Understanding *Understanding Risk* and Moving Forward

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Carolyn Raffensperger (1998) makes some important points about the scientific basis for environmental decision making that can move the field a step beyond the National Research Council (1996) report, *Understanding Risk: Informing Decisions in a Democratic Society*. Before engaging in the discussion about what this next step should be, however, I wish to address two misconceptions of the report that appear in Raffensperger's paper.

One is that *Understanding Risk* presumed that risk assessment, as typically practiced, was the only tool available for informing risk decisions. It is true that the NRC study was originally framed in the language of risk assessment, but the study committee immediately broadened that frame, as noted in the preface. The report's title was carefully chosen to reflect the committee's view that its topic was how best to inform environmental and public health decisions, not how to improve quantitative risk assessment. The committee emphasized that risks and hazards are multidimensional and warned about the dangers of using any analytic technique that attempts to reduce these dimensions to one, without open deliberation about the value judgments that are inevitably involved. It specifically criticized "legislative proposals and agency guidances that call for using analytic techniques of benefit-cost analysis or risk analysis as the sole or primary basis for making 'comparative risk' judgments or for 'risk-based decision making,' " saying these approaches are not "appropriate for many of the highly controversial choices for which these proposals are being promoted" (ibid., 105-106). In keeping with this position, *Understanding Risk* advocated a synthesis of analysis and deliberation as the best way to understand risks, not just as the best way to do risk assessment. It advised government to resist the temptation to "use analytic techniques [including standard-issue risk assessment] as substitutes for informed and appropriately broad-based deliberation in weighing conflicting values" (ibid., 104).

It is important to mention in passing that Raffensperger's characterization of quantitative risk assessment (QRA) might raise hackles among some practitioners of the field. QRA does not by its nature focus only on death, even though in practice it typically does. There is respectable work on risk assessment coming out of the tradition of decision analysis that presumes that any undesirable and uncertain outcome deserves assessment. The difficulty occurs in the practice of risk assessment, when outcomes that cannot be estimated quantitatively by available techniques are ignored and then treated as though they had been analyzed and their risk values found equal to zero. In promoting decision approaches that go beyond QRA, it is not worth alienating the most open-minded risk analysts by caricaturing their field. Their contributions are essential for decision making, if they are interpreted in the right social context.

The second misconception is that *Understanding Risk* advocated stakeholder involvement only because it makes better policy and not because it makes better science. In fact, the report makes a series of strong epistemic arguments that broadly based deliberation makes for better informed decisions (see, e.g., 79-81):

- deliberation helps formulate scientific questions so that the answers will be decision relevant;
- broadly based deliberation provides a more complete knowledge base for decisions by bringing to bear knowledge of local conditions, more likely to be possessed by nonscientists, so that analytic assumptions made in the absence of full knowledge are reasonable given real-world conditions (an example offered is the need to listen to people who work in farm fields when estimating the exposure of farm workers to pesticides);
- broad participation ensures that all the outcomes of concern receive consideration and not just those that are readily quantifiable, thus providing a more complete picture of the choices available and their implications;
- broadly based deliberation can help determine the appropriate uses for potentially controversial analytical techniques and the appropriate interpretations to put on their results;
- deliberation can help make sense of summaries of scientific information, which have the potential to create conflicting or mistaken impressions; and
- deliberation can help identify which disagreements among the parties interested in a decision might be resolved by gathering further information.

Thus, my understanding of *Understanding Risk* (and as co-editor of the book, I write as a sort of stakeholder) is that it is much more compatible with Raffensperger's position than her paper suggests. So, rather than debating the text further, it makes sense to think about next steps. A good place to begin is with two central points in Raffensperger's paper with which I agree.

One is an apparent paradox: that a scientific understanding of the choices available in environmental policy requires

the participation of nonscientists. This proposition holds true because environmental policy has the following characteristics: the outcomes of concern are multidimensional, the relevant science is uncertain, those affected by policy decisions have conflicting and sometimes changing values, many people mistrust available scientific analyses, and decisions must be made before scientific uncertainties decrease or value differences narrow (Dietz and Stern 1998). In any domain with these characteristics, science alone cannot provide all the needed knowledge in a timely manner; consequently, knowledge and wisdom from outside science must be integrated, in some sort of "analytic deliberation," to get the highest quality information possible. The challenge is to figure out how, where, and when to achieve this integration.

Raffensperger's other central point is that there is a pressing need to consider and carefully evaluate a variety of decision rules for acting under uncertainty in environmental policy. In fact, a variety of decision rules is already in use in U.S. environmental policy. Several of them depend on QRA, which is not itself a decision rule. QRA-based rules typically rely on so-called margins of safety: for example, under one rule, analysts provide a "best estimate" of the risk of a particular adverse outcome (e.g., death from cancer) and decision makers establish a "bright line" (e.g., 10^{-6} risk), and limit exposure to a set fraction of that level (e.g., 10^{-8}) to account for uncertainty in the risk assessment and to leave a margin of safety. Other decision rules that use QRA balance risks (usually just a few undesirable health outcomes) against benefits, or against other risks (e.g., loss of jobs). Still other decision rules do not rely on QRA. Some are based only on risk identification. One such rule is to keep exposure to a hazard below the lowest level at which a negative effect has been observed. Another famous decision rule is to ban any food additive that has been determined to cause cancer in animals. Still others do not appear to require quantitative science to be implemented. One such is the precautionary principle that Raffensperger mentions — the rule that no new action should proceed until all the alternatives have been assessed. Because some of the conflict in environmental policy seems to focus on disagreement about the appropriateness of the decision rules now being used, it makes sense to look more closely at the decision rules.

These two points suggest two next steps for the field.

1. Initiate a program of systematic research on how to implement broadly-based analytic-deliberative processes more effectively for informing environmental decisions. Many government agencies and other decision makers are trying to involve stakeholders more fully and at earlier stages in informing their decisions, in the spirit of *Understanding Risk*. For the most part, each such actor is trying to learn the techniques of analytic deliberation from its own experience — an admirable effort, but inferior in the long run to one based on systematic research. This approach can result, at best, in manuals that offer guidance on how to manage public participation, based on the personal experiences of the authors and a reading of some unsystematic case literature. Such manuals are beginning to proliferate, but there is no validation of the advice they offer (Webler 1997).

Public policy can benefit greatly from systematic empirical research on the new efforts at analytic deliberation. Such research can build a body of cumulative knowledge about which techniques work best in which situations that can free future decision makers from the burden of starting from scratch. *Understanding Risk* noted the absence of such research in 1996. Now, with analytic deliberation being tried more frequently, a body of case experience is staring to appear that could be used, if carefully interrogated, to build generic knowledge. Researchers in the field are just now beginning to develop the concepts needed for such work (e.g., Webler 1995; Tuler and Webler forthcoming). These concepts can be used to examine available case experience to identify the attributes of analytic deliberations, their topics, and their scientific, social, and political contexts that are associated with outcomes that various participants consider desirable. Such research would lead to some tentative findings and, no doubt, to conceptual refinements that would improve the ability to study future cases productively.

2. Initiate an analytic-deliberative process to consider the utility of various decision rules for environmental policy making under uncertainty. Government agencies use different decision rules for making different decisions, often because they are legislatively required to use particular rules. It may be that in each case, agencies use the rules that an intelligent and informed populace would select after careful consideration of all the implications of adopting one rule or another, but this may not be the case. Given the advances that have been made in decision science in the past quarter century, now may be a good time to examine the range of decision rules being used or proposed for environmental policy from two standpoints: the moral, ethical, and scientific assumptions they embody, and the practical effects that are likely to result from implementing them.

Participation of both scientists and nonscientists is necessary for careful consideration of the implications of decision rules. Nonscientists who have a strong concern with values may not fully comprehend the value assumptions behind a decision rule without first gaining a detailed understanding of how the rule actually operates in practice. Similarly, scientists who have a particular concern with the risk implications of using one or another decision rule may not fully

understand these implications unless they are acquainted with the various values and ethical concerns that animate those who may be affected by the decision.

Both of these proposed activities are simultaneously analytic and deliberative. Although the first is basically a research activity, it is likely to be most useful if it is informed by the concerns of the various participants in analytic deliberations. Thus, a participatory research approach to the activity would be advisable. The second is mainly a dialogic or discursive activity, but it will probably be most useful if the participants are in interaction with specialists in implementing particular decision rules. Each activity could significantly advance thinking along the lines set out by *Understanding Risk.*

References

Dietz, T. and P.C. Stern. 1998. Science, values, and biodiversity. *BioScience* 48, 441-444.

National Research Council. 1996. *Understanding Risk: Informing Decisions in a Democratic Society*. P.C. Stern and H.V. Fineberg (eds.). Washington, DC: National Academy Press.

Raffensperger, C. 1998. Guess who's coming for dinner? The scientist and the public making good environmental decisions. *Human Ecology Review* 5 (1).

Tuler, S. and T. Webler. Forthcoming. Voices from the forest: Participants and planners evaluate a public policy making process. *Society and Natural Resources.*

Webler, T. 1997. Organizing public participation: A review of three handbooks. *Human Ecology Review* 3(1), 245-254.

Webler, T. 1995. 'Right' discourse in citizen participation: An evaluative yardstick. In O. Renn, T. Webler, and P. Wiedemann (eds.) *Fairness and Competence in Citizen Participation: Evaluating Models for Environmental Discourse*, 35-86. Boston, MA: Kluwer Academic Press.