Risk Perception and Affect

Paul Slovic and Ellen Peters

Current Directions in Psychological Science 2006 15: 322
DOI: 10.1111/j.1467-8721.2006.00461.x

Risk Perception and Affect

Paul Slovic[1,2] and Ellen Peters[1]

[1]Decision Research, Eugene, Oregon, and [2]University of Oregon

ABSTRACT—***Humans perceive and act on risk in two fundamental ways.*** **Risk as feelings** ***refers to individuals' instinctive and intuitive reactions to danger.*** **Risk as analysis** ***brings logic, reason, and scientific deliberation to bear on risk management. Reliance on risk as feelings is described as "the affect heuristic." This article traces the development of this heuristic and discusses some of the important ways that it impacts how people perceive and evaluate risk.***

KEYWORDS—*risk perception; risk analysis; the affect heuristic*

Risk in the modern world is perceived and acted upon in two fundamental ways. *Risk as feelings* refers to our instinctive and intuitive reactions to danger. *Risk as analysis* brings logic, reason, and scientific deliberation to bear on risk assessment and decision making. This article discusses what recent research reveals about risk as feelings, an important vestige of humans' evolutionary journey.

That intuitive feelings are still the predominant method by which human beings evaluate risk is cleverly illustrated in a cartoon by *Doonesbury* creator, Garry Trudeau. Two characters decide whether it is safe to greet one another on a city street by systematically tabulating a list of risk and risk-mitigating factors to determine which are more numerous. The reader instantly recognizes that people in such a situation would never be this analytical, even if their lives were at stake. Most risk analysis in daily life is handled quickly and automatically by feelings arising from what is known as the "experiential" mode of thinking.

BACKGROUND AND THEORY: THE IMPORTANCE OF SPECIFIC EMOTIONS AND AFFECT

Strong visceral emotions such as fear and anger sometimes play a role in risk as feelings. These two emotions appear to have opposite effects—fear amplifies risk estimates, and anger attenuates them (Lerner, Gonzalez, Small, & Fischhoff, 2003; Lerner & Keltner, 2000). Lerner and colleagues have explained these differences by proposing that fear arises from appraisals of uncertainty and situational control, whereas anger arises from appraisals of certainty and individual control.

Fortunately, most of the time people are in a calmer state, being guided by much subtler feelings. We shall focus this review on a "faint whisper of emotion" called *affect*. We use the term affect to mean the specific quality of "goodness" or "badness" (a) experienced as a feeling state (with or without consciousness) and (b) demarcating a positive or negative quality of a stimulus. We have used the term "the affect heuristic" to characterize reliance on such feelings (Slovic, Finucane, Peters, & MacGregor, 2002); the experienced feelings are used as information to guide judgment and decision making (Schwarz & Clore, 1988).

Affect plays a central role in what are known as dual-process theories of thinking. According to these theories, people apprehend reality in two fundamentally different ways, one labeled intuitive, automatic, natural, nonverbal, narrative, and experiential, and the other analytical, deliberative, and verbal (see, e.g., Epstein, 1994). One of the main characteristics of the intuitive, experiential system is its affective basis. Although analysis is certainly important in some decision-making circumstances, reliance on affect is generally a quicker, easier, and more efficient way to navigate in a complex, uncertain, and sometimes dangerous world. Many theorists have given affect a direct and primary role in motivating behavior. Pleasant feelings motivate actions that people anticipate will reproduce those feelings. Unpleasant feelings motivate actions that people anticipate will avoid those feelings.

There are strong elements of rationality in both systems of thinking. The experiential system enabled human beings to survive as they evolved. Intuition, instinct, and gut feeling were relied upon to determine whether an animal was safe to approach or the water was safe to drink. As life became more complex and humans gained more control over their environment, analytic tools such as probability theory, risk assessment, and decision analysis were invented to "boost" the rationality of experiential thinking.

THE AFFECT HEURISTIC

Evidence of risk as feelings was present in early studies of risk perception (Fischhoff, Slovic, Lichtenstein, Read, & Combs, 1978). Those studies showed that feelings of dread were the major deter-

Address correspondence to Paul Slovic, Decision Research, 1201 Oak Street, Suite 200, Eugene, OR 97401; e-mail: pslovic@darkwing.uoregon.edu.

miner of public perception and acceptance of risk for a wide range of hazards. This explained, for example, why the public judges radiation exposure from nuclear power plants (highly dreaded) as far riskier than radiation from medical X-rays—an assessment not shared by risk experts. In today's world, terrorism has replaced nuclear power at the top of the list of widely dreaded risks.

Risk and Benefit Judgments

Research has found that, whereas risk and benefit tend to be positively correlated across hazardous activities in the world (i.e., high-risk activities tend to have greater benefits than do low-risk activities), they are negatively correlated in people's minds and judgments (i.e., high risk is associated with low benefit, and vice versa). The significance of this finding was not realized until a study by Alhakami and Slovic (1994) found that the inverse relationship between perceived risk and perceived benefit of an activity (e.g., using pesticides) was linked to the strength of positive or negative affect associated with that activity as measured by rating the activity on bipolar scales such as good/bad, nice/awful, and so forth. This finding implies that people judge a risk not only by what they think about it but also by how they feel about it. If their feelings toward an activity are favorable, they tend to judge the risks as low and the benefits as high; if their feelings toward the activity are unfavorable, they tend to make the opposite judgment—high risk and low benefit (i.e., the affect heuristic; Finucane, Alhakami, Slovic, & Johnson, 2000).

If affect guides perceptions of risk and benefit, then providing information about benefit should change people's perception of risk and vice versa (see Fig. 1). For example, information stating that benefit is high for a technology such as nuclear power should lead to more positive overall affect, which should, in turn, decrease perceived risk (Fig. 1A).

Finucane et al. (2000) tested this hypothesis for various technologies, providing information designed to manipulate affect by increasing or decreasing perceived benefit for the technology or by increasing or decreasing its perceived risk. Their predictions were confirmed. Further support for the affect heuristic came from a second experiment by Finucane et al. showing that the inverse relationship between perceived risks and benefits increased greatly under time pressure, when opportunity for analytic deliberation was reduced. Coupled with the findings of Alhakami and Slovic (1994), these experiments indicate that affect influences judgment directly and is not simply a response to a prior analytic evaluation.

As a key element of experiential thinking, the affect heuristic was essential to risk assessment and survival during the evolution of the human species. But, as we describe below, affect can also mislead people.

Judgments of Probability, Relative Frequency, and Risk

The experiential system of thinking encodes reality in images, metaphors, and narratives to which affective feelings have become attached. To demonstrate this, Denes-Raj and Epstein (1994) showed that, when offered a chance to win $1 by drawing a red jelly bean from an urn, individuals often elected to draw from a bowl containing a greater absolute number of red beans but a smaller proportion of them (e.g., 7 in 100) rather than from a bowl with fewer red beans but a better probability of winning (e.g., 1 in 10). These individuals reported that, although they knew the probabilities were against them, they felt they had a better chance when there were more red beans.

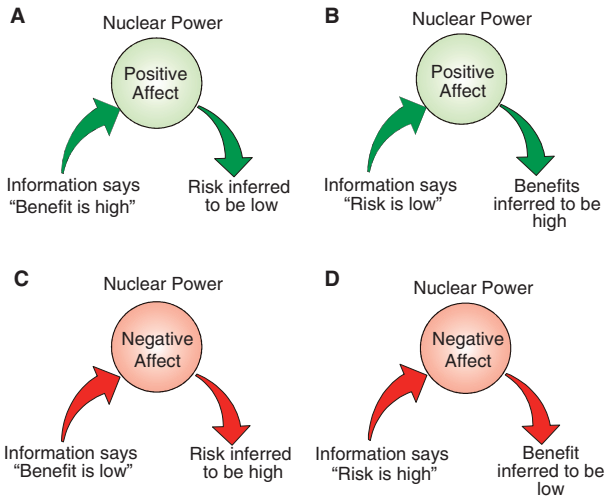

Fig. 1. A model, based on the affect heuristic, showing how information about benefit (A) or information about risk (B) could increase the positive affective evaluation of nuclear power and lead to inferences about risk and benefit that coincide affectively with the information given. Similarly, information could make the overall affective evaluation of nuclear power more negative (as in C and D), resulting in inferences about risk and benefit that are consistent with this more negative feeling. Support for this model was found by Finucane, Alhakami, Slovic, & Johnson (2000). From "The Affect Heuristic in Judgments of Risk and Benefits," by M.L. Finucane, A. Alhakami, P. Slovic, and S.M. Johnson, 2000, *Journal of Behavioral Decision Making*, *13*, pp. 1–17. Copyright 2000, John Wiley & Sons Limited. Reproduced with permission.

We can characterize Denes-Raj and Epstein's subjects as following a mental strategy of "imaging the numerator" (i.e., the number of red beans) and neglecting the denominator (the number of beans in the bowl). Consistent with the affect heuristic, images of winning beans convey positive affect that motivates choice.

Although the jelly-bean experiment may seem frivolous, imaging the numerator brings affect to bear on judgments in ways that can be both nonintuitive and consequential. Slovic, Monahan, and MacGregor (2000) demonstrated this by asking experienced forensic psychologists and psychiatrists to judge the likelihood that a hospitalized mental patient, "Mr. Jones," would commit an act of violence within 6 months after being discharged from the facility. An important finding was that clinicians who were given another expert's assessment of the patient's risk of violent behavior framed in terms of relative frequency subsequently labeled him as more dangerous than did clinicians who were shown a statistically "equivalent" risk expressed as a probability. For example, when clinicians were told that "20 out

of every 100 patients similar to Mr. Jones are estimated to commit an act of violence," 41% refused to discharge him. But when the risk was expressed to another group of clinicians as "patients similar to Mr. Jones are estimated to have a 20% chance of committing an act of violence," only 21% refused to discharge him. Follow-up studies showed that representations of risk in the form of individual probabilities of 10% or 20% led to relatively benign images of Mr. Jones as being unlikely to harm anyone, whereas the "equivalent" relative-frequency representations created frightening images of violent patients (e.g., "Some guy going crazy and killing someone"). These affect-laden images in the relative-frequency conditions likely induced perceptions of greater risk.

Insensitivity to Probability (Probability Neglect)

When the consequences of an action or event carry strong affective meaning, as is the case with a lottery jackpot or a cancer, the probability of such consequences often carries too little weight. As Loewenstein, Weber, Hsee, and Welch (2001) observe, responses to uncertain situations appear to have an all-or-none characteristic that is quite sensitive to the possibility of strong positive or negative consequences, regardless of their probability. Empirical support for this observation comes from Rottenstreich and Hsee (2001), who show that, if the potential outcome evokes strong positive or negative affect, its attractiveness or unattractiveness is relatively insensitive to variation in probability as great as from .99 to .01.

Legal scholar Cass Sunstein (2003) labels this insensitivity *probability neglect* and argues that the emotion associated with terrorist threats causes public officials and private citizens to overreact: "Probability neglect is highly likely in the aftermath of terrorism . . . When probability neglect is at work, people's attention is focused on the bad outcome itself, and they are inattentive to the fact that it is unlikely to occur" (p. 122).

Insensitivity to Numbers

Our affective responses and the resulting value we place on protecting human lives may follow the same sort of "psychophysical function" that characterizes our diminished sensitivity to a wide range of perceptual and cognitive entities—brightness, loudness, heaviness, and money—as their underlying magnitudes increase. The importance of saving one life appears great when it is the first, or only, life saved, but it diminishes marginally as the total number of lives saved increases. We will likely not "feel" much different, nor value the difference, between saving 87 lives and saving 88, if these prospects are presented to us separately.

Fetherstonhaugh, Slovic, Johnson, and Friedrich (1997) documented this potential for diminished sensitivity to the value of life—an effect they called "psychophysical numbing"—by evaluating people's willingness to fund various lifesaving medical treatments. In a study involving a hypothetical grant-funding agency, nearly two thirds of the respondents raised the minimum lifesaving requirements to warrant funding a $10 million grant request when there was a larger at-risk population. A median value of 9,000 lives needed to be saved when 15,000 were at risk, whereas a median of 100,000 lives needed to be saved when 290,000 were at risk. Fetherstonhaugh et al. also found that people were less willing to send aid that would save 1,500 lives in Rwandan refugee camps as the size of the camps' at-risk population increased.

These studies suggest that, when people evaluate life-saving measures, the proportion of lives saved may convey stronger affect and carry more weight than the number of lives saved. We (Slovic et al., 2002) tested this hypothesis. We predicted (and found) that college students would more strongly support an airport-safety measure expected to save a high percentage of 150 lives at risk than a measure expected to save 150 lives (Fig. 2). Saving 150 lives is diffusely good, and therefore somewhat hard to evaluate, whereas saving a high percentage of 150 lives is clearly very good because 98% is so close to the upper bound on the scale, thus creating more positive feeling and support.

DIRECTIONS FOR FUTURE RESEARCH

The affect heuristic, relying on positive and negative feelings, predicts and explains numerous aspects of perceived risk. However, it is obviously too simple a model, as demonstrated by the research showing that two negative emotions, fear and anger, produce different responses to risk and by research showing that affect has direct and indirect influences on risk perceptions when mixed emotions of anger and fear exist (Peters, Burraston, & Mertz, 2004). Peters, Lipkus, and Diefenbach (2006) extend the affect-heuristic model by describing four functions of affect, relating these functions to communications about the prevention and treatment of cancer, and arguing for the place of these four functions in enriching health-behavior theories. Other discrete emotions such as sadness may induce greater deliberation

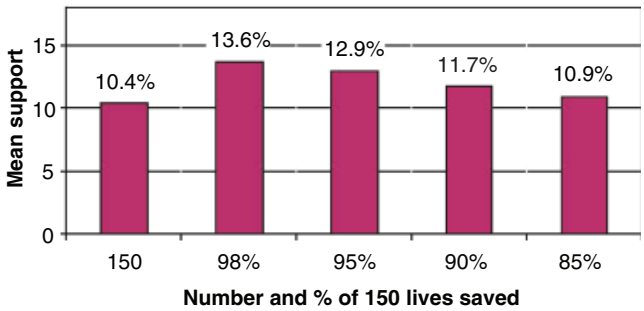

Fig. 2. Mean support expressed for a proposed lifesaving airport safety measure as a function of the number or percentage of lives that would be saved. Bars denote mean responses to the question, ''How much would you support the proposed measure to purchase the new equipment?'' The response scale ranged from 0 (would not support at all) to 20 (would very strongly support). Saving a percentage of 150 lives received higher support ratings than did saving 150 lives.

(Bodenhausen, Gabriel, & Lineberger, 2000), resulting in less reliance on experiential thinking in risk perceptions. Research is needed to better understand the interplay between cognition, appraisals of specific emotions, mixed emotions, background feelings (moods), and valenced feelings emanating from the stimuli being evaluated.

Research is also needed to think creatively about what the new understandings of the dynamic between affect and reason mean for improving risk-related decisions. Because risk as feeling tends to disproportionally weight frightening consequences in certain situations, we need research to reveal how to engage risk as analysis, in order to provide perspective on the likelihood of such consequences. The opposite problem emerges when important numerical information (e.g., numbers of deaths resulting from war or genocide) comes across as "dry statistics," lacking the affect necessary to motivate proper action. How can we engage our analytic capabilities to overcome the numbing effects of mass tragedies? Can we improve people's understanding and use of statistical information by supplementing it with affect-rich images, narratives, or symbols? Research on numeracy and decision making may be useful here (Peters et al., 2006).

In sum, the affect heuristic is a sophisticated mechanism that helps people to respond effectively in many risk situations. In other circumstances, affect may lead us to judge probabilities and consequences in ways that are not beneficial. Additional research is needed to understand the circumstances in which affect protects us and the circumstances in which it leads us astray.

Recommended Reading

Gigerenzer, G. (2004). Dread risk, September 11, and fatal traffic accidents. *Psychological Science*, *15*, 286–287.

Loewenstein, G.F., Weber, E.U., Hsee, C.K., & Welch, E.S. (2001). Risk as feelings. *Psychological Bulletin*, *127*, 267–286.

Slovic, P. (2000). *The perception of risk*. London: Earthscan Ltd.

Slovic, P., Finucane, M.L., Peters, E., & MacGregor, D.G. (2004). Risk as analysis and risk as feelings. *Risk Analysis*, *24*, 1–12.

Acknowledgments—This paper is based upon the authors' joint work with Melissa Finucane, Donald MacGregor, and Daniel Västfjäll. Preparation of the manuscript was supported by Grants SES-0241313, SES-0339204, and SES-0517770 from the National Science Foundation and a grant from the Hewlett Foundation.

REFERENCES

Alhakami, A.S., & Slovic, P. (1994). A psychological study of the inverse relationship between perceived risk and perceived benefit. *Risk Analysis*, *14*, 1085–1096.

Bodenhausen, G.V., Gabriel, S., & Lineberger, M. (2000). Sadness and susceptibility to judgmental bias: The case of anchoring. *Psychological Science*, *11*, 320–323.

Denes-Raj, V., & Epstein, S. (1994). Conflict between intuitive and rational processing: When people behave against their better judgment. *Journal of Personality and Social Psychology*, *66*, 819–829.

Epstein, S. (1994). Integration of the cognitive and the psychodynamic unconscious. *American Psychologist*, *49*, 709–724.

Fetherstonhaugh, D., Slovic, P., Johnson, S.M., & Friedrich, J. (1997). Insensitivity to the value of human life: A study of psychophysical numbing. *Journal of Risk and Uncertainty*, *14*, 283–300.

Finucane, M.L., Alhakami, A., Slovic, P., & Johnson, S.M. (2000). The affect heuristic in judgments of risks and benefits. *Journal of Behavioral Decision Making*, *13*, 1–17.

Fischhoff, B., Slovic, P., Lichtenstein, S., Read, S., & Combs, B. (1978). How safe is safe enough? A psychometric study of attitudes towards technological risks and benefits. *Policy Sciences*, *9*, 127–152.

Lerner, J.S., Gonzalez, R.M., Small, D.A., & Fischhoff, B. (2003). Effects of fear and anger on perceived risks of terrorism: A national field experiment. *Psychological Science*, *14*, 144–150.

Lerner, J.S., & Keltner, D. (2000). Beyond valence: Toward a model of emotion-specific influences on judgment and choice. *Cognition & Emotion*, *14*, 473–493.

Loewenstein, G.F., Weber, E.U., Hsee, C.K., & Welch, E.S. (2001). Risk as feelings. *Psychological Bulletin*, *127*, 267–286.

Peters, E., Burraston, B., & Mertz, C.K. (2004). An emotion-based model of risk perception and stigma susceptibility: Cognitive appraisals of emotion, affective reactivity, worldviews, and risk perceptions in the generation of technological stigma. *Risk Analysis*, *24*, 1349–1367.

Peters, E., Lipkus, I., & Diefenbach, M.A. (2006). The functions of affect in health communications and in the construction of health preferences. *Journal of Communication*, *56*, S140–S162.

Peters, E., Västfjäll, D., Slovic, P., Mertz, C.K., Mazzocco, K., & Dickert, S. (2006). Numeracy and decision making. *Psychological Science*, *17*, 407–413.

Rottenstreich, Y., & Hsee, C.K. (2001). Money, kisses and electric shocks: On the affective psychology of probability weighting. *Psychological Science*, *12*, 158–190.

Schwarz, N., & Clore, G.L. (1988). How do I feel about it? Informative functions of affective states. In K. Fiedler & J. Forgas (Eds.), *Affect, cognition, and social behavior* (pp. 44–62). Toronto, ON, Canada: Hogrefe International.

Slovic, P., Finucane, M.L., Peters, E., & MacGregor, D.G. (2002). The affect heuristic. In T. Gilovich, D. Griffin, & D. Kahneman (Eds.), *Heuristics and biases: The psychology of intuitive judgment* (pp. 397–420). New York: Cambridge University Press.

Slovic, P., Monahan, J., & MacGregor, D.G. (2000). Violence risk assessment and risk communication: The effects of using actual cases, providing instruction, and employing probability versus frequency formats. *Law and Human Behavior*, *24*, 271–296.

Sunstein, C.R. (2003). Terrorism and probability neglect. *The Journal of Risk and Uncertainty*, *26*, 121–136.