

5 Oceanic Uncertainty

Instead of transcending perspectives, you become skilled
at never getting stuck in one. Blur becomes your *métier*.

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(UN)SETTING UNCERTAINTY

With this chapter, I go back to the beginning of the book and to the wager I raise in the Introduction: That an *allyship with uncertainty is not only possible but necessary*. This chapter addresses my wager by focusing on uncertainty in itself and by finally asking: What is uncertainty, really?

Uncertainty is, in the simplest terms, when I do not know what might or might not happen. Uncertainty signals a state, variedly described as ambiguous, indeterminate, vague, blurry, that may provoke anxiety and paralyze action but also produce bursts of creativity and disclose unexpected solutions to problems. Yes, uncertainty has a bad reputation. It is often seen as something to be wary of, to wish away or, at least, to try to manage and contain. While I do not deny that uncertainty can be debilitating, destabilizing and disempowering, I want to make a case for living with and in uncertainty as the route to achieving a fuller, rounder life.

To say that uncertainty concerns limited knowledge or inadequate understanding is only half of the story. Uncertainty is not only epistemic. Its multifaceted nature has deeper roots. Uncertainty is woven through the very fabric of the world. It is *the* very fabric of the world. Uncertainty is inescapable. It is oceanic. It is cosmic. Thus, it demands a counter-metaphysics of how it should be inhabited, seriously, radically, uncompromisingly, dangerously even.

¹ Barry Allen, 'The Cloud of Knowing. Blurring the Difference with China'. Symposium: Fuzzy Studies, part 1. *Common Knowledge* 17, no. 3 (2011): 458.

Starting from this premise, this chapter looks at images, metaphors and assumptions around uncertainty; it examines what distinguishes uncertainty from risk; it tackles the historical development of determinism, and concludes by considering Heisenberg's principle and the quantum discovery of uncertainty as foundational of the post-Newtonian world. The chapter uses this constellation to sketch a counter-metaphysics of uncertainty. My choice of describing uncertainty as *oceanic* assists me in grasping its multifaceted, vast nature and steers me to imagine an 'otherwise' of uncertainty without freezing its flow. This is where other kinds of knowledge – atmospheric, intuitive, cunning, sublunary, sidereal, pan-sensible – can pool, pivot and unfold. I see this space shaped like a pause, where the unknown is a channel for the cultivation of hesitation; where ambiguity is an advantage; where not knowing is nourishment. This is the space of *maybes* evoked by the title of the book.

THE VERTIGO OF UNCERTAINTY

But what is uncertainty, exactly? Like many other difficult-to-define notions, uncertainty is socially and culturally constructed. It is a subjective and relational affair. The same event may be interpreted as uncertain (or not) depending on the cause attributed to it. How I cope with, and react to, uncertainty is driven by a mix of personal feelings, collective beliefs, cultural expectations, affective scripts and socio-economical contexts. My expectations play a part in how I perceive and respond to uncertainty because they inform my disposition (how I prepare for uncertainty), which in turn shapes my attitude to unknown futures (how I will react to it).

Furthermore, ideas around uncertainty and how to deal with it tend to be subject-specific and to differ across disciplines, fields and sectors. For instance, the way artists may appropriate uncertainty as a source of 'chance encounters' differs from how uncertainty is viewed by statisticians and policymakers as 'risk management', or by scientists as 'ambiguity'. While these are crude generalizations, they point to a wide variety of interpretations.

So, what is uncertainty? On an immediate level, uncertainty is the by-product of imperfect information, when information is incomplete and asymmetrical, when I do not know whether something is true or false, when I know that I do not know enough. But, if I dig deeper, uncertainty is the unavoidable condition of existing in a world that is mutable, kaleidoscopic, stratified, shimmering and never 'done'. Uncertainty signals the unpredictability of tomorrow, the unknowability of the future. It is also synonymous with everything that makes life unstable and precarious – events and contingencies beyond my control.

How do I relate to uncertainty? What is my first, instinctive reaction? Do I even have one? Probably like you, I respond to uncertainty through a heady mix of anxiety and curiosity, apprehension and logic, fatalism and anger, puzzlement and powerlessness, but also, and here it is where things become interesting, with longing, desire, wonderment, courage and a readiness to yielding. My own experience of uncertainty tells me that if I try to control it not only am I

likely to exacerbate it, but I may lose what uncertainty has to offer, that is, the richness of potential. Potential is what may or may not happen. It is also what I do not know in advance.

How do I describe uncertainty? Which words, images and metaphors am I drawn to? Matters of language are not secondary. The images I use to think with create worlds. They are the figurations that scaffold my constructed realities. They give tangible orientation to how the semiotic-material knots that stitch realities and worlds together come to be realized. They are also enactors of power. Thus, the metaphors I use to describe uncertainty shape how I anticipate the future. I hear uncertainty described as void, lack, or deficiency (of information, knowledge, certainties); as ‘blindness’, ‘obstructed vision’ or as a ‘black hole’; as ‘fog’ or ‘blur’. Not surprisingly, many of these expressions signal the lack of something (not enough knowledge or information), or powerlessness (inability to decide, to make a move, to choose) or apprehension (anxiety, fear, paralysis). Uncertainty is all these things, but not only. The richer aspects of uncertainty are there too, lurking. Borrowing Michael Smithson’s apposite expression, uncertainty is an ‘ocean’ of infinite unknowability within which knowledge becomes an ‘island’.² It is an ocean of possibilities where my capacity to choose floats. Or else said, it is the oceanic vastity of uncertainty that propels my agency. My freedom is a by-product of uncertainty. One cannot exist without the other.

Furthermore, to pose uncertainty as an oceanic space allows me to see it not only as a territory to inhabit, a zone to ‘enter’ and dwell in, but also in its temporal connotations as a pause, interval and recess. Put differently, my figuration wants to evoke a ‘taking’ space, ‘making’ space, ‘occupying’ space, which I also configure as a ‘taking’ time, ‘making’ time, ‘occupying’ time. In this space, hesitation, doubt, dithering, ambiguity, vagueness, opacity circulate as those modes of knowing and un-knowing whose liminality introduces stuttering temporalities.³ I am interested in the value that uncertainty brings to the production of knowledge, and in how to capitalize on the not-knowing inherent in it. I wonder how this not-knowing can be understood not as lack, or inadequacy, but as pivotal to a specific kind of uncertainty-driven knowledge-making, with uncertainty as a counter-epistemic engine too. The questions, therefore, are: How do I positively cultivate this space of uncertainty and its unknowability?

² Michael Smithson, ‘The Many Faces and Masks of Uncertainty’, in *Uncertainty and Risk. Multidisciplinary Perspectives*, ed. Gabriele Bammer and Michael Smithson (London: Earthscan, 2008), 13–25.

³ My list echoes cultural theorist Steven Connor’s ‘knowledge-feeling’ list that includes ‘irritation, rage, envy, lust, misery, boredom and melancholy just as much as satisfaction, assurance, excitement and triumph’ (Steven Connor, *The Madness of Knowledge. On Wisdom, Ignorance and Fantasies of Knowing* [London: Reaktion, 2021], 14). He uses the term ‘epistemopathy’ to describe this ‘production and development of complex states of feeling and imaginative projection in relation to knowledge’, in other words, how I feel about what I know and what I do not know. Ibid., 10.

What are the most efficacious routes to devise to inhabit uncertainty and its unknowability without capturing and constraining its potential?

To reiterate this point: A mode of knowing driven by uncertainty ‘takes’ space and ‘takes’ time. It forces a pause. Uncertain situations ask me to ponder, reflect, assess. Sometimes the pause is experienced as inability to decide – whether for lack of, or asymmetrical access to, information. Sometimes, it is a paralysis of initiative and agency. Sometimes it is the lingering over a precipice. No matter how they manifest themselves, instances of uncertainty force me to press pause, and pressing pause can become an active stance against acceleration. This is important to reclaim uncertainty’s potential as a radical gesture without falling into endorsing uncertainty as an asset for the optimization of creativity, of which more shortly.

Gestures that introduce the grain of temporality are like the *sabots* thrown by eighteenth-century weavers into the industrial looms. They reclaim time. They create time. And while the *saboteurs* were revolting against the automation that was pushing labourers to destitution, what I evoke here is a gesture whose purpose is to claw back recess from the relentless capture of potential *we* are all subjected to.⁴ This stand-making against a seamless, friction-less world by means of reclaiming incertitude and hesitation as positive affects is a way of instantiating a pause within the instantaneous; of troubling immediacy and through this disturbance regain slowness; of allowing a crack to materialize between what I type in the search box and the reply. This is why I pose the vertigo of hesitation as a space to nurture. It is in this space where things may (or may not) happen.

UNCERTAINTY IS CREATIVE (AND BLEAK)

That uncertainty has the power to fuel and galvanize action by expanding the range of unthought-of connections should be familiar to anyone who has ever engaged in creative pursuits based on chance encounters – be they with ideas, images, materials, people, events. Artists have long known how to foster uncertainty in order to increase their creative chances, for example by inserting asymmetries in highly predictable situations or by shaking up routines in order to disrupt expectations and formalized behaviours. By opening up to chance, uncertainty is poised to become a collaborator in creative processes, like in the unexpected encounters among *objets trouvés*, collage-making and *cadavre exquis* the Surrealists were so fond of; or in Freudian psychoanalysis’s penchant for free association and dream exploration; or in Leonardo da Vinci’s counsel to stare at a peeling wall, a fire, or the clouds to ‘find really marvellous ideas’. It is worth quoting at length from the entry in his diary where Leonardo notes:

⁴ I am aware of the difficulty in using ‘we’ at any point in the text. I believe however that in this circumstance it is justified. No person, no body, no thing on the planet can be said to go untouched by planetary computation and unsubjected to processes of extraction of potential directly or indirectly, as user or abuser.

Look at walls splashed with a number of stains, or stones of various mixed colours. If you have to invent some scene, you can see there resemblances to a number of landscapes, adorned with mountains, rivers, rocks, trees, great plains, valleys and hills, in various ways. Also, you can see various battles, and lively postures of strange figures, expressions on faces, costumes and an infinite number of things, which you can reduce to good integrated form. This happens on such walls and varicoloured stones, (which act) like the sound of bells, in whose pealing you can find every name and word that you can imagine. Do not despise my opinion, when I remind you that it should not be hard for you to stop sometimes and look into the stains of walls, or ashes of a fire, or clouds, or mud or like places, in which, if you consider them well, you may find really marvellous ideas. The mind of the painter is stimulated to new discoveries, the composition of battles of animals and men, various compositions of landscapes and monstrous things, such as devils and similar things, which may bring you honour, because *by indistinct things the mind is stimulated to new inventions*.⁵

While examples such as these illustrate the firm connection between uncertainty and creativity, they do not deflect, however, from a fundamental issue: that uncertainty is also used as a reservoir of potential to be extracted, exploited and monetized. The rhetoric of ‘embracing uncertainty’ to ‘unlock potential’ is a neoliberal mantra. So are strategies that engineer uncertainty as the Trojan horse that fire starts ‘innovation’ and aggressively attempts to trigger growth by choreographing controlled serendipity.⁶

This is another important wager. How do I de-link uncertainty’s potential from the neoliberal capture that seizes, squeezes, swallows and spews uncertainty as an instrument for productivity and optimization? The exploitation of uncertainty’s potential for ‘creative’ purposes is also where the bleak side of uncertainty is exposed, a festering wound cannibalizing the very thing that gives it nourishment. The planetary production of un-liveable, catastrophic precariousness – when uncertainty is artificially enforced by design – must be resisted. The swelling of the populations (human and nonhuman) and ecosystems (social, geo-political, biological) trapped in this kind of uncertainty urgently calls for it.

I have discussed resistance at length in Chapter 3, which foregrounded the necessity to switch to the impotential in conceptualizing uncertainty away from mechanisms of capture. As Chapter 6 will articulate, this calls for the design of stratagems to counteract the capture of potential that formats a life to its bare levels, erodes its richness, thins out its pulsating roundness. Here is a design brief if I ever see one.

⁵ Quoted in Sasha Grishin, *Uncertainty as a Creative Force in Visual Art* (London: Routledge, 2008), 115 (emphasis added).

⁶ Sebastian Olma, *In Defence of Serendipity. For a Radical Politics of Innovation* (London: Penguin Random House, 2016).

UNCERTAINTY IS *META*

Uncertainty is always *meta*.⁷ The more I try to define it, the more slippery it becomes. Even though many similar terms can be used to describe uncertainty, significant distinctions exist: *uncertainty* suggests a lack or asymmetry of information; *vagueness* is when the exact meaning of something cannot be determined and it is not possible to distinguish between the unknowable and the unknown; *ambiguity* is when more than one meaning can be assigned to something, resulting in competing meanings; *indeterminacy* (or indeterminism) is the ontological phenomenon concerning states that are irreducibly indeterminate in themselves, independently from an external observer.⁸

Uncertainty can be further differentiated into *aleatory*, *epistemic* or *ontological*. Uncertainty around the predictability of outcomes is called *aleatory* or statistical (e.g. when I toss a coin).⁹ Uncertainty that refers to situations when my knowledge is incomplete and I simply do not or cannot have all the necessary information is *epistemic*; it has to do with the limits of my knowledge, which can be measured, and is subjective.¹⁰ Finally, *ontological* uncertainty is about states and changes of state that are assumed to be independent of an external observer, thus concerning things that are indeterminate per se; it has to do with the contingency of the world. This is radical, oceanic uncertainty.

The key distinction seems therefore to be between *epistemic* uncertainty, when I do not know something, and *ontological* uncertainty, when variability and unpredictability are said to be inherent in a given system.¹¹ As it will become clear in the course of this chapter, however, even this difference between epistemic

⁷ Michael Smithson, *Ignorance and Uncertainty. Emerging Paradigms* (New York: Springer-Verlag, 1989); Smithson, 'The Many Faces and Masks of Uncertainty'; Gabriele Bammer and Michael Smithson, eds, *Uncertainty and Risk. Multidisciplinary Perspectives* (London: Earthscan, 2008). Nikolas Rose and Filippa Lentzos, 'Governing Insecurity. Contingency Planning, Protection, Resilience', *Economy and Society* 38, no. 2 (2009): 230–54, which uses as a starting point sociologists Richard V. Ericson and Aaron Doyle's definition of uncertainty as 'the lack of secure knowledge about an unwanted outcome'. Richard Ericson and Aaron Doyle, *Uncertain Business. Risk, Insurance and the Limits of Knowledge* (Toronto: University of Toronto Press, 2004), 5.

⁸ Jose V. Ciprut, 'Definition, Distinctions, and Dilemmas', in *Indeterminacy: The Mapped, the Navigable, and the Uncharted*, ed. Jose V. Ciprut (Cambridge, Mass. and London: MIT Press, 2008), 1–40.

⁹ Probability can be distinguished between the *frequentist* (probability as the attribute of repeated events) and the *subjective* approach (or Bayesian interpretation, where probability expresses the observer's degree of belief, given the information available). This latter interpretation is subjective because knowledge varies from observer to observer. In other words, every time I say probability that means 'my' probability rather than 'the' probability.

¹⁰ All uncertainty has an irreducible element of subjectivity, and eventually any difference between aleatory and subjective uncertainty tends to dissipate.

¹¹ Karen Barad, *Meeting the Universe Halfway. Quantum Physics and the Entanglement of Matter and Meaning* (Durham: Duke University Press, 2007); Andrew J. E. Seely, 'Embracing the Certainty of Uncertainty. Implications for Health Care and Research', *Perspectives in Biology and Medicine* 56, no. 1 (2013): 65–77; Stephen Toulmin and June Goodfield, *The Architecture of Matter* (Chicago: University of Chicago Press, 1962).

and ontological uncertainty tends to dissipate the more one delves into the incandescent matter of things (literally).

UNCERTAINTY IS RISK

One way of responding to uncertainty is by framing it as a *risk*. This is the approach found in social sciences, economics, statistics and the insurance sector.

Risk is the general term for unwanted and negatively perceived events (e.g. hazard, loss, damage, threat), and for the calculation of the probability of said unwanted events.¹² Framing something as a 'risk' implies the evaluation of a potential negative outcome. Thus, risk expresses the present calculation of a future uncertainty. It indicates in mathematical terms the statistical probability and the cost of the worst possible outcome. However, no matter how objective and scientific the assessment of a given situation is, it is always informed by socially shared beliefs, in other words, by what in this precise moment and in this current context (socio-cultural, financial, economic, legal and so on) is *perceived* as risk. There is no risk assessment (and therefore no risk per se) without contextualization.

Indeed, what is risk if not a perception? Sociologist Gerda Reith puts it bluntly when she writes: 'there is no such thing as risk in the world, only dangers we construct in our head'.¹³ Far from being an intrinsic property of things, or an autonomous entity, risk is always a contextual one. It emerges from the web of connections that weaves together a potential cause *of* risk, what may be *at* risk and what I expect to be (or I perceive as) the consequences. Therefore, it is more correct to say that risk is a 'cognitive frame', rather than a real (or quasi-real) phenomenon that I experience directly.¹⁴ In any case, what matters is the extent to which the quantification of a future contingency (my perception of risk, or a society's) becomes a guide for present anticipatory action. Thus, how I (or a society) conceptualize the relationship between uncertainty and

¹² Risk refers also to behaviours and actions that are deliberate 'risk taking' or 'edgework', and that may produce experiential benefits, such as a release from the monotony of the everyday via thrill-seeking; a way of experimenting with endurance through boundary-pushing activities; a vehicle to choose risk as the path toward self-actualization, self-growth, knowledge-growth and accomplishment. Jens O. Zinn ed., *Social Theories of Risk and Uncertainty. An Introduction* (Oxford: Blackwell, 2008); Deborah Lupton, 'Sociology and Risk', in *Beyond the Risk Society. Critical Reflections on Risk and Human Security*, ed. Gabe Mythen and Sandra Walklate (Maidenhead and New York: Open University Press, 2006), 11–24.

¹³ Gerda Reith, 'Uncertain Times. The Notion of "Risk" and the Development of Modernity', *Time & Society* 13, no. 2–3 (2004): 386.

¹⁴ In their seminal work on risk, anthropologists Mary Douglas and Aaron Wildavsky argued that the perception of risk is highly based on, and shaped by, individual opinions and collectively shared cultural beliefs; current and past social relations; memories, legacies, discourses and practices; trust in institutional expertise, distribution of knowledge and hierarchies of power. Mary Douglas and Aaron Wildavsky, *Risk and Culture. An Essay on the Selection of Technological and Environmental Dangers* (Berkeley and Los Angeles: University of California Press, 1982).

risk is instructive of where my (or that society's) priorities are. How I perceive risk reveals how I see my future. Thus, it shapes my present too.

But risk and uncertainty are not the same thing. Uncertainty cannot be measured, calculated or insured. Risk can. And while the management, governance and reduction of risk are widely researched, uncertainty – intended not as 'risk to manage', but as 'ocean to swim in' – is less so. From these considerations, it emerges that if risk is the eventuality that something bad might happen, what I experience is not risk per se but my knowledge of its (contextually constructed) calculation. Risk has to do with *knowing* (how much or how little), not with *being*. Risk is epistemic, not ontological. This leads to the familiar paradox that the more information and knowledge I have, the more uncertainty seems to grow. The more I attempt to immunize myself against accidents, failures or negative events, the more I may be inclined to see the 'future' exclusively on the basis of how risk can be assessed, locking my expectations into a mode driven by strategies of anticipatory governance such as pre-emption, prevention and precaution.

THE *PRE* MODES: PRE-EMPTION, PREVENTION, PRECAUTION

Risk can be managed through strategies of control whose goal is to neutralize real or perceived threats. This section briefly examines three of these strategies: pre-emption, prevention and precaution. Although they are all driven by the same logic, they deal with the *concept* of future risk slightly differently.

To start with, *Pre-emption* enlists the unknowability of the future into present decision-making processes; it intervenes on a specific slice of expectations curated from a wider pool of possibilities.¹⁵ Pre-emption deals with a potential risk that has not emerged yet. Here the uncertainty is ontological. With *Prevention*, on the other hand, uncertainty is epistemic. Prevention conceptualizes the future as the replication of past occurrences and assumes that a risk (and its causes) is known and measurable.¹⁶ Thus, prevention is based on the secular faith in scientific know-how and technical control, and on the (fiction of) objectivity in the measurement of risk. Its key concern is not the compensation for potential losses but how to reduce the chance of incurring them. Securing knowledge is fundamental, but, like in the tale of the map covering the territory narrated by Jorge Luis Borges, there is a certain utopian madness in wishing to foresee and prepare for every possible eventuality. After all, I cannot plan for what I truly do not know.¹⁷

¹⁵ Louise Amoore, *The Politics of Possibility. Risk and Security Beyond Probability* (Durham: Duke University Press, 2013).

¹⁶ Brian Massumi, 'Potential Politics and the Primacy of Preemption', *Theory & Event* 10, no. 2 (2007).

¹⁷ François Ewald, 'The Return of Descartes' Malicious Demon. An Outline of a Philosophy of Precaution', in *Embracing Risk. The Changing Culture of Insurance and Responsibility*, ed. Tom Baker and Jonathan Simon (Chicago: University of Chicago Press, 2002), 273–301.

The asymptotic gap in knowledge leads to the third strategy: *Precaution*. Operating in the discrepancy between what empiric knowledge about future occurrences can tell me, and what I can only imagine, fear, or suspect, precaution presents itself as a promise of safety. It is precaution as a governance paradigm that impels a nation to be in a state of permanent alert, ready to respond appropriately to potential threats, disasters or crises. As a mode of governing the uncertain yet-to-come, precaution is underpinned by the discourse of prudence, and its consequences can be stifling. Think of the exhortation, highly prized by the insurance industry, to consider the worst hypothesis as the most likely to succeed. This may well result in catalysing its perverse anticipation into not *a*, but *the* possible future, inhibiting present action. By transforming the unknown into manageable packets, precaution funnels potential futures and their unpredictable trajectories into what is known to be already actualizable, which is another way of describing the process that throughout the book I call the capture of potential. By reducing the latitude of what may happen, the capture of potential also reduces the extent to which the unknowable participates in the construction of worlds and subjectivities. By stifling the emergence of other ways of existing, it contains what may diverge from, or contest, the status quo. Pre-rendering what has not been even imagined yet, makes it thinkable and erodes the creation of other possible alternatives.¹⁸

Furthermore, precaution acts on the social imaginary, impinges on the potential this imaginary could express (but will not), and shrinks the capacity to dream alternative futures – social, political, individual, collective.¹⁹ Common imaginaries, especially when they manifest as forms of antagonism, resistance and insubordination, operate in the space where uncertainty is a feature of the collective, in other words, where it is social. As Rosalyn Diprose observes, common imaginaries are nourished by unscripted encounters with the world. They thrive on uncertainty. Indeed, uncertainty is essential to them. It is what makes them grow. The capture of potential weakens collective modes of dealing with uncertainty – for instance, organized systems of beliefs, be them myth-making, religions, superstitions, folk worldviews, secular faiths, revolutionary aspirations, activist world-building – with the result that coping mechanisms become increasingly individualized. This personalization of how to deal with uncertainty not only reinforces the unfair and asymmetrical distribution of resources dictating who is able to cope with what, but it also shows the fundamental fallacy of personalized responses to risk. Given that the calculation of risk can be generated only through population (not individual) analysis, it is only in the collective and the commons that strategies for coping with uncertainty can be more successfully located, not in the ‘market of one’.²⁰

¹⁸ Amoore, *The Politics of Possibility*, 157.

¹⁹ Rosalyn Diprose et al., ‘Governing the Future. The Paradigm of Prudence in Political Technologies of Risk Management’, *Security Dialogue* 39, no. 2–3 (2008): 267–88.

²⁰ Introna, ‘The Algorithmic Choreography of the Impressionable Subject’, 39.

THE EROSION OF DETERMINISM

In every culture and in every time people have developed ways of dealing with the uncertainty that life throws at them, in order to harness and (attempt to) explain life's radical contingency. The unknowability and unpredictability of the future have prompted individuals and societies time and time again to devise strategies of interpretation, prediction, forecast, prophecy, divination; to invent belief systems, supernatural agencies and social taboos so that causes could be attributed, adversities rebuffed and ever-present dangers exorcised; to create techniques, rituals, superstitions, apotropaic magic, rules and games in the attempt to explain (and contain) what is a fragile and precarious existence. All these strategies of management of the unknown – whether through religious, spiritual or agnostic means; through the evocation of benevolent or malevolent forces; through the suspension of belief, the recourse to delusion, even the invention of compelling and believable stories with the twofold aim of making desired outcomes more attractive and of keeping doubt at bay – are somehow not too different from what today is known as 'risk management'.²¹ The difference is that, until recently, it was not called 'risk'.

If risk is the product of time and uncertainty brought together into a quantifiable relation that can be scientifically calculated, then pre-industrial times had no conception of risk. Everything happened because of the will of God. Divine providence was the conceptual framework that justified it all, chance and randomness included. It was only in seventeenth-century Europe that a cascade of social, cultural, intellectual and political transformations began to produce the notion of risk as it is understood today. This shift from providence to risk (and uncertainty) was both a conceptual transformation and a process of secularization. Uncoupled from divine providence, destiny and predestination, chance acquires an autonomous ontological dimension and becomes an object of scientific inquiry. Divine laws once set in stone become statistical probabilities. The idea that the past would determine exactly what happened next began to dissolve.

This process of 'erosion of determinism' is well-documented.²² First, the rise of the bourgeois mercantile class with commerce as its prerogative, births the abstractions of finance and insurance. Then, the new mathematical fields of probability and statistics, developed from studies of gambling, show for the first time that seemingly random events follow recurring patterns and predictable trajectories. A new understanding of temporality as a long-term, open-ended future begins to emerge, signalling the shift from the determinism of 'what

²¹ Åsa Boholm, 'The Cultural Nature of Risk. Can There Be an Anthropology of Uncertainty?' *Ethnos* 68, no. 2 (2003): 159–78; Simon Dein, 'The Anthropology of Uncertainty. Magic, Witchcraft and Risk and Forensic Implications', *Journal of Forensic Anthropology* 1, no. 1 (2016): 1–7; David Tuckett, 'Irreducible Uncertainty and its Implications. A Narrative Action Theory for Economics', *Institute for New Economic Thinking* (working paper, 2013).

²² Ian Hacking, *The Taming of Chance* (Cambridge: Cambridge University Press, 1990).

will happen' to the probabilism of 'what might happen'.²³ God time (divine providence) becomes merchant time. The parameters of Newtonian science, which postulated the universe as an entirely predictable machine ruled by causation and linear progression, within which the concepts of space, time and matter were assumed to be fixed, absolute and immutable, begin to crumble. The new rationality triumphantly states that among the apparent chaos, laws could be discovered, patterns detected and probabilities calculated. During the European Enlightenment, any residual sense of fatalism about chance became synonymous with unreason, until the quantum discovery that the world was not deterministic in the nineteenth century tilted irreversibly the concept of causality and ushered in the era of irreducible uncertainty.²⁴

UNCERTAINTY IS IRREDUCIBLE

There is, indeed, still some dispute about the proper interpretation of Heisenberg's principle. Does the 'indeterminacy' in question mean only that we are restricted in our powers to observe and measure quantities which nevertheless have, in reality, perfectly definite and determinate values? Or does it mean that the fundamental entities of matter-theory are like clouds or claps of thunder – things which, by their very nature, have vague, indefinite boundaries, so that there are no absolutely determinate physical properties to be measured? Or is it rather a question of meaning and definition – do the equations by which our concept of 'electrons' is intellectually constructed somehow imply that the idea of an absolutely exact simultaneous measurement is devoid of physical significance? Whether one regards Heisenberg's principle as reflecting a limitation on our measurements, an essential property of material things, or a consequence of the meaning of our concepts, the practical effect of the principle is the same: though the theory explains the overall statistical patterns of events which occur in any physical situation, it obliges one to abandon all hope of predicting individual quantum events with complete accuracy.²⁵

The uncertainty principle, as articulated by German physicist Werner Heisenberg in 1927, states that I cannot measure both the position and the velocity of an object. My acts of observing *and* of attempting to measure something will alter what is observed. Thus, the notions of exact position and exact velocity have no meaning together.²⁶

²³ Gerd Gigerenzer et al., *The Empire of Chance. How Probability Changed Science and Everyday Life* (Cambridge: Cambridge University Press, 1989); Reith, 'Uncertain Times', 386. This is exactly the opposite of what statistical predictive machines do today.

²⁴ Ian Hacking, *The Emergence of Probability. A Philosophical Study of Early Ideas about Probability, Induction and Statistical Inference* (Cambridge: Cambridge University Press, 1975); Hacking, *The Taming of Chance*, 181.

²⁵ Toulmin and Goodfield, *The Architecture of Matter*, 290.

²⁶ Heisenberg's concern was with attempting to measure the position of an electron. This led to the realization that, in doing so, the electron's speed would change and that, vice versa, attempting to measure the electron's speed would result in its position changing.

The debate on the specific word that Heisenberg chose to describe his principle – variously translated as inaccuracy, uncertainty, indeterminacy, un-sharpness – is ongoing and far from settled.²⁷ Some argue that Heisenberg's principle should be called the 'principle of indeterminacy' to signify that what came to prominence with the discoveries of quantum physics is an ontological phenomenon.²⁸ The vast literature discussing this point highlights the fierce diatribe between Heisenberg and fellow physicist Niels Bohr, who maintained that the real issue of quantum mechanics was indeed indeterminacy, not uncertainty.²⁹ For Bohr, the premise of Heisenberg's argument wrongly assumed a speed and a position impacted upon by the observer, while he (Bohr) understood the *relation* between position and momentum in semantic and ontological terms first, and only secondarily in epistemic terms. In other words, if the variables 'position' and 'momentum' cannot be determined simultaneously, then the key point is not unknowability, says Bohr, but what can be said to exist (or not) concurrently. As physicist David Peat writes, in Bohr's view:

Every act of making a measurement is an act of interrogating the universe. The answer one receives to this interrogation depends on how the question is framed – that is, how the measurement is made. Rather than trying to unveil an underlying quantum property, the properties we observe are in a certain sense the product of the act of measurement itself. Ask a question one way and Nature has been framed into giving a certain answer. Pose the question in another way and the answer will be different. Rather than disturbing the universe, the answer to a quantum measurement is a form of co-creation between observer and observed.³⁰

This is the key point: co-creation. As neither the object nor the measuring instrument exists outside or independently from their relationship, the issue is *not* epistemic.³¹ Put differently, I cannot know something definite about some-

²⁷ Heisenberg used both *Ungenauigkeit* (imprecision, inexactness) and *Unbestimmtheit* (indefiniteness, indeterminacy, indetermination, undeterminedness or vagueness). Only in the end notes did he switch to *Unsicherheit* (uncertainty). In using this word, Heisenberg appears to have made a choice between 'inexactness' and 'indeterminacy'. In the English-language version of Heisenberg's textbook *The Physical Principles of the Quantum Theory*, published in 1930, the translation 'uncertainty' was used, hence his principle is known as the principle of uncertainty.

²⁸ Barad (*Meeting the Universe Halfway*) explains the difference between uncertainty and indeterminacy framing them as competing claims on how relations of reciprocity among elements should be understood.

²⁹ David Lindley, *Uncertainty. Einstein, Heisenberg, Bohr and the Struggle for the Soul of Science* (New York and London: Doubleday, 2007); David F. Peat, *From Certainty to Uncertainty. The Story of Science and Ideas in the Twentieth Century* (Washington DC: Joseph Henry Press, 2002); Carlo Rovelli, *Helgoland. The Strange and Beautiful Story of Quantum Physics* (London: Allen Lane, 2021).

³⁰ Peat, *From Certainty to Uncertainty*, 16.

³¹ This is, in a nutshell, Bohr's complementarity principle, which explains the mutual exclusivity of characteristics of quantum phenomena (e.g. wave/particle, position/momentum) and is the ground for Barad's notions of intra-action and agential realism. Barad, *Meeting the Universe Halfway*, 118.

thing for which there is nothing definite to know. It may even be argued that it is indeterminacy (lack of determination) that causes uncertainty (lack of certainty).

One thing is certain (!), however. With his principle, Heisenberg did not 'discover' uncertainty. What he did was to change its meaning forever.³² The collapse of the Newtonian categories of space, time, matter and causality had seismic repercussions beyond the realm of physics or mechanics. The fundamental indeterminacy of the post-Newtonian world, where causal laws are replaced by stochastic probability,³³ has reconfigured not only the natural world but social and subjective worlds too. The most profound impact of the principle of uncertainty remains in the challenge it brings to determinism. As physicist Stephen Buckman explains:

In our indeterminant quantum world, particles behave in a probabilistic manner and there are many possible paths that a particle may follow. Indeed, in this quantum mechanical world the fundamental microscopic particles (electrons, protons, atoms and so on) can be in more than one quantum state (for instance, a different energy level or state of an atom) at the same time. That these so-called superpositions of states exist in the microscopic world is well known because they produce observable interference effects in measurements. However, if we perform a discrete measurement of the system, to determine its state, we always find particular value or state for the particle, rather than a mix of two or more. This seemingly bizarre consequence of quantum theory led to Schrodinger's famous 'cat paradox'.³⁴

With indeterminate activity present at all levels of the visible and the invisible world, relativity undermines causality. All kinds of events resist patterning and sequencing. The universe is revealed as made not of stable or quasi-stable autonomous elements interacting with each other but of relations whose dynamic outcomes can acquire only a partial, situated, temporary and ever-mutable 'identity'. If no object exists independently from an apparatus capable of measuring it then there are no pre-existing properties in a given system. Properties do not exist per se but emerge and will be 'defined' only by acts of observation and intervention.

This is where the physicist and the philosopher concur in saying that 'reality is made up of relations rather than objects'³⁵ and 'relata do not precede

³² The notion of uncertainty was, of course, already familiar. Described as slack, latitude, elbow room or ambiguity, all terms broadly denoting a general systemic unknowability, uncertainty is what spurs inquiry. It is what galvanizes the relationship between scientific theory and laboratory experiment. No research, no discovery, no inquisitiveness can occur without an uncertain starting point, a not-knowing that galvanizes curiosity into action.

³³ Stochastic distribution: a pattern that may be analysed statistically but may not be predicted precisely. Reith, 'Uncertain Times', 391.

³⁴ Stephen J. Buckman, 'Uncertainty in the Physical Sciences. How Big? How Small? Is It Actually There at All?', in *Uncertainty and Risk*, ed. Gabriele Bammer and Michael Smithson (London: Earthscan, 2008), 74.

³⁵ Rovelli, *Helgoland*, 3.

relations'.³⁶ The discovery of the quantum world reveals the 'incandescence' of reality at its utmost granular scale. That thing called 'reality' is a continually woven (and unwoven) universe of infinite alterity and tremor. Thus, the question of whether uncertainty is *epistemic* or *ontological*, whether it is more about what I do not know, or about something that is inherently unknowable, eventually loses traction. The indeterminate and the indeterminable are not mutually exclusive. What matters is not how they differ, but how they connect. Uncertainty is onto-epistemological because it braids the epistemic and ontological dimensions together with the tremor of invisible, incandescent matter.

In his poetic explanation of quantum theory, Rovelli writes: 'The world is a network of relative facts: relations realized when physical entities interact. A stone collides with another stone. The light from the Sun reaches my skin. You read these lines'.³⁷ And he continues:

The quantum world is more tenuous than the one imagined by the old physics; it is made up of happenings, discontinuous events, without permanence. It is a world with a fine texture, intricate and fragile as Venetian lace. Every interaction is an event, and it is these light and ephemeral events that weave reality, not the heavy objects charged with absolute properties that our philosophy posited in support of those events.³⁸

Far from remaining confined to the realms of physics, the radical uncertainty posed by quantum theory almost a century ago alters not only how I conceptualize my experience of the world but the most profound essence of this experience. This can be compared to what happens when I take a photo with my back to the sun. No matter how much I try to move or twist my body, my shadow will always be in the photo. There is no 'real-world' without me already in it.³⁹ This impossibility to measure and observe at the same time is the collapse of Newtonian determinism. It is also the collapse of the fiction of the objective, neutral and impartial observer. Besides, radical uncertainty also suggests that the absolute relationality of the universe works in tandem with the universe's utmost indifference. On one hand, this tells me that nothing can be untouched by my human intervention; on the other, that everything is perfectly immune to it.⁴⁰ The universe I partake of is indeterminate. It is undecidable. There is nothing outside it, nothing before it, absolutely nothing that grounds it.⁴¹ Viewed as a quantum phenomenon and with the same rules found in the

³⁶ Barad, *Meeting the Universe Halfway*, 334.

³⁷ Rovelli, *Helgoland*, 74.

³⁸ *Ibid.*, 75.

³⁹ Peat, *From Certainty to Uncertainty*, 14.

⁴⁰ Connor, *The Madness of Knowledge*, 20.

⁴¹ Jonathan Basile, 'Other Matters. Karen Barad's Two Materialisms and the Science of Undecidability', *Angelaki* 25, no. 5 (2020): 3–18; Elie Ayache, 'The Medium of Contingency', *Contingency. PLI the Warwick Journal of Philosophy*, University of Warwick 22 (2011): 62–87.

indeterminate behaviour of electrons and photons, consciousness itself is nothing but the entanglement of vibrating, unstable, incandescent matter that flows in and through me, you, every body and every thing else.⁴²

WITHOUT UNCERTAINTY LIFE WOULD BE VERY DULL

Over one hundred years ago, in his work on risk theory, American economist Frank H. Knight celebrated uncertainty as a highly desirable state. Without uncertainty, he writes, life would be very dull. Humans would turn into bare automata.⁴³

If risk concerns a future that can be acted upon in the present via calculations, uncertainty is a much cloudier territory where the probabilistic dimension needs to include the aesthetic, the affective, the experiential. There is so much more to uncertainty than the version claimed by risk managers, insurance experts, future-proofers, economists. When I frame uncertainty solely as a risk to manage, I squash into a quantifiable nomenclature all those other aspects that make uncertainty alive and brimming with possibilities, in short, its vast oceanity. I parcel the infinite horizon of potential into discrete packets, assigning value to each on the ground of cost-benefit calculations. This parsing manoeuvre reduces the incalculable. It compresses contingency.

But contingency is like an arrow, and like an arrow it cuts through the air, moving, tending toward, alive.⁴⁴ It cannot be compressed, nor stopped. Nothing that happens is necessary, but everything that happens touches me. I am enveloped in contingency, all the time, as if I was caught in a web, but not trapped like a fly. Rather, I am like the spider who comes alive the moment the web pulls her in, vibrating with the intensity and the oceanic uncertainty of what *may be* happening.

⁴² Entanglement is the 'phenomenon by which two distant objects maintain a kind of weird connection, as if they continued to speak to each other from afar' (Rovelli, *Helgoland*, 81).

⁴³ Frank H. Knight, *Risk, Uncertainty and Profit* (Boston: Houghton Mifflin, 1921), 348.

⁴⁴ Ayache, 'The Medium of Contingency', 62.

