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 Pfuel's belief in science.[1] For Pfuel 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] Pfuel'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 Zanotti 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] Zanotti 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 slippage 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 Whitington 2018: 6, 9.
[70] Klinke 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. [78] Levy 2012: 3–4.
[79] Pauly 2025. [80] Ip 2025. [81] Beck 1992, 2005, 2006. [82] Eidinow 2011: 158.
[83] Lewis 2023: A20. [84] Taleb 2007: 78.

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 unsettled[95] – 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 Sisyphian 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. [98] Burkeman 2024: xv–xxvi. [99] Jackson 2024: xiii.
[100] Jackson 2024: xiv. [101] Fierke 2022: 43.

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 visioneering." 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 *un*reasonableness 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 scientistic 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 outmoded 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.