Human and Ecological Risk Assessment, 9: 1–10, 2003
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ISSN: 1080-7039 print
DOI: 10.1080/10807030390240382

Going Beyond the Red Book: The Sociopolitics of Risk

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ABSTRACT

The National Research Council's study *Risk Assessment in the Federal Government: Managing the Process*, known as the "Red Book," that produced the Red Book in 1983 sought "institutional mechanisms that best foster a constructive partnership between science and government" for informing contentious public decisions about hazards from exposure to toxic substances. More than a decade later, a new National Research Council committee was formed to reexamine the process of risk characterization, which played a central role in the framework developed in the Red Book. In seeking to understand why risk management often breaks down at the stage of risk characterization, this new committee broadened the charge to improve risk characterization in ways that better inform decision-making and resolution of controversies over risk. This led to a report (*Understanding Risk: Informing Decisions in a Democratic Society*) that carefully examined social, behavioral, economic, and ethical aspects of risk that were not made explicit in the Red Book. This paper will describe some of the research that led to a greater recognition of the importance of these "sociopolitical" factors and their implications for designing an analytic-deliberative process that informs decision-making and improves the ability of interested and affected parties to participate in the decision process.

Key Words: risk assessment, Red Book, risk perception, EPA, risk management, National Research Council, understanding risk.

INTRODUCTION: THE RISK ASSESSMENT BATTLEFIELD

The practice of risk assessment has steadily increased in prominence, as risk managers in government and industry have sought to develop more effective ways to meet public demands for a safer and healthier environment. Dozens of scientific disciplines have been mobilized to provide technical information about risk, and billions of dollars have been expended to create this information and distill it in the context of risk assessments structured according to the framework presented in the National Research Council's (NRC's) report *Risk Assessment in the Federal Government: Managing the Process* (NAS 1983), called the "Red Book" because of its vivid red cover.

Ironically, as our society and other industrialized nations have expended this great effort to make life safer and healthier, many in the public have become more, rather than less, concerned about risk. These individuals see themselves as

exposed to more serious risks than were faced by people in the past, and they believe that this situation is getting worse rather than better. Nuclear and chemical technologies (except for medicines) have been stigmatized by being perceived as entailing unnaturally great risks (Gregory *et al.* 1995). As a result, it has been difficult, if not impossible, to find host sites for disposing of high-level or low-level radioactive wastes, or for incinerators, landfills, and other chemical facilities. Nonmedical applications of biotechnologies have engendered similar concerns and opposition.

Public perceptions of risk have been found to play an important role in determining the priorities and legislative agendas of regulatory bodies, much to the distress of technical experts who argue that hazards other than those the public fears most deserve higher priority.

Great disparities in monetary expenditures designed to prolong life may also be traced to public perceptions of risk. As noteworthy as the large sums of money devoted to preventing a statistical fatality from exposure to radiation and chemical toxins are the relatively small sums expended to prevent a fatality from mundane hazards such as automobile accidents. Other studies have shown that serious risks from national disasters such as floods, hurricanes, and earthquakes generate relatively little public concern and demand for protection (Palm 1995; Kunreuther, in press).

Such discrepancies are seen as irrational by many harsh critics of public perceptions. These critics draw a sharp dichotomy between the experts and the public. Experts are seen as purveying risk assessments, characterized as objective, analytic, wise, and rational—based upon the *real risks*. In contrast, the public is seen to rely upon *perceptions of risk* that are subjective, often hypothetical, foolish, and irrational (see, *e.g.*, DuPont 1980 or Cohen 1983). Weiner (1993) defends the dichotomy, arguing that "This separation of reality and perception is pervasive in a technically sophisticated society, and serves to achieve a necessary emotional distance. . . " (P 495).

In sum, polarized views, controversy, and overt conflict are common within risk assessment and risk management. This is not a surprise to the authors of the Red Book who distinctly observed that ". . . improvements in risk assessment methods cannot be assumed to eliminate controversy over . . . risk management decisions" (NRC 1983; P 48).

Research during the past two decades has helped us appreciate that dissatisfaction with risk assessment and risk management can be traced, in part, to a failure to appreciate the complex and socially determined nature of the concept "risk." In the remainder of this paper, I shall briefly illustrate this complexity, which has pointed out the need for new definitions of risk and new approaches to risk characterization and risk management.

THE NEED FOR A NEW PERSPECTIVE

New perspectives and new approaches are needed to manage risks effectively in our society. Social science research has provided some valuable insights into the nature of the problem that have indicated some promising prescriptive actions. For

example, early studies of risk perception demonstrated that the public's concerns could not simply be blamed on ignorance or irrationality. Instead, research has shown that many of the public's reactions to risk can be attributed to a sensitivity to technical, social, and psychological qualities of hazards that are not well-modeled in technical risk assessments (*e.g.*, qualities such as uncertainty in risk assessments, perceived inequity in the distribution of risks and benefits, and aversion to being exposed to risks that are involuntary, not under one's control, or dreaded). The important role of social values in risk perception and risk acceptance has thus become apparent (Slovic 1987).

More recently, another important aspect of the risk-perception problem has come to be recognized. This is the role of trust. In recent years there have been numerous books, articles and surveys pointing out the importance of trust in risk management and documenting the extreme distrust we now have in many of the individuals, industries, and institutions responsible for risk management (Cvetkovich and Löfstedt 1999; Cvetkovich *et al.* 2002; Earle and Cvetkovich 1995; Freudenburg 1993; Frewer *et al.* 1996; Slovic 1993). This pervasive distrust has also been shown to be strongly linked to the perception that risks are unacceptably high and to political activism to reduce those risks.

A third insight pertains to the very nature of the concept "risk." Current approaches to risk assessment and risk management are based upon the traditional view of risk as some objective function of probability (uncertainty) and adverse consequences. Social scientists have argued for a conception of risk that is starkly different from this traditional view. This new approach highlights the subjective and value-laden nature of risk and conceptualizes the act of defining and assessing risk as a game in which the rules must be socially negotiated within the context of a specific problem.

THE SUBJECTIVE AND VALUE-LADEN NATURE OF RISK ASSESSMENT

Attempts to manage risk must confront the question: "What is risk?" The dominant conception views risk as "the chance of injury, damage, or loss" (Webster 1983). The probabilities and consequences of adverse events are assumed to be produced by physical and natural processes in ways that can be objectively quantified by risk assessment. Much social science analysis rejects this notion, arguing instead that risk is inherently subjective (Funtowicz and Ravetz 1992; Krimsky and Golding 1992; Otway 1992; Pidgeon *et al.* 1992; Slovic 1992; Wynne 1992). In this view, risk does not exist "out there," independent of our minds and cultures, waiting to be measured. Instead, human beings have invented the concept risk to help them understand and cope with the dangers and uncertainties of life. Although these dangers are real, there is no such thing as "real risk" or "objective risk." The nuclear engineer's probabilistic risk estimate for a nuclear accident or the toxicologist's quantitative estimate of a chemical's carcinogenic risk are both based on theoretical models, whose structure is subjective and assumption-laden, and whose inputs are dependent on judgment. As we shall see, nonscientists have their own models, assumptions, and subjective assessment techniques (intuitive risk assessments), which are sometimes very different from the scientists' models.

Table 1. Some ways of expressing mortality risks.

- Deaths per million people in the population
- Deaths per million people within **x** miles of the source of exposure
- Deaths per unit of concentration
- Deaths per facility
- Deaths per ton of air toxic released
- Deaths per ton of air toxic absorbed by people
- Deaths per ton of chemical produced
- Deaths per million dollars of product produced
- Loss of life expectancy associated with exposure to the hazard

One way in which subjectivity permeates risk assessments is in the dependence of such assessments on judgments at every stage of the process, from the initial structuring of a risk problem to deciding which endpoints or consequences to include in the analysis, identifying and estimating exposures, choosing dose-response relationships, and so on.

For example, even the apparently simple task of choosing a risk measure for a well-defined endpoint such as human fatalities is surprisingly complex and judgmental. A few of the many different ways that fatality risks can be measured are shown in Table 1. How should we decide which measure to use when planning a risk assessment, recognizing that the choice is likely to make a big difference in how the risk is perceived and evaluated?

An example taken from Wilson and Crouch (1982) demonstrates how the choice of one measure or another can make a technology look either more or less risky. For example, between 1950 and 1970, coal mines became much less risky in terms of deaths from accidents per ton of coal, but they became marginally riskier in terms of deaths from accidents per employee. Which measure one thinks more appropriate for decision-making depends on one's point of view. From a national point of view, given that a certain amount of coal has to be obtained, deaths per million tons of coal is the more appropriate measure of risk, whereas from a labor leader's point of view, deaths per thousand persons employed may be more relevant.

Each way of summarizing deaths embodies its own set of values (NRC 1996). For example, "reduction in life expectancy" treats deaths of young people as more important than deaths of older people, who have less life expectancy to lose. Simply counting fatalities treats deaths of the old and young as equivalent; it also treats as equivalent deaths that come immediately after mishaps and deaths that follow painful and debilitating disease or long periods during which many who will not suffer disease live in daily fear of that outcome. Using "number of deaths" as the summary indicator of risk implies that it is as important to prevent deaths of people who engage in an activity by choice and deaths of those who have been benefiting from a risky activity or technology as to protect those who get no benefit from it. One can easily imagine a range of arguments to justify different kinds of unequal weightings for different kinds of deaths, but to arrive at any selection requires a value judgment concerning which deaths one considers most undesirable. To treat the deaths as equal also involves a value judgment.

Framing the Risk Information

After a risk analysis has "negotiated," all the subjective steps of defining the problem and its options, selecting and measuring risks in terms of particular outcomes, determining the people at risk and their exposure parameters, and so on, one comes to the presentation of this information to the decision maker, often referred to as "framing." This process of presentation is also rife with subjectivity.

Numerous research studies have demonstrated that different (but logically equivalent) ways of presenting the same risk information can lead to different evaluations and decisions. One dramatic example of this comes from a study by McNeil *et al.* (1982), who asked people to imagine that they had lung cancer and had to choose between two therapies, surgery or radiation. The two therapies were described in some detail. Then one group of subjects was presented with the cumulative probabilities of surviving for varying lengths of time after the treatment. A second group of subjects received the same cumulative probabilities framed in terms of dying rather than surviving (*e.g.*, instead of being told that 68% of those having surgery will have survived after one year, they were told that 32% will have died). Framing the statistics in terms of dying changed the percentage of subjects choosing radiation therapy over surgery from 18% to 44%. The effect was as strong for physicians as for laypersons.

Equally striking changes in preference result from framing the information about consequences in terms of either lives saved or lives lost (Tversky and Kahneman 1981) or from describing an improvement in a river's water quality as a *restoration* of lost quality or an *improvement* from the current level (Gregory *et al.* 1993).

We now know that every form of presenting risk information is a frame that has a strong influence on the decision maker. Moreover, when we contemplate the equivalency of lives saved vs. lives lost, mortality rates vs. survival rates, restoring lost water quality vs. improving water quality, and so forth, we see that there are often no "right frames" or "wrong frames"—just "different frames."

The Multidimensionality of Risk

As noted above, research has also shown that the public has a broad conception of risk, qualitative and complex, that incorporates considerations such as uncertainty, dread, catastrophic potential, controllability, equity, risk to future generations, and so forth, into the risk equation. In contrast, experts' perceptions of risk are not closely related to these dimensions or the characteristics that underlie them. Instead, studies show that experts tend to see riskiness as synonymous with expected mortality, consistent with the dictionary definition given above and consistent with the ways that risks tend to be characterized in risk assessments (see, *e.g.*, Cohen 1985). As a result of these different perspectives, many conflicts over "risk" may result from experts and laypeople having different definitions of the concept. In this light, it is not surprising that expert recitations of "risk statistics" often do little to change people's attitudes and perceptions.

There are legitimate, value-laden issues underlying the multiple dimensions of public risk perceptions, and these values need to be considered in risk-policy decisions. For example, is risk from cancer (a dread disease) worse than risk from auto accidents (not dreaded)? Is a risk imposed on a child more serious than a known risk accepted voluntarily by an adult? Are the deaths of 50 passengers in separate

automobile accidents equivalent to the deaths of 50 passengers in one airplane crash? Is the risk from a polluted Superfund site worse if the site is located in a neighborhood that has a number of other hazardous facilities nearby? The difficult questions multiply when outcomes other than human health and safety are considered.

The Risk Game

The multidimensional, subjective, value-laden, frame-sensitive nature of risky decisions, as described above, supports a view which Thompson and Dean (1996) call "the contextualist conception" of risk. This conception places probabilities and consequences on the list of relevant risk attributes along with voluntariness, equity, and other important contextual parameters. On the contextualist view, the concept of risk is like the concept of a game. Games have time limits, rules of play, opponents, criteria for winning or losing, and so on, but none of these attributes is essential to the concept of a game, nor is any of them characteristic of all games. Similarly, a contextualist view of risk assumes that risks are characterized by some combination of attributes such as voluntariness, probability, intentionality, equity, and so on, but that no one of these attributes is essential. The bottom line is that, just as there is no universal set of rules for games, there is no universal set of characteristics for describing risk. The characterization must depend on which risk game is being played.

RESOLVING RISK CONFLICTS

Technical Solutions to Risk Conflicts

There has been no shortage of high-level attention given to the risk conflicts described in the introduction to this paper. One prominent proposal by Supreme Court Justice Stephen Breyer (1993) attempts to break what he sees as a vicious circle of public perception, congressional overreaction, and conservative regulation that leads to obsessive and costly preoccupation with reducing negligible risks as well as to inconsistent standards among health and safety programs. Breyer sees public misperceptions of risk and low levels of mathematical understanding at the core of excessive regulatory response. His proposed solution is to create a small centralized administrative group charged with creating uniformity and rationality in highly technical areas of risk management. This group would be staffed by civil servants with experience in health and environmental agencies, Congress, and the White House's Office of Management and Budget (OMB). A parallel is drawn between this group and the prestigious Conseil d'Etat in France.

Similar frustration with the costs of meeting public demands has led Congress to repeatedly introduce bills designed to require all major new regulations to be justified by extensive risk assessments. Proponents of this legislation argue that such measures are necessary to ensure that regulations are based upon "sound science" and effectively reduce significant risks at reasonable costs.

The language of this proposed legislation typically reflects a narrow view of risk and risk assessment. A proposal drafted for the 104th Congress advocated risk assessment based "...only on the best reasonably available scientific data and scientific understanding ..." Agencies are further directed to develop a systematic program

for external peer review using "expert bodies" or "other devices comprised of participants selected on the basis of their expertise relevant to the sciences involved... (U.S. Senate 1995). Public participation in this process was recommended, but no mechanisms for this were specified. Similar proposals have been presented to the 105th, 106th, and 107th Congresses (Schierow 2003). For example, S.746 as reported in the 106th Congress would have required scientists to consider all relevant scientific data and perform an "objective" assessment of risk. H.R. 2694 put before the 107th Congress contained a section requiring quantitative risk assessment, cost assessment, and comparative risk assessment for each proposed or final regulation relating to public health and safety or the environment.

The proposals by Breyer and several recent sessions of Congress are typical in their call for more and better technical analysis and expert oversight to rationalize risk management. There is no doubt that technical analysis is vital for making risk decisions better informed, more consistent, and more accountable. However, value conflicts and pervasive distrust in risk management cannot easily be reduced by technical analysis. Trying to address risk controversies primarily with more science is, in fact, likely to exacerbate conflict.

Process-Oriented Solutions

A major objective of this paper has been to demonstrate the complexity of risk and its assessment. To summarize the earlier discussions, danger is real, but risk is socially constructed. Risk assessment is inherently subjective and represents a blending of science and judgment with important psychological, social, cultural, and political factors. This complexity leads to a "contextualist view" in which risk is conceptualized as a game whose rules must be socially negotiated within the context of specific decision problems.

Whoever controls the definition of risk (*i.e.*, determines the rules of the risk game) controls the rational solution to the problem at hand. If you define risk one way, then one option will rise to the top as the most cost-effective or the safest or the best. If you define it another way, perhaps incorporating qualitative characteristics and other contextual factors, you will likely get a different ordering of your action solutions (Fischhoff *et al.* 1984). Defining risk is thus an exercise in power.

The limitations of risk science, the importance and difficulty of maintaining trust, and the subjective and contextual nature of the risk game point to the need for a new approach—one that focuses upon introducing more public participation into both risk assessment and risk decision-making in order to make the decision process more democratic, improve the relevance and quality of technical analysis, and increase the legitimacy and public acceptance of the resulting decisions. Work by scholars and practitioners in Europe and North America has begun to lay the foundations for improved methods of public participation within deliberative decision processes that include negotiation, mediation, oversight committees, and other forms of public involvement (English 1992; Kunreuther *et al.* 1993; Renn *et al.* 1991, 1995).

This need for a new approach has been clearly recognized by several high-level committees formed in recent years to examine risk assessment practices. The study that produced the Red Book in 1983 sought "institutional mechanisms that best foster a constructive partnership between science and government" for informing

contentious public decisions about hazards from exposure to toxic substances. More than a decade later, a new National Academy of Sciences/National Research Council committee was formed to reexamine the process of risk characterization, which played a central role in the framework developed in the Red Book. In seeking to understand why risk management often breaks down at the stage of risk characterization, this new committee broadened the charge to improve risk characterization in ways that better inform decision-making and resolution of controversies over risk. This led to a report (*Understanding Risk: Informing Decisions in a Democratic Society* [NRC 1996]) that carefully examined social, behavioral, economic, and ethical aspects of risk that were not made explicit in the Red Book, including many of the concepts and ideas described in the present essay. The Committee concluded that risk characterization should be performed as part of an iterative analytic-deliberative process designed to inform risk management decision-making. According to the Committee, each step of the process should have an appropriately diverse participation or representation of the spectrum of interested and affected parties, decision makers, and specialists in risk analysis.

The Understanding Risk report (NRC 1996) was soon followed by the report of the Presidential/Congressional Commission on Risk Assessment and Risk Management (Presidential Commission 1997), which came to similar conclusions. The Commission proposed a six-stage framework to guide risk-management decision-making that puts stakeholders in the center of the process. As noted by Charnley and Elliott (2002), "The Risk Commission believed that stakeholder collaboration is important because there are many conflicting interpretations about the nature and significance of risk, and collaboration provides opportunities to bridge gaps in understanding, language, values, and perceptions. Stakeholders bring to the table important information, knowledge, expertise, and insights for crafting workable solutions and are more likely to accept and implement a risk management decision they have participated in shaping"(P 1403).

Involvement of a wider range of people and their perspectives and values in risk decision-making processes has also been advocated by the EPA's Science Advisory Board, which urged the Agency to make clear the role of societal (public) values in deciding what to protect (see Schierow 2003).

CONCLUSION

The 20 years following the publication of the Red Book have seen increasing recognition of the complex, sociopolitical nature of risk, and the need to include interested and affected citizens as legitimate partners in the exercise of risk assessment. Serious attention to participation and process issues is no short-term panacea, but may, in the long run, lead to more satisfying and successful ways to manage risk.

ACKNOWLEDGMENT

Preparation of this paper was supported in part by the National Science Foundation under Grant Nos. SES-0241313 and SES-0112158.

This paper contains material adapted from two sources: (1) Kunreuther H. and Slovic P. 1996. Science, values, and risk. Annals Am Acad Political Social Sci 545:116–125. (2) Slovic P. 1997. Trust, emotion, sex, politics, and science: Surveying the risk-assessment battlefield. In: Bazerman M *et al.* (eds.), Environment, Ethics, and Behavior, pp 277–313. New Lexington, San Francisco, CA, USA.

Assistance from David Clarke in locating material on recent congressional activities is gratefully acknowledged.

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