

## 10 Of Gardens, Forests, and Parks

---

*Peter J. Katzenstein*

The task becomes not one of looking for some single thing, but managing . . . multiple shifting perspectives, and negotiating . . . between irreducibly different contexts. If one wants to call this a “world view” then I have no objection to that.

Raymond Geuss (2020)<sup>1</sup>

Why are scholars of world politics unable to recognize the importance of uncertainty in world politics? I argued in Chapter 1 that humanist Newtonian and hyper-humanist Post-Newtonian worldviews shape analytical perspectives on risk and uncertainty. Humanist Newtonianism is central to conventional analyses of world politics. With most students of world politics following, economics took the lead by viewing reality as timeless; it deployed the lens of probability and paid little attention to uncertainty.<sup>2</sup> Since much of twentieth-century economics has resembled, roughly speaking, the physics of the 1870s and 1880s, this is not surprising.<sup>3</sup> Post-Newtonianism takes uncertainty for granted and is conceptually better equipped to explore terrains of world politics marked by uncertainty. The worldview of the analyst makes a difference: worldviews inform basic understandings of world politics.

Accepting the predictable/controlled and the unpredictable/uncontrollable as linked aspects of human experience, garden, park, and forest (or jungle) metaphors offer a convenient way to organize my discussion in this concluding chapter. Is the world neat or unkempt? We can make things look similar by failing to examine them closely. There exists a difference in intellectual styles between the mind of the French and the mind of the English. In understanding the laws of the natural (and we might add, the social) world, did God think like a French mathematician

I thank Matthew Evangelista for his careful reading and invaluable comments on an earlier draft of this chapter; Richard Price for making me consider some of the normative implications of my argument; and Begüm Adalet, Peter Gourevitch, and Stephen Krasner for their general reactions.

<sup>1</sup> Geuss 2020: 163. <sup>2</sup> Smolin 2013: 258–63. <sup>3</sup> Mirowski 1989.

or did she have the untidy mind of the English?<sup>4</sup> My answer is a resounding “both.” Leaving gods aside, Newtonian humanists imagine the world as a garden to be observed and controlled. Often, the garden fights back, revealing itself to be a jungle that is not tamed and might not be tamable. Hyper-humanist Post-Newtonians seek to understand the jungle as it is, well aware that this task is impossible due to the problem of radical uncertainty: not knowing what one does not know, one hence does not know what to include in a predictive model. My interest in uncertainty inclines to Post-Newtonianism, yet I remain tethered to visions of the garden in which I was raised. I thus find refuge in parks, which offer vistas to both garden and jungle.

Section 10.1 explores gardens and forests; it summarizes the core arguments of Henry Nau and Prasenjit Duara (presented in Chapters 6 and 7); and investigates the garden of experiments and the forest of experimentation as different ways of operating under conditions of putatively controllable risk and acknowledged uncertainty. Section 10.2 considers parks as zones of contact between gardens and forests; inquires into the complementarities between worldviews; surveys Newtonian and Post-Newtonian workarounds; and addresses the role of values. The final section (10.3) discusses the arguments of Bentley Allan and Timothy Byrnes (in Chapters 8 and 9) and science and religion more broadly as the two reigning worldviews that help us navigate a world filled with uncertainties.

### **10.1 Garden and Forests, Experiments and Experimentation**

Drawing on a broad variety of literary and cultural sources, Robert Harrison meditates on humanity, nature, and society as he explores gardens and forests.<sup>5</sup> Harrison’s gardens embody care and cultivation as quintessentially human traits. Life without them is soulless and humanity loses its defining purpose. Harrison shows gardens of many different types and in many different places: real, mythical, historical, literary, monastic, republican, princely, and imperial. All of them are central to the care of mortal life and defend against the ever-threatening reign of inhumane, passive, stillborn sterility. Lack of care drove Eve, the first human planter (of the seeds of the forbidden pomegranate), and Adam

<sup>4</sup> Cartwright 1999: 19.

<sup>5</sup> I thank my colleagues and friends in Cornell’s Circle seminar, as well as Caryl Clark, Patchen Markell, and Divya Subramanian for directing me to some of the sources used in this section. I also would like to thank Roderick Floud for reading this section and offering helpful criticisms and suggestions. Unlike Munroe (2008: 7–14) and others, I am not interested here in theorizing spatial and social relations. Harrison 1992; 2008.

out of God's garden. Care, "in its self-transcending character, is an expansive projection of the intrinsic ecstasy of life."<sup>6</sup> For gardeners, as for teachers, cultivation is not the same as creation. Planting seeds and nourishing life is what gardeners do and teachers aspire to do in the garden of young minds.

For Harrison, as in Rome, forests are birth sites of city and civilization; of profane pagan worship resisting Christianity; of spiritual solitude and savagery; of chivalrous knights gone mad; of royal prerogatives for hunting; of outlaws pursuing justice; of lyric nostalgia and error-filled tradition; and of presumed national essences. What is true of forest ecosystems holds also for the entire biosphere of the earth: a complex and integrated system of relations. Humanity is part of a diverse web of jungle- or forest-like, planetary sprawling relations. The Greek word *logos* originally "means 'relation.' *Logos* is that which binds, gathers or relates. It binds humans to nature in the mode of openness and difference."<sup>7</sup> It is true that past civilizations have typically encroached on the wilderness of forests in the interest of economic efficiency.<sup>8</sup> Yet, it is also true that in most classical Indian texts *jangal* refers to dry lands that turned out to be suitable for agriculture.<sup>9</sup> Forests are about ever-changing relations.

Metaphors that capture the awe-inspiring wilderness of forests and the tamed harmony of gardens express different worldviews.<sup>10</sup> Are gardeners and forest-dwellers occupying altogether different spaces? Are they experiencing a similar world differently? Or are they sharing some similar experiences in the world? These are old questions. Materialist and mechanistic Newtonian beliefs express a view of nature as lifeless matter, in motion and subject to universal laws. Vitalists and organicists saw instead an active nature filled with living entities and swarming matter much closer to the Post-Newtonian worldview of quantum mechanics and scientific cosmology. Mechanically interacting lifeless matter is more legible than a world teeming with always changing possibilities. Calvin, gardener extraordinaire, could not stand that "filthy dog" Lucretius and other vitalists who concealed the craftsmanship of an omniscient God that diligent astronomers, to Calvin's great satisfaction, highlighted so well.<sup>11</sup>

<sup>6</sup> Harrison 2008: 33.     <sup>7</sup> Harrison 2008: 200.

<sup>8</sup> Skaria 1999: vi–vii. Modest elevations protected peasants in Southeast Asia and Europe alike from the powers of taxation and conscription by the urban centers of civilizations.

<sup>9</sup> Skaria 1999: viii; Barton 2000: 557, 572–73. To complicate matters further, in contemporary Pakistan *jangal* refers to forest or jungle even though its etymological antecedent, the Sanskrit term *jangala*, referred to a man-made savanna. See Dove 1992: 231.

<sup>10</sup> Cooper 2006.     <sup>11</sup> Allan, Chapter 8.

Garden and forest metaphors capture experiences in and views of the world that reach deep and resonate profoundly. Forests often depict sites of solitude and resistance. In the Middle Ages, European peasants saw in forests a wilderness that differed starkly from their plowed fields. “Wood” and “wald” derive etymologically from “wild”: inhospitable domains of lawless unpredictability.<sup>12</sup> Forests were sites of contestations over power, authority, and identity in places as far apart as historical Germany and contemporary Southeast Asia. The introduction of modern forestry methods in eighteenth- and nineteenth-century Prussia and Saxony exemplified the power of the modern state. Carefully planned seeding, planting, and cutting aimed at transforming wild forests into predictable and profitable enterprises – a metaphor for the modern state’s effort of making civil society fully legible.<sup>13</sup> It was precisely that legibility that made Ernst Jünger’s fictitious forester a militant loner and solitary elitist willing to fight the authoritarian and dictatorial tendencies of modern social and economic systems.<sup>14</sup> Between the 1950s and 1970s, insurgency and counterinsurgency warfare in Southeast Asia occurred in forested territories invariably referred to as jungles. Discursively, institutionally, and practically, these spaces became objects for military conquest and political incorporation into national societies.<sup>15</sup> By the beginning of the twenty-first century, the jungle had become a rainforest – a fragile ecosystem deserving of humankind’s collective, defensive mobilization.<sup>16</sup> In America the sequence was reversed. In the first half of the nineteenth century, Thoreau’s *Walden* became an introspective call for a return to simple authenticity and a declaration of independence from society.<sup>17</sup> By the first half of the twentieth century, Americans had come to think of jungles as grim landscapes, the realm of dangerous apes and violent peoples. In memories and imaginations, the characteristics of forests are not firmly fixed.

England offers many examples of this fluidity. Shakespeare’s “sea-walled garden” was Edenic and set on the road to discovery and, eventually, world domination. Garden design changed dramatically from intimate medieval to expansive estate gardens, marked first by manicured, formal areas and later by more natural, though carefully planned, parks.<sup>18</sup> Kitchen gardens were common among all social strata; formal gardens with trimmed hedges and geometric arbors were only for elite households. Despite many attempts at imitation, eighteenth-century England had no Versailles, where “aesthetic displays of control over natural forces yielded stunning

<sup>12</sup> Jackson 1984: 45. <sup>13</sup> Harrison 1992: 108, 115–23; Scott 1998: 11–22.

<sup>14</sup> Jünger 2013. <sup>15</sup> Peluso and Vandergeest 2011: 589. <sup>16</sup> Enright 2008: 556.

<sup>17</sup> Cronon 1983. <sup>18</sup> Tigner 2012: 1–2, 5; Hunt and Willis 1975: 1–46.

visual effects . . . In the microcosm of the garden, the tools of French land-based politics were revealed in all their glory.”<sup>19</sup> In contrast, London’s Vauxhall was an innovation. It evolved from a formal garden catering to an aristocratic clientele to a kaleidoscopic pleasure garden and vivacious capitalist enterprise offering a public space wherein people who otherwise would never encounter each other could mingle.<sup>20</sup> Reflecting the growing complexity of social identities, nineteenth-century England proliferated a variety of gardens: wild, cottage, formal, and various syntheses.<sup>21</sup> And with the spreading of the British empire in the eighteenth and nineteenth centuries, landscaping practices linked imperial centers and colonial outposts.<sup>22</sup> Botanical gardens became one of the domestic symbols of empire.<sup>23</sup> It was only fitting when a young Princess Elizabeth compared the British empire in 1946 to an “English garden”—not formal and forced, but natural and organic.<sup>24</sup>

Garden and jungle or forest metaphors come up frequently in the sciences, the humanities, and the arts. Oxford mathematician Marcus Du Sautoy, for example, writes that “for any scientist the real challenge is not to stay within the secure garden of the known but venture out into wilds of the unknown.”<sup>25</sup> For Fields Medal winner Maryam Mirzakhami, “doing research . . . is like being lost in a jungle and trying to use all the knowledge that you can gather to come up with some new tricks, and with some luck you might find a way out.”<sup>26</sup> Neuroscientists conceptualize the development of the synapses between brain neurons in garden terminology, as a process in which synapses are first exuberantly overproduced and subsequently “pruned.”<sup>27</sup> And in his discussion of different kinds of scientific fraud, Charles Babbage writes about the trimming of experimental data, “clipping off little bits here and there from those observations which differ most in excess from the mean.”<sup>28</sup>

The Garden of Eden and other paradisaical depictions of the Golden Age are the religious and classical mothers of European garden metaphors. Bereft of nature’s seasonal cycle – birth, life, and death – God’s garden lacked a defining sign of humanity. Did Eve perhaps take a bite from the forbidden fruit to find in nature’s cycle the humanity that remained inaccessible to her in the celestial realm? Exiled to the real world, she did not lose touch with the divine – for on earth, a gardener’s bottom is often pointing to heaven. In contrast to theological tracts, Hobbes’s state of nature did not allow for any Edenic discourse.<sup>29</sup> Eventually, however,

<sup>19</sup> Mukerji 1997: 2. <sup>20</sup> Dubois 2015; Coke and Borg 2011. <sup>21</sup> Helmreich 2008: 274.

<sup>22</sup> Casid 2005; Herbert 2011; Barton 2000; Drayton 2000. <sup>23</sup> Tigner 2012: 159–94.

<sup>24</sup> [www.bbc.co.uk/archive/princesselizabeth/6602.shtml](http://www.bbc.co.uk/archive/princesselizabeth/6602.shtml). <sup>25</sup> Du Sautoy 2016: 8.

<sup>26</sup> Carey 2014. <sup>27</sup> Neniskyte and Gross 2017. <sup>28</sup> Chevassus-au-Louis 2019: 2.

<sup>29</sup> Moloney 1997.

the Hobbesian jungle, governed by Leviathan, was challenged by Proudhon's anarchist utopia.<sup>30</sup> More than a century later, while advocating social coordination without the state, public choice theorists searched for their utopian "equilibrium in the jungle."<sup>31</sup>

In eighteenth-century music, the free fantasia occupied a jungle-like space combining composition with improvisation – "fragmentary, subjective, open-ended, it simultaneously resists interpretation and offers itself promiscuously to multiple readings."<sup>32</sup> More generally, discourses of nature have been a major preoccupation for classical composers. Nature, natural settings, and outdoor spaces are recurrent opera themes. Many Baroque and later operas feature enchanting, bewitching, or seductive garden scenes.<sup>33</sup> Music composed by Mahler, Sibelius, Grieg, Bartok, and Copeland incorporate folklore traditions that have close connections to nature.<sup>34</sup> And in the twentieth century, Duke Ellington developed jungle jazz. Initially it was an exotic form of entertainment for white audiences frequenting Harlem's Cotton Club in the 1920s and 1930s. In the 1960s and 1970s, late in Ellington's career, jungle became a self-conscious reclaiming of a diasporic history for African and African-American audiences. A generation later, as part of the rave scene, jungle became a genre of electronic music.

In philosophy, theater, movies, and literature, gardens and forests are also persistent metaphors. Acknowledging its intrinsic value, philosopher Michael Smith advocates "letting the jungle in," arguing that ethical concerns about the jungle and the environment more generally should not focus on the relative distance between moral objects and ourselves, but on a community of relationships that commands respect and care.<sup>35</sup> The French poet and playwright Antonin Artaud sought a radical break from the carefully scripted, grammatically correct language and its predictable order that modern audiences had rejected for their pretentious and unrealistic claim of France, and the French, as a well-tended garden.<sup>36</sup> He pleaded instead for the primacy of the body as a jungle where anarchic impulses could be acted out. The 1955 movie *Blackboard Jungle* stirred debate about its treatment of teenage violence in America's inner-city schools.<sup>37</sup> For Werner Herzog, writer and director of the epic 1982 film *Fitzcarraldo*, the jungle was the attractive and yet repulsive epitome of excess. Rudyard Kipling's *The Jungle Book* offered a series of

<sup>30</sup> Coyne 2003: 557–58. <sup>31</sup> Piccione and Rubinstein 2007. <sup>32</sup> Richards 2001: 15.

<sup>33</sup> Hunter 1993. Haydn's oratorios, Act IV of Mozart's *The Marriage of Figaro*, the middle acts of Wagner's *Tristan*, and Klingsor's magic garden in *Parsifal* all draw on garden and jungle or forest metaphors.

<sup>34</sup> Peattie 2015: 8; Grimley 2006. <sup>35</sup> Smith 1991: 152. <sup>36</sup> Artaud 1958: 74–83.

<sup>37</sup> Stoever-Ackermann 2011.

animal fables set in the Indian jungle, where fantastically unpredictable events were set in motion.<sup>38</sup> And Upton Sinclair's *The Jungle* became a classic depiction of the raw capitalism of America's meat-packing industry at the outset of the twentieth century.<sup>39</sup>

The American West is also filled with jungle or forest and garden imagery. Nineteenth-century American landscape painting shaped popular imaginations by depicting the frontier west of the Mississippi as an idyllic, unspoiled land inhabited by "noble savages."<sup>40</sup> The frontier's most famous and persistent proponent, Jackson Turner, disagreed. The West was a meeting point of forest and garden, savagery and civilization. American democracy emerged from the forest as it regenerated from America's forever moving frontier.<sup>41</sup> In the twentieth century, America's pastoral dreams and imagination were transformed by the assault of an industrial machine that wreaked havoc inside the garden without destroying its mythical powers. Nick Carraway, the narrator in F. Scott Fitzgerald's *The Great Gatsby*, struggles emotionally with the "garden" and "wilderness" images of the New World. Gatsby impersonates the American Adam, and America exemplifies a "complex pastoralism" forged in history and through politics.<sup>42</sup> A century later, the experience with garden cities and the environmental necessity of lowering the carbon imprint of urban life points to a possible narrowing of the difference between machine and garden.<sup>43</sup> Some have gone so far as calling postwar Oakland an "industrial garden."<sup>44</sup>

The garden metaphor aptly captures Nau's analysis in Chapter 6, just as the forest metaphor shines through much of Duara's Chapter 7. Nau expresses a profound worry that high modernity may rob humanity of the ability to make individuals accountable for their choices. We risk, he argues, losing sight of the importance of the self-extending gardener's care for and cultivation of the welfare of life nourished in humanity's garden. Expressing a worldview that goes beyond humanist Newtonianism, Duara looks for civil society actors whose holistic cosmologies and religious resources may equip them to address the counterfinalities that are threatening the planet's very existence in high modernity.

<sup>38</sup> Kipling 1894. <sup>39</sup> Sinclair 1906. <sup>40</sup> Goetzmann and Goetzmann 1986.

<sup>41</sup> Smith 1950: 251, 253. <sup>42</sup> Lewis 1955: 197; Marx 1964: 356–57, 363.

<sup>43</sup> Hurley and Reynolds 2014: 77.

<sup>44</sup> Self 2003: 23. The "jungle" of Japan's chaotic cities conveys a dynamism lacking from planned cities in other parts of the world. Half a century later, a proposed design for Berlin's new Humboldt Forum museum would conceal the façade of the restored historical Hohenzollern palace with lianas and plant a jungle on its roof. <http://hybridspacelab.net/project/humboldt-jungle/>. Accessed 03/12/20.

Nau pushes back against what he regards as relationalism's attack on the Enlightenment values of rationality and individuality.<sup>45</sup> Following Max Weber, he contends that individual human beings, with their capacity for self-consciousness and reason, give meaning to the social and natural world. While reason is only one among several human faculties, it is the one that creates space for choice and hence accountability in human affairs. Relationalism, by contrast, accords greater influence to nonrational faculties – emotion, religion, intuition, habit – and diffuses the agency for change throughout a holistic universe that leaves little room for individual responsibility.

In line with Dilthey and Weber, Nau argues that it is a mistake to model social science after natural science. The Newtonian worldview was never simply atomistic and disenchanting. It was inspired by a Christian (Protestant) worldview valuing individual human beings and a predictable cosmos. Weber secularized that view: human beings, not the divine, give meaning to life. For Nau, relationalists hold that the quantum world implies a universe of entanglement and nonlocality that dispenses with reasoning individuals and insists on the observed world as the only one we can know. For Nau, the individual and an objective universe do not disappear in quantum science or scientific cosmology. The investigator becomes more important than ever, but as an “outside” actor who asks the questions. And for Nau the objective world exists and remains the only basis for supporting or disproving quantum propositions.

Because the world is holistic and is open to interpretations offered by all worldviews, Nau argues, relationalism has nothing to say about individual or collective ethical and moral responsibilities. It simply denies the human freedom to choose and be held responsible. What's left are sciences that blend diverse values with localized (not universal) experimentation (trial and error) and are compatible but not commensurable, harmonious but not integral, and equivalent but not competitive. Multiple beliefs and realities cut or “smear” into one another like quantum waves. They blend and harmonize. But what if multiple worldviews do not harmonize? What if some worldviews condone slavery, genocide, discrimination against women (Islam in Saudi Arabia) or minorities (Uighurs in China), holy war against the infidel, and so on? Do we welcome those worldviews too, or consider them wrong only in their specific time but not in general (respecting quantum locality)? The Weberian worldview – the human capacity for individual agency, free

<sup>45</sup> Chapter 6.



thinking, and choice – for Nau is an indispensable defense against those sorts of evil.

In Chapter 7, Duara's hyper-humanist concern with the Anthropocene and planetary politics offers a striking contrast to Nau's humanist engagement with international politics as it is conventionally understood. Duara works within a conceptual approach that relies on individual and distributed agency, relational and processual thinking, layered and interactive temporalities, and a willingness to explore worldviews other than Newtonian humanism. He focuses on China's rise, as well as on an issue that receives no specific mention in Nau's chapter: the ocean as a concrete illustration of the metaphorical jungle. Duara responds to a profound crisis of high modernity that China's rise accentuates as the world is struggling to find a sustainable future.<sup>46</sup> Since the ocean (or jungle) threatens to submerge the planet, Duara is profoundly skeptical of Nau's claim of the overwhelmingly beneficial control of humanist Newtonianism over nature.

Duara locates his argument at the point where humanism meets hyper-humanism and Newtonian science meets Post-Newtonian science. He builds on both the substantialism of Newtonianism and the relational and processual ontology of the world of quantum physics and scientific cosmology, embodied in and by the ocean. For Duara, efficiency-driven, resource-exploiting, nature-controlling, and competing nation-states are the epistemic engine driving the conventional realist or liberal worldview that frames current world orders and world politics. Central to that worldview is nationalism as a secular religion that has transfigured salvation into progress – testimony to the dynamic achievements of the Enlightenment projects and modern science and technology.

In China's past, the issue of otherness differs from the sharp distinction between national self and other in the Westphalian system. Indifference, conversion, negotiation, and occasionally conquest were played out in a world conceptualized as concentric discs that went out of focus the further removed they were from the Heavenly City. Insiders were civilized people who belonged. Outsiders were beasts who did not. And an intermediary disc consisted of various kinds of semi-barbarians who might become civilized and absorbed through continuous interaction with insiders.<sup>47</sup> Expressed in open-ended, flexible tribute practices and language games, the traditional Chinese world order and worldview, Duara argues, differed greatly from the codes and rules of the Westphalian system. The Chinese order was hierarchical and paternalistic rather than constituted by states equal in legal status. Unlike European states,

<sup>46</sup> Duara 2015. <sup>47</sup> Katzenstein 2012: 3, 6.

the rulers of imperial China were for the most part uninterested in controlling space lying beyond imperial frontiers. Military operations, mostly limited, were designed to stabilize the tributary system at the frontier rather than seeking to control the foreign territories beyond it. What mattered was the symbolic subordination of neighboring states, communities, and groups that were otherwise peripheral to China.

The contrast among different kinds of cosmopolitanism and nationalism is unmistakable, as Michael Barnett shows in Chapter 5. Barnett distinguishes between a revisionist Zionism that builds on a mixture of territorial and particularistic components and a rooted cosmopolitanism indebted to deterritorialized and universal building blocks. These conceptions fit into the Westphalian system more readily than traditional Chinese notions of hierarchically negotiated harmony. Duara argues that, at least to some extent, that system lingers on in contemporary China's worldview, expressed in the ideals of harmony, authority, and nonintervention. This vision appears to be at odds with Westphalia, even though the Belt and Road initiative has unfolded along Westphalian lines of capitalism, nationalism, and statism. Duara is uncertain what differences may emerge as China becomes a superpower. China has become a driving force of the contemporary epistemic engine shaping global developments. It entered the garden of modernity on a path different from the one charted by the Enlightenment projects; but we know it arrived because its worldview's reliance on Newtonian humanism can be seen everywhere. Within this framework, China has invested greatly in clean energy and poor countries, while at the same time outsourcing its requirements for natural resources and intensifying its authoritarian techniques of surveillance and suppression. In the foreseeable future, Duara argues, China is unlikely to offer a new vision of a global order.

Coupled tightly with China's ascendancy, the rising ocean is destroying life as we know it. High modernity contains unknowable futures toward which nations are racing, perhaps unstoppably. Such counterfinalities point beyond the walls of the Newtonian-humanist garden, toward dimly perceived alternatives with different cosmologies, moralities, and possibilities. Even though there exist no ready-made alternatives, the bulk of the world's population may not fully believe in the disenchanting cosmology of modernity. The *Panchashila* "principle-based development" movement of decolonizing nations, Iranian theocracy, and Saudi Arabia's neofeudalism are not viable alternatives to the "hegemonic doxa" of Newtonian humanism and the Westphalian state system that currently organize world politics. In the future, pandemics and other natural disasters may become more effective brakes than the competition between states. For Duara, the ocean is the real and metaphorical

incarnation of planetary processes that create unpredictable effects that Newtonian humanism struggles to explain and cope with. Duara ends with the thought that protection of human rights and the defense of a world endangered by the intellectual forces that made those rights more or less secure offer a dual moral mandate for an era that both builds on and transcends conventional Newtonian-humanist premises, exhortations, and critiques.

*Experiments.* Before presenting my overall argument that parks comprise bridges between garden and jungle, let us first stroll through the garden of experiments and trek in the forest of experimentation.<sup>48</sup> Since the world is conceptualized in Newtonian terms as a decomposable system, theories are tested via application on its constituent parts.<sup>49</sup> 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.<sup>50</sup> The attempt to control for all but one or, at most, a small number of variables, is central to experimental studies that cannot rely on randomization in a laboratory setting.<sup>51</sup> Experimental work sometimes reports statistical significance tests even when those effects are small, of short duration, and highly unstable over time. Most of the time, however, we are interested in the size of a statistical effect rather than its existence.<sup>52</sup> And the assessment of size requires substantive argumentation and agreement among communities of experts and, perhaps, as in physics, a priori theoretically informed specification. There is no substitute for scientific, policy, or personal judgments. Physicists do not rely much on standard tests of statistical significance and are wary of replacing judgments with tables of conventionally defined goodness-of-fit measures.<sup>53</sup>

<sup>48</sup> I am grateful to David Bateman, Alexandra Blackman, Alexandra Cirone, Ilene Grabel, Sabrina Karim, Sarah Kreps, Douglas Kriner, Adam Levine, Bryn Rosenfeld, Geoffrey Wallace, Jeremy Wallace, and Christopher Way for their critical comments and suggestions on earlier drafts of this section.

<sup>49</sup> Green and Gerber 2002: 822–23, 828.

<sup>50</sup> Druckman, Green, Kuklinski, and Lupia 2011; Teele 2014; Gerber and Green 2012; Chilton and Tingley 2013; Hyde 2015.

<sup>51</sup> Conjoint experiments seek to identify the causal impact of a potentially larger number of factors on some quantity or outcome of interest. See Hainmueller, Hopkins, and Yamamoto 2014.

<sup>52</sup> Gaines, Kulinski, and Quirk 2006; McCloskey and Ziliak 2008a; Gerber and Green 2012: 65–66. The field of American politics, and public policy more generally, typically focuses on the magnitude of effects, for example of different modes of increasing voting. Green and Gerber's (2015) focus on behavioral outcomes makes it more intuitive and easier to calculate effects than the attitudinal outcomes typically measured in the survey experiments reported by students of international relations.

<sup>53</sup> McCloskey and Ziliak 2008b: 42–44, 51–52.

In contrast to students of American politics, comparative politics, and public policy, students of international relations rely heavily on survey experiments. Most often, they simply are in no position to conduct field experiments on substantively important questions. Unfortunately, the external validity of survey experiments is highly suspect; for example, asking respondents about their policy choices in an imagined nuclear crisis simply cannot duplicate decision-making dynamics in a real nuclear crisis. Furthermore, in the analysis of international politics, experiments 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 when applied in the social sciences. With quantum mechanics very much on his mind as early as 1946, Morgenthau warned against the use of experiments, for both theoretical and practical reasons.<sup>54</sup> In taking measurements of the social 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.”<sup>55</sup> Measurement alters the characteristics of the object that is being measured.<sup>56</sup> It is thus very difficult, if not impossible, to create proper experimental setups. In the field 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.<sup>57</sup> Since phenomena are difficult to replicate reliably, especially outside of a laboratory, “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.”<sup>58</sup>

Understandably, proponents of experiments disagree. They believe that tight controls over all plausibly relevant conditions except the treatment establish a firm ground for causal inference. A philosopher of physics, Nancy Cartwright, and a heterodox economist, George DeMartino, disagree. Cartwright argues that as we shift from controlled micro- to uncontrolled macro-environments, we run into the fact that all “generalizations” in the natural and, by extension, social world are *ceteris paribus* laws.<sup>59</sup> They are not general; they obtain only under specifically defined circumstances. This limits greatly their contribution to the search for generalizability and simplification. Furthermore, DeMartino argues, all causal arguments about the past, present, and future depend on counterfactual reasoning.<sup>60</sup> It is not only our knowledge of the future

<sup>54</sup> Morgenthau 1946: 125–44. <sup>55</sup> Morgenthau 1946: 143.

<sup>56</sup> Morgenthau 1946: 141, 143–44. <sup>57</sup> Deaton and Cartwright 2018: 11.

<sup>58</sup> Porter 1995: 13. <sup>59</sup> Cartwright 1999: 25–29. <sup>60</sup> DeMartino 2018.

that is fictitious and uncertain, as critics of rational expectation theories have argued. It is also our knowledge of the past, for we do not and cannot distinguish between contending counterfactuals concerning past events. This is true of all randomized control trials in field and survey experiments.<sup>61</sup> Whether World War I would have happened in the absence of the assassination of the Archduke is based unavoidably on a constructed narrative about the past. In sharp contrast to Newtonianism, all causal claims in a quantum worldview are based on counterfactuals about different, possible worlds. Theories are based not on what is seen but 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."<sup>62</sup> We solve this thorny problem by adhering to the convention that only one framework is feasible or legitimate. For the proponents of experiments, that one convention is a Newtonianism that denies a constitutive role of uncertainty. Put differently, we accept without further thought what we purport to test empirically.

In survey and field 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."<sup>63</sup> Nancy Cartwright is more laconic when she writes that randomized control trials are not the gold standard, for the simple reason that there are no gold-standard experiments beyond those held under extremely narrow scope conditions and thus resistant to generalizations.<sup>64</sup> The average of a treatment effect, though useful, does not tell us what percentage of the population is affected positively, or negatively, or not at all.<sup>65</sup> We need to understand not only the experiment but also its context and operative mechanisms before we can evaluate its relevance to our understanding of the world we are part of. In a world marked by heterogeneity and large numbers of covariates, the knowledge gained from randomized control trials is often oversold.<sup>66</sup> Experiments are good for isolating specific treatment effects. They are narrow by design. Local average treatment effects apply only to the specific treatment applied to a specific sample. External validity remains a huge challenge when it comes to generalizing the results of one or a few experiments. When all is said and done, experiments are precise and narrow.

<sup>61</sup> DeMartino 2018: 10. <sup>62</sup> DeMartino 2018: 13. <sup>63</sup> Deaton 2010: 438.

<sup>64</sup> Quoted in Deaton 2010: 426. <sup>65</sup> Deaton 2010: 449.

<sup>66</sup> Deaton and Cartwright 2018: 3, 10.

To understand “what works,” we need a theory of why things work rather than just experiments that test whether things work.<sup>67</sup> Simple extrapolation and generalization from repeated successful replication is not a theory in and of itself. Many practitioners of experiments agree that well-established results do not necessarily export to other settings. It takes good reasons to justify even making the attempt. And such reasons often do not exist.<sup>68</sup> 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. Both randomized control trials and field and survey experiments run this chicken risk. To be sure, proper specification of scope conditions, heterogeneous treatment effects, and how to address problems of replication offer avenues for protecting experimental research against the charge of claiming more than it can prove. However, the deeper problem is not with the method itself but with a possible lack of understanding of the social conditions that give rise to the causal relationship the chicken, or experimenter, observes.<sup>69</sup>

At best, randomized control trials can establish “circumstantial” causality that points to observable effects under specific historical circumstances, rather than generalized causality. 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.”<sup>70</sup> But, as Blaug mischievously suggests, history repeats itself because “historians repeat each other.”<sup>71</sup> Since for many historians (and some physicists) the past is as open and indeterminate as the future, this is at best an argument for a world of weak causal effects, with the concept of cause encompassing Aristotle’s four different kinds of causes rather than being restricted only to Hume’s notion of efficient cause. Furthermore, long chains of causation cannot be foreseen with “any degree of certainty.”<sup>72</sup> No easy shortcuts get us around the problems raised by differences in contexts, mechanisms, *ceteris paribus* conditions, and counterfactuals – other than the confidence instilled by a Newtonian worldview of politics.

*Experimentation.*<sup>73</sup> Experimentation that reflects a Post-Newtonian worldview proceeds along a different line of reasoning. It assumes that appropriate scientific practice is rooted not in a better philosophy of epistemological and ontological claims or a better set of methods, but in

<sup>67</sup> Deaton 2010: 442. <sup>68</sup> Deaton and Cartwright 2018: 10–12.

<sup>69</sup> Deaton and Cartwright 2018: 11–14. <sup>70</sup> Basu 2014: 459. <sup>71</sup> Blaug 1963: 152.

<sup>72</sup> Morgenthau 1946: 127.

<sup>73</sup> I would like to thank Ilene Grabel for commenting critically on an earlier version of this section.

a better understanding of the scientific enterprise. Rather than imagining that a well-designed experiment can yield insights on widely generalized phenomena, it starts with the proposition that one well-designed and focused experiment can yield insights that, at best, another such experiment can build on.<sup>74</sup> Experiments are events; experimentation is a process. In practice, both the natural and the social sciences are based on trial and error. They are “multifaceted, epistemologically opportunistic” and not dogmatically associated with a particular philosophy.<sup>75</sup> But, in contrast with the practice of 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.”<sup>76</sup> This is no small matter. In the analysis of world politics, Henry Kissinger, a realist here turned Post-Newtonian, holds that context is everything.<sup>77</sup> Stressing a profound similarity between the natural and the social sciences, experimentation is informed by a Post-Newtonian worldview.

Albert Hirschman was a man of forests. He developed his very own Post-Newtonian social scientific approach. It was well attuned to making things work without searching for law-like generalizations, relying on any one “ism,” or touting any one “killer method.”<sup>78</sup> He 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 experimentation with new forms of practice and institutional arrangements. His belief in small-scale experimentation resonates with those who advocate experiments more generally. However, he rigorously opposed the temptation to argue that any lesson learned from small-scale experiments could be scaled up to larger settings marked by unknown yet surely different conditions. Learning by doing, listening rather than preaching, humility, and the capacity to adjust and adapt to changing circumstances were the hallmarks of his approach. He favored incoherence over coherence and 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 capitalized S), often enunciated as part of a Newtonian worldview. 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*.”<sup>79</sup> Not quite. His disposition was

<sup>74</sup> In this it resembles Weber’s suggestion of the usefulness of ideal types drawn from empirical research as abstract stepping stones for the next empirical inquiry.

<sup>75</sup> Wight 2013: 340. <sup>76</sup> Adams 2020: 360. <sup>77</sup> Mead 2018.

<sup>78</sup> Grabel 2017: 29–54; Meldolesi 1995.

<sup>79</sup> Urbinati 2015. See also the epigraph to Chapter 1.

Post-Newtonian. In a complex world filled with unknowable uncertainties, he opposed reductionist models, epistemic certainty, and the pretense of 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.<sup>80</sup> After half a century of obscurity, development economics has recently been swept up by the excitement of RCTs, which was both widely noted and criticized when it was recognized with the 2019 Nobel Prize for Economics.<sup>81</sup> Taken together with the macro approach of large-N statistical studies, this micro approach may undergird a new and better development economics.<sup>82</sup> But Hirschman would have presented both epistemic and ethical grounds for skepticism of the positivist RCT approach in general, and especially its dubious claim that microscopic experiments can lead to actionable knowledge about how to achieve large-scale growth and development. He would likely have been repulsed by the power disparities between economic experts and vulnerable populations exposed to ethically dubious experiments. More likely, he would have welcomed the pragmatic learning-by-doing approach to development through an inclusive growth strategy, as illustrated by China since 1979.<sup>83</sup>

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 of research sites made accessible by local gatekeepers, and suspicion of efforts to transplant observed local average treatment effects to unrelated and distant sites are hallmarks of an experimentation approach. Most importantly, it is the faith in and embrace of what is possible.<sup>84</sup>

Experimentation is based on a worldview that acknowledges the existence of uncertainty, and incomplete, dispersed, partial, tacit, and limited knowledge. It is also marked by humility. 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 was a serious neurosis that afflicted economics and other social sciences that were also grounded in Newtonianism.<sup>85</sup> His commitment to complexity was as unshakable as his commitment to intervention. Practical intervention always has unknowable effects that are set in motion by contending forces and a totality of circumstances that is

<sup>80</sup> Hirschman 1958. <sup>81</sup> Reddy 2013; Dehejia 2016. <sup>82</sup> Grabel 2017: 32–33.

<sup>83</sup> Ang 2016. <sup>84</sup> Grabel 2017: 33. <sup>85</sup> Grabel 2017: 37.



unknown to the researcher or practitioner at the time the intervention is made.

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, linear, decomposable, and analytically tractable system, Hirschman's approach expressed the hope of exploiting unforeseen possibilities for improving it.<sup>86</sup> Hirschman's "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."<sup>87</sup> Hirschman regarded a nonprojected, open future as a truly inalienable right for every person or nation.<sup>88</sup> As did Russian Nobel Prize-winning physicist and human rights activist Andrei Sakharov, who wrote in a letter from his exile in Gorky: "fortunately, the future is unpredictable and also – because of quantum effects – uncertain."<sup>89</sup> As for the social 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."<sup>90</sup> Convinced of the importance of uncertainty, he resolutely refused to cede possibilistic ground to probabilistic thinking.

Playing off Adam Smith's "invisible hand," Hirschman's "hiding hand" principle captures many of these observations.<sup>91</sup> The hiding hand recognizes ignorance as a precondition for rather than an obstacle to progress. In most domains, actors unavoidably are ignorant and make mistakes as they operate under conditions of uncertainty. This ignorance can be highly productive. Embarking on a project that seems manageable at the outset and then turns out to be fiendishly difficult, ignorance cultivates unknown capacities for innovation and adaptation. Hirschman's hiding hand beneficially conceals those difficulties and thus frees previously untapped powers of creativity. Without our ignorance, we would not start projects and thus forego the possibility of learning and the creation of possibly long-term beneficial outcomes or effects. We stumble into progress rather than plan for it. Predictions based on laws of change are misleading, and predictive failures breed success. We can literally "fall from error into truth."<sup>92</sup> Hirschman did not

<sup>86</sup> Hirschman 1971. <sup>87</sup> Grabel 2017: 46. <sup>88</sup> Hirschman 1971: 30.

<sup>89</sup> [http://people.bu.edu/gorelik/AIP\\_Sakharov\\_Photo\\_Chrono/AIP\\_Sakharov\\_Photo\\_Chronology.html](http://people.bu.edu/gorelik/AIP_Sakharov_Photo_Chrono/AIP_Sakharov_Photo_Chronology.html). Accessed 09/30/20.

<sup>90</sup> Hirschman 1980: xii.

<sup>91</sup> Hirschman 1967; Gladwell 2013; Meldolesi 1995: 38, 118–20.

<sup>92</sup> Hirschman 1967: 13, 20.

believe that context-independent and timeless factors, such as economic fundamentals, determine the success or failure of our projects in the world. Instead, he acknowledged the importance of a norm-based, practical wisdom that embraces “possibilism” and humility as two of its guiding principles.

How can experimentation be made workable in the analysis of world politics that relies heavily on survey experiments? In a paper indebted to quantum theorizing, Leonardo Orlando points to “elicitation” interviews as a research method that may bolster an experimentation approach.<sup>93</sup> It offers a way of probing consciousness and experience through “introspection” as an alternative to treating humans as responding to set questions in survey experiments. The elicitation method seeks to get around a well-established finding in psychology that shows reliable self-reporting to be impossible because mental processes cannot be accessed introspectively.<sup>94</sup> However, being unaware of a mental act does not mean we cannot access it with an interview method that differs from the conventional approach. Retroactive awareness can activate passive memory and the constant, involuntary memorization of lived experience that escapes our notice.<sup>95</sup> To access that awareness requires bypassing explanations as to *why* a subject did or did not do X and guiding the subject to her cognitive processes through the “elicitation interview method,” which leads the subject to share increasingly detailed elements of how past choice processes unfolded. Elicitation interviews rely on rigorous protocols that direct attention to the description of fine-grained elements of the evoked choice process while deflecting the subject’s attention from explanations and abstractions.<sup>96</sup> This method seeks to remedy our normal blindness to lived experience and avoids diving ever deeper into the trap of providing post-hoc reasons for past choices.<sup>97</sup> Decision points are productively conceptualized as choice processes that are inherently indeterminate. This method self-consciously foregoes the search for universal laws or generalizations.

Beyond issues of methodology, how we think about the world has causal effects and will affect how we might want to change it. Hirschman’s possibilism sidesteps both the overconfidence that we can fix everything and the fatalism that nothing can be changed. Instead of

<sup>93</sup> Orlando 2020: 468–471. I thank Dr. Orlando for reviewing the accuracy of this paragraph for me.

<sup>94</sup> Orlando 2020: 469–70. <sup>95</sup> Orlando 2020: 470. <sup>96</sup> Orlando 2020: 470–71.

<sup>97</sup> Orlando 2020: 472–74 disarms the criticisms of interpretive, retrospective, and unverifiable representational biases by quantizing introspection – that is, by linking minimally interpreted descriptions of decision processes to transversal structures operating like Schrödinger’s equations without depending on individual subjects or specific contexts.

epistemic certainty, he believed in the importance of path-dependent change, small steps, local contexts, unintended consequences, and adaptive learning. Above all, he prized experimentalism and improvisation as practices, along with slow reform-mongering that creates the possibility for substantial change.

*Conclusion.* Informed by different worldviews, as we make our way in the world 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 performing smartly designed field or survey experiments. Experiments share in the hope of studying the effects of treatment assignments and then, perhaps, 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 conditions in a dynamically evolving world filled with uncertainties that resist law-like generalizations. Like risk and uncertainty, experiments and experimentation are two halves of one walnut.

Bentley Allan concludes his chapter with an ecumenical argument for a processual social science that strives to generate general or middle-ground theories. The aim is not to create a catalogue of laws or mechanisms, supported by experiments. Rather, processual social science should offer an “agile base for an experimental approach to politics.”<sup>98</sup> This stance might help in orienting us to the uncertainties of the world, juggling several causal factors, observing trade-offs, and locating potential points of engagement: “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.”<sup>99</sup>

A similar sense of intellectual openness in an indeterminate world is also central to Milja Kurki’s capacious treatment of how to think about causation and Peter Galison’s detailed studies of the material culture of microphysics. Kurki seeks to free the concept of cause from the deterministic and mechanistic connotations that it has for many students of world politics and social theorists.<sup>100</sup> She probes a multiplicity of meanings that the concept of cause can have, so that we can appreciate the many

<sup>98</sup> Chapter 8.

<sup>99</sup> Chapter 8. A similar sense of intellectual openness in an indeterminate world is also central to Milja Kurki’s capacious treatment of how to think about causation and Peter Galison’s detailed studies of the material culture of microphysics. Kurki seeks to free the concept of cause from the deterministic and mechanistic connotations that it has for many students of world politics and social theorists.

<sup>100</sup> Kurki 2008: 11–12. Clarke and Primo (2012) remind us repeatedly and helpfully that different models serve different purposes. In testing models “final cause” may therefore be as important, or more important, than “efficient cause.” Most scholars of world

nondeterministic senses in which causes can work. In doing so she embeds the Humean notion of efficient cause (observed regularity relations of patterned events) within Aristotle's broader conceptual apparatus, which acknowledges three additional notions of cause: material (the passive potentiality of matter), formal (defining shapes or relations), and final (purposes that guide both rest and change). Kurki thus provides a rich and flexible understanding of causation that locates efficient causes in their relation to final causes and within the constitutive or causally enabling or constraining context understood in terms of material and formal causes. The task of analysis is not to isolate one kind of cause, but to focus on the complex concatenation of different types of causes, thus resisting the reductionist impetus to focus only on risk and thereby neglect uncertainty as a constitutive part of world politics.

Focusing on what he calls zones of exchange, Galison warns against the barrenness of all dichotomies.<sup>101</sup> Here: positivism and science as a series of prescribed and rigorous rules for discovery, replication, verification, and confirmation, and theory-independent data offering an empirical form of knowledge drawn from raw experience. There: creative muddling through and adaptive learning catching emergent processes. What holds physics together, Galison argues, is not a single scientific apparatus or a veneer of rationality concealing the exertion of raw interests, but a patchwork of many things and practices. Instrument makers, theorists, and experimenters generate and operate in distinct cultures connected by trading zones and border regions that reveal how the whole of physics fits together. Communication is made possible by different pidgin and creole languages that pre-Einsteinians, Einsteinians, and post-Einsteinians fashion as they seek contingent, local forms of coordination among dynamically evolving material and epistemic traditions marked by different interpretive practices. This is where and how the whole of physics is worked out. It should be no surprise, then, that in the polycultural history of physics – and perhaps the social sciences and the analysis of world politics – the meanings of “experiments” and “experimentation” have

politics are unaware of conceptions of cause that differ from and go beyond the concept of efficient cause.

<sup>101</sup> She probes a multiplicity of meanings that the concept of cause can have, so that we can appreciate the many nondeterministic senses in which causes can work. In doing so she embeds the Humean notion of efficient cause (observed regularity relations of patterned events) within Aristotle's broader conceptual apparatus, which acknowledges three additional notions of cause: material (the passive potentiality of matter), formal (defining shapes or relations), and final (purposes that guide both rest and change). Kurki thus provides a rich and flexible understanding of causation that locates efficient causes in their relation to final causes and within the constitutive or causally enabling or constraining context understood in terms of material and formal causes. The task of analysis is not

been unstable and contested for the last 350 years. This would not be a surprise for Harry Lipkin, a theoretical particle physicist. He writes that “the best physics I have known was done by experimenters who ignored theorists completely and used their own intuitions to explore new domains where no one had looked before.”<sup>102</sup>

Expressed as the practice of experiments and experimentation in the history of physics, Newtonian and Post-Newtonian worldviews resonate with a long arc of intellectual history. Toulmin argues that for about 300 years, from the middle of the seventeenth century to the middle of the twentieth, philosophy focused on the general, the timeless, and the theoretical. Before and after, in its medieval and post-Wittgensteinian forms, it focused instead on the local, the timely, and the practical.<sup>103</sup> Montaigne and Descartes exemplify this difference, as reflected in “the practical modesty and the intellectual freedom of Renaissance humanism, and the theoretical ambitions and intellectual constraints of 17<sup>th</sup>-century rationalism.”<sup>104</sup> For Toulmin, “cosmopolis” offers a comprehensive account of the world that binds things together in politico-theological as much as in scientific-explanatory terms. In the early eighteenth century, the cosmopolitical function of the Newtonian worldview counted for more than its explanatory function.<sup>105</sup> Today, Newtonianism’s cosmopolitical function has fallen silent. And it is largely forgotten that Newton was an accomplished experimentalist. Unaware, we now focus only on the explanatory presuppositions of Newtonianism’s worldview. Hirschman’s plea for experimentation reminds us of the existence of a different, Post-Newtonian alternative that acknowledges uncertainty as an irreducible aspect of world politics.

## 10.2 Inhabiting the Same Park? Complementarities, Workarounds, and Values

Parks mix elements of forest and garden, sometimes in unexpected ways. Parks are designed to suppress the appearance of a garden’s artificiality, its rigid imposition of discipline and fixed borders.<sup>106</sup> Seventeenth-century English gardens were highly artificial, walled environments. But as wilderness began its slow retreat from the English countryside, aesthetic preferences for fertile and cultivated scenery faded. Eighteenth-century sensibilities and fashions ran toward irregular, asymmetrical, and “natural” forms of gardening.<sup>107</sup> In the second half of that century,

<sup>102</sup> Quoted in Clarke and Primo 2012: 104.

<sup>103</sup> Toulmin 1990: 36; Toulmin 1982: 12, 231. <sup>104</sup> Toulmin 1990: 42.

<sup>105</sup> Toulmin 1990: 128, 132. <sup>106</sup> Zetzel 1989: 331. <sup>107</sup> Williamson 1995: 1–4.

picturesque perspectives on nature invited visitors to participate in park landscapes guided by their own imaginations and interpretative freedoms. Nature was not seen as an immutable thing that reflects either garden or forest. Parks emerged as a hybrid of both.

In the words of Walpole, “the contiguous ground of the park without . . . was to be harmonized with the lawn within; and the garden in its turn was to be set free from its prim regularity, that it might assort with the wilder country without.”<sup>108</sup> Parks were tended by livestock, not gardeners. Visually, gardens and parks began to resemble one another. Recessed methods of landscape design, such as the ha-ha, created a vertical barrier that cattle could not cross to enter the garden while preserving an uninterrupted view of the wider park landscape. Classical buildings, lakes, blocks of woodlands, or clumps of trees became widely accepted design elements of parks. And after parks were no longer treated as a habitat for deer, they became unfenced landscapes. Curvilinear and serpentine forms replaced linear plantings and geometric vistas. Appearing close to untreated nature, the visual simplicity of parks concealed a complex landscape design. Parks blurred the boundary between aesthetic and functional landscape, and between leisure and production.<sup>109</sup> English parks became models for Germany. One of the largest public parks in Europe, Munich’s English Garden, dates back to the late eighteenth century. Many other German public gardens followed. Combining park and garden elements, Hamburg’s *Stadtpark* was created in the early twentieth century.<sup>110</sup>

In an increasingly urban America, parks also offered a compromise between fast-paced city life and the more sedate countryside: “Machine and garden exist in a state of continual tension . . . [the park] was, in short, a pastoral ‘middle’ landscape in every sense of the term.”<sup>111</sup> One of America’s foremost landscape architects, Frederick Olmsted, argued that “the pastoral middle landscape was an appropriate compromise” between city and wilderness.<sup>112</sup> City parks were a place to reconstruct a way of life that had been lost.<sup>113</sup> Weaving together images of domesticated and wild nature, *Garden and Forest* was a weekly magazine in late nineteenth-century America that offered an integrative vision of city and nature.<sup>114</sup>

America’s national parks offer a sharp contrast to such a peaceful vision. At the very moment that the frontier was vanishing, Americans sought to protect and celebrate the wilderness of the West as a symbol of its manifest destiny. But American ideas about wilderness changed over

<sup>108</sup> Quoted in Williamson 1995: 2. <sup>109</sup> Williamson 1995: 75–78, 122–23.

<sup>110</sup> Richards 2001: 10, 28–30. <sup>111</sup> Zetzel 1989: 291, 295. <sup>112</sup> Cranz 1982: 24.

<sup>113</sup> Miller 1976: 181, 184. <sup>114</sup> Hou 2012.

time. The country's first national park, Yellowstone, opened in 1872 to a delighted public who admired it mostly from afar. But by the end of the century, the wilderness of the national parks was linked indelibly to the Indian reservation policy, restricting Indians to isolated patches of land or assimilating native peoples into American society. In fact, it took decades to remove Indian populations from three of America's iconic parks: Yosemite, Yellowstone, and Glacier. Yosemite, for example, was a large-scale experiment of keeping "the animals in and the humans out."<sup>115</sup> Wilderness preservation and native dispossession were two aspects of one complex process that stretched over more than half a century. Wilderness was not natural and empty but populated and shaped by native populations who thought of the wilderness as tame.<sup>116</sup> Depopulation became the precondition for creating a man-made, artificial wilderness. Massive acts of human violence and cruelty were thus indelibly stamped as constitutive elements of America's national identity.

Not so in Olmsted's most important creation, New York's Central Park. Designed together with Calvert Vaux, it was modelled on Birkenhead, one of England's first public parks. Olmsted's approach to landscaping self-consciously and deliberately differed in both style and scale from gardening. It reflected design principles that diverged greatly from those of the gardeners of his day. He avoided flower-bedding and specimen-planting of hybrids as they violated the character of a park's natural surroundings. Letting things alone was central to Olmsted's art – an almost impossible dictum for any gardener.<sup>117</sup> He infused a combination of the pastoral and the picturesque with his philosophy of unconscious recreation and the importance of contemplation. A deliberate, eye-level interplay of light and shadow was intended to convey a heightened sense of mystery. The thick planting style in some parts of Olmsted's parks was borrowed from his encounter with the tropical jungles and forests he had wandered through while travelling in Central America in 1863.<sup>118</sup> "The result was a series of designs that combined richness and wildness of planting with unified composition."<sup>119</sup> Olmsted's reliance on picturesque landscapes broke with the geometrical and symmetrical designs of European gardens and parks that were laid out in a gardenesque style. Knowing that pure wilderness could not be recreated in urban settings, Olmsted opted instead for a compromise between pastoral transcendentalism and rural landscapes.<sup>120</sup>

<sup>115</sup> Schama 1995: 7. <sup>116</sup> Spence 1999: 4–5. <sup>117</sup> Howett 1998: 83.

<sup>118</sup> Beveridge 1977: 39–41. <sup>119</sup> Beveridge 1977: 43. <sup>120</sup> Taylor 1999: 436–38.

Olmsted's efforts to build pastoral scenery into parks were belittled by John Muir and other wilderness enthusiasts who found his scenery too tame. Philosophically, Olmsted was antagonistic to the idea of wilderness, and specifically to the semi-Hobbesian state of nature reigning at the American frontier. He regarded that state as antithetical to "civilization" as he defined it, with reference to principles of cosmopolitan community, common culture, and genteel order. He saw beautiful landscapes created in public parks both as powerful instruments for a vibrant democracy and profound symbols of a civilized society.<sup>121</sup> Central Park followed an explicitly political logic and a design inspired by a dual vision of democracy and landscaped art tailored to plutocratic and polyglot New York.<sup>122</sup> It was a space understood in terms not only of ownership and management, but also of public use and inclusiveness – a kind of modern village commons set up, in Thomas Bender's words, by a combination of Olmsted's "sincere feeling for the less fortunate with a somewhat manipulative concern."<sup>123</sup> Grounded in a stubborn democratic faith, Olmsted's approach also reflected the logic of social control and a "profoundly conservative concept of reform."<sup>124</sup>

*Complementarities of Newtonian and Post-Newtonian Worldviews.* Faith in order helped define Olmsted's vision of parks as a zone connecting gardens and forests. Similarly, Stuart Kauffman holds that nature's evolution is partly governed by the laws of nature, yet moves partly outside and beyond them.<sup>125</sup>

Haas and Nau appear to suggest that Newtonianism and Post-Newtonianism must be rivals.<sup>126</sup> The rhetorical strategy of their chapter conceals to the casual reader a possibility that they themselves suggest: Newtonianism and Post-Newtonianism may coexist in a complementary relationship with one another. "Lets assume," Haas and Nau write,

that the specific questions we are asking as investigators trigger the relationalist quantum world to yield the Weberian world . . . That assumption is not inconsistent with the new relationalism and allows this Weberian analysis to proceed. After all, if Newtonian science is good enough for understanding tennis balls, but not quanta and galaxies (black holes), it may be good enough for the study of politics since the latter operates on the level of tennis balls not quanta or galaxies.<sup>127</sup>

<sup>121</sup> Lewis 1977: 388–89, 392–403. <sup>122</sup> Blackmar and Rosenzweig 1994: 113–14.

<sup>123</sup> Quoted in Cranz 1982: 286.

<sup>124</sup> Blodgett 1976: 870. For example, the Olmsted-designed Morningside Park in Northern Manhattan eventually became an effective barrier separating the predominantly minority, poor neighborhood of West Harlem from the predominantly white, middle-class neighborhood of Morningside Heights. See Solecki and Welch (1995: 95) and Schaffer and Smith (1986: 358).

<sup>125</sup> Kauffman 2008: 231–33, 287–88. <sup>126</sup> Chapter 2, this volume. <sup>127</sup> Chapter 2.



This is true. In comparison to Planck's constant  $h$  (which establishes the small but nontrivial difference between classical and quantum measurements), quantum effects are dependent on the size of an object multiplied by its typical momentum. When predicting the path of a flying tennis ball, uncertainties due to quantum theory are infinitesimal (about ten million billion billionth). When trying to describe the path of electrons moving in an atom, quantum uncertainties dominate.<sup>128</sup> Haas and Nau do not address, let alone resolve, the inherent contradiction between the inert materialism of their Newtonianism and the importance of human experience in their Weberianism. And they do not spell out the implication of their important point. Shaped by the laws of gravity, does world politics operate at the level of tennis balls, as they suggest? The world's leading physicist of tennis, Howard Brody, would probably have disagreed, acknowledging that individual ball control, motivation, mutual weakness recognition, and interaction with the spectators produce enough uncertainty to make the score of any match unpredictable.<sup>129</sup> Excitement-generating uncertainty completes its task before Newtonian physicists begin theirs.

Furthermore, in a worldview that includes Groves' notion of space-time, "there are relations at every scale crossing into every other scale. Which relations are most important, most operative, and most determinative . . . depends upon the region investigated."<sup>130</sup> If the scale of a tennis match were like that of world politics, then both of them constitute regions that are a far cry from the Newtonian world of mechanistic laws yielding accurate predictions. Indeterminacy, unpredictability, and quantum weirdness thus can enter the orderly, classical model and become the stage for a Weberian analysis of world politics. Despite all their differences, there is a connection between Nau and Kurki: in different formulations, they both suggest that Newtonian and Post-Newtonian worldviews are complementary. For Kurki

[r]elational traditions pry open seemingly well-sealed liberal individuals or national communities, and reveal the "other aspects of ourselves," the porosity and coming, the overlaps, the complex constitution of individuals and communities and species . . . what is needed is fewer new total single global visions – a worldview; rather, what is needed is "multiplying viewpoints so as to complicate all 'provincial' or 'closed' views with new variants."<sup>131</sup>

Grove and Allan suggest such multiplying viewpoints by embedding a Weberian Newtonianism in more encompassing, complementary perspectives. Grove's analysis is deeply relational. He points to Weber's

<sup>128</sup> Pagels 1982: 90. <sup>129</sup> The Economist 2015. <sup>130</sup> Chapter 4, this volume,

<sup>131</sup> Chapter 3, this volume.

individualism as profoundly relational, constituted by four different modes of action: instrumental rationality, value rationality, emotions, and habits. The individual, in his reading of Weber, is not a unified actor (as Nau argues in his critique of relationalism in Chapter 6), but is constituted by a deep relationality between these four distinctive Weberian categories marked by “a plastic and oscillating intensity of relations” that constitute human consciousness and senses.<sup>132</sup> Grove’s analysis of the Cuban missile crisis puts into a different scale the conventional depiction of the American President as the heroic leader holding in her hands “the football” that contains the codes for starting nuclear war. It was not the President that replaced a collectivity, Congress, in October 1962. Instead, it was one collectivity, the “nuclear-sovereign-*assemblage*,” that replaced another, Congress.<sup>133</sup> Executive power rests on complex and evolving networks of a myriad of systems. In this relational account, individual accountability is submerged in a variety of assemblages and relationships. Grove argues that a perspective that only focuses on the accountability of a sovereign individual or groups of individuals, as do Haas and Nau in Chapter 2 and Nau in Chapter 6, downplays that the individual is embedded in relays, connections, resonances, and actants that are presupposed in each subsequent iteration of sovereign decisions layered into multiple streams of time: “The decision and the decider only appear singular when we truncate time and space to the moment the president ‘pushes the button.’”<sup>134</sup> Put differently, individualism primes us to discern only an already constituted, single decider situated in time and space. This individualist orientation may undermine the capacity of members of a polity to resist or steer nuclear politics. Grove does not seek to replace sovereign decisions with assemblages. He insists instead that those decisions are embedded in fields of relations and resonances from which decisions emerge. In October of 1962, he argues, President Kennedy was “the titular focal point of an *assemblage*, a mascot not a quarterback.”<sup>135</sup>

Similarly, conventional Weberian analysis, Allan argues in Chapter 8, is beholden to too narrow a worldview. Weber analyzes the rationalization of life embodied in scientific ideas that undermine traditional worldviews as constraints on action. Rationalization thus furthers disenchantment. Weber’s failing was to not place himself reflexively within that history. Pushing historical analysis further and deeper, as Allan does, generates a vision of a relational self. It is constituted by cosmological elements that, propelled by individual choices and actions, generate changing worldviews. Two mainstays of

<sup>132</sup> Chapter 4.    <sup>133</sup> Chapter 4.    <sup>134</sup> Chapter 4.    <sup>135</sup> Chapter 4.

Newtonianism – materialism and object-orientation – are cosmological elements that have been incorporated into European and American political discourses and traditions. This makes Weberian value-orientations possible and natural, including the valorization of reason: “Reason could now be conceptualized and defined in means–ends terms as knowledge of the outside for the manipulation of the outside in the service of internal ends. Rationality itself is a value-orientation.”<sup>136</sup> Put differently, rationalism is a product of history. It is not a natural object. And this crucial point, Allan argues, is missed by defenders of rational worldviews, like Haas and Nau in Chapter 2. Their “defense of individualism . . . is unpersuasive because it ignores the history of the concepts they themselves deploy.”<sup>137</sup> Affirming agency, Haas and Nau make us see it as operating at the surface. For Allan, this is less than fully convincing. It simply does not go deep enough. Their Weberian map misses the territory, the cosmological background that constrains actors by placing them into a specific political landscape. The agency Haas and Nau highlight is relationally constituted. It is made possible by specific configurations of historical legacies and interactions with other actors. If a materialist and mechanical ontology had not prevailed over vitalist and organicist views in the nineteenth century, then the relational scientific worldview of emergence that informs Kurki’s chapter would perhaps not be “new,” as Kauffman calls it. And a much messier and less predictable world would perhaps be taken for granted, rather than the rationally legible world of mechanically interacting matter.<sup>138</sup> Allan’s historicized relationalism situates Weberian analysis in a deeper history and thus opens up multiple viewpoints of the kind that Kurki’s chapter advocates and evokes.

Finally, writing on religion in Chapter 9, Byrnes adopts an argument that resonates with the possibility of complementarities between Newtonian and Post-Newtonian thought. Religious worldviews are in some contexts meticulously maintained Newtonian gardens. In other contexts they are deeply relational Post-Newtonian forests, grounded in the intricate and evolving connections between the human and the divine, and within humanity, as cocreative forces of “a world that is always in the process of becoming.”<sup>139</sup> This formulation is remarkably close to Kauffman’s 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.<sup>140</sup>

<sup>136</sup> Chapter 8, this volume.    <sup>137</sup> Chapter 8.    <sup>138</sup> Kauffman 2008.

<sup>139</sup> Chapter 9, this volume.    <sup>140</sup> Kauffman 2008: xi, 283.

Despite their profound differences, Newtonian and Post-Newtonian worldviews thus can exist in complementary relations.<sup>141</sup> After all, initial doubts about the classical model at the outset of the twentieth century and, eventually, its replacement by quantum physics arose within Newtonianism and a shared view of ignorance. Newtonianism and Post-Newtonianism both think of epistemic uncertainty as a function of the present state of ignorance. In the form of better models and improved theories, additional knowledge will reduce ignorance and, with it, uncertainty. Predictive accuracy is highly prized in the practical work of classical and quantum physics. Confirming a theoretical claim made almost half a century earlier by a group of physicists, the discovery of the Higgs Boson in 2012 was a widely celebrated achievement. And so was a 2017 experiment of nonlocality that provided extremely strong support for entanglement, Einstein's "spooky action at a distance," on a cosmic scale. Theoretical claims and experimental data lined up according to the classical view of how science should operate. Quantum mechanics embeds discrete cause-and-effect sequences in an encompassing relationalism.<sup>142</sup> It thus is able to identify specific domains of efficient cause-and-effect relations within a broader set of entanglements subject also to material, formal, and purposive causation in the natural and social world.<sup>143</sup> Time and again, quantum mechanics has generated hypotheses with a fabulously high predictive accuracy about the natural world, accounting for observations covering a range of 25 orders of magnitude, from the smallest particles of matter to the cosmos.<sup>144</sup> The theory works with spectacular success at scales many millions of times smaller than those for which it was originally developed.<sup>145</sup> It works while economics, the "queen" of the social sciences most eager to imitate physics, does not, as physicist David Mermin observed caustically.<sup>146</sup>

At least in principle, classical and quantum physicists believe ignorance will increasingly be overcome as science advances. For physicist and public intellectual Marcelo Gleiser, this assumption is questionable. He argues that "as the Island of Knowledge grows, so do the shores of our ignorance – the boundary between the known and the unknown."<sup>147</sup> But the growing reach of instruments and practices do more than extend the vast horizon of our ignorance. They also extend the limits of our thinking, as we probe our ignorance and seek to comprehend our own mortality in a world of

<sup>141</sup> Sil and Katzenstein (2010a, b) have made the same basic point in writing about analytic eclecticism of different paradigms and research traditions in international relations.

<sup>142</sup> Wendt 2022b. <sup>143</sup> Kurki 2008.

<sup>144</sup> Barad 2007: 110 fn21, 415–16 fn55, 423 fn21, 419 fn28.

<sup>145</sup> Mermin 2016: 58, 62–63. <sup>146</sup> Mermin 2016: 132.

<sup>147</sup> Quoted in Ahmari 2020: 25.

incomprehensible complexity and infinitude. The only thing we do seem to know is that science, philosophy, and religion will continue in the future as they have in the past: seeking meaning as they engage with the unfathomable.

Illustrated by the neglect of uncertainty, in the words of international relations scholar Robert Jervis, “many of the social-science attempts to understand behavior in classical terms are at best incomplete.”<sup>148</sup> For him, quantum physics

provides better analogies for reality than does classical mechanics, with its faith in invariant relationships and its radical separation between the observed and the observer. In the social world, and even more in international politics, uncertainties (of both scholars and actors) reflect not only lack of knowledge that in principle could be gained, but multiple possibilities that have yet to be realized.<sup>149</sup>

Jervis appeals metaphorically to postclassical theory as a way of helping the classical model overcome specific forms of ignorance about the social and political world. Left unaddressed in his acknowledgment of the complementary relations between these two worldviews are the specific terms of their coexistence.<sup>150</sup> Below I argue that two workarounds exemplify different kinds of coexistence. In the first, complexity and subjective probability leave some room for elements of Post-Newtonianism in a Newtonian worldview. In the second, subjective beliefs and human experience in quantum physics offer an innovative theoretical intervention into a debate about the meaning of Post-Newtonianism and Newtonianism.

*Newtonian Terms of Coexistence: Complexity and Subjective Probability.* Unable or unwilling to break with the conventional Newtonian worldview, scholars have relied on different argumentative moves to address the issue of uncertainty. Here, I briefly consider two. A Newtonian worldview does not preclude conceptualizing world politics as a complex, open system that evolves within a complicated yet closed Newtonian system.<sup>151</sup> Furthermore, scholars can sidestep the issue of uncertainty by insisting that the main thing that matters is what unites conditions of uncertainty and probability: they are both experienced subjectively.

<sup>148</sup> Jervis 2017: 171.    <sup>149</sup> Jervis 2017: 186.

<sup>150</sup> The term ‘complementary’ is used in this section in its conventional rather than quantum sense. Warm thanks to Begüm Adalet, Jill Frank, Patchen Markell, and Alexander Wendt for giving detailed comments on this and the following section, to my colleagues at the Wissenschaftszentrum Berlin for reacting to these sections in two seminars convened on January 6 and 7, 2021, and to Patchen Markell for suggesting how to bring the two sections together.

<sup>151</sup> The intermediate case of a loosely coupled mechanical system that is partly decomposable is discussed by Simon 1962.

The determinist or probability-inflected Newtonian world can be thought of as a special case that reveals itself when the quantum world of infinite possibilities and radical uncertainty collapses. Following the insights of relational cosmology and quantum mechanics, the world can thus be conceived of as indeterminate and open, nested in a closed Newtonian universe. We are not observing that universe, be it natural or political, at a distance; we are part of it. Something resembling Quantum weirdness thus can enter the orderly classical, Newtonian model of world politics once we substitute the assumption of an open system for that of a closed one. Complexity theory applied to world politics thus accommodates some nonclassical possibilities and potentialities within a Newtonian worldview while excluding others, such as nonlocality.<sup>152</sup> It is the closed system assumption that makes the classical model of world politics gloss over uncertainty. Complexity theory thus affirms what Newtonianism denies: the existence of uncertainty that also marks the broader Quantum context in which the Newtonian world exists.

All too often we are stunned by events in world politics and ask ourselves “how was that possible?”<sup>153</sup> Complexity theory answers that question by focusing on the adaptive characteristics of open systems, their emergent properties, and their uncertainties. It distinguishes between *complicated* systems, which can be predictable and are made out of tightly or loosely coupled modules, and *complex* systems, which are not predictable and cannot be readily decomposed. The management of complexity demands persistent experimentation, incessant improvisation, successive approximation, continuous innovation by recombination, local knowledge, and accumulated experience. It acknowledges the inescapability of uncertainty. Even when uncertainty yields to local predictability, at a system level “a high degree of complexity and unpredictability” coexist.<sup>154</sup> All too often the confluence and interaction of many factors form wholes that are not readily captured by simple models of how small things follow from large ones. Indeed, large things may follow from small ones in complex systems. This is a world of clouds, not clocks.<sup>155</sup> Large-scale weather patterns can be predicted with growing accuracy, but the movement, size, and shape of individual clouds remain mysteries. There is no bell-shaped curve, yet, charting the future of a world of individual clouds.

<sup>152</sup> Kellert 1993; Axelrod and Cohen 1999; Jervis 1997; Byrne and Callaghan 2013; Kiel and Elliott 1996; Harrison 2006.

<sup>153</sup> This discussion of complexity theory builds on Seybert and Katzenstein 2018: 16–21.

<sup>154</sup> Jervis 1997: 16.

<sup>155</sup> Almond and Genco 1977; McClosky 1991; Tetlock and Gardner 2015: 8–10.

In complex systems, many group and individual behaviors and events are inherently unpredictable and seemingly erratic. Historical probabilities offer no reliable guide to a future that remains radically open. Complexity thus brings risk and uncertainty into one view. It opens a perspective on a world of emergent properties and regularities with a short half-life that leaves space for human inventiveness and low probability or totally unpredictable conjunctions. Pervasive chaos and disequilibria mark processes in the natural worlds of biology, geological patterning, climate, and other open systems. Creative evolution is its hallmark, not predetermined laws. System evolution can be tracked *ex post*; it is not predictable *ex ante*.

In open systems with emergent properties, predictive capacity is limited by the time it takes a system to run through sufficient repetitions to record how things eventually map out. Human interactions make uncertainty an integral part of world politics for four separate reasons.<sup>156</sup> First, slowdowns on interstate highways without accidents and stampeding crowds with no apparent trigger point to unexpected results that are not related to human intentions; human interactions can produce “emergent” phenomena. Second, in the social world of incessant human interaction, probabilities are forever changing; social processes are often nonrepeating or “non-ergodic.” Third, human interactions are so complex that they elude attempts to anticipate correctly; the world is filled with “computational irreducibility.” Finally, the belief that we live only in a world of knowable, manageable risk is sheer fantasy; instead, often we live in a world marked by “radical uncertainty,” and the probability of some kinds of outcomes is simply unknowable. Complexity thus forces us to adopt an inherently humble approach to our understanding and conduct of world politics.<sup>157</sup>

A second workaround that avoids breaking with a Newtonian worldview takes on the problem of uncertainty more directly, by circumventing the distinction between risk’s known probability distributions and uncertainty, where distributions are unknown.<sup>158</sup> What really matters is that all conditions of risk and uncertainty can be known only subjectively. A subjective probability is defined for situations in which one cannot know the correct probability which one should assign to the state of the

<sup>156</sup> Bookstaber 2017; Kay and King 2020.

<sup>157</sup> Bousquet and Geyer 2011: 1; Kauffman 2008: 258.

<sup>158</sup> Friedman 2019. I am very grateful for an extended email exchange with Jeffrey Friedman that helped clarify my thinking. Here, I am bypassing risk-based models that seek to integrate strategic uncertainty by including the possibility of ignorance about player preferences and beliefs. Such ignorance can yield suboptimal strategies. Uncertainty is thus reduced to a lack of information, in this case about the payoff matrix and attributes of one of the players. Common knowledge and common prior beliefs about the rules of the game are still assumed to exist. See Weinhardt 2017, 2020.

world based on the information that is available. The quantification of subjective probabilities pushes back against the idea of a ‘correct’ or ‘objective’ probability assessment about the state of the world – say, a crisis in national security decision-making.<sup>159</sup> Only subjective assessments are possible. In this view, assessments of uncertainty are only considered to be “correct” in as far as they coherently reflect an actor’s personal beliefs given specific circumstances. Since ultimately everything rests on personal conviction, objective assessments of or correct answers about probability and uncertainty are unobtainable. But the ability to give well-structured and coherent assessments of judgments is not.<sup>160</sup> Although we cannot assess uncertainty in any objective fashion, we should exploit fully and consistently the subjective insights we do have. This requires distinguishing clearly between “assessments of probability (which reflect the chances that a statement is true) with assessments of confidence (which reflect the extent to which analysts believe they have a sound basis for drawing conclusions).”<sup>161</sup> Confidence depends on the reliability of available evidence, the range of reasonable opinion surrounding a judgment, and the susceptibility of a judgment to new information that might be forthcoming.<sup>162</sup> Put simply, confidence is analytic.<sup>163</sup>

This is where Keynes makes his central contribution. After he had abandoned the effort of making a compelling case for objective probability that did not ultimately rest on personal convictions, and after years of speculating in financial markets, Keynes developed a broader conception of confidence.<sup>164</sup> Practical men and women, he reasoned, had no choice but to rely on “conventions, stories, rules of thumb, habits, and traditions in formulating our expectations and deciding how to act.”<sup>165</sup> All of these instill confidence as an essential ingredient of decision-making under uncertainty. Confidence is “a state of mind, a belief or feeling about the adequacy or otherwise of the knowledge base from which the forecasts of an inescapably uncertain future are derived.”<sup>166</sup> In financial markets,

<sup>159</sup> Friedman 2019: 51–52; Gillies 2000: 55–58.

<sup>160</sup> Bayesian statistics offers a more formal approach to subjective probabilities. Compared to a more flexible and integrative approach, in the area of national security studies its usefulness is currently restricted by very large calculative tasks that may exceed human intellectual capacities. But the humanism that inheres in the Newtonian worldview which supports subjective probability approaches is an unnecessary restriction. A Hyper-Humanist Post-Newtonian worldview could readily accommodate approaches in the field of Artificial Intelligence that manages very large calculative tasks with greater ease.

<sup>161</sup> Friedman 2019: 23; see also 51, 57, 62, 63 fn37. <sup>162</sup> Friedman 2019: 61–63.

<sup>163</sup> Friedman 2019: 14, 58–63; Friedman and Zeckhauser 2018.

<sup>164</sup> Friedman 2019: 59; Gillies 2000: 25–52; Keynes 1937.

<sup>165</sup> Skidelsky 2009: 87. See also Lawson 1986, 916. <sup>166</sup> Gerrard 1994: 332.



Keynes did not see “analytic confidence” at work but rather “animal spirits . . . of daring and ambitious entrepreneurs taking risks and placing bets in an environment characterized by uncertainty: that is by crucial unknowns and unknowables.”<sup>167</sup>

Most scholarship on subjective probability assumes implicitly that accuracy is the only concern that influences a decision-maker’s choice. Yet in American foreign policy it is implausible to think that presidents care simply about predictive accuracy when they confront risk and uncertainty in international affairs. The widespread resistance of decision-makers to rely only on probabilistic reasoning that Friedman reports in his book suggests as much.<sup>168</sup> Logic, cognition, and rigor are surely relevant.<sup>169</sup> But typically they work along with other factors, including individual or group emotions, religious and other beliefs, and social conventions.<sup>170</sup> Besides accuracy, all of these factors also are relevant for instilling the confidence that decision-makers have in their subjective beliefs.<sup>171</sup>

In sum, as these workarounds illustrate, a Newtonian worldview can accommodate elements of a Post-Newtonian one. Scholars committed to a Newtonian worldview can introduce uncertainty into the analysis of world politics by drawing on complexity theory. And they can erase the distinction between uncertainty and risk by relying on a subjective probability approach. Both moves are workable. For reasons that remain opaque, however, both resist letting go of the conventional Newtonian worldview and making space for a broader range of insights into world

<sup>167</sup> Kirshner 2009: 532. Friedman (2019: 59) calls Keynes’s argument “logically coherent” but with consequences that are “untenable for anyone who seeks to contribute to foreign policy debates.” Perhaps. Elsewhere (Friedman 2019: 193) he acknowledges the relevance of factors such as emotions, values, and organizational and other cultures that also shape the confidence of decision-makers. Until those factors are fully integrated into a comprehensive explication of decision-making under conditions of uncertainty, for the practice of foreign policy the pessimistic skepticism of the many decision-makers that he is reporting in his book appears to me to be as tenable as Friedman’s optimistic rationalism.

<sup>168</sup> Friedman 2019: 12, 96–98. <sup>169</sup> Friedman 2019: 12, 34, 49.

<sup>170</sup> 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, at least for now. See Friedman 2019: 6–10, 192–95.

<sup>171</sup> Friedman 2019: 12, 14–15. He concedes (pp. 67, 88) that the distinction between “mathematicians” and “poets” may make sense from organizational and cultural perspectives. This concession acknowledges the limits of the scope of analytic confidence that concerns Friedman’s analysis. More generally, Bayesian decision theory is not the only rational way to make decisions in all situations. Savage (1954: 16) restricted the application of his theory to “small worlds” that sidesteps the enormous cognitive challenge of evaluating all possible action paths in a “large world.” It is descriptive rather than prescriptive. See Binmore 2017: 260, 263–64.

politics. Such broadening would have the advantage of taking more fully into account developments that have transformed the natural sciences during the last century and avoid extending the record of frequent and shocking failures of predictive accuracy in the Newtonian study of world politics. Stuart Kauffman writes that “scientists tend to live with philosophies of science that are decades out of date.”<sup>172</sup> In the case of the study of world politics, it has been more than a century. Early formal 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 . . . Soon after, philosophers abandoned the Received View as a description of scientific theories.”<sup>173</sup> Most students of world politics, however, have stuck with the received view and have thus failed to incorporate uncertainty as a constitutive part of world politics.<sup>174</sup>

*Post-Newtonian Terms of Coexistence: Individual Beliefs and Subjective Experience.* Quantum mechanics works.<sup>175</sup> Compared to all other theories in physics, it has had the most spectacular success. Its understanding of the structure of matter is so powerful and precise that most contemporary technology rests on it. Physicists learn how to use quantum mechanics. But there exists no consensus about what they are talking about. As David Mermin argues, “there is an unprecedented gap between the abstract terms in which the theory is couched and the phenomena the theory enables us so well to account for. We do not understand the *meaning* of this strange conceptual apparatus that each of us uses so effectively to deal with our world.”<sup>176</sup> In contrast to the theoretical workarounds of Newtonianism, Post-Newtonianism’s is philosophical. In the form of Quantum Bayesianism (or QBism), it restates the insights of quantum mechanics in a language congruent with subjective probability theory and consonant with Dilthey’s writings on worldviews.<sup>177</sup> QBism is a way of thinking about uncertainty, quantum mechanics, and

<sup>172</sup> Kauffman 2008: 293. <sup>173</sup> Clarke and Primo 2012: 65–66.

<sup>174</sup> Wendt (2015: 154–73) discusses quantum decision theory as a serious alternative to a humanist substantialist analytical perspective grounded in the humanist Newtonian worldview that characterizes decision theories based on subjective probabilities.

<sup>175</sup> I am grateful for the detailed comments that David Mermin made on this section. For an informative critical engagement of Qbism, see Mohrhoff 2014a, 2014b and 2019a, 2019b.

<sup>176</sup> Mermin 2019: 1.

<sup>177</sup> Confounded by the weirdness of the quantum world that they can measure and manipulate without grasping its meanings, realist interpretations of quantum mechanics view quantum states as objective properties of the quantum system and thus disagree with QBism. For two sharply differing views, see Becker 2018: 89–162, 289–94 and Baeyer 2016: 235–39. Mermin (2019: 2, 13–15) argues that the insights of QBism are relevant

the sciences generally.<sup>178</sup> For Mermin, “QBism is as big a break with 20<sup>th</sup>-century ways of thinking about science as cubism was with 19<sup>th</sup>-century ways of thinking about art.”<sup>179</sup> QBism grapples with the “weirdness” of central aspects of quantum physics. David Mermin has attempted to reduce the puzzles of quantum mechanics to just one: interpreting quantum probabilities.<sup>180</sup>

Q stands for quantum and B for Bayesian. QBism offers a radically subjective interpretation of probability, stipulating that each actor makes bets and updates odds.<sup>181</sup> The question of probability goes to the heart of physics, “where everything had seemed to be regulated by firm laws that were universal and irrevocable.”<sup>182</sup> In QBist interpretations, all probabilities in quantum states are interpreted as the private beliefs of individuals. Based on past experience and following the rules of Bayesian probabilities, agents calculate the probability of what might happen next. Based on evolving experience that creates new information, agents update their prior beliefs to improve their predictions of future events. This process involves only the agent’s evolving experiences and beliefs through continuously updated information. Einstein refused to believe that God played dice: “If he had wanted to do this, 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 quite thoroughly. That’s the message of QBism. It is not a plan for *his* gambling, but for *ours*.”<sup>183</sup>

In QBism, wave functions are the products of an individual’s experiences. Like other interpretations of quantum mechanics, QBism thinks of the wave function not as an objective entity but as a mathematical abstraction. Wave functions do not exist ‘out there in the real world.’<sup>184</sup>

also for puzzling, though less vexing, aspects of the classical world such as the problem of ‘Now’; for those instances he suggests the label CBism.

<sup>178</sup> Mermin 2016: 232–48; Fuchs, Mermin and Schack 2014; Healey 2016.

<sup>179</sup> Mermin 2016: 233. <sup>180</sup> Mermin 1998; McCall 2001; Fuchs and Schack 2009: 48.

<sup>181</sup> Caves, Fuchs, and Schack 2002a, 2002b; Fuchs 2017; Mermin 2016: 232–48. There is a vast technical literature on these matters in physics that is inaccessible to me. Baeyer 2016, Timpson 2008, Bächtold 2008, Bacciagaluppi 2014, and Healey 2016, 2017 provide expositions and critical reviews; Bächtold and Healey develop the link to American pragmatism.

<sup>182</sup> Rovelli 2016: 18. <sup>183</sup> Fuchs 2017: 20.

<sup>184</sup> As Baeyer (2016: 131–43) argues, QBism is anti-realist. Because of “quantum weirdness” it wholeheartedly agrees with Carlo Rovelli (2017), no QBist by any means, that *Reality is not what It Seems*. And it disagrees with the thrust of Adam Becker’s (2018) *What Is Real?* And because QBism zeroes in on the personal experience of individual agents, it also differs from most Copenhagen interpretations: Objective for those interpreting Bohr as focusing only on the material aspects of measurement apparatuses, intersubjective for those interpreting Bohr as focusing also on the verbal or written

Experience is an agent's inner manifestation of what other interpretations take to be on the outside and call the collapse of the wave function. Experience "confers meaning by anticipating future information in relation to an organism's evolving purposes through time. The effect of this appropriation of the future is to transform objective information into subjective meaning – and it is on the basis of the latter that people act."<sup>185</sup> QBism focuses on beliefs and information and captures the idea that individual experience is intrinsically private and inaccessible to other observers.

In QBism, nature's deterministic laws do not exist. 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 yet for hitching a ride with the universe's pervasive creativity and doing what we can to contribute to it."<sup>186</sup> As is true also for Lee Smolin's version of scientific cosmology, humans are part of a participatory rather than an inert universe.<sup>187</sup> In this view, the big bang at the origin of the universe is a continuing occurrence rather than an event that happened about 13.8 billion years ago. Billions and billions of elementary observer-participatory acts help constitute the shape of the universe but without determining it.<sup>188</sup> Acts of observation and participation cannot be separated. Quantum mechanics is not a description of the world, but a technique for navigating and operating in it.

Laws and mechanisms are invented by observing scientists who are part of the natural and social world. They are developed as hypotheses, tested, and, over time, if confirmed by the private experiences of large numbers of individuals, they are crystallized into conventional wisdoms.<sup>189</sup> The source of the laws of nature "must be the books of human authors and not the original Book of Nature. What we end up with through this process is bound to be a thoroughly human and social construction, not a replica of the very laws that God wrote."<sup>190</sup> The laws of nature are an accretion of dispersed, variegated human experiences. Ours is a *Dappled World*, as Nancy Cartwright argues.<sup>191</sup> For Leonard Savage it is "small."<sup>192</sup> Classical physics works well in some domains; quantum physics in others. It is a patchwork of practices, each more or less successful in its more or less well-bounded domains. It is not experience that

communications of measurement practices. See Mermin (2016: 241–44) and Barad (2007) for different interpretations of Bohr's positions.

<sup>185</sup> Wendt 2015: 141. See also Fierke 2017: 145, 147; Baeyer 2016: 187–95; Timpson 2008: 18.

<sup>186</sup> Fuchs 2017: 20. <sup>187</sup> Baeyer 2016: 202–10. <sup>188</sup> Fuchs 2017: 5–6.

<sup>189</sup> Baeyer 2016: 196–201. <sup>190</sup> Cartwright 1999: 46.

<sup>191</sup> Cartwright 1999: 2; Daston 2019: 24–25.

<sup>192</sup> Savage 1954: 16; Binmore 2017: 260, 263–64.

yields to the world, as the classical model holds. It is the world that yields to experience – until the accumulation of experience changes. Laws of nature are never absolute, and always provisional. Shaped by the beliefs of scientists, we do not need to search for nature’s laws and mechanisms any further than the beliefs and experiences expressed in scientific theories and experimental practices. In brief, scientific practices in the classical model represent the natural and social world; in the quantum model, they coproduce that world.<sup>193</sup>

QBism holds that self’s understanding of the world rests entirely on the experience gained over a lifetime. “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.”<sup>194</sup> 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.”<sup>195</sup> This is *not* to argue that the world exists only in the head of self.<sup>196</sup> The material from which self constructs a picture of its external world includes the effects that the world has on self’s experience in response to her measurement and argumentative practices. For self’s practices normally do not control how the world acts back. Self’s experience of other 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  $p=1$ .<sup>197</sup>

QBism’s subjectivity does not mean that the world exists only in the mind of the individual agent. Although self does not have any access to the private experience of other, a very 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. Through language and other forms of communication, different agents affect private perceptions and create a state of deep entanglement.<sup>198</sup> Communication makes it possible for agents to plausibly conclude that each of them has private experiences that are quite alike, though perhaps not identical to, their own. Bridging

<sup>193</sup> Jasanoff 2004; Camic, Gross, and Lamont 2011.

<sup>194</sup> Spengler 1965: 54. My translation.

<sup>195</sup> Mermin 2016: 233 fn1, 238; Mermin 2019: 5–6.

<sup>196</sup> Becker 2018: 25–27, 29–30, 48, 168, 234.

<sup>197</sup> “Probability-1 measures the intensity of a belief: supreme confidence: It does not imply the existence of 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). Alien to the conventional view of frequentist probability, Mermin insists that this interpretation is perfectly congruent with Hume’s views on induction: Mermin 2019: 4–5, 7.

<sup>198</sup> Fierke 2017: 151; Wendt 2015: 207–21; Mermin 2019: 2–4, 6.

the privacy of subjective individual experiences, they thus can arrive at common or intersubjective understandings of the outside world. Hence, QBism does not give any space to the reification of a common external world. Language enables self and other to share a portion of what each has experienced. And the effects of their measurement and argumentative practices constitute the world, external to each actor's subjective beliefs. QBism is not a solipsistic theory that holds that each of us is free to make up our own private world.

There exists, then, a world external to each agent.<sup>199</sup> This proposition is more useful and strongly confirmed by experience than any other empirical hypothesis. That, however, does not mean that the concepts of quantum mechanics correspond directly to features in the world. When we think that physicists "measure" the world we imply, conventionally, that as measuring agents they themselves are described by their theory of the external world rather than taking the measuring agent as a given (or primitive). The orthodox view makes the agent inert and passive when, arguably, she is active and engaged. QBism holds to a strongly subjective and active view of agency. Agents act on their personal experiences and beliefs and, based on their measurement practices of the world, they acquire wholly personal experiences. This does not mean that the theory is only about self and not about other. Anyone can use the theory and, in using it, each assures herself that beliefs about the consequences of their encounters with the world are consistent. Every action by 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."<sup>200</sup> When actors prod the external world, the world can and often does generate something new that no agent could have predicted. The core, then, is about the relationship between something that is both profoundly personal and profoundly relational.

It is surprising how much of the discussion of knowledge and experience in quantum physics resonates with Dilthey's writings.<sup>201</sup> Individual experience and belief are central for both. Dilthey's insistence on the creative power of life as an engine of all human experience offers a humanist's worldview not unlike QBism's scientific one. If we view Dilthey as a QBist before QBism, the metaphorical description of Dilthey as the Newton of the humanities needs to be corrected.<sup>202</sup> For Dilthey,

<sup>199</sup> Fuchs and Schack 2009: 48–55. <sup>200</sup> Mermin 2019: 8.

<sup>201</sup> Mermin 2016: 165–66, 232–48; Wendt 2015: 29–32, 141–43.

<sup>202</sup> Rickman 1979: 1.

I and world are given components in lived experience before questions of objectivity and representations are raised. . . . to live is to be situated in a world prior to the split between theory and practice. The theoretical world of the natural sciences arises as an abstraction from this lived, practical context, and it is given mediately as a representational construct.<sup>203</sup>

The conventional view of quantum mechanics may miss much of what QBism and Dilthey have to offer.<sup>204</sup>

Dilthey's theory of life is consonant with QBism. Both offer their theories "for the use of agents immersed in and interacting with the world."<sup>205</sup> This is not to deny some important differences between the two. Dilthey rejects the empiricism that QBism embraces. And compared to QBism, he distinguishes less self-consciously between individual experiences and collective beliefs.<sup>206</sup> Equating science with Newtonian physics, Dilthey laid the groundwork for the venerable two-cultures view of science and humanities, or "hard" or "soft" versions of Kuhn's paradigms. QBism and Smolin's scientific cosmology suggest otherwise. Versions of the two-cultures paradigm are part of the human effort of meaning-making, with the world acting back on human intervention in more or less unpredictable ways. The abstract concepts of quantum physics, such as waves and particles, are human creations to make sense of specific personal experiences. They are not real. "For practical purposes," as Mermin said,

it does not matter if, like most physicists, I confer objective reality on the theoretical abstractions that enable me to calculate the likelihood of my subsequent experience. But for resolving certain conceptual puzzles . . . it is essential not to reify what are fundamentally intellectual tools, and not to treat what is fundamentally subjective and personal as if it were objective and universal . . . It can be hard to acknowledge that it is humanity all the way down, in all fields – even physical science.<sup>207</sup>

Different points of departure for the humanities and the natural sciences thus meet at the same intersection as the human sciences overlap with the natural sciences.<sup>208</sup> For both Dilthey and QBism, knowing is not a spectator sport played at a distance by impartial and objective observers. Knowing is part of life. The knowing subject is not a self-aware, self-contained, independently rational agent that comes to knowledge fully

<sup>203</sup> Owensby 1994: 32–33. <sup>204</sup> Fuchs and Schack 2009: 47.

<sup>205</sup> Fuchs and Schack 2009: 48.

<sup>206</sup> Dilthey thus runs afoul of the "shifty split" between quantum and classical that Bell identified and that Mermin (2016: 219–26, 239–40) discusses.

<sup>207</sup> Mermin 2019: 15. Clarke's and Primo's (2012) view of models as objects expressing human purpose aims in the same direction.

<sup>208</sup> Hodges 1944: 34–35.

formed. Instead, knowledge is a distributed practice that includes material and argumentative arrangements. Humans are part of the larger configuration of the world and its open-ended articulation.<sup>209</sup> For both QBism and Dilthey, knowing is not the playing of ideas in the mind of a Cartesian subject that stands outside and apart from the world the subject seeks to know. It is, rather, a practice of engagement with a world that is made explicable in terms of scientific theories, philosophical inquiries, artistic creations, and religious practices.

QBism has restored the important role of senses in understanding nature.<sup>210</sup> Intellect seeks to understand the world as it really is, trying to discover its true essence. It focuses on the object of inquiry. Senses insist that they are indispensable for learning what nature tries to teach us. Humans are equipped with senses that convey the surfaces of things. “It is,” as Lorraine Daston writes,

appearances all the way down . . . The surfaces that nature presents so abundantly and incessantly to view are also ordered, in ways more obvious, more reliable, and more permanent than most artifacts. It is the natural appearances of day-in, day-out experience, not the natural depths revealed by electron microscopes and cyclotrons, which still shape some of our most sturdy intuitions about what an order can be.<sup>211</sup>

Senses remind us of the role subjectivity plays in science generally. Specifically, they help account for Newtonianism’s enduring appeal. Modern physics had done away with senses and the subject – until the weirdness of quantum states prompted the articulation of QBism. Einstein established in 1905 that the observer’s frame of reference was indispensable for making sense of mechanics, thus eliminating the unvarnished objectivity of Newton’s absolute notions of time and space. The wave/particle duality in quantum mechanics staged another assault on objectivity. An electron is not a wave or a particle, but a hybrid revealing different properties, depending on the questions agents ask and the measurement and argumentative practices they engage in. Extending well beyond dispassionate reason, the questions scientists pose and the answers they offer are shaped by what William James called temperament. This includes the senses. Will, taste, emotions, and passion are all implicated in and contribute to scientific practice, just as they are present in all other human affairs. Temperament conditions our receptivity for heuristic and obfuscating concepts, confirmatory and disconfirming evidence, and illuminating and distracting methods of inquiry.<sup>212</sup>

<sup>209</sup> Barad 2007: 341–42, 379. <sup>210</sup> Baeyer 2016: 144–55. <sup>211</sup> Daston 2019: 65–67.  
<sup>212</sup> Fuchs 2017: 5–6.



Numbers play a central part in science and in the study of world politics. They are stories self and other can share, rooted in their private experiences. They are fictions, like poems and paintings, and they become instruments of taking imaginative leaps with which we try, Deborah Stone argues, to make others leap with us. Numbers are accumulated experiences and judgments. They have souls that become social conventions when shared.<sup>213</sup> Because counting forces things into categories that ignore differences, numbers have power. As is true of the collapsing wave function that creates one real world from an infinity of possible worlds, we construct numbers by making our own decisions about how to separate things into groups. In the split second before we decide, things could go either way: “It could be *this* or it could be *that*. Numbers are a magic wand that resolves ambiguity into one-ness.”<sup>214</sup> We fool ourselves into believing that they are objective or inhere in the world outside. As in QBism, numbers are our creation, our way of making sense of the world. And, just like language, they can never pin things down definitively.<sup>215</sup>

Like Smolin’s scientific cosmology, QBism demands thinking of science in “radically unfamiliar ways.”<sup>216</sup> It asks us to trade in deeply held Newtonian convictions about the existence of an objective, external world for a view of the world based on individual beliefs rooted in personal experience. Its radical subjectivism is grounded in the firmest of beliefs that in their own private experiences self and other are very much alike. And this belief makes it possible for self to function in the world. QBism thus contains a close link to the idea of intersubjectively shared beliefs. The objective world is affirmed by the fact that other acts back on self.

*Conclusion.* Workarounds such as subjective belief and human experience offer, as is true of complexity and subjective probability, specific terms of coexistence between Post-Newtonianism and Newtonianism. Confronted by uncertainty, QBism insists that the world is constituted by subjective beliefs and human experience all the way down. In contrast, Newtonian workarounds do not let go of the notion of risk in a closed classical world governed by objective laws and mechanisms. With QBism, Post-Newtonian workarounds offer a radical subjectivist argument that does away with the notion of a law- or mechanism-governed external world, while at the same time excelling in the conduct of controlled

<sup>213</sup> Stone 2020: xiv–xvi, 12, 61, 115, 218, 241–42.   <sup>214</sup> Stone 2020: 4.

<sup>215</sup> Stone 2020: 217. In her review, Cheng (2020: 37) insists on the importance of rigor, logic, consistency, and controlled experiments that Stone does not question. But she also extends Stone’s argument: “Higher-level math involves exactly the complexities she [Stone] is asking us to be aware of elsewhere.”

<sup>216</sup> Mermin 2019: 2.

experiments in a world radically open to human intervention and interpretation.

The conventional understanding of uncertainty is Newtonian, as it applies to statistical distributions that defy the assignment of probabilities. Newtonianism even accommodates subjective probability theory, which elides a clear distinction between risk and uncertainty and links up with the more radical subjectivism of QBism. Both subjective probability theory and QBism distinguish clearly between subjective probabilities and objective conditions.<sup>217</sup> A subjective probability expresses a degree of belief about the truth of some proposition. In the form of subjective probability theory and QBism, Bayesian theory thus distinguishes clearly between subjective and objective parts of its arguments. The subjective part relates to the initial judgment of an agent that leads to the assignment of the probability of prior beliefs. The objective part is the application of the rules of probability to such priors. Even probabilities produced by physical laws have subjective roots: “Probabilities are degrees of belief, not facts. Probabilities cannot be derived from facts alone. Two agents who agree on the facts can legitimately assign different prior probabilities.”<sup>218</sup> The epistemic state of an actor is part of the reason for her prediction about the world, not part of some process that occurs in the world. Subjective probability theory lives in a halfway house. It wagers that information updating and careful calibration of different streams of information will reconcile subjective perceptions with an objective external world governed by determinist laws, probabilistic tendencies, and causal mechanisms. The classical model operates quite well for many practical purposes since statistical quantum effects wash out at the macro level. For many, the decohered world that the classical model describes is thus thought to be an adequate approximation of the macro social and political world.<sup>219</sup> But the classical model has no room for nonlocality (Einstein’s “spooky action at a distance”), where cause-and-effect relations operate without mechanisms, and it fails to acknowledge uncertainty as a constitutive part of the world, be it natural or political.

Taking a subjective view of probability leads unavoidably to a QBist interpretation.<sup>220</sup> Quantum probabilities offer a complete description of the quantum system, an infinity of potential realities. Quantum mechanics describes the probabilities of finding some specific properties when they are being measured rather than the properties of material objects and forces in the classical world. Like subjective probability theory, QBism narrows the concept of probability to apply only to single agents. But, in

<sup>217</sup> Caves, Fuchs, and Schack 2007: 1–2. <sup>218</sup> Caves, Fuchs, and Schack 2007: 6.

<sup>219</sup> Waldner 2017; Nau, Chapter 6, this volume. <sup>220</sup> Mermin 2019: 7, 10.

contrast to subjective probability theory, it broadens the concept of probability by including all personal experiences, subject only to the constraints of being free from mathematical contradictions. This broadening captures a web of shared individual probability assignments that makes science a powerful endeavor for collective human inquisitiveness and ingenuity. It has generated a large common core of experiences that organize our scientific and common sense of how the world works.

Quantum mechanics and the classical model are not antithetical. The former covers the latter as it recovers classical theory at the limit. The infinity of possible quantum worlds collapses, with measurement, into the classical world in which we live. That transition, or “decoherence,” remains one of the great mysteries in quantum mechanics. Evidence in several fields, including quantum decision theory, points to quantum effects in the classical world that Post-Newtonianism may explain better than Newtonianism.<sup>221</sup> Unsurprisingly, in navigating the practicalities of life, common sense often makes us rely on the “both/and” logic of quantum probability that is multivalent and nonlocal, rather than the “either/or” Boolean logic that is binary and local.

QBism’s radical subjectivist stance does not sit well with the many quantum physicists who hold to a realist interpretation of science.<sup>222</sup> Most quantum physicists step back when they confront the weirdness of the natural world. For all intents and purposes, they have stopped probing the meaning of doing physics, throwing up their hands before the unfathomable strangeness they navigate so expertly. In Nobel Prize-winner Richard Feynman’s possibly apocryphal but often quoted words, “No one understands quantum mechanics. Do not keep saying to yourself, if you can possibly avoid it, ‘But how can it be like that?’ because you will go ‘down the drain’ into a blind alley from which nobody has yet escaped. Nobody knows how it can be like that.”<sup>223</sup> Feynman’s advice is readily understandable. Why heed the implication of the radically subjectivist call of QBism, if the experimental practice of quantum mechanics has worked so well in helping physicists to navigate the world even without understanding it? Furthermore, the success of that practice provides a strong and durable link to the Newtonian worldview of scientific practice.

This pragmatic move breaks the symmetry in the partial accommodation of Post-Newtonian elements in Newtonianism and of Newtonian elements in Post-Newtonianism.<sup>224</sup> For Post-Newtonian science to create circumscribed cause-and-effect chains to conduct experiments with great accuracy,

<sup>221</sup> Wendt 2022a, 2022b. Wendt 2015: 91–108. <sup>222</sup> Becker 2018.

<sup>223</sup> Quoted in Pagels 1982: 135.

<sup>224</sup> Patchen Markell pushed this point so compellingly that I have used some of his language in the rest of this paragraph. Thank you.

based on situationally specific human purpose, for Post-Newtonianism to treat Newtonianism seriously as a special case when the wave function collapses, and for Post-Newtonianism to define substantively its terms of coexistence with Newtonianism would require sustained inquiry into the meaning of Post-Newtonianism and the reasons why Newtonianism is valid in delimited ways but not in general. The practical success of quantum physics has been so great, however, that it has sidelined inquiry into the meaning of twentieth-century particle physics. To the extent that physicists working with a Post-Newtonian worldview unquestioningly take for granted the goal of predictive accuracy as a matter of undisguised practicality, they share a view of science that is familiar to those holding a Newtonian worldview. As committed a QBist as David Mermin suggests that, “if and when quantum mechanics is successfully modified, the motivation will come from unambiguous deviations of actual data from its predictions, and not from discomfort with any interpretations of its formalism.”<sup>225</sup>

Newtonianism expresses a combination of common and tacit knowledge, as in commonsensical Newtonianism and tacit, experimentally triumphant Post-Newtonianism.<sup>226</sup> This combination is arguably the main reason why Newtonianism retains such a powerful grip on our understanding of the world and our inability to recognize uncertainty as a constituent part of world politics.

Common knowledge focuses on what actors consciously think about and which information they rely on to make their choices and coordinate their behavior. Tacit knowledge highlights what agents think *from* and take for granted: their unspoken worldviews. In the analysis of world politics, most scholars share in the common knowledge that the world is fundamentally orderly and predictable and that it is their task to discover the laws and mechanisms revealing the enabling conditions of order and predictability. They hold this commonsensical Newtonian view, fortified by the tacit knowledge of the experimental success of Post-Newtonianism. Together, Newtonian commonsense and Post-Newtonian experimental success offer a compelling combination of common and tacit knowledge.<sup>227</sup> The interpretation of reality as consisting only of risk is not readily open to rational reconstruction or refutation.<sup>228</sup> Most students of world politics thus hold that their subject is defined by risk. Uncertainty as a constitutive principle is ignored.

Scholars and commentators alike lavish attention on risk, expressing a profound belief in an orderly universe. In doing so their contingent,

<sup>225</sup> Mermin 2019: 2.

<sup>226</sup> For a longer discussion of common and tacit language, see Katzenstein 2018: 383–88; Adler 2019: 18–20, 301; Collins 2010.

<sup>227</sup> Collins 2010: 119–38. <sup>228</sup> Jackson 2002: 70–71.

mid-level, probabilistic propositions have not come close to the explanatory rigor, predictive accuracy, and prescriptive practicality of Newton's theory of gravity. In focusing on risk to the exclusion of uncertainty, they subscribe, often unwittingly, to a whole slew of other contested and inherently contestable foundational ideas marking Newtonian and Post-Newtonian thought. Efficient causation, neutralist epistemologies, individualist ontologies, linear temporality, and asocial space are taken for granted; constitutive causality, entangled epistemologies, relational ontologies, nonlinear temporality, and social space are ignored.

Greater awareness of these foundational differences has implications for the analysis of world politics. The complementarities between Newtonianism and Post-Newtonianism provide ample intellectual justification for engaging in self-reflection and increasing toleration of intellectual pluralism in the analysis of world politics.<sup>229</sup> This could make some of us less hesitant to acknowledge personal experience and emotions as relevant factors in research. It could make the study of methods less interesting, and the study of epistemology more so. It could lead to trading in the aspiration for unobtainable predictive accuracy in favor of greater explanatory depth. It could encourage searching out approaches, theories, and models that are open to or informed by both Newtonian and Post-Newtonian worldviews. And it could lead us to reject Dilthey's widely accepted argument that there exists an irreconcilable difference between the natural sciences and the humanities. Post-Newtonianism offers perspectives on the natural sciences that make us question the conventional equation of Newtonianism with science: "Just as it would be mistaken to rule out explanation from the interpretive human sciences, so quantum theory and the cosmology of dark matter have raised unresolved questions about the universe and its origin that make it unreasonable to exclude interpretation from the natural sciences."<sup>230</sup>

The analysis of world politics thus confronts a deep predicament. Both the commonsensical appeal of Newtonianism and the practical successes of quantum mechanics are deeply appealing. In contrast, the practical accomplishments of scholars of world politics are small. Compared to quantum mechanics, their record of predictive accuracy is embarrassingly poor and shows little prospect of improving. Refusing to inquire into the meaning of this failure amounts to an act of willful ignorance. The analysis of world politics in current research practice remains so strongly tethered to Newtonianism that it confronts enormous difficulties in entertaining alternative worldviews. And, in so doing, it continues to deny the constitutive role uncertainty plays in world politics.

<sup>229</sup> Kauffman 2008: 258. <sup>230</sup> Makkreel 2020: 323.

*Values.* Because measurement and observation have a great deal to do with the world we make and experience, Newtonian and Post-Newtonian workarounds underline the importance of ethics and accountability.<sup>231</sup> In this view, science is constituted by collections of ethical communities.<sup>232</sup> This evokes theorist Satkunanandan's calculable and extraordinary responsibilities.<sup>233</sup> We ordinarily focus on our countable and dischargeable responsibilities. But this calculative move does not free us from confronting our ontological condition of uncountable responsibility constitutive of being human. Calculative responsibility is attractive because it gives a sense of control over our lives. It coexists with the incalculable dimension of the world and the enormity of freedom. Although the first often effaces or conceals the second, both responsibilities are important for an inquiry into moral values.

In the social sciences and the study of world politics, this is especially clear when numbers are used to characterize the world. Deborah Stone reminds us of the dual meaning of the verb "count": to add things up reciting numerals in ascending order, and to matter in the sense of being included and having importance. The two meanings are always intertwined, and always implicate values and power in, for example, the national accounts of GDP, in the assessment of teacher performance, in the evaluation of a slave in the Constitution as a three-fifths person, and in the many other examples she thoughtfully analyzes.<sup>234</sup> Despite their sharp disagreements on many issues, Nau's humanist Newtonian advocacy of individual accountability in Chapter 6 and Kurki's hyper-humanist Post-Newtonian plea for a morally infused practice of all sentient beings in Chapter 3 are less divided than one might think. Worldviews compel us to take a stand as they incorporate world-inquiring and action-coordinating policies and practices.<sup>235</sup> Whether and to what extent ethics or power shape argumentative outcomes and different normative standards is a proper subject of empirical and theoretical inquiry.<sup>236</sup> Worldviews tolerate dilemmas, tensions, and contradictions that philosophy, science, and religion seek to resolve once and for all. This is their weakness – and their strength.

Values are inextricable components of all worldviews that offer an ethical universe linking the here-and-now to the supernatural, and the practical to the metaphysical.<sup>237</sup> To the world's jungle, worldviews offer

<sup>231</sup> I thank Richard Price for helping me think through this point.

<sup>232</sup> Kurki, Chapter 3, this volume. <sup>233</sup> Satkunanandan 2015: 6–7. <sup>234</sup> Stone 2020.

<sup>235</sup> Brown and Eckersley 2018: 7–8; Reus-Smit 2008: 67–70, 76–77.

<sup>236</sup> Price 2008: 11–12, 43–46; Martineau and Squires 2012: 530–34; Checkel 2013: 228–30, 235–36; Erman and Möller 2013.

<sup>237</sup> Reus-Smit 2008: 54–57; 2013, 601–03.

a transcendental canopy.<sup>238</sup> Henry Nau argues as he does in Chapters 2 and 6 because of his deep commitment to individual choice and accountability; Milja Kurki in Chapter 3 because of her equally deep sense of care about the environment and ecological collapse. The intensity of the debates and disagreements during our meetings and in the different chapters was perhaps not as great as the two-generation split between climate change denier Donald Trump and climate change advocate Greta Thunberg. But it was qualitatively different from normal academic disagreements. Everybody felt and understood that the stakes under discussions were very high. For different worldviews lead to different expectations of what world orders are or might be feasible and what ethical considerations could or should come into play.

Because humans are self-reflective, their practices are inextricably linked to their worldviews. And because values are baked very deeply into our scientific theories and religious beliefs, we may not be able to recognize them easily in our daily discourses and practices. But they exist nonetheless.<sup>239</sup> What is true of all metatheoretical discussions of ontology, epistemology, and methodology holds also for a praxis-shaping morality: it is always provisional and contestable. Political engagement of citizen practices and government policies matter no less than philosophical arguments, scientific discoveries, or religious beliefs. As part of worldviews, moral values and social purposes gain strength and salience, for “individuals cannot escape the moral language embedded in the social conventions which have previously constituted them as moral subjects.”<sup>240</sup>

This is true also for an empirical theory of world politics that leans heavily on Newton and is indebted to Weber. While struggling with the difference between fact and value, Weber insisted on the mutual relevance of science, normative discourse, and human choice. Weber’s arguments sharpen our thinking rather than bridge the gaps between is and ought, means and ends. We can choose to accept basic values. Seeking to justify them, however, is a hopeless endeavor. There exists no ultimate rational foundation for our most basic values. One of the classical functions of theory is its practical efficacy, its formation of an orientation toward practical action. In the conduct of social science and international

<sup>238</sup> Barnett, Chapter 5, this volume.

<sup>239</sup> Monteiro and Ruby 2009; Bernstein 1976: 61–62, 104, 110–11, 113–14; Adler 2019: 2, 265–94. Operating at different levels of abstraction, Levine and Barder (2014) and Paipais (2017) make the same point in their critiques of how prominent realist and liberal international relations scholars and different philosophical schools of thought deal with issues of pluralism and difference.

<sup>240</sup> Linklater 1998: 64.

relations, this is often constrained by various barriers – theoretical, methodological, and otherwise – that create an intellectual and practical vacuum between theory and practice. Marked by their action-inducing features, worldviews do not give rise to such restrictions. They fill the void left by theory and methods.

Take, for example, pressing environmental issues. Although many scholars of world politics worry about the environment, that concern is not yet reflected in their publications. Between 2011 and 2015, three leading IR journals published virtually no articles on conventionally understood, noncatastrophic environmental issues.<sup>241</sup> It is a safe assumption that catastrophic scenarios are a negligible proportion of these very small numbers.<sup>242</sup> Attended by scholars from all over the world, the 2015 annual meeting of the International Studies Association featured 1,250 panels; only one paper title referred explicitly to the Anthropocene.<sup>243</sup> And even though they ranked climate change as the most important issue facing the world, only 2.4 percent of about 4,000 international relations scholars listed the environment as their main area of research.<sup>244</sup> To the extent that the environment matters, however, debate expresses two different worldviews travelling under cornucopian-exemptionalist and catastrophic-ecological labels. A “cornucopian” position centers on core values such as economic growth and humankind’s justified mastery of nature. A “catastrophic” worldview questions the rightfulness of a man-over-nature stance and foresees doom unless changes in individual and socially transformative values move us away from a materialist status-quo. Relatedly, an “exemptionalist” worldview insists that unique achievements in science and technology free humankind from ecological limitations that constrain other species. An “ecological” worldview holds instead that the human species is embedded in rather than emancipated from ecological constraints.<sup>245</sup> In Chapters 3 and 6, Kurki and Nau articulate these differences. Both positions ground themselves in the achievement of or aspiration for Enlightenment values understood in the singular, such as freedom, human rights, and economic prosperity.<sup>246</sup> Nau champions an abstract ethics to justify action on

<sup>241</sup> 0% in *International Organization*, 0.3% in *International Studies Quarterly*, and 1.6% in the *European Journal of International Relations*. It is a safe assumption that the catastrophic possibilities that Pelopidas (2020) focuses on are a tiny proportion of these very small numbers. Underdal 2017: 170.

<sup>242</sup> Pelopidas 2020.

<sup>243</sup> I thank Colin Chia for his assistance in generating these figures. See also Kelly 2019

<sup>244</sup> Harrington 2016: 486–87. <sup>245</sup> Dake 1991: 64.

<sup>246</sup> Nau (Chapter 6) and Duara (Chapter 7) differ in their recognition of Enlightenment thought. Nau talks about the Enlightenment in the singular; Duara calls attention to its different strands. It is very rare that the work of African philosophers Yacob and Amo is



universal grounds; Kurki advocates an intense practicality without offering answers to questions of public policy. Kurki challenges Nau's claim that self-reflective experience makes humans stand apart from and above the environment and that humans operate in a Newtonian world of things against a background of empty space and linear time. It is that difference which animates the clash of two scientific worldviews and their different value commitments.

Hirschman's possibilism<sup>247</sup> provides an opening for future explorations. Possibilism does not reject the individual accountability standards that concern Haas and Nau in Chapter 2 and Nau in Chapter 6. And it embraces the social normativity of engaging the other in open dialogue that Kurki espouses in Chapter 3. Grove and Barnett (Chapters 4 and 5) develop variations of these normative stances. Exposure to different values and ways of being and viewing the world can contribute to an ecumenical outlook and the practical and ethical injunction for toleration that is at the heart of different Enlightenment traditions. As Duara shows in Chapter 7, with the world at the brink of planetary catastrophe, even in the absence of a clearly and rationally articulated path, it may be necessary to explore further the morality of possibilism. In Chapter 8 Bentley Allan historicizes nineteenth- and twentieth-century values such as "civilization" and "economic growth" as constituted by cosmological elements. Finally, without denying that faith can lead to value absolutism, Timothy Byrnes stresses in Chapter 9 that humble recognition of the uncertainty that accompanies faith can also engender an ecumenism grounded in empathy with and respect for other religious traditions.

Considerations of values are the subject of metatheoretical debates in the analysis of world politics.<sup>248</sup> Such debates make the stability of any foundational commitments inescapably provisional and inherently contestable.<sup>249</sup> Chris Reus-Smit, for example, does not believe that "fundamental questions of epistemology and ontology – the stuff of metatheory – are resolvable in any final or absolute sense."<sup>250</sup> This is not to deny that even though "debate with a view to resolution" is an unobtainable objective, "reflection with an eye to consequences" is not.<sup>251</sup> The Newtonian worldview that permeates

ever acknowledged, even though they preceded and anticipated many of the European Enlightenment's core tenets. Not grounded in notions of salvation (through science or religion) such non-European worldviews highlight alternatives, such as tearing and repairing, yielding different ethical and political arguments. Robbie Shilliam's interventions in our discussions made this point several times. See also Herbjørnsrud 2017; Rutazibwa and Shilliam 2020; Trowsell et al. 2020.

<sup>247</sup> I thank Richard Price for this line of thought. <sup>248</sup> Wendt 1991: 383.

<sup>249</sup> Gunitsky 2019; Monteiro and Ruby 2009: 17, 25–26.

<sup>250</sup> Reus-Smit 2013: 590, 594–95; Hamilton 2017; Levine and Barder 2014: 868–72.

<sup>251</sup> Reus-Smit 2013: 605.

the major paradigms of international relations has led to this bet: the best scientific knowledge can be gained by presupposing that the world is governed only by risk.<sup>252</sup> In contrast, Post-Newtonianism is more ready to acknowledge the constitutive role of uncertainty in world politics. This leads to inescapable conflicts that are both important and unresolvable.

Newtonian and Post-Newtonian worldviews offer complementary ways for engaging with and navigating the world in never-ending, partly self-correcting processes of trial-and-error. Newtonianism has sidelined uncertainty as a constitutive feature of world politics. Too often, therefore, students of world politics are left speechless by stunning surprises. Creating a park out of garden and forest, and adopting Post-Newtonianism, not to the exclusion of Newtonianism, would help to account better for uncertainty as a central feature of world politics.

### 10.3 Science and Religion

Parks exemplify the possibility of a meaningful coexistence of garden and forest, here science and religion – the most deeply anchored worldviews. On this point, Aquinas and Newton appear to have agreed.<sup>253</sup> 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 today, Mark Lilla argues, humankind is not well 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 and are drawn to those who, in the end, promise more than they can deliver. Priestesses then and pundits now eagerly offer to provide an unlimited supply of unobtainable knowledge. We have a hard time acknowledging uncertainty because it makes us come to terms with 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.”<sup>254</sup> This is not surprising. Most occurrences in the world, philosopher Nancy Cartwright argues, are “subject to no law at all . . . the claims to knowledge we can defend by our impressive scientific successes do not argue for a unified world of universal order, but rather for a dappled world of mottled objects.” The search for universal laws governing nature and society is a fool’s errand. Yet, the belief in the existence of universal laws embodied in a single scientific system of inquiry exists across all sciences: “The yearning for ‘the system’ is a powerful one; the faith that our world must be rational

<sup>252</sup> Jackson and Nexon 2013: 549; Wæver 1997. <sup>253</sup> Konyndyk 1995.

<sup>254</sup> Lilla 2020.

and well-ordered through and through plays a role where only evidence should matter.”<sup>255</sup> And, in the field of international relations, that evidence points powerfully to the importance of uncertainty as an important aspect of global politics.

As we slowly stumble through the fog, Michael Barnett writes in Chapter 5, we “blend the worldly and the heavenly.” Along the way we rely on worldviews to steady us as we seek to secure our anxious sense as fleeting beings in this world. The search for ontological security, like the politics of fear, seeks to eradicate uncertainty through fight-or-flight responses and their conservative or reactionary political consequences. But as Catarina Kinnvall and Jennifer Mitzen argue, it can also steady us as we try to cope with a more diffuse anxiety.<sup>256</sup> Such a disposition permits a broader range of political responses than the emotion of focused fear, including resistance, exploration, anticipation, and even excitement. Even though fear and anxiety may be difficult to sort out empirically, ontological insecurity avoidance differs from ontological security seeking. In either case, the experience of the fundamental contingency of being is mitigated by scientific and religious worldviews.

Moving in a fear- and anxiety-inducing fog, science and numbers can 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.”<sup>257</sup> Confronted with uncertainty and chaos,

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 looking for deliverance from our human predicaments? . . . We want the comfort of certainty.<sup>258</sup>

Or we crave the comfort of religion. As conventionally used today, the concept of religion is barely 200 years old. Most communities had to invent new categories – such as *shukyo* in Japanese and *zongjiao* in Chinese – to describe a novel foreign phenomenon. They simply lacked indigenous categories that corresponded to the contemporary understanding of religion. Even ancient Greece lacked a single word that corresponded to the Latin *religio*.<sup>259</sup> Over time, religions have changed

<sup>255</sup> Cartwright 1999: 16–17.      <sup>256</sup> Kinnvall and Mitzen 2020.

<sup>257</sup> Stone 2020: 100–1, 178.      <sup>258</sup> Klay 2020: 10.

<sup>259</sup> Casanova 2012: 193; Byrnes, Chapter 9.

from compact to complex symbolic systems and practices that tie humankind to the ultimate conditions of its existence. Established binaries such as sacred–profane, transcendent–mundane, and religious–secular do not really capture the multiplicities that this change has wrought.<sup>260</sup> Religious worldviews reflect, inform, and simplify more or less explicit understandings that individuals or groups share as they search for the meaning of being a very small part of a very large whole.<sup>261</sup>

“The world’s great religions provide world views; but so does the scientific rationality that is emblematic of modernity.”<sup>262</sup> Religious and scientific worldviews can shift, sometimes gradually, sometimes quickly. The rise of Axial Age religions and the rise of modern science are two of the most notable shifts that humanity has experienced. The Axial Age witnessed powerful and independent cultural developments in China, India, Iran, Palestine, and Greece. This gave rise to the world’s great religions. At that pivotal moment, humankind moved from a less reflective to a self-reflexive striving for human agency, transcendence, criticism, self-determination, and, eventually, future-oriented progress. Around the year 1,000 the first wave of globalization was powered by a desire to spread religious beliefs and by religious conversions. The vast majority of today’s believers subscribe to one of the major religions that spread across the globe at that time.<sup>263</sup> In the sixteenth and seventeenth centuries, scientific advances discovered new ideas about motion and matter in a universe governed by the laws of nature. In the eighteenth and nineteenth centuries, geological and biological scientists transformed the understanding of time, development, and progress. In the twentieth century, quantum mechanics probed the infinite possibilities and uncertainties of the subatomic world while scientific cosmology developed new ways of thinking about the universe. Religion and science have evolved along plural and often contradictory lines. Today, the two provide foundations for worldviews that give meaning to the experience of being in a world marked by inescapable uncertainties.

*Religion.* Though often unacknowledged, theology has retained an important influence in modernity. Gillespie argues that the hidden origins of modernity precede the Age of Enlightenment and are to be found in “the great metaphysical and theological struggle that marked the end of the medieval world”: the struggle between nominalism, with its insistence on nonteleological singularities accessed by biblical revelation or mystical experience, and scholasticism, with its belief in divinely created and revealed

<sup>260</sup> Casanova 2012: 193, 200, 202.

<sup>261</sup> Ossio 1997: 549; Hamilton 2018b: 377–78; Hamilton 2018a.

<sup>262</sup> Goldstein and Keohane 1993: 8. <sup>263</sup> Hansen 2020.

universals.<sup>264</sup> At stake in this struggle were questions about the nature of God and the nature of being rather than, as emerged subsequently, the process of human self-assertion and control. Modern science neither opposed nor displaced religion. Unwittingly, it became an extension of earlier theological debates. And this, Gillespie argues, has created a concealed theology of philosophical disagreements that has stretched throughout modernity down to the present. God does not disappear. His attributes and capacities are transferred to nature and man. In the shift from divine to natural law, disenchantment thus merges with re-enchantment.<sup>265</sup>

Religious worldviews also remain deeply embedded in contemporary world politics in other ways, as Byrnes shows in Chapter 9. For example, they provide a hidden script about order in anarchy that lies at the center of realist theories of international relations.<sup>266</sup> As the founder of modern political science, Hobbes offers a “worldly application of a theological pattern.”<sup>267</sup> Existing in the state of nature, man is a believer in God and acknowledges his obligations under God’s law. These are real obligations rooted in real law, made and enforced by men on the basis of and legitimized by their worldviews. Just as God created the universe, so man can create the commonwealth and an international order, even if their sovereign is only imagined. In Bain’s reading, Hobbes is thus a theorist of interstate society rather than of international anarchy.<sup>268</sup> Contemporary realist theories of order are not strictly modern or secular; traces of medieval theological discourses can be discerned by those who choose to look. In our accounts of world politics, religion remains constitutive of how we think about the world. Nominalist theology remains embedded in modernist conceptions of sovereignty as immanent and necessary or imposed and contingent order.<sup>269</sup> 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” as a way to reason from natural phenomena or God as the first cause of the universe.<sup>270</sup> Today, the connections between religious, social, and political cosmologies typically are implicit, often contradictory, and always consequential.<sup>271</sup>

<sup>264</sup> Gillespie 2008: 12, 14.   <sup>265</sup> McClure 2010.   <sup>266</sup> Bain 2020.

<sup>267</sup> Mitchell 1993: 78, quoted in Bain 2020: 129; Bain 2015.   <sup>268</sup> Bain 2020: 130–31.

<sup>269</sup> Bain 2020: 9–10; Gillespie 2008.   <sup>270</sup> Kurki 2020: 26–27.

<sup>271</sup> Kurki 2020: 39–40, 67–68, 79–80; Kragh 2004: 12, 51.

It follows, as Byrnes argues in Chapter 9, that religion and politics are not separate “variables” as Haas and Nau hold in Chapter 2, but coconstitutive ways of “being in” the world. Haas and Nau, Byrnes writes,

want to insist that relational worldviews imply their own kinds of . . . “Gods” that pose a threat to human freedom because we don’t really possess the capacity to truly know or resist their effects. But if a relational cosmology is grounded in faith or in the pursuit of what is “really real,” 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 through Newtonian scientific methods.

In contrast to nondogmatic religions such as Buddhism and Hinduism, which tolerate the uncertainties of forests and the foibles of divine personages, fundamentalist political projects of doctrinal religions wish to create orderly and predictable gardens. 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. 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.”<sup>272</sup> “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.”<sup>273</sup> In the end, all religions require “the life-defining act of leaping, faithfully, into the unknown.”<sup>274</sup> Reflecting on Wittgenstein’s philosophical astonishment about the existence of the world, author John Kaag articulates a similar idea: “Philosophy is the activity of climbing a ladder, and once you reach the top, the ladder disappears.”<sup>275</sup>

In its current global resurgence, religion is not an idiom of the discontended or the displaced. It is a set of ideas, values, practices, and traditions that shape many communities and their political struggles in all parts of the world. Often it is not religion per se but its various manifestations that matter politically, “as cognitive statements of truth, identificatory symbols, comprehensive ways of life, modes of voluntary association, moral and ethical obligations, vulnerable collective identities, and so forth.” What matters politically is not religion as such but “the multiple values

<sup>272</sup> The Economist 2020: 68. <sup>273</sup> Byrnes, email sent to the author 04/12/2020.

<sup>274</sup> Byrnes, Chapter 9. <sup>275</sup> Kaag 2020.

that particular dimensions of religion realize.”<sup>276</sup> Religious resurgence is not a “fundamentalist” or “anti-modernist” reaction to science and modernity. It is part of modernity and often a normative critique of developments that have failed to deliver on the promises of the Enlightenment project.

Enlightenment expectations of the inevitable march of secularization and rationalization turn out to have been mistaken. As a legacy from the past and an adaptation to the present, religion continues to shape contemporary worldviews and world politics. In America’s social and political life, the “fourth great awakening” has made religion once again a vital force. The enlargement of the European Union toward the South and East has broadened the scope for human population flows, yet a growing stream of illegal migrants and refugees have made religion a vital concern in secular Europe.<sup>277</sup> Catholicism thrives in Africa, Protestantism in Latin America. Folk religions flower in East Asia, specifically China and Japan. And Islam is going through a global resurgence. Indeed, religious traditions all over the world are showing a great capacity to reinvent and reinvigorate themselves.

*Science.* Allan argues in Chapter 8 that worldviews are local, temporary, and political stabilizations of cosmological elements. In contrast to ascetic Protestantism, “the world remained a great enchanted garden” for Asia’s popular religions, in the words of Weber. Concretizing further Weber’s historical account, Allan highlights the constitutive effects that two cosmological elements – materialism and object orientations – have had for modernist values of rationality and control and thus for the very basis of the contemporary science of world politics. In other works, Allan shows how economy and climate became in the twentieth century objects of governance that lent themselves to the exercise of control in a putatively law-governed yet highly unpredictable universe.<sup>278</sup> He also shows how the separation of object and subject creates in history the very basis for the concept of rationalization that Weber deploys. Referring to Shilliam’s discussion of the importance of Vodou (*lwa*) in the Haitian revolution, Allan concurs with Byrnes: the historical evolution of the conceptual apparatus of the modern natural and social sciences has created enormous barriers to reckon with the importance of religious worldviews. Furthermore, that apparatus simply cannot acknowledge that the *lwa* might have real agency in the world, and thereby misunderstands the way that cosmology forges action in ways that differ from Western concepts of modernity.<sup>279</sup>

<sup>276</sup> Laborde 2017: 2.   <sup>277</sup> Katzenstein 2006.   <sup>278</sup> Allan 2017.

<sup>279</sup> Allan, Chapter 8; Shilliam 2017; Byrnes, Chapter 9.

Although the scientific method buttresses a worldview that has acquired global significance in the last 400 years, different sciences can embody different worldviews.<sup>280</sup> A radical break in scientific worldviews occurred in the sixteenth and seventeenth centuries. Leading scientists put on a different “thinking-cap” that permitted them to leave behind an Aristotelian worldview that had been unassailable for centuries.<sup>281</sup> The ascendant scientific worldview replaced that of a well-ordered, hierarchical cosmos with visions of an “indefinite and even infinite universe.”<sup>282</sup> Over time, this scientific worldview increasingly supplanted the views embodied in the world’s major religions. For modern orders science became a secular equivalent to religion.

Kuhn’s celebrated theory of scientific revolutions offers a good illustration. Central in the evolution of his thinking about science was the “Aristotle Experience” Kuhn had in the summer of 1947 in Harvard’s Kirkland Hall. Kuhn discovered for himself the fundamental difference between the Aristotelian and Newtonian views of the world. At one moment Aristotle seemed to be just a bad and ignorant physicist.<sup>283</sup> And then, suddenly, “the fragments in my head sorted themselves out in a new way, and fell into place together. My jaw dropped, for all at once Aristotle seemed a very good physicist indeed, but of a sort I’d never dreamed possible.”<sup>284</sup> Aristotle’s physics suddenly seemed plausible and it was no longer puzzling why his view of the world had been so widely shared for so many centuries. Throughout his life Kuhn reflected often on this revelatory experience. He writes that scientific “paradigms are constitutive not only of science but of nature . . . in a scientific revolution, what we take to be nature must itself, in a sense, change.”<sup>285</sup> And he described scientific revolutions as “conversions” prompted more by transformative personal experiences or leaps of faith than reason, observation, and careful experimentation.<sup>286</sup> For those following Kuhn, different paradigms have “incommensurable ways of seeing the world and practicing science in it.”<sup>287</sup> Scientific revolutions can change the meaning of conventionally accepted concepts and thus reconfigure “the conceptual network through which scientists view the world.”<sup>288</sup>

<sup>280</sup> Becker 2018: 284. <sup>281</sup> Butterfield 1957: 1–2. <sup>282</sup> Koyré 1957: 2.

<sup>283</sup> Weinberg 2015 writes that Aristotle was the first scientist to insist on the need for observation to check speculative theories. But he had no sense that mathematics could be an important part of the study of nature and did not recognize the importance of experiments. Over the centuries and millennia science has progressed.

<sup>284</sup> Kuhn 2000: 16. <sup>285</sup> Bernstein 1976: 87.

<sup>286</sup> My discussion follows Reisch 2019: xxxii–xiii, 61–62, 65–68, 79; Bernstein 1976: 87, 92; and Weinberg 1998: 8–9, 12–13.

<sup>287</sup> Kuhn 2012: 4. <sup>288</sup> Kuhn 2012: 102.



Classical and quantum physics are both part of modern science and thus are not separated by as dramatic a shift in scientific worldviews as were Aristotle's and Newton's. But as specimens of modern science, their view of nature is arguably very different. One holds that nature is passive and subject to control; the other that nature is active and always threatening to escape control. One neglects uncertainty; the other builds on its constitutive effects. One holds a determinist or probabilistic view of the world that excludes uncertainty; the other incorporates uncertainty. These are foundational differences in outlook on the natural and, by implication, also on the political world.

*Science and Religion.* Religious worldviews share some features with Post-Newtonian scientific worldviews. Building on Schütz and in agreement with Post-Newtonianism, Bellah argues that we live in multiple worlds.<sup>289</sup> Much of the time, we live in the world of ordinary daily life, organized by the coordinates of standard time and standard place. Pragmatic and practical interests and means-and-ends calculations rule that life. But we do not spend all of our time in the ordinary reality of daily life. Sleeping and dreaming, for example, do not operate in standard time and standard space. They contradict the logic of daily life. So do other activities: watching a sports event, movie, or play; gazing at a piece of art; reading; listening to stories or music; playing games. All of these divert us from daily life and suspend or alter its rules. Both science and religion are part of those other worlds.

Newton personifies the intimate relations of religion and science. While he drafted the *Principia Mathematica*, covertly and intensely during a quarter of a century, "Copernicus and Faustus in one," he also wrote extensively about alchemy and magic.<sup>290</sup> Einstein believed that objective reality could be understood; he called this belief a "religion."<sup>291</sup> Both science and religion are variegated practices of different ways of knowing. Neither one takes the appearance of daily life for granted. Neither suspends, as we do in daily life, a disbelief in the world as it appears. Both inquire into the possibility that the world might be different than it appears. Both are instances of us living in multiple realities and thus are examples of the profound human capacity of meaning-making. Physicists who believe in God are "unusual" but "not rare." Religious and scientific practices are rooted in the world of play. The practice of seeking an understanding of the universe is a good in and of itself, with consequences that can reflect back on and shape our daily life.<sup>292</sup>

<sup>289</sup> Bellah 2011: 1–3. <sup>290</sup> Keynes 1951: 323. <sup>291</sup> Henderson 2020: 39.

<sup>292</sup> Bellah 2011: 112–14.

In scientific as in religious odysseys, the journey matters more than the destination. Both trips are open ended. Another bend in the road always awaits and always promises a new vista. It could be an old idea thought anew, or a new idea no one has thought before. The culture wars between science and religion – and between competing scientific explanations of nature and society and humanistic interpretations of meanings – are worldviews expressed by and within science and religion. Michael Barnett ends Chapter 5 by recounting Martin Buber's personal odyssey. In the final stage, Buber adopted a relationalism steeped deeply in both the immanent and the transcendental, the particular and the universal. This relationalism provides the foundation for his magisterial *I and Thou* and the fluidity between being and becoming that he pleads for. Barnett concludes that Buber might well have been critical of the metaphysics and the ethics of both humanist substantialism and hyper-humanist relationalism; both threaten to destroy the human. Perhaps. But this book points to possible variants and combinations of substantialism and relationalism, and science and religion. They constitute part of the fleeting and contested multiple realities that enrich our daily life.

Newton knew this only too well. On account of religion, he refused to speculate about the causes of gravity. He considered himself to be God's right hand and not his opponent. For him and other modern scientists, like Descartes, the link between science and religion was explicit. Both theologians and scientists conducted astro-theological inquiries into the order of the world and God's role in upholding it. Now the link is implicit. Many today believe that Science (with a capital S) is looking for a theory that can explain the world. Eternal and universal Laws of Nature are not in this world but stand behind it;<sup>293</sup> "This implies at least the possibility, if not the existence, of a god."<sup>294</sup> Unger and Smolin label this a "transcendental folly."<sup>295</sup> Like God, such a scientific theory would embody absolute and eternal principles that account for the order of the world; it would work toward unveiling a transcendental reality that somehow lies "behind" the world we experience. In a public address given in November 1951, Pope Pius XII went so far as to assert that the big bang theory confirmed the story of Genesis. He soon realized that much of his flock was not prepared to consider such an explicit and direct link between religion and science.<sup>296</sup>

Many physicists working with the standard model are extremely reticent to probe the conditions that made the big bang possible.<sup>297</sup> Scientific

<sup>293</sup> Smolin 1997: 193–94, 198–99. <sup>294</sup> Smolin 1997: 200.

<sup>295</sup> Unger and Smolin 2015: 366. <sup>296</sup> Rovelli 2017: 204–05. Healey 2016: 2–6.

<sup>297</sup> Kurki 2020: 48–49.

cosmology is neutral science as it is conventionally understood, but it also has speculative aspects not normally associated with modern science. The Standard Model is mute on what existed before the big bang moment of singularity. How could that moment have emerged? Why are the laws of physics what they are today? Why are conditions in the universe so constant? These questions push scientific cosmology to its very boundaries, and perhaps beyond. Roger Penrose, winner of the 2020 Nobel Prize in physics, suggests – without, yet, any strong evidence – that universes existed before the big bang and others might well follow the end of this one.<sup>298</sup> The current inability to conceptualize convincingly what came before the big bang puts scientific cosmology in touch with religious world-views: “The question of what happened during, and perhaps even before, the Big Bang is slowly coming into focus in the last years of this century in the same way that the question of what happened before the origin of our species came into focus during the last.”<sup>299</sup> In seeking to answer that question, why should the sciences assume that the laws of nature are eternal rather than the creation of time-bound natural processes?<sup>300</sup>

Today, ordinary language presents religion as about beliefs while science is about facts. But for others, including some of the twentieth-century’s leading physicists, the border between quantum mechanics and religion is porous and, in the case of Schrödinger, best captured by the concept of worldview.<sup>301</sup> Werner Heisenberg is less than definitive about the separation between religion and science: “In science a decision can always be reached as to what is right and wrong. It is not a question of belief, or *Weltanschauung* [worldview], or hypothesis; but a certain statement could be simply right and another statement wrong . . . It is decided by nature, or if you prefer by God, in any case not by man.”<sup>302</sup> But what happens if we replace the singular Science with plural sciences and their different worldviews? Do the encounter with the code of the cosmos and the surrender of notions of absolute space and time really render scientific worldviews implacably opposed to religion and philosophy? Or are both 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. 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.”<sup>303</sup>

<sup>298</sup> Healey 2016: 8–9. <sup>299</sup> Smolin 1997: 17. <sup>300</sup> Smolin 1997: 18.

<sup>301</sup> Schrödinger 1985; Burgess 2018; Wilber 1984; Smetham 2010.

<sup>302</sup> Quoted in Pagels 1982: 74. <sup>303</sup> Pagels 2019: 13.

The legacies and interrelations of Axial Age religions and science affect our worldviews to this day. Each of them has evolved along plural and often contradictory lines. Together, they constitute much of the discursive forms informing world politics today. Charles Taylor sees secularization as furthering both science and faith.<sup>304</sup> A meaningful life can be had by all. Religion is a matter of choice. Believers and nonbelievers alike must 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 nonbelievers 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.

In Taylor's terms, we 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. 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 cling to the categorical assertion of a universally valid truth, or we can seize the opportunity, subject ourselves to the requirements of "warranted assertability" by relevant communities of practice, and learn something new as we enter "a different world of definitions and procedures" – all at the risk of disrupting earlier certainty.<sup>305</sup> Religion and science and their various traditions inhabit the park which contains most of the worldviews that individuals hold and argue about today.

Stuart Kauffman agrees, in his reverential awe of the ceaseless creativity of the web of life and human history, which tumbles forward and breaks no laws of physics, while always remaining partially lawless. This is one way of naming 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. We live our lives forward into mystery, and do so with faith and courage."<sup>306</sup> This worldview has a place for both the promise and the inadequacy of reason. Uncertainty is not a problem to be solved but a condition to be experienced.

This broad understanding of the relation between science and religion offers a productive way of thinking about the relationship between Newtonian and Post-Newtonian science and between humanism and hyper-humanism. Steven Weinberg, for one, suggests that, in the end,

<sup>304</sup> Taylor 2007; Brooks 2013. <sup>305</sup> Jackson 2015: 16–17. <sup>306</sup> Kauffman 2008: xi.

the coming together of cosmology and particle physics in two widely accepted “standard models” will produce one story.<sup>307</sup> Dark matter and dark energy are central in a 13.8 billion-year-old “transparent” universe that is accessible to science. (The “nontransparent” universe that preceded the big bang remains accessible only to faith). Weinberg concedes that a “crude anthropic explanation” may be the best we can do since the particular “bubble” in the multiverse or assemblies of an unknown and perhaps unknowable number of universes that we inhabit may constrain our ability to construct a “rational explanation” for all multiverses. The values for the matter and energy that we do know might be no more than an accident of the particular part of this particular multiverse we inhabit. “Any beings like ourselves that are capable of studying the universe must be in a part of the universe in which the constants of nature allow the evolution of life and intelligence. Man may indeed be the measure of all things, although not quite in the sense intended by Protagoras.”<sup>308</sup>

Eager to disobey his orders at the Battle of Copenhagen, Admiral Nelson reportedly inverted his looking glass, put it on his blind eye and shouted – “Mate! I cannot read the signal!” And so it is with worldviews when they encounter “a relatively sudden and unstructured event” that reorders our perceptions of the world.<sup>309</sup> The pandemic of 2020 may be one such event that creates a moment of profound epistemic uncertainty about the future of world politics. As the crystallizations of comforting worldviews confront the contingencies of a world in unfathomable flux, perhaps the time has come to fully acknowledge this uncertainty and to start waking up from our “deep Newtonian slumber.”<sup>310</sup> This suggestion is in tune with Tom Stoppard’s *Arcadia* and its many allusions to gardens and forests. The play’s mathematical biologist, Valentine, ruminates that “the unpredictable and the predetermined unfold together to make everything the way it is. It’s how nature creates itself, on every scale, the snowflake and the snowstorm. It makes me so happy. To be at the beginning again, knowing almost nothing.”<sup>311</sup> Does not the study of world politics share this with the study of nature? And if it does, why wouldn’t we want to acknowledge the obvious – the existence of uncertainty as a constitutive part of world politics?

### Bibliography

Adams, Thomas Jessen. 2020. “A Lesson in Eventful Temporality: Pedagogies of Donald Trump from Abroad,” *PS: Political Science & Politics* (April): 360–61.

<sup>307</sup> Weinberg 2013. <sup>308</sup> Weinberg 2013: 8; Kauffman 2008: 27–30.

<sup>309</sup> Jackson and Nexon 2009: 909. <sup>310</sup> Kavalski 2012. <sup>311</sup> Stoppard 1993: 47.

- Adler, Emmanuel. 2019. *World Ordering: A Social Theory of Cognitive Evolution*. Cambridge: Cambridge University Press.
- Ahmari, Sohrab. 2020. "They Blinded Us with Science: The History of a Delusion," *Commentary* (May): 23–29.
- Allan, Bentley B. 2017. "Producing the Climate: States, Scientists, and the Constitution of Global Governance Objects," *International Organization* 71, 1: 131–62.
- Allan, Bentley B. 2018. *Scientific Cosmology and International Orders*. New York: Cambridge University Press.
- Allan, Bentley B. 2019. "Paradigm and Nexus: Neoclassical Economics and the Growth Imperative in the World Bank, 1948," *Review of International Political Economy* 26: 183–206.
- Almond, Gabriel A. and Stephen J. Genco. 1977. "Clouds, Clocks, and the Study of Politics," *World Politics* 29, 4: 489–522.
- Ang, Yuen Yuen. 2016. *How China Escaped the Poverty Trap*. Ithaca, NY: Cornell University Press.
- Artaud, Antonin. 1958. *The Theatre and Its Double*. Translated by Mary Caroline Richards. New York: Grove Press.
- Asad, Talal. 2003. *Formations of the Secular: Christianity, Islam, Modernity*. Stanford, CA: Stanford University Press.
- Axelrod, Robert and Michael D. Cohen. 1999. *Harnessing Complexity: Organizational Implications of a Scientific Frontier*. New York: Free Press.
- Bacciagaluppi, Guido. 2014. "A Critic Looks at QBism," in M.C. Galavotti, S. Hartmann, M. Weber, W. Gonzalez, D. Dieks, and T. Uebel, eds., *New Directions in the Philosophy of Science*. Switzerland: Springer International, pp. 403–15.
- Bächtold, Manuel. 2008. "Interpreting Quantum Mechanics According to a Pragmatist Approach," *Foundations of Physics* 38, 9: 843–68.
- Baeyer, Hans Christian von. 2016. *QBism: The Future of Quantum Physics*. Cambridge, MA: Harvard University Press.
- Bain, William. 2015. "Thomas Hobbes as a Theorist of Anarchy: A Theological Interpretation," *History of European Ideas* 40, 1: 13–28.
- Bain, William. 2020. *Political Theology of International Order*. New York: Oxford University Press.
- Barad, Karen. 2007. *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*. Durham, NC: Duke University Press.
- Barton, Gregory. 2000. "Keepers of the Jungle: Environmental Management in British India, 1855–1900," *The Historian* 62, 3: 557–74.
- Basu, Kaushik. 2014. "Randomisation, Causality and the Role of Reasoned Intuition," *Oxford Development Studies* 42, 4: 455–72.
- Becker, Adam. 2018. *What Is Real? The Unfinished Quest for the Meaning of Quantum Physics*. New York: Basic Books.
- Bellah, Robert N. 2011. *Religion in Human Evolution: From the Paleolithic to the Axial Age*. Cambridge, MA: The Belknap Press of Harvard University Press.
- Bernstein, Richard J. 1976. *The Restructuring of Social and Political Theory*. New York: Harcourt Brace Jovanovich.

- Beveridge, Charles E. 1977. "Frederick Law Olmsted's Theory of Landscape Design," *Nineteenth Century* 3 (Summer): 38–43.
- Binmore, Ken. 2017. "On the Foundations of Decision Theory," *Homo Oeconomicus* 34: 259–73.
- Blackmar, Elizabeth and Roy Rosenzweig. 1994. "The Park and the People: Central Park and Its Publics: 1850–1910," in Thomas Bender and Carl E. Schorske, eds., *Budapest and New York: Studies in Metropolitan Transformation: 1870–1930*. New York: Russell Sage, pp. 108–34.
- Blaug, Mark. 1963. "The Myth of the Old Poor Law and the Making of the New," *The Journal of Economic History* 23, 2: 151–84.
- Blodgett, Geoffrey. 1976. "Frederick Law Olmsted: Landscape Architecture as Conservative Reform," *Journal of American History* 62 (March): 869–89.
- Bookstaber, Richard. 2017. *The End of Theory: Financial Crises, the Failure of Economics and the Sweep of Human Interaction*. Princeton, NJ: Princeton University Press.
- Brousseau, Antoine and Robert Geyer. 2011. "Introduction: Complexity and the International Arena," *Cambridge Review of International Affairs* 24, 1: 1–3.
- Brooks, David. 2013. "The Secular Society," *New York Times* (July 8). [www.nytimes.com/2013/07/09/opinion/brooks-the-secular-society.html](http://www.nytimes.com/2013/07/09/opinion/brooks-the-secular-society.html). Accessed 08/29/20.
- Brown, Chris and Robyn Eckersley. 2018. "International Political Theory and the Real World," in Chris Brown and Robyn Eckersley, eds., *The Oxford Handbook of International Political Theory*. New York: Oxford University Press, pp. 3–18.
- Burgess, J. Peter. 2018. "Science Blurring Its Edges into Spirit: The Quantum Path to Ātma," *Millennium* 47, 1: 128–41.
- Butterfield, Herbert. 1957. *The Origins of Modern Science 1300–1800*. London: G. Bell and Sons.
- Byrne, David and Gill Callaghan. 2013. *Complexity Theory and the Social Sciences: The State of the Art*. New York: Routledge.
- Camic, Charles, Neil Gross, and Michèle Lamont, eds. 2011. *Social Knowledge in the Making*. Chicago, IL: The University of Chicago Press.
- Carey, Bjorn. 2014. "Stanford's Maryam Mirzakhani wins Fields Medal," *Stanford News* (August 12).
- Cartwright, Nancy. 1999. *The Dappled World: A Study of the Boundaries of Science*. New York: Cambridge University Press.
- Casanova, José. 2012. "Religion, the Axial Age, and Secular Modernity in Bellah's Theory of Religious Evolution," in Robert N. Bellah and Hans Joas, eds., *The Axial Age and Its Consequences*. Cambridge MA: The Belknap Press of Harvard University Press, pp. 191–221.
- Casid, Jill. H. 2005. *Sowing Empire: Landscape and Colonization*. Minneapolis: University of Minnesota Press.
- Caves, Carlton M., Christopher A. Fuchs, and Rüdiger Schack. 2002a. "Quantum Probabilities as Bayesian Probabilities," *Physical Review A* 65, 022305: 1–6.
- Caves, Carlton M., Christopher A. Fuchs, and Rüdiger Schack. 2002b. "Unknown Quantum States: The Quantum de Finetti Representation," *Journal of Mathematical Physics* 43, 9: 4537–59.

- Caves, Carlton M., Christopher A. Fuchs, and Rüdiger Schack. 2007. "Subjective Probability and Quantum Certainty," *Studies in History and Philosophy of Modern Physics* 38, 2: 255–74.
- Checkel, Jeffrey. 2013. "Theoretical Pluralism in IR: Possibilities and Limits," in Walter Carlsnaes, Thomas Risse and Beth Simmons, eds., *Sage Handbook of International Relations*, 2nd ed. Newbury Park, CA: Sage Publications, pp. 220–42.
- Cheng, Eugenia. 2020. "Two plus Two: An Argument for not Putting too Much Stock in Numbers," *The New York Times Book Review* (November 8): 37.
- Chevassus-au-Louis, Nicolas. 2019. *Fraud in the Lab: The High Stakes of Scientific Research*. Translation Nicholas Elliott. Cambridge, MA: Harvard University Press.
- Chilton, Adam and Dustin Tingly. 2013. "Why the Study of International Law Needs Experiments," *Columbia Journal of Transnational Law* 52, 1: 173–239.
- Clarke, Kevin A. and David M. Primo. 2012. *A Model Discipline: Political Science and the Logic of Representation*. New York: Oxford University Press.
- Coke, David and Alan Borg. 2011. *Vauxhall Gardens: A History*. New Haven, CT: Yale University.
- Collins, Harry M. 2010. *Tacit and Explicit Knowledge*. Chicago, IL: The University of Chicago Press.
- Cooper, David E. 2006. *A Philosophy of Gardens*. Oxford: Clarendon Press.
- Coyne, Christopher J. 2003. "Order in the Jungle: Social Interaction Without the State," *The Independent Review* 7, 4: 557–66.
- Cranz, Galen. 1982. *The Politics of Park Design: A History of Urban Parks in America*. Cambridge, MA: The MIT Press.
- Cronon, William. 1983. *Changes in the Land: Indians, Colonists, and the Ecology of New England*. New York: Hill and Wang.
- Dake, Karl. 1991. "Orienting Dispositions in the Perception of Risk: An Analysis of Contemporary Worldviews and Cultural Biases," *Journal of Cross-Cultural Psychology* 22, 1: 61–82.
- Daston, Lorraine. 2019. *Against Nature*. Cambridge, MA: The MIT Press.
- Deaton, Angus. 2010. "Instruments, Randomization, and Learning about Development," *Journal of Economic Literature* 48 (June): 424–55.
- Deaton, Angus and Nancy Cartwright. 2018. "Understanding and Misunderstanding Randomized Controlled Trials," *Social Science & Medicine* 210: 2–21.
- Dehejia, Vivek. 2016. "The Experimental Turn in Economics," *Livemint*. [www.livemint.com/Sundayapp/IM5bHpfFjniYIONzrIqJWJ/The-experimental-turn-in-economics.html](http://www.livemint.com/Sundayapp/IM5bHpfFjniYIONzrIqJWJ/The-experimental-turn-in-economics.html). Accessed 03/19/20.
- DeMartino, George. 2018. "The Specter of Irreparable Ignorance: The Confounding Problem of the Counterfactual in Economic Explanation." Presidential Address, Association of Social Economics, Atlanta, GA (January 5).
- Dove, Michael R. 1992. "The Dialectical History of 'Jungle' in Pakistan: An Examination of the Relationship between Nature and Culture," *Journal of Anthropological Research* 48, 3: 231–53.



- Drayton, Richard. 2000. *Nature's Government: Science, Imperial Britain, and the 'Improvement' of the World*. New Haven, CT: Yale University Press.
- Druckman, James N., Donald P. Green, James H. Kuklinski, Arthur Lupia, eds. 2011. *Cambridge Handbook of Experimental Political Science*. New York: Cambridge University Press.
- Du Sautoy, Marcus. 2016. *The Great Unknown: Seven Journeys to the Frontiers of Science*. New York: Viking.
- Duara, Prasenjit. 2015. *The Crisis of Global Modernity: Asian Traditions and a Sustainable Future*. New York: Cambridge University Press.
- Dubois, Pierre. 2015. "Porous Places: Music in the (Late) Pleasure Gardens and Social Ambiguity," *XVII-XVIII* 72: 115–28.
- The Economist*. 2020. "Pandemic Cinema: Will and Grace," (August 1): 68.
- Enright, Kelly. 2008. "On the Jungle," *Environmental History* 13, 3: 556–61.
- Erman, Eva and Niklas Möller. 2013. "Political Legitimacy in the Real Normative World: The Priority of Morality and the Autonomy of the Political," *British Journal of Political Science* 45: 215–33.
- Fierke, Karin M. 2017. "Consciousness at the Interface: Wendt, Eastern Wisdom and the Ethics of Intra-Action," *Critical Review* 29, 2: 141–69.
- Friedman, Jeffrey A. 2019. *War and Chance: Assessing Uncertainty in Politics*. New York: Oxford University Press.
- Friedman, Jeffrey A. and Richard Zeckhauser. 2018. "Analytic Confidence and Political Decision-Making: Theoretical Principles and Experimental Evidence from National Security Professionals," *Political Psychology* 39, 5: 1069–87.
- Fuchs, Christopher A. 2017. "Notwithstanding Bohr, the Reasons for QBism," *Mind and Matter* 15, 2: 245–300.
- Fuchs, Christopher A., N. David Mermin, and Rüdiger Schack. 2014. "An Introduction to QBism with an Application to the Locality of Quantum Mechanics," *American Journal of Physics* 82: 749–54.
- Fuchs, Christopher and Rüdiger Schack. 2009. "Quantum-Bayesian Coherence," arXiv:0906.2187v1[quant-ph] (June 11).
- Gaines, Brian J., James H. Kuklinski, and Paul J. Quirk. 2006. "The Logic of the Survey Experiment Reexamined," *Political Analysis* 15, 1: 1–20.
- Galison, Peter. 1997. *Image and Logic: A Material Culture of Microphysics*. Chicago, IL: The University of Chicago Press.
- Gerber, Alan S. and Donald P. Green. 2012. *Field Experiments: Design, Analysis, and Interpretation*. New York: W.W. Norton.
- Gerrard, Bill. 1994. "Beyond Rational Expectations: A Constructive Interpretation of Keynes's Analysis of Behavior under Uncertainty," *The Economic Journal* 104, 423: 327–37.
- Geuss, Raymond. 2020. *Who Needs a World View?* Cambridge, MA: Harvard University Press.
- Gillespie, Michael Allen. 2008. *The Theological Origins of Modernity*. Chicago, IL: The University of Chicago Press.
- Gillies, Donald. 2000. *Philosophical Theories of Probability*. New York: Routledge.
- Gladwell, Malcolm. 2013. "The Gift of Doubt: Albert O. Hirschman and the Power of Failure," *The New Yorker* (June 24). [www.newyorker.com/magazine/2013/06/24/the-gift-of-doubt](http://www.newyorker.com/magazine/2013/06/24/the-gift-of-doubt). Accessed 03/15/20.

- Goetzmann, William H. and William N. Goetzmann. 1986. *The West of the Imagination*. New York: W.W. Norton.
- Goldstein, Judith and Robert O. Keohane. 1993. "Ideas and Foreign Policy: An Analytical Framework," in Judith Goldstein and Robert O. Keohane, eds., *Ideas and Foreign Policy: Beliefs, Institutions, and Political Change*. Ithaca, NY: Cornell University Press, pp. 3–30.
- Grabel, Ilene. 2017. *When Things Don't Fall Apart: Global Financial Governance and Developmental Finance in an Age of Productive Incoherence*. Cambridge, MA: MIT Press.
- Green, Donald P. and Alan S. Gerber. 2002. "Reclaiming the Experimental Tradition in Political Science," in Ira Katznelson and Helen V. Milner, eds., *Political Science: The State of the Discipline*. New York: Norton, pp. 805–32.
- Green, Donald P. and Alan S. Gerber. 2015. *Get Out the Vote: How to Increase Voter Turnout*, 3rd ed. Washington, DC: The Brookings Institution.
- Grimley, Daniel M. 2006. *Grieg: Music, Landscape and Norwegian Identity*. Rochester, NY: Boydell Press.
- Gunitsky, Seva. 2019. "Rival Visions of Parsimony," *International Studies Quarterly* 63, 3: 707–16.
- Hainmueller, Jens, Daniel J. Hopkins, and Teppei Yamamoto. 2014. "Causal Inference in Conjoint Analysis: Understanding Multidimensional Choices via Stated Preference Experiments," *Political Analysis* 22, 1: 1–30. <https://doi.org/10.1093/pan/mpt024>.
- Hamilton, Scott. 2017. "A Genealogy of Metatheory in IR: How 'Ontology' Emerged from the Inter-Paradigm Debate," *International Theory* 9, 1: 136–70.
- Hamilton, Scott. 2018a. "The Measure of all Things? The Anthropocene as a Global Biopolitics of Carbon," *European Journal of International Relations* 24, 1: 33–57.
- Hamilton, Scott. 2018b. "Foucault's End of History: The Temporality of Governmentality and Its End in the Anthropocene," *Millennium* 46, 3: 371–95.
- Hansen, Valerie. 2020. *The Year 1000: When Explorers Connected the World – and Globalization Began*. New York: Scribner.
- Harrington, Cameron. 2016. "The Ends of the World: International Relations and the Anthropocene," *Millennium* 44, 3: 478–98.
- Harrison, Neil E. ed. 2006. *Complexity in World Politics: Concepts and Methods of a New Paradigm*. Albany: State University of New York Press.
- Harrison, Robert Pogue. 1992. *Forests: The Shadow of Civilization*. Chicago, IL: The University of Chicago Press.
- Harrison, Robert Pogue. 2008. *Gardens: An Essay on the Human Condition*. Chicago, IL: The University of Chicago Press.
- Healey, Richard. 2016. "Quantum-Bayesian and Pragmatist Views of Quantum Theory," *The Stanford Encyclopedia of Philosophy* (Spring 2017 Edition), Edward N. Zalta (ed.). <https://plato.stanford.edu/archives/spr2017/entries/quantum-bayesian/>. Accessed 10/10/2017.
- Healey, Richard. 2017. *The Quantum Revolution in Philosophy*. New York: Oxford University Press.
- Helmreich, Anne. 2008. "Body and Soul: The Conundrum of the Aesthetic Garden," *Garden History* 36, 2: 273–88.

- Henderson, Bob. 2020. "The Quantum Mechanic," *The New York Times Magazine* (June 28): 36–39, 54–55.
- Herbert, Eugenia W. 2011. *Flora's Empire: British Gardens in India*. Philadelphia: University of Pennsylvania Press.
- Herbjørnsrud, Dag. 2017. "The African Enlightenment," Aeon (December 13). <https://aeon.co/essays/yacob-and-ammo-africas-precursors-to-locke-hume-and-kant>. Accessed 2/2/2021.
- Hirschman, Albert O. 1958. *The Strategy of Economic Development*. New Haven, CT: Yale University Press.
- Hirschman, Albert O. 1967. "The Principle of the Hiding Hand," *The Public Interest* 6 (Winter): 10–23.
- Hirschman, Albert O. 1971. *A Bias for Hope: Essays on Development and Latin America*. New Haven, CT: Yale University Press.
- Hirschman, Albert O. 1980 [1945]. "Preface to the Expanded Paperback Edition," in *National Power and the Structure of Foreign Trade*. Berkeley: University of California Press, pp. v–xii.
- Hodges, H.A. 1944. *Wilhelm Dilthey: An Introduction*. New York: Oxford University Press.
- Hou, Shen. 2012. "Garden and Forest: A Forgotten Magazine and the Urban Roots of American Environmentalism," *Environmental History* 17, 4: 813–42.
- Howett, Catherine. 1998. "Ecological Values in Twentieth-Century Landscape Design: A History and Hermeneutics," *Landscape Journal* 17: 80–98.
- Hunt, John Dixon and Peter Willis, eds. 1975. *The Genius of the Place: The English Landscape Garden 1620–1820*. London: Paul Elek.
- Hunter, Mary. 1993. "Landscapes, Gardens, and Gothic Settings in the Opera Buffe of Mozart and his Italian Contemporaries," *Current Musicology* 51: 94–104.
- Hurley, Amanda Kolson and Timothy J. Reynolds. 2014. "The Machine is a Garden," *Foreign Policy* 208 (2014): 72–77.
- Hyde, Susan D. 2015. "Experiments in International Relations: Lab, Survey and Field," *Annual Review of Political Science* 18: 403–24.
- Jackson, John Brinckerhoff. 1984. *Discovering the Vernacular Landscape*. New Haven, CT: Yale University Press.
- Jackson, Patrick T. 2002. *International Relations and Scientific Progress: Structural Realism Reconsidered*. Columbus: Ohio State University Press.
- Jackson, Patrick T. 2015. "Fear of Relativism," *International Studies Perspectives* 16: 13–22.
- Jackson, Patrick T. and Daniel H. Nexon. 2009. "Paradigmatic Faults in International Relations Theory," *International Studies Quarterly* 53: 907–30.
- Jackson, Patrick T. and Daniel H. Nexon. 2013. "International Theory in a Post-Paradigmatic Era: From Substantive Wagers to Scientific Ontologies," *European Journal of International Relations* 19, 3: 543–65.
- Jasanoff, Sheila. 2004. "The Idiom of Co-Production," in Sheila Jasanoff, ed., *States of Knowledge: The Co-Production of Science and Social Order*. New York: Routledge, pp. 13–45.
- Jervis, Robert. 1997. *System Effects: Complexity in Political and Social Life*. Princeton, NJ: Princeton University Press.

- Jervis, Robert. 2017. "One World or Many?" *Critical Review* 29, 2: 170–88.
- Jünger, Ernst. 2013. *The Forest Passage*. Candor, NY: Telos Press.
- Kaag, John. 2020. "Being and Time: How Wittgenstein, Benjamin, Cassirer and Heidegger Altered the Way We see Reality," *The New York Times Book Review* (September 27): 13.
- Kalberg, Stephen. 2016. "Protestant Ethic," in George Ritzer, ed., *The Blackwell Encyclopedia of Sociology*. New York: Wiley. <https://doi.org/10.1002/9781405165518.wbeos0826>.
- Katzenstein, Peter J. 2006. "Multiple Modernities as Limits to Secular Europeanization," in Timothy A. Byrnes and Peter J. Katzenstein, eds., *Religion in an Expanding Europe*. New York: Cambridge University Press, pp. 1–33.
- Katzenstein, Peter J. 2012. "China's Rise: Rupture, Return, or Recombination?" in Peter J. Katzenstein, ed., *Sinicization and the Rise of China: Civilizational Processes Beyond East and West*. New York: Routledge, pp. 1–38.
- Katzenstein, Peter J. 2018. "The Second Coming? Reflections on a Global Theory of International Relations," *The Chinese Journal of International Politics* 11, 4: 373–90.
- Kauffman, Stuart. A. 2008. *Reinventing the Sacred: A New View of Science, Reason, and Religion*. New York: Basic Books.
- Kavalski, Emilian. 2012. "Waking IR Up from its 'Deep Newtonian Slumber,'" *Millennium* 41, 1: 137–50.
- Kay John and Mervyn King. 2000. *Radical Uncertainty: Decision-Making Beyond the Numbers*. New York: Norton.
- Kellert, Stephen H. 1993. *In the Wake of Chaos: Unpredictable Order in Dynamic Systems*. Chicago, IL: The University of Chicago Press.
- Kelly, Duncan. 2019. *Politics and the Anthropocene*. Cambridge: Polity.
- Keynes, John Maynard. 1937. "The General Theory of Employment," *Quarterly Journal of Economics* 51, 2: 209–23.
- Keynes, John Maynard. 1951. "Newton the Man," in Geoffrey Keynes, ed., *Essays in Biography*. London: R. Hart-Davis, pp. 310–23.
- Kiel, L. Douglas and Euel Elliott. 1996. *Chaos Theory in the Social Sciences: Foundations and Applications*. Ann Arbor, MI: The University of Michigan Press.
- Kim, Sabrina. 2017. "Using Experimental Methods in Post-Conflict Countries to Understand the Effects of Gender Reforms in the Liberian National Police," in Andreas Kruck and Andrea Schneiker, eds., *Researching Non-state Sectors in International Security: Theory and Practice*. London: Routledge, pp. 187–203.
- Kinnvall, Catarina and Jennifer Mitzen. 2020. "Anxiety, Fear and Ontological Security in World Politics: Thinking with and beyond Giddens," *International Theory* 12, 2: 240–56.
- Kipling, Rudyard. 1894. *The Jungle Book*. New York: Doubleday.
- Kirshner, Jonathan. 2009. "Keynes, Legacies, and Inquiry," *Theory and Society* 38, 5: 527–41.
- Kirshner, Jonathan. 2021. "Keynes and the Elusive Middle Way," in Jonathan Kirshner and Peter J. Katzenstein, eds., *The Downfall of the American Order: Liberalism's End?* (in production).

- Klay, Phil. 2020. "Human Experience Can't be Quantified," *The New York Times* (November 8): 10. [www.nytimes.com/2020/11/07/opinion/sunday/dat-a-science-limits.html](http://www.nytimes.com/2020/11/07/opinion/sunday/dat-a-science-limits.html). Accessed 12/12/20.
- Konyndyk, Kenneth J. 1995. "Aquinas on Faith and Science," *Faith and Philosophy: Journal of the Society of Christian Philosophers* 12, 1: 3–21.
- Koyré, Alexandre. 1957. *From the Closed World to the Infinite Universe*. Baltimore, MD: The Johns Hopkins University Press.
- Kragh, Helge. 2004. *Matter and Spirit in the Universe: Scientific and Religious Preludes to Modern Cosmology*. London: Imperial College.
- Kuhn, Thomas S. 2000. *The Road Since Structure*, ed. James Conant and John Haugland. Chicago, IL: Chicago University Press.
- Kuhn, Thomas S. 2012. *The Structure of Scientific Revolutions*. 4th ed. Chicago, IL: The University of Chicago Press.
- Kurki, Milja. 2008. *Causation in International Relations: Reclaiming Causal Analysis*. New York: Cambridge University Press.
- Kurki, Milja. 2020. *International Relations in a Relational Universe*. Oxford: Oxford University Press.
- Laborde, Cécile. 2017. *Liberalism's Religion*. Cambridge, MA: Harvard University Press.
- Lawson, Tony. 1986. "Uncertainty and Economic Analysis," *Economic Journal* 95 (December): 909–27.
- Levine, Daniel J. and Alexander D. Barder. 2014. "The Closing of the American Mind: 'American School' International Relations and the State of Grand Theory," *European Journal of International Relations* 20, 4: 863–88.
- Lewis, Robert. 1977. "Frontier and Civilization in the Thought of Frederick Law Olmsted," *American Quarterly* 29, 4: 385–403.
- Lewis, R.W.B. 1955. *The American Adam: Innocence, Tragedy and Tradition in the Nineteenth Century*. Chicago, IL: Chicago University Press.
- Lilla, Mark. 2020. "No One Knows What's Going to Happen," *The New York Times* (May 24). [www.nytimes.com/2020/05/22/opinion/sunday/coronavirus-prediction-future.html](http://www.nytimes.com/2020/05/22/opinion/sunday/coronavirus-prediction-future.html). Accessed 2/2/2021.
- Linklater, Andrew. 1998. *The Transformation of Political Community: Ethical Foundations of the Post-Westphalian Era*. Columbia: The University of South Carolina Press.
- Makkreel, Rudolf A. 2020. "Metaphysics and the Hermeneutical Relevance of Worldviews," *The Review of Metaphysics* 74: 321–44.
- Martineau, Wendy and Judith Squires. 2012. "Addressing the 'Dismal Disconnection': Normative Theory, Empirical Inquiry and Dialogic Research," *Political Studies* 60: 523–38.
- Marx, Leo. 1964. *The Machine in the Garden: Technology and the Pastoral Ideal in America*. New York: Oxford University Press.
- McCall, Storrs. 2001. "The Ithaca Interpretation of Quantum Mechanics and Objective Probabilities," *Foundations of Physics Letters* 14, 1: 95–101.
- McCloskey, Donald N. 1991. "History, Differential Equations, and the Problem of Narration," *History and Theory* 30: 21–36.

- McCloskey, Deirdre N. and Stephen T. Ziliak. 2008a. *The Cult of Statistical Significance: How the Standard Error Costs Us Jobs, Justice and Lives*. Ann Arbor, MI: University of Michigan Press.
- McCloskey, Deirdre N. and Stephen T. Ziliak. 2008b. "Signifying Nothing: Reply to Hoover and Siegler," *Journal of Economic Methodology* 15, 1: 39–55.
- McClure, Kirstie M. 2010. "Reflections on Michael Gillespie's Theological Origins of Modernity," *The Review of Politics* 72, 4: 697–704.
- Mead, Walter Russell. 2018. "A Word from Henry Kissinger," *The Wall Street Journal* (February 6): A17.
- Meldolesi, Luca. 1995. *Discovering the Possible: The Surprising World of Albert O. Hirschman*. Notre Dame, IN: University of Notre Dame Press.
- Mermin, N. David. 1998. "The Ithaca Interpretation of Quantum Mechanics," *Pramana* 51: 549–65.
- Mermin, N. David. 2016. *Why Quark Rhymes with Pork: And Other Scientific Diversions*. New York: Cambridge University Press.
- Mermin, N. David. 2019. "Making Better Sense of Quantum Mechanics," *Reports of Progress in Physics* 82: 1–16.
- Miller, Ross L. 1976. "The Landscaper's Utopia versus the City: A Mismatch," *The New England Quarterly* 49, 2: 179–93.
- Mirowski, Philip. 1989. *More Heat than Light: Economics as Social Physics – Physics as Nature's Economics*. New York: Cambridge University Press.
- Mitchell, Joshua. 1993. "Hobbes and the Equality of All under the One," *Political Theory* 21, 1: 78–100.
- Mohrhoff, Ulrich J. 2014a. "QBism: A Critical Appraisal." arXiv preprint: arXiv:1409.3312.
- Mohrhoff, Ulrich J. 2014b. "First-Person Plural Quantum Mechanics." <http://hilsci-archive.pitt.edu/11130/1/FPPQM.pdf>
- Mohrhoff, Ulrich J. 2019a. "Bohr, QBism, and Beyond." arXiv preprint: arXiv:1907.11405.
- Mohrhoff, Ulrich J. 2019b. "'B' is for Bohr." arXiv preprint: arXiv:1905.07118.
- Moloney, Pat. 1997. "Leaving the Garden of Eden: Linguistic and Political Authority in Thomas Hobbes," *History of Political Thought* 18, 2: 242–66.
- Monteiro, Nuno P. and Kevin G. Ruby. 2009. "IR and the False Promise of Philosophical Foundations," *International Theory* 1, 1: 15–48.
- Morgenthau, Hans J. 1946. *Scientific Man vs. Power Politics*. Chicago, IL: The University of Chicago Press.
- Mukerji, Chandra. 1997. *Territorial Ambitions and the Gardens of Versailles*. New York: Cambridge University Press.
- Munroe, Jennifer. 2008. *Gender and the Garden in Early Modern English Literature*. Burlington, VT: Ashgate.
- Neniskyte, Urte and Cornelius T. Gross. 2017. "Errant Gardeners: Glia-Cell-Dependent Synaptic Pruning and Neurodevelopment Disorders," *Nature Reviews Neuroscience* 18 (November): 658–70.
- Orlando, Leonardo. 2020. "The Fabric of Agency: Navigating Human Potentialities through Introspection," *Security Dialogue* 50, 5: 467–81.
- Ossio, Juan M. 1997. "Cosmologies," *International Social Science Journal* 49, 154: 549–62.

- Owensby, Jacob. 1994. *Dilthey and the Narrative of History*. Ithaca, NY: Cornell University Press.
- Pagels, Elaine. 2019. "Faith and Reason," *The New York Times Book Review* (December 1): 1, 12–13.
- Pagels, Heinz R. 1982. *The Cosmic Code: Quantum Physics as the Language of Nature*. New York: Simon and Schuster.
- Paipais, Vassilios. 2017. *Political Ontology and International Political Thought*. London: Palgrave MacMillan.
- Peattie, Thomas. 2015. *Gustav Mahler's Symphonic Landscapes*. New York: Cambridge University Press.
- Pelopidas, Benoît. 2020. "Power, Luck, and Scholarly Responsibility at the End of the World," *International Theory* 12, 3: 459–70.
- Peluso, Nancy Lee and Peter Vandergeest. 2011. "Political Ecologies of War and Forests: Counterinsurgencies and the Making of National Natures," *Annals of the Association of American Geographers* 101, 3: 587–608.
- Piccione, Michele and Ariel Rubinstein. 2007. "Equilibrium in the Jungle," *The Economic Journal* 117, 522 (July): 883–96.
- Porter, Theodore M. 1995. *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life*. Princeton, NJ: Princeton University Press.
- Price, Richard M. 2008. "Moral Limit and Possibility in World Politics," in Richard M. Price, ed., *Moral Limit and Possibility in World Politics*. New York: Cambridge University Press, pp. 1–52.
- Reddy, Sanjay G. 2013. "Randomise This! On Poor Economics," *Review of Agrarian Studies* 2, 2: 60–73. [www.ras.org.in/randomise\\_this\\_on\\_poor\\_economics](http://www.ras.org.in/randomise_this_on_poor_economics). Accessed 03/19/20.
- Reisch, George A. 2019. *The Politics of Paradigms: Thomas S. Kuhn, James B. Conant and the Cold War "Struggle for Men's Minds."* Albany, NY: SUNY Press.
- Reus-Smit, Christian. 2008. "Constructivism and the Structure of Ethical Reasoning," in Richard M. Price, ed., *Moral Limit and Possibility in World Politics*. New York: Cambridge University Press, pp. 53–82.
- Reus-Smit, Christian. 2013. "Beyond Metatheory?" *European Journal of International Relations* 19, 3: 589–608.
- Richards, Annette. 2001. *The Free Fantasia and the Musical Picturesque*. New York: Cambridge University Press.
- Rickman, H.P. 1979. *Wilhelm Dilthey: Pioneer of the Human Studies*. Berkeley: University of California Press.
- Rovelli, Carlo. 2016. *Seven Brief Lessons on Physics*. New York: Riverhead Books.
- Rovelli, Carlo. 2017. *Reality is Not What It Seems: The Journey to Quantum Gravity*. New York: Riverhead Books.
- Rutazibwa, Olivia U. and Robbie Shilliam, eds. 2020. *Routledge Handbook of Postcolonial Politics*. New York: Routledge.
- Satkunanandan, Shalini. 2015. *Extraordinary Responsibility: Politics Beyond the Moral Calculus*. New York: Cambridge University Press.
- Savage, Leonard J. 1954. *The Foundations of Statistics*. New York: Wiley.
- Schaffer, Richard and Neil Smith. 1986. "The Gentrification of Harlem?" *Annals of the Association of American Geographers* 76, 3: 347–65. [www.jstor.org/stable/2562585](http://www.jstor.org/stable/2562585). Accessed 12/12/20.

- Schama, Simon. 1995. *Landscape and Memory*. New York: Knopf.
- Schrödinger, Erwin. 1985. *Mein Leben, Meine Weltansicht*. Wien: Paul Zsolnay.
- Scott, James C. 1998. *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*. New Haven, CT: Yale University Press.
- Self, Robert O. 2003. *American Babylon: Race and the Struggle for Postwar Oakland*. Princeton, NJ: Princeton University Press.
- Seybert, Lucia A. and Peter J. Katzenstein. 2018. "Protean Power and Control Power: Conceptual Analysis," in Peter J. Katzenstein and Lucia A. Seybert, eds., *Protean Power: Exploring the Uncertain and Unexpected in World Politics*. New York: Cambridge University Press, pp. 3–26.
- Shilliam, Robbie. 2017. "Race and Revolution at Bwa Kayiman," *Millennium* 45, 3: 269–92.
- Sil, Rudra and Peter J. Katzenstein. 2010a. *Beyond Paradigms: Analytic Eclecticism in the Study of World Politics*. New York: Routledge.
- Sil, Rudra and Peter J. Katzenstein. 2010b. "Analytic Eclecticism in the Study of World Politics: Reconfiguring Problems and Mechanisms across Research Traditions," *Perspectives on Politics* 8, 2: 411–31.
- Simon, Herbert A. 1962. "The Architecture of Complexity," *Proceedings of the American Philosophical Society* 106, 6: 467–82.
- Sinclair, Upton. 1906. *The Jungle*. New York: Doubleday.
- Skaria, Ajay. 1999. *Hybrid Histories: Forests, Frontiers and Wildness in Western India*. New York: Oxford University Press.
- Skidelsky, Robert. 2009. *Keynes: The Return of the Master*. New York: Public Affairs.
- Smetham, Graham. 2010. *Quantum Buddhism: Dancing in Emptiness – Reality Revealed at the Interface of Quantum Physics & Buddhist Philosophy*. Brighton: Shunyata Press.
- Smith, Henry Nash. 1950. *Virgin Land: The American West as Symbol and Myth*. Cambridge, MA: Harvard University Press.
- Smith, Michael F. 1991. "Letting in the Jungle," *Journal of Applied Philosophy* 8, 2: 145–54.
- Smolin, Lee. 1997. *The Life of the Cosmos*. New York: Oxford University Press.
- Smolin, Lee. 2013. *Time Reborn: From the Crisis in Physics to the Future of the Universe*. Boston, MA: Houghton Mifflin Harcourt.
- Solecki, William and Joan Welch. 1995. "Urban Parks: Green Spaces or Green Walls?" *Landscape and Urban Planning* 32: 93–106. [https://doi-org.proxy.library.cornell.edu/10.1016/0169-2046\(94\)00193-7](https://doi-org.proxy.library.cornell.edu/10.1016/0169-2046(94)00193-7). Accessed 12/12/20.
- Spence, Mark David. 1999. *Dispossessing the Wilderness: Indian Removal and the Making of the National Parks*. New York: Oxford University Press.
- Spengler, Oswald. 1965. *Urfragen: Fragmente aus dem Nachlass*. Ed. Anton Mirko Kotanek. Munich: C.H. Beck.
- Stoeber-Ackerman, Jennifer. 2011. "Reproducing US Citizenship in 'Blackboard Jungle': Race, Cold War Liberalism, and the Tape Recorder," *American Quarterly* 63, 3: 781–806.
- Stone, Deborah. 2020. *Counting: How We Use Numbers to Decide What Matters*. New York: Norton.
- Stoppard, Tom. 1993. *Arcadia*. New York: Farrar, Straus and Giroux.



- Taylor, Charles. 2007. *A Secular Age*. Cambridge, MA: Harvard University Press.
- Taylor, Dorceta E. 1999. "Central Park as a Model for Social Control: Urban Parks, Social Class and Leisure Behavior in Nineteenth-Century America," *Journal of Leisure Research* 31, 4: 420–77.
- Teele, Dawn Langan, ed. 2014. *Field Experiments and Their Critics: Essays on the Uses and Abuses of Experimentation in the Social Sciences*. New Haven, CT: Yale University Press.
- Tetlock, Philip and Dan Gardner. 2015. *Superforecasting: The Art and Science of Prediction*. New York: Random House.
- Tigner, Amy L. 2012. *Literature and the Renaissance Garden from Elizabeth I to Charles II: England's Paradise*. Burlington, VT: Ashgate.
- Timpson, Christopher G. 2008. "Quantum Bayesianism: A Study," *Studies in History and Philosophy of Modern Physics* 39, 9: 579–609. arXiv:0804.2047v1 [quant-ph].
- Toulmin, Stephen. 1982. *The Return to Cosmology: Postmodern Science and the Theology of Nature*. Berkeley: University of California Press.
- Toulmin, Stephen. 1990. *Cosmopolis: The Hidden Agenda of Modernity*. New York: The Free Press.
- Trowsell, Tamara A. , Arlene B. Tickner, Amaya Querejazu, et al. 2020. "Differing about Difference: Relational IR from around the World," *International Studies Perspectives* 22, 1: 25–64.
- Underdal, Arild. 2017. "Climate Change and International Relations (After Kyoto)," *Annual Review of Political Science* 20: 169–88.
- Unger, Roberto Mangabeira and Lee Smolin. 2015. *The Singular Universe and the Reality of Time*. Cambridge: Cambridge University Press.
- Urbinati, Nadia. 2015. "'Proving Hamlet Wrong': The Creative Role of Doubt in Albert Hirschman's Social Thought," *Humanity* 6, 2: 267–71. <http://humanityjournal.org>. Accessed 03/19/20.
- Wæver, Ole. 1997. "Figures of International Thought: Introducing Persons instead of Paradigms," in Iver B. Neumann and Ole Wæver, eds., *The Future of International Relations: Masters in the Making*. New York: Routledge, pp. 1–37.
- Waldner, David. 2017. "Schroedinger's Cat and the Dog that Didn't Bark: Why Quantum Mechanics is (Probably) Irrelevant to the Social Sciences," *Critical Review* 29, 2: 190–233.
- Weber, Max. 1946. "Religious Rejections of the World," in H.H. Gerth and C. Wright Mills, eds., *From Max Weber: Essays in Sociology*. New York: Oxford University Press, pp. 323–59.
- Weinberg, Steven. 1998. "The Revolution That Didn't Happen," *The New York Review of Books* (October 8). [www.nybooks.com/articles/1998/the-revolution-that-didnt-happen](http://www.nybooks.com/articles/1998/the-revolution-that-didnt-happen). Accessed 9/10/2019.
- Weinberg, Steven. 2013. "Physics: What We Do and Don't Know," *The New York Review of Books* (November 7). [www.nybooks.com/articles/2013/11/07/physics-what-we-do-and-dont-know/](http://www.nybooks.com/articles/2013/11/07/physics-what-we-do-and-dont-know/). Accessed 03/20/20.
- Weinberg, Steven. 2015. "Eye on the Present – The Whig History of Science," *The New York Review of Books* (December 17). [www.hrstud.unizg.hr/\\_news/3](http://www.hrstud.unizg.hr/_news/3)

- 4443/Pages%20from%20New%20York%20Review%20of%20Books%20-%2017%20December%202015-2.pdf. Accessed 03/20/20.
- Weinhardt, Clara. 2017. "Playing Different Games: Uncertain Rules in EU–West Africa Trade Negotiations," *International Studies Quarterly* 61: 284–96.
- Weinhardt, Clara. 2020. *Negotiating Trade in Uncertain Worlds: Misperception and Contestation in EU–West Africa Relations*. New York: Routledge.
- Wendt, Alexander. 1991. "Bridging the Theory/Meta-theory Gap in International Relations," *Review of International Studies* 17: 383–92.
- Wendt, Alexander. 2015. *Quantum Mind and Social Science: Unifying Physical and Social Ontology*. New York: Cambridge University Press.
- Wendt, Alexander. 2022a. "Why IR Scholars Should Care about Quantum Theory: Part I. Burdens of Proof and Uncomfortable Facts," *International Theory* 14:1: 119–129.
- Wendt, Alexander. 2022b. "Why IR Scholars Should Care about Quantum Theory: Part II. Critics in the PITs," *International Theory* 14:1: 193–209.
- Wight, Colin. 2013. "The Dualistic Grounding of Monism: Science, Pluralism and Typological Truncation," *Millennium* 41, 2: 326–45.
- Wilber, Ken, ed. 1984. *Quantum Questions: Mystical Writings of the World's Greatest Physicists*. Boston, MA: New Science Library.
- Williamson, Tom. 1995. *Polite Landscapes: Gardens and Society in Eighteenth-Century England*. Baltimore, MD: The Johns Hopkins University Press.
- Zetzel, Susanna S. 1989. "The Garden in the Machine: The Construction of Nature in Olmsted's Central Park," *Prospects: An Annual of American Cultural Studies* 14: 291–339.