

Chapter Four

RISKS: PERCEPTION AND REALITY

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Many intelligent people believe in the foolish notion known as Murphy's Law, which says that anything that can go wrong will go wrong. If this were true, the entire insurance sector would have disappeared long ago, and many other business sectors never would have gotten off the ground. Constant public harping on environmental threats caused one German expert to remark that some of the country's children are now living in exaggerated fear. He cited the example of a young boy who said that he paid regular visits to the doctor, who listened to his heart to determine whether he was still alive.

Concepts of risk and damage are at the core of the environmental discourse. How do we rank the risks confronting us? How can we assess future risks? How much do our fears affect our perception of specific hazards? Why is there strong disagreement on the dimensions and urgency of a particular risk? Mary Douglas and Aaron Wildavsky suggest that the perception of risk is determined culturally and socially: "*different people worry about different risks – war, pollution, employment, inflation.*" (1) One might also add 'at different times'.

There is much to be said for this hypothesis. It is generally accepted that beauty is in the eye of the beholder. Why should fear be different? If someone is afraid of household spiders, does that make the tiny creatures dangerous? If children are afraid of big bad wolves, what does that tell us? Nothing about risks, because wolves are near the bottom of the list of dangers to children in Western society. It tells us something about our culture, however, in which children are told frightening fairy tales.

The literature of risk communication substantiates the idea that actual risk often diverges dramatically from its perception. What is implied by the fact that different people, different societies, different nations seem to have very different perceptions of the same risk? Douglas and Wildavsky ask another significant question in their book, *Risk and Culture*: "*Are dangers really increasing or are we more afraid?*" (2) That such a fundamental question has to remain largely unanswered demonstrates how little we know.

Sources of Risk

Risks to ecosystems and human health originate in a variety of ‘point sources’ (concentrated or single-origin sources) and ‘non-point sources’ (dispersed risk originators). Risk arises, in varying degrees, from activities in spheres as diverse as industry, energy, transport, mining, agriculture, fishing, households and tourism. Government activities are another source of risk. Furthermore, some major risks are ‘natural’ in origin. The eruption of volcanoes may radically alter or wipe out ecosystems. Radon is also a good example. It is formed by the natural radioactive decay of uranium, and is colorless, odorless, tasteless and chemically inert. (3)

As the above list illustrates, almost all human activities present risks. Environmental damage is not the exclusive result of production activity. Serious direct damage also arises from the consumption end of the spectrum. This is also a source of indirect damage through the demand created for goods and services.

While industry is commonly seen as playing the leading role of ‘polluter’, even the most superficial analysis demonstrates that the share of general environmental risk attributable to this sector is not as great as the public has been led to believe.

The Greater Visibility of Industry

This skewed perception is mainly due to the much greater visibility of industry relative to the numerous, dispersed, small sources of pollution. This has been reinforced by the publicity and public outrage that have followed serious industrial environmental disasters. It is now being strengthened by the mass demonstrations against globalization whose targets include the ‘multi-nationals’.

When people think of mercury contamination of the environment, for example, they rarely consider the innumerable broken thermometers discarded by ordinary citizens every day. What comes to mind instead is the notorious Minimata case in the 1950s, in which people died after eating fish poisoned by industrial mercury emissions in Japan’s Minimata Bay.

This is not to say that industrial disasters are not serious and frightening. In 1976, the toxic chemical dioxin was accidentally released from a plant in Seveso in Northern Italy. It caused disfiguring skin disease in the

nearby community and contaminated many millions of square meters of land. Much worse was the incident in 1984, when another toxic chemical was accidentally released from a plant in Bhopal, India. More than 2,000 people were killed and over 100,000 were permanently disabled.

The Notoriety of Major Accidents

Another widely-publicized industrial accident with severe environmental consequences was the fire at the Schweizerhalle Works near Basel, Switzerland in October 1986. The overflow of water used to extinguish the fire caused considerable pollution of the Rhine with a variety of pesticides, some of which contained mercury. The high concentration of toxins in the river killed millions of fish.

In the energy sector, the 1986 explosion at the Chernobyl nuclear reactor and the 1989 Exxon Valdez oil spill have made a deep impression. Of the accidents mentioned, however, Schweizerhalle and Valdez did not lead to human injury and Seveso did not cause human death.

As a consequence of the notoriety surrounding such accidents, there is a deeply-held public perception that pollution, damage to the environment and risks are linked closely to industry's emission pipes, transport vehicles and waste sites. The transport sector is also criticized for the noise and air pollution caused by trucks, cars and airplanes, and oil spills by ships.

Non-industrial businesses also come in for their share of environmental criticism, however. Fast food restaurants and food retailers have been censured for the amount of packaging waste they generate. Nonetheless, the attention of environmentalists and the general public largely remains focused on industry.

One can never be sure where the next hazard will come from, even in environmentally-advanced countries. In 2000, a fireworks warehouse exploded in a residential neighborhood in the Dutch city of Enschede. Seventeen people were killed and the entire neighborhood was flattened. The ensuing public inquiry revealed a long list of shortcomings in supervision of the fireworks sector. The province had carried out a risk analysis a year before, and it was determined that there was a risk of no more than a large fire breaking out in the warehouse. The report thus recommended that the local fire department prepare a detailed contingency plan for such an eventuality. (4)

Non-Point Sources of Risk

Dreadful as they may be, accidental industrial emissions do not represent the greatest environmental risks. By way of comparison, consider indoor pollution, a significant, non-industrial environmental risk which receives relatively little attention in most countries. Health-threatening indoor pollution may be caused by such natural sources as radon emission, and by man-made substances. This may be typical of non-point pollution sources in that the low level of public concern it arouses does not reflect the true, relatively serious degree of risk that it poses. In the United States alone, natural radon is allegedly responsible for many thousands of cancer cases each year. (5)

Indoor air contamination from chemical exposure and airborne bacteria may also lead to many health problems. In the United States, and probably elsewhere as well, this kind of pollution causes a significant loss of worker time and productivity. The term ‘Sick Building Syndrome’ has been coined to describe this phenomenon. During one of my visits to the EPA in the mid-90’s, I was told that one of their own buildings was affected by this syndrome: sad but also ironic.

Indoor air is a mixture of chemicals and biological agents, only a small number of which has been identified. The complexity of all this is demonstrated by the fact that there are more than 4,000 chemical compounds in tobacco. (6)

Non-point sources of pollution are much more difficult to control than point sources. Despite the damage they cause to human health and the ecosystem, they receive much less attention than industrial pollution. A 1988 report by the Science Advisory Board of the EPA notes: “...*our strategy for reducing environmental and health risks must evolve in response to changing circumstances. For one thing, we are discovering environmental contamination in our homes – e.g., radon – and in the stratosphere – e.g. chlorofluorocarbons – that are not emitted by ‘pipes’ in the traditional sense.*”

“Some types of environmental contamination, such as runoff from farms and construction sites, are decentralized and therefore not amenable to Federal command-and-control solutions. And because so many new or residual environmental problems, such as indoor air pollution and ground-level ozone, are linked to thousands – if not millions – of small sources of pollution, traditional approaches to pollution control are not likely to be as effective in the future as they have been in the past.” (7)

Thus environmental improvement will not be obtained exclusively by further reducing the impact of industry on the environment. Progress with other sources must make a significant contribution in coming decades. There is no consensus yet, however, on the way in which this should be achieved.

Defining the Risks

What are the main environmental hazards and how can their relative importance be measured? Many of those suffering from noise pollution consider it much more important to spend money on solving this problem than on dealing with global warming. In 1987, the EPA carried out a comparative assessment of environmental problems. The 'universe of environmental problems' was divided into 31 problem areas, such as contaminants in drinking water, abandoned hazardous waste sites, and residues of pesticide on food. For each of these problem areas, four different types of risk were considered: cancer risks, non-cancer health risks, ecological effects and welfare effects. The latter included issues such as visible impairment of environmental quality – for example, due to littering.

None of the environmental problem categories analyzed ranked high with regard to all four risks. It is interesting that a number of human-health risks high on the EPA list ranked low in public concern. These included indoor air pollution, exposure to potentially harmful consumer products and radiation from non-nuclear power sources.(8) The less one hears about certain health hazards, the less politicians will fight to have substantial funding allocated to protect the public against the risks they may pose.

Since publishing this report, the EPA has tried to reorient its efforts toward higher risk categories, with some success. Nonetheless, there will always be a gap between scientists' perception of serious environmental risks and that of the general public. This worries experts, because it is a leading factor in the misdirection of both resources and efforts, and contributes further to the seemingly independent development of the rational and irrational routes in environmental policy.

Risk and Damage Assessment

Rigorous assessment of potential environmental risks is handicapped by a lack of well-developed methodologies; this means that current assessments are inaccurate and tend to be somewhat subjective. This

problem is not unique to environmental issues: quantification of serious risks in many other social fields is also difficult. This is evident, for example, with regard to political risks. The fall of the Iron Curtain, which originally appeared to signify a decline in risk, may turn out to have been a change in the nature of risk, from concentrated to fragmented.

The development and testing of better environmental risk assessment methodologies will take many years. The nature of the risks to be assessed covers a wide range, including ongoing industrial risks, episodic industrial risks, risks from old and abandoned waste sites, from agricultural runoff, from various natural sources, and from toxic and municipal waste. It is doubtful, however, whether easily applicable methodologies can actually be developed for analyzing the full range of these risks.

The ability to assess environmental damage in financial terms would also be useful. Very crude estimates of annual environmental damage have been drawn up, but much more work will be required in the future if we are to significantly improve our understanding of this matter.

The Outrage Factors

“The risks that kill you are not necessarily the risks that anger and frighten you.” This quotation from Prof. Peter Sandman of Rutgers University, an expert in risk communication, offers the essence of the risk perception problem. (9) A range of research shows that people have a demonstrably disproportionate fear of certain hazards, environmental or otherwise.

In the Western world, a person is statistically much more liable to die in an automobile accident than at the hands of a Jack the Ripper; yet the latter inspires exaggerated fear compared to the actual risk involved. Sometimes, indeed, such fear can become pathological.

This phenomenon is easier to understand if we accept the risk communicator’s approach that a perceived hazard has two components: ‘calculated risk’ and ‘outrage’. When a stunt pilot carries out a dangerous maneuver with his plane, he risks his life entirely by his own volition. He knows the risks he is taking. Other than his family and friends, few people are likely to be emotionally affected if he has an accident, provided he does not harm anybody else in the process. Similarly, a tourist may contract a tropical illness in the course of his travels. However severe the resulting health problems may be, they will evoke

less outrage than would someone's suffering from a bronchial problem attributable to toxic emissions from a nearby factory.

According to Sandman, scholars of risk perception have identified more than 20 'outrage factors'. A risk undertaken voluntarily, such as the risk of injury while skiing, is much more acceptable than a risk involving coercion, such as being pushed down a mountain slope.

Fairness, Morality, Memorability...

A perceived lack of fairness – i.e., incurring greater risks than one's neighbors without commensurate benefits – is another outrage factor. This helps explain why people oppose the establishment of nuclear power plants or incinerators in their own community, but might be willing to see them located elsewhere. The same may be true for jails or psychiatric institutions.

Morality is an additional outrage factor. "*American society*," suggests Sandman, "*has decided over the last two decades that pollution isn't just harmful – it's evil.*" Another outrage factor is memorability: "*A memorable accident – Love Canal, Bhopal, Times Beach – makes the risk easier to imagine and thus... more risky.*" Dread is also on the outrage list: "*Some illnesses are more dreaded than others, compare AIDS and cancer with, say, emphysema. The long latency of most cancers and the undetectability of most carcinogens add to the dread.*"

Highlighting two very different aspects of risk perception, one which can be calculated and another which is irrational and is expressed by anger, explains the problems industries face in communicating about their facilities with the general public, and particularly communities in the vicinity of their plants and factories. When a perceived risk involves a considerable outrage component, psychologists are usually much better equipped than engineers to engage local residents in a constructive dialogue. An engineer's linear approach to problems is unsuitable in the face of fears, worries and perceptions, as he often cannot understand that the perceived risk exists, not in the factory, but in the minds of his fellow citizens.

One example of the extent to which some industries are now willing to accommodate their neighbors' attitudes is an English factory which considers treating perception as important as removing real environmental problems. As this plant is situated close to a nature reserve, the management decided to invest considerable amounts of

funding not only in a reduction of marginal dust emissions, but also in the elimination of the water damp plume of their chimney. They knew that this steam was innocuous, but wished to be perceived by their neighbors as causing no visible emissions.

Perception and Reality

One implicitly assumes that people behave rationally in their daily lives, that problems are perceived for what they are and that people respond to them in a reasonable manner. In fact, we all behave irrationally at times, and our perceptions are frequently distorted, sometimes wildly so. Our tendency toward irrationality is clearly expressed in these distorted perceptions. At the beginning of the 16th century, Machiavelli identified this phenomenon, and wrote: *“Everyone sees what you appear to be, few experience what you really are.”* (10)

The divergence of perception and reality is universal, rather than limited to the environmental sphere. A few examples will suffice. No radical change in the economic situation or its prospects is necessary in order for stock exchange prices to plummet suddenly. It is often merely a matter of changed perceptions. ‘Perception is reality’, as they say on Wall Street. A market crash may cause an economic down-trend, rather than the reverse. Perception thus may also create reality.

Consider, too, the way in which Westerners perceive different kinds of political issues in countries remote from their own. They may get excited about the freeing of an incarcerated man halfway around the world; yet thousands of people dying of hunger or hundreds of people murdered for ideological reasons a few kilometers away from that man’s cell may evoke negligible interest.

Reality and perception interact until the subjective and objective worlds are fused, leading to confused policies. The – often ineffective – manner in which governments deal with environmental issues demonstrates the extent and influence of this phenomenon.

Risk Hierarchies

For a long time, environmental issues received a disproportionately small fraction of our attention; then the pendulum swung to the other extreme. Today, public perception is focused acutely on environmental risk, while other issues, involving perhaps even more danger to humanity, tend to be ignored. Malcolm Peltu, an English journalist specializing in risk

communication, offered the following list of activities in decreasing order of risk: (11)

1. Smoking 1.4 cigarettes
2. Drinking 0.5 liters of wine
3. Living two days in New York or Boston
4. Travelling ten miles by bicycle
5. Travelling 150 miles by car
6. Flying 6,000 miles by jet
7. Having one chest X-ray taken in a good hospital
8. Eating 40 tablespoons of peanut butter
9. Living within five miles of a nuclear reactor for 50 years

(An important clarification: with respect to the last item, the calculation is based on the presence of a Western nuclear reactor, not one in a former communist country.)

The literature of risk communication is full of such lists, but the public is not easily convinced. Risk hierarchies like Peltu's may be presented many times without any noticeable impact on audiences.

Sharks Versus Cars

Risk comparisons make little impact on the lay public. The best-selling Neapolitan author De Crescenzo, who writes about philosophy for the popular reader, quotes a mathematics teacher, Palumbo. He reproaches his daughter's friend for refusing to go swimming because she is afraid of sharks. There are, he insists, no sharks in Italian waters: *"Do you know anybody personally who has been bitten by a shark? If so, tell me his name. No. That proves that there are no sharks. I assume though that you know many people who have had car accidents. In Italy each year, 200,000 people are killed or wounded by them. That does not frighten you. You were not afraid to come by car from Rome to Positano. Now you come here and attack a poor animal which, unless you bring proof to the contrary, has never killed anybody. That is what I call not having a statistical mind..."*

"The shark is a movie, not a fact," cried Palumbo. *"The reality is that you have this shark in your mind, in the darkness of your subconscious, the same way as you have your nightmares and who knows what other stupidities."* (12)

Some day, people may be willing to consider the fact that Western nuclear reactors represent much less danger than travelling long distances by car; but as long as the public does not think so, government policy will continue to reflect perception. Thus, after the accident at Chernobyl, several European countries drastically scaled back or even abandoned their nuclear energy plans. As a consequence, many countries in the West now tend to marginalize a form of energy which does not add to the greenhouse effect.

This policy will lead to the burning of more fossil fuels, resulting in larger emissions of the greenhouse gas, carbon dioxide. According to mainstream scientific opinion, this will cause further global warming in the coming decades. Many people may be frightened by the perceived risks of global warming, but they are apparently even more frightened by their perception of the risks of nuclear energy. The pros and cons of nuclear energy represent one of the toughest practical issues in environmental public policy. We are trading one set of risks for another with few hard facts on which to base our decision.

This is highly unsatisfactory. Awareness of the dilemma is the beginning of a long, difficult, but necessary process, a first step on the path to dealing with risks more rationally. However emotional we may be about the environment, dealing rationally with environmental issues is the only way to progress.

- (1) Mary Douglas and Aaron Wildavsky, *Risk and Culture*. Los Angeles: University of California Press, 1983.
- (2) *Ibid.*
- (3) See the web site of the Environmental Health Center: www.nsc.org/ehc/radon.htm
- (4) *De Volkskrant*, May 18, 2000. [Dutch]
- (5) See: Sheldon Krimsky and Alonzo Plough, *Environmental Hazards*. Dover, Mass.: Auburn House, 1988, p. 130.
- (6) *EPA Journal*, October-November 1993.
- (7) U.S. Environmental Protection Agency, *Future Risk: Research Strategies for the 1990s*. 1988.
- (8) *Unfinished Business: A Comparative Assessment of Environmental Problems*. U.S. EPA, Volume 1, 1987.
- (9) Peter M. Sandman, *Risk Communication: Facing Public Outrage*. *EPA Journal*, November, 1987.
- (10) Niccolo Machiavelli, *The Prince*, Penguin Classics.
- (11) Lecture at international convention of Italian Republican Party, "Environment, Another Challenge to Industry". Rome, April, 1990.
- (12) Luciano De Crescenzo, *Storia della Filosofia Greca: Da Socrate in Poi*. Milan: Arnaldo Mondadori, 1986, p. 145. [Italian]