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RISK IN THE REPUBLIC

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The Cummings Colloquia on Environmental Law at Duke University were launched in 1996 by a generous gift in honor of Jasper L. Cummings, Jr., and by the leadership of Dean Norman L. Christensen of Duke's Nicholas School of the Environment and Dean Pamela B. Gann of Duke Law School. The mission of these annual Colloquia is simple but ambitious: to bring together diverse disciplines to confront the most difficult intellectual and practical challenges in environmental law and policy.

The first of the Cummings Colloquia, held in April 1996, addressed the challenge posed to environmental law by the "new ecology": the rejection by ecologists of the static "balance of nature" equilibrium paradigm, and its replacement with a new non-equilibrium paradigm in which nature is seen as perpetually in flux.¹

The second Cummings Colloquium, held in November 1996, is the subject of this symposium issue. At this gathering we examined the growing importance of comparing risks as the basis for setting

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1. See Symposium, *Beyond the Balance of Nature: Environmental Law Faces the New Ecology*, 7 DUKE ENVTL. L. & POLICY FORUM 1 (1996).

environmental policy priorities. First, we asked how diverse risks should be compared. Not comparing risks – setting priorities without regard to the importance of one risk relative to another – is to compare implicitly and most likely arbitrarily. There is no escaping some kind of comparative perspective. But the methods and procedures employed in comparative risk analysis (CRA) can substantially affect the outcome of such analysis.² The Colloquium examined what can be learned from current applications of comparative risk analysis at the federal, state and local levels. It sought practical insights into how our methods of CRA can be improved.

Second, we addressed how government can and should engage in setting priorities using CRA when there is deep divergence about the basis on which risks should be compared. Experts and the public appear to evaluate risks on quite different criteria.³ Why, for example, does the public appear to rank hazardous waste sites as a serious risk while ranking indoor radon as a low risk, and rank nuclear power as a serious risk while ranking medical x-rays as a low risk, whereas in each case experts say the opposite?⁴ Is this because the public is mistaken about the quantitative facts, or is it because the public's value judgments depend on qualitative attributes of these risks ignored by experts? In the face of such divergence between expert and public evaluation of risks, how should a democratic republic set intelligent priorities to protect health and the environment: should it cater to public views, follow expert judgments, or craft some combination of the two?

To try to answer these questions, the Cummings Colloquium on Environmental Law, in partnership with the Society for Risk Analy-

2. See *COMPARING ENVIRONMENTAL RISKS: TOOLS FOR SETTING GOVERNMENT PRIORITIES* (J. Clarence Davies ed., 1996). Even critics of CRA agree that some form of comparison is inevitable and that it must be done constructively; they object to a purely quantitative version of CRA that omits attention to qualitative attributes. See Donald T. Hornstein, *Reclaiming Environmental Law: A Normative Critique of Comparative Risk Analysis*, 92 COLUM. L. REV. 562 (1992); Donald T. Hornstein, *Paradigms, Process, and Politics: Risk and Regulatory Design*, in *WORST THINGS FIRST? THE DEBATE OVER RISK-BASED NATIONAL ENVIRONMENTAL PRIORITIES* 147 (Adam M. Finkel & Dominic Golding, eds., 1994).

3. See the essays by Ann Bostrom and Howard Margolis in this symposium issue.

4. See STEPHEN G. BREYER, *BREAKING THE VICIOUS CIRCLE: TOWARD EFFECTIVE RISK REGULATION* 21 & Table 4, 34 & Table 6 (1993) (citing studies by EPA and by Paul Slovic). Citing EPA, *UNFINISHED BUSINESS: A COMPARATIVE ASSESSMENT OF ENVIRONMENTAL PROBLEMS* (1987), Breyer reports that the public ranks hazardous waste sites #1 whereas experts rank them "medium-to-low," and the public ranks indoor radon #25 whereas experts rank it "high." *Id.* at 21 & Table 4. Citing Paul Slovic, *Perception of Risk*, 236 SCIENCE 280, 281 (1987), Breyer reports that the public ranks nuclear power #1 whereas experts rank it #20, and the public ranks x-rays #22 whereas experts rank it #7. *Id.* at 34 & Table 6.

sis, Research Triangle Chapter (SRA-RTC), brought together risk analysts, physicians, toxicologists, epidemiologists, decision theorists, psychologists, government officials, political scientists, economists, ethicists, legal scholars, and the invited public to engage in a two-day discussion and debate.

I. CRA IN ACTION

A. *Macro Applications*

After welcoming remarks by John Strohbehn, the Provost of Duke University, and Norm Christensen, the Dean of the Nicholas School of the Environment, the Colloquium began with presentations by Gail Charnley, Executive Director of the U.S. Commission on Risk Assessment and Risk Management, and Thomas Grumbly, Under Secretary of the U.S. Department of Energy, on current U.S. government efforts to improve and apply CRA. Dr. Charnley emphasized the increasing recognition that comparison of risks is incapable, leading the Congress to launch her Commission with the charge of advising the nation on the best ways to conduct and improve risk analysis and risk policy. The Commission's two-volume report was just about to be released as our Colloquium convened. She previewed its findings, notably that whereas our scientific and legal institutions have tended to treat risks one at a time, in fact we live in a "multi-risk" environment: multiple exposures to multiple substances associated with multiple kinds of risks. The Commission therefore is urging much greater attention to the potential synergies among these risk factors, to the need to make difficult trade-offs among interrelated risks, and to the need for improved methods of comparing diverse risks.

Secretary Grumbly, a longtime proponent of CRA in numerous federal positions and in the private sector, described his agency's efforts to bring a comparative risk approach to the dismantling and cleanup of the nation's nuclear weapons facilities.⁵ Grumbly detailed the difficult choices involved in managing both the environmental risks of these facilities, including the transport and disposal of contaminated materials, and the security risks of the materials stored at these facilities. He argued that the environmental risks of nuclear wastes need to be managed assiduously, but that the security risks are

5. See his remarks in this issue.

also environmental risks: as he put it, “one rogue nuclear weapon can ruin your whole day.”

A central theme of both Charnley and Grumbly’s remarks was the need to involve *both* expert *and* public input in risk policymaking. Democracy is enhanced when the public is well informed by expert analysis. Expert analysis is enhanced when experts take account of the insights and values of non-experts.⁶ At the same time, Charnley and Grumbly put their fingers on a pivotal ambiguity: Who is the “public”? Charnley’s call for greater involvement of “stakeholders” was met with concerns among the audience that this strategy would be just another route for well-organized special interests to influence and distort risk policy. Grumbly favored involving “citizens” rather than “stakeholders”, but it remained unclear how millions of affected citizens could effectively participate in particular risk policy choices.⁷

The afternoon sessions focused on the “macro” use of CRA to rank numerous risks facing society as a priority-setting device. Ken Jones of the Green Mountain Institute for Environmental Democracy and Debra Gutenson of U.S. EPA discussed developments in the use of CRA by states and localities.⁸ Both argued that CRA can be a very useful undertaking for states and cities trying to allocate limited budgets to diverse health and environmental challenges. Both emphasized the role of CRA as a process, not just an outcome: the involvement of affected parties in the CRA exercise can help clarify facts and options and can improve the parties’ satisfaction with (and hence loyalty to) the policy decisions made thereafter.

Jennifer Crawford, a student at the Nicholas School of the Environment at Duke, presented her research comparing the large-scale CRA exercises conducted to date, including the *EPA’s Unfinished Business: A Comparative Assessment of Environmental Problems* (1987), the EPA Science Advisory Board’s *Reducing Risk: Setting Priorities and Strategies for Environmental Protection* (1990), and the State of California’s *Toward the 21st Century: Planning for the Protection of California’s Environment* (1994). Crawford observed that these exercises reflected varying approaches to involving “the public”

6. Indeed, advocates of expertise in risk policy fully expect and desire that decisions will be made democratically. See BREYER, *supra* note 4, at 73-78; Alice M. Rivlin, *Rationalism and Redemocratization: Time for a Truce*, in WORST THINGS FIRST? THE DEBATE OVER RISK-BASED NATIONAL ENVIRONMENTAL PRIORITIES, *supra* note 2, at 21, 23-26.

7. See MANCUR OLSON, *THE LOGIC OF COLLECTIVE ACTION: PUBLIC GOODS AND THE THEORY OF GROUPS* (1965) (political voice systematically over-represents organized groups’ special interests and under-represents citizens’ diffuse general interests).

8. See their essays in this issue.

in the risk evaluation process. She also observed that although the EPA/SAB 1990 report had urged the ranking of “risk reduction opportunities” (policy actions) rather than only of baseline risks, so far none of the macro CRA exercises had engaged in this effort.⁹

B. *Micro Applications*

These analyses of macro CRA exercises were followed by even more detailed discussions of several “micro” CRA studies: comparisons of interrelated risks involved in a specific policy choice.¹⁰ David Matchar of the Center for Health Policy Research & Education at Duke presented results of a study of a stroke prevention surgical therapy (carotid endarterectomy) that clears out occluded blood vessels leading to the brain. Compared to standard non-surgical medical care, carotid endarterectomy surgery substantially reduces the risk of stroke, but also slightly increases the risk of a sudden fatal hemorrhage. For patients showing symptoms of likely stroke, this new therapy would extend their predicted life span; but for asymptomatic patients, this therapy might reduce their net expected life span because the increased risk of hemorrhage would outweigh the reduced risk of stroke. Matchar then asked prospective patients about their evaluations of these risks. Interestingly, Matchar reported, many of the prospective patients he surveyed ranked instant death as qualitatively preferable to permanent stroke-induced disability (such as full paralysis or vegetative state), so that the risky surgical therapy could be preferred by patients even where it would not extend (or even where it would reduce somewhat) the quantitative number of expected years of life.

Robert Tardiff of EA Engineering (and a former President of the SRA) presented the evidence on drinking water safety, comparing chemical disease risks (such as liver disease, kidney disease, and cancer) to microbial disease risks (such as gastrointestinal illnesses like diarrhea and cholera). Both kinds of risks can cause disabilities and death. Tardiff observed that the chemically-induced risks tend to be latent (occurring decades after exposure), occur in roughly one out of every one million persons exposed to contaminated water, and are predicted with low statistical confidence. The microbial risks, by

9. See her essay in this issue.

10. Often these risk pairs are linked in a risk-risk tradeoff, such that efforts to reduce one risk would induce increases in the other risk. In such cases, some way of comparing and weighing the risks is essential. See *RISK VERSUS RISK: TRADEOFFS IN PROTECTING HEALTH AND THE ENVIRONMENT* (John D. Graham & Jonathan Baert Wiener, eds., 1995).

contrast, tend to be acute (occurring hours to days after exposure), occur in roughly one out of every one thousand persons exposed to contaminated drinking water, and are predicted with high statistical confidence. These divergent attributes make these two kinds of risks difficult to compare. Meanwhile, however, these dissimilar risks occur simultaneously and interdependently: disinfectant chemicals such as chlorine are purposefully added to drinking water in order to reduce microbial risks. Hence comparison of these risks is essential if society is to achieve optimal protection of drinking water that minimizes the combined risk.¹¹ On a quantitative basis, Tardiff argued, the microbial risks are more serious, and proposals to curtail chlorination of drinking water in order to reduce chemical risks may only invite a larger increase in microbial risks.¹² But in addition to the quantitative magnitude of the chemical and microbial risks, there may be differences in how people evaluate the qualitative attributes of these risks. For example, people might be more worried about long-term chemically-induced cancer than about acute microbially-induced gastrointestinal disease; and this view might be a factual mistake or a considered value choice.

Chris Frey of North Carolina State University presented a model of the health and environmental effects of acid rain. He argued that the risks of acid rain are diverse – including human mortality, human disease, damages to aquatic resources, and reductions in visibility – and that different policy options would yield different combinations of these risks. Thus, an integrated assessment model is required to evaluate these multiple risks in concert.

C. *Improving CRA*

The session concluded with thought on improving CRA, offered by Lester Lave of Carnegie Mellon University (a former President of the SRA) and by James Hammitt of the Harvard School of Public Health. Lave furnished a broad critique of current methods of risk assessment, such as the choice of animal species used in bioassays and the use of worst-case upper bounds, arguing that these methods may yield estimates that are “precisely wrong” rather than “vaguely right” – estimates that are sometimes “completely useless” and “so bad you

11. See Susan Putnam & Jonathan Baert Wiener, *Seeking Safe Drinking Water*, in RISK VERSUS RISK: TRADEOFFS IN PROTECTING HEALTH AND THE ENVIRONMENT, *supra* note 10, at 124.

12. As Tardiff noted, other disinfectants might be used instead of chlorine, and their risks need evaluation. See Putnam & Wiener, *supra* note 11.

wouldn't use them." He urged that EPA reform its cancer risk assessment guidelines to focus on the distribution of risk rather than the upper bound. He also argued that risk ranking exercises involving the public in CRA are essential. In particular, he stressed the encouraging results that he and colleagues have observed with "informed citizen juries" – groups of lay citizens educated about the facts and then asked to deliberate about risk rankings.

Hammit offered several suggestions for improving CRA. He urged that future CRA exercises rank not only baseline risks, but also risk reduction options. This is important because different options entail different benefits and different costs. Some "large" risks may be relatively intractable, whereas great progress might be made against some "medium" or "small" risks. He also urged attention to the expected value of risk reduction, incorporating uncertainties into risks and risk reduction options.¹³

II. EXPLAINING DIVERGENT RISK EVALUATIONS

A. *Experts vs. Public*

Dean Pamela Gann of Duke Law School opened the second day of the Colloquium. The first session confronted the basic difficulty in CRA: whose risk comparisons count? Ann Bostrom of the School of Public Policy at Georgia Tech surveyed the "psychometric" research seeking to explain why experts and the public evaluate risks so differently.¹⁴ This research, she observed, does indicate that members of the public are often incompletely informed about the factual parameters of risks, and moreover that they often make heuristic errors in their perceptions of risks. These factual and cognitive errors may yield systematic over-estimation of small risks. But, Bostrom argued, the psychometric research also shows that informed and careful lay citizens still evaluate risks differently from the purely quantitative approach ascribed to experts.¹⁵ The leading hypothesis explaining these citizens' risk evaluations is that the public assigns importance to a series of qualitative attributes of risks, including the degree of dread associated with the risk, its unfamiliarity, its uncertainty, its unnaturalness, its inequity, and other attributes.¹⁶ These qualitative

13. See his essay *Improving Comparative Risk Analysis* in this issue.

14. See her essay in this issue.

15. She also noted that experts are not purely quantitative number-crunchers; they also bring their own values, leanings and cognitive approaches to risk evaluations.

16. See Slovic, *supra* note 4; K.S. SHRADER-FRECHETTE, *RISK AND RATIONALITY* (1991);

factors could explain some of the public's preference for expensive environmental protection measures aimed at quantitatively small but qualitatively worrisome risks (such as cancer from synthetic chemicals and nuclear power plants), and its neglect of more inexpensive opportunities to reduce quantitatively large but qualitatively mundane risks (such as automobile accidents, radon in homes, and microbes in water).¹⁷

Howard Margolis of the Harris School of Public Policy at the University of Chicago countered that this "usual story" does not, in his view, adequately explain the observed divergence between expert and public evaluations of risk.¹⁸ He argued that qualitative accounts of public risk perceptions are more often post hoc rationalizations than true causal explanations. That is, he argued, people find Risk A more worrisome than Risk B for unconscious reasons, and then construct a qualitative account only when pressed to justify their choice. Margolis argued that these unconscious reasons have more to do with whether people are thinking about the full consequences of a risk choice – the benefits and costs of trying to reduce the risk – than with whether the risk is especially dread or not. It may be that people rank chemical carcinogens as a more serious risk than automobiles or indoor radon, for example, not because of qualitative dread of the former, but because people are especially likely to ignore the diffuse downsides of restricting synthetic chemicals (e.g., outbreaks of waterborne microbial illnesses) whereas they are likely to consider the persona downsides of restricting the sources of more mundane risks (e.g., curtailing their automobile travel, or having to retrofit their homes to vent indoor radon).

B. *Quantities, Qualities, and the "Willingness to Sacrifice"*

James Hammitt of Harvard reported the results of the risk-ranking exercise completed by the Colloquium attendees.¹⁹ In advance of the Colloquium, I had thought it would be interesting to survey the attendees about their own risk perceptions, and asked Jim to design and administer the study. In particular, I was interested in

Clayton P. Gillette & James E. Krier, *Risks, Courts and Agencies*, 138 U. PA. L. REV. 1027 (1990).

17. See, e.g., George Tolley et al., *State-of-the-Art Health Values*, in VALUING HEALTH FOR POLICY: AN ECONOMIC APPROACH 323, 339-44 (George Tolley et al., eds., 1994) (people appear to value avoiding death by cancer several times more than they value avoiding an equal quantitative likelihood of death by automobile accident).

18. See his essay in this issue.

19. See his essay *Comparative Risk Analysis: an Informal Survey of Experts* in this issue.

whether the qualitative attributes hypothesized to explain risk perceptions could be measured quantitatively. One way to measure these attributes would be to ask survey respondents their financial willingness to pay (WTP) to avoid selected hypothetical increments of the qualitative attributes.²⁰ But there is some evidence that survey respondents have difficulty translating the value of risk reduction increments into dollar terms, and this difficulty may be heightened when it is just the qualitative attribute of a risk that respondents are being asked to monetize.²¹ Therefore, I thought it might be more successful to ask respondents to translate qualitative attributes of risk into risk units – into the additional quantity of risk (e.g. number of additional lives) they would be willing to sacrifice in order to avoid the undesirable qualitative characteristic, or put another way, the number of additional lives needed to be lost from the qualitatively more benign risk in order to make respondents judge the two risks as equally important. This “willingness to sacrifice” (WTS) measure is in effect a measure of the opportunity cost of avoiding qualitative attributes of risk: if the public chooses to invest in reducing qualitative attributes of risk, it is giving up some quantitative degree of risk that could otherwise have been avoided. But how much? How many lives would one sacrifice to avoid a risk that is incrementally more dread or unfamiliar?²²

20. See, e.g., Tolley, *supra* note 17; Robin Gregory & Sarah Lichtenstein, *A Hint of Risk: Tradeoffs Between Quantitative and Qualitative Risk Factors*, 14 RISK ANALYSIS 199 (1994); Timothy L. McDaniels et al., *Risk Perception and the Value of Safety*, 12 RISK ANALYSIS 495 (1992); Ian Savage, *An Empirical Investigation into the Effect of Psychological Perception on the Willingness-to-Pay to Reduce Risk*, 6 J. RISK & UNCERTAINTY 75 (1993); W. Kip Viscusi, Wes Magat, & Joel Huber, *Pricing Environmental Health Risks: Survey Assessments of Risk and Risk-Dollar Trade-offs for Chronic Bronchitis*, 21 J. ENVTL. ECON. AND MGMT. 32 (1991). The observed risk premia (compensating wage differentials) actually demanded by workers to face higher risks on the job are presumably also sensitive to the qualitative attributes associated with different risks, but the literature on worker risk premia does not appear to have attempted to distinguish and measure the WTP for these qualitative attributes. See W. KIP VISCUSI, *FATAL TRADEOFFS: PUBLIC AND PRIVATE RESPONSIBILITIES FOR RISK* 51-74 (1992).

21. See Gregory & Lichtenstein, *supra* note 20; Viscusi et al., *supra* note 20.

22. Previous efforts developing measures of the tradeoff between risk quantities and risk qualities include Gregory & Lichtenstein, *supra* note 20, and MAUREEN L. CROPPER & UMA SUBRAMANIAN, *PUBLIC CHOICES BETWEEN LIFESAVING PROGRAMS: HOW IMPORTANT ARE LIVES SAVED?* (The World Bank, Policy Research Working Paper No. 1497, August 1995). But Gregory & Lichtenstein only compared the number of deaths or injuries needed to warrant a new technology (bicycle brakes or plastic cars) by two groups of respondents, one presented with a qualitative description and the other not, rather than asking each respondent to indicate along a sliding scale the incremental number of lives saved that would justify incremental increases in the qualitative attribute. Cropper and Subramanian did ask for the incremental lives that would need to be saved to warrant facing a qualitative attribute, but studied only voluntariness, controllability, seriousness, and personal impact, and did not focus on qualitative at-

Hammitt presents the questions asked and the results of our WTS survey in his second paper in this issue. Among the most interesting findings of our efforts is that, at least for the comparison between smoking prevention and air pollution control, our sample of experts attending the workshop generated much lower WTS estimates than the sample of public respondents surveyed by Cropper and Subramanian. In other words, the expert sample appeared to care more about risk qualities than did the public sample. Our sample also preferred nuclear power to coal-generated electricity when the quantitative risks were assumed to be twice as high for coal as for nuclear (in reality the ratio may be much higher); given the qualitative dread often associated with nuclear power, presumably a public sample would have a high willingness to sacrifice lives from coal in order to avoid nuclear power. As to automobile airbags, when instructed to assume that airbags kill 10 children for every 300 adults saved (which now seems lower than the real ratio), our sample reported that it would be willing to sacrifice between 10 and 275 children for every 300 adults saved. Here both the number of years of life lost (*e.g.*, 80 for children versus 40 for adults) and the qualitative attributes of risk would presumably weigh more heavily toward saving children. It is surprising that 10% of the respondents equated more than 200 children lost with 300 adults lost. Hammitt observed that our survey respondents appeared to underweight not only the qualitative attributes of risk, but even some quantitative attributes as well (such as years of life lost); he worried that the results seemed driven by a compulsion to minimize the number of premature fatalities regardless of the context or the age of the victim.

III. SHOULD COMPARATIVE RISK ANALYSIS GUIDE RISK POLICY?

The penultimate session addressed the impact that CRA should have on policy outcomes – on regulation and budget allocation. Should Congress, the President, and/or states impose an overarching rule that regulation and budgets be re-targeted based on CRA? How would such a rule be defined and enforced? John Graham of the Harvard School of Public Health (and the President of SRA) presented an overview of risk legislation moving through the Congress. He noted that agencies are being asked to perform a number of different kinds of analyses, including risk assessment, cost-effectiveness analysis, cost-benefit analysis, and CRA. While he favored the use of more careful risk analysis, Graham cautioned that piling on the num-

tributes such as dread, unfamiliarity and unnaturalness.

ber and kind of analyses required, without providing agencies the resources to conduct these analyses, could overload agencies and begin to diminish their ability to produce even those regulations that would pass all of these analytic tests (and hence provide a net benefit to society). He therefore urged that agencies be furnished additional funding as they are obliged to perform additional analyses. And Graham argued that the most important use of CRA may not be within agencies, but across the government as a whole – across agencies, across statutes, and across Congressional committees – because it is the misallocation of priorities across the entire government that yields the greatest lost opportunities for more effective health and environmental protection.

IV. SHOULD PUBLIC VALUES GUIDE RISK POLICY?

The final session returned to the question of the conflict between expert and public approaches to risk evaluation. The central problem is the role of democracy in risk policy. Given the divergence between expert and public evaluations of risk, how should government regulate? If the public is making factual and cognitive errors, how can government simultaneously represent both the public's current views, and the public's best interests? Alternatively, if the public is expressing different value choices about different risks, how can democratic government *not* adhere to the public's views?

A standard prescription is that regulators should ignore citizens' misunderstandings of fact, while adhering to citizens' value choices about risks. But it may be very difficult to distinguish which is which. And certain of these democratic "value" choices might even be questioned by a progressive republic as inconsistent with principles of liberty and tolerance. If so, what criteria should guide regulators in "filtering" public attitudes?

Frank Cross of the University of Texas argued that even if public evaluations of risks are driven by value choices rather than by factual and cognitive errors, it is not the duty of a republic to cater blindly to those value choices. He argued that public values may be prejudicial and that, in other areas of public policy, the republic treats such values as illegitimate or at least as worthy of enlightened moderation. For example, an aversion to what seems "dread" and "unfamiliar," when expressed in immigration policy as to foreigners, is treated as an ill-considered intolerance requiring filtering or rejection before it becomes public policy. Dread of unfamiliar (but quantitatively small) risks may reflect similar intolerant prejudice, whether it is

dread of a new energy source like nuclear power being introduced in place of a familiar source like coal. Distaste for “unnatural” risks (such as nuclear power, chlorination of drinking water, recombinant DNA biotechnology, and purposive interbreeding of dwindling species) juxtaposed with acceptance of risks seen as “natural” (such as indoor radon, microbial infestation of drinking water, classic cross-breeding biotechnology, and letting species dwindle) may also reflect a fictitious ideological distinction that invites an increase in real environmental harm.²³

Cass Sunstein of the University of Chicago had previously written that government risk regulation should in general reflect public values regarding risk.²⁴ However, he had also written that, in some circumstances, observed private choices in the market domain are an unreliable basis for policy (because, for example, citizens’ choices are impaired by market imperfections such as limited information and limited mobility) and that government should be understood as a deliberative process of shaping rather than reflecting public attitudes.²⁵ At the Colloquium, he argued for a system of weighting life-years saved according to whether they involve suffering (proxied, he argued, by dread) and inequity – a system of maximizing “decently livable life years.”²⁶ He urged that invidious prejudices and heuristic errors be rejected as qualitative grounds for risk evaluation by progressive republican government. Moreover, he questioned whether the qualitative attributes of “involuntariness” and “controllability” are sound normative bases for regulatory distinctions, because categorizing a risk as relatively involuntary or uncontrollable only means that it is relatively more costly to control – a finding that goes to whether government should intervene, but not to whether the risk is qualitatively more troublesome.²⁷ A risk is involuntary or uncontrollable only in the sense that it would be very difficult (*i.e.* costly) to avoid the risk. A risk is voluntary or controllable

23. See Jonathan Baert Wiener, *Beyond the Balance of Nature*, 7 DUKE ENVTL. L. & POLICY FORUM 1 (1997).

24. See Richard H. Pildes & Cass R. Sunstein, *Reinventing The Regulatory State*, 62 U. CHI. L. REV. 1, 62 (1995) (“when the differences [in risk evaluation] arise from clashes between the value frameworks of experts and laypeople ... there is no reason to defer to experts; democracies should be responsive to the informed values of their citizens.”).

25. See Cass R. Sunstein, *Preferences and Politics*, 20 PHIL. & PUB. AFF. 3 (1991).

26. See Cass R. Sunstein, *Which Risks First?* 1997 U. CHI. LEGAL FORUM (forthcoming 1997) (on file with U. CHI. L. REV.). See also Cass R. Sunstein, *Bad Deaths*, 14 J. RISK & UNCERTAINTY 259 (1997).

27. See his essay in this symposium issue. See also Sunstein, *Which Risks First?*, *supra* note 26.

only in the sense that it would be easy (*i.e.* less costly) for individuals to choose to avoid it. Indeed, it would be double-counting to consider controllability/voluntariness both as an extra benefit of risk control (which is how it is typically treated in the risk perceptions literature, as an added dimension of risk) *and* as a measure of the cost of risk control (which is what it really amounts to, in Sunstein's view).

V. THE PRINCE AND THE PAUPER?

The debate about public versus expert evaluation of risk is part of a long and large debate about the best basis for all public policy – for all law.²⁸ In a representative system of government, do those in power best serve democracy by reflecting the views of the citizenry, or by exercising judgment and leadership that educates the public to see things in a different way? Besides the practical reality that representatives must stand for re-election, are there any normative parameters to cabin the exercise of such public-spirited leadership, lest it become antidemocratic opportunism, especially given the public's limited ability to supervise its agents in government?

Thomas Jefferson appears to have articulated the former, preference-reflecting approach. He said: "I know of no safe repository of the ultimate powers of society but the people themselves; and if we think them not enlightened enough to exercise their control with a wholesome discretion, the remedy is not to take it from them, but to inform their discretion by education."²⁹ In other words, the Prince should not run off on his own agenda when the Pauper, if informed, would choose a different course. Edmund Burke appears to have endorsed the latter, preference-shaping approach. Said he: "Your Representative owes you, not only his industry, but his judgment; and he betrays, instead of serving you, if he sacrifices it to your opinion."³⁰

28. Public (majoritarian) vs. expert (rationalist) control of government was at the heart of the debate over the structure of the American Constitution, and of the compromise of checks and balances fashioned by Madison. See William Eskridge, Jr., *Politics Without Romance: Implications of Public Choice Theory for Statutory Interpretation*, 74 VA. L. REV. 275 (1988).

29. THOMAS JEFFERSON, Letter to Mr. Jarvis, Sept. 28, 1820, in 7 THE WRITINGS OF THOMAS JEFFERSON 177 (H.A. Washington ed., 1854). See also THOMAS JEFFERSON, Letter to Samuel Kercheval, July 12, 1816, in 15 THE WRITINGS OF THOMAS JEFFERSON: MEMORIAL EDITION 32, 33 (Andrew A. Lipscomb & Albert Ellery Bergh eds., 1904) ("[G]overnments are republican only in proportion as they embody the will of the people, and execute it."). But see JOSEPH J. ELLIS, THE AMERICAN SPHINX (1997) (arguing that Jefferson was not as pure a populist as is often assumed).

30. EDMUND BURKE, Speech at the Conclusion of the Poll, Nov. 3, 1774, in 3 THE WRITINGS AND SPEECHES OF EDMUND BURKE 64, 69 (W.M. Eofson & John A. Woods eds., 1996). There is room for agreement between these pronouncements of Jefferson and Burke;

In other words, the Prince may best represent the Pauper not by catering mechanically to the Pauper's current expressed preferences, but by deploying on the Pauper's behalf the Prince's best understanding of the issues and their resolution, and helping the Pauper to see the issues accordingly. The democratic Prince is not a potted plant.

Surely both Jefferson and Burke are right to some degree. Elections force representative political agents to be faithful to some degree to their public principals³¹ – principals who may desire and reward a complex mixture of both preference-reflecting and preference-shaping behavior.³² Meanwhile, however, the principal-agent disjunction in politics enables representatives to escape some public review and thereby to serve concentrated constituencies or their own viewpoints rather than maximizing public well-being (however measured).³³ The public's perceptions of risk are surely impaired to some degree by market imperfections (such as incomplete information and limited mobility)³⁴ and to some degree by heuristic failures to consider risks clearly and to weigh both dangers and opportunities.³⁵ Meanwhile, educating the public about risks seems obligatory and may be helpful, but it is a long-term and potentially arduous strategy.³⁶

Risk regulation in a democratic republic confronts hard choices. In our republic, representatives are not Princes, and citizens are not Paupers; indeed every "expert" is also a citizen, and the citizenry is

for example, both might agree that the best instrumental method of "informing the public's discretion" would be for government officials to demonstrate enlightened leadership that, although it diverges from current public opinion, prompts reflection and shapes a new and better public opinion. Cf. R. DOUGLAS ARNOLD, *THE LOGIC OF CONGRESSIONAL ACTION* 10-16 (1990) (successful representatives do not just reflect current public views, but respond to, and help shape, citizens' "potential preferences").

31. See DAVID R. MAYHEW, *CONGRESS: THE ELECTORAL CONNECTION* (1974).

32. See R. DOUGLAS ARNOLD, *supra* note 30; Edward L. Rubin, *Beyond Public Choice: Comprehensive Rationality in the Writing and Reading of Statutes*, 66 N.Y.U. L. REV. 1 (1991); ARTHUR MAASS, *CONGRESS AND THE COMMON GOOD* (1983); MARC K. LANDY & MARTIN A. LEVIN, *THE NEW POLITICS OF PUBLIC POLICY* (1995); James Q. Wilson, *The Politics of Regulation*, in *THE POLITICS OF REGULATION* 357, 363 (James Q. Wilson ed., 1980).

33. See MANCUR OLSON, *THE LOGIC OF COLLECTIVE ACTION* (1965); James Q. Wilson, *supra* note 32, at 366-372; JAMES Q. WILSON, *POLITICAL ORGANIZATIONS* 327-45 (1973); WILLIAM A. NISKANEN, JR., *BUREAUCRACY AND REPRESENTATIVE GOVERNMENT* (1971); DENNIS C. MUELLER, *PUBLIC CHOICE II* (1989).

34. See Sunstein, *Preferences and Politics*, *supra* note 24.

35. See BREYER, *supra* note 4, at 35-38; Howard Margolis's essay in this symposium issue; Roger G. Noll & James E. Krier, *Some Implications of Cognitive Psychology for Risk Regulation*, 19 J. LEGAL STUD. 747 (1990). See *supra* text accompanying note 18.

36. See BREYER, *supra* note 4, at 39.

the source of government's ultimate authority. The real question is what representation means. If public evaluations are based on factual mistakes or heuristic errors, the solution might be for experts to educate the public (Jefferson), or by contrast to insulate risk policy decisions from the foibles of populist politics (Breyer). If public evaluations are instead based on different value choices, the solution may be to adhere to those value choices and override expert opinion (Jefferson), or by contrast, to exercise wise, expert leadership by shaping public attitudes (Burke).

This matrix presents choices that are difficult enough already. But the complicating irony is that, like the Prince and the Pauper, the "expert" and "public" approaches to risk regulation switch places!

As the story begins, the "expert" approach is seen as quantitative and technocratic, the domain of policy wonks who crunch risk data and perform cost-benefit analysis. The "public" approach is seen as qualitative and populist, the domain of communities and the psychologists who study them.

But as the tale unfolds, the approaches put on each other's clothing. In a very real way, the "expert" approach is quite populist, and the "public" approach might actually be elitist. This is not nonsensical. Consider that the "expert" approach employs cost-benefit analysis to judge whether risk control is worth the expense. In order to measure the benefits side of this calculus, the expert must gather risk assessment data – the units of risk (say, life-years lost) associated with each unit of exposure to the hazard. So far this is quantitative and austere. But then the expert economist must translate those risk figures into "benefits" – into some measure of the *value* of avoiding a unit of risk.³⁷ Hence, economists "monetize" risk avoidance estimates by applying a valuation measure such as the public's willingness to pay (WTP) to avoid an increment of risk or its willingness to accept (WTA) to incur the risk.³⁸ These WTP and WTA numbers implicitly and inescapably incorporate the public's reactions to the diverse qualitative attributes of risks. When the worker demands a certain wage premium to face an occupational hazard, or the consumer pays a premium to purchase a safer product, or the survey re-

37. Approaches that seek to maximize the number of lives saved, or of life-years saved, or some other purely physical measure of risk, do not involve benefits valuations, and may be criticized for their failure to link risk data to public evaluations of the different qualitative contexts surrounding different risks. In economic terms, the maximand is the *utility* of risk reduction, not the physical units of risk reduction.

38. See W. KIP VISCUSI, *supra* note 20, at 19-21.

spondent bids a price to avoid species loss, in each case she is responding to the risk in its totality and in its qualitative context. The observed WTP or WTA reflects all the quantitative *and* qualitative features of those risks in concert (albeit in a single aggregated measure that does not elucidate which, or to what degree, qualitative attributes are driving the public's valuations, and that is sensitive to market or survey imperfections).³⁹ The "expert" engaged in such a cost-benefit analysis is thus applying a fundamentally *public* metric of risk. The Prince is seeing life as the Pauper does.

Meanwhile, the psychometric characterization of public attitudes toward risk could be seen as an elite imputation of views to an unassuming public. If it is true that the public really does respond to qualitative aspects – dread, unfamiliarity, involuntariness, inequity, unnaturalness, trust, and so on – in comparing risks, then the public is being populist, as alleged. But efforts to find the public expressly articulating the importance of these qualitative attributes have been inconclusive.⁴⁰ Instead, the public's appreciation for these qualitative attributes has often been inferred by expert psychologists from the indirect evidence that the public is ranking some risks higher than others. The experts then examine the features of the risks being ranked and infer that the qualitative attributes noticed by the experts are what is driving the public's evaluations.⁴¹ This is what Margolis

39. Applying a one-size-fits all measure of the average value of risk avoidance, such as, say, valuing benefits at \$5 million per statistical life saved regardless of the source or setting of the health risk, would obscure the different qualitative factors and different value choices embedded in different risk contexts. Employing more finely disaggregated values of risk avoidance, thereby matching the context of the observed marketplace choice or contingent valuation survey question to the context of the risk policy being examined by the expert, would yield a more qualitatively accurate risk valuation. See VALUING HEALTH FOR POLICY: AN ECONOMIC APPROACH, *supra* note 17.

40. *E.g.*, CROPPER & SUBRAMANIAN, *supra* note 22, at 31-32, found that the median respondent traded a life for a life regardless of the qualitative variations. They did find, however, that 20% of the respondents placed nearly infinite importance on the qualitative attributes, refusing to trade any number of quantitative lives to incur the qualitative attributes.

41. This positivist inference confronts the problem of nonfalsifiability. It is a bit like the approach of observing legislative outcomes, separately observing that certain industry groups benefited from the legislation, and then inferring that these industry groups must have been the key political force driving the adoption of the legislation. Maybe, but maybe not – other variables could have explained the legislative outcome. See Roger G. Noll, *Economic Perspectives on the Politics of Regulation*, in 2 HANDBOOK OF INDUSTRIAL ORGANIZATION 1253, 1276-1277 (Richard Schmalensee & Robert D. Willig eds., 1989) ("[T]he empirical studies surveyed here are broadly consistent with, but do not really prove, the political theory of regulation ... [There is] the lurking danger of tautology [because it] is impossible to imagine that regulation could be imposed without redistributing income. Hence, a look for winners in the process ... is virtually certain to succeed."). Likewise, it is virtually certain that in hindsight we will be able to point to qualitative differences among differently ranked risks, but that does not necessarily mean

calls the “usual story.” If Margolis is right (and he may not be) that this inference about risk perceptions is a post-hoc rationalization – just an explanation offered by experts for what is really something else (say, irrational and heuristic errors by public respondents, or perhaps some other qualitative values which have not yet been pinpointed by psychologists) – then the “public” approach to risk evaluation turns out to be an elite expert construct. If so, the public does not compare risks based on dread and unfamiliarity; rather, the experts impute these views to a public that is thinking about something else (or just making mistakes).⁴² The Pauper is just being dressed up by the Prince.

In many risk evaluation settings, then, the Prince and the Pauper may have switched roles: the expert economist is reflecting public risk valuations, whereas the purportedly public attitudes regarding qualitative risk attributes may be an expert gloss. If so – and here I suggest only the plausibility of this role reversal, not its widespread occurrence – the current debate about “expert” versus “public” approaches to risk regulation is missing the mark. Expert risk analysts performing cost-benefit analysis are not ignoring the public; they are listening. But experts interpreting public risk evaluations may be imputing more than they are hearing.

Or, at least, the economic and psychometric experts are *both* listening to the public, each in a different way. So there are really *two expert approaches to interpreting the public*, rather than one cloistered expert approach and one inclusive public approach.

Recognizing this irony does not answer the normative questions regarding whether the republic should try to reflect or to shape public attitudes about risk. It does suggest that there is far less separating the “expert” and “public” approaches than is commonly asserted. It does suggest that the normative questions about the preference-reflecting or preference-shaping role of government are far more important than is the strawperson conflict between contrived “expert” and “public” approaches. If government should play a preference-shaping role, subject to electoral system checks (that is, the voters’ ability to unseat the incumbent whose leadership has strayed

that the qualitative differences account for the variations in public concern. Margolis’s concern is that other variables could explain the observed public responses to diverse risks, besides the qualitative attributes noticed after the fact by experts.

42. See Howard Margolis’s essay in this symposium issue; HOWARD MARGOLIS, DEALING WITH RISK: WHY THE PUBLIC AND THE EXPERTS DISAGREE ON ENVIRONMENTAL ISSUES (1996).

too far), then the premium is on developing and communicating a normative theory of ideal risk evaluations.⁴³

Before concluding that preference-shaping is the proper role for government, we might begin to sketch such a normative theory of ideal risk evaluations, to see what it would look like before we are committed to it. In the table below, I try to find a reconciliation between the “expert” and “public” approaches that highlights their shared normative premises. I pair the psychometric qualitative attributes of “complete” risk perception, on the left, with the economist’s conditions for “efficient” risk valuation in benefits estimation (*i.e.*, valuations under efficient conditions undistorted by market imperfections), on the right.

Both psychologists and economists are seeking a comprehensive picture of risk. Economists do not assume or insist that risk be evaluated in the purely quantitative terms of the magnitude and probability of adverse health consequences. Economists are just as interested in the intangible, qualitative attributes of risk that may influence public values and utility and hence expressed WTP and WTA. Moreover, economists are interested in the conditions necessary for the public’s revealed valuations to reflect the public’s true preferences, unbiased by market barriers such as incomplete information and high transaction costs. In other words, risk valuation in efficient market settings would more accurately reflect true public utility than does observed risk valuation in inefficient market setting where workers and consumers have impaired choices. If present markets in which risk valuations are revealed do not exhibit full information and mobility, we can imagine a “reconstituted” market in which observed risk valuations are “efficient.” This is the normative premise of the right-hand column below.

The point of this table is that although the ostensibly “public” (psychometric) and “expert” (economic) approaches to risk have been posed as adversaries, in reality there is a great deal of commonality between them – not necessarily in the descriptions they offer of currently observed risk evaluations, but in the normative criteria they offer for the expression of ideal risk evaluations. A progressive republic seeking to develop a normative thesis of ideal risk evaluation could try to reconcile these two approaches (with certain caveats, such as the need to address the lurking xenophobia in

43. Some preference-shaping role for government may be inescapable, insofar as government defines and enforces the terms of market arrangements, rights, and other features of life that influence private endowments, options, and expressed preferences.

“dread/unfamiliarity”). Such a reconciliation would help clarify the conditions under which observed or elicited risk evaluations by the public could be worthy of adherence by public officials. It also would help public officials target their efforts toward bringing about these conditions – full information, choice, low transaction costs, cooperation, and so on – which would in and of itself facilitate the improved resolution of risk issues throughout society. It would also help government exercise considered judgment in its preference-shaping role, by articulating a reconstituted ideal toward which risk policy might progress.

Table 1. Toward a Common Normative Basis for Risk Perception and Risk Valuation

Parameters of Complete Risk Perception	Conditions for Efficient Risk Valuation
No factual errors	Full information
No heuristic errors	Accurate decision making; low costs of information processing
Account for involuntary vs. Voluntary risk	Full mobility, choice (Or, treat as part of cost analysis – degrees of involuntariness reflect relative costs of risk avoidance)
Account for dread, unfamiliar risk	Account for quality of life concerns (But: may also be proxy for prejudice, xenophobia)
Account for loss aversion – the preference for “old” or “natural” risks over “new” or “unnatural” risks (to the extent that these are not heuristic errors)	Account for the observation that the Willingness to Accept (WTA) price to incur a new risk (lose a current health asset) may exceed the willingness to pay (WTP) to remove an equivalent existing risk (gain an equivalent new health asset). This may reflect income effects associated with different initial endowments, or it may reflect the implicit costs of initially acquiring the health asset or an equivalent asset; or other factors (perhaps heuristic errors)
Consider benefits of the risky activity (“opportunity” as well as “danger”)	Consider the compensating wage/price differentials and other utility gains for incurring the risk (based on full information, mobility); consider costs avoiding the risk
Trust in institutions	No free riders or rent-seeking

VI. MOVING FORWARD

One conference will not resolve how risks are best handled in the republic. But our discussions, and the papers in this symposium issue, suggest several central observations. First, risk comparisons are inescapable – not just to set priorities among independent risks, but because many risks are interrelated and policy actions to reduce one risk will induce increases in other risks. Sound risk policy therefore requires weighing risk versus risk.

Second, political bodies facing multiple demands on scarce risk protection resources are going to employ some version of CRA notwithstanding its limitations. The problem is that these political bodies may employ dysfunctional approaches to setting priorities, by making implicit and ill-considered choices that disguise tradeoffs and serve political power rather than social well-being, or by making needlessly mechanical comparisons of purely quantitative data. In the interests of both democratic and rational decision-making, analysts need to assist these governments to do the best job of CRA they can. This includes taking account of the salient qualitative aspects of risk. One avenue to explore in this regard is the use of the Willingness to Sacrifice (WTS) to measure the qualitative attributes of risk. In these ways, expert analysis can *support* democratic, transparent and intelligent public policy.

Third, explaining the divergence between “expert” and “public” approaches to risk is more complex than has previously been claimed. It is not just that experts are merely quantitative while the public has a “richer” qualitative appreciation of risk. It may be that some of the public’s views are factually and heuristically erroneous. And it may be that the economic experts are actually listening to the public more attentively than are the psychometric experts – or that both are listening, in different and complimentary ways. There appear to be *two approaches to eliciting and interpreting public evaluations, not one expert approach and one public approach*.

Fourth, even assuming that public risk evaluations do reflect a “richer” appreciation of the qualitative attributes of risk, it is wrong to leap from this positive observation to the normative conclusion that a democratic republic should automatically incorporate these public attitudes into regulatory policy.⁴⁴ Good government – even in

44. The normative goal might be to make risk regulation “efficient” in the sense of maximizing social well-being. Critics argue that current risk regulation does not maximize social well-being, because current regulations target many quantitatively small risks and thus miss more cost-effective opportunities to maximize the number of lives saved (or life-years saved).

its representative function – may need *both* to supplement austere quantitative measures of risk with contextual qualitative judgment, *and* to filter out public prejudice and intolerance. In sum, government should not just react to numbers or to public attitudes, but should work with both experts and citizens to select appropriate rationales for prioritizing and regulating risk. Government should prompt citizens to question and reflect upon the qualitative attributes of risk. And government, experts, and citizens should fashion a normative vision of the conditions for ideal risk evaluation and ideal risk regulation, reconciling the psychometric approach to risk perceptions with the economic approach to risk valuation. If we could agree on what constitutes a legitimate expression of public evaluations of risk, unadulterated by market imperfections, heuristic errors, and invidious intolerance, we could make much progress on translating both expert and public evaluations into law and policy.

See BREYER, *supra* note 4; Tammy O. Tengs & John D. Graham, *The Opportunity Costs of Haphazard Social Investments in Life-Saving*, in RISKS, COSTS AND LIVES SAVED 167 (Robert W. Hahn, ed., 1996). Defenders of current risk regulation may counter that it does maximize social well-being once qualitative values are taken into account. See, e.g. M. Granger Morgan, *Quantitative Risk Ranking: More Promise than the Critics Suggest*, in WORST THINGS FIRST?, *supra* note 2, at 133, 137-38 (describing the contention that current risk priorities are ideal once qualitative factors are considered). Cf. Dan M. Kahan, *Social Meaning and the Economic Analysis of Crime*,—J. LEGAL STUD. – (forthcoming 1998) (criminal law, even if it does not minimize the number of crimes, might be efficient once one takes account of the social meanings (*i.e.* qualitative attributes) of the condemnatory messages expressed in criminal laws).

Certainly optimal risk regulation would maximize the social value of risk reduction, not just the number of lives saved. But the claim that this is *already* the situation again confronts the problem of nonfalsifiability. See *supra* note 41 (on potential nonfalsifiability of interest group theory of regulation). It would be too easy to assert that whatever pattern of risk regulation emerges must be socially efficient because it reflects unmeasurable qualitative values. Any regulatory pattern could be explained on this basis, inferring the relevant qualitative attributes in hindsight. On this account, the status quo would always be the best of all possible regulatory worlds. Thus, a more tractable and predictive identification of qualitative attributes, and one that allows the possibility of other explanatory factors for observed regulatory priorities (*e.g.* heuristic errors and interest group rent-seeking), is needed to address this question.

Moreover, even if qualitative attributes – the values of the social meaning of risk – do in fact explain observed regulatory outcomes, this positivist claim does not necessarily warrant the normative conclusion that these qualitative attributes are the proper basis for regulation. Public values may at times be venal, vengeful, or xenophobic. See Frank Cross's essay in this symposium issue. Hence a more coherent normative synthesis is needed to distinguish majoritarian risk regulation from socially ideal risk regulation.