

## A NEW ACCOUNT OF EXPERT/LAY CONFLICTS OF RISK INTUITION

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The prevailing view of expert versus lay conflicts of risk intuition on such matters as nuclear waste and pesticides is that experts focus on a very narrow range of consequences, but ordinary people have a much richer sense of what is involved in choices about risk.<sup>1</sup> Experts may feel comfortable with a level of precaution that seems wholly inadequate to ordinary people because experts typically assess risks in terms of quantitative measures, while ordinary citizens care a great deal about qualitative aspects of risk, such as voluntariness, how far authorities responsible for managing the risk have earned their trust, and about risk to future generations. In a recent book (henceforth DWR<sup>2</sup>), I argue that this widely accepted view is, in fact, wrong. I sketch here, but of course can only sketch (not argue in detail) a contrary view. So this surely will be insufficient to persuade a skeptical reader, but it will at least put the possibility on the table.

I work out an account that turns on how all of us tend to miss cues that do not tie readily to our experience in the world. There are (almost) always opportunities foregone when we take precautions, and danger accepted when we do not. Good judgment—judgment that will look reasonable when the passions of the moment have passed—has to deal with what I label the “fungibility” (between opportunities and dangers) that ordinarily confronts us.<sup>3</sup> A person, and a society, needs to seek a prudent balance between the advantages of boldness and the advantages of caution. We cannot have all we want of one without giving up what is likely to turn out to be more than we want to give up of the other.

As a matter of good sense, no one really can doubt that. But cognitively—that is, as a matter of how our brains actually work,

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1. See VINCENT T. COVELLO, *Risk Comparisons and Risk Communication: Issues and Problems in Comparing Health and Environmental Risks*, in COMMUNICATING RISKS TO THE PUBLIC 79 (Roger E. Kasperson & Pieter J.M. Stallen, eds., 1991); PAUL SLOVIC ET AL., *Facts and Fears: Understanding Perceived Risk*, in SOCIETAL RISK ASSESSMENT: HOW SAFE IS SAFE ENOUGH 161, 183 (Richard C. Schwing and Walter A. Albers, Jr., eds., 1980).

2. See HOWARD MARGOLIS, *DEALING WITH RISK: WHY THE PUBLIC AND THE EXPERTS DISAGREE ON ENVIRONMENTAL ISSUES* (1996).

3. See *id.*

which may be far from how we suppose or would want our brains to work—it is easy to miss one side or the other (danger or opportunity), so that fungibility is lost. Then we will be easily prompted to very firm intuitions that treat one side or the other as negligible, even when that is not at all plausible as an assessment of what is actually known about the situation. This yields cases in which experts are worried but ordinary people are hard to persuade (as in the case of seat belts, cigarette smoking, and so on). There are converse cases where ordinary citizens are very worried about something that experts perceive as not very serious. In DWR, I show how following up this line of analysis leads both to an account of stubborn expert/lay controversies in either direction, and also to an account of how people respond to the psychometric surveys that underlie the usual view.<sup>4</sup> And it also suggests something about a step that might be inserted into the process (what I call the “do no harm” assessment) which might alleviate at least some of the difficulty we see.<sup>5</sup>

I can only open the door to that story in the space available here, mainly by developing a point that every reader in some at least casual way already knows: namely that correlation does not guarantee causation. Beyond doubt, responses on the psychometric dimensions correlate with lay perceptions of risk. But that the risk perceptions at issue are caused by the responses on these qualitative dimensions is something I want to put in question. And, if that skepticism is warranted, it would have consequences both for pragmatic and for normative appraisal of how a free society would best respond to this dilemma of conflicting expert versus lay intuitions.

Trust is item 12 on Vincent Covello’s list of 19 dimensions of risk that have shown up as significant influences on lay perceptions in psychometric studies (fig. 1).<sup>6</sup> But placement in that list is not intended to reflect relative importance. In this instance it conspicuously does not. Loss of trust is the most common explanation of expert/lay conflicts. The claim is that the public has lost trust in the huge corporate or government actors seeking to assure us that the interests of ordinary citizens are being respected.<sup>7</sup> But if one party (the public) does not believe what another is saying (here, some corporate

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4. *See id.*

5. *See id.* at 165-89.

6. *See* COVELLO, *supra* note 1, at 112. The list was developed from the work of Slovic, Fischhoff, and collaborators, *see generally* SLOVIC, *supra* note 1, at 183-94.

7. *See, e.g.*, Paul Slovic et al., *Perceived Risk, Trust, and the Politics of Nuclear Waste*, 254 SCIENCE 1603 (1991).

or government agency), it is tautological that A does not trust B, at least with respect to this issue. So while it is plain that the public is not reassured by the assurances of the Department of Energy with respect to nuclear waste, it does not follow that the public disbelieves what it is told because it does not trust the source. An alternative explanation is that the public does not trust the source because it cannot believe the message. Or the explanation may fall somewhere in between: while distrust is real, it has major consequences on particular issues (and not so on many others) because those are the very issues about which the public would have difficulty believing assurances, even from some entity in which it had great trust.

There is plenty of evidence for at least the compromise view (where disbelief causes distrust as much as distrust causes disbelief).<sup>8</sup> The most direct comes from the very data commonly cited to show that people do not trust the organizations trying to be reassuring. Polls routinely show a declining level of trust in government and corporate actors. But those same polls show a continuing high level of trust in doctors and scientists.<sup>9</sup> Yet reassuring reports from distinguished panels of scientists and doctors on issues of conspicuous expert/lay conflict seem to have no great impact, which surely argues that there is something about particular issues or contexts, not simply something about corporate or government actors, that is prompting disbelief.

But parallel concerns about a possible confusion of cause and effect arise with respect to all 19 of the psychometric dimensions on Covello's exhaustive list. And it is certainly important to consider how far the qualitative dimensions that make up such lists actually provide reasons that explain conflicts of intuition, or only rationalizations that defend intuitions that have their roots somewhere else. The most transparent, as well as the most pervasive, illustration of ambiguity over what is cause and what is effect is provided by the trust issue just discussed.<sup>10</sup> It is an automatic entry in a list like that of figure 1, since on any conceivable view of the matter, if people do not believe what you tell them, they do not trust what are saying. Since it is

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8. See MARGOLIS, *supra* note 2, at 29-32.

9. JAMES A. DAVIS & TOM W. SMITH, NATIONAL OPINION RESEARCH CENTER, GENERAL SOCIAL SURVEYS, 1972-1993: CUMULATIVE CODEBOOK 823-48 (1994); ORTWIN RENN & DEBRA LEVINE, *Credibility and Trust in Risk Communication*, in COMMUNICATING RISKS TO THE PUBLIC 175, 203-209 (Roger E. Kasperson & Pieter J.M. Stallen, eds., 1991).

10. See MARGOLIS, *supra* note 2, at 41-42.

an automatic entry, its mere presence tells us nothing whatsoever about whether it is cause or only effect.

*Figure 1: Covello's list (Covello, supra note 1, at 112)*

<b>Factor</b>	<b>Conditions associated with increased public concern</b>	<b>Conditions associated with decreased public concern</b>
1. Catastrophic potential	Fatalities and injuries grouped in time and space	Fatalities scattered and random
2. Familiarity	Unfamiliar	Familiar
3. Understanding	Mechanisms or process not understood	Mechanisms or process understood
4. Uncertainty	Risks scientifically unknown or uncertain	Risks known to science
5. Controllability (personal)	Uncontrollable	Controllable
6. Voluntariness of exposure	Involuntary	Voluntary
7. Effects on children	Children specifically at risk	Children not specifically at risk
8. Effects manifestation	Delayed effects	Immediate effects
9. Effects on future generations	Risk to future generations	No risk to future generations
10. Victim identity	Identifiable victims	Statistical victims
11. Dread	Effects dreaded	Effects not dreaded
12. Trust in institutions	Lack of trust in responsible institutions	Trust in responsible institutions
13. Media attention	Much media attention	Little media attention
14. Accident history	Major and sometimes minor accidents	No major or minor accidents
15. Equity	Inequitable distribution of risks and benefits	Equitable distribution of risks and benefits
16. Benefits	Unclear benefits	Clear benefits
17. Reversibility	Effects irreversible	Effects reversible
18. Personal stake	Individual personally at risk	Individual not personally at risk
19. Origin	Caused by human actions or failures	Caused by acts of nature or God

However, there is actually a much more striking warning signal which is only rarely discussed, though it is “hidden in plain sight” in lists of psychometric dimensions. Anyone who talks informally to people concerned about environmental risks (and surely we all do that) will find that the first response to questions about risk is invariably that the activity or substance is dangerous. Lack of trust is then the characteristic next response to the follow-up question: Why worry if the experts say it is not a worrisome thing? But when the argument takes its next turn, discussion readily moves to the full-blown possibility that what the lay public means by dangerous is not the same as what an expert is likely to mean by dangerous. We come to the possibility of rival rationalities where responses are different, but not necessarily in a way that makes one wrong whenever the other is right.

This sequence makes sense. But it is not what the psychometric work reports. If you look through even as extensive a survey of the psychometric dimensions as the 19 in figure 1, you will find that expected harm, or something equivalent to that, appears nowhere. Intensity of worry and actuarial information on expected fatalities turn out to be essentially uncorrelated.<sup>11</sup> That raises a severe difficulty for the “rival rationalities” story. It is not surprising that Wildavsky, as a principal critic of what he took to be excessive environmental worries, was convinced that what research on lay attitudes shows is that lay intuition is driven by qualitative features, ignoring quantitative features entirely.<sup>12</sup> But at least for radiation and chemicals (that is, for just the areas where stark expert/lay conflicts are most often encountered), the leading contributor to the rival rationality view also reports that “there appears to be little relationship between the magnitude of risk assessed by experts (health physicists, epidemiologist, and toxicologists) and the magnitude of perceived risks.”<sup>13</sup>

But surely it is bizarre to suppose that likely damage is not even an important factor in lay perception. It is reasonable to want an explanation of why that is so inconsequential in the psychometric work as to be missing entirely from Covello’s list. Actual danger apparently rates no higher than twentieth on a list of what accounts for lay perception of risk! But if an array of possibilities at all comparable to

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11. *See id.* at 34.

12. Aaron Wildavsky & Karl Dake, *Theories of Risk Perception: Who Fears What and Why*, 119 DAEDALUS 41, 51-57 (1990).

13. PAUL SLOVIC, *Perception of Risk: Reflections on the Psychometric Paradigm*, in SOCIAL THEORIES OF RISK 117, 127 (Sheldon Krinsky & Dominic Golding, eds., 1992).

Covello's list is offered, then perceived risk and anything else (such as nearly all the items listed in fig. 1) are also only modestly correlated, though with a long enough list of worrisome items we can, of course, account for whatever we happen to observe. On the other hand, the sheer multiplicity of the dimensions that do correlate with perceived risk is also a puzzle. There are just too many, and especially too many that apparently correlate better than actual damage does. In DWR, I try to provide a detailed resolution of this puzzle through an exercise in "inverting Covello's list."<sup>14</sup>

In sum, a study like DWR could not have been undertaken without the point of departure pioneered by Slovic, Fischhoff, and their colleagues. But the absence of expected damage from the psychometric dimensions raises a flagrant warning signal that something odd is going on. For as every reader will find from introspection, and confirm by inquiring among even her most zealously committed environmentalist friends, no one in fact regards expected damage as the almost irrelevant factor the psychometric studies (on their face) find it to be.

Suppose we temporarily set aside dread (item 11 on Covello's list). And set aside distrust (item 12), since we have already noticed that it is automatically a reason whenever expert/lay intuitions stubbornly conflict, independent of any particular account of what is causing the conflict. Trust is also qualitatively different from other dimensions of the psychometric list, for trust as an explanation is not inconsistent with lay judgment turning on just the same considerations as expert judgment. So trust is not intrinsically part of a rival rationalities (or of an ideological) story. But consider some other items that, like trust, might prompt us to wonder whether there may be substantial confusion between what is the cause of a perception of risk and what is a consequence of a perception of risk. The most conspicuous candidates are press attention (item 13) and accident record (item 14), which are tightly linked. For example, item 14 ("major and sometimes minor accidents") by itself hardly makes any sense. All technologies, and indeed all human activities, involve at least minor and usually also some risk of more serious accidents. Therefore, everything would go into the "greater concern" category of figure 1. However, perceived accidents are what are relevant here.

Suppose we tend to fix in memory incidents related to some risks and take no special notice of comparable incidents involving other

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14. See MARGOLIS, *supra* note 2, at 99-119.

risks. Then apparently there is some underlying propensity to see some risks as saliently worrisome, so that we are very ready to notice and remember anything that fits with that disposition. But the media attends mainly to what we are interested in hearing about, which prompts special media attention to just such risks. And, in turn, that press attention reinforces the background propensity. So there is great public concern about transport of nuclear waste—it might provide the most extreme point for a ratio of expert-to-lay concerns. But the safety record for shipments of nuclear waste is “gold star.” We worry a lot about nuclear waste shipments, even if the record is gold star. A nuclear waste truck that was driven into a ditch injuring nobody would be news to any editor as obviously as a similar accident involving almost any cargo other than nuclear waste would be of no interest whatever.

In 1986, a truck carrying low-level nuclear waste took a wrong turn at the Queensborough Bridge in New York and became jammed into an overpass too low for the height of the truck. There were no injuries and no leakage of radioactive material. But this commonplace accident is nevertheless familiar to anyone interested in nuclear waste transportation and was the subject of intense investigation and local news coverage.<sup>15</sup> Since the event was trivial in terms of what it ordinarily takes to make news in a vast city like New York, the case is unambiguous as an example of how prior disposition to perceive danger prompted concern, which prompted intense press coverage, which (for a time) spread and reinforced concern about an incident that would have been treated as trivial had nuclear waste not been involved.

Further, ambiguity of cause and effect arises even where there is a clearly reasonable basis for an influence on risk perception. Voluntariness of risks (item 6) is conspicuous here, since how strongly people sense voluntariness (or its absence) turns out to be substantially subjective, and not simply a property that a computer or a human being outside the social situation could understand. The paradigmatic example of an activity with large expected fatalities (the conspicuous criterion by which experts rate riskiness), but where lay perceptions of risk are modest on psychometric responses, is driving a car. Everyone is familiar with auto accidents: almost everyone can recall near misses, where serious injury could easily have occurred; spectacular

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15. ROGER E. KASPERSON, *The Social Amplification of Risk: Progress in Developing an Integrative Framework*, in *SOCIAL THEORIES OF RISK* 153, 170 (Sheldon Krinsky & Dominic Golding, eds., 1992).

examples are common items of news reports. More than 40,000 people a year are killed in the United States.<sup>16</sup> But almost none of us exhibit the intensity of concern about auto safety that many people exhibit about the possibility of nuclear waste shipments going anywhere near their city. A public that never exhibited regret at being required to wear a seat belt on an airplane for a generation resisted wearing a belt in a car. Yet even the dimmest citizen is likely to understand that the prospect that wearing a belt would do some good in the event of a crash is surely at least as good for the car as for the plane.

The lack of concern about driving a car can be explained mainly in terms of voluntariness. Yet traveling by car is not really a voluntary choice for most of us. And even for the driver, many aspects of auto dangers are not voluntary in any reasonable sense at all. The obvious examples are risks from drunk drivers, who kill many people besides themselves, and highway design, which has strong effects on the risk of fatal crashes. Both drunk drivers and less than maximally safe highways kill vastly more people than are plausibly killed by the disputed handling of all radiation or chemicals combined. Exposing yourself to the risks of drunk drivers and less than maximally safe highways is scarcely more voluntary (item 6) or more natural (item 19) than eating foods that contain pesticide residues, but only much more likely to kill you. However, it is pesticides that we worry about and for which we doubt that government regulation can be trusted to be adequately careful. In general, there is a large amount of arbitrariness in what is *perceived* as voluntary, and the same holds for every other item in Covello's list. But once we understand that characteristics like "voluntariness" in the rival rationalities argument means perceived voluntariness, then a very wide door is open for rival rationalities to be invoked to rationalize any response, from ignoring flagrant risks to intense concern about nonexistent risks.

Continuing on the list, familiarity (item 2) is plausible as something reassuring, while unfamiliarity is a cue to something worth worrying about. But some things seem to stay unfamiliar even after they have been around a long time. After tens of thousands of shipments of nuclear waste around the world with no notable accidents, the idea of shipping nuclear wastes remains fearfully novel and unfamiliar. Understanding (item 3) makes Covello's list. But is it true that in general we understand nuclear waste storage less than we understand why the plane we are riding on does not fall out of the sky? Other

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16. ROBERT N. ANDERSON ET AL., U.S. DEP'T OF HEALTH AND HUMAN SERVS., *Report of Final Mortality Statistics, 1995*, MONTHLY VITAL STATISTICS REPORT, June 12, 1997, at 23.



items in figure 1 have the character that, if indeed they are important factors, they would be more puzzling than explanatory. Why would uncertainty (item 4) be worrisome for subtle risks where the uncertainty resides in whether a nonzero risk even exists? For many of the cases in which uncertainty is cited (e.g., uncertainty over modest perturbations of radiation exposure relative to natural background) are of just that character. A common account of this involves some claim that there are “many orders of magnitude” of uncertainty. But if the lower bound is zero, then any positive upper bound, however small, gives a range with an infinite number of orders of magnitude of uncertainty. So the “many orders of magnitude” claim may be both perfectly accurate and perfectly trivial, but still scary even when trivial.

Why would someone be more concerned about delayed risk (item 8) than a risk that will come promptly? Would anyone actually prefer a given risk of cancer discovered tomorrow to the same risk of cancer discovered after 20 years’ delay? Personal controllability is item 5 on the list. But for how many people would having a chauffeur seem daunting, since they no longer would be in control of the car? Yet it would be a mistake to focus too narrowly on particular items, since the general difficulty with the psychometric list lies not in particular items, but in something characteristic of the list as an aggregate. It is truly a buffet with something to suit any taste.

Are victims identifiable? Then item 10 enhances worry. On the other hand, if the victims are statistical or otherwise unidentifiable, that will also be worrisome (items 3, 4, 8, and 9 could all come into play). Is the victim me? Then items 5, 6, and 18 could be useful. But if the victim is not me, then 7, 9, and 15 will be useful. Am I worried though there is no sign or evidence of damage? Then 3, 4, 8, 9, and of course 1 are all available. That I cannot see any effect makes sense if the danger is in the future, or by some not-understood mechanism (so I don’t know where to look), or a risk of catastrophe (so although I have not seen it yet, it might be just around the corner). And so on.

Of particular interest here is the concern over fairness (obviously, item 15 but others also, notably 7, 16, and 18). For we find lots of evidence of reversals of usual ethical judgments, since ethical judgments ordinarily follow what I elsewhere call the NSNX principle (“neither selfish nor exploited”).<sup>17</sup> We ordinarily see it as selfish for an individual to insist on absolute protection of his rights and

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17. Howard Margolis, *Free-riding and Cooperation*, in STRATEGY AND CHOICE 83, 95-100 (Richard J. Zeckhauser, ed., 1991).

property with no regard for the costs to others or to society generally. We usually see a person who demands that others accept large costs to avoid trivial infringement on his rights as selfish, or stupid, even if we allow that he is within his rights. We do not see that as morally admirable, and we do not feel that it is unfair if the community is less than sympathetic to people demanding their rights when no significant harm is threatened. Eventually, social norms and even criminal law put limits on how selfish a person can be without punishment. So what is fair is not always a simple matter, and cause/effect ambiguities arise also on this item. Fairness, and how ambiguities involving fairness are resolved, eventually play an important role in the argument of DWR, since the principal reform proposal (what I call a “do no harm” proposal) is tied to that.<sup>18</sup>

A particular dilemma arises with the item set aside earlier: dread (item 11). For here the problem is not just to sort out which way the causal arrow goes, but to see what the point is of including as a claimed cause something that (in this context) seems indistinguishable from the effect to be explained. Dread is easily understood as an additional and reasonable consideration in a context like that of a woman who has been raped: She might intensely want to avoid situations in which she would have to so much as think about the possibility of an attack. But even in this kind of case (and much more easily in cases of dread of snakes, spiders, lightning, or flying), a person may come to see their own situation as one of excessive concern and seek to overcome it or distract it, not rationalize it. But in our psychometric context, dread seems to mean only that concern about this source of risk has a visceral quality beyond logic, hence (for logically slight risks) tautologically must exceed what an expert assessment would judge reasonable. But with 18 other candidates on the list, we might suppose that dread would be redundant. The other 18 items, we might expect, would explain dread. That dread itself is an element reflects the fact that even a list of 18—17 not counting the automatically available trust—does not do a good enough job of accounting for striking expert/lay conflicts of intuition. We need, apparently, to add a catch-all category (dread) for cases in which everything else fails. Suppose we try an analysis of why some marriages stay together while so many others end in divorce. And suppose that after considering 18 contributors to successful marriages, so much of the variance is unaccounted for that a basket category—essentially identical with

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18. MARGOLIS, *supra* note 2, at 165-89.

just what was supposed to be explained (like “happy home”)—also had to be thrown in. No doubt married couples with a happy home life rarely seek divorce, and no doubt risks that inspire a high level of dread are worrisome, but does either explain rather than merely describe what is under examination?

But let us return to the absence from Covello’s list of expected fatalities, or some other usual measure of danger. Even if we take the items on the list as unproblematically causative, one might have supposed that it is when danger in its usual sense is present that lay sensitivities to other dimensions of risk would be heightened. The absence of the most common indicator of risk (probability of death or serious injury) might suggest that what we are looking at is not really a list of extra dimensions that worry lay people but a list of things that might be used to rationalize lay concern in the absence of evidence of danger in its usual sense.

So the question reasonably arises: since the primary response to riskiness of ordinary people (not just experts) is to mention danger (meaning, if you ask, what you would expect, i.e., danger of killing people, of causing cancers, etc.), then why is it that this usual focus of expert analysis is nowhere on the psychometric list?

Douglas and Wildavsky have argued that cultures select risks to serve other purposes than avoiding physical harm.<sup>19</sup> No doubt there is some merit to that claim. All the same, it seems to be going much too far to suppose that physical danger has nothing to do with what is perceived as dangerous.

But suppose that lay concern is not essentially caused by giving a (much) greater weight to qualitative dimensions than experts would give, but by something quite outside the psychometric list. Then it might be that the sense of visceral risk *prompts* elevated responses to items on Covello’s list, rather than the other way around. In DWR, I give a detailed account of how that inversion of the psychometric dimensions might work.<sup>20</sup> The cause/effect ambiguities for these qualitative dimensions make it less surprising that psychometric responses do not correlate well with statistical risk. The reason for that turns on noticing that expert/lay controversies seem invariably about statistical risks very much smaller than risks we ordinarily attend to. If you ordinarily worried about risks unless they were at or below EPA’s one-in-a-million standard, then you would have time to do nothing

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19. MARY DOUGLAS & AARON WILDAVSKY, *RISK AND CULTURE* 1-15 (1982).

20. MARGOLIS, *supra* note 2, at 99-119.

else all day long than take note of all the risks you are running. A decided peculiarity of sharp expert/lay controversy, then, is that it is almost always associated with risks so statistically remote that ordinarily they would not prompt any sense of visceral risk at all.<sup>21</sup>

But it is in just that sort of case where it would be hardest for cues necessarily acquired from everyday experience to function in their ordinarily reliable way. Hence it is also for just such risks (that is, for statistically very subtle risks) that it would most easily happen that perceived risk—the visceral sense of risk that is at issue here—could show little connection with statistical risk, as if “kills few” versus “kills a lot” or something of that nature were important only for experts and of almost no interest to the rest of us.

Consider a contrast between a fractionally microscopic risk of cancer and a microscopic fraction of some large budget—say a few million dollars spent by the Department of Energy on a cleanup. Human judgment is pervasively marked by anchor-and-adjust effects. Far more than we consciously notice, we are somehow cued into a “ballpark,” and then we adjust from there. Even if no good cues to the right ballpark are available, we are remarkably apt to use whatever does happen to be available. Kahneman and Tversky demonstrated very big effects on such things as estimates of the population of unfamiliar foreign countries by spinning a carnival wheel in front of the groups of college students making the estimate: the groups clearly anchored on whatever number showed up on the wheel.<sup>22</sup> Many other experiments have confirmed such effects, as well as much public opinion research showing that recent salient news items will sometimes have huge effects when they have little competition in providing the anchor for public responses.<sup>23</sup>

In the context we are considering, even one chance in a million of a cancer gives us something to anchor on that we can recognize: some single individual with cancer, and we all know someone who has died of cancer. I expect every reader will be able to feel the tug of this anchor, but that virtually no reader has any such immediate intuitive sense of what is lost by DOE wasting a million dollars of its budget. It isn't that, if challenged, you could not come up with something. But one side (the danger) is something with an immediate in-

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21. *Id.* at 95-96.

22. Amos Tversky & Daniel Kahneman, *Judgment Under Uncertainty: Heuristics and Biases*, 185 *SCIENCE* 1124 (1974).

23. *See, e.g.*, SHANTO IYENGAR & DONALD R. KINDER, *NEWS THAT MATTERS: TELEVISION AND AMERICAN OPINION* 34-46 (1987).

tuitive bite, and the other side (the opportunity foregone by inefficiently spending \$1 million of the DOE budget) has almost no bite at all.

An important aspect of this turns on the powerful propensity of humans to yearn for reasoning. This lies behind the propensity to religion, to science, and to a great deal else, some of which (we tend to think) seems admirable, and some of which seems an embarrassment. Cancer has a special role here because it differs from other major contributors to human mortality except accidents and war (and that qualification does not contravene the argument sketched next). Unlike heart and circulation disease (the other two current major killers) cancer is not readily assimilated to our sense that as things get old they wear out. And unlike what used to be the dominant killers (contagious diseases), we do not have a well-entrenched supply of social lore about just what causes the harm. Cancer somehow invades otherwise healthy organs of the bodies, and then insidiously spreads to other parts of the body until a person is killed. That leaves us very open, indeed eager to grasp at, something *blameable* which might be causing this terrible thing. And that propensity to find a reason-why makes cancer an especially effective prompter of concern, feeding into the anchor-and-adjust process already sketched. There is a good deal more to this story. Some is sketched in DWR, and more elsewhere.<sup>24</sup>

But now consider that differential intuitive force of danger (especially in the form of cancer), as against fractionally tiny budget misallocations. I want to put that into the more general context of what I call the *risk matrix* (fig. 2). In DWR, this simple scheme for categorizing responses to risk is used extensively in working out a detailed account of expert vs. lay conflicts of risk intuition.<sup>25</sup> In the risk matrix, whether the cost of accepting a risk is on-screen is arrayed against whether the cost of opportunity foregone by taking precautions is on-screen. Both sorts of cost are to be understood in a wide and intuitive sense, by no means limited to costs or risks measurable in dollars, even in the case of a person inclined to assess things that way. On the other hand it is the costs (and negative costs: benefits) that are *on-screen* for a person, not what an expert might assert ought to be considered, that must be relevant to a person's perception of risk.

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24. See Howard Margolis, *What's Special About Cancer?*, in *CULTURE MATTERS: ESSAYS IN HONOR OF AARON WILDAVSKY* 133 (Richard J. Ellis & Michael Thompson, eds., 1997).

25. MARGOLIS, *supra* note 2, at 71-97.

Figure 2: The risk matrix (after Margolis, *supra* note 2, at 76).

		OPPORTUNITY	
		YES	NO
DANGER	YES	Fungibility 1	"Better safe than sorry" 2
	NO	"Waste not, want not" 3	Indifference 4

In the lower-right cell 4, neither the cost of (marginal) precautions nor the (marginal) risk of not taking precautions are salient. The whole situation is *off-screen*. We may know it is there, but it is not a focus of active attention. But in cell 1, a person is alert to the situation, with the costs that go with the risk on-screen, and also the costs of taking precautions against that risk. What characterizes this context is *fungibility*: we are in a situation where we can see a need to consider, and usually a need to somehow balance or trade off, the advantages of caution against the advantages of boldness. Usually, we must give up values on one dimension to secure values on the other.

For the remaining two cells (2 and 3), either costs or benefits, but not both, are on-screen. Response is dominated by one side or the other, and intuition is then governed in a one-sided way either by "waste not" intuitions (cell 3) or "better safe" intuitions (cell 2).

When the response is active but contested (cell 1), we can expect an attempt to reach some balanced judgment, to see both sides of an argument, to seek expert advice, and so on. If we reach a balance, so that nothing much seems to be gained by shifting a bit either toward more boldness or more caution, we will eventually slip to cell 4. For if we have no clear preference about which way to move, we come to feel comfortable with, or at least resigned to, where we are.

Suppose two individuals with differing experience face the same risk; then one person might see "waste not" while another sees "better safe." That would be no more surprising (for individuals with

different experience in the world — e.g., one is an expert in this matter and the other is not) than that one of a pair of animals choosing to fight in a context where another chooses to flee. But human beings, unlike other creatures, often face choices in which one decision must be made for all (we make social choices, not just individual choices). If the choice is social, I am stuck with your choice unless you are stuck with mine. We face a “locked-in” situation, where a person may have no way to respond to visceral discomfort, since by himself he cannot move (or can only move at a cost that seems unreasonable) to a more comfortable setting. And as social creatures we may be called upon to vote or otherwise influence a choice that involves other people. So even when we are not personally at risk, we may experience visceral discomfort at the situation being imposed on other people.

Expert/lay conflicts can arise for both situations — individual or social choice — because in any context at all, there will be cues that are subtle or complicated or otherwise difficult to use for an inexperienced person, but are familiar and automatically significant for the experienced person. Just what we mean by *expert* is that a person has a lot of experience on some matter. A pair of individuals with very similar intelligence and values may be responding differently to a common set of cues. Subjectively they see different situations, though both agree that objectively it is the same situation. But why that is happening cannot be directly observed, since what governs our intuitions, and the way we use (or discard, or never notice) cues are inaccessible to direct perception.

For social issues, if the predominant lay response is firmly in cell 2, political realities will easily push precautions beyond what seems sensible to expert judgment; this puts experts in cell 3. But pragmatic constraints on how much expense and inconvenience can be managed will often halt precautions well short of what will move lay judgment out of cell 2. So we get a polarized situation, where a one-sided sense of the situation for some set of individuals (mainly lay) eventually leads to an opposing gestalt for another class of individuals (mainly expert). People with one kind of experience in the world find themselves in cell 2, while others—equally intelligent, well-motivated, and so on—find themselves in cell 3. Looking across that axis from either side, a person sees people whose judgment is perverse, narrow, untrustworthy, and so on.

Such reactions can occur even when only individual choices are at issue: I think it is pathetic that you are so timid, you think it is crazy that I am so reckless. But the conflicts will be most intense in

the context of social choice, since both sides are locked into living with a common choice, which looks too timid to one side and too reckless to the other. And it is also in the context of social judgments that social knowledge (what “everyone knows”) is particularly likely to have taken hold, and further constrain the possibility of mere reasoning to shift intuitions.

But the story, to this point, can be read in a way that still fits comfortably with the “usual story”, where expert intuition is focused narrowly on statistical expectations of damage, but lay intuition is shaped by many other dimensions. Although it is indeed the contrasting experience of experts and nonexperts that accounts for the conflicting intuitions, what is most important about that contrast is that the experience of experts makes them focus narrowly on what they have been trained to attend to. Lay intuition is no doubt not so fluent at responding to subtle information about statistical risks. But, in the usual story, what is accounting for the stubborn conflicts is less what experts *see* that other people *miss*, but what ordinary people *feel* about risk that experts *neglect*. But I have from the start made it clear that I want to present a very different interpretation, where “off-screen/on-screen” is a far more starkly dichotomous response than we can consciously notice or would consciously prefer. I try to support that with a good deal of detailed evidence from the cognitive payoff literature of recent decades.

So long as *both* danger and opportunity are off-screen, the matter is left to others (bureaucrats, experts, politicians, or even persons unknown). If both danger and opportunity are on-screen, then we have fungibility and, consequently, an awakened interest in whether the matter is being well handled. Ordinarily that means relying on the judgment of people with particular experience with the matter. But outside the range of normal experience, cases in which we are alerted to both danger and opportunity are least common, cases in which we are alerted to neither are most common, and the cases in which many people are alerted to either danger *or* opportunity, but not both, although rarer than the “neither” case (cell 4), are just those that generate controversy and hence come to wide attention.

Logically, that is not how we would expect our brains to work. But cognitively there is a great deal of evidence (a fair sampling reviewed in DWR) that in fact things commonly do work that way.<sup>26</sup> Then we will be easily prompted to very firm intuitions that treat one

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26. *Id.* at 49-69.



side or the other (danger or opportunity) as negligible even when that is not at all plausible as an assessment of the relative magnitudes given what is actually known about the situation. We get cases in which experts are worried but ordinary people are hard to persuade (as for some years held for seat belts, cigarette smoking, etc.). And we get converse cases in which ordinary citizens are very worried about what risks experts see as not very serious. I would argue that these polarized expert/lay cases for environmental risks should ultimately be seen as a special category of the more general phenomenon of social and political polarization, but here I will just conclude with some summary remarks about the consequences for environmental matters.

On this view, the characteristic case will be one where danger ordinarily too remote to win attention is on-screen, often because it is related to cancer and its special aspects noted earlier, hence provides the anchor for intuitions. But what might be seen as relevant offsetting opportunities do not get on-screen, as also discussed earlier. And so long as danger is on-screen but opportunity off, fungibility is lost. You are in “better safe than sorry” cell 2 of the risk matrix, with consequences already reviewed. A more adequate account, as spelled out in DWR,<sup>27</sup> needs to consider “3 F’s”: framing and fairness, as well as fungibility, though I cannot get to that here. But the result is that we reach an account which makes sense of stubborn expert/lay conflicts of intuition without supposing that only experts care about how far anyone is actually hurt (or helped) by the regulatory choices we make.

This account invites a straightforward empirical test. Sometimes situations arise—even more strikingly, sometimes a given situation changes—so that the opportunity side which on the risk matrix argument had been cognitively invisible gets pushed on-screen. But then we ought to see a striking shift in lay response to the risk, and in lay trust in experts who assess the risk as small. I go through a series of exemplary cases in DWR, for example the intense popular pressure on Congress to *block* an FDA proposal to ban saccharin, which by usual regulatory standards had to be considered a carcinogen.<sup>28</sup> Across a varied array of such cases, we see what the risk matrix view implies we ought to see. And that (it seems to me, and as I argue in the concluding chapters of DWR) has important normative implica-

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27. *Id.* at 117-19.

28. *Id.* at 168-72.

tions, since what seems to account for dramatic shifts in lay perceptions in these cases is not something objectively new—something that logically was not part of the choice already—but something that was there all along but very hard for anyone but an expert to see. But a substantial part of why what is there is so often hard for anyone but an expert to see is not that it is intrinsically beyond what lay judgment can understand but because of the way Congress and courts and regulators have set the *process* of reviewing environmental risks. Readers of a law journal hardly need to be told that process is important, and so although there is no space to do so here, I want to at least mention that there are process reforms sketched out in the concluding chapters of DWR which might merit some attention.<sup>29</sup>

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29. *Id.* at 145-205.