

## Emotion and Rationality: A Critical Review and Interpretation of Empirical Evidence

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The relation between emotion and rationality is assessed by reviewing empirical findings from multiple disciplines. Two types of emotional phenomena are examined—incidental emotional states and integral emotional responses—and three conceptions of rationality are considered—logical, material, and ecological. Emotional states influence reasoning processes, are often misattributed to focal objects, distort beliefs in an assimilative fashion, disrupt self-control when intensely negative, but do not necessarily increase risk-taking. Integral emotional responses are often used as proxies for values, and valuations based on these responses exhibit distinct properties: efficiency, consistency, polarization, myopia, scale-insensitivity, and reference-dependence. Emotions seem to promote social and moral behavior. Conjectures about the design features of the affective system that give rise to seeming sources of rationality or irrationality are proposed. It is concluded that any categorical statement about the overall rationality or irrationality of emotion would be misleading.

*Keywords:* emotion, cognition, rationality, decision, affect

The relation between emotion and rationality, affect and reason, is an ageless question. This question has preoccupied philosophers, commoners, and classical writers for many centuries. It is only recently, however, that it has become the subject of scientific inquiry and empirical investigations. In the past 20 years, investigations related to this question have been conducted across a wide range of scientific disciplines, including cognitive and social psychology, economics, decision research, consumer research, and neuroscience. Unfortunately, because empirical studies are necessarily grounded in a certain theoretical, substantive, and methodological context, any one study can provide, at best, only a very partial answer to the extremely complex question of emotion and rationality. The empirical literature on emotion and rationality is thus very fragmented and sometimes seemingly inconsistent. What is

needed, therefore, is a comprehensive review of the wide range of empirical findings that have emerged across various literatures about the relation between emotion and reason. This is the object of this article.

The article is structured in five sections. The first section introduces distinctions between two types of emotional phenomena—incidental emotional states and integral affective responses—and three conceptions of rationality—logical, material, and ecological. The next section focuses on incidental emotional states and reviews their effects on reasoning, belief accuracy, self-control, and risk-taking. The third section focuses on the role of integral affective responses in judgment and decision making. This section identifies distinct properties of affective responses as proxies for value and evaluates the “somatic marker hypothesis.” The fourth section examines the role of emotions in social and economic interactions. The concluding section discusses identified empirical regularities and advances theoretical conjectures about the principles of an affective system of judgment and behavioral regulation that gives rise to seeming sources of rationality and irrationality. It is concluded that any categorical statement about the overall rationality or irra-

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tionality of emotion may be simplistic and misleading.

### Types of Emotional Phenomena and Types of Rationality

Emotions refer to complex states of the organism characterized by changes in autonomic nervous system arousal accompanied by distinct physiological expressions, specific action tendencies, and subjective feeling experiences of a certain valence (see Strongman, 1987). Emotions generally, though not always, arise from a cognitive appraisal of the emotional object or situation in terms of its meaning for one's well-being (Lazarus, 1991). In this review, the term "emotion" will be used somewhat broadly to refer to the presence of affect in general. It will be used not only in reference to emotions proper—that is, intense affective experiences such as anger, fear, joy, and love that have clear emotional referents—but also in relation to milder affective responses, feelings, and states, including moods that do not have clear referents. This wide-ranging use of the term "emotion" is intentional. If one is to have a full appreciation of the rationality or irrationality of emotional phenomena, it is important not to restrict one's analysis to the most intense emotional experiences.<sup>1</sup>

When studying the effects of emotion on judgment, decision, and behavior, two types of emotional phenomena should be distinguished: incidental emotional states and integral emotional responses (Bodenhausen, 1993). Incidental emotional states are those whose source is unrelated to the object of judgment or decision. These states include current emotions not caused by the target object, preexisting mood states, and enduring emotional dispositions such as chronic anxiety. Integral emotional responses are those experienced in relation to the object of judgment or decision. More specifically, integral affective responses are emotions and feelings that are elicited by features of the target object, whether these features are real, perceived, or only imagined (Cohen, Pham, & Andrade, 2007).<sup>2</sup>

Three conceptions of rationality also need to be distinguished in discussing the relation between emotion and rationality. The first conception emphasizes reasoning, consistency, and logic. According to the Webster's New World

Dictionary (Neufeldt, 1991, p. 1115), the word "rational" implies "the ability to reason logically, as by drawing conclusions from inferences." People are rational (irrational) if their beliefs, judgments, choices, and actions respect (violate) certain standards of logic. For example, in the standard economic theory of choice, rationality requires that preferences be transitive: if a person prefers A over B and prefers B over C, then this person must also prefer A over C. Similarly, according to normative (Bayesian) rules of inference, if a person has to guess which of two types of taxis was more likely involved in a hit-and-run accident, it would be rational to take into account the relative proportion of each type of taxi in the area. This first conception of rationality has been referred to as logical (Kahneman, 1994).

A second conception of rationality emphasizes the consistency between a person's decisions and actions and this person's objectives and self-interests. According to renowned economist Amartya Sen (1990, p. 210), "rationality . . . demands cogent relations between aims and objectives actually entertained by the person and the choices that the person makes." This conception is central to standard economic theorizing where it is posited that rational individuals choose courses of actions in a way that maximizes these individuals' own utility. Choices of inferior alternatives are irrational so are behaviors that are not in the person's self-interest (e.g., compulsive gambling, excessive smoking, and unprotected sex with strangers). This second conception of rationality may be referred to as material.

The study of emotion raises a third type of rationality. Certain types of behaviors and actions are "rational" not because of they are logically consistent or serve the person's self-interest but because they fulfill broader societal

<sup>1</sup> For instance, in his treaty on emotion and rationality, Elster (1999) concentrates his analysis on intense emotional experiences of the kind discussed by classical writers. This analytical strategy introduces two major sampling problems. First, it is unlikely that classical writings, however insightful, are statistically representative of human reality. Second, even if they were, an exclusive focus on intense emotions is bound to overstate their general consequences.

<sup>2</sup> Unfortunately, space constraints prevent a discussion of the extensive work on memory for affective experiences and affective forecast of future experiences (see, e.g., Kahneman, 1994).

goals, meet higher moral standards, or serve greater evolutionary purposes. Some of these behaviors and actions, in fact, may be against the person's material self-interest. For example, it would not be in a bystander's self-interest to take on an armed mugger and attempt to rescue the mugger's victim. However, if the bystander elects to do so, one could hardly call this act irrational. Such benevolent, altruistic acts are quite reasonable, even desirable, from a societal or moral standpoint, even if they seem irrational from a strictly material standpoint. Similarly, people's almost universal attraction to certain ideals of beauty may seem irrational from a logical standpoint and could also be materially irrational if it leads to unfortunate outcomes (e.g., heartbreak). However, there is evidence that the attraction to certain standards of beauty is sensible from an evolutionary standpoint (see Etcoff, 1999). Certain behaviors and attitudes may therefore be "rational," not in the logical or material sense, but in terms of their consistency with societal goals, moral standards, or evolutionary purposes. This third form of rationality can be termed "ecological" in that it reflects humans' ability to relate to their environment, whether social, cultural, or natural.<sup>3</sup> A primary function of emotions may in fact be to support this ecological form of rationality.

### Rationality/Irrationality of Incidental Emotional States

Emotional states are incidental if their source is unrelated to the object of judgment or decision. Incidental emotional states have a variety of rational and irrational influences on judgments, decisions, and behaviors. They influence people's reasoning processes, the accuracy of their beliefs, their ability to exert self-control, and their tendency to take risks. They are also often misattributed to target objects.

### *Effects of Emotional States on Reasoning*

Emotional states influence people's reasoning processes, and therefore their logical rationality. The desirability of these influences seems to be a function of the intensity of the states, their valence, and their appraisal content.

Most intense emotional states, except sadness, are accompanied by high levels of autonomic

arousal, which is known to impair working memory capacity (Darke, 1988a; Humphreys & Revelle, 1984). This decrement in processing capacity has a variety of consequences that seem detrimental to sound reasoning. For example, compared to nonanxious participants, anxious participants tend to (a) have lower ability to recall information and organize this information in memory (Mueller, 1977, 1978), (b) take longer to verify the validity of logical inferences (Darke, 1988b), (c) scan alternatives in a more haphazard fashion (Keinan, 1987), (d) select an option without considering every alternative (Keinan, 1987), (e) commit more errors in geometric and semantic analogical problems (Keinan, 1987; Leon & Revelle, 1985), and (f) process persuasion arguments less thoroughly (Sanbonmatsu & Kardes, 1988, but see Pham, 1996). Intense emotional states, such as anxiety, therefore appear to produce deficits in people's reasoning abilities. However, this conclusion needs to be qualified in several respects.

Because most of these findings pertain to the effects of high anxiety, it is not clear whether they generalize to other intense emotions (e.g., joy, anger, intense pride). For example, unlike other intense emotions, anxiety involves a cognitive element of worry that could be driving some of the above-described deficits. In addition, the effects of intense arousal on cognitive performance are not always negative (Humphreys & Revelle, 1984). Finally, states of intense emotional arousal appear to benefit reasoning in at least one respect. In task settings where multiple cues are available, emotionally aroused individuals seem to adjust to their reduced processing capacity by narrowing down their cue-utilization to the more diagnostic cues at the expense of the less diagnostic cues (e.g., Bacon, 1974; Hockey, 1973). As a result, states of high emotional arousal tend to increase the relative

<sup>3</sup> Clore (2005) recently proposed that in the study of emotion and rationality, the notion of "value" should be defined more broadly than in typical economic discourse. In addition to (a) the desirability of outcomes (captured by the notion of material rationality), Clore suggests including (b) the consistency of actions with standards and (c) the consistency of attributes of objects with tastes and attitudes. The ecological rationality proposed here subsumes Clore's second category (the consistency with standards) and part of his third category, namely the consistency with tastes and attitudes rooted in evolutionary logic.

reliance on diagnostic versus nondiagnostic information in judgment (Pham, 1996).

Milder emotional states also influence reasoning processes. Compared to neutral moods, good moods have been found to lead individuals to (a) categorize objects more broadly (Isen & Daubman, 1984; Isen, Niedenthal, & Cantor, 1992), (b) generate more creative answers in response-generation tasks (Greene & Noice, 1988; Hirt, Melton, McDonald, & Harackiewicz, 1996), (c) perform better in problem-solving tasks that require ingenuity (Greene & Noice, 1988; Isen, Daubman, & Nowicki, 1987), and (d) solve multiattribute decision problems more efficiently (Isen & Means, 1983). According to Isen (2001), these and other findings show that positive moods have generally beneficial effects on reasoning, problem solving, judgment, and decision making. This conclusion needs to be tempered because other studies suggest that positive moods lead to poorer reasoning performance in a variety of respects. Positive mood individuals are more likely to overestimate the degree to which others' actions are driven by personal disposition as opposed to situational factors, a bias known as the "fundamental attribution error" (Forgas, 1998). Positive mood has also been found to decrease performance in deductive reasoning tasks (Oaksford, Morris, Grainger, & Williams, 1996) and result in more intransitive preferences (Fiedler, 1988). Numerous attitude and persuasion studies also indicate that positive moods decrease the depth with which people process substantive information (Batra & Stayman, 1990; Bless, Bohner, Schwarz, & Strack, 1990; Bless, Mackie, & Schwarz, 1992; Mackie & Worth, 1989; Worth & Mackie, 1987). Positive mood individuals seem to rely instead on global knowledge structures and internal cues including scripts (Bless, Schwarz, Clore, Golisano, & Rabe, 1996), stereotypes (Bodenhausen, Kramer, & Suesser, 1994), and judgmental heuristics, such as ease of retrieval (Ruder & Bless, 2003). Overall, positive moods seem to have mixed effects on people's reasoning. On the one hand, they seem to promote greater flexibility and creativity in problem solving, which appears logically desirable; on the other hand, they seem to promote a more top-down, less data-driven, and less thorough mode of processing, which appears logically less desirable.

Negative moods, especially those of the sadness kind, have generally been found to have effects that mirror those described above. Compared to neutral and pleasant moods, sad moods have been found to increase the care with which people process substantive information in persuasion (Bless, Bohner, Schwarz, & Strack, 1990; Sinclair, Mark, & Clore, 1994), decrease the reliance on general knowledge structures such as scripts and stereotypes (Bless, Schwarz, Clore, Golisano, & Rabe, 1996; Bodenhausen, Kramer, & Suesser, 1994), increase the ability to estimate covariation from scatter plot data (Sinclair & Mark, 1995), reduce the susceptibility to halo effects (Sinclair, 1988), reduce fundamental attribution errors (Forgas, 1998), and increase the transitivity of preferences (Fiedler, 1988). Overall, sad moods seem to trigger a more systematic, data-driven, and analytical form of reasoning consistent with logical rationality. One possible explanation, based on the "affect-as-information" hypothesis (Schwarz, 1990), is that sad moods signal to the individual that the situation is problematic and therefore requires a more vigilant form of processing (Schwarz, 2002). Not all negative moods trigger this vigilant form of processing. States of anger and disgust seem to decrease the depth of processing and increase the reliance on stereotyping and other heuristic cues, apparently because these states trigger a sense of certainty (Bodenhausen, Sheppard, & Kramer, 1994; Tiedens & Linton, 2001). Note also that only mild states of sadness (sad moods) seem to produce these beneficial effects. More intense states of sadness such as chronic depression seem to interfere with reasoning and effortful processing (Conway & Giannopoulos, 1993; Hartlage, Alloy, Vazquez, & Dykman, 1993; Silberman, Weingartner, & Post, 1983).

#### *Misattribution of Incidental Affective States*

A robust result about the psychology of emotion is that people tend to attribute their affective states to whatever object is the current focus of their attention (Schwarz & Clore, 1996). When the object of attention is indeed the source of feelings, this is logically rational. However, people tend to make this attribution even when the actual source of the feelings is totally unrelated to the object of attention. In a

classic study, Schwarz and Clore (1983) found that respondents who were in a good mood as a result of being surveyed on a sunny day reported higher levels of life satisfaction than respondents who were in a bad mood as a result of being surveyed on a rainy day. Respondents mistakenly inferred that their weather-induced moods reflected how they felt about their personal lives. Similar logically irrational misattributions have been found in numerous studies showing that incidental mood states generally have assimilative (mood-congruent) effects on object evaluation (Albarracín & Kumkale, 2003; Ottati & Isbell, 1996; Siemer & Reisenzein, 1998).

The widespread misattribution of incidental mood states may explain the puzzling effects of weather on the stock market, the presumed citadel of rationality. In a challenge to the hypothesis that financial markets are efficient, a number of studies have recorded above-average stock market performance on sunny days and below-average performance on rainy and winter days (Hirshleifer & Shumway, 2003; Kamstra, Kramer, & Levi, 2003; Saunders, 1993). A plausible explanation is that a sunny weather puts investors in a good mood that they misinterpret as optimism about the stock market, therefore taking more risk; rainy or winter weather puts investors in a depressed mood that they misinterpret as pessimism about the stock market, therefore taking less risk.

People misattribute not only the valence of their incidental affective states, but also their arousal and cognitive appraisal components. Numerous studies have shown that incidental emotional arousal is often misinterpreted as an integral affective response to a target, resulting in more polarized evaluations of this target (Dutton & Aron, 1974; Foster, Witcher, Campbell, & Green, 1998; Gorn, Pham, & Sin, 2001; Mattes & Cantor, 1982; White, Fishbein, & Rutsein, 1981; Zillmann, 1971). Incidental arousal is misconstrued as an integral response to the target, resulting in polarization because people “feel strongly about” the target (Gorn, Pham, & Sin, 2001). People also seem to interpret the appraisal content of their incidental emotional states as if the states were related to the target. For example, Lerner, Small, and Loewenstein (2004) found that incidental states of disgust decreased the perceived value attached to possessions that were objectively un-

related to the source of disgust. This is presumably because disgust typically signals an internal source of discomfort, which encourages the rejection of possessions.

The degree to which people misattribute their affective states is not absolute, however. Misattributions usually disappear when people are made aware of the true source of their affective states (e.g., Gorn, Goldberg, & Basu, 1993; Schwarz & Clore, 1983; Siemer & Reisenzein, 1998). This explains why intense emotions, whose source tends to be salient, are less likely to be misattributed. Attributions seem to depend on the perceived representativeness of the affective state with respect to the target (Pham, 1998; Strack, 1992). For example, incidental affective states are more likely to be misattributed when there is a surface resemblance between the source of the affective state and the domain of the decision (Raghunathan, Pham, & Corfman, 2006).

### *Effects of Emotional States on Belief Accuracy*

A basic requirement of logical rationality is an accuracy of perceptions and beliefs. A large body of evidence indicates that incidental affective states tend to distort people’s perceptions and beliefs about objects in an assimilative fashion (Isen, Shalcker, Clark, & Karp, 1978; Mayer, Gaschke, Braverman, & Evans, 1992), especially if the target is ambiguous (Gorn, Pham, & Sin, 2001; Isen & Shalcker, 1982; Miniard, Bhatla, & Sirdeshmukh, 1992). For example, participants who watched a commercial appearing in a happy TV program perceived it to be more effective than participants who watched the same commercial embedded in a sad program (Goldberg & Gorn, 1987), and consumers who tasted a soft drink after watching a pleasant movie rated the beverage’s attributes more favorably than participants who tasted it after watching an unpleasant movie (Dommermuth & Millard, 1967). These assimilative influences extend beyond strict evaluative judgments. For example, risks are perceived to be higher under negative moods than under positive moods (Johnson & Tversky, 1983; Wright & Bower, 1992) and under incidental states of fear than under incidental states of anger (Lerner & Keltner, 2001). Sad events are also perceived to be more likely under incidental states of sadness

and angering events more likely under incidental states of anger (DeSteno, Petty, Wegener, & Rucker, 2000). These assimilative influences can be explained in terms of misattribution: incidental affective states may be misinterpreted as integral affective responses to the target (Schwarz, 1990). However, other processes may also be at work (Forgas, 1995), including selective encoding or retrieval of affect-consistent information under incidental emotional states (Bower, 1981; Isen, Shalcker, Clark, & Karp, 1978).

Although momentary emotional states often distort people's perceptions, it has been hypothesized that chronically depressed individuals have more accurate perceptions of reality than nondepressed individuals, whose perceptions tend to be self-enhancing—a hypothesis known as depressive realism (Alloy & Abramson, 1988). In a seminal study, Alloy and Abramson (1979) found that depressed individuals had more accurate perceptions of the contingency between their behavior and some environmental outcome than did nondepressed individuals who tended to overestimate this contingency when the outcome was desirable and underestimate it when the outcome was undesirable. Seemingly more objective perceptions among depressed individuals have been observed in several other studies (e.g., Alloy & Ahrens, 1987; Gotlib, McLachlan, & Katz, 1988; Keller, Lipkus, & Rimer, 2002; Lewinsohn, Mischel, Chaplin, & Barton, 1980; Martin, Abramson, & Alloy, 1984; see Dobson & Franche, 1989, for a review). For example, compared to nondepressive individuals, depressive individuals have been found to attend more evenly to positive, neutral, and negative words (Gotlib, McLachlan, & Katz, 1988) and revise their estimates of health risks more accurately after receiving medical feedback (Keller, Lipkus, & Rimer, 2002). However, other studies have failed to support the depressive realism hypothesis (Benassi & Mahler, 1985; Dunning & Story, 1991) and suggest that the phenomenon might not generalize to more meaningful and consequential tasks (Pacini, Muir, & Epstein, 1998). For example, Dunning and Story (1991) found that depressed individuals were less accurate and more overconfident in predicting the probability of future personal events than nondepressed individuals. Some analyses suggest that the original Alloy and Abramson (1979) findings may

have been a methodological and statistical artifact (Allan, Siegel, & Hannah, 2007); Msetfi, Murphy, Simpson, & Kornbrot, 2005). Empirical support for the depressive realism hypothesis is therefore very mixed. One possible explanation for this inconsistency may be that depression only enhances realism in tasks that involve some reassessment of the current situation. This is because, as explained in the concluding section, sadness-related states may serve as a signal for situational reassessment.

In summary, it seems that incidental affective states undermine logical rationality by distorting beliefs in an assimilative fashion, especially if the target is ambiguous and if the state is improperly attributed to the target. One debated exception could be chronic states of depression, which may enhance belief accuracy under certain conditions.

### *Effects of Emotional States on Self-Control and Risk-Taking*

Improper self-control and excessive risk-taking (or avoidance) are primarily matters of material rationality (although they also raise issues of ecological rationality). It is well established that intense drive states such as hunger, pain, sexual arousal, drug cravings, and sleep deprivation produce breakdowns in self-control and increase people's willingness to take risks in order to alleviate the drive state (Loewenstein, 1996). For example, states of high sexual arousal increases people's willingness to use unethical means of getting sex and decrease their willingness to practice safe sex (Ariely & Loewenstein, 2005; Bouffard, 2002).

Negative emotional states, especially intense ones, produce similar breakdowns in self-control. Negative affective states have been found to (a) reduce the ability to resist temptation and delay gratification among children (Fry, 1975; Schwarz & Pollack, 1977; Seeman & Schwarz, 1974), (b) increase the tendency to overeat among dieters (Ruderman, 1986), (c) increase the chance of relapse among people trying to quit smoking (Shiffman & Waters, 2004), (d) encourage shopping among compulsive buyers (Faber & Christenson, 1996), (e) increase procrastination (Tice, Bratslavsky, & Baumeister, 2001), and (f) produce overconsumption of limited collective resources (Knapp & Clark, 1991). Recent studies suggest that this

phenomenon is not because of a decrease in motivation or ability to self-regulate under negative affective states, but to a shift in priority among distressed individuals who seem to place the immediate goal of feeling better ahead of other goals (Tice, Bratslavsky, & Baumeister, 2001).

Given the disruptive effects that intense negative affective states have on self-control, one would intuitively predict that these states should also make people more risk-risking. The empirical evidence is in fact very mixed. Several studies indicate that negative emotional states with strong arousal increase risk-seeking (Fessler, Pillsworth, & Flamson, 2004; Leith & Baumeister, 1996; Mano, 1992, 1994). For example, Leith and Baumeister (1996) found that participants who were angry or anticipated an impending embarrassment were more likely to choose economically inferior “long-shot” gambles over superior “safe-bet” gambles, whereas sad participants did not exhibit this bias. Fessler, Pillsworth, and Flamson (2004) also found that anger triggered more risk-seeking in gambling, especially among men. Similarly, Mano (1994) found that intense emotional arousal increased the willingness to pay for lotteries and decreased the willingness to pay for insurance, in other words increased risk-taking for both potential gains and potential losses.

However, other findings indicate that people’s attitude toward risk under negative emotions is not just a function of the level of arousal associated with the emotion, but also a function of the appraisal content of the emotion (Lerner & Keltner, 2001; Raghunathan & Pham, 1999). Raghunathan and Pham (1999) observed that in risk-reward-tradeoff situations, anxious individuals tend to prefer low-risk/low-reward options, whereas sad individuals tend to prefer high-risk/high-reward options—a seeming reversal of the high-arousal/high-risk pattern observed elsewhere (see also Raghunathan et al., 2006). According to Raghunathan and Pham (1999), this is because anxiety, which is typically associated with situations of low control and high uncertainty, activates a goal of risk and uncertainty minimization, whereas sadness, which is typically experienced in response to the loss of a source of reward, activates a goal of reward maximization. Other studies have also uncovered decreased risk-seeking under anxiety when

the level of arousal is held constant (Mano, 1992, 1994). Lerner and Keltner (2001) similarly observed that fear tends to trigger risk-aversion, whereas anger tends to trigger risk-seeking even though both are high-arousal negative emotions. This is because fear, like anxiety, is typically associated with situations of uncertainty and low control, whereas anger is typically associated with situations of certainty and high control. Disgust, another high arousal emotion, has also been found to decrease risk-seeking in gambling among women (Fessler, Pillsworth, & Flamson, 2004).

In summary, unlike drive states, intense negative emotions do not have a uniformly positive effect on risk-seeking (see Hockey, Maule, Clough, & Bdzola, 2000). High emotional arousal seems neither necessary, nor sufficient to explain risk-seeking under negative emotions. Rather, the effects of negative emotions on risk-seeking seem to depend on complex interactions between the goals activated by the emotional state and the nature of the risks to be taken. This may explain why a meta-analysis of published studies relating chronic states of anger, sadness, and anxiety to risky sexual behavior found virtually no correlation (Crepaz & Marks, 2001).<sup>4</sup>

### Rationality/Irrationality of Integral Emotional Responses as Proxies for Value

Unlike incidental affective states, integral affective responses are those elicited by perceived or imagined features of the target object. Integral affective responses play a major role in people’s evaluations of, decisions about, and behavior toward objects, even if the attributes of the objects are held constant (e.g., Abelson, Kinder, Peters, & Fiske, 1982; Hsee & Kunreuther, 2000; Pham, 1998; Pham, Cohen, Pracejus, & Hughes, 2001). The primary reason seems to be that integral affective responses are often used as proxies for value: things that feel good must be desirable, and things that feel bad must be undesirable (see, e.g., Damasio, 1994; Pham, 2004; Schwarz & Clore, 1996; Slovic, Finucane, Peters, & MacGregor, 2002), a pervasive infer-

<sup>4</sup> Another explanation could be that chronic emotional states have lesser effects on risk-taking than momentary states.

ence that accounts for the often-observed assimilative effect of incidental affective states on target evaluations.

### *Properties of Integral Emotional Responses as Proxies for Value*

*Speed and processing efficiency.* Judgments and decisions based on integral emotional responses are generally reached more rapidly than those based on descriptive inputs, both in stimulus-based tasks (Pham et al., 2001; Zajonc, 1980) and in memory-based tasks (Verplanken, Hofstee, & Janssen, 1998). This seems to be because integral affective responses can arise very rapidly (LeDoux, 1996; Zajonc, 1980) and enter evaluations through simple associations (De Houwer, Thomas, & Baeyens, 2001) or straightforward interpretation (Pham et al., 2001; Strack, 1992). Judgments and decisions based on integral affective responses also generally require less processing resources (Epstein, 1990). This is evident from the robust finding that constraints on processing resources such as time pressure, distraction, or cognitive load generally increase the reliance on integral affective responses in judgment and choice (e.g., Avnet & Pham, 2004; Nowlis & Shiv, 2005; Pham et al., 2001; Shiv & Fedorikhin, 1999). Overall, it seems that integral affective responses provide fast and resource-efficient assessments of value. Whether these assessments are logically and materially rational depends on a variety of considerations—some of which are evaluated below. However, from an ecological standpoint, judgmental speed and resource-efficiency seem to be desirable properties.

*Extremity and polarization.* Everything else equal, judgments, decisions, and behaviors based on integral affective responses tend to be more extreme and polarized than those based on more descriptive inputs—a phenomenon related to the so-called “vividness effect” in judgment (Nisbett & Ross, 1980). For example, in France, newspaper articles using the emotional label “Mad Cow disease” resulted in more dramatic decreases in beef consumption than comparable articles using the scientific label “Creutzfeldt-Jakob disease” (Sinaceur, Heath, & Cole, 2005). In general, responses to risks seem to be stronger when the risks are conveyed in an emotion-provoking manner than when they are

conveyed in a nonemotional manner (e.g., Hendrickx, Vlek, & Oppewal, 1989; Loewenstein, Weber, Hsee, & Welch, 2001). In a different setting, Ratner and Herbst (2005) observed that after investment with a broker with a strong track record produced a disappointing outcome, individuals who focused on their affective responses to the outcome tended to “overreact” and switch their investments to a broker with an inferior track record. Emotional responses to a single outcome appeared to override the presumably more reliable track-record of the brokers.

Several factors can explain why evaluative and behavioral responses based on integral affect tend to be more polarized. First, affective responses to everyday objects tend to be more extreme than reason-based assessments of the same objects, even when the information about the object is held constant (Pham et al., 2001). Second, initial affective responses to an object seem to trigger a confirmatory search for information that supports the initial feelings (Pham et al., 2001; Yeung & Wyer, 2004). This confirmatory search increases the subjective coherence of judgments based on affect (Pham, 2004), increasing polarization. In addition, as discussed further, affective responses seem to be relatively insensitive to probability and quantity, which would otherwise mitigate interpretations of these responses (Hsee & Rottenstreich, 2004; Rottenstreich & Hsee, 2001). Finally, integral affective responses have inherently strong drive properties (Frijda, 1988; Lazarus, 1991).

The greater polarization of affect-based evaluative and behavioral responses may lead to logical irrationalities. For instance, Johnson, Hershey, Meszaros, and Kunreuther (1993) observed that people were willing to pay more for a flight insurance policy covering “death due to any act of terrorism”—a concrete, emotion-producing threat—than for an insurance policy covering “death due to any reason”—a logically higher, but less concrete threat. Similarly, the “overreaction” of emotion-focused investors observed by Ratner and Herbst (2005) seems to be a case of logically irrational overweighing of single instances relative to more reliable base-rates. Nevertheless, it would seem premature to draw firm conclusions about the general rationality or irrationality of affect-based response polarizations. For example, in the Ratner and

Herbst (2005) studies, it is not clear that it was irrational for the emotional investors to place more weight on the broker's recent performance than on the broker's stated track record, especially in a domain where past records are notoriously unpredictable of the future performance. It is also not clear that the decrease in beef consumption following articles emotional titled "Mad Cow Disease" was materially, ecologically, or even logically irrational. Rather, it seems that response polarization is a natural by-product of an important function of affective and emotional responses, which is to motivate behavior and redirect action if necessary. That this function occasionally produces "overreactions" does not necessarily undermine the apparent ecological rationality of this function.

*Myopia.* Evaluations and decisions based on integral affect tend to be more myopic in that immediate affective rewards and punishments are weighted much more heavily than delayed affective consequences (Loewenstein, 1996). This property is very salient in self-control situations where people have to trade-off the immediate hedonic consequences of an option against its long-term consequences. According to Loewenstein (1996), the myopia of affect-based judgments and decisions is because of the differential accessibility of current and delayed affective responses. Whereas the experience of immediate integral affect has strong drive properties, it is much more difficult to picture a future affective experience. Consistent with this proposition, recent brain imaging studies indicate that preferences for immediate rewards are associated with greater activation in parts of the limbic system associated with affect (McClure, Laibson, Loewenstein, & Cohen, 2004). Affective rules of valuation thus seem to be geared to the present (Pham, 2004), which will lead to material irrationality in domains where present and long-term hedonic consequences are negatively correlated.

*Concreteness and scale insensitivity.* As epitomized by the notion of expected-monetary value, a logically rational measure of value would take into account the magnitude of the value-producing stimulus and the uncertainty that surrounds it. It appears, however, that when integral affective responses are used as proxies for value, these responses are not scaled properly for either magnitude or probability. Hsee and Rottenstreich (2004) observed that judg-

ments and decisions based on integral affective responses tend to be sensitive to the presence or absence of affect-producing stimuli but relatively insensitive to variations in the magnitude of these stimuli. In one study, respondents were asked how much they would be willing to donate to save either one or four pandas. When the number of pandas saved was represented in an abstract fashion, donations were much higher in the four-panda condition than in the one-panda condition, as would logically be expected. However, when the number of pandas saved was represented in an affectively rich fashion, donations were not different in the four- and one-panda conditions. These results echo other findings showing that when assessing the value of programs designed to save a large number of human lives—an emotionally charged judgment—people exhibit substantial insensitivity to the absolute number of lives saved (Fetherstonhaugh, Slovic, Johnson, & Friedrich, 1997). According to Hsee and Rottenstreich (2004), this phenomenon arises because integral affect-based evaluations are often based on mental images (see also Pham, 1998). These images tend to involve discrete prototypical representations of the target but not continuous quantitative information (see also Kahneman, Ritov, & Schkade, 1999).

Similarly, evaluations and decisions based on integral affective responses tend to be insensitive to probabilities, except for the presence or absence of uncertainty (Loewenstein, Weber, Hsee, & Welch, 2001; Monat, Averill, & Lazarus, 1972; Rottenstreich & Hsee, 2001; Sunstein, 2003). For example, Rottenstreich and Hsee (2001) observed that, consistent with economic theory, people were willing to pay much more to avoid a high probability of losing \$20 than to avoid a low probability of losing \$20. However, people were not willing to pay much more to avoid a high probability of receiving an electric shock—a prospect rich in negative affect—than to avoid a low probability of receiving the same shock (see also Sunstein, 2003). According to Loewenstein and colleagues (2001), this phenomenon again arises because affective decisions under uncertainty rely on discrete images of the options that do not incorporate probabilities. This is consistent with the finding that awareness of the timing of imminent threat produces the same level of stress and physiological arousal whether the threat has a 5%, 50%, or 100% probability of occurrence (Monat,

Averill, & Lazarus, 1972). This is also consistent with the finding that when given a chance to draw a winning red bean either from a small bowl containing a single red bean and 9 white beans or from a larger bowl containing between 5 and 9 red beans and 91 to 95 white beans, many people's "gut feeling" is to draw from the larger bowl, even though the probability of winning is greater when drawing from the smaller one (Denes-Raj & Epstein, 1994; Kirkpatrick & Epstein, 1992). This finding again suggests that affective valuations of chances are driven by concrete representations of exemplars (seeing multiple red beans) rather than more abstract notions of probability (the distribution of beans in a random draw process).

Note, however, that affect-based decisions and evaluations are very sensitive to one range of probability: deviations from absolute certainty, from impossibility to small probability and vice versa (Brandstatter, Kuhberger, & Schneider, 2002). For example, people grossly overpay to turn zero probabilities of winning in big lotteries, a prospect rich in affect, into probabilities that are infinitesimal. Similarly, most people would be willing to pay large insurance or security premiums to convert minute probabilities of catastrophic events, prospects also rich in affect, into zero probabilities. In affective valuations people thus appear to be sensitive to possibility—that is, deviations from certainty—rather than actual probability (see also Slovic et al., 2002).

Overall, the above findings suggest that valuations based on integral affect tend to be insensitive to scale, whether scale refers to the quantitative magnitude of the stimulus or to the probability that surrounds it. This scale insensitivity violates logical rationality. One interpretation is that integral affect is a mostly categorical means of assessing value. Integral affective responses arise from objects being categorized in terms of their significance for well-being (Lazarus, 1991). This categorization appears to obey a principle of concreteness. For objects to be categorized as emotionally significant—that is, for them to elicit integral affective responses—they need to be represented concretely. For example, people will be happier if they know for sure whether they have won a dinner or a CD than if they are uncertain about which of these two prizes they have won (Vandijk & Zeelenberg, 2006). In this representation, the identity of the object is more critical than its distribution. In the resultant affective accounting of value, saving people's lives or avoiding elec-

trical shocks is important, regardless of the number of lives saved or the actual probability of shock.

*Reference-dependence.* Compared to those based on more descriptive inputs, assessments of value that are based on integral affective responses tend to be more relativistic or reference-dependent. That is, affective valuations are often not based on the focal object or outcome in isolation, but in relation to other objects or outcomes. For example, emotional responses to the outcome of a gamble are driven not only by the monetary value of the actual (realized) outcome, but also by how this outcome compares relative to unrealized outcomes (Mellers, Schwartz, Ho, & Ritov, 1997). Winning \$10 in a gamble will elicit greater pleasure if the other possible outcome is losing \$5 than if it is losing only \$1. Similarly, losing \$5 in a gamble will elicit greater displeasure if the other possible outcome is winning \$10 than if it is winning only \$2. This finding is consistent with a large body of research showing that emotional responses to outcomes are very sensitive to spontaneous comparisons with outcome counterfactuals (e.g., Kahneman & Miller, 1986; Landman, 1987; Medvec, Madey, & Gilovich, 1995). More direct evidence comes from a study by Tversky and Griffin (1991) in which participants were asked to evaluate two hypothetical jobs: one company offered a higher salary, but offered other colleagues even more money; the other offered a lower salary, but offered other colleagues even less money. When asked to predict which of the two jobs they would be happier at—that is, when asked to make an affective evaluation—most participants selected the lower-paying job. When asked to make a choice between the two jobs—a presumably less affective evaluation—most participants chose the higher-paying job. Therefore, participants asked to make a "cold" decision seem to focus on the objective personal payoff, whereas those asked to make a more affective assessment seem to also take into account social comparisons with their colleagues. In a similar study, participants were asked to compare two hypothetical jobs that were identical in terms of compensation and workload: company A offered a small office and gave another comparable employee an equally small office, whereas company B offered a larger office and gave another comparable employee an even larger office (Hsee, Zhang, Yu, & Xi, 2003). When asked to make a cold choice, participants

tended to choose the job with the objectively larger office. However, when asked to assess which job would make them feel happier, participants tended to select the one with the smaller office.

The greater relativism or reference-dependence of affective assessments of value is logically irrational. Logically, utility should depend only on realized and personal outcomes, not on counterfactual comparisons with unrealized outcomes or social comparisons with others' welfare. Whether this relativism is also materially irrational depends on assumptions about people's utility function. If we assume that this function incorporates only objective arguments (e.g., the magnitude of the person's lottery gain, the absolute size of the person's office), this relativism would be materially irrational. However, if we assume that people's long-term well-being also depends on the broader context in which personal outcomes are realized and experienced, this relativism may in fact be materially rational. After all, a person working for a more modest salary in a smaller office at a company that treats its employees with equity may be happier than a comparable employee working for a larger salary in a larger office at a company that treats other comparable employees better. This relativism may be also beneficial from an ecological standpoint, as discussed further in the discussion of the role of emotion in social and economic interactions. In addition, the counterfactual outcome comparisons that underlie emotional experiences of regret, rejoicing, disappointment, or elation may help people learn from their failures and successes (Roese, 1997), whereas social comparisons with other's welfare may support norms of justice and equity that seem broadly desirable at a societal level. One possible interpretation of this relativism is that the affective system of valuation is mostly ordinal, as opposed to cardinal. That is, the affective system may be more concerned with the relative desirability ordering of alternative states of the world or alternative courses of actions than with their absolute desirability.

*Interpersonal and intrapersonal consistency.* A growing body of evidence suggests that judgments based on integral affective responses have high interpersonal consistency. Contrary to the notion that "Beauty is in the eye of the beholder," judgments of physical attractiveness, which are largely affective, exhibit a high degree of consensus both within and across cul-

tures (Langlois et al., 2000). Similarly, emotional responses to music appear largely shared (Peretz, Gagnon, & Bouchard, 1998). People also exhibit high consensus in how outraged they are by various types of wrongdoings (Kahneman, Schkade, & Sunstein, 1998) and how upset they feel about various environmental problems (Kahneman, Ritov, Jacowitz, & Grant, 1993). People seem to agree more on how they feel toward everyday stimuli such as magazine pictures and TV commercials than they do on their reason-based assessments of the same stimuli (Pham et al., 2001). Therefore, contrary to popular beliefs that feelings are highly subjective, a variety of findings suggest that judgments based on integral affect are quite consensual, sometimes even more so than judgments based on descriptive inputs.<sup>5</sup>

There is also growing evidence that judgments and decisions based on integral affect also tend to be more consistent intrapersonally. Indirect evidence comes from the finding that individuals who verbalized their reasons for liking or disliking various posters before making a choice, and presumably relied on these reasons, were subsequently less satisfied with their choice than individuals who were not asked to verbalize their reasons and presumably relied on their spontaneous affective responses to the posters (Wilson et al., 1993). More direct evidence comes from the finding that for high-involvement products (e.g., camcorders, cell phones), integral affective responses to the products are more predictive of long-term satisfaction with the products than utilitarian beliefs about the product's benefits (Darke, Chattopadhyay, & Ashworth, 2006). Other research suggests that reliance on integral affective responses increases not only intrapersonal consistency over time, but also intrapersonal consistency over choices. Lee and Ariely (2006) recently ob-

<sup>5</sup> According to Pham and colleagues (2001), affect-based judgments will tend to be very consensual whenever the underlying integral affective responses are triggered through hardwired programs involved in bioregulation or through emotional schemata acquired through socialization. Such affect-based judgments will generally be more consensual than reason-based judgments that are constructed in a piecemeal fashion. However, affect-based judgments will be less consensual when based on integral affective responses arising through controlled appraisal processes. Such judgments will generally be less consensual than reason-based judgments based on shared stereotypes and widely-accepted normative criteria.

served that conditions that are known to increase the reliance on affect in decision making (e.g., pictures, time pressure, memory load, expression of own preference) also increase the transitivity of choices between products.

In summary, compared to judgments and decisions based on descriptive inputs, judgments and decisions based on integral affective responses tend to exhibit higher consistency, both within and across people. Intrapersonal consistency is logically desirable. It is also materially desirable if it reduces the chance of postdecisional regret. In domains where a common criterion of value can be assumed, interpersonal consistency is also logically desirable because, even if interpersonal agreement does not guarantee accuracy, lack of agreement implies that at least one party is inaccurate (Kruglanski, 1989). Consensus is also desirable on ecological grounds. For example, if a society is to set standards of punishment for various types of crimes, it would be desirable to have a common metric to assess each crime's undesirability. The emotional outrage that people have been found to share could provide such a metric.

### *Integral Affective Responses as Somatic Markers*

In an influential series of studies, patients with emotional deficits related to damages in the ventromedial prefrontal cortex area (VMPC) were found to perform more poorly than normal and presumably emotionally functional participants on a task known as the Iowa Gambling Task (IGT; Bechara, Damasio, Damasio, & Anderson, 1994; Bechara, Damasio, Tranel, & Damasio, 1997; Damasio, 1994). The IGT involves repeated drawings from four decks of cards. Two decks have higher nominal card value but lower expected value because of severe occasional penalties, and two decks have lower nominal card value but higher expected value because of lesser penalties. Compared to normal participants, VMPC patients were found to draw more from the riskier and less advantageous decks, resulting in lower monetary performance (Bechara, Damasio, Damasio, & Anderson, 1994). Over time, normal participants also exhibited heightened levels of galvanic skin response whenever they were about to choose from the risky decks, and this apparently even before they could consciously recognize the structure of the decks; VMPC patients

did not exhibit such anticipatory activation (Bechara, Damasio, Tranel, & Damasio, 1997). According to the *somatic marker hypothesis* (Damasio, 1994), in normal individuals, emotional responses evoked by objects are stored with memory representations of these objects as somatic markers of these objects' value. Subsequent encounters with these objects will trigger anticipatory feelings that will steer the decision maker either toward or away from these objects depending on the valence of the stored markers. Among normal participants in the above studies, emotional responses to early penalties of the risky decks were registered and subsequently steered participants away from these decks, apparently even unconsciously. Among emotionally deficient VMPC patients, no such learning took place; as a result, they continued to draw from the more tempting but less advantageous decks. According to Damasio and his colleagues (see Bechara, 2004; Damasio, 1994), emotional deficits associated with prefrontal damages impair performance not just in the IGT but in decision making in general. For example, Bar-On, Tranel, Denburg, and Bechara (2003) found that compared to control patients with brain lesions outside those associated with emotional responding, patients with VMPC damages score lower on various measures of emotional and social intelligence and various dimensions of social functioning such as postlesion employment status, social status, and interpersonal relationships.

Although these findings have been widely interpreted as demonstrating the importance of emotions for (materially) rational decision making, more recent studies have challenged their original interpretation. Findings by Maia and McClelland (2004) suggest that in the IGT task normal participants are more conscious of decks' structure than previously thought, challenging the notion that somatic markers could guide choice unconsciously. Findings by Fellows and Farah (2005) suggest that the poor performance of VMPC patients in the original IGT studies may be because of an inability to reverse learned associations acquired in the early rounds of the game, not the inability to encode somatic markers. In tasks that do not involve outcome feedback—one-shot choices among risky lotteries, intertemporal preferences, and behavior in wealth-sharing games—VMPC patients and normal subjects exhibit comparable levels of risk-seeking and impulsivity

(Leland & Grafman, 2005). This suggests that presumably emotionally impaired VMPC patients are not inherently more risk-seeking and impulsive; rather they differ in how they respond to and learn from outcome feedback. Moreover, studies that have used psychopathy as an alternative operationalization of emotional deficit have uncovered inconsistent effects of psychopathy on performance on the IGT (e.g., Blair & Cipolotti, 2000; Losel & Schmucker, 2004; Mitchell, Colledge, Leonard, & Blair, 2002; Schmitt, Brinkley, & Newman, 1999). The lack of parallelism between results obtained with VMPC patients and with psychopaths raises the possibility that an emotional deficit may not be the only factor at work in the original Damasio findings. Finally, even if the original VMPC/IGT findings were correct, the superior economic performance of emotionally functional participants does not, by itself, establish the superiority of emotion-based decision-making. One should note that in the IGT there is a negative correlation between the riskiness of the decks and their long-term expected monetary value. Therefore, negative emotional responses to the risky decks' penalties are good predictors of the decks' actual undesirability. In other domains, however, the correlation between risks and expected returns is in fact positive. In such situations, emotional apprehension toward taking risks may be materially detrimental. Consistent with this reasoning, emotionally deficient VMPC patients (who do poorly in the original Damasio task) were found to perform better than emotionally functional control subjects in a repeated investment task where investment risk was associated with higher expected returns. Emotionally functional subjects tend to be overly apprehensive about taking risks, especially after incurring a loss (Shiv, Loewenstein, Bechara, Damasio, & Damasio, 2005).

The overall evidence about the somatic marker hypothesis seems to warrant only a weaker (and relatively mundane) version of this hypothesis. It is well established that integral affective responses to a target that are positive generally trigger approach tendencies, whereas those that are negative generally trigger avoidant tendencies,<sup>6</sup> even if descriptions of the targets and their cognitive assessments are held constant (e.g., Abelson, Kinder, Peters, & Fiske, 1982). In other words, integral affective responses often serve as distinct proxies for value. What the Damasio studies, along with other studies (Ratner & Herbst, 2005), suggest is

simply that integral-affect-motivated approach and avoidance—that is, affective behavioral regulation—is very sensitive to emotion-producing outcome feedback. Moreover, the contrast between the original Damasio findings and more recent Shiv and colleagues findings shows that it is not possible to draw firm conclusions from these studies about the general material rationality or irrationality of integral affect as a proxy for value: it depends on the correlation between the emotional responses to the target and its criterion value—correlation that is under the researcher's control.

### Integral Affective Responses in Social and Economic Interactions

Although most of the empirical evidence on emotion and rationality pertains to individuals considered in isolation, it is important to keep in mind that humans are also part of social groups such as families, organizations, communities, markets, and societies. As highlighted by the notion of ecological rationality, the desirability of emotions should also be assessed in terms of how they influence an individual's ability to function as a member of a group and how they affect the group's overall welfare (see also Clore, 2005 and Loewenstein & Small, 2007).

Emotional responses appear to play an important and mostly positive role in the regulation of social and moral behavior (Eisenberg, 2000). Emotional responses are a necessary component of empathic responses, an established determinant of prosocial behavior (Eisenberg et al., 1994; Eisenberg & Miller, 1987). More importantly, emotions are very sensitive to the fulfillment or violation of social and moral norms such as honesty, reciprocity, and loyalty. Guilt and shame, for example, typically arise from the perception of having transgressed such norms while pride often arises from the perception of having fulfilled or exceeded them. Anger and indignation often arise from observing others transgressing social and moral norms, whereas gratitude and admiration are generally reserved for those who fulfill or exceed them (Ortony, Clore, & Collins, 1988). There is growing evidence that emotional responses are not just consequences of social and

<sup>6</sup> One exception is anger, which generally triggers a drive to confront the anger-producing object.

moral appraisals but also inform these appraisals. For example, people tend to make more severe moral judgments and become less tolerant of moral violations if the level of repulsion that they experience when making moral judgments is artificially increased through an incidental affect manipulation (Schnall, Haidt, & Clore, 2006; Trafimow, Bromgard, Finlay, & Ketelaar, 2005) or through hypnotic conditioning (Wheatley & Haidt, 2005). Conversely, they become more tolerant of moral violations if they are led to misattribute part of their integral affective responses to these violations to external sources (Trafimow et al., 2005). These findings suggest that people infer the severity of moral violations in part from their spontaneous affective responses to these violations (see also Kahneman, Schkade, & Sunstein, 1998). Spontaneous emotional responses may in fact be the primary means by which many moral dilemmas are evaluated, including some that are very difficult to solve using pure logic (Haidt, 2001). Neuroimaging studies indicate that parts of the brain typically associated with emotions are uniquely engaged by certain moral dilemmas and that it is this emotional engagement that drives the resolution of the dilemma (Greene & Haidt, 2002; Greene, Sommerville, Nystrom, Darley, & Cohen, 2001; Moll et al., 2002, 2005).

The importance of emotions in social and moral regulation is also evident from studies of psychopathic populations. Clinical psychopaths typically exhibit antisocial personality disorders such as consistent disregard for social norms, pervasive violations of the rights of others, and a tendency for aggression and violence (Hare, 1985). Numerous studies suggest that psychopaths tend to have lower baseline levels of emotional activity and weaker physiological responses to emotional stimulation, especially with respect to negative stimuli (Blair & Cipolotti, 2000; Lorber, 2004; Patrick, 1994; Pham, Philippot, & Rime, 2000). This lower general emotionality may explain psychopaths' characteristic lack of guilt, remorse, and empathy (Blair, 1995), and therefore their common pattern of antisocial and immoral behavior (Blair, 1997; Blair & Cipolotti, 2000). Therefore, while emotional responses such as guilt, shame, indignation, or empathy entail psychic costs that may seem materially irrational, these responses appear to fulfill an important ecological function: that of promoting socially and morally desirable behavior, both by the person experiencing the emotion and by others eliciting the emotion.

The ecological rationality of these responses transpires as well in experimental studies of economic interactions in which participants play "games" where they interact with one another along a specific set of rules to maximize some economic payoff (see Goette & Huffman, 2007, for a review). For example, in the ultimatum game, two players have to split a given amount of money (e.g., \$20). One player, the proposer, makes an offer (e.g., \$5 for you/\$15 for me), which the other player, the receiver, either accepts or rejects. If the offer is accepted, the money is split accordingly; if it is rejected, neither player receives anything. According to economic theory, a materially rational receiver would accept any offer greater than zero because this offer would always be more attractive than rejecting and receiving nothing. Anticipating this, a materially (and logically) rational proposer would make the smallest offer possible (e.g., \$0.05 for you/\$19.95 for me), knowing that it would be accepted. The logically and materially rational "equilibrium" of this game is thus a split in which the proposer keeps most of the money and the receiver receives a positive residual. Numerous studies have shown that this prediction is rarely fulfilled (Camerer, 2003; Roth, 1995). Offers of less than 20% of the total amount typically have a 50% chance of being rejected by the receiver. Many receivers would therefore sacrifice their material self-interest rather than accept an offer they perceive unfair. These materially irrational rejections appear to be driven primarily by emotional responses of anger following unfair offers (Pillutla & Murnighan, 1996; Sanfey, Rilling, Aronson, Nystrom, & Cohen, 2003). Interestingly, however, many proposers seem to anticipate these emotional responses and make offers that are more equitable and therefore more likely to be accepted. The modal empirical offer in ultimatum games is 40–50%, which is generally accepted (Camerer, 2003). Therefore, a materially irrational emotional response—anger at an unfair, tough positive offer—and its anticipation lead to an ecologically desirable solution, one that leaves both players better off than the dead-end usually produced with materially rational strategies. This equilibrium is similar to the type of social and moral equilibrium discussed above. Transgressions of social norms (here, fairness) usually elicit angry responses among others and activate unpleasant moral emotions such as guilt or shame within the self. Anticipation of these emotions acts a strong deterrent against norm vi-

olations, leading to more socially sustainable equilibriums.

Similar findings emerge with other games. For example, in public-good games, players have to decide how much to contribute to a collective good. The more people contribute, the better off the entire community is. However, noncontributing members cannot be easily excluded from the benefits of the public good. In these games, the materially rational course of action is to “free-ride”: not contribute anything and enjoy the common good supported by others. Of course, if every player behaves this way, the system collapses and the entire community suffers. Research suggests that a potent mechanism for ensuring cooperation in public good games is to allow players to punish free-riders (Fehr & Fischbacher, 2002). Public-good experiments show that a majority of players are willing to incur personal financial costs to punish free-riders even in settings where players meet only once and where, therefore, there is no material incentive to punish—a phenomenon called altruistic punishment (Fehr & Gächter, 2002). Again, it appears that the main driver of these altruistic—and materially irrational—punishments is the anger that punishers feel toward the free-riders (de Quervain et al., 2004; Fehr & Gächter, 2002). Interestingly, when such punishment opportunities are present, cooperation increases over time, whereas when they are absent, cooperation decreases over time. Therefore, as with the ultimatum games, in public-good games, emotional responses to norm-violating behavior again produce norm-enforcement behaviors that may appear materially irrational in the short term but lead to more ecologically rational outcomes in the long run.

Emotional responses and their anticipation appear to have similar effects in various other games such as the dictator game (a variant of the ultimatum game), the classic prisoner’s dilemma game, and various “trust” games that involve costly investments in a partnership that may or may not be honored by the other party (Camerer, 2003; Dawes, McTavish, & Shaklee, 1977; Fehr & Fischbacher, 2002; Lehmann, 2001). In many economic interactions, emotional responses to the violation or fulfillment of norms such as fairness, equity, and trust, and anticipations of these responses by the various players seem to promote ecologically desirable cooperation and norm-consistent behavior. Some theorists suggest that it is precisely because they make players override

their material self-interest that emotional responses and their anticipations produce these socially desirable outcomes (Frank, 1988; Howard, 1993).

### The Affective System of Behavioral Regulation and Judgment: Empirical Generalizations and Theoretical Conjectures

This review suggests several empirical generalizations and associated theoretical conjectures about the affective system of behavioral regulation and judgment.

Negative emotional states of high intensity generally interfere with people’s reasoning abilities. This is true of both high activation states such as anxiety and low activation states such as intense depression. The only reliable reasoning benefit of intense emotional states seems to be a greater selective reliance on diagnostic information under states of high activation. These findings seem to reflect an affective system of behavioral regulation, which under high activation mobilizes responses based on quick assessments of diagnostic features of the situation rather than more careful considerations of potential consequences of alternative courses of action. This conjecture is consistent with other findings showing that judgments and decisions based on integral affective responses are less resource-demanding and reached faster than those based on reason-based assessments. In contrast, the effects of intensely pleasant emotional states (e.g., intense joy or pride) are less well understood. If the proposed resource-mobilization conjecture is correct, intense positive emotional states might have less influence on reasoning processes because situations conducive of such states typically require less behavioral adjustment.

Milder incidental states of sadness generally promote a more systematic, data-driven, and analytical form of reasoning, whereas positive mood states generally promote a less systematic, more top-down, but more flexible and creative form of reasoning. Whereas the effects of intense emotional states on reasoning may reflect the requirements of fast response mobilization, the effects of milder sadness and positive moods seem to arise from a signaling function of these milder states (Schwarz, 2002). From an evolutionary standpoint, positive mood

states may have served as a signal to engage in more contemplative thoughts and explorative behaviors. This conjecture is consistent with the finding that positive mood encourages variety-seeking (Kahn & Isen, 1993) and the positive-psychology hypothesis that a primary function of positive affect is to broaden the thought-action repertoire in order to build future resources (Fredrickson, 1998). In contrast, because sadness typically highlights a discrepancy between a desired state and a current state (Higgins, 1987), states of sadness may signal a need to reassess the situation and analyze environmental inputs more carefully, which may explain occasional findings of depressive realism among individuals whose depression is not too severe on tasks that are interpretable in terms of situational reassessment. Tasks that cannot be interpreted in those terms may not be amenable to depressive realism.

Incidental emotional states are often misattributed to attentional objects and tend to distort beliefs about these objects in an assimilative fashion, especially if the emotional states are perceived to be representative of the objects. Although logically irrational, this phenomenon may be rooted in an ecologically rational property of emotions. If an original function of emotion was to promote fast responses to the environment, it would be ecologically efficient to assume by default that one's emotional experiences are genuine responses to the focal objects, especially if these feeling experiences appear representative of these objects. The assimilation of beliefs toward the content of emotions may have had the purpose of promoting faster behavioral responses by promoting intrapsychic consistency (Pham, 2004). This is consistent with findings showing that integral affective responses to target objects also steer thoughts in the direction of initial affective responses.

Negative emotional states that are intense generally disrupt self-control, but do not necessarily increase risk seeking. This phenomenon again seems to reflect a response mobilization function of intense negative emotional states. Like drive states such as hunger, tiredness, and sexual arousal, intense negative emotional states seem to direct behavior toward goal objects that appear capable of alleviating these states. However, the goal objects being pursued under intense negative emotional states appear to be less specific than those pursued under

typical drive states. Although a person would likely forego food or sex to alleviate an intense sleep deprivation, an emotionally upset person would likely consider a wider range of options in order to feel better. This suggests that the affective system of behavioral regulation operates at a more abstract level than the various physiological drive systems.

Although the evidence does not support a radical form of the somatic marker hypothesis, there is considerable support across disciplines for a more benign version of this hypothesis, which is that (a) integral emotional responses to objects are often interpreted as signals of these objects' value and (b) these integral responses are very sensitive to recent experiences with the target object. Besides being typically faster and resource-efficient, affective assessments of value differ from typical reason-based assessments in important respects. Affective assessments of value tend to be more extreme and polarized and more sensitive to recent concrete outcomes. This phenomenon may again reflect the response-mobilization function of emotions, which are meant to motivate and redirect behavior if necessary. Although occasionally logically irrational, the greater polarization of affect-based valuations may thus have been evolutionary adaptive.

Valuations based on integral affect tend to be myopic, emphasizing immediate hedonic consequences (positive or negative) over future consequences. The affective system of valuation and behavioral regulation seems to be a system of the present. This anchoring in the present may have been ecologically rational in a world where the current value of objects was generally positively correlated with their long-term value. However, in today's world, this anchoring in the present would produce materially irrational valuations in domains where the correlation between short-term hedonic value and long-term criterion value is negative. One of these domains is the investment domain, where the fear of losses may inhibit investments in risky prospects such as stocks, even though stocks generally have higher expected returns—a phenomenon known as myopic loss aversion (Benartzi & Thaler, 1995). Still, one should be careful not to overgeneralize this case of material irrationality, for it is restricted to those domains where the correlation between short-term hedonic value and long-term crite-

tion value is negative. One should bear in mind that in many domains the correlation is likely positive.

The above caveat applies more broadly to alleged demonstrations of the material rationality or irrationality of integral affective responses as proxies for value. For example, some studies suggest that VMPC-related emotional deficits decrease performance (and economic welfare) in the Iowa Gambling Task, and other findings suggest that the same deficits enhance performance in other investment tasks. In any particular study, appearances of rationality or irrationality will be driven by the correlation between the emotional responses to the target (conveyed for instance through outcome feedback) and its criterion value. One should not forget that this correlation is a parameter under the researcher's control. A more pertinent question, therefore, is whether integral affective responses are good predictors of value in a broader ecological sense. As discussed by Pham (2004) using Brunswick's (1952) terminology, this would depend on the relative magnitude of two correlation coefficients in the representative universe of objects to be evaluated: (a) the correlation between the integral feelings elicited by this universe of objects and these objects' true criterion value (the ecological validity of the feelings) and (b) the correlation between other available proxies of value and the objects' criterion value (the ecological validity of alternative bases of evaluation). The ecological merits of integral feelings as proxies of value would additionally depend on the relative reliabilities of integral feelings and alternative inputs because, everything else equal, more reliable predictors make better proxies. Unfortunately, empirical estimates of these correlations and reliabilities across broadly representative sets of targets have yet to be documented.

Valuations based on integral affect also tend to be insensitive to scale, whether scale refers to the quantitative magnitude of the stimulus or the probability that surrounds it. Although it seems to violate logical rationality, this scale insensitivity may indicate that the affective system assigns value primarily through processes of categorization: target objects or events are mapped onto existing categories or schemas and, depending on which category or schema is activated, a particular value-laden emotional response is triggered. In the affective system, the

value of objects is thus determined by their identity, not by their distribution. This conjecture would explain why affective valuations are particularly sensitive to concrete representations of exemplars.

Affective valuations also tend to be more consistent, both interpersonally and intrapersonally. This consistency may reflect a general reliability and stability of integral feeling responses as a basis for judgment. If the affective system assigns value primarily through object categorization, evolutionary pressures would have demanded that these categorizations be consistent both within and across individuals. For example, an ecological benefit of consistent affective valuation across individuals would be improved social coordination. A society would not be stable if object-emotion mappings (e.g., what is considered shameful) varied widely among its members. However, the ecologically rational consistency of affective valuations comes at a cost. As is evident in pathological phobias, affect-producing categorizations are difficult to unlearn, which will produce instances of logical or material irrationality.

Valuations based on integral affect are also more relativistic and reference-dependent. They are very sensitive, for instance, to spontaneous comparisons with outcome counterfactuals and to social comparisons. One conjecture is that the affective system of valuation is mostly ordinal as opposed to cardinal (i.e., interval scaled). This would be sensible from an evolutionary standpoint, if affective valuations were primarily meant to support behavioral choices (do A, B, or C), which require only ordinal judgments. The affective system may be more concerned with the relative desirability ordering of alternative states of the world or alternative courses of actions than with their absolute desirability. An ordinal affective system of valuation may also explain why people do not place much weight on the duration of hedonic experiences in retrospective valuations these experiences (Fredrickson & Kahneman, 1993).

Finally, a major function of emotion appears to be the promotion of socially and morally desirable behavior and the deterrence of undesirable behavior. Emotions are a necessary component of empathic responses, which are important drivers of prosocial behavior. Emotions are also very sensitive to the fulfillment or violation of social and moral norms, and therefore an

essential component of social and moral self-regulation. Finally, in social and economic interactions, emotions promote the fulfillment and enforcement of social and moral obligations by overriding the players' material self-interests. In this sense, the emotional person is not irrational, but ecologically rational. Therefore, although the physiological drive systems (fatigue, pain, hunger, sexual arousal, etc.) may be inherently selfish (Loewenstein, 1996), the affective system (love, pride, anger, guilt, shame, etc.) may be distinctively social and moral.

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