6 The Nature of Fear and the Fear of Nature from Hobbes to the Hydrogen Bomb

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There are good reasons to be suspicious of claims for a 'scientific' approach to natural disasters. Disasters are, by definition, events that elude the predictive knowledge of the sciences,[1] and to pretend otherwise places a society at risk. Technical responses to catastrophe have often provided false security, as in the tragic failure of Japan's sea walls to defend against the 2011 tsunami. Just as disturbingly, technical responses can distract from the underlying societal problems exposed by disasters.[2] Reconstruction after Hurricane Katrina, for instance, failed to address the unequal distribution of risk in New Orleans, placing low-income and African American residents at comparatively even greater danger in the event of another extreme storm.[3] What's more, history offers many examples of self-confidently 'scientific' responses to natural catastrophes that turned out to be mere pretexts for the centralization of power and the curtailment of liberty. For instance, it was in the aftermath of major earthquakes in Italy and Japan in the early twentieth century that the concept of the state of emergency was first articulated.[4] In light of examples like these, disaster science may seem like little more than a tool for the manipulation of popular fears. Jean Baudrillard has argued in this

[1] M. Voss, *Symbolische Formen: Grundlagen und Elemente einer Soziologie der Katastrophe* (Beilefeld: Transcript, 2006), 13.

[2] T. Steinberg, *Acts of God* (Oxford: Oxford University Press, 2000); S. Hoffman and A. Oliver-Smith (eds.), *The Angry Earth: Disaster in Anthropological Perspective* (London: Routledge, 1999).

[3] J. Schwartz, 'A Billion Dollars Later, New Orleans Still at Risk', *New York Times* (12 August 2007), https://nyti.ms/2mUcmZO.

[4] M. Orihara and G. Clancey, 'The Nature of Emergency: The Great Kanto Earthquake and the Crisis of Reason in Late Imperial Japan', *Science in Context* 25 (2012), 103–126; G. Agamben, *State of Exception*, trans. K. Attell (Chicago: University of Chicago Press, 2005); W. Scheuerman, *Between Norm and Exception: The Frankfurt School and the Rule of Law* (Cambridge, MA: MIT Press, 1997). For other examples, see C. Walker, *Shaky Colonialism: The 1746 Earthquake-Tsunami in Lima, Peru, and Its Long Aftermath* (Durham, NC: Duke University Press, 2008); J. Buchenau and L. L. Johnson, *Aftershocks: Earthquakes and Popular Politics in Latin America* (Albuquerque: University of New Mexico Press, 2009).

vein that any state capable of predicting and controlling natural catastrophes would be so coercive that its citizens would *prefer* a catastrophe.[5]

Our twenty-first century intuitions thus tell us that the very idea of disaster science poses a threat to democracy. Intuitions like these have undoubtedly helped to feed skepticism of the science of global warming. Yet those intuitions have little to say about how knowledge of natural disasters is actually produced. This chapter uses the tools of the historian of science to open up the black box of knowledge production. It sketches some key elements of a history of disaster science from the Scientific Revolution to the Cold War, with a particular focus on the political and epistemic functions of fear. I look first at Thomas Hobbes's notion of a 'civil and moral science' that would defend against future 'miseries'. Then I turn to the European sciences that took shape in response to the Lisbon earthquake of 1755 and other natural disasters of the eighteenth and nineteenth centuries. Finally I consider the rise of a sociology of disaster in the United States during the Cold War. Not until the twentieth century, I argue, did the aspiration to a science of disaster come to connote the circumvention of a democratic process of evaluating threats. Until then, there was no reason to assume that a more scientific approach to disasters would mean a less political one. It was also not until the twentieth century that states conceived the ambition of exerting total control over the emotion of fear. Though fear had long been subject to manipulation from above, it had also drawn respect from earlier philosophers and scientists as a motivation to knowledge and a clue to the analysis of natural hazards.

I. The Fear of Nature after the State of Nature

> For all men are by nature provided of notable multiplying glasses, (that is their passions and self-love) through which, every little payment appeareth a great grievance; but are destitute of those prospective glasses (namely moral and civil science) to see afar off the miseries that hang over them, and cannot without such payments be avoided.[6]

Thomas Hobbes recognized already in the middle of the seventeenth century that fear is a principal motivator of men's actions, and he was the first to appreciate the potential of fear to act as the glue binding civil society together. Hobbes also knew that individuals are often poor judges of the dangers that represent their most serious long-term threats. They

[5] J. Baudrillard, 'Paroxysm: The Seismic Order', European Graduate School, available at www.egs.edu/faculty/jean-baudrillard/articles/paroxysm-the-seismic-order.

[6] T. Hobbes, *Leviathan*, ed. J. C. A. Gaskin (Oxford: Oxford University Press, 1998), 122.

might be unable to see, for instance, how paying their taxes might one day ensure their safety against a still invisible danger. Hobbes therefore reasoned that the sovereign must have absolute authority to decide what constitutes a danger to his subjects. On these grounds it has been claimed that Hobbes anticipated the politics of fear in the modern liberal state. The political scientist Corey Robin argues that liberalism has followed Hobbes in using the rhetoric of fear to create the appearance of consensus.[7] Liberalism posits supposedly apolitical objects of fear and makes them the grounds for concerted action. Without disputing Robin's characterization of the modern politics of fear, I want to suggest that his historical claim for continuity rests on certain misleading assumptions about what Hobbes meant by 'science'. Robin tells us that Hobbes trusted the sovereign to identify appropriate objects of fear because 'the sovereign would be able to act on behalf of an impartial, disinterested, and neutral calculation of what truly threatened the people as a whole and of what measures would protect them'; he would be able to 'get the calculations right'.[8] This may describe what modern states expect of science, but I will argue that it bears no resemblance to Hobbes's expectations.

To be sure, Hobbes recognized that the fear of disasters, natural and civil, was a potent political tool. He explained that religious leaders used the fear of 'sickness, earthquakes' and other misfortunes in order to ensure their followers' obedience. He exposed the manipulations of prognosticators, who prey on men's 'fear' and 'ignorance' to convince them of approaching calamities. He was equally suspicious of 'natural' as of 'supernatural' forecasters, evincing little faith in the possibility of a predictive natural philosophy.[9] With good reason: the only branch of physics whose predictions could be trusted in the early seventeenth century was celestial mechanics, since earthly mechanics was still beset by a poor understanding of friction and the lack of a reliable method for measuring experimental error. Early modern meteorology, for instance, as taught at universities, took almost no interest in forecasting, while the predictions of popular almanacs did not meet Hobbes's causal definition of science.[10] This was a world where natural disasters were, understandably, 'acts of God', and where particular facts and instances still did not

[7] C. Robin, *Fear: The History of a Political Idea* (Oxford: Oxford University Press, 2004).
[8] C. Robin, 'The Language of Fear: Security and Modern Politics', in J. Plamper and B. Lazier (eds.), *Fear across the Disciplines*, (Pittsburgh: University of Pittsburgh Press, 2012), 118–131, at 120.
[9] Hobbes, *Leviathan*, ch. 12, 'Of Religion.'
[10] C. Martin, *Renaissance Meteorology: Pomponazzi to Descartes* (Baltimore: Johns Hopkins University Press, 2011), 11–14.

fit comfortably into the epistemological frameworks of natural philosophy. From this perspective, an uncertain natural science might be more dangerous to the polity than none at all. Thus Hobbes stressed that the fear of nature was just as vulnerable to political manipulation as the fear of other people. Indeed, Hobbes himself became a victim of it in the wake of the disastrous plague and fire that struck London in the 1660s. In 1666 'the House of Commons cited the atheism of Hobbes and of his friend the Roman Catholic priest Thomas White as a probable "cause" of the Great Fire and Plague of London, and ordered an investigation of their works.'[11] Hobbes thus gained direct experience of the manipulation of the fear of nature to political ends.

Even so, Hobbes never made the modern move of arguing that nature trumped politics, that it constituted a body of facts about which agreement could be achieved without resorting to a political process of decision-making. On the contrary, he strenuously rejected this step when it was taken by proponents of the new experimental philosophy.[12] When the Royal Society claimed to have created a space in which matters of fact could be decided on strictly apolitical grounds, Hobbes cried foul. To cordon off nature from the sovereign's authority in this way, he argued, was to open the door to cancerous disagreements, and ultimately to civil war. Thus Hobbes in no way called for a 'disinterested' science of civil security. As Steven Shapin and Simon Schaffer showed in their classic study of Hobbes's natural philosophy, Hobbes was his generation's fiercest critic of the emerging ideology of disinterested science. Hobbes saw all too clearly the power plays involved in such claims.

In addition, Hobbes did not make a distinction that political theorists are prone to make today: between human and non-human objects of fear (between civil hazards like warfare, on one hand, and natural hazards, on the other). Robin, for instance, intentionally leaves aside environmental hazards in his treatise on the politics of fear.[13] Writing circa 2004, he insists that a natural disaster like a tidal wave does not generate the kind of fear that inspires political commitments. A decade later, this statement is no longer plausible. Certainly, Hurricane Katrina brought a surge of social-justice activism in its wake. In the age of global warming, the

[11] S. Mintz, *The Hunting of Leviathan: Seventeenth-Century Reactions to the Materialism and Moral Philosophy of Thomas Hobbes* (Cambridge: Cambridge University Press, 1962), 62.

[12] S. Shapin and S. Schaffer, *Leviathan and the Air Pump: Hobbes, Boyle and the Experimental Life* (Princeton, NJ: Princeton University Press, 1985).

[13] He explains: 'If fear is to commit us to political values like the rule of law or liberal democracy, we must confront a political threat to those values. After all, a coastal city threatened by a tidal wave may be incited to public action, but natural disaster seldom provokes citizens to embrace or enact specific political principles.' Robin, *Fear*, 4.

public is better able to spy the injustices that leave some populations more vulnerable to natural disasters than others. The notion that the risks associated with the natural world are apolitical has become as untenable as the claim that terrorism is a threat that transcends politics.

Hobbes never made the mistake of overlooking the politics involved in dealing with 'natural dangers'. Indeed, as Shapin and Schaffer observed, Hobbes 'allowed no boundaries between the natural, the human, and the social'.[14] Hobbes vehemently opposed the efforts of his contemporaries to separate natural 'matters of fact' from other objects of knowledge. In his insistence on the indivisibility of natural knowledge from politics, Hobbes was distinctly pre-modern, or perhaps post-modern. By no means was he – or his notion of science – modern in Robin's sense of the term.

Nor did Hobbes think that fear could or should be controlled by the state. For fear was not simply, for Hobbes, a motivation for civic union and collective action. Following an ancient tradition, he saw fear equally as a path to knowledge.[15] 'Anxiety for the future time, disposeth men to inquire into the causes of things: because the knowledge of them, maketh men the better able to order the present to their best advantage.' As he explained, fear needs to have an object if it is not to devolve into a generalized and paralyzing anxiety. In an age of *scientia*, fear finds its object in the restless search for *causes*. In this sense, anxiety gives rise to another passion, curiosity: 'Curiosity, or love of the knowledge of causes, draws a man from the consideration of the effect, to seek the cause.'[16] Lorraine Daston and Katharine Park describe Hobbes as the most 'voluble' thinker of the seventeenth century on the topic of curiosity, which he believed was the passion that distinguishes man from animals.[17] As J. W. N. Watkins observes, Hobbes viewed reason as the servant of the passions: we read in *Leviathan* that 'the thoughts are to the desires, as scouts, and spies, to range abroad, and find the way to the things desired.'[18]

For Hobbes, then, fear is the force that opens people's eyes to the natural world. Indeed, if fear can drive people to superstitious beliefs, it

[14] Shapin and Schaffer, *Leviathan*, 21.
[15] See Plamper and Lazier, 'Introduction', in *Fear across the Disciplines*, 5. On fear and knowledge, see too L. Daston, 'Life, Chance, and Life Chances', *Daedalus* 137 (2008), 5–14.
[16] Hobbes, *Leviathan*, 70.
[17] L. Daston and K. Park, *Wonders and the Order of Nature: 1150–1750* (Cambridge, MA: Zone Books, 1998), 307.
[18] Quoted in J. W. N. Watkins, *Hobbes's System of Ideas: A Study in the Political Significance of Philosophical Theories* (London: Hutchinson, 1965), 94.

can also help to unmask those beliefs, exposing natural causes in the place of supernatural ones. Sometimes this exposure removes the fear, as when an oracle's effects are explained by 'the intoxicating vapour' of 'sulphurous caverns', or a heavenly portent is explained as a consequence of celestial mechanics.[19] Even if the impulse to explain nature at times serves to eliminate fear, nonetheless fear is its point of origin.

Moreover, Hobbes was too sophisticated an epistemologist to believe that security is merely a matter of 'getting the calculations right.' As Leibniz observed, Hobbes was a nominalist: truth depended on proper logical relations among signs, without regard to what they signified. 'No man can know by discourse that this, or that, is, has been, or will be; which is to know absolutely: but only, that if this be, that is; if this has been, that has been; if this shall be, that shall be: which is to know conditionally, and that not the consequence of one thing to another; but of one name of a thing, to another name of a thing.'[20] From this perspective, differences of opinion cannot be settled by appeal to an external reality. If the disputants cannot reach agreement, Hobbes argues, they 'must, by their own accord, set up, for right reason, the reason of some arbitrator, or judge, to whose sentence they will both stand, or their controversy must either come to blows, or be undecided, for want of a right reason constituted by nature; so is it also in all debates of what kind soever'.[21] In this way, Hobbes's conventionalist theory of knowledge was meant to guarantee that disputes could be resolved peacefully.

We are now in a position to ask about the nature of Hobbes's 'prospective glasses'. What exactly was this science of 'far-off miseries' that Hobbes envisioned? What was the sovereign if not a scientist intent on 'getting his calculations right'? Answering these questions will help to throw into relief the peculiarities of more modern interpretations of disaster science.

Watkins observes that Hobbes modeled his civil science on Galileo's natural philosophy: begin with absolutely true principles, deduce consequences from them and confirm those by experiment.[22] Experiential knowledge thus has a role to play in this science, but a circumscribed role. To be sure, Hobbes expected the sovereign to rely on expert advisers: 'to the person of a commonwealth, his counsellors serve him in the place of memory, and mental discourse.'[23] Yet it is probably an exaggeration to claim, as Loralea Michaelis does, that Hobbes conceived of governance as 'a science over which the expert, and not the ruler,

[19] Hobbes, *Leviathan*, 77. [20] Hobbes, *Leviathan*, 42.
[21] Ibid., 28, quoted in Watkins, *Hobbes's System*, 147. [22] Watkins, *Hobbes's System*, 44.
[23] Hobbes, *Leviathan*, 172.

ultimately presides'.[24] At issue here is what this science was supposed to achieve. As we have seen, science was only of use to the Hobbesian state insofar as it drew absolute assent by demonstrative force. Predictive claims, whether based on natural or supernatural theories, were inherently uncertain and potentially destructive of social disorder. A merely probabilistic science might inform, but could not constrain, the sovereign's deliberations. If the future looks more predictable in Hobbes's commonwealth than in the state of nature, it is not because the sovereign relies on the predictions of experts. Hobbes was not counseling blind trust in expertise.

On the contrary, it is precisely because scientific expertise does not have the last word in Hobbes's commonwealth that its 'prospective glasses' work. The quest for natural knowledge always remains subordinate to the need to maintain civil order. By guaranteeing order, the absolute power of the sovereign guarantees a more predictable future – or, at least, the appearance thereof. We catch a glimpse of this reading in Michaelis: 'Such a science does not make the future more transparent', she concedes, 'but it does make it more available as an object of planning and control: one might say that the future becomes all the more stable and predictable.'[25] This point can be fleshed out with reference to the broader context of the Enlightenment. Lorraine Daston has proposed that the rise of probabilistic reasoning in the seventeenth and eighteenth centuries reflected the experience of a more predictable world: 'A safer life could have been experienced as a more stable, predictable one, for it encouraged planning for the future in a way that periodic fortunes did not. Children that usually survived past infancy; ships that usually returned from exotic destinations; dwellings that usually withstood fires for generations: in a mathematical sense these patterns were no more regular than the worst consistently coming to pass, or even cycles of prosperity and want, but they promoted a sense of security that the other equally well-defined patterns did not.'[26] For readers in Hobbes's own day, there was thus no need to imagine a predictive science behind his 'prospective glasses'. It was enough to believe that a Hobbesian state would bring about a more certain future.

By framing the question of what to fear as a matter for 'science', Hobbes did indeed hope to build consensus around objects of fear. But

[24] L. Michaelis, 'Hobbes's Modern Prometheus: A Political Philosophy for an Uncertain Future', *Canadian Journal of Political Science* 40 (2007), 101–127, at 121.
[25] Michaelis, 'Hobbes's Modern Prometheus', 122.
[26] L. Daston, *Classical Probability in the Enlightenment* (Princeton, NJ: Princeton University Press, 1988), 183.

he rejected the familiar modern move that would force consensus by framing the matter at hand as *above* politics. For Hobbes, there was no knowledge without fear, no science without politics. The Leviathan could not afford to sever any domain of knowledge from the sovereign's authority, for doing so could lead to ungovernable disputes. This might well sound like a recipe for something like Lysenkoism. However, Hobbes did not expect the sovereign to preside over the formulation of predictive sciences, as Stalin would do.[27] For predictive science was not the path to order and security, in Hobbes's view. In the 1640s there was good reason to believe that forecasting would always be playing with fire, and that a more orderly world could be achieved only by fiat. The clarity of the view through the sovereign's 'prospective glasses' came about because, in that 'far off' future, many competing wills would have been reduced to one.

II. The Lisbon Earthquake and Nineteenth-Century Disaster Science

If Hobbes is not the source of our modern view of natural disasters, it is plausible to look for it instead in the aftermath of the catastrophic Lisbon earthquake of 1755. Philosophers tell us that natural disasters were thereafter removed from the purview of theology and moral philosophy and set squarely in a framework of technical analysis, prediction and control.[28] Once again, however, the historical reality is not so clear cut. To be sure, philosophers like Kant and Rousseau roundly rejected theological interpretations of the disaster in favor of strict naturalism. Rousseau blamed the victims for the location of their homes, while Kant offered (in Walter Benjamin's estimation) the very first work of seismology. In the aftermath of the disaster, earthquakes received scientific attention throughout Europe. The French Academy of Sciences rapidly organized a system of empirical studies of seismic activity on French soil.[29] In the 1780s, a series of temblors in Calabria offered European naturalists prime conditions for the elaboration of an enlightened account of earthquakes.[30] Thus, in the late eighteenth century,

[27] E. Pollock, *Stalin and the Soviet Science Wars* (Princeton, NJ: Princeton University Press, 2006).

[28] D. N. Robinson, 'Wisdom through the Ages', in J. R. Sternberg (ed.), *Wisdom: Its Nature, Origins, and Development* (Cambridge: Cambridge University Press, 1990), 22–23.

[29] G. Quenet, *Les Tremblements de Terre aux XVIIe et XVIIIe Siècles: La Naissance d'un Risque* (Paris: Editions Champ Vallon, 2005).

[30] S. B. Keller, 'Section and Views: Visual Representation in Eighteenth-Century Earthquake Studies', *British Journal for the History of Science* 31 (1998), 129–159.

earthquakes came to be studied from the modern perspective of risk: not as acts of divine retribution, but as expected consequences of a seismically active landscape.[31]

However, if we agree with the many commentators, then and now, who insist that seismology became a modern science after 1755, then we need to use the term 'modern science' more cautiously than usual. To begin with, religious explanations of earthquakes hardly disappeared after 1755, even among savants. Theological interpretations not only endured but sometimes even motivated the seismological investigations of the Enlightenment.[32] Nor did seismology become a science of prediction and control. On the contrary, those who claimed to be able to predict earthquakes, even on the basis of natural causes, were quickly deemed quacks by the scientific elite. Scientists studying earthquakes in the nineteenth century were remarkably modest about what they claimed to know, and they typically urged the public to err on the side of caution when it came to earthquake-sensitive construction. Instead, most seismological investigators of this period in Europe and North America saw their task as a quest to *understand* the forces that had shaped the earth over the course of its history, not to control them.

To that end, many scholars of earthquakes turned to the public for help. They organized networks of lay observers to watch for seismic activity. As I have shown elsewhere,[33] many of these projects were undertaken in a populist spirit by naturalists with democratic leanings. As the California seismologist John Casper Branner put it in 1913, 'To our requests for information about earthquakes we are frequently told apologetically that "I don't know anything about earthquakes." There is but one reply to be made to such remarks, and that is that "we know precious little about them ourselves; we are just now trying to find out, and we want your help."'[34]

Most fundamentally, seismology remained untroubled by the mingling of natural and human phenomena that constituted its object of study. Like Hobbes, early seismologists understood themselves to be studying the workings of nature alongside those of society. They

[31] Quenet, *Les Tremblements de Terre*.
[32] M. Gisler, *Göttliche Natur? Formationen im Erdbebendiskurs der Schweiz des 18. Jahrhunderts* (Zurich: Chronos Verlag, 2007).
[33] D. R. Coen, *The Earthquake Observers: Disaster Science from Lisbon to Richter* (Chicago: University of Chicago Press, 2013), from which this section of the current chapter is adapted.
[34] J. C. Branner, 'Earthquakes and Structural Engineering', *Bulletin of the Seismological Society of America* 3 (1913), 1–5, at 5.

certainly saw their enterprise as a modern one, yet they did not make the move that, as Latour tells us, defines modernity: to delimit a strictly apolitical realm of 'nature'.[35]

Instead, nineteenth-century seismologists pursued what they termed the 'monographic' method. This meant studying an earthquake 'in and for itself', in its 'unique aspects'.[36] They drew their evidence from field observations of the affected site, from eyewitness reports of the event and from records of past events in provincial archives. Human observations of earthquakes are surprisingly rich in scientific information. They demonstrate – in a way that geophysical observatories cannot – the local variability of the impacts of earthquakes, which is a complex function of factors such as tectonic structure, soil type and building style. They also profit from the familiarity of local observers with the normal state of their surroundings: locals are in the best position to recognize anomalies before and after earthquakes, such as variations of groundwater levels, unusual weather, remarkable animal behavior or changes in the surface of the land. The methods of nineteenth-century seismology thus combined geology, sociology, psychology and history. Scientists sought both a better understanding of fundamental geophysics and a means of protecting the public against future disasters.[37]

The principal tool for turning lay observations into scientific evidence was the intensity scale, which quantified the *felt* effects of ground movement. A standard scale was introduced in 1883 and still forms the basis for those used today. These scales operated (and still operate) in part by calibrating the public's reactions. The most widely used version in the late nineteenth century distinguished, for instance, between a degree 6 event, in which 'some frightened people leave their dwellings', and a degree 7, characterized by 'general panic'.

As this suggests, nineteenth-century seismology did not treat fear as an irrational response to geophysical hazards. On the contrary, scientists were invested in documenting fear as a legitimate emotional response to changes in the physical environment. In this vein, the seismologist Alexander McAdie distinguished between the 'depression of spirits which is physical and real, brought about by some as yet unknown relation between the nervous system and conditions of air-pressure, humidity, and purity', and the 'unnecessary' fear that was 'largely the

[35] Cf. B. Latour, *We Have Never Been Modern*, trans. C. Porter (Cambridge, MA: Harvard University Press, 1993).
[36] Quoted in D. Coen, *The Earthquake Observers*, 22.
[37] On lay observers in seismology, see too the essays by F. Fan and C. Valencius in *Science in Context* 25 (2012), and C. Bolton Valencius, *The Lost History of the New Madrid Earthquakes* (Chicago: University of Chicago Press, 2013).

work of the imagination'.[38] Nineteenth-century seismology thus activated an ancient tradition in which fear is not merely a motivation to or a consequence of knowledge; rather, fear is in itself knowledge of the state of the world. In Martha Nussbaum's elegant formulation of this point of view, it is through emotion that 'the world enters into the self'.[39]

In this framework, lay seismic observers functioned partly as human seismographs, as passive registers of the physical event. Yet intensity scales also treated laypeople as naturalists in their own right. Witnesses were expected to be discerning observers of nature. A shock of degree 3, for instance, was described as 'strong enough that the duration or direction could be appreciated'. A shock of degree 6 would produce an '*apparent* shaking of trees and bushes'.[40] These phrases hinted at the mindfulness expected of laypeople. Intensity scales codified their dual status as both experimental subjects and amateur naturalists; they were expected to react to ground movement with an appropriate degree of fear while remaining accurate observers.

What is perhaps most remarkable about this particular disaster science is the way that it distributed the power to determine appropriate objects and levels of fear. Rather than dictating what the public *should* fear, nineteenth-century seismology made ongoing adjustments between its evaluation of geophysical hazards and of social psychology. Seismologists were not only interested in what could be learned about the physical nature of earthquakes from human perceptions; occasionally, they turned the tables, using their physical data to analyze human phenomena. In an influential paper of 1900, 'The Effects of Earthquakes on Human Beings', the British mathematician and seismologist Charles Davison grouped responses to earthquakes into four 'rough' categories: 'A) No persons leave their rooms. B) Some persons leave their houses. C) Most persons run into the streets, which are full of excited people. D) People rush wildly for open spaces, and remain all night out of doors.' Applying these categories to the Charleston, North Carolina, earthquake of 1884, Davison was able to identify a culturally specific reaction. In some areas where the shaking was 'not even strong enough to cause doors and windows to rattle', nonetheless 'some persons were so alarmed that they left their houses, and public meetings were dispersed. Whether these effects were due to the rarity of the phenomenon or to the highly-strung

[38] A. McAdie, 'Needless Alarm during Thunderstorms', *The Century Magazine* 58 (1899), 604–605, at 605.
[39] M. Nussbaum, *Upheavals of Thought: The Intelligence of Emotions* (Cambridge: Cambridge University Press, 2001), 78.
[40] Quoted in Coen, *The Earthquake Observers*, 86.

nerves of the American people, it may, I think, be inferred that in no other civilized country would such alarm be shown at a sudden and unexpected occurrence.'[41]

In this judgment, Davison offered an important corrective to a widespread Victorian prejudice. Nineteenth-century British and German writers, reflecting on the difference between Europe and its colonies, and between the north and south of Europe itself, argued that human reason could not withstand repeated exposure to natural dangers – least of all to earthquakes. Consider this passage from Henry Thomas Buckle, the Victorian who famously hoped to turn history into a science:

> The mind is thus constantly thrown into a timid and anxious state; and men witnessing the most serious dangers, which they can neither avoid nor understand, become impressed with a conviction of their own inability, and of the poverty of their own resources. In exactly the same proportion, the imagination is aroused, and a belief in supernatural interference actively encouraged. Human power failing, superhuman power is called in; the mysterious and the invisible are believed to be present; and there grow up among the people those feelings of awe, and of helplessness, on which all superstition is based, and without which no superstition can exist.[42]

According to this widely held view, the *physical* destruction due to earthquakes was secondary to the *psychic* devastation they caused. Repeated earthquakes could impair the use of reason and destroy all chance of progress in science and industry. In the place of such stereotypes, Davison pointed the way to a systematic evaluation of the fear that was warranted in different places at different times.

The appropriate level of fear could not be judged from geophysical data alone, since it also depended on variables such as construction standards and on the social conditions that shaped a society's ability to cope with disasters. Nineteenth-century seismology effectively distinguished between a background fear *of earthquakes*, and a situational fear *in an earthquake*, such that the former partly determined the latter.[43] In other words, an individual's emotional response in the moment of danger depended on a lifetime of experience with that danger. Thus Alexander von Humboldt noted with approval that natives of earthquake-prone lands had learned to keep their wits about them when the ground began to shake.[44]

[41] C. Davison, 'The Effects of Earthquakes on Human Beings', *Nature* 63 (1900), 165–166.
[42] H. T. Buckle, *History of Civilization in England*, 2nd ed., vol. 1 (New York: Appleton, 1884), 88.
[43] See Nussbaum, *Upheavals of Thought*, 67–76.
[44] See Coen, *Earthquake Observers*, 109–112.

For all these reasons, the fear of nature – or the absence thereof – could not be dictated from above; it required empirical study jointly from the perspectives of the natural and human sciences. In the nineteenth century, then, the scientific identification of natural hazards took a form that was both democratic (reflecting the perceptions of ordinary people) and pluralistic (allowing for variation across cultures).

Other branches of natural science developed similarly integrated approaches to disaster in the eighteenth and nineteenth centuries. Famines, droughts, and epidemics all became objects of scientific investigation in the late eighteenth century, in frameworks that encompassed both natural and social factors.[45] For instance, as Mike Davis has shown, famines in colonial India were analyzed not simply in terms of weather and soil conditions but as 'complex economic crises induced by the market impacts of drought and crop failure'.[46] Victims' experiences were a valued form of evidence for all these sciences. In the field of medical geography, for instance, experts were interested in a patient's own accounts of illness, her own observations of triggering factors in her natural environment.[47] In scientific accounts from this period, victims of disaster would have seen their own experiences reflected clearly.

Then, beginning in the 1870s, explanations of natural disasters turned increasingly reductive. Theories of climate-related catastrophes like drought came to focus on sunspot cycles and global atmospheric oscillations. Simultaneously, the hunt for microbes replaced the early nineteenth century's more multifaceted, socio-environmental explanations of disease. And seismologists gradually turned to the 'hard' evidence of seismographs and accelerometers, rejecting data filtered by human bodies. By the 1950s, Georges Canguilhem could argue that 'the essential function of science is to devalue the qualities of objects that make up the milieu proper, by offering itself as a general theory of the real, that is to say nonhuman, milieu. Sensory data are disqualified, quantified, and identified.'[48] Whether this devaluation is inevitable or historically contingent remains open to debate. What is clear, however, is that the histories of climatology, epidemiology and seismology since the 1870s

[45] K. Anderson, *Predicting the Weather: Victorians and the Science of Meteorology* (Chicago: University of Chicago Press, 2005); L. Nash, *Inescapable Ecologies: A History of Environment, Disease, and Knowledge* (Berkeley: University of California Press, 2006).

[46] M. Davis, *Late Victorian Holocausts: El Niño Famines and the Making of the Third World* (New York: Verso, 2001), 19.

[47] C. B. Valencius, 'Histories of Medical Geography', *Medical History Supplement* 20 (2000), 3–28, and *The Health of the Country: How American Settlers Understood Themselves and Their Land* (New York: Basic Books, 2002).

[48] G. Canguilhem, 'The Living and Its Milieu', trans. J. Savage, *Grey Room* 3 (2001), 6–31, at 26.

all involve the construction of incommensurability between scientific expertise and common experience. Scientists no longer culled their evidence from survivors of disaster, and they no longer worried about the fit between their account and the public's. They tended to abandon field studies and to narrow their focus to non-human data – observatory-based instrumental measurements replaced eyewitness reports, laboratory germ cultures replaced victims' bodies. In this way, they eliminated the disaster itself from their field of study. Victims of natural disasters today have little hope of recognizing their own experiences in the models and theories of the environmental sciences.

III. Disaster Science in the Twentieth Century

As these natural scientists retreated to their laboratories and observatories in the early twentieth century, others began to step in to create a new social science of disaster. It was in the wake of the Second World War that this project gained momentum. In the United States, the National Research Council inaugurated a 'Committee on Disaster Studies' in 1952 (renamed the 'Disaster Research Group' in 1957), including members from the social sciences, law, engineering and medicine. In the absence of a history of this research, I will consider it here through the lens of the report published by members of the Disaster Research Group in 1962, *Man and Society in Disaster*.[49]

The goal of the new disaster science was to learn to predict and control social behavior in the event of a nuclear war by studying responses to natural disasters. 'Many of the physical effects of more common disasters are not unlike the physical effects we might expect from an atomic bombing.'[50] Despite the overlap in subject matter, however, *Man and Society in Disaster* marked a break with nineteenth-century studies of natural disasters. Indeed, it emphasized the distinctly twentieth-century origins of its research. The inspiration lay in 'the Depression of the early thirties and the Second World War, when the challenges to understand and control behavior during periods of extreme national and international stress were most urgent'.[51]

Reversing the move made by Kant in 1755, the new disaster scientists eliminated from their fields of view the physical phenomena responsible

[49] G. W. Baker and D. W. Chapman (eds.), *Man and Society in Disaster* (New York: Basic Books, 1962). For a participant history, see E. L. Quarantelli, 'Disaster Studies: An Analysis of the Social Historical Factors Affecting the Development of Research in the Area', *International Journal of Mass Emergencies and Disasters* 5 (1987), 285–310.

[50] Baker and Chapman, *Man and Society in Disaster*, 309. [51] Ibid., 407.

for the disaster; they would attend only to the human response. Indeed, they noted that their research did not even require the occurrence of a 'destructive event', since cases of 'hoaxes and false alarms' could serve their needs equally well. 'It is the perception of threat and not its actual existence that is important.'[52] By contrast, for nineteenth-century scientists, as we have seen, the study of the threat and of its perception could not be separated. *Man and Society* was thus described as 'a scientific report on the behavior of individuals and groups in response to stress'.[53] By ignoring the source of the stress, the new disaster science was able to apply the common Cold War analytical lenses of cybernetics, systems theory and information theory. The disaster itself was reduced to 'an increase in entropy'.[54]

In these senses, Cold War–era Disaster Studies was not a disaster science of the kind Hobbes had envisioned. It was not about identifying appropriate objects of fear, since the objects of fear were not in question. Either the 'stressors' were irrelevant or there was only one worth mentioning. As one reviewer of *Man and Society* reflected: 'Should a surviving historian chance upon a preserved copy of this book in the conceivable future, he may think it disastrous that in 1962 seventeen behavioral scientists had nothing to say about the gravest question of their times: How might international behavior have been controlled to *prevent* a nuclear disaster?'[55] In addition, the project was defined in such a way that it foreclosed discussion of the ways in which nuclear war would *not* resemble natural disasters. The research approach precluded acknowledging the rationality of fear of a nuclear war or discussing the means to avert one. The one and only task of this science was to learn to control fear. 'Every effort must be bent in the direction of modifying behavior *now* and increasing the tolerance for disruption *now* in order to reduce in some way the almost total disruption that would face an unprepared nation if the disaster were to occur.'[56] So it was that in 1962 disaster science adopted the model that has been misleadingly attributed to Hobbes, in which 'danger is whatever the state says it is.'

The new Disaster Studies was predicated on a new understanding of fear itself, one that had emerged in the early twentieth century, inspired by the ideas of Darwin and Freud.[57] Fear in this new sense was void of the moral and epistemic significance that Hobbes and his contemporaries

[52] Ibid., 30. [53] Ibid., vii. [54] Ibid., 117.
[55] N. J. Demarath, 'Review of *Man and Society in Disaster*', *Journal of Health and Human Behavior* 4 (1963), 220–222.
[56] Baker and Chapman, *Man and Society in Disaster*, 36–37.
[57] R. Leys, 'How Did Fear Become a Scientific Object and What Kind of Object Is It?', in Plamper and Lazier (eds.), *Fear across the Disciplines*, 51–77.

had attributed to it. It was an evolutionarily conditioned, physiologically defined and politically manipulable phenomenon. Fear no longer needed an object, as Hobbes had insisted; researchers now expected it to take the generalized form of 'anxiety'. The new Disaster Studies condemned fear as a poison to rational thought – even as it acknowledged an alternative interpretation. Thus the sociologist Pitirim Sorokin, author of the 1942 *Man and Society in Calamity*, described the mental effect of disasters as 'undulatory' – 'the general trend toward impairment of mental function being interrupted by intermittent flashes of enlightenment, penetrating and inspirational thought'.[58] Where nineteenth-century seismology had recognized fear as a form of knowledge about the world, Sorokin concluded that disasters deprive the mind of its 'requisite autonomy'. When the evidence contradicted their emotionless model of cognition, disaster sociologists ignored it.

More weight was placed on the role of the emotions in the chapter of the 1962 report titled 'The Psychological Effects of Warnings'. The author described an attitude that he termed 'vigilance', involving 'increased attentiveness to environmental events and readiness to take protective action in response to any cue perceived as indicating the onset of danger'. He theorized that vigilance was possible only with a high degree of 'ego development', which made it possible to 'bear the emotional tension that goes along with vigilance. Even many adults find it difficult to adopt a set of watchfulness, alertness, and readiness to take protective action in the face of known danger.'[59] Thus far, the account of vigilance echoes pre-twentieth-century notions of the path from fear to knowledge. In 1962, however, vigilance was no longer of interest as a condition under which ordinary citizens might produce scientific knowledge. Instead, it was regarded as a form of mass therapy. The author of the chapter on 'Disaster and Mental Health' called for a 'moral equivalent of disaster, which, like William James' moral equivalent of war, would provide a stimulating and unifying outer challenge without unfortunate side-effects such as the destruction of life and property. Certainly disaster encourages Freud's dual prescription for the healthy mental life: love and work.'[60] The new disaster sociology thus adopted the Freudian conception of emotions as the non-intentional expression of inner drives.[61] In this way, it voided fear of its epistemic and moral value and promoted it merely as an exercise in psychic self-regulation.

[58] P. A. Sorokin, *Man and Society in Calamity* (New York: E. P. Dutton, 1942), 36.
[59] Baker and Chapman, *Man and Society in Disaster*, 62. [60] Ibid., 132.
[61] Leys, 'How Did Fear Become a Scientific Object?'.

Where earlier scientists and philosophers had assumed that fear was the driving force behind the production of knowledge at a scene of disaster, the new disaster scientists argued instead that knowledge was motivated by a desire for 'environmental mastery':

> Perhaps the greatest ally in the attempt to promote effective handling of crisis is the general human propensity to strive for environmental mastery . . . The intense desire to perform capably, in the deepest sense to *know* one's environment, offers substantial theoretical help in assessing the reasons for good disaster performance.[62]

Knowledge was now equated with control – control of the self and of the environment. Oddly, there appears to be no emotional source of this 'intense desire' for control. The philosophical chain between fear and knowledge had been severed, and fear was no longer to be trusted as an indicator of hazard.

IV. Conclusion

The history of science shows that a scientific approach to disaster is compatible with a democratic and pluralistic method of identifying the appropriate objects and levels of fear. Only in the twentieth century did disaster science come to mean a top-down imposition of phobic norms. Twentieth-century disaster science broke with its predecessors by abstracting away the object of fear. Cold War–era social science analyzed human responses in isolation from what earlier scientists had termed the disaster 'in and for itself'. It thus paved the way for the framework of risk analysis that emerged in the late twentieth century and that still dominates thinking about natural disasters today.

Social scientists today theorize risk as a discourse unconstrained by the reality or unreality of 'hazards'. Paradigmatic for this trend was Mary Douglas and Aaron Wildavsky's *Risk and Culture: An Essay on the Selection of Technological and Environmental Dangers* (1983), which argued that 'public perception of risk and its acceptable levels are collective constructs, a bit like language and a bit like aesthetic judgment.' Douglas and Wildavsky acknowledged that their analysis would need to be supplemented by attention to the 'reality of physical dangers' and the 'conditions of knowledge', but insisted that the first was 'beyond our scope' and the second 'beyond our capacity'.[63] In the absence of such

[62] Baker and Chapman, *Man and Society in Disaster*, 131.
[63] M. Douglas and A. Wildavsky, *Risk and Culture: An Essay on the Selection of Technological and Environmental Dangers* (Berkeley: University of California Press, 1983), 186.

extensions, social scientists persist in analyzing environmental fear as a purely discursive phenomenon, isolated from the environment and from the production of environmental knowledge. In this vein, Nikolas Luhmann's influential systems-theoretical model of environmental politics assumes that the self-referentiality of risk discourse prevents a direct coupling between the social and natural 'systems'.[64]

It is only in these last few decades that the term 'hazard' has taken on its current meaning of an objective, 'natural' condition, in opposition to the human-centered concept of 'risk'. Yet etymology belies this overly neat distinction. The term 'hazard' derives from the French for a game of chance; it is thus by definition something that eludes our full knowledge and predictive abilities. It is an inherently expansive concept, pointing beyond material facts towards perceptions and possible courses of action. The concept of hazard singles out the perspective of the victim of an unpredictable world, not of a disinterested observer. Its etymological origins remind us that a hazard is a hazard not merely because of 'natural' conditions, but also because of a given state of knowledge and affect, a certain balance between certainty and uncertainty, between confidence and fear.

Therein lies a weakness of today's discourse on climate change. Those who label global warming a catastrophe stand accused of 'alarmism', both by critics who believe there is cause for alarm and by those who do not. The former critics contend that the rhetoric of catastrophe risks overwhelming the public with anxiety, thereby inflicting general paralysis. The skeptics, meanwhile, suspect an attempt to manipulate public fear in order to undermine capitalism. Both sides converge in their assumption that science should serve to eliminate fear, not provoke it. Why? There is no reason to expect that greater knowledge should produce a stronger sense of security.[65] Moreover, science sometimes serves us best when it delineates the scope of our ignorance, the limits of our predictive capacities. Despite the optimism of the Cold War sociology of disaster, comfort is not always to be found in 'the healthy exercise of rationality involved in submitting the inconceivably terrible to scientific scrutiny'.[66] In this vein, science can generate anxiety that successfully provokes public debate and political reform.

[64] N. Luhmann, *Soziologie des Risikos* (Berlin: De Gruyter, 1991).
[65] Daston, 'Life, Chance, and Life Chances', 14.
[66] M. Brewster Smith, 'Preface', *Journal of Social Issues* 10 (1954), 1, at 1, cited in J. Bourke, *Fear: A Cultural History* (Emeryville, CA: Shoemaker & Hoard, 2005), 283.