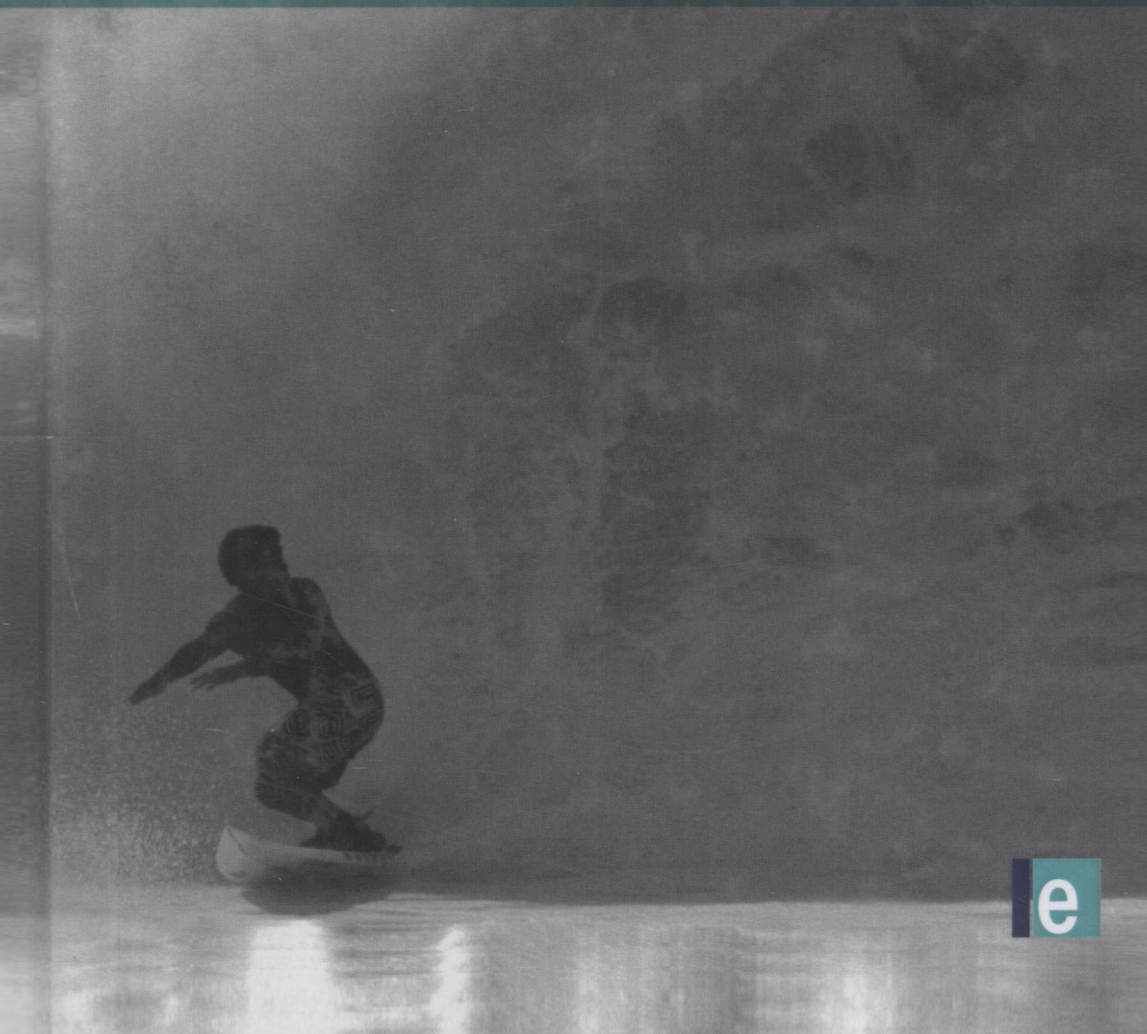
# THE FEELING OF RISK

New Perspectives on Risk Perception

**Paul Slovic**



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# The Feeling of Risk

# Acronyms and Abbreviations

| | |
|---|---|
| ANOVA | analysis of variance |
| ATSDR | Agency for Toxic Substances and Disease Registry |
| CA | completely avoidant |
| FDA | Food and Drug Administration |
| FTP | future time perspective |
| GMO | genetically modified organism |
| IRSA | Industrial Relations and Social Affairs |
| LULU | locally unwanted land-use |
| MANOVA | multivariate analysis of variance |
| NCA | not completely avoidant |
| NIMBY | not in my back yard |
| NIMTOF | not in my term of office |
| NRC | National Research Council |
| ppm | parts per million |
| RT | response time |
| SARF | social amplification of risk framework |
| SWL | subjective well-being |
| SUNY | State University of New York |
| UEA | University of East Anglia |
| USDHHS | US Department of Health and Human Services |
| USEPA | US Environmental Protection Agency |

# Acknowledgements

My profound thanks go to the co-authors of the chapters in this book, who have played such an important role in extending risk-perception research into this new century. What a pleasure it has been to work with you.

As the introductory chapter indicates, the inspiration and support for the present work began in the middle of the last century with the research and guidance of Clyde Coombs and Ward Edwards, and the work of their students and colleagues in the fields of judgment, decision making, and risk analysis. Among the many, Paul J. Hoffman, Lew Goldberg, Sarah Lichtenstein, Baruch Fischhoff, Amos Tversky, Danny Kahneman, and Howard Kunreuther were particularly inspirational to my early efforts in this field.

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Once again, I dedicate this book to Roz Slovic, a remarkable woman who has been at my side since 1959, and to our children, Scott, Steven, Lauren, and Daniel. Scott and Lauren have even written papers with me, one of which appears in this volume.

Paul Slovic
Eugene, Oregon
June, 2010

# Introduction and Overview

My earlier book, *Perception of Risk* (Slovic, 2000a), presented a selection of articles describing a 25-year programme of research that took place during the latter part of the 20th century. The present book, *The Feeling of Risk*, picks up where the last one left off, and describes the extension of risk-perception research into the first decade of the new century.

## Risk as feelings

Although the present book follows in the same tradition as the first book, centred around the 'psychometric paradigm,' there are clear new paths with both theoretical and practical implications. The last chapter of Slovic (2000a) by Finucane et al introduced the *affect heuristic*, a cognitive process in which people look to their positive and negative feelings as a guide to their evaluation of an activity's risks and benefits. According to this view, information must convey emotion or feeling to be meaningful. This general notion, 'risk as feelings,' has continued to play an important role in research and has been highlighted in the title of the present volume and in the first section of the book.

Before launching into the specific contents of *The Feeling of Risk*, I would like to reminisce a bit about the long journey that led to my interest in this topic.

I was enticed to begin my study of risk in 1959. My first mentor, Clyde Coombs, gave me a draft of his paper using choices among gambles as a way to test the theory that people choose the gamble with the highest expected value (the sum over outcomes of the probability times the value of the outcome; Coombs and Pruitt, 1960). I was captivated by the idea that psychologists could do research with gambles and my first study was designed to replicate and extend Coombs' experiment. Close to 50 years later, I find myself still doing research on simple gambles (see Chapter 1).

In 1959, there was little consideration of the possibility that feelings might play a role in people's judgements and decisions about risk. An important paper by my second mentor, Ward Edwards, introduced psychologists to the 'theory of decision making' (Edwards, 1954). The focus was on an ideal decision maker, 'economic man,' who was completely informed, infinitely sensitive, and rational in the sense of making choices that maximized expected value (what Coombs was

testing) or a subjective version of value, expected utility. Edwards, like Coombs, questioned these assumptions as accurate descriptions of how people actually behave and he encouraged psychologists to conduct empirical research to test the economic theories. To be sure, Edwards pointed out that the concept of utility, as originally conceived by Jeremy Bentham (1789/1823), centred around the pleasure or pain-giving properties of an object. Edwards also noted the similarity of the notion of utility to the notion of valence espoused by social psychologist Kurt Lewin (1946). Thus, said Edwards (1954), 'psychologists might consider the experimental study of utilities to be the experimental study of valences' (p389).

Researchers inspired by Edwards began to study utility as an expression of value that could be measured by observing choices, with little regard for the underlying psychological processes. The theories of this era described conscious, deliberate and rather mechanical processing of probabilities and payoffs.

A major change in direction occurred around 1970, when pioneering studies by Amos Tversky and Danny Kahneman began to shed light on fascinating mental strategies called 'heuristics' that could explain people's judgements of probability and their risk-taking decisions (Kahneman et al, 1982). For example, in some situations people seemed to be judging the probability of an event by the ease with which past instances of the event could be recalled or the ease with which the event could be imagined, a process named the *availability heuristic*. Further studies uncovered situations in which people judged probability by the extent to which an event was similar to its parent population, a process named the *representativeness heuristic*. Studies of choice uncovered other mental strategies; elimination by aspects, choosing according to the most important attribute, and so on.

I recall, in the midst of this growing collection of heuristic strategies, wondering how people decided when it was safe to cross a busy street. Certainly they were not calculating probabilities and utilities or their summed products, and the known judgement heuristics did not seem to offer any insight.

Some years later, I think I know the answer. The information available to us conveys positive and negative feelings that we rely upon when deciding when to cross the street or, indeed, when making any decisions involving risk. My first glimmer of this occurred one day when my car ran out of gas on a busy freeway. I had to cross the freeway on foot to get to the gas station. I surveyed the traffic coming toward me at high speed, trying to assess a safe distance to begin the crossing. Several times I took a few steps into the road only to jump back to the curb when the distance to the nearest car closed so fast as to send a chilling fear through my body. Only when my emotions remained calm as I began and continued the crossing did I proceed the whole way. No numerical calculations aided me; only my feelings.

Although this experience may have primed me to be receptive to the idea of risk as feelings at some later date, it did little to change my research, which continued to examine rather deliberate, mechanistic strategies for processing information.

The change in my thinking came gradually. My colleagues and I were asked by officials of the State of Nevada to advise them about the potential for adverse

economic impacts to occur in southern Nevada if the government decided to locate a repository for storing high-level nuclear waste 90 miles from Las Vegas. We knew we could ask people whether such a facility would deter them from coming to Nevada for recreation, or to retire or start a business. We also knew that the answers might not be trustworthy. A previous survey had found that people insisted they would stop swimming at a popular beach if a nuclear power plant were located nearby. The plant was built. No decline was observed in attendance at the beach.

Clearly survey questions are limited in their ability to forecast actual behaviours, especially with regard to a unique facility with which no one has had any experience, and in response to events that will take place far into the future. For several decades marketers had been assessing imagery and associations to consumer products to figure out how to make their products maximally appealing. Following the marketing approach and borrowing a method for studying imagery developed by Szalay and Deese (1978), we first tested whether we could predict people's preferences for visiting cities and states by eliciting images and associations to those places along with the feelings attached to those responses: for example, What word or phrase comes to mind when you hear the word 'Colorado'? It worked: we could predict a person's location preferences by the rated favourability or unfavourability of the images and associations linked to those places. We also found that a nuclear waste repository evokes many strongly negative images, consistent with perceptions of extreme risk and stigmatization. We advised the state that there was a real possibility that, to the extent that adverse events and publicity linked Nevada with nuclear waste (highly negative imagery), visitation to the state would probably be reduced.

We also began appreciating the link between risk and feelings that was being demonstrated in other studies. Our earliest perception studies had found that perceived risk and acceptable risk were most closely associated with the feelings of dread evoked by a hazard (Fischhoff et al, 1978). Another important early finding was that perceived risk and perceived benefit were inversely correlated across diverse hazards. The relevance of this inverse relationship for risk as feelings became clear to us only some 15 years later when my student, Ali Alhakami, decided to investigate it for his doctoral thesis. He found that the extent of this inverse relationship was related to the degree to which people judged an activity as good or bad (Alhakami and Slovic, 1994). This insight, supported further by controlled laboratory experiments (Finucane et al, 2000a), became the basis for the affect heuristic (Slovic et al, 2002), a model asserting that feelings serve as an important cue for risk/benefit judgements and decisions. If we like an activity, we tend to judge its benefits as high and its risks as low; if we dislike it, we judge it the opposite – low benefits and high risk. These inversely structured judgements may not correspond at all to the environment where risks and benefits tend to be positively correlated across activities.

Another important step in the development of risk as feeling came from a dissertation by Alida Benthin (Benthin et al, 1993), who used imagery and associations to study adolescents' perceptions of risk and benefit associated with a

variety of behaviours known to be dangerous to youth, such as smoking, drinking, marijuana and sexual intercourse, or health-enhancing (exercise and seat belts). Positive and negative image scores were found to be highly predictive of engagement in the target behaviours. Images and associations produced by frequent participants in an activity were much more favourable than associations produced by non-participants.

These ideas and findings were the scaffolding upon which the notion of risk as feelings was constructed. We soon began seeing links to many other findings in the risk and decision-making literature, such as the discovery by Chris Hsee and colleagues that information had to be evaluable (in the sense of conveying feelings) in order to be useful for judgements and decisions (Hsee, 1996b). An earlier finding by Slovic et al (2000b), regarding the different response to risk expressed as a frequency such as 1 in 10 vs. a risk expressed as a percentage such as 10 per cent, could be linked to images and feelings created by the frequency format: 'Who is the 1 in the 1 of 10? Is she doing something bad?'

Important influences also came from connecting the work of many other theorists during the past half century. Charles Osgood (Osgood et al, 1957) demonstrated the importance of positive and negative affect for understanding the meaning of words. Affect was shown to be an important factor for explaining animal learning studies (Mowrer, 1960a, b), for motivating and guiding all rational human behaviour (Damasio, 1994), and for helping to explain the very nature of human thinking (Berkowitz, 2000). At about the same time that my colleagues and I were integrating much of this work into our review paper 'The Affect Heuristic' (Slovic et al, 2002), George Loewenstein and colleagues crafted a similar story and gave us the rubric 'Risk as Feelings' in their excellent review article (Loewenstein et al, 2001).

So, in this way, over many years, stimulated by personal experiences and by the findings from diverse studies, I have come to appreciate the important role that feelings play in guiding human behaviour in general and risk perceptions and risk decisions in particular.

With this as background, let's examine Part I of the present book, illustrating the variety of risk judgements and decisions that have been investigated recently through the lens of the affect heuristic and risk as feelings. The first chapter, by Bateman et al, shows that 50 years after beginning to study people's judgements of gambles, my colleagues and I found that there is still something that can be learned from this experimental paradigm. We focus on a very simple prospect, offering a 7/36 chance to win $9, otherwise win nothing. We find, consistent with Hsee's notion of evaluability, that even a very familiar outcome such as winning $9 is not very evaluable. We lack a firm feeling of how good or bad $9 is in this context. As a result, it carries little weight in the judgement of the gamble. But we can inject positive feeling into the $9 by changing the other outcome in the gamble to lose 5¢. The $9 win now 'comes alive with feeling,' looking very good in comparison to the small loss. It is evaluable (good) and carries weight in the judgement, thus making the gamble with a small loss more attractive than the gamble with no loss.

The second chapter demonstrates that feelings are important in determining our reactions to risks from a broad range of personal or societal threats. Building on the distinction between experiential and analytic thinking about risk, Slovic et al demonstrate ways that emotional reactions (risk as feelings) are associated with vividness of imagery, proximity in time, and other variables that play a minimal role in analytic evaluations. The difference between analytic and experiential reactions poses a dilemma for policy makers who are urged to follow deliberative approaches (e.g. cost–benefit analysis) that act as a check against unwarranted fears (e.g. Sunstein, 2005) but are also advised to respect the public's sensitivity to important value-laden considerations that are often ignored in expert deliberations (e.g. National Research Council [NRC], 1996). This dilemma is explored in depth in Chapter 12 by Kahan et al.

An important chapter in Slovic (2000a) by Fetherstonhaugh et al (1997) documented a form of insensitivity to the value of human life that parallels the insensitivity observed in early psychophysical studies of sensory perceptions. Just as a fixed increase in light energy leads to a greater increase in perceived brightness when the original intensity is small than when it is large, saving a fixed number of lives seems more valuable when fewer lives are at risk to begin with – a form of 'psychophysical numbing.' Subsequent research has linked this numbing to a limitation in our ability to 'feel the meaning' in large numbers. Chapters 3, 4, 5 and 6 describe studies attempting to better understand the importance of feelings in motivating decisions to help people in need.

The study by Dickert and Slovic (Chapter 3) demonstrates the role that attention plays in the generation of feelings toward people who are at risk. One experiment shows that sympathy toward a child in need is reduced when that child's image is presented in the context of distracting images. A second study finds that sympathy judgements made when the child's image is in view are greater than those made from a memory of the child's image.

The research described by Small, Loewenstein and Slovic in Chapter 4 shows that donations to a starving child in Africa were greatly reduced when potential donors were informed that this child was one of millions in need. Other research demonstrates that people help others, in part, to make themselves feel good (e.g. Andreoni, 1990). The data in Chapter 4 suggest that making donors aware of needy persons 'out of reach' may trigger negative feelings that counter the good feelings that come from giving aid. This is non-rational. We should not be deterred from helping those we can help by knowledge that there are others we cannot help.

Chapter 5 argues that our attitudes and behaviours towards saving lives are guided more by the feelings associated with our moral intuitions than by the reasoned actions that would result from a more deliberative form of thinking, moral judgement. Because moral intuition tends to be insensitive to large losses of life, moral judgement must be invoked to create laws and institutions dedicated to preventing and halting mass abuses of human beings, even when our feelings convey no sense of alarm.

Chapter 6 further explores the problem of insensitivity to mass tragedies. Paul Slovic describes the difficulties that people have in understanding the meaning of

large-scale human and environmental catastrophes represented numerically by dry statistics, '... human beings with the tears dried off.' Scott Slovic, a writer and eco-critic, provides a brief introduction to ways that writers attempt to overcome this insensitivity and create feelings and meanings through stories. Stories have the power to help us understand larger, complex problems – including threats to the environment – that we cannot apprehend through quantitative information alone.

Chapter 7 argues that the initiation of cigarette smoking is based on experiential thinking (feelings) rather than an analytic evaluation of risk. It describes important ways in which young smokers fail to understand the risks they are taking. Chapter 8 applies the affect perspective to explaining the impact of the South Asia tsunami (in which 600 Swedes were killed) on the lives of the Swedish population. The study suggests that the negative affect elicited by thinking about a recent major natural disaster leads to a more pessimistic view of the future. The implications of this infusion of affect in everyday judgement are vast, perhaps influencing decisions about consumption, health, social interactions and finance.

## Culture, cognition and risk

Part II highlights another important perspective on risk, documenting the interplay between cultural factors and cognition. The first three chapters (9, 10 and 11) take the 'white male effect' as a starting point for deeper analysis of race, gender and cognition. The original study of this effect by Flynn et al (1994) found that 30 per cent of the white male population in the United States had extremely low perception of risk across a diverse array of hazards. In Chapter 9, Finucane and colleagues replicate and extend the original study, finding sizeable differences between white males and other respondents on a variety of sociopolitical attitudes. Finucane et al speculate that the world seems safer and hazardous activities seem more beneficial to white males than to others. Using the same National Survey data, Satterfield et al (Chapter 10) show that feelings of vulnerability, linked to experience with discrimination and injustice, are important drivers of the effect such that even white males have relatively high perceptions of risk if they, too, have had these experiences. Chapter 11, by Kahan and colleagues, proposes a new explanation for why white men fear risks less than women and minorities. According to this view, individuals selectively acknowledge or dismiss associated dangers in a manner supportive of their cultural identities. Thus the white-male effect can be seen as a reflection of the scepticism that hierarchist and individualistic white males display when activities integral to their cultural identities are challenged as harmful.

Much of the early research on risk perception documented striking differences of opinion between experts and the public that were quite resistant to change (Slovic, 2000a). In 2005, Cass Sunstein published a careful and comprehensive analysis of this literature and its implications for a normative account of how the law should respond to public risk perceptions (Sunstein, 2005).

Concerned that numerous social and cognitive mechanisms drive members of the public to exaggerate risks, Sunstein proposed a number of important institutional mechanisms designed to shield 'deliberative democracy' from the influence of risk panics. Chapter 12 by Kahan et al, written as a review of Sunstein's work, critiques his arguments from the perspective of cultural cognition. A model is proposed whereby individuals behave neither as rational nor irrational judges but rather as cultural evaluators of risk.

Chapter 13 by Satterfield et al examines culture in a different way, documenting the despair and life-disruption that took place when a close-knit African-American community in Georgia was told by the Environmental Protection Agency that their neighbourhood was severely contaminated by chemical releases from a nearby pesticide manufacturing factory. One of the well-documented effects on technologies, products and places that have become associated with an abnormal degree of risk is stigmatization (Gregory et al, 1995). Satterfield et al convey what it feels like to be forced to live in a risk-stigmatized community.

## New psychometric studies

Much of the research presented in Slovic (2000a) and the present volume grew out of what was called the 'psychometric paradigm.' This paradigm encompasses a theoretical framework that assumes risk is subjectively defined by individuals who may be influenced by a wide array of psychological, social, institutional and cultural factors. The paradigm assumes that, with appropriate design of survey instruments, many of these factors and their interrelationships can be quantified and modelled in order to illuminate the responses of individuals and their societies to the hazards that confront them.

Part III of the present volume presents a short selection of recent studies that have applied the psychometric paradigm to specific, and sometimes new, hazard domains.

Finucane, Slovic and Mertz (Chapter 14) examined American attitudes toward blood transfusion. At the time of data collection, 1997, it was clear that transfusion was a stigmatized activity, with a substantial proportion of people believing that the US blood supply was unsafe. The authors conclude that perceptions of risk from blood transfusion need to be monitored and the study methodology provides a guideline for doing this.

Savadori et al (Chapter 15) compared experts and a public sample on perceptions of risk associated with medical and food applications of biotechnology. Compared to the public, experts perceived less risk for every biotech application, but both groups judged the risk from food-related applications as higher than the risk from medical applications.

During the period 1987–1991, national surveys in Sweden and Canada examined public attitudes and perceptions regarding the risks and benefits of prescription drugs. Chapter 16 by Slovic et al describes similar results from a national study in the United States, more than a decade later. Prescription

medicines were perceived to be high in benefit and low in risk and were sharply differentiated from other chemicals.

Burns and Slovic (Chapter 17) demonstrate how basic psychometric surveys can provide insights vital to modelling the consequences of a terrorist attack in an urban area. Not surprisingly, a terrorist act is much more alarming than non-terrorist events (e.g. accidents, diseases) that cause equivalent direct harm. But not all terrorism is equivalent. Disease agents (e.g. anthrax) are more scary than bombs and the motives of the terrorists matter to risk perception. But, consistent with the findings described in Chapters 4, 5 and 6, the number of victims (ranging from 0 to 495) did not seem to matter. The study, while exploratory, provides a model for research that can inform policy decisions in this important risk domain.

Kahan et al (Chapter 18), working within the framework of 'cultural cognition,' find that members of the public who hold relatively egalitarian and communitarian worldviews perceive the risks from nanotechnology to be greater and its benefits smaller than do persons who hold hierarchist and individualistic worldviews.

## Risk knowledge and risk communication

Part IV examines the role of risk perception within a broader context of knowledge and communication.

One of the most important theoretical frameworks to emerge out of the study of risk perception is that of the 'social amplification of risk.' This framework attempts to integrate findings from media and communication research, from the psychometric and cultural schools of risk-perception research, and from studies of organizational responses to risk. In Chapter 19, Kasperson et al review research on the framework that took place during the 15 years subsequent to its introduction in 1988. Among various applications, social amplification appears to have been particularly useful for studying risk-induced stigma and its policy implications.

Much information about risk comes to us in the form of statistics and probabilities. In Chapter 20, Peters et al introduce the important concept of numeracy, showing that individuals who differ in their ability to understand numbers often fail to comprehend risk information adequately. Those who design health risk communications need to consider what can be done to help less-numerate people make better health care decisions.

But even more basic than understanding risk numbers is understanding the consequences being quantified by the numbers. Risk perception has been shown to be a layered process starting with superficial knowledge (e.g. smoking is harmful) and progressing (sometimes) to deeper levels of understanding (e.g. what forms of harm are caused by smoking and how does it feel to experience them?). In Chapter 21, Weinstein et al demonstrate that, although people may recognize that smoking can lead to adverse health effects, they do not have even a

basic understanding of the nature and severity of these harmful consequences. Graphic images of smoking-induced disease have been assumed to boost knowledge and produce negative affective reactions that may counter the positive images conveyed by billions of dollars in tobacco advertising. In support of this assumption, Chapter 22 by Peters et al shows, by means of controlled experiments, that putting graphic images on cigarette packages may help to reduce smoking initiation and increase quit attempts.

## Where do we go from here?

It is exciting to view the profound improvement in our understanding of judgement and decision making under risk that has occurred during the past 50 years. If anything, new technological advances involving computers, Internet testing, high-fidelity simulations, and neuroimaging, coupled with the ability to easily communicate and collaborate with others around the world, have speeded up innovation and discovery.

In particular, I hope that 50 years from now we will have found ways to overcome insensitivity to large-scale tragedies. Perhaps new methods of education, starting in the early years of school, will teach us how to understand the reality underlying large numbers, so we can act effectively to prevent and halt mass destruction of people and nature. I also hope that a vastly improved understanding of the feeling of risk will enable us to integrate feelings with technical analysis so that we can communicate about risk more effectively and make wiser decisions, even when dealing with people of different worldviews and cultures. Certainly sophisticated methods of neuroimaging will add valuable new insights into risk perception. But will the study of simple gambles still be part of our methodological toolkit a half-century from now? I wouldn't bet against it.

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