Emotion and Decision Making

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Abstract

A revolution in the science of emotion has emerged in recent decades, with the potential to create a paradigm shift in decision theories. The research reveals that emotions constitute potent, pervasive, predictable, sometimes harmful and sometimes beneficial drivers of decision making. Across different domains, important regularities appear in the mechanisms through which emotions influence judgments and choices. We organize and analyze what has been learned from the past 35 years of work on emotion and decision making. In so doing, we propose the emotion-imbued choice model, which accounts for inputs from traditional rational choice theory and from newer emotion research, synthesizing scientific models.

Contents

Bounded rationality: the idea that decision making deviates from rationality due to such inherently human factors as limitations in cognitive capacity and willpower, and situational constraints

Normative: how and/or what people should ideally judge or decide

Emotion: multifaceted, biologically mediated, concomitant reactions (experiential, cognitive, behavioral, expressive) regarding survival-relevant events

JDM: judgment and decision making

INTRODUCTION

Hence, in order to have anything like a complete theory of human rationality, we have to understand what role emotion plays in it.

Herbert Simon (1983, p. 29)

Nobel laureate Herbert Simon (1967, 1983) launched a revolution in decision theory when he introduced bounded rationality, a concept that would require refining existing normative models of rational choice to include cognitive and situational constraints. But as the quote above reveals, Simon knew his theory would be incomplete until the role of emotion was specified, thus presaging the critical attention contemporary science has begun to give emotion in decision research. Across disciplines ranging from philosophy (Solomon 1993) to neuroscience (e.g., Phelps et al. 2014), an increasingly vibrant quest to identify the effects of emotion on judgment and decision making (JDM) is under way.

Such vibrancy was not always apparent. In economics, the historically dominant discipline for research on decision theory, the role of emotion, or affect more generally, in decision making rarely appeared for most of the twentieth century, despite featuring prominently in influential eighteenth- and nineteenth-century economic treatises (for review, see Loewenstein & Lerner 2003). The case was similar in psychology for most of the twentieth century. Even psychologists' critiques of expected utility theory focused primarily on understanding cognitive processes (see Kahneman & Tversky 1979). Moreover, research examining emotion in all fields of psychology remained scant (for review, see Keltner & Lerner 2010). The online **Supplemental Text** for this article examines the curious history of scientific attention to emotion (follow the **Supplemental**

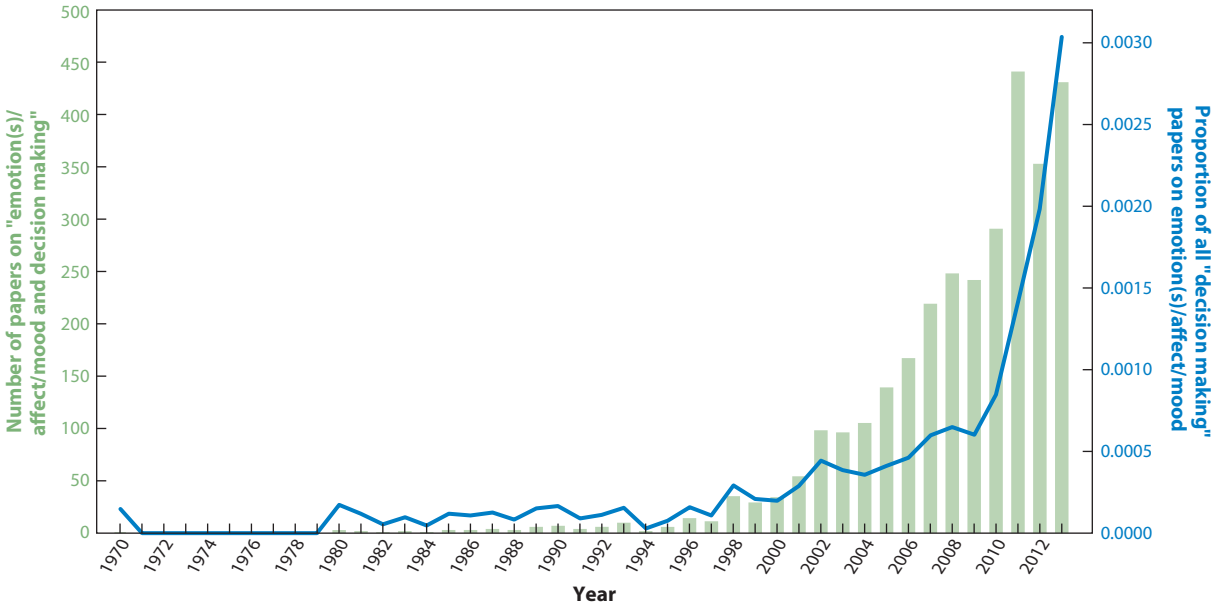

Figure 1

Number of scholarly publications from 1970 to 2013 that refer to "emotion(s)/affect/mood and decision making" (*green bars*) and proportion of all scholarly publications referring to "decision making" that this number represents (*blue line*).

Material link from the Annual Reviews home page at **http://www.annualreviews.org**). The supplement also includes primers on the respective fields of (*a*) emotion and (*b*) JDM.

But a veritable revolution in the science of emotion has begun. As shown in **Figure 1**, yearly scholarly papers on emotion and decision making doubled from 2004 to 2007 and again from 2007 to 2011, and increased by an order of magnitude as a proportion of all scholarly publications on "decision making" (already a quickly growing field) from 2001 to 2013. Indeed, many psychological scientists now assume that emotions are, for better or worse, the dominant driver of most meaningful decisions in life (e.g., Ekman 2007, Frijda 1988, Gilbert 2006, Keltner et al. 2014, Keltner & Lerner 2010, Lazarus 1991, Loewenstein et al. 2001, Scherer & Ekman 1984). Decisions can be viewed as a conduit through which emotions guide everyday attempts at avoiding negative feelings (e.g., guilt and regret) and increasing positive feelings (e.g., pride and happiness), even when they do so without awareness (for reviews, see Keltner & Lerner 2010, Loewenstein & Lerner 2003). Similarly, decisions can serve as the conduit for increasing a negative emotion or decreasing a positive emotion, tendencies associated with mental illness. Regardless of whether the decisions are adaptive or not, once the outcomes of our decisions materialize, we typically feel new emotions (e.g., elation, surprise, and regret; Coughlan & Connolly 2001, Mellers 2000, Zeelenberg et al. 1998). Put succinctly, emotion and decision making go hand in hand.

Affect: unspecified feelings; the superordinate umbrella of constructs involving emotion, mood, and emotion-related traits

Objectives and Approach

We examine theories and evidence from the nascent field of emotion and decision making, ranging from approximately 1970 until the present. Our objective is to provide organizational structure to and critical analysis of the field. We place emphasis on studies in the behavioral sciences, especially psychology (including all its subdisciplines), noting that a complementary review of

studies emphasizing neuroscience appears in the *Annual Review of Neuroscience* (see Phelps et al. 2014).

Owing to strict space and citation-count limits as well as to the unusually long (three-decade) span of material to be covered, research included here is exceedingly selective. When multiple studies represented reliable scientific discoveries, for example, we necessarily restricted ourselves to one prototypic study. We have also given preference to studies that contribute to theoretical development over studies that, as yet, stand alone as interesting phenomena.

EMOTIONAL IMPACT ON JUDGMENT AND DECISION MAKING: EIGHT MAJOR THEMES

In our survey of research on emotion and decision making, eight major themes of scientific inquiry emerged. Consistent with the fact that the field is in its infancy, these themes typically (*a*) vary in the amount of research conducted, (*b*) contain few competing theories, (*c*) include few definitive conclusions, (*d*) display relative homogeneity in methodology, and (*e*) examine fundamental questions about the nature of emotion and decision making rather than refinements about known phenomena. Nonetheless, the themes reveal rapid progress in mapping the psychology of emotion and decision making. Collectively, they elucidate one overarching conclusion: Emotions powerfully, predictably, and pervasively influence decision making.

Theme 1. Integral Emotions Influence Decision Making

Integral emotion: feelings arising from a decision at hand, e.g., fear of losing money when deciding between investments; a normatively defensible input to JDM

It is useful, when surveying the field, to identify distinct types of emotion. We start with emotions arising from the judgment or choice at hand (i.e., integral emotion), a type of emotion that strongly and routinely shapes decision making (Damasio 1994, Greene & Haidt 2002). For example, a person who feels anxious about the potential outcome of a risky choice may choose a safer option rather than a potentially more lucrative option. A person who feels grateful to a school s/he attended may decide to donate a large sum of money to that school even though it limits the decision maker's own spending. Such effects of integral emotions operate at conscious and nonconscious levels.

Integral emotion as beneficial guide. Although a negative view of emotion's role in reason has dominated much of Western thought (for discussion, see Keltner & Lerner 2010), a few philosophers pioneered the idea that integral emotion could be a beneficial guide. David Hume (1978 [1738], p. 415), for example, argued that the dominant predisposition toward viewing emotion as secondary to reason is entirely backward: "Reason is, and ought only to be, the slave of the passions, and can never pretend to any other office than to serve and obey them." Following this view, anger, for example, provides the motivation to respond to injustice (Solomon 1993), and anticipation of regret provides a reason to avoid excessive risk-taking (Loomes & Sugden 1982).

Compelling scientific evidence for this view comes from emotionally impaired patients who have sustained injuries to the ventromedial prefrontal cortex (vmPFC), a key area of the brain for integrating emotion and cognition. Studies find that such neurological impairments reduce both (*a*) patients' ability to feel emotion and (*b*) the optimality of their decisions, reductions that cannot be explained by simple cognitive changes (Bechara et al. 1999, Damasio 1994). Participants with vmPFC injuries repeatedly select a riskier financial option over a safer one, even to the point of bankruptcy in a game with real money, despite their cognitive understanding of the suboptimality of their choices. Physiological measures of galvanic skin response suggest that these participants behave this way because they do not experience the emotional signals—somatic markers—that lead normal decision makers to have a reasonable fear of high risks.

Integral emotion as bias. Despite arising from the judgment or decision at hand, integral emotions can also bias decision making. For example, one may feel afraid to fly and decide to drive instead, even though base rates for death by driving are much higher than are base rates for death by flying the equivalent mileage (Gigerenzer 2004). Integral emotions can be remarkably influential even in the presence of cognitive information that would suggest alternative courses of action (for review, see Loewenstein 1996). Once integral emotions attach themselves to decision targets, they become difficult to detach (Rozin et al. 1986). Prior reviews have described myriad ways in which integral emotion inputs to decision making, especially perceptually vivid ones, can override otherwise rational courses of action (Loewenstein et al. 2001).

Bias: systematic deviation from normative JDM

Valence: the positive versus negative value of affect

Mood: diffuse feeling that persists in duration without a necessary specific triggering target; can be integral or incidental to the decision at hand

Incidental affect (encompassing emotion and/or mood): feelings at the time of decision not normatively relevant for deciding, e.g., fear about giving a speech when deciding between investments

Theme 2. Incidental Emotions Influence Decision Making

Researchers have found that incidental emotions pervasively carry over from one situation to the next, affecting decisions that should, from a normative perspective, be unrelated to that emotion (for selective reviews, Han et al. 2007, Keltner & Lerner 2010, Lerner & Keltner 2000, Lerner & Tiedens 2006, Loewenstein & Lerner 2003, Pham 2007, Vohs et al. 2007, Yates 2007), a process known as the carryover of incidental emotion (Bodenhausen 1993, Loewenstein & Lerner 2003). For example, incidental anger triggered in one situation automatically elicits a motive to blame individuals in other situations even though the targets of such anger have nothing to do with the source of the anger (Quigley & Tedeschi 1996). Moreover, carryover of incidental emotions typically occurs without awareness.

Incidental emotion as bias. Psychological models have begun to elucidate the mechanisms through which the carryover effect occurs as well as the moderators that amplify or attenuate the effect. Early studies of carryover either implicitly or explicitly took a valence-based approach, dividing emotions into positive and negative categories and positing that emotions of the same valence would have similar effects. For example, such models hypothesized that people in good moods would make optimistic judgments, and people in bad moods would make pessimistic judgments (for reviews, see Han et al. 2007, Keltner & Lerner 2010, Loewenstein & Lerner 2003).

Using a valence-grounded approach, Johnson & Tversky (1983) conducted the first empirical demonstration of incidental mood effects on risk perception. This foundational study developed a compelling methodological procedure for assessing the effects of incidental emotion, features of which would be replicated numerous times. Participants read newspaper stories designed to induce positive or negative mood, and then estimated fatality frequencies for various potential causes of death (e.g., heart disease). As compared with participants who read positive stories, participants who read negative stories offered pessimistic estimates of fatalities. The influence of mood on judgment did not depend on the similarity between the content of stories and the content of subsequent judgments. Rather, the mood itself generally affected all judgments.

In an equally foundational set of studies that same year, Schwarz & Clore (1983) found that ambient weather influenced people's self-reported life satisfaction, setting the stage for research across disciplines that would study relationships between macro-level phenomena (e.g., weather, sports outcomes) and individual-level behavior. For example, based on Schwarz & Clore's (1983) finding that people have a greater sense of happiness and satisfaction on sunny days, economists have found a positive correlation between the amount of sunshine on a given day and stock market performance across 26 countries (Hirshleifer & Shumway 2003, Kamstra et al. 2003). In a related example, stock market returns declined when a country's soccer team was eliminated from the World Cup (Edmans et al. 2007). Increasingly, such studies make a promising connection between microlevel and macrolevel phenomena that should be further refined as promising new

methods emerge for measuring public mood and emotion (e.g., Bollen et al. 2011) as well as for measuring individual subjective experiences across time and situations (for promising methods, see Barrett & Barrett 2001, Stayman & Aaker 1993).

Moderating factors. The field is starting to identify moderating factors for carryover of incidental emotion. One auspicious line of work is Forgas's (1995) affect infusion model, which elaborates on the circumstances under which affect—integral and/or incidental—influences social judgment. The model predicts that the degree of affect infusion into judgments varies along a processing continuum, such that affect is most likely to influence judgment in complex and unanticipated situations. Another promising line of research on moderating factors revolves around the hypothesis (e.g., Yip & Côté 2013) that individuals with high emotional intelligence can correctly identify which events caused their emotions and, therefore, can screen out the potential impact of incidental emotion. In one study, individuals high in emotion-understanding ability showed less impact of incidental anxiety on risk estimates when informed about the incidental source of their anxiety. Although solid evidence supports both of these emerging approaches to mapping moderators, the field needs more attention to moderators in order to understand how emotion and decision making processes occur in the varied private and high-stakes public settings in which decisions are made. In future reviews, we hope to see studies of emotion and decision making in such contexts as federal governing bodies, diplomatic negotiations, operating rooms, intelligence agencies, and major financial institutions.

Theme 3. Emotional Valence Is Only One of Several Dimensions That Shape Emotions' Influence on Decision Making

Most literature on emotion and JDM has implicitly or explicitly taken a valence-based approach (e.g., Finucane et al. 2000, Schwarz & Clore 1983), revealing powerful and provocative effects for that dimension of emotion. But valence cannot account for all influences of affect on judgment and choice. Though parsimonious, hypotheses relying only on the valence dimension explain less variance across JDM outcomes than would be ideal because they do not take into account evidence that emotions of the same valence differ in essential ways. For example, emotions of the same valence, such as anger and sadness, are associated with different antecedent appraisals (Smith & Ellsworth 1985); depths of processing (Bodenhausen et al. 1994b); brain hemispheric activation (Harmon-Jones & Sigelman 2001); facial expressions (Ekman 2007); autonomic responses (Levenson et al. 1990); and central nervous system activity (Phelps et al. 2014). At least as far back as 1998, an *Annual Review of Psychology* article on JDM noted the insufficiency of valence and arousal in predicting JDM outcomes: "Even a two-dimensional model seems inadequate for describing emotional experiences. Anger, sadness, and disgust are all forms of negative affect, and arousal does not capture all of the differences among them . . . . A more detailed approach is required to understand relationships between emotions and decisions" (Mellers et al. 1998, p. 454).

Appraisal-tendency framework (ATF): a multidimensional theoretical framework for linking specific emotions to specific JDM outcomes; proposed by Lerner & Keltner (2000, 2001)

To increase the predictive power and precision of JDM models of emotion, Lerner & Keltner (2000, 2001) proposed examining multidimensional discrete emotions with their appraisal-tendency framework (ATF). The ATF systematically links the appraisal processes associated with specific emotions to different judgment and choice outcomes. Unlike valence-based models, the ATF predicts that emotions of the same valence (such as fear and anger) can exert opposing influences on choices and judgments, whereas emotions of the opposite valence (such as anger and happiness) can exert similar influences.

The ATF rests on three broad assumptions: (*a*) that a discrete set of cognitive dimensions differentiates emotional experience (e.g., Ellsworth & Smith 1988, Lazarus 1991, Ortony et al.

1988, Scherer 1999, Smith & Ellsworth 1985); (*b*) that emotions serve a coordination role, automatically triggering a set of concomitant responses (physiological, behavioral, experiential, and communication) that enable the individual to address problems or opportunities quickly (e.g., Frijda 1988, Levenson 1994, Oatley & Jenkins 1992); and (*c*) that emotions have motivational properties that depend on both an emotion's intensity and its qualitative character. That is, specific emotions carry specific "action tendencies" (e.g., Frijda 1986), or implicit goals, that signal the most adaptive response. In this view, emotions save cognitive processing by triggering what Levenson and colleagues call time-tested responses to universal experiences (such as loss, injustice, and threat) (Levenson 1994, Tooby & Cosmides 1990). For example, anger triggers aggression, and fear triggers flight. Relatedly, Lazarus (1991) has argued that each emotion is associated with a "core-relational" or appraisal theme—the central relational harm or benefit that underlies each specific emotion.

Appraisal theme: each emotion's macrolevel summary of specific harms/benefits that may arise in the environment, which influence a specific course of action

The ATF points to a clear empirical strategy: Research should compare emotions whose appraisal themes are highly differentiated on judgments and choices that relate to that appraisal theme (Lerner & Keltner 2000). Han and colleagues (2007) refer to this strategy as the "matching principle," which we discuss further in the next section. By illuminating the cognitive and motivational processes associated with different emotions, the model provides a flexible yet specific framework for developing a host of testable hypotheses concerning affect and JDM.

The appraisal-tendency hypothesis. According to the ATF, appraisal tendencies are goal-directed processes through which emotions exert effects on judgments and decisions until the emotion-eliciting problem is resolved (Lerner & Keltner 2000, 2001). The ATF predicts that an emotion, once activated, can trigger a cognitive predisposition to assess future events in line with the central appraisal dimensions that triggered the emotion (for examples, see **Table 1**). Such appraisals become an implicit perceptual lens for interpreting subsequent situations. Just as emotions include action tendencies that predispose individuals to act in specific ways to meet environmental problems and opportunities (e.g., Frijda 1986), the ATF posits that emotions predispose individuals to appraise the environment in specific ways toward similar functional ends.

An early study that contributed to the development of the ATF examined the effects of anger and sadness on causal attributions (Keltner et al. 1993). Although both anger and sadness have a negative valence, appraisals of individual control characterize anger, whereas appraisals of situational control characterize sadness. The authors predicted that these differences would drive attributions of responsibility for subsequent events. Consistent with this hypothesis, incidental anger increased attributions of individual responsibility for life outcomes, whereas incidental sadness increased the tendency to perceive fate or situational circumstances as responsible for life outcomes.

In an early test of ATF-based predictions, Lerner & Keltner (2000) compared risk perceptions of fearful and angry people. Consistent with the ATF, dispositionally fearful people made pessimistic judgments of future events, whereas dispositionally angry people were optimistic about future events. Subsequent studies experimentally induced participants to feel incidental anger or fear and found similar patterns (Lerner & Keltner 2001). Participants' appraisals of certainty and control mediated the causal effects of fear and anger on optimism.

Findings consistent with the ATF in many other contexts have further supported this approach (for discussion, see Bagneux et al. 2012, Cavanaugh et al. 2007, Han et al. 2007, Horberg et al. 2011, Lerner & Tiedens 2006, Yates 2007). For example, one study challenged the valence-based idea that people in positive moods make positive judgments and vice versa for negative moods, finding differential effects of sadness and anger on judgments of likelihood, despite both

Table 1 Two illustrations of the appraisal-tendency framework, originally developed by Lerner & Keltner (2000, 2001) and updated here.[a] Table adapted from Lerner JS, Keltner D. 2000. Beyond valence: toward a model of emotion-specific influences on judgment and choice. *Cogn. Emot.* 14(4):479, table 1, with permission from the publisher

Cognitive appraisal dimensions	Illustrations: negative emotions		Illustrations: positive emotions	
	Anger	Fear	Pride	Surprise
Certainty	High	Low	High	Low
Pleasantness	Low	Low	High	High
Attentional activity	Medium	Medium	High	Medium
Anticipated effort	High	High	Low	Low
Individual control	High	Low	High	Medium
Others' responsibility	High	Medium	Low	High
Appraisal tendency	Perceive negative events as predictable, under human control, and brought about by others	Perceive negative events as unpredictable and under situational control	Perceive positive events as brought about by self	Perceive positive events as unpredictable and brought about by others
Influence on relevant outcome	Influence on risk perception		Influence on attribution	
	Perceive low risk	Perceive high risk	Perceive self as responsible	Perceive others as responsible

[a]Certainty is the degree to which future events seem predictable and comprehensible (high) versus unpredictable and incomprehensible (low). Pleasantness is the degree to which one feels pleasure (high) versus displeasure (low). Attentional activity is the degree to which something draws one's attention (high) versus repels one's attention (low). Control is the degree to which events seem to be brought about by individual agency (high) versus situational agency (low). Anticipated effort is the degree to which physical or mental exertion seems to be needed (high) versus not needed (low). Others' responsibility is the degree to which someone or something other than oneself (high) versus oneself (low) seems to be responsible. We refer interested readers to Smith & Ellsworth (1985) for comprehensive descriptions of each dimension and each emotion's scale values along the dimensions.

emotions having a negative valence (DeSteno et al. 2000). DeSteno and colleagues have also shown several ways that positive emotions predict behavior beyond the contributions of the valence (Bartlett & DeSteno 2006, Williams & DeSteno 2008). For example, several studies show that specific positive emotions, such as gratitude and pride, have unique effects on helping behavior and task perseverance. Other studies have delineated the unique profiles of various positive states in accordance with differences in their appraisal themes (Campos & Keltner 2014, Valdesolo & Graham 2014).

Cognitive appraisal: cognitive meaning making that leads to emotions, usually along dimensions of certainty, pleasantness, attentional activity, control, anticipated effort, and self-other responsibility

Theme 4. Emotions Shape Decisions via the Content of Thought

Based on evidence that discrete emotions are associated with different patterns of cognitive appraisal (for review, see Keltner & Lerner 2010) and that such appraisal dimensions involve themes that have been central to JDM research, a natural opportunity for linking discrete emotions to JDM outcomes arises. Consider two illustrations of how emotions shape the content of thought via appraisal tendencies, drawn from Lerner & Keltner (2000). **Table 1** compares two pairs of emotions from the same valence that are highly differentiated in their central appraisal themes on a judgment related to those appraisal themes. Each of these four emotions can be characterized in terms of the six emotion appraisal dimensions originally identified by Smith & Ellsworth (1985): certainty, pleasantness, attentional activity, anticipated effort, control, and others' responsibility. The ATF predicts that dimensions on which an emotion scores particularly low or high are likely

to activate an appraisal tendency that influences JDM, even for incidental emotions. The penultimate row in the table lists appraisal tendencies for each emotion that follow from the dimensions on which the emotion is low or high.

Appraisal tendency: from the ATF, a hypothesized mechanism through which emotions activate a cognitive and motivational predisposition to appraise future events according to appraisal dimensions that triggered the emotion (emotion-to-cognition)

For example, anger scores high on the dimensions of certainty, control, and others' responsibility and low on pleasantness. These characteristics suggest that angry people will view negative events as predictably caused by, and under the control of, other individuals. In contrast, fear involves low certainty and a low sense of control, which are likely to produce a perception of negative events as unpredictable and situationally determined. These differences in appraisal tendencies are particularly relevant to risk perception; fearful people tend to see greater risk, and angry people tend to see less risk. As described above, correlational and experimental research support this idea (Lerner & Keltner 2000, 2001). The last row of **Table 1** illustrates the ATF matching principle, introduced in the prior section. Specifically, a match between the appraisal themes of a specific emotion and the particular domain of a judgment or decision predicts the likelihood that a given emotion will influence a given judgment or decision.

Differences in appraisal dimensions of pride and surprise, meanwhile, suggest different effects on attributions of responsibility. Specifically, pride scores lower than surprise on the dimension of others' responsibility, whereas surprise scores low on certainty. These differences suggest that pride will produce an appraisal tendency to attribute favorable events to one's own efforts, whereas surprise will produce an appraisal tendency to see favorable events as unpredictable and outside one's own control. These differences are likely to be relevant to judgments of attribution; pride increases perceptions of one's own responsibility for positive events and surprise increases perceptions of others' responsibility for positive events, even when the judgment is unrelated to the source of the pride or surprise. Once again, this last part illustrates the ATF matching principle.

An experiment conducted in the wake of the 9/11 terrorist attacks tested whether these patterns would scale up to the population level. A nationally representative sample of US citizens read either a real news story (on the threat of anthrax) selected to elicit fear or a real news story (on celebrations of the attacks by some people in Arab countries) selected to elicit anger, and then participants were asked a series of questions about perceived risks and policy preferences (Lerner et al. 2003). Participants induced with fear perceived greater risk in the world, whereas those induced with anger perceived lower risk, for events both related and unrelated to terrorism. Participants in the anger condition also supported harsher policies against suspected terrorists than did participants in the fear condition.

Theme 5. Emotions Shape Decisions via the Depth of Thought

In addition to influencing the content of thought, emotions also influence the depth of information processing related to decision making. One interesting school of thought (Schwarz 1990, Schwarz & Bless 1991) proposes that, if emotions serve in an adaptive role by signaling when a situation demands additional attention, then negative mood should signal threat and thus increase vigilant, systematic processing, and positive mood should signal a safe environment and lead to more heuristic processing. Indeed, numerous studies have shown that people in positive (negative) affective states were more (less) influenced by heuristic cues, such as the expertise, attractiveness, or likeability of the source, and by the length rather than the quality of the message; they also relied more on stereotypes (Bless et al. 1996, Bodenhausen et al. 1994a).

Note that systematic processing is not necessarily more desirable than automatic processing. Studies have shown that increased systematic processing from negative affect can aggravate anchoring effects owing to increased focus on the anchor (Bodenhausen et al. 2000). Similarly, negative affect reduced the accuracy of thin-slice judgments of teacher effectiveness except when

participants were under cognitive load, suggesting that the accuracy decrease for sad participants was caused by more deliberative processing (Ambady & Gray 2002). Finally, dysphoric people show excessive rumination (Lyubomirsky & Nolen-Hoeksema 1995).

Although this research shows clear influences of positive versus negative affect on processing depth, it has typically operationalized positive affect as happiness and negative affect as sadness. In one exception, Bodenhausen and colleagues (1994b) compared the effects of sadness and anger, both negatively valenced emotions. Relative to neutral or sad participants, angry participants showed greater reliance on stereotypic judgments and on heuristic cues, a result that is inconsistent with valence-based explanations but may be consistent with the affect-as-information view that anger carries positive information about one's own position (Clore et al. 2001).

Tiedens & Linton (2001) suggested an alternative explanation for the difference between happiness and sadness in depth of processing: Happiness involves appraisals of high certainty, and sadness involves appraisals of low certainty. In a series of four studies, the investigators showed that high-certainty emotions (e.g., happiness, anger, disgust) increased heuristic processing by increasing reliance on the source expertise of a persuasive message as opposed to its content, increasing usage of stereotypes, and decreasing attention to argument quality. Furthermore, by manipulating certainty appraisals independently from emotion, they showed that certainty plays a causal role in determining whether people engage in heuristic or systematic processing.

Since Lerner & Tiedens (2006) introduced emotion effects on depth of thought into the ATF framework, studies have revealed effects of discrete emotion on depth of processing across numerous domains. For example, Small & Lerner (2008) found that, relative to neutral-state participants, angry participants allocated less to welfare recipients, and sad participants allocated more—an effect that was eliminated under cognitive load, suggesting that allocations were predicted by differences in depth of processing between sad and angry participants.

Theme 6. Emotions Shape Decisions via Goal Activation

Many theorists have proposed that emotions serve an adaptive coordination role, triggering a set of responses (physiological, behavioral, experiential, and communication) that enable individuals to address encountered problems or opportunities quickly (for review, see Keltner et al. 2014). For example, in their investigation of action tendencies, Frijda and colleagues (1989) found that anger was associated with the desire to change the situation and move against another person or obstacle by fighting, harming, or conquering it. As one would expect, readiness to fight manifests not only experientially but also physiologically. For example, anger is associated with neural activation characteristics of approach motivation (Harmon-Jones & Sigelman 2001) and sometimes with changes in peripheral physiology that might prepare one to fight, such as increasing blood flow to the hands (Ekman & Davidson 1994).

Such emotion-specific action tendencies map onto appraisal themes. For example, given that anxiety is characterized by the appraisal theme of facing uncertain existential threats (Lazarus 1991), it accompanies the action tendency to reduce uncertainty (Raghunathan & Pham 1999). Sadness, by contrast, is characterized by the appraisal theme of experiencing irrevocable loss (Lazarus 1991) and thus accompanies the action tendency to change one's circumstances, perhaps by seeking rewards (Lerner et al. 2004). Consistent with this logic, a set of studies contrasted the effects of incidental anxiety and sadness on hypothetical gambling and job-selection decisions and found that sadness increased tendencies to favor high-risk, high-reward options, whereas anxiety increased tendencies to favor low-risk, low-reward options (Raghunathan & Pham 1999).

Endowment effect: an anomaly in economic transactions wherein sellers value goods more than buyers value the same goods, possibly because sellers see the sale as a loss of ownership

Lerner and colleagues (2004) followed a similar logic in a series of studies that tested the effects of incidental sadness and disgust on the endowment effect (Kahneman et al. 1991). The authors

hypothesized that disgust, which revolves around the appraisal theme of being too close to a potentially contaminating object (Lazarus 1991), would evoke an implicit goal to expel current objects and to avoid taking in anything new (Rozin et al. 2008). Consistent with this hypothesis, experimentally induced incidental disgust reduced selling prices among participants who owned the experimental object (an "expel" goal) and reduced buying prices among participants who did not own the object (an "avoid taking anything in" goal). For sadness, associated with the appraisal themes of loss and misfortune, both selling old goods and buying new goods present opportunities to change one's circumstances. Consistent with predictions, sadness reduced selling prices but increased buying prices. In sum, incidental disgust eliminated the endowment effect, whereas incidental sadness reversed it.

Han and colleagues (2012) further tested the effects of disgust on implicit goals in the context of the status-quo bias, a preference for keeping a current option over switching to another option (Samuelson & Zeckhauser 1988), and ruled out more general valence- or arousal-based disgust effects: A valence-based account would predict that any negative emotion should devalue all choice options, preserving the status-quo bias (Forgas 2003). An arousal-based account would predict that disgust would exacerbate status-quo bias by amplifying the dominant response option (Foster et al. 1998). In contrast, an implicit goals-based account would predict that disgust would trigger a goal of expelling the current option. Data supported this latter interpretation: Given the choice between keeping one unknown good (the status quo) or switching to another unknown good, disgust-state participants were significantly more likely than were neutral-state participants to switch. As is commonly the case with effects of incidental emotion, the effects of disgust on choices eluded participants' awareness.

Lerner and colleagues (2013) tested whether the effect of sadness on implicit goals would increase impatience in financial decisions, possibly creating a myopic focus on obtaining money immediately instead of later, even if immediate rewards were much smaller than later awards. As predicted, relative to median neutral-state participants, median sad-state participants across studies accepted 13–34% less money immediately to avoid waiting 3 months for payment. Again, valence-based accounts cannot explain this effect: Disgusted participants were just as patient as were neutral participants.

The view that discrete emotions trigger discrete implicit goals is consistent with the "feeling is for doing" model (Zeelenberg et al. 2008), a theoretical framework asserting that the adaptive function of emotion is defined by the behaviors that specific states motivate. According to Zeelenberg and colleagues, these motivational orientations derive from the experiential qualities of such emotions, as opposed to, for example, the appraisal tendencies giving rise to their experience. Thus, the behavioral effects depend only on the perceived relevance of an emotion to a current goal, regardless of whether the emotion is integral or incidental to the decision at hand. Given that the ATF does not distinguish informational versus experiential pathways, an important agenda for future work is to develop more granular evidence of the mechanisms through which emotions activate implicit goals in judgment and choice. At present, the models appear to make similar predictions.

Theme 7. Emotions Influence Interpersonal Decision Making

Emotions are inherently social (for review, see Keltner & Lerner 2010), and a full explanation of their adaptive utility requires an understanding of their reciprocal influence on interaction partners. As an example of how complex such influences can be, people derive happiness merely from opportunities to help and give to others with no expectation of concrete gains (Dunn et al. 2008). Indeed, prosociality is sometimes used instrumentally to manage one's mood, relieving sadness or distress (Schaller & Cialdini 1988).

Emotions help optimally navigate social decisions. Many scholars have conceptualized emotions as communication systems that help people navigate and coordinate social interactions by providing information about others' motives and dispositions, ultimately allowing for the creation and maintenance of healthy and productive social relationships (Keltner et al. 2014, Morris & Keltner 2000). In the case of psychopathology (e.g., narcissism), emotions impede healthy and productive social relationships (Kring 2008).

Frank (1988) argues that the communicative function of emotions has played a crucial role in helping people solve important commitment problems raised by mixed motives. That is, whether we decide to pursue cooperative or competitive strategies with others depends on our beliefs about their intentions (cf. Singer & Fehr 2005), information that is often inferred from their emotions (Fessler 2007). This approach has been particularly evident in the study of mixed-motive situations (e.g., negotiation and bargaining; cf. Van Kleef et al. 2010). For example, communicating gratitude triggers others' generosity (Rind & Bordia 1995) and ultimately helps an individual build social and economic capital (DeSteno 2009).

Research to date leads to the conclusion that emotion may serve at least three functions in interpersonal decision making: (*a*) helping individuals understand one another's emotions, beliefs, and intentions; (*b*) incentivizing or imposing a cost on others' behavior; and (*c*) evoking complementary, reciprocal, or shared emotions in others (Keltner & Haidt 1999). For example, expressions of anger prompt concessions from negotiation partners (Van Kleef et al. 2004a) and more cooperative strategies in bargaining games (Van Dijk et al. 2008) because anger signals a desire for behavioral adjustment (Fischer & Roseman 2007). This effect is qualified by contextual variables, such as the motivation and ability of interaction partners to process emotional information (Van Kleef et al. 2004b) as well as the morally charged nature of a negotiation (Dehghani et al. 2014). Multiparty negotiations show different effects; for example, communicated anger can lead to exclusion in these contexts (Van Beest et al. 2008).

One study investigating this mechanism found that people seem to use others' emotional displays to make inferences about their appraisals and, subsequently, their mental states (de Melo et al. 2014). Discrete supplication emotions (disappointment or worry) evoke higher concessions from negotiators as compared with similarly valenced appeasement emotions (guilt or regret; Van Kleef et al. 2006). As compared with anger, disappointment also engenders more cooperation: In the "give-some game" (Wubben et al. 2009), two participants simultaneously decide how much money to give to the other participant or keep for themselves. Any money given is doubled, and this procedure is repeated over 14 trials. After perceived failures of reciprocity, expressing disappointment communicates a forgiving nature and motivates greater cooperation, whereas expressing anger communicates a retaliatory nature and promotes escalation of defection.

Although interpersonal emotions can influence others' behavior by communicating information about an emoter's intentions, they can also change decisions and behavior as a function of the corresponding or complementary emotional states they evoke in others. Anger can elicit fear when communicated by those high in power (or corresponding anger when communicated by those low in power; Lelieveld et al. 2012) and also a desire for retaliation (Wang et al. 2012). Communicating disappointment with a proposal can evoke guilt in a bargaining partner and motivate reparative action (Lelieveld et al. 2013).

Decision makers try to use the emotional communications of bargaining partners as sources of strategic information (Andrade & Ho 2007). Increasing knowledge of how emotion communication influences others' decisions also raises the possibility for the strategic display of emotional expression. The few studies investigating this possibility have produced mixed results: Although such strategies can prompt greater concessions (Kopelman et al. 2006), inauthentic displays that

are detected are met with increased demands and reduced trust (Côté et al. 2013). The costs and benefits of intentionally deploying emotional expressions in such contexts will be an interesting area of future research. For example, initial work (Elfenbein et al. 2007, Mueller & Curhan 2006) suggests that emotionally intelligent individuals should be better able to elicit desired emotions from counterparts and, therefore, might (consciously or nonconsciously) use such skills to achieve desired outcomes.

Emotion influences on group processes and perceptions of groups. Research on group-level emotional processes is surprisingly scant, given that so many high-stakes decisions are made in groups and that the existing research reveals important effects. For example, research has found that, although team members tend to feel happy and to enjoy groups that have a shared sense of reality, such feelings are associated with groupthink—the destructive tendency to minimize conflict and maximize harmony and conformity (Janis 1972). Given that general positivity or negativity can spread through groups and influence performance outcomes (e.g., Barsade 2002, Hatfield et al. 1993, Totterdell 2000), considerably more research in this area is needed, especially at the level of specific emotions.

Theme 8. Unwanted Effects of Emotion on Decision Making Can Be Reduced Under Certain Circumstances

Numerous strategies have been examined for minimizing the effects of emotions on decision making in situations where such effects are seen as deleterious. These strategies broadly take one of two forms: (*a*) minimizing the magnitude of the emotional response (e.g., through time delay, reappraisal, or induction of a counteracting emotional state), or (*b*) insulating the judgment or decision process from the emotion (e.g., by crowding out emotion, increasing awareness of misattribution, or modifying the choice architecture).

Solutions that Seek to Minimize the Emotional Response

Time delay. In theory, the simplest strategy for minimizing emotional magnitude is to let time pass before making a decision. Full-blown emotions are short-lived (Levenson 1994). Facial expressions are fleeting (Keltner et al. 2003), and physiological responses quickly fade (e.g., Mauss et al. 2005). The extensive literature on affective forecasting has documented the surprising power of adaptation and rationalization to bring our emotional states back toward baseline even after traumatic events (see Wilson & Gilbert 2005). In certain instances, perhaps rare ones, induced anger may cause immediate changes in participants' decisions but show no such effects when the induction and decision are separated by a 10-minute delay (Gneezy & Imas 2014). Anyone who has ever observed a family member nurse a grudge for years may question the boundary conditions of time delay. In short, although it cannot be said that time heals all wounds, research in psychology has revealed that humans revert back to baseline states over time, an effect we typically underestimate (Gilbert 2006, Loewenstein 2000).

That said, there is a reason why a strategy as simple as waiting is so rarely used: Delay is fundamentally antithetical to the function of many emotional states, which motivate immediate behavioral responses to adaptive concerns. Most would agree that taking a moment to decide how to react after discovering a spouse in the arms of another would be prudent. Few would be capable of doing so. The immediate effects of emotional states can render us "out of control" and incapable of waiting for a neutral state to return (Loewenstein 1996).

Discount rate: degree to which an individual devalues future outcomes (e.g., $100 next week) relative to immediate outcomes; a measure of impatience

Suppression. Although suppression is often touted in the popular literature (e.g., "control your anger"), research indicates that it is often counterproductive, intensifying the very emotional state one had hoped to regulate (Wenzlaff & Wegner 2000). Attempting to avoid feeling an emotion will typically reduce one's expressive behavior but have little or no impact on one's subjective experience of the emotion (Gross & Levenson 1993). Indeed, physiological reactions to suppression are often mixed and frequently deleterious (Gross 2002, Gross & Levenson 1993). Specifically, attempts at suppression are cognitively costly, impairing memory for details of what triggered the emotion (Richards & Gross 1999). This effect has important practical implications for how individuals might best respond to unexpected accidents that trigger intense emotion.

Reappraisal. Reframing the meaning of stimuli that led to an emotional response, i.e., reappraisal, has consistently emerged as a superior strategy for dissipating the emotional response (Gross 2002). Reappraisal includes such behaviors as reminding oneself "it's just a test" after receiving a poor exam grade, adopting the mind-set of a nurse or medical professional to minimize the emotional impact of viewing someone's injury, or viewing a job layoff as an opportunity to pursue long-forgotten dreams (Gross 1998, 2002). In contrast to suppression, reappraisal not only reduces self-reported negative feelings in response to negative events but also mitigates physiological and neural responses to those events (Jamieson et al. 2012, Ochsner et al. 2002). Those who employ strategic reappraisal typically have more positive emotional experiences (Gross & John 2003) and show fewer incidences of psychopathology (Aldao et al. 2010).

As yet, we find few studies applying reappraisal techniques to emotion effects on JDM, but one groundbreaking paper suggests that this area holds promise. Halperin and colleagues (2012) examined the responses of Israelis to the recent Palestinian bid for United Nations recognition. Participants who were randomly assigned to a reappraisal training condition (compared with a control condition) showed greater support for conciliatory policies and less support for aggressive policies toward Palestinians at planned assessments both one week later and five months later.

The relative efficacy of suppression and reappraisal techniques derives from the content of thoughts about emotions (i.e., don't think about this, or think about this differently). A separate literature on mood repair suggests the possibility of another route to regulation: triggering other target emotional states that neutralize the original state.

The "dual-emotion solution" (inducing a counteracting emotional state). Theoretically, one could counteract an unwanted decision effect by inducing another emotion—one that triggers opposing tendencies in JDM. We call this the "dual-emotion solution" even though the decision process would still involve bias because the decision outcome would not. A provocative example of this approach examined the well-known phenomenon of excessively high financial discount rates, as described in the JDM primer. Whereas sadness is known to increase excessive discount rates (Lerner et al. 2013), gratitude has now been shown to reduce such rates, even below the levels one would experience in a neutral state (DeSteno et al. 2014). These results suggest the unusual possibility that inducing an incidental emotion (in this case, gratitude) may reduce an existing bias. Akin to the creative paper by Loewenstein et al. (2012), one might use one bias to counteract another.

Solutions that Seek (but Sometimes Fail) to Insulate the Decision Process from the Emotion

Increasing cognitive effort through financial incentives. Few studies have systematically tested ways to reduce the carryover of incidental emotion; results to date suggest that such

reduction will be difficult. Increasing a decision maker's attention to the decision task by having real financial outcomes is often considered a good way to reduce bias, but this intuition does not seem to be effective. Incidental emotions routinely serve as perceptual lenses even when real financial rewards are at stake (e.g., DeSteno et al. 2014; Lerner et al. 2004, 2013; Loewenstein et al. 2001).

Crowding out emotion. Saturating the decision maker with cognitive facts about a particular decision domain and making the domain relevant might also seem like useful ways to diminish the carryover effect. Unfortunately, neither strategy appears promising. For example, although US citizens paid close attention to matters of risk and safety in the wake of 9/11, incidental emotions induced shortly after the attacks shaped citizens' global perceptions of risk and their preferences for risky courses of action (Lerner et al. 2003).

Increasing awareness of misattribution. On the basis of the idea that emotion-related appraisals are automatic (Ekman 1992, Lazarus 1991, LeDoux 1996), the "cognitive-awareness hypothesis" (Han et al. 2007) posits that appraisal tendencies will be deactivated when decision makers become more cognitively aware of their decision-making processes. Schwarz & Clore (1983) pioneered this approach, discovering in a seminal study that ambient weather effects on judgments of subjective well-being disappeared when people were reminded of the weather. Thus, they demonstrated that a simple reminder to attribute (positive or) negative mood to its correct source could eliminate the carryover of incidental mood.

In a similar vein, Lerner and colleagues (1998) showed that inducing decision makers to monitor their judgment processes in a preemptively self-critical way, via the expectation that they would need to justify their decisions to an expert audience (i.e., accountability), reduced the impact of incidental anger on punishment decisions by leading people to focus on judgment-relevant information and dismiss incidental affect as irrelevant to the judgment. Notably, the accountable decision makers did not feel any less anger than the nonaccountable decision makers; they simply used better judgment cues.

These examples of deactivation of emotional carryover may be more the exception than the rule, as numerous factors can thwart cognitive awareness. First, people often lack the motivation to monitor their decision-making processes. Moreover, even when people are motivated, attaining accurate awareness of their decision processes is a difficult task (for review, see Wilson & Brekke 1994). For example, incidental disgust led participants to get rid of their possessions even when they were directly warned to avoid this carryover effect of disgust (Han et al. 2012).

Stepping back to consider broader frameworks for organizing and understanding bias in JDM, the type of incidental emotion carryover observed appears most consistent with what Wilson & Brekke (1994) refer to as "mental contamination" and Arkes (1991) calls "association based errors"—processes wherein bias (e.g., incidental emotion carryover) arises because of mental processing that is unconscious or uncontrollable. These models suggest that the best strategy for reducing such biases would be to control one's exposure to biasing information in the first place. This is a difficult task for the decision maker. Thus, debiasing may be accomplished more effectively by altering the structure of the choice context, as we describe below.

Choice architecture. All the strategies discussed so far are effortful and therefore unlikely to be broadly successful tactics for helping busy decision makers. By contrast, the burgeoning literature on choice architecture offers an alternative set of tactics that affects behaviors automatically without restricting choices (Thaler & Sunstein 2008). It does so by changing the framing and structure of choices and environments in a way that relies on JDM's understanding of people's sometimes faulty decision processes to counteract more pernicious errors. For example, Thaler & Sunstein

(2003) suggest that cafeterias should be organized so that the first foods consumers encounter are healthier options, thus increasing the chance that the combination of visceral hunger and mindless consumption does not derail their health goals.

The cafeteria example illustrates that one of the most powerful yet simple forms of choice architecture is setting good defaults. For example, setting a default to enroll new employees in a 401(k) plan automatically is highly effective at increasing saving rates (Madrian & Shea 2001). Setting good defaults is especially important when emotions such as happiness or anger reduce the depth of cognitive processing (Tiedens & Linton 2001). That is, when people rely on easily accessible cues and heuristic processing, a good default is especially likely to improve average decision quality.

More heavy-handed choice architecture can also be utilized to help consumers delay their choices to reduce the influence of immediate emotion. For example, most US states require a waiting period before individuals can buy guns, thereby reducing any immediate influences of temporary anger. Similarly, 21 US states require couples to wait from 1 to 6 days to get married after receiving a marriage license.

By involving relatively unconscious influences, choice architecture provides a promising avenue for reducing the impact of unwanted emotions in a way that can actually benefit the general public. Yet, most choice architecture is designed with only cognitive decision-making processes in mind, overlooking emotion, and this omission may limit its effectiveness. The field would benefit by initiating research in the spirit of choice architecture that specifically targets unwanted emotional influences.

GENERAL MODEL

Here we propose a model of decision making that attempts to account for both traditional (rational choice) inputs and newly evident emotional inputs, thus synthesizing the findings above. Specifically, we propose the emotion-imbued choice (EIC) model (**Figure 2**), descriptively summarizing ways in which emotion permeates choice processes. The model intentionally draws inspiration from prior models, especially the risk-as-feelings model (Loewenstein et al. 2001, figure 3, p. 270) and Loewenstein & Lerner's (2003, figure 31.1, p. 621) model of the determinants and consequences of emotions. For the purposes of this article, the EIC model assumes that the decision maker faces a one-time choice between given options, without the possibility of seeking additional information or options. The model ends at the moment of decision and does not include actual (as opposed to expected) outcomes and feelings that occur as a result of the decision. Finally, although we include visceral influences that shape decision processes, we do not account for reflexive behavior, such as when one jumps back or freezes upon hearing an unexpected, loud blast. That is, our model attempts to explain conscious or nonconscious decision making but not all human behavior.

We begin by discussing the aspects this model shares with normative, rational choice models of decision making such as expected utility and discounted utility theories (**Figure 2**, solid lines). Decision theory requires the decision maker to evaluate the options at hand by assessing the utility of each expected outcome for each option. These outcome utilities are combined with characteristics of the options, such as probabilities and time delays, and characteristics of the decision maker, such as risk aversion and discount rate. These factors are combined (**Figure 2**, lines A, B, and C) to form an overall evaluation of each option, and the best option is chosen (**Figure 2**, line D).

The EIC model adds emotions to this process in two ways. The first departure from the strictest rational choice models is to allow for constructed rather than stable preferences (Payne

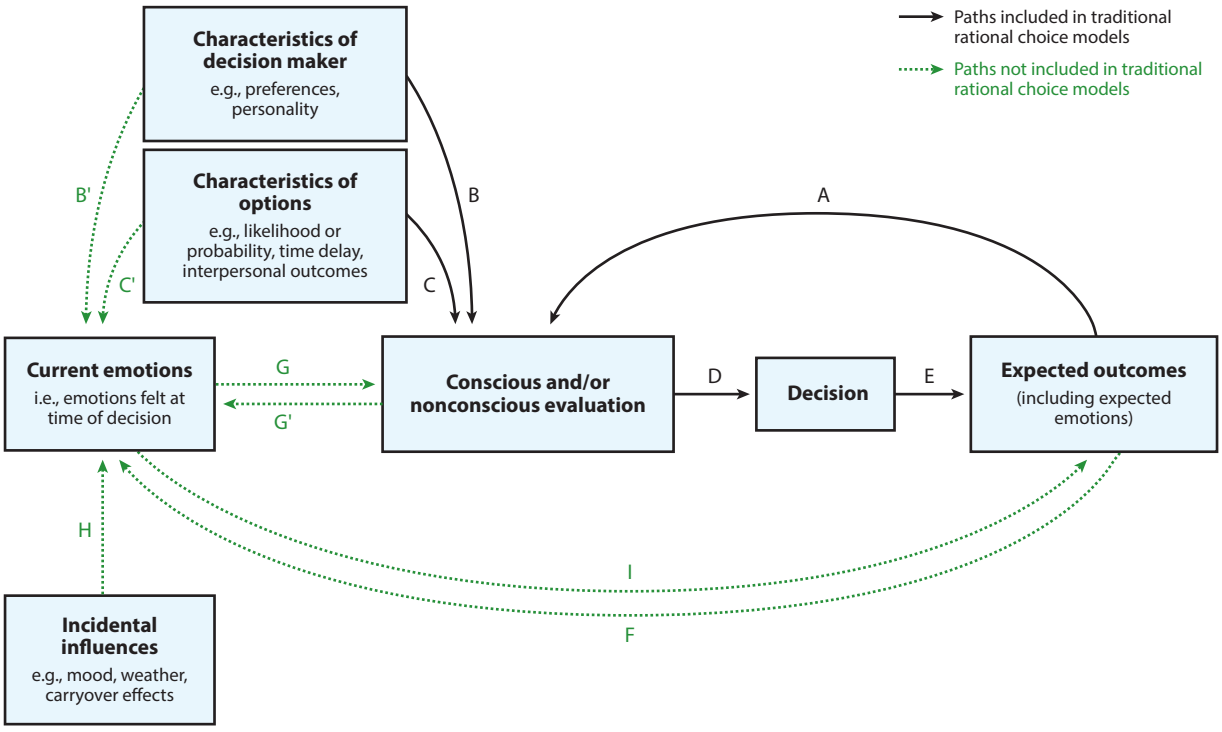

Figure 2

Toward a general model of affective influences on decision making: the emotion-imbued choice model.

et al. 1993, Slovic 1995), such that the utility for each decision outcome is judged by predicting one's emotional response to that outcome. These predicted emotions still enter as rational inputs in the decision process (**Figure 2**, line A) and are evaluated much like utility, consistent with the concept of "somatic markers" (Damasio 1994).

The second kind of emotion in the EIC model consists of emotions that are felt at the time of decision making (referred to as current emotions in the figure), which are entirely outside the scope of conventional rational choice models. Green dotted lines depict five potential sources of current emotions. First, characteristics of the decision maker, such as chronic anxiety or depression, can lead to a baseline level of current emotion (**Figure 2**, line B′). Second, characteristics of the choice options can directly impact current feelings (**Figure 2**, line C′). For example, ambiguous information or uncertain probabilities can directly lead to anxiety, or time delays may lead to anger. Third, predicted emotions can have an anticipatory influence on current emotions (**Figure 2**, line F). For example, someone anticipating a painful shock may feel fear now. Fourth, contemplating the decision can directly cause frustration (**Figure 2**, line G′), particularly if the options are nearly equivalent or feature difficult, possibly even taboo, trade-offs (Luce et al. 1997). Finally, whereas the first four sources contribute to integral emotions, incidental emotions due to normatively unrelated factors—such as emotions arising from an unrelated event, the weather, or mood—can also carry over (**Figure 2**, line H).

As described above, current emotions directly influence the evaluation of the outcomes (**Figure 2**, line G) by affecting which dimensions the decision maker focuses on, whether s/he uses heuristic or analytic processing, and which motivational goals are active—the three tenets

Intertemporal choice: decisions involving trade-offs among costs and/or benefits occurring at different times

of the ATF. These affective influences change how rational inputs are evaluated. For example, specific emotions may increase the weight put on certain dimensions (e.g., Lerner & Keltner 2000, 2001), reduce the number of dimensions considered (e.g., Tiedens & Linton 2001), distort probabilities (Rottenstreich & Hsee 2001), increase or decrease discount rates (DeSteno et al. 2014, Lerner et al. 2013), and set different motivational goals (Lerner et al. 2004, Raghunathan & Pham 1999). Current emotions can also indirectly influence decision making (**Figure 2**, line I) by changing predicted utility for possible decision outcomes (Loewenstein et al. 2003).

The following example illustrates the EIC model in action, although it is not an exhaustive account of the relationships among the model's links. Imagine that someone experiencing sadness due to the death of her dog is offered an intertemporal choice: She can receive $50 now or $100 in 1 month. As noted above, her decision could be affected by personal characteristics; for example, if she has a high discount rate, she would be less likely to choose the delayed amount (**Figure 2**, line B). In accordance with the ATF, her sadness, though incidental to the decision (**Figure 2**, line H), would increase her motivation to attain rewards immediately, even at the expense of longer-term gains (**Figure 2**, line G). However, the anticipatory influences of expected positive outcomes might mitigate her sadness by triggering a positive feeling in the future, such as excitement over the prospect of receiving money either way (**Figure 2**, line F). Conversely, current sadness might also temper such expectations, making both outcomes seem less rewarding (**Figure 2**, line I). Finally, frustration about waiting for a time-delayed reward (line C′) and anxiety about the size of the discrepancy between the rewards (line G′) may further color her current emotions. The ultimate decision will be predicted by the combination of her sadness-modified discount rate, her monetary goals, and how she values the potential rewards (**Figure 2**, line D).

CONCLUSIONS

The psychological field of emotion science, originally slow to develop, is undergoing a revolutionary phase that has already begun to impact theories of decision making (Keltner & Lerner 2010, Loewenstein et al. 2001, Loewenstein & Lerner 2003). Major conclusions from the past 35 years of research on emotion and decision making include the following:

1. Emotions constitute potent, pervasive, predictable, sometimes harmful and sometimes beneficial drivers of decision making. Across different types of decisions, important regularities appear in the underlying mechanisms through which emotions influence judgment and choice. Thus, emotion effects are neither random nor epiphenomenal.
2. Emotion effects on JDM can take the form of integral or incidental influences; incidental emotions often produce influences that are unwanted and nonconscious.
3. Path-breaking valence-based theories of emotion and JDM characterized research in the 1980s-1990s. More recent theories treat the valence dimension as only one of multiple emotion dimensions that drive JDM outcomes, affording more precise and non-intuitive predictions.
4. Although emotions may influence decisions through multiple mechanisms, considerable evidence reveals that effects occur via changes in (*a*) content of thought, (*b*) depth of thought, and (*c*) content of implicit goals—three mechanisms summarized within the ATF.
5. Whether a specific emotion ultimately improves or degrades a specific judgment or decision depends on interactions among the cognitive and motivational mechanisms triggered by each emotion (as identified in conclusion 4) and the default mechanisms that drive any given judgment or decision.
6. Emotions are not necessarily a form of heuristic thought. Emotions are initially elicited rapidly and can trigger swift action. But once activated, some emotions (e.g., sadness) can

trigger more systematic thought. Distinguishing between the cognitive consequences of an emotion-elicitation phase and an emotion-persistence phase may be useful in linking emotion to modes of thought.

7. When emotional influences are unwanted, it is difficult to reduce their effects through effort alone. Strategies for reducing such influences cluster into three broad categories—those that aim at (*a*) reducing the intensity of emotion, (*b*) reducing the use of emotion as an input to decisions, or (*c*) counteracting an emotion-based bias with a bias in the opposite direction. Overall, we suggest that less effortful strategies, particularly those involving choice architecture, provide the most promising avenues here.
8. The field of emotion and decision making is growing at an accelerating rate but is far from mature. Most subareas contain few competing theories, and many areas remain relatively unexplored. Existing studies can raise as many questions as they answer. The research pathways ahead therefore contain many fundamental questions about human behavior, all ripe for study.
9. Despite the nascent state of research on emotion and decision making, the field has accumulated enough evidence to move toward a general model of affective influences on decision making. Here we propose the EIC model, building on existing models and nesting rational choice models. We hope it provides a useful framework for organizing research in the future.

Inasmuch as emotions exert causal effects on the quality of our relationships (Ekman 2007, Keltner et al. 2014), sleep patterns (e.g., Harvey 2008), economic choices (Lerner et al. 2004, Rick & Loewenstein 2008), political and policy choices (Lerner et al. 2003, Small & Lerner 2008), creativity (Fredrickson 2001), physical (Taylor 2011) and mental health (e.g., Kring 2010), and overall well-being (e.g., Ryff & Singer 1998), the theories and effects reviewed here represent key foundations for understanding not only human decision making but also much of human behavior as a whole.

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Emotion and Decision Making:
Online Supplement

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S-I. BRIEF PRIMER ON EMOTION

Overview. The field of emotion research is still in its infancy. In terms of Thomas Kuhn's (1962) approach to scientific revolutions, it has yet to become a "normal science" with established paradigms. It instead features sparring theories, each trying to best represent the true nature of emotion. Even the question posed in the title of William James' (1884) essay "What is an Emotion?" still sparks debate today (see Keltner & Lerner 2010, Russell & Barrett 1999). It is not surprising, then, that within the JDM literature, specifically, researchers have labeled a wide variety of mental states as "emotional": from fleeting, momentary reactions (e.g., Todorov et al 2007) to protracted, durable moods that last a lifetime (e.g., Lerner & Keltner 2001); from states characterized solely by subjective feelings to those characterized by complex coordination of physiological, hormonal, and expressive activity (e.g., Bechara et al 1997, Chapman et al 2009, Kassam et al 2009); and from evaluations that involve simple positive and negative associations to those that involve more complex affective relationships (for review, see Loewenstein & Lerner 2003). Although a full understanding of these relationships is not needed to study the impact of emotion on JDM, it is nonetheless useful to mention two theoretical questions that can contextualize this review within the current state of emotion research: 1) How are emotion and cognition related? 2) What is the consensual model for the universe of emotions (discrete versus dimensional)?

How are emotion and cognition related? The interplay of emotion and cognition has been debated for centuries (Descartes 1649, Descartes 1989). Notable scholars have long contributed to it. For example, in *The Expression of Emotion in Man and Animals*, Charles Darwin described an attempt to determine whether his cognitive awareness that a piece of glass prevented a snake from striking could override the emotional response of fear:

> I put my face close to the thick glass-plate in front of a puff-adder in the Zoological Gardens, with the determination of not starting back if the snake struck at me; but, as soon as the blow was struck, my resolution went for nothing, and I jumped a yard or two backwards with astonishing rapidity. My will and reason were powerless against the imagination of a danger which had never been experienced (1872/1998, p. 38).

Darwin captures two crucial elements of the relationship between cognition and emotion with which researchers have been concerned: the separability of cognition and emotion and the notion of "affective primacy." Though largely ignored through the eras of behaviorism and the cognitive revolution (see Simon 1967, for a notable exception), these issues were thrust to the forefront of psychology in the 1980s due in large part to Robert Zajonc (1980, 1984). He proposed that emotions operate independently, and in advance of, cognitive operations, an idea that has since accumulated empirical support (Bargh 1984, Clore 1992, Kuhnen & Knutson 2005, LeDoux 1996, Murphy & Zajonc 1993). Some emotion processes, at least in primitive form at the stage of elicitation, can precede and even diverge from cognitive assessments; emotions need not depend on cognitions. For example, recent neuroscience studies have shown

that certain emotional circuits in the brain send faster (sub-cortical) signals than do circuits that involve the cortex (for review, see Phelps et al in press). Such evidence, along with related lines of work, have contributed to the conclusion that emotion is not epiphenomenal and can influence cognition and behavior in powerful ways (for reviews, see Damasio 1994, Loewenstein 1996, Loewenstein et al 2001, Phelps 2006, Rozin et al 2008).

At the same time, cognitive processes can also shape emotion (e.g., Folkman et al 1986, Roseman 2001, Scherer et al 2001, Smith & Ellsworth 1985), and the past few decades of neuroscience research have revealed a complex interplay between the two processes (Kassam et al 2013, Phelps 2006). Few would now dispute that emotion and cognition are intertwined, and many theories model them as such (Bechara et al 1999, Beer et al 2006, Izard 1992, Phelps et al in press, Schachter 1964). Contrary to the view that a "limbic system" serves as the set of pathways for emotion, it is now believed that emotion and cognition are not separate systems, *per se*; they interact continuously even if an emotion-based signal arrives milliseconds sooner.

How should emotion be modeled? Much debate remains about the processes generating emotion and the implications these processes have for appropriate models. Researchers generally fall into one of two camps (for reviews, see Barrett 2006, Barrett et al 2007b, Ekman 1992, Ekman & Davidson 1994, Izard 2007, Lindquist 2013, Panksepp 2007b). Basic emotion theorists suggest that specific emotion programs are given to us by nature—that disgust, for example, is a coordinated set of responses shaped over millennia by natural selection. They find evidence in the universality of emotional responses across cultures (Darwin 1998, Ekman 1993) and in analogous or homologous responses in non-human primates and other mammals (Panksepp 2007a). Constructionists, on the other hand, argue that language, culture, and conceptual knowledge shape our emotional responses—that simple components of emotion such as valence (i.e., simple positivity or negativity) may represent hardwired reactions, but more complex aspects of emotional response are learned, involve non-emotional processes, and are heavily dependent on the contextual factors. They point to shortcomings in the research on universality and analogy, the sometimes absent correlation between various aspects of emotional response in published studies (e.g., subjective feelings and physiological response), and research suggesting culture and language shape emotional response (Barrett 2006, Barrett et al 2007a, Lindquist & Gendron 2013). In many respects, this is a nature-versus-nurture debate. No one doubts that we have evolved some capacity for emotional response or that learning or cognitive schema can serve to shape that response. Instead, the question is whether culture, learning, and language play a relatively minor role in complex emotional responses (basic emotion theory) or a substantial one (constructionist theory).

Each emotion-generation theory has been linked to a corresponding model. Such models suggest a relationship between the components of emotional response—subjective feeling states; facial, vocal, and bodily expressions; hormonal and physiological responses; cognitive processing changes; and *action tendencies* (for more detail, see below). Basic emotion theories favor a discrete emotion model (e.g., Ekman 1992) characterizing states as clusters of responses in these channels. Constructionist theories favor dimensional models, where states are

characterized predominantly by values along continuums such as valence (negative to positive) and arousal (lethargic to energized). According to such models, feelings of negativity/positivity or lethargy/energy are more closely tied to expression, bodily response, and cognitive-processing changes. More complex emotional states (such as anger) stem from a combination of valence and arousal together with non-emotional processes (e.g., conceptual knowledge about the situation at hand; Lindquist 2013).

Beyond theoretical debates, we emphasize that both discrete and dimensional frameworks are merely *models*, offering different descriptions of the same underlying phenomena while emphasizing different aspects. Neither model is expected to be perfectly represented in the underlying emotion-generation process: There is little evidence that the brain contains circuits dedicated solely to the generation of discrete emotional states such as anger (Kassam et al 2013, Lindquist et al 2012), and it is similarly unlikely that valence and arousal are the only bottom-up influences responsible for differences in emotional response (Panksepp 2007a).

Of importance for models of JDM, discrete and dimensional models of emotion differ in terms of their number of parameters. Dimensional models typically require two parameters: valence and arousal. Discrete models require values for each discrete emotion, but generally agree that six dimensions best define the patterns of cognitive appraisal underlying discrete emotions: certainty, pleasantness, attentional activity, control, anticipated effort, and self-other responsibility (for review, see Smith & Ellsworth 1985). At the same time, some cognitive-appraisal theorists have argued that each emotion is best defined by one or two dimensions that characterize its core meaning or theme (Lazarus 1991, Smith & Ellsworth 1985). For example, certainty, control, and responsibility are the central dimensions that distinguish anger from other negative emotions. Anger arises from appraisals of (a) other-responsibility for negative events, (b) individual control, and (c) a sense of certainty about what happened (Averill 1983, Betancourt & Blair 1992, Smith & Ellsworth 1985, Weiner et al 1982). Notably, as mentioned above, emotions may arise in other ways, including relatively non-cognitive methods, such as bodily feedback or unconscious priming (for review, see Keltner & Lerner 2010). In these cases, appraisals do not play a causal role in generating the emotion; nonetheless, the corresponding appraisals will ultimately be experienced as influencing subsequent choices and judgments. Thus, fully experiencing a discrete emotion may also mean experiencing the cognitive appraisals that comprise that emotional state (Clore 1994, Frijda 1994, Lazarus 1994).

With additional degrees of freedom, discrete models are able to account for more patterns of response than dimensional models can. For example, research has found that discrete emotional states characterized by similar valence and arousal levels have divergent effects on risk perception (Lerner & Keltner 2001) and a variety of other outcomes, reviewed in Section V of this paper. More generally, the ideal emotion model will depend on the domain of inquiry. Studies of facial expression have traditionally employed discrete models (Ekman 1993), whereas physiological responses to emotional stimuli have more typically employed dimensional models (Larsen et al 2008). The best model for decision-making domains will likewise depend on the particular decision-making context.

S-II. BRIEF PRIMER ON JUDGMENT AND DECISION MAKING

Overview. The study of JDM has a long, multi-disciplinary history. This primer focuses on individual judgments and decisions (for more on interpersonal contexts, see Camerer 2003).

JDM research is generally characterized by efforts to compare how people actually make judgments and decisions with normative standards from probability and decision theory of how people ideally should make judgments and decisions. Much as vision scientists study optical illusions to understand the visual system, this approach focuses on systematic deviations—that is, where judgments and decisions are inaccurate, inconsistent, or otherwise suboptimal. These deviations provide insight into underlying processes, leading to more accurate descriptive models. Indeed, the field can be summed up as an attempt to develop models that blend descriptive reality and normative precision. Here, we present three topics in which this paradigm has devoted considerable attention and in which emotion effects are now actively investigated.

Topic: judgment processes. Systematic study of human judgment is exemplified in the influential heuristics-and-biases program of research pioneered by Tversky and Kahneman (for review, see Gilovich et al 2002). Biases, or systematic deviations from normative standards, are used to identify the heuristics—simple rules-of-thumb or shortcuts—underlying JDM. Initial work focused on probability judgments. For example, in the "Linda problem" (Tversky & Kahneman 1983), participants read a description of Linda, including that "she was deeply concerned with issues of discrimination and social justice" as a college student. Thereafter, participants judged Linda as more likely to be "a bank teller and active feminist" than simply "a bank teller." Yet, a compound probability (A and B) cannot be more probable than a simple probability (A). This error identifies the *representativeness* heuristic, whereby people use similarity to judge probability rather than integrating information normatively (using Bayesian standards). The availability, representativeness, and anchoring heuristics (Tversky & Kahneman 1974) launched a paradigm that has since spread far beyond probability judgments (for review, see Gigerenzer et al 1999, Shah & Oppenheimer 2008).

One potential consequence of using heuristics is that they tend to produce *overconfident* judgments. For example, when Alpert and Raiffa (1982) asked people to generate 98% confidence intervals for quantities such as the length of the Amazon River, the intervals only included the true value 60% of the time. One explanation is that people anchor on what they believe to be the true value and adjust the endpoints of the interval insufficiently. More generally, although heuristics are generally thought to make a tradeoff between effort and accuracy (Payne et al 1993, Shah & Oppenheimer 2008), using heuristics can produce efficient yet accurate judgments depending on the structure of the environment (Gigerenzer & Gaissmaier 2011).

Topic: decision making under risk. Most JDM research on decision making focuses on deviations from expected utility (EU) theory, a normative model of decision making under risk and uncertainty (Savage 1954, Von Neumann & Morgenstern 1947), a number of deviations soon surfaced (e.g., Allais 1953, Edwards 1954, Ellsberg 1961). Psychologists Kahneman and

Tversky (1979) famously summarized these issues and proposed an alternative descriptive model of risky decision making: "prospect theory." The article is the most cited in all of economics.

Prospect theory is comprised of two parts: a value function and a probability weighting function. The value function describes how objective values (e.g., money) are subjectively perceived and identifies three deviations from EU. First, EU assumes that utility is defined over final wealth states (e.g., a $100 coin flip for someone with $1,000 of wealth is evaluated as 50% chance at $1,100 and 50% chance at $900). Instead, prospect theory's value function exhibits *reference dependence*—utility is defined as changes in wealth relative to a *reference point*. Second, whereas in EU, the positive utility from a gain (e.g., $100) is weighed the same as the negative utility from a loss of the same amount, prospect theory's value function allows for *loss aversion*—a tendency to weigh losses more heavily than gains. Finally, whereas EU generally assumes that people are either risk-averse or risk-seeking, prospect theory allows for both: people are risk-averse in gains and risk-seeking in losses.

Prospect theory's probability weighting function describes how probabilities are distorted relative to objective levels: people overweigh small probabilities, underweigh large probabilities, and are relatively insensitive to differences in moderate probabilities. For example, the difference between 0% and 1% or 99% and 100% seems large in comparison to the difference between 33% and 34%. Combining these two functions, prospect theory explains a "fourfold pattern of risk attitudes," including anomalies such as why people pay a premium to gamble on long shots (i.e., risk-seeking for low-probability gains) yet pay a premium for insurance (i.e., risk-averse for low-probability losses).

One implication of prospect theory is possible inconsistencies arising from framing effects. For example, in the "Asian disease problem" (Tversky & Kahneman 1981), people evaluated treatment programs for a disease expected to kill 600 people. People mostly prefer a program that saves 200 lives for sure over one with a "one-thirds probability that 600 people will be saved and a two-thirds probability that no people will be saved." They also prefer a program that has a "one-third probability that nobody will die and a two-thirds probability that 600 people will die" over one where 400 people will die for sure. Although these two choices are objectively identical, people in the "die" frame are more likely to reason in terms of losses than people in the "lives saved" frame. Framing outcomes as gains versus losses may also explain the *endowment effect* (Kahneman et al 1991), whereby sellers value objects more than buyers do, perhaps because sellers think of the sale as a loss of ownership. Similarly, whether someone paid for basketball tickets or received them as a gift should not affect whether she attends the game during a snowstorm, yet it does, perhaps because paying for tickets is framed as a loss. As this example shows, people exhibit the *sunk cost* effect, becoming more likely to continue with an action after making an investment of money, time, or effort (Arkes & Blumer 1985).

Topic: intertemporal choice. Just as EU became the de facto economic model of risky choice, the discounted-utility (DU; Samuelson 1937) model dominated early economic thinking on intertemporal choice—decisions involving alternatives whose costs and benefits occur at different times. JDM researchers have similarly documented a number of descriptive

shortcomings for DU and its axioms. For example, discount rates—how much less future utility is worth relative to today—are inconsistent across time. DU requires a delay of 1 month to discount the utility of an outcome by the same degree whether that 1 month is a delay from today to next month or from 12 to 13 months, and for the total discounting over one year to be equivalent to the degree of discounting over 1 month compounded 12 times. To demonstrate inconsistent discount rates, Thaler (1981) asked participants how much they would require in 1 month, 1 year, and 10 years to make them indifferent to receiving $15 today. The median responses of $20, $50, and $100 suggest discount rates of 345%, 120%, and 19%, respectively. A number of descriptive models have been proposed to account for this phenomenon of high discount rates for short delays and lower discount rates for longer delays, commonly referred to as present bias or hyperbolic discounting (e.g., Ainslie 1975, Laibson 1997, O'Donoghue & Rabin 1999). Other systematic anomalies such as the magnitude (less discounting for larger amounts), sign (less discounting for losses than gains), and direction (less discounting to decrease than to increase delays) effects required further relaxations of DU's assumptions (Frederick et al 2002, Loewenstein & Prelec 1992).

Summary. More than half a century of JDM research has catalogued numerous empirical "anomalies" in judgments and decisions. Identifying these deviations from normative models has led to the development of more descriptively accurate models. By clarifying JDM processes, the field—often paradoxically referred to as behavioral economics despite the fact that many of its founders (e.g., Kahneman, Tversky, Edwards, Dawes) were psychologists—has built a foundation for more effective research and application in a wide array of fields, including political science, finance, law, and medicine.

S-III. HISTORY OF RESEARCH ON EMOTION AND DECISION MAKING

Across disciplines ranging from philosophy (Solomon 1993) to neuroscience (e.g., Phelps et al in press), a vigorous quest to identify the effects of emotion on judgment and decision making (JDM) is in progress. In some disciplines, this quest dates to ancient times. Aristotle first described the tendency for anger to influence behavior in a global, undiscerning way (*Nicomachean Ethics*). In other fields, research in emotion and JDM has a much shorter history.

Economics, the historically dominant academic discipline for research on decision theory, offers an interesting case. Two hundred and fifty years ago, Adam Smith (1759) highlighted the power of emotion to bias decisions (see Bentham 1879, Jevons 1871 for other early treatments of emotion in economic theories), much of modern economics overlooked this aspect of Smith's writing, with a few notable exceptions (e.g., Elster 1998, Loewenstein 1996, Loewenstein 2000). But its wisdom has resurfaced in light of several developments, including (a) breakthroughs in the methodology for studying emotion (for review, see Keltner & Lerner 2010, Phelps et al in press); (b) solid evidence that emotion drives economic behavior (for review, see Rick & Loewenstein 2008); and (c) the failure of rational choice models to predict or explain the worldwide economic crisis that began in 2008. In the wake of the crisis, Paul Krugman, 2008 Nobel Laureate in economics, argued that neoclassical economic theory and its elegant mathematical models had experienced a devastating failure (Krugman 2009, September 2).

Indeed, Alan Greenspan, chairman of the U.S. Federal Reserve from 1987 to 2006, admitted that he was in a state of "*shocked* disbelief" because "the whole intellectual edifice" had "collapsed" (Andrews 2008, October 24). It should be noted, however, that at least one leading macroeconomist was not shocked. Nobel Laureate Robert Shiller predicted the housing market crash and that it would do so because of "irrational exuberance"—an emotional phenomenon (Shiller 2005).

In psychology, a causal role for emotion in decision making also hardly ever appeared, and this, too, held for most of the 20th century. Even the behavioral decision researchers' early critiques of rational decision models in economics primarily focused on identifying cognitive processes. Moreover, for most of the 20th century, research examining emotion in *all* fields of psychology was scant (for a review, see Gilovich & Griffin 2010). As far as the psychology literature went, one almost needed to go back to Freud to find theoretical bases for emotion in decision making.

Undoubtedly, many factors contributed to this dearth of research on emotion and decision making. One factor was the dominance of behaviorism in psychology from approximately 1940 to 1975. B. F. Skinner, behaviorism's greatest champion, actively discouraged research on emotion: "The 'emotions' are excellent examples of the fictional causes to which we commonly attribute behavior (1953, p. 160)." Therefore, "The safest practice is to hold the adjectival form…by describing behavior as fearful, affectionate, timid, and so on, we are not led to look for *things* called emotions" (pp. 162-3). Skinner treated emotions as merely unscientific, shorthand ways of characterizing behavior; observable behavior was all that mattered for scientific theory, not mental states (Cunningham 2000). When Skinner retired in 1974, peer-reviewed journals contained essentially no studies of emotion and cognition.

Perhaps as equally important as the behaviorist era in delaying the dawn of modern emotion research was the subsequent counter-revolution to behaviorism, termed the "cognitive revolution." Cognitive science emerged in the 1970s, systematically inserting the concept of *cognition* between behaviorism's famous stimulus-response pairing. As much as early years of the cognitive revolution illuminated the role of cognition (see Miller 2003, Simon et al 2008), it obscured the role of emotion.

But "when the 'cognitive revolution' ebbed, there was a rapid and pronounced return to the study of emotion" (Gilovich & Griffin 2010, p. 559). Since approximately 1980, research in decision making has begun to increasingly incorporate affective factors. Figure 1 in the main paper (repeated below for convenience) displays the results of Google Scholar searches for scholarly publications using the exact terms "[emotion(s)/affect/mood] and decision making," from 1970 to the present. The data reveal that the field is young and growing tremendously; yearly works on emotion and decision making doubled from 2004 to 2007 and again from 2007 to 2011, and increased by an order of magnitude as a percentage of all scholarly publications on "decision making" (already a quickly growing field) from 2001 to 2013.

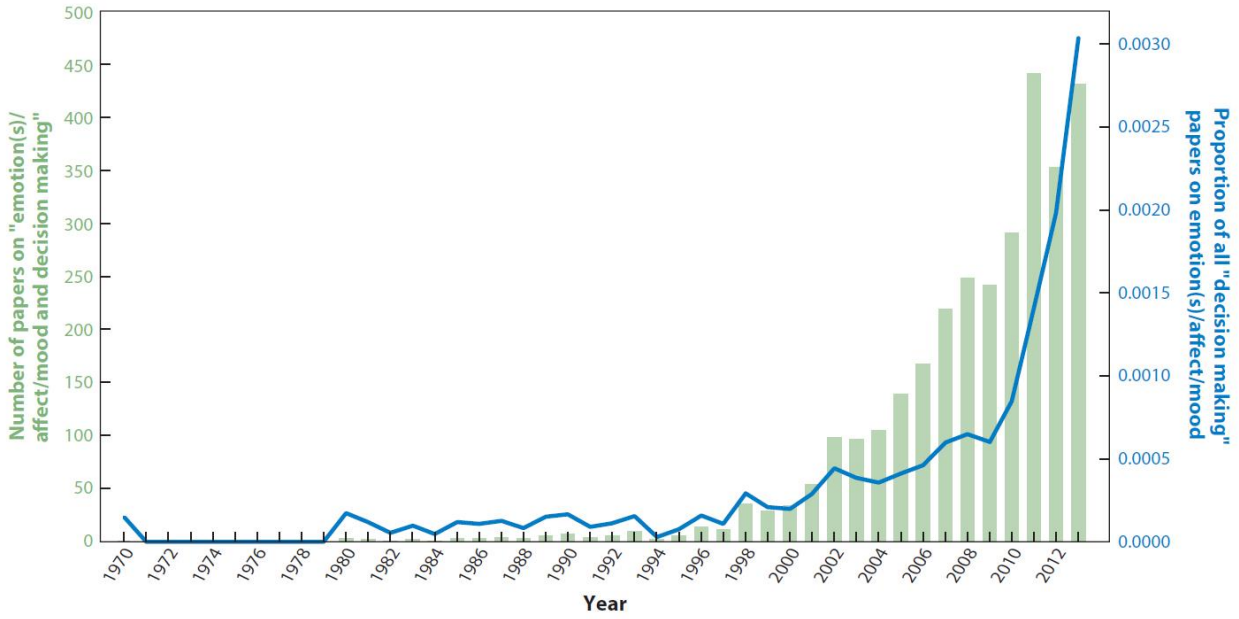

Figure 1

Number of scholarly publications from 1970 to 2013 that refer to "emotion(s)/affect/mood and decision making" (*green bars*) and proportion of all scholarly publications referring to "decision making" that this number represents (*blue line*).

Unsurprisingly, this relatively young subfield is only just beginning to grapple with fundamental questions about emotion and decision making. To provide the reader with a context for interpreting these discoveries, we present two brief primers, one on key concepts in the field of emotion and one on key concepts in the field of judgment and decision making.

S-IV. ADDITIONAL DEFINITIONS LIST

Rationality: accuracy and consistency of expressed beliefs as well as the degree to which choice reflects utility maximization

Heuristic: Mental shortcut that generally allows quick and efficient JDM but can lead to bias under certain situations

Bias: Systematic deviation from rational JDM

Prospect Theory: Risky choice model that allows for reference-dependence, loss aversion, risk-aversion for gains and risk-seeking for losses, and distortions of probability

Frame: Mental representation of a decision; the same decision can be perceived, structured, or interpreted differently, for example, by shifting reference points.

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