

Public Values in Risk Research

By BARUCH FISCHHOFF

ABSTRACT: Risk research is a complex social enterprise, reflecting the beliefs and values of those closest to its creation. For public values to be expressed in risk research, the public needs the same access as those who conduct and directly sponsor that research. Providing that access requires more open research management and more responsive research methods.

Baruch Fischhoff is professor of social and decision sciences and of engineering and public policy at Carnegie Mellon University. He is a member of the Institute of Medicine of the National Academy of Sciences, past president of the Society for Judgment and Decision Making, and a fellow of the Society for Risk Analysis and of the American Psychological Association.

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SCIENCE is often justified by its contribution to the common good. At times, that contribution is presented as a matter of faith. Society is said to be a better place for having this kind of activity in its midst, much as it benefits from having clerics say prayers on its behalf. For example, science may be valued for providing a haven for free inquiry, regardless of the topics it pursues and the results it produces. Science may also be valued for fostering a sense of wonder and a connection with issues beyond our mundane existence. In this view, science's contribution to society may be greatest when it addresses impractical and slowly resolved topics, like the origins of the universe and of our species within it.

Most science, though, is justified on more practical grounds. Scientists argue that their work helps other people improve their lot in life. These claims have been effective enough that most industrialized countries devote a significant portion of their gross domestic product to research, with most of these funds being tied to solving specific problems. In the United States, the federal research budget is some \$70-80 billion, predominantly distributed by mission-oriented agencies.¹ Even more government support comes indirectly, through laws encouraging research, such as tax credits for industrial research, nonprofit status for universities, and patent and copyright protection for inventors.

Risk research is justified overwhelmingly by its practicality. The

1. National Research Council, *Criteria for Federal Research and Development* (Washington, DC: National Academy Press, 1995).

present volume shows that pure intellectual satisfaction can be derived from pondering mortality through this unusual lens. This taste is not widely shared, however. Moreover, pure risk science would be hard to support financially. Established disciplines often have dedicated funding streams—such as named National Science Foundation programs—allowing some freedom for curiosity-driven research. Newer disciplines typically secure funds by claiming to be useful. In their fund-raising, risk researchers promise to improve the estimation, evaluation, communication, and management of risks.

This article considers how values are expressed in the conduct and communication of risk research. It ends with a set of conditions that risk researchers should satisfy in order to secure public trust; these conditions are modeled on the conditions that researchers typically provide for their colleagues and sponsors. Achieving them will require both good research and good intentions.

VALUES IN RISK RESEARCH

Inevitably, a field is shaped by those who pay its bills. Researchers learn to focus on topics that interest their sponsors. Doing so need not threaten the integrity of research conducted within these constraints. Indeed, the sanctions of science make the outright manipulation of results rare. Nonetheless, sensitivity to sponsors may create more subtle pressures. For example, researchers might double-check uncomfortable results more rigorously than desired ones. They might be unwittingly in-

fluenced in the assumptions that they make about variables that are not examined in detail. They may learn to explain their work in terms that sponsors can understand, and to create work that sponsors care about hearing. Over time, any imbalance can be corrected, as the research is exposed to varied critiques. But that may take a while, especially when research is expensive. Risk researchers may be entirely impartial. However, producing balanced research requires a balanced set of pressures.

Direct consumers of research also have the power to judge its usefulness and then reward or punish researchers accordingly. Thus firms may reduce their support for university labs that fail to affect their bottom line. Government agencies may abandon research and development projects with particularly large cost or time overruns. Funders can issue requests for proposals and then solicit bids on favored topics. They can set reporting requirements, demand private briefings, and delay publication (for proprietary or procedural reasons). In all these ways, their values are deeply embedded in the research process.

Risk research bears some obvious stamps of its direct consumers. It was invented, somewhat independently, by various industries—for example, space, chemical, and nuclear—in order to manage their internal affairs by revealing the relative riskiness of alternative designs.² It acquired a public face when the need arose to demonstrate the safety of chosen de-

signs.³ Naturally enough, the risk analysis seen by the public looked much as it always had, addressing the problems and speaking the language of industry. The needs and dispositions of those shaping its creation can be seen in such technical details as how risk analyses treat structural uncertainty and how they define "risk."⁴

Similar shaping processes affect calculations on the benefits side of the ledger. Many of these procedures were devised to guide resource allocations in institutions, such as the U.S. Army Corps of Engineers, for its water management projects. Analysts and theoreticians gradually identified and addressed limits to benefits assessment, such as the thorny problems of assigning market prices to unmarketed goods. At times, there have been imaginative breakthroughs. At other times, analysts have reconciled themselves to shaky conventions, allowing them to get on with the work but without a strong theoretical or empirical basis, as in the selection of discount rates or the treatment of equity issues.⁵

Not surprisingly, these techniques have often evoked skepticism, especially among audiences that were not involved in their creation. The cur-

3. Nuclear Regulatory Commission, *Reactor Safety Study* (Washington, DC: Nuclear Regulatory Commission, 1975).

4. Baruch Fischhoff et al., *Acceptable Risk* (New York: Cambridge University Press, 1981); Silvio Funtowicz and Jeremy Ravetz, *Uncertainty and Quality in Science* (Dordrecht: Kluwer, 1990).

5. Judith Bentkover, Vincent Covello, and Jeryl Mumpower, eds., *Benefits Assessment: The State of the Art* (Dordrecht: Reidel, 1985); John Campen, *Benefit, Cost and Beyond* (Boston: South End Press, 1988).

2. Norman McCormick, *Risk Assessment* (New York: John Wiley, 1981).

rent U.S. debate over risk analysis, risk ranking, and risk comparison is the latest expression of the deep controversy surrounding this enterprise.⁶ Opponents are offended, to varying degrees, by risk research's producers, promoters, obscurity, and rhetoric. Some distrust the very idea of analyzing risk.⁷

Much of this opposition reflects a superficial understanding of risk science—as would be expected with procedures that are seldom explained in any detail.⁸ Indeed, even the supporters of risk research often seem ill informed, as reflected in the clumsy formulation of recent bills promoting risk assessment.⁹ Some opposition, however, is very well informed. Indi-

6. Stephen Breyer, *Breaking the Vicious Circle: Toward Effective Regulation* (Cambridge, MA: Harvard University Press, 1993); Adam M. Finkel, "A Second Opinion on Environmental Misdiagnosis," *New York University Environmental Law Journal*, 3:295-381 (1994); Donald T. Hornstein, "Reclaiming Environmental Law," *Columbia Law Review*, 92:562-98 (1992).

7. Maya Fischhoff, *Ordinary Housewives: Women Activists in the Grassroots Toxics Movement* (Cambridge, MA: Harvard University, Department of Social Studies, 1993); *Journal of Pesticide Reform*, 4(2) (1994); William Leiss and Christina Chociolko, *Risk and Responsibility* (Montreal and Kingston: McGill and Queen's University Press, 1994); Mary O'Brien, *A Proposal to Address, Rather than Rank, Environmental Problems* (Missoula: University of Montana, Institute for Environmental Studies, 1993).

8. K. Jenni, M. Merkhofer, and C. Williams, "The Rise and Fall of a Risk-Based Priority System," *Risk Analysis*, 15:397-410 (1995); National Research Council, *Improving Risk Communication* (Washington, DC: National Academy Press, 1989).

9. Some cynics claim that incoherence is the goal of these bills, whose proponents hope to gum up the works, slowing the pace of government action.

viduals (and institutions) who are deeply affected by the outcomes of risk research often probe it deeply. Often, they do not like what they find—perhaps because they have sought problems that would justify rejecting analyses that produced troublesome outcomes. Often, the analysts themselves will become targets of suspicion: what kind of people could produce such untrustworthy results? Such personal enmity can be much harder to take than an assault on the work alone.

VALUES IN RISK COMMUNICATIONS

How we speak reflects what we think of ourselves and the targets of our words. Insensitivity to public values can be found in attempts to communicate with the public about risks.

Communication to the public

Most risk messages are just some experts' ad hoc determination of what people ought to know. As a result, communications waste recipients' time and trust, by saying things that are already known or are not worth knowing.¹⁰ Very few messages are evaluated empirically prior to dissemination, again wasting recipients' time and communicators' credibility.

10. Ann Bostrom, Baruch Fischhoff, and M. Granger Morgan, "Characterizing Mental Models of Hazardous Processes," *Journal of Social Issues*, 48:85-100 (1992); Caren Chess, Karen Salomone, and B. J. Hance, "Managing Risk Communication Agency," *Risk Analysis*, 15:128-36 (1995); Baruch Fischhoff, "Giving Advice: Decision Theory Perspectives on Sexual Assault," *American Psychologist*, 47:577-88 (1992).

There are benign explanations for this sloppiness: time was short; no one on staff knew how to do it better; a committee approved the communication, undermining its coherence. These excuses imply that the task was not important enough to summon the resources needed to do it right.

A less benign explanation is that only experts' opinions matter. Who has not purchased a heavily marketed product, only to find its instructions incomprehensible? How much more objectionable it becomes when the garbled messages deal with matters of life and death. Insult is added to confusion when laypeople are blamed for these communication failures. Injury is added to insult when misunderstanding keeps workers or consumers or patients from coping with the risks in their lives. Failing to ensure that people can protect themselves would express another value of risk science.¹¹

Communication from the public

For public values to inform risk management, policymakers and scientists need to know what those values are. Unfortunately, the procedures for gathering information from citizens often are as flawed as the procedures for providing them information.¹² One conventional approach

11. James Reason, *Human Error* (New York: Cambridge University Press, 1990).

12. Robin Gregory, Thomas C. Brown, and Jack L. Knetsch, "Valuing Risks to the Environment," this issue of *The Annals of the American Academy of Political and Social Science*; J. Burgess and C. M. Harrison, "People, Parks, and the Urban Green," *Urban Studies*, 25:455-73 (1988); Baruch Fischhoff, "Value

is the public opinion poll. Unfortunately, polls cannot convey the detailed information that citizens need in order to formulate stable, thoughtful, informed opinions. Polls might obtain snapshots of current beliefs; however, those beliefs should have little value for policymakers who are contemplating long-term policies or anticipating the outcome of an intensive public debate. The typical poll (or polling firm) is ill suited to measuring or creating understanding. As a matter of principle and economics, pollsters typically refrain from providing information, correcting misconceptions, or allowing time to think. They prefer structured questions, which are easily administered and readily analyzed. As a result, they elicit public views on restricted topics with few nuances. Doing so clearly saves money, relative to more labor-intensive procedures. Some pollsters argue that more detailed explication and probing would be unethical, violating the norm of nonreactive measurement—by changing respondents as a result of the elicitation procedure.

Being satisfied with a narrow communication channel reflects a value about the public's role in risk management. Namely, the public should speak when spoken to, by responding quickly to the specific topics on policymakers' minds. Thus the public has a role in choosing policies but not in designing their content—and no right to reflect before answering.

A second conventional approach is the focus group, in which a moderator guides some citizens in discussing an issue. Although these discussions

Elicitation: Is There Anything in There?" *American Psychologist*, 46:835-47 (1991).

might allow participants to ask clarifying questions, most moderators are generalists, without the substantive expertise needed to provide answers. These moderators might even be proud of their ignorance, because it keeps them from influencing the discussion. Focus group interactions are typically summarized impressionistically. Indeed, the vendors of focus groups may have an incentive to mystify their synthetic abilities, contrary to the scientific norm of valuing results that different scientists could and would interpret similarly.¹³

Every measurement procedure has its limits. Often a set of complementary flawed methods is needed. Opinion polls, where respondents shoot from the hip, might predict whether a proposed policy will even get a hearing. More intensive interactions, patterned after a citizens' jury, might capture what people really think, when they are given time (and help) to think—thereby putting them on more equal footing with the experts and their immediate clients.¹⁴ The choice of elicitation method expresses a value regarding citizens' role in the political process. That happens even if risk managers know little about the choices that they are making. Not investing enough to know about these methods expresses a low value regarding the public and its views.¹⁵ Placing undue faith in clumsy communications incurs the

direct costs of offending and confusing the public, as well as the opportunity costs of not doing something better.

CONDITIONS FOR RECOGNIZING PUBLIC VALUES

The public lacks the direct access to risk science that is available to the institutions that fund it. Even complaining about incomprehensible messages requires a struggle. These gaps often become apparent first in rapidly escalating confrontations: a risk unexpectedly attracts attention, forcing technical experts to explain their work to a suspicious public.¹⁶ These specialists may be ill prepared not only for explaining the specific risk but for communicating at all. Leiss describes three stages in the development of risk communication as a field, as it gradually recognized complications like those discussed here.¹⁷ A similar developmental sequence often occurs in individuals and institutions, as they come to grips with having a risk problem to explain. Table 1 offers an eight-stage version of this process, expressed in terms of the signal beliefs at each stage.

The challenge to risk managers is to hasten this learning process, especially when trial and error can inflict lasting scars—on the public, the risk specialists, and the relations between them. It is hard to accelerate

13. Robert K. Merton, "The Focussed Interview and Focus Groups," *Public Opinion Quarterly*, 51:541-57 (1987).

14. John Dryzek, *Rational Ecology* (Boston: Basil Blackwell, 1987).

15. Timothy Earle and George Cvetkovich, *Social Trust: Toward a Cosmopolitan Society* (Westport, CT: Praeger, 1995)

16. Roger E. Kasperson and Jeanne X. Kasperson, "The Social Amplification and Attenuation of Risk," this issue of *The Annals of the American Academy of Political and Social Science*.

17. William Leiss, "Three Phases in the Evolution of Risk Communication Practice," this issue of *The Annals of the American Academy of Political and Social Science*.

TABLE 1
DEVELOPMENTAL STAGES IN RISK MANAGEMENT

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- All we have to do is get the numbers right.
 - All we have to do is tell them the numbers.
 - All we have to do is explain what we mean by the numbers.
 - All we have to do is show them that they've accepted similar risks in the past.
 - All we have to do is show them that it's a good deal for them.
 - All we have to do is treat them nice.
 - All we have to do is make them partners.
 - All of the above.
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SOURCE: Baruch Fischhoff, "Risk Perception and Communication Unplugged: Twenty Years of Process," *Risk Analysis*, 15:137-45 (1995).

developmental processes simply by exhorting people to grow up. Lest time just take its course, the norms of grown-up behavior must be explicated. That detail is especially needed when the prescribed behavior is counterintuitive, for those hoping to short-circuit the learning process.

Table 2 offers one specification of the conditions that risk specialists must meet in order to secure public trust. It is patterned after the conditions that experts must meet in order to secure one another's trust. It includes both scientific and social conditions, concerning, respectively, the content and the conduct of science. In each domain, there are conditions associated with both each specific case and the general process of analyzing risk issues.

Thus, in order to trust a specific risk (or benefit) analysis, a specialist would want to understand the models being used, review the parameter estimates, request appropriate sensitivity analyses, and double-check results. Professionals can exercise such due diligence because they know the historical process that led to the selection of currently favored methods, the basic science underlying the

analysis, the (often unwritten) auxiliary assumptions that the analysis incorporates, and the philosophy of using models to manage risks.

To be fully comfortable with an analysis, experts typically need more than just its written artifacts. Science is a social institution. It helps to know the analysts, especially when one has a continuing relationship with them, encouraging their candor. It helps to have one's concerns explicitly recognized in the analysis, to be rewarded for participation, and to be treated respectfully. More generally, it helps to feel like part of the enterprise, to know the players, to influence the regulatory process that specifies the terms of analysis, and to have a long-term interest in the process. Finally, it helps to feel part of the analytical community, comfortable with its accommodation to the inevitable limit of analysis.

Why should the public expect less from the experts than the experts do from one another?

ACHIEVING THE CONDITIONS FOR PUBLIC TRUST

These conditions are achieved routinely in any healthy, functioning sci-

TABLE 2
 CONDITIONS FOR PUBLIC TRUST
 IN RISK ANALYSES

Scientific Conditions	
Immediate	
•	Familiarity with specific models
•	Familiarity with specific inputs
•	Access to sensitivity analyses
•	Ability to double-check
Ambient	
•	Familiarity with historical development
•	Familiarity with underlying science
•	Familiarity with auxiliary assumptions
•	Familiarity with analytical perspectives
Social Conditions	
Immediate	
•	Familiarity with analysts
•	Recognition by analysis
•	Reward for participation
•	Respectful treatment
Ambient	
•	Familiarity with analytical community
•	Influence on regulatory process
•	Long-term involvement
•	Accommodation with process

entific or technical community. Members have relatively similar training and outlooks. Their behavior holds few surprises. They extend one another professional courtesy. Their actions show how they value one another, as individuals, even as they fiercely dispute specific results and compete for particular contracts. The institutions that fund risk research typically have technical staffs to monitor fulfillment of the scientific conditions for trust; their financial leverage assures fulfillment of the social conditions.

Enterprising members of the general public can—and often do—learn enough to see whether risk research meets the scientific conditions for trust. Alternatively, they may hire

consultants to provide that assurance. The very fact of the struggle, however, will undermine the social conditions for trust. Outsiders seldom have the resources or the access needed to conduct fully satisfactory reviews or independent studies. What they cannot verify they may distrust. Thus lacking the social conditions for trust may magnify the importance of gaps in the science. What should one think when the evidence is buried in mountainous computer codes or laboratory protocols?

Risk research conducted for or by government agencies, or in response to government edicts, is ostensibly done in the public's name. Nonetheless, its connection with the public's values is usually tenuous. As noted, the communication channels between government and public are ill suited to sharing complex messages about risk issues. As a result, government actions are only vaguely related to public concerns. For example, the United States has institutes bearing the names of most major diseases. Inquiring citizens can, therefore, be told that "we are working on it," for a great many "its." Yet those institutes historically paid little attention to women's health risks. Can one claim that this is what the public wanted? Pundits today revel in blaming the public for misplaced risk priorities. Yet those priorities primarily reflect the machinations of politicians, bureaucrats, interest groups, and pundits, speaking for the public. Indeed, the public might be aghast at much of what is done in its name.

Providing sustained public access to risk research will require changes

in how research is conducted, how public input is solicited, and how results are reported.

*How risk research
is conducted*

Research driven by public values would focus on the most important aspects of those problems that most concern the public: problems where scientific progress is a possibility. Identifying those topics requires explicitly characterizing the public's problems and analyzing the opportunities for scientific progress.¹⁸ Letting public values direct research might change which topics are studied, how projects are formulated, and how results are summarized. There would be less place for vague claims of usefulness and greater demand for candid expressions of uncertainty.

*How public
input is solicited*

In order to address public concerns, risk scientists need to know what those concerns are. That requires systematic measurement of public values, in a way that provides citizens with a balanced overview of the issues, and time to think about them. In order to express their views in a rich and nuanced fashion, citizens need a broad communication channel. Something like these conditions is created by the Environmental Protection Agency in the citizens' commissions that it has convened for

18. National Research Council, *Priority Mechanisms for Toxic Chemicals* (Washington, DC: National Research Council, 1983).

states and regions, in order to rank the risks that these communities face.¹⁹ Indeed, citizens' commissions might be a better guiding metaphor for assessing public values than the opinion poll, which creates nothing like these conditions.²⁰

*How research
results are reported*

Once the research has been completed, it must be summarized appropriately. Citizens need to know what the results mean, not only in the aggregate but also for them personally.²¹ They need to understand the quality of the science underlying the analyses and not just receive best guesses at expected risks and benefits. The presentation of results must be evaluated empirically in order to ensure that it is understood as intended. The chances of that happening are increased by research identifying the mental models that recipients bring with them to interpreting the messages.

19. Environmental Protection Agency, *Comparing Risks and Setting Environmental Priorities* (Washington, DC: Environmental Protection Agency, 1993).

20. B. Fischhoff, "What Do Psychologists Want?" in *Determining the Value of Non-Marketed Goods*, ed. N. Schwarz and R. Kopp (New York: Plenum, forthcoming).

21. B. Fischhoff, "Acceptable Risk: A Conceptual Proposal," *Risk*, 5:1-18 (1994), which argues that a policy is acceptable if it produces acceptable risk-benefit trade-offs for everyone affected by it. See Jon Merz et al., "Decision-Analytic Approach to Developing Standards of Disclosure for Medical Informed Consent," *Journal of Toxics and Liability*, 15:191-215 (1993).

The task ahead

Addressing these challenges requires political work, legitimating concern for the public's values, and scien-

tific work, creating credible procedures for incorporating those values. Even if we would like to give risk research away, it is not clear that we know quite how.