

Risk
and
Reason

Safety, Law, and the Environment

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Introduction: Magnitudes, Tradeoffs, and Tools

The German psychologist Dietrich Dorner has designed some fascinating experiments to see whether people can reduce social risks.¹ Dorner's experiments are run via computer. Participants are asked to relieve suffering and reduce risks faced by the inhabitants of some region of the world. The problems and risks may involve pollution, poverty, poor medical care, inadequate fertilization of crops, sick cattle, insufficient water, or excessive hunting and fishing. Through the magic of the computer, many policy initiatives are available – improved care of cattle, childhood immunization, drilling more wells. Participants are able to choose among them. Once particular initiatives are chosen, the computer projects, over short periods and then over decades, what is likely to happen in the region.

In these experiments, success is entirely possible. Some initiatives will actually make for effective and enduring improvements. But many of the participants – even the most educated and professional – produce calamities. They do so because they fixate on isolated problems and do not see the complex, systemwide effects of particular interventions. For example, they may appreciate the importance of increasing the number of cattle, but once they do that, they create a serious risk of overgrazing, and they fail to anticipate that problem. They may understand full well the value of drilling more wells to provide water, but they do not anticipate the energy and environmental effects of the drilling, which then endangers the food supply. Only the rare participant is able to see a number of steps down the road – to understand the multiple effects of one-shot interventions into the system and to assess a wide range of consequences from those interventions. The successful participants seem to take small, reversible

¹ Dietrich Dorner, *The Logic of Failure: Recognizing and Avoiding Error in Complex Situations* (New York: Metropolitan Books, 1996).

steps or to see the full set of effects at once, and thus to protect themselves against major blunders.

Dorner's experiments are somewhat artificial. They involve computers, rather than real-life problems, lived in real time. But consider an illuminating episode in Britain in 2000, when a train crashed at Hatfield, injuring dozens of passengers and killing several of them. After the crash, railway travel suddenly seemed "unsafe" to many people, and no less than one-third of rail travellers in Britain started using the highway instead. As it happens, Britain's roads are more than ten times as dangerous as its railways. It has been estimated that the increase in automobile traffic led to five additional deaths in the first thirty days after the Hatfield crash – nearly equal the total number of deaths from train accidents in the previous thirty years.

People's behavior in the aftermath of the Hatfield crash tells us a great deal about our reactions to risks. It shows, for example, that a salient example can greatly influence what we do, even if the example does not reveal anything about the statistical reality. As I will emphasize, salient, vivid examples can make people overreact to small risks. When examples are not salient and vivid, people may be indifferent to real dangers. Equally important, the episode also says something about social influences on behavior. After the crash, people undoubtedly spoke with one another about their fears, creating a kind of cascade of concern about train safety. We shall also see that cascade effects can lead people to large-scale errors about risks. But government regulation, my principal topic here, was not involved. Turn now to an ambitious, entirely well-intentioned governmental effort to control risks – in particular, certain risks associated with air pollution from cars. Unfortunately, the effort was a Dorner-style failure. As we shall see, the failure offers many lessons for the future.

Motor vehicles and gasoline contribute to many air pollution problems. If the United States, or any other industrialized nation, could reduce pollution from cars and trucks, it would also decrease the health risks associated with dirty air. In the process, it would do something about global warming as well. Many policies, in the United States and elsewhere, have been extremely successful in this vein. But this is not a tale of success.

In the early 1980s, American environmentalists became interested in what was, at the time, a radical new step: governmentally mandated "clean fuels." These are motor fuels that consist, in whole or in part, of substitutes for gasoline. The most popular clean fuels come from two sources: ethanol, an alcohol fuel usually made from corn, and methanol, an alcohol fuel usually made from natural gas or coal. According to many environmentalists, clean fuels promised to reduce motor vehicle emissions of numerous sources of air pollution, including carbon monoxide, which contributes to ozone. Because tens of millions of Americans lived

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(and continue to live) in areas that exceed federal standards for ozone, any step that would reduce carbon dioxide emissions could be a big help.

At first clean fuels seemed like an exotic and strange idea, urged only by a small group of like-minded individuals. But as the 1980s drew to a close, a bandwagon effect was well underway. People seeking better ways to control air pollution came to believe that clean fuels were both desirable and feasible. It did not hurt that the influential “corn lobby” had much to gain from the widespread use of ethanol. Various industry groups joined environmentalists to spread the news: clean fuels would be good for the environment. The pressure for action was rapidly becoming irresistible. Public officials, including high-level appointees in the first Bush Administration, took interest in the bandwagon.

As Congress began to debate the question, the oil and gas industry, much threatened by the effort to replace its product, suggested an intriguing compromise: “reformulated gasoline,” consisting of a mixture of ordinary gasoline and additives that would reduce harmful emissions. Oil company executives urged that reformulated gasoline could provide the benefits of clean fuels at a fraction of the cost – and far more quickly. Environmental groups rapidly agreed, seeing reformulated gasoline as a chance to move in the direction that they had been seeking all along.

In 1990, the movement for reformulated gasoline spread like wildfire. As the year drew to a close, Congress imposed new legal mandates, requiring reformulated gasoline to be sold in areas suffering from significant air pollution – mostly big cities like Los Angeles, New York, and Chicago. Congress did not specify the oxygenate that must be used, but most companies chose a methanol derivative, methyl tertiary butyl ether (MTBE) – an oxygen-boosting additive that improves combustion, thus reducing carbon dioxide emissions.

So far, perhaps, so good. But there were early indications that MTBE might also produce serious health risks. As compared with conventional gasoline, MTBE increases formaldehyde emissions. MTBE is also far more toxic than gasoline and highly soluble in water. When it leaks from underground gasoline tanks, or is spilled, it travels readily to wells. A few years after the inauguration of the government’s program, MTBE was found to have polluted the water in many areas in which reformulated gasoline is sold – enough to have been detected in no less than 20 percent of the groundwater in such areas. Thousands of groundwater sites in California were contaminated. By the mid-1990s, MTBE was found in drinking water in at least forty-one states.

This is not good news. Even at low levels, MTBE is dangerous to drink, frequently causing nausea, vomiting, headaches, and disorientation. Many scientists believe that MTBE is a human carcinogen. Citing contamination by MTBE, water-well operators have brought lawsuits against gasoline distributors. Things

got even worse. In the late 1990s, an independent study suggested that MTBE had only a modest effect in reducing ozone levels. At the same time, it is not costless, adding to the price of gasoline.

In March 1999, the Environmental Protection Agency (EPA) called on Congress to phase out MTBE, citing water pollution and urging, "Americans deserve both clean air and clean water, and never one at the expense of the other." To replace MBTE, the EPA argued that gasoline should include ethanol and "other safe biofuels." The corn lobby loves ethanol and continues to argue on its behalf. But ethanol seems to be an ambiguous blessing too. Importantly, it decreases carbon monoxide emissions, and it does not contribute to water pollution. But it also increases emissions of both hydrocarbons and volatile organic compounds. In any case, new technology in motor vehicles might well be mooted the whole idea of reformulated gasoline. As the debate rages, state and federal issues are spending a lot of money to clean up water pollution from MTBE.

In some ways, this is an unusual episode, but it tells us a great deal about the control of risks. For air pollution, *laissez-faire*, or reliance on the free market, is not a sensible course. Urban air pollution from motor vehicles creates serious health problems, and aggressive steps have been necessary in response. Many of those steps have succeeded, and there is much more to be done. But it was never clear that the reformulated gasoline program is an especially effective way of reducing air pollution from cars. The government never made a serious effort to compare the reductions from this program with the reductions from many other possibilities. Worse still, the very steps chosen by government were also responsible for the creation of a health risk, one probably more serious than the one that the government was seeking to solve.

When push came to shove, the EPA's recommendation must have turned on a form of balancing. Everyone agreed that it was necessary, at a minimum, to weigh the environmental benefits of regulation against the environmental costs of regulation. But the EPA left that weighing process in a mind-numbing fog, with its unhelpful claim that "Americans deserve both clean air and clean water." The claim is unhelpful because as this very episode reveals, clean air is a matter of degree; no on-off switch separates "clean" from "unclean." What were the particular grounds for the EPA's proposal? And how do we know that "ethanol and other safe biofuels" are the best approach to reducing the risks associated with air pollution from motor vehicles? To both questions, the EPA offered silence. One of the major goals of this book is to criticize that silence and to outline the issues that EPA should have tried to resolve instead.

Gradually and in fits and starts, the American regulatory state, and indeed regulatory states all over the globe, are becoming cost-benefit states. By this

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I mean that government regulation is increasingly assessed by asking whether the benefits of regulation justify the costs of regulation. For arsenic in the water and ozone in the air, for global warming and clean-up of hazardous waste dumps, for safety in the workplace and in cars, for genetically modified food and regulation of cellular telephones, for airline safety and for risks from contaminated water, governments are making decisions after making an effort to quantify and balance both benefits and costs. In many ways, this counts as a genuine revolution, especially in the control and reduction of risks. The revolution is indeed worldwide,² and I shall have something to say about practices in various nations. But my focus here is on American practice, with a hope that the discussion will have more general implications.

I believe that the United States is rapidly reaching the end of an intense “first-generation” debate about whether to base regulatory choices on cost–benefit analysis at all. This debate is now ending, with a substantial victory for the proponents of cost–benefit analysis. In fact, a bipartisan consensus has emerged in favor of the basic approach. The consensus features three points.

First, government should attempt to assess the *magnitude* of any problem that it is attempting to solve, through quantitative assessments to the extent possible. Government should explore whether the problem is large or small. It should try to see if many or few lives are at stake. Where scientific knowledge does not allow for specific estimates, government should try to identify ranges. If it is issuing a new regulation of arsenic in drinking water, for example, government should try to specify how much it is gaining, in terms of deaths and illnesses prevented.

Second, government should attempt to assess *tradeoffs*, by exploring the costs of regulation, also in quantitative terms if possible. Those tradeoffs include a consideration of the extent to which air quality regulation (for example) would compromise water quality goals, automobile safety, and energy requirements. Suppose, for example, that fuel economy standards for cars would significantly reduce air pollution, including emissions of carbon dioxide, which contributes to global warming. Suppose too that fuel economy standards are likely to make cars smaller and less safe, and hence would result in some number of additional deaths each year. The tradeoff should be made explicitly and self-consciously. Indeed, an appreciation of the need for tradeoffs might produce creative solutions that avoid the most serious risks on either side.

Third, government should attempt to use *tools* that are both effective and inexpensive. The most important of the emerging “smart tools” involve disclosure requirements, economic incentives, risk reduction contracts, and free

² See Robert Hahn, *Global Regulatory Reform* (Washington, D.C.: American Enterprise Institute, 2001).

market environmentalism. Because these tools ensure that regulation will be cheaper, they promise to soften resistance to risk reduction policies, and in that sense they are a great friend of such policies. A special benefit of smart tools is that they minimize the burdens placed on government itself – and thus reduce risks in a way that also reduces the need for government planning.

These three principles are simple but also quite powerful. If they were taken seriously, and implemented in the right way, they would have an extremely important effect on risk regulation, potentially saving billions of dollars and tens of thousands of lives. Understood in light of this pragmatic goal, the movement toward cost–benefit analysis should be seen as an effort to ensure, not that companies “save money,” and not that regulation is “scaled back,” but that regulation is undertaken with a firm sense of its consequences for those who are subject to it. I will therefore urge that the antonym of cost–benefit balancing is not “regulation,” but uninformed stabs in the dark. I will also urge that this form of balancing should play a central role in a genuinely deliberative democracy, one that aspires to combine political accountability with a large measure of reflection.

The consensus in favor of cost–benefit balancing has been enshrined in the formal law of the executive branch. In a series of executive orders, Presidents Ronald Reagan, George Bush, Bill Clinton, and George W. Bush have strongly and specifically endorsed the three principles outlined here. But it would be a big mistake to think that cost–benefit balancing has been firmly reflected in the law. Whatever presidents have said, regulatory agencies have sometimes gone off on their own. And a number of important laws, generally enacted by Congress in the 1970s, reject cost–benefit balancing and indeed all three of these principles. A major current question involves the relationship between the new consensus and the old laws, under which most regulatory activity takes place.

Equally important, we are beginning to enter a “second-generation” debate, and here the key questions remain unresolved. The second-generation debate involves the *nature* of cost–benefit analysis – the question of what, in particular, cost–benefit analysis entails. It also raises questions about the limits of cost–benefit analysis – about whether, and why, there are domains in which cost–benefit analysis has no place. A special issue here involves the rights and interests of future generations. How, if at all, should they be counted in the overall calculus?

This book has two major goals. The first is to explore people’s difficulties in thinking well about risks and to connect those difficulties to issues of legal and institutional reform. I suggest that an effort to specify consequences, in as much detail as possible, is an excellent response to the cognitive limitations of individual human beings and of the governments that they create. As we shall see, people rely on mental shortcuts that often work well but that can

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also produce big mistakes. People embrace a form of “intuitive toxicology” that leads to unsupportable fears. Their emotions can lead them astray. Too much of the time, they do not see the need for tradeoffs. They are vulnerable to social influences, leading to “cascades” of both fear and neglect. Well-organized interest groups, from industry and the public interest community, are all too willing to exploit cognitive limitations and social influences to their advantage.

In these circumstances, the chief advantage of cost–benefit analysis is that it can get the effects of various approaches on the table, helping to spur government action where the problem is genuinely large and helping to dampen intrusive regulation where there is little reason for concern. Above all, I make a *cognitive* argument for cost–benefit balancing. I try to show that the emergence of cost–benefit balancing has been a sensible response to some of the problems associated with existing regulation. In its ideal form, an assessment of costs and benefits would prevent the sorts of problems associated with government mandates of MTBE. And in its ideal form, cost–benefit balancing is not opposed to democratic self-government, but instead is one of its best allies. For democracy to work well, people must be reflective about what, exactly, should be done. To know whether government should impose more stringent controls on arsenic in drinking water, it is necessary to have some sense of the costs of those controls (will water bills double? triple?) and also of the benefits (will fewer people get cancer? how many fewer?).

If people choose to proceed even though the costs outweigh the benefits, they are certainly entitled to do that, certainly if they can identify some reason for proceeding. At least cost–benefit analysis will help show them what they are doing. Because I will place a high premium on technical expertise and sound science, this book is, in many ways, a plea for a large role for technocrats in the process of reducing risks. In my view, we need far less in the way of intuitions and interest groups, and not a great deal of pure populism, but far more in the way of science, peer review, and informed public deliberation.

We can sharpen this point with the suggestion that from the inception, the United States has aspired to be a deliberative democracy, one that combines electoral control with a large measure of reflection and reason-giving.³ A deliberative democracy does not simply respond to people’s fears, whether or not those fears are well-founded. Indeed, participants in a deliberative democracy are alert to the fact that people might be frightened of risks that are actually quite small and indifferent to risks that are extremely serious. In these circumstances, a quantitative analysis of risks, to the extent that it is possible, is indispensable to a genuinely deliberative democracy. Deliberative democrats also know that “costs” are no mere abstraction. When the costs of regulation are high, real

³ See William Bessette, *The Mild Voice of Reason* (Chicago: Univ. Chicago Press, 1993).

Table I.I Deaths from preventable risks in the United States

Risk	Percent of		Total Deaths Per Year
	Total Deaths	Range	
Tobacco	19	14–19	400,000
Diet/activity	14	14–27	300,000
Alcohol	5	3–10	100,000
Microbial	4	—	90,000
Toxic agents	3	3–6	60,000
Firearms	2	—	35,000
Sexual behavior	1	—	30,000
Motor vehicles	1	—	25,000
Illicit drugs	<1	—	20,000

people will be hurt, through increased prices, decreased wages, and even greater unemployment. The key point is that the costs should be placed “on-screen,” so that if they are to be incurred, it is with knowledge and approval rather than ignorance and wishful thinking. An understanding of costs, no less than an understanding of benefits, is crucial to democratic deliberation.

My second goal is to establish the meaning and limits of cost–benefit analysis, and in the process to set out a range of reforms for law and policy. By itself, the ideas of “costs” and “benefits” tell us too little. We need to have some sense of how to specify these ideas. We also need to have some sense of institutional reforms, from Congress, the executive, and the courts. I try to provide some guidance on these issues. I urge, for example, that Congress should authorize agencies to use smart tools, designed to increase the benefits and to reduce the costs associated with regulation, in large part by minimizing government’s burden. I also urge that agencies should be required to be alert to health–health tradeoffs, which arise when regulation of one risk ends up increasing another risk. I urge as well that an executive office should publicize risk-related information, put risks in a comparative context, spur private and public attention to serious risks, and discourage costly expenditures on small risks. With minor adjustments, proposals of this sort could be used in any nation. Most generally, I attempt to show how a mature democracy, alert to its own failures, attempts to create institutions and tools to ensure that the law will not merely express the right values, or make the right statements, but actually promote human welfare.

Properly understood, a cost–benefit state attempts to make people’s lives better. The effort to quantify and to balance is designed not to assess everything in terms of money but to promote close attention to the actual consequences

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of what government does. As we shall see, that is no small feat, and it holds out considerable promise for the practice of democracy itself.

BIG RISKS THAT CAN ACTUALLY BE PREVENTED

By way of preparation for what follows, it will be useful to close with some numbers that might make the problem more vivid (see Table I.I).⁴ What is illuminating about this table is its demonstration of the truly extraordinary gains that could be obtained from a sustained effort to reduce the risks associated with smoking, poor diet and exercise, and alcohol abuse. By contrast, many of the risks that excite public attention are small, even infinitesimal. I shall devote considerable attention to explaining how and why this is so and to exploring what might be done about the situation.

⁴ J. Michael McGinnis & William H. Foege, *Actual Causes of Death in the United States*, 270 *JAMA* 2207 (1993).