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The Songlines of Risk

SHEILA JASANOFF

John F. Kennedy School of Government
Harvard University
Cambridge, Massachusetts 02138, USA

ABSTRACT: Two decades of social and political analysis have helped to enrich the concept of *risk* that underlies the bulk of modern environmental regulation. Risk is no longer seen merely as the probability of harm arising from more or less determinable physical, biological or social causes. Instead, it seems more appropriate to view risk as the embodiment of deeply held cultural values and beliefs – the *songlines* of the paper's title – concerning such issues as agency, causation, and uncertainty. These values are incorporated into the formal methodologies, such as quantitative risk assessment, by which industrial societies assess risk. The meaning of risk accordingly varies from one cultural context to another, posing difficult problems for global environmental governance. The paper reflects on the role of science in promoting convergent perceptions of risk across disparate political cultures.

KEYWORDS: environmental risk, risk assessment, agency, causation, uncertainty

In the world's industrial nations, 'risk' has become *the* organising concept that gives meaning and direction to environmental regulation. The stated purpose of most environmental legislation today is to reduce the likelihood of harm from our myriad ingenious technological activities to levels that are either demonstrably safe, or – if safety is an unattainable goal – then at least to levels that can be shown to be reasonable. Agencies implementing environmental laws increasingly are required to justify their actions on the basis of risk assessment, often done in quantitative form; in turn, scientists are called upon to satisfy the regulators' needs with reliable methods of detecting, measuring, and representing risks to human health and the environment.

Although risk assessment in one form or another provides the cornerstone for much environmental regulation, it would be a mistake to think that either policymakers or technical experts can claim a complete monopoly on the concept of risk. In a time when Brent Spar, BSE (bovine spongiform encephalopathy or 'mad cow disease'), climate change, and the ozone hole have come to symbolise the tribulations of high-tech living, it is hardly possible for ordinary citizens to get along without their own working models of risk. Where do risks

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come from, who is to blame for them, and how can they be mastered, coped with, or altogether avoided? Just as, a century or so ago, the idea of *progress* helped to name an optimistic era, so today *risk*, by its very pervasiveness, seems to be the defining marker of our own less sanguine historical moment. European social theorists have taken the lead in arguing that the social circumstance which matters most in our intolerably jumbled modern condition is risk: all of us who inhabit the earth at the end of the 20th century – rich and poor, high and low, young and old – live equally in the embrace of the 'risk society' (Beck 1992).

Risk, at any rate, is impossible to ignore for anyone professionally concerned with the making and evaluation of environmental policy. Since the early 1970s, risk has been the focal point worldwide of countless legislative inquiries, guidance documents, court decisions, workshops, symposia, newspaper and television reports, and, of course, published articles and books. New journals, professional societies, research centres, and specialised university departments have been formed to enable systematic research and scholarly debate about risk. In the United States alone, more than a dozen studies of risk have been commissioned over the past fifteen years from the prestigious National Academy of Sciences. Through its policy arm, the National Research Council (NRC), the Academy has issued reports on particular sources of risk, such as pesticides (NRC 1987) or genetically modified organisms (NRC 1989), as well as on the practices and procedures of risk assessment (NRC 1983, 1994, 1996). The 1990 amendments to the U.S. Clean Air Act not only called for a technical review of risk assessment methods by the NRC, but also demanded that a joint presidential and congressional commission be formed to evaluate the conduct of risk assessment and risk management under federal environmental laws (Risk Commission 1997).

How much, then, can we claim to have learned from all this activity? What, in particular, have social scientists done to deepen our understanding of how risk functions in regulatory programmes or in societal relationships more broadly? And how might such work point the way toward more effective control of environmental hazards? In this paper, I would like first to offer a necessarily abbreviated overview of three major critical traditions that have emerged from the intensive social and political analysis of environmental risk. I will point out some of the strengths and weaknesses of these positions and show how they complement or extend one another. Much of the research I draw on for this purpose was based on national experiences with risk analysis and risk management, and to some extent on comparisons among national regulatory approaches. Yet, environmental hazards today have causes and consequences that often cut across national boundaries. These unruly problems strain the capacity of national and international decisionmakers to craft credible responses to risk. I will end with some reflections about the implications of social scientists' understandings of risk for the management of environmental hazards on a global scale.

RISK AND SOCIAL KNOWLEDGE

Social critiques of risk-based environmental regulation can usefully be separated into three strands that differ along two significant dimensions: first, in their theoretical stance with respect to the nature of environmental knowledge, and, second, in their prescriptions for linking knowledge to political action (Jasanoff 1998). The first of these positions, which has tended to dominate governmental and scientific discussions of risk, espouses a positivist (or realist) theory of knowledge and a bureaucratic-rationalistic policy orientation. Risk, for critics of this school, is a tangible by-product of actually occurring natural and social processes. It can be mapped and measured by knowledgeable experts, and, within limits, controlled. If ruling institutions fail to achieve this mission, it is chiefly because their knowledge and competence are unequal to the task or because they lack the political will to take unpalatable action.

A second line of explanation, grounded in the sociology of scientific knowledge, looks upon environmental knowledge as a social construct and proposes a liberal, and pluralistic, solution to the problem of meshing knowledge with action. Risks, according to this point of view, do not directly reflect natural reality but are refracted in every society through lenses shaped by history, politics, and culture. Faced with the same 'facts' about nature, Americans, for instance, fear cancer more than the British, the French tolerate nuclear power better than their German neighbours, and Americans are more receptive to biotechnology than Danes, Norwegians or Germans. In the light of such variations, the attempt to regulate risk solely on the basis of expert knowledge looks reductionist and conceptually inadequate. Constructivist analysis suggests that more attention needs to be paid to the connections between risk and culture, and it asks for increased negotiation and stakeholder engagement so that different perspectives on risk can be uncovered and accommodated. As we shall see, this approach has begun to gain ground in some recent, high-level U.S. proposals concerning risk and regulation.

The third, and in some ways most challenging, line of social analysis also takes its inspiration from constructivist theories of knowledge, but its focus is on the ways in which the concept of risk mediates between knowledge and power. Risk analysis, according to this approach, is first and foremost a specialised language and set of practices – in formal terms, a discourse (Foucault 1972) – that serves to channel power in society. The decision to frame environmental problems in terms of *risk*, for example, rules out other possible ways of talking about harms to human beings and the environment. Risk-talk implicitly empowers some people as experts and excludes others as inarticulate, irrelevant or incompetent (Winner 1986). Some examples may help to give these ideas greater concreteness.

The Theory of Bureaucratic Failure

Industrial accidents, policy stalemates, discoveries of latent health and environmental hazards, the spiralling costs of clean-up and prevention – such problems continually beset even the best-planned programs of environmental regulation, and no literate citizen in an industrial society can be wholly oblivious to them. As commonplace as the failures is the explanatory impulse that lays the blame on faulty institutions. Rational courses of action, according to realist critics of regulation, are usually discoverable through inquiry, but corruption, incapacity, incompetence, political pressure, or lack of will get in the way of satisfactory institutional performance.

In the United States, this position has perhaps been most forcefully and articulately championed by Justice Stephen Breyer, a distinguished federal judge and former administrative law professor whom President Clinton appointed to the Supreme Court. In a cycle of lectures delivered at Harvard University in 1992, Breyer blamed a three-fold pathology for the perceived failures of environmental regulation of the preceding decades. First, he said, agencies are guilty of 'tunnel vision', which has led them to regulate negligible risks at enormous social and political cost. Second, he criticised a random agenda-setting process which has been driven too much by irrational public fears and thus has skewed national priorities. Finally, he blamed political pressures and faulty institutional design for inconsistent results in environmental risk management.

Breyer's proposed solution flowed with admirable logic from his three premises. In brief, he wished to establish within the executive branch of the U.S. government 'a specific kind of group: mission oriented, seeking to bring a degree of uniformity and rationality to decision making in highly technical areas, with broad authority, somewhat independent, and with significant prestige. Such a group would make general and government-wide the rationalising efforts in which EPA [the U.S. Environmental Protection Agency] is currently engaged' (Breyer 1993: 61). This centralised risk assessment body would depend for its success on the traditional bureaucratic virtues of rationality, expertise, insulation, and authority.

Rationality was Breyer's *summum bonum*; he cited with dismay a well-known scatter diagram created by a team of American social psychologists (Slovic et al. 1985) to show that the public tends to elevate unknown and unfamiliar risks over more familiar ones – regardless of their actual statistical frequency. Breyer's urge to insulate rational analysis from mere superstition and public misunderstanding corresponded well with the prevailing doctrine of the 1980s that technical risk assessment should be cleanly separated from political risk management – a doctrine authoritatively set forth by the National Research Council (NRC 1983). The NRC proposed that risk decisions could be carried out in a linear, and largely non-intersecting, sequence of steps, from research to the assessment, characterisation, and management of risk.

The concept of an insulated 'superagency' for risk seemed to fly in the face of democratic politics and met with considerable public resistance. Breyer's answer was that democracies need authoritative decisions, and that public respect for government depends, 'in part, upon an organization's successful accomplishment of a mission that satisfies an important societal need. (Consider the rebound of confidence in the military during the 1980s)' (Breyer 1993: 63). Doing appointed public tasks well, Breyer argued, was central to creating a 'politics of trust'. After all, even a closed organisation like the military had been able to maintain public confidence through effective performance of its ordained mission. That people might differ in their assessments of success and failure in risk management – not to mention in their ideas of 'need' and 'mission' – seemed undreamt of in the judge's philosophy.

A closer look at the experiences of the Environmental Protection Agency, an organisation Breyer lauded, might have shaken the judge's confidence in closed expert decisions. By the early 1980s, repeated court challenges and ideologically motivated attacks had profoundly undermined EPA's hard-earned credibility. Scientific controversies, in particular, became so bitter that it became necessary to shore up the agency's claims to expertise with new forms of public accountability. True, EPA had to seek legitimation through layers of external scientific advice, but it could not do so without also increasing the transparency of the advisory process (Jasanoff 1992). Insulation, as EPA administrators learned over time, was not an especially successful formula for garnering public respect in the maelstrom of American politics.

Risk as a Social Construct

A very different view of why environmental risk management fails emerges from research on the social foundations of scientific knowledge. Studies of scientific controversies about risk have revealed the complex processes by which reliable knowledge about the environment is constructed. Consensus on such 'facts' as the risks of formaldehyde or DDT arises not from demonstrated deaths, disability or environmental damage, but from repeated confrontations among disparate scientific observations, their interpretation by experts and stakeholders, and the ingrained moral and social commitments of decisionmaking institutions (Jasanoff 1986; Johnson and Covello 1987; Irwin and Wynne 1996).

In democratic policy environments, the knowledge that environmental regulators would like to live by is always vulnerable to deconstruction – that is, to being pulled apart so that the underlying assumptions or value judgments are exposed to public review and criticism (Jasanoff 1986, 1987). Moreover, when environmental values are sharply divided, scientific information and expert discourses alone offer insufficient protection against the scepticism of people representing different social positions or interests. The degree to which scientists' assumptions are questioned or contested depends in large part on the ability

of relevant state institutions, such as courts, regulatory agencies, and expert advisory bodies, to set credible limits on the scope of technical debate. In cases where such boundary drawing proves ineffectual, experimental methods, instruments, models, interpretations, and even scientists' personal integrity may be relentlessly questioned by the media and the lay public – sometimes to the point where contested claims no longer support policy action. Environmental science, in this sense, bears within it the seeds of its own unmaking.

Faced with the prospect of endless controversy and deconstruction, policy institutions in some countries have accepted the need for early, possibly repeated, consultation with multiple viewpoints in the processes of environmental regulation (Power and McCarty 1998). We shall return below to two such proposals that have emerged from recent U.S. policy deliberations. These new approaches mark a step forward in acknowledging that technical analysis and political deliberation should not be placed in separate compartments, as suggested in the 1983 NRC study. Rather, these elements should be recoupled through appropriate institutional and procedural arrangements.

A Dangerous Discourse

It has been difficult enough for regulatory agencies to recognise that risks in the modern world do not flow deterministically from conditions fixed by nature. A realisation that is only gradually dawning on policy institutions is that even the dominant framings of environmental problems do not represent neutral readings of reality. A policy-shaping conceptual framework such as *risk* builds upon underlying social models of agency, causality, and responsibility. Such frames in turn are intellectually constraining in that they delimit the universe of scientific inquiry, political discourse, and possible policy options (Jasanoff and Wynne 1998).

How does our attitude toward regulatory failure change if we shift attention from bureaucratic incapacity and the socially constructed character of knowledge to the problem framings presupposed by risk analysis? What additional insights do we gain if we pause to ask how the techniques of risk assessment, especially of the formal, mathematical kind, deal with the uncertainties and indeterminacies of human interactions with the environment. What does the very choice of these methods tell us about the choosers' underlying social relationships and their views about the distribution of power and responsibility in society? And what alternative conceptions of the good society are given up or set aside when environmental policy is founded on widespread use of formal risk analysis?

To see how ideas about environmental risk may indeed encode tacit normative and political judgments, let us embark first on a slight literary detour. Bruce Chatwin, the famed travel writer and novelist, wrote an account of his journeys in Australia that was at the same time a brilliantly suggestive meditation on the

nature of reality and our perceptions of it. In *The Songlines*, Chatwin described the ancestral myth of the 'Dreamtime' among Australian aboriginals. This was the time in which 'each totemic ancestor, while travelling through the country, was thought to have scattered a trail of words and musical notes along the line of his footprints' (Chatwin 1988: 13). These 'Dreaming-tracks lay over the land as "ways" of communication between the most far-flung tribes'. They were not merely ways of communication, however, but also ways of constructing reality through particular modes of singing. In a marvellously evocative passage, Chatwin (1988: 14) interrogated his Russo-Australian friend and informant Arkady:

> Aboriginals could not believe the country existed until they could see and sing it – just as, in the Dreamtime, the country had not existed until the Ancestors sang it.
>
> 'So the land', I said, 'must first exist as a concept in the mind. Then it must be sung? Only then can it be said to exist?'
>
> 'True.'
>
> 'In other words, 'to exist' is 'to be perceived'?'
>
> 'Yes.'
>
> 'Sounds suspiciously like Bishop Berkeley's Refutation of Matter.'
>
> 'Or Pure Mind Buddhism', said Arkady, 'which also sees the world as an illusion.'

Formal risk assessment, I would like to propose, is the 'songline' of contemporary risk society's anxiety about its own technological achievements. Threats dimly conceived in the mind must be sung in this melody to exist and be perceived, as well as predicted and controlled. The commitment to risk assessment by both conservatives and liberals in American politics shows how deeply this particular form of analysis influences our very ability to think coherently about environmental harms. What are the distinctive elements of this songline? I want to dwell briefly on three: causation, agency, and uncertainty.

Causation. In the world of regulatory risk assessment, causation generally is viewed as a linear and mechanistic phenomenon. Asbestos causes cancer and dioxins cause birth defects in animals, but perhaps not in humans. The classical model of cancer risk assessment used by most U.S. federal regulatory agencies still conceives of risk as the result of individual or population exposure to single substances that are suspected of causing cancer. Regulators, of course, have learned over the years to add a lot of complexity to this causal picture. The old single-hit model of carcinogenesis has been replaced by one that views cancer more realistically as a multi-stage process; the new theory is mathematically expressed by differentiating, among others, the initiation stage from the stage of promotion. The notion that risk can be adequately represented as a single number has been largely discredited. We now recognise that risk is distributed over

populations of varying composition and susceptibility, exposed for variable lengths of time, and by multiple pathways (NRC 1994). Quantitative models have grown increasingly sophisticated in their ability to combine and manipulate all these discoveries about people's varying encounters with environmental threats. The numbers generated by risk assessment appear to be getting better, although they may also be getting harder for ordinary people to interpret.

But how accurately does this picture in fact represent the totality of what is known even about such relatively well understood risks as environmentally induced cancer? A closer look immediately reveals how partial and selective are some of the most up-to-date models of risk assessment. A focus on analysing particular substances, for example, may overlook the importance of others. The American biochemist Bruce Ames and his associates have argued for years that most industrial chemicals are of far less concern as health risks than identical or similar substances to which we are exposed by 'nature' through our diets (Ames et al. 1987). This work has attracted an ideological following and much controversy, but this should not keep us from acknowledging that Ames and others are trying to impose on risk assessment an alternative, and in some ways more comprehensive, picture of the chemical induction of cancer – one that does not treat all 'causes' as if they fall on the 'artificial', or industrially produced, side of human exposure to chemicals in the environment.

The work of Ames and his colleagues tends to exonerate many of the chemical bad actors that have occupied the regulatory process for twenty-five years. But, as environmental groups have been quick to point out (Tal 1997), adding 'natural' causes to our ideas of causation should not necessarily reduce concern about exposure to industrial pollution or chemical products. We need only note a few of the ways in which quantitative risk assessment models simplify the world so as to lower the regulators' overall perception of risk. The impact of multiple exposure routes and possible synergistic effects is rarely captured in routine risk assessments. Behavioural patterns that may aggravate risk for particular subpopulations (a well-known example is smoking among asbestos workers) are similarly downplayed or disregarded. Aggregated risk figures may ignore specially vulnerable groups, such as children or the elderly. Socio-economic factors that tend to concentrate risk from many sources for poor, minority, and disenfranchised populations are only now beginning to get a harder look under intensifying pressure from the environmental justice movement (Bullard 1993; Greenberg 1993). Only an impoverished notion of causation could keep us from recognising the legitimacy of such criticisms, even though they are difficult to incorporate into models of quantitative assessment.

Agency. A second issue that bears investigation in this connection is the conception of agency that underlies the songlines of risk assessment. Implicit in this mode of analysis is the notion that risk originates in the inanimate world, although human behaviour can exacerbate its intensity. That this is only a simplifying assumption tends to fade from view because imputing risk to

inanimate objects generally increases our sense of control and social order. It is easier, after all, to manage things than people, even when it is known that people are part of the problem. Thus, the U.S. gun lobby offers a complex understanding of agency through its bumper-grabbing slogan, 'Guns don't kill people, people kill people.' But as British regulators learned from the massacre of schoolchildren at Dunblane, it is the gun control advocates who have the advantage of simplicity: if guns are taken away, it no longer matters whether psychopaths or criminals can be effectively disciplined.

The gun lobby's troublesome sociological insight could be generalised just as readily to most of the environmental risks that we seek to characterise through mathematical modelling. Organisational sociologists have been writing for years about the complicated ways in which the physical and human elements of technological systems interact to produce risky conditions and periodic disasters (Turner 1978; Perrow 1984; Clarke 1989). More recently, the French sociologists Michel Callon and Bruno Latour have taken this reasoning even further, dissolving the perceived solidity of the boundary between animate and inanimate actors (Callon 1986; Latour 1992). For these analysts, any artifact, be it a door stop or a bicycle or a refrigerator filled with chlorofluorocarbons, is not simply a *thing* with hard and fast contours: it is a physically stabilised, congealed embodiment of an entire history of social assumptions, conventions, interests, and cultural practices. The stability of artifacts, moreover, may be contingent or illusory.

The force of such insights is most often recognised in the wake of major disasters. The Rogers Commission appointed to investigate the Challenger disaster in the United States provides an example. One Commission member, the late physicist Richard Feynman, caught the media headlines with his celebrated demonstration that a part used in the booster rocket, a rubber o-ring, froze at the temperature of freezing water (Gieryn and Figert 1990). The Commission as a whole, however, understood that blame could not be fixed on a malfunctioning inanimate object. People, too, were responsible for the disaster, because the decision to launch under suboptimal weather conditions had been, after all, a human act. The Commission ultimately blamed a management structure that failed to convey engineers' concerns to the uppermost reaches of political decisionmaking (Challenger Commission 1986).

Subsequent sociological analysis has shown that even this conclusion unduly simplified the relationship between humans and non-humans. In Diane Vaughan's (1996) painstaking reconstruction of the events, no single agent was necessarily to blame. Responsibility (if this is a useful term at all) was distributed up and down through a political and cultural system that kept each significant actor or group of actors unaware of the decision's full complexity, and hence ignorant of all the possible points at which such a delicately coupled technological system could fail. Yet, in the conduct of environmental risk assessment – the formal prediction of future harm – things are generally deemed risky or safe in and of

themselves. Whether for analytic simplicity or through deeper cultural conditioning, risk assessors seem to forget the permeability of the human and material spheres and the interchangeability of 'thing-causes' and 'people-causes'.

Uncertainty. My third observation about the Dreamtime that gave birth to environmental risk assessment has to do with the nature of uncertainty and social perceptions of it. Quantitative risk assessment has made great strides in the past ten years or so in its ability to conceptualise and mathematise uncertainty. This is an important and powerful method of organising what is known, what is merely surmised, and how sure people are about what they think they know. Quantified approaches can represent – often in very useful and understandable forms – the zones of uncertainty that should be most worrying when regulators attempt to manage risk.

Yet, these abstract and reductive techniques also give rise to some well-founded concerns. Social critics of modernity, such as the German sociologist Ulrich Beck (1992), have argued that modelling the world represents a form of domination and control that is deeply misleading; it is founded on the untenable premise that a perfectly objective, god's-eye view can be attained through scientific inquiry (see, for example, Ashley 1983). Others have suggested that the project of controlling nature by such means only induces alienation and apathy in those who are not prepared, for moral or historical reasons, to accept modernity's founding presumptions (Irwin and Wynne 1996; Jasanoff and Wynne 1998). But there are reasons to worry about risk assessment even if one does not reject outright the scientific management of nature.

Scepticism about the rationality of such analytic tools as quantitative risk assessment flows in part from cross-national, comparative, and historical research on the foundations of public policy (Jasanoff 1986; Porter 1995). What clearly emerges from these investigations is the socially embedded character of much that we do not know, as well as of much that we claim to know, about the interactions of nature and society. Uncertainty about the environment, in particular, increasingly appears as a very special form of politics. It is a social admission that there are things about our condition that we do not know (simple ignorance), but it is also an affirmation that we have the means and the will to find out more about those things that we label 'uncertain'.

Translating 'uncertainty' into formal quantitative language washes out the concept's cultural and political origins. To restore the cultural dimension, it is helpful to compare the discussion of uncertainty in different national settings. Let us consider for this purpose, two interesting and nearly contemporaneous papers about environmental uncertainty, the first by the British analysts Brian Wynne and Sue Mayer (1993), and the second by the American ecologist Simon Levin (1992), written when he was president of the Ecological Society of America. In their article, Wynne and Mayer challenged British scientists to be more open and humble in admitting their uncertainties about events in the natural world – to admit in effect that there are things that science does not have the

means to know. Levin, on the contrary, asked his fellow ecologists to be bolder about characterising uncertainty and thus to draw parts of the unknown back into the grasp of science. Only in this way, Levin argued, could his community of experts help ensure that decisions in the face of uncertainty would be made with 'proper scientific input'. The differences in these divergent expectations of science are not accidental. They reflect, in ways that are beyond the scope of this paper, longstanding cultural traditions about the appropriate way to legitimate political decisions in Britain and the United States (see, for example, Ezrahi 1990; Jasanoff 1986). The point to note for now is simply that there *is* a political dimension to ways of thinking about uncertainty; yet, experts and policymakers are seldom aware of the deep-seated political and cultural biases that may influence their approaches to grappling with the unknown.

RISK AND REGULATION IN GLOBAL PERSPECTIVE

How does the preceding discussion bear on the risks of global magnitude that are now confronting people on the earth: climate change, deforestation, marine pollution, loss of biodiversity, and new epidemics, to name just a few? I have tried to show thus far that risk concepts are not simply neutral descriptions of nature, but are culturally and politically conditioned ways of interpreting both our relationship to the world around us and our obligations to others on the planet. What conclusions can we draw from what we have learned about the socially embedded character of the risk concepts that are currently being deployed to deal with environmental debates at the international level?

There has been a tendency in elite decisionmaking circles to take for granted that science's planetary perspective on environmental risks will resonate in the same way with all people everywhere in the world. Globalisation, in this view, should present no special or different regulatory challenges from the ones we already know within national regulatory contexts. The chief difficulties that people foresee are those of developing the will and the technical capacity to implement potentially costly solutions to transnational problems (Skolnikoff 1993; Haas et al. 1994). At the cognitive level, many believe that the task of globalisation is already complete. Let me first document and then question these convictions – and, finally, come back to a possible way around the conflicts that I foresee.

The Fourth Discontinuity

Many people associate the birth of the modern environmental movement with the picture of earth suspended alone in space, as first seen by the Apollo astronauts. In the basic texts of modern environmentalism, author after author alludes to the transformative impact of this single image. Here is a typically

lyrical passage from the ecologist Daniel Botkin (1990: 5):

> It is more than 20 years since the phrase 'spaceship Earth' was coined and made popular and 20 years since the Apollo astronauts took this famous photograph of the Earth from space – a blue globe, enveloped by swirling white clouds, against a black background – creating an image of a small island of life floating in an ocean of empty space.

A remarkably similar point was made by the World Commission on Environment and Development (WCED) in its influential report, *Our Common Future*:

> In the middle of the 20th century, we saw our planet from space for the first time. Historians may eventually find that this vision had a greater impact on thought than did the Copernican revolution of the 16th century, which upset humans' self-image by revealing that the Earth is not the centre of the universe. From space, we see a small and fragile ball dominated not by human activity and edifice but by a pattern of clouds, oceans, greenery, and soils. Humanity's inability to fit its activities into that pattern is changing planetary systems fundamentally (WCED 1987: 308).

The idea of a 'scientific revolution' has never been far from the minds of those who commented on the Apollo picture. Laurence Tribe, a one-time critic of technology policy and later a constitutional scholar at Harvard Law School, noted the role of this image – 'the earth as a dramatically finite and surprisingly delicate blue-green globe' (Tribe 1973: 620) – in ushering us toward 'the fourth discontinuity'. This was a moment that displaced the human ego by making it conscious of the physical limitations of the place that it inhabits. This decentering effect, Tribe and others have said, was on a par with three great intellectual discontinuities of the past: the Copernican revolution, which displaced the earth from the centre of the universe; the Darwinian revolution, which displaced human beings from the pinnacle of the tree of creation; and the Freudian revolution, which exposed the workings of the unconscious mind and made humankind aware that we are not, after all, masters in our own house.

Continuing the theme of scientific revolutions, many environmentalists have suggested that the picture of our lonely planet brought about nothing less than a paradigm shift in ways of thinking about how the world works. Lynton Caldwell (1990: 21), an eminent environmentalist and policy analyst, is one exponent of this position:

> [T]he change from the belief that the sun, moon, and stars revolved around the earth to the Copernican view of the earth's place in the solar system was a paradigm shift. The change marked by [the aftermath of Apollo] is from the view of an earth unlimited in abundance and created for man's exclusive use to a concept of the earth as a domain of life or biosphere for which mankind is a temporary resident custodian … The newer view sees it as an ultimately unified system … that may supply man's needs as long as he observes the system's rules.

There is wide agreement, then, that Apollo confronted us with a unique historical moment – a moment defined by such radically new ways of seeing the earth that science was forced, in effect, to adopt a new environmental paradigm. Some have referred to this as the ecological epistemic paradigm, which stresses the interconnectedness of all of the earth's living and non-living systems (Haas 1990).

But the new paradigm raised many new questions and left some old problems profoundly unsettled. Chief among the uncertainties was the place of human beings in the biosphere. Hints of disagreement on this point can be found even in the passages quoted above. Take, for instance, from *Our Common Future* the observation that 'Humanity's inability to fit its activities into that pattern is changing planetary systems fundamentally.' Looking upon the earth's bounded periphery, the World Commission was apparently inclined to regard humanity as an unwanted disturbance in the balance of the biosphere. In contrast, Caldwell's designation of our species as a 'temporary resident custodian' grants more active agency to human beings, but imposes on them duties, increasingly recognised in the work of ethicists and international lawyers (Weiss 1989), to care for the inherited planetary system and to pass it on intact to future generations. These two views of humankind – interloper versus custodian – clearly imply very different moral obligations in relation to the biosphere. They point as well toward different kinds of limitations on the rights of human societies to use, alter, and manage the environment.

The scientific theory of ecological interconnectedness leaves unanswered some fundamental questions about what human beings are entitled to do with their environment. This is because the ecological paradigm focuses on the physical constraints of the biosphere without paying much attention to the economic, aesthetic, moral or spiritual dimensions of our relationship to the world around us.

There is another picture, somewhat less well-known than the Apollo image, that shows a night-time view of the earth's major population centres. It is one way – and a very compelling one – in which the ecological view of the biosphere has been visually represented. It was published some years ago in a special issue of *Scientific American* entitled 'Managing Planet Earth'. In his introductory essay for that volume, ecologist William Clark (1990: 1) of Harvard University explained the picture's significance in the following terms:

> The global pattern of lights created by today's civilisations is not unlike the pattern of exuberant growth that develops soon after bacteria are introduced to a nutrient-rich petri dish. In the limited world of the petri dish, such growth is not sustainable. Sooner or later, as the bacterial populations deplete available resources and submerge in their own wastes, their initial blossoming is replaced by stagnation or collapse.

This is a powerful analogy, and quite consistent with the premises of the ecological paradigm in emphasising the physical and biological limits on human

existence. But notice what the analogy does *not* explicitly talk about: it does not say whether it is better – *before* reaching the point of stagnation or collapse – to have the lights in clusters, as they currently are in the world's major industrial regions, or evenly divided all over the earth's surface; nor does it say whether the lights are any more or less threatening for environmental sustainability depending on how they have been powered – with natural gas, solar panels, windmills, or nuclear energy.

Seeing Things Globally

The notion of the 'fourth discontinuity' is founded ultimately on a view of risk and scientific discovery that looks suspiciously like Justice Breyer's. It assumes that reasonable people the world over will perceive environmental threats and challenges in the same way, especially if they are shown how to look at them by science. This perspective on risk and its scientific representation asserts itself with the confidence of a supreme artist. Just let science show people the truth, and they will acknowledge its power and agree to live by it. Vincent Van Gogh wrote with just such confidence to his beloved brother Theo about the pictures that he would not sell in his lifetime. His sunflower paintings in particular, Van Gogh imagined, captured the essence of these blossoms in a way that might change how others would see them. He wrote in this vein to Theo both while and after he was painting them:

> I have three canvases on hand: first, three huge flowers in a green vase, with a light background; the second, three flowers – one gone to seed, one in flower, and the third a bud, against a royal blue background. This has a 'halo'; that is, each object is surrounded by a glow of the complementary colour of the background against which it stands out. The third, twelve flowers and buds in a yellow vase. This last is, therefore, light on light, and I hope will be the best (Stone 1969: 379).

Later, he urged his brother to exhibit the paintings, saying that, while other artists might claim to have mastered other flowers, 'the sunflower is mine in a way' (Stone 1969: 407).

It is of course true that for many 20th-century citizens Van Gogh did forever transform the experience of seeing sunflowers, but the mistake is to think that this happened simply through the miracle of his painting. Even a little reflection brings to light the other ingredients in the story that had to come together in order for millions to appreciate Van Gogh's genius: his legendary lack of success in his lifetime, his madness and suicide (which resonated well with emerging modern myths of the alienated artist), his sister-in-law's careful tending of his memory, and the rise of a museum culture that brought these paintings to the masses. Nor should one forget that Van Gogh, for all his rebelliousness, was working within a culturally grounded painterly tradition that had taught artists to paint and people to see paintings in particular ways. His letters are full of

detailed technical commentary on his own work and that of his fellow artists. His obsession with paint, light, and colour shines through even in the short sunflower passage quoted above.

If it takes all this weight of history and tradition to make people appreciate great works of art in the same way, then what work will it take to forge a common vision of problems in the global environment? There is a disquieting answer to this question and it centres on the use of force. The critic and cultural historian Paul Fussell (1975) describes in his unforgettable account of the Great War how sunrise and sunset became for British soldiers in the trenches the emblems of nature, continually contrasted with the horrors and ironies of war. As Van Gogh was born into an active painterly tradition, so these young men from every class of society had been educated in a literary tradition that ran from Shakespeare to Ruskin and the Romantics. This tradition had given them a vocabulary for the expression of 'sky-awareness', itself a culturally transmitted taste among country-loving Britons. But it was the discipline of the trenches that fundamentally reshaped the soldiers', and eventually their whole culture's, experience of this aspect of nature.

It was one of the war's cruel reversals, according to Fussell (1975: 52), 'that sunrise and sunset, established by over a century of Romantic poetry and painting as the tokens of hope and peace and rural charm, should come to be exactly the moments of heightened ritual anxiety'. This was the time when enemy lines were most distinctly revealed to each other, the Germans in the morning and the British in the evening. Dawn, Fussell adds, 'never recovered from what the Great War did to it'; this once-peaceful time accumulated 'the new, modern associations of dawn: cold, the death of multitudes, insensate marching in files, battles, and corpses too shallowly interred' (Fussell 1975: 63). We recognise this as the dawn of 20th-century poets, from T.S. Eliot to Philip Larkin.

Fussell's story makes us quail anew before Justice Breyer's vision of bureaucratically rational risk assessment. Is centralised authority, aiming for military precision and control, really the way to override historical and cultural differences in the perception and management of environmental risk? Should regulators in fact emulate the military in order to gain the public's trust? Even if top-down authority disciplines multitudes of people into common ways of seeing hazards, will the resulting agreement be worth the costs entailed? Is there any other way forward?

Fortunately, a very different conception of the risk-based regulatory process has begun to emerge from recent studies by several significant policy institutions, including the U.S. National Academy of Sciences and the Presidential/ Congressional Commission on Risk Assessment and Risk Management (Power and McCarty 1998). Three aspects of the new approach are especially worth noting: (1) each study advocates the intertwining of analysis (science) with deliberation (politics) from the very earliest stages of the process; (2) both

emphasise feedbacks and recursion, so that initial problem frames can always be revisited and redrawn in the light of experience; and (3) both accept the idea that closure comes from the needs of decisionmaking, not from a search for ultimate scientific resolution. The older linear model of risk assessment/risk management has not been abandoned, but it is now part of an entirely more complex process, one that is cyclical and grounded in, not separate from, the rhythms of deliberative politics.

To conclude, then, I have suggested that the social sciences have deeply altered our understanding of what 'risk' means – from something real and physical if hard to measure, and accessible only to experts, to something constructed out of history and experience by experts and laypeople alike. Risk in this sense is culturally embedded and has texture and meaning that vary from one social grouping to another. Trying to assess risk is therefore necessarily a social and political exercise, even when the methods employed are the seemingly technical routines of quantitative risk assessment. Judgments about the nature and severity of environmental risk inevitably incorporate tacit understandings concerning causality, agency, and uncertainty, and these are by no means universally shared even in similarly situated western societies.

Against this background, it makes very little sense to regulate risk on the basis of centralised institutional authority, insulation from public demands, and claims to superior expertise. Environmental regulation calls for a more open-ended process, with multiple access points for dissenting views and unorthodox perspectives. Like science itself, any particular approach to understanding risk needs to acknowledge its own provisional status, in all humility, 'lest one good custom should corrupt the world' (Tennyson 1930: 327).

NOTE

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