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Risk as Feelings

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Virtually all current theories of choice under risk or uncertainty are cognitive and consequentialist. They assume that people assess the desirability and likelihood of possible outcomes of choice alternatives and integrate this information through some type of expectation-based calculus to arrive at a decision. The authors propose an alternative theoretical perspective, the risk-as-feelings hypothesis, that highlights the role of affect experienced at the moment of decision making. Drawing on research from clinical, physiological, and other subfields of psychology, they show that emotional reactions to risky situations often diverge from cognitive assessments of those risks. When such divergence occurs, emotional reactions often drive behavior. The risk-as-feelings hypothesis is shown to explain a wide range of phenomena that have resisted interpretation in cognitive–consequentialist terms.

> The worst disease here is not radiation sickness. The truth is that the fear of Chernobyl has done more damage than Chernobyl itself. (Specter, 1996)

Decision making under risk and uncertainty has been one of the most active and interdisciplinary research topics in judgment and decision making (J/DM). Stimulated in part by the existence of a strong normative benchmark, expected utility (EU) theory, both psychologists and economists have made important theoretical and empirical contributions. These include tests of EU and its assumptions, identification of a wide range of deviations from EU predictions, and the development of alternative descriptive models such as prospect theory and other rank- and sign-dependent EU-type models (for recent summaries, see Harless & Camerer, 1994; R. D. Luce & von Winterfeldt, 1994; Starmer, 2000). EU-type theories also have wide currency in social and industrial–organizational psychology; take for example Ajzen and Fishbein's (1980) theory of reasoned action and the health belief model (Becker, 1974). The convergence in the theoretical perspectives of psychologists and economists in this area has been greater than for any other topic of mutual interest to the two disciplines.

Part of this convergence can be traced to a common implicit, and thus largely unquestioned, theoretical orientation. With some important exceptions (e.g., Janis & Mann, 1977; Mann, 1992; Slovic, Finucane, Peters, & MacGregor, in press), both psychologists and economists who study risky choice adhere to what could be characterized as a consequentialist perspective. We use the term *consequentialist* in its conventional sense to mean that people make decisions on the basis of an assessment of the consequences of possible choice alternatives.

As illustrated in Figure 1, EU-type theories posit that risky choice can be predicted by assuming that people assess the severity and likelihood of the possible outcomes of choice alternatives, albeit subjectively and possibly with bias or error, and integrate this information through some type of expectation-based calculus to arrive at a decision. Feelings triggered by the decision situation and imminent risky choice are seen as epiphenomenal—that is, not integral to the decision-making process. In this sense J/DM theorists assume (either implicitly or explicitly) that risky decision making is essentially a cognitive activity. Many choice theorists are deliberately agnostic about the psychological processes underlying the patterns of choice that their models predict. However, modelers who are explicit about process (e.g., Lopes, 1995; Payne, Bettman, & Johnson, 1993) typically articulate algebraic accounts of underlying processes that are cognitive in character. Overt or covert cognitive information evaluation and integration are assumed to underlie the full gamut of risk-related decisions, from health and safety decisions such as dieting, seatbelt use, and smoking to choices about recreational and workplace activities.

In this article, we propose a distinction between anticipatory emotions and anticipated emotions. *Anticipatory emotions* are immediate visceral reactions (e.g., fear, anxiety, dread) to risks and

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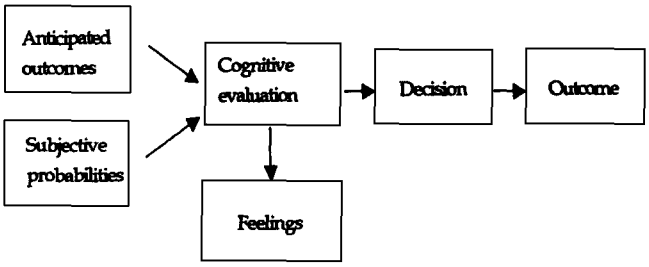

Figure 1. Consequentialist perspective.

uncertainties. *Anticipated emotions* are typically not experienced in the immediate present but are expected to be experienced in the future. To the extent that J/DM research has addressed emotions, the emotions that have been taken into account are anticipated emotions. Several J/DM theories of risky choice provide a prominent role for such emotions, which include the disappointment or regret that might arise from counterfactual comparisons (Bell, 1982, 1985; Loomes & Sugden, 1982, 1986; Mellers, Schwartz, Ho, & Ritov, 1997; Mellers, Schwartz, & Ritov, 1999). As illustrated in Figure 2, decision makers are assumed to anticipate how they will feel about obtaining different outcomes as the result of various counterfactual comparisons. These anticipated emotions are a component of the expected consequences of the decision; they are emotions that are expected to occur when outcomes are experienced, rather than emotions that are experienced at the time of decision. The decision-making process in these theories is still modeled as the implicitly cognitive task of predicting the nature and strength of future emotions in response to possible decision outcomes and weighting them according to their likelihood of occurring.

Likewise, in Isen's work examining the impact of affect on decision making (e.g., Isen & Geva, 1987; Isen & Patrick, 1983; Nygren, Isen, Taylor, & Dulin, 1996), the assumed role of affect is anticipated rather than anticipatory. Isen and her colleagues have investigated the role of positive affect on risky decision making, presenting research participants with simple decision tasks after inducing positive affect by, for example, giving them a small bag of candy. Although happy decision makers are generally more optimistic about their probability of winning a given lottery (Isen & Patrick, 1983), they are much less willing to gamble than controls. Isen and colleagues (e.g., Isen, Nygren, & Ashby, 1988) explain this effect in terms of what they call a *mood maintenance hypothesis*—that people in a good mood are reluctant to gamble because losing might undermine their good mood. This is inherently consequentialist reasoning.

Whereas decision researchers have focused mainly on anticipated emotions, researchers in fields outside of decision making, such as neuroscience and social psychology, have focused instead on the role of anticipatory emotions in decision making. In contrast to the historical view of emotions (and other "passions") as destructive influences on decision making, much of the new work highlights the role played by emotions as informational inputs into decision making and the negative consequences that result when such inputs are blocked.[1] For example, Damasio's somatic marker hypothesis posits that normal decision making is guided by somatic reactions to deliberations about alternatives that provide information about their relative desirability. In support of this perspective, Damasio and colleagues (Bechara, Damasio, Tranel, & Damasio, 1997; Damasio, 1994) show that certain neurological abnormalities that block such somatic reactions but produce minimal cognitive deficits lead to significant impairments of risky decision making. Other research by Wilson and colleagues (e.g., Wilson et al., 1993; Wilson & Schooler, 1991) shows that the quality of decision making suffers when affective inputs are suppressed by having decision makers think systematically about the pros and cons of a decision.

Research by Zajonc (1980, 1984a, 1984b), Bargh (1984), and LeDoux (1996) likewise shows that affective reactions to stimuli are often more rapid and basic than cognitive evaluations. Such immediate affective responses, the researchers have argued, provide organisms with a fast but crude assessment of the behavioral options they face, which makes it possible to take rapid action. An even more recent interpretation of the evidence, that is consistent with an early argument by Simon (1967), holds that these rapid emotional reactions serve as a mechanism to interrupt and redirect cognitive processing toward potentially high-priority concerns, such as imminent sources of danger (Armony, Servan-Schreiber, Cohen, & LeDoux, 1995, 1997; de Becker, 1997). Armony et al. (1997) commented that

> a threatening stimulus occurring outside of the focus of attention may fail to be processed by cortical systems (as its representation is filtered out by a topdown attentional influence). In contrast, the direct pathway is not subject to this type of filtering, and therefore will transmit the information about the threatening stimulus to the amygdala, regardless of whether or not that stimulus occurs in the focus of attention. (p. 33)

A similar argument, with respect to anxiety as opposed to fear, has been advanced by Luu, Tucker, and Derryberry (1998), who argued that "appropriate levels of anxiety reflect the highest level of normal motivational control of working memory, through which the operations of memory in planning and behavioral sequencing are continually linked with adaptive significance" (p. 578).

Clore and Schwarz's affect-as-information hypothesis (Clore, Schwarz, & Conway, 1994; Schwarz & Clore, 1983) draws on very different types of evidence to reach a similar conclusion. As presented in Clore (1992), the affect-as-information hypothesis is a model of how feelings influence (social) judgments. Judgments of others, for example, are affected by the positive and negative feelings of liking and disliking. The critical difference between the affect-as-information and other social judgment models that address the role of affect is that, according to the affect-as-information perspective, affect has a direct effect (as a sample of experience of the object of judgment) rather than being mediated by affect-congruent memories or concepts. The affect-as-information hypothesis correctly predicts that feelings during the judgment or decision process affect people's judgments or choices in those cases where the feelings are (correctly or through misattributions) experienced as reactions to the imminent judgment or

[1] The same pattern can be seen in the popular press and literature. Witness a recent *Newsweek* article titled "Don't Ignore Your Fear" (1997) a Spiegel (1997) article titled "Die Macht der Gefuehle" (The power of feelings), or the recent popular bestseller "The Gift of Fear: Survival Signals That Protect Us From Violence" (de Becker, 1997).

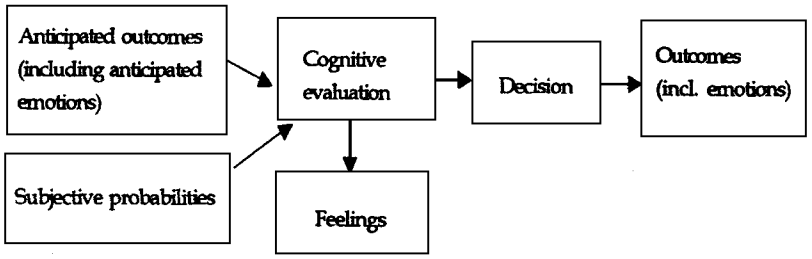

Figure 2. Consequentialist perspective with anticipated emotions.

decision. If feelings are attributed to a source that is normatively irrelevant to the decision at hand, their impact is reduced or eliminated (Schwarz & Clore, 1983; but see Winkielman, Zajonc, & Schwarz, 1997).

Most directly relevant to our focus on decision making under risk, and also consistent with the positive view of emotions, Slovic and collaborators (e.g., Finucane et al., 2000; Slovic et al., in press; Slovic, Flynn, & Layman, 1991; Slovic et al., 1991) have proposed an "affect heuristic" that highlights the importance of affect for risk perceptions and risk-related behavior. Over the past 20 years, Slovic, Fischhoff, and Lichtenstein have explored the emotional bases of risk judgments using a range of innovative methods. Adopting a psychometric paradigm (e.g., Fischhoff, Lichtenstein, Slovic, Derby, & Keeney, 1981), these researchers found that people's perceptions of the risks of hazardous technologies or activities are influenced by risk dimensions that have little to do with consequentialist aspects (i.e., possible outcomes and their probabilities).[2] Peters and Slovic (1996) have subsequently found that the "psychological" dimensions of risk can be distilled into two primary factors: *dread,* defined by the extent of perceived lack of control, feelings of dread, and perceived catastrophic potential, and *risk of the unknown,* the extent to which the hazard is judged to be unobservable, unknown, new, or delayed in producing harmful impacts. The first of these dimensions clearly suggests an affective rather than cognitive evaluation of hazards.

Although neither the affect-as-information hypothesis nor the affect heuristic rule out the possibility that affective reactions to decisions can diverge from cognitive evaluations, neither perspective draws attention to such divergences or their consequences for behavior. In contrast, other strands of literature in psychology most closely associated with the clinical literature suggest that emotions often conflict with cognitive evaluations and can in some situations produce pathologies of decision making and behavior. Research on anxiety, for example, shows that emotional reactions to a risky situation often diverge from cognitive evaluations of risk severity (Ness & Klaas, 1994). When such departures occur, moreover, the emotional reactions often exert a dominating influence on behavior and frequently produce behavior that does not appear to be adaptive. Fear causes us to slam on the brakes instead of steering into the skid, immobilizes us when we have greatest need for strength, causes sexual dysfunction, insomnia, ulcers, and gives us dry mouth and jitters at the very moment when there is the greatest premium on clarity and eloquence. Most people, therefore, have at least occasionally experienced their own emotions as a destructive influence that they wish they could turn off. As Rolls (1999) wrote,

> the puzzle is not only that the emotion is so intense, but also that even with our rational, reasoning capacities, humans still find themselves in these situations, and may find it difficult to produce reasonable and effective behaviour for resolving the situation. (p. 282)

Rolls argues that such divergences between emotional reactions and cognitive evaluations arise because

> in humans, the reward and punishment systems may operate implicitly in comparable ways to those in other animals. But in addition to this, humans have the explicit system [closely related to consciousness] which enables us consciously to look and predict many steps ahead. (p. 282)

The divergence of emotional responses from cognitive evaluations of risks, as well as the potency of emotional responses in influencing behavior, are evident in the large numbers of individuals who suffer from often-debilitating fear- and anxiety-related disorders who, in the words of one anxiety researcher, are typically "well aware that there is little or nothing to fear in situations they find so difficult" (Barlow, 1988, p. 13). Even people who are not suffering from full-blown phobias commonly experience powerful fears about outcomes that they recognize as highly unlikely (such as airplane crashes) or not objectively terrible (such as public speaking); in contrast, many experience little fear about hazards that are both more likely and probably more severe (such as car accidents). The divergence between emotional reactions to, and cognitive evaluations of, risk is a common source of the feeling of intrapersonal conflict (see, e.g., Schelling, 1984). As Schelling documented, people often use sophisticated tactics to override their emotional responses to situations—to "conquer their fears."

In other related developments, psychologists from different subdisciplines (clinical, social, and cognitive) have been drawing similar distinctions between two qualitatively different modes of

[2] Holtgrave and Weber (1993) demonstrated that Slovic et al.'s risk dimensions have explanatory power even after controlling for the effect of probabilities and outcomes. They attempted to explain subjective assessments of a wide variety of financial and health and safety risks on the basis of both probabilities and utilities (as captured by a simplified version of R. D. Luce and Weber's 1986 conjoint expected-risk model) and Slovic, Fischhoff, and Lichtenstein's (1986) psychometric risk dimensions. The best fits were obtained by a hybrid model that added Slovic et al.'s three *dread* risk dimensions to the conjoint expected-risk model. These results suggest that even evaluations of the risk of financial investments have emotional components that are not completely described by the objective components of cognitive information-integration models.

information processing (e.g., Chaiken & Trope, 1999; Epstein, Lipson, Holstein, & Huh, 1992; Sloman, 1996; Windschitl & Weber, 1999). Sloman, for example, distinguished between rule-based and associative processing. Rule-based processing is a relatively controlled form of processing that operates according to formal rules of logic and evidence and is mediated by conscious appraisal of information. A response driven by *rule-based processing* follows from the execution of one or more rules that are assumed to be relevant to the task (e.g., *modus ponens* or the conjunction rule). *Associative processing* is a more spontaneous form of processing that operates by principles of similarity and temporal contiguity. In associative processing, the situational context influences responses directly, just as associatively based priming influences the recognition of a target word. Pathways and patterns of activation follow principles of similarity and temporal contiguity; the stronger the association between two concepts (which depends on similarity, repeated joint exposure, etc.), the more activation passes from one to another. Because associative processing is not mediated by conscious appraisal it is difficult to suppress its influence on judgments and decisions.

In support of his two-process dichotomy, Sloman (1996) provided examples from reasoning, categorization, and judgment research in which people find two simultaneously contradictory responses—one presumably mediated by associative processing and the other by rule-based processing—to be compelling for a given problem. For example, although people know that a whale does not fit the classification of "fish," statements like "technically a whale is a mammal" suggest that people are influenced by the similarity between whales and fish. Windschitl and Weber (1999) showed that associative processing of contextual information affected judgments of subjective likelihood even in situations where numeric estimates of likelihood were provided by credible experts.

Focusing narrowly on the topic of decision making under risk, we attempt to integrate these two strands of literature, one showing that emotions inform decision making and the other showing that emotional responses to risky decision situations—that is, anticipatory emotions—often diverge from cognitive evaluations. As demonstrated by the many studies that support the somatic marker, affect-as-information, and affect heuristic theories, emotional reactions and cognitive evaluations typically work in concert to guide reasoning and decision making. However, anticipatory emotional reactions sometimes diverge from cognitive evaluations and, when they do, the emotional reactions often exert a dominating influence on behavior. We attempt to explain when and why such emotional reactions diverge from cognitive evaluations of risk and to explain how these responses interact to determine behavior. The theoretical framework we propose, which we label the *risk-as-feelings hypothesis,* provides a parsimonious account of a number of risk-related phenomena that are not explained by existing consequentialist models of risky decision making.

The risk-as-feelings hypothesis, illustrated in Figure 3, postulates that responses to risky situations (including decision making) result in part from direct (i.e., not cortically mediated) emotional influences, including feelings such as worry, fear, dread, or anxiety. People are assumed to evaluate risky alternatives at a cognitive level, as in traditional models, based largely on the probability and desirability of associated consequences. Such cognitive evaluations have affective consequences, and feeling states also exert a reciprocal influence on cognitive evaluations. At the same time, however, feeling states are postulated to respond to factors, such as the immediacy of a risk, that do not enter into cognitive evaluations of the risk and also respond to probabilities and outcome values in a fashion that is different from the way in which these variables enter into cognitive evaluations. Because their determinants are different, emotional reactions to risks can diverge from cognitive evaluations of the same risks. As illustrated in Figure 3, behavior is then determined by the interplay between these two, often conflicting, responses to a situation. Note that the term *decision* in Figures 1 and 2 is deliberately replaced with *behavior* in Figure 3. This substitution reflects the observation that many types of emotion-driven risk-related behaviors, ranging from panic reactions (e.g., slamming on the brake when one skids on ice) to the agoraphobic individual's inability to leave the house, do not seem to reflect decisions in the sense that the term is usually used.

The risk-as-feelings hypothesis is similar to the somatic marker hypothesis, the affect-as-information perspective, and the affect heuristic in drawing attention to the important role played by affect in decision making, but the risk-as-feelings hypothesis has a some-

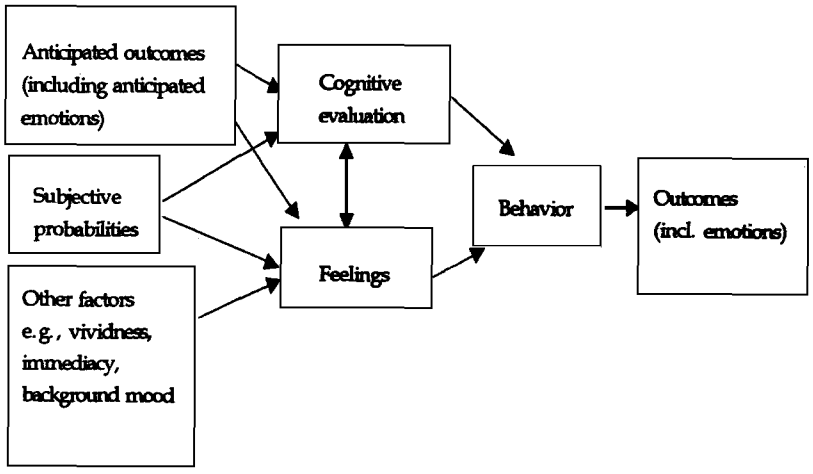

Figure 3. Risk-as-feelings perspective.

what different focus. Although these approaches do not rule out the possibility that emotional reactions could diverge from cognitive reactions, they focus mainly on the complementary role of the two systems. They assume that affect typically plays an informational role in decision making—that it provides inputs into decision making that help people to evaluate alternative courses of action, albeit not always in a normative fashion. In contrast to these other theories, the risk-as-feelings hypothesis posits that, in addition, emotions often produce behavioral responses that depart from what individuals view as the best course of action. Our intent in this article is to begin to make sense of when and why such divergences occur.

In highlighting the role played by emotions in risk-related decision making, the research we review is representative of an emergent interest in the role played by emotions in decision making more generally. For example, Kahneman and co-authors (Kahneman & Ritov, 1994; Kahneman, Ritov, & Schkade, 1999; Kahneman, Schkade, & Sunstein, 1998) observed that when jurors make decisions or when the public makes contingent valuations of public goods, their judgments are often erratic and cannot be understood from an economic preference perspective. However, these responses can be interpreted as a manifestation of the decision maker's gut feelings toward the target at the time of decision making. M. F. Luce, Bettman, and Payne (1997, 1999) studied another type of decision-moment feeling—tradeoff difficulty emotions. They found that tradeoff difficulty in decision making can evoke negative emotions that bear no relationship to the valence of the consequences but that in turn lead decision makers to alter their coping strategies or avoid the decision altogether. Loewenstein (1996, 1999) has studied the role of emotions and other "visceral factors" such as hunger, sexual arousal, and pain in decision making (see also Loewenstein & Lerner, in press).

The next section lays out the risk-as-feelings hypothesis in detail and presents evidence supporting each of its specific assumptions. The second section discusses the determinants of risk-related feelings to explain why such feelings often diverge from cognitive evaluations of risk severity and reviews a wide range of phenomena that are consistent with the risk-as-feelings perspective but are difficult to explain in terms of standard cognitive–consequentialist approaches. The third section concludes with a discussion of further predictions of the risk-as-feelings hypothesis and implications for public policy.

Risk-as-Feelings Hypothesis

If risk-related feelings and cognitive evaluations had identical determinants as well as consequences for behavior, the risk-as-feelings hypothesis would be little more than an alternative description of the psychological processes underlying decision making, and anticipatory feelings would not be required as an intervening construct. However, people's emotional reactions to risks depend on a variety of factors that influence cognitive evaluations of risk only weakly or not at all. These include the vividness with which consequences can be imagined, personal exposure to or experience with outcomes, and past history of conditioning. Cognitive assessments of risk, on the other hand, tend to depend on more objective features of the risky situation, such as probabilities of outcomes and assessments of outcome severity. Even when feelings about risk are influenced by these objective features, the functional form of such dependence is different. For example, it has been demonstrated that feelings about risk are largely insensitive to changes in probability, whereas cognitive evaluations do take probability into account. As a result, feelings about risk and cognitive risk perceptions often diverge, sometimes strikingly.

Evidence from different areas of psychology provides support for different aspects of the risk-as-feelings hypothesis, as illustrated in Figure 3. Some elements are not controversial. For example, few would question that cognitive evaluations give rise to affective responses, although there is debate about the relationship between specific cognitions and specific emotions (e.g., Ellsworth & Smith, 1988; Ortony, Clore, & Collins, 1988; Roseman, 1984; Scherer, 1984; C. A. Smith & Ellsworth, 1985).

There is also little disagreement that important influences operate in the reverse direction, from emotion to cognition. From a neurophysiological perspective, the finding that emotions exert a powerful influence on judgments is not surprising. As LeDoux (1996) noted, "emotions can flood consciousness . . . because the wiring of the brain at this point in our evolutionary history is such that connections from the emotional systems to the cognitive systems are stronger than connections from the cognitive systems to the emotional systems" (p. 19). Numerous studies have found that people in good moods make optimistic judgments and choices and that people in bad moods make pessimistic judgments and choices (Bower, 1981, 1991; Isen, Shalker, Clark, & Karp, 1978; Johnson & Tversky, 1983; Kavanagh & Bower, 1985; Mayer, Gaschke, Braverman, & Evans, 1992; Mayer & Hanson, 1995; Schwarz & Clore, 1983; Wright & Bower, 1992). For example, Johnson and Tversky found that people who read sad newspaper articles subsequently gave higher risk estimates for a variety of potential causes of death (e.g., floods, disease) than people who read happy newspaper articles. More recent research has gone beyond the valence approach to examine the different effect of different specific emotions of the same valence on judgments and choices. Most relevant to the framework proposed here, many studies have found effects of fear and anxiety on various types of judgments that tend to favor cautious, risk-averse decision making (Lerner & Keltner, 1999, 2000). Eysenck (1992), for example, proposed that highly anxious individuals attend preferentially to threat-related stimuli and interpret ambiguous stimuli and situations as threatening, and a number of studies have supported these predictions (e.g., Derakshan & Eysenck, 1997; Eysenck, MacLeod, & Matthews, 1987; Vasey, El-Hag, & Daleiden, 1996). Raghunathan and Pham (1999) found that induced anxiety increased individuals' preference for low risk, low reward options, whereas induced sadness had the opposite effect. Lerner and Keltner (2000) found that fearful individuals make relatively pessimistic risk assessments and relatively risk-averse choices.

The two more controversial aspects of the theoretical framework summarized in Figure 3 are (a) that feelings can also arise without cognitive mediation (probabilities, outcomes, and other factors can directly give rise to feelings) and (b) that the impact of cognitive evaluations on behavior is mediated, at least in part, by affective responses (cognitive evaluation gives rise to feelings that in turn affect behavior). We focus on these two points in the remainder of this section.

Feelings Need Not Be Cognitively Mediated

There is considerable support for the notion that the pathway from risky stimulus to emotional reaction can be direct, that is, not mediated by any cognitive evaluation of the situation except for the most basic perceptual processing. Evidence for the affect-as-information hypothesis (Clore, Schwarz, & Conway, 1994; Schwarz & Clore, 1983) in social cognition supports the direct effect of feelings on judgments and decisions over indirect (cognitively mediated) effect interpretations that assume that feelings selectively prime semantic concepts (i.e., Bower, 1981, 1992). Clore (1992) provided a summary of two decades of research that shows direct effects of emotions on judgment. The idea that feelings need not be cognitively mediated is also supported by the research of Zajonc (1980, 1984a, 1984b), who first argued for greater speed and automaticity of affective over cognitive reactions and showed that people can have an affective reaction to a stimulus before they know what it is they are reacting to. For example, sudden, unexpected noises can cause fear well before we determine the source of the noise. Zajonc also showed that memory for affective reactions can be dissociated from memory for details of a situation, with the former often being better. An example is that we often remember whether we liked or disliked a particular person, book, or movie without being able to remember any details other than our affective reaction (Bargh, 1984).

Recent research by LeDoux and his colleagues (summarized in LeDoux, 1996) provides the anatomical neurological underpinnings for such direct effects. LeDoux and colleagues have shown that there are direct neural projections from the sensory thalamus (which performs crude signal processing) to the amygdala (which is widely believed to play a critical role in the processing of affective stimuli) that are not mediated by cortical processing. More recently, Servan-Schreiber and Perlstein (1998), in research with humans, have shown that intravenous injections of procaine, which produce powerful emotional responses, also produce amygdal activation. People who receive such injections report experiencing panic sensations and other powerful feelings that are disturbing precisely because they have no obvious cognitive antecedents. Other research has found that when the amygdala and other fear sites are stimulated electrically, people verbally report powerful feelings of foreboding (Panksepp, 1985, 1998). These evoked fears are often described in metaphoric terms; for example, "Somebody is now chasing me," "just like entering into a long, dark tunnel," or "surf coming from all directions," as if the cortex attempts to make sense of these disembodied forebodings (Panksepp, 1998, p. 214). Whatever the reason for these crude, rapid, emotional responses, all of this research suggests that powerful emotional responses can occur with minimal, or possibly no, mediation by higher level cognitive processes.

Feelings as Determinants of Behavior

Diverse evidence also supports the proposition that affect mediates, at least in part, the relationship between an individual's cognitive evaluation of risk and his or her behavioral response to it. The idea that emotions exert a direct and powerful influence on behavior receives ample support in the psychological literature on emotions. Zajonc (1998) in his chapter on emotions in the *Handbook of Social Psychology* argued that the defining characteristic of emotions is that they are designed to help people make approach–avoidance distinctions (whereas cognitions help people make true–false distinctions). Frijda (1986) has been a major proponent of the idea that a change in action readiness is the central core of an emotion and has shown that qualitatively distinct emotional states can be distinguished, not only on the basis of the cognitive appraisals that give rise to them, but also in terms of the state of action readiness that they create (Frijda, Kuipers, & ter Schure, 1989).

A number of authors have postulated that emotions play a critical role in rational, risk-averse, forward-looking, decision making. Liddell (cited in Barlow, 1988) referred to anxiety as the "shadow of intelligence." "The capacity to experience anxiety and the capacity to plan," Barlow noted, are "two sides of the same coin" (p. 12). Cottle and Klineberg (1974) argued that people only care about the delayed or uncertain consequences of their decisions to the degree that contemplating such consequences evokes immediate affect. In support of this view, they cited the effects of frontal lobotomies which, they believe, create a deficiency in areas of the brain [that] somehow underlie the capacity for images of absent events to generate experiences of pleasure or discomfort (p. 15). The neurosurgeons who performed these operations wrote of their frontal lobotomy patients that "the capacity for imagination is still present, and certainly not sufficiently reduced to render the patients helpless, and affective responses are often quite lively, [but there is] a separation of one from the other" (Freeman & Watts, 1942, p. 303). Consistent with the notion that such emotions are critical for forward-looking decision making, these surgeons noted that such patients were highly impulsive and risk taking and generally seemed "confined to what is here and now."

More recent work by Damasio lends further support to this perspective. Damasio and colleagues (Bechara et al., 1997; Damasio, 1994) argued that decision makers encode the consequences of alternative courses of action affectively and that such "somatic markers" are an essential input into decision making. Like Cottle and Klineberg (1974), Damasio argued that the prefrontal cortex plays a critical role in translating cognitive inputs from the cortex into terms that the emotional brain can understand. The prefrontal lobe is one terminus for dopaminergic neural pathways that are widely viewed as playing a critical role in volitional behavior.

Damasio and collaborators conducted a study in which patients suffering damage to the prefrontal cortex and non–brain-damaged individuals played a game in which the objective was to win as much money as possible (Bechara et al., 1997). Players earned hypothetical money by turning over cards on which were written either monetary gains or losses. On any given turn, individuals could draw from any of four decks, two of which included high payments ($100) and two of which contained lower payments ($50). The high-paying deck, however, also included occasional very large losses, to the point where these decks had a net negative expected value. Bechara et al. (1997) found that both nonpatients and those with prefrontal damage began by sampling from all four decks, and both groups avoided high-paying decks immediately after penalty cards were encountered. Compared to nonpatients, those with prefrontal damage returned to the high-paying decks more quickly after suffering a loss. As a result of this tendency, they often went "bankrupt" despite a (reportedly) strong desire to win and a thorough understanding of the game. One possible

interpretation of the patients' behavior is that even though they "knew" the high-paying deck was risky, their inability to experience fear when contemplating a draw from one of those decks made risky draws more palatable. Consistent with this interpretation, subsequent research using the same task found in a sample of nonpatients that those who were higher in reactivity to negative events (as measured by two standard scales) were more prone to sample from the lower paying but safer decks of cards (Peters & Slovic, in press).

It should be noted that the lack of emotional responses does not necessarily lead to poor decisions. It is the specific design of Damasio's (1994; Bechara et al., 1997) experiment that makes his patients with frontal damage go bankrupt. One could easily design an experiment where the expected value of the high-risk deck (that contains some large losses) is actually higher than that of the low-risk deck. In this case, prefrontal damaged patients would do better in the long run than nonpatients, because the fear in the latter group would hinder them from choosing from the risky but higher expected value deck. Indeed, there may be a real-world analog of such an experiment; because of fear and myopic loss aversion, most employees have historically foregone substantial financial gains by investing their retirement in safe bond or money market funds rather than in equities, even though the long-term return of equities is often many times higher (Benartzi & Thaler, 1995; Gneezy & Potters, 1997; Thaler, Tversky, Kahneman, & Schwartz, 1997).

The anomalous behavior of patients with frontal damage might be consistent with a consequentialist view of decision making if their emotional reaction to losing was simply less intense than that of nonpatients. In this case, their strategy could be seen as a reasonable adaptation to different subjective feedback. However, they did not appear to be operating under different incentives. They were highly engaged in the task and wanted to win. After encountering a penalty card, they avoided the high-risk deck for a few turns (but returned to the high-risk decks more quickly than the nonpatients). Where the patients with frontal damage differed from nonpatients was in the arousal they experienced immediately before cards were turned over. In later phases of the game, when individuals had had experience drawing from all four decks, most of them drew an occasional card from one of the high-risk decks. Contemplating this selection evoked a galvanic skin conductance response in nonpatients in the moments before making their choice, but no such reaction in patients with frontal damage. Damasio concluded from this research that anticipatory emotions—somatic markers—play a critical role in decision making by encoding in a tangible fashion a summary of the likely consequences of a particular action. Lacking such somatic markers, his frontal-lesioned patients did not take account of the future consequences of their choices and, as a result, made bad decisions. They also had difficulty *making* decisions, even trivial ones. Anticipatory emotional reactions thus seem to facilitate the process of risky decision making and to be a crucial input for good decisions.

Damasio's research (Damasio, 1994) derived further support from observations of another abnormal population: criminal psychopathic individuals. Like frontal patients, criminal psychopathic individuals are characterized by insensitivity to the future consequences of their behavior (to themselves as well as other people). Although the neurological bases of this disorder are still not well-understood, there also appears to be a connection to a specific emotional deficit. During the 1940s, researchers speculated that the inability of psychopathic individuals to take account of future consequences of their actions, or the impact of their actions on others, could be due to a defect in their propensity to experience fear (Cleckley, 1941). In support of this hypothesis, Lykken (1957) showed that, compared to controls, sociopathic individuals have less intense physiological reactions to a conditioning stimulus that had been previously paired with a painful electric shock. Hare (1965, 1966) showed that sociopathic individuals have less intense physiological reactions to the prospect of an impending painful shock. Patrick (1994) demonstrated that sociopathic individuals display fewer physiological symptoms of negative affect when exposed to aversive stimuli than controls (see also Fowles & Missel, 1994; Williamson, Harpur, & Hare, 1991).[3]

In summary, consistent with the notion that anticipatory emotions play a critical role in risk aversion and farsighted decision making, several populations who do not feel or fear the future in the same way that others do make decisions that display a profound disregard for future consequences. We acknowledge, however, that none of these studies conclusively demonstrates a causal link, because the observed correlations between affective deficiencies and decision myopia may result from some type of collateral damage to neural systems. However, evidence from a quite different stream of research points to a similar conclusion.

Eisenberg, Baron, and Seligman (1995) asked people who differed in trait anxiety and depression to make a series of choices between pairs of more and less risky options. For some of the choices, the riskier option was the default (it did not involve taking action), whereas the less risky option did involve taking action. For other choice pairs, the riskier option involved taking an action. The researchers found that trait anxiety was strongly and positively correlated with risk aversion, whereas depression was related to a preference for options that did not involve taking an action. In a second study reported in the same article, participants were asked to make these types of decisions not only for themselves, but also for a hypothetical other person. They found that trait anxiety did not correlate with risk aversion for decisions made on behalf of another person.

In a study that produced similar results to those of Eisenberg et al. (1995), Hsee and Weber (1997) examined whether individuals could accurately predict the risk preference of others who were described either in generic (the average student on campus) or specific (another student sitting across the room) terms. Research participants were asked to choose between riskless monetary gains and risky monetary gains and also to predict the choices of others who were described in a generic or specific fashion. Participants were generally risk averse in their own choices, and their predictions of risk preference for another specific student (whom they did not know but could observe across the room) were close to

[3] More recent research casts some doubt on these earlier results. One study compared psychopathic and nonpsychopathic incarcerated men and found no difference in trait anxiety or fear between the two groups (Schmitt & Newman, 1999). Another study compared psychopathic and nonpsychopathic incarcerees' performance on Damasio's card sort task (Schmitt, Brinkley, & Newman, 1999). Although psychopathic incarcerated men did not perform differently from nonpsychopathic incarcerated men, individuals high in trait anxiety became more risk averse relative to those low in trait anxiety as they gained experience with the cards.

their own risk preferences. However, their predictions for the average student on campus were closer to risk neutrality. Hsee and Weber hypothesized that people's personal risk preference is driven at least in part by emotional reactions to risky options, or, as Lopes (1987) put it, that risk preference reflects a compromise between greed and fear. To the extent that risk aversion is the dominant response to risky decisions, negative feelings (i.e., fear, dread, or anxiety) toward risk tend to dominate positive feelings. When people predict the risk preference of another individual, they can base their prediction on their own feelings and reactions to the risky choice situation (i.e., predict by projection), which would be expected to occur when the "other" is a concrete individual. When the prediction is for an abstract "other," people find it more difficult to project and may ignore the impact of positive or negative emotional reactions on the decision, arriving at a prediction much closer to risk neutrality.

In a new study that we conducted for this article, we obtained further support for the idea that the self–other discrepancies in risk preferences are produced by self–other discrepancies in feelings toward risky options. We asked 115 college students to imagine the following scenario: They were riding in a taxi and found out that the driver was drunk. There were no other taxis around or other means of transportation. They could either (a) remain in the taxi (a relatively risky option) or (b) get out of the taxi and walk to their destination 5 miles away (a lower risk option). Participants were asked how worried they would feel if they remained in the taxi cab and to predict how the average student at their university would feel if he or she remained in the cab. Participants were also asked whether they would get out of the cab and to predict the decision of the average student at their university. The results were consistent with the risk-as-feelings hypothesis. With respect to feelings, respondents rated themselves (on a scale from 0 = not worried at all to 5 = extremely worried) as significantly more worried than the average student (Ms = 3.71 and 3.16, $t = 4.09$, $p < .001$). In decisions, respondents also rated themselves (on a scale from 0 = not likely at all to 5 = extremely likely) as significantly more likely to get out of the cab than the average student (Ms = 2.93 and 2.39, $t = 3.45$, $p < .001$). Moreover, the self–other difference in decision was highly correlated across respondents with the self–other difference in feelings ($r = .58$, $p < .001$).

Additional support for the idea that affect plays an important role in behavioral intentions comes from a series of studies conducted by Slovic and his collaborators. In a typical study, participants free-associate about a concept of interest to the experimenters—for example, different states and cities (Slovic, Layman, et al., 1991), a nuclear waste repository (Slovic, Flynn, & Layman, 1991), or health-related behaviors (Benthin et al., 1995)—and then provide affective ratings of these associations. These affective ratings are shown to correlate strongly with attitudes and self-predicted behavior, such as desire to vacation or retire in particular states and cities, willingness to accept a nuclear waste repository in one's state, and the propensity to engage in health-related behaviors. Slovic and coauthors have also shown that, whereas risks and benefits tend to be positively associated in the real world (because high-risk activities are only tolerated to the extent that they provide benefits), they are negatively associated in people's minds (Alhakami & Slovic, 1994; Finucane et al., 2000). This negative relationship, they find, stems from people's reliance on general affective evaluations in making risk and benefit judgments. Through a kind of halo effect, activities that have a negative affective valence are seen as both high in risk and low in benefit.

Summary

In this section, we have sought to establish the central role that feelings play in determining people's choices and other responses under conditions of risk and uncertainty. The risk-as-feelings hypothesis suggests that feelings play a much more prominent role in risky decision making than they are given credit for by the cognitive–consequentialist tradition of J/DM research. Behavioral evidence suggests that, to the extent that emotional reactions to, and cognitive evaluations of, risky choice options are dissociated, risk preference is often determined by the former. Emotional reactions guide responses not only at their first occurrence, but also through conditioning and memory at later points in time, serving as somatic markers. Patient populations who lack these markers not only have difficulty making risky decisions, but they also choose in ways that turn their personal and professional lives to shambles. Thus, feelings may be more than just an important input into decision making under uncertainty; they may be necessary and, to a large degree, mediate the connection between cognitive evaluations of risk and risk-related behavior.

Determinants of Feelings

As we noted in the introduction, the risk-as-feelings hypothesis is only interesting if the addition of feelings as a predictor variable makes risky choice more predictable, both within and across different decision domains and contexts. This can only be the case if emotional reactions have determinants that differ from those that drive cognitive evaluations. In this section we show that divergences between emotional and cognitive reactions occur for two reasons. First, emotions respond to the two central input variables of cognitive consequentialist accounts of risk-related perception and behavior—probabilities and outcomes—in a fashion that is different from cognitive evaluations of riskiness. Second, emotions are influenced by situational variables that play only a minor role in cognitive evaluations. These factors include the time-course of the decision (i.e., the time between the decision and the realization of the outcome of the decision), nonconsequentialist aspects of the decision outcomes (e.g., their vividness or the associations they evoke), and evolutionary preparedness for certain emotional reactions.

In addition to reviewing each of these discrepancies between emotional reactions to, and cognitive evaluations of, risk, we discuss phenomena observed in the laboratory and in natural settings that can be explained by such discrepancies but which are difficult to explain in conventional consequentialist terms. When viewed through the lens of consequentialist models such as the expected utility model, people's risk-taking behavior often appears to be highly variable and inconsistent across domains and situations (Isaac & James, 2000; MacCrimmon & Wehrung, 1986; Schoemaker, 1990). Barsky, Juster, Kimball, and Shapiro (1997), for example, classified respondents to the Health and Retirement Survey (a large-scale panel study of older Americans) into four categories of risk tolerance on the basis of three questions that measured their degree of risk aversion for hypothetical decisions

involving a change of job. They found that the resultant measure of risk tolerance correlated only very weakly with other risk-related behaviors such as drinking, smoking, and investment decisions. Weber, Blais, and Betz (1999) similarly found only weak correlations between self-reports of risk taking in decisions involving either financial, health, social, ethical, or recreational risks. To the extent that the risk-as-feelings hypothesis identifies situational factors that can influence risk taking that would not be predicted by consequentialist models, it can help explain the content- and context-specific nature of risk taking.

Effects of Vividness

One of the most important determinants of emotional reactions to future outcomes is the vividness with which those outcomes are described or represented mentally (Damasio, 1994). To the extent that anticipatory emotions are generated in response to mental imagery about the experience of decision outcomes, factors that influence the occurrence or vividness of mental images are likely to be important determinants of anticipatory emotions.[4]

One such factor is individual differences in mental imagery. Several studies find a correlation between people's self-reported ability to form mental images and visceral responses that are plausibly related to anticipatory emotion. For example, compared with nonvivid imagers, vivid imagers salivate significantly more while thinking about their favorite food (White, 1978), become more sexually aroused in structured fantasy exercises (D. Smith & Over, 1987), and have greater ability to voluntarily increase their heart rate using visual imagery (Carroll, Baker, & Preston, 1979). Consistent with the idea that imagery influences affective response, Miller et al. (1987) reported that enhancing individuals' ability to form vivid images through training increases their visceral response to personalized scripts designed to elicit particular affective reactions, such as anger and fear.

Vividness, and hence the strength of anticipatory emotions, depends not only on individual differences in mental imagery ability, but also on situational factors, such as how an outcome is described. Nisbett and Ross (1980) illustrated this effect by contrasting two descriptions of the same event. In the first description, one learns that "Jack sustained fatal injuries in an auto accident." This description of death evoked weaker emotional reactions than the second description that "Jack was killed by a semi trailer that rolled over on his car and crushed his skull" (p. 47).

The effect of vividness on emotional responses to risk may help explain some common patterns of insurance purchase behavior that are anomalous within the consequentialist framework. Consequentialist models of risky choice (e.g., EU theory) predict that insurance purchases depend exclusively on the magnitude of the loss, its probability, the cost of insurance, and the consumer's wealth and risk tolerance, all variables that are immune to differences in the description of potential losses. Consideration of anticipatory emotions, on the other hand, suggests that the description of the outcomes may matter. Images of losses that evoke vivid negative mental imagery should lead to greater willingness to purchase insurance. Evidence supporting this prediction comes from Johnson, Hershey, Meszaros, and Kunreuther (1993), who found that people were willing to pay more for airline travel insurance covering death from "terrorist acts" (a highly imaginable event) than death from "all possible causes" (which, of course, implicitly subsumes terrorist acts in addition to a range of other causes but does not spontaneously bring fear-provoking mental images to mind). At the opposite extreme, people tend to be underinsured against hazards that evoke relatively pallid mental images. Flood insurance is notoriously difficult to sell, even when premiums are heavily subsidized (Insurance Advocate, 1994; Kunreuther, 1976). Consequentialist explanations for this phenomenon would focus on systematic failures to predict the true devastation of a flood or on actuarially optimistic estimates of a flood's likelihood. Slovic, Fischhoff, and Lichtenstein (1980), on the other hand, speculated that people's willingness to insure against small-probability losses may be related to how much these potential losses cause worry or concern. A number of studies have shown that knowing someone who has been in a flood or earthquake, or having been in one oneself, greatly increases the likelihood of purchasing insurance (Browne & Hoyt, 2000). Although these findings could be explained in consequentialist terms as resulting from an increase in individuals' expectations of experiencing a flood or earthquake in the future, the effect remains significant even after controlling for subjective expectations (Kunreuther et al., 1978).

The importance of personal experience has also been noted in other areas. Weinstein (1989) presented evidence showing that the effect of the personal experience of adverse consequences on subsequent precautionary or self-protective behavior goes beyond what one would expect if its main effect is to simply provide "additional information that is inserted into a decision equation" (p. 47). Weinstein documented how personal experience can modify people's emotional reactions to risky situations in complex, situation- and domain-specific ways—for example, increasing feelings of worry, resulting in an increase in self-protective behavior in some domains, but also decreasing feelings of controllability in other situations, with the opposite effect on precautionary responses. In a similar vein, Hendickx, Vlek, and Oppewal (1989) found that warnings are more effective when they are linked to people and anecdotes (and hence emotionally involving) than when they are based on statistics, suggesting that anxiety induction through the use of vividness manipulations can produce desirable changes in risk behaviors.

Anxiety induction is not, however, a panacea when it comes to promoting self-protective behavior. Besides the fact that evoking anxiety saddles people with the hedonic burden of the anxiety itself, it can also induce defensive reactions that undermine efforts at risk mitigation. Thus, for example, Janis and Feshbach (1953)

[4] In a study that illustrates the importance of mental imagery, Shiv and Huber (2000; see also Shiv & Fedorikhin, 1999) asked individuals to choose between a series of two-choice alternatives. In all cases, one was inferior on a pallid dimension (e.g., a higher price), and the other was inferior on a fear-inducing dimension (e.g., no power protection on a computer). In a 2 × 2 factorial design, some individuals were asked to think about their feelings about each of the products and others were not, and some individuals were instructed to *not* use imagery when they made their choice and others were not. The main finding was that encouraging individuals to think about their feelings about the products increased the weight placed on the fear-inducing dimension, but only when they were not instructed to not use imagery (i.e., when they were, presumably, using it). Asking individuals to not imagine using the product inhibited the impact of feelings on choice.

found that high levels of fear induced by a message about dental hygiene led to defensive avoidance, that is, subsequent warding off of exposures to the content of the message. Leventhal and Watts (1966) exposed visitors to a state fair to motion pictures dealing with smoking and lung cancer that were designed to elicit high, medium, or low levels of fear. Consistent with defensive avoidance, the researchers found that higher levels of fear led to less willingness to get an X-ray but did produce a decrease in smoking relative to the other two groups. Thus, high levels of fear led to both information avoidance and some degree of risk mitigation. More recently, Lieberman and Chaiken (1992) found that defensive processing was heightened when the fear-inducing content of a message was personally relevant, as generally is the case with breast cancer. Indeed, there have been suggestions in the literature on breast self-exams that women's anticipatory anxiety about cancer prevents them from examining themselves (Bernay, Porrath, Golding-Mather, & Murray, 1982; Murray & McMillan, 1993; O'Malley & Fletcher, 1987).

Insensitivity to Probability Variations

In the EU model, the value of a prospect is equal to the sum of the utilities of outcomes that could be experienced, weighted by their likelihood of occurrence. Probabilities and outcomes thus have symmetrical effects on evaluations. This is not the case for emotional reactions. Changes in probability within some broad midrange of values have little effect on anticipatory emotions perhaps because, as just discussed, emotions arise in large part as a reaction to mental images of a decision's outcomes (Damasio, 1994). Because such images are discrete and are not much affected by probabilities, the emotions that arise from them are likewise insensitive to variations in probability. One's mental image of what it would be like to win the state lottery, for example, is likely to be about the same, whether there is a 1 in 10,000,000 chance of winning or a 1 in 10,000 chance of winning. The mental image of winning $10,000,000 or $10,000, on the other hand, is likely to be very different. This is not to say that fear responses are completely unaffected by probabilities, but they are largely unaffected by orders-of-magnitude differences at the extreme (e.g., between a 1 in 100,000,000 chance of winning the lottery and a 1 in 100,000 chance).

Psychophysical studies of anxiety illustrate the relatively small role probability plays in anticipatory emotion. In these experiments, research participants experienced a series of countdown periods of stated length at the end of which they received, with some stated probability, a painful electric shock of varying intensity. Anxiety is operationalized by changes in participants' heart rate and skin conductance during the countdown period. The general finding from this research is that people's physiological responses to the impending shock are correlated with their expectations about the intensity of the shock—that is, bigger shocks elicited greater arousal (Deane, 1969). The probability of receiving the shock, however, does not affect arousal (Bankhart & Elliott, 1974; Elliott, 1975; Monat, Averill, & Lazarus, 1972; Snortum & Wilding, 1971) except for trials in which the probability is stated to be zero. Evidently, the mere thought of receiving a shock is enough to arouse individuals, but the precise likelihood of being shocked has little impact on level of arousal. These results suggest that feelings of fear or worry in the face of decisions under risk or uncertainty have an all-or-none characteristic; they may be sensitive to the possibility rather than the probability of negative consequences.

In a study designed to investigate cross-cultural differences in risky decision making, Weber and Hsee (1998) asked participants to provide maximum buying prices for risky investment options that differed in the probabilities with which gains or losses of different magnitude would be realized. Although not reported in Weber and Hsee, participants were also asked to rate, for each investment option, the degree of worry or concern they would experience between the time they invested in the option and the time they would find out which outcome actually occurred. Whereas maximum buying prices were sensitive to both probability and outcome levels, $F(1, 6634) = 4.64$ and 5.12, respectively, $ps < .05$, reported feelings of worry were far less sensitive to probability levels, $F(1, 6634) = 1.69$, $p > .10$. A similar dissociation between intellectual judgments of risk and emotional reactions expressed by judgments of worry has been reported by Sjöberg (1998) in a study of subjective risk perceptions.

The observation that some changes in probability affect risky decisions more than others has been confirmed by many studies of decision making (for a review, see Camerer, 1989) and has been incorporated into the predictions of many non-EU models as nonlinearities in the probability weighting function (e.g., Kahneman & Tversky, 1979). One of the most robust observations in the domain of decision making under uncertainty is the overweighting of small probabilities, particularly those associated with extreme outcomes (see Prelec, 1998). Many of the famous EU anomalies, such as the Allais paradox and the common ratio effect (see Kahneman & Tversky, 1979, for a description of both), can be explained parsimoniously in such terms (Camerer, 1995, p. 637). A 1% change in the probability of an aversive event seems trivial when there is already a 49% chance, but is likely to cause great concern, and concomitant effort to avert it, if it changes the chances from none at all to 1%, that is, away from the certainty of not being exposed. Viscusi and Magat (1987), for example, found that people were willing to pay considerably more to reduce the risk of inhalation poisoning or skin poisoning from an insect spray from 5 in 10,000 to 0 than from 15 in 10,000 to 5 in 10,000.

Although these nonlinearities in probability weights have been extensively documented and have a well-known label (the *certainty effect;* Kahneman & Tversky, 1979), relatively little work has been done to explain them. Incorporating emotional reactions into the prediction equation helps to explain these phenomena. As the probability of an aversive event passes the zero threshold, a consequence that was previously of no concern now becomes a source of worry. Subsequent increments in probability, however, have little additional emotional impact and, presumably for this reason, have little impact on choice.

In a recent paper, Rottenstreich and Hsee (1999) found not only that people were insensitive to probability variations, but also that such insensitivity depended on the emotional impact of the associated outcomes. This result lends support to the risk-as-feeling hypothesis, according to which people should be more insensitive to probability variations for emotional and vivid outcomes than for pallid outcomes. In one study, Rottenstreich and Hsee asked participants to indicate the largest amount of money they would be willing to pay to avoid an undesirable outcome that occurred with different levels of probability. The undesirable outcome was either

a loss of $20 (a relatively pallid outcome) or a brief but painful electric shock (a more emotional–visceral outcome). The results were dramatic. When the outcome was pallid (losing $20), the participants were quite sensitive to probability variations: The dollar value placed on the uncertain outcome changed from $1 (for $p = .01$) to $18 (for $p = .99$). However, when the outcome evoked emotion (receiving an electric shock), participants were extremely insensitive to probability variations: The dollar value changed only from $7 (for $p = .01$) to $10 (for $p = .99$). In other words, when probability increased by a factor of 99 (from 1% to 99%), the value of the uncertain prospect increased by less than a factor of 1.5 (from $7 to $10). Rottenstreich and Hsee (1999) replicated these results using positive outcomes as well. For example, when the outcome was a $500 discount on their tuition (a relatively pallid outcome), students were quite sensitive to probability variations. However, when the outcome was a $500 coupon they could use for their dream trip to Paris and Rome (a more emotion-laden outcome), students were less sensitive to probability variations.

Although most consequentialist decision theories consider probability weighting as independent of the nature of the outcome, the findings of Rottenstreich and Hsee (1999) suggest that the impact of probability depends strongly on the nature of the outcome. The probability weighting function is flatter (i.e., more overweighting of small probabilities) for vivid outcomes that evoke emotions than for pallid outcomes. It seems that the overweighting of small probabilities is a result of feelings of fear and hope—fear in the case of a negative outcome and hope in the case of a positive outcome.

The relationship between probabilities and emotions can help to explain one of the major paradoxes in decision making under uncertainty: the prevalence of simultaneous gambling and purchasing of insurance. According to EU, risk aversion (which motivates insurance purchase) is caused by diminishing marginal utility of wealth (or increasing marginal disutility of poverty). If this is the case, then people who, through purchases of insurance, reveal themselves to be risk averse should not purchase actuarially unfair lottery tickets. Friedman and Savage (1948) argued that the observed pattern of behavior suggests that utility functions take a complicated S-shaped form. H. Markowitz (1952) critiqued Friedman and Savage's explanation by demonstrating that it produced many unrealistic behavioral predictions, and advanced an alternative formulation that assumed (a) that people care about losses and gains relative to some reference point (usually the status quo) rather than about absolute levels of wealth and (b) that they evaluate losses and gains with a value function that is generally risk averse for gains and risk seeking for losses. Kahneman and Tversky (1979) further developed Markowitz's model by adding a nonlinear probability weighting function that overweighted small probabilities of both losses and gains. Prospect theory and similar models explain gambling on the basis of an overweighting of small probabilities of a gain (which is, however, countered by the general tendency toward risk aversion for gains) and insurance purchases on the basis of an overweighting of small probabilities of a loss (which is mitigated by the tendency toward risk seeking for losses).

Although the overweighting of small probabilities may be partly responsible for lottery playing and insurance purchases, the overweighting of small probabilities may, itself, stem from the disproportionate fear and pleasurable anticipation evoked by such prospects, as discussed earlier. Consistent with this prediction, Hogarth and Kunreuther (1995) found that, when people make decisions regarding investment in protective measures such as warranties, they do not think about probabilities of malfunctions unless these figures are given to them. Rather, they use arguments such as peace of mind or sleeping well at night to defend their positions. Only when probabilities are explicitly provided do people include them as part of their reasoning. Marketers of insurance in fact rarely provide probabilities; instead, they tend to emphasize qualitative or emotional considerations. Likewise, lottery marketers highlight the pleasure of anticipation associated with lottery purchases with slogans such as "buy a dream." Middle class and lower middle class families who are struggling to make ends meet can savor the possibility that their money problems may come to an instant end when the weekly number is drawn.

The affective response to risks may also help to address another anomaly in the literature on risk taking. For many risky decisions, the moment of uncertainty resolution is different from the time when consequences are actually realized. In some cases, moreover, individuals have some degree of control over when uncertainty is resolved. People can choose whether and when to be tested for diseases such as Huntington's chorea, HIV, or genetic markers associated with increased vulnerability to various types of cancer. Students can decide when to pick up grades, and parents can decide whether and when to learn the sex of a fetus. In some cases, early resolution can only be obtained at a cost. For example, in plea bargaining, early resolution can be achieved at the cost of accepting the prosecutor's offer. In all types of negotiations, the party who can wait longer typically does better; succumbing to the desire for early resolution in the form of a settlement, therefore, usually comes at the expense of a less favorable settlement.

Consequential models of risk taking predict that early resolution will be preferred if other decisions have to be made that depend on the value of the obtained outcome (H. M. Markowitz, 1959; Mossin, 1969; Spence & Zeckhauser, 1972). For example, knowing the value of one's year-end bonus should help one to make more rational spending decisions during the intervening year. Studies that have tested this prediction have generally found, consistent with consequentialist models, that people do typically prefer early resolution of uncertainty. However, there are important exceptions to this general preference for early resolution. Specifically, people often prefer to delay resolution of uncertainty for gambles with small probabilities of gains or large probabilities of losses (Ahlbrecht & Weber, 1996). Elster and Loewenstein (1992, p. 228) argued that, in these cases, delayed resolution is desirable because it provides utility from anticipation. Small probabilities of large gains provide substantial utility from "savoring" the gamble (Loewenstein, 1987) even when there is actually little likelihood of winning. Large probabilities of losses also provide utility from savoring because they are cognitively reframed as a (virtually) certain loss plus a small probability of a gain. Delaying resolution is desirable in these cases because it prolongs the period of hopeful anticipation. Consistent with this interpretation, Lovallo and Kahneman (2000) found an extremely strong positive correlation between people's evaluations of the attractiveness of a set of gambles and their willingness to delay those gambles. Recent theories that deal with delayed resolution preference have introduced considerations of utility derived from anticipation—hope,

fear, and dread (Caplin & Leahy, 1997; Chew & Ho, 1994; Pope, 1985).

Time Interval Between Decision and Realization of Outcome

One of the most important determinants of fear that is likely to be relatively uncorrelated with cognitive assessments of risk is the time between the decision and the realization of its outcomes. As the prospect of an uncertain aversive event approaches in time, fear tends to increase, even when cognitive assessments of the probability or likely severity of the event remain constant (Loewenstein, 1987; Paterson & Neufeld, 1987; Roth, Breivik, Jorgensen, & Hofmann, 1996). Breznitz (1971) informed individuals that they would receive a strong electric shock in either 3, 6, or 12 min. The average heart rate was lower for the distant warning group than for either of the other two groups, which did not differ from one another. Monat (1976) threatened individuals with an electric shock that they were told would occur after 1, 3, or 12 min. Heart rate, galvanic skin response, and self-reported anxiety were all inversely related to the duration of the waiting period. Such a temporal pattern of fear is highly adaptive; organisms that experienced similar levels of fear toward distant and immediate risks would be unlikely to survive long in a hostile environment. Indeed, one of the characteristics of certain types of stress disorders is the tendency to ruminate over risks that are remote in time (e.g., Nolen-Hoeksema, 1990; Sapolsky, 1994) or to continue to experience fear toward no longer threatening events that happened in the past (e.g., Barlow, 1988).

The increase in fear just before the "moment of truth" has a range of diverse consequences. Several studies have found that people lower their expectations just prior to receiving important self-relevant information (e.g., Nisan, 1972; Sanna, 1999; Shepperd, Ouellette, & Fernandez, 1996). Welch (1999) showed that the increase in fear before the moment of outcome resolution has behavioral consequences. In one study, students were offered a payment of $1 in exchange for telling a joke in front of a class the following week. When the appointed time arrived, both students who had agreed to tell the joke and those who had declined to do so were given the opportunity to change their minds. As predicted by the risk-as-feelings hypothesis, with the added assumption that fear increases as the moment of taking a risky action draws near, there was substantial "chickening out." Sixty-seven percent of those who initially volunteered to tell a joke (6 out of 9) decided not to when the time came, but none of those who had initially declined the offer (0 out of 49) changed their mind and decided to tell a joke at the last minute ($p < .01$).

Other studies have provided more direct evidence that pessimistic shifts and chickening out are caused by emotional changes. Savitsky, Medvec, Charlton, and Gilovich (1998) found that pessimistic shifts are associated with an increase in arousal. In a different study, Welch (1999) incorporated an explicit test of the hypothesis that chickening out was caused by affective reactions. The design of the study was identical to the study just described except that half of the students watched a fear-inducing film-clip (2 min from Kubrick's *The Shining*) before making their initial choice about whether to tell the joke in front of the class. Table 1 presents the results for the two groups. As can be seen, risk taking was sensitive to both the temporal proximity of the risk and the immediate mood state induced by the film, with less risk taking occurring when fear was aroused by the immediacy of the risky action or the scary film clip. The tendency to chicken out at the last minute undoubtedly overlaps in many situations with the tendency, demonstrated in research by Liberman and Trope (1998), for people to place greater weight on practical considerations (e.g., do I really have the time to attend the conference?) relative to more vague dimensions of desirability (the topic matter to be discussed at the conference) as the moment of taking an action draws near. Both effects produce changes in behavior with the passage of time; the increase in fear leads people to change their minds about taking risks, whereas the effect discussed by Liberman and Trope leads people to change their minds about actions that are desirable in a gestalt sense but have practical drawbacks.

Table 1
Effect of Fear Manipulation on Fear, Choice at Time 1, and Choice at Time 2

Response	No fear induction (n = 30)	Fear induction (n = 32)	Significance of difference
Self-reported fear about telling the joke[a]	6.1	7.3	$p < .04$
Agree to tell a joke at Time 1 (%)	33	6	$p < .03$
Agree to tell a joke at Time 2 (%)	13	0	*ns*

Note. Time 1 = 1 week before joke would be told; Time 2 = just before joke would be told.
[a] Measured on a 0–10-point scale.

Public Panics

It is well established that decision makers' emotional states can affect their cognitive evaluations of a risk (e.g., Johnson & Tversky, 1983). These cognitive evaluations, in turn, can affect the individual's emotional states. Because these effects exert reciprocal, self-reinforcing influences, there is a potential for self-reinforcing feedback effects. Fear increases arousal and arousal increases the intensity of new fear responses (Lang, 1995). Feedback processes of this type have the potential to create unstable situations in which relatively mild fears rapidly build into a panic reaction. One prominent theory of panic attacks (at the level of the individual) is precisely based on such a feedback process—namely, the idea that fearful thoughts (induced by a focus on internal bodily sensations) produce further bodily sensations, which intensify fears, which increase physiological reactions, and so on (Beck & Emery, 1985; Clark, 1986).

Attacks of panic can be seen at a societal level (Bartholomew, 1997). Such social panics are characterized by an explosion of public concern about a problem—typically unconnected with any sudden change in the underlying risk—followed by an also-sudden collapse of concern (Weinstein, 1989, p. 37). Well-publicized panics include outbreaks of Koru in Asia (an epidemic of fear in which people believe that their genitals are shrinking; Chakraborty, Das, & Mukherji, 1983; Gwee, 1968), unsubstantiated rumors of mad "slashers" and "gassers" on the loose (Jacobs, 1965), and, recently in the United States, hysterical reactions to herpes and disappearing children (Loewenstein & Mather, 1990).

Panics are typically set off by highly vivid cases, or clusters of cases, that receive concentrated media attention (Weinstein, 1989, p. 46). As with individual-level panics, public panics seem to be fueled, in part, by an interplay between anxiety, fear, and subjective probabilities. Evidence supporting such a dynamic interplay of risk perceptions and anxiety comes from field studies. According to Simon Wessely, who has conducted several case studies of mass panics (see, e.g., David & Wessely, 1995; Wessely, 1987; Wessely & Wardle, 1990), almost all cases fit a common pattern. Someone observes a fear-inducing event or is exposed to a vivid frightening rumor, begins to experience anxiety, displays symptoms such as hyperventilating or collapsing that others see, and those others begin to get anxious themselves. As Wessely (cited in Gladwell, 1999) described it, "before you know it everyone in the room is hyperventilating and collapsing" (p. 24). Feelings clearly play a prominent role in this process.

Evolutionary Preparedness

Although cognitive evaluations of the likelihood and magnitude of outcomes are relatively domain independent, the work of Garcia and other researchers in the 1970s (see Seligman, 1971) suggests that the ability of events to evoke fear and other emotional reactions is restricted by biological or evolutionary preparedness. Humans and other animals seem to be preprogrammed to experience certain types of fears. For example, cage-reared rats who have never been exposed to a cat show signs of fear if exposed to the smell of cat fur (Panksepp, 1998). In some cases such preparedness seems to vary over the life course. For example, stranger fear has been observed in humans in a wide range of cultures, usually develops between 4 and 9 months of age, peaks around 12.5 months, and does not require aversive experience with strangers to develop (Menzies, 1995).

Beyond such preprogrammed fears, primates and humans seem to be biologically prepared to become fear-conditioned to certain objects (e.g., snakes, spiders, water, and enclosed spaces) but not to others (but see McNally, 1987). Öhman (1986), for example, found superior conditioning using fear-relevant slides of snakes and spiders as conditional stimuli as compared to fear-irrelevant conditioned stimuli such as slides of flowers and mushrooms or geometric figures. More recent studies have followed up on Lazarus's research on subliminal influences (e.g., Lazarus & McCleary, 1951) by demonstrating that subliminal presentations of fear-relevant, but not of fear-irrelevant, conditioned stimuli are sufficient to elicit conditioned responses. Öhman and Soares (1993) argued that subliminal evocation of fear may help explain the irrationality of fears and phobias "because their origin rests in cognitive structures that are not under the control of conscious intentions" (p. 129; see also Öhman & Soares, 1994).

In many instances of phobias, the inability to uncover any traumatic conditioning history has led to a search for alternative mechanisms. One mechanism, which has received substantial documentation in animal research, has been labeled *vicarious conditioning*. Mineka and colleagues (e.g., Cook & Mineka, 1990; Mineka & Cook, 1993) have demonstrated strong and persistent vicarious conditioning of snake fear in rhesus monkeys. In a prototypical experiment, cage-raised monkeys do not initially show a fear-reaction to snakes but developed one almost instantly after witnessing a fear response from a wild-reared monkey. Subsequent research indicated that vicarious conditioning also exhibits the phenomenon of preparedness. Cage-reared monkeys developed a fear reaction after viewing a tape in which another monkey appeared to react fearfully to a snake, but they did not develop such a reaction when, in a similar tape, the same monkey reacted fearfully to a flower stimulus.

Besides showing very rapid acquisition, certain types of fears also exhibit resistance to extinction. Even when fear conditioning is extinguished through repeated presentation of a conditioned stimulus (e.g., a tone) in the absence of the aversive unconditioned stimulus (e.g., a shock), the fear conditioning of the original association is not lost but remains latent. Such latency has been demonstrated in studies of spontaneous recovery of fear conditioning (Pavlov, 1927) and in studies in which reinstatement of conditioning has been shown to follow presentation of the unconditioned stimulus (Bouton, 1994; Bouton & Swartzentruber, 1991) or as a result of severing connections between the amygdala and the cortex (LeDoux, 1996). The latter finding suggests that the cortex plays an important role in the extinction of fear conditioning and is consistent with the idea that cortical and subcortical processing of fear may often be at odds with one another. The fear is, in a sense, still there, but either the subjective experience of fear or the behavioral response to it is cortically suppressed.

The critical implication of the research on evolutionary preparedness is that people are likely to react with little fear to certain types of objectively dangerous stimuli that evolution has not prepared them for, such as guns, hamburgers, automobiles, smoking, and unsafe sex, even when they recognize the threat at a cognitive level. Types of stimuli that people are evolutionarily prepared to fear, such as caged spiders, snakes, or heights (when adequate safety measures are in place), evoke a visceral response even when, at a cognitive level, they are recognized to be harmless.

It is tempting to draw a connection between such discrepancies in cognitive evaluations and fear reactions and the often-lamented discrepancy between scientists' and the lay public's concern for risks. Just as an animal might be very slow to develop fear toward an unfamiliar poison-emitting flower, there may also be a lag between cognitive and emotional reactions toward risks for which we are not prepared to have emotional reactions. On the one hand, even when environmental policy makers have become convinced that the existing information about the probability and negative consequences of risks such as global warming or radon warrant precautionary action, such sacrifices may require a level of public fear that does not exist. On the other hand, public alarm over risks that experts view as inconsequential, such as Alar or cyanide in Chilean grapes, can force the hand of reluctant policy makers (Gregory, Flynn, & Slovic, 1995; Gregory, Slovic, & Flynn, 1996; Slovic, Flynn, & Gregory, 1994).

Summary

The research reviewed in this section can be summarized as follows. First, fear as the emotional response experienced in risky situations reacts to probabilities and outcomes in a manner that is very different from that postulated by EU theory and its generalizations. Second, fear depends on a variety of factors that are not part of such models. Fear typically peaks just before a threat is experienced and is highly dependent on mental imagery (and thus subject to vividness effects). Fear responses also seem to be

conditioned, in part, by our evolutionary makeup; we may be prepared to learn very rapidly about some types of risks but much more slowly about others. Fear responses are evoked, often by crude or subliminal cues. Fear conditioning may be permanent, or at least far longer lasting than other kinds of learning. To the extent that these differences exist between the calculus of objective risk and the determinants of fear, and to the extent that fear does, in fact, play an important role in risk-related behaviors, behavior in the face of risk is unlikely to be well-described by traditional consequentialist models.

Conclusions

Although decision making under risk has been a central topic of decision theory, the decision-theoretic approach to decision making under risk has largely ignored the role played by emotions. Whereas some theorists have considered the effects of emotions experienced after the decision (i.e., emotions elicited by good or bad outcomes), very little attention has been given to the impact of emotions experienced *during* the decision-making process. In contrast, such anticipatory emotions play a prominent role in clinical and social psychological theory and research and have received recent attention from neuroscientists.

People react to the prospect of risk at two levels: they evaluate the risk cognitively, and they react to it emotionally. Although the two reactions are interrelated, with cognitive appraisals giving rise to emotions and emotions influencing appraisals, the two types of reactions have different determinants. Cognitive evaluations of risk are sensitive to the variables identified by decision theory, namely probabilities and outcome valences. Although emotions do respond to cognitive evaluations, they can also arise with minimal cognitive processing (Zajonc, 1980), and people can experience fear reactions without even knowing what they are afraid of. In contrast to cognitive evaluations, emotional reactions are sensitive to the vividness of associated imagery, proximity in time, and a variety of other variables that play a minimal role in cognitive evaluations. Moreover, although emotional reactions are also sensitive to probability and outcome valence, the functional relationships are quite different from those for cognitive evaluations. As a result of these differences, people often experience a discrepancy between the fear they experience in connection with a particular risk and their cognitive evaluation of the threat posed by that risk.

Implications for Research

One important implication of the risk-as-feelings hypothesis is that those doing risk-related research should make it a routine practice to collect information on emotional reactions to risks, in addition to such traditional measures as probabilities and outcome values. Ideally, such measures would include physiological measures as well as self-reports. Two areas in which these measures could provide useful information are gender and age-related changes in risk taking.

When it comes to gender, large numbers of studies have found that male individuals tend to be more risk averse than female individuals (see Byrnes, Miller, & Schafer, 1999, for a recent meta-analysis). These differences are particularly pronounced when it comes to physical, or life-threatening, risks (Hersch, 1997), but have also been observed in other domains such as investment decisions (Bajtelsmit, Bernasek, & Jianakoplos, 1997). Very little of this research has paid explicit attention to the role of risk-related emotions. There is, however, some intriguing evidence suggesting that gender differences in risk taking may be linked to parallel differences in emotional responsiveness. Several studies have found that female individuals report more and better imagery than male individuals (see Harshman & Paivio, 1987, for a review of several studies) and that they experience emotions more intensely than male individuals, on average. When men and women are asked to recall their saddest memory, positron emission tomography scans indicate that brain activity increases significantly more in the female brain than in the male brain (George, 1999). Of greatest relevance to the risk-as-feelings hypothesis, women report experiencing nervousness and fear more intensely than men do (Brody, 1993; Brody, Hay, & Vandewater, 1990; Fujita, Diener, & Sandvik, 1991; Stapley & Haviland, 1989). Further studies are needed to determine whether observed male–female differences in risk taking may be mediated by differences in emotional reactions to risks. If true, it would be interesting to examine whether women are more risk seeking in situations to which they respond less emotionally than men.

There is also a possibility that emotional changes associated with *aging* may help to explain observed age-based differences in risk taking, and specifically adolescents' high risk-taking propensities. One popular explanation for adolescent risk taking is the so-called invulnerability hypothesis according to which adolescent risk taking stems from feelings of invulnerability (see, e.g., Burger & Burns, 1988; Whitley & Hern, 1991). From a decision-making perspective, the invulnerability hypothesis implies that adolescents either do not consider some potentially harmful consequences of risky behavior or underestimate the likelihood of these consequences happening to them. Despite its popularity, however, there is surprisingly little evidence that supports the invulnerability hypothesis and some evidence that conflicts with it. Beyth-Marom, Austin, Fischhoff, Palmgren, and Quadrel (1993) and Quadrel, Fischhoff, and Davis (1993), for example, compared adolescents and adults on their cognitive evaluations of the consequences of engaging or not engaging in various risky behaviors. Contrary to the invulnerability hypothesis, these studies found relatively few differences in the subjective probabilities of negative outcomes. The possibility that age-based differences in risk taking are affectively mediated (and possibly the result of differences in the vividness of mental simulations of behavior), therefore, merits further exploration.

A second pressing need in basic research is to examine the effects of *intense* emotions on risk taking and behavior. Most of the current research on the effects of emotions examines relatively mild emotions that are induced using techniques such as guided imagery. It is exactly at such low levels of intensity that emotions are most likely to play the largely advisory role emphasized by many of the current theories reviewed in the introduction. The clinical literature on fear and anxiety may have been the area in which cognition–emotion conflicts are most prevalent in part because the emotions examined in clinical settings and with clinical populations are much more intense than those elicited in the laboratory with nonclinical populations. Eliciting powerful emotions in normal populations is certainly problematic; perhaps the best opportunities for such research occur in naturalistic settings in

which emotions reliably run high (e.g., just before parachuting, or in the courtroom).

Policy Implications

Individuals' emotional reactions to risks not only often differ from their cognitive evaluations of those risks; they also often diverge from the evaluations of experts. Public perception of the risks of silicone implants in causing autoimmune diseases, for example, led Dow Corning to stop production of implants in 1992 and file for bankruptcy in 1995, despite two major medical reports that revealed no evidence of silicone-related illnesses and a clean bill of health from the American College of Rheumatology (Cowley, 1995). Controversies about the licensing of technologies such as genetic engineering or the siting of facilities such as landfills, incinerator plants, or halfway houses for the mentally handicapped tend to be fueled primarily by emotional reactions to the risks, rather than by scientific evaluations of objective risk levels. Although the controversy about location of the high-level nuclear waste repository generates powerful emotions, large numbers of people seem amazingly unconcerned about the fact that high-level nuclear waste is currently being stored at nuclear reactors that are in close proximity to major population centers. Referring to the current controversy about the Department of Energy's nuclear waste disposal plans for Yucca Mountain (Nevada), Slovic, Flynn, and Layman (1991) described officials from the Department of Energy, the nuclear industry, and their technical experts as "profoundly puzzled, frustrated, and disturbed by public opposition that many of them consider to be based on irrationality and ignorance" (p. 1603). Whereas business or government experts have clear quantitative definitions of such risks on the basis of objective data or models, members of the general public often seem to evaluate the same options in very different ways. Much of the early work by Slovic, Fischhoff, and Lichtenstein (1986) on psychological risk dimensions was funded by the Nuclear Regulatory Commission (NRC) to explain how public perception of the riskiness of nuclear technology could differ so drastically from the estimates provided by NRC engineers. In the intervening years, these differences in perception have shown no sign of diminishing. Future research should continue to investigate whether these differences in perception are the result of differences in the degree to which risks are processed cognitively versus affectively by different segments of the population.

The divergence between the emotional reactions of the public to risks and professionals' appraisals of risks creates a significant dilemma for policy makers. On the one hand, many policy makers would like to be responsive to public attitudes and opinions. On the other hand, there is a strong rationale for basing public policy on the best scientific assessments of risk severity. Sunstein (in press) justified cost–benefit analysis precisely on the basis that it provides an impartial assessment of programs that are resistant to the influence of public fears. He noted that governments allocate the limited resources for risk mitigation in an inefficient fashion in part because they are responsive to lay judgments about the magnitude of risks. Sunstein then cited results from diverse lines of research showing that a government that could insulate itself from such misinformed judgments could save tens of thousands of lives and tens of billions of dollars annually. Consistent with the risk-as-feelings hypothesis, Sunstein attributed the public's misinformed judgments in part to emotional influences:

> Risk-related objections can be a product not so much of thinking as of intense emotions, often produced by extremely vivid images of what might go wrong . . . . The role of cost–benefit analysis is straightforward here. Just as the Senate was designed to have a "cooling effect" on the passions of the House of Representatives, so cost–benefit analysis might ensure that policy is driven not by hysteria or alarm, but by a full appreciation of the effects of relevant risks and their control. (p. 16)

Sunstein argued further that cost–benefit analysis could not only act as a check on unwarranted fears (e.g., Alar), but could also serve to introduce regulation of risks that are objectively threatening but that do not elicit visceral reactions in the populace (e.g., lead in gasoline and radon in homes).

Simply disregarding the public's fears and basing policy on the experts, however, is difficult in a democracy and ignores the real costs that fears impose on people, as is well documented in the literatures on stress and anxiety. The best policy, then, would be one that involves mitigating real risks and irrational fears. Although clinical treatment of anxiety disorders "represents one of the great success stories of applied psychological science" (Bouton, Mineka, & Barlow, 2001, p. 4), there is very little research on fear-reduction strategies that might be effective at a societal level.

In this article we have proposed a model of risky choice that highlights the role of anticipatory emotions—immediate visceral reactions (e.g., fear, anxiety, dread) to risks and uncertainties that arise at the time of decision making. The model is fundamentally different from the consequentialist approach that characterizes most existing risky-choice theories. Consequentialist models, to the extent that they include emotions at all, tend to incorporate anticipated emotions—emotions that are expected to result from the consequences of the decision. By taking account of the role of anticipatory emotions that are experienced at the moment of decision making, our model explains a variety of phenomena that have puzzled decision theorists who have attempted to explain them at a purely cognitive level.

Although the focus of this article has been on choices under risk, the basic theme can be applied to any type of decision, whether it involves risks or not. Like theories of risky choice, most theories of riskless choice, including multi-attribute utility theories, also take a consequentialist perspective, assuming that decisions are made to maximize the utility of future consequences. Even theories that do take emotions into consideration typically view emotions as a consequence of one's decision. In contrast, our model, and the substantial body of research on which it is based, suggest that gut feelings experienced at the moment of making a decision, which are often quite independent of the consequences of the decision, can play a critical role in the choice one eventually makes.

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