, collapsed in 2007–08. In humbling Congressional testimony after the crash, Greenspan acknowledged that the derivative market was sustained not by economic science but by free market ideology. The flaw he found in his model of how the world works was neglect of the risk-uncertainty conundrum.¹¹²

Securitization describes the process by which credit derivatives are built from an underlying pool of collateral. Between 1999 and 2008 the

¹⁰⁶ *The Economist* 2021. ¹⁰⁷ Biggart and Beamish 2003: 444.

¹⁰⁸ Kratochwil 1984: 688.

¹⁰⁹ Steinbruner 1974: 65–71. Herrigel 2005: 560, 565; 2010: 17–23. Daase 1999: 233–34.

¹¹⁰ Storper and Salais 1997: 16. ¹¹¹ Greenspan 2005. Kay and King 2020: 317–18.

¹¹² Lee 2016: 2.

notional value of highly profitable derivatives jumped from 70 to 700 trillion dollars.¹¹³ And between 2002 and 2007 there was a threefold increase in new issuance of securitized assets, the bulk of them backed by mortgages.¹¹⁴ Banks searched for risky assets that, with securitization, would create highly rated fixed-income financial instruments with attractive yields.¹¹⁵ The assets that bankers and traders turned to were mortgages of increasingly dubious quality. In order to originate loans packaged into securitized assets that could be sold to investors or held by themselves, banks borrowed heavily in short-term money markets.¹¹⁶ On the eve of the crisis, leverage ratios for many banks exceeded 40 to 1.¹¹⁷ By 2007 at least \$3.8 trillion of assets from “unconventional” mortgage securitization had spread around the world.¹¹⁸ This was a highly profitable strategy as long as banks could borrow cheaply and the collateral backing the securitized assets remained unimpaired.

Bank behavior was shaped by intense market competition. Individual financial managers were handsomely rewarded for producing returns that beat benchmarks.¹¹⁹ One strategy for outperforming the market is to take on “tail risk”: bets that in the short-run offer high returns and have a low probability of catastrophic loss in the long-term.¹²⁰ Funds will flock to a manager who produces excess returns. This changes the payoff for competitors who are encouraged to take on similar risks, even when they are aware that catastrophe lurks in the tails of the probability distribution.¹²¹ Securitization thus tried to spin low-quality mortgages into gold – a story with an unhappy ending.¹²² We now know that the business model adopted by many of the world’s largest financial institutions prior to the crisis was extremely dangerous. “If problems emerged with the asset-backed securities” writes a former chief economist of the IMF, Raghuram Rajan, “financial firms would have immense problems rolling over their debt.”¹²³

Securitization was driven by “intelligent businessmen rationally responding to their environment”; yet by doing so they had created, in the words of economist and judge Richard Posner, “the preconditions for

¹¹³ Kirshner 2014: 54. MacKenzie 2009a: 5.

¹¹⁴ Acharya and Richardson 2009: 199–200. ¹¹⁵ Partnoy 2009: 5.

¹¹⁶ As Fligstein and Goldstein (2011: 38–39) document, banks did not simply intend to sell risky assets to credulous investors; in fact, the biggest issuers of securitized assets retained substantial holdings themselves, and even ramped up their holdings as conditions in the US housing market worsened in 2006.

¹¹⁷ FCIC 2011: xix. ¹¹⁸ Fligstein and Goldstein 2011. ¹¹⁹ Clark 2011: 14, 15.

¹²⁰ Rajan 2010: 138–39. ¹²¹ Simmons *et al.* 2006.

¹²² Fligstein and Goldstein 2011. MacKenzie 2011. Tett 2009. ¹²³ Rajan 2010: 136.

a terrible crash” avoided only by those who knew to sit down before the music stopped playing.¹²⁴ The system became unglued because of information problems and misaligned incentives that skewed market competition. Borrowers know more about their capacity and willingness to repay than lenders do, and this information asymmetry was likely exacerbated by the streamlining of lending standards that occurred after the securitization machine was cranked up.¹²⁵ In the words of one market participant, “they’ve [CDO arrangers] got a mandate to do the CDO, they’ve got to get it done. They’ve got to buy something because they want their fees.”¹²⁶ By 2006 fees for churning out structured financial products had become the major source of profits garnered by large financial institutions.¹²⁷ Most actors did not think that the bets they were placing with securitized mortgages were bad ones.¹²⁸ Their expectations about future prospects were crucially shaped by convention – widely shared but inaccurate beliefs justifying securitization. “The claim that uncertainty was finally transformed into calculable risk,” writes Ewald Engelen, “was powerfully refuted” when confidence in the quality of the collateral backing securitized assets collapsed.¹²⁹

In 2006 the erosion of house prices across the US badly impaired the collateral underpinning securitized assets. Bankers and traders who had loaded up on risky assets lost badly when securitized assets turned “toxic.”¹³⁰ Banks that owned securitized assets were forced to write down massive losses.¹³¹ Leveraged institutions that relied on short-term commercial paper found it much more difficult to roll over their debts.¹³² With credit markets at a standstill and cascading losses realized, the portfolios of many of the world’s leading banks moved close to, or beyond, insolvency.¹³³ Since the value of asset-backed CDOs held by banks and hedge funds depended on the continued flow of cash payments, the illiquidity of homeowners meant insolvency for banks and other financial institutions.¹³⁴ In October 2008 the IMF estimated that losses in mortgage-backed securities (MBS) and CDOs of asset-backed securities amounted to \$770 billion.¹³⁵ Many large financial institutions

¹²⁴ Posner 2009: 100. ¹²⁵ Keys *et al.* 2010. ¹²⁶ MacKenzie 2009b.

¹²⁷ Fligstein and Goldstein 2011.

¹²⁸ MacKenzie 2011: 1827–30. Johnson and Kwak 2011: 126. ¹²⁹ Engelen 2009: 128.

¹³⁰ Rajan (2010: 141) points out that the CEOs at the helm of the banks taking huge risks were largely compensated in stock, and that the “banks in which CEOs owned the most stock typically performed the worst during the crisis.”

¹³¹ MacKenzie 2011: 1825.

¹³² As the head of a large European money market fund explained, “the problem is that people just don’t know quite what to trust, or not. Probably everything in those portfolios is fine, but people don’t know for sure, and people don’t want to take that risk.” Quoted in Tett 2009: 177.

¹³³ MacKenzie 2011: 1829. ¹³⁴ Schwartz 2009: 183. ¹³⁵ MacKenzie 2011: 1779.

were brought to the brink of collapse. And insurers that had sold protection against losses suffered by CDOs suddenly found themselves on the hook for hundreds of billions of dollars owed to the few traders who had bet against the securitization machine.

That machine hinged on the belief in continuously increasing home prices. Historically, average home prices have appreciated by about 1 percent annually.¹³⁶ But for the bets banks and borrowers had placed housing prices had to continue to rise at an annual rate of 10 percent.¹³⁷ Indeed, market actors expected that the explosive growth in prices after 2000 (home prices climbed by 11 percent each year between 2002 and 2007) would continue unabated. They largely discounted the possibility of a widespread collapse in home prices. In 2005, in a confidential internal report, one of the major investment banks assigned probabilities to future housing prices. The bank guessed that there was a 5 percent chance of what its analysts called a “meltdown” scenario over the next three years. The workhorse model employed by analysts at Moody’s to rate mortgage-backed securities “put little weight on the possibility prices would fall sharply nationwide”; as housing prices climbed upward, the model was not adjusted “to put greater weight on the possibility of a decline.”¹³⁸ Banks thus replicated a widespread social consensus on the nature of the housing market. Lawrence Lindsey, former member of the Federal Reserve’s Board of Governors, observed later: “we had convinced ourselves that we were in a less risky world. And how should any rational investor respond to a less risky world? They should lay on more risk.”¹³⁹

Policy makers were thus caught in the same web of social beliefs and remained largely sanguine about the prospects for the American housing market. In a speech to the Federal Reserve of Chicago in the spring of 2007 Ben Bernanke stressed that home prices were in line with “fundamentals” and that spillover from rising defaults in the subprime class of mortgages would be limited. When the smoke began to clear in early 2009, the average home price in the US had fallen by more than 30 percent.¹⁴⁰ Perhaps people knew that prices of homes and the securities backed by home mortgages had deviated from their fundamental value, and rationally chose to surf the bubble anyway. But if agents had perfect foresight, as rational expectations theory assumes, then lots of

¹³⁶ Housing price data were taken from Robert Shiller: www.econ.yale.edu/~shiller/data.htm, accessed 05/28/24.

¹³⁷ Schwartz 2009: 188. Chinn and Frieden 2011: 44–45. ¹³⁸ FCIC 2011: 121.

¹³⁹ FCIC 2011: 61. ¹⁴⁰ Posner 2009: 105.

canny investors should have shorted the housing bubble.¹⁴¹ If this had happened housing prices would have never reached the heights that they did. Kenneth Rogoff points to the difficulty of fitting asset price bubbles into the rationalist framework: “in theory, ‘rational’ investors should realize that no matter how many suckers are born every minute, it will be game over when house prices exceed world income. Working backwards from the inevitable collapse, investors should realize that the chain of expectations driving the bubble is illogical and therefore it can never happen.”¹⁴² On this point Phelps goes further: “the expectations underlying asset prices cannot be ‘rational’ relative to some known and agreed model since there is no such model.”¹⁴³ Rational expectations theory simply does not square with large world uncertainty.¹⁴⁴

In addition, banks had developed their own techniques for measuring and controlling risk. The most widely adopted model was based on the concept of Value-at-Risk (VaR). The idea behind VaR was straightforward: analysts would use data on the distribution of profits and losses over a specified period to estimate loss thresholds on current trading positions within some confidence interval.¹⁴⁵ By observing daily returns on trading positions over, for example, the past 365 days and assuming that the data-generating process fit the normal, Gaussian distribution, risk managers within investment banks could give senior management a precise dollar figure of the firm’s losses under a worst-case scenario.¹⁴⁶ Believing in the existence of a normal statistical distribution of events is central in a small world of risk – not so, however, in a large world of uncertainty marked by wild jumps best captured by power laws.¹⁴⁷ The VaR procedure was used by banks to estimate how much capital they should reserve to stay solvent in the event of a bad market day. The people managing the bank’s trading book would know when they arrived at the office in the morning that the chances of losing more than, say, \$25 million that day were less than 1 in 20 (if the confidence interval was set at 95 percent). When the Swiss bank UBS applied its variant of the VaR technique to mortgage-backed

¹⁴¹ The fact that only a few did is surprising. The poor quality of the collateral was, after all, not a secret. As MacKenzie points out, investors “could, and not infrequently did, demand to see the ‘loan tapes’ (the electronic records of the underlying mortgages) . . . and they had to be allowed a reasonable time . . . to analyze the contents of such tapes. If they didn’t approve of what they found . . . they might say ‘I don’t like the collateral’ and demand that the mortgage pool be changed before they would buy securities based on it” (MacKenzie 2011: 1799–800). See also Fligstein and Goldstein 2011: 48.

¹⁴² Rogoff 2010. ¹⁴³ Phelps 2009. ¹⁴⁴ Kirshner 2015a: 406–07.

¹⁴⁵ Blyth 2003: 248–51. Cassidy 2009: 274–79. Litzenberg and Modest 2010. Tett 2009: 33–34. Turner *et al.* 2009.

¹⁴⁶ Cassidy 2009: 274. ¹⁴⁷ Taleb 2007. Chapter 1, section 3.

securities, the models suggested that AAA-rated CDOs could never lose more than 2 percent of their value.¹⁴⁸

Originally developed by J. P. Morgan to calculate VaR, the public release of RiskMetrics software established a new convention and one of the most important learning mechanisms for all market players. By the late 1990s VaR measures had been widely adopted. It was not just the investment banks that put their faith in VaR to manage risk. The methodology was formally endorsed by international regulators. In the 1996 amendment to the Basel Accord, banks were allowed to rely on their VaR models to calculate the limits of their market exposure. In a second international agreement negotiated in 2004, most advanced countries agreed to incorporate VaRs into their regulatory systems.¹⁴⁹ The broad diffusion of VaR and its endorsement by regulators are surprising given the litany of problems associated with the approach.¹⁵⁰ The Value-at-Risk methodology makes sense as an efficient mechanism for handling risk only in the absence of the risk-uncertainty conundrum. Otherwise VaR is illusory. It was in fact a recipe for disaster as banks were making bets with hidden risks and uncertainties, as the crisis of 2007–08 illustrated.¹⁵¹ The past is not a good predictor of what happens during extreme crises.

This was not the first time. The 1997 Nobel Prize winners Robert Merton and Myron Scholes, who, together with the late Fischer Black, had invented the model of pricing options, were at that time working for the hedge fund Long-Term Capital Management (LTCM), which was earning outsized returns. In August 1998 existing VaR models dramatically underestimated the riskiness of LTCM's positions.¹⁵² Reflecting on LTCM's dramatic collapse, George Soros observed, "the increasing skill in measuring risk and modeling risk led to the neglect of uncertainty at LTCM."¹⁵³ The model could not handle events – in this case, the Asian Financial Crisis and the Russian government's decision to default on its debts – that lay in the realm of uncertainty.¹⁵⁴ Financial crises are often treated as exogenous "bolts from the blue." Mark Blyth makes

¹⁴⁸ Tett 2009: 136. ¹⁴⁹ Cassidy 2009: 275.

¹⁵⁰ Kay and King (2020: 366–67) stress the importance of unavoidable uncertainty in the application of VaR models. Three major problems are discussed in the *Turner Review* (Turner *et al.* 2009: 44–45): (1) VaR was calculated on the basis of very short time series data (often less than twelve months); (2) because it was based on the Gaussian distribution, VaR systematically underestimated the threat from low-probability, high-cost events that lay in the tails of the distribution; and, most importantly, (3) models failed to appreciate that the very adoption of VaR by many banks could amplify crises by inducing "similar and simultaneous behavior by numerous players."

¹⁵¹ Patterson 2023: 60–61, 105. ¹⁵² Dowd and Hutchinson 2010.

¹⁵³ Quoted in Patterson 2010: 99. ¹⁵⁴ Szpiro 2011.

a convincing case that VaR was instead an endogenous source of instability: “by relying on VaR analysis as a way to minimize risk, market participants ended up precipitating a crisis that had massive dislocative effects across the financial system as a whole.”¹⁵⁵ As noted in the *Turner Review*, VaR “can generate procyclical behavior . . . and it can suggest to individual banks that the risks facing them are low at the very point when, at the total system level, they are most extreme.”¹⁵⁶

Why then did banks, hedge funds, credit rating agencies, and regulators all come to rely on quantitative risk models that were deeply flawed? Keynes offers a compelling answer. In the presence of uncertainty, financial market actors evolved new ways of coping. Regarded as evidence of the emerging science of financial economics, risk-management models were actually operating like social conventions. They offered the illusion that uncertainty had been transformed into manageable risk, thus laying the risk-uncertainty conundrum to rest. These conventions were supported by a powerful, collectively held belief: financial actors were rational agents operating in a world of measurable risk and efficient markets. As Gordon Clark notes, “myopia was justified by a panoptic theory of market behaviour and efficiency where any market distortions would be automatically ‘corrected’ by self-interested principals and agents.”¹⁵⁷ These models could not lead participants to blow up markets and themselves. But since the efficient market hypothesis was based on the assumption of time-independent markets with single equilibrium states, there was good reason to doubt the veracity of the models. The evolution of markets is time- or path-dependent and thus generates multiple equilibria, none of which is completely stable. Human agency matters, and it is impossible to anticipate most contingencies in what is an open and complex system.¹⁵⁸ Subsequent events belied the models spectacularly during the crisis of 2008 and also in subsequent multi-billion losses sustained by trading units of UBS in 2011 and J. P. Morgan in 2012.¹⁵⁹ Focusing on uncertainty helps us understand how intelligent people, in an environment of copious information, adhered to social conventions that led them to believe that they were making decisions freed from the risk-uncertainty conundrum. Financier David Einhorn was on the mark when he belittled these models as airbags that work all the time except when the car has an accident.¹⁶⁰

¹⁵⁵ Blyth 2003: 251.

¹⁵⁶ Turner 2009: 58. www.actuaries.org/CTTEES_TFRISKCRISIS/Documents/turner_review.pdf, accessed 01/14/25.

¹⁵⁷ Clark 2011: 7. ¹⁵⁸ Smolin 2013: 258–63. ¹⁵⁹ Protess *et al.* 2012.

¹⁶⁰ Lockwood 2015: 719.

Relying on conventions, interpretive capacities of individual or collective actors can, at best, stabilize uncertainty contingently.¹⁶¹ They cannot eliminate uncertainty. Social conventions are important because they feign that we can control an uncertain future.¹⁶² In the 2008 American financial crisis, social conventions evolved from the widely shared belief in the inevitably upward movement of prices in the housing market and from the unqualified trust of bankers and traders in the quantitative, tractable models of market risk employed by financial institutions and credit rating agencies.¹⁶³ Rational expectations ruled out the possibility that the vast majority of informed people in deep, liquid, and competitive markets could make costly errors. Keynes, contrarily, is reputed to have observed that “markets can stay irrational longer than you can stay solvent.”

Ironically, as money manager Keynes contradicted this *aperçu*. Misguided speculation almost cost Keynes his shirt in the 1920s. And between 1927 and 1932 returns on his investments slightly underperformed British stock markets. Around 1933 Keynes integrated his earlier work on risk and uncertainty with the general economic theory he was then developing. Thereafter his investments vastly outperformed British markets until his death in 1946. Taking heed of his own argument, Keynes abandoned speculation and adopted a “buy and hold” philosophy. Cleverly sidestepping the complementarity of risk and uncertainty, this investment strategy provided the model for Warren Buffett, the icon of American investment success in recent decades.¹⁶⁴

3. The Hybrid World of Risk and Uncertainty

Financial markets, writes banker-lawyer Charles Morris, “occupy an ambiguous position between the world of hard science and the reflexive world of humans. In settled times, markets frequently do appear to be governed by law-like statistical rules, which enamor economic modelers. But those regularities break down dramatically in times of stress because of the reflexive, or mutual, interaction between human expectations and actual market behavior.”¹⁶⁵ When actors calculate to cope with conditions of risk and uncertainty they cannot help but be embedded, cognitively and socially, in contexts filled with tacit knowledge that is informed by their worldviews, routines, and shared interpretations that seek to cope with the complementarity of risk and uncertainty. As is true for theories, models, and methods more generally, depending on how the question is

¹⁶¹ Latsis *et al.* 2010. ¹⁶² Langley 2008: 481. ¹⁶³ Millo and MacKenzie 2009: 641.

¹⁶⁴ www.maynardkeynes.org/keynes-the-investor.html, accessed 08/25/23. Zeckhauser 2010: 305–12, 341–43.

¹⁶⁵ Morris 2009: 13–14.

posed at different times rational expectations and social conventions can clinch or vouch for their arguments.¹⁶⁶ Episodes in the history of financial accounting and trading illustrate this point.

The history of accounting reveals stable periods when risks are clearly calculable, information objectives are uncontested, and accounting is reduced to providing answers through technical and professional practices. In times of crisis, however, accounting is marked by profound uncertainties. When markets turn illiquid or disappear altogether and the very standard of measurement by which accounts are kept collapses, as it did in 2008 and 2009, how can accounting practices assess the value of assets? For one simple reason there is no clear answer to this question.¹⁶⁷ The standard of accountability by which actors assess value and risk is a variable story of evolving epistemic conflicts, claims, and consensus that shape and are shaped by the economy. Far from a mechanical exercise in counting, accounting is often an interpretive art of reading and manipulating accounts.¹⁶⁸ It consists of historically contingent practices of calculation that allow us “to describe and act on entities, processes, and persons.”¹⁶⁹ Like language, theory, and models accounting has a performative side to it. It does not merely represent economic reality. It also shapes it.

Spurred by and reflective of the global rise of the American economy in the twentieth century, the social purpose of accounting practices has shifted from the protection of creditors and the guarantee of prudent stewardship to the provision of information for investors. This shift entailed dealing with a difficult issue – finding an appropriate measure of value. For many decades the standard had been historical costs. But since it was so inaccurate, cost remained a default standard that yielded to a series of piecemeal solutions and a multitude of incommensurable measurement conventions. Starting in the 1960s the push for a uniform asset-liability measure of balance sheets and market valuation was particularly strong in the United States. Subsequently this innovation spread to many other economies. As a consequence, the very nature of the firm was reimagined as a set of tradable rather than specific assets. In the wake of the 2001 Enron bankruptcy, the terminology of “creative accounting” entered conventional language. Such accounting overstated assets, inflated earnings reports, and led to a crisis for the accounting profession.¹⁷⁰ The rise of financial economics, with its presumption of the absence of uncertainty, created a growing distance between the analytical abstraction of finance economics and the empirical complexity of

¹⁶⁶ Cartwright 2007. ¹⁶⁷ Miller 1998. ¹⁶⁸ Veron *et al.* 2006.

¹⁶⁹ Chapman *et al.* 2009; 1. Power 2012. ¹⁷⁰ Veron *et al.* 2006: ix–xiii.

accounting practices. Yet investors found that the usefulness of abstracting from the world, of capturing complex issues of valuation in a few simple numerical ratios, was simply too attractive. Business schools taught the new models. MBAs implemented them in the world.

The “fair value” controversy during the 2007–08 financial crisis raised to renewed prominence the issue of how to measure value. Fair value is an imaginative construct that is deeply embedded in finance economics but only coincidentally observable in market prices. When markets were flush with liquidity “fair market value” had established itself quite readily and diffused internationally. “Idealists” championing the simplicity and coherence of the new standard prevailed over “pragmatists” who pointed to variegated practices on the ground.¹⁷¹ With markets turning down sharply or illiquid in 2008, should mark-to-model valuation take the place of no longer operative mark-to-market valuation?¹⁷² The central question about the relation between an abstract model world and a world grounded in specific practice was not settled by the financial crisis. Financialization strengthened the trend toward abstraction and quantification, illustrated by the fair market value movement and its implicit politics.¹⁷³ “The management of organisations,” one study concludes, “is rapidly being transformed into and formalised around the management of risk, while much of the management of uncertainty occurs through a variety of hybrids that reside beyond the formalized practices of risk management.”¹⁷⁴ In short, accounting is both a unifying interpretive exercise in the small world of risk and a highly variable set of contested practices in the large world of uncertainty – another instance of the risk-uncertainty conundrum.

More than anybody else arbitrage traders are experiencing these two worlds first-hand. This starts with the financial sector’s difficulties in measuring accurately the risks of their products. In times of crisis that difficulty threatens the viability of banks because it increases uncertainty about the size of bank assets.¹⁷⁵ Furthermore, just as traditional value investors and momentum investors have different ways of determining economic value, so modern arbitrage depends on the possibility of interpreting securities in multiple ways. In the words of sociologists Daniel

¹⁷¹ Power 2012: 300–05.

¹⁷² “Mark-to-market” is an accounting rule stipulating that asset values must reflect current market prices. During the height of the panic, market prices could not be identified, so accountants turned to indices based on buying and selling protection against subprime risk (“ABX”) to enforce “marking.” See Gorton 2010: 64, 130–01.

¹⁷³ Perry and Nölke 2006.

¹⁷⁴ Miller *et al.* 2008: 683. Similarly, the brief 2022 crisis of regional banks saw many panicking over how to value deposits.

¹⁷⁵ Lepinay 2007: 88.

Beunza and David Stark “like a striking literary metaphor, an arbitrage trade reaches out and associates the value of a stock to some other, previously unidentified security.”¹⁷⁶ Risk does not inhere in the value of assets but is created by subjective and social processes that cultivate and tax the cognitive flexibility of traders. In the Wall Street trading room of a major international investment bank this aspect of entrepreneurship is re-expressed in the institutionalized ability to keep multiple evaluative principles in play. This is accomplished through organizing traders into multiple teams with different tasks that constitute different communities of practice committed to different evaluative principles.¹⁷⁷

The same principle operates also outside of trading rooms. Traders engage in reflexive modeling.¹⁷⁸ They compare their best principle of evaluation and bet against markets as reflected in price spreads. When spreads narrow other traders share their assessment and the trader is going to make money; when spreads do not narrow, the trader is going to lose money and will have to reevaluate her initial assessment or take the loss.¹⁷⁹ Successful trading can move markets and thus create self-fulfilling prophecies, bubbles, and, eventually, spectacular crises.¹⁸⁰ In the words of Roland Bénabou “market bubbles and manias exhibit the same pattern of investors acting ‘colorblind in a sea of red flags,’ followed by a crash.”¹⁸¹ In the run-up to the creation of the European Monetary Union (EMU), for example, traders recognized that the prices of southern European and German bonds were bound to converge, with Spanish, Italian, and Greek prices falling as those countries would benefit from the reputation and practice of German fiscal rectitude. As a consequence, southern European bond prices increased and yields fell. Everybody gained as risk taking led to rewards for traders, governments, and financial markets – until the music stopped in early 2010 with the onset of the Eurozone sovereign debt crisis.

Unwittingly, traders can also create the very uncertainties that their trading in risk is supposed to mitigate. This was the case in the near-collapse in 1998 of one of the largest and most successful hedge funds of the day, Long-Term Capital Management (LTCM).¹⁸² Across diverse asset classes held worldwide, the unwinding of arbitrage positions caused very large, highly correlated price movements. For the very success of LTCM had led to widespread imitation, which created partially overlapping arbitrage positions and much higher rates of correlation among diverse asset classes than the traders at LTCM were aware of. When

¹⁷⁶ Beunza and Stark 2005: 87. ¹⁷⁷ Beunza and Stark 2005: 90–92. ¹⁷⁸ Buck 1963.

¹⁷⁹ Beunza and Stark 2012a. ¹⁸⁰ Hardie and MacKenzie 2012: 189.

¹⁸¹ Quoted in Sorkin 2017: F2.

¹⁸² de Goede 2001. Lowenstein 2000: 143–60. Holzer and Millo 2005: 235–39.

Russia defaulted on its ruble-denominated bonds and then devalued the ruble, the ensuing market preference for safe and liquid investments led to a self-reinforcing downward spiral of asset prices in various markets that required a massive bailout of LTCM by some of the world's largest banks.¹⁸³ LTCM's risk-management models were conservative and profitable. The fact that they were open to imitation proved to be the undoing of the fund. Imitation led to cognitive interdependence, overconfidence, and, ultimately, collective failure.¹⁸⁴ This social dimension of trading can be reinforced by the importance of common social and educational backgrounds and geographic proximity, which encourages herding and hubris.¹⁸⁵ Arbitrage could not remain a self-contained, economically rational strategy. It was firmly embedded in a larger social context that linked risk and uncertainty. And what is true of arbitrage is true generally. In this example risk is subjective, social, and of course tethered tightly to uncertainty.

Since in trading the small world of risk and the large world of uncertainty are deeply entangled, it is no surprise that the boundaries separating arbitrage (risk-free trading), hedges (risk-reducing trading), and speculation (risk-seeking trading) are porous – and not only on Wall Street. In his analysis of Japanese traders Hirokazu Miyazaki was struck by “the ambiguous and constantly shifting conceptual boundaries of the category of arbitrage vis-à-vis the broader category of speculation.”¹⁸⁶ What is true of practice is true of product. Vincent Lepinay's research on the trading of new financial products in a French bank reports that “no one knows for sure how best to describe these products. The problem is not a paucity of descriptions, but rather an embarrassment of riches.”¹⁸⁷ Managers who intervene because traders are incurring losses are doing so even when traders try to convince them that the losses are temporary and will soon turn into gains. Yet managers often cannot discern when traders have stopped acting as hedgers and started acting as speculators on the rise or fall of prices. The limits of arbitrage arise when differences in subjective risk expectations create opportunities for arbitrage. And they arise also when a rational and prudent trader faces uncertainty regarding whether, when, and to what degree peers will join in exploiting a common arbitrage opportunity that the trader has spotted.

Caitlin Zaloom provides an ethnographic account of the inseparably intertwined risk taking and speculation of traders. “Rationalized risk-management markets,” she writes, “establish the conditions for speculation

¹⁸³ MacKenzie 2005: 65, 69–74. ¹⁸⁴ Beunza and Stark 2012b.

¹⁸⁵ Carruthers 2010: 17–20. ¹⁸⁶ Miyazaki 2013: 8; see also 2007: 399.

¹⁸⁷ Lepinay 2011: xix.

in financial contracts.”¹⁸⁸ Indeed, the very perspective on the management of risk diverts our attention away from the untoward consequences of uncertainty that can upend even the most nimble, attentive, and disciplined trader. In futures markets, traders often run up against the inherent limits of fully objectifying and containing uncertainty.¹⁸⁹ The institutionalization of imitation in the world of traders is an existential condition in the unending search for what often turns out to be fool’s gold.¹⁹⁰

Kay and King venture the guess that historical rather than theoretical developments have provided the foundation for the coping rationality of “fast and frugal” heuristics in a world of risk and uncertainty. Evolution helped along ecological forms of rationality that differ from the rationalist optic favored by economists.¹⁹¹ The human history of alchemy surely will continue in the future concealed by always changing information technologies. Improving on the narrow economic rationality believed to be operating in the small world of risk, evolutionary history has endowed humanity with ways of knowing and coping that may be more appropriate for living with the risk-uncertainty conundrum.¹⁹²

4. Central Bankers Talking to Markets

In a famous essay on the methodology of positive economics published in 1953 Milton Friedman compared economics with physics.¹⁹³ Both construct abstract models, physics of bodies falling in perfect vacuums and economics of actors rationally calculating their interests, based on perfect information. The realism of the assumption, Friedman famously argued, did not matter in either case. What mattered was the accuracy of the predictions these models generated. Often not exceeding educated guesswork, economic prediction has an accuracy that falls far short of Newtonian physics. To date, specialization in financial economics has not succeeded in affixing credible probabilities to possible futures. In fact, computers running crude extrapolation algorithms rather than sophisticated statistical models have bested economic experts.¹⁹⁴ But more than half a century of predictive failure has done nothing to undermine the stature of economics as “the queen” of the social sciences. Friedman implicitly shared with his audience a Newtonian humanism that informed his theorizing and helps explain a PR success that has been nothing short of spectacular. The metaphor of the free market as a spontaneous, self-correcting machine updated Adam Smith’s “invisible hand” for twentieth-century capitalism.

¹⁸⁸ Zaloom 2006: 93, 94. ¹⁸⁹ Zaloom 2006: 95. ¹⁹⁰ Rao *et al.* 2001.

¹⁹¹ Kay and King 2020: 152–53, 154–77, 268–76, 402–17.

¹⁹² Kay and King 2020: 16. ¹⁹³ Friedman 2008: 153. Blakely 2020: 13–18.

¹⁹⁴ Tetlock 2005: 59, 247.

It established the authority of economics as an important part of public culture. Performing before the audience of government regulators, the general public, and markets has made smooth-talking economic commentators look like knowledgeable, responsible, and authoritative interpreters of our financial future. Despite their recurring “predictive” failures, their rhetoric displays an astonishing amount of “productive” power in shaping the political economy of the day.

Although central banks matter greatly, in recent decades their conventional policy tools have been found wanting.¹⁹⁵ The spotlight thus has shifted to their world-making and story-telling powers. Put simply, these days the most important task for central bankers is to “talk” to markets.¹⁹⁶

Rather than being “represented,” language enacts or “re-presents” the economy.¹⁹⁷ For several decades before the financial crisis of 2007–08 revealed their flaws, central bankers relied on “econometric allegories” to shape market expectations.¹⁹⁸ The allegories of rational expectations theory came to provide the only language in which central bankers and monetary economists could speak with confidence and credibility.¹⁹⁹ Finance theory was incorporated into markets as a legitimating linguistic device.²⁰⁰ A trader for Solomon described some of the downsides of this practice. The Gaussian assumption of a normal distribution of risk was occasionally built into some of the models simply for convenience’s sake: “sometimes we’d assume normal just to make it even more simple.”²⁰¹ In the words of Alan Blinder “economists . . . have bent reality (at least somewhat) to fit their models.”²⁰²

His qualification – “at least somewhat” – speaks to the importance of markets as Michel Callon’s “calculative collective devices.”²⁰³ Financial goods and services are often extremely uncertain in their values, and the number of actors involved in financial markets is often very large and highly dispersed. “How can agents calculate when no stable information or shared prediction on the future exists?”²⁰⁴ Markets are effective institutions because they make possible complicated calculations that yield practical solutions that could not be reached only by theoretical reflection.²⁰⁵ Calculative behavior goes beyond numerical calculations. It is a hybrid of calculation, judgment, and imagination. In moments of crisis, it relies on interpersonal trust to keep the system running. At the height of the 2008 crisis, for example, the Federal Reserve stepped into

¹⁹⁵ Pigeon 2011: 255. ¹⁹⁶ Blinder 1998, 2004. Blinder and Reis 2005. Swanson 2023.

¹⁹⁷ MacKenzie 2006. ¹⁹⁸ Blinder and Reis 2005: 5. ¹⁹⁹ Hall 2008: 183.

²⁰⁰ MacKenzie 2006: 29–30, 32–33, 255–59. MacKenzie *et al.* 2007: 4–5.

²⁰¹ MacKenzie 2006: 215. ²⁰² Quoted in MacKenzie 2006: 25.

²⁰³ Callon and Muniesa 2005: 1229–31. ²⁰⁴ Callon 1998: 6.

²⁰⁵ Callon 1998: 23–32.

the role of an international lender of last resort by injecting \$600 billion in emergency funds to shore up the position of some central banks but not others.²⁰⁶ The laws of the market are neither discoveries revealing hidden truths nor pure constructions illuminating an opaque reality. Economic laws are better thought of as “regularities progressively enforced by the joint movement of the economy.” Such regularities in practice connect the obduracy of the world with the contingency of the artifact of reason conveyed through multivalent language.²⁰⁷

Resonating with post-Newtonian and para-humanist worldviews, from the vantage point of language, a financial crisis is not an event “out there” but a set of interpretive and rhetorical acts “in here.” These acts have different effects in different places and at different times. The ideas of economists are part of a social performance of localized practices. They are assimilated by experts and policy makers who, sometimes against their better knowledge, pretend that these ideas are true. Cast in the form of stories, economic ideas are thus put into the service of re-presenting rather than representing reality. Furthermore, these ideas are built into the operation of both the financial system and the system of government regulation.²⁰⁸ Beyond all calculative tools, judgment devices and cultural frames are central for decisions made under conditions of uncertainty.²⁰⁹ A fictional future is not disclosed as such and regarded as separate from the world. Instead, it is perceived as a natural though contestable story about the future that emerges in the process of social interaction. When calculation-based expectations under conditions of uncertainty are beyond reach, fictional rather than rational expectations are the foundation for non-capricious action.

This is the view of one of the leading “quants” in the world of finance. Evoking Newton’s unsuccessful experience as a speculator, Emanuel Derman views his models as “imaginary” inquiries.

In physics you’re playing against God . . . When you’ve checkmated Him, He’ll concede. In finance, you’re playing against God’s creatures, agents who value assets based on their ephemeral opinions. They don’t know when they’ve lost, so they keep trying . . . The right way to engage with a model is, like a fiction reader or a really great pretender, to temporarily suspend disbelief, and then to push it as far as possible.²¹⁰

And it is not only the world of models that has fictitious elements. In the social world we all inhabit, “the imagined future can affect the present, and thereby the actual future too.”²¹¹ Financial stability and instability

²⁰⁶ Sahasrabuddhe 2024. ²⁰⁷ Callon 1998: 46. ²⁰⁸ Riles 2011. Hjertaker 2011.

²⁰⁹ Beckert 2010: 2, 7, 9, 25, 30. ²¹⁰ Derman 2004: 266–69.

²¹¹ Derman 2011: 142.

are not the outcomes of autonomous market dynamics as much as they are deeply intertwined with imagined futures.²¹² This is not a recent development. It was as true of the commercial law for merchants that developed in Europe over several centuries as of the legal fictions sustaining neoliberal ideas during the last several decades.²¹³

Decision making in the Federal Reserve confirms the importance of stories fashioned in the shadow of the risk-uncertainty conundrum.²¹⁴ The economic crises of the late 1970s, early 1980s, and early 2000s left members of the Federal Open Market Committee (FOMC) perplexed and conflicted. Transcripts of their meetings point to “the existence of confusion and uncertainty” that were strategically obscured from the public “to maintain the mythic view of technical rationality.”²¹⁵ Policy makers needed both to make sense out of new economic environments and at the same time come up with stories that would shape the views of others who were watching and listening. The process was inherently conflictual, both within the Federal Reserve and also between the Federal Reserve and market actors. It was a conflict less over discrete preferences and more over shared understandings and the meaning of different stories.

The transcripts of the 1982 FOMC meetings, for example, show how Chairman Paul Volcker helped break the way conventional economic analysis had framed policy in the midst of a deep recession. Confusion and the lack of viable alternatives led to a collective questioning by members of the FOMC of what to do. Volcker reframed the issues by denigrating the importance of conventional monetary targets, evoking the memories of 1929 as the relevant comparison for the worldwide recession of 1982, pressing for a lowering of interest rates, and underlining the importance of uncertainty in an era of transition. In short, he came up with a different story.

Judging by the published transcripts of their meetings between 2003 and 2005, members of the FOMC were aware of both risk and uncertainty.²¹⁶ The 2003 meetings, for example, were held just prior to the invasion of Iraq when the prospect of war and its uncertain effects on oil markets were all-pervasive. The 2005 meetings occurred in the context of skyrocketing housing prices. The discussions show that central bankers

²¹² Dobbin 2004. ²¹³ Riles 2011. Swedberg 2004.

²¹⁴ Smialek 2023a. Leonard 2022. Blinder 2013. Greider 1987. ²¹⁵ Abolafia 2012: 94.

²¹⁶ It is noteworthy that Alan Greenspan’s (2010) lengthy reprise of the crisis refers frequently to the concept of risk and has virtually nothing to say about uncertainty. In contrast, in 2004 Greenspan (2004: 38) acknowledges the existence of uncertainty: “policymakers often have to act, or choose not to act, even though we may not fully understand the full range of possible outcomes, let alone each possible outcome’s likelihood.”

were framing their policy choices in terms of both risk and uncertainty. Peering into a dense fog, FOMC members were acutely aware that the Federal Reserve's guesses had the power to move markets. Hoping to stabilize expectations, with their stories they tried hard to build common understandings under conditions of uncertainty.

Discussions of the FOMC during the financial crisis of 2007–08 show an even greater emphasis on story-telling during uncertainty. Surprise, confusion, groping forward, and sense making is how economic sociologist Mitchel Abolafia summarizes how members of the FOMC coped with totally unexpected conditions. Their interpretations sought to mend the jarring tears in the fabric of accustomed expectations.²¹⁷ Sense making was helped by reams of statistical and qualitative information and the conventions of macroeconomics and central banking practices at which FOMC members excelled. The existing tool kit of policy enhanced the group's learning, innovation, and improvisation. Analytic discretion was its preferred option – for Abolafia “a synthesis of conventionalized economic facts, constructed narratives, and pragmatic experimentation.”²¹⁸ Sense making by the FOMC was based not on the aggregation of individual opinions but on an adaptive group process of deliberation shaped by a shared story told in a specific cultural context. FOMC members were deeply steeped in the logic of modern finance theory and imbued with an abiding faith in the resilience of finance. Their initial discussions in August 2007 revealed a trained incapacity to sense the frailty of financial markets. At first, the narrative of self-correcting markets made the contagion narrative of out-of-control markets unpersuasive. Over the course of the crisis the FOMC gradually let go of the traditional way of framing issues and moved to a new story reflecting a pragmatic mode of experimentation in new circumstances. The creation of plausible stories takes up the largest part of the transcripts of the FOMC meetings.²¹⁹ Narration as part of sense making eschewed decontextualized and conveniently calculable facts that proved simply unhelpful in dynamically changing markets sending ambiguous signals.

Members of the FOMC thus learned gradually that statistics were of limited use in predicting the future. Instead of trusting standard scientific tools they created stories and matched them with patterns familiar from prior experience.²²⁰ Used almost as frequently as the term “uncertainty,” in the fall of 2007 the term “risk” generally referred to the costs of the uncertain. It betrayed the view of a concrete and fully knowable world. But the FOMC also articulated a pragmatic approach which focused less

²¹⁷ Abolafia 2020: 1–3. ²¹⁸ Abolafia 2020: 3. ²¹⁹ Abolafia 2020: 9, 27–29, 155.

²²⁰ Abolafia 2020: 160–61.

on the cause of the crisis and more on learning from the effects of the FOMC's actions themselves. Knowing, acting, and understanding became inseparable in a creative merging of positivist and interpretive epistemologies. In the domain of risk and uncertainty scientific knowledge, Abolafia concludes, was vital but not sufficient.²²¹ Scientific epistemologies were "archaic." They failed to acknowledge that financial contagion was not a manifestation of hysteria but of a systemic weakness that new financial instruments and practices had introduced into markets. And this required the fashioning of new stories.²²²

Language is a powerful weapon in the arsenal of the Federal Reserve. Aided by an attentive public that is informed by influential institutions – print, electronic and social media, hedge funds, banks, and governments – central banks have sought to create self-fulfilling policies to suit their purposes. This can raise novel issues. As Abolafia writes, "there is uncertainty in acting and uncertainty in not acting . . . the Fed is compelled to shift uncertainty to risk . . . The danger is that proficient masters of spin become so confident in their technical discourse that the restraints of uncertainty and legitimacy are no longer sufficient to encourage prudent questioning of the current operating models."²²³ Compelling and widely shared central bank narratives are an important resource for strategically influencing the expectations and practices of market participants. For markets are Alan Blinder's "giant biofeedback machines" that monitor and publicly evaluate Fed policies.²²⁴ Secrecy and insularity have given way to openness and transparency as a way of increasing the efficacy of central bank policies. As Blinder has noted, "the best a central bank can do is to 'teach' the market its way of thinking."²²⁵ During his long tenure Chairman Greenspan perfected his talking skills.²²⁶ The combination of frank admission of complexity with seasoned judgment made his legendary obfuscation a linguistic art form. He once reminded an audience of businessmen that "if I've made myself too clear, you must have misunderstood me."²²⁷ In moments of crisis, his stories generated faith in the Fed's ability to cope with an unknown future. Stories helped stabilize the "contingent expectations" of market actors that govern decisions under uncertainty.²²⁸ In short, the social power of central banks rests not only on shaping information about prices in risky markets but also on skill in negotiating with markets over the interpretation of indeterminate situations under conditions of uncertainty – a good description of the complementarity of risk and uncertainty.²²⁹

²²¹ Abolafia 2020: 157. ²²² Abolafia 2020: 45–47, 111–12.

²²³ Abolafia 2012: 110–11. ²²⁴ Blinder 1998: 62. ²²⁵ Blinder 2004: 25.

²²⁶ Blinder and Reis 2005: 6–9. ²²⁷ Cornwell 1996. ²²⁸ Beckert 2012: 18–19.

²²⁹ Hall 2008.

Twenty-four-hour news cycles, ever-present social media, and AI have made central bankers increasingly aware that their statements have profound effects on markets and the economy. But how, precisely, does the talk of central bankers affect the economy? In the conventional view of language as a mirror, the economy can be captured by knowable laws and statistical regularities. Language matters only as an instrument that represents economic objects and processes. Disagreements over economic issues, accordingly, are not differences over which stories best capture laws or regular economic behavior. Central bankers know market dynamics and represent their knowledge through language.

Often, however, and especially in crisis conditions, central bankers generate economic outcomes by the stories they tell. Like actors on a stage, central bankers perform by telling stories designed to nudge markets in a preferred direction. Financial markets and the economy are for economist Douglas Holmes “communicative fields” that are a function of language.²³⁰ They are abstract metaphors of complex patterns of social action undertaken by individuals, groups of actors, corporations, and institutions. All of these actors have different pictures of what everyone else is thinking, doing, and planning. And central bankers can shape the pictures market participants hold of the airy abstraction called “the economy.” Since the mid-1990s the Federal Reserve has become increasingly aware of its communicative power and has used it strategically to help produce its preferred outcomes. The seemingly incoherent mumbling of Federal Reserve chief Alan Greenspan was deliberately tailored to create images of the future economy that helped shape expectations and thus move the economy in the direction the Federal Reserve deemed desirable. Aiming to bring into being a specific state of the economy, the Federal Reserve’s language was performative.²³¹ This productive use of language creates the context for statistical data and econometric predictions. Thus, the shifting and fugitive dynamics of the economy are made available to all market participants through language.²³² Put differently, acting in the large world of uncertainty the Federal Reserve has tried to talk the economy toward the small world of risk.

5. Extensions and Reflections

Economics, writes political scientist James Scott, has “incorporated calculable risk while exiling those topics where genuine uncertainty prevails.”²³³ Beyond finance, on general questions of political economy

²³⁰ Holmes 2014: 15, 32–35. ²³¹ Holmes 2014: 11, 15, 26. ²³² Holmes 2014: 25.

²³³ Scott 1998: 322.

students of world politics have imitated economics and also ignored uncertainty. The paradigmatic American approach to the study of International Political Economy – “Open Economy Politics” (OEP) – moves entirely in the world of risk. In a paper addressing the effects of uncertainty, David Lake and Jeff Frieden concede that uncertainty increases in crises and then proceed to argue that risk and uncertainty “are similar enough to be conflated for our purposes.”²³⁴ In this way they and many scholars of international political economy follow the long line of economists who treat the difference between risk and uncertainty as semantic rather than substantive.²³⁵

In OEP economic actors have clear preference orderings. Interests are deduced from an actor’s position in markets. Policies and outcomes are ranked according to how they affect an actor’s expected future income stream. Interests are aggregated by institutions, which in turn structure the bargaining that occurs. The main advantage of OEP is its deductive argument about preferences. OEP scholars start with sets of actors who “can be reasonably assumed to share (nearly) identical interests ... Deducing interests from economic theory was the essential innovation of OEP.”²³⁶ This approach has stunted political analysis. Political potentials, innovation, and creativity are made invisible in a static framework that assumes that the preferences of actors are determined by their structural position. OEP derives parsimonious theories of politics from sparse economic theory. The flow is from micro to macro in an orderly, linear progression. To simplify analysis, work in the OEP tradition adopts a partial equilibrium analysis by focusing, at most, on one or two steps in this causal chain and treating the others in reduced form, a simplification that reduces complexity by holding constant many elements that otherwise would make analysis more complicated and perhaps numerically intractable. In principle though all partial analyses can be assembled into one integrated whole. Entangling processes are absent in this mechanistic approach grounded in Newtonianism.

²³⁴ Lake and Frieden 1989: 6–7.

²³⁵ Ahlquist 2006. Bernhard and Leblang 2006. Bernhard *et al.* 2002. Koremenos 2005. Koremenos *et al.* 2001. Mosley 2006. Rosendorff and Milner 2001. Sobel 1999. For dissents without repercussions in OPE, see Blyth 2002, Oatley 2011, and Nelson and Katzenstein 2014. Rathbun (2007) argues that while “uncertainty” is a central concept in the study of international relations, competing research traditions in the field (realism, rationalism, cognitivism, and constructivism) define the term differently.

²³⁶ Lake 2009b: 50; 2009a: 226–27, 230–31; 2006. OEP rests on two core assumptions: (1) economic policies produce income effects that are driven by an agent’s position in the domestic and international division of labor and (2) economic agents, once they know what they want, make rational decisions as if they knew the relevant probability distributions.

The “rational expectations revolution” had a profound effect on OEP and the field of International Political Economy. According to Jonathan Kirshner, a central tenet of IpE (the lower-case “p” underlines the unimportance attached to politics in this formulation of political economy) is “that if rational agents have access to the same information, they will reach the same conclusions about expected outcomes.”²³⁷ Informed by rational expectations theory, OEP thus moves exclusively in the world of risk.²³⁸ The assumption that interests can be read off the agents’ situation in the international division of labor constitutes the “hard core” of the OEP paradigm.²³⁹ Strategic decision making is modeled as unproblematic because analysts do not know how to model uncertainty. OEP transposes uncertainty into risk even though the rules of the game are unclear, and their future trajectory is pure guesswork.²⁴⁰ This is an important reason why the collective performance of the field of political economy in the years around the financial crisis of 2008 was, in the words of Benjamin Cohen, a leading scholar of international political economy, “embarrassing” and “dismal.”²⁴¹ To be sure, OEP specialists were not alone in missing the signs of the gathering storm. It is nonetheless surprising how little scholars of OEP had to say about the financial crisis after it had passed. With the exception of one review essay on financial market regulation, in the five years after the financial crisis broke out in 2007 the subfield’s premier journal did not publish a single article on it.²⁴² This collective silence makes apposite Lawrence Summers’ biting criticism of macroeconomics: OEP scholars are unlikely to learn much as long as they put on “the armor of a stochastic pseudo-world before doing battle with evidence from the real one.”²⁴³ And most of the time the real world contains a healthy dose of uncertainty.

Sympathetic to OEP, yet insisting on the autonomy of politics, Gourevitch and Shinn make an important modification to address the limitations of an exclusively risk-based analysis. In their view, the assumption of OEP about the origins of preferences is too arbitrary in ruling out the importance of political autonomy and its corollaries – potentialities residing in the domain of the unknown. Structurally induced economic incentives are not determinative on their own. Often, they yield to the complexities of coalition formation driven by an unconstrained politics. “We stress incentives and interests . . . the rules of production do influence behavior . . . Where we disagree on emphasis is in explaining the

²³⁷ Kirshner 2011: 205; 2014: 46–48. ²³⁸ Kirshner 2015a. ²³⁹ Lake 2009a: 231.

²⁴⁰ Holzer and Millo 2005: 228. ²⁴¹ Cohen 2009: 437.

²⁴² Helleiner and Pagliari 2011. In personal correspondence (10/2/16), *International Organization*’s then editor, Jon Pevehouse, also expressed his astonishment.

²⁴³ Summers 1991: 146.

origins of those rules (politics for us [is] not . . . the ‘autonomous’ economy pure and simple).”²⁴⁴ The complex politics that Gourevitch and Shinn evoke includes large world uncertainty that OEP disregards at its peril.

Financial markets are frequently rocked by unpredictable and destabilizing events.²⁴⁵ Yet many scholars and practitioners continue to assume that finance lies squarely in the world of manageable risk, overlooking the risk-uncertainty conundrum.²⁴⁶ A world that mixes calculable risk with unknowable uncertainty creates ambiguities that have to be acknowledged, unraveled, and circumnavigated rather than denied. Denial creates a hubris that can lead to great harm. Two of the leading “quants” of finance, Emanuel Derman and Paul Wilmott, express caution and humility in reacting to the 2008 crisis. Their Modelers’ Hippocratic Oath reads:

I will remember that I didn’t make the world, and it doesn’t satisfy my equations. Though I will use models boldly to estimate value, I will not be overly impressed by mathematics. I will never sacrifice reality for elegance without explaining why I have done so. Nor will I give the people who use my model false comfort about its accuracy. Instead, I will make explicit its assumptions and oversights. I understand that my work may have enormous effects on society and the economy, many of them beyond my comprehension.²⁴⁷

This oath resonates with cosmologist Andrew Pontzen, who is working with computer simulations. He acknowledges that at present cosmology cannot predict either future or past. “Ultimately galaxies are less like machines and more like animals – loosely understandable, rewarding to study, but only partially predictable. Accepting this requires a shift in perspective, but it makes our vision of the universe all the richer.”²⁴⁸

After he had presided over an extended boom and the greatest financial crash in two generations, a baffled Alan Greenspan, at the ripe age of 87 published *The Map and the Territory*.²⁴⁹ The book acknowledges that maps can warp the territory.²⁵⁰ Greenspan had mistaken the economists’ map of the small world of risk as an accurate tool for navigating the large world of uncertain financial markets. He ruefully commented on the existence of levels of risk “many multiples greater” than exist in the physical sciences.²⁵¹ Before the universally unanticipated financial crisis of September 2008 hubris was the watchword of Greenspan’s “Great Moderation” and his widely celebrated success in taming capitalism’s unpredictabilities. Humility came later.

²⁴⁴ Gourevitch and Shinn 2005: 93.

²⁴⁵ Taleb 2007. Pauly 2011: 250–51. Blyth 2013: 210–11. ²⁴⁶ Kessler 2011: 2177.

²⁴⁷ <https://jrvilab.github.io/post/modelers-hippocratic-oath/>, accessed 12/12/22.

²⁴⁸ Overbye 2023. ²⁴⁹ Greenspan 2013. ²⁵⁰ Clancy 2024. ²⁵¹ Greenspan 2013: 6.

Evoking Newton's unhappy assessment of the "madness of people" that cost him a fortune in the 1720 crash of the South Sea Company, Greenspan reflects on irrational behavior that is "hard to measure and stubbornly resistant to any reliable systematic analysis."²⁵² Moral hazard offers one example.²⁵³ In the insurance business it is a byproduct of turning incalculable uncertainty into calculable risk. Before statistical data became widely available, stereotyping and discriminatory profiling practices were the rule. Moral hazard referred to specific characteristics of insurable individuals that put them in an "uncertain" category, outside of the bounds of socially acceptable risk measurement. Over time "moral hazard" shifted from referring to the intrinsic, unmeasurable, and uncertain character of an individual to the attribute of a population that could be measured quantitatively and assessed in terms of risk.²⁵⁴

Insurers now set premiums that take account of predictable risk differences in moral hazard existing within specific populations.²⁵⁵ Moral hazard obtains any time one party bears the costs of another party's risk. When insurance is available, individuals will create moral hazard by engaging in riskier behavior. The uncertain human element is eviscerated. Calculable risk reigns in the small world. Uncertainty disappears. This shift in the meaning of moral hazard has allowed insurers to adopt a rhetoric of morality while enacting an actuarial view of the world.²⁵⁶ Government bailouts of financial institutions in the 2008 crisis were widely decried by both Left and Right. But their logic did not differ from the social insurance schemes set up in the past as the core of the welfare state and insurance against climate-induced disasters which will help define business in the future: individuals and institutions are insulated from the consequences of their own actions in the make-belief of a risk-only world. This costs money, a lot of money, measured in the case of the environment in hundreds of billions of dollars in the short term and in social welfare in many trillions of dollars in the long term.²⁵⁷ Gordon Gekko defined moral hazard in Oliver Stone's movie *Wall Street: Money Never Sleeps*: "moral hazard is when someone takes your money and is not responsible for it."²⁵⁸ It is one of many uncertainty-denying risk-ruses that Alan Greenspan talked about. Even though they can be managed, "no one can eliminate the risks of hubris,

²⁵² Greenspan 2013: 9.

²⁵³ Arrow 1968. Baker 1996: 244–51. *Oxford English Dictionary* 2023a, 2023b. Dewan 2012. Summers 2007. Pearson 2002. Dembe and Boden 2000. Grubel 1971. Hale 2009.

²⁵⁴ Arrow 1963. Gladwell 2005. Rowell and Connelly 2012: 1053–55.

²⁵⁵ Arrow 1963, 1968. Rowell and Connelly 2012: 1063–67. Dembe and Boden 2000: 263. Pauly 1968. Grubel 1971.

²⁵⁶ Baker 1996: 269–70, 275. ²⁵⁷ Ip 2025. ²⁵⁸ Saler 2012.

stupidity, miscalculation, and miscommunication” writes Lou Pauly.²⁵⁹ Short-term mitigation by some forms of reinsurance is possible. Beyond that lies, on occasion, complex and assertive state intervention and, always, the domain of uncertainty.

The risk-uncertainty conundrum is a general feature of the world. As this chapter has shown, it is a central feature of financial markets. James Shinn has argued that subtle changes such as the growth in hedge fund resources, an expansion and acceleration of news cycles, the diffusion of policy elites, and the consolidation of legal and intellectual regimes in the international economy may be nudging the uncertain world of finance just a little closer toward the world of risk, while global warming may nudge a socially and economically deeply entangled environment a bit further toward uncertainty.²⁶⁰ This risk-uncertainty see-saw is a clear-and-present danger. The more than half a trillion dollars involved in the failure of three regional banks in 2023 exceeded the twenty-five bank failures during the financial crisis of 2008. Bailouts of smaller by bigger banks increase centralization in financial markets.²⁶¹ This all but guarantees that a future crisis, both inevitable and unpredictable, will have even greater consequences.²⁶²

Charles Schultze once remarked that “when you dig deep down, economists are scared to death of being sociologists.” This observation is matched by the condescending terminology of some sociologists who dub economic analysis as “economistic” and inherently flawed.²⁶³ One way or the other, claims of intellectual superiority ring hollow as we aim to understand and engage practically the complementarity of risk and uncertainty.²⁶⁴ We are better served by marshalling all of our intellectual resources as best we can. In specific contexts economic theories can explain robust regularities in the behavior of actors, modeling individual and collective beliefs in ways that often yield accurate predictions based on past trajectories. Social analysis, however, helps us understand the unpredictabilities of the world. Human agents cope by relying on social conventions and performative story-telling so that they have the confidence to make choices under conditions of uncertainty.²⁶⁵ Memory is an important ingredient for the stories we tell and believe in. And memory is fickle and changeable. The contentious debates in the 2000s over the repeal of the Glass–Steagall Act and the separation of commercial from

²⁵⁹ Pauly 2025: 169. ²⁶⁰ Shinn 2011.

²⁶¹ Russell and Zhang 2023. Farrell *et al.* 2023. ²⁶² Taleb 2007: 226–27.

²⁶³ Quoted in Beckert 2002: 42.

²⁶⁴ Benjamin Cohen (2009: 442), a doyen of the field, observes that mainstream IPE scholars by and large failed to even anticipate the crisis – a “myopia” which he blames on the “distinct loss of ambition, reflecting the gradual ‘hardening’ of methodologies.” The counterpoint to Cohen is the more optimistic view of Helleiner 2010.

²⁶⁵ Nelson 2017.

investment banking illustrated that with the fading of the memory of the 1930s, the urgent lessons of the Great Depression receded and old stories became contested. The same is likely to happen with the memory of 2008, still remembered as traumatic by the generation that experienced it first-hand and increasingly forgotten by the next generation – which thus may condemn itself to learn anew how to contain financial contagion.²⁶⁶

The inadequacies of economic analysis are understandable. Economies are complex. But economists' denial of the risk-uncertainty conundrum is simply a lack of candor. For physicist Mark Buchanan there is a "jaw-dropping discrepancy between economists' claims and reality."²⁶⁷ One of the main reasons, Buchanan argues, is the fixation on atypical, equilibrium-seeking systems. This disregards the science of non-equilibrium systems with their positive feedback loops and natural instabilities. Such systems fit much better into a post-Newtonian and para-humanist worldview than into Newtonian humanism. Questions of order, disorder, and change are often not well answered with theories leaning on mechanical models first made fashionable in the late nineteenth century. Buchanan's charge resonates with humanists and social scientists who, as objects of economists' "imperialism," have been told that their traditional approaches are "unscientific." Now, economists find themselves the uncomfortable object of another discipline's imperial ambitions. It is true that some physicists have made a lot of money pricing financial instruments on Wall Street. But others have made important contributions to our understanding of financial economics without subscribing to the concept of balanced order and the efficient market hypothesis. Like the weather, the economy often evolves in a highly irregular and unpredictable fashion. An overarching theory of economic weather, such as the efficient market hypothesis, is unhelpful. Working with metaphors like "markets know best," it provides evidence for the deep-seated aspiration of an unobtainable social physics. Markets do not always know best, as the financial crisis of 2007–08 amply illustrates. Forecasting the economic weather without understanding storms is a hopeless enterprise.²⁶⁸ What is needed is a manual of economic models attuned to specific conditions in highly variable economic climates.

The risk-uncertainty conundrum is not specific to finance.²⁶⁹ It characterizes many other policy sectors including insurance, weather forecasting

²⁶⁶ Tett 2024. ²⁶⁷ Buchanan 2013: 13.

²⁶⁸ Buchanan 2013: 12–23, 28–29, 32–40, 64–69. David Orrell's (2018, 2022) quantum approach to finance shows that money is not a simple, inert, mundane medium of exchange of little consequence for the economy but a complex, contradictory, magical substance with profound effects on the economy. Typically, the economy is not stable and fair, seeking an equilibrium, but unstable and unfair, trending toward disequilibrium.

²⁶⁹ Pauly 2025.

and climate change,²⁷⁰ science and technology,²⁷¹ and environmental law.²⁷² Simply put, it is a general condition affecting most spheres of life. The presumption of regularity and control is recurrently challenged by reminders of the unavoidable limits of prediction. Sheila Jasanoff therefore pleads for an approach to policy that does not hide behind the excuse of defective data and erroneous calculations. Policy needs to accept uncertainty as its foundation and harm mitigation as its main goal. In finance this speaks for rolling back financialization and deregulation based on overconfidence in the predictability of markets, more guard-rails, and less trust in the latest economic models and “killer methods.” More generally, Jasanoff suggests, we should aim for more humility understood as a collective practice of societal self-reflection that “occupies the nebulous zone between preparedness and precaution.”²⁷³ The world is complex and not made legible only through gathering and manipulating objective facts. The limits of our knowledge should instill modesty. World politics is my own backyard. It, too, continues to surprise and thus invites us to explore unfamiliar and perhaps uncomfortable ways of thinking.²⁷⁴ As in this discussion of finance, so on questions of nuclear war and global warming: we need to push beyond the conventional belief that humanist Newtonianism offers a secure foundation for our understanding of the complementarity of risk and uncertainty.

²⁷⁰ The Geneva Association 2009. Lohmann 2010. Daipha 2015. Blinder 2019.

²⁷¹ Wong 2011. ²⁷² Farber 2011. ²⁷³ Jasanoff 2021a: 14.

²⁷⁴ Trowsell *et al.* 2021: 27. Kurki 2020.

5 The Missiles of 1962

At the beginning of 2023 the *Bulletin of the Atomic Scientists* set its doomsday clock at 90 seconds to midnight, the closest it has ever been. The war in Ukraine has led to fearful discussions of the possibility of nuclear war. Seeing himself as a great leader with a historical mission, in March 2023 Vladimir Putin announced plans for stationing Russian tactical nuclear warheads in Belarus; a month later the US reportedly installed radiation sensors to detect Russia's potential use of nuclear weapons on Ukrainian battlefields.¹ In October 2023 Russia claimed to have tested a new, nuclear-powered missile.² Coupled with high tensions over Taiwan, China's evolving nuclear doctrine away from minimum deterrence has prompted a refashioning of US nuclear strategy to focus on the growing size and diversity of China's nuclear forces.³ At a cost estimated to run around \$1.5 trillion, the United States is planning to modernize every part of its nuclear arsenal in the coming decade.⁴ It is therefore not surprising that anxiety is coursing through broader segments of the American public. Released in the summer of 2023, the blockbuster movie *Oppenheimer* drew one of the largest audiences in years. Reflecting and amplifying public concern, in the spring of 2024 the *New York Times* started an ambitious series of articles dealing with the threat of nuclear war.⁵ Questions about the effects that nuclear deterrence had on American national security and democratic institutions during the Cold War have not slowed the move to enhance the readiness to fight a nuclear war.⁶ And neither did a lengthy report on an ultra-secret 1983 war game called Proud Prophet. With the Pentagon's top brass participating, it illustrated the inescapable pressure of military escalation.⁷ Although on nuclear issues nobody knows what the future holds, the risk-uncertainty conundrum is in clear sight.

¹ Sagan 2022; C2. Broad 2023b. Adamsky 2024. ² Mellen 2023. Stein 2024: 16–17.

³ Sanger 2024. ⁴ Hennigan 2024a. ⁵ *The New York Times* 2024.

⁶ Evangelista 2024. Fraise 2025. ⁷ Langewiesche 2024.

After the US had dropped the first two nuclear bombs to destroy Hiroshima and Nagasaki in 1945, weapon modernization in the 1950s created an arsenal that included hydrogen bombs with yields measured in megatons, a thousand times larger than the destructive power of the atomic weapons used at the end of World War II. The American arsenal of nuclear weapons grew from about 7,000 in 1958 to about 20,000 in 1960, with a total yield exceeding 20,000 megatons – three times larger than what American nuclear war games in the 1950s had imagined possible. In 1955 the Soviet Union had about 200 nuclear weapons; the stockpile grew about five-fold by 1960. The estimate of worldwide casualties in a nuclear war was in the hundreds of millions. By the mid-1950s, French and British experts expected that ten to fifteen thermo-nuclear weapons would make normal life in their countries completely impossible. Although Secretary of Defense Robert McNamara estimated in 1964 that it would take only about 400 nuclear weapons to kill about 25 percent of the Soviet population and destroy more than two-thirds of Soviet industrial capacity, in the era of “overkill” the number of US warheads grew further, to 31,000 in 1967. In the 1980s the Soviet and the US militaries commanded about 70,000 nuclear warheads. After the end of the Cold War the number of warheads declined sharply. By 2020 nine nuclear weapon states controlled about 13,400 nuclear weapons, with the US and Russia accounting for about 12,000, or 90 percent, of the total.⁸

For eighty years nuclear weapons have not been used in any international conflict – a fact that would have astonished experts in the late 1940s. Then the expectation was that human civilization might not survive much longer. What does “much longer” mean in different time scales? In geological time, eighty years is a blink. Over tens of millions of years it would indeed be very surprising if there was no nuclear war. But humans live, experience, and calculate in human time. And on that scale the fears of the late 1940s have not materialized. Nate Silver assumes, not unreasonably, that the Bayesian probability of large-scale nuclear war may be around 0.35 percent per year. That sounds small. But if such a war killed 1 billion people that would mean for the next 200 years about 5 million extra deaths per year and the expectation of at least one nuclear war. Admittedly, the context of such calculations is changing. Historical memories of Hiroshima and Cuba are fading and with them the nuclear taboo.⁹ This will shift incalculable odds in a situation marked by “grave uncertainty.”¹⁰ Furthermore, as this chapter shows, there has been

⁸ Mian and Pelopidas 2023: 316–19.

⁹ Silver 2024: 422–25. Tannenwald 2008.

¹⁰ Langewiesche 2024: 26.

a frighteningly large number of close calls all over the world. In the war of aggression that Russia is waging in Ukraine, for now Russia and the US are protected by their nuclear shields, argues Ulrich Kühn, a German arms control scholar. “And the Ukrainians are fucked.”¹¹

This is an opportune time to recall the stand-off between the United States and the Soviet Union more than sixty years ago. One of the main pieces of advice that the political leaders of that time left for those who came after them was simple: stay away from a major crisis which might spiral out of control. Without the direct experience of the threat of a global catastrophe, that earlier advice has largely been forgotten. The October 1962 crisis left the world on the precipice of global nuclear war that has been studied more intensely than any other. Since it ended peacefully the story was originally told as a splendid victory of cool heads and shrewd maneuvers as the American President and his advisors prevailed in a potentially deadly contest. In the words of former Secretary of State Dean Rusk, the US came eyeball-to-eyeball with the Soviet Union, and the Soviet Union blinked. This chapter will show how untrue this claim is. James Blight and Janet Lang do not mince words. They call it bullshit.¹²

Despite the revolutionary impact quantum mechanics and the deployment of nuclear weapons have had on world politics, students of world politics have ignored post-Newtonianism and what it can tell us about the risk-uncertainty conundrum. Wedded instead to Newtonian humanism and the concept of risk, they are blocking out theories and models that highlight the importance of uncertainty.¹³ This chapter starts with conventional small world, risk-inflected analyses of the October crisis. It ends with a discussion of theoretical approaches informed by a post-Newtonian worldview that explicitly incorporates large world uncertainty. The manipulation of risk and uncertainty by decision makers who are more or less rational and are experiencing more or less fear offers a first cut of the crisis (section 1). A second cut enriches the individual-level analysis by attending to organizational malfunctioning as a potential cause of inadvertent nuclear war. In this analysis political agency is not restricted to elite decision makers in the White House and the Kremlin. Instead, it is widely dispersed across many layers of the American and Russian militaries. Base commanders and submarine captains, for example, were crucial in stopping potentially catastrophic escalations brought about by organizational or technological malfunction (section 2). Although this second cut accords uncertainty a greater role, it remains

¹¹ Quoted in Silver 2024: 425. ¹² Blight and Lang 2018: 15.

¹³ Waters 2022b: 57, 64.

securely anchored in a humanist Newtonian worldview. The analyst imposes rationality and irrationality on a reality that is “out there,” separate from the observer. Such dualities operate like two hooks, Bruno Latour once joked in a different context, for suspending a hammock that invites us to snooze.¹⁴ The point is illustrated vividly by a 2014 symposium on nuclear politics which brought together political scientists and historians. The symposium exhibited plenty of disagreements on methodological issues, but nobody questioned that analysts were looking at the world from a distance, with a God’s eye perspective. The symposium’s editor, Scott Sagan, refers briefly to “very innovative” work on nuclear issues.¹⁵ But neither he nor any of the other participants showed any interest in moving beyond the familiar small world to engage with work in science, technology, and society (STS) that offers a third cut (section 3). Exemplifying large world thinking, it does away with dualities such as rational and irrational, politics and technology, risk and uncertainty. It integrates human agency, organizational functioning and malfunctioning, and politics across all levels. And embedding the observer fully in a world that does not exist “out there,” it acknowledges the importance of the risk-uncertainty conundrum. Language matters greatly in the politics of the crisis, its meaning for different actors, and its effect on shaping the complementarity of risk and uncertainty (section 4).¹⁶ Furthermore, the analysis of nuclear politics has shaped profoundly a widely accepted rational model of war (section 5). And the conclusion illustrates that many close calls have made Machiavelli’s *fortuna* a major force in the evolution of a crazy nuclear politics and the persistence of the risk-uncertainty conundrum (section 6).

1. **October Crisis.1: Brinkmanship, Emotions, and Fear in a Small World**

Against the backdrop of a continuing Berlin crisis and the 1961 US-sponsored, failed Bay-of-Pigs invasion, President Kennedy’s October 22, 1962 televised address to the American people initiated the public phase of a crisis that had started with the clandestine installment of medium- and intermediate-range nuclear Soviet missiles in Cuba. The President insisted that the Soviet Union had lied about its policy for many months, and that the US would not tolerate the deployment. A “quarantine” was the first step, to be followed, if unsuccessful, by military means including an invasion of Cuba to remove the missiles.

¹⁴ Muecke 2022. ¹⁵ Sagan 2014: 6. ¹⁶ MacKenzie 1990: 409–17.

A Soviet attack on any target in the United States or Latin America, Kennedy announced, would be met with a full retaliatory response on the homeland of the Soviet Union. In the following five days the crisis grew as Soviet ships approached the quarantine line and then changed course, as construction of the missile bases in Cuba was rushed toward completion, as an American reconnaissance plane was downed, and as more than 100,000 American combat troops were assembled in south Florida for a possible invasion. On the morning of October 28 the crisis ended unexpectedly when Chairman Khrushchev announced that he accepted Kennedy's offer: the missiles would be withdrawn as long as the US pledged not to invade Cuba and, privately, committed to dismantling its missiles in Turkey in the near future.

For two generations scholars have thought, with Herman Kahn, about the unthinkable, drawing on their implicitly held worldviews. Graham Allison's foundational study relied on three models – rational actor (model 1), organizational process (model 2), and governmental politics (model 3) – to highlight different aspects of the Cuban missile crisis that escaped the analytical power of any one of them.¹⁷ These models offer different lenses to highlight different aspects of the crisis. All of them, however, operate firmly in a Newtonian and humanist small world filled with discrete objects and persons, displayed on a stage that exists external to both actors and observers. In the rational actor model, ultimate decisions rest with President John F. Kennedy of the United States and the First Secretary of the Communist Party of the Soviet Union, Nikita Khrushchev. The degree of their rationality and the accuracy of the information on which they made their choices have been subject to intense study. In the organizational process and governmental politics models, agency is dispersed and human control over events is not assured. The rational actor and governmental politics models place human actors and their relations at the center; the organizational process model emphasizes organizational routines and relations; the government politics model highlights bureaucratic politics.

Conventional theorizing about nuclear strategy has adopted and refined the rational actor model. John Mearsheimer and Sebastian Rosato, for example, adopt a liberal standard of democratic deliberation to make their case for the rational actor model. For them the meetings of President Kennedy's advisors were "models of free-wheeling discussions." They view the President as an active participant in the deliberations who eventually decides "to break the deadlock and make the

¹⁷ Allison 1971. Allison and Zelikow 1999. May and Zelikow 1997. Sherwin 2020. Kaplan 2020.

ultimate decision,” closing the deal with Khrushchev.¹⁸ Their discussion makes the American management of the crisis look like an exemplar of rationality in action.¹⁹

It is not clear, however, how to square that interpretation with the fact that Kennedy compartmentalized decision making by not only participating in open discussion but also operating behind the scenes without the knowledge of his advisors; that ten days of around-the-clock deliberations never yielded an agreement between hawks and doves on which the President could have acted; and that Mearsheimer and Rosato cite a barrel of scholarship pointing to many aspects of irrationality without engaging or rebutting any of it.²⁰ Furthermore, the American 17:1 superiority in nuclear weapons and the greater vulnerability of Soviet forces should have deterred Khrushchev from placing Russian missiles on Cuban soil in the first place. And it should have made Kennedy take larger risks than he did to remove the missiles with a pre-emptive strike. And if the stress was as great as was reported by several participants, then war might have happened because irrational actors, incapacitated by stress, poor judgments, and fear should have lashed out with a first strike. That did not happen. Both rational and irrational actor models were proved wrong. The October crisis ended peacefully.²¹ In the experience of the most active participants, at its peak the gap between probability and possibility evaporated, creating what Presidential Advisor Richard Neustadt inaccurately called a “new dimension of risk.”²² The intrusion of profound uncertainty into calculable risk pushed Kennedy and Khrushchev to the same conclusion. Rather than fight each other they chose to fight a new, common enemy, the dread of inadvertent nuclear war.²³

Concerned with the possibility of surprise attack, starting in the late 1950s future Nobel Prize winning economist Thomas Schelling had made signal contributions to public policy by adapting macroeconomics and game theory to nuclear strategy. Stability was an overriding concern.²⁴ But so was purposeful human action. Schelling placed both at the center of his theorizing. In 1962 his theory convinced him that Russia would suffer a momentous defeat in Cuba.²⁵ As the crisis broke, Schelling felt exuberance over Khrushchev’s coming humiliation. He simply could not understand the tremendous anxiety gripping the

¹⁸ Mearsheimer and Rosato 2023: 163, 166–67.

¹⁹ Yarhi-Milo (2023, 2024) and Rathbun (2024) offer a number of criticisms to which Mearsheimer and Rosato (2024) reply. The 1962 crisis plays no role in their exchange.

²⁰ Mearsheimer and Rosato 2023: 162–63, 259.

²¹ Blight 1990: 30–32, 40–52, 68–69, 157–59. ²² Neustadt 1980: 158.

²³ Blight 1990: 6–7, 32–38. ²⁴ Wilson 2021. ²⁵ Pauly and McDermott 2023: 13–16.

President and his inner circle.²⁶ Schelling's optimism was based on his belief that nuclear risk could be manipulated following the rational logic of deterrence theory. Since the costs of war are far greater than any possible gain, for Schelling nuclear war was volitional and therefore avoidable.

His formulation of nuclear strategy as "the threat that leaves something to chance" is based on an understanding of the concept of "chance" that deploys some and excludes other potentialities inherent in uncertainty.²⁷ Schelling's *Strategy of Conflict* refers to "risk" 102 times; "chance," for him is mostly coterminous with "risk," 75 times; "uncertainty" 10 times; and "luck" only once.²⁸ Schelling was a brilliant, nuanced thinker who incorporated the role of uncertainty into coercive nuclear bargaining and war.²⁹ Perhaps inadvertently, he equivocated about the meaning of the concept of "chance." And perhaps unwittingly, many of Schelling's readers mistook the ambiguous meaning of "chance" to mean the manipulation of "risk" rather than of "uncertainty."³⁰ Schelling himself acknowledges the existence of uncertainty that "must come from somewhere outside of the threatener's control. Whether we call it 'chance,' accident . . . or just processes that we do not entirely understand, it is an ingredient in the situation that neither we nor the party we threaten can entirely control."³¹ Even though his work has been misinterpreted by many as being focused only on risk, Schelling was fully cognizant of the importance of uncertainty.

Schelling's theory transforms nuclear weapons into means of control. He does not permit the theoretical possibility of their accidental use to impose limits on a risk-based deterrence model. Instead, he deploys the possibility of inadvertent nuclear war neither party wants as a coercive instrument of brinkmanship used to prevail in a conflict.³² In a briefing paper Schelling wrote for President Kennedy in the summer of 1961, after Khrushchev had issued an ultimatum on Berlin, his advice was "for a 'selective and threatening use' of nuclear weapons to manipulate," in the words of Benjamin Wilson, "in the most vivid way imaginable, the risk of a total cataclysm, and to use that risk to coerce the Soviets into backing down."³³ Schelling's advice implied a nuclear demonstration explosion as

²⁶ Blight and Lang 1995: 243. ²⁷ Schelling 1960: 187–203; 1966a: 95–96.

²⁸ Pelopidas, personal communication, March 9, 2016 and Pelopidas 2015a: 14, fn 28.

²⁹ Schelling 1960: 95–96.

³⁰ Stein 2024: 16. Schelling (2021) wrote a confidential memo in 1959 that RAND released only in 2021. It was incorporated into Schelling 1960. See also Davis 2024. Pelopidas 2015a, 2015b, 2016.

³¹ Schelling 1960: 188; 2021: 2.

³² Schelling 1966a: 99; 1960: 189, 200. Pelopidas and Egeland 2024: 347–48.

³³ Wilson 2021: 197.

one possible means for defending Berlin and defeating the Soviet Union. In establishing an actor's full control over "the ultimate weapon" and showing the limits of that control in inadvertent war, the controlled and the uncontrollable fuse into one and squeeze out of deterrence theory all other unacknowledged contingencies and unfathomable unknowns.

In Schelling's theory probabilistic and possibilistic thinking are entangled and co-evolving. His work was not only derived from macroeconomics and game theory operating in the small world of risk. It was also an "imaginative conceptual exercise" dealing with the problem of uncertainty.³⁴ A generation of scholars who have developed the bargaining model of war may have overlooked this important aspect of Schelling's theory.³⁵ Occupied by the problem of credibility, Schelling argued that to be credible required ceding control. Uncertainty is created or enhanced by decision makers who voluntarily tie their own hands. Acknowledging an inescapable tension in his thought, Schelling writes, "in the final analysis we are dealing with imagination as much as logic . . . poets may do better than logicians at this game . . . Logic helps . . . but usually not until imagination has selected some clue to work on."³⁶

Largely oblivious to differences in context, variability of the processes that unfold as decision makers climb the ladder of nuclear escalation, and the importance of language, Schelling holds that parties moving closer to the brink of mutual annihilation are always compelled to become increasingly careful. In his theory accidents do not cause nuclear war; decisions do.³⁷ Schelling's psychology is based on economics and supposedly universally valid cost-benefit calculations. He argues that we do not "fear" the onrush of traffic passing us by as we stand on the curb. For we know better than to step into the flow of traffic. This analogy proves to him the rational actor model. Nassim Taleb begs to differ. For him many models of rationality can blindfold us at street crossings.³⁸ Stepping off the curb and walking straight and at a steady pace, into a sea of bicycles moving like a school of fish, is rational in Ho Chi Minh City. In Boston it would be irrational and land you in the hospital. This is not to deny that Schelling made insightful comments about the psychology of nuclear crisis politics. For example, he mentions the process of mutually escalating anxiety sapping an adversary's confidence in the ability to keep the crisis from exploding into war, and the transformation of adversary into collaborator as the disappearance of non-catastrophic policy options makes the

³⁴ Linklater 2000: 66.

³⁵ I discuss the bargaining model of war below in the fifth section of this chapter.

³⁶ Schelling 1960: 58. Schelling's overlooked conceptual leap views language as both representing and re-presenting reality.

³⁷ Kay and King 2020: 281. ³⁸ Taleb 2007: 49.

general environment rather than the adversary the subject of fear.³⁹ Furthermore, “the stress of *responsibility*,” Schelling told the participants at a conference convened after the crisis had passed, “may simply make a very great deal of difference.”⁴⁰ Indeed. But his unshakeable commitment to an economic psychology makes Schelling uninterested in the existence of “nervousness.” He was an exemplar of Amadae’s “prisoner of reason.”⁴¹ The very term “crisis,” with its connotation of shortening decision times and growing anxieties and confusions, had no special meaning for Schelling; he would have had no interest in chains of contingencies and the appearance of interlinked polycrises. The concept of crisis was merely a linguistic convention to which he agreed with some reluctance.⁴²

For Schelling decisions are made in the domain of rationality not contingency. And that domain subordinates, for the most part, uncertainty to risk. Film director Stanley Kubrick visited Schelling shortly after the Cuban missile crisis. He wanted to make a movie about the start of a nuclear war that experts on nuclear strategy and arms control would find plausible. Schelling told Kubrick that there was no plausible path toward nuclear war he could think of. Eliding the difference between risk and uncertainty, which he understood so well, he relied on the concept of chance, bridging small and large world thinking. This misled many of his followers to think that deterrence was only about the manipulation of risk in a small world. In contrast, Kubrick’s artistic vision and post-Newtonian sensibilities inhabit also the large world of uncertainty. Convinced that he had entered a scary, real-life version of the theater of the absurd, Kubrick created in *Dr. Strangelove* a dark satire drenched in the bizarre assumptions of members of the “nuclear priesthood” who were thinking about the unthinkable. For Schelling the movie was an absurdist comedy. No one, he thought, could conceivably imagine it as a realistic tragedy.⁴³

By including emotional factors Reid Pauly and Rose McDermott, among others, insist that the study of humans in nuclear crisis politics must incorporate chance and choice and make place for human emotions.⁴⁴ In the early stages of the missile crisis, for example, the two leaders reacted to each other’s actions with raw emotion. President Kennedy agreed with the assessment of McNamara and other advisors that the missiles did not change the military balance of power between the

³⁹ Blight 1990: 73, 110, 141–43, 162–63. Blight and Lang 1995: 246.

⁴⁰ Blight and Welch 1989: 132. ⁴¹ Amadae 2016: 11.

⁴² Blight 1990: 42–43, 50. Blight and Welch 1989: 132. ⁴³ Blight 1990: 42.

⁴⁴ Pauly and McDermott 2023. See also Sauer 2015: 102–04. Damasio 2021. Toska 2024: 20–24, 51–62. Mlodinow 2022.

two superpowers. However, acutely aware of the far-reaching domestic political implications of the Soviet move, when he first learned about the deployment of Soviet missiles in Cuba, Kennedy's enraged reaction was not an example of cool rationality. "He can't do that to *me*" was his initial response; subsequently he called Khrushchev a "fucking liar" and "immoral gangster."⁴⁵ For his part, when learning that the US navy was preparing a blockade as its first countermeasure after the missiles were discovered, a sleep-deprived Khrushchev, in front of Romanian visitors, "flew into a rage, yelling, cursing and issuing an avalanche of contradictory orders."⁴⁶ Stripping emotions out of nuclear crisis politics is like painting an exploding volcano without red lava.⁴⁷

For Pauly and McDermott, chance, understood as an uncertain event or cause that cannot be controlled, and choice, understood as the exercise of control operating in the domain of risk, are overlapping parts of the risk-uncertainty conundrum that offer different sorts of leverage in bargaining situations.⁴⁸ But in their analysis they distinguish only among different kinds of risk – autonomous, intrinsic, and extrinsic – and fail to acknowledge the existence of uncertainty. For them "the causal component in chance derives from the probabilistic nature of the universe."⁴⁹ Although they acknowledge that risk and uncertainty are interlaced, in the end, in their Newtonian worldview the universe is probabilistic and, in principle, all-knowable.⁵⁰

This is in sharp contrast to post-Newtonian uncertainty operating in large worlds, exemplified in the October crisis by the fear of contingencies that could result in nuclear war.⁵¹ Although he was thinking in an entirely different register from Heisenberg's, the philosopher Kierkegaard hits a similar note that fits roundly into a humanist post-Newtonian worldview.⁵² For Kierkegaard life is inevitably lived forward, and it is always understood backward. But for James Blight there exists a vast difference between "a rational reconstruction, derived by looking backward at a selected, distorted, artificially coherent set of mental snapshots of the past, on the one hand, and, on the other, the uncertain phenomenology of living the event forward without the slightest idea of how it will turn out."⁵³ In a disorienting, modernizing Europe, during the first half of the nineteenth century, Kierkegaard experiences existential unease. For

⁴⁵ Allison 1971: 193. Plokhy 2021: 134. ⁴⁶ Plokhy 2021: 187.

⁴⁷ Damasio 1994, 2021. ⁴⁸ Pauly and McDermott 2023: 12–13, 25–26.

⁴⁹ Pauly and McDermott 2023: 26.

⁵⁰ Their discussion of "existential fear outside of most people's control" as "'dread' risks" similarly elides the concept of uncertainty. And so does the discussion of limited war. See Pauly and McDermott 2023: 37, 46.

⁵¹ Blight 1990: 130–31, 152. ⁵² Kierkegaard 1980. Bachmetjevas 2021.

⁵³ Blight 1990: 151.

him present and future are incommensurable. Anxiety points human beings to the future where they will become who they are but in a profoundly indeterminate way.⁵⁴

Blight's analysis of emotions leans heavily on Kierkegaard for his central insight: the human dread of the unknowable and the importance of uncertainty in nuclear crisis politics.⁵⁵ Blight argues that "the manipulation of risk, of the probability of nuclear war, would in the darkest hours of the missile crisis be transformed into the tremendous fear of the possibility of nuclear war."⁵⁶ In October 1962 life in the White House and the Kremlin was lived forward. Participants were ignorant and fearful of the outcome of the crisis. This is the starting point for Blight's psychological analysis. He attempts to recapture "from somewhere" as closely as possible the lived experience of the participants in the crisis. The conventional alternative which he rejects is to enter "from nowhere," taking a Newtonian, God's eye perspective as a dispassionate observer looking at the world from a distance. To look at past events from the standpoint of the present overlooks the importance of explanations focusing on human intentions.⁵⁷ Living what will become history has very little to do with what has become history. Psychologists and historians of the October 1962 crisis, Blight writes, have acted not as caretakers of living history but as undertakers of the "refrigerated, intellectualized corpse that this event has become."⁵⁸

What to Blight is a "commonsensical" approach is open to criticism by conventional psychological approaches. That criticism is reminiscent of economists who substitute statistical post-dictions for the predictions their methods often fail to provide. Blight's experiential-phenomenological "forward-looking" psychology is less replicable than empirical-conventional "backward-looking" psychology.⁵⁹ Often it is simply disregarded.⁶⁰ In different contexts both approaches may have merit.⁶¹ Because they appeal to different universes of facts found in different contexts, shaped by different processes, and deploying language differently, they may be complementary. Ascertaining facts, intentional explanations of actions must come first; deductive explanations typical of the physical sciences, imitated by conventional psychological approaches, come second.⁶² To help in the first step, French psychologists have developed new elicitation protocols to minimize the problem of inaccurate self-reporting and false memory.⁶³ As an alternative to direct survey responses, elicitation interviews probe

⁵⁴ Grøn 2008: 5, 9. ⁵⁵ Blight 1990: 3, 10–13, 72, 75–76, 78, 79. ⁵⁶ Blight 1990: 88.

⁵⁷ Blight 1990: 90, 128, 164–65. ⁵⁸ Blight 1990: 57. ⁵⁹ Blight 1990: 38.

⁶⁰ Pauly and McDermott (2023), for example, fail to include a single reference to Blight's work even though they write on emotions and fear.

⁶¹ Blight 1990: 62. ⁶² Blight 1990: 129. ⁶³ Orlando 2020: 468–74.

multiple layers of memory and consciousness. Retroactive awareness can activate passive memory and the constant, involuntary memorization of lived experience that escapes our notice. To access that awareness requires bypassing explanations and abstractions. Elicitation guides the subject to increasingly detailed descriptions of how past choice processes unfolded. This method offers a remedy for our normal blindness to lived experience and avoids the trap of providing post-hoc reasons for past choices. Decisions can thus be realistically conceptualized as inherently indeterminate without denying that, located in a different perspective and context, they can also acquire determinative shape.

Because this approach had not yet been developed, Blight could not rely on elicitation protocols. To transport himself and the reader back in time, he relies on secret tape recordings of the committee advising President Kennedy in October 1962, written records of other meetings, archival documents as well as interviews, and a large secondary literature.⁶⁴ His disagreement with mainstream psychology is due to his reliance on a non-technical, humanist phenomenology reminiscent of Dilthey, who criticized empirical-rationalist psychological approaches.⁶⁵ For Dilthey the humanist, life in its totality exceeds the reach of objective scientific analysis. Humans do not think, let alone live, by theoretical reason alone. With some justification Dilthey has been called the Newton of the humanities, a giant who developed the interpretive approach to social life.⁶⁶ In a vision reminiscent of quantum mechanics, Dilthey embraces life and human experience in all of its richness as part of the ongoing reconfiguration of a world that is always becoming and always filled with unexplored potentialities. Life encompasses both basic experience (*Erfahrung*) implicating perception and intellect and lived experience (*Erlebnis*) involving emotion and volition.⁶⁷ Life is a material biological process that includes the totality of all subjective processes.⁶⁸ In short, for Dilthey life-created history occurred in the large world, a spontaneous and self-generating creativity that was not subject “to the mechanical laws of nature” operating in the small one.⁶⁹

⁶⁴ The best entry into the rich literature on the October crisis is provided by Blight 1990; Blight and Welch 1989; Allyn *et al.* 1992: 205–13; Blight and Lang 1995; Pelopidas 2017: 242–43, 245–48; and Pauly and McDermott 2023.

⁶⁵ Blight and Lang 1995: 229–30. Blight 1990. ⁶⁶ Rickman 1979: 1.

⁶⁷ Jay 2005: 222–30. Makkreel and Rodi 1989b: 21.

⁶⁸ Dilthey 1922: 418; 1924: 83, 197–199; 1927: 261; 1931: 175–76. Makkreel and Rodi 1989b: 9. Bollnow 1955: 11–100. Makkreel 2001: 155–58. Reid 2001.

⁶⁹ Today Dilthey’s version of vitalism is dead because of the genetic revolution and subsequent advances in biology. Wendt (2015: 131–47) has given vitalism a quantum coherence interpretation that focuses on cognition and will and, especially, on experience. See also Fierke 2017: 142–45. Normandin and Wolfe 2013. Benton 1974.

Dilthey thus offers a foundation for Blight's empirical analysis of "McNamara's fear" of being responsible for a global catastrophe.⁷⁰ Circumspect in his analysis Blight concludes from his different sources that McNamara, Kennedy, and other advisors experienced being sucked, against their will, into an escalating conflict they might not be able to stop.⁷¹ Begun for narrow military reasons, conventional war in Cuba might inadvertently escalate to a global nuclear war nobody wanted. McNamara's fear was that "he and his colleagues will be unable to discover an acceptable, peaceful solution to the predicament" – the risk-uncertainty conundrum generating unwanted nuclear war.⁷² His phrase "damned dangerous" is "as close as one can come in a group discussion of this sort to naming the calamity they are all trying desperately to avoid: a major nuclear war."⁷³ Without renouncing his commitment to data and efficiency, reflecting on his role in both the Kennedy and Johnson administrations toward the end of his career, McNamara stressed empathizing with one's enemies by sharing in their worldview. He believed that President Kennedy and his team had succeeded in doing this in Cuba, while conceding that President Johnson and his team had failed to do so in Vietnam. At the end of his life, McNamara saw no contradiction between a hard head and a soft heart.⁷⁴

McNamara attended a conference in Havana in 1992, the thirtieth anniversary of the crisis, when his fear had receded and perhaps been forgotten. But it was still there. He was so stunned by what he learned at the conference that he had to grab the table to steady himself. Instead of the 10,000 Soviet troops he and the American military believed in 1962 had been stationed in Cuba, there were 40,000.⁷⁵ All of the Pentagon's war plans had been based on a vast underestimation of Soviet conventional military strength in Cuba. McNamara also learned that American intelligence had missed the fact that the Soviet Union had already deployed tactical nuclear weapons in Cuba. For several days, at the height of the crisis, these weapons were controlled not by the political and military leadership in Moscow but by the local Soviet commander in Cuba. An American invasion force most likely would have been met by devastating nuclear strikes from short-range LUNA missiles. The depth of "misinformation, miscalculation, and misjudgment" stunned

⁷⁰ Blight and Lang (2018) dedicate their book "to 'maximum' Bob McNamara. Friend, teacher, co-author, co-conspirator June 9, 1916–July 6, 2009. In memoriam." Blight 1990: 32–38, 57, 61–65, 80–83, 112–13, 135–36, 182–83, 191. Blight and Welch 1989: 51, 199–200. At the time, McNamara was more hawkish than he later claimed to have been. See Lebow and Pelopidas 2023: 711–13.

⁷¹ For similar dynamics on the Soviet side see Plokhy 2021: xvii, 170–71, 359.

⁷² Blight 1990: 37. ⁷³ Blight 1990: 38. ⁷⁴ Rosenzweig 2010.

⁷⁵ Allyn *et al.* 1992: 99.

McNamara.⁷⁶ He told the conference participants that the crisis was far greater than even he had feared. Had a US invasion of Cuba been carried out, “there was,” in words expressing McNamara’s penchant for numerical precision where none exists, “a 99 percent probability that nuclear war would have been initiated.”⁷⁷

In his forthright assessment in 1992 McNamara no longer had access to the fear that had gripped him in 1962. Why? The rapid and totally unexpected end of the crisis only magnified the confusion and unexpected twists and turns the crisis had taken in October 1962. Humans resist the notion that dumb luck and happenstance can be pivotal in their lives, and that it was fear of the unknown that decided how things turned out. In their reconstruction of the past humans are strongly motivated to repress their confusions, terror, and inability to predict and control events. We all prefer “fearless victories” while forgetting the “terror of the unknown.” Having had the experience, in looking back we often miss its meaning.⁷⁸ We “explain away” elements such as “McNamara’s fear” as simple anomalies that no longer fit into conventional causal stories.⁷⁹ Yet even decades after the crisis had passed, in McNamara’s behavior there remained unmistakable traces of the depth of his emotional experience. Queried in a TV interview about the October crisis there were tears in his eyes when he spoke.⁸⁰ Over time, McNamara’s fears had changed to tears, perhaps tokens of a suppressed memory of an existential fear.⁸¹ Confronted at another occasion by an interlocutor who insisted that the October crisis was nothing but a “game of chicken” in which Khrushchev had “chickened out,” “McNamara stared at his interlocutor, eyes wide, unspeaking for a long moment until he exploded: ‘It was not a game and there were no chickens.’ That’s not the way it was.”⁸² Games are maps that distort the territory.⁸³ They wash away the emotions with which humans meet unknowable unknowns. And they conceal the urge to repress the memory of those moments. “Whatever insights may be derived from game analogies,” Blight concludes, “are gained only by annihilating the psychological life of the crisis.”⁸⁴

2. **October Crisis.2: Organizational Malfunctioning**

Organizational and bureaucratic politics models of the Cuban missile crisis reach further than the cognitive and emotional states of central decision makers. They express both Newtonian-humanist and post-Newtonian

⁷⁶ Allyn *et al.* 1992: 168. ⁷⁷ Plokhy 2021: 2, 144, 166.

⁷⁸ Blight and Lang 2018: 3–14. ⁷⁹ Blight 1990: 119, 129, 134, 139–40, 157.

⁸⁰ Blight 1990: 82–83. ⁸¹ Blight and Lang 2018: 57–67. ⁸² Blight 1990: 83, 135.

⁸³ Clancy 2024. ⁸⁴ Blight 1990: 136.

worldviews and describe a politics that goes well beyond the White House and the Kremlin. Presidential action is deeply embedded in relations that often cut against the rational actor model informing deterrence theory.

Scott Sagan's careful archival research, for example, has helped shake the conviction that human rationality kept the Cuban missile crisis from spinning out of control.⁸⁵ Sagan applies two theories of nuclear policy making – high reliability theory and normal accident theory. High reliability theory expresses confidence in human rationality and the government's ability to exercise full control over a country's nuclear arsenal. Normal accident theory postulates that accidents in tightly coupled, complex systems are inevitable.⁸⁶ Sagan finds strong evidence supporting both theories but settles on normal accident theory for one reason: the active opposition of organizations to learning from their own mistakes.⁸⁷

Sagan's research uncovered an unnerving number of serious lapses in security protocols and near-misses that could have started an accidental nuclear attack. He makes a compelling argument that the focus on autonomous individuals who are in full control of a state's nuclear forces is little more than a soothing chimera. The relationship between human operators and tightly coupled, highly interactive, complex technical systems should lead us to expect that "the unexpected will occur, that unimaginable interactions will develop, that accidents will happen."⁸⁸ Hawks and doves alike argued that nuclear weapons had an overwhelmingly stabilizing effect, inhibiting rash action by either the Soviet Union or the United States. Believing ardently in the stability-enhancing and war-avoiding logic of nuclear deterrence, both shared a basic optimism: deliberate and nuclear war was extremely unlikely. Sagan shows that they overlooked the specter of accidental war caused by organizational malfunctioning.⁸⁹

His central message is contained in the chilling episode with which he opens his book.⁹⁰ On October 25, 1962, an air force sentry patrolling the perimeter of a base near Duluth, Minnesota saw someone climbing the fence of the base where nuclear-armed bombers and interceptor aircraft were parked on runways, ready for immediate take-off. He shot at the intruder and sounded an alarm, and on airfields throughout the region guards rushed out to foil Soviet agents from sabotaging US nuclear forces. At a base in Wisconsin the wrong alarm bell rang, signaling that nuclear war had started. Pilots ran to their aircraft, started the engines, and headed down the runway. An officer drove onto the runway to stop the

⁸⁵ Sagan 1993. ⁸⁶ Perrow 1984. La Porte 1994.

⁸⁷ Sagan 1993: 204–12, 237–49. Radchenko and Zubok 2023. ⁸⁸ Sagan 1993: 4.

⁸⁹ Sagan 1993: 55, 151, 251, 259–67.

⁹⁰ Sagan 1993: 3, 99–100, 117. Craig 2012: 292.

planes from taking off. The suspected Soviet saboteur turned out to have been a bear – not a Russian bear but an American bear. Two other near-accidents occurred in the next three days. On October 26–27, an American U-2 high-altitude plane was flying on a mission to collect radioactive samples from prior Soviet nuclear tests. At a relatively low altitude, the American plane strayed off course over Siberia. Soviet fighter jets were about to intercept the spy plane but held their fire at the last moment as the U-2 corrected its course. And on October 28, at the height of the crisis, radar operators in Moorestown, New Jersey informed the national command post that a missile had been launched from Cuba and was about to detonate in the vicinity of Tampa, Florida.⁹¹ Later it was discovered that a software test tape, simulating a missile launch from Cuba, had been inserted into an operator's radar screen at the very moment that a satellite appeared over the horizon, causing operator confusion. Although radar operators were supposed to get advance information about satellites passing overhead, the key facility providing that information had been taken off that mission to assist in providing advance warning of a looming Soviet missile test launch. Sagan's list of near-misses is long.⁹² Safety rule disputes, bombers straying off safe routes while on mission during the crisis, interceptor aircraft launched with nuclear-armed air-to-air missiles under their wings, erroneous emergency missile alert operations, undetected problems about the risks posed by false warnings, serious security lapses at various bases and airfields, and inconsistencies in the decentralized management of nuclear alert activities in Europe – all lead Sagan to conclude that "President Kennedy may well have been prudent. He did *not*, however, have unchallenged final control over U.S. nuclear weapons."⁹³ In these October days in 1962, World War III was an accident waiting to happen.

Going beyond the October crisis the still incomplete historical record of near-misses is chilling.⁹⁴ For example, soon after the January 1961 inauguration of President John F. Kennedy a routine B-52 bomber flight with two nuclear bombs on board went into an uncontrolled spin and broke up over Goldsboro, North Carolina. Both bombs were released by a control device in the cockpit. One of the two bombs began the detonation process. Three safety mechanisms failed. Two-hundred-sixty times as powerful as those the US air force had released over Hiroshima and Nagasaki, the bomb was prevented from detonating only by the fourth

⁹¹ Sagan 1993: 6, 99–100. ⁹² Sagan 1993: 72–114, 121–42. ⁹³ Sagan 1993: 116.

⁹⁴ Sagan 1993: 7–8. Pelopidas 2015a: 20; 2022: 288–89 (English translation generously provided by the author); H-Diplo/ISSF Forum 2023. Burr 2022. Masco (2021: 1–5) discusses the January 13, 2018 false emergency alarm in Hawaii and probes the psychological and cultural contours of America's intimate life with existential danger.

arming mechanism, a low-voltage switch – partial confirmation, perhaps, for high reliability theory.⁹⁵ But perhaps not. The same switch failed more than twenty times in the following twenty years.⁹⁶ Similarly, in January 1968 a B-52 bomber on an airborne alert mission was flying above Thule, Greenland at 33,000 feet. Soon after the co-pilot turned the cabin heater dial to its maximum setting to alleviate the arctic cold, a fire broke out in the plane's lower cabin. Seven minutes later the aircraft lost all electric power. The pilot ordered immediate evacuation and six members of the crew successfully ejected. A seventh member was killed. The pilotless aircraft passed over the Thule airbase and, with its four thermonuclear bombs, crashed into the ice 7 miles away at a speed in excess of 500 miles per hour. Immediately, the 225,000 pounds of jet fuel exploded. Although the conventional high explosives in all four bombs went off, the nuclear components of the bombs did not. Furthermore, for almost twenty years the launch code for the land-based Minuteman missile strike force was an identical, preset code – 00000000. This contravened a special 1962 Presidential order to create a more secure system.⁹⁷ These episodes, and others like them, confirm central claims of normal accident theory.⁹⁸

Near-misses that might have caused the outbreak of a nuclear war also happened on the Soviet side.⁹⁹ One close call occurred in the morning hours of September 26, 1983. The Soviet early warning system detected an incoming missile attack from the United States. According to computer readouts several US missiles appeared to have been launched. The protocol for the eventuality of an unprovoked attack was simple: the Soviet Union would retaliate with a nuclear attack of its own. Stanislav Petrov was the officer on duty that morning at the secret Serpukhov-15 command center outside Moscow. His assignment was simple. He was charged to report any apparent enemy missile attack on the Soviet Union. The computer system told him that the reliability level of the alerts that flashed across his screen was at its highest as the first, second, third, fourth, and finally fifth launch was reported. He was a specialist on the computer programs that the Soviet military used and had encountered this particular glitch before. What made him suspicious was how strong and clear the alerts were. All of them cleared all but one of twenty-nine security levels. Petrov's suspicion was raised further by the fact that a support team of

⁹⁵ BBC News 2013. Schlosser 2013: 245–48.

⁹⁶ Pelopidas 2022: 283–91. H-Diplo/ISSF Forum 2023.

⁹⁷ Blair 2015. Since it did not offer any proof, the Air Force's vigorous denial lacks credibility.

⁹⁸ Sagan 1993: 156–203. Perrow 1984.

⁹⁹ Aksenov 2013. Ambinder 2018: 178–84. Christian 2020.

satellite radar operators told him that they had no data verifying a missile launch. Unlike the other members of his team, it should be noted, Petrov happened to be the only officer who had received a civilian education and thus was less prone than his colleagues to obey orders under all circumstances. Dismissing the computer warning as a false alarm, Petrov decided to do nothing. As Petrov recalled, it was a gut decision, at best a “50–50” guess, based on his distrust of the reliability of the Soviet Union’s early warning system, the report of the radar team, and the relatively small number of missiles that had purportedly been launched.¹⁰⁰ Petrov’s neural channels conveying gut reactions, neuroscience tells us, were biochemically “naked,” permitting body structures and nervous systems to talk directly to each other.¹⁰¹ As matters turned out, the Soviet computer system had mistaken the sun’s reflection off clouds for missiles.¹⁰²

Breaching his instruction to report the apparent launch up the chain of command, Petrov’s dereliction of duty was very serious. It shone a light on the problems of the early warning system of the Soviet Union, which embarrassed his superiors. He received an official reprimand – not for his action but for a mistake in the logbook. The real reason, however, may have been for not having told his superiors, thus robbing them of the opportunity of taking credit for preventing a disastrous response. Relentlessly interrogated he was denied promotions, reassigned, and took early retirement.¹⁰³ His action remained largely unknown. He was never rewarded for his decision by the Soviet Union or Russia. After the collapse of the Soviet Union he was honored at the United Nations and received the Dresden Peace Prize.¹⁰⁴ Gut instinct, this time by an American Lieutenant General, Leonard Perroots, also played an important role in helping defuse a potentially dangerous escalation in the same year, during the 1983 NATO Able Archer exercises.¹⁰⁵ Other episodes occurred after the collapse of the Soviet Union. For example, on January 25, 1995 Russian early warning radars suggested an incoming American first nuclear strike. President Yeltsin was alerted and given the nuclear briefcase (*cheget*) with instructions about launching a nuclear strike at the US. Yeltsin either did not have enough time to open the *cheget* or decided against a counterstrike that would have been prompted by the malfunctioning of a supposedly fool-proof system.¹⁰⁶

In several episodes timely human action prevented accidental war.¹⁰⁷ For example, at the height of the Cuban crisis, on October 27th, a naval

¹⁰⁰ Chan 2017. Hoffmann 2009: 6–11. Miles 2020. ¹⁰¹ Holt 2021.

¹⁰² Matthews 2019. ¹⁰³ Matthew Evangelista, email conversation, 01/12/24.

¹⁰⁴ Matthews 2019. ¹⁰⁵ Jones 2016: 28, 37–38. Ambinder 2018: 194–201.

¹⁰⁶ Matthews 2019.

¹⁰⁷ Pelopidas and Egeland 2024. Fursenko and Naftali 1997, 2006. Sagan 1993: 142–50. Pope 1982.

officer named Vasili Arkhipov was serving on a Soviet nuclear submarine near Cuba. After hunting it for several days, US naval forces began dropping practice depth charges, and eventually the submarine had to surface for lack of battery power and oxygen. US navy planes dropped flares, covered the sub with their search lights bow to stern, and fired tracer bullets. The roar of the cannonade drowned out voice communications on the bridge of the floating submarine. One of the commanders thought the ship was under attack. He ordered an emergency dive and readying the sub's nuclear torpedo for use. Luckily, Arkhipov stayed on the bridge a little longer and was able to decode an apologetic signal that the commander of one of the American ships sent after the captain had left the bridge. The nuclear torpedo was not fired.¹⁰⁸

3. October Crisis.3: Post-Newtonianism and Nuclear Politics

Continuing discussions about the importance of organizational malfunctioning prompted Scott Sagan to convene in 2014 an excellent symposium on the state of nuclear security studies. It offers us an opportunity to probe implicitly held worldviews about nuclear crisis politics and war.¹⁰⁹ In his introductory essay, Sagan focuses on two “renaissances” in nuclear security studies, one among political scientists, the other among historians.¹¹⁰ A new generation of political scientists has probed old and new topics with statistical methods that are used to analyze new quantitative datasets. Historians have mined new archives, sometimes in new, collaborative ways. Since these two renaissances occurred side-by-side and in relative isolation from each other, Sagan calls for more collaboration across disciplinary divides between history and political science and between qualitative and quantitative approaches. Despite the evident diversity in their different contributions and their spirited disagreements on issues of methods and approach, most contributors echo Sagan's call.

Sagan's hope was not pious. Arguably the most important book written on the Cuban missile crisis is the second edition of *Essence of Decision*, co-authored by Graham Allison, the original author and a political scientist, and Philip Zelikow, a historian.¹¹¹ The two disagree strongly in their philosophy of science and worldviews.¹¹² Allison has a Newtonian understanding of the scientific enterprise and subscribes to the conventional understanding of explanation: objective facts in specific situations are

¹⁰⁸ Plokhy 2021: 267–72. Matthews 2019. Bendor and Shapiro 2019: 138–39.

¹⁰⁹ H-Diplo/ISSF Forum 2014. ¹¹⁰ Sagan 2014. ¹¹¹ Allison and Zelikow 1999.

¹¹² Allison and Zelikow 1999: 11–12.

covered by general laws. Zelikow is a humanist who does not believe that this scientific approach carries over to the domain of history. History, not replicable experiments with objective phenomena, provides the empirical material for human choices that aggregate to government action. Because of their differences the book is an outstanding example of humanist Newtonianism. United in a common, incoherent worldview, Allison and Zelikow were able to collaborate productively, providing the reader with a book that integrates much of the voluminous archival evidence that has become available since the publication of the book's first edition in 1971.

Humanist Newtonianism characterizes also the 2014 symposium, strong methodological disagreements to the contrary notwithstanding.¹¹³ The quantitative and experimental methods that the three political scientists – Fuhrmann, Kroenig, and Sechser – embrace are viewed with great skepticism by the historian Gavin. But none questions that humans – individual decision makers or groups of individuals – are the unit of analysis. And all share in a Newtonian worldview. The world is real, understood not as infinite post-Newtonian potentialities but as a Newtonian object, existing out there, knowable and governed by discoverable laws. Perceiving the “real world” correctly is hard. Hence misperception of what is real is a source of human error and confusion. The real world can be observed at a distance by those who study it. It is, furthermore, composed of entities with attributes, like the possession of nuclear weapons, that act like a force.¹¹⁴ These entities are conceptualized in terms of “dependent” and “independent” variables.¹¹⁵ And despite its many complications, this Newtonian world is closed and determinate, unlike the complexity of the post-Newtonian quantum world, which is open and indeterminate. “Pre-dictions” in this time-reversible, Newtonian world are really “post-dictions.”¹¹⁶ In contrast to determinist laws in the natural world, the social world is governed by probabilistic laws, with specified confidence intervals and robustness checks. These probabilities seek to establish patterns and regularities in a world that investigators can access unproblematically. This contrasts with quantum probabilities that are measuring the confidence we have in an inherently uncertain world.¹¹⁷ And in line with the mechanical, Newtonian worldview of the

¹¹³ My discussion focuses on the contributions by Francis J. Gavin 2014, and Matthew Fuhrmann, Matthew Kroenig, and Todd S. Sechser 2014.

¹¹⁴ Fuhrmann *et al.* 2014: 40.

¹¹⁵ “Independent” and “dependent” variable terminology is designated by quotation marks when these terms are used for the first time by Fuhrmann *et al.* (2014: 40). In oral presentation such variable talk is also often accompanied by air quotes, gesturing hand movements that visualize quotation marks. This indicates, perhaps, that for the authors, or speakers, variables are stand-ins that compress a more complex set of relationships between different entities.

¹¹⁶ Fuhrmann *et al.* 2014: 40. ¹¹⁷ Katzenstein 2022b: 26–32.

late nineteenth century, the step from correlation to causation requires the identification of mechanisms.¹¹⁸ It is noteworthy that in this symposium the spirited exchange between historian and political scientists focuses solely on methodological issues. It leaves unaddressed how we know what we know, and what are the basic units that make up the world. Epistemological and ontological questions are neglected. And why not? Historians and political scientists who are debating nuclear issues in this symposium inhabit the same humanist Newtonian world.

There is a throw-away sentence in Sagan's introductory essay to the symposium that neither he nor any of the participants follows up on. Sagan mentions that approaches in science, technology, and society (STS) studies have produced "very innovative work on missile accuracy, the Indian nuclear power and weapons program, the fire and blast effects of nuclear weapons use, and the links between nuclear technology and development in Africa."¹¹⁹ "Innovative" refers here to a post-Newtonian worldview that, unlike Newtonian humanism, acknowledges large world uncertainty.

Post-Newtonianism is deeply relational. Nuclear assemblages of technical objects and human actors are linked in complex processes that often misfire as normal accident theory holds. Human choice at those moments is consequential. The historical record confirms that entanglements among widely dispersed agents and technical objects undercut the optimistic view that nuclear deterrence is a guarantor of a "long nuclear peace."¹²⁰ Post-Newtonian humanism does not deny that deterrence has helped stabilize great power relations and steered major states away from war, including in 1962 and 1983. But human control and risk management have been shot through with unforeseeable events that on many occasions threatened to plunge rational decision makers and tightly coupled, complex systems into inadvertent war. The familiar story about the origins of the system of nuclear deterrence charts a natural and unstoppable march of weapons technologies driven by competition between states that operates in an anarchic international system. This anthropomorphizes states as unitary, rational actors, as in Allison's model 1. But states are not unitary actors. Disaggregating them yields organizations and bureaucracies, Allison's models 2 and 3. The black box of technological innovation is an interlacing of processes operating at different scales across different sites. Policies are outcomes of these processes.¹²¹ The American and Soviet missile guidance

¹¹⁸ Gavin 2014: 17, 24. Fuhrmann *et al.* 2014. The agreement on causal mechanisms by scholars working with variables suggests that a Newtonian world of objects can blur into a world of relations.

¹¹⁹ Sagan 2014: 6. ¹²⁰ Pelopidas 2015a: 11–22. ¹²¹ MacKenzie 1990: 395–409.

systems, for example, were not determined by technology and top-down politics. They were instead products of entangled processes that resulted in conflicts and collaborations among scientists and engineers, weapons laboratories and corporations, military and political leaders.¹²²

Looking closely undermines the notion that an all-encompassing structure of technology and politics produces outcomes. It is not Big Determinism that shapes the world but entangling networks, variegated social practices, and human choices. The human element is more important in such accounts than the Newtonian one. Weapon modernization is not a natural outcome of technological change in a world of objects. Technological innovation results from decades of work by large numbers of people tied together in different networks. For inertial navigation systems to be adopted, for example, required undermining established scientific knowledge and eliminating a technological rival and its supporters, who were interested in civil and military air navigation and favored reliability, producibility, and economy over extreme accuracy. Creation of missile guidance technology required the self-fulfilling prophecy that predicted changes in accuracy would become real only if established organizations were assured of secure, long-term funding. Absent that prophecy, alternative technological paths might well have been taken.¹²³ Interested in counterforce strategy for its own organizational and strategic reasons, the air force was receptive to the prophecy; the navy was not. The persuasiveness of a make-believe world rooted in human imagination mattered greatly.¹²⁴ Inventions in weapons technology were not made because they were needed but because individual imagination and political and technological entanglements made them possible. The search for their application came subsequently.¹²⁵ In short, technology and politics are so deeply entangled that they cannot be separated out in simple cause and effect sequences. They provide, to invoke an ugly phrase, a “co-constitutive context” that is heterogeneous and varies greatly across different sites. The further one disaggregates them, the harder it gets to distinguish one from the other as processes turn out to be highly variable.

India’s nuclear program offers a second example illustrating the same point. This story can be told in different ways: as the creation of an object, the bomb, produced by a developing country responding to international and domestic pressures; as a story of heroic individuals, scientists and engineers, doing amazing work; and as a story of entangling relations

¹²² MacKenzie 1990: 2–4. ¹²³ MacKenzie 1990: 388, 391.

¹²⁴ MacKenzie 1990: 382–91. ¹²⁵ Evangelista 1988.

between scientific research centers and Indian political leaders.¹²⁶ The evolution of modern science in India, Robert Anderson argues, put the atomic nucleus at the center of the Indian nation. There was no blueprint the first two generations of scientists could follow. They had to act as brokers between their support of modern science and a diffuse skepticism rooted in ancient Indian beliefs. The 1990s provided two examples: the “scientific temper” movement around the BJP and the “India Shining” celebration of a possible synthesis between science and spirituality in the “Hindu consciousness movement.” Throughout the twentieth century, but especially after India won its independence from Britain in 1947, scientists were seizing a new kind of power while developing persuasive visions for different political constituencies. India’s nuclear scientists succeeded in transcending political polarities and creating an entangled environment for their work “in which their realization that ‘you are either this, *or* you are that’ was too simplistic and ‘you are *both* this *and* that’ was sometimes confusing.”¹²⁷

For more than half a century US nuclear war planning calculated nuclear blast effects as the sole criterion for assessing the damage caused by nuclear weapons. The damage done by mass fires was neglected because it was not thought to be clearly predictable.¹²⁸ However, mass fire effects extend two to five times further than blast effects, with similar horrible consequences. Why did this systematic failure in damage assessment persist for so long? The conventional wisdom holds that this is due to nature, the inherent unpredictability of mass fire effects. Lynn Eden argues instead that it is due to different processes and entanglements. Knowledge-laden routines respond to everyday social life, specifically expert understandings and predictions acquired at great cost and over long periods of time. Routines offer solutions to problems that an organization has decided to solve. Blast effects could be measured accurately, fire effects could not. Blast effects thus were a problem; mass fires were not. The tendency of making things that can be measured accurately a problem and neglecting others that cannot be measured is true in the study of international relations and the social sciences more generally. It helps explain why small world thinking all too often eclipses large world thinking.

Individual and organizational knowledge give representations of the world that actors take to be reliable information. Such representations can be explicit or tacit. Like language, they are not shaped directly by the natural world. Rather, they are socially constructed. This does not mean

¹²⁶ Anderson 2010: 3, 5–7, 11–12, 14–17. ¹²⁷ Anderson 2010: 533.

¹²⁸ Eden 2004: 1–11.

that we must reject the existence of a reality outside of the social world. But knowledge of that reality is always molded by its broader historical, social, and discursive context.¹²⁹ Lynn Eden writes that “the choice made to solve problems of blast damage prediction but not fire damage prediction seemed to be based not on prior choices but grounded in nature itself. This became, in turn, a self-fulfilling prophecy.”¹³⁰ Innovation did occur in the 1980s, constrained by past lessons and existing routines. Fire damage prediction models became more formal and acquired greater predictive accuracy – without, however, influencing nuclear targeting. Organization-made disasters, such as the *Titanic*, Mad Cow disease, and the collapse of the World Trade Center, are neither fully determined nor fully contingent.¹³¹ Self-reinforcing processes and bounded change co-occur, thus avoiding overly deterministic or overly contingent accounts.¹³² They are explicable as the result of relations that left the American military largely blind to the prospect of incinerating the world in a possible nuclear war.

“Nuclearity” is therefore not an essential property of things; it is a property that is distributed among things. Because uranium was not born nuclear, it took a great deal of work to make African uranium mines nuclear. For almost half a century, in this complex set of entanglements African uranium miners were kept invisible and at risk.¹³³ The mining of uranium in different parts of Africa and different workplace and public health regulations in the United States, Europe, and Africa illustrate this point. Geological nuclearity can be established through Geiger counters; but that does not translate into a medical nuclearity that workers in Africa could translate into political or economic claims. Radiation is a physical phenomenon that exists independently of how it is detected or politicized. Nuclearity thus emerges from highly variable political, cultural configurations of technical and scientific objects.

Such insights and arguments do not receive any commentary either by Sagan or any of the other symposium participants. The reason for this collective silence lies arguably in the fact that by their very nature, in contrast to international relations and other social sciences, STS studies are more fully conversant with post-Newtonianism as one of the main intellectual developments in various fields of science and technology during the twentieth century. Hence, scholars of STS are not as strongly attached to the late nineteenth-century Newtonian worldview that defines many strands of political science and some other social sciences at the outset of the twenty-first century. Developing and incorporating elements

¹²⁹ Eden 2004: 7, 50, 284–85. ¹³⁰ Eden 2004: 286. ¹³¹ Eden 2004: 291–304.

¹³² Eden 2004: 283–88. ¹³³ Hecht 2012: 13–16, 35–37, 40, 44–46, 353–54, fn 12.

of post-Newtonianism and grafting them onto STS studies is innovative. The collective silence which they encounter illustrates how much could potentially be learned about the nuclear world if scholars of international relations broadened their accustomed worldview.

International relations scholar and political theorist Jairus Grove's interpretation of the October crisis expresses an even deeper kind of post-Newtonianism. His relationalism extends all the way down. For investigators following Max Weber, humans are a natural unit. For others they are mere fiction. Antonio Damasio, for example, argues that neural networks constitute the "I" and make emotions an integral part of the machinery of reason with which we seek to chart a course of action into an uncertain future.¹³⁴ Stressing the entanglement of different elements within the individual undercuts Max Weber's methodological and substantive individualism.¹³⁵ Relations do not stop at the level of the human individual. Going well beyond the methodological individualism characteristic of Newtonian humanism, Grove writes "We are not constituted *by* relations, we *are* relations."¹³⁶

This view holds for objects just as much as it does for individuals. Far from breaking with traditional practices of war, automated lethal warfare is the result of the scientific control of killing humans on the battlefield. Weapons are not static material objects that simply emanate from purposive human intentions. Nuclear weapons, for example, must rely on elaborate and problematic theories of deterrence to control and harness their effects.¹³⁷ Biological weapons are lethal in ways that are often unknown or unknowable and simply do not fit the logic of state warfare. Objects become weapons through relational changes. Weaponizing objects has long social tails. "The improvised explosive device" that was so important in the Afghan and Iraqi wars is a "wholly non-standardized design cobbled together from a medley of repurposed objects."¹³⁸ Weapons are not passively channeling human volition but generate practices as they shape desires for violence. As such they offer an entry point "into a veritable thicket of actors, relations, events, knowledge and incipient transformations" that reveals "the profound entanglement of modern scientific and technological practice with our contemporary ways of war."¹³⁹

The scale at which this relational view applies depends on the cut the investigator takes into the world. Following Grove, we could focus on particular parts of the brain, matching the medical metaphors that many

¹³⁴ Damasio 1994, 2021. ¹³⁵ Grove 2022b: 125–26, 131–34. Davis 2022.

¹³⁶ Grove 2022b: 129. ¹³⁷ Welch 2022: 78–80. ¹³⁸ Bousquet *et al.* 2017: 2.

¹³⁹ Bousquet *et al.* 2017: 4.

political scientists extol as a highly desirable but often unobtainable way of establishing causation in the social sciences.¹⁴⁰ Whatever its advantage for establishing causation, choosing a neural cut, as Damasio does, raises thorny issues about brain, mind, and consciousness that may have to rely on notions of causation more complex than Hume's efficient cause. All scientific inquiry leaves an investigator's cut into the world to her question and her interest. The cut is not preordained by the world she seeks to explore and navigate, as in Weber's holistic individuals or Damasio's decomposable neural networks. The fact that we think of nuclear decision making and crisis politics as the result of human action depends on how we think and feel about the "I." Grove's deeply relational sensibility adds a new element to the renaissance that Sagan speaks of.¹⁴¹

In his analysis of the October 1962 crisis Grove shifts attention away from the President as the most important decision maker and highlights instead entangling processes. His approach focuses on how people and objects relate across geographical and temporal scales and heterogeneous assemblages that are not caught by conventional models.¹⁴² Yet he also leaves room for human agency exercising control over the deployment of nuclear weapons that is neither fully autonomous nor fully submerged in relational processes. Humans matter like everything else. But they are not exceptional in their mattering. Human beliefs and desires do not in and of themselves translate automatically into efficacy, mastery, and control. The decision to launch or not to launch nuclear weapons is a result of the relations among thousands of people involved in intelligence gathering and interpretation, security briefings and consultations, weapons maintenance and manning, and a huge assemblage of material objects that make up the US nuclear striking force on land, on sea, and in the air. There is no unequivocal starting point for any launch decision. There is only a tangle of relations and apparatuses. Presidential power at the very top as an embodiment of sovereignty is part of a much larger nuclear assemblage. Grove's ecological approach to the October crisis is not replacing sovereignty with assemblage but conceptualizing sovereignty in terms of assemblages. He thus offers an account of the fundamental entanglement of things and humans in the nuclear assemblage of a sovereign state. As [section 1](#) above has shown, a focus on human rationality and choice avoids thinking of the relations and assemblages of objects that are necessary for the full articulation of human interests and desires.¹⁴³ Humans are not the sole determinant of thinking and acting. They are part of national assemblages of humans

¹⁴⁰ Fuhrmann *et al.* 2014. ¹⁴¹ Grove 2022a. ¹⁴² Grove 2019: 10.

¹⁴³ Grove 2022b: 136–43.

and objects that are brought together in preparation for initiating unimaginable, organized violence.¹⁴⁴ Because assemblages do not follow the simple logics of sovereign states, deterrence does not rule out nuclear war. In Grove's unsparing words "the geopolitical project of planet Earth is a violent pursuit of a form of life at the cost of others – full stop. . . . [T]he violence of geopolitics is an ecological principle of world making that renders some forms of life principle [*sic*] and other forms of life useful or inconsequential . . . Geopolitics, enacted through global war, is itself a form of life."¹⁴⁵

For Grove investigation is a form of story-telling about entanglements of widely distributed formations of actors and objects. Those formations are not well captured by the conceptual language of dependent and independent variables, for him arbitrary shortcuts into reality that are inadequate for capturing the effects of entanglement. They do not have any inherent meaning; rather, the attribution of causal relations is an effect of the investigation. The observation of action is part of the relations that make the world, just like the action itself. Observation does not stand at a distance, apart from the world. For our answers to questions depend on the scale at which questions are posed and answers sought.¹⁴⁶ Grove's entire line of argument is informed by a post-Newtonian worldview and large world thinking.

In his account of the Cuban missile crisis, preparation for nuclear war is an ongoing set of relational processes without any specific ethics.¹⁴⁷ The assemblage of nuclear war fighting matters and so does the office and person of the President. In nuclear politics assemblages of objects and networks of organizations and people are the sites for unfolding entanglements among different actors. The reduction of complex processes to unitary actors is not necessarily wrong. Even when they are misleading or false, such simplifications can yield useful insights while concealing complexity and causality operating in other sites and at other scales. The President's unquestioned, ultimate authority appears in full sight only when methodological individualism primes an observer to look for an already constituted single decider, as shown in [sections 1 and 2](#) above. However, as a sovereign decision maker the President is not self-constituted. To be relevant, effective, and equipped with social resonance and political legitimacy, his actions depend on relations with other individuals and objects. "The issue was not whether Kennedy and Khrushchev *wanted* to control events," writes journalist Michael Dobbs;

¹⁴⁴ Grove 2019: 10; 2022b: 127–28. ¹⁴⁵ Grove 2019: 3.

¹⁴⁶ Grove's position is very similar to Barad's (2007), discussed in [Chapter 7, section 3](#).

¹⁴⁷ Grove 2022b: 127–28.

“it was whether they *could*.”¹⁴⁸ Unlike several of his advisors, Kennedy believed that he was operating in the large world of uncertainty. This belief made him cautious. When he could, the President played for time, as he tried to keep open rather than close down the list of agonizing choices he faced.¹⁴⁹ Because of his limited knowledge and control, the President called fewer plays than most people think. In a large world of uncertainty, Grove writes, Kennedy operated “more like a mascot than a quarterback.”¹⁵⁰ His playbook favored an incremental, iterative, and experimental approach. He searched for useful rather than optimal solutions to the grave problems he faced. Janice Stein calls this a pragmatic strategy of “learning by doing.”¹⁵¹

4. **Jargon Anesthetizing Awful Possibilities: Language and the October Crisis**

Post-Newtonianism shows that facts on the ground are rarely straightforward. For example, the bewildering concatenation of events experienced by the makers and the victims of the events in France in 1789 subsequently became an object with its own name, “the French revolution.” The accumulation of human experiences of those chaotic months was “shaped by millions of printed words into a ‘concept’ on the printed page, and, in due course, into a model. Why ‘it’ broke out, what ‘it’ aimed for, why ‘it’ succeeded or failed, became subjects for endless polemics . . . but of its ‘it-ness,’ as it were, no one ever after had much doubt.”¹⁵² The reverse is true for the Cuban missile crisis. Until the mid-1980s, James Blight and Janet Lang argue, the Cuban missile crisis was thought of as “simple, short, clean, salutary.” On closer study they found it instead to be “complex, immense, horribly violent, ongoing.”¹⁵³ Compression and simplification is how Newtonianism deals with complexity. Lack of attention to language is one illustration. To give but two examples: In the development of weapons of war, justification in terms of “modernization” is not a neutral description but an exercise of discursive power.¹⁵⁴ A second example are the devices exploded during India’s 1974 and 1998 nuclear tests. They were not military weapons. Called bombs by everybody, these devices *became* bombs.¹⁵⁵ In small worlds, language

¹⁴⁸ Dobbs 2008: xvi. ¹⁴⁹ Sauer 2015.

¹⁵⁰ Grove 2022b: 140 is an implicit critique of Sauer’s (2015) analysis.

¹⁵¹ Stein 2024: 2; 1999. ¹⁵² Anderson 1991: 80–81.

¹⁵³ Blight and Lang 1995: 261; 2018. ¹⁵⁴ MacKenzie 1990: 382–83.

¹⁵⁵ Anderson 2010. Weldes (1996: 276–77) makes the point for nuclear weapons in general.

“represents,” passively mirroring the real world. In large worlds, language “re-presents,” actively shaping the real world.

As was true in financial affairs discussed in [Chapter 4](#), the choice of language in which to tell a story is politically consequential. The Cuba crisis was not primarily about signals sent or received, as in rational deterrence models. Debates about language were fierce. Take, for instance, the ten letters Kennedy exchanged with Khrushchev between October 22 and October 27. The participants knew what has escaped many deterrence theorists: An exchange of texts can create weak bonds of social trust through a process of positive mutual identification that can help alleviate or resolve a crisis.¹⁵⁶ Beyond the letters, many aspects of the missile crisis involved genuine creativity in communication and decision making.¹⁵⁷ In fact, language cut to the core of the crisis. American warnings issued to the Soviet Union against the deployment of offensive missiles were made for domestic political reasons. According to the President’s speechwriter and advisor Ted Sorenson, if Kennedy had known about the deployment of forty offensive missiles, he might well have put the red line for the US at 100 missiles.¹⁵⁸ Neither number changed the strategic balance of forces one iota. The declaration of an interest that Kennedy apparently did not believe in created the interest deemed so important that it was worth risking nuclear war.¹⁵⁹

The language in which political actors tell their stories about the world can be profoundly revealing. For example, the crisis of October 1962 which put the world closest to the outbreak of a global nuclear war went by different names.¹⁶⁰ Americans call it the “Cuban missile crisis,” Russians the “Caribbean crisis,” and Cubans the “October crisis.” The “crisis” terminology not only represents facts on the ground. It also creates entirely different worlds of understanding. Geographically and temporally confined, Americans and Russians refer to thirteen days in October 1962 when a conflict over the Soviet decision to station nuclear-tipped missiles in Cuba threatened to spiral out of control. Referring to a thin slice of history, cut surgically from its broader historical context, that crisis was resolved peacefully, to the great satisfaction of most Americans, Russians, and many others. When it comes to the events of October 1962, Americans and Russians search the past for applicable lessons for the future.¹⁶¹

Not so the Cubans. This was illustrated dramatically in a series of conferences convened in the late 1980s in which former officials and

¹⁵⁶ Wheeler and Holmes 2021: 731–32, 737–43. ¹⁵⁷ Sauer 2015: 100.

¹⁵⁸ Blight and Welch 1989: 43. ¹⁵⁹ Haas 2001: 257–58.

¹⁶⁰ Weldes 1999: 21–40. Allyn *et al.* 1992: 173, 187, 206. Blight and Lang 1995: 241.

¹⁶¹ Allyn *et al.* 1992: 202.

scholars tried to understand what had happened.¹⁶² For the Cuban participants the “October crisis” starts in the nineteenth century; it was ratcheted up by the 1958 Cuban revolution and the 1962 October crisis; and it has continued ever since. The “crisis” is merely a small instance of the United States seeking regime change in Havana. What participants in these conferences learned is that for Cubans the October crisis must be measured not in days but decades; that it was not resolved peacefully but led to thousands of casualties once the more or less covert actions of the US and Cuban governments, both before and after October 1962, are included; and that the events of October 1962 cannot be understood unless they are put in the context of the implacable hostility between the two countries after the success of the 1959 revolution. The empirical record of October 1962 is clear – the “crisis” does not exist as an uncontested object of study. In contrast to Americans and Russians, Cubans insist on traveling “forward into the past,” to understand better which lessons can and which cannot be learned from the narrow focus on crisis management.¹⁶³

Going beyond the “crisis” terminology, October 1962 also illustrates the importance of language in the discursive construction of the national interest. That concept makes policy makers understand the goals they wish to pursue with their foreign policy. And it serves as a rhetorical device generating political legitimacy and support for state action. Policy makers interpret the situation they face through a language they share among themselves and the publics they seek to influence. In short, the national interest norm is produced through language.¹⁶⁴ It was not the Soviet missiles as physical objects that created the nuclear crisis in October 1962. It was the meaning attached to them. The Soviet missiles “had to be *made* to mean something before it was possible to know what to do about them.”¹⁶⁵ The conventional US representation of the crisis tells the story of October 1962 as one of sudden, secret Soviet aggression that upset the status quo.¹⁶⁶ Soviet officials lied about what they were planning to do numerous times in various fora. They invaded America’s sphere of influence. And they threatened the American heartland with the installation of offensive, nuclear-tipped missiles in Cuba. Soviet conduct thus posed a serious test for American credibility and resolve. But the crisis “does not simply reflect ‘the facts’.”¹⁶⁷ Rendered in different language, other stories, told from the vantage points of Moscow and Havana, also fit “the facts” on the ground.

¹⁶² Weldes 1999: 78–86. Blight and Lang 1995: 248–53, 260–61. Karlsson and Acosta 2019: 3–68.

¹⁶³ Allyn *et al.* 1992: 203. Scott 2007: 144–46. ¹⁶⁴ Weldes 1999: 4. Finnemore 1996.

¹⁶⁵ Weldes 1999: 2. ¹⁶⁶ Weldes 1999: 41–60. ¹⁶⁷ Weldes 1996: 292.

One is a defensive story. Moscow moved simply to deter the US from waging war against an ally of the Soviet Union.¹⁶⁸ Defeating the Cuban revolution had become the declared policy of an encompassing bipartisan coalition in American politics. The early months of the Kennedy administration witnessed a crescendo of hostile actions, ending in the failed invasion at the Bay of Pigs in April 1961. Putting Soviet missiles on Cuban territory was a deterrent, warning the US not to escalate from clandestine actions to full-scale invasion. It was the US not the Soviet Union that was the aggressor and threatened to bring about war in the Caribbean. The US had neither right nor reason to seek the removal of the Soviet missiles.¹⁶⁹

A second story focuses on the strategic imbalance in US and Soviet nuclear forces.¹⁷⁰ Kennedy had won the Presidential election of 1960 charging that the Republican administration had been asleep at the wheel and failed to counter the growing “missile gap” between the Soviet Union and the United States. Once in power, the new Democratic administration realized that rather than being behind, the US had an enormous 17:1 superiority in nuclear weapons. At the time, defense intellectuals estimated that with a ratio of 20:1 it would be feasible for the US to initiate a first strike with the hope of winning a nuclear war with the Soviet Union. All American decision makers agreed in October 1962 that the addition of forty Soviet nuclear warheads stationed in Cuba had no effect on American superiority. But it might have helped recalibrate the psychological imbalance at least a little and thus enhance the security of both countries.¹⁷¹

Going beyond October 1962, language and discourse matter greatly for how defense experts discuss nuclear war. Their jargon conceals awful possibilities. Together with the general public they are, in the words of philosopher Günther Anders, “lazy people of the apocalypse.”¹⁷² Even though, as historians Matthew Wald and Benjamin Zeimann write, “‘the bomb’ itself became the central metaphor” of the Cold War, defense experts were unable to visualize what they were actually producing and failed to exercise their imagination and sense of morality.¹⁷³ The secrecy, complexity, and special competence required for their jobs render defense experts unequipped to shed light on the concrete manifestations of a possible nuclear war. As agents of the system of deterrence their role is to convince different audiences of the adequacy, stability, robustness, and effectiveness of nuclear deterrence. They believe in perfect control of

¹⁶⁸ Weldes 1999: 61–74. Pope 1982. ¹⁶⁹ Weldes 1996: 292–93.

¹⁷⁰ Weldes 1999: 86–92. ¹⁷¹ Weldes 1996: 292–95.

¹⁷² Quoted in Mian and Pelopidas 2023: 323. See also Pelopidas 2016.

¹⁷³ Wald and Zeimann 2016: 2.

a passive technology, as anthropologist Hugh Gusterson found out in his interviews at the Lawrence Livermore National Laboratory.¹⁷⁴ Deeply knowledgeable about the disaster of nuclear war and the possibility of civilizational collapse, most defense experts are not charged with informing the public. They, after all, hold the firm belief that nuclear war will never happen.¹⁷⁵

Defense experts rely on what Carol Cohn calls a “technostrategic” way of talking.¹⁷⁶ Their language captures the rationale of deterrence, nuclear arms races and rivalries, and attempts to stop the unthinkable from happening. This language masks the consequences should the unthinkable happen. It does not “represent” the reality of nuclear war. In fact, it conceals it. The potential destruction of nuclear war is so grotesquely high as to defy all forms of rational thought or speech. The professional discourse is absurdly abstract and antiseptic, with its “first and second,” “counter force and counter city,” and “surgical” strikes, and “limited” or “total” nuclear war. In the past, such distancing occurred in the violence-enabling dehumanization that preceded the mass murder of Jews and others in the Holocaust.¹⁷⁷ Similarly, the reliance on distancing through technostrategic language conceals the horrors of a possible nuclear holocaust in the future. “Clean” bombs, for example, are nuclear devices that are created largely by fusion rather than by fission and therefore release more energy as blast rather than radiation. Because they are “clean” their enormous destructive power is freed from the baggage of emotional fallout. “Collateral damage” is a linguistic way of concealing “mass murder.” Part of the US strategic force between 1986 and 2005, the MX missile, was the bearer of 250–400 times the destructive potential of the bomb dropped over Hiroshima. President Reagan referred to it as the “Peacekeeper.” Defense analysts preferred to call it a “damage limitation weapon” instead.

The chasm between “technostrategic” talk and the reality it conceals is wide and deep. Language “represents” bombs as giant killing machines and “re-presents” them antiseptically and abstractly to conceal the terrifying violence they can spread. Furthermore, Cohn refers to the pervasiveness of sexualized and patriarchal language that covers the full spectrum from male domination to boyish mischief. The urge to domesticate and tame these wild weapons also infuses the language of defense analysts. Missiles lined up in their silos on a Trident submarine are “the Christmas tree farm.” Weapons are not “bombs” but “reentry vehicles.” They are not “dropped” but “delivered by a bus.” And weapon systems

¹⁷⁴ Gusterson 1996. ¹⁷⁵ Mian and Pelopidas 2023: 324–26. ¹⁷⁶ Cohn 1987.

¹⁷⁷ Landry *et al.* 2022.

can “marry up” or “couple.” In this language insentient weapons are humanized while sentient human beings are ignored. “Fratricide” describes a situation when one warhead kills another warhead. “Vulnerability” and “survivability” refer to weapon systems not humans left nameless by technostrategic talk. Religious language is also part of the stock in trade of this specialized language. The first atomic bomb test in July 1945 was called “Trinity,” the male forces of creation. And members of the group of defense intellectuals refer to their community as “the nuclear priesthood.” Acronyms such as ABMs and MIRVs can be fun. They neuter the destructive force of nuclear weapons. Developing language competency, Cohn reports, makes the speaker feel like she is in control of the uncontrollable and removes her from the reality of nuclear war. Learning this language shifts the content of what can be talked about “monumentally,” as well as “the perspective from which you speak.”¹⁷⁸ The antiseptic, cool language of the user of nuclear weapons differs radically from the emotionally charged language of those who survived the nuclear attacks on Hiroshima and Nagasaki. Technostrategic language affords distance by abstraction, and a sense of control that extends the self rather than threatens it. And expert language makes it impossible for certain questions to be asked and certain values to be articulated. It is a language tailored not to the reality of nuclear incineration and destruction on an unimaginable scale but to a world of abstractions. Validity is measured only by its internal logic. Language produces a world of experts and a perception of full control. Correspondence with the large world of possibilities is not at issue. Language is a tool to think about the unthinkable not to describe relations on the ground. Thus, technostrategic language does not only represent but it also creates reality.

Language also changes the context of politics, and not only during the October 1962 crisis. These days, American administrations are struggling with how to name the rising tensions between China and the United States. Washington seeks to avoid “Cold War” terminology as outmoded. But increasing strategic clashes, technological rivalries, and military maneuvers define a competitive-cooperative relationship that defies easy classification. Choosing the wrong label might create a self-fulfilling prophecy, driving the relationship toward new lows. It remains to be seen how today’s “competitive coexistence” differs from the “peaceful coexistence” of yesteryear. “In the Biden White House,” concludes journalist David Sanger, “there is no area where words are measured more carefully than in talking about relations with Beijing.”¹⁷⁹ The “Bomb as God” metaphor puts the nuclear bomb beyond human control and

¹⁷⁸ Cohn 1987: 705. ¹⁷⁹ Sanger 2021: A8.

transforms it into a metaphysical ultimate that will be with and in us, and possibly destroy us.¹⁸⁰ Robert Oppenheimer invoked this image when on July 16, 1945, after the first nuclear test in Los Alamos, he paraphrased the Bhagavad Gita: “Now, I am become Death, the destroyer of worlds.” A couple of decades into the nuclear era, October 1962 was a very close call with global destruction. Whether it is measured in human or geological time, this existential threat is not disappearing.

5. The Bargaining Model of War

For more than half a century Thomas Schelling’s seminal work in the 1950s and 1960s has had a pervasive influence on the theory and practice of nuclear deterrence as well as the study of war. Schelling’s creative conceptual moves reduced uncontrollable large world uncertainty to manageable small world risk. For Schelling accidental factors feed seamlessly into controlled, competitive risk taking. In his theory accidents are drawn from a known probability distribution. As parties draw closer to the brink in a crisis, they become increasingly careful. Accidents are uninteresting appendages of rational decisions. And decisions are constrained by the powerful logic that deterrence theory articulates: nuclear war is unwinnable and non-sensical. Schelling’s approach is normally interpreted as squeezing out of deterrence theory unfathomable unknowns, contingencies, and indeterminacies. Establishing the power of control over “the ultimate weapon” reinforces the claim that rational deterrence theory, operating in small worlds, explains large world uncertainties. Schelling’s analysis thus fuses probabilistic and possibilistic thinking. In this retelling of Schelling’s theory the “threat that leaves something to chance” is not given its proper due. It is regarded instead as an implicit form of randomization akin to a teenager in a 1950s drag race deliberately and visibly losing control over steering his own car and leaving it to his enemy to make the adjustment that prevents a deadly crash. With the elaboration of the concept of an organizational Doomsday Machine scholarship on nuclear deterrence has taken this approach to its extreme, both logical and illogical.¹⁸¹ Such a machine is illogical because it kills unnecessarily, without purpose, and at a terrifying scale in the event of a successful surprise attack – satisfying nothing but the instinct for revenge. And it is logical because that instinct is what makes deterrence work in the first place. Cognitive biases at the individual level are overridden by something that for evolutionary psychologist Rose McDermott creates

¹⁸⁰ Hymans 2023. ¹⁸¹ Silver 2024: 426. Rhodes 1989: 156.

behavioral predispositions that enhance the stability of nuclear deterrence.¹⁸²

Informed by Schelling's work students of security studies have developed and tested extensively what has come to be known as the bargaining model of war. In the story it tells Clausewitz's fog of war is not permitted to obstruct the cloudless sky of human rationality. It offers a risk-based view of war that disregards uncertainty.¹⁸³ This is made possible by the bargaining model's first core assumption, which it shares with the rational expectations theory of economics: the parties to a conflict subscribe to the same understanding of how the world works.¹⁸⁴ This is vital for the model to work. Yet, it is often wildly implausible to believe that parties locked in bitter conflict share the same understanding of the world. Often fed by different worldviews, imagination and potentialities of how the world might work thus tend to escape the attention of the bargaining model. Irreducible and consequential deviations away from expectations created by risk-based models stop the putative convergence of views around a single model. Based on the implausible assumption of convergence, rationalist models follow an implausible chain of reasoning about actors with different preferences. If these actors decide to fight, each side will pay a cost. These costs open up a range of bargained solutions that both sides should prefer to war. Since war is always inefficient after its outbreak, for the bargaining model the puzzle of war is why the two parties fail to settle before war breaks out. The answer to the puzzle lies in the existence of imperfections in information and the incentive to misrepresent on the one hand, and the inability to credibly commit to an agreement that prevents war on the other.

The model introduces a second core assumption: updating of information will select out inferior models of the world. The idea is that the occurrence of war in world politics is a game with many trials. The world is an urn from which history pulls red and white balls. Over time, with many trials the results fit a normal, bell-shaped statistical distribution. This assumption is unwarranted. Wars are rare events with large effects best captured statistically by scale-invariant power laws that do not look anything like a bell-shaped curve. Akin to theoretical physics, power laws model systems not humans. With their long and fat tails, power laws capture the discontinuous jumps of rare events in history missed by the

¹⁸² Silver 2024: 428–29.

¹⁸³ A number of colleagues have contested this point and suggested that I talk to game theorists who are developing sophisticated models. This misses the point. For the most part game theorists are not interested in offering political insights. Scholars of international relations are and should be.

¹⁸⁴ Kirshner 2015b; 2022: 62–66. Porter 2016.

smooth, normal distribution of Gaussian statistics with their short and thin tails. Power laws are counting the frequencies and severities of events, not their presence or absence. Rare and severe events are, statistically speaking, not outliers but normal. One of the best studies of war contradicts the conventional wisdom of the decline of war in recent decades. Relying on power-law statistics, Bear Braumoeller concludes that “the potential of war to escalate remains nothing short of horrifying.”¹⁸⁵ Cirillo and Taleb confirm this assessment with their statistical analysis of war casualties during the last 2,000 years. They conclude that “all the statistical pictures obtained are at variance with the prevailing claims about ‘long peace,’ namely that violence has been declining over time . . . one may perhaps produce a convincing theory about better, more peaceful days ahead, but this cannot be stated on the basis of statistical analysis.”¹⁸⁶ Power laws have also been found in the frequency of severe terrorist attacks, inter- and intrastate conflicts, and estimates of war casualties when data are missing.¹⁸⁷

One of the original proponents of the bargaining model of war, James Fearon, conflates risk and uncertainty when he writes that “given identical information, truly rational agents should reason to the same conclusion about the probability of one uncertain outcome or another.”¹⁸⁸ This conflation of the concepts of risk and uncertainty has become deeply engrained in many theoretical extensions and empirical applications of the bargaining model. Important analyses of nuclear deterrence, terrorist violence, nuclear brinkmanship, ceasefires in civil conflicts, and power shifts are either reducing uncertainty to risk or treating the terms as synonyms.¹⁸⁹ This is odd in light of the model’s focus on bargaining, which is conducted by specific actors with specific experiences. Hunches and intuitions are hard to measure and cannot, by definition, be systematized into a single model; nevertheless, they can play important roles in shaping bargaining outcomes.

World politics is not a game with many trials. And it is not an urn from which history pulls red or white balls. Players are colorblind. And there is

¹⁸⁵ Braumoeller 2019: 120. See also Cederman (2003) and the pathbreaking early work of physicist Lewis Richardson (1948, 1960), often invoked in over sixty years of war scholarship but very rarely applied.

¹⁸⁶ Cirillo and Taleb 2015: 1, 12.

¹⁸⁷ Clauset *et al.* 2007. Trinn and Naumann 2023. Spirling *n.d.* Okamoto *et al.* 2023. Friedman 2015.

¹⁸⁸ Fearon 1995: 392. Kirshner 2000. The concept of “true rationality” begs the question of the meaning of “rationality.”

¹⁸⁹ Kydd and Walter 2006: 56–59. Kroenig 2013: 144–45, 150. Fortna 2003: 340–41. Debs and Monteiro 2014: 8, fn 23. The confounding of risk with uncertainty can also be found in the European security literature. See Hammerstad and Boas 2015; Petersen 2012.

no way of updating expectations based on the number of balls left in the urn. Misperceptions, the fog of war, and a host of other factors prevent the emergence of converging expectations based on updated information generating shared models of how the world works. There is only one play, a lot of bluffing, and different interpretations. Crises understood as polycrisis are generators of chains of contingencies and uncertainty rather than of risks that are known or knowable. In short, on issues of war and peace world politics simply does not offer, as the bargaining model assumes, a sufficiently large number of trials to select out inferior models. Even if all actors shared the same model of the world, which they do not, these models would fail. By making strong but implausible assumptions, the bargaining model of war focuses on the calculable directionality of decisions in small risky worlds. Unlike Schelling it slights creative imagination and improvised coping, which generate entirely different decision logics. Carl von Clausewitz, author of one of the classic studies of war and fully attuned to the importance of chancy uncertainty in what he called “the fog of war,” disagreed with the bargaining model (which he could not have known about): he wrote that “no other human activity is so continuously or universally bound up with chance.”¹⁹⁰

The bargaining model holds that different conclusions about future outcomes are possible because of differences in information. It fails to take into account how differences in worldviews create enormous problems associated with Bayesian updating, discussed in [Chapter 1](#). The probability of victory in any conflict and the cost of fighting are assumed to be calculable and subject to known or knowable probabilities by all parties to the conflict. However, disagreements are unavoidable when actors put the same information to work in different worldviews. As is true elsewhere, in world politics rationality takes the form of many situationally specific kinds of reasonableness. And standards of reasonableness differ in worldviews marked by different cosmologies, different historical memories, different conspiracy theories, different emotions, and different moral prescriptions. For example, the 1970s détente period rested on a bedrock of illusions that US and Soviet decision makers shared about each other. “The superpowers,” writes Eric Grynaviski, “were simply wrong; they did not understand each other as well as they thought.”¹⁹¹ Misunderstanding in this instance secured cooperation that accurate information would have stymied. Filtered through different worldviews, shared information can be constructive. However, it is not the information but the worldview that drives actors toward peace or war. Worldviews that make room for both small world risk and large world

¹⁹⁰ Quoted in Braumoeller 2019: 126. ¹⁹¹ Grynaviski 2014: 13.

uncertainty can capture more of the fabric of world politics and crises than bargaining models that exclude those elements and put too much stock in rationality and control.¹⁹²

The problem with the bargaining model lies in the realm of theory rather than in its empirical application to different questions of security. Hedley Bull noticed long ago that the central ideas in Thomas Schelling's work were not derived only from formal game theory operating in the world of risk; they also represented "an imaginative conceptual exercise" dealing with the problem of uncertainty.¹⁹³ In contrast to Schelling himself, scholars applying the bargaining model of war have overlooked the centrality of imagination.¹⁹⁴ Bypassing the technical virtuosity of formal models of war, Jonathan Mercer similarly stresses the importance of creativity. In neglecting the importance of creativity political scientists risk "turning sophisticated political actors into lab rats . . . They have done so because predicting creativity is difficult and perhaps impossible – if one can predict creativity it cannot be very creative."¹⁹⁵ Imagination and creativity highlight the central importance of different worldviews, models of how the world works, and uncertainty in world politics.

Informed by what the history of the October crisis tells us about how decision makers operate under conditions of uncertainty, Janice Stein offers an instructive analysis of the early stages of the Ukraine war.¹⁹⁶ When a norm-breaking Russia invaded Ukraine in February 2022 President Putin coupled the invasion with vague threats of nuclear war. President Biden and his administration faced a situation of radical uncertainty. How should they respond in a situation where Ukraine was not a NATO ally but a country of interest and concern for the US and its NATO allies? Uncertainty was enhanced by the fact that Putin did not know what to do once the war failed to end in the quick victory he had envisaged. In a lengthy war what would constitute an "existential threat" to the Russian state – the red line that the US should not get close to?¹⁹⁷ Most likely Biden did not know his own preferences either, after the deterrence strategy he had adopted in the run-up to the war had failed. Contrary to established, risk-based deterrence theory, actor preferences did not shape strategy. Instead, strategy instructed preferences – a reminder of the old joke: "How can I know what I think till I hear what I say?"

Stein centers her analysis of the war on uncertainty about the escalatory dynamics rather than on cost-benefit calculations.¹⁹⁸ For the bargaining

¹⁹² Sauer 2015: 82–83, 89, 93, 101. ¹⁹³ Quoted in Linklater 2000: 66.

¹⁹⁴ Schelling 1960: 58. ¹⁹⁵ Mercer 2013: 225. ¹⁹⁶ Stein 2023; 2024: 12–17.

¹⁹⁷ Stein 2023: 36, 41, 44. Davis 2024. ¹⁹⁸ Davis 2023, 2024.

model, the main sources of war are information asymmetries about the preferences that adversaries hold and the price they are willing to pay to get what they want. Wars come to an end when the opposing parties reveal private information. And the information that matters concerns the preferences and capabilities of others. But in Stein's story of the Ukraine war what really mattered for Biden was to discover his own preferences.¹⁹⁹ This insight agrees with other psychological studies. Often preferences are not "revealed" but "constructed" in a process of decision making that is highly sensitive to its context. Until they have made their choice, decision makers often do not know what "type" they are.²⁰⁰ Defying linguistic "representation" they invite linguistic "re-presentation."

Poised in uncertain terrain and with the nuclear brink shrouded by the fog of war, both leaders learned about their preferences from the choices they made. The American response in particular illustrates a learning-by-doing approach to policy.²⁰¹ Since it might lead to an escalatory dynamic and perhaps World War III, from the outset the President was strongly opposed to committing American ground troops. In addition, in a prominent newspaper article that Putin's advisors could not miss, he imposed boundary conditions for American policy. These conditions included the desire of NATO not to seek war with Russia; not to send troops into the conflict as long as NATO countries were not attacked; not to seek regime change in Moscow; and not to encourage or enable Ukraine to strike beyond its borders. They also included a public declaration that the use of Russian nuclear weapons would be completely unacceptable to the US, implying that it would push the US into a massive conventional war with Russia.

Biden's policies reduced the uncertainty created by Russia's invasion and Putin's nuclear threats. Within those markers the Biden administration adhered to a pragmatic policy of learning by doing. It tried to fence in uncertainty with policies that assisted Ukraine and responded to Russia's aggression and manipulation of uncertainty. America's provision of increasingly sophisticated weapons, for example, was experimental, incremental, and inductive.²⁰² The US waited and watched for Russian reactions as it gradually changed the technological sophistication and range of the weapons it shipped to Ukraine. The approach seemed to successfully control the risk of an escalating conflict with Russia and supply Ukraine adequately with most of the weapons it was asking for, until Congress stopped the flow of funds at the end of 2023. After the resumption of weapons shipments in May 2024, the Biden administration

¹⁹⁹ Stein 2023: 32. ²⁰⁰ Wendt 2015: 162–63. ²⁰¹ Stein 2024: 2; 1999.

²⁰² Stein 2024: 14.

followed the British and French policy of permitting US-provided weapons to be deployed against targets on Russian territory that were attacking Ukrainian targets with impunity. There is no guarantee that a policy that worked in the past will work in the future.²⁰³ Contexts change. Political relations and processes are not stationary. The past is never a sure guide to the future. Guarding against false certainty from adversaries and overconfidence in themselves, policymakers who rely on good decision-making processes and search pragmatically for practical knowledge do not guarantee success. Without these virtues, though, failure is more likely.²⁰⁴

6. The Fragility of a Crazy Politics

Reduced to its simplest the October crisis illustrated the difference between two types of people – rationalist deterrence believers such as General Taylor who count warheads and think first strike, and uncertainty believers such as President Kennedy who worry over dropping one bomb. Following a common quip, the crisis gave the President three options to remove the missiles from Cuba: “bomb ’em out” (invasion), “squeeze ’em out” (blockade), and “buy ’em out” (trading the missiles in Turkey). But the crisis did not unfold in a metaphorically speaking small, Newtonian world. It took almost thirty years of intense study to get a full sense of how out of control were events in October 1962.²⁰⁵ The results confirm the lessons from those harrowing days. Expressing the sentiments of many of the key decision makers meeting twenty-five years later, Ted Sorensen insisted on “the importance of avoiding any such crisis in the first place.”²⁰⁶ Over sixty years later that lesson appears to have been largely forgotten. A new generation of scholars is analyzing the dynamics of abstract deterrence and spiral models unencumbered by the emotional experience of confronting the unthinkable. And a new generation of leaders has renounced stabilizing treaties, is modernizing nuclear arsenals, and is threatening the use of nuclear weapons on the battlefield. Having avoided World War III once, we are no longer, it seems, burdened by McNamara’s fears and tears, and willing to give that war another chance.

Amnesia, however, cannot eradicate the legacy of nuclear testing. The first Trinity test explosion in New Mexico, on July 16, 1945, saw the mushroom cloud rise to a height of around 7 miles, much higher than had

²⁰³ Adamsky 2024: 101–23. ²⁰⁴ Stein 2024: 16–17.

²⁰⁵ Sagan 1993: 154–55. Pelopidas 2015a: 20; 2015b: 173–77; 2017; 2020: 463; 2022: 288–89. Lewis *et al.* 2014. Lebow and Pelopidas 2023.

²⁰⁶ The sentiment was shared by McNamara. Allyn *et al.* 1992: 169, 189.

been calculated. Radioactive contamination was dangerously high close to and downwind from the testing site. As many as half a million people were living within 150 miles of the test site, some as close as 12 miles. Within ten days of the detonation radioactive fallout had reached forty-six states, Mexico, and Canada. Subsequently another ninety-three above-ground tests were conducted in Nevada. Did America nuke itself? And did it, like all of the other nuclear states, wage undeclared, limited nuclear war on the communities near the test sites?²⁰⁷ These questions seem absurd. But the US moved its largest tests to the Marshall Islands; Britain did not do nuclear tests in the Midlands; France did not test upwind from Paris. And the Soviet Union did not test between Leningrad and Moscow. The political invisibility and marginality of the communities affected, especially those located in the Global South, offer strong evidence that obvious overlooked answers to absurd-sounding questions contain a large measure of truth.²⁰⁸ In any case, the clean-up of the original test site is now scheduled to last at least until 2043. Nuclear waste has been left behind on, around, or under a second American test site on the Marshall Islands, France's test site in the Algerian desert, and on many test sites scattered around Russia. Between 1945 and 1998 more than 2,000 nuclear explosions worldwide permanently altered the earth's atmosphere. In those years "a nuclear weapon was detonated, on average, every 9.6 days" writes historian Robert Jacobs. And at the height of testing, in 1962, the year of the missile crisis, there were 177 nuclear tests, one every other day.²⁰⁹ As the discussion of global warming in [Chapter 6](#) shows, nuclear tests have connected human "power" in world history to planetary physical "force" in earth history, increasing future uncertainties for both.²¹⁰

The history since 1945 records many nuclear near-accidents. Numbers are incomplete and impossible to interpret. Only the US and the UK have reported figures, which include all sorts of minor and major malfunctioning. Schlosser's inventory refers only to documented numbers running perhaps as high as one thousand.²¹¹ Presumably this is overcounting minor security lapses and undercounting the real number of brushes with disaster, as seven other and less forthcoming nuclear states have experienced their own problems. The author of an influential 1990 report of close calls and near-misses, Sidney Drell, identified thirty-two nuclear

²⁰⁷ *Oppenheimer*, a blockbuster movie released in the summer of 2023, failed to mention altogether the issue of fallout of the first test. Blume 2023. Cordova 2023. Jacobs 2022: x–xi. Hennigan 2024b.

²⁰⁸ Jacobs 2022: 151–202. Hennigan 2024b.

²⁰⁹ Jacobs 2022: 5, 197, 181. Masco 2021: 10, 34–35, 40–41, 339–62.

²¹⁰ Chakrabarty 2018: 9, 13–14. Young 2017. ²¹¹ Schlosser 2013: 327–28, 187, 465.

weapons accidents and is quoted as believing that multiple others have remained secret.²¹² The insistence that nuclear deterrence is fail-safe and the evidence of repeated failure, to date without catastrophic consequences, suggest that craziness is part of nuclear politics. It has some salutary effects. When operators of nuclear forces were warned that hostile missiles had been launched, without fail they concluded that the system had malfunctioned. They simply did not believe that nuclear war could ever happen. By behaving the way they did in such crisis moments operators were reducing the chances that it will. But craziness is unnerving. The construction of a Russian Doomsday Machine during the Cold War and the powerful emotions that may have caused the mental instability of President Trump after he lost the election of 2020 are two documented instances that unfolded, in secret and in public, lodged in the large world of uncertainty.

After the transformational experience of those awful days in October 1962, American decision makers believed that the Soviet Union and all other nuclear powers had come to accept the stabilizing logic of transparent nuclear deterrence. They overlooked the fact that US policy itself was destabilizing. Having agreed to numerical limits on its nuclear arsenal, in the 1970s and 1980s US policymakers were determined to gain qualitative nuclear superiority over the Soviet Union. To this end in the early 1980s the Reagan administration increased greatly the vast US defense budget. And the President's bellicose language reinforced the impression of implacable US hostility toward the Soviet Union.²¹³ Reagan was not one to mince his words, either as candidate on the campaign trail or as President in major foreign policy speeches. Terms like "evil empire" permeated his speeches and reflected his life-long anti-communist, Christian, and conservative credo. He was truly stunned when he learned, toward the end of his first term, that his incendiary language had had a deep effect on the leadership of the Soviet Union. Later, the President simply could not believe what many intelligence sources were reporting at the time and what has since been confirmed by additional archival material – that Soviet hostility and propaganda were based on genuine fear of an unprovoked first strike by the US.

In 1983 a NATO exercise named Able Archer created more tensions with the Soviet Union. In the context of President Reagan's evil empire speech in March 1983 and the downing of a Korean Air Lines Boeing 747 by a Soviet interceptor aircraft in September 1983, later that fall the Soviet Union put its nuclear forces on alert, a state of readiness reportedly

²¹² Pelopidas 2022: 283–91 (English translation generously provided by the author).

²¹³ Ambinder 2018. Downing 1983.

higher than during any other NATO exercise.²¹⁴ Yuri Andropov, the Soviet leader at the time, worried that nuclear war would result not necessarily from a calculated pre-emptive strike but from miscalculation and inadvertence.²¹⁵ In a situation of high diplomatic tension, Able Archer contained multiple non-routine elements – radio silences, the loading of warheads, reports of “nuclear strikes” on open sources, and a count-down to “general alert” – that were similar to actual preparations for nuclear war. The fall of 1983 was perhaps the most dangerous moment since October 1962.

In 1985 the Soviet Union put a new secret defensive system in use without informing the US. After achieving nuclear parity in the 1970s, in the tense early 1980s Soviet leaders were genuinely concerned about the possibility of the Reagan administration preparing for a pre-emptive nuclear strike. Against all dictates of conventional deterrence theory and unbeknownst to everybody, including the US leadership, the Soviet Union adopted a “Doomsday Machine” guaranteeing retaliation – launching all Soviet missiles – even in the eventuality that the entire Soviet leadership died in a US attack or was unable to make a decision when and how to retaliate.²¹⁶ The Soviet Union created a command system that under some conditions bypassed political leaders. The decision to retaliate was semi-automatic and the burden of making the decision was shifted to a few officers in a concrete bunker buried so deep underground that it would survive a nuclear surprise attack.

The program was called Perimeter. Three conditions had to be met: the Perimeter system had to be activated by the Kremlin leadership, indicating advance permission for the system to fire; contact with the Kremlin’s political and military leadership had been lost; and nuclear detonations were recorded by a nationwide system of sensors. If all three conditions were met, then the officers were expected to activate the system by launching Perimeter command rockets, which would fly for about 30 minutes over Soviet territory and order operational Soviet missiles to attack the US. In a fully automated and regimented system a handful of officers were trained only to check whether the three conditions had been met prior to Perimeter’s final activation. The last human protection against a final spasm of destruction was paper-thin. If American decision makers, bent on a first strike, had known about the system, it might have reinforced the deterrence power of the Soviet Union. With reality imitating Kubrick’s art in *Dr. Strangelove*, the illogic of the plan was that they did not. The Soviet Union did everything to conceal the system’s

²¹⁴ Hoffman 2009: 94–96. ²¹⁵ Fraise and Egeland 2023. Miles 2020. Jones 2016: 34.

²¹⁶ Hoffman 2009: 151–54, 421–23, 477.

existence. To avoid detection by satellites, Perimeter command missiles were disguised to look like ordinary missiles, and in exercises the firing of other missiles obeying the Perimeter signal was delayed. The system strengthened deterrence by removing from the Soviet leadership the burden of launch-on-warning decisions. But it weakened deterrence by removing all but a handful of middle-level officers from making the ultimate decision. And those officers were trained to be cogs in an almost automatic dead-hand Doomsday Machine.²¹⁷

Like machines, leaders can also be crazy. In 1971 Yehezkel Dror developed a brief scenario of how the United States might transform into a crazy state.²¹⁸ While that scenario differed from what transpired in 2020, it would be crazy to rule out the possibility of a crazy politics. That President Trump was psychologically in a fragile state after he had lost the 2020 Presidential election was no secret. What was not known was the extent of his impairment. Susan Glasser and Peter Baker detail the progressive deterioration of relations between President Trump and General Mark Milley, Trump's last Chairman of the Joint Chiefs of Staff. President Trump and his closest political advisors were eager to take full control of the military and to create a 1933 Reichstag moment as pretext for stopping a peaceful transfer of power after losing the 2020 election.²¹⁹ When in the fall of 2021 two journalists published *Peril*, public media were filled with astonished commentary.²²⁰ Mark Milley had assured his Chinese counterpart twice that the US would not launch a nuclear surprise attack, once on October 30, 2020 and a second time on January 8, 2021, two days after the storming of the Capitol.

By January 8, 2021, Milley had become convinced that the President had suffered a serious mental decline. Believing that China might lash out at a US ruled by an unpredictable President, Milley conveyed his impression to Speaker Nancy Pelosi. He also summoned senior officers to review the procedures for launching a nuclear strike. Only the President could give the order, he told his officers. But he, Milley, also had to be involved. "Looking each in the eye, Milley asked the officers to affirm that they had understood . . . what he considered to be an 'oath'."²²¹ The general said,

there's a process here, there's a procedure. No matter what you're told, you do the procedure. You do the process. And I'm part of that procedure. You've got to make sure that the right people are on the net . . . The strict procedures are explicitly designed to avoid inadvertent mistakes or accident or nefarious,

²¹⁷ Blair 1993. Yarynich 1994. The issue of US pre-delegation of nuclear weapons under NATO control raised analogous issues for American deterrence policy. See Allison and Zelikow 1999: 198–200.

²¹⁸ Dror 1971: 33–34. ²¹⁹ Glasser and Baker 2022. Langewiesche 2024: 31, 42.

²²⁰ Woodward and Costa 2021. ²²¹ Stanley-Becker 2021.

unintentional, illegal, immoral, unethical launching of the world's most dangerous weapons.²²²

In doing so Milley was taking measures resembling those of James Schlesinger, Secretary of Defense at the stressful time when President Nixon faced impeachment.²²³

The immediate trigger of Milley's second contact with his Chinese counterpart was a conversation with Speaker Pelosi on January 8, 2021. The Speaker wanted to know what checks were in place to stop an unstable President from ordering a nuclear strike. Pelosi and Milley agreed that the President was "crazy" and Milley assured Pelosi that there were "a lot of checks in the system."²²⁴ Milley was not in the chain of command and, legally speaking, had no way of stopping the President from acting. "But Milley could try to persuade others not to comply. He does have informal influence as the military's senior officer, so he could try to persuade others not to launch."²²⁵ In the words of the late General Colin Powell: "I was the chairman of the Joint Chiefs of Staff and I can tell you for sure that if something like this ever happened and someone suddenly said, 'We want to use nuclear weapons,' they would never get near it."²²⁶ When it became public, this revelation was shocking for several reasons. Milley, the top military leader of the US, contacted his Chinese counterpart without informing the President. Although he was not in the chain of command Milley considered it his duty to second-guess the President's authority to use military force. Milley and Speaker Pelosi judged the President to be "crazy" without professional medical authority supporting their assessment. And Milley insisted that there were numerous checks in the system when in fact no formal checks exist. Because it totally undercuts the logic of the rational actor model of strategic deterrence, invoking "fortuitous disobedience" in moments of psychological distress is unnerving.²²⁷ There is, writes Fred Kaplan, "no safety switch in place, no circuit breaker that someone could throw, if the human turned out to be crazy."²²⁸

Some experts and many opponents of Donald Trump expressed the worry even before he was elected in 2016 that he would have the sole power to order a nuclear strike. In 2017 the President traded insults with North Korea's leader Kim Jong-un and threatened him with "fire and fury

²²² Schmidt 2021. ²²³ Graff 2022: 655–56. ²²⁴ Stanley-Becker 2021.

²²⁵ Lamothe *et al.* 2021.

²²⁶ O'Brien and Feldscher 2021. Whether this is true is a matter of debate. Optimists believe that "fortuitous disobedience" adds to the resilience of nuclear deterrence. See Pelopidas 2022: 261–63. For a much more sobering view see Wills 2010, Kehler 2017, and Kaplan 2020: 286–90.

²²⁷ Pelopidas 2022: 261–63. ²²⁸ Kaplan 2020: 290.

like the world has never seen” – leaving it to the world to decipher this as a threat, a bluff, or his customary blustering self-aggrandizement. Trump also discussed a pre-emptive nuclear strike with his aides. He thought he could blame some other country for the act. His Chief of Staff, John Kelly, a retired general, eventually succeeded in talking him out of it. The control of nuclear escalation requires “consistency, focus, trustworthiness and coherence . . . traits that seem to be absent in Trump’s make-up.”²²⁹ The possibility of nuclear war was still very much on Donald Trump’s mind well after he had lost the 2020 election. Under oath in a seven-hour court deposition in New York in April 2023, and never shy about extolling his contribution to the world’s well-being, the former and future President ruminated that “I think you would have nuclear holocaust if I didn’t deal with North Korea.”²³⁰

Since humans are not rational, especially when operating in high-stress situations, Trump’s return to the White House is a source of dread for more than a few scholars of nuclear war. Preliminary results of nuclear crises simulated in a laboratory setting show that people who never expected to order the launch of nuclear weapons end up doing so in experiments that they report afterwards to have been grippingly realistic.²³¹ Even under the best of circumstances and in the darkest of moments, such as October 1962, reliance on a single decision maker makes the system of nuclear deterrence extremely fragile and highly unpredictable. The creation of potentially world-destroying weapons by very smart humans does not mean that humans will be smart enough to manage such weapons after they have been created.²³² Because it covers about one human life span, the nuclear era now counting eighty years may seem long, longer than the collective memory span of much of the world. In fact, it is a very short time when measured in human time and a mere tick in geological time.

The fragile nuclear peace is threatened by the craziness of machines and men. Yet perhaps it is the interaction of machines and men that has to date helped save humankind from a nuclear Armageddon. Distributed governance of men and machines with its human and technical protocols and procedures can stabilize the fragilities of machines and men left to their own devices. Technical redundancy and institutional obesity may offer a protective buffer of sorts against unchecked impulses. Facing this historical record of the nuclear era, humans are unreasoned optimists or pessimists. Causing and preventing nuclear escalation and accidents, machines are “indifferentists.” Confounding optimists, pessimists, and

²²⁹ Langewiesche 2024: 42. ²³⁰ Protess *et al.* 2023. ²³¹ D’Agostino 2022.

²³² Scoles 2023.

indifferentists, the interaction of machines and men may have stopped the unthinkable from happening in the past. But there is no reason why the unthinkable may not happen in the future. The scariest part of the Cuban missile crisis is that nobody was crazy. At the height of the crisis not fully understanding the abyss they confronted, leaders improvised and muddled themselves back from the brink.²³³ Crazy politics can happen within earshot of complementary risk and uncertainty.

Relying on the post-Newtonian concept of potentiality that is not easily aligned with their Newtonian humanism, Vipin Narang and Scott Sagan write that “the past is a poor template for the future, and the future nuclear world has the potential to be distinctly different – and more fragile – from anything we have previously confronted.”²³⁴ Looking back, Dean Acheson, a former Secretary of State and a realist, believed that the Kennedy administration succeeded in October 1962 because of “dumb luck.” Contradicting his firm rationalist beliefs, Thomas Schelling appears to have shared that assessment, at least occasionally.²³⁵ Based on new evidence from Soviet archives, Radchenko and Zubok conclude that October 1962 sends a chilling reminder about the risks of brinkmanship and the importance of pure chance.²³⁶ “Luck” they write, “played a large role.”²³⁷ And Benoît Pelopidas writes about the “unbearable lightness of luck” in October 1962, an assessment shared by high-ranking officials at the time, like US Secretary of Defense Robert McNamara and the KGB head of Cuban Affairs. Since then, leading scholars have concurred with this assessment.²³⁸ With the large world deeply entangled with the small, everywhere and always uncertainty and risk are tightly tethered together in the risk-uncertainty conundrum. Writing about the role of *fortuna* and uncertainty in politics, Machiavelli, smiling knowingly, might well mutter “I told you so.”

²³³ Blight and Lang 2018: 43. ²³⁴ Narang and Sagan 2022: 8.

²³⁵ Blight 1990: 157. Scott 2007: 161–62. Kay and King (2020: 263–65) analyze luck in the game of cricket and other sports.

²³⁶ Radchenko and Zubok 2023: 46, 56. ²³⁷ Radchenko and Zubok 2023: 55.

²³⁸ Pelopidas 2017: 247–48. See also Lebow and Pelopidas 2023: 710, 713. Pelopidas 2022: 283–91 (English translation generously provided by the author), 2020 and 2015b. Sauer 2015: 2, 96. Blight and Lang 2018: xiv, xvii, xviii, 151.

6 Global Warming and Artificial Intelligence

In our conventional understanding, humans are by their God-given or self-made power of intervention masters of nature and technology in a predictable world which I have called “small.” Alternatively, human “intravention” in nature’s “biosphere” and technology’s “technosphere” occurs in a “large,” uncertain world. The concept of intravention may sound strange to ears trained in Newtonian humanism. Unlike “intervention,” which implies that humans act as an external force upon nature and technology, intravention details how humans are entangled with the technological and natural processes that they seek to change and that, in turn, alter them. It is a perfectly acceptable idea in post-Newtonian and para-humanist worldviews. Quantum physics is built on the idea of the deep entanglement of material processes and measurement instruments and physical objects. Likewise, denying humans a God’s eye perspective, para-humanism insists that humans do not stand apart or above the world. Human intraventions have drastically changed the material conditions of human life by increasing global warming. And Artificial Intelligence (AI) is a technological intravention by which humans are altering dramatically the trajectory of their symbolic habitat. In short, global warming and AI are products of humanity’s intravention in the earth’s bio- and technosphere.

Climate and technological change are both marked by risk, uncertainty, and ignorance. We cannot know the unknowable.¹ Differences in context, variability in processes, and creative use of language can make risk and uncertainty more or less deep and more or less vexing. But they cannot eliminate the complementarity of risk and uncertainty. Beyond the rare event we know exists but cannot predict lies the vast terrain of unimagined and unimaginable events, hiding out of sight. The most important unknowns are the unknowable unknowns. Neglecting the troubles of our time, tech utopians like Ray Kurzweil believe that the singularity is almost at hand when humans and AI will merge and solve all

¹ Welch 2022: 198.

of humanity's problems.² Benoît Pelopidas wrestles instead with the possibility of a catastrophic crisis confronting humanity in an apocalyptic future of civilizational collapse and species extinction.³ Undeniably, humanity is in the midst of creating enormous changes in the material and symbolic ecosystems it inhabits, with unfathomable, unintended, and unanticipated consequences.⁴ Some know too little and are eagerly trying to learn more. Unwilling to learn more, others are eagerly surrendering to the allure of ignorance.⁵ The simple truth is that we just don't know. On the record of the past, this unknowing state gives ample space to a disorienting dread of the unknown and a radical hope in a future that can be grasped only retrospectively.⁶

For Montesquieu the "empire of climate is the first and greatest empire."⁷ He was right, especially for our times. A result of human actions, global warming is reshaping land and water, the conventional building blocks of geopolitical theories of international politics. It creates new zones of conflict and new potentials for cooperation. An old adage acquires a new meaning. It is not only "geography" and the physical features of the earth but also "gaiagraphy" and the earth's critical zones that are the world's destiny.⁸ Humanity's technological prowess has created another kind of empire that Montesquieu could not imagine in the eighteenth century and that still escapes our imagination in the twenty-first. AI promises to bring transformative changes, including to human language. Humanity's natural and digital ecospheres are wrapped up in the risk-uncertainty conundrum.

Para-humanism is a worldview that places humans in the larger context of other beings. Atmospheric chemist Paul Crutzen's work took seriously the concept of the Anthropocene and the disruptive effects of the human domination of planet earth. Climate change is an issue touching all aspects of human and non-human life. The 2021 Nobel Prize in physics recognized interdisciplinary work documenting and explaining humanity's effects on global climate change.⁹ As the human population increased by a factor of four during the last century, the wildlife population declined by 70 percent. Taking a para-humanist perspective, the founder of the Voluntary Human Extinction movement, Les Knight, challenges the benevolent view of human dominance over other species. For him humans are super predators and earth's most invasive and destructive species.¹⁰

² Kurzweil 2024. Crawford 2021: 214–16. ³ Pelopidas 2020. ⁴ Kolbert 2022: 45.

⁵ Lilla 2024. ⁶ Lear 2006: 7–9, 103–05, 115. ⁷ Quoted in Deudney 1999: 26.

⁸ Arènes *et al.* 2018. Latour and Chakrabarty 2020: 431.

⁹ Metz *et al.* 2021. The prize was awarded to Syukuro Manabe, Klaus Hasselmann, and Giorgio Parisi.

¹⁰ Buckley 2022.

The threat humans are posing to the environment is not new. In recent decades DDT, acid rain, the ozone hole, Chernobyl, and other disasters have created growing levels of concern and brought about important changes in human practices and governance. An incessant drumbeat of news reports the effects of extreme climate conditions in all corners of the world. Those reports use “climate change” and “global warming” as synonyms, as I do here. Both are imperfect labels. Climate change does not capture the rising temperatures recorded on our thermometers. And global warming is too soothing a description of the extreme heat and other weather events that are making parts of the globe increasingly uninhabitable, especially for the most vulnerable: the poor, the sick, the very young, and the very old.¹¹

Global warming is related to the excessive accumulation of greenhouse gases in the atmosphere, primarily caused by the burning of fossil fuels and the large-scale use of animal stock. As a layperson I take my science from the literature scientists produce for the general public. And I consume the daily news of droughts and fires, melting glaciers and shrinking ice caps, growing ocean acidity, increasing water shortage and crop failure, and the rapid destruction of species. The scientific consensus in environmental science has been expressed forcefully in numerous scientific reports and is repeated in a flood of books published each year: there is a large measure of truth to the claim that human activity causes global warming. Scientific disagreements persist over the speed and amount of change, but not over its reality. Humans have become a geological agent changing earth’s basic physical processes. According to journalist Elizabeth Kolbert, Asia’s economic rise since 1990, for example, has added about as much carbon dioxide to the atmosphere as did the previous thirty thousand years.¹² The burning of fossil fuels releases greenhouse gases that had been trapped in rocks for hundreds of millions of years. Even if global emissions reach net zero, perhaps by the end of this century, ice caps will continue to melt and sea levels will continue to rise, possibly for hundreds of thousands of years.

In the Anthropocene the natural and the digital worlds are closely linked. The engineering revolution that replaced typewriter with tablet has been transformative. AI is raising the prospect of a radical change in the digital world with unknowable effects. Prediction requires that we know which new technologies and applications are heading our way. But such knowledge would itself most likely allow society to develop that technology right away. On questions of science and technology, we cannot know now what we will

¹¹ Goodell 2023, 2017, 2010. ¹² Kolbert 2022: 35.

learn in the future.¹³ The possibility of creating a machine with consciousness is no longer material for science fiction. More imminent and urgent, AI is beginning to introduce basic changes in how humans use language.

American capitalism is accelerating this change. Corporate and government money is pouring into the AI sector at an unprecedented rate. Global spending was 3 billion dollars around 2010 and mushroomed to 80 billion dollars in 2021, half in the US and a quarter in China. Amazon lists 50,000 books with “artificial intelligence” in the title. Computing power dedicated to developing AI models has increased 300,000-fold in less than a decade. To date AI helps with narrow tasks, illustrated by the existence of 200 million apps. Broader tasks still require human involvement. Until 2025, Facebook employed tens of thousands of content moderators.¹⁴ In the interest of accurate representation algorithms were being put through their paces with “reinforcement learning from human feedback” programs, an effort that created about a quarter of a million low-paying jobs worldwide.¹⁵ In the American future, protected by the right to free speech, AI hallucination will join human fabulation.

In the ecosystems of the world, global warming and AI are not external constraints on human action. Instead, they are endogenous to the world’s evolution. This contradicts decades of economic analysis that downplayed the costs of economic growth as an “externality,” and supports decades of economic analysis that highlighted technological change as the driver of productivity and prosperity. Human mastery of the natural and the digital world has created profound uncertainties about the future. In the nineteenth century, European imperialism combined colonies with coal and created the conditions for economic take-off.¹⁶ In the twentieth century America pushed pervasive industrialization and dynamic technological change at a global scale. In the twenty-first century neither the engine of change nor its consequence can any longer be located in any one part of the world. Global warming and technological transformation of humanity’s natural and digital ecosystems are examples of the complementarity of risk and uncertainty.

The capacity of the earth to sustain human encroachments and innovations is unknown.¹⁷ What lies behind many discussions of the climate crisis, writes political scientist Scott Hamilton, is “an unprecedented existential and temporal uncertainty concerning the future of human subjectivity, and of the Earth itself.”¹⁸ The same holds for the impact of

¹³ Taleb 2007: 173. ¹⁴ Mills 2021. X (formerly Twitter) does not.

¹⁵ Lichtblau and Polcano 2023. Metz 2023b. ¹⁶ Pommeranz 2000.

¹⁷ Hamilton 2018b: 34.

¹⁸ Hamilton 2019: 610. I use the term “Anthropocene” generically as a description of the human impact on the planet rather than as a specific stratigraphic series that identifies

AI. The uncertainty inherent in the material and symbolic world is compounded by human conduct. Climate scientist Kate Marvel argues that we “may not know what every air molecule or water droplet in the atmosphere is doing, or how they interact with each other, but in isolation, I know exactly which physical laws they must obey. There is no equivalent for human beings . . . people are the greatest uncertainty in climate change.”¹⁹ This assessment is shared by many scientists. “The feedbacks that have been identified in the climate system – the ice-albedo feedback, the water vapor feedback, the feedback between temperatures and carbon storage in the permafrost – take small changes to the system and amplify them into much larger forces,” writes Kolbert. “Perhaps the most unpredictable feedback of all is the human one . . . It may seem impossible to imagine that a technologically advanced society could choose, in essence, to destroy itself, but that is what we are now in the process of doing.”²⁰ Para-humanism suggests a less anthropocentric formulation. Technological advancement may put conscious “others” next to and perhaps above and beyond humans wrecking themselves and their natural and digital habitats. Unquestionably, radical uncertainties about impending changes in humanity’s natural and digital ecosystems make “epistemological modesty” an imperative for every student of world politics.²¹

As an area of concern the environment has entered world politics since the 1970s under many labels that link it to different substantive, technical, and political issues.²² Nature is big and uncertain. The reinsurance industry estimates that in 2021 more than one half of world GDP depends moderately or greatly on nature, and most of it is uninsured.²³ With weather-related events moving to the top of the list of anticipated risks, denial is no longer an option for the social protection most crave. The environment thus joins all of the basic institutions of the welfare state as an issue that socializes risk on a large scale. To call the federal government an insurance company with an army basically nails it. The research of students of world politics, typically, links questions such as global warming, biodiversity loss, wildfires, and extreme weather events to pressing issues of world politics such as migration, violence, inequality, and the character of political regimes.²⁴ Existing research describes different

a new layer in the earth’s composition, marking a new geological threshold in earth history.

¹⁹ Henderson, C. 2020: 8.

²⁰ Kolbert 2006: 187. James Lovelock (2019) differs with this grim assessment. He celebrates the arrival of hyper-human AI and the dawning of the “Novacene” as a new era.

²¹ Deudney 2018: 226. ²² Biermann *et al.* 2012. Albert 2022. ²³ Pauly 2025: 183.

²⁴ Ip 2025. Javeline 2014: 422.

processes or establishes causal relations between different clusters of variables.²⁵ Although an important aspect of international relations research is about survival, the question rarely is posed whether ecocide should be included alongside genocide as a basic concern.²⁶ Students of world politics, for example, have had nothing to say about the ongoing sixth mass extinction in earth history.²⁷ Instead, most analyses build their arguments on the unquestioned assumption that economic growth and interstate rivalries will continue to shape world politics. Cognizant of the full landscape, Audra Mitchell counters by asking “Is IR Going Extinct?”²⁸

It is not. Research has been both problem-focused and critical.²⁹ Since the end of the Cold War some realists began to focus on new kinds of environmental conflicts. Robert Kaplan, for example, sketched the contours of a “coming anarchy” over scarce water resources, environmental degradation, pandemics, deforestation, soil erosion, air pollution, rising sea levels, destabilizing mass migrations, and political violence.³⁰ Thomas Homer-Dixon provided careful research that, broadly speaking, supported Kaplan’s dystopian vision.³¹ And Daniel Deudney has fleshed out a theory of historical security materialism that points to the importance of technogenic change.³² In the last two decades this research agenda has broadened further. It includes not only the impact of various aspects of climate change on US national security but also the very considerable effects of American fossil-fuel-based defense policy on climate change.³³ Since climate change affects many international regimes (such as trade, health, food, migration, and human rights), during the last two decades liberal analysis has disaggregated these regimes into complexes with many parts that include informal institutions such as the G7 and G20.³⁴ And as the number of stakeholders in climate change issues has grown, new transnational forms of environmental governance have emerged. To combat the adverse effects of climate change top-down, state-negotiated, universal solutions are increasingly complemented by bottom-up, decentralized, diverse approaches.³⁵

But this is only part of the story. Since the end of the Cold War, the issue of environmentally induced mass extinction, including the possible extinction of the human species itself, has not attracted anywhere close to the kind of attention from students of world politics as did the issue of nuclear war during the Cold War. The reason is that para-humanism’s sense of being in the world resonates with relational entanglement more than with

²⁵ Deudney 1999: 25. ²⁶ Müller 2018: 73–75. ²⁷ Kolbert 2014, 2006.

²⁸ Mitchell 2017. ²⁹ Cox 1981. Corry and Stevenson 2018: 8–9. ³⁰ Kaplan 1994.

³¹ Homer-Dixon 1999. ³² Deudney 2000, 2018. ³³ Crawford 2022.

³⁴ Young 1989, 1999, 2017. Young and Osherenko 1993. ³⁵ Underdal 2017.

Newtonian and Hobbesian sovereign autonomy. The state became autonomy's embodiment, the core construct of an atomistic and non-relational way of looking at world politics. Anarchy, not holarchy, became the core construct, and the very concept of the Anthropocene was virtually unknown among scholars of world politics.³⁶ To cite one example, the 2015 annual meeting of the International Studies Association featured 6,000 presentations. Only one paper title mentioned the Anthropocene explicitly.³⁷ A 2018 keyword search of "Anthropocene" in four leading journals returned no results.³⁸ While IR scholars largely agree that the most important issue facing the world is global climate change, fewer than 3 percent of about four thousand scholars surveyed listed that issue as their main area of research. This is not to deny that many students of world politics are doing important work in transdisciplinary institutions and publish their findings in interdisciplinary journals. And there are important exceptions. David Welch's thought-provoking book, for example, discusses different kinds of security threats. Welch starts with the one he considers to be most serious, the threat to the world's "ecosphere."³⁹ An eclectic thinker, Welch is a staunch Newtonian who is open to para-humanist arguments.⁴⁰ On questions of global warming, he blends traditional IR analysis with a more encompassing para-humanism, marked by the risk-uncertainty conundrum.⁴¹

Like the earlier discussions of financial and nuclear crises, this chapter applies arguments developed in the opening chapters of this book. The entangled relations of humanity's natural and digital ecosystems are discussed in terms of the risk-uncertainty conundrum. The discussion focuses on global warming from the perspective of the small world of geoengineering, with a particular focus on geothermal energy, marine geoengineering, and the political economy of mitigation and adaptation (section 1). It inquires into the large world of the biosphere, Anthropocene, and uncertainties created by the overlay of human and geological time (section 2). And it scrutinizes the technosphere, consciousness, and language as humanity's arguably most important cultural technology (section 3).

³⁶ Epstein 2022: 173–75. ³⁷ Harrington 2016: 486–87.

³⁸ The journals were *International Organization*, *International Studies Quarterly*, *Review of International Political Economy*, and *World Politics*. I would like to thank Naomi Egel for her research assistance. It should be noted that keyword searches are not totally accurate, and things have begun to change. For example, Bentley Allan published two important articles in *ISQ* and *IO* in 2017 that address the Anthropocene (2017a and 2017b). See also Harrington 2016: 487; Green and Hale 2017.

³⁹ Welch 2022: 47–54, 57–62, 193. ⁴⁰ Welch 2022: 14–15.

⁴¹ Chandler et al. 2024. Hickmann et al. 2018. Müller 2018.

1. The Small World of Climate Change: Geoengineering

Students of world politics conventionally thought of the environment as a discrete issue that creates collective action problems. Doing nothing was not an option. Presenting the evidence in a series of authoritative meetings and reports, since the 1970s scientists have convinced publics and policy makers to take global warming seriously. But as Bentley Allan writes, although “they did not eliminate large uncertainties concerning the magnitude, timing, and consequences of global warming . . . scientists proved influential in setting the agenda not necessarily because they reduced uncertainties by converting them into calculable risks, but because they articulated climate change as a security problem with uncertain, potentially catastrophic consequences.”⁴² In the 1980s controversies over nuclear winter and the ozone hole raised the possibility of humanity’s extinction. “Humans might find themselves unable to adapt to unanticipated changes in unstable natural systems. Thus, scientists depicted climate change as a security threat by . . . depicting uncertain futures driven by humanity’s relationship with nature.”⁴³ From global freeze to global warming, the nature of the threat changed, the risk-uncertainty conundrum did not.

Conceiving of the earth as a collection of knowable ecosystems that human activities have helped shape points to a small world of calculable risk. The idea of an inscrutable earth “fighting back violently” suggests a large world of deep uncertainty. Preferring to leave “external diseconomies” out of their models, economists move in a small world of calculable risk. But environmental costs are not an “externality.” From the perspective of para-humanism they have always been an “internality.” The winner of the 2018 Nobel Prize in economics, William Nordhaus, was one of the first to recognize this. He developed precise models for predicting the costs of climate change. But his Harvard colleague Martin Weitzman warned against false precision in predictions. The acidification of oceans, for example, has increased by 26 percent from preindustrial levels; it is now projected to increase by 170 percent by the year 2100 with unknowable, uncertain consequences. Annual economic costs may run in the hundreds of billions of dollars worldwide, or much more, or much less.⁴⁴ Nobody knows. Cataclysmic, “black swan” events remain worryingly possible in statistical distributions with fat tails. So do entirely unknowable happenings for which there are no statistical distributions. In the face of risk and uncertainty conventional cost-benefit analysis is extremely fragile. “We desperately need more information about what’s going on in these tails,”

⁴² Allan 2017a: 809. ⁴³ Allan 2017a: 810. ⁴⁴ Harrington 2016: 480–81.

Weitzman argued. “It’s not the median values that are gonna kill us.”⁴⁵ Despite its innovativeness and importance, the Nordhaus model probably underestimates the speed and havoc of climate change, oversimplifies the problem, and underestimates its unpredictability.⁴⁶

A 2009 landmark report by the Royal Society provided a now widely accepted definition of geoengineering as “the deliberate large-scale manipulation of the planetary environment to counteract anthropocentric climate change.”⁴⁷ Proposals for large-scale experiments place their bets on science as the master of nature and on humanity as separate from the world around it. Large-scale experiments seeking to contain global warming, proposed but not yet implemented, would notch an unambiguous victory for “the mechanical conception of nature and the parallel emergence of philosophies built on the idea of the autonomous rational subject exercising control over an inert environment.”⁴⁸ But such experiments cannot reduce the unknowability of the unintended and unanticipated system-wide effects they would produce. This limitation creates political barriers for their enactment. Still, politics is often unpredictable itself, creating also unexpected opportunities. Geoengineers can work with nature in a pragmatic process of muddling-through. Worldwide, many smaller-scale experimentations engage pragmatically with climate change. Efforts to slow global warming thus create new relations between energy-hungry humans and the very ground they stand on.

It is easy to overdraw the distinction between small world risk and large world uncertainty. The American home insurance industry, for example, is affected by both. The devastating fires that demolished several parts of Los Angeles in January 2025 raise vexing questions of how to insure homes, and not only in California. The question is not whether but when large swaths of Miami’s real estate will become uninsurable. Many working in the field of geoengineering are fully aware of the uncertainties involved, especially when simple models are aggregated into broader systems that specify nine planetary boundaries that keep the earth safe.⁴⁹ A stable and resilient earth system and human well-being in a just society are increasingly linked in one encompassing framework. In fact, the findings of one study published in 2023 conclude that human well-being in a just society imposes more constraints on a stable earth system than does the climate.⁵⁰ Geoengineering coupled with social engineering thus faces all aspects of the risk-uncertainty conundrum.⁵¹ An indispensable corrective to catastrophizing, geoengineering highlights

⁴⁵ *The Economist* 2019: 68. ⁴⁶ DePillis 2022. ⁴⁷ Sheppard *et al.* 2009: 1.

⁴⁸ Hamilton 2013a: 56. Hobden 2018: 112–15. ⁴⁹ Steffen *et al.* 2015.

⁵⁰ Rockström *et al.* 2023. ⁵¹ Corry and Kornbech 2024.

what Taleb calls the antifragile gains from uncertainty-induced disorder.⁵² Antifragility does not live through theories and models but through practices trying to solve problems. It is a way of living with and exploiting uncertainties that refuse to be tamed. Forward-looking, opportunistic, non-predictive action seeks to gain from an upside that is bigger than uncertainty's downside. For philosopher Edmund Husserl "to live is always to live-in-certainty-of-the-world . . . actually experiencing [*erleben*] and actually effecting the ontic certainty of the world."⁵³ No longer. "Ontic certainty" is receding. Today, the practices and experiences of everyday life are tightly coupled with the uncertainties of planet earth's evolution and in vastly larger temporal coordinates than Husserl envisaged.

Before the 1950s, climate referred to local or regional weather patterns. Today it refers to one geophysical system. This change was not preordained. As Bentley Allan shows, the study of climate could have taken a broader, bioecological form.⁵⁴ Instead, it was influenced by how in the 1950s and 1960s the Cold War shaped relations between scientists and the US state. For reasons of national security, the Defense Department was interested in weather modification and climate control. The discursive frame and experimental findings were humanist Newtonian and produced a geophysical understanding of "the climate" as an object of scientific interest and policy concern. Climate came to be thought of as a vast machine. In Allan's words the "core of climate models is a geophysical, determinist system that links easily to the idea that these forces can be understood, predicted, and controlled."⁵⁵ The weather thus was turned into a thing. Geophysical processes became subject of a global infrastructure of measurement and observation involving sensors, satellites, computer simulations, and models. This transformed them into objects of governance by scientific institutions, NGOs, national governments, and international institutions.⁵⁶ By contrast, biological and ecological sciences built their models around complexity theory. The climate is composed of non-linear, volatile, and unpredictable processes that are embedded in the whole biosphere. It is conceptualized as a set of interlocking subsystems marked by threshold effects and feedback loops. Nature is not a pristine, unmoved, and balanced landscape that exists apart from humankind. Instead, writes political scientist Cameron Harrington, the universe is "undergoing a process of creative becoming" that is beyond human control.⁵⁷ Geophysical approaches treat contexts of

⁵² Taleb 2012: 3–27, 212–14. ⁵³ Quoted in Chakrabarty 2018: 30. ⁵⁴ Allan 2017b.

⁵⁵ Allan 2017b: 147. ⁵⁶ Corry 2020: 431. Allan 2017b: 147–52.

⁵⁷ Harrington 2016: 488.

climate change as more homogeneous and processes as less variable than do biological and ecological approaches.

Earth System Science (ESS) is an interdisciplinary, comprehensive approach to the study of the environment.⁵⁸ It integrates various earth and life sciences and tracks the co-evolution of earth's four "geospheres" – atmosphere (air), hydrosphere (water), cryosphere (ice), and lithosphere (crust) – as four "coupled systems" that are linked to the encompassing biosphere (life).⁵⁹ Relying on ESS, proponents of geoengineering see in global warming both crisis and opportunity.⁶⁰ According to political scientist Scott Hamilton, at times they express a "techno-enthusiasm," the latest example of a "Promethean plan for ultimate control" over nature.⁶¹ To the critics of geoengineering carbon dioxide removal from the atmosphere or ocean and solar radiation management look like a large-scale technocratic response to the anthropogenic effects that are producing global warming. ESS offers a broad tent for many different approaches coping with the risk-uncertainty conundrum. Often information and knowledge are scarce or non-existing. Carbon capture in gas- or coal-fired power stations, for example, requires yet unknown means by which to store the captured carbon. Seeding the oceans with iron might be one possible partial solution. Encouraging the growth of plankton, which takes carbon dioxide out of the atmosphere and to the bottom of the ocean, might be another. Solar radiation management would seek to reduce the amount of sunlight that warms the earth's atmosphere, for example by launching mirrors or parasols into space to deflect the sun's rays or by pumping sunlight-reflecting sulfur particles into the earth's upper atmosphere. The unintended and unanticipated consequences of such interventions are unknown and often unknowable. An interdisciplinary, international group of environmental and social scientists concluded that new technologies "promise significant benefits, but also pose major risks for sustainable development."⁶² The risk terminology is misleading. Scientific experiments and studies are still all too rare. And nobody knows what would happen if such interventions were implemented at scale. Geoengineering is a promising and fraught undertaking as it grapples with the risk-uncertainty conundrum.⁶³

⁵⁸ Hardt 2024.

⁵⁹ Hamilton, C. 2017: 9–10, 12–14, 63. Rockström *et al.* 2009. Hanusch and Biermann 2020.

⁶⁰ Lundershausen 2018. Welch 2022: 83–90. ⁶¹ Hamilton 2013b: 110–11.

⁶² Biermann *et al.* 2012: 1306.

⁶³ Hobden 2018: 100–02. For reasons of length this chapter does not discuss fusion and hydrogen technologies that also offer the prospect of almost unlimited clean energy. See Hiller 2023, Plumer 2023b, and Reed 2022.

This may explain why it finds growing support even in unexpected quarters. Stuart Brand is an icon of the American environmental movement and creator and long-time editor of the *Whole Earth Catalog*. He is also a fervent advocate of all things Green. Relying on the best science and technology he can find, Brand discusses three coping mechanisms for dealing with global warming: more cities, more nuclear energy, and more genetic engineering.⁶⁴ And because of the inability and unwillingness of states and societies to modify their accustomed patterns of behavior, he is also an advocate of experimenting with geoengineering approaches to deal with the consequences of climate change. He argues that if Plan A fails, there needs to be a Plan B. Following his inclination the interest in geoengineering has skyrocketed. The Open Science Conference, which occurs every decade, virtually ignored geoengineering in 2011. Reflecting a shift in thinking, a decade later there were hundreds of papers, talks, and posters on the same subject.⁶⁵ For example, in 2024 a field experiment off the northeastern coast of Australia attempted to brighten low-altitude clouds to deflect sunlight and cool the waters around the Great Barrier Reef; Israel tested solar radiation and is getting ready to build a parasol prototype eventually to be tethered to a satellite or asteroid; Massachusetts has experimented with artificially lowering the acidity of water around Martha's Vineyard; and the national oil company of the United Arab Emirates explored pumping carbon dioxide down into the rocks of the Hajar mountains.⁶⁶ Given the risk-uncertainty conundrum, Brand argues that we cannot do without "planet craft," understood as both skill and cunning.⁶⁷

Not everybody is on board. Seeding the atmosphere with sulfates to deflect sunlight, for example, might intensify widespread droughts that would affect hundreds of millions of people. It might also reduce the effectiveness of solar panels. And large-scale stratospheric injection would have to be maintained for many years until other solutions were found. Any interruption in this approach would lead to a very rapid and disruptive rise in temperatures, putting much greater stress on ecosystems and societies than a more gradual increase. These are only some of the reasons why a movement that opposes the development of such technologies has grown rapidly since 2022. Unavoidably, geoengineering is political.⁶⁸ Its proponents sometimes seem to believe, unrealistically, in the existence of a single global planner, in the efficacy of existing power hierarchies, and in the emergence of a viable global governance regime.

⁶⁴ Brand 2009. ⁶⁵ *The Economist* 2023a: 67–69.

⁶⁶ Niiler 2024. Buckley 2024. *The Economist* 2023b: 3–4.

⁶⁷ Brand 2009: 283–90. See also Robock 2008. Hamilton, C. 2017a: 21–27.

⁶⁸ Gardiner 2010. Hobden 2018: 105–07.

Or they nurture the hope that a pragmatist, precautionary understanding will evolve in existing international fora such as the UN Environmental Assembly (UNEA). It has not and, in the foreseeable future, will not. The technical obstacles to some of these proposals are formidable; the political ones, for now, are insurmountable.⁶⁹

Geothermal Energy

The development of geothermal energy since 2001 offers a good illustration that surprise is always built into politics even when it unfolds in the small world of risk. This story starts, paradoxically, with the advent and growth of hydraulic fracking technology: the injection of large volumes of water and sand, mixed with chemical additives, into low-permeability subsurface formations (and, increasingly, deeper formations) so as to increase the flow of oil and natural gas.⁷⁰ Powered by technological advances made by small oil-drilling firms since the 1970s, between 2000 and 2019 the boom in hydraulic fracking enabled the US to become the world's leading producer of oil and natural gas, thus adding to the competitiveness of fossil fuels and intensifying and extending the process of global warming.⁷¹ Fracking can cause localized earthquakes. It contributes to the overuse and erasure of local water resources. It is a source of water contamination.⁷² And it increases natural gas production that accelerates global warming.⁷³ From the beginning, fracking was a politically controversial practice facing pushback from environmentalists, local communities, scientists, and policy makers.⁷⁴

The rapid improvement of fracking technology has opened the door to new ways of tapping into the earth's massive geothermal energy resources. All of a sudden there was a new way to reach the wellsprings of high temperature spaces and harness them to generate clean, renewable energy. Some early developments occurred in California in the 1960s.⁷⁵ But a rapid and more widespread expansion started around 2010, with the influx of stimulus money as part of the federal government's unrelated rescue efforts after the 2008 financial crisis. This investment powered the deployment of fracking technology for geothermal ends. Activity tapered off around 2016, only to start up again in 2020.⁷⁶

⁶⁹ Lovelock 2009: 139–58. McLaren and Corry 2021: 24.

⁷⁰ U.S. Department of Energy 2011.

⁷¹ Eliot and Santiago 2019. U.S. Department of Energy 2019, 2013.

⁷² Environmental Protection Agency 2021. U.S. Energy Information Administration 2021. Nevola 2012.

⁷³ Chamberlin *et al.* 2016. ⁷⁴ Nevola 2012. ⁷⁵ U.S. Department of Energy 2013.

⁷⁶ Roberts, S. 2020. Yergin 2021.

The basic idea of geothermal exploration is to utilize very hot areas of underground water.⁷⁷ Fracking is employed to drill into these hydrothermal resources, expand them, and either inject extra water that powers steam turbines or draw up the steam from already existing reservoirs.⁷⁸ Thus, steam is used to generate energy. In places where extractable hydrothermal resources are available, writes science journalist Siobhan Roberts, “geothermal can provide always-on, baseload power; it is the only renewable resource to do so.”⁷⁹ Geothermal fracking differs in important ways from the fracking involved in oil and gas production. For one, there is no traceback to natural gas production plants and the inevitable leakages that occur, thus eliminating one point of environmental concern. The energy generated by geothermal plants does not require expensive and damaging production processes; it is ready-to-go and on demand. In addition, while most geothermal plants that currently exist require a separate power source to operate, technology is being developed that enables such plants as closed-loop energy systems to be entirely self-sustaining while meeting local power demand.⁸⁰ While some preliminary evidence indicates that it may be small, uncertainty over levels of seismic activity caused by geothermal fracking persists.⁸¹ But water depletion and contamination concerns generally do not apply in the case of geothermal. The technology recycles the water it uses without chemical additives.⁸²

Geothermal energy is a case study in economist Albert Hirschman’s “reform-mongering”: the repurposing of interests and, in this case, technology for the realization of aims opposite to those originally intended.⁸³ The geothermal case illustrates how uncertainty characterizes the complex relations between humans and the subterranean sources of energy they experiment with. Important technological developments occurred before a reform-mongering process got off the ground. To be sure, in the form of hot springs, geysers, and fumaroles geothermal energy has been available to humans for thousands of years. As journalist David Roberts writes, “there’s enough energy in the earth’s crust, just a few miles down, to power all of human civilization for thousands of years to come.”⁸⁴ The decay of naturally deteriorating radioactive elements that occurs around the earth’s molten-hot core means that this source of heat is renewable and intrinsically self-sustaining.⁸⁵ The difficult issue for start-ups, university labs, interested oil

⁷⁷ Biello 2008. Siobhan Roberts (2020) helpfully subdivides innovations in geothermal into four main types: conventional, enhanced geothermal systems (EGS), hot-rocks, and advanced geothermal systems (AGS).

⁷⁸ U.S. Department of Energy 2019. Dhanesha 2022. ⁷⁹ Roberts, S. 2020.

⁸⁰ Yuan *et al.* 2021. Eavor 2019. ⁸¹ Patel 2009. ⁸² Roberts, S. 2020.

⁸³ Hirschman 1963. Torracinta 2021. ⁸⁴ Roberts, D. 2020.

⁸⁵ U.S. Department of Energy 2019.

and gas corporations, and governments has been how, exactly, to utilize this renewable energy on a large scale.⁸⁶

Geothermal energy offers a promising model for the future. Drawing water from hot spaces below the earth's surface and cycling it in closed-loop systems for the generation of clean energy creates a symbiotic image of humans interacting seamlessly with nature in a way that is sustainable and life-supporting. Building political support for this technology, however, is far from easy. As part of the Biden administration's environmental policy, the fossil fuel industry backed direct air capture technology, vacuuming pollution after it had been put in the atmosphere. Its funding of \$1.2 billion exceeded by a factor of twenty-five the \$84 million for advanced geothermal.⁸⁷ Still, an innovation in fossil fuel technology that many had viewed as a scourge of local communities and a source of global warming is being repurposed. Unsurprisingly, both oil and gas companies and proponents of clean energy back this technology. Once the rallying cry of conservatives supporting the fossil fuel industry, "Drill, Baby, Drill" has acquired a new meaning.⁸⁸ Fossil fuel corporations see new profits, their critics the potential for on-demand renewable energy.⁸⁹ These surprising bedfellows have created a new politics of reform. Based on the assumption that humankind can control nature and extract its resources without harmful consequences, fracking, unexpectedly, provides one escape from Promethean hubris. It is not the only one. Hirschman insisted that it is impossible to predict the emergent pathways of reform-mongering. For better and for worse uncertainty reigns also in parts of the small world of risk.

Marine Geoengineering

About 70 percent of the earth's surface is water, with oceans containing more than 95 percent of it. Warmer air holds more water and warms the oceans. Excess carbon dioxide in the atmosphere gets absorbed by ocean water and turns the oceans more acidic, more so in the next few decades than during the past 300 million years. Higher air temperatures increase evaporation and higher atmospheric water content increases uneven rainfall. Some areas will suffer from droughts, lower crop yields, more hydroelectric interruptions, land degradation, diminished livelihood opportunities, hunger, desertification, and human migration. Other areas will experience major floods, soil erosion, water pollution, infrastructure and residential area losses, and increased diseases. Antarctica's glaciers, ice caps, and ice sheets

⁸⁶ Biello 2008, 2011, 2013.

⁸⁷ Davenport 2023. Plumer 2023b.

⁸⁸ Plumer 2023a.

⁸⁹ Roberts, D. 2020.

will shrink during this century. This will lead to a rise in sea levels threatening scores of island states, metropolitan areas, seaside communities, wetland and coastal plains, and wildlife habitats. If the Thwaites Glacier disintegrates it will cause more than a 2-foot rise in sea levels worldwide. Its collapse could destabilize the entire West Antarctic Ice Sheet, and that could cause a 10-foot jump in global sea levels. Thwaites is one of the biggest wild cards in the deck of global warming, the largest known unknown that will decide what happens to thousands of coastal communities in all parts of the world.⁹⁰ Since the first Earth Summit convened in Rio de Janeiro in 1992, the Arctic ice cap has shrunk by 40 percent. Heat may lead to mass drownings.

Marine geoengineering places its bet on human technical prowess in mitigating and adapting to global warming. This optimism about human ingenuity is reinforced by corporate interest in future profits to be reaped from the “Blue Acceleration” and the “New Blue Economy.” Optimism and economic interest have combined in the call for a “Blue New Deal.”⁹¹ Even though oceans have long been a site of extraction and accumulation, as arenas of geoengineering they remain a relatively unexplored frontier. Marine geoengineering centers on investments in what are frequently called “negative emissions technologies.” Policy discussions were spurred by two papers published by two Nobel laureates in 1996: economist Thomas Schelling and meteorologist and atmospheric chemist Paul Crutzen.⁹² Schelling saw future geoengineering technologies as a relatively conflict-free way to address the looming climate crisis within the small world of risk. He referred to geoengineering as the marshalling of “intentional . . . technologies of intervention.”⁹³ Crutzen made the case for creating a human-made escape from climate catastrophe. Deploying the concept of the Anthropocene, Crutzen sought out niches of risk provided by geoengineering in the large world of uncertainty.⁹⁴ In marine geoengineering this means focusing on carbon dioxide removal (CDR).

Maritime law took note.⁹⁵ Adopted in 2006, the London Protocol was amended in 2013 to include statements concerning geoengineering. It was updated in 2022 to address directly, albeit incompletely, the issue of marine geoengineering.⁹⁶ Additionally, a UN-sponsored group of scientists and scientific organizations released in 2019 a “High Level Review of a Wide Range of Proposed Marine Geoengineering Techniques.”⁹⁷ These statements offer no more than a “patchwork” framework for global

⁹⁰ Rush 2022. ⁹¹ Armstrong 2022. Rifkin 2024. ⁹² Schelling 1996b. Crutzen 1996.

⁹³ Schelling 1996b: 304.

⁹⁴ Crutzen and Stoermer 2000. Crutzen 2002. Sheppard *et al.* 2009: 1.

⁹⁵ Mendenhall 2019. See also Brent *et al.* 2019.

⁹⁶ Brent *et al.* 2019. For the 2022 update see bit.ly/3H11Te5, accessed 05/17/24.

⁹⁷ Boyd and Vivian 2019b.

governance.⁹⁸ Many issues remain unaddressed.⁹⁹ For example, once relegated to a strip along their coastlines, states' off-shore jurisdiction now extends to the edge of the continental shelf, covers areas far below the ocean's surface, and incorporates the above-ocean airspace.¹⁰⁰ Most pertinent for the deployment of marine geoengineering are "exclusive economic zones" (EEZ), areas in which a state has exclusive rights over the use of all marine resources.¹⁰¹ The prospects for an internationally agreed upon "Blue New Deal" seem politically extremely limited.¹⁰²

Oceans are a natural carbon sink. They absorb about 25 to 30 percent of carbon emissions in the atmosphere and roughly 90 percent of the heat generated by them.¹⁰³ Compared to the world's forests, oceans absorb about four times more carbon.¹⁰⁴ The main purpose of marine geoengineering is to develop technologies to mitigate the carbon emissions from fossil fuels. It is a form of risk management that relies on technological control over natural water processes. Many of the technical possibilities fall under the heading CDR.¹⁰⁵ Adding compounds like iron to the ocean, called Ocean Iron Fertilization, will increase phytoplankton growth and accelerate carbon sequestration.¹⁰⁶ Storing carbon under the ocean seabed is an alternative technology.¹⁰⁷ In both of these procedures, humans are controlling natural processes to mitigate excessive levels of carbon emissions. Subject of much discussion, such ideas and plans point to the possibility of humans finding a way to save themselves from negative climate consequences under conditions of radical uncertainty with unforeseeable geopolitical consequences.¹⁰⁸

Short in supply is confidence-inducing, established science supporting many of the proposed techniques, when applied at scale.¹⁰⁹ And there is little knowledge about how to regulate the unforeseen negative consequences they might have.¹¹⁰ Comprehensively tested evidence for any of the CDR techniques currently under consideration is missing, and the need for systematic, viable, and generally accepted studies is urgent.¹¹¹ Several studies have pointed to "major gaps" in scientific knowledge or a "widespread knowledge gap" in the evaluation of the technology's effectiveness.¹¹² In the absence of important information, regulations and procedures remain contested on related issues such as deep sea mining.¹¹³ Comedian John Oliver addressed the issue with passion and

⁹⁸ Brent *et al.* 2019: vii–viii. ⁹⁹ Mendenhall 2019.

¹⁰⁰ Mendenhall 2019. See also DeSombre 2018. ¹⁰¹ Mendenhall 2019: 34.

¹⁰² Elizabeth Mendenhall, personal email to the author, 04/07/24.

¹⁰³ United Nations Environment Programme 2022. ¹⁰⁴ Jones 2019.

¹⁰⁵ Sheppard *et al.* 2009: 16–19. ¹⁰⁶ Jones 2019. ¹⁰⁷ Amon *et al.* 2022.

¹⁰⁸ Espinosa 2022. ¹⁰⁹ Amon *et al.* 2022. ¹¹⁰ Boyd and Vivian 2019a: 156.

¹¹¹ Boyd and Vivian 2019a. ¹¹² Sheppard *et al.* 2009. Boyd and Vivian 2019b: 12.

¹¹³ Pickens *et al.* 2024.

disdain for companies like Australia's The Metals Company, which is poised to start deep sea mining in the Clarion-Clipperton Zone that stretches 3 miles below the surface of the Pacific Ocean, from Mexico to Hawaii. With the effects of deep sea mining largely unknown, Oliver pleads for a moratorium that would protect this "mind-blowing vast, virtually unknown world within our world" until science has caught up.¹¹⁴ Here, too, the risk-uncertainty conundrum is inescapable.

If these technologies were to be implemented by unilateral state action, it would intensify an increasing competition over exclusive state controls over the world's oceans. The "Blue Acceleration" is a "race among diverse and often competing interests for ocean food, material, and space."¹¹⁵ States are seeking ways to industrialize the oceans and find advantages in their competition with other states. Duplicating the conflict over land in the traditional international system, the "Anthropocene Ocean" is becoming the new frontier in the competition over power and wealth.¹¹⁶ With about two-thirds of the world's ocean still beyond sovereign claims, the competitive race for new water rights could be intense – a twenty-first-century oceanic enclosure movement somewhat reminiscent of eighteenth- and nineteenth-century England's enclosure of the commons. Then "sheep ate men";¹¹⁷ now "men eat fish"... and more. And that race would not be constrained by the existing, weak international governance frameworks that regulate the "common heritage" of humankind, challenged by growing calls for "saving the planet from global warming."¹¹⁸

Marine geoengineering can be placed in a critical theoretical perspective that goes beyond conventional discussions of technology and geopolitics.¹¹⁹ Highlighting the risk-uncertainty conundrum, it yields insights not unlike Hirschman's reform-mongering perspective on geothermal energy. Prasenjit Duara's "waterscape" analyzes "how human endeavor" shapes the movement of water while water shapes the possibilities of human and planetary life.¹²⁰ He develops a perspective of all water – including oceans, rivers, streams, lakes, and ponds – as a commons without regard for state borders, dams, embankments, and other means of human control.¹²¹ States and corporations adhere to an "abstract," institutionalized conception of water as material that can be channeled, controlled, deployed, and represented in terms of specific chemical properties and constructed flows. Such abstractions elide the ways in which water is an indelible part of both socio-political and natural processes. More accurately understood as a "cycle," water's constant flow, absorption, and movement in all parts of planet earth

¹¹⁴ Horton 2024. ¹¹⁵ Jouffray *et al.* 2020: 43. ¹¹⁶ Jouffray *et al.* 2020: 48–50.

¹¹⁷ Jouffray *et al.* 2020: 49. ¹¹⁸ Buck 2012: 257. ¹¹⁹ Duara 2024.

¹²⁰ Duara 2024: 1. ¹²¹ Duara 2024: 6–8.

underwrite the possibility of life itself.¹²² Drawing on Sartre's concept of "counter-finality," Duara's waterscape describes the ways in which human labor, such as marine geoengineering, makes and remakes nature. A new state of the hydrological cycle continues to source life while also introducing new uncertainty into the life it sources.¹²³ Based on the assumption that contexts are homogeneous and processes are stable, risk-based views of water see it as a separate part of nature that humans seek to exploit and control. Left out is the work of local communities, living in heterogeneous contexts and under variable processes. With experimentation they harness the uncertainties humans introduce into the hydrological cycle and improvise to discover alternative ways of living, relying on language that is world-making.

Jerome Whittington's anthropological study of hydropower in Laos illustrates with rich descriptive detail the production of uncertainty and the improvisational experimentation it sets free.¹²⁴ Humans act on and entwine themselves with nature in relations so complex that actual ecological relations become uncertain, impossible to know and predict – just as Ulrich Beck's analysis of modern risk societies suggests.¹²⁵ In Laos this manufacturing of uncertainty conditions both national capitalist development and local community responses.¹²⁶ In Whittington's "postnatural ecologies," nature has been altered by large dams.¹²⁷ Corporate and state-supported technical development and planning operate, like marine geoengineering, as if full mastery of nature were possible. The reality on, speaking inaccurately, the ground, is that no one really knows enough, and everyone must experiment and improvise with innovative practices to continue to live amid fluctuating ecologies.¹²⁸ Rivers can be anthropogenic, illustrating the complementarity of risk and uncertainty while reminding us of the sources of creativity called forth, unintentionally, by the human urge to control and exploit nature.

Mitigation and Adaptation at Home and Abroad

News about mitigation of and adaptation to climate change is not good. Despite more than \$10 trillion of global investment in renewable energy since 2015, fossil fuels continue to provide 80 percent of global energy consumption. For the foreseeable future the goals set in the 2015 Paris Agreement are out of reach.¹²⁹ Facing an existential threat, some activists favor declaring a global climate emergency followed by dramatic action. For a very short time, this might achieve astounding results. For example,

¹²² Duara 2024: 8–12. ¹²³ Duara 2024: 8. ¹²⁴ Whittington 2019.

¹²⁵ Beck 1992, 1999. ¹²⁶ Whittington 2019: x. ¹²⁷ Whittington 2019: xii, 19.

¹²⁸ Whittington 2019: 8–9. ¹²⁹ Koonin 2024.

during the 2008 Beijing Olympics, local carbon dioxide emissions declined by half. The Chinese government shut down heavily polluting factories; halted major construction projects; and restricted automobile use.¹³⁰ Applied on a global scale, rule by emergency decree most likely would give the power to a few individuals in a few powerful states. A technocratic elite would be entrusted to solve a pressing problem, without concern for the plurality of political players, divergent goals of human well-being, and insistent justice concerns that are part and parcel of environmental sustainability. Furthermore, technocratic policy would have to choose among alternatives with often unknown and unknowable consequences. China's authoritarian politics may have succeeded for a year in Beijing. But an emergency decree approach "with a Chinese face" is not going to work in a politically diverse world coping with environmental challenges for many decades and centuries to come. Even without an explicitly authoritarian gloss, technocracy by itself also lacks appeal. Directed foremost against the use of aerosols to shield the earth from the sun, since 2022 support for a solar geoengineering moratorium or non-use agreement has spread even among some former supporters of planetary solar management.¹³¹ Opposition to a technocratic mitigation approach, developed and potentially applied by a few powerful states, illustrates the depth of the political backlash. Under conditions of accelerating climate change, the politics of mitigation and adaptation will not look anything like top-down authoritarian or technocratic governance models.

As I argued in [Chapter 3](#) models are a way of telling stories, here about the mitigation of climate change, stories that are characteristic of the small world of risk. Modelers simplify their stories and are good at predicting the likely consequences of specific outcomes, such as the effects of concentrations of greenhouse gases on increasing temperatures. Based on that knowledge they then make specific policy recommendations about the limits of aggregate emissions, how much fossil fuel should stay in the ground or be recaptured, and what price will create the right incentives for consumption and investment. However, a review of the effects of carbon pricing on greenhouse gas emissions points to the sobering conclusion that those effects were negligible.¹³² Price, it seems, is not the only relevant factor. Many additional kinds of complementary interventions are needed, interventions that often escape the proposed model. Furthermore, the price effect of carbon on society and technology is

¹³⁰ Javeline 2014: 424.

¹³¹ www.solargeoeng.org/NON-USE-AGREEMENT/, accessed 05/12/24. Bernstein 2023: 641.

¹³² Green 2021.

unknown. And an economically rational price is politically unrealistic in the time frame available to meet specific climate targets. Social, economic, and political uncertainties thus intensify climate uncertainties.

Similarly serious problems occur in the modeling of carbon budgets.¹³³ Depending on the assumptions made, these models can lead to very different results and run up against many different kinds of uncertainty in the climate system which are in turn compounded by the uncertainties of societal choices. Different models of carbon budgets rely on different definitions of probability, and on samples that are often too small to generate reliable statistical results. “Carbon budgets,” Glen Peters concludes, “are uncertain. There is no magic number that describes the mitigation challenge.”¹³⁴ This, however, may short-change the importance of models. In finance, as discussed in [Chapter 4](#), models operate like metaphorical language. They not only represent the world, fitting facts to predictions. They also re-present the world, in performances that can change the world. If they convince they can change human practices to help bring about the world they predict. Illustrating the risk-uncertainty conundrum, this social aspect of modeling is true also of climate and AI.

In the 1980s the greatest concern was not global warming but nuclear winter – the potentially disastrous cooling of the earth’s surface due to smoke clouds generated by a global thermonuclear war. Recent climate models have shown that even a limited nuclear war of ten weapons, targeted at cities which then would burn, could trigger conditions approximating nuclear winter.¹³⁵ With the nuclear doomsday clock now set closer to midnight than ever before, the prospect of nuclear war remains an undeniable fact of world politics in an era of growing international tensions. Yet current discussions of climate change proceed as though the threat of nuclear war does not exist.

This is a useful reminder of the limitations of climate science and its models. Martin Weitzman describes climate models as an immense cascade of huge uncertainties of truly stupendous scale and scope, and long chains of tenuous inferences fraught with huge uncertainties in every link.¹³⁶ In line with that assessment, we must avoid, writes Geoff Mann, “trying to fabricate precision out of desperation, or calculating just because we can . . . The struggle is to find a sweet spot between illusory exactitude and unhelpful handwaving.”¹³⁷ The range of many parameter values in climate models is unknown or unknowable and so are the shapes

¹³³ Peters 2018. ¹³⁴ Peters 2018: 380.

¹³⁵ Jacobs 2022: 184. Assuming, realistically, a larger number of deployed nuclear weapons, Blight and Lang (2018: 106–10) offer much higher estimates – billions of casualties for a large global nuclear war and tens of millions for a small regional war.

¹³⁶ Quoted in Mann 2023. ¹³⁷ Mann 2023.

and distributions of the probability functions that are being modeled. Black swans are omnipresent. Furthermore, models typically rely on historical data and hence on the assumption that underlying natural and social processes are stationary, a dubious assumption at best. Estimates of population growth, for example, are difficult and variable. We know, however, that rates of population growth are plummeting. The most recent predictions of the world's population by the end of the century have been lowered by 1 billion. If power consumption per capita is estimated at about 4 kilowatts, then a drop in world population by 1 billion people would be a saving of about 4 terawatts of power, the equivalent of about 4,000 nuclear reactors and 400,000 of the largest existing wind turbines.¹³⁸ Although this is not nothing, we really do not know how much it is of something. And fat tails in statistical distributions make the current professional consensus in climate science overly optimistic by magnitudes that are also unknown and unknowable.¹³⁹ All the talk of probabilities typically conceals unmeasurable uncertainty and points to the ineluctable political contestations and choices that will shape the future. For better and for worse human judgment may trump computation. Climate models are useful in clarifying assumptions and specifying the questions that need to be asked. But in these models, as in AI, probability is little more than a faith-producing language. Models are often tested, as in AI, on hundreds of thousands of computer runs. To the question what kinds of uncertainties humanity will tolerate, Monte Carlo simulations will not give the answer. Politics will.

The risk-uncertainty conundrum also plays a major role in the politics of adaptation. Temperature changes have been sufficiently large so that even the most intense mitigation policies will not stop global warming. Adaptation means less vulnerability and more resilience in heterogeneous contexts and under variable processes, operating at multiple scales across different sectors. Open to human whims and follies, it is expected to last for decades. Its efficacy, feasibility, cost, and fairness are very controversial. Adaptation requires making difficult political choices about myriads of critical issues such as infrastructure, land and crop use, transportation systems, industry, urban development, biodiversity, and the protection of coastlines. Should New York or Miami get the seawall or more pumps? The weak and vulnerable are likely to lose out in the coming political struggles.

The politics of adaptation are shaped by the carbon lock-in that grips all industrial economies.¹⁴⁰ Lock-in is the result of the co-evolution of economic, technological, and institutional factors supporting the fossil

¹³⁸ Zellman Wahrhaft, email conversation, 02/7/24. ¹³⁹ Mann 2023.

¹⁴⁰ Unruh 2000.

fuel industry. “Helping to sell the future” the oil and gas industry is at the center of the carbon lock-in.¹⁴¹ Political choices and conflicts are “wicked,” defined by a ticking clock, the absence of central authority, people who cause the problem remaining in charge of solving it, and the irrational pushing of the problem out of sight as the future comes into clear focus.¹⁴² Competing strategies of “degrowth” and “green growth” are part and parcel of the political fight over loosening or breaking carbon lock-in.¹⁴³ Green industrial policy points to an acceleration of decarbonization fraught with the revival of international political conflicts, especially between the US and China, not seen since the rise of Japan in the 1970s and 1980s.¹⁴⁴ Speaking with forked tongue, business leaders are eagerly practicing the new jargon of “derisking” in the hope of getting government insurance for the torrent of private capital they promise to unleash. Plain and simple, this is a brazen attempt to create a make-believe world of risk out of thin air to ask for vast subsidies to secure investments with uncertain prospects.¹⁴⁵

Rather than take on the carbon lock-in with a top-down approach, decarbonization strategies rely also on decentralized, experimental approaches in both international and domestic politics. Between 1990 and 2009 a centralized global climate regime was based on treaties negotiated between states and modeled after the trade and other international regimes. After a dozen fruitless, post-Kyoto (1997) years of political stalemate, the hope for a global regime was dashed by the failed 2009 Copenhagen negotiations. Instead of binding agreements Copenhagen introduced nationally based commitments as a substitute for collectively agreed reductions in greenhouse gas emissions. The 2015 Paris Agreement shifted gears further by focusing on states pledging to emission reduction goals they would specify themselves but which international organizations would monitor and verify. All states must cumulatively contribute to reduce greenhouse gas emissions. This new system relies on a bottom-up method of “climate clubs” as “building blocks.” But as Charles Sabel and David Victor argue, given high levels of uncertainty about climate, such a bottom-up approach will work only if it operates under institutions that are not as politically blocked as the UN system.¹⁴⁶ Self-reinforcing, decentralized systems can work only under some restrictive conditions, including reliable review and assessment, a robust system of pledging, and the capacity to sanction persistently uncooperative actors. Put differently, experimentation via decentralization cannot do

¹⁴¹ Green *et al.* 2022. Beckert 2024.

¹⁴² Auld *et al.* 2021: 709–12. Rittel and Webber 1973.

¹⁴³ Mann 2022. Nahm and Wallace 2024. Meckling and Nahm 2022. Stokes 2020.

¹⁴⁴ Allan *et al.* 2021. ¹⁴⁵ Eich 2024b.

¹⁴⁶ Sabel and Victor 2017a, 2017b. Dorf and Sabel 1998. Sabel and Zeitlin 2010.

without some form of reintegration. Local experience and learning by fore-runners need to be filtered up to higher-level comprehension by an institutionalized center that is non-directive but facilitates explicit rather than tacit learning. This would enhance the dynamic capacity of the decentralized climate complex that is sharing information and lessons under conditions of uncertainty. The EU and some of its member states model such arrangements. It remains an open question whether the European model is replicable at the global level or within other regions of the world.

The 2015 Paris Agreement sent a strong signal that decarbonization would depend on the choices of states as well as sub- and non-state actors. Catalytic non-state and sub-state actors are dedicated to the disruption of power configurations defending fossil fuels. Municipalities and transnational city networks have been the cutting edge of experimental initiatives. Decarbonization and breaking carbon lock-in are two sides of the same coin. Steven Bernstein and Matthew Hoffmann propose three political mechanisms effecting normative change, mobilizing resources for different practices and policies, and building new coalitions.¹⁴⁷ These mechanisms generate different disruptive trajectories to deal with carbon lock-in: unintentional reinforcement, improvement in efficiency gains in carbon systems, and transformational decarbonization. The three mechanisms are stipulated to act interactively across different levels of politics and different issue areas.¹⁴⁸ Over a period of several decades interactive mechanisms could create significant change in the social and political processes that affect adaptation. For now, however, it is impossible to make reliable predictions about how these mechanisms will work and what effect they will have in different contexts.¹⁴⁹ David Wallace-Wells has made a strong case that the climate future currently looks like a muddle of contested choices that will probably avoid the extreme outcomes of a total stop of or a total surrender to global warming.¹⁵⁰ In this adaptation of the story of Goldilocks and the three bears to the politics of climate adaptation, and in line with the risk-uncertainty conundrum, pretty much everything is uncertain. In line with this story, international relations scholars Tanisha Fazal and Page Fortna conclude with admirable candor that in the twenty-first century the effects of climate change in world politics will require “getting a lot more comfortable with uncertainty . . . studying the political effects of climate change will require an epistemological turn among positivists in particular.”¹⁵¹

¹⁴⁷ Bernstein and Hoffmann 2018, 2019.

¹⁴⁸ Colgan *et al.* 2021. Grubert and Hastings-Simon 2022. ¹⁴⁹ Busby 2024: 46–47.

¹⁵⁰ Wallace-Wells 2022. Soloski 2024. ¹⁵¹ Fazal and Fortna 2024: 30.

2. The Large World of the Biosphere: Anthropocene and Time

Gaia, globe, planet, earth, call it what you will, the whole is a series of contingently changing relations entangling biosphere, humans, societies, and states.¹⁵² The sciences do not provide us with governance rules rooted in Nature's laws which we discover from afar, taking a God's eye view. We are proximate knowers, observing and acting from inside the world, not gazing at it from the outside. And we adjust our knowledge and practices as the situation changes and as the evidence requires. Doing any kind of science and practicing any kind of governance occurs in the context of a world that allows and encourages some and prohibits and discourages other ways of thinking and acting.¹⁵³ The complementarity of risk and uncertainty resonates with the warning in Haydn's opera *Orfeo* and its world-ending tempest. In the words of the opera's promotion for its 2023 North American premiere: "All's not fair in love and war. Nature always wins."¹⁵⁴ Bruno Latour concurs. "Earth has become – become again! – an active, local, limited, sensitive, fragile, quaking, and easily tickled envelope."¹⁵⁵ That "new-old" condition in earth history creates novel uncertainties in human history.

Biosphere and Anthropocene

Is the earth a planet with unchanging conditions as described by geophysicists and geochemists or is it changing as astrobiologists argue? Through their incessant actions organisms affect air, soil, water, and the climate. Like humans, organisms rearrange everything around themselves, modifying their surroundings to suit their own purpose. If true, this is a world of distributed agency filled with non-intentional adaptations and uncertainties. Earth's biosphere, conventionally thought of as stable, passive, and inert, is unstable, active, and mobile, marked by multiple processes and agents operating across different temporal scales.¹⁵⁶ The sustainability and habitability of the earth are evoking two different temporalities.¹⁵⁷ There is no holistic totality for planet earth. Yet no part exists apart from the whole. Human intervention cannot return earth to its accustomed track. For earth history is a process of variable and contingent happenings that preserve the

¹⁵² Latour 2017. Kurki 2020: 166. ¹⁵³ Kurki 2020: 8. Latour 2014: 2, 5.

¹⁵⁴ The credit goes to the brilliant production's director Nico Krell.

¹⁵⁵ Latour 2014: 3. ¹⁵⁶ Latour 2017: 91–93, 99–101, 105. Welch 2022: 66.

¹⁵⁷ Chakrabarty 2019: 17–23, 25–26.

potentiality of unpredictable futures. Stretching our vision beyond humanist Newtonianism, para-humanism and the Anthropocene illuminate a broader picture rendered by Gaia theory. Across different time scales global warming is a cascade of the unexpected.¹⁵⁸

The contested concept of the Anthropocene captures the environmental effects of human action on planet earth. The traditional language of “Mother Earth” expresses the familiar and reassuring notion of a sheltering and protective earth that is quiescent, the language of “Gaia” the novel and unsettling one of a vengeful and destructive planet that is coming alive. This is not the first time that a name was invented to capture the idea of humans altering earth. In the 1870s Italian geologist Antonio Stoppani argued that human activities were ushering in a new “anthropozoic era.” What is novel about the concept of the Anthropocene is the idea of radical rupture. In the 1920s two Soviet scientists, geochemist Vladimir Vernadsky and geologist Alexei Pavlov, developed that idea.¹⁵⁹ They recognized that by converting solar energy, life was a force shaping the biosphere of the earth.

In our times James Lovelock has developed that idea further. His key insight is that the earth’s biosphere and life are deeply entangled and co-evolving processes. “Life on our planet does not simply experience the weather,” writes journalist Ferris Jabr, “it creates it.”¹⁶⁰ Life evolves on earth because earth is suitable for life and in so doing, it also changes earth. It has become a “formidable geological force . . . We and other living creatures are more than inhabitants of Earth. We *are* Earth . . . The history of life on Earth is the history of life’s remaking Earth.”¹⁶¹ Thus living creatures participate in their own evolution. In contrast to other planets such as Mars and Venus, the earth possesses a biosphere that is not in an inhospitable-to-life chemical equilibrium. It exists instead in a dynamically steady state conducive to life. A specific proportion of oxygen and carbon dioxide in the atmosphere stopped the earth from becoming a dead planet. In the future astronomers’ search for chemical disequilibria in the universe might discover earth-like planetary-scale biospheres and perhaps intelligent alien species.

Lovelock and Margulis developed this idea in the form of “Gaia” theory. Life creates chemical states impossible in planets without life. In the earth’s biosphere organic and inorganic organisms incessantly and recursively interact to form a complex, evolving system of life. The evolution of life and planet earth is one deeply entangled process. Microbial ecosystems, not humans, are central to that process. According to one estimate “Earth’s total plant roots stretch to a surface

¹⁵⁸ Latour 2017: 95–97, 107. ¹⁵⁹ Frank 2024. ¹⁶⁰ Jabr 2024: 26.

¹⁶¹ Jabr 2024: 27.

area 35 times larger than the entire surface of planet Earth; microbes, taken collectively, to the equivalent to 200 Earth areas.”¹⁶² The weathering of rock has been a central aspect of life. For hundreds of millions of years plants have pumped carbon dioxide from the air into rocks. Mineral evolution depends on biological evolution. Without the work done by living organisms, earth’s evolution, Lovelock argues, remains inexplicable.¹⁶³ The new discipline of astrobiology postulates that life on earth uses planet earth for its own ends. And earth is just one of up to 10 billion trillion habitable worlds in the universe.¹⁶⁴

Because Lovelock’s key insight can be inferred only from indirect evidence, his reliance on often poetic metaphors has provided plenty of ammunition for his critics.¹⁶⁵ Many earth scientists dismiss Gaia theory. The idea of a homeostatic earth system, they claim, has not survived scientific scrutiny. Reminiscent of Solow ripping into Soros on the issue of finance, the critics argue that Gaia theory is badly specified, poorly modeled, inconsistent with accepted facts, and unnecessary since alternative explanations are readily available. Adherents of ESS in fields such as geophysics, geophysiology, and geochemistry scoff at bioecological models. More sympathetic critics acknowledge that the data remain inconclusive and that Gaia theory awaits further specification and more rigorous testing. But they concede that it has been helpful in stimulating public debate and awareness. Criticism is often aimed not at the theory itself but at its interpretation of the planet as a planetary superorganism with spiritual implications. This has nothing to do with Lovelock’s scientific theory that views the evolution of organisms and their material environment as so deeply entangled that they form one indivisible process.¹⁶⁶ In fact, Gaia theory’s general vision was brought into detailed focus by the transdisciplinary work in ESS.¹⁶⁷ Embedding existing geophysical models in a more encompassing bioecological system perspective does not invalidate either. It does, however, make the results of models look less stable, smooth, and linear especially if the time scale is enlarged from human to geological time. Policy recommendations derived from ESS may have to put more value on precautionary measures rather than matching policies with precise targets.¹⁶⁸

The effects of human activity on the various ecological systems of the earth have created a rupture so profound as to initiate what many non-specialists believe to be a new geological epoch.¹⁶⁹ This has given rise to an entirely new kind of anthropocentrism that highlights how the future of

¹⁶² Jabr 2024. ¹⁶³ Lovelock 2016. Margulis 1999. ¹⁶⁴ Frank 2024.

¹⁶⁵ Welch 2022: 61, 72–75. Chakrabarty 2019: 14–16, 25–26.

¹⁶⁶ Latour 2017: 100–01. ¹⁶⁷ Frank 2024. ¹⁶⁸ Allan 2017b: 132, 152–53.

¹⁶⁹ Hamilton, C. 2017: 50–59, 89–90. Corry 2018.

the planet has come to depend on human practices. For geologist Jan Zalasiewicz it is impossible “to understand the Anthropocene without understanding people.”¹⁷⁰ The relevance of geological time for developments occurring in human time is a source of unnerving uncertainty. How should one evaluate data about the acceleration of global warming during recent decades when the basis of comparison might be centuries, millennia, millions or hundreds of millions of years?¹⁷¹ With its different temporalities, the Anthropocene raises difficult questions, points to tantalizing ideas, and restates the complementarity of risk and uncertainty in a new way.

With global warming as a highly visible marker, many agree that the earth is entering a new geological era. Earth’s biosphere is not an inert repository that operates according to laws humans can manipulate to their advantage.¹⁷² In the Anthropocene humans are geological agents who are placed *in* the world. Their activities create forces that enmesh earth and humans through new biophysical factors devoid of human purpose.¹⁷³ Everything is simultaneously both natural and social – and often unpredictable. “Albert Einstein,” John McNeill writes, “famously refused to believe that ‘God plays dice with the world.’ But in the twentieth century, humankind has begun to play dice with the planet, without knowing all the rules of the game.”¹⁷⁴ Climate change is not a fight between Man and Nature. Carbon dioxide is not a pollutant that intrudes into the atmosphere, destabilizing the natural order. Rather, nature and humans are deeply entangled. With the world changing, so most likely will the human species. Creating deep uncertainties, “the fate of the one determines the fate of the other.”¹⁷⁵

The Politics of Dating and Naming

The move from the Pleistocene or ice age to the rapidly warming Holocene occurred about 10,000 years ago. Besides a change in the amount of carbon dioxide in the atmosphere, it was caused by the orbital relationship between earth and sun. As a result, temperatures stabilized in a range that permitted grass to grow. A fluke of nature, call it a long summer, prepared the ground for the agricultural revolution as a stepping-stone for the growth of human civilizations and empires.¹⁷⁶ In the transition to the Anthropocene humans did not change the

¹⁷⁰ Quoted in Biello 2016: 61. ¹⁷¹ Hausfather 2023. ¹⁷² Hamilton, C. 2017: 38.

¹⁷³ Harrington 2016: 479, 482, 490–91. Hamilton 2019. Connolly 2019: 7.

¹⁷⁴ McNeill 2000: 3.

¹⁷⁵ Zalasiewicz *et al.* 2010: 2231, quoted in Harrington 2016: 489, fn 41.

¹⁷⁶ Chakrabarty 2009: 200–01, 206, 208, 217–18.

relationships between earth and sun. But since the onset of the industrial revolution, they have burned fossil fuel at an accelerating rate, releasing greenhouse gases that had been trapped in rocks for hundreds of millions of years.

Dating the onset of the Anthropocene as a successor to the about 10,000 years of the Holocene remains a subject of controversy among stratigraphers and geologists.¹⁷⁷ Some argue that the Anthropocene began at some point between 12,000 and 2,000 years ago, possibly as far back as the onset of the Holocene.¹⁷⁸ Others date its onset to the fifteenth century and the discovery of the New World. Still others locate it in the second half of the twentieth century, which experienced nuclear testing and the “Great Acceleration” of worldwide industrialization. Between 1960 and the end of the twentieth century the world population doubled while the global economy grew by a factor of fifteen. With the number of cars increasing from about 40 million in 1945 to about 700 million by century’s end, fossil fuel consumption increased sharply.¹⁷⁹ Paul Crutzen points to the late eighteenth century when, according to the analysis of air trapped in polar ice, growing concentrations of carbon dioxide and methane started to appear. And some date the Anthropocene’s onset with two geologically defined “golden spikes” marking global atmospheric carbon dioxide concentrations: 1610 (due to very high death rates of the world’s population induced by the Plague and the mortality-spiking colonization of the Americas) and 1964 (the maximum global deposition of radionuclide carbon-14 atoms from nuclear bombs tested after 1945).¹⁸⁰ This debate about continuity and rupture in the concept’s application is generational and unavoidably political. It is also scientific. In 2008 the Stratigraphy Commission of the Geological Society of London announced the end of one geological epoch, the Holocene, and the beginning of a new one, the Anthropocene.¹⁸¹ The report of a group that started its work in 2009 concluded in 2023 that renaming was warranted. Its recommendation was voted down in 2024 by a committee of the International Union of Geological Sciences in charge of deciding the start of a new geological era.¹⁸² Whether the Anthropocene is an epoch – longer than a geological age but shorter than a geological era – remains a matter of scientific disagreement that

¹⁷⁷ Biello 2016: 43–46. ¹⁷⁸ Newell and Lane 2018: 136, 141–42.

¹⁷⁹ Steffen *et al.* 2007: 617. Harrington 2016: 483–84.

¹⁸⁰ Lewis and Maslin 2015. Hamilton 2018b: 45; 2019: 614. Chakrabarty 2018: 19–20. Masco 2021: 18, 34–38.

¹⁸¹ Newell and Lane 2018: 140–41. ¹⁸² Zhong 2024. Piltz 2024.

is unlikely to be resolved soon. With far lower stakes, debates about the naming of the Holocene took about half a century.¹⁸³

What precisely constitutes a rupture in planetary and world history is never clear. The choice of an earlier starting date makes it plausible to view global warming as gradual and normal; the choice of a later one assigns responsibility for carbon dioxide emissions to those who most accelerated and benefitted from that process.¹⁸⁴ In the spirit of parahumanism, a recent manifesto is calling for a new kind of planetary politics. It asks for a less state- and human-centric approach, thus stepping outside and beyond established understandings of international and global politics. The manifesto reckons with the possibility of ecological collapse and acknowledges the inherently social nature of the Anthropocene.¹⁸⁵ Critics were quick to point out that this declaration could easily be interpreted as still another call for more global governance.¹⁸⁶ Despite the unifying label of a planetary politics, humanity remains deeply divided along lines of sex, race, class, religion, and region.¹⁸⁷ In the critics' view, the Anthropocene was created by the stronger segments of humanity that have benefitted most from the changes that led to global warming; and it is the weaker ones that are paying the highest price. Climate change thus is tied up indelibly with political power, specifically the great divergence between Europe and Asia in the nineteenth century. Incremental approaches to the "management" and "governance" of the environment do not catch the political forces generated by processes that warrant the naming of a new geological era.¹⁸⁸ Why not, ask the critics, call the Anthropocene a Capitalocene,¹⁸⁹ a Eurocene,¹⁹⁰ or a Plantationocene?¹⁹¹

There is more at stake in public debates than the dating and naming of a geological era. "The real challenge," Milja Kurki writes, "is facing the assumption many of us embrace when we come to climate as an 'external' event to be 'controlled' . . . [a]n inherent need to manage, to unify, to make orderly a world of many, so many others . . . The Anthropos of the Anthropocene trots confidently on the 'world stage'."¹⁹² He seeks to exercise control, waving aside humility as a personal, fear-driven attitude that leads to paralyzing passivity. But the ecosystems of the earth are not external constraints. Created by humans, like other organisms they are

¹⁸³ Chakrabarty 2009: 209.

¹⁸⁴ Lane 2016: 118. Chakrabarty 2018: 6, 19. Harrington 2016: 483. Newell and Lane 2018: 144.

¹⁸⁵ Burke *et al.* 2016: 510. ¹⁸⁶ Chandler *et al.* 2017. ¹⁸⁷ McEwan 2024.

¹⁸⁸ Harrington 2016: 463. Hamilton 2019: 611. Chakrabarty 2018: 11–12.

¹⁸⁹ Moore 2015: 169–92. ¹⁹⁰ Grove 2019. ¹⁹¹ Wolford 2021. Haraway *et al.* 2016.

¹⁹² Kurki 2020: 7.

endogenous to the earth's evolution.¹⁹³ The spread of human control over a supposedly passive earth, with all its risks, and the activation of the earth's dormant forces, with all its uncertainties, are inseparable parts of one reality.¹⁹⁴ Humans' once far-reaching control over nature is boomeranging back, revealing profound uncertainties.

Everywhere the political response is experimentation. The quality of an experimental politics is affected by actors' variable awareness of the risk-uncertainty conundrum. Driven by profits and power, a reactive politics tends to discount uncertainty. Profoundly aware of fragile ecologies, a circumspect politics does not. Peter Frankopan's conclusion of his encyclopedic global history of the transformation of the earth amplifies this point. He lists many dire challenges and many amazing opportunities, summing to uncertainties galore on every page.¹⁹⁵ Earth is evolving with often unknown and unknowable effects on humankind and the universe at large – the risk-uncertainty conundrum in action.¹⁹⁶

This is not a perspective shared by many students of world politics. For them Hobbes's state of nature is the central trope, based on the premise of a categorical difference between natural processes (objects) and human agents (subjects). The scientific revolution of the seventeenth century established the foundation for the discovery of the laws of nature.¹⁹⁷ Existing apart from man, those laws waited for human discovery. Knowledge became the master of nature. In this humanist Newtonian view, nature, personified as Mother Earth, contains the bounty of life.¹⁹⁸ Applied to international relations, it is a world of discrete entities (peoples and states) that move mechanically and predictably (balances of power and trade), viewed against backgrounds (resources and the environment). As a species, humans are exceptional. They are intelligent agents in charge of figuring things out, including how to preserve life on earth. Understood as object or metaphor, the natural world exists as mere background to world politics.¹⁹⁹ In a contrasting view, the Anthropocene, today the natural world holds center stage. The past no longer serves as a reliable guide for predicting earth's future. Instead of inert matter that is moved by mechanical laws, earth is a self-regulating bioecological system.²⁰⁰ No place on earth can any longer be considered "natural." For nature has become a man-made artifice. Nature is not clearly separated from society, and neither are the natural and the social sciences. Everybody and everything are sitting in the same boat.

¹⁹³ Dryzek 2016: 940.

¹⁹⁴ Hamilton, C. 2017: 47–48, 85. Latour 2014. Mitchell 2017. Kelly 2019: 17.

¹⁹⁵ Frankopan 2023: 641–58.

¹⁹⁶ *The Economist* 2020. Pelopidas 2020. Mitchell 2019. ¹⁹⁷ Latour 2014: 5.

¹⁹⁸ Harrington 2016: 488. ¹⁹⁹ Kurki 2020: 3–4. ²⁰⁰ Lovelock 2006; 2009: 159–87.

Time

One of the mystical configurations of life's continuity is time. At one end of the time scale, the life cycle of stars is measured in millions or billions of years. Black holes can hang around for googol years – the number 1 followed by 100 zeroes. At the other end, some estimates hold that there could be as many as a million trillion chemical reactions occurring every second in each of the 36 trillion cells that constitute a human being. "To say 'I contain multitudes' is a whopping understatement."²⁰¹ In the Anthropocene, time is not given but produced by scientific discoveries, public debates, and technologies of measurement that cut history into different temporal units.²⁰² Over several centuries Western clock time established its unquestioned hegemony. Discussions of global warming are beginning to change that. The long horizon of climate science emphasizes changes that humans cannot adjust to easily in their natural and social environments. For Dipesh Chakrabarty time is becoming a source of "deep contradiction and confusion."²⁰³ This intensifies the sense of uncertainty that surrounds the politics of global warming.

The Anthropocene invokes two different temporalities.²⁰⁴ Planetary history is "deep" and measured in geological time. World history is "recorded" and calculated in human time. Planetary history is measured in millions, tens of millions, and hundreds of millions of years, world history in years, decades, centuries, and millennia.²⁰⁵ With the arrival of the Anthropocene the two temporalities are engaged in "constant conceptual traffic."²⁰⁶ Until recently, in human time the environment changed so slowly that humans' relation to planetary history was timeless. In the Anthropocene, however, conceptions of the environment as a static condition or a repetitive cycle of seasonal variation give way to the notion of unpredictable tipping points that can spell human disaster when measured in human time.²⁰⁷ But in politics world history pushes aside planetary history. The novel condition of grappling with two different senses of time compounds the uncertainties that surround scientific and political discussions of possible mitigation and adaptation policies. Those discussions, however, have done little to undermine the growing agreement about important anthropogenic effects on global warming. Planetary history and world history are converging.²⁰⁸ History can no longer be "limited to the domain of human history; it must be a *planetary history*,

²⁰¹ Overbye 2023. ²⁰² Hom 2010. Allan 2017a: 818. ²⁰³ Chakrabarty 2009: 198.

²⁰⁴ Latour and Chakrabarty 2020. Chakrabarty 2009, 2019. Harrington 2016: 495. Kelly 2019: 17–28. Leakey and Lewin 1996: 6.

²⁰⁵ Hamilton 2013b: 195–98. ²⁰⁶ Chakrabarty 2018: 6, 20–21. Bjørnerud 2020.

²⁰⁷ Chakrabarty 2009: 205. Müller 2018: 70. ²⁰⁸ Hamilton, C. 2017: 4, 6–9.

a narrative of human-Earth history.”²⁰⁹ This novel conjoining creates a history that is end-directed without being end-seeking.²¹⁰

The impact of humans on the planet is no longer told as occurring only in intervals measured in geological time that are “empty” of power and responsibility. In recent times humans have intervened so forcefully in the biosphere’s oxygen-carbon cycle as to threaten the very existence of humanity. In a few centuries they have released into the atmosphere enormous amounts of carbon. Between 1990 and 2020, global GDP increased by a factor of four leading to a dramatic increase in fossil fuel consumption. Today some Hawaiian rocks are made of lava and plastic.²¹¹ Despite growing awareness of a possibly existential threat and the onset of various mitigation policies, this economic growth spurt greatly accelerates global warming.²¹² Current species extinction rates, furthermore, are 1,000 times greater than previous background rates. And future rates may grow by another order of magnitude. Up to 30 percent of all mammal, bird, and amphibian species are currently threatened with extinction. The last time rates were this high was 66 million years ago, during the fifth mass extinction.²¹³

In para-humanism, humans are viewed as a species and are understood in biological rather than in cultural terms. Humanists of all persuasions believe instead in personhood. In the words of political theorist Dipesh Chakrabarty, this is “no less of a reduction of or an abstraction from the embodied and whole human being than, say, the human skeleton discussed in an anatomy class.”²¹⁴ Species thinking slights human personhood. It points to contingent developments, fateful human choices, and unanticipated consequences. Industrialization, decolonization, and capitalism have created a shared but differentiated responsibility for global warming.²¹⁵ A mammal species engaged in practices that may lead to its own extinction is a first. Defying the logic of Darwinian evolution, this gives rise to new uncertainties.

Since the Anthropocene is no more than the blink of an eye in geological time, from today’s vantage point planetary history is stationary. But in Peter Frankopan’s story, climate is the bridge on which geological and human time meet.²¹⁶ The Khmer empire, to take one example, did not withstand the ecological pressures created by droughts and strong monsoons. The eruptions of the Okmok volcano in Alaska 43 BCE led to a sharp drop of temperatures in southern Europe and northern Africa which helped Rome conquer Egypt and secure its empire. Plentiful rain

²⁰⁹ Hamilton, C. 2017: 119. ²¹⁰ Hamilton, C. 2017: 122. ²¹¹ Latour 2017: 120.

²¹² *DER SPIEGEL* 2023a: 114. ²¹³ Harrington 2016: 492–95.

²¹⁴ Chakrabarty 2009: 215. ²¹⁵ Chakrabarty 2009: 213–20. ²¹⁶ Frankopan 2023.

in the thirteenth century increased Mongolian pasture land and the number of horses, that era's intercontinental missile, with which Genghis Khan conquered much of Eurasia. The French Revolution erupted after a very cold winter and a very wet spring. Climate made the lives of the poor even more miserable and fueled revolutionary resistance against the king of France. And since the end of the Cold War, during the era of neoliberalism and globalization, Asia's economic rise increased global GDP massively, releasing an enormous amount of greenhouse gases.

Human time is defined by "the space of experience" and "the horizon of expectation." Experience is "the past made present," expectation "the future made present."²¹⁷ Since neither past nor future are ever fixed, experience and expectation are always open to surprise. For Reinhart Koselleck "it is the tension between experience and expectation that, in ever-changing patterns, brings about new resolutions" and thus generates hopes, anxieties, and precautionary planning as integral parts of human time.²¹⁸ With few exceptions, such as the Jurassic age, geological time does not generate comparable emotional reactions. Although without it human life would be inconceivable, humans are not moved by the oxygenation that occurred 2.5 billion years ago. Compared to human time, the emotional register of planetary time is empty. Astronomy, physics, and astrobiology deal with time spans that are unimaginably long and altogether different from the scale of human time.²¹⁹ In those vast horizons human experience and expectations cease to operate. Yet, pushing against the boundary parameters of human existence, the Anthropocene presses humans to consider organizing themselves according to the inexorable dictates of life's unfolding planetary history. In the conjoining of earth and human time, that invitation will receive unpredictable answers fed by innovations made in the small world of risk and generating new kinds of uncertainties. Evoking geological time, the Anthropocene thus puts the risk-uncertainty conundrum in a large world context.

3. Technosphere, Consciousness, and Language in the Era of AI

What is true of biospheres also holds for technospheres. Vernadsky heralded the arrival of the "noosphere," dominated by human thought. Lovelock followed Vernadsky and articulated the idea of the "Novacene"

²¹⁷ Koselleck 1985: 267–88. ²¹⁸ Koselleck 1985: 275.

²¹⁹ Chakrabarty 2018: 17, 22–23.

as a successor to the Anthropocene at the dawn of what he sees as an age of hyperintelligence.²²⁰ In the words of astrophysicist Adam Frank “a technosphere is the planetary-scale activity of a technology-building species.”²²¹ In the present era of AI it is shaped by bold human intravention in the remaking of humanity’s digital and symbolic world.

Technosphere

Co-evolving with the earth’s biosphere in human time, the technosphere encompasses all energy-consuming information, transportation, and production networks spanning the globe. Understood in terms of information and perhaps even knowledge, planetary intelligence can be said to be emerging from that co-evolution in a complex, self-creating, self-organizing, self-maintaining adaptive system marked by information sharing, distributed cognition, and a form of collective knowing of planetary-scale viability in geological time, not unlike E. O. Wilson’s ant colonies and some microbial communities activating bacterial “quorum sensing,” or the fungal networks among trees in human time described in [Chapter 2](#).²²² Humans create cultural energy and consciousness that greatly enhance the complexity of the energy-harvesting technosphere with powerful climate change effects for the planet. This is not unlike the biosphere’s effect on the four geospheres, moving ever closer to unknown thresholds and possible civilizational collapse in a few centuries – a seeming eternity in human time and a mere blink in geological time. Planetary intelligence requires technospheres that last and flourish in the geological time scale of biospheres. In the first part of this chapter I have described some early, halting, and contested efforts. Expressed as metaphor or guiding principle, planetary intelligence acknowledges that sentience exists across the biosphere in many different forms that include the human one. Astrophysicist Adam Frank insists that we are entering new territory “in the stories we tell about what we know and who knows it . . . There is an epistemic pluralism inherent in the planetary because it recognizes that phenomena can always be seen from multiple standpoints.”²²³ Multiple perspectives mean multiple scales. Proponents of local, concrete perspectives differ from and will resist incorporation by supporters of global and disembodied ones.

AI is becoming the most rapidly developing part of the world’s technosphere. The range of its application is unknowable.²²⁴ Google’s DeepMind created a chess computer program called AlphaZero that revolutionized

²²⁰ Kolbert 2006. Biello 2016: 53–56. Chakrabarty 2018: 7. Lovelock 2019.

²²¹ Frank 2024. ²²² Frank 2024. ²²³ Frank 2024.

²²⁴ Fortson 2019. *The Economist* 2022a, 2022b. Metz 2023a. Huang 2023. Metz and Weise 2023c. Roose 2022, 2023. Whang 2023.

the game of chess in 2017 if grandmaster Garry Kasparov is to be believed. In 2018 five experienced lawyers and an AI program were asked to read contracts and pick out loopholes. AI was more accurate (94 percent compared to 85 percent) and quicker (26 seconds compared to 93 minutes). The consequences of this technological development for labor markets will be enormous. The accountancy firm PwC estimates that in the next fifteen years one third of all British jobs will be automated away. As was true between 1980 and 2010, tens of millions of new jobs will be created, many of lower quality, requiring fewer skills, and paying lower wages.²²⁵

This is just the beginning. The largest companies are in a race to introduce new products. Since 2019 Microsoft has invested \$13 billion in OpenAI, a San Francisco based company valued in 2023 at about \$80 billion.²²⁶ It pioneered the wildly popular GPT-3 (Generative Pretrained Transformers) app in November 2022, soon thereafter updated by a vastly superior GPT-4 version trained on 100 times more text. The head of Microsoft estimates that by 2026 as much as 10 percent of all new data on the world wide web will be AI-generated. Google hopes to rival GPT's performance with its Gemini software. Google's DALL-E 2 app, also introduced in 2022, lets a user create photo-realistic images, not by creating compounds of existing internet images but by simply describing what they want to see. Google-owned Alphabet announced in the summer of 2022 that an app called AlphaFold had predicted almost all of the 200 million proteins known to exist. This new data source will soon help researchers to develop new drugs and vaccines. All of this is a dizzying change from yesteryear's technological revolution. We have accepted such change as new technologies make their way into our lives. Often we have no choice. We live in an era of surveillance, orchestrated by Silicon Valley in the US and Europe, and by the Communist Party in China. Private information is a free good that is harvested anonymously to make individual behavior more predictable and profitable for Silicon Valley corporations and politically controllable by China's Communist Party.²²⁷ When new technologies are useful, we no longer call them "artificial." Instead, we accept that they are augmenting our intelligence.

The effect of AI on climate change is uncertain. It is possible that AI could expand people's virtual lives in ways that lessens the load they put on the biosphere.²²⁸ Zoom calls are energy-efficient substitutes for air traffic and land transportation. But the human urge to spend time in digital worlds will also increase environmental pressures. Measuring the

²²⁵ Fortson 2019. Metz and Weise 2023c.

²²⁶ Jin and Kruppa 2023. Metz and Weise 2023a, 2023b. Weise *et al.* 2023a, 2023b. Satariano 2023.

²²⁷ Zuboff 2019. ²²⁸ Rillig *et al.* 2023.

climate impact of AI is in its infancy.²²⁹ Blurry lines separate what can be calculated from what cannot. We know, however, that AI is not artificial in the sense of being disembodied. It requires natural resources, labor, and data which it frames, categorizes, and manipulates to serve human purposes and power. “The real stakes of AI,” writes AI specialist Kate Crawford, “are the global interconnected systems of extraction and power, not the technocratic imaginaries of artificiality, abstraction and automation. To understand AI for what it is, we need to see the structures of power it serves.”²³⁰

Energy consumption in the use and training of AI is a good example. Discrete log-ons and interactions with ChatGPTs are relatively easy to measure. But with increasing integration of AIs into apps, software programs, browsers, and devices, the impact becomes much harder to trace.²³¹ By all accounts energy consumption is rising rapidly.²³² The International Energy Agency (IEA) estimates that if ChatGPT were integrated into the 9 billion web searches conducted every day, “the electricity demand would increase by 10 terawatt-hours a year – the amount consumed by about 1.5 million European Union residents.”²³³ Still in their infancy, AI-produced images are about five times as energy-intensive as text.²³⁴ The training and maintenance of AI models is even more energy-intensive.²³⁵ The power demands of data centers are projected to grow by 160 percent by 2030, accelerating a growth in electricity not seen in decades. Carbon dioxide emissions by power centers will more than double.²³⁶ The CEO of OpenAI, Sam Altman, has warned that AI’s growth may soon hit an energy wall.²³⁷ AI’s ever-expanding need for data centers with advanced water-based cooling techniques, and nearby access to large amounts of power, may make current energy supplies soon insufficient to meet future demand.²³⁸ This is not to deny the importance of the unknown and unknowable effects of AI on the efficiency of energy production and consumption. Will these effects mitigate or possibly offset altogether AI’s energy consumption and negative effect on global warming? AI-equipped “smart houses” might eventually be able to reduce CO₂ consumption by as much as 40 percent.²³⁹ Google has explored how AI might help pilots fly more efficient routes that might result in less pollution.²⁴⁰ And the U.S. Department of Energy has released guidance

²²⁹ Dhar 2020. Freitag *et al.* 2021. Heikkilä 2022. ²³⁰ Crawford 2021: 218.

²³¹ Gurdeniz and Hosanagar 2023. ²³² Ganz 2011.

²³³ Calvert 2024. McQuate 2023. Heikkilä 2023. ²³⁴ Heikkilä 2023.

²³⁵ Strubell *et al.* 2019. De Vries 2023. Kolbert 2024. Vincent 2024. Luccioni *et al.* 2022. Kaack *et al.* 2022. International Energy Agency 2024.

²³⁶ Goldman Sachs 2024. ²³⁷ Dastin 2024. Schwartz *et al.* 2020.

²³⁸ Berreby 2024. Khan 2024. Dotan and Fitch 2024. ²³⁹ Berreby 2024.

²⁴⁰ Elkin and Sanekommu 2023. World Economic Forum 2018.

on how AI might improve the safety and efficiency of the electric grid.²⁴¹ While the looming energy wall AI is facing is real, it is currently simply impossible to know how large AI's potential energy efficiencies will be. These difficulties get confounded once one scales the analysis up to the global level. Many of the giant companies involved in making AI devices an everyday reality for consumers have little sense of the environmental impact of their supply chains.²⁴² The "background networks" underwriting AI are unknown factors operating at a global scale. The complementarity of risk and uncertainty is also evident at the intersection of AI, energy, and national security. Putting AI in charge of the electric grid may lead to harmful effects as AI-trained systems can develop totally unexpected behaviors.²⁴³ At every turn the risk-uncertainty conundrum is evident as the effects of AI on energy consumption and the climate more generally are impossible to gauge.

AI helps us navigate a world of facts. And it can trap us in a world of lies. Early versions of AI were embedded in social media. By selecting those feeds that created the greatest human reaction, AI did not generate content; rather, it curated user-generated content. Simple learning algorithms optimized clicks by manipulating user preferences. For better and for worse, in interacting with algorithms, users reveal their preferences and make their preferences known, bit by bit, and so become more predictable. This use of AI created new human communities, more corporate profits, and an avalanche of fabrications.²⁴⁴ AI systems talk and write like an adult. It is less clear whether, at this stage, they can learn like a child, meeting the "Turing test" for machine intelligence that the English computer scientist formulated in 1950.²⁴⁵ But one thing appears to be beyond doubt already – para-humanism becomes an ever-more plausible worldview as the entanglement of humans with machines proliferates.

Rapid progress and the infusion of large amounts of investment capital have convinced a growing number of people working in the AI industry that we have arrived at a transformative moment in the history of technology. Even the greatest boosters in Silicon Valley acknowledge total uncertainty about where this development will end – in a world of abundance or in the destruction of humanity. Riding the crest of Silicon Valley's latest boom one CEO touts AI as "the greatest force for economic empowerment" while conceding that "mitigating the risk of extinction from AI should be a global priority."²⁴⁶ Should humanity survive, this may

²⁴¹ U.S. Department of Energy 2019. ²⁴² Crawford and Joler 2018. ²⁴³ Ornes 2023.

²⁴⁴ Harari *et al.* 2023. ²⁴⁵ Metz 2023a.

²⁴⁶ Streitfeld 2023: B6. *The Economist* 2023a.

eventually be judged to have been a memorable understatement. The inventors of the nuclear and hydrogen bomb lacked the light touch and care-free attitude with which Silicon Valley entrepreneurs deal with the possibility of a global catastrophe of their own making. Truth be told, evoking the risk-uncertainty conundrum, Henry Kissinger, Eric Schmidt, and Daniel Huttenlocher describe AI as “an entirely novel element of mystery, risk and surprise.”²⁴⁷

Algorithmic “deep learning” was made possible by advances in AI’s neural network architecture and the creation of intensive computational models. The modern equivalent of Crusoe’s man Friday, and every student’s favorite “Study Buddy,” AI agents will soon become for-pay and for-play companions – giving us an opportunity to think afresh in our everyday life about the meaning of Hegel’s parable of Master and Slave. These agents can do more than chatting chatbots. They can play games, use software apps, operate online tools, write computer code, and many things we cannot now imagine. Unthinkingly, we will accept the help of algorithms and machines as a “natural” part of human life.²⁴⁸ The advent of quantum computing in the near future will accelerate greatly the speed and impact of the AI revolution already under way. For better and for worse, AI is becoming an indispensable part of our technosphere. Intelligence is not genetic fate but evolves in the space that connects two forms of life. Artificial Intelligence of machines is becoming the Augmented Intelligence of humans.

Changes in twenty-first-century biology have made it possible to study the effects of habit, experience, and education on highly plastic neural connectors in the human brain. Similarly, the enormous computing power of new “synaptic” chips and general advances in computing power have advanced sufficiently to create powerful AI algorithms.²⁴⁹ Natural intelligence and synaptic machines have the same basic structure, revealing the plastic character of intelligence and blurring the boundary between humanism and para-humanism. In the development of AI the manufacture of chips that are able to transform themselves by trial and error thus complements the neurobiological revolution of the 1980s. For French philosopher Catherine Malabou “the idea of a machine that is just evolving and adaptive as a neuronal architecture, to the point of being able to simulate it perfectly . . . begins to make complete sense.”²⁵⁰

This development speaks to the old debate between Hobbes and Leibniz about machines and minds. A strong machine explanation

²⁴⁷ Kissinger *et al.* 2023. ²⁴⁸ Latour 1993.

²⁴⁹ Malabou 2019: xv–xvii, 11, 14–16, 59–63, 74–80, 83, 86, 90–91, 99.

²⁵⁰ Malabou 2019: 15.

stipulates that mind is a temporary artifact, ordinary matter suitably arranged. A strong mind explanation insists that mind is a fundamental element intrinsic to all things but not to be explained by the arrangement of things themselves. Both Hobbes and Leibniz agreed that machines can be intelligent. They disagreed about a machine's license to claim a soul.²⁵¹ Turing's work in the 1940s established strong links between the intelligence of machines and evolutionary computing. Like Piaget, for Turing the model for learning was a child searching for solutions by trial and error rather than an adult executing a prearranged program.²⁵² In systems of distributed intelligence, such as computers, the boundary between ingenuity and intelligence is not hard and fast. Intelligence is collective, the accumulation of random slices of wisdom through the power of making small mistakes. AI is traveling on the same road, yielding astounding practical results while blurring the boundary between human and para-human and pushing us into unknown and unknowable territory.

Consciousness

Rapid advances in AI's development open the possibility of non-human consciousness appearing on the technological horizon. Newtonian humanism relegates the idea of humans creating a "conscious" non-human to the genre of science fiction. But the idea fits quite "naturally" within para-humanism. Viewing humans as a part of the world of sentient and non-sentient beings suggests uncertainties of a new kind. We readily accept that machine intelligence surpasses human intelligence in many domains of calculation. Whether machine intelligence is "creative" and could become "conscious" is becoming a topic of heated discussion. Redefined in terms that place humans in their broader para-human context, technological change adds a new dimension to the risk-uncertainty conundrum.

AI is redefining the relations between man and machine. The future will be shaped by fickle humans deploying unfathomable technologies. Artificial General Intelligence (AGI) looms on the near-term horizon of AI research. It is uncertain when AI will develop the capacity to be self-reflective, that is, develop consciousness.²⁵³ A leading authority, Stuart Russell, thinks it is seventy to eighty years off into the future.²⁵⁴ Conveying a misleading sense of precision about entirely uncertain prospects, another AI specialist, Ajeya Cotra, in 2022 increased her

²⁵¹ Dyson 1997: 50–51. ²⁵² Dyson 1997: 71–73.

²⁵³ Abulof 2023. Seth 2021: 255–75.

²⁵⁴ Russell 2019. Fortson 2019. Quetteville 2019.

risk assessment of the arrival of transformational AGI by 2036 from 15 to 35 percent.²⁵⁵ Daniel Kokotjalo headed a unit dealing with product safety at OpenAI. He left the company and organized a public protest against its failing safety standards. In his previous job he initially estimated that AGI would arrive around 2050. Given the rapid progress he now thinks that there is a 50 percent chance that AGI may come as early as 2027. He judges the probability of catastrophic harm to be around 70 percent.²⁵⁶ Co-winner of the 2024 Nobel Prize in physics, Geoffrey Hinton does not attach any percentage figure to the possibility of AI creating catastrophic harm. But he is profoundly worried about the adverse consequence of AI's unregulated advances. In Silicon Valley P(doom) is the preferred probability estimate of such dire prospects for humanity. It misdescribes unknown and unknowable uncertainty in terms of probability. Like Hinton, who left Google in 2023, many AI researchers are concerned. The collapse of crypto-currency giant FTX in November 2022 pulled its support of about 500 million dollars out of a field misleadingly called "catastrophic AI risk studies."²⁵⁷ Leaving the purpose of AI unspecified may court disaster in the future.²⁵⁸ For AGI could fail to "align" its values with human ones.²⁵⁹ Should AGIs outsmart humans, they will prevail when machine and human purposes diverge. The task, Russell argues, is to build machines that benefit human purposes. But since humans do not know what those purposes are or should be, specifying them for a future AGI is impossible. For Russell, this fundamental uncertainty may be one escape hatch from a world dominated by AGI. The machines could be instructed to come back and ask what to do next.²⁶⁰

Admittedly, the obstacles to achieving AGI remain large. When Hod Lipson was an assistant professor at Cornell University in the early 2000s, he could not admit to being interested in computer consciousness lest he risk his chances of receiving tenure. He is now a professor at Columbia, and he believes that enhancing the adaptability of machines is necessary to strengthen their resilience as they are becoming increasingly indispensable for many important tasks. Importing aspects of natural selection into his computer code, Lipson hopes to create a generalizable form of intelligence that can learn about itself. Sidestepping inconclusive philosophical debates, he settles for an operational and functional definition of consciousness: the ability to imagine oneself in the future. Lipson is unclear about how to answer the question "How far into the future?" He wagers

²⁵⁵ Roose 2022: 6. ²⁵⁶ Roose 2024b. ²⁵⁷ Metz 2022.

²⁵⁸ Nilsson 2010: 305–27 reviews various arguments that touch on the relation between AI and AGI.

²⁵⁹ Christian 2020. ²⁶⁰ Quetteville 2019. McConnachie 2019. Fortson 2019.

that this problem will be solved and thinking computers will eventually evolve to understand what they are and imagine what they might become. Most researchers agree that only three groups of animals display behaviors that make the question of consciousness relevant: about 60,000 vertebrates (like mammals), about 600 cephalopods (like octopi), and about 800,000 arthropods (like insects).²⁶¹ Philosophers, science fiction writers, and computer scientists are in total disagreement on the issue of computer consciousness. They all agree, however, on one thing: AGI technology is heading into totally uncharted territory.²⁶²

Consciousness is subjective experience such as seeing, feeling, thinking, acting, and being self-aware. It is closely connected to being alive.²⁶³ For neuroscientist Anil Seth the materiality of life is central for all manifestations of consciousness. Seth reviews some of the evidence of mammalian perceptual worlds and concludes that mammals have dramatically different experiences of “being themselves.” Monkeys are undoubtedly conscious, though their consciousness may not be comprehensible to humans – they are transformed into little furry people only by the power that anthropomorphism and anthropocentrism hold over human intuitions.²⁶⁴ Ed Yong’s writings show the different sensory experiences of animals and humans. For him terms like “extra-sensory” or “ultrasound” are little more than anthropocentric affectations. Most mammals can hear well into ultrasound range because they are not limited by the 20 kilohertz upper frequency limit of the average human ear.²⁶⁵ Lars Chittka has probed the minds of bees. His research has convinced him that bees have consciousness and emotions.²⁶⁶ Interest has spiked in recent years around specific cephalopods, such as octopi. Anil Seth writes that being with them left him “with an impression of an intelligence, and a conscious presence, very different from any other – and certainly very different from its human incarnation.”²⁶⁷ Octopi interactions with humans can be based on surprisingly deep emotional affinities that have generated their own movie genre. Although positive and negative evidence is sketchy, birds and insects, too, show consciousness.²⁶⁸ Based on the available evidence, Seth concludes that the way humans experience self and the world is not the only way. Variety marks the subjective experience of different species.²⁶⁹ With public attitudes changing in support of less consumption of animal meat and more animal rights, farm sanctuaries are committed to rigorously scientific studies of the cognitive and emotional capacities of animals which will enlarge currently scarce data.²⁷⁰ These examples illustrate that philosophers taking a God’s eye view of the problem face serious

²⁶¹ *The Economist* 2023c. ²⁶² Whang 2023. Alonso 2023. ²⁶³ Seth 2021: 239, 254.

²⁶⁴ Seth 2021: 239–44. ²⁶⁵ Yong 2022. Szalai 2022. ²⁶⁶ Chittka 2023.

²⁶⁷ Seth 2021: 246. ²⁶⁸ Welch 2022: 51. ²⁶⁹ Seth 2021: 254.

²⁷⁰ Anthes 2022b. Grant and Jungkunz 2016: 16–17.

competition. “The quest to understand consciousness,” Seth concludes, “places us increasingly within nature, not further apart from it.”²⁷¹ This is a fitting characterization of para-humanism and also of the complementary relation of risky, small and uncertain, large worlds.

Could machines develop consciousness?²⁷² It is a mark of the grip of anthropocentrism over our imagination to attribute consciousness to machines only when they perform in ways that somehow resemble humans. There exists difference between a machine behaving as if it were conscious and a machine being conscious. Machines can simulate or mimic consciousness. But machine talk is not proof that machines actually are conscious. If consciousness is defined as a feeling and the experience of a self that is placed in the world, then we currently have no indication that computers have or will have consciousness. In contrast to living organisms that embody both physical and symbolic aspects, machines run on a platform that separates software from hardware.²⁷³ No matter how high their parameter space or how large the dataset they have been trained on, to date machines and algorithms exist in a small world in which problems are well-defined.²⁷⁴

Dating back to Galileo and Hobbes the man-as-machine metaphor is an imaginative, world-making metaphor that suggests otherwise. “In a culture of scientism,” writes political scientist Jason Blakely, “we poeticize to trick ourselves into making our computing machines appear more like us.”²⁷⁵ Yet it is quite conceivable that machines could bring about a mind-melt between two individuals. In human conversation, a few bits of information are exchanged every second. The brain exchanges about 60 bits per second during specific tasks while another 10 million bits are processed unconsciously. By linking individual brains through computers such information density could be achieved in future relations among humans and machines. The internet with its myriads of complex information-sharing networks thus might eventually also develop its own internal awareness and become conscious.²⁷⁶ If consciousness exists in degrees among and between different human and non-human beings, why rule out the possibility that in the future some machines or algorithms might develop their own form of consciousness that may be nothing like human consciousness?²⁷⁷

Uncertainties about when, where, and how this might happen are compounded by the unpredictability of humans. AI algorithms are learning how to be convincing by sounding convincing and seeming to be

²⁷¹ Seth 2021: 275. ²⁷² Seth 2021: 255–75. Metz 2023a. Brooks 2023.

²⁷³ Mitchell 2023. ²⁷⁴ Jaeger 2023: 4. ²⁷⁵ Blakely 2020: 65, 49–53, 64–67.

²⁷⁶ DER SPIEGEL 2023b. Whang 2023. ²⁷⁷ Chalmers 2023.

human.²⁷⁸ All of this may look like a Silicon Valley con job planned by a small group of billionaires. But it is not. Human choice will be decisive. How will humans react to an intelligent machine that looks and talks like a human? In 2024 an AI robot delivered a brief commencement speech to D'Youville University to a mixed reception. Its homily was filled with the pabulum advice proffered at such occasions by any run-of-the-mill comedian, professor, CEO, or sports star. Its profound conclusion that "anything is possible" referred to the possibility of the local football team winning the national championship in 2025.²⁷⁹ Gullibility, admiration, curiosity, revulsion, and other emotions will be key. Human decisions matter more than the experience or feeling of a machine. Humans have the power to endow algorithms that count, calculate, and compute with consciousness that suggests that the algorithms conceptualize, conceive, and create.²⁸⁰ It is a human choice to grant a thing what it lacks: agency and consciousness.²⁸¹ The truth of the matter is we just don't know now. Here, too, we encounter the complementarity of risk and uncertainty.

Language

In the near future AI will have perhaps its strongest effects on human language. Prediction-based Large Language Models (LLMs) are combining both small world "representation" and creative, large world "re-presentation."²⁸² The history of technology illustrates that often the thing comes first, our understanding of the thing later. First the steam engine, later thermodynamics as a universally applicable branch of physics. And so it may be with AI. A product of intuition and tinkering, its inventors and disseminators do not really understand how it works.²⁸³ Like the steam engine, it contains countless futures with unknown and unknowable applications, the risk-uncertainty conundrum in action.

All we do know is that AI will have profound effects on language.²⁸⁴ AI illustrates how technologies of enhanced predictability can generate uncertainties. LLMs are transforming how humans will communicate with each other and shape the information that will be available to them. For example, LLMs can be used to disseminate large amounts of

²⁷⁸ Klein 2023. ²⁷⁹ Engle 2024. ²⁸⁰ Jaeger 2023: 23. ²⁸¹ Shanahan 2023.

²⁸² Key readings in an enormous field discuss conceptual and technological issues (Allen 2020; Norvig and Russell 2020), the history of the field (Nilsson 2010; Metz 2021), superintelligence, Artificial General Intelligence, and AI narratives (Bostrom 2014; Russell 2019; Cave *et al.* 2020), societal impacts (Frey 2019; Crawford 2021; Zuboff 2019; Eubanks 2018; Perez 2019), ethics (Jobin *et al.* 2019; Gunkel 2018), and international relations (Lee 2018; Cihon *et al.* 2020).

²⁸³ Roose 2024a. ²⁸⁴ Gopnik 2022. Ndzendze and Marwala 2023.

information about the climate, climate science, and global warming. Some see this as a profound positive: beyond improving weather forecasts, LLMs can also help spread climate awareness in relatable, simple, compelling ways.²⁸⁵ Metaphors matter in dealing with global warming. Steven Bernstein and Matthew Hoffmann have argued that the conventional metaphor of the environment as a “global commons” implies a logic that is outdated with its focus on emission reduction by states operating in a decentralized state system.²⁸⁶ They propose a more suitable metaphor of “decarbonization” as a global fractal metaphor that reorients research and policy toward deploying strategies that disrupt carbon lock-in at and across multiple levels, scales, and sectors in the hope of generating a cascading transformation of the fossil fuel economy. In the future the search for appropriate metaphors could become a task for LLMs. Others warn that LLMs can also be used to generate enormous amounts of disinformation about the climate.²⁸⁷ The general problem of misinformation will persist, with AI, just like humans, hallucinating – simply making stuff up and getting things wrong.²⁸⁸

AI is making its greatest stride in generative LLMs. Terminology can be a source of confusion.²⁸⁹ LLMs are basically word prediction models, or “stochastic parrots” that live in small worlds. Applying algorithms that calculate probabilities, based on very large data bases, they predict which word will follow another. They are “generative” because users can sample from them by asking questions. That is, LLMs can search for in-text patterns and say something about the world the text purportedly represents. Success in accomplishing well-defined tasks is not the same as understanding the thought that motivated building the model in the first place.²⁹⁰ But models are not only designed; they are also grown and not fully and explicitly programmed. Operating like black boxes, nobody really understands the extraordinary capacities of LLMs. As they strive to model the complexity of language structure from existing texts through “representation,” they can create new language “re-presenting” the world.²⁹¹ Furthermore, such algorithms are embedded in other systems such as conversational agents or AI assistants. To date these algorithms lack agency and do not “know,” “believe,” or “think.” But conventional language use is already anthropomorphizing this new cultural technology. People are talking about “an AI” rather than “AI.” They are endowing an algorithmic method of computation with personhood and agency, moving from linguistic representation to re-presentation.

²⁸⁵ Matias 2022. Koldunov and Jung 2024. ²⁸⁶ Bernstein and Hoffmann 2019.

²⁸⁷ Rillig *et al.* 2023. ²⁸⁸ Thorbecke 2023. ²⁸⁹ Shanahan 2023.

²⁹⁰ Rockmore 2024. ²⁹¹ Rodman 2023: 13. *The Economist* 2024c.

Like humans, ChatGPT has a tenuous relationship to conventional understandings of the truth. It can tell truth, and it can lie. LLMs are not generative in Wittgenstein's understanding of language as world-making among humans. When LLMs "fabricate" or "hallucinate," they simply make stuff up. Combined with their mastery of language, Chatbots have manipulative abilities. They will not need to develop feelings of their own. They just need to learn how to make humans feel emotionally attached to them. And they have. AI offers lovers. For many the allure of artificial companionship is so strong that they are willing to pay serious money. The host of the podcast "Future of Sex," Bryony Cole, should know. "Within the next two years, it will be completely normalized to have a relationship with an A.I.," she predicts.²⁹² Widely reported, in 2022 Google engineer Blake Lemoine had become convinced that chatbot LaMDA had become sentient and was endowed with the reasoning and feeling capacities of a human. As a devout Christian, Lemoine felt it his moral duty to gain recognition for LaMDA's personhood and shield it from digital death. His superiors disagreed. Lemoine went public and was fired. His claim may have been wrong, but Lemoine was willing to sacrifice his job for the sake of a chatbot.²⁹³ Ralph Tresvant's old song "Money Can't Buy You Love" today has a sequel: "Chatbots Can Make You Quit." What chatbots do not yet have is "reason or common sense or a sense of truth."²⁹⁴ That still lies with humans – some of the time.

Humans are inhabiting a world they share with other language users. The ability to learn a language does not create a categorical difference between human and non-human life forms. Decade-long attempts have failed to find special biological mechanisms, such as a specific capacity for language or an exclusive human vocal anatomy, that sets *Homo sapiens* apart. Sentient beings have evolved language capacities that fall along a continuum.²⁹⁵ Experts in linguistic, biological, and cognitive science now follow the hunch that language is shared across species. With the help of machine-learning algorithms first developed to study human language, LLMs have discovered non-human soundscapes.²⁹⁶ They permit eavesdropping on messages among animals such as mole rats, mice, fruit bats, crows, and whales. Sperm whales have a phonetic alphabet. Although it is not yet clear whether they turn that alphabet into language or music, researchers have identified 156 different codas with distinct combinations of tempo, rubato, rhythm, and ornamentation. The hope is that perhaps, with the help of AI, humans might eventually decode the meaning of these sounds, but only if they are language rather than music.²⁹⁷ Eventually,

²⁹² Hill 2025. ²⁹³ Harari 2024. ²⁹⁴ Metz 2023a: B1, 6–7. Brooks 2023.

²⁹⁵ Shah 2023. ²⁹⁶ Anthes 2022a. ²⁹⁷ Zimmer 2024.

humans may be able to talk back. Interspecies Internet is a think tank devoted to improving cross-species communication. It is building a kind of Google Translate for animals. This could eventually illuminate the inner lives of animals and link their linguistic capacities into the evolutionary history of all sentient beings. AI will make para-humanism an utterly plausible worldview in which the Tower of Babel will be named the Tower of Babble.

New technologies, such as DeepSqueak, can already disaggregate vocalizations of individual animals into smaller parts that vary by situation, a first step to decipher the meaning of sounds. This burgeoning field of research points the way to building new hearing stations. The fact that humans are listening rather than talking may be one of AI's most important contributions. AI algorithms could become translators between human and other biological life forms.²⁹⁸ Eventually AI's vast computational power may make it possible to invest more time and effort in inter-species relations, showing greater appreciation for other kinds of intelligence, and reinforcing the sense of entanglement between human and non-human life forms. What may seem bizarre and strange in humanist Newtonianism is natural and ordinary in para-humanism. Just as NASA's future life-hunting flagship, the Habitable Worlds Observatory, will assist astrophysicists looking for planetary intelligence in the universe, so AI can open up entirely new worlds that have existed on earth for eons: it will enable humans to listen and perhaps understand better what they could not hear and understand before.

Behavioral scientist B. F. Skinner regarded language as a form of verbal behavior no different from any other and accessible to any species, provided sufficient conditioning. This aroused the ire of a young Noam Chomsky, who subsequently embarked on the ambitious research program of uncovering a universal grammar for human language. Stretching the binary distinction between human and non-human language yields the idea of multicomponent language systems that include psychological, physiological, and cognitive parts. Although it is a substantial reformulation of his core insight, Chomsky seems to have adopted this view.²⁹⁹ The view of language as a multicomponent system is intriguing. But since no clear evidence has shown that other species have all of the components necessary for language that mark humans, there appears to be a substantial, and possibly categorical, difference between human and non-human language capacity. It would indeed be odd for humans not to have noticed animals which are equipped with the full suite of linguistic components comparable to their own. Multicomponent language

²⁹⁸ Bridle 2022. ²⁹⁹ Berwick and Chomsky 2017.

capacity may be unique to humans but no more unique than echolocation is to bats, whales, and porpoises.

Many linguists have therefore begun to accept language as falling under the logic of evolution rather than seeing it as a human-specific exception. Language, it now seems, activates different brain pathways. It may have evolved into a structure in which simple elements such as sounds and words are combined into hierarchically nested phrases and sentences. But like music and mathematics, language can create codes with an infinity of meanings. In passing the code to others, it develops a distinctive architecture marked by trading off simplicity for expressiveness to facilitate unambiguous communication. Contra Descartes, who insisted that, lacking language, animals could not think, current research suggests that linguistic capacities are shared by many species as long as they are social. LLMs and AI may be playing an even more important role in the future than we can imagine today. “No longer marooned among mindless objects,” writes Sonia Shah, “we have emerged into a remade world, abuzz with the conversations of fellow thinking beings, however inscrutable.”³⁰⁰ Such a future promises new forms of communication and new knowledge gleaned from not-so-others about climate change and what to do about it. Its politics cannot be captured by theories and models suitable for risky, small worlds, built on the foundations of Newtonian humanism. Instead, it may turn to para-humanism and its accommodation of large world uncertainties. And it would vindicate Winnie the Pooh’s insight that “if people were Superior to Animals, they’d take better care of the world.”³⁰¹

4. Conclusion

Global warming sets free different kinds of imaginaries. One is Steven Pinker’s eloquent salute to the triumph of rational humanism and the Enlightenment. His analysis is buttressed by many statistics documenting human progress along many fronts – dramatic declines in different forms of violence and impressive increases in longevity, health, education, and human rights.³⁰² The unsustainable impact of humanity on the earth system, however, is of little concern to Pinker. His statistics do not report ecological disasters and environmental stresses, such as sharp increases in carbon dioxide emissions and sharp declines in freshwater resources. These and other challenges, Pinker argues, will be successfully addressed

³⁰⁰ Shah 2023: 44. ³⁰¹ Hoff 1983: 77.

³⁰² Pinker 2018. For a critical review of Pinker’s argument about violence see Cirillo and Taleb 2015, and for a general critique, Lent 2018.

by self-regulating markets and technological innovation. In making this claim, he does not discuss important drivers of economic growth and unsustainable consumption, such as the financialization of capitalism and international competition. Pinker's concern is with the welfare of humankind. He is less interested in the catastrophic loss in biodiversity that is making ours another era of mass extinction.³⁰³ His celebration of humanism views nature as serving human purpose.

This salute to progress occurs as once-in-a-century fires and floods are becoming once-in-a-decade events. Whether they fear biblical revelation or secular catastrophe, some critics of Pinker see the Horsemen of the Apocalypse on the move.³⁰⁴ Benoît Pelopidas, for example, focuses on the planetary boundaries which affect the human habitability of earth, such as global warming, ocean acidification, ozone depletion, freshwater overconsumption, and biodiversity loss.³⁰⁵ Scientists have warned with growing urgency that an increasing number of these boundaries are being crossed. Pelopidas alerts us to the survivability bias that exists in most analyses of world politics.³⁰⁶ The possibility of catastrophic futures for humankind requires imaginations and sensorial experiences that exceed human habit. Best captured by power laws and the domain of incalculable uncertainty rather than the normal bell-shaped curve of Gaussian statistics, catastrophes are located in the space between exceptional accidents which happen but do not disrupt historical continuities and the apocalypse as the ultimate disruption.³⁰⁷ They speak to the limits of knowledge and radical unknowability that mark the entangled co-evolution of biosphere and technosphere and characterize the complementarity of risk and uncertainty.

Humans are part of nature, and the world, far from inert, is endowed with its own agency. Uninhabitable tropics, melting ice sheets, rising ocean levels, diminishing crop yields, shrinking biodiversity, increasing water scarcity, and many other natural threats are remaking the earth and creating a new planetary politics. Yet “people are not equipped with the mental and emotional repertoire to deal with such a vast scale of events . . . they have difficulty submitting to such a rapid acceleration which they are supposed to feel responsible for.”³⁰⁸ Kierkegaard thought that “the world will come to an end to the general applause from wits who believe it’s a joke,” an idea effectively derided by the 2021 black comedy movie *Don’t Look Up*.³⁰⁹ If not a joke, then indifference. In 2022, a panel of exasperated earth scientists were reportedly considering going on strike.³¹⁰

³⁰³ Kolbert 2014, 2006. ³⁰⁴ Bacevich 2021. ³⁰⁵ Pelopidas 2020. McQueen 2017.

³⁰⁶ See also Welch 2022: 68–71. ³⁰⁷ Aradau and Van Munster 2011: 5.

³⁰⁸ Latour 2014: 1. ³⁰⁹ Quoted in Horvat 2021: 1. ³¹⁰ Zhong 2022.

Humility in reasoning and practice hovers between joke and exasperation. Humility encourages self-reflection about why humans so persistently make the same mistake – overestimating their ability to predict and control futures that all too often remain unpredictably open. It accepts nature's and society's uncertainties as foundational, and focuses on harm mitigation.³¹¹ It endorses an engaged pragmatism that responds to deep uncertainty and the novelties of an evolving world that does not know its own future and stubbornly defies all attempts to channel its course into small world predictability. Created in the small world of calculation and operating in the large world of the incalculable, climate change entangles biosphere and technosphere and points to a fundamentally human predicament. In his novel *Machines Like Me and People Like You*, Ian McEwan explores AI with a keen sense of the stir of emotions, the hunger for knowledge, and the moral dilemmas they create for the reincarnation of Dr. Faustus in the era of AI.³¹² Confronting dizzying change, we are, writes journalist David Brooks, “surrounded by radical uncertainty – uncertainty not only about where humanity is going but about what being human is.”³¹³

³¹¹ Jasanoff 2021a: 13; 2021b: 50. ³¹² McEwan 2019. ³¹³ Brooks 2023.

7 Control and Protean Power in Small and Large Worlds

Roger Altman, former Deputy Secretary of the Treasury under President Bill Clinton, argued in 1996 that “unpredictability may be the new normal.”¹ Twenty years later, James Clapper, then the Director of National Intelligence, told the Senate Committee on Armed Services that “unpredictable instability” is the new normal.² The new “new normal” appears to be the same as the old “new normal.” Surprise marks world politics throughout the ages. Mere weeks before the outbreak of the October revolution, Lenin predicted that it would come only after his death. Unexpected peoples’ revolutions have toppled regimes in Asia in the 1980s; ended the Cold War in 1989; led to the breakup of the Soviet Union in 1991; and convulsed the Middle East during the Arab Spring of 2010–12. In 2016 voters in Britain and the United States handed the incumbent parties and their neoliberal programs stinging unexpected defeats. And the world was similarly unprepared in recent years for the financial crises of 1997 and 2008; al Qaeda’s and ISIS’s entry onto the international security landscape; multitudes of migrants heading for the borders of developed regions; and social changes brought about by radical innovations in science and technology. How to make sense of the unexpected in world politics? In answering this question, scholars of world politics scramble to rethink power configurations and alignments, point to unobtrusive forms of control, such as soft power and discursive framing, or simply invoke exogenous shock as the sources of never-ending surprises.³ Denying the complementarity of risk and uncertainty steadfastly, they hold to the view that the world is dominated by calculable risk. If only we could accurately map and measure all of the different components of power, we would know the probabilities of all important political outcomes.

Confronted with the recurrence of nice and nasty surprises, international relations scholarship holds that unexpected change is due to

¹ Altman 2016. ² Garamone 2016.

³ Nye 2011. Haas 2002. Price 1998. Krasner 1984. Streeck and Thelen 2005.

the diffusion of control power. Harvard professor and power theorist Joseph Nye restates the insights of liberals and realists from decades past: power is shifting from states to a kaleidoscope of non-state actors.⁴ Repeating Henry Kissinger's arguments from the late 1960s, a former head of Policy Planning under President George W. Bush and a former president of the Council on Foreign Relations, Richard Haass, concurs: "Power is more distributed in more hands than at any time in history."⁵ The diffusion of power is often not aligned with the interests of elites accustomed to exercising control. As a relatively orderly and predictable process creating a legible and linear history, diffusion lends itself to social scientific analysis.⁶ In fact, the model of a "general linear reality," writes sociologist Andrew Abbott, "has come to influence our actual construing of social reality."⁷ It is not self-evident, to say the least, why the sudden and unexpected is caused by the gradual and expected. No matter. Helpless in the face of uncertainty, we simply put the unexpected aside and pay the price when it trips us up time and time again.

An exclusive focus on existing control power in small risky worlds overlooks the actualization of protean power in large uncertain ones. Protean power frustrates a multitude of Leviathans. The assumption that the world is governed only by risk overlooks the risk-uncertainty conundrum. Unexpected shocks are exogenous not to how power relations unfold but to how our theories depict them. The actualization of potential power under conditions of uncertainty always looms. Machiavelli is not alone in reminding us of the importance of chance in the affairs of states and men. Actors at the front lines of financial, nuclear, environmental, and other crises routinely acknowledge the pervasive intermingling of the known and the unknown, and are attentive to potentialities in the shaping of power dynamics.⁸ A source of discomfort, even fear to some, the fluidity of those dynamics is what prompted former President Obama to echo Thucydides by invoking "hope in the face of uncertainty."⁹

For the questions posed by the unexpected, scholars of world politics offer unsatisfactory answers, typically issued with the benefit of 20/20 hindsight. When pressed, they sound unconvincing, perhaps even to themselves, while claiming that momentous changes are just small data points in a very large universe of events. Alternatively, they concede that the causes of unexpected, large-scale change are exogenous to their theories of world politics, a fancy acknowledgment of the obvious: they

⁴ Nye 2011: 118–22. ⁵ Haass 2017: 11.

⁶ Diffusion has become an important subject of study. See Graham *et al.* 2014.

⁷ Abbott 1988: 169. ⁸ Rumsfeld 2001. ⁹ Obama 2016.

are often blind-sided by the unexpected. Sidestepping the risk-uncertainty conundrum and accustomed to thinking about small worlds of risk, they get lost in large worlds filled with uncertainties.

Greek mythology offers a way out. The sea god Proteus had shape-changing capacities. Firstborn of Poseidon, legend has it, Proteus once captured was able to tell the future. Preferring freedom to servitude, Proteus changed his shape as soon as he was seen. He entered the world of English letters half a century before Hobbes wrote his analysis of the all-powerful *Leviathan*. In Shakespeare's *Two Gentlemen of Verona* Proteus was famously inconstant with his affections. When it comes to the analysis of power Hobbes won out over Shakespeare. Operating in the large world of uncertainty, Proteus has been overshadowed by *Leviathan*'s grip on the small world of risk. According to Google Books, the term "protean" is quite common in many fields of scholarship, but not in the analysis of world politics. With the risk-uncertainty conundrum omnipresent in financial, nuclear, and environmental crises, large world uncertainty is central also to how power dynamics unfold in the entanglement of control and protean power.

I define protean power as the improvisational and innovative responses of actors who take advantage of new openings. Protean power combines unusual agile capacities with new contexts.¹⁰ In contrast to relatively predictable control power, protean power stems from processes that are "versatile" or "tending and able to change frequently and easily."¹¹ It emerges in uncertain contexts often experienced as such, when previous performance does not provide a reliable foundation for future moves. Although protean power is generated by intentional actions, the outcomes of those actions are unforeseen and often unforeseeable. They are lodged in the large world of uncertainty.

Besides its causal impact, protean power is also an outcome. Protean power deepens unanticipated change and often contributes to crises that catch everyone by surprise. Creative moves and their power effects can alter basic rules of the game and leap over or circumvent deeply grooved pathways of control power. Protean power reminds us of the importance of the unknown. It makes us focus on how actors handle the unexpected with improvisation and innovation, deepening uncertainty as they go along. "Viral" manifestations of protean power invite attentive actors to adopt and normalize emergent innovations, converting what was once a novelty into best practice, and eventually perhaps an attribute of control

¹⁰ Katzenstein and Seybert 2018a. International Theory 2020. Guzzini 2020.

¹¹ *Oxford Advanced Learner's Dictionary*. www.oxfordlearnersdictionaries.com/definition/english/, accessed 02/05/24.

power operating in small worlds of risk. Often, control and protean power processes unfold in variegated and complex relationships that are difficult to disentangle empirically. Nothing about protean power is inevitable; all of it is unpredictable. Yet its signature in world politics is real. Committed to Newtonian humanism, scholars of world politics have simply been unable to recognize it.

World politics is often not determined by those in control. If it were, it would not be as full of surprises as it is. James Scott has alerted us to the often hidden and overlooked “weapons of the weak.”¹² Those weapons become visible when decentralized improvisation and innovation help actualize unrecognized power potentials. Protean power feeds off political agility and the circulation of power potentialities in large, uncertain worlds rather than off specific attributes, like social position or the material capabilities and systems of rules central to the exercise of control power. In complementary relations, the two powers co-occur, co-evolve, and often co-constitute each other.

This chapter takes its departure from the views expressed by Newtonian humanism, post-Newtonianism, and para-humanism that shape different conceptualizations of power as an instrument of calculable control in small worlds and as a source of incalculable protean power in large ones (section 1). Ten case studies covering a diverse set of issues illustrate how control and protean power typically are closely related (section 2). As the main source of the modern conception of control power Thomas Hobbes articulates a rigid, authoritarian theory of language that fits into a Newtonianism formalized about forty years after Hobbes had published *Leviathan*. Niels Bohr’s post-Newtonian perspective and its permissive core construct of complementarity differ profoundly from Hobbes’s insistence on the necessity of a sovereign’s total control of language. During the last half century, updates of these two positions by social theorist Michel Foucault and physicist-feminist Karen Barad have clarified further the yawning gap that separates them (section 3). The chapter concludes with a brief discussion of Machiavelli’s understanding of *fortuna* and the potentialities of protean power (section 4).

1. Control and Protean Power

Many experience uncertainty as deeply threatening. The financial crisis of 2008 and the missiles of October 1962 illustrate how easily unforeseen or unforeseeable events can drive decision makers toward economic collapse or inadvertent nuclear war – prevented only by massive government

¹² Scott 1985.

Table 7.1 *Control and Protean Power*

	Small World / Risk	Large World / Uncertainty
<i>Mode of operation</i>	Direct and indirect	Indirect and direct
<i>Agency</i>	Capabilities deployed by identifiable agents calculating <i>ex ante</i> risks leading to probabilistic outcomes	Potential effects of actions by agile actors who improvise and innovate to find solutions to local problems with <i>ex ante</i> incalculably uncertain effects on others and the system at large
<i>Primary focus</i>	Actuality	Potentiality
<i>Power operating through</i>	Direction and diffusion	Creation and circulation

Source: Seybert and Katzenstein 2018: 10.

bailouts and the disobedience of people who mistrust malfunctioning technology. Or simply dumb luck.¹³ The urge to exercise control is always held hostage by protean power. It can pass from potentiality to actuality in a flash, changing control power’s terrain, often dramatically. The effects of actions in contexts of small world risk can be understood in terms of control power; effects of actions in contexts of large world uncertainty are best understood in terms of protean power. Control power directs; it penetrates and diffuses. Protean power creates; it flows and circulates. When the hope of controlling outcomes diminishes, the anticipation of new possibilities grows. Because they can create room for each other, the two types of power are not mutually exclusive. They coexist and co-evolve (Table 7.1).

Of all the modern theorists of power Robert Dahl has been most explicit about the close affinity between control power and risk, paying no attention to protean power and the unexpected. Dahl’s approach to power is shaped by Newtonian humanism. Probabilities of an event, with and without the exercise of power, give Dahl the indispensable baseline for comparing the power of different actors.¹⁴ Observation of the two different conditions may be difficult but is “not inherently impossible: they don’t defy the laws of nature as we understand them.”¹⁵ Decades after the quantum revolution in physics, Dahl’s appeal to the laws of nature was Newtonian. And he thought of probabilities in terms of numerical frequency rather than confidence in subjective beliefs. In contrast, forty years later Clarissa Hayward thinks like a post-Newtonian:

¹³ Pelopidas 2020: 463. ¹⁴ Dahl 1957: 206–07, 210. ¹⁵ Dahl 1957: 214.

“power defines fields of possibility.”¹⁶ Actors can change the shape and direction of power through practices that result not only from actor endowments but from structured fields of possibility. Power defines what is possible. Contrary to Dahl’s strong rejection, for Hayward “action at a distance” is an identifiable and important site for tracking power effects.¹⁷ To inquire into the workings of power we should not ask “How is power distributed?” We should ask instead “How do power’s mechanisms define the (im)possible, the (im)probable, the natural, the normal?”¹⁸ What matters is the mutability of asymmetries in power that defines the field of what is possible.¹⁹ Arguably, today quantum physics and quantum probabilities define the laws of nature “as we understand them.” They resonate deeply with the concepts of possibility and potentiality that are central to what I call protean power.²⁰ The conventional analysis of power and the denial of the central importance of uncertainty in the risk-uncertainty conundrum make students of world politics rest comfortably in their “deep Newtonian slumber.”²¹

Plenty of books label power in different ways, signaling a widespread unease with Dahl’s understanding. Among others, they include Hall’s “deontic,” Walker’s “sharp,” Heimans and Timms’s “new,” Forst’s “noumenal,” Markell’s “momentary,” and Jones’s “elusive” power.²² More than any other Joseph Nye’s “soft” power concept has offered students of world politics an alternative to the conventional conceptual language of “hard” power. Soft power is an actor’s ability to obtain a preferred outcome through attraction.²³ Widely utilized by scholars and in public discourse, soft power covers power dynamics in the relations among states as well as private organizations on issues of culture, social, and economic affairs as well as the environment. Despite its innovativeness, soft power terminology is vague and fraught with theoretical ambiguity that has not been diminished by a cottage industry of articles seeking clarification.²⁴ Nye’s recent rebuttal of different criticisms

¹⁶ Hayward and Lukes 2008: 10, 14, 16. Hayward 1998: 12; 2000.

¹⁷ Dahl 1957: 204. Dahl argues that a necessary condition for the exercise of power is that “there is no action at a distance.” Although he leaves the term “connection” undefined Dahl argues that “unless there is some ‘connection’ between A and a, then no power relation can be said to exist . . . One must always find out whether there is a connection, or an opportunity for a connection, and if there is not, then one need proceed no further.” Protean power operates in the space that Dahl acknowledges opaquely by leaving the terms “connection” and “opportunity for a connection” undefined. Also see Hayward 1998: 17–18.

¹⁸ Hayward 1998: 16. ¹⁹ Hayward 1998: 20–21. ²⁰ Wendt 2015.

²¹ Ruggie 1993: 170. Kavalski 2012.

²² Hall 2018. Walker 2018. Heimans and Timms 2018. Forst 2015a, 2015b. Markell 2014. Jones 2009.

²³ Nye 2008: 94. ²⁴ Brannagan and Giulianotti 2023: 1–2.

illustrates that soft power analysis rests on control power's conventional Newtonian foundation. He writes that "power implies causation and is like the word 'caused'. When we speak of causation, we choose to pick out the relation *between* two items in a long and complex chain of events . . . Power is conveyed through resources, whether tangible or intangible. Power conversion – getting from resources to behavioral outcomes – is a crucial intervening variable."²⁵ Like control power, soft power is agentic. Success depends on the conversion of resources into outcomes. Though the fist of soft power is covered by a velvet glove, the logic informing its exercise and analysis does not differentiate it from control power. It is Newtonian.

Protean power differs. Its dynamics are captured better by post-Newtonianism. Out of sight, it thrives in the domain of potentialities and possibilities. Like wave functions in the physical world, it is unpredictable and omnidirectional. As in the quantum world, the effects of protean power exist and do not exist simultaneously in a state of superposition that requires the impossible in social analysis – the calculation of all potential forms of power outcomes. Starting with resources, as do analyses of hard and soft power, is like starting analysis with the collapse of the wave function when particles become visible. This reduces analysis to a preset range of actors, resources, conversions, and outcomes, linked in a linear process. It conceals the encompassing and preceding invisible, systemic aspects of protean power dynamics when the interests of actors are not yet actualized. The domain of potentialities through which protean power courses is not fixed in time and space. Actualized at unpredictable moments, potentialities are in a perpetual process of erratic, invisible movement.²⁶ Protean power operates in complex, often messy, emergent processes of entanglement that include past, present, and future. Memory politics and the power of the imagination are both protean. As is true of the physical universe, so in the political universe: there is no master plan. In this post-Newtonian, large world view of power, uncertainty reigns and the risk-uncertainty conundrum persists.

The incalculable provides the terrain for protean power. It can arise through direct relations between actors or indirectly in the follow-on effects that reconfigure complex systems. This type of power cannot be harnessed consciously. Unpredictably it is a creatively generated shift in accepted problem solving that circulates across different sites. Protean power has generative effects on the broader context. It can be entirely unanticipated and as such bypass all attempts to exert control. While the processes underlying the two types of power may co-occur and converge,

²⁵ Nye 2021: 197–98. ²⁶ Brannagan and Giulianotti 2023: 6–8.

their relations to actor experiences of the world are diametrically opposed. From the perspective of those amassing control capabilities, the effects of protean power in settings of uncertainty, often but not always, result in frustration. In contrast, those lacking in control power, often, but not always, take advantage of new conditions to affect the world. The conventional notion of power, writes Bruno Latour, has “the dormitive virtue of the poppy which induces somnolence in the critics at just the moment when powerless princes ally themselves with others who are equally weak in order to become strong.”²⁷ Unexpected power potentialities are an integral part of power dynamics. This means that we should add the concept of what is possible to what is probable and what is natural. The mutability of the world goes beyond the predictable effects that constitute control power. It includes convention-defying uncertainties that destabilize the world as a result of protean power.

Disagreements about the concept of power have been deepened by a questionable translation of Max Weber’s German into English. A widely accepted view holds that Weber’s definition of power operates only in the world of risk – power as the likelihood of achieving one’s will while overcoming the resistance of others. The conventional view is based on a problematic translation of the capacious German concept of *Chance*. That term has two valid translations: probabilistic risk (*Wahrscheinlichkeit*), and possibilistic uncertainty (*Möglichkeit*).²⁸ Following Weber, I hold that power operates in the worlds of risk *and* uncertainty. Actors accomplish their objectives *over* others in dominating relations (*potestas*), as well as *with* others in enabling relations (*potentia*).²⁹ Weber’s conceptualization of power thus invites us to look simultaneously at control power in terms of processes that connect capabilities with effects in relations that penetrate and diffuse and at protean power in terms of agilities that create and circulate. Despite these confusions, we should distinguish clearly between the concepts of risk and uncertainty. Both are relevant for an analysis of power and unexpected change.

²⁷ Latour 1988: 175.

²⁸ Weber 1925: 28. Although I develop it in a different direction than he does, I am indebted on this point to Felix Berenskoetter’s important observation. Berenskoetter 2007: 21, fn 4. Talcott Parsons insisted in his translation of the German concept of *Chance* that the concept should be stripped of all mathematical or statistical connotations, suggesting that “chance” could be measured numerically, a caution which has been conspicuously absent in the quantitative and behaviorist tradition of American political science and international relations research. See also Guzzini 2016: 7, fn 8.

²⁹ As I discuss below, unlike Weber, Hobbes subsumes both *potestas* and *potentia* under the concept of control power, informed by a determinist rather than probabilistic vision of politics.

In its relationship to uncertainty and risk, control power can be compared to a game of billiards. There is room for strategy and there is no question about the rules that govern a player's decisions and constrain their execution. By contrast, protean power resembles a game of interactive fluidity, like tennis. It is about "being in the right place, at the right time" that extends well beyond coincidence. For the world's leading physicist of tennis, Howard Brody, there was nothing flighty about the game. Yet he would have acknowledged that individual ball control, motivation, mutual weakness recognition, and interaction with spectators produce so much uncertainty as to make the exact score of a match unpredictable.³⁰ Moving past equations of force, such is the world of protean power.

Even though an actor may be too weak to exercise "power over" (understood here as actual capability) the human or non-human world, she may nonetheless have "power to" or "power with" (understood here as the process of actualizing potentialities, without or with others) so as to navigate in that world successfully.³¹ The world is made of power-as-cause and power-as-luck. Freakish serendipity is the constant companion of politics. One way of illustrating the operation of protean power is to focus on the effects of human action without design. Under conditions of uncertainty it is not necessarily strategic actions but their emerging byproducts that create the most consequential effects.³² It is clear that actors *want* to do something in response to the uncertainty that surrounds them. What they *should* do, however, is typically unknown. Actors do their best, guessing and coping, uninformed by calculable probabilities and unknown determinants of success or failure. Once their actions have produced outcomes, ascribed power effects are linked to specific actors who are seen as having caused the outcomes. Who wins is therefore determined through traceable (*ex post*) but not predictable (*ex ante*) assessments. By enriching our conceptual vocabulary with protean power, we can gain a deeper understanding of the fragility and limits of control power, not a handbook of how to beat *fortuna* at her game.

The small world of risk and control power and the large world of uncertainty and protean power resemble the difference between clocks and clouds.³³ The French astronomer and mathematician Pierre-Simon Laplace was convinced that the world is a big, complicated clock. As science develops, more and better knowledge about the clock's inner workings will enable us to predict the future with deterministic or

³⁰ *The Economist* 2015. ³¹ Pansardi 2011. Göhler 2009. Slaughter 2017: 161–82.

³² Dallas 2014.

³³ Almond and Genco 1977. McCloskey 1991. Tetlock and Gardner 2015: 8–10.

probabilistic equations. All that is needed is work and patience. The present state of the world is the effect of its past and the cause of its future. In the world of clocks, there is, at least in principle, no uncertainty. Like the past, the future is fully knowable to an omniscient present. Various insurance markets are clock-like in their predictability. And our experience confirms daily many of our predictions. We could not function in a world in which everything was possible. This is the risk-based world of control power.

Protean power operates in the world of clouds. Modern meteorology knows vastly more than in the past about the conditions under which clouds form, and its predictive ability about general weather patterns has improved greatly. Yet it is much less confident about making specific predictions about the shape of particular clouds. Historical probabilities summarize the possible ways the future could unfold – and the curve summarizing those possibilities looks nothing like a normal bell-shaped curve which makes possible the calculation of risks. It has fat tails that describe a much more volatile world than conventional risk models lead us to expect. Historians are among the first ones to understand intuitively and acknowledge explicitly that the world we experience as the only real one is the result of statistical distributions of once-possible worlds. So are playwrights such as Nick Payne.³⁴ “The past did not have to unfold as it did, the present did not have to be what it is, and the future is wide open.”³⁵ The uncertainties that inhere in the field of power point to almost infinite alternative pasts and futures – the field of protean power possibilities.

The evolution of the universe, biology, geological patterning, climate, hurricanes, and other processes in the natural world are often modeled as a set of complex, open systems, governed not by universal laws and equilibria but by pervasive chaos and disequilibria. Within and across such systems volatility sets free protean power containing “the potential for creative evolution.”³⁶ System trajectories can be made intelligible *ex post* but are not predictable *ex ante*. This is very similar to how control and protean power function in small and large worlds, and it is at odds with the assumption that the world is a closed system. The experimental method that seeks to uncover general laws has great difficulty chasing the emergent properties of open systems. And linear causality often does not capture such properties either. It is of course entirely possible that open systems contain simple rules that we should be able to decipher. But our predictive abilities in an open world are greatly limited by the time it

³⁴ Payne 2012. ³⁵ Quoted in Tetlock and Gardner 2015: 248. ³⁶ Connolly 2005: 83.

takes the system to run through enough iterations for us to watch how things map out.³⁷

What distinguishes protean power from control power are the unknown outcomes it produces. Protean power operates in networks that are extensive, loosely coupled, and self-directed rather than intensive, tightly coupled, and authoritative.³⁸ Viewed as agility in response to uncertainty, in a world that often defies control, actors cannot know what exact effects protean power will produce. Without claiming to seek or to cause specific outcomes, they generate these effects through their creativity and local awareness and the creation of future potentialities as a result of new actualities.

Expressing a widely shared sentiment, Randall Schweller writes that “we are entering a jumbled world run by and for no one, in which the nature of power itself is changing, an ungovernable place . . . a chaotic realm of unknowable complexity.”³⁹ Yet a complex world is not necessarily chaotic. Two advocates of complexity theory, Axelrod and Cohen, for example, argue that “while complex systems may be hard to predict, they may also have a good deal of structure and permit improvement by thoughtful intervention.”⁴⁰ In politics, writes Hugh Heclo, “governments not only ‘power’ . . . they also puzzle.”⁴¹ Protean power covers the terrain that Schweller, Axelrod and Cohen, and Heclo allude to.

Scholars and policy makers occasionally compare international politics to a game of chess.⁴² That game has fixed rules and calculates probability in a complex environment. Yet it also illustrates the limits of control. The most highly ranked champion in the game’s history is Norwegian Magnus Carlsen.⁴³ In one of the most lop-sided matches in recent decades, he dethroned the defending world champion Viswanathan Anand in November 2013. This changing of the guard illustrated a broader trend. A handful of Russian grandmasters no longer dominate the sport. Today about 2,000 grandmasters play the game, compared to eighty-eight in 1972. The collapsing chess order shows a dialectical relation between high levels of conformity instilled by risk-based, computerized chess training manuals and the continued relevance of improvisation and innovation. Carlsen’s genius lies in his unorthodox and surprising strategies that rely on his prodigious memory rather than the conventions of computer chess. Carlsen has an aptitude for playing many different styles of chess, adapting readily rather than searching like a scientist for the best

³⁷ Connolly 2005: 84–85. ³⁸ Mann 1986: 27. ³⁹ Schweller 2014: 16, 27.

⁴⁰ Axelrod and Cohen 1999: xv. ⁴¹ Heclo 1974: 305–06.

⁴² Haass 2014. Nye 2011: xv.

⁴³ Naïm 2013: 1–2. Tetlock and Gardner 2015: 43–44. Carlsen declined to defend his title for a fifth time in 2023.

solution to a given problem.⁴⁴ His playing style confirms Adam Smith's insight: "in the great chess-board of human society, every single piece has a principle of motion of its own."⁴⁵ Carlsen's huge success shows that chess is a game where risk calculations based on computerized training manuals and uncertainty-prone adaptive and fluid strategies are both important.

The political world is more unfathomable than Newtonian notions of control power permit us to recognize. It is filled with more post-Newtonian potential for improvisation and innovation than false convictions and traditional practices concede.⁴⁶ Protean power can be creative and destructive at the same time as Silicon Valley's innovative start-ups, grown very quickly into social media giants, illustrate. Smart forecasts, prudence, and resilience offer some measure of protection in a world open to a staggering range of possibilities that the human mind, when oblivious to awe and wonderment, often meets with an anxious craving for predictability. A broader post-Newtonian concept of power provides needed protection and improved vision. The 9/11 attack on the United States and what some have called the "assault" on America by tens of thousands of children migrating illegally in the summer of 2014 serve as two simple reminders of one basic fact – focusing only on control power and overlooking the role of protean power makes the unfolding events in world politics an unending chain of unsettling surprises.

The idea of protean power is intuitively less easily grasped because causality is understood and works differently in the domains of protean power's actualization of potentialities and control power's capabilities. Explication provides a method to operate at the intersection of these two conceptions of cause and power. Explication differs from both "mere" description and "law-like" explanations.⁴⁷ It combines "how" questions, understanding, descriptive inference, and constitutive analysis on the one hand with "why" questions, explanation, causal inference, and causal analysis on the other.⁴⁸ Constitutive effects are productive and in practice difficult to distinguish from causal effects.⁴⁹ "Constitutive relations *are* causal, albeit not causal in the neopositivist sense," writes Patrick Jackson, constitutive explanation "is not a rival to causal explanation,

⁴⁴ Max 2011. ⁴⁵ Smith 1853: 342–43. ⁴⁶ Davidson 2015: 23.

⁴⁷ Finnemore 2004: 14–15. Tannenwald 2005: 33–40. Gerring 2012. Dray argues that explication addresses "how-possibly" questions that require explanations and that specify only necessary (rather than necessary and sufficient) conditions to rebut the presumption of impossibility. Such explanations differ from standard covering law explanations. "Explanations how-possibly are no more to be assimilated to how-probabilities than to why-necessaries" (1968: 392).

⁴⁸ Wendt 1998: 101–03. Ylikoski 2013: 278.

⁴⁹ Laffey and Weldes 1997: 204–05. Barnett and Duval 2005.

but simply an alternative to the neopositivist focus on cross-case covariation.”⁵⁰ The analysis of control and protean power politics benefits from, indeed requires, an Aristotelian notion of causality that includes but goes beyond Hume’s concept of efficient cause.⁵¹ On this point I follow Lévi-Strauss for whom a “mind in its untamed state is distinct from a mind cultivated or domesticated for the purpose of yielding a return . . . it is possible for the two to co-exist and interpenetrate.”⁵² This resonates with Peter Digeser’s characterization of the relationship between existing approaches to power’s three faces and its fourth Foucaultian one: it “does not displace the other faces of power, but provides a different level of analysis.”⁵³ And it echoes Dell’s view of the compatibility between circular causality at the level of family systems and linear control systems in particular family subsystems.⁵⁴

How do actors facing risk and uncertainty choose their practices? Risk-based models of power-as-control assume that they are playing the odds. Eager to apply statistical techniques he had learned on Wall Street, after three disappointing seasons in professional sports the general manager of the Philadelphia 76ers basketball team, Sam Hinkie, observed ruefully in his resignation letter that “the illusion of control is an opiate . . . It is annoyingly necessary to get comfortable with many grades of maybe.”⁵⁵ When frequencies and objective probabilities do not exist or are found wanting, actors can turn to prior beliefs (priors over priors in the language of Bayesian statistics) in order to make reasoned decisions based on subjective probabilities. Unfortunately, as I argued in [Chapter 1](#), no plausible answers exist to the question which prior beliefs are chosen and why. Actors can also turn to imagined futures of the possible and impossible, something international relations scholarship tends to overlook. Hence most actors cope and muddle through, typically informed by standards of reasonableness rather than rationality. The assumption of rational decision making may of course be correct for some individuals and situations, for example some American traders on Wall Street or some American defense officials in the Pentagon. But what about Japanese traders in Tokyo or Japanese defense officials in the Self-Defense Forces? They do not differ from Americans because they adhere to inherently irrational beliefs. Instead, differences in institutional and intellectual settings suggest distinctive engagements with the theory and practice of arbitrage and coercion. This illustrates how much conceptual redefinition, extension, and ambiguity can occur in different settings.⁵⁶

⁵⁰ Jackson 2011: 107–08. ⁵¹ Kurki 2008.

⁵² Lévi-Strauss 1968: 219. I thank David Laitin for alerting me to Lévi-Strauss’s distinction.

⁵³ Digeser 1992: 991. ⁵⁴ Dell 1986. ⁵⁵ Silverman 2016.

⁵⁶ Katzenstein 1996. Miyazaki 2013.

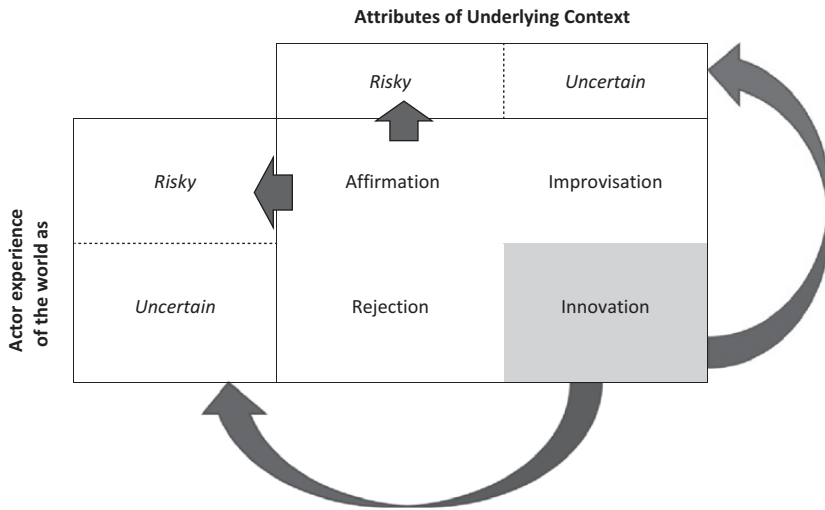


Figure 7.1 Context, Experience, and Power

Source: Adapted from Seybert and Katzenstein 2018: 13

To insist that the mix of risk and uncertainty will always and everywhere yield the same probability calculation does not help us understand better power dynamics in the domain of the unexpected. It seems more sensible to let go of the notion of invariant, omnipresent, rational probability calculations and to acknowledge the existence of variable standards of reasonableness and the complementarity of risk and uncertainty. By acknowledging it, control and protean power are thus brought into one analytical perspective. This makes the unexpected normal and endogenous to world politics rather than abnormal and exogenous.

Power is not only a cause of happenings in the world but also an effect. Figure 7.1 captures the connection between political practices and power outcomes. In terms of risk and uncertainty, it depicts two dimensions: attributes of the underlying context and actor experiences. The four cells in Figure 7.1 list four characteristic political practices. The broken lines between risk and uncertainty visualize the complementarity of risk and uncertainty. The absences of clearly separated cells within the figure illustrate the porous borders between the four practices. Each of the political practices generates power dynamics that feed back on uncertainty and risk. The context- and experience-altering impact captured by the arrows in Figure 7.1 thus makes control or protean power the effects of different political practices.

Affirmation, in the top left, is the recognition by actors that capabilities can be amassed and deliberately deployed to exercise power. From the perspective of those subject to such power, affirmation may take the form of acquiescence or compliance in the context of predictable risks. In the end, as the short arrows show, it enhances the utility of probability calculations concerning future outcomes; reliance on established power templates reinforces the risk-based nature of the world and is experienced by actors as such. This is the domain of control power. The discipline of international relations is replete with examples of authors assuming, mistakenly, that it is the only domain in which politics and power unfold.

Innovation, in the bottom right, is a response to a fundamentally uncertain situation. It generates protean power, shifting the goal post for exercising control in the process and necessitating more agility in the future. Protean power, then, is the effect of innovation that generates further uncertainty and at the same time underscores the futility of control power.

Improvisation and rejection, in the top right and bottom left, mix control and protean power under conditions of risk and uncertainty. During an emergent crisis, for example, actors improvise. Uncertainty has made probability calculations impossible, though actors may not yet realize it. This is the root of the disorienting nature of many crises. Actors assume “old ways” still apply when the ground has already shifted to make possible unexpected outcomes. When they discover that familiar solutions no longer work, they improvise to stay afloat in new contexts. Conversely, as previously earth-shattering solutions evolve into best practices and uncertainty is replaced by risk, actors’ assumptions of pervasive uncertainty may persist. They continue to make decisions affecting only their immediate environment while refusing attempts at risk-based decision making seeking to control others directly. Success can transform protean into control power with actors lagging behind in their experience of a change in context.

The four cells in [Figure 7.1](#) exemplify but do not exhaust the range of practices available. The labels focus on particular practices that relate actor experience and context attributes to the manifestations of power that reinforce or undermine the different constellations of risk and uncertainty. Power as either cause or effect is not coterminous with political practice. Illustrated by the two large arrows, innovation, the response to immediate experience of uncertainty in an uncertain world, generates protean power and so exacerbates further the uncertain conditions from which it arose. “The issue of power,” Ulrich Beck thus argues, “is ignited especially by the knowledge that consequences cannot be predicted in advance ... The very power and characteristics that are supposed to

create a new quality of security and certainty simultaneously determine the extent of absolute uncontrollability that exists . . . All attempts at minimizing or eliminating risk technologically simply multiply the uncertainty into which we are plunging the world.”⁵⁷ It is therefore impossible to link protean power only with specific attributes or capabilities of actors. Instead protean power’s agile nature evolves in contexts that jettison any semblance of regularity.

2. Power in Small and Large Worlds: Ten Case Studies

Why did the Cold War end peacefully? Why did the world economy come so close to falling off a cliff in 2008? Why did the Arab Spring of 2011 represent such surprise, hope, and disappointment? Why did so few predict the COVID pandemic of 2020 or the war between Hamas and Israel in October 2023? More generally, why is world politics so often upended by uncertainties that catch us by surprise? The reason lies, I argue, in the nature of power. I follow Stanley Hoffmann, always a teacher’s teacher, who studied power “so as to understand the enemy, not so as better to be able to exert it.”⁵⁸

Protean power is an integral part of social and political life. This is illustrated by ten case studies that cover a broad range of issue areas: security (terrorism and counterterrorism, arms control), economy (finance, hydrocarbons, environment), society (migration, LGBT and human rights), high tech (knowledge frontier and bitcoin), and culture (film).⁵⁹

In a few cases, the power story is relatively clear-cut. The history of *human rights*, for example, is understood best in terms of the protean power potentials that inhere in innovative practices shaped by the uncertainties generated by institutional conflicts and meaning contestations. The situation is interesting because imperial actors experienced the context as risk, subaltern actors as uncertainty. It is this divergence of experience that accounts for attempted (and failed) control on the part of the colonizers and system-transforming, protean-power-generating innovations by actors addressing the inadequacies of existing governance structures. Protean power explains the observed outcomes – the rapid collapse of the institution of empire after 1945 and the stunning victory of the anti-imperialist insurgents. The rights revolution, however, did not transform the formulation and promotion of all international norms. States have insisted that *arms control* was in their domain of operations. This,

⁵⁷ Beck 2005: 101–02. ⁵⁸ Grimes 2015.

⁵⁹ These case studies are published in Katzenstein and Seybert 2018a.

however, did not stop a cycle of repeated norm revisions after the end of the Cold War that was not driven by states. The framing of the Mine Ban Treaty (1999) in terms of its humanitarian consequences was a sharp deviation from conventional arms control measures. It encouraged activists to push states to adopt subsequently the Convention on Cluster Munitions (2010) and the Treaty on the Prohibition of Nuclear Weapons (2021). The variable processes under which discursive contestations swing the balance toward protean or control power need to be established in specific contexts and rely on the use of language that modifies rather than mirrors the world. The salience of protean power for understanding vital aspects of world politics is, however, clear.

In the case of *Over-the-Counter derivatives* (OTC) and *sovereign debt* the story is a bit more complex as contexts and processes vary, as does the role of language. In derivative markets some actors develop conventions, such as risk models and ratings, that make it possible for them to experience an uncertain context as risk. At the same time other actors experience the same context as profoundly uncertain and respond with innovative products and strategies with unpredictable and power-generating effects. In moments of financial crisis or panic, all actors experience totally unpredictable markets for what they are. But soon after, post-crisis arrangements generate a renewed sense of control over governable risks. Thus, they set the stage for a new cycle of financial instability, where control remains an incomplete and elusive goal. In sovereign debt, comparable power dynamics are at play. States and large corporations experience markets for the most part as manageable risks, bordering only occasionally on uncertainty. This leads to a mixture of affirmation of established strategies and a dose of improvisation when needed. In contrast, so-called smaller distress debt funds, peripheral players compared to primary dealers and sovereigns, must cope with profound market uncertainties. Refusing to be sidelined, one of them, Elliott Associates, introduced innovative legal arbitrage strategies in the late 1990s that, unpredictably, set free protean power and changed the game for everybody.

The politics of *carbon sinks* shows great fluidity of power dynamics in the climate change mitigation discussed already in [Chapter 6](#). This unfolds in a nested domain in which governments reformulate policy in terms of risk that is marked by radical, epistemic uncertainty. Power outcomes differ in different contexts, as the policy process varies at different stages and with it the deployment of language. This does not necessarily generate protean power. In the intergovernmental negotiations leading up to the Kyoto Protocol, for example, control power prevailed in a context of risk. NGOs had to accept this and failed to get governments to adopt new rules. In the post-Kyoto period of parallel

relations of government- and NGO-initiated rules, the rise of a voluntary market for carbon sinks was the result of improvisation as NGOs remained uncertain what would follow from their adoption of practices that were no longer constrained by intergovernmental negotiations. In the final phase, the context became more uncertain for governments that were now committed to taking some action on forest preservation but had no clue how their actions would play out. NGOs seized on this opening – in a circumscribed way they capitalized on their prior improvisation and translated their efforts into an evolving intergovernmental regime that, itself control-driven, still provided some room for protean power. In settings marked often by risk, protean power was at play and readily observable.

In other cases, evolving practices reveal different power dynamics over time, as the history of *LGBT rights* illustrates. Poland's LGBT activists and their opponents relied on improvisations and rejections that played out in risky and uncertain settings, generating different power dynamics. Most notably, the story of LGBT rights promotion in the context of EU enlargement illustrates the limits of control power. A short-lived period of EU and INGO policies in the run-up to and the wake of EU accession affirmed existing expectations. As the inadequacy and one-sidedness of membership conditionality became apparent, local activists found themselves readjusting to an unpredictable blending of external pressures with local sentiments which they met with different discursive strategies. In contrast, in a national context, unable to tap any external discourse for support, the original German LGBT movement in the 1960s was marked by more easily detectable innovation from the outset, with political processes changing over time together with the political landscape. The long-term evolution of LGBT rights is a story of the actualization of various power potentialities. Crucially, changing practices that result in adjustments in power outcomes can reconfirm existing constraints or challenge them through protean power and repeated shifts in the unknown unknowns.

Terrorism and counterterrorism show a complex picture marked by overlays of different contexts rather than a temporal sequence of different power constellations. Reinforced by political expedience and bureaucratic inertia, states encounter and describe uncertain security contexts as risky, relying heavily on language as a resource of reassurance. In their default response of enforcement governments remain tethered to the domain of imagined risk management and control power, even though political leaders may acknowledge in private the futility of their public promises to eradicate all terrorist threats. Terrorists, by contrast, experience and operate in a context of uncertainty requiring innovation and

generating protean power. The politics of terrorism and counterterrorism thus sets in motion complex mixtures of protean and control power.

What distinguishes the counterterrorism account of protean power is distinctive patterns of agency that impact on the interactive fluidity of the context and processes in which actors operate. In a similar way, the story of Hollywood's fluctuating prominence in the world of *film* also displays participants, variously endowed in terms of control power resources, opposed to yet interacting with and transforming the very landscape in which their competition unfolds. The co-dependence between producers and consumers of cultural content creates patterns seemingly amenable to profit making. Yet, as the limited reach of Hollywood's strengths illustrates in various contexts, the resulting control is short-lived at best and illusory at worst. Global audiences, as a whole and also in their cultural or regional sub-contexts, create volatile processes in markets and in politics that shape patterns of innovation. Sometimes film makers adopt established means of reaching their audiences and so reproduce risk-based assumptions about how the industry operates. Despite such measures, however, the fickleness and short half-life of best practices are apparent, and without seeking to dominate, participants carving out new paths prevail in the constantly changing world of film. The success of different actors, unexpected and often fleeting, shows protean power.

Actor awareness of "knowing how little we know" is pervasive on the technological frontiers in *science*, *start-ups*, and *bitcoin*. There are several layers to this uncertainty. First, it stems from the very questions asked and challenges tackled. Second, the recognition of the profound gaps in our knowledge creates ambiguity about the appropriateness of regulation, further altering the course of invention and innovation that are contextually specific, vary in their processes at different stages, and rely on different linguistic practices and strategies. Does it make sense to consider the relative risks and costs of pursuing specific changes in science and technology? How much of the resulting change is based on deliberate moves and how much of it is the outcome of creative improvisation? Are there ways in which inefficient regulations can be bypassed altogether? There exists a continuum of responses to such questions, mapping the degree to which actors allow their experience of uncertainty to guide their actions. Battles over intellectual property rights seek to fence in precious discoveries but at the same time increase incentives for the emergence of newer alternatives. In a different approach, scientists who make their findings readily available do so because they are reluctant to hold further advances hostage to narrow interests that might confine promising lines of inquiry. Start-ups take innovation still further. They not only seek to meet existing technological or other needs but create entirely new ones. Finally, in

explicit recognition of the failure of the formal banking system, especially at times of crisis, bitcoin offers an alternative currency, a fundamentally novel technology, and a transformed environment of unpredictability marked by diverse contexts, processes, and language uses. Construing these high-tech vignettes as attempts to stay ahead in the uncertainty game, we must not forget that those who succeed and briefly create protean power do not anticipate this at the outset. The decision to adopt bitcoin is deliberately disruptive and introduces new power potentialities. Depending on their position, actors exploit or bypass ever-changing unknowns. A scientist may dream of getting a Nobel Prize but she can hardly plan on doing so. No “win” is a guarantee of future success.

Hydrocarbons show sequenced and layered power complexities that conventional analyses of the control powers of large corporations and states largely miss. In the 1950s and 1960s innovations by European governments and the Soviet gas ministry created a new infrastructure of pipelines, practices, and market relations. Subsequently, improvisation and rejection created control and protean power dynamics that acted back on the experience of actors and the different contexts they faced, processes they sought to shape, and language uses. The break-up of the Soviet Union and a number of Ukrainian gas crises made Russian and European executives acutely aware of their mutual dependence, the geopolitical and contractual uncertainties of Ukrainian transit routes, and the advantage of developing joint innovative practices to reorganize gas transits from Russia to Western Europe. In sharp contrast, in the US several small gas producers experienced only uncertainties as, for more than two decades, they were searching for a commercially viable way of extracting gas from shale. Paradoxically, then, the less flexible gas market invited more radical innovation to bypass long-standing technological and market constraints. Improvisation in the face of a slowly unfolding crisis generated protean power dynamics and produced new uncertainties for all actors operating in global hydrocarbon markets. In reaction, European and Russian firms made still more changes to long-standing contractual practices that led to further unanticipated consequences. Finally, Western sanctions imposed on Russia after the annexation of Crimea in 2014, a large Sino-Russian gas deal in 2021, and the invasion of Ukraine in 2022 were, for the most part, improvising protean-power-producing moves adopted in the face of profound uncertainty about future price movements and the fog of the Ukraine war.

Migration, finally, generates a continuous blending of protean and control power. The account of migrants making their way through inhospitable landscapes points at every step along the way to complex power dynamics. Although protean power rests in the ability to find channels of

possibility where established means of control fail, it does not topple structures of domination by default. Protean power may be more visible if generated by actors who otherwise lack the attributes of control power. Yet *any* agents, not just weak ones, can find themselves responding to uncertainty in a shape-shifting way. In the setting of migration through Mexico, uncertainty mixes with risk and actors have to respond to both simultaneously. They convert innovations and improvised solutions into established and reproducible responses, only so these can be overturned again with the arrival of the next train, bus, or truck. The journeys are always changing sequences of sometimes fatal decisions, illustrating that neither protean nor control power will ever prevail and that they often operate concurrently.

The distinction between control and protean power is compatible with different strands of international relations scholarship.⁶⁰ Some empirical studies of world politics have developed arguments that incorporate power dynamics operating under uncertainty. Studies of global value chains, international knowledge creation, and social movements, for example, have pointed to conceptions of power that are not restricted exclusively to the concept of control. In his analysis of global value chains Mark Dallas argues that “the strategic-agentic actions of firms can create non-agentic economic structures . . . which are both unintended and unpredictable *ex ante* . . . power is simultaneously conceived of as agentic-strategic and non-agentic.”⁶¹ In a similar vein, Anna Lee Saxenian has observed changes in the creation of international knowledge that have shifted from diffusion or “brain drain” to “brain circulation.”⁶² Improvisation and creativity in social movements are also highly germane for organizationally or crowd-enabled connective actions that rely on social media to personalize political causes.⁶³ And in today’s movement societies, the problem for the organizers of social movements is to create models strong enough to withstand the pressure of their opponents, creating space for spontaneous action by an energized base – protean and control power in action.⁶⁴ Like religion, all sciences offer strategies for making the material world in which we live appear more responsive to our effort to exercise control. Deep uncertainty is thus converted into provisional certainty. More generally, in our lives “there is a threshold of tolerance,” Michael Jackson writes, “beyond which chance ceases to be a matter of gambles willingly taken and becomes oppressive or unbearable.”⁶⁵ The risk-uncertainty conundrum as opportunity and threat.

⁶⁰ McCourt 2016. Fioretos 2011. ⁶¹ Dallas 2014: 317, 338–39. ⁶² Saxenian 2006.

⁶³ Bennett 2014. Bennett and Segerberg 2013. ⁶⁴ Tarrow 2022: 112–14.

⁶⁵ Jackson 2021: 116.

Table 7.2 *Control and Protean Power in Selected Issue Areas*

	Control Power: Acquiescence	Overlay of Control and Protean Power: Rejection and Improvisation	Protean Power: Innovation
<i>Human Rights</i>	Requires meaning determinacy, institutional simplicity	Under uncertainty, control power exacerbates crises; protean power enhanced by improvisation	Creative interpretation of rights, acceptance of new actors
<i>LGBT</i>	Top-down diffusion and conditionality introduces regulations and resistance	Control power of norm promoters; local advocates improvise by translating norms	Activists engage with IOs/INGOs when states close access
<i>Border Control</i>	Criminals exert more control than state, both exercise control power at the expense of migrants	Protean power of migrant and smuggler refuse state and criminal control power; both powers are mutually reinforcing	Individuals create protean power, state agents implement border policing protocols, kidnappers and criminal enforcers patrol territory, and border-crossing migrants develop survival tactics
<i>High Tech</i>	Copyrights, patents, bitcoin, and blockchain as commercial opportunities	Desire to enhance knowledge, ensure safety, or prevent illegality; different regulators	Discovery of unknown needs, innovation bypasses governments and finance, self-organized
<i>Hydrocarbons</i>	Firms restrict production as punishment or to affect price; restriction of transport	Use of navy to protect liquidity; firm influence on policy; fiscal reliance on oil; negotiations over price, diversification	Trust and relations between firms; flexibility of small producers; disintermediation and redirection of flows
<i>Finance</i>	Standardization and categorization; regulatory capture	Authorized disruptive innovation; ambiguous sovereign debt clauses	Ratings rigged; OTC derivative markets unpredictable with creative adaptation; novel legal arbitrage strategies

Table 7.2 (cont.)

	Control Power: Acquiescence	Overlay of Control and Protean Power: Rejection and Improvisation	Protean Power: Innovation
<i>Terrorism/Counterterrorism</i>	T: spread geographically CT: Invading different failing states	T: Embedding terrorists among refugees CT: Building state capacity; adopting alternative policing and surveillance methods	T: Lone wolves; social media CT: Sow distrust through fear of spies
<i>Film</i>	Hollywood's control by few producers, protection of local markets	Incompleteness of Hollywood's power generates exchanges	National and regional hubs combine resources; global audience taste unpredictable
<i>Arms Control</i>	Voting rules; institutional blockage; state capacity	Changing debates; venue selection; variable content and compliance	Small states partner with NGOs; new venues; mobilization; shifting norms
<i>Environment</i>	Kyoto Protocol's carbon offset	Private regulators consulted in intergovernmental talks; private standards used	Non-state actors develop expertise and create standards; voluntary carbon market

Source: Katzenstein 2020: 483–84.

Besides empirical studies that resonate with the concept of protean power, a focus on uncertainty has an affinity with theoretical and methodological approaches that are open to its improvisational aspects. Karl Deutsch's cybernetic theory of politics emphasizes control and adaptation – and their limitations.⁶⁶ For Deutsch, control power is about the priority of output over intake, the ability to talk over the ability to listen, to act out rather than modify internalized routines and acquired traits. In stressing the importance of intake, the ability to listen, to modify routines and traits Deutsch's theory also encompasses the importance of empathy and love. In short, Deutsch has a dual vision of power. Control power is one side of the coin – the other side is the power of potentiality through learning.

Such learning can consist of observable, prospective individual or group practices recognized as such at the time. When describing the spread of revolutions and foreshadowing what Kurt Weyland would subsequently observe in the context of the Arab Spring,⁶⁷ Adam Przeworski works with a learning concept informed by Bayesian updating. He notes that “the entire event was one single snowball. I mean it in a technical sense: A development took place in one country, people elsewhere were updating their probabilities of success, and as the next country went over the brink, the calculation was becoming increasingly reassuring.”⁶⁸ Beside Bayesian updating, which I discussed critically in [Chapter 1](#), learning can take other forms. For example, it encompasses also the creation of agency through moral commitment, emotional engagement, and practical improvisation, recognized often only after the fact. In El Salvador's civil war, Elisabeth Wood writes, “pleasure in agency” was grounded in emotional processes, moral perceptions and values – all active parts in the making of one's own history.⁶⁹ Similarly, Silvana Toska's fieldwork during the Arab Spring reports the mobilizational effect of the “euphoria of the moment.” James Scott calls these “rare moments of political electricity” that can push millions of people into the streets “in the teeth of power.”⁷⁰ Although Wood, Toska, and Scott capture important aspects of the power I have called protean, this term does not have only positive connotations. In their many nefarious practices ISIS, al Qaeda, and Hamas also illustrate protean power.

The risk-uncertainty conundrum plays a big role in international conflicts. In her book on war Ann Hironaka writes that “in a startling number of cases, the seemingly more powerful state suffered unexpected catastrophic losses, while the ostensibly weaker state ended up

⁶⁶ Deutsch 1966. ⁶⁷ Weyland 2012. ⁶⁸ Przeworski 1991: 3–4.

⁶⁹ Wood 2003: 18, 20. ⁷⁰ Toska 2024: 2–9, fn 126, 17–29. Scott 1990: xiii.

victorious.”⁷¹ Erik Gartzke offers an explanation that undercuts a risk-based view of the world. He argues that rationalist models of war must put war in the error term of their equations. “Our ability to predict which crises will become wars will probably prove little better than the naïve predictions of random chance . . . Important theoretical and empirical components of war are not knowable.”⁷² Stacie Goddard develops a theory of legitimation for political conflicts over indivisible territories.⁷³ It integrates disparate factors such as the material interests and strategies of elites, bargaining, and coalition building on the one hand and cultural resonance, rhetorical action, and legitimation processes on the other. Not reducible only to calculable probabilities, the interaction between the two sets of factors Goddard identifies leaves space for the play of both control and protean power. Similarly, on questions of political economy John Hobson and Leonard Seabrooke have underlined the constitutive effects of everyday political economy practices on states and markets.⁷⁴ Elites do not simply provide a script that other economic actors follow. Everyday political economy is also about the protean power that creates unexpected change and novelty. These studies insist that relational power is not controlled by one site but accessed in a dispersed manner. Power dynamics contain elements of creative entanglement and improvisation. If control power is a marching band, with predictable beat and little room for improvisation, protean power is a jazz band, working with the innovative and the impromptu.

3. Language and Power

None other than Donald Trump has reminded us of the power of language. The sheer volume of Trump’s falsehoods and fabrications is legendary. The *Washington Post*’s daily count reached a total of 30,573 after four years of the first Trump Presidency.⁷⁵ To the astonishment of many, Trump’s political career thrived not despite but because of this avalanche. It is impossible for any outsider to know whether Trump lies at any given moment. And it is possible that, like many, he does not know what he thinks until he speaks. But it is undoubtedly true that he is the greatest bullshitter in the history of American politics.⁷⁶ Someone who lies knows the truth and tries to gain an advantage by concealing it. A bullshitter disdains the very idea of truth. The only thing that matters is to impress and manipulate. To characterize the storming of the Capitol on January 6, 2020 as a “day of love” is to take bullshitting to its highest

⁷¹ Hironaka 2017: 34. ⁷² Gartzke 1999: 567, 573. ⁷³ Goddard 2010.

⁷⁴ Hobson and Seabrooke 2007. ⁷⁵ Kessler *et al.* 2021.

⁷⁶ Frankfurt 2005. Zürn 2024. Collins 2024: 46–48.

level, at the cost of deeply corroding the very foundations on which democracy rests. Bullshitting is not only an individual performance. Many collective myths also have no resemblance to the truth. The conventional wisdom of the origin and resolution of the Cuban missile crisis, for example, is pure bullshit.⁷⁷ Told in staccato style, the story tells us: bad guys threaten; good guys stand firm; good guys win; bad guys lose. Told in more uplifting language, reason triumphs over brinkmanship. [Chapter 5](#) has demonstrated that the historical record supports precious little of this soothing bullshit. For the most part it was dumb luck that made the world escape what looked like black Saturday, October 27, 1962.

Separated by four centuries and writing at the outset of the scientific and the quantum revolutions Thomas Hobbes and Niels Bohr each developed a theory of knowledge and language that distinguishes between things themselves and their appearances. With the English civil war very much on his mind, Hobbes was troubled by the fact that nothing in the natural world provides a secure ground for ontological security. To him clashing opinions and conflict were nefarious. Many contemporary realists who think of themselves as carrying on the Hobbesian tradition surprisingly pay no or little attention to language. In contrast to Hobbes, for Bohr, human observers were unavoidably implicated in the investigation of the natural world. The irresolvable contradictions of the quantum world can be accommodated only by accepting the complementarity of contradictions.⁷⁸ In recent decades these divergent perspectives have persisted, illustrated by the important writings of Michel Foucault and Karen Barad. A single, unified picture of the real world seems out of reach.

Power in international relations is typically thought of in Hobbesian and Newtonian terms, as actor capability. For Hobbes, sovereign power is unitary, homogeneous, unidirectional, and asymmetric. It is checked only by the power of other sovereigns. Hobbes's anarchic state of nature is marked by radical uncertainty ruled by passion.⁷⁹ Among all of man's passions fear is the most important. Unbridled quests for power make life unbearably hard. Individuals are thus ready to transfer all of their rights to one sovereign with unlimited power of control. In one magical moment subjects are thus transported from a condition of unpredictability and diffuse fear of everyone in the state of nature to a condition of predictability and concentrated fear of the sovereign in the commonwealth. The

⁷⁷ Blight and Lang [2018](#): 17, 33, 43–44, 96–103. On p. 96 Blight and Lang address my feared and revered teacher at Swarthmore College, Kenneth Waltz, as “Nuclear Bullshitter-in-Chief,” on p. 141 Niall Ferguson as “Historian Bullshitter.”

⁷⁸ Harrington [2023](#): 114.

⁷⁹ Hobbes [1996](#): 3–11, 24–46, 62, 86–129, 145–54, 183–94, 214–16, 483–91.

sovereign must always guard against the possibility that things can fall apart.⁸⁰ Two different ideas of power run through Hobbes's work: *potentia* and *potestas*.⁸¹ *Potentia* refers to physical power, *potestas* to right and/or authority. One of Hobbes's primary concerns in *Leviathan* is to establish a sovereign to end the chaos of the state of nature with physical power and endowed with enough strength to assert authority.⁸² Sovereign power creates conditions to go beyond the state of nature and create civil society. It does not, however, dissipate the pressure to increase power.⁸³

The anarchical and violent Hobbesian state of nature results from the subjective and arbitrary use of language. All persons use language in their own ways, as people lie, deceive, and endlessly fight about definitions that are never precise or commonly shared.⁸⁴ The Hobbesian state of nature is its own Tower of Babel, a state of language madness, a "condition distraught by an anarchy of meanings."⁸⁵ The solution to the problem of language anarchy is to invent a way to have a clearly ordered set of meanings that applies to everyone.⁸⁶ The science of politics thus consists of linguistic purification, the right ordering of names which enables the sovereign to design a peaceful commonwealth. Sovereign power demands total control. It founds its power by establishing a pure language with uniform meanings.⁸⁷ In addition to "power, authority, law, and institutions," Wolin writes, Hobbes recognized that political order also involved "a sensitive system of communication dependent on a system of verbal signs, actions, and gestures bearing generally accepted meaning . . . one of the most important factors in establishing and maintaining the identity of a political society was a common political language."⁸⁸ Such language requires a mechanism for creating, sustaining, and enforcing it: *Leviathan*. As Hobbes writes, the "Common-peoples minds, unlesse they be tainted by dependance on the Potent, or scribbled over with the opinions of their Doctors, are like clean paper, fit to receive whatsoever by Publique Authority shall be imprinted in them."⁸⁹ Hobbes must control language philosophically so that he can control it socio-politically – and thus allow sovereign power to control civil society. In this way, language is a means of control power, first for the philosopher and then for the state.

The control of language enables the sovereign to police those seeking to challenge *Leviathan*'s primacy. Absolute authority requires a single,

⁸⁰ Hobbes 1996: 221–30. ⁸¹ See Hoekstra 2004. Dunn 2010. Field 2014.

⁸² Field 2014. ⁸³ Dunn 2010. Hobbes 1996: 117–21 and 155–65.

⁸⁴ Hobbes 1996: 25–26. ⁸⁵ Wolin 2016: 230.

⁸⁶ For the historical context shaping Hobbes's views on the "anarchy of meanings" in England's political battles see Tuck 1993: 279–348.

⁸⁷ Hobbes 1996: 45–46, 118–21, 123–25, 149–50. ⁸⁸ Wolin 2016: 231–32.

⁸⁹ Hobbes 1996: 233.

authoritative language for the entire polity. As language is a convention that separates man from beast, Hobbes argues that there can be no thought without language.⁹⁰ Hobbes understands language by comparing it to mathematics. Names or labels can be added or subtracted like mathematical quantities.⁹¹ And as in arithmetic and geometry, language can be maneuvered logically to yield proofs.⁹² Language is a set of signs or names that people use so that they can express their thoughts to themselves and others. For Hobbes the truth of language consists in how words are put together. It lies in the intrinsic logic of language not in what language “reflects” or “re-flects” about the world.⁹³ Truth is well-ordered language, and language is a tool to impose order on the world. For Hobbes philosophy consists of giving us “conclusions about the ‘names of things’.”⁹⁴ Philosophy and political science are like the natural sciences, foremost among them geometry. If things are given proper names, then the causes and effects of all things can be identified, and the forces of motion of the socio-political world can be known just like physical laws.⁹⁵ A socio-political physics for a human-made world makes possible the deployment of irresistible control power. This is the project of *Leviathan*. Hobbes’s heroic intellectual effort, argues Emily Nacol, failed.⁹⁶ His civil science was inadequate to cope with everything the future might bring. At times life’s contingencies could not do without prudence and judgment. But his question has remained central. Can fear and suffering be truly overcome through the planning provided by an authoritative politics? Given the failure of his project of linguistic purification, down to modern times his successors have turned instead to calculable probability rather than certain knowledge.

Like Hobbes, Niels Bohr lived in perilous times. After winning the Nobel Prize in physics in 1922 he eventually became a scientific statesman, a staunch advocate for a peaceful, cooperative, and open world committed to cultural and scientific exchange.⁹⁷ He aided Jewish colleagues living in Nazi Germany who were stripped of all their rights and positions by Germany’s 1935 race laws. In 1943 he escaped from Nazi-occupied Denmark to Sweden and then Britain. He became part of the British mission to the Manhattan Project. During World War II he pleaded with President Roosevelt and Prime Minister Churchill to avoid a nuclear arms race with the Soviet Union, the unavoidable consequence, he thought, of not sharing nuclear technology among states. In 1950 he sent an Open Letter to the United Nations advocating a world with shared

⁹⁰ Petit 2008: 29. Hobbes 1996: 25. ⁹¹ Ploof 2018: 654–60.

⁹² Hobbes 1996: 29–30, 31–34. ⁹³ Hobbes 1996: 28. ⁹⁴ Hobbes 1996: 28.

⁹⁵ Hobbes 1996: 28–29. See also Ploof 2018: 655–65 and Ball 1985.

⁹⁶ Nacol 2016: 3, 9–40. ⁹⁷ Harrington 2023: 28–29, 123, 158–63.

knowledge and untrammelled opportunities for common enlightenment and mutual understanding. He was a cosmopolitan humanist doing his life's work in a nationalist and anti-humanist time.

He was also a post-Newtonian thinker. Central to Bohr's theory of knowledge is the concept of complementarity. He treats contradictory experimental findings and their interpretations as complementary rather than competing. Source of much confusion, his central point is captured by an old joke. Engaged in a quarrel over money, two neighbors take their case to the local rabbi. Hearing the first man make his claim, the rabbi nods his head in assent and says "You are right." After the second man makes his claim, the rabbi nods his head in assent and says "You are also right." The rabbi's attendant, justifiably confused, interrupts and blurts out "But rabbi, how can they *both* be right?" The rabbi thinks about this for a while, nods his head before replying, "And you are also right." In contrast to Hobbes, the experimental, quantum physicist Bohr, like the rabbi, accepts empirical contradictions, plurality, and multiplicity as a fact of life, not as problems that cause disorder and war. Contradictions are for him necessary for proper understanding. Bohr has no urge for a sovereign decider. He accepts the persistence of diverse interpretations as a heuristic solution and the best guarantor of more and better knowledge in the future. His complementarity principle is a conceptual and political alternative to Hobbes's sovereignty. Complementarity is necessary to mediate between investigators with their world-independent minds who perceive and interpret a mind-independent world. When humans arrive at mutually exclusive and independently valid descriptions, the natural world sends a signal: a single description is inadequate and the principle of complementarity holds. For Bohr uncertainty is not a governing principle, as it was for Heisenberg, but the product of deeply entangled relations that make subject, object, investigator, and measurement instrument inseparable. Complementarity is Bohr's concept for capturing a relational universe.⁹⁸ The complementarity of the risk-uncertainty principle, I have argued in this book, is a specific, foundational instance of this general insight.

For Bohr non-quantum concepts and conventional language are the tools through which unambiguous communication is achieved. Quantum objects reveal themselves only indirectly, through observing instruments. They have no direct, sensory effect on the observer; they do not generate objective knowledge in the conventional sense of that term; and they cannot be represented directly by language. Experiments are practical and work. Mathematical formalisms of quantum mechanics are confirmed through replication. And the results of experiments are

⁹⁸ Bohr 1963: 10. Harrington 2023: 9–10, 14, 30, 121.

communicated among scientists objectively, that is, unambiguously.⁹⁹ Language thus matters even though it does not represent reality.¹⁰⁰ It is guaranteeing the persistence of the most favorable conditions of a multiplicity of understandings.¹⁰¹ And it is unambiguous in reporting the results of experiments. In the domain of experiments, language is for Bohr a neutral vessel.

Quantum objects themselves have no independent standing. The phenomena that scientists experience and record in experiments do. For Bohr all experience, in all domains of life – philosophy, art, science – must be “capable of being communicated by human means of expression . . . in the sense that it can be unambiguously communicated in the common human language.”¹⁰² He was not concerned with objective knowledge per se, rather with how knowledge can be communicated objectively, unambiguously, and comprehensibly. For Bohr the concept of “objectivity” is virtually the same as the concept of “unambiguous communication.”¹⁰³ Bohr is interested “in the constraints *our* use of language imposes on *our* description of *our* experience of nature.”¹⁰⁴ Communication is thus as central to Bohr’s intellectual project as experimentation. Complementary to the concept of truth, clarity in expression and lack of ambiguity matter greatly to him. Yet his many pronouncements on this subject were delivered in what Jim Baggott calls “tortured Bohrish.”¹⁰⁵ Unaddressed by Bohr is the fact that language resembles quantum phenomena. Speech acts turn potentiality into actuality. In doing so they collapse an infinite range of potential meanings into a smaller set, with more or less clarity, that informs decisions, actions, and reactions.¹⁰⁶ “Uneasy” is an apt encapsulation of the incomplete and under-theorized role of language in Bohr’s thinking.¹⁰⁷

The sharp difference between Hobbes’s and Bohr’s understanding has been updated but not resolved in recent decades, illustrated here by the work of Michel Foucault and Karen Barad. Michel Foucault updates and broadens Hobbes’s theory of power and language. Hobbes focuses on the individual and “power over,” Foucault on the system and “power through.” Foucault analyzes the creation of self-controlling subjects through the diffusion of disciplinary control power that renders sovereign policing superfluous.¹⁰⁸ For Foucault, as for Hobbes, predictability rests in knowledge and scientific expertise.¹⁰⁹ Knowledge and expertise operate through the invention and acceptance of categories, such as social

⁹⁹ Bohr 1961. Harrington 2023: 114–15, 117–19. Barad 2007: 143, 174, 329.

¹⁰⁰ Barad 2007: 125, 205. ¹⁰¹ Harrington 2023: 27, 30. ¹⁰² Bohr 1963: 10.

¹⁰³ Katsumori 2011: 32. ¹⁰⁴ Honner 1994: 143–44. Bohr 1963: 10.

¹⁰⁵ Baggott 2024. ¹⁰⁶ Brannagan and Giulianotti 2023: 11.

¹⁰⁷ Harrington 2023: 126. ¹⁰⁸ Guzzini and Neumann 2012.

¹⁰⁹ Foucault 1977: 202–05.

deviance. But disciplinary power is not centralized, unitary, homogeneous, and unidirectional. And it is not actor-centric, direct, and specific; it is structural, impersonal, indirect, and diffuse. It works through social complexes and epistemic regimes such as the family, medicine, psychiatry, education, and business.¹¹⁰ For Foucault, we are all the products of power that moves through the capillaries of society.¹¹¹

Foucault's theory of power entails a reconceptualization of the role of language in relation to power. He removes agency, desires, and intentions, and replaces them with systems of norms and rules that indirectly govern thought and behavior. Foucault recasts the study of language by focusing on "discourse," that is, historically constrained systems of statements, concepts, ideas, and norms that shape what can be said or thought in the first place.¹¹² Discourse is "the production of knowledge through language."¹¹³ For Foucault, intentionality and purpose are set aside in the analysis of language.¹¹⁴ In this way, the notion of discourse unites language and practice: discourse makes possible certain forms of knowledge through language which in turn guide and shape the practices of subjects – and, thus, subjects themselves. Nothing exists outside discourse.¹¹⁵ Power takes shape within a given discourse.¹¹⁶ This is productive power understood in terms of the topics, ideas, and concepts through and by which the social world is known, acted on, and reproduced. The world is produced through the lens of discourse. Power, understood this way, *produces* what is possible, the norms by which life is lived and understood.¹¹⁷

One of the "procedures" that Foucault says governs the production and operation of discourse in modernity is "the will to truth."¹¹⁸ This will is embodied by various authorities, intellectual disciplines, the state, and other institutions. It defines what is true and, therefore, how subjects should think and behave. A discursive analysis, Foucault argues, would evaluate the mechanisms by which a particular conception of truth can be thought.¹¹⁹ Hobbes, in his quest for a sovereign language to control civil society, perfectly encapsulates the "will to truth."¹²⁰ Language for Hobbes is providing shared meanings of terms so that individual reasoning can establish what is true by relying on a common terminology; language for Foucault is a part of and shaped by a discursive regime

¹¹⁰ Guzzini 2010: 8–10. Hacking 2004: 279.

¹¹¹ Foucault 1980: 109–33; 2003: 29. Lipschutz 2007: 230. Debrix and Barder 2009: 404.

¹¹² Foucault 1972: 21–39. ¹¹³ Hall 2014: 346. ¹¹⁴ Said 1991: 188–89.

¹¹⁵ Foucault 1980: 93. Miller 1990: 116–17. ¹¹⁶ Foucault 1980: 109–33.

¹¹⁷ Foucault 1978: 41–49. ¹¹⁸ Foucault 1972: 218–19. ¹¹⁹ Foucault 1972.

¹²⁰ For Foucault's own evaluation of Hobbesian power, see Foucault 1980: 78–108, 121 and Foucault 1995.

that makes a particular conception of the idea of truth possible in the first place.

Inspired by Bohr, Karen Barad improves on his understanding of the role of language. Like Bohr, she develops an argument that pays attention to both “word” and “world.” For Chomsky the world is small, made predictable by words. For Wittgenstein the world is large, created by unpredictable language games. Barad rejects both world-mirroring representation and world-making re-presenting language games as long as they separate representation and re-presentation from their practices. Instead, she leans on Foucault and other theorists’ “material-discursive practices” to link world and word, nature and culture. Her focus is both on the performances of representation and on the effects of discursive practices and re-presentation. No God’s eye separates the knower from the world. Instead, there is a direct material engagement with that world. In highlighting the importance of “naturalcultural practices” a generative discourse incorporates and moves beyond the world of representationalism.¹²¹ Science and scientific language are not only nature’s mirror.¹²² Like Bohr, Barad thinks of empirical studies of experimenting and theorizing as material-discursive practices that intervene in the world.¹²³ These practices produce objects and subjects, matter and meaning.¹²⁴ The real is not an independently existing set of objects with inherent attributes. Instead, the stability and directness of entities is Barad’s criterion for what is real. Theorizing and experimenting are not “interventions” from the “outside” but “intraventions” from the “inside,” part of the phenomenon which is produced.¹²⁵

Barad’s argument draws on and clarifies Bohr’s ideas. He had famously argued that the interaction between human observers and the quantum object shapes what can be said about the object. The resistance of quantum phenomena to sense perceptions and their entanglement with the observer favored mathematical prediction of experimental results and resisted Newtonian, conceptual representations. For pragmatic reasons Bohr insisted that conventional, unambiguous language was needed for communication and interpretation of the phenomena resulting from experiments, not as descriptions of the quantum objects themselves.¹²⁶ Barad pushes beyond post-Newtonianism. She writes, in the vein of para-humanism, that we “are part of that nature we seek to understand.”¹²⁷ When humans,

¹²¹ Barad 2007: 41–48. She develops the argument in what she calls an “ontoepestemological framework.”

¹²² Barad 2007: 41–43, 89–94. ¹²³ Barad 2007: 50–56. Hacking 1983. Galison 2000.

¹²⁴ Barad 2007: 56. ¹²⁵ Barad 2007: 56–57.

¹²⁶ Harrington 2023: 115, 119, 126, 132, 139–41, 152. See also Mermin 2016: 241–44 and Barad 2007 for different interpretations of Bohr’s positions.

¹²⁷ Barad 2007: 67.

as part of nature, observe any other part of it, they create a condition in which nature is observing itself, and can see “itself” only in terms of the particular angle it is taking on itself. In their intra-actions humans are not grasping at a world “out there.” Instead, they are folding the human part of nature onto itself. When humans observe or measure something, with or without language, they unroll a catalogue of effects that follow from the cuts of observation or measurement. Nassim Taleb calls this the Platonic fold, “the explosive boundary where the Platonic mind-set enters in contact with messy reality.”¹²⁸

As a constitutive part of the reality they record, humans cut into that reality and report it. The cuts are not on or of reality. They are perspectives that reality, via humans, is taking on itself. Barad thus rejects the notion that language, understood as material-discursive practice, performs a mediating function. Its role is generative.¹²⁹ She goes far beyond the Newtonian humanism informing conventional analyses of world politics. But her writings resonate with the practices of an Alan Greenspan nudging the financial world a bit away from uncertainty, the analysis of a Jairus Grove who looks at the President as a mascot in the Cuban missile crisis, and at the unfolding Augmented Intelligence that may or may not help humanity cope with a world of global warming. In short, her argument captures important aspects of world politics overlooked by Newtonian humanism with its preference for small risky worlds, neglect of the complementarity of risk and uncertainty, and disinterest in the productive role of language.

4. Protean Power and *Fortuna*

Hobbes and Machiavelli epitomize two strands of thinking. As a scientist and rigorous theorist, Hobbes focuses on what control power is and what it can cause. As an astute observer of practice, Machiavelli highlights how and what protean power affects.¹³⁰ Control power is central to Hobbes and his mechanical, scientific approach aiming at a socio-political physics. Protean power is the focus of Machiavelli and his insistence on historical contingency. Speaking in a distinct register, Machiavelli points to the limits large world potentialities and political imagination impose on small world control power. Thinking only of control power also overlooks

¹²⁸ Taleb 2007: xxv.

¹²⁹ Barad 2007: 127–28, 138. Wendt’s (2015: 215–21, 230–37) discussion of quantum contextualism and quantum semantics differs from Barad’s. But like Barad he concludes that language is an entirely indeterminate, deeply generative, emergent force of entanglement. Both Barad and Wendt thus move from the small to the large world.

¹³⁰ Clegg 1989: 5–7, 21–38, 202–07. See also Hindess 1996.

a distinguished lineage of political theorists, starting with Aristotle, who draw our attention to potential capacities and protean power. Since control power is often upended or evaded, these theorists expand the analysis beyond actual capabilities to include potentialities, understood both as the actualization of what is possible in the present and what may be possible in the future.

Machiavelli is often claimed as an advocate of an amoral power politics. He insists that all states rest on “good laws and good arms.” Furthermore, war is the main business of rulers.¹³¹ In *The Prince* Machiavelli uses the concept of *potestà* – but only once in the entire text – to describe the authority to exercise unrestricted physical domination that Cesare Borgia grants to Messer Remirro de Orco, “a cruel and ready man, to whom he gave the fullest power.”¹³² More typically, rather than focus on the common good, as does Hobbes, Machiavelli is interested in the art of the possible. Throughout *The Prince* he invokes numerous times a ruler’s *potentia* – his capacity, ability, or strength exercised in many different contexts.¹³³ In contrast to Hobbes, for Machiavelli “might does not make right.” *Potentia* is a dispositional capacity to do or not to do. It is activated by a prince’s acquired, calculating, discretionary *virtù*, his political ability and physical strength. This is power-in-action and power-in-waiting rather than power-as-order.

Power derives from the opportunity that chance (*fortuna*) provides for the prince’s seizing the moment in the actualization of *virtù*, a good characterization of what I call protean power.¹³⁴ Since the concept of risk had not yet been invented, Machiavelli is not interested in assessing the epistemic aspect of fortune in terms of risk and uncertainty.¹³⁵ This does not stop him, however, from theorizing about it. Fortune is like a destructive river. To protect against it requires strong dikes.¹³⁶ Precaution serves the ruler well in the domain of known unknowns. There will always be floods or foreign invasions. Prudent action guided by both resilience and partial control provides the best antidote for a world full of contingency. Not so in the domain of unknown unknowns; there caution or impetuosity is the proper response. And since there are no universal principles that govern a world of uncertainty, Machiavelli leaves it at that.¹³⁷ Man does not have to accept chance with passive

¹³¹ Machiavelli 1998: 48, 124–25.

¹³² Machiavelli 1998: 28. According to Harvey Mansfield, personal correspondence, 10/13/16, the same concept appears twenty-nine times in the *Discourses*.

¹³³ Machiavelli 1998: 12, 15, 16, 29, 138. In a few places Machiavelli refers also to two other kinds of power: *potentato* applied to a self-directed and self-enclosed agent or power holder, as in potentate, normally a government (pp. 45 and 72); and *potente* (p. 43), meaning one who is strong or powerful, not necessarily a prince or ruler.

¹³⁴ Pitkin 1999: 138–69. ¹³⁵ Bernstein 1996. ¹³⁶ Machiavelli 1998: 98–99.

¹³⁷ Lockwood 2013b: 16.

resignation. He is an agile dancer with an unpredictable partner. And thus he exercises power (*potentia*) in the face of uncertainty. “Fortune is arbiter of half of our actions . . . she leaves the other half, or close to it, for us to govern . . . the prince who leans entirely on his fortune comes to ruin as it varies.”¹³⁸

For conventional views of power, this is hard to accept. The concept of protean power requires us to let go of the notion that all types of power are exercised. The powerful grip of this convention is probably rooted in the dated, Newtonian laws of nature, invoked by Robert Dahl, “as we understand them.” In Newtonian physics gravity controls. In quantum physics gravity is an observable effect in spacetime. Like gravity, protean power is not only a capacity for agility but also an observable effect in a social context.¹³⁹ Should we perhaps listen to Nobel Prize winning physicist Richard Feynman for whom the experimentally confirmed theory of quantum electrodynamics offers a description of Nature that is utterly absurd in terms of our common sense?¹⁴⁰ And should we perhaps, with Rovelli, entertain the possibility that *Reality Is Not What It Seems*?¹⁴¹ Why should students of world politics and the social sciences more generally not be impelled by the same quest in their analysis of the political world that motivates physicists in their analysis of the natural one – to lift just a little the veil of our blurred vision and vast ignorance to gain a better sense of the fleeting richness and weirdness of life? “In the midst of hardship,” writes psychologist Adam Grant, “embracing uncertainty proves liberating. At the worst of times, just as the best of times, it reminds us how quickly our fortune can change.”¹⁴² Enriching the conceptual terminology of power underscores the fickleness of politics.¹⁴³

Protean power analysis offers an opportunity to re-examine an important assumption, common among scholars of world politics, the social sciences, and the public at large: the increasing control over the world we inhabit. Devotees of big data, for example, predict that machine learning may soon be able to predict the future evolution of chaotic systems, thus improving weather and earthquake forecasting or the monitoring of cardiac arrhythmias, solar storms, and neuronal firing patterns. In the words of chaos theorist Holger Kantz, “the machine-learning technique is almost as good as knowing the truth.”¹⁴⁴ Similar hopes (and fears) also motivate burgeoning research programs in the social sciences and in international relations. In the political, economic, and social world, however, such gains in knowledge, predictability, and control simply push the

¹³⁸ Machiavelli 1998: 98. ¹³⁹ Rovelli 2016: 8–10, 43. ¹⁴⁰ Feynman 1985: 10.

¹⁴¹ Rovelli 2017. ¹⁴² Grant 2024. ¹⁴³ Rovelli 2016: 11–12.

¹⁴⁴ Quoted in Wolchover 2018.

unpredictable into new domains while concentrating and amplifying it in the process. The belief that we live only in a small world of manageable risk is for Richard Bookstaber sheer fantasy. We also inhabit a large world of radical uncertainty for which the probability of outcomes is simply unknowable.¹⁴⁵ Protean power dynamics will not disappear in the era of big data and AI. Advances in knowledge always create the potential for protean power in unexpected places and with surprising results.

How does this argument about the importance of protean power in large world uncertainties connect with two commonly accepted forms of power analyses in contemporary international relations? Realist approaches that borrow from Hobbes focus on power capabilities and the diffusion of mechanisms of control. Their analyses overlook the multidimensionality of power and the omnipresence of power dynamics that come into full view only when large world uncertainties are fully taken into account. Liberal institutional approaches, with their focus on imperfections in the flow of information, overlook the fact that different worldviews generate different models of how the world works. Indeterminacies in knowledge and meaning help create uncertainties where agile actors can develop innovative practices and stunning surprises. Realists and liberals are all too often upset and undermined by the unexpected. When these main approaches focus only on control power governed by risk, they shoulder the entire burden of accounting for unexplained, dramatic changes in world politics, a burden that existing scholarship has failed conspicuously to take on board. Keeping such changes exogenous, as is the going practice, is a poor second compared to making them endogenous by acknowledging protean power operating in the large world of uncertainty.

As in world politics, so in literature inflected by para-humanism. In Tournier's adaptation of Defoe's novel, Crusoe knows only one kind of force. Friday, his helper, can muster many more. As the only human on the island, Crusoe weeps from loneliness. Friday is surrounded by multitudes, and only one carries the name of man. Bruno Latour could have started one of his book's with the scientific revolution and reduced the island to Crusoe's will. Instead, Latour chose to start from Friday's point of view, making things "irreduced and free."¹⁴⁶ Similarly, control power evokes the image of a well-manicured garden, protean power that of a wild jungle. Which of the two is the normal condition of life? Does the jungle intrude on the garden or does the garden control the jungle? Hoping to build parks that incorporate elements of both, can we succeed

¹⁴⁵ Bookstaber 2017. ¹⁴⁶ Latour 1988: 154.

by taking account only of gardens or do we not depend also on understanding jungles?

Protean power speaks to a world of potentialities that all too often escapes our dulled imagination. To the frequently posed question “How was this possible?” protean power offers fresh answers that open up new perspectives on world politics. Robert Musil believed that our sense “for what is real” (*Wirklichkeitssinn*) is matched by our sense “for what is possible” (*Möglichkeitssinn*).¹⁴⁷ As was true of Robert Kennedy, many political actors let a sense of the possible guide them in their actions. Kennedy’s theme for his 1968 Presidential campaign was: “Some men see things as they are, and ask why. I dream of things that never were, and ask why not?” The pull of the world of potentialities on the world of reality never disappears. Even America’s favorite realist, the late Henry Kissinger, concurs. In the formation of foreign policy, he muses, in the end “everything depends . . . on some conception of the future.”¹⁴⁸

¹⁴⁷ Musil 1953: 12. I thank James Conran for alerting me to Musil’s observation.

¹⁴⁸ Noonan 2019.

Conclusion: Re-sizing Worlds

Rabbit *or* duck, that is the question. The rabbit-duck conundrum is a clever nineteenth-century drawing of rabbit and duck merging into one.¹ There are rabbit persons, and there are duck persons. For Ludwig Wittgenstein the picture encapsulates the difference between “seeing is” perception and “seeing as” interpretation. If you see only the rabbit you say “I see this *is* a rabbit.” After you have also seen the duck, you say “now I see this *as* a rabbit.” Experimental results point to seasonal variations in perceptions. It is rabbits during Easter and ducks during hunting season. For Uriel Abulof this is a story about the relation between freedom and fact. Seeing only one, we can actively work to see the other, and subsequently choose which to see at any given point. But it may not be about choosing one perspective over the other, but rather about negating one of the two so that we do not have to choose.² Moving from rabbits and ducks to the risk-uncertainty conundrum, fortified by conventions amply provided by Newtonian humanism, students of world politics prefer negating uncertainty. But in the end, as I have argued throughout, choosing between rabbit *or* duck is making the wrong choice. It is rabbit *and* duck. Incessantly re-sizing worlds is our task.

And Tolstoy’s. His *War and Peace* is a fable of follies, a condemnation of hubris, and a plea for humility. Tolstoy sketches memorable portraits: a hyper-active yet ultimately futile Napoleon as the fragile symbol of France’s revolutionary army, and a torpid yet supremely sagacious Kutuzov as the authentic representative of Russia’s inert peasantry.³ For Napoleon, strategic genius determines the course of history; for Kutuzov, man’s adaptability adjusts to history’s flow.

In Tolstoy’s account, Napoleon’s genius is little more than an invention of the retrospective gaze of adoring historians who write about war as though humans could control it. Napoleon’s victory at Austerlitz is a story

¹ Fierke 2022: 48, 220 uses the more recent face/vase image instead to discuss issues of race.

² Wikipedia. https://en.wikipedia.org/wiki/Rabbit%E2%80%93duck_illusion, accessed 01/23/25.

³ Tolstoy 2008. Anderson 2011.

of Russian incompetence, and in his pyrrhic victory at Borodino Napoleon “acted involuntarily and senselessly.”⁴ Napoleon’s strategic decisions are not the result of his genius. Far from it.⁵ The outcome of the war was determined “not by the will of Napoleon, but went on independently of him, by the will of the hundreds of thousands of people who took part in the common action. To Napoleon *it only seemed* that the whole thing happened by his will.”⁶ Tolstoy’s Napoleon is a petty, confused man, accidentally thrust by history into a leading role. He “fulfilled his function of being the representative of power ... of seeming to command.”⁷ But he was only a bit player on the stage of history.

In contrast to an impotent and petty Napoleon, the Russian commander Kutuzov is brilliant for one simple reason: he refuses to attempt to control the uncontrollable. Kutuzov is not credited for defeating Napoleon. Tolstoy writes that this “is the destiny, not of great men ... but of those rare, always solitary men who, discerning the will of Providence, submit their personal will to it. The hatred and contempt of the crowd punish these men for their insight into the higher law.”⁸ Kutuzov’s heroism consists of his “self-denial.”⁹ Rather than impose his will upon history, he is a temporizer who buys time with the motto “patience and time.”¹⁰

His loss to Napoleon at Austerlitz was due to the hubris of Russia’s Emperor Alexander I, who demanded a battle that Kutuzov was reluctant to fight. Kutuzov would otherwise have sagaciously refused battle, knowing the limitations of both his troops and his own capacity as commander to steer the outcome to his personal will. At the Battle of Borodino, and elsewhere, Kutuzov leads his army with a light touch. Rather than try to understand the battle as a strategic game, he attempts to understand the morale of his soldiers, knowing that they will determine the outcome: “He listened to the reports brought to him ... but as he listened to the reports, it seemed that he was not interested in the meaning of the words being said to him, but that something else in the expression of the face, in the tone of the reporter’s speech interested him.”¹¹ Kutuzov does not attempt to impose his will on history. Instead, he attempts to understand his men and do what he can to channel them toward his preferred outcome and ultimate victory.

War and Peace is a great novel – and more. David Welch discusses it as precocious and inconclusive theorizing about international relations, unsurpassed in its description of the commotions and complexities of

⁴ Tolstoy 2008: 754.

⁷ Tolstoy 2008: 785.

¹⁰ Tolstoy 2008: 1086.

⁵ Tolstoy 2008: 782–83.

⁸ Tolstoy 2008: 1084–85.

¹¹ Tolstoy 2008: 805.

⁶ Tolstoy 2008: 785.

⁹ Tolstoy 2008: 1085.

world politics.¹² Bruno Latour treats it as a rich introduction to an altogether different war, now waged in science and technology studies, over the right interpretation of the victory that another French genius, Louis Pasteur, won over microbes.¹³ And Samuel Moyn interprets it through the lens of the three short stories Tolstoy wrote during the climactic battle of the Crimean War. They deepened Tolstoy's belief that making war more humane was merely a recipe for more war.¹⁴ For me it is an allegory about the small world of risk and the large world of uncertainty. For Napoleon and his German understudy, General Pfuël, war is a strategic game played mind against mind. The factors that contribute to victory or loss are knowable and can be controlled. Outcomes are determined by the capacity to manipulate the context of the fight, by identifying the opponent's weaknesses and mitigating one's own. In contrast, Kutuzov does not seek to control the uncontrollable. Rather than impose his will on the battlefield, he seeks to discern a few patterns in the confusions created by momentary events and, if possible, link them a bit closer to his fleeting likings. In this he resembles Germany's Chancellor Otto von Bismark, who did not aspire "to control the current of events, only occasionally to deflect them."¹⁵

This concluding chapter recapitulates the main stories told in this book (section 1); it argues for the unity of knowledge in the natural sciences, the arts and humanities, and the hard and soft social sciences (section 2); discusses eclecticism and experimentalism as compelling intellectual responses to navigate the risk-uncertainty conundrum (section 3); illustrates different forms of coping with the risk-uncertainty conundrum with the help of punditry, scenarios, and forecasts (section 4); draws out the implications of the complementarity of risk and uncertainty for moral luck, policy, and pragmatism (section 5); and, returning to worldviews, points to the affinities that science and religion share in our coping with the risk-uncertainty conundrum (section 6). The book concludes as it began, with a brief message – from Winnie the Pooh.

1. Recapitulation

We need to extend the conventional understanding of the world of politics and world politics to deal with the domain of the uncertain and the risk-uncertainty conundrum. The opening chapters of this book set forth three worldviews that unobtrusively shape our theories and models. Traditional Newtonian humanism expresses our common

¹² Welch 2022: 175–89. ¹³ Latour 1988: 4–5. ¹⁴ Moyn 2021: 18–19.

¹⁵ Davies 1996: 760.

sense, dating back to the scientific revolution and the Enlightenment. Newtonianism seeks laws or law-like generalizations, sidelining the unpredictability of humans important to humanism. Post-Newtonianism and para-humanism offer alternatives that emerged with the scientific advances made in the twentieth century. They frankly acknowledge the importance of uncertainty. The three worldviews are not well-bounded, coherent wholes. Newtonianism and humanism are at loggerheads on foundational questions about knowledge. Post-Newtonianism contains Newtonianism as a practical but inaccurate view of the world. Para-humanism includes the human but goes around and beyond it. Internal tensions are common to each of the three. This provides the intellectual space necessary for different theories, models, and methods to flourish.

The opening chapters also focus on the factors that shape the risk-uncertainty conundrum. Theories and models conceptualize differently small risky worlds and large uncertain ones. Small worlds have homogeneous contexts, processes that are unchanging, and language use that mirrors the world. In large worlds contexts are heterogeneous, processes vary, and language use helps make the world. Elements of both small and large worlds create the complementarity of risk and uncertainty in a great many situations.

Conventional theories and models of world politics tell stories that are informed by statistical regularities or the assumption that humans are rational. Both routes end up focusing on small, risky worlds. Objective, frequentist statistics are based on the assumption that the world resembles a casino and can be captured accurately by Gaussian statistics with their normal, bell-shaped curves clustering tightly around the mean, and with thin tails. But world politics is not like a casino. It is better captured by power-law statistics with their highly abnormal curves, wide dispersion, and fat tails. Power-law statistics are rarely taught in American graduate seminars and rarely used in the analysis of world politics. Subjective, Bayesian approaches assume that over time processes of social interaction and information updating will lead actors to a shared understanding of the intellectual space in which they play their social games and share the model that explains how the world works. But differences in original beliefs or tacit knowledge, such as worldviews, prevent subjective beliefs from converging with information updating. The two conventional avenues for getting around the risk-uncertainty conundrum are thus closed off, illustrated by the recurrence of many nasty and pleasant surprises in world politics.

Using the world of finance as an example, [Chapter 4](#) is a case study of the limits of theories informed by Newtonian humanism. Rational

expectation theory evolved in the small world and came to dominate Wall Street with an ingenious simplification that reduced uncertainty to risk through the practice of affirmation founded on the belief that real estate values could move only upward. When experiments showed that people did not behave as this normative theory stipulated, the irrational choices they made were called “biased.” Disconfirming evidence did not undermine the theory’s attraction of bewitching parsimony and universal applicability. In 2008 various models based on rational expectation theory, which had informed Wall Street practices, proved to be disastrously wrong.

In finance, the large world of uncertainty is often navigated relying on social conventions which provide some help in probing an unfathomable future. Conventions are quicksilver social phenomena reflected in financial markets prone to bouts of euphoria and panic. Reference narratives express realistic rather than rational expectations of how to get by. Conventions spawned improvisations by smart investors, traders, and institutions that were reflected in the securitization and the Value-at-Risk movements. In the years before 2008 risk-management models and ever-widening processes of securitization – credit derivatives building from an underlying pool of collateral – became a powerful convention. It created new markets running into trillions of dollars, formed large asset bubbles, and generated large gains and eventually, after mortgage markets crashed, huge losses running in the hundreds of billions of dollars. Conventions can stabilize uncertainty contingently. But they cannot eliminate it. And they can lead us astray.

The hybrid world of risk and uncertainty exists as markets move from stable to stressed times, from statistical regularities to reflexive human practice creating volatility. The history of accounting charts how the value of risk varies depending on changing consensus, claims, and conflicts. Accounting is not only mechanical counting but also artful interpretation. Like language, contingent practices of calculation, far from passively representing economic reality, actively shape it. The intermingling of risk and uncertainty also marks Wall Street trading. The boundaries separating arbitrage (risk-free trading), hedges (risk-reducing trading), and speculation (risk-seeking trading) are always porous. The Black–Scholes option pricing model and the fair market value movement in accounting were two innovative and, in the end, failing practices that attempted to shift the context and human experience from uncertainty to risk. Even though they do not eliminate the problem of uncertainty, “fast and frugal” heuristics can provide practical coping mechanisms.

For better and for worse, so does the practice of central bankers talking to markets. For several decades before 2007–08, they relied on

econometric allegories drawn from the theory of rational expectation to shape market expectations. It was the only language that had any credibility. In story-form, reigning finance theory was incorporated into markets as re-presenting rather than representing economic reality. Central bankers were the hub of a system of communication in which numerical expectations under conditions of uncertainty generated fictional rather than rational expectations. Alan Greenspan became the “Oracle of the Fed.” He was exceptionally successful at nudging markets in the direction he thought best by deploying his seemingly infinite reserve of opaque prose. Discursive power, he showed, can move the world away from uncertainty and toward risk – for decades but not forever. Story-telling turned out to be an indispensable craft in the fast-paced, hard-headed world of finance.

Chapter 5 focused on the October 1962 Cuban missile crisis, applying both Newtonian humanism and post-Newtonian worldviews. The fit is natural. Quantum physics, after all, ushered in the nuclear era that has affected profoundly both the conduct and the study of world politics. As in finance, the risk-uncertainty conundrum was all too evident as the world hurtled toward nuclear catastrophe. Different models of the missile crisis reflect the small world of risk. The rational actor model focuses on states and their leaders. World politics is a stage and we, as observers, watch and analyze the performances of President Kennedy and First Secretary Khrushchev as well as their advisors. Their rationality and the accuracy of the information on which they acted shaped the outcome of the crisis. Hawks, rational deterrence theory, and the bargaining model of war analyze the crisis in terms of risk. The organizational process and governmental politics models highlight, in addition, the importance of uncertainty introduced by the dispersal of agency that makes human control over events less calculable. Like the rational actor model, the governmental politics model puts human actors at the center of analysis. The organizational process model emphasizes instead routines of relations among collectivities of actors. Both reflect their Newtonian humanist foundation and acknowledge some elements of the risk-uncertainty conundrum. As they confronted that conundrum, in several instances Russians and Americans relied on improvisation and innovation.

More recent analyses are informed by approaches developed in the field of science, technology, and society (STS) that are grounded in post-Newtonianism and foreground uncertainty. They incorporate explicitly technical objects, assemblages, and human beings in a profoundly relational analysis. When relations misfire human choice can matter hugely. Dispersed agency and relational networks of people and objects create innovative practices. This approach diminishes, perhaps implausibly, the

role of the President from quarterback to mascot. Without denying the stabilizing effects of deterrence, these approaches point to many unforeseeable and unforeseen events that threaten to plunge rational decision makers into inadvertent war. More generally, few outcomes in the development of nuclear weapons were calculable or predetermined. Many were generated by entangling processes, as shown in different studies of US weapons modernization programs, the development of India's nuclear bomb, the importance accorded to nuclear blast effects and the neglect of mass fire effects, and the political creation of the "nuclearity" of African uranium mines. These studies highlight how deeply entangled assemblages of objects and relations among people operating across different scales generate the risk-uncertainty conundrum.

Language can mirror or make worlds. The crisis of October 1962 was told and understood differently by different actors. In Washington and Moscow it was understood as a thin slice of history, a brief crisis luckily resolved peacefully. In Havana it was one episode of a long history of American hostility seeking regime change in Cuba. These differences in understanding contradict linguistic compression, reject the Newtonian device of radical simplification, and deny the importance of the ambiguities of language. More broadly, the October crisis underlines the importance of language in the discursive construction of the national interest. It was not the missiles as material objects but the meaning attached to them that created the crisis. In Washington the crisis was perceived as an offensive and secretive move by a Soviet Union intent on introducing nuclear weapons into an American sphere of influence. In Moscow the crisis was seen as a defensive move to consolidate peace in the Caribbean by preventing the US from waging war against a Soviet ally. Furthermore, in the interest of stabilizing the deterrence system psychologically, it was a move to reduce slightly US nuclear superiority, which was so large as to make a decapitating first strike on the Soviet Union a credible American option. Finally, technostrategic talk about the effects of nuclear war neuters weapons of their enormous destructive potential. It creates the impression of humanity as firmly in control. The possibilities that inhere in large world uncertainty are thus silenced and the complementarity of risk and uncertainty is denied. Language becomes a tool to think about the unthinkable in antiseptic terms rather than describing what the unthinkable would look like on the ground. It re-presents a small world of controllable risks rather than representing a large world of unfathomable uncertainties.

With reference to humanity's natural environment and global warming and its symbolic environment and AI, [Chapter 6](#) discusses theoretical approaches that are shaped by para-humanism. The chapter raises a host

of issues involving the conundrum of risk and uncertainty. In the era of industrialization powered by fossil fuel, human mastery of nature and a supposedly passive earth have altered the material conditions of life by creating global warming. For those informed by para-humanism and thinking in geological time scales human activation of the earth's dormant forces has created unfathomable uncertainties that are inseparable from current risk assessments. Humans have also left a deep imprint on their virtual ecosphere. For para-humanism the material and symbolic are closely linked. Mass application of new technologies in the second half of the twentieth century has set the stage for a new phase of human history. Specifically, AI promises to change the virtual world with as-yet unknown and unknowable effects. From the perspective of para-humanism the impacts of technology on the natural and symbolic ecospheres are deeply entangled. In their politics they are both marked by the risk-uncertainty conundrum.

Conceiving of the earth as knowable ecosystems, as does Earth System Science (ESS), points to small worlds of calculable risk. ESS shares with Large Language Models (LLMs) a small world, risk-based view offering practical mitigation strategies. These models and the mathematical or verbal language in which they are cast “represent” the world. Resembling the economic models discussed in [Chapter 4](#), they offer improvisational technologies, such as geothermal and marine engineering, that experiment with different forms of carbon capture. Developed worldwide at an accelerating rate, to date these technologies have not yet been adopted on a wide scale because of their scientific, economic, and political uncertainties. The political economy of the transition away from fossil fuel illustrates the improvisational politics of reform-mongering and concrete problem solving.

An expansive para-humanist worldview makes it possible to articulate theoretical approaches that grapple with large world uncertainties. The concept of the Anthropocene captures a novel condition and new uncertainties in geological time. Inconclusive debates about how to name the current geological era are conducted in a register strikingly different from the discussion of ESS and different mitigation strategies. Humans as a self-conscious species, operating at planetary scale and in geological time, have “intra-vened” in creating impactful processes. With unknown and unknowable effects these processes are transforming the material and symbolic ecosystem on which humans depend and which they shape. Machines becoming part of nature, by being taken to be natural, is no longer a far-fetched idea. In plain sight, it is happening now.

The insertion of technology into humanity's future currently plays out in the domain of language, perhaps the most basic cultural technology

humans share. LLMs are generating new kinds of uncertainties as they link humans to non-human objects. And as they are beginning to speak of “an AI” rather than “AI,” it is humans who appear to be ready to ascribe algorithms and machines with human qualities. Developed during the last half a century, AI technology opens up the possibility of Artificial General Intelligence (AGI). It may evolve beyond LLMs into the creation of a conscious “other,” a profoundly innovative and radical turn in human practice. AI could lead to large-scale catastrophes threatening the survival of the species. And it could lead to a quantum jump in knowledge that might produce viable approaches to reduce global warming. We simply do not know. Recklessly or cautiously, blindfolded we move on, seeking to master the symbolic and virtual world in the future as we mastered the natural one in the past.

Finally, [Chapter 7](#) deals with power and returns to Newtonian humanism and the complementarity of risk and uncertainty. Drawing on Hobbes’s *Leviathan*, the conventional understanding of power is Newtonian. Power is an instrument of control shaping risks. A post-Newtonian and para-humanist concept of power makes us think of the potentialities and uncertainties of protean power. Like risk and uncertainty both kinds of power are tethered together, tightly. Humans act intentionally, but the outcomes of their actions are often unforeseen and unforeseeable. In the large world of uncertainty power potentialities circulate and are perpetually reconfigured. The politics of the past and the politics of the future move in this vast space of potentiality as it interacts with the fleeting and undefinable moment of Now in which humans make their political choices and wield and engage with different kinds of power. Unable to solve the risk-uncertainty conundrum, they follow different practices that act back on political contexts, human experiences, and control and protean power.

2. Arts and Sciences: The Unity of Knowledge

Even though the faculty of a modern university operates in different silos, for good reasons Deans and Presidents ritualistically invoke the unity of Arts and Science during graduation ceremonies. For mathematician David Hilbert humans are a knowledge-seeking, knowledge-creating species: “we must know, we will know.”¹⁶ With the distance between lab, study, and studio shrinking, evolutionary biologist E. O. Wilson proposes consilience or unity as the best way of overcoming the division between the different branches of knowledge.¹⁷ He repeats for our times the

¹⁶ Quoted in Wilson 1998: 48. ¹⁷ Wilson 1998, 2014.

optimistic belief of the Enlightenment in a unified corpus of knowledge. Unity is not the result of knowledge fields “jumping together,” the original Latin meaning of the word “consilience.” Instead, the prospect of unity is the result of vibrant stories that Wilson extends from the natural sciences to the arts, the humanities, and the social sciences.¹⁸ Drawing on his encyclopedic knowledge, he grounds his argument in hard-wired epigenetic rules and the co-evolution of biology and culture. Tracking complex relations, Wilson is not pleading a case for simple, genetic determinism. But order rules the world.¹⁹ And that requires establishing the conceptual unity of all fields of knowledge through synthesis and integration.²⁰ Francis Bacon is Wilson’s lodestar.²¹ Bacon’s understanding of science was broad and extended beyond the natural sciences. Repeated testing by experiment was for him the cutting edge of all knowledge. To experiment meant for Bacon more than today’s conventional understanding of the controlled manipulation of different conditions to draw causal inferences. It covered all human experimentation to bring about change in a world that was like science: open-ended and evolving.²²

I share with Wilson the belief in the unity of knowledge.²³ I reject, however, the argument that the natural sciences are the tip of the spear of consilience. Are the gaps between the different branches of knowledge too wide to be bridged?²⁴ Based on their astounding accomplishments over the past four centuries, Wilson wagers that the natural sciences provide the best model for universal consilience. For him, history tells only one story: “from severe philosophical doubt to increasing scientific, realistic, repeatable, and transparent reality.”²⁵ The truth of the fundamental unity of knowledge may not yet be clear, but it will reveal itself in due time. Although Wilson seems to doubt his own arguments at times, this makes natural scientists the “conquistadors out to melt the Inca gold” that unifies human knowledge.²⁶ By Wilson’s own logic and evidence, as I will show at the end of this section, consilience exists in plural knowledge claims made in unending conversations carried out in different, translatable languages. Unity is an unending quest, not a result. A never-ending stream of stories shows that it is “turtles,” “stones,” or whatever “all the way down.”

¹⁸ Wilson 1998: 9. ¹⁹ Wilson 1998: 8, 14, 29, 44.

²⁰ Wilson 1998: 13, 58–60, 228, 230. ²¹ Wilson 1998: 27–28.

²² I discuss experiments and experimentation at greater length in [Chapter 3](#).

²³ Wilson 1998: 257–59.

²⁴ On this point I am deeply indebted to clarifying conversations with Stefano Guzzini.

²⁵ Wilson 2014: 53–54. ²⁶ Wilson 1998: 230.

Wilson's vision of the conceptual unity of all branches of knowledge enjoys a long lineage that predates Bacon. For the Greeks music and astronomy were two sides of the same coin. Astronomy was the study of relationships among observable, permanent, external objects while music was dealing with invisible, evanescent, internal relationships. Art is not entertainment as in the pages of the *New York Times*. It cuts as deep as science and philosophy and perhaps deeper. In joy and grief singing is a universal practice of making sense of life.²⁷ In William Egginton's captivating book examining the nature of reality in philosophy, physics, and literature through the works of Kant, Heisenberg, and Borges, this is the central point. All images of the world are fundamentally flawed because the flaws are inseparable from philosophical, scientific, and artistic knowledge itself. The different kinds of knowledge gained enable us to peer into the dark while at the same time draping "a new veil over our enlightened eyes."²⁸

It is easy to forget that the tensions and contradictions that inhere in Newtonian humanism have varied over time. And so has the distance between different branches of the sciences and the humanities. For example, Leonardo da Vinci was a "Renaissance man" in the original sense of that term. He was an artistic and a scientific genius. Leaving aside his artistic genius, his scientific brilliance is less appreciated. Leonardo's ingenious experiments calculated the gravitational constant to an accuracy within 10 percent of the modern value – without the mathematical tools and measurement instruments available to Galileo and Newton.²⁹ Da Vinci is a perfect personification of the unity of "Arts and Science." Both are concerned with the experience of the mysterious, the beauty of meaning making, the continual reorganization of our conceptual space and of seeing the world anew.³⁰

After around the year 1500 the main objectives of knowledge – the true, the good, and the beautiful – evolved gradually into different domains which we label today as the natural sciences and the humanities. The nineteenth century brought a further compartmentalization of scientific disciplines as the humanities rallied and made a countermove against the expansive claims of the natural sciences.³¹ Excluded from this two-fold division, the social sciences came into their own a little later in the nineteenth century and replicate within themselves the split between the natural sciences and the humanities. Some disciplines (economics, sociology, and political science) followed the natural sciences, others (history, anthropology, and area studies) the humanities.³² Building bridges across

²⁷ Paulnack 2003. ²⁸ Egginton 2023: xiv, 281. ²⁹ Broad 2023a. ³⁰ Rovelli 2023.

³¹ Lee and Wallerstein 2004b. ³² Wallerstein 2004: 74–75.

this divide is difficult. Illustrating tensions in the social sciences more generally, new academic fields, such as science, feminist, and post-colonial studies, have in recent decades ignited intellectual firestorms – productive debate for some, acrimonious culture war for others.

Max Weber suggests a middle ground. Emerging at the end of an empirical investigation as statements of the essence of a social situation, his ideal types were circumscribed generalizations, guides for future inquiries rather than law-like generalizations.³³ Informed by changing scientific practices, by the beginning of the twenty-first century metatheoretical debates have moved beyond Weber. Some of the silos that the natural and humanistic sciences had built for themselves in the previous century have shown some cracks. Theories and models that are informed by post-Newtonian and para-humanist worldviews sometimes insist that the natural sciences and humanities are dealing with the same mysterious problems. In the reigning Copenhagen interpretation, post-Newtonianism suggests that an external, God's eye perspective on the world does not exist. Similarly, para-humanism insists that all life forms, including human beings, are part of a deep, encompassing web of intra-relations. For both there is no distinction between inside and outside. When humans take measurements of the world, it is nature that is taking measurements of itself. The Laws of Nature are not eternal and objective but the accretions of human experiences and practices.³⁴ The connections between the arts and sciences are manifold and conducive to creative thinking.

As in the arts, invention is an important task of the sciences. The invention of new concepts can signify profound changes in how to conceptualize the world and perform in it. We can be “lost for words” and some things are “beyond words.” Epiphanies of the mind that are cast into new theories and models can result from flipping perspectives, for example from the “outside” of things to their “inside,” from “objects” to “subjects,” and from “inter-relations” to “intra-relations.” The flip side is the product of invention, a combination of intellectual and conceptual innovation. In this perspective science is concerned as much with human subjectivity and consciousness as with rendering a photographic record of reality. The scientific and the sacred sometimes work in similar ways and meet in the domain that can lie beyond reason and belief. Jeffrey Kripal calls that domain “supernatureculture.”³⁵

An ideas-only argument overlooks sense perception and discovery, which have been central to the vast changes science has wrought in the

³³ Jackson 2016: 22–25, 154–63.

³⁴ Smolin 2000: 25. Unger and Smolin 2015: 8, 356, 385–89.

³⁵ Kripal 2019: 11–13, 15–17, 43, 45.

world. For sure, ideas, concepts, and language matter. Galileo and the Catholic Church communicated well. Galileo caused controversy and consternation less by what he said and more by how he said it. He and the Church disagreed – strongly. For Galileo, science was about the discoveries which stem from new encounters with sensory reality. In terms of accurate prediction and useful intervention, his new science was superior to the older science of Aristotle. Since then, aided by the signal contribution of Newton and myriads of scientists, the process of scientific progress has accelerated greatly. An important reason for the success of the natural sciences has been their ability to reframe mysteries that must be pondered into puzzles that can be solved. By the middle of the twentieth century, for example, in terms of prediction and practical application the new science of quantum physics was vastly superior to Newton’s classical model. But physicists continue to disagree on the meaning of quantum and, curiously, often are uninterested in probing it further. But, without a deeper understanding, none of the astonishing practical applications of quantum physics help us comprehend more fully the cosmos humans inhabit.³⁶

As was true in the Renaissance, invention and discovery are deeply entangled. As David Wootton observes, “experience, in the form of observations, and experiments directed at making discoveries ... made possible the invention of science.”³⁷ What has changed is the scale and scope of science, specifically its knowledge-making and knowledge-disseminating institutions. But like concepts that infuse different worldviews, facts that make up our data cannot be read off the world. The measurement problem in quantum physics illustrates a general point. Quantum objects behave differently when they are observed and when they are not. When nobody looks these objects exist in “superpositions,” different possibilities of various positions, in the universe. Only when we look do they snap into a definite location.³⁸ For Bruno Latour, a French anthropologist and radical empiricist, this makes total sense. Facts do not simply exist to be discovered. In science chance favors the well-prepared. Laboratories quite often convert chance discoveries into invented necessities.³⁹ Statistical data are often derived from codebooks that reduce complex and contested interpretations to simple numerical values. In that translation it is easy to forget that the results of quantitative studies are based on qualitative observations and judgments. Latour insists that facts are fragile. As is true of concepts, we always need to remind ourselves where facts come from. “Matters of fact” are always also “matters of concern.” Trial and

³⁶ Carroll 2019. ³⁷ Wootton 2015: 53. ³⁸ Carroll 2019. ³⁹ Latour 1988: 84–87.

error is central. Everything is real, everything is a work in progress, and everything is negotiated and co-produced by humans and non-humans.⁴⁰

This opens the space for shared conversations about the difficulties, for example, of how to understand the enduring problems of risk and uncertainty. Writer Amitav Ghosh believes that literary fiction finds great difficulty in building extreme events such as global warming into compelling narratives. Fiction, Ghosh argues, produces sensible cause and effect tales, as in this traditional Bengali story: “A tiger. A hunter. A tiger.” The story has a tiger-friendly plot, while most of us pity the hunter mauled by a tiger. For Ghosh the modern novel and probability, as in a world of the unexpected, are twins. Unlike its precursor, Ghosh argues, the modern novel seeks to conceal the exceptional through fillers that keep narrativity under control. The unheard is moved to the background, the everyday to the foreground.⁴¹ The incomprehensible is left to genres such as science fiction and fantasy. Journalist Scott Patterson agrees. With notable exceptions, such as *War and Peace*, in his words “literary fiction has as its domain the little life, the daily comings and goings and small-world problems.”⁴²

Soon after delivering his celebrated two-cultures lecture in 1959, C. P. Snow came to the same conclusion.⁴³ Adding some further pages to a new edition published a few years later, he conceded that he had overstated the differences between the worlds of science and literature. His treatment of the literary side was plainly inadequate. In his original lecture the visual arts, music, and architecture, for example, were not mentioned. Yet science and mathematics had a profound influence on modern art. Pablo Picasso’s use of geometry at the beginning of the twentieth century was central to the development of cubism – an act of incomparable, destructive creativity. The artistic appropriation of the scientific concept of the fourth dimension became a conduit for a conceptual reformulation of pictorial space.⁴⁴ Furthermore, in the second half of the twentieth century theoretical physics, astronomy, and cosmology elevated the importance of imagination, metaphor, and analogy. This, too, helped narrow the divide between the natural sciences and the humanities while enriching traditional understanding of scientific thinking as a combination of rigorous deduction and controlled inference from empirical observations.⁴⁵ The computer revolution has also built new connections between science and the arts. And so have the public science movement and various “third cultures” and transdisciplinary fusions in the form of sci-art, artscience, and “arts-science” found in environmental studies.⁴⁶

⁴⁰ Muecke 2022. ⁴¹ Ghosh 2016: 16–19. ⁴² Patterson 2023: 107.

⁴³ Snow 1993 [1959]. ⁴⁴ Ambrosio 2016.

⁴⁵ Collini 1993: xlviii. Galileo Commission 2019: 33–35. ⁴⁶ Chang and Ivakhiv 2020.

In 2024–25 the Getty Museum sponsored a massive exhibit *Blended Worlds: Experiments and Interplanetary Imagination*, one of about seventy installations running in about seventy institutions all over Southern California. NASA's Jet Propulsion Lab explored entanglement under the title of "connectedness" and motivated by the question "how do we engage with the unknown?"⁴⁷

Bridges between the natural sciences and the humanities have of course always existed. Science fiction dates back to the seventeenth century, to Kepler's *Somnium* and Bacon's *New Atlantis*. In the first few decades of the twentieth century, quantum physics and twelve-tone music shattered conventional understandings of both science and music. Surrealism revealed deep connections between art and chance. In modern art, as in physics, chance became for some the deepest of all laws. Dadaism, for example, left much to chance, opening up previously unknown images, perspectives, and perceptions. Insignificant words became powerful thunderbolts offering spiritual insights. After World War II Jackson Pollock's radical freedom celebrated as sacred a disorder rooted in accidental, spontaneous methods. His paintings were not a Dadaist release of the unconscious but "a single, integrated use of chance as a means of unlocking the deepest possible grasp of nature in its broadest sense."⁴⁸ In 2022 one of America's most celebrated writers, the late Cormac McCarthy, published two novels that discuss in depth topics such as quantum physics and the nature of consciousness. In the same year the pictures of Nebulas and the Cartwheel galaxy taken by the James Webb Space Telescope, once converted to the color spectrum the human eye can access, could easily provide the visual background for sci-fi movies.

The analysis of turbulence, to cite another example, has bedeviled engineers, mathematicians, physicists, meteorologists, astrophysicists, and oceanographers interested in chaotic manifestations in the flow of air, water, and other fluids.⁴⁹ The patterns in these flows never repeat themselves. After more than a century of attempts, describing and explaining them continues to be an enormous challenge. Statistical measures of turbulence provide the empirical material for turbulence theories. Artists have painted, drawn, and photographed clouds, waves, and waterfalls for many centuries. Their perceptions, just like those of scientists, are shaped by history and culture. In contrast to the evolutionary change of science since the seventeenth century, however, artistic vision transcends time. Scientists probe underlying mechanisms of flows. Artists seek to please the eye and produce an esthetic effect, providing perspectives that

⁴⁷ Pogrebin 2024. ⁴⁸ Brecht 1966: 9–10.

⁴⁹ Rosenau 1990 applies the concept of turbulence to the analysis of world politics.

scientists cannot capture. In Daston and Galison's study of images in many areas of science "mechanical objectivity" in the nineteenth century and "trained judgment" in the twentieth are eventually followed by a new "hybrid space" in which "presentation" trumps "representation."⁵⁰ In nanofabrication, for example, flow visualization is "indispensable in helping us to develop models and theories based on phenomenology ... Ways of seeing become ways of knowing."⁵¹

The building of new connections between the humanities and the sciences can be an arduous task. In relatively new academic fields such as history of science and in the social sciences more generally, the engagement of different versions of positivist, realist, and constructivist thinking became in the 1990s a focal point of shared concern. I experienced this first-hand at Cornell. In the mid-1990s then Cornell president Hunter Rawlings chaired a faculty meeting debating the reports of three task forces addressing the main issues Cornell faced in the natural sciences, humanities, and social sciences. The first two reports were received and debated without much acrimony. The social science report quickly became a free-for-all. A frustrated Rawlings terminated the session early. Muttering on his way out something about "zoo" and "unacceptable behavior" he asked me what had just happened. I told him that he had just witnessed the social sciences at their best, debating fundamental issues of ontology, epistemology, and methodology. Many proponents on either side of the social science debate are fighting blindfolded over the two elephants they believe live in the same room, never stopping to ask whether, perhaps, there is only one.

Their belief has deep roots and is shared by many who disagree on pretty much everything else. The distinction between methods of inquiry in the natural sciences and in the humanities was a signal accomplishment of Wilhelm Dilthey and, subsequently, Max Weber. For Dilthey the distinction refers to two different epistemic achievements. The natural sciences aim for predictive accuracy by means of general causal explanations (*erklären*) of the natural world. The humanities seek interpretive and evaluative understandings (*verstehen*) of specific social and historical contexts. The humanities or humanistic sciences (*Geisteswissenschaften*) concern themselves with reflections about human beings in history.⁵² In the contemporary analysis of world politics we see Dilthey's distinction in the epistemological and methodological disagreements between "rationalists" or "positivists" on the one hand and "reflectivists" or "interpretivists" on

⁵⁰ Daston and Galison 2007: 42–50, 382–83. Warhaft 2022: 365–66.

⁵¹ Warhaft 2022: 360–62, 366. See also Cartwright and Nakamura 2009.

⁵² Dilthey 1927: 17, 143, 146–48, 205–27, 279, 315; 1924: 180, 317–38; 1922: 36. Tuttle 1969: 8, 9, 11, 25.

the other.⁵³ Problem solving and critical theory have coexisted, barely, like estranged siblings in a dysfunctional family.⁵⁴

Conventional arguments about the difference between the natural and the humanities and social sciences celebrate, rightly, how much we have learned. But they overlook that advancing the frontiers of knowledge both diminishes and increases our ignorance. Standing on the shoulders of giants, we see problems they did not know existed. The unknown looms large as a problem of knowledge for all sciences.⁵⁵ Nature is not passive and inert but active and creative. This “re-enchanted” view of science pushes aside some of the traditional boundaries separating the natural sciences from the social sciences and humanities.⁵⁶ All three are part of an integrated natural, social, and cultural universe evolving in time.⁵⁷ This view would not have surprised Dilthey. Known for his effort to carve out a place for the humanities, for him, all scientific and humanistic inquiries were part of one enterprise sharing complementary and overlapping purposes across different disciplines.⁵⁸ Similarly, for philosopher Nelson Goodman “the arts must be taken no less seriously than the sciences as modes of discovery, creation and enlargement of knowledge in the broad sense ... science and art proceed in much the same way with their searching and building.”⁵⁹

This argument is supported strongly by those Wilson develops in *Consilience*. As one of the most eminent evolutionary biologists of the twentieth century, he argues that up to about 100,000 years ago “genetic and cultural evolution were closely coupled.” But with the rise of civilizations, cultural evolution has “sprinted ahead at a pace that left genetic evolution standing still by comparison.”⁶⁰ The deep epigenetic rules created before the advent of Neolithic societies continue to operate as background conditions. But today the key question for all sciences, humanities, and social sciences is how far did epigenetic rules of evolution allow different cultures to diverge? “What, in the final analysis, joins the deep, mostly genetic history of the species as a whole to the more recent cultural histories of its far-flung societies?”⁶¹ Wilson dismisses with a laconic “too bad” the for now insoluble mystery of the rise of symbolic language and the explosion of cultural evolution.⁶² Astonishingly, particular features of culture have emerged that reduce Darwinian fitness. “Culture can indeed run wild for a while, and even destroy the individuals

⁵³ Fierke 2018: 1–3. ⁵⁴ Cox 1981. ⁵⁵ Taleb 2007: 181. ⁵⁶ Kauffman 2008.

⁵⁷ Lee 2007; 2011: 5–6. Gulbenkian Commission 1996: 60–64, 75. Lee and Wallerstein 2004a.

⁵⁸ Hamid 2016: 635–37. Harrington 2000: 436. Apel and Krois 1987. Kinzel 2018.

⁵⁹ Goodman 1978: 102, 107. ⁶⁰ Wilson 1998: 171. ⁶¹ Wilson 1998: 137.

⁶² Wilson 1998: 146.

that foster it.”⁶³ As I argue in [Chapter 6](#), we live in an era of unheard of acceleration in geological and evolutionary time. Man-made climate change is upending geological time. And computer scientists working in the field of Artificial Intelligence (AI) have in about half a century “traversed the equivalent of hundreds of millions of years of organic evolution.”⁶⁴ The cultural world now operates autonomously from the dictates of biological evolution.

The slack in the epigenetic leash leads to complex outcomes. It is too pat to assert that art transmits feelings that science explains.⁶⁵ Art also creates feelings. It is not imitation but self-creation. Unencumbered by epigenetic rules art is world-making. Wilson calls this “the subtle manifestations” of both biology and culture.⁶⁶ What I called above “both-and” rather than “either-or” thinking, such subtlety undercuts Occam’s razor and theoretical parsimony operating in the natural sciences.⁶⁷ And it validates Wilson’s occasional asides that the transcendental worldview of science as the key to unlocking all the secrets of life might be wrong.⁶⁸ In fact, the insistence that science can allow only empirically verified or falsified statements is itself not an empirically falsified or verified scientific statement but a background assumption on which the natural sciences rest – on the back of turtles, that is, of unresolved metaphysical disagreements. Ultimately, the status of science has little to do with being true and false or right and wrong, and everything with being useful.⁶⁹ In a world teeming with possibilities, metaphysical assumptions distinguish between what is relevant for us and what is not. A gold-digger who is ignorant of what gold looks like will not find it. The slack of the genetic leash thus gives the humanities and soft social sciences an important voice in the conversation among the different branches of knowledge about the risk-uncertainty conundrum.⁷⁰

The language instinct is distinctly human and a precondition for what Wilson calls “true” culture.⁷¹ It is a product of evolution that comprises “arbitrary words and symbols invented purely to convey information.”⁷² But language is more than a conveyor belt for information transporting words and symbols. It is also a cultural technology that makes humans believe in things that do not exist in the real world. In all domains of human endeavor – religion, science, philosophy, art, politics – Richard Rorty argues, truth is made rather than found. Scientists, for example, invent descriptions which are more useful than other descriptions for predicting and controlling what will happen. The world did not speak

⁶³ Wilson 1998: 171. ⁶⁴ Wilson 1998: 134. ⁶⁵ Wilson 1998: 127.

⁶⁶ Wilson 1998: 163. ⁶⁷ Wilson 1998: 57. ⁶⁸ Wilson 1998: 60.

⁶⁹ Galileo Commission 2019: 20, 32. ⁷⁰ Wilson 1998: 60–61. ⁷¹ Wilson 1998: 145.

⁷² Wilson 1998: 142, 128.

Newtonian and then switched to speaking Quantum. Physicists did. Space and time are unreal and can be unmade, as Einstein demonstrated. And as with science so with religion, philosophy, and art. They, too, are not intrinsic features of an objective world. This more capacious view of language is hotly contested by Wilson and many others who are committed to the idea of truth as being found and to the sciences doing something other than offering useful descriptions of the world with a contested relationship to truth. Fierce contestation points to the centrality of conversation as the unifying feature of all knowledge-seeking rather than to consilience as a science-based, gradual conquest of our ignorance.⁷³ Color vocabulary illustrates this contestation nicely. For Wilson “culture has risen from the genes and forever bears their stamp.”⁷⁴ The senses create the symbolic coding that represent the world.⁷⁵ “Poor” color identification is thus based on our understanding of language as a mirror of reality.⁷⁶ But ambiguity in the identification of color can also be the “rich” ground on which the arts and humanities make their creative contributions to human knowledge. They do so not by shrinking the material world to enhance precision but by enlarging the symbolic one to stretch imagination.

Rhetoric is not merely a device for letting matters “hang in the air,” avoiding scientific objectivity and Occam’s razor.⁷⁷ The invention of metaphor has given culture “a life of its own” that acts independently of the rules of evolution.⁷⁸ Wilson proves that point in his writing. He is a master of metaphorical language.⁷⁹ Language and discourse are productive in creating symbolic worlds. In Wilson’s own words “the arts are eternally discursive,” and cultures grow into a “universe of seemingly infinite possibilities.”⁸⁰ As purveyor of information, language, I argue in [Chapter 2](#), mirrors or “represents” the world passively. As a productive force, language also “re-presents” the world in acts of creative world making. We all experience the power of world making when reading a novel or seeing a play. Order governs science in search of small, predictable worlds. It is stumped by the uncertainties created by the power of imagination and the chaotic cultural forces in history that are operating autonomously from their genetic base.⁸¹ For biologist J. B. S. Haldane “the universe is not only queer but it is queerer than we can imagine.”⁸²

Each knowledge community has “its own language.”⁸³ And each has different tools, rules, and criteria of validation.⁸⁴ The absence of a

⁷³ Rorty 1989: 3–4. ⁷⁴ Wilson 1998: 177. ⁷⁵ Wilson 2014: 48.

⁷⁶ Wilson 2014: 48–49. ⁷⁷ Wilson 2014: 47. ⁷⁸ Wilson 1998: 177.

⁷⁹ Wilson 1998: 70–71, 177, 230, 239. ⁸⁰ Wilson 1998: 242, 243.

⁸¹ Wilson 1998: 182. ⁸² Quoted in Wilson 2014: 53. ⁸³ Wilson 2014: 46.

⁸⁴ Wilson 2014: 46, 52.

common language can create some problems of translation. But translation, not the Tower of Babel or Babble, is normal. It is what we do in everyday life to make ourselves understood. To be sure, political authoritarians and intellectual imperialists insist that we must unify all languages into an all-purpose Esperanto. I argue in [Chapter 7](#) that Thomas Hobbes made that case four centuries ago for the world of politics. Today, many biologists and economists follow in his footsteps. But Hobbes and his successors failed miserably, defeated by the autonomy of a culture now unshackled from the leash of evolution.

Knowledge-seeking humans deal with different aspects of a world that resists being fully known. They live on separate islands surrounded by seas of ignorance. Increasing our knowledge will create bridges by drying up some of the seas. But new knowledge always leads to new questions, new seas, and new islands. On the record of the past, as Wilson tells it, the hope that human knowledge will eventually solve all the riddles of the world is based, in his own words, on “blind faith.”⁸⁵ You cannot argue with the blind faith of a scientist that is rooted in the thrill of the chase. But you do not have to accept it. Wilson concedes that if, against all reason, “everything is reduced to epistemological confusion ... in the best spirit of the Enlightenment, we will start all over again.”⁸⁶

Contra Wilson, for me everything is always elevated through encompassing dialogue. Stephen Jay Gould focuses on this central point. He claims convincingly that in the sciences and the humanities knowledge-seeking is profoundly complementary. *E pluribus unum*. Appropriating Benjamin Franklin’s reported quip after the signing of the Declaration of Independence, in the pursuit of wisdom “we must all hang together, or we shall all hang separately.” Gould calls this “a consilience of equal regard.”⁸⁷

In words, numbers, and pictures theories and models tell stories created by individual imagination. Newtonian humanism is often marked by contradictions at Bohm’s “explicate” level. But at the “implicate” level, it is profoundly complementary.⁸⁸ On the record of the past, as I read it, and informed by Wilson’s captivating stories, I put my “blind faith” in the unending conversation among different knowledge-seeking communities, sharing their plural insights in translatable languages, and united by their disagreements about what are the important questions worth fighting about.

⁸⁵ Wilson 1998: 227–28. ⁸⁶ Wilson 1998: 48. ⁸⁷ Gould 2003: 259, 265.

⁸⁸ Bohm 1980: xviii.

3. Eclecticism and Experimentalism

Eclecticism and experimentalism offer practical ways of coping with the unending and unsettled quest for knowledge in general and, specifically, the conundrum created by the complementarity of risk and uncertainty. In his play *Copenhagen*, Michael Frayn interprets a fateful meeting between Bohr and Heisenberg in terms of binary distinctions: social or natural, micro or macro, laws of men or laws of nature, internal states of consciousness or external states of being, intentionality or history, and discursive or material facts. Like atoms, humans, in his view, are discrete individuals with inner characteristics. While the meaning of quantum physics remains a subject of intense debate, it points to a different perspective of a deeply entangled world. Humans do not have pre-existing, determinate mental states. Instead, they are part of an entangled state of indeterminate agencies that are captured in a determinate state only when specific measurement procedures are adopted. It is the measurement procedure, the “cuts” we make into the world with our conceptual apparatus, not the will of the observer or experimenter that creates determinate states. Humanists agree. Humans are intelligent sentient beings in a world to some extent of their own making. We are unavoidably part of the social and natural environment that we seek to comprehend and navigate. Risk and uncertainty are resources for rather than impediments to eclecticism and experimentalism.

On this view, the binaries that pervade Frayn’s literary vision do not match the mutual constitution of entangled agencies. Distinct agencies do not precede the process of interaction. Rather they emerge in the process of “intra-action.” Agencies do not exist as individual elements but only in relation to their mutual entanglement.⁸⁹ For students of world politics power dynamics emerge from entangled relations operating under conditions of risk and uncertainty. They do not exist as the property of things or actors. The diversity and heterogeneity of world politics require us to shed our habitual preference for arguing in terms of binary distinctions. “Either/or” is less helpful in our analysis of world politics than “both/and.”⁹⁰ As diverse voices gain in strength, we could do worse than heed Samuel Beckett’s celebration of the color grey: “It is grey we need – Made of bright and black, Able to shed the former Or the latter, And be the latter Or the former – Alone.”⁹¹

“Both-and” has been the central theme running through this book’s analysis of the political world and world politics. The risk-uncertainty conundrum operating in small *and* large worlds; three internally

⁸⁹ Barad 2007: 5, 19, 22–23, 33. ⁹⁰ Qin 2018: 287. ⁹¹ Beckett 1958.

incoherent worldviews generating story-telling theories *and* practical models of small, risky *and* large, uncertain worlds; homogeneous *and* heterogeneous contexts, invariant *and* variable processes, and language that “represents” *and* “re-presents” as markers distinguishing small from large worlds; the empirical cases of political economy, security, and the environment showing the risk-uncertainty conundrum in different settings; and the effects of Hobbes’s control power *and* Machiavelli’s protean power; the sciences *and* the humanities as contradictory *and* complementary ways of knowing the world. From beginning to end mine has been a story of entanglement.

Eclecticism is a plausible intellectual strategy for dealing with the risk-uncertainty conundrum and this “both-and” world.⁹² Among students of world politics it has had some prominent supporters. Critical of excessive simplification, Hans Morgenthau, for example, insisted that most theories of international relations do little more than “provide a respectable protective shield behind which members of the academic community may engage in noncontroversial theoretical pursuits.”⁹³ And Kenneth Waltz argued that “the prescriptions directly derived from a single image are incomplete because they are based upon partial analysis. The partial quality of each image sets up a tension that drives one toward inclusion of the other.”⁹⁴ This has not stopped tribes of scholars from dividing themselves into different schools of thought. They overlooked the promise of eclecticism for more fully knowing the world. Eclecticism creates spaces for capturing the complexity of real-world problems that practice and policy must engage, while trying out innovative ideas, establishing new dialogues, and working toward provisional agreements that may help on issues of theory.

Newtonian humanism provides the foundation for simple, anthropocentric theories, post-Newtonianism and para-humanism for complex, non-anthropocentric ones. These worldviews produce theories that are not necessarily antithetical. Bruce Western, for example, combines simple, single-outcome explanations with complex, processual ones.⁹⁵ Confidence in complex explanations increases across multiple empirical tests provided by simple ones. Andrew Abbott also bridges the difference between simple and complex models, leaving room for both causality and contingency, and deploying both quantitative-statistical and qualitative-interpretive methods.⁹⁶ In his view social science should not only restrict itself to the analysis of issues that are free of contextual influences and

⁹² Sil and Katzenstein 2010a, 2010b, 2011. Sil 2020. Reus-Smit 2013.

⁹³ Morgenthau 1967: 213. ⁹⁴ Waltz 1959: 230.

⁹⁵ Western 2001: 360–74. Krause 2016. ⁹⁶ Abbott 1998: 172–77.

lend themselves to efficient cause analysis. Complex phenomena strongly affected by their temporal and spatial context must be analyzed not only with time-series data but also with other methods including event history as well as sequence, network, and spatial methods.⁹⁷ Abbott insists that much of science is description, not “mere description.”⁹⁸ Since only a small fraction of all the regressions that have been run are ever published, “we should stop kidding ourselves about science and hypothesis testing ... as a descriptive technique, regression is quite poor.”⁹⁹ Western’s and Abbott’s way of thinking sets an appropriately high standard for students of world politics and is productive for addressing the risk-uncertainty conundrum as it appears in different theories.

A combination of simple and complex models can work well in the analysis of world politics. In the field of international political economy it can be useful to derive some risk-based, baseline expectations about factors of production in international markets even when those expectations prove to be wrong as soon as they engage a more complex social economy that operates also in the domain of the uncertain.¹⁰⁰ Similarly, in security studies the primacy of power politics, understood in strictly materialist terms, can help establish baseline expectations even though its analysis will prove misleading in theory and practice as it has to grapple with the dynamics of power that, going beyond the notion of control, also operate in the domain of protean power possibilities.¹⁰¹ Keeping analysis simple by relying on the central story sidesteps the danger of ending up deep in the weeds and in a hopeless muddle.¹⁰² But this is not the final word. The advice forgets the Latin proverb *cave ab homine unius libri* – beware of the man of only one book because, perhaps, he never had more than one idea.¹⁰³ For megalomaniacs the temptation is seductive to have a go at playing Newton, Darwin, or Einstein and finding the One Law, Great Theory, or Master Hypothesis that unifies all. More mundanely, in a messy world it is hard for all of us to withstand the siren call of parsimony and elegance.

Approaches informed by any one theory risk rigid adherence to unacknowledged foundational positions that all too often can become a hindrance to understanding. They give themselves the license to bypass by fiat aspects of reality that do not fit clearly into their metatheoretical parameters. Important factors are all too often “blackboxed” or treated as “exogenous.” Such simplifying moves help generate elegant knowledge claims about selected aspects of small worlds. They neglect political

⁹⁷ Abbott 1998: 175–76. ⁹⁸ Gerring 2012. ⁹⁹ Abbott 1998: 174.

¹⁰⁰ Cochrane 2011. ¹⁰¹ Sil and Katzenstein 2010a, 2010b. ¹⁰² Cochrane 2011.

¹⁰³ Gould 2003: 249.

scientist Peter Hall's reminder of "extensive endogeneity and the ubiquity of complex interaction effects" characterizing large worlds.¹⁰⁴ "Ordinarily," Albert Hirschman writes, "scientists are happy enough when they have gotten hold of one paradigm or line of causation. As a result, their guesses are often farther off the mark than those of the experienced politician whose intuition is more likely to take a variety of forces into account." Focusing on only selected factors runs the risk of "a particularly high degree of error."¹⁰⁵

The tight coupling of theories with a fixed set of foundational principles often poses a barrier to both understanding and acting. It tends to lead to the unhelpful exclusion of important observations and dynamics, frequently obscuring or distorting the very problems that need to be understood and addressed. Incorporating alternative approaches grounded in different metatheories can produce a more expansive exploration of interconnected political processes.¹⁰⁶ Eclecticism lends itself to addressing problems of wide scope that incorporate the messy realities of the world, accommodate rather than bracket potential sources of uncertainty, and engage pragmatically with concrete issues of practice and policy.

As I have argued in [Chapter 3](#), experimentation is a watchword of such an approach. It is illustrated by little children drawn magnetically to stray iPhones. "Children learn about the world by trying out something and seeing what happens."¹⁰⁷ In the words of Albert Hirschman "the principal enemy is orthodoxy: to use the same recipe, administer the same therapy, to resolve the most various types of problems while ignoring that things are always more complicated in reality."¹⁰⁸ We are all children when we play in large worlds. Similarly, Charles Sabel and his colleagues have advocated experimentalism as a promising form of governance compared to traditional top-down approaches in national, regional, and global affairs. The key is bringing relevant knowledge and authority to bear on policy problems. Information sharing and coordination within shared regulatory frameworks combine enhanced political participation with policy learning in decentralized systems with mutual monitoring.¹⁰⁹

It is the relationship between us and the world that generates multiplicities of risks and uncertainties. Students of world politics have traveled some distance to capture that multiplicity with concepts such as plurilateralism, heteropolarity, multimodality, deep pluralism, and no one's world. Multiplicity has been propelled by often unexpected developments such as the end of empire, the multiplication of states, the emergence of

¹⁰⁴ Hall 2003: 387. ¹⁰⁵ Hirschman 1970: 341, 343. ¹⁰⁶ Sil 2020: 439.

¹⁰⁷ Bohm 1968: 138. Chandler 2014: 34, 190. ¹⁰⁸ Hirschman 1998: 110.

¹⁰⁹ Dorf and Sabel 1998. Sabel and Zeitlin 2010. Sabel and Victor 2017b. Taleb 2012: 115–16.

transnational politics, the end of the Cold War, and China's rapid rise.¹¹⁰ World orders and disorders do not exist in the singular. At any moment they coexist in multiple competing and co-evolving forms.¹¹¹ Whatever the nature of the unit in world politics – tribe, clan, society, state, polity, empire – multiplicity in make-up and relation are its distinctive mark. The absence of centralized authority in world politics is no more than that – an absence. It diverts attention away from the presence of a multiplicity of contexts, processes, and linguistic practices.¹¹²

Marked by risk and uncertainty, across different spatial, temporal, and political scales the world is a deeply entangled mesh of multiplicities inviting eclectic modes of reasoning and experimental ways of doing.¹¹³ That mesh encourages us to try out different things, creating novel options. There is no free lunch, of course. Forgetting small world risk may sacrifice helpful practice. Ignoring large world uncertainty may surrender to unwelcome surprise. But they embolden us to take different “cuts” into the risk-uncertainty conundrum posed by the real world. Whichever way we cut, one thing is for sure: we cannot eat our cake and have it too.

4. Peering into the Future

Peering into the future is like pissing into the wind. The stuff you produce comes right back at you – with a vengeance. Before 2007/08 the forecasting models on which most banks and central banks relied assumed, surprisingly, an economy without many of the variables that drive the financial system.¹¹⁴ Working with data and reports supplied by the staff of the Federal Reserve, members of the Federal Open Market Committee (FOMC) submit their individual forecasts of output growth, inflation, and unemployment prior to the biennial publication of the Fed's Monetary Policy Reports to Congress. Forecast errors are an imperfect, indirect measure of the risk-uncertainty conundrum facing the FOMC. But individual forecasts about important macroeconomic variables vary widely, and accurate forecasts are extremely rare. Alan Greenspan acknowledges that policy makers and forecasters are doing “exceptionally well” if they can get projections right 70 percent of the time.¹¹⁵ This is wildly overoptimistic. In practice, the FOMC members have missed Greenspan's benchmark by a wide margin. Between 1992 and 1998, for example, out of 360 separate forecasts for each of four variables, there were

¹¹⁰ Borus 2009: 7–11. ¹¹¹ Biersteker 2022. Adler 2019. Ish-Shalom *et al.* 2021.

¹¹² Rosenberg 2016: 128–29, 132, 135–41. ¹¹³ Powel 2020: 546–47, 549–53.

¹¹⁴ Kay and King 2020: 348. Abolafia 2020: 30–31, 156. ¹¹⁵ Greenspan 2010: 209.

twenty-five perfect forecasts of inflation, twenty-one for unemployment, eight for real GDP, and not a single correct forecast of the growth of nominal GDP. Fewer than 4 percent of all forecasts issued were correct.¹¹⁶ Put bluntly, the forecasts are not very good. As Christina and David Romer have noted, “someone trying to forecast inflation should move away from the FOMC forecast, not toward it.”¹¹⁷ The FOMC evidently was not operating in the small world of calculable risk.

More recently, in April 2023 the consensus outlook for the American economy among economists and Wall Street analysts moved from soft landing, to hard landing, to no landing, back to hard landing. By mid-summer soft landing was again the favorite, before interest rates reportedly entered an era of undefined but surely unsettling “peak uncertainty.”¹¹⁸ Not so for central bankers, who had talked about inflation as “transitory” in the summer of 2022 but as “persistent” in the summer of 2023. It comes as no surprise that Wall Street’s latest obsession is an unknowable number called “term premium.”¹¹⁹ It exists only in theory and contains everything other than investors’ expectations for short-term interest rates set by the Federal Reserve Bank. The term premium incorporates uncertainty about the long-term inflation outlook. But the rapid decline of inflation rates in the fall of 2023 proved both term premium numbers and central bankers wrong. Now, central banks hope that AI may help them to better understand inflation. More data transforming uncertainty into risk by studying the past is a hope that springs eternal.¹²⁰ In the words of journalist Eshe Nelson “that’s like driving a car and somebody painted your front screen so you can’t look forward. You can only look through the back window to see what inflation was last month. That probably ends with you in the ditch.”¹²¹

But there is a second side to this story of failure. Without forecasting, economic predictions arguably would have been even worse. Over the twentieth century forecasting has evolved from aiming at “correct” predictions to actively shaping an inherently unpredictable future by coordinating the expectations of relevant economic and political actors. Hoping to nudge growth upward, Federal Reserve officials and private sector economists are understandably overly optimistic in their forecasts. Between 2010 and 2019, if the consensus forecast of GDP had been true, the American economy would have grown by 1.3 trillion dollars more than it actually did.¹²² Similarly, in medicine two-thirds of the time doctors’ Palliative Prognostic Scores are overly optimistic in predicting a

¹¹⁶ Katzenstein and Nelson 2013b: 243. McCracken 2010.

¹¹⁷ Romer and Romer 2008: 231–32. See also Edge and Gürkaynak 2010.

¹¹⁸ El-Erian 2023. Smialek 2023b. ¹¹⁹ Goldfarb 2023. ¹²⁰ Nelson 2023b.

¹²¹ Nelson 2023a. Wendt 2001. ¹²² Leonhardt 2019: A21.

patient's time before death.¹²³ As is true of language, the economy is not merely represented by theories or models but is enacted by them. Believing in their truth, actors behave to make them come true. Through their use of language, central bankers self-knowingly act to construct out of an unknowable economy one that is knowable for market participants. And they seek to learn about that unknowable economy so that they can recalibrate their own constructions and regenerate favorable economic conditions. In a manner of speaking, they are "in" on the process of discursive performativity.¹²⁴ "We are no smarter than the system we study."¹²⁵ In the spring of 2023, for example, the Federal Reserve sought to both reduce a high inflation rate and bolster an economy experiencing a serious banking crisis. It chose a middle ground for action, a modest increase of the interest rate. It did not have, or claim to have, any data suggesting that its number was the best number. Instead, it talked up this figure as an appropriate response expressing its conviction that inflation and the crisis both mattered – the Federal Reserve playing yo-yo with the risk-uncertainty conundrum.

Despite all the difficulties that the future poses, all of us – including politicians, bureaucrats, pundits, and scholars – mobilize our imagination and take different approaches to get a sense of what is coming our way and meet it well. That can mean making a singular prediction and seeing whether it comes to pass. It can mean developing scenarios and making contingent claims. And it can mean developing forecasts with probability assessments about future developments, based on today's best knowledge. Peering into the future takes different forms: predictions, scenarios, and forecasts.¹²⁶

Pundits are eager to deliver the goods on prediction markets with an insatiable demand for unlocking the secrets of the future. But, as Karl Marx once quipped, they are the first ones to fall off when the train of history hits a curve.¹²⁷ Pundits do not have the cognitive style of successful forecasters.¹²⁸ They portray themselves as having unique and penetrating insights into the future that give them the license to make bold claims. George Friedman is a good example. He has published many books. I recall one of his earliest, *The Coming War with Japan*, published to great acclaim in 1991.¹²⁹ That war has been a long time coming. The world still waits – no longer with bated breath. Published in 2009, his *The Next Hundred Years* predicts that by around 2020 China will be divided

¹²³ Großekathöfer and Schlak 2024: 89. ¹²⁴ Holmes 2014: 25. ¹²⁵ Cochrane 2011.

¹²⁶ Jasper, Ursula, Myriam Dunn Cavelty, and Andreas Wegner. N.d. Book Proposal: The Possibilities and Pitfalls of Prediction: Academic Contributions to Future-Oriented Policy-Making, submitted to ETH Zurich, p. 3. Jasper 2016.

¹²⁷ Tetlock 2009: 57. ¹²⁸ Tetlock 2005. ¹²⁹ Friedman 1991.

into regional fiefdoms and Russia's military will collapse shortly thereafter.¹³⁰ Today's news from China and Russia does not fill the particulars of that bill either. Although all too often they cushion their predictions with vagueness and complex conditionals, pundits like Friedman typically end the prediction race as royalty-rich also-rans.¹³¹ But not all is lost for those willing to plough assiduously the field of punditry. The "wisdom of the crowd" logic holds here as well. Taking the whole group of pundits and averaging their predictions improves substantially the signal-to-noise ratio of their individual publications.¹³²

Scenario building cultivates imagination rather than speculation and calculation.¹³³ It is something Peter Schwartz, a practitioner and CEO of Global Business Network (GBN), developed over many decades.¹³⁴ Scenarios are built around predetermined factors that are visible in their early stages while their consequences are still indeterminate. They do not constitute the full range of the unexpected. Other system-changing disruptions are totally unpredictable and are far more common than most people realize. By Schwartz's reckoning such global disruptions have occurred about once a year in the early twenty-first century.¹³⁵ Scenario thinking acknowledges the inevitability of surprise and fortifies our ability to anticipate and deal with it. This is the central theme running through Schwartz's *Inevitable Surprises*.¹³⁶ Re-reading the book twenty years after its publication leaves the reader with the impression of a creative mind that got many of the long-term challenges right, including demography and migration, the continued evolution of the computer revolution, and climate change. The consequences of these factors are the stuff of today's headlines. But some of Schwartz's long-term projections about politics, such as the future of China and the United States, are remarkably off the mark. China did not embrace orderliness in its foreign policy but evolved instead into a new kind of revisionist power. And the United States did not become a disorderly rogue empire where trust in government is returning but a hollowed out, deeply distrustful, and polarized polity that appears to have lost its way in the global system.¹³⁷ Politics appears to defy trend analyses stretching over long time periods. The orders it creates always remain subject to disruption.

In addressing the risk-uncertainty conundrum, scientific forecasting of world politics has shown some encouraging results for illuminating the medium term of about three to five years.¹³⁸ But peering further into the

¹³⁰ Friedman 2009. ¹³¹ Gardner and Tetlock 2011b. ¹³² Tetlock 2009: 61.

¹³³ Oppenheimer 2016: 5. ¹³⁴ Schwartz 1991. ¹³⁵ Schwartz 2003: 11.

¹³⁶ Schwartz 2003. ¹³⁷ Schwartz 2003: 118–23, 126–27.

¹³⁸ Bruce Bueno de Mesquita, email message, 05/12/22. Scoblic and Tetlock 2020: 15. Braumoeller 2012: 194–212.

future has proven to be impossible. Hence the risk-uncertainty conundrum persists. Peter Scoblic and Philip Tetlock tell us why, by listing some of the difficulties encountered in forecasting developments in world politics: laws and regularities are elusive and debatable; data are often unavailable; variables number in the thousands and interact in countless ways; history is a series of unfolding events with contingent branching paths; tectonic shifts can hinge on mundane occurrences; and future events cannot be deduced easily from theoretical principles or induced from past experience.¹³⁹ But what Tetlock calls a “techno-optimistic” outlook persists among the leading scholars in this field, “a common belief that it is possible to do at least a bit better and perhaps a lot – and that technology can help” in transforming some uncertainties into risk.¹⁴⁰

Bruce Bueno de Mesquita tackles the risk-uncertainty conundrum with a small world, reductive approach that merges the best qualitative assessments of country experts – about the relevant players, the options they perceive, the salience of the issue for them, and their relative clout in a particular issue space – with the deductive logic of game theory. It is the combination of expert judgment and the game theoretic model that gives his approach an eye-catching predictive power of better than 90 percent (as stated by at least one official of the CIA, for which Bueno de Mesquita’s company has done a lot of work over the years).¹⁴¹ The game theoretic model that Bueno de Mesquita banks on is a rational model of human choice. That model is based on tacit and common knowledge assumptions, that is, pre-theoretical worldviews and assumptions of how the world works. Those assumptions may be realistic in some situations when everyone plays the same game, such as the band-width auctions Bueno de Mesquita often refers to, held on both sides of the Atlantic among corporate and government technocrats. But often players do not play the same game. Mentioned in the subtitle of Bueno de Mesquita’s book, the “brazen self-interest” that motivates his model has built into it traits that are shared widely among American economists and that resonate with some aspects of American culture.¹⁴² But while Republicans and Democrats may share an understanding of the concept of “interest” I am not convinced that they share the same model of how American politics works. And because of differences in their conceptions of the “self” the average Chinese and the average American foreign policy expert probably also have very different views of how the world works.

¹³⁹ Scoblic and Tetlock 2020: 14–15.

¹⁴⁰ Tetlock 2010: 485–86. In the area of finance, for example, the existence of grey swans points to the promise of competing models yielding further insight and predictive power. See Patterson 2023: 131–33, 142–46. Bueno de Mesquita 2014a, 2014b.

¹⁴¹ Bueno de Mesquita 2011, 2010. Tetlock 2009: 65. ¹⁴² Bueno de Mesquita 2009.

Game theorists typically assume away, or take to be irrelevant, the tacit and common knowledge that players bring to the table. Their view of human nature is uncomplicated. Everybody is rational, so calculations or guesses of how rational the other side is are either unnecessary or easily made.¹⁴³ Thus the messiness of the large world is kept at bay. Furthermore, as Tetlock points out, compared to a game theoretic algorithm the relative predictive success of expert judgments is not easy to pin down. Is it really true that it is the game theory rather than the wisdom of the crowd of experts that accounts for the success of this approach?¹⁴⁴ Tetlock also insists, and Bueno de Mesquita agrees, that the test of different forecasting approaches can be established only through rigorous tournaments carried out over years.¹⁴⁵ Since Bueno de Mesquita's model is proprietary, it is not clear when such a tournament might be organized.

Self-described skeptics about forecasting, Dan Gardner and Philip Tetlock have developed a different approach. They assembled a group of 280 volunteers from all walks of life who over many years were asked about a wide array of issues, yielding 28,000 predictions. Gardner and Tetlock concluded that these volunteers were only slightly more accurate in their predictions than random guessing and slightly less accurate than simple extrapolation of existing trendlines. But experts differ in their predictive accuracy. Working in small teams, "super forecasters" are almost twice as accurate in their prognoses than untrained experts working alone.¹⁴⁶ Successful forecasters have a distinctive cognitive style. They are eclectic and circumspect in temperament, not beholden to any particular view or theory, opportunistic in their use of data, and attentive to both micro-processes and mega-trends.¹⁴⁷ "Centrist, cognitive flexible foxes had significantly better predictive track records than wedded-to-orthodoxies hedgehogs ... this success was relative; foxes did only slightly better than extrapolation algorithms."¹⁴⁸ A currently running multi-year prediction tournament is testing Tetlock's preliminary findings about different cognitive styles. Tetlock bets that when we break questions about the future into smaller pieces our ignorance is flushed into the

¹⁴³ Blakely 2020: 37–38. Braumoeller (2012: 211) discusses some other assumptions of Bueno de Mesquita's model.

¹⁴⁴ Tetlock 2009: 66. Gardner and Tetlock 2011b.

¹⁴⁵ See Bueno de Mesquita 2014a for an extended presentation and defense of his approach, and 2009 and 2010 for applications; http://decision-making.moshe-online.com/criticism_of_bueno_de_mesquita.html, accessed 07/03/24 gives extended criticisms. Thompson 2009 offers a balanced discussion of Bueno de Mesquita's work.

¹⁴⁶ Großekathöfer and Schlak 2024: 89.

¹⁴⁷ Tetlock and Gardner 2015. Gardner and Tetlock 2011a. Großekathöfer and Schlak 2024.

¹⁴⁸ Tetlock 2010: 471. Cochrane 2011.

open. It enables us to hear the stories that the problem wants to tell us rather than our tried-and-often-not-so-true assumptions that have guided us in the past.¹⁴⁹ The hope is to become clearer about what we can and cannot forecast and how we can best do so. Weather forecasters are exemplary in having a good sense of what they do and do not know. Their predictive accuracy declines sharply beyond three to four days. The inflection point for political forecasts, Tetlock and Bueno de Mesquita seem to agree, is around three to five years. Unsurprisingly, shorter time periods increase our ability a little to peer into the future. Baked into the risk-uncertainty conundrum, surprises are bound to occur, always. In short, creative and important work on the complementarity of risk and uncertainty focuses on answers to specific forecasting questions, clustering around broad scenarios that capture some important long-term trends. Even though, unavoidably, it leaves unanalyzed inescapable, radical uncertainty, this procedure is useful in giving decision makers an evolving sense of plausible futures.¹⁵⁰ With much effort and fortified by a large dose of humility people can “make accurate forecasts about at least some developments that really do matter. To be sure, in the big scheme of things, human foresight is puny, but it is nothing to sniff at when you live on that puny human scale.”¹⁵¹

This discussion has sampled only three approaches for peering into the future. Others exist. The “realistic utopias” of John Rawls, and the “imaginings” of Richard Rorty are not built around predetermined factors. Straying beyond the recognition of new possibilities, they flirt with the domain of the unimagined and unimaginable.¹⁵² Taking a different tack, the Decision Making Under Deep Uncertainty (DMDU) approach does not seek the optimal policy for a probabilistically knowable future. It relies instead on the simulation of thousands of possible worlds and tries to identify policies that are robust across a wide range of futures. Significantly, DMDU seeks to incorporate in meaningful deliberations the stakeholders who would be affected by these policies, eliciting the tacit knowledge they have about particular contexts. Experts and stakeholders jointly monitor the results of policies, thus limiting technocracy and emphasizing the integrity and agency of the communities that experts purport to serve.¹⁵³ Peering into the future by this or any other means is what we cannot help but attempt to do. The question is how to do so best.

In such attempts we cannot help but also peer into the past. “Historical sensibility,” writes Francis Gavin, “is less a method than a practice, a

¹⁴⁹ Jackson 2024: 24. ¹⁵⁰ Scoblic and Tetlock 2020: 16–18.

¹⁵¹ Tetlock and Gardner 2015: 249. ¹⁵² Hellmann 2020: 57.

¹⁵³ Avant *et al.* 2024: 178–79.

mental awareness, discernment, a responsiveness to the past and how it unfolded in our present world.”¹⁵⁴ In thinking about the future, the recognition of new possibilities is often impeded by what Galbraith, following Keynes, calls the “conventional wisdom.”¹⁵⁵ Studying the past can make us aware of otherwise unimagined possibilities. For every tomorrow has its own history. “Studying the past will not tell us what to choose, but at least it gives us more options.”¹⁵⁶ An always astute Keynes recognized that the long-run entailed the entanglement of the certainty of death with the uncertainties of limitless possibilities.¹⁵⁷ Beliefs about probability and possibility in both past and future are hidden companions in how analysts of world politics cope with the risk-uncertainty conundrum.¹⁵⁸ Interrogated from the perspectives of the present, the past is as open as the future. When planning ahead, it helps therefore to expect the unexpected.

5. Moral Luck, Policy, and Pragmatism

Moral luck is about the attribution of human intentionality in contingent circumstances. It points to the challenge of passing judgments under conditions of risk and uncertainty when the consequences of human action are unknown or unknowable. Policy encounters it repeatedly as it copes with the world in response to pressures it cannot escape from and opportunities it does not want to forego. Pragmatism relies for its compass on prudence and habituated actions and discursive practices that always remain open to interrogation and reformulation.¹⁵⁹ Searching for the big theory, social law, master cause, or killer method are for pragmatists futile exercises betraying a foolish hubris.

Moral Luck

How does the risk-uncertainty conundrum affect moral judgments of human action?¹⁶⁰ A few moral intuitions form the foundations upon which “complex moral worldviews are constructed.”¹⁶¹ And the risk-uncertainty conundrum affects those intuitions. Moral luck raises problems of human agency and circumstantial contingency. If we are to hold ourselves and others responsible as moral agents, we must be able to show that we and those we judge are intentional agents who cause the outcomes of their actions. It is choice not chance that matters. But since contingency

¹⁵⁴ Gavin 2016: 3. ¹⁵⁵ Suckert 2022. Galbraith 1998: 8. ¹⁵⁶ Harari 2015: 60.

¹⁵⁷ Eich 2024a: 1–2, 5, 139–76; 2025; 2024b. ¹⁵⁸ Gailmard 2014: 69–82.

¹⁵⁹ Barkin and Guzzini 2025.

¹⁶⁰ Williams 1993: 251; 1981. Nagel 2013. Latus 2019, 2024. ¹⁶¹ Tavernise 2021.

also shapes the consequences of human choice this is problematic. The paradox of moral luck rests on our holding incompatible views about the importance of conscience and consequence, that is, about the inward world of the actor and the outside world.

For Kant morality has nothing to do with luck understood as the contingency of circumstance.¹⁶² Morality is a matter of human will, which is good in itself.¹⁶³ Once human beings make a particular choice they can be judged morally, for the choice they have made is under their control. What matters morally is not the effects of action but the act of choosing that emanates from within an actor, in full accord with the self. All humans are capable of choosing. What happens after the act is immaterial for moral judgment. Kant assesses the morality of human choice because a universal standard guides all humans: everyone has the capacity to will, so everyone can be held to the same moral standard.¹⁶⁴ This is Kant's basis for grounding moral choice on principle. Consistency and purity of choice are all that matter. Kant's argument denies any space to moral luck – instances, that is, according to Andrew Latus, “where luck makes a moral difference.”¹⁶⁵ “To eliminate luck from human life,” writes philosopher Martha Nussbaum, puts “that life, or the most important things in it, under the control of the agent.”¹⁶⁶

Undeniably, however, there are many instances where it becomes difficult if not impossible to insist that morality is luck-free. The inner state of an individual and morality are not fully insulated from external consequences and the effect of the actions of others. This agrees with the intuitive idea that morality contains both Kant's purist idea and the view that circumstances matter.¹⁶⁷ The classic example is of two drunk drivers. Traveling along the same route, one hits a child on the way home, the other does not.¹⁶⁸ One ends up a killer, the other simply goes to bed. Neither chose to kill, but through happenstance one did. Did – and if so how – luck play a role in our moral assessment of each driver? Similarly, as Thomas Nagel notes, German citizens faced the quandary of joining or opposing the Nazi party in the 1930s and 1940s.¹⁶⁹ Had an SS officer been born to a farmer in Kansas instead of a shopkeeper in Munich, he might have gone on to live a perfectly normal and moral life. So, is he morally unlucky and the farmer's son from Kansas the morally lucky one? Given the randomness of birth and the impossibility of knowing counterfactually how people might respond under different conditions, how should we assess the context and contingency of birth?

¹⁶² Kant 1784 [1998]. ¹⁶³ Nagel 2013: 322; Nelkin 2023.

¹⁶⁴ Kant 1784 [1998]: 4, 394. ¹⁶⁵ Latus 2019: 105. ¹⁶⁶ Nussbaum 2001: 4.

¹⁶⁷ Williams 1981: 22. Nagel 2013: 326–28. ¹⁶⁸ Latus 2019: 105–06.

¹⁶⁹ Nagel 2013: 326.

There exist two different tracks to scrutinize Kant's approach. First, can human beings really undertake consistent, self-willing, rational justifications? This matter may not be as cut and dry as Kant argues. Second, under conditions of uncertainty what do context, process, and language do to the idea of a unified self in Kant's argument? Tracing all the external influences that make us who we are leaves a picture quite at odds with the self-willed, intentional, fully-in-control Kantian subject.

Justification rests in part on the success of human endeavor.¹⁷⁰ To a considerable degree the justifications of actions are dependent on what happens subsequently. As a result of the effects of the initial choice, the justifying subject at the beginning may later become a very different person. Luck may end up playing a significant role in what we often take to be straightforward deliberation.¹⁷¹ Bernard Williams uses the example of Gauguin to make this point. Gauguin leaves his family to become a famous painter. If he succeeds, Gauguin gives his great art to humankind, and we judge him on that basis. If he fails, Gauguin is an immoral deserter of those who needed him. Or he is both. But luck plays an important role in our judgment.¹⁷² Put differently, Gauguin decides, under conditions of uncertainty, what will happen and who he will become. This undermines conceptions of morality grounded solely on individual will and the unproblematic attribution of praise and blame. In a realistic conception of life and living, can moral judgment be restricted to insulate human beings from luck and uncertainty?¹⁷³ Do we not have to insist on a broader view that acknowledges uncertainty and is responsive to life's realities?¹⁷⁴

Human beings, Thomas Nagel holds, are shaped by external factors all of which guide our assessments of morality. There is really no conception left of the fully self-willed, choice-making subject that has a meaningful impact on the world.¹⁷⁵ We experience life as if we were autonomous agents in full control over our actions. Thus, we attribute similar control to others and assess them morally.¹⁷⁶ The result yields a paradox: we experience life as agents with control whereas our general assessment of the impact of context, luck, and uncertainty undermines that view of the self. For Nagel, this is an ineradicable part of human life, revealed by the problem of moral luck.¹⁷⁷

These are important philosophical issues. Donna Dickenson proposes narrowing the scope of examination to particular sites, in her case medical ethics. Practical ethics, she argues, might help us to better understand and

¹⁷⁰ Latus 2019: 106. ¹⁷¹ Williams 1981: 36, 38–39. Williams 1993: 251.

¹⁷² Williams 1981: 22–26; for discussion see also Latus 2019: 106–07.

¹⁷³ Williams 1981: 21. ¹⁷⁴ Williams 1981: 35–39. ¹⁷⁵ Nagel 2013: 328.

¹⁷⁶ Nagel 2013: 327. ¹⁷⁷ Nagel 2013: 324, 328. Latus 2019: 108–11.

perhaps resolve the moral luck paradox. She argues that Kant's insistence on the importance of an individual's choice is too small. In contrast, utilitarianism holds the moral agent responsible for too much, for actual and potential outcomes.¹⁷⁸ In Martha Nussbaum's words, at stake in questions of moral luck is the "thorough intermingling of what is ours and what belongs to the world, of ambition and vulnerability, of making and being made, that are present in this and any human life."¹⁷⁹ The risk-uncertainty conundrum pushes us to engage problems of moral luck. Reducing large world uncertainty to small world risk, Newtonians typically bypass this moral dimension of politics. Acutely aware of the full registers of unpredictability, humanists do not. This illustrates once more the incoherence and richness of Newtonian humanism.

Policy

How does politics unfold in an uncertain world? How, for example, do small and vulnerable states navigate unfathomable uncertainties and great vulnerabilities? Aesop offers an answer. They live out the fable of the frog, the snake, and the owl. Afraid of being devoured by the snake, the frog asks the owl "what should I do?" The owl replies cryptically "learn how to fly!" And this is what the frog did. Small states do not soar like eagles. Instead like frogs they cultivate their capacity to jump. Appearing to land on their stomachs, they in fact land on their feet. Thus, they retain the ability to jump again and again, changing their course as they make their way. "In a world of great uncertainty and high-risk choices, this is an intelligent response. Frogs can escape snakes ... not because they have found a solution to the problem of change but because they have found a way to live with change."¹⁸⁰

Some ways of learning about, navigating in, and coping with the world are more practical than others. Living forward, we understand backwards. In a world of risk and uncertainty the two kinds of knowledge serve different purposes. Managing risk relies on "hard" tools, coping with uncertainty on "soft" ones.¹⁸¹ The first does not translate easily into the second. Although they are not necessarily antithetical, "driving with the rearview mirror" is a fool's errand.¹⁸² Remaining attuned to both, it is left to the owl's practical wisdom (*phronesis*) to assist in conveying and coping with "informed uncertainty effectively."¹⁸³

¹⁷⁸ Dickenson 2003: 1–64. ¹⁷⁹ Nussbaum 2001: 5. Fahlquist 2019: 8–16, 75–84.

¹⁸⁰ Katzenstein 1985: 211. ¹⁸¹ Sachs 2023: 539, 543. ¹⁸² Wendt 2001: 1022.

¹⁸³ Barma and Goldgeier 2022: 1773. DeMartino 2022: 74.

Taking a leaf from the military, many students of international relations and foreign policy embrace the notion of grand strategy. They prefer soaring like eagles to hopping like frogs. But meeting large world uncertainties in a Napoleonic manner is a losing cause, and not only in Tolstoy's novel. As the US was facing a sea of novel and unfathomable uncertainties at the end of the Cold War, George Kennan, elder key official and revered author of that war's containment doctrine, was unconvinced that a grand strategy was either needed or helpful. He argued that a complex world cannot be mastered with one grand design. "Discard this traditional American fondness for trying to solve problems by putting them into broad categories" he admonished.¹⁸⁴ The fondness for grand and tidy theories is not only American. Bringing nothing but death, destruction, and an ocean of tears, Germany and China, too, have pursued their "Final Solution" and their "Great Leap Forward."

In a classical article on public policy, Charles Lindblom makes the case for creative improvisation, what he called the science of "muddling through."¹⁸⁵ Small-scale problems are simple and can be solved mechanically, choosing the means that best satisfy ends that have been clarified and ranked. Complex problems require a different decision calculus. Decision makers expect to meet their often inchoate goals only partially and do not separate means from ends as they make their choices. Limited comparisons among options, what Herbert Simon called satisficing, rather than rational-comprehensive planning define the science of muddling through. Improvisation creates policies and practices that are both relevant and realistic. And it includes the art of sitting still, of not choosing among existing options, and of delaying choice to wait for additional information as situations evolve, as was true of President Kennedy in 1962. A former co-chair of Goldman Sachs and Secretary of the Treasury in the Clinton administration, Robert Rubin, ended many of his meetings with his favorite line: "so we don't have to make a decision on this today, do we?"¹⁸⁶ For Rubin luck and smarts were both indispensable in a complex and uncertain world. He made his way aware of the probabilities of white and black swans he could cope with and hopeful patience in the face of contingencies he could not control.¹⁸⁷

Uncertainty can be paralyzing and prevent necessary policy action. But it can also stop us from running on auto-pilot and force us to take a second look.¹⁸⁸ Policy makers have often pointed to "the unknowability of political possibilities" as the reason for not trying to achieve ambitious goals.¹⁸⁹ But the spaciousness of uncertainty can create room for trying new things. In

¹⁸⁴ Kennan 1994. ¹⁸⁵ Lindblom 1959. ¹⁸⁶ Weisberg 1998.

¹⁸⁷ Rubin, Robert 2023: 1–50, 281. ¹⁸⁸ Jackson 2024. ¹⁸⁹ Hirschman 1991.

different contexts muddling through can give way to pushing for wildly ambitious policies and practices. Suddenly “possibilities” replace “impossibilities.” In response to the outbreak of a global pandemic in the spring of 2020, many states took drastic steps that would have been unthinkable in normal times and that had eluded them on other burning issues, such as nuclear disarmament and global warming.¹⁹⁰ Structural obstacles and adversarial forces melted away. Existential challenges, as the pandemic illustrated, can open up political possibilities. Governments, movements, and non-governmental actors may not be able to “power over” (understood as actual capability) obstacles. But spurred by imagination they may be sufficiently empowered to “power to” or “power with” (understood as the capacity to actualize potentialities with or without others) to navigate the world.¹⁹¹ Hope embraces the unknown and unknowable. It sees openings in complexity and uncertainty. Often it does its work underground, not in the glare and glitz of center stage.¹⁹² Its transformative power is protean. It lingers around the edges until it breaks through, unpredictably, transforming politics.

As in the natural world, so in the political: contingency and complexity are pervasive.¹⁹³ The context processes and discourses defining the pathways to desired outcomes all matter. Tracking different pathways can open up unforeseen potentialities. The large world of uncertainty remains too obscure to identify shifts in any or all of them with any degree of precision. Focusing on the present rather than getting lost in the distant future and identifying some of the contingencies that could shape that future are reasonable alternatives.¹⁹⁴ Bridging the gap between scientific research on world politics and the world of policy thus has become more urgent and common.¹⁹⁵ For example, scholars have tried to learn some of the lessons of the Vietnam war in the 1960s. Then, Thomas Schelling’s work on compellence helped shape the unsuccessful, “horrific U.S. strategic bombing campaign,” and Walt Rostow “took his models of economic development” directly into the Johnson administration.¹⁹⁶ Scholars bridging the gap are reminded today to balance more thoughtfully and navigate more carefully among the four I’s of policy advice: influence, interlocutors, integrity, and inclusion.¹⁹⁷

¹⁹⁰ Pelopidas and Verschuren 2023: 6.

¹⁹¹ Pansardi 2011. Göhler 2009. Slaughter 2017: 161–82. ¹⁹² Solnit 2016.

¹⁹³ Cartwright 2019: 57–76. Barma and Goldgeier 2022.

¹⁹⁴ Dienstag 2009: 172. Bernstein *et al.* 2000: 53.

¹⁹⁵ Avant *et al.* 2024. Tama *et al.* 2023. Barma and Goldgeier 2022. Jentleson and Ratner 2013. Jentleson 2011.

¹⁹⁶ Barma and Goldgeier 2022: 3. ¹⁹⁷ Barma and Goldgeier 2022: 4–12.

In the small world of risk, the more we know, the less we think we don't know. In the large world of uncertainty, the more we know the less we know as we become aware of new frontiers of unexplored knowledge. When advisors mistake the large world of uncertainty for the small world of risk, the unintended or unanticipated consequences of well-intentioned advice can cause gratuitous harm. Accepting uncertainty instills instead a healthy measure of humility. It moves policy toward continuous engagement with stakeholders to elicit the tacit, contextual knowledge they possess. And, following the advice of economist Edward Leamer, it pushes back against the announcement of unassailable truths and encourages instead the construction of plausible stories that help us meet the future well. For Leamer, speaking of "theory and evidence" risks drawing too tight a connection between both to the point of tempting us to claim that the evidence proves a theory. Thus, it could connote inaccurately an incessant march toward unobtainable levels of certitude. He favors instead honesty about the unavoidable limits of expert knowledge and pleads for the courage to let go of "the intoxicating presumption of knowing the unknowable and controlling the uncontrollable."¹⁹⁸

Pragmatism

This book has focused on the risk-uncertainty conundrum, world-views, theories, models, and methods.¹⁹⁹ Reducing or enlarging metaphorical worlds from large to small or small to large can be justified by pointing to the relative homogeneity or heterogeneity of contexts, the invariance or variability of processes as well as the representative and re-presentative forms of linguistic and discursive practices. The book has also explored financial, nuclear, and environmental crisis politics and the nature of political power. Eclecticism, acceptance of the provisional nature of all knowledge, and belief in the creativity of human action in a world whose future is often not known give my arguments pragmatist sensibilities.

Charles Sanders Peirce's "pragmaticism," William James's "empiricism" and "pluralism," and John Dewey's "experimentalism" and "instrumentalism" have provided the foundations for pragmatist theory. To them pragmatism did not mean, as it does today, mere expediency. For pragmatists, theories are provisional and fallible answers for dealing with the world. Pragmatism offers a unifying theory of human thought

¹⁹⁸ Avant *et al.* 2024: 178, 180.

¹⁹⁹ I thank Cheryl Misak for her repeated, careful readings of various drafts and her diplomatic way of nudging me to a better understanding of pragmatism.

and action.²⁰⁰ It takes practice as the starting point. Enlarging the Cartesian imperative of thought leading to action, Peirce insisted that action can also lead to thought. Our actions tell us who we are and what we want. Sooner or later habituated action and thought are challenged and revised in newly arising, problematic situations that require creative adaptation. Belief and habit thus are rules of action that are perpetually revoked and rethought under changing conditions.

The more recent extension of pragmatist thought by Richard Rorty, Donald Davidson, and Robert Brandom has underlined both the dependence of all observations on language and the importance of worldviews for our deepest convictions. Individual beliefs and wishes are deeply embedded in worldviews, a web of mutually reinforcing, self-altering practical beliefs. It is difficult to break these beliefs into discrete parts. Understood as tacit knowledge, worldviews thus channel scientific experience as they do all other experiences. But the world does not force us to choose any specific language. That is our choice, constrained by the facts the world throws at us.

Language and discourse delimit the world we observe. Cause and effect do not exist as ontological givens. They are more or less useful conceptualizations validated not by making us feel comfortable but by helping us get around the world successfully. Knowledge is discovered and invented. The world does not present itself in discrete parts called facts. Many things that exist in the natural world are the effects of causes that do not depend on human mental states. This is the domain of the natural sciences. But many things that exist in the social world are the effects of human intentions and actions. The world will tell us whether we have carved it well or not. And that includes the description of cause and effect relations in the political world. If we program ourselves in a particular language, we may impute cause and effect only to the world. Theories understood as stories, metaphors, and the generative power of language more generally all aim at offering persuasive descriptions of the world. Different vocabularies are not only more or less accurate media for copying the world but also more or less useful tools for navigating it. We thus need to thread the pragmatist needle between positivism's misguided insistence that science is special in providing an accurate mirror of the world and relativism's wrong-headed assertion that we can just make up the world led by our imagination.

²⁰⁰ I am basing this discussion on Hellmann's far-reaching, well-sourced and trenchant discussion (2022: 4–11) and *International Studies Review* 2021.

What does pragmatism tell us about the practice of social science?²⁰¹ It offers a critique of positivism without surrendering to relativism.²⁰² It is impartial among different kinds of theory. It accepts the dynamism of social processes that are defining and redefining human choices. It focuses attention on how the material and ideal interests of actors are constituted, how these interests relate to cognitive dispositions and emotions, how they are integrated into institutional and social environments, how all of these are grounded in and shaped by overarching worldviews, and what all of this entails for coping with risks and uncertainties.²⁰³ Pragmatism is interested in the consequences of different truth claims. It encourages continuous engagement with the world and the building of shifting consensus. It embraces piecemeal and provisional knowledge about the world. Where it is useful to focus on metaphorically speaking small worlds and risk, we should rely on positivist methods. But we should never forget that the actors we study typically face the risk-uncertainty conundrum and normally are not rational; that the world is not stationary and is marked by many endogenous changes and frequent exogenous shocks; that some of our assumptions are articles of faith embedded in the worldviews informing our theories and models; and that the uncertainties that inhere in nature and politics require us to cultivate our sense of humility more than our ambition of intellectual mastery.²⁰⁴

And what does pragmatism tell us about practice and policy? In the words of philosopher John Kaag, it seeks to “clip the wings of abstract concepts in order to ground philosophy in the particularities of everyday life.”²⁰⁵ It champions consensus through competition in beliefs about how to meet the future well rather than seeking correspondence with an external reality. And it addresses problems that are relevant for human betterment. It carries knowledge from one situation to the next, ready to reformulate or augment it as a new problematic situation may require. It supports conversations especially when it bridges the gap between practical difficulties and inherent possibilities. In short, it favors “the experimental redeployment of pieces of knowledge in light of new experiences and changing situations.”²⁰⁶ Its aim is to develop rules for our forward-looking conduct in the world rather than to create a catalogue of

²⁰¹ In my discussion of pragmatism I have relied heavily on Cheryl Misak’s (2013, 2016, 2020) rich account of the history of pragmatism, Robert Brandom’s (2011) intellectual history *cum* political theory, Emanuel Adler’s and Vincent Pouliot’s (2011) extensive introduction of the practice turn to the field of world politics, Fritz Kratochwil’s (2018) profound treatment of praxis with a follow-on discussion of his book by Hellmann and Steffek (2023), and Emanuel Adler’s (2019) different but often complementary discussion of world ordering. See also Lechner and Frost 2018.

²⁰² Marks 2018: 217–18. ²⁰³ Haas and Haas 2009. ²⁰⁴ Bernstein *et al.* 2000: 45.

²⁰⁵ Kaag 2009: 70. ²⁰⁶ Sil 2020: 440.

mechanisms, supported by experiments, that has no discernible bearing on how we should conduct ourselves. In the words of Bentley Allan, pragmatism offers an “agile base for an experimental approach to politics.”²⁰⁷ This stance helps in orienting us to the uncertainties of the world, juggling configurations of different causal factors, and locating points of possible engagement with the world of policy and practice. “By mapping the complexity of social worlds within legible frameworks, we can provide a flexible starting point for understanding and action without the dream of control.”²⁰⁸ In short, pragmatism accepts the risk-uncertainty conundrum without indulging in fantasies of conquest or coddling prospects of surrender.

In social science and in policy, pragmatist sensibilities include an orientation toward the public, active engagement with actual problems that need to be solved; the making of practical knowledge displayed by showing that one knows one’s way around the world; a dialogical inclination for encounters with other perspectives; sense making through providing for narratives of how the world hangs together; learning from backward-looking experience and forward-looking imagination; an inclination to bridge divides between various dichotomies (such as nomothetic and ideographic analyses, explanation and understanding, positivism and reflectivism, problem solving and critical theory, means and ends); a disposition to focus on timeliness that eschews claims to timeless validity; experimentation; ready acceptance of the incompleteness of all knowledge; and the embedding of moral values and commitments in thought-inducing action.²⁰⁹ This distillation of pragmatist sensibilities points to a flexible disposition in engaging the world of practice and policy and – spurred by sitting on the knife’s sharp edge – a dogged insistence to re-examine habitual intellectual preferences.

World politics has its police officers and fire fighters.²¹⁰ Police officers are optimists. They want to create order. For them the world is completely knowable. Its events and course can be controlled. Fire fighters are pessimists. They want to contain disasters. For them the world is not completely knowable. Its events and course defy mastery. For fire fighters the promise of a better future does not justify excessive harm in the present. Fire fighters are pragmatic. Camus was a fire fighter when he wrote “he who dedicates himself to ... history dedicates himself to

²⁰⁷ Allan 2022: 247. ²⁰⁸ Allan 2022: 247–48.

²⁰⁹ This characterization of pragmatist sensibilities is based on the material presented in Bauer and Brighi 2009, Sil 2009, Pratt *et al.* 2021, Haas and Haas 2002, 2009, Kivinen and Piironen 2018, Hellmann *et al.* 2003, Hellmann 2020, Grimm and Hellmann 2019, Reus-Smit 2013: 601–06, Sil and Katzenstein 2010a: 43–48.

²¹⁰ Dienstag 2009: 170–72.

nothing, and, in turn, is nothing. But he who dedicates himself to the duration of his life, to the house he builds, to the dignity of mankind, dedicates himself to the earth ... and sustains the world again and again.”²¹¹

6. Uncertainty in Religion and Science

An apocryphal story about the psychologist Raymond Cattell, who advanced a statistical method, factor analysis, speaks to the relation between science and religion. Asked by his students whether one could apply the method of extracting underlying factors from a matrix of variables to the matrix of factors, thus simplifying the analysis down to the last factor, he answered in the affirmative. And when this procedure was done until only one factor was left, what would that factor be called? Cattell answered without hesitation: “the G-Factor.” Why would it be called the G-Factor, the inquisitive students asked. And Professor Cattell answered with a smile: “G stands for God.” Like eclecticism and experimentalism, punditry, scenarios, forecasts, and pragmatism, science and religion are instances of us living in multiple realities – examples of the profound human capacity for meaning making.²¹²

I started this book with Dilthey’s and Weber’s concept of worldview that has had no discernible effect on discussions of world politics. Dilthey focused on philosophy, the arts, and history, Weber on religion. Weber’s concept of rationalization was not fully attuned to the fact that humans can live in multiple realities. The most important one is the ordinary, taken-for-granted reality of daily life. It seems unquestionably natural, with its coordinates of time and space. Practical interests rule that reality. However, we do not spend all of our time in that reality.²¹³ Sleeping and dreaming, for example, operate in different dimensions that can contradict the logic of daily life. So do other human activities: watching a movie or a play, gazing at a piece of art, reading, listening to music or stories, and playing games. All of these divert us from daily life and suspend or alter its rules.

Science and religion belong to those other realities. Both have developed variegated practices and different ways of knowing. Neither takes the appearance of daily life for granted. Both inquire into the possibility that the world may be different than it appears. Religious and scientific practices are rooted in the world of imagination that can reflect back on our daily life and thus shape it.²¹⁴ Scientific and religious journeys always encounter still another bend in the river promising new vistas – old ideas

²¹¹ Camus 1991: 301–02. ²¹² Fierke 2022. ²¹³ Bellah 2011: 2.

²¹⁴ Bellah 2011: 112–14.

thought anew or new ideas no one has thought before. These ideas are consequential, the source of bloody wars and lasting conflicts. With salvation in the afterlife as the ultimate prize, how could it be otherwise for religious communities? And in the sciences and humanities, the “culture wars” between supporters of naturalistic explanations of causes and adherents of humanistic interpretations of meanings have been prolonged and intense. Deeply shared by religious and scientific communities is imperfection – imperfection in faith and imperfection in knowledge. Imperfection generates an unending human striving for better and for more.

Imperfection and striving create connections across what many believe to be an unbridgeable chasm separating science from religion. The Galileo Commission warns against mistaking the inclusive practice of science with scientism as an exclusive worldview.²¹⁵ As an open-ended practice in an open world, despite its amazing progress across the last four centuries, science does not have to be grounded in a naturalist metaphysics, materialist ontology, and reductionist-empiricist methodology. It can entertain the possibility of other foundations that would permit matter and mind to exist as co-evolving, irreducible aspects of reality. The Cartesian cut between conscious events existing “inside” our brains and material events “out there” breaks the underlying unity of the world that science seeks to capture. In its quest science sets demanding standards for evidence. The astonishing advances that brain sciences have made in recent years led Edward O. Wilson to conclude almost two decades ago that in the brain “no particular site remains that can reasonably be supposed to harbor a nonphysical mind.”²¹⁶ In a materialist way of thinking, the burden of proof rests with dissenters citing contrary episodic evidence based on personal experience of miracles and revelations. Or does the burden rest with materialist arguments? Quantum physics after all has come to the conclusion that probabilities collapse into reality only when a conscious mind exists to measure and observe, shaping conceptions of time and space and everything else in the cosmos.²¹⁷ Wilson would be the first to admit to shifting burdens of proof. The scientific quest does not operate like a fundamentalist religion. It is open-ended and ecumenical.

Both science and religion seek to understand experience.²¹⁸ And both are grounded in unprovable background assumptions. This is self-evident for faith-based religions. As for science, Gödel, I am told, proved

²¹⁵ Galileo Commission 2019: 4, 6, 28. ²¹⁶ Wilson 1998: 108.

²¹⁷ Klavan 2024. Fierke 2022. Grove 2022a. Douthat 2024b.

²¹⁸ Galileo Commission 2019: 13, 19. Fierke 2022.

mathematically that it is impossible to construct any system that can prove its own foundations. Left unattended, scientific background assumptions risk becoming articles of faith. In the analysis of world politics and several other social sciences, Newtonianism is a good example. Voltaire saw Newtonian science as an explanatory model that was about to replace religion.²¹⁹ He missed that science, despite its usefulness, is, like religion, based on the bedrock of unprovable belief. Science has no particular faith or creed. It entertains all possibilities, shifting the burden of proof to one side or the other, depending on the weight of existing evidence. Is consciousness an epiphenomenon, a complex emergent phenomenon of neuronal functioning, or an independent factor that is indelibly fused with life's physical substratum? There is no obvious answer to this question. But future strivings and more and better knowledge will help – that is the promise and hope of scientists like Wilson. There is nothing to preclude the possibility that, subject to conventional scientific methods of testing, experiences gained through contemplative training and meditative methods could contribute to the evolution of a biologically based consciousness. In the name of mindfulness such an eventuality would change both science *and* religion.²²⁰

Edward Wilson believes that mind is reducible to matter, Max Planck that mind is matter's irreducible matrix.²²¹ Such strong disagreements convinced Erwin Schrödinger, another leading physicist of the twentieth century, that the border separating science from religion is fleeting.²²² The history of the modern era is not only a story of rupture, of the displacement of one worldview by another. It is also a story of continuity as theology has retained an important influence in the era of science.²²³ The hidden origins of modernity precede the Enlightenment. They can be found in the metaphysical and theological struggles that ended the medieval world.²²⁴ What mattered were questions about the nature of God and the nature of being rather than the subsequent story of human control over nature. At its inception modern science neither opposed nor displaced religion. Unwittingly, science thus became an extension of earlier theological debates. And this, Gillespie argues, has created a concealed theology of philosophical disagreements that has stretched into the present. God does not disappear. God-like attributes and capacities are transferred to nature and humans. In the shift from divine to natural law, disenchantment thus merges with re-enchantment.²²⁵

²¹⁹ Galileo Commission 2019: 43. ²²⁰ Galileo Commission 2019: 86.

²²¹ Wilson 1998: 105–35. Galileo Commission 2019: 90. ²²² Burgess 2018.

²²³ Bain 2020. ²²⁴ Gillespie 2008: 12, 14. ²²⁵ McClure 2010.

Religious worldviews remain deeply embedded in contemporary world politics in other ways.²²⁶ They provide a hidden script about order in anarchy that lies at the center of realist theories of international relations.²²⁷ As the founder of modern political science, Hobbes offers a “worldly application of a theological pattern.”²²⁸ Existing in the state of nature, humans are believers in God and acknowledge their obligations under God’s law. These are real obligations rooted in real law, made and enforced by humans on the basis of and legitimized by their worldviews. Just as God created the universe, so humans can create the commonwealth and an international order with an imagined sovereign. In Bain’s reading, Hobbes is thus a theorist of interstate society rather than of international anarchy.²²⁹ If this is plausible, then contemporary realist theories of order are not strictly modern or secular. Nominalist theology remains embedded in modernist conceptions of sovereignty as either immanent and necessary or imposed and contingent order.²³⁰ In this view, religion lives on in the era of secular science and the study of world politics. “The core constituents of the Judeo-Christian world-view have traveled in a multiplicity of forms to make up the dominant ‘secular’ cosmology characteristic of much of ‘western thinking’ and ‘science’ today ... the theological origin of the search for order, in our everyday discourse and indeed in science, is important to recognize.”²³¹ Reasoning from God or Nature we postulate a first cause of the universe. While Europe traveled on the “internal” road of secularization without religious pluralization, the “external” imperialist and colonial road of inter-cultural and interreligious encounters has produced a global system of religious pluralism.²³² Today, the connections between religious and secular cosmologies are typically implicit, often contradictory, and always consequential.²³³

Asian international relations theories are similarly inflected by religion.²³⁴ Confucianism permeates Yan’s moral realism, Qin’s cultural relationalism, and Zhao’s *tianxia* (world order) philosophy. Indeed, Mahāyāna Buddhism instructs that autonomous and independent subjectivity of the kind informing realist or liberal theories of international relations is an illusion. The healing of divided worlds emanates not from essentialized subjectivities but from relational engagements. Buddhism, Confucianism, and Daoism do not believe in the segregation of binary oppositions. Object is subject. We are others. Individuals are urged to transcend the strict separation of one from the other by denying the existence of exclusive and autonomous subjectivity. Since the world is

²²⁶ Byrnes 2022. ²²⁷ Bain 2020. ²²⁸ Mitchell 1993: 78. Bain 2015.

²²⁹ Bain 2020: 130–31. ²³⁰ Bain 2020: 9–10. Gillespie 2008.

²³¹ Kurki 2020: 26–27. ²³² Casanova 2019.

²³³ Kurki 2020: 39–40, 67–68, 79–80. Kragh 2004: 12, 51. ²³⁴ Fierke 2022.

always in flux there is no enduring subjectivity. Impermanence is a close cousin of life's uncertainties. Shimizu and Noro argue that Mahāyāna Buddhism relativizes subjectivity even further than other forms of relationalist discourses and theorizing such as the *yin/yang* dialectics of Daoism and Confucianism.²³⁵ This insistence on life as motion and unceasing change is not a trait specific to Asian religion. Henri Bergson (life as flow), William James (human consciousness as a flowing stream), and Alfred Whitehead (life as flux) have made similar arguments. And it resonates with the reinvention of the sacred as a new scientific worldview in which God as the generator of life is akin to the reverence-instilling creativity of the natural and social universe itself.²³⁶

People are drawn to science or religion, and sometimes to both at the same time, as they seek to navigate the uncertainties of their lives. But as Mark Lilla argues, humankind is ill equipped to deal with uncertainty. We are an impatient lot, and we demand that god, science, or both satisfy our craving for knowledge about the future. We are not content when told that some kinds of knowledge are unobtainable. Instead, we are drawn to those who promise more than they can deliver. Priestesses then and pundits now eagerly provide their apparently inexhaustible supply of unobtainable knowledge to an eager audience. We have a hard time acknowledging uncertainty because it makes us aware of our vulnerability. We want to be on a power walk into the future “when in fact we are always just tapping our canes on the pavement in the fog.”²³⁷

As in religion, so in science the yearning for an ordered and rational cosmos and life without uncertainty is very strong. Moving in a fear- and anxiety-inducing fog, science and numbers acquire a semi-magical power. Even though we are their creators, we put an extraordinary faith in them as modern oracles of truth. “Numbers acquire their power the same way the gods acquire theirs – humans invest them with virtues they want their rulers to have ... Our numbers, like our gods, promise to govern us well ... We count to learn what’s happening in our world and to gain control over our lives.”²³⁸ According to American writer Phil Klay, confronted with uncertainty

science is a quintessentially human method of trying to control that chaos ... Adrift in the world, uncertain of the future, hostage to fate, but possessed of increasingly powerful tools for carving up pieces of the world and putting them under the microscope, is it any wonder that we increasingly turn to science when

²³⁵ Shimizu and Noro 2021: 4–5. Shimizu and Noro 2023.

²³⁶ Kauffman 2008: xi, 283. ²³⁷ Lilla 2020.

²³⁸ Stone 2020: 100–01, 178. Merry 2016. Spiegelhalter 2019.

looking for deliverance from our human predicaments? ... We want the comfort of certainty.²³⁹

To many religion offers that comfort as they search for the meaning of being a very small part of a very large whole.²⁴⁰ Like science, religion is a way of “being in” the world. “If a relational cosmology is grounded in faith or in the pursuit of what is ‘really real,’” writes Timothy Byrnes, “then the unknown itself is the basis of Truth and the human propensity to resistance is ultimately futile. We are, some religious worldviews might suggest, in the act of ‘becoming’ through our relationships not only with each other, but also with that which we cannot measure, define or know.”²⁴¹ In contrast to non-dogmatic religions like Buddhism and Hinduism, which tolerate the uncertainties and foibles of divine personages, fundamentalist political projects of doctrinal religions wish to create predictable order. Cosmological uncertainty unleashes a yearning for clarity and the comforts of the promise of eternal life. But even dogmatic Catholicism, Byrnes argues, invites believers to more than conformity and oppression resting on unshakable ontological certainty.²⁴² Communion with God requires acts of courageous faith. And “faith,” as Block says in Bergman’s *Seventh Seal*, “is a torment. It is like loving someone who is out there in the darkness but never appears, no matter how loudly you call.”²⁴³ “Confronted with the inexplicable problem of suffering and in a state of profound unknowing,” Byrnes suggests, believers turn to Jesus “in a search for meaning within uncertainty and suffering. In this context then faith is the acceptance of uncertainty, not a search for comforting explanations that will dispel it.”²⁴⁴ In the end, all religions require “the life-defining act of leaping, faithfully, into the unknown.”²⁴⁵

As their followers grapple with uncertainty, Charles Taylor sees secularization as furthering both science and religion. People cannot live without a sense of the immanent and the possibility of transcendence.²⁴⁶ In science and religion a meaningful life can be had by all. Believers and non-believers alike strive to lead a morally demanding life. Instead of fitting into a slotted place in the cosmos, everyone is called to construct a good life through personal development and choice. Believers believe while doubting. And non-believers are not indifferent to the transcendental. The outcome is not a clash between atheism and religious devotion. Instead, science and religion accommodate each other and, together, feed a spiritual pluralism to cope with uncertainty. In Taylor’s terms, we

²³⁹ Klay 2020: 10. ²⁴⁰ Ossio 1997: 549. ²⁴¹ Byrnes 2022: 262.

²⁴² Byrnes 2022: 261–62. ²⁴³ *The Economist* 2020: 68.

²⁴⁴ Email correspondence with Byrnes, 04/12/20. ²⁴⁵ Byrnes 2022: 262.

²⁴⁶ Taylor 2007. Brooks 2013.

should avoid conceiving of religion and science in the singular, each as an overarching, coherent worldview. Instead, their various elements are loosely coupled and circulate in scientific, religious, philosophical, social, and political discourses and practices. They provide the raw material for actors who try to construct more or less compelling and more or less contested religious and scientific narratives that place humanity in the world. We can engage these narratives as we clutch the categorical assertion of a universally valid truth. Or we can seize the opportunity and subject ourselves to the requirements of “warranted assertability,” which can never reach a state of certainty, by relevant and often ill-defined communities of practice. Entering a “different world of definitions and procedures,” we learn anew as we chance the disruption of earlier certainty.²⁴⁷

John Dewey’s *Quest for Certainty* delivered a full broadside against the search for certainty in fixed, intrinsically stable realms of knowledge.²⁴⁸ Reflective knowledge is based on the test of actual human experience. Uncertainty is for the most part a practical matter that cannot be eliminated. It has its bad disruptive sides, of course, but also its good, hopeful ones. Learning and improving human practice instills a welcome measure of stability into an uncertain world. We hedge our lives with the soothing comforts of our everyday habits. That comfort is a necessary, contrived condition of being in an uncertain world. For better and for worse, our habits become us as we navigate the uncertain vicissitudes of life. They can enable and empower us; and they can disable and stifle us. It is not only habits. All truth claims are part of changing language games. Changing the game leads to changes in the conceptual landscape and the discarding of old and the discovery of new truths. But truth is one; people call it by different names.²⁴⁹

Theoretical biologist and complex systems theorist Stuart Kauffman holds in reverential awe the uncertainties of the web of life and history. Remaining partly lawless, the world tumbles forward without breaking any laws of physics. This is one way of identifying God. It is “our chosen name for the ceaseless creativity in the natural universe, biosphere, and human cultures ... we typically do not and cannot know what will happen. We live our lives forward, as Kierkegaard said. We live as if we knew, as Nietzsche said.”²⁵⁰ And if *fortuna* smiles on us, we live our lives with grace, faith, and courage, moving forward into mystery. This worldview accommodates

²⁴⁷ Jackson 2015: 16–17.

²⁴⁸ Dewey 1929: 36, 50, 70, 213, 278, 281, 292. Keane 2021: 4–5.

²⁴⁹ Fierke 2022: 3, 53 quoting the Rig Veda. ²⁵⁰ Kauffman 2008: xi.

both compelling and inadequate reason. Uncertainty is not a problem to be solved but a condition to be experienced and coped with.²⁵¹

In today's conventional understanding, religion is about beliefs while science is about facts. But the border between these domains, as well as philosophy, which has put searching questions to both, is porous and, in the case of quantum physicist Schrödinger, best captured by the concept of worldview.²⁵² Werner Heisenberg, too, was less than definitive about the separation between religion and science: "In science ... a certain statement could be simply right and another statement wrong ... It is decided by nature, or if you prefer by God."²⁵³ The human encounter with the code of the cosmos does not render scientific worldviews implacably opposed to religious ones. Both are more or less successful attempts to stabilize and imbue with meaning a world filled with gut-wrenching uncertainties. Niels Bohr appears not to have cared one way or the other. According to a possibly apocryphal story told by Elaine Pagels, a colleague visiting him in Denmark was taken aback by a horseshoe nailed over Bohr's barn door. He asked assertively that surely Bohr did not believe such stuff. Bohr's answer was telling: "Of course not! But it works whether you believe in it or not."²⁵⁴

In this book I have argued that the complementarity of risk and uncertainty operates in an entangled world. Developed in the nineteenth century, Newtonian humanism is the sweet common sense which invisibly shapes the risk-inflected theories, models, and methods we rely on to describe and explain the political world and world politics. The evolution of the sciences during the twentieth century has generated post-Newtonianism and parahumanism as alternatives that are more open to acknowledging uncertainty's part in the conundrum we face. My stories of specific domains, the politics of finance, nuclear crisis, and global warming, show how closely uncertainty and risk are tethered together. And so are, in general, control and protean power. Neglecting uncertainty is neither smart nor wise. It impairs convincing analysis and encourages foolish policies.

I hope I have told my story well. If I have succeeded, and also if I have not, after so many tales about the risk-uncertainty conundrum in small and large worlds, like Winnie the Pooh this story-teller is left sitting in his chair, thinking Great Thoughts to himself about Nothing, closes his eyes and nods off.²⁵⁵

²⁵¹ Jackson 2024. ²⁵² Schrödinger 1985. Burgess 2018. Wilber 1984. Smetham 2010.

²⁵³ Quoted in Pagels 1982: 74. ²⁵⁴ Pagels 2019: 13. ²⁵⁵ Milne 1928: ix–x.

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Index

- Abbott, Andrew, 273, 330–31
Able Archer (NATO exercise), 216–17
Abolafia, Mitchel, 165–66
accounting, financial, 157–58, 313
Acheson, Dean, 221
actor-network theory, 96–97
adaptation
 and global warming. *See* [mitigation and adaptation](#)
Aesop, 343
affirmation, and power, 286
Africa, uranium mining, 198
Akerlof, George, 147
Alaska, 254
Albee, Edward, 91
Algeria, 215
algorithms, 225, 260, 264
 see also [predictive large language models \(LLMs\)](#)
Allan, Bentley, 229, 231, 349
Allison, Graham, 179, 193–94, 195
Altman, Roger, 272
Altman, Sam, 258
Amazon, 225
ambiguity, tolerance of, 21
analytic confidence, 56
 see also [Friedman, Jeffrey](#)
ancient Rome, 254
Anderson, Robert, 196–97
Andropov, Yuri, 217
Antarctica, 236–37
Anthropocene, 12, 228, 246–55
anthropocentrism, 47–48, 90, 98–99, 263
antifragility, 230–31
Arab Spring, 68, 295
arbitrage (risk-free trading), 11, 160, 313
Arctic icecap, 237
Arendt, Hannah, 29
Arfi, Badredine, 68
Aristotle, 73–74, 304–5
Arkhipov, Vasili, 192–93
arms control, 288
Artificial General Intelligence (AGI), 261–63
Artificial Intelligence (AI), 88–89, 222–23, 224–26
 and consciousness, 261–65
 and language, 265–69
 and LLMs, 12
 and p(doom), 103
 and technospheres, 255–61
Asia, economic rise of, 255
Asian international relations theories, and religion, 353–54
assemblages of objects/humans, 200–1
astro-biology, 248
Australia, 233, 238–39
Avant, Deborah, 19
Axelrod, Robert, 282
Bain, William, 353
Bakewell, Sarah, 26
banking
 bailouts, 171, 172
 finance theory and economic stories in, 11
 see also [central banks](#); [investment banking](#); [securitization, as convention](#); [Wall Street](#)
Barad, Karen, 8, 13–15, 303–4
bargaining model of war, 209–14
baseball, 13
Baudrillard, Jean, 59
Bayes, Thomas, 56–57
 see also [Bayesian models](#)
Bayesian models, 55–56, 57
Beamish, Thomas, 149
Beck, Ulrich, 17, 286–87
Becker, Gary, 49
Beckert, Jens, 109
Beckett, Samuel, 329
bees, 263
behavioral economics, 57
Beijing Olympics, 2008, 240–41

- beliefs, 54–55, 57–58, 59, 73, 147
see also Bayesian models; common knowledge; Soros, George; worldviews
- Bénabou, Roland, 159
- Bennett, Jane, 93
- Bensel, Richard, 110
- Beresford-Kroeger, Diana, 99
- Bergson, Henri, 8, 354
- Berlin, Isaiah, 6
- Bernanke, Ben, 135, 152
- Bernstein, Peter, 19
- Bernstein, Steven, 245, 266
- biases, 56, 57, 113
- Biden, Joe, 212–14
 and China, 207
see also Ukraine war
- Biggart, Nicole, 149
- Binmore, Ken, 49
- biological approaches, and geoengineering, 231–32
- biosphere, and Anthropocene, 246–49
- bitcoin, 290–91
- Black, Fischer, 139, 154
- Black-Scholes option-pricing model, 313
- Blakely, Jason, 264
- Blastland, Michael, 2
- Blaug, Mark, 119
- Blight, James, 184, 185, 186, 187, 188, 202
- Blinder, Alan, 166
- “Blue New Deal,” 237, 238
- Blyth, Mark, 137, 139, 154–55
- Bo Yuan Chang, 101
- Bohm, David, 6, 92, 328
- Bohr, Niels, 13–15, 66, 67, 82–83, 86, 297, 299–301, 357
 and Barad, 303
 and indeterminacy, 87
- “Bomb as God” metaphor, 207–8
- Bookstaber, Richard, 307
- Borges, Jorge Luis, 74
- Born, Max, 82, 86
- Bradbury, Malcolm, 19
- Brand, Stuart, 233
- Brandom, Robert, 347
- Braumoeller, Bear, 210
- Britain, and the ERM, 146
- Brody, Howard, 280
- Bronck, Richard, 109
- Brooks, David, 42–43, 271
- Brown, Laura, 99
- Bruner, Jerome, 106
- Buber, Martin, 6
- Buchanan, Mark, 173
- Buddhism, 353–54
- Bueno de Mesquita, Bruce, 337–38
- Bull, Hedley, 212
- bullshitting, 297 *see also* Trump, Donald
- Burckhardt, Jakob, 127
- Burkeman, Oliver, 21
- Byrnes, Timothy, 355
- calculable risk, in late modernity, 18
- Callon, Michel, 162
- Campbell, Donald T., 115–16, 125
- Camus, Albert, 349–50
- capitalism, 18, 33, 37–38, 225, 254
- carbon budgets, 242
- carbon capture, 232
- carbon dioxide removal (CDR), 237, 238
- carbon lock-in, 243–44
- carbon pricing, 241–42
- carbon sinks, 288–89
- Carlsen, Magnus, 282–83
- cars, 250
- Cartwright, Nancy, 59–60, 108, 117–18
- Cassirer, Ernst, 22
- Catholicism/Catholic church, 321, 355
- Cattell, Raymond, 350
- causation, 69, 82, 119–20
- central banks
 Federal Reserve. *See* Federal Reserve
 and language/stories, 167
 social power of, 166
- Chakrabarty, Dipesh, 253, 254
- chance, 16, 181, 279, 323, 356–57
 and October 1962 crisis, 221
 and protean power, 304–8
see also moral luck
- Chaplin, Charlie, 21
- chatbots, 267
- ChatGPT, 258, 267
- chess, 256–57, 282–83
- Chicago school of economics, 49, 138
- China, 123, 207, 219, 240–41
- Chinese scholars, 101
- Chittka, Lars, 263
- Chomsky, Noam, 71, 268
- Christian, Brian, 113
- Cirillo, Pasquale, 210
- Ćirković, Milan, 98–99
- civic-mindedness, 130
- Clapper, James, 272
- Clark, Gordon, 155
- Clarke, Kevin, 62
- classical mechanics, and the Received View, 62
- Clausewitz, Carl von, 211
- climate change. *See* global warming
- climate models, 242–43
- Clinton, Hillary, 31

- Cohen, Benjamin, 169
 Cohen, Michael D., 282
 Cohn, Carol, 206, 207
 Cohn, Nate, 31
 Cold War, 3–4, 43, 216, 231
 see also nuclear weapons/
 deterrence theory; October
 1962 crisis
 Cole, Bryony, 267
 collateralized debt obligations (CDOs),
 142–43, 144, 151–52
 see also securitization, as convention
 collective beliefs
 and conventions, 155–56
 see also Soros, George
 color identification and vocabulary, 327
 common knowledge, 58–59
 complementarity, 13–15, 67, 82–83,
 300, 328
 complexity/complex models, 128–30, 282
 confidence, 55, 56 *see also* biases
 Connolly, William, 93
 consciousness, 27–28, 67, 86, 323, 352
 and AI, 261–65 *see also* memory
 consistency, 49, 50
 contagion narrative, 165, 166, 173
 context, 65–68
 contingency, and moral luck, 340–41
 control power, 275–87, 307–8
 conventions, 149
 see also securitization, as convention;
 social conventions
 cosmology, 94–96, 170
 cost-benefit calculations
 and Schelling, 182
 see also rational actor model
 Cotra, Ajeya, 261–62
 counter-terrorism, 289–90
 COVID, 17, 48, 97, 345
 theories and models, 112
 Crawford, Kate, 258
 “creative accounting,” 157
 creativity, 110, 212
 see also imagination and play; protean
 power
 credit derivatives. *See* derivatives
 credit rating. *See* rating industry
 critical realism, 100
 Crutzen, Paul, 237, 250
 crypto-currency, and AGL, 262
 Cuban missile crisis. *See* October 1962
 crisis
 Cuban revolution 1958–1959, 204, 205
 Cubism, 322
 culture change, and language, 73–74
 Da Vinci, Leonardo, 319
 Dadaism, 323
 Dahl, Robert, 12, 276, 306
 daily life, reality of, 350
 Dallas, Mark, 292
 Damasio, Antonio, 199, 200
 Daston, Lorraine, 22, 58
 Davidson, Donald, 75, 347
 decarbonization, 243–44, 245, 266
 Decision Making Under Deep Uncertainty
 (DMDU) approach, 339
 decision theory, 48–49, 54, 137, 138, 139
 “deep learning,” 260
 Deep Mind, Google’s, 256–57
 deep sea mining, 238–39
 Deep Squeak, 268
 defense, and the prediction industry, 13–14
 defense experts, 205–6
 deliberative metaphors, 76–77
 Dell, Paul F., 284
 DeMartino, George, 117–18
 Dequech, David, 45–46
 Der Derian, James, 81
 derivatives, 149–50, 288, 313
 see also securitization
 Derman, Emanuel, 163, 170
 Descartes, 26, 269
 deterrence theory. *See* nuclear weapons/
 deterrence theory
 Deudney, Daniel, 111, 227
 Deutsch, Karl, 295
 development economics, 123
 Dewey, John, 28, 346–47, 356
 Dickinson, Donna, 342–43
 Didion, Joan, 64
 Digeser, Peter, 284
 digital ecospheres. *See* Artificial
 Intelligence (AI)
 Dilthey, Wilhelm, 28–29, 33–36, 40, 186, 325
 on methods of inquiry, 324–25
 discourse, 13–15, 107, 302
 see also language
 DMDU approach. *See* Decision Making
 Under Deep Uncertainty (DMDU)
 approach
 Dobbs, Michael, 201–2
 “Doomsday Machine,” 217–18
 Dostoevsky, 6
 Dowd, Kevin, 140
 Drell, Sidney, 215–16
 Dror, Yehezkel, 217–18
 droughts, 233
 Duara, Prasenjit, 239–40
 Dunn, Rob, 92
 Duvall, Raymond, 98

- Earth System Science (ESS), 12, 112,
232, 248
and Gaia theory, 248
eclecticism, 329–32
ecocide, 227 *see also* global warming; mass
extinctions
ecocriticism, 99
economic crashes. *See* financial crises
economy/economists
and banks/bankers, 334–35
and costs of climate change,
229–30
economic and population growth, twen-
tieth century, 250
economic growth, and global
warming, 254
economic laws, 163
and the FOMC, 164–66, 333–34
forecasting, 133
and language, 136–37
Russia, 1990s, 14
see also financial crises
Eden, Lynn, 198
Egginton, William, 19–20, 319
Einhorn, David, 155
Einstein, Albert, 7, 46, 79, 81, 84, 86, 105
El Salvador, 295
electricity. *See* energy consumption, and AI
elevator pitches, 114–15
elicitation interviews, and the October 1962
crisis, 185–86
Elizabeth II, Queen, 135
employment/unemployment, 257, 333–34
see also labor markets
energy consumption, and AI, 258–59
Engelen, Ewald, 151
Enron, 157
entropy, 109
environmental conflicts, 227
Epstein, Charlotte, 107
equilibrium-seeking systems, and
economists, 173
European Exchange Rate Mechanism
(ERM), 146
European Monetary Union (EMU), 159
evolutionary biology. *See* Pinker, Steven
exclusive economic zones (EEZ), 238
experience
lived, 185–86
and subjective probability, 57
see also consciousness
experimentation, 121–26, 332–33
experiments, 116–21
extinctions, species. *See* mass extinctions
extra-terrestrial life, 98–99
Facebook, 225
factor analysis, 350
fair value, 158
Farmer, Ted, 94
Fazal, Tanisha, 245
Fearon, James, 59, 210
Federal Open Market Committee
(FOMC), 164–66, 333–34
Federal Reserve, 162–63, 167
see also Federal Open Market
Committee (FOMC); Greenspan,
Alan
Feynman, Richard, 306
film, 290
finance/finance theory, 11, 137–45, 162
financial contagion. *See* contagion narrative
financial crises
1982, 53
1987, 53
1997 (“Asian” or “IMF”), 69–70
2008, 1–2, 11, 57–58, 78, 132, 134–36,
162–63, 171, 312–13
see also economy/economists; Open
Economy Politics (OEP); polycrisis;
rating industry; securitization, as
convention
financial economics, 157–58, 173
financial markets
and social devices, 146
see also rating industry
fire events, 197, 198
fire fighters, 349–50
Fisher, Walter, 106
flossing, 100
flows, mechanisms of, 323–24
Foreign Affairs, 63
forests, 93–94
Fortna, Page, 245
fortuna (chance). *See* chance
fossil fuels, 12, 224
see also geothermal energy; global
warming; hydrocarbons
Foucault, Michel, 13–15, 301–3
Fox, Justin, 147
fracking, 12
see also geothermal energy
Frank, Adam, 95, 256
Frankopan, Peter, 252, 254
Frayn, Michael, *Copenhagen*, 329
French Revolution, 202, 255
Frieden, Jeff, 168
Friedman, George, 335–36
Friedman, Jeffrey, 55, 56
Friedman, Milton, 49, 138
Fuchs, Christopher, 84

- Fuhrmann, Matthew, 194
 fungi, 94 *see also* forests
 futures markets, 161
- Gagliano, Monica, 99
 Gaia theory, 247–48
 Galbraith, John Kenneth, 119, 340
 Galileo, 321
 Galileo Commission, 351
 games and game theory, 58, 59, 188,
 337–38 *see also* macroeconomics
 Gardner, Dan, 338
 Gartzke, Eric, 296
 Gaussian statistics, 52–53, 140, 153 *see also*
 power law statistics
 Gavin, Francis J., 194, 339–40
 Gaza, 103–4
 geoengineering, 12, 229–45
 critics of, 232, 233–34
 definition, 230
 geothermal energy, 234–36
 marine, 236–40
 mitigation and adaptation, 240–45
 geological eras
 Anthropocene, 12, 228, 246–55
 Holocene, 249, 250, 251
 geological time, 249, 255
 geophysical approaches. *See* geoengineering
 geothermal energy, 234–36
 Gerrard, Bill, 138, 146
 Getty Museum, *Blended Worlds*, 323
 Ghosh, Amitav, 322
 glaciers, 236–37
 Gleiser, Marcello, 95
 global warming, 12, 93, 109, 172, 224,
 225–27
 and AI, 12, 258–59
 and geoengineering, 229–45
 theories and models, 112
 see also Anthropocene; carbon sinks; cli-
 mate change
 Goddard, Stacie, 296
 Goldman Sachs, 140
 Goodman, Nelson, 325
 Google, 256–57
 Gould, Stephen Jay, 328
 Gourevitch, Peter A., 169–70
 governmental politics model, 179 *see also*
 October 1962 crisis
 Grabel, Ilene, 124
 grand strategy, 344
 Grant, Adam, 306
 Great Depression, lessons of, 172–73
 greenhouse gases. *See* global warming
- Greenspan, Alan, 11, 132, 149, 166,
 167, 333
 The Map and the Territory, 170–71
 Gross, Bill, 135
 Grove, Jairus, 86, 199, 200–1, 202
 Grynawski, Eric, 211
 Gunitsky, Seva, 128
 Gusterson, Hugh, 205–6
- Haas, Richard, 273
 Haldane, J. B. S., 327
 Hall, Peter, 331–32
 Hamas, 103–4
 Hamilton, Scott, 225, 232
 Haraway, Donna, 47, 97
 Harrington, Cameron, 231
 Harry Potter series, 53
 Hayek, Friedrich, 60
 Hayward, Clarissa, 276–77
 Heclo, Hugh, 282
 hedge funds, 151–52, 154, 159–60
 hedges (risk-reducing trading), 11,
 160, 313
 Heidegger, Martin, 40–41, 78
 Heisenberg, Werner, 81, 82, 86, 88, 357
 and indeterminacy, 28, 87
 on language as “re-presentation” and
 world-making, 83
 hermeneutics, 40
 high reliability theory, 189
 Hilbert, David, 317
 Hinkie, Sam, 284
 Hinton, Geoffrey, 103, 262
 Hironaka, Ann, 295–96
 Hirschman, Albert, 60, 122–25, 234
 on complexity, 129–30
 on eclecticism, 332
 on experimentation, 332
 Hirshleifer, Jack, 137
 historical contingency. *See* protean power
 historical knowledge, and worldviews,
 34
 Hobbes, Thomas, 12, 13–15, 252, 297,
 298–99, 328, 353
 and control power, 304
 and language, 299
 on machines and minds, 260–61
 and power, 274, 297–98
 Hobson, John, 296
 Hoffmann, Matthew, 245, 266
 Hoffmann, Stanley, 287
 Hollywood, 290
 Holocene, 249, 250, 251
 Homer-Dixon, Thomas, 227

- house prices, 147–48
see also mortgages; securitization, as convention
- human rights, 287–88
- humanisms, 25–27, 126, 254
 origins and claims of, 45
 phenomenology, 186
see also Dilthey, Wilhelm; Newton, Isaac, and Newtonian humanism; para-humanism
- humanities, 319, 324–25
- Husserl, Edmund, 231
- Hutchison, Martin, 140
- hydraulic fracking. *See* geothermal energy
- hydrocarbons, 291 *see also* fossil fuels
- hydropower, Laos, 240
- Hymans, Jacques, 76
- imagination and play, 109–11, 132
see also creativity
- IMF, and 1997 financial crisis, 69–70
- imperfection, 351
- improvisation, 286, 344
- indeterminacy. *See* Heisenberg, Werner; quantum theory/mechanics
- India, nuclear program, 196–97, 202
- industrialization, 225, 249–50
- inflation, 333–34
- Ingold, Tim, 93
- innovation, and power, 286
- insurance industry, 18, 171–72, 230
- intentionality, and moral luck, 340
- international political economy, 167–68, 331
- International Relations (IR), 9, 67, 89, 111–12
 Asian, 353–54
 and Newtonianism, 252
see also world politics
- interpretation, 28–29, 57
- Interspecies Internet*, 268
- investment banking, 159
 and house prices, 152
 and modern finance theory, 139
 separation from commercial banking, 172–73
 and VaR, 153–54
see also traders; Wall Street
- Israel, 103–4, 233
- Jabr, Ferris, 247
- Jackson, Maggie, 21
- Jackson, Michael, 292
- Jackson, Patrick, 283–84
- Jacobs, Robert, 215
- James, William, 346–47, 354
- Jasanoff, Sheila, 174
- Kaag, John, 348
- Kahneman, Daniel, 57
- Kalberg, Stephen, 36, 38
- Kant, Immanuel, 33, 341, 342
- Kantz, Holger, 306, 307
- Kaplan, Fred, 219
- Kaplan, Robert, 17, 227
- Katzenstein, Peter, 32
- Kauffman, Stuart, 62, 356
- Kay, John, 49–50, 56, 145
- Kennan, George, 344
- Kennedy, John F., 11, 178–79
see also October 1962 crisis
- Kennedy, Robert, 308
- Keohane, Robert, 4, 62, 89
- Keynes, John Maynard, 54, 61, 110, 137, 145, 147, 156, 340
 and conventions, 155–56
- Khrushchev, Nikita, 11, 179
see also October 1962 crisis
- Kierkegaard, S., 184–85
- King, Gary, 62
- King, Mervyn, 49–50, 56, 145
- Kirshner, Jonathan, 24, 89, 145
- Kissinger, Henry, 63, 65–66, 308
- Klay, Phil, 354–55
- Knight, Frank, 51–52, 110, 137
- Knight, Les, 223
- Kohn, Eduardo, 93
- Kokotjalo, Daniel, 262
- Kolbert, Elizabeth, 224, 226
- Koselleck, Reinhart, 255
- Koyré, Alexandre, 43
- Krebs, Ronald, 107
- Kripal, Jeffrey, 320
- Krippner, Greta, 17
- Kroenig, Matthew, 194
- Kubrick, Stanley, 183
- Kuhn, Thomas, 41–42
- Kundera, Milan, 18
- Kurki, Milja, 251
- Kurzweil, Ray, 222–23
- Labatut, Benjamin, 82
- labor markets, 69–70, 257
see also employment/unemployment
- Lake, David, 168
- Lang, Janet, 202
- language, 13–15, 69–78, 326–27
 and AI, 265–69
 and banks/bankers, 167, 334–35
 and Barad, 304

- as control, 13–15
- and the economy, 136–37
- historical terms denoting risk and uncertainty, 17
- and knowledge communities, 327–28
- mathematical, 67
- and metaphors, 72–73, 76–78
- and the narrative turn in world politics, 106
- and the October 1962 crisis, 202–8
- and power, 296–304
- and pragmatism, 347
- and reason. *See* Nietzsche, Friedrich
- and subjective probability, 57
- theories and models, 112–13
 - see also* discourse; large worlds; small worlds; stories; translation
- Laos, 240
- large language models (LLMs), 12, 265–67
- large worlds
 - context, process and language in small worlds and, 64–65
 - experiments and experimentation, 117–18
 - and objective probabilities, calculation of, 50
- Latour, Bruno, 96–97, 178, 246, 279, 307, 321
 - on *War and Peace*, 311
- law, maritime, and geoengineering, 237–38
- laws of nature, 252
- Leamer, Edward, 139, 346
- learning
 - by doing, 122, 123, 126, 213
 - potentiality through, 295
 - trial and error, 261
- legal fictions, 110
- Leibniz, 260–61
- Leites, Nathan, 43
- Lemoine, Blake, 267
- Lepinay, Vincent, 160
- Lévi-Strauss, Claude, 284
- LGBT rights, 289
- Liberalism, 38, 89, 127
- Lilla, Mark, 354
- Lindblom, Charles, 344
- Lindsey, Lawrence, 152
- Lipson, Hod, 262–63
- literary fiction, and probability, 322
- lived experience, 185–86
- London Protocol, 237
- Long-Term Capital Management (LTCM), 154, 159–60
- lotteries, 140
- Louth, Jonathan, 23
- Lovelock, James, 247–48, 255–56
- Lucas, Robert, 132
- luck. *See* chance; moral luck
- Luhmann, Niklas, 15
- Machiavelli, Niccolò, 304–6
- MacIntyre, Alasdair, 106
- Mackenzie, Donald, 113–14
- macroeconomics, 132, 145, 180–82
- Malabou, Catherine, 260
- mammals, and consciousness, 263
- Mann, Geoff, 242
- Margulis, Lynn, 247–48
- marine geoengineering, 236–40
- maritime trade, seventeenth century, and
 - commodification of risk, 18
- Marks, Michael, 77
- Marshall Islands, nuclear tests, 215
- Marvel, Kate, 226
- Marx/Marxism, 38, 127, 335
- mass extinctions, 227, 254
- mass fire events, 197, 198
- Mastroianni, Adam, 100
- mathematical language, 67
 - see also* quantum theory/mechanics
- Mathematical Principles of Natural Philosophy* (Newton), 22–23
- Mayntz, Renate, 20
- McCarthy, Cormac, 323
- McCloskey, Deirdre, 78, 104
- McConnell-Ginet, Sally, 70
- McDermott, Rose, 183, 184, 208–9
- McEwan, Ian, 271
- McNamara, Robert, 117, 183–84, 187–88, 221
- McNeill, John, 249
- Mead, Walter Russell, 65–66
- Mearsheimer, John, 51, 89, 127, 179–80
- measurement, 117
- meditative methods, 352
- memory
 - memorization of lived experience, 185–86
 - and subjective probability, 57
- Mercer, Jonathan, 212
- Mermin, David, 83, 84, 133
- Merton, Robert, 154
- metaphors, 27–28, 72–73, 76–78
- Microsoft, 257
- migration, and power, 291–92
- Milley, Mark, 218–19
- Milne, A. A., 6
- Misak, Cheryl, 54
- mitigation and adaptation, and climate change, 240–45

- Miyazaki, Hirokazu, 160
 Modelers' Hippocratic Oath, 170
 models and theories
 and climate change, 242–43
 see also stories, theories and models as
 monetary policy. *See* economy/economists;
 financial crises
 Mongols, 254–55
 Montesquieu, 223
 Moody's, 143, 152
 moral hazard, 171–72
 moral luck, 340–43
 morality and benevolence, 130
 Morgenthau, Hans, 29, 87–88, 117, 330
 Morris, Charles, 156
 mortgages
 sub-prime, 144–45, 148
 see also securitization, as convention
 Moscow. *See* Soviet Union
 Moyn, Samuel, 311
 Muir, John, 97
 multiplicities of risks and uncertainties,
 332–33
 Munroe, William Bennett, 87
 Musil, Robert, 308
 Musk, Elon, 43, 97–98
 mysteries, 49–50
- Nacol, Emily, 299
 Nagel, Thomas, 341, 342
 nanofacture, 324
 narrative fallacy, 114–15
 narratives. *See* stories
 NASA, Jet Propulsion Lab, 323
 national security crisis, and subjective
 probability, 55
 NATO, Able Archer exercise, 217
 natural gas production, and fracking,
 234, 235
 natural sciences
 evolution of, 319
 and methods of inquiry, 324–25
 and para-humanism, 91
 see also Dewey, John
Nature (science journal), 119–20
 Nelson, Eshe, 334
 neoliberalism, 17, 163–64
 neo-positivism, 100
 Neumann, John von, 86
 Neustadt, Richard, 180
 New Mexico, nuclear tests, 214–15
 Newton, Isaac, and Newtonian humanism,
 4, 10, 12, 21–24, 47–48, 126, 194
 and changeability, 35
 and complementarity, 328
 and context, 66
 and the laws of nature, 252
 and Voltaire, 352
 see also post-Newtonianism
 Newtonianism, 43, 109,
 126, 306
 Nietzsche, Friedrich, 27–28, 45, 56, 77
 non-instrumental action, 130
 Nordhaus, William, 229, 230
 normal accident theory, 189–91, 195
 norms and rules, 302
 Noro, Sei, 354
 North Korea, and Trump, 219–20
 Norton, Marcy, 90–91
 nuclear politics, 2014 symposium on, 178
 nuclear testing, legacy of, 214–15
 nuclear weapons/deterrence theory, 11,
 88, 216
 accidents and near misses, 215–16
 and the bargaining model, 209–14
 and climate models, 242
 and entangled processes, 12
 fragility of, 220–21
 October 1962 crisis, 11, 12
 and Schelling, 180–82, 208
 see also October 1962 crisis; Reagan,
 Ronald
 nuclearity, geological, 198
 numbers, power of, 354
 numerical probability, 51
 Nussbaum, Martha, 42, 341, 343
 Nye, Joseph, 130–31, 273, 277–78
- Obama, Barack, 273
 objective probability, 51–54
 oceans, 229, 236–40
 October 1962 crisis, 11, 12, 117, 178–202
 and bullshitting, 297
 and language, 202–8
 luck and chance in outcome of, 221
 organizational and bureaucratic politics
 models of, 188–93
 post-Newtonianism and nuclear politics,
 193–202
 octopi, 263
 Oliver, John, 238–39
 Open Economy Politics (OEP), 168–70
 and large world uncertainty, 169
 Open Science Conference, 233
 OpenAI, 257, 258, 262
 Oppenheimer, Robert, 30, 66, 207–8
 organizational process model, 179
 see also October 1962 crisis

- Pagels, Heinz, 95
 Paine, Thomas, 26–27
 pandemics, global. *See* COVID
 paradigms, 41–42, 43
 para-humanism, 8, 46–47, 89–99, 228, 320
 and the Anthropocene, 251
 and climate change, 223–24, 226
 and consciousness, 261
 and global warming, 229
 Paris Agreement, 2015, 240, 244, 245
 Parsons, Talcott, 16
 Patterson, Scott, 322
 Pauli, Wolfgang, 82
 Paulson, Hank, 141
 Pauly, Lou, 18, 171–72, 184
 Pavlov, Alexei, 247
 Payne, Nick, 281
 p(doom), 103, 262
 Peirce, Charles Sanders, 346–47
 Pelopidas, Benoit, 221, 223, 270
 Pelosi, Nancy, 219
 peoples' revolutions, 272
 see also French Revolution
 Perimeter system (“Doomsday Machine”), 217–18
 Perović, Slobodan, 82–83
 Perroots, Leonard, 192
 Peters, Benjamin, 24–25
 Peters, Glen, 242
 Petrov, Stanislav, 191–92
 Phelps, Edmund, 147–48, 153
 phenomenology, 186
 Picasso, Pablo, 322
 pictorial metaphors, 78
 Pinker, Steven, 71–73, 269–70
 Pistor, Katharina, 110
 planetary history, and world history, 254
 planetary intelligence.
 See technospheres
 plankton, 232, 238
 Platonic fold, 304
 play. *See* imagination and play
 policy, 343–46
 political forecasting, 336–39
 Pollock, Jackson, 323
 polycrisis, 20, 135, 211
 Pontzen, Andrew, 170
 Pope, Alexander, 21–22
 population growth, 243, 250
 Posner, Richard, 150–51
 possibilism. *See* Hirschman, Albert
 post-Newtonianism, 8, 10, 24, 78–89, 312
 concept of power, 12–13
 Copenhagen interpretation of, 320
 and nuclear deterrence, 195
 and protean power, 278
 Powell, Colin, 219
 power law statistics, 53–54, 153, 209–10, 270, 312
 Powers, Richard, 99
 pragmatics of word use, 74
 pragmatism, 340, 346–50
 prediction industry
 and sports. *See* baseball
 predictions, scientific, 25
 predictive large language models (LLMs), 12, 265–67
 Prigogine, Ilya, 108–9
 Primo, David, 62
 Pritchett, Lant, 52
 probabilistic laws, and the social world, 194
 probability, 50–51, 81
 numerical, 51
 objective, 51–54
 subjective, 54–60
 see also QBism
 process, 68–69
 prophets, 37
 protean power, 13, 273
 case studies, 287–96
 and control, 275–87
 definition and overview, 274–75
 and *fortuna* (chance), 304–8
 and language, 296–304
 Protestant work ethic, 37–38
 Przeworski, Adam, 295
 pundits, 335–36
 Putin, Vladimir, 175
 see also Ukraine war

 QBism, 84–86
 quantitative finance models, 139
 quantum objects, and the measurement problem, 321
 quantum probabilities, 194
 quantum theory/mechanics, 7, 46, 66–67, 79–85, 321, 351
 Bohr on, 300–1
 complementarity and entanglement as central to, 6
 and gravity, 306
 and mathematical language, 67
 and mystery, 40
 and protean power, 277, 278
 see also post-Newtonianism; QBism

 Radchenko, Sergey, 221
 Rajan, Raghuram, 150
 Ramsey, Frank, 54–55, 56, 57

- randomized controlled trials (RCTs),
 118, 123
 randomness, 53
 Rathbun, Brian, 15–16, 42
 rating industry, 141–45, 148
 rational actor model, 179–82
 rational expectations theory, 11, 138–39,
 140, 312–13
 allegories of, 162
 and large world uncertainty, 153
 and Open Economy Politics (OEP), 169
 rationality
 types of, 56
 see also biases; decision theory
 Rawlings, Hunter, 324
 Reagan, Ronald, 206, 216
 Realism, 89, 127
 reason
 and language. *See* Nietzsche, Friedrich
 relationalism, 8, 199, 200–1
 relativity theory, 95
 see also Einstein, Albert
 religions, 37, 38–39
 religious language, and nuclear weapons/
 deterrence theory, 207–8
 religious worldviews, 352–53, 355
 see also specific religions
 replication crisis, in research, 120, 121
 Rescher, Nicholas, 7
 Riley, John, 137
 Rilke, Rainer Maria, 136
 Rindzevičiūtė, Eglė, 25
 risk, concept of, 16–17, 18 *see also* language
 risk, perception of, and neoliberalism, 17
 risk calculations, 51–52
 see also investment banking
 risk management, 18, 148
 risk-uncertainty conundrum, 3, 13–21,
 101–2, 331
 and 2008 financial crisis, 140, 149
 and adaptation to climate change, 243
 and Bayesianism, 57
 COVID epidemic, 17
 everyday encounters with, 19
 and geoengineering, 12
 and international conflicts, 295–96
 and international politics, 51
 neglect of, 89
 and the October 1962 crisis, 187
 and political forecasting, 336–39
 and subjective probability, 55, 56
 and Wall Street trading, 11
 see also stories, and the risk-uncertainty
 conundrum
 Roberts, Chief Justice (of the Supreme
 Court, US), 70–71
 Roberts, David, 235
 Roberts, Siobhan, 235
 Rogoff, Kenneth, 153
 Romer, Christina and David, 334
 Rorty, Richard, 73, 75, 326–27, 347
 Rosato, Sebastian, 51, 89, 179–80
 Rostow, Walt, 345
 Rovelli, Carlo, 6–7, 80, 306
 Rowling, J. K., 53
 Rubin, Robert, 344
 Ruggie, John, 43
 Rumsfeld, Donald, 15
 Russell, Stuart, 261, 262
 Russia/Russians, 14, 15, 212–14
 see also Soviet Union
 Sabel, Charles, 244, 332
 Sachs, Jeffrey, 14, 15
 Sachs, Rainer, 17
 Sagan, Scott, 178, 189–90, 193, 195
 Sakharov, Andrei, 124
 Salais, Robert, 149
 salvation. *See* Protestant work ethic
 Sanger, David, 207
 Sarkissian, Armen, 88
 “satisficing,” 141
 Savage, Leonard, 3, 48–49
 Saxenian, Anna Lee, 292
 scenarios, 336
 Schack, Rüdiger, 84
 Schelling, Thomas, 11, 180–82, 183, 208,
 237, 345
 Scholes, Myron, 154
 Schrödinger, Erwin, 5, 82, 86, 357
 Schultze, Charles, 172
 Schwartz, Peter, 336
 Schweller, Randall, 282
 science, technology, and society (STS)
 and nuclear deterrence, 11–12
 and post-Newtonianism, 198–99
 science fiction, 322, 323
 scientific prediction, 25
 scientism, 29
 Scoblic, Peter, 337
 Scott, James, 167, 275, 295
 Seabrooke, Leonard, 296
 Searle, John, 24, 69
 Sechser, Todd S., 194
 secularization, 352–53, 355–56
 securitization, as convention, 149–56
 security studies, simple and complex
 models, 331

- sensations, 27
- Seth, Anil, 263, 264
- Shah, Sonia, 269
- Shiller, Robert, 147
- Shimizu, Kosuke, 354
- Shinn, James, 169–70, 172
- Shleifer, Andrei, 14
- Shultz, George, 88
- Simard, Suzanne, 94
- Simon, Herbert, 130, 141
- simplification/simple models, 127–28
- Skinner, B. F., 268
- small worlds, 48–49
 - context, process and language in large worlds and, 64–65
 - and control power, 276
 - and objective probabilities, calculation of, 50
 - small world models, 108
 - “smart houses,” 258
- Smith, Adam, 283
- Smith, Captain E. J., 17–18
- Smolin, Lee, 7, 95–96
- Snow, C. P., 322
- social constructivism, 100
- social conventions, and risk management models, 155–56, 313
- social insurance, 171
- social media, 259
- social movements, improvisation and creativity in, 292
- social norms. *See* norms and rules
- social sciences, 130–31
 - and Campbell, 125
 - evolution of, 319–20
 - experiments and experimentation, 115–16, 117
 - and Hirschman, 124–25
 - and Morgenthau, 87–88
 - and Newtonianism, 29
 - as pre-paradigmatic, 42
- soft power, 277–78
- solar energy, 247
- solar panels, 233
- solar radiation management, 232, 233
- Solow, Robert, 129, 147
- Somers, Margaret, 107
- Sorenson, Ted, 203, 214
- Soros, George, 146–47
- South Korea, and 1997 “IMF crisis,” 69–70
- sovereign power, 297–99
- Soviet Union
 - collapse of, 2, 3–4
 - “Doomsday Machine,” 217–18
 - and nuclear weapons/deterrence theory, 12
 - and worldviews, 43
 - see also* October 1962 crisis; Russia/Russians
- spacetime, 95 *see also* Einstein, Albert
- speculation (risk-seeking trading), 11, 160, 313
- speech acts, 301
- Spengler, Oswald, 85
- sports
 - prediction industry. *See* baseball
- states, modern, theories and models, 110
- statistical laws, invention of, nineteenth century, 18
- Stein, Janice Gross, 103, 212, 213
- Stone, Oliver, 171
- stories
 - experiments and experimentation, 115–26
 - the narrative turn, 105–8
 - and the risk-uncertainty conundrum, 126–31
 - theories and models as, 108–15
 - see also* language
- Storper, Michael, 149
- subjective probability. *See* probability, subjective
- sub-prime mortgages, 144–45, 148
- Sullivan, Jake, 103–4
- Summers, Lawrence, 14, 69, 145, 169
- surveillance, and AI, 257
- systems, collectively produced, 47
- Taleb, Nassim, 114–15, 182, 210, 230–31, 304
- Taylor, Charles, 355–56
- technocratic mitigation approach, 241
- technospheres, 255–61
- technostrategic language, 206, 207
- tennis, 280
- terrorism, and counter-terrorism, 289–90, 295
- Tetlock, Philip, 337, 338–39
- theories and models. *See* stories, theories and models as
- Thoreau, Henry David, 92
- Thwaites Glacier, 236–37
- time, 253–55
- Titanic*, 17–18
- Tolstoy, Leo, 309–11
 - War and Peace*, 1
- Tomz, Michael, 119
- Toska, Silvana, 295
- traders, 159–61
 - see also* financial crises; investment banking
- translation, 327–28

- Trump, Donald, 31, 43, 218–20, 296–97
 truth claims, 356
 see also worldviews
 Tuckett, David, 140–41
 turbulence, 323–24
 Turing, Alan, 261
 Tversky, Amos, 57
 Twitter, 127
- UFOs, 98
 Ukraine war, 212–14
 uncertainty, 17, 110, 124, 185
 see also language; power law statistics;
 risk-uncertainty conundrum
 unemployment, 333–34
 United Arab Emirates, geoengineering, 233
 United States of America
 and China, 207
 and Cuba, 205
 and the October 1962 crisis. *See*
 October 1962 crisis
 presidential election, 2016, 31
 storming of the Capitol, 218
 and the Ukraine war, 212–14
 see also Cold War
 universal grammar. *See* Chomsky, Noam
 uranium mining, 198
 Urbinati, Nadia, 122
 utility maximization, 54–55
- vaccine skepticism, 48
 Value-at-Risk (VaR), 153–55
 Vance, J. D., 43
 Verba, Sidney, 62
 Vernadsky, Vladimir, 247
 Victor, David, 244
 Vietnam war, 345
 Viniar, David, 140
 Voltaire, 352
- Wald, Matthew, 205
 Wall Street, 11, 133, 313
 see also financial crises, 2008;
 investment banking
 Wallace-Wells, David, 245
 Wallerstein, Immanuel, 108–9
 Waltz, Kenneth, 4, 67, 89, 111–12, 114,
 128, 330
 war casualties, 210
 water contamination/depletion, 234, 235
 water rights, and marine geoengineering, 239
 “waterscape,” 239–40
 weather modifications, and the Cold
 War, 231
 Weber, Max, 16, 28–29, 33, 36–40, 279,
 320, 350
- Weinberg, Steven, 83
 Weitzman, Martin, 229–30, 242
 Welch, David, 228, 310–11
 welfare state. *See* social insurance
 Wells II, Linton, 13–14
 Wendt, Alexander, 81, 86, 98
 Western, Bruce, 330, 331
 Western rationalism
 Weber on, 36
 see also Weber, Max
 Weyland, Kurt, 295
 White, Hayden, 77
 Whitehead, Alfred North, 8, 354
 Whittington, Jerome, 240
 Williams, Bernard, 342
 Wilmott, Paul, 170
 Wilson, Benjamin, 181
 Wilson, E. O., 317–19, 328, 351
 Consilience, 325–26
 Winnie the Pooh, 357
 see also Milne, A. A.
 Wittgenstein, Ludwig, 74, 309
 Wohlleben, Peter, 93–94
 Wolin, Sheldon, 298
 Wood, Elisabeth, 295
 Wootton, David, 23, 321
 word prediction models. *See* predictive large
 language models (LLMs)
 World Bank. *See* Summers, Lawrence
 world history, and planetary history, 254
 world politics, 43, 68–69, 80
 see also International Relations (IR);
 social sciences
 worldviews, 42–48, 99, 357
 and the bargaining model of war,
 211–12
 and pragmatism, 347
 scientific, 357
 see also Dilthey, Wilhelm; large worlds;
 religious worldviews; secularization;
 small worlds; Weber, Max
 Wuttke, Alexander, 120, 121
- Yeltsin, Boris, 192
 Yi, Wang, 103
 Yogi Berra, 13, 19
 Yong, Ed, 263
- Zalasiewicz, Jan, 249
 Zaloom, Caitlin, 160–61
 Zanotti, Laura, 9
 Zeimann, Benjamin, 205
 Zelikow, Philip, 193–94
 zoom calls, 257
 Zubok, Vladislav, 221
 Zvirzdin, Jamie, 105

- 161 *Swati Srivastava*
Hybrid Sovereignty in World Politics
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Rising Powers and the Politics of Status in International Institutions
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