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Control Your Emotions or Follow Your Heart: Discussing the Contradictions in Psychology of Emotions and Behaviour

Reema Bansal[1] Dr. Randhir Singh Ranta[2]

[1]Research Scholar, Singhania University, Rajasthan, India

[2]Sr. Research Officer, Institute of Integrated Himalayan Studies, Hp, India

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INTRODUCTION

Get a grip… control your emotions… don't let your feelings get in the way! Listen to your heart…get in touch with your emotions… express yourself! These messages from the academic community, as well as popular treatments of emotion, are contradictory. The rationalist history of Western thought portrays emotions as fundamentally flawed, and something we must therefore control (Haidt, 2001). Yet, there has been another voice in history—and one echoed in recent evolutionary treatments of emotion—that suggests that emotions are wise and not to be ignored (Buss, 2001; Clore, in press; Keltner & Haidt, 1999; Ketelaar, 2004, 2005; Ketelaar & Clore, 1997).

Emotions do indeed pose a paradox. There is little doubt that emotions are a ubiquitous and a universal feature of our human nature (e.g., Ekman, 1992; Ekman & Friesen, 1971; Fessler, 1999), and thus it is hard to believe that emotions emerged through evolution only to disrupt judgment and decision-making. On the other hand, the phenomenology of emotion certainly suggests otherwise: The effects of emotion often seem objectively irrational and we feel the need to get them under control (Baumeister, Vohs, & Tice, this volume; Varey & Kahneman, 1992; Kahneman, 1999; Forgas & Ciarrochi, 2002).

In this paper we argue that an evolutionary perspective on emotions and behavior may help to resolve this paradox. To do so, we review two promising evolutionary approaches to emotion, discuss research linking particular emotions to specific adaptive problems, and argue that these theoretical arguments and empirical findings are consistent with the claim that the emotions often display evidence of being designed to aid, rather than hinder social decision-making. Finally, we conclude by suggesting that mismatches between our evolved emotional responses and the novel modern environments in which they currently operate often lead to outcomes we can legitimately view as suboptimal.

EVOLUTIONARY THEORIES OF EMOTION

Although numerous adaptive-evolutionary treatments of emotion have emerged over the years (e.g., Ekman & Davidson, 1994; Plutchik, 1994), an evolutionary- psychological approach distinguishes itself from other evolutionary approaches by adopting an explicitly adaptationist perspective (Barkow, Cosmides, & Tooby, 1992). An adaptationist perspective is guided by the simple assumption that the mind is comprised of many mental adaptations, each of which is the product of natural and sexual selection operating over many generations during the course of human evolution (Buss, Haselton, Shackelford, Bleske, & Wakefield, 1999).

Our ancestors faced a multitude of adaptive problems—evading predators, gathering food, finding shelter, attracting mates, caring for kin, and communicating with conspecifics, to name just a few (Barkow, Cosmides, & Tooby, 1992; Buss, in press). Because each of these adaptive problems required a unique solution (escaping a predator involves different skills than acquiring a mate), evolutionary psychologists argue that we should expect that our minds consist of a great variety of distinct psychological mechanisms, each shaped to address a specific adaptive challenge (Barrett, 2005; Symons, 1979). Similarly, we argue that it is reasonable to expect that humans have evolved a multitude of distinct emotions, each designed to deal with a specific set of adaptive problems.

Emotions affect the way that we think and behave in a variety of personal and social contexts (Clore, Schwarz, & Conway, 1994; Holmes & Anthony, this volume; Morris & Keltner, 2000; Zeelenberg & Pieters, 2005). Evolutionary approaches to emotion and social decision-making have ranged from broad theoretical models of emotion (Buck, 1999; Cosmides & Tooby, 2000; Tooby & Cosmides, 1990) to empirical investigations of specific emotions (Ketelaar & Au, 2003). One of the broadest theoretical approaches to emotion and decision-making

(emotions-as-commitment devices) uses the tools of experimental economics to explore game-theoretic aspects of emotions. A second theoretical approach proposes that emotions are superordinate cognitive programs that coordinate thoughts and behaviors in response to specific adaptive challenges. We describe each of these approaches before turning to a brief review of recent empirical research linking specific emotions to specific adaptive problems.

EMOTIONS AS COMMITMENT DEVICES

Humans can be coldly calculating and selfish, and like many animals, humans have preferences for immediate gains due to heavy discounting of the future (Ainslie, 1975; Ainslie & Herrnstein, 1981; Frederick, Loewenstein, & O'Donoghue, 2002). Theorists from Adam Smith (1759) to Robert Trivers (1971) and more recently economists Jack Hirschliefer (1987) and Robert Frank (1988), have argued that emotions operate as mechanisms for sustaining subjective commitments to strategies that run counter to speciously attractive immediate rewards. Frank summarized the logic of the theory as follows (Frank, 1988, p. 82):

The idea is that if the psychological reward mechanism is constrained to emphasize rewards in the present moment, the simplest counter to a specious reward from cheating is to have a current feeling that tugs in precisely the opposite direction. …because [the emotion] coincides with the moment of choice...it can negate the spurious attraction of the imminent material reward.

Frank illustrated this view with examples of how emotions such as love and guilt can influence social decision-making. When one experiences feelings of love for a romantic partner, for example, the immediate positive reward the emotion produces counteracts the pull of desire for an attractive other. Likewise, feelings of guilt immediately punish thoughts of selfishly cheating an ally and thus prevent the individual from compromising a cooperative relationship. In doing so, these emotions help us to stick with strategies that lead to rewards in the long run despite the fact that they often necessitate forgoing smaller immediate gains. For example, if one were drawn away from every possible romantic commitment by the prospect of finding a still more attractive mate, one could never reap the fitness benefits of long-term mateship, including cooperative child rearing (Hurtado & Hill, 1992; Marlowe, 2003; Pillsworth & Haselton, 2005) and assurance of mutual care in times of dire need (e.g., Nesse, 2001).

The bulk of the work on the commitment-device theory has been purely analytical (e.g., testing theoretical assumptions with mathematical models; see Hirshleifer, 1987, and Nesse, 2001, for reviews). Recently, however, this theory has also been subject to empirical tests. For example, in one study of the effects of guilt on cooperation, participants played an Ultimatum Game and emotions recorded after the first transaction were used to predict behavior one week later (Ketelaar, & Au, 2003). In an Ultimatum Game, participants are assigned the role of the proposer or respondent. The proposer is allotted a sum of money and allowed to give some percentage of it to the responder, who then decides whether to accept or refuse the offer. If the offer is accepted, the proposer and respondent split the money as proposed; if the offer is rejected neither party receives any money. In this study, the researchers found that over 90% of subjects who felt guilty after proposing an unfair offer (less than 50-50 split) reversed their behavior a week later and made a generous monetary offer (Ketelaar & Au, 2003). By contrast, less than 25% of the individuals who experienced no feelings of guilt made a similarly generous offer; in fact, the vast majority of them (> 75%) continued making selfish offers a week later. The effects of guilt on social decision-making observed in this study are consistent with the claim that individuals under the influence of certain emotions often make decisions that forego immediate benefits in favor of more profitable long-term outcomes (e.g., a cooperative alliance; Frank, 1988).

In sum, the immediate rewards or punishments that we feel when we experience certain emotions can serve as a potent counterweight to our tendency to overweight short- term gains. These emotions may appear irrational in the short run because they lead us to forgo sure gains, but ultimately they lead us to acquire still greater long-term benefits.

SUPERORDINATE COORDINATION THEORY

Perhaps the broadest and most inclusive evolutionary theory of emotions is one that views these states as superordinate cognitive programs (e.g., Cosmides & Tooby, 2000; Levenson, 1999; Tooby & Cosmides, 1990). If evolution has created a multitude of "microprograms," serving many different functions with outputs that sometimes conflict, there must be some way for the brain to selectively activate only the subset of programs needed when an organism faces a particular adaptive problem. Otherwise, the action of these mechanisms would be chaotic and self-defeating—does one flee or court, collect food or seek shelter, sleep or eat?

Cosmides and Tooby (2000; Tooby & Cosmides, 1990) propose that the emotions serve precisely this sort of governing function by orchestrating systems of perception, attention, goal pursuit, and energy and effectiveness, as well as by activating specialized inferences, recalibrating decision weightings, and regulating behavior. They illustrate using the emotion of fear: You can imagine walking alone at night and hearing some rustling in the brush. Your energies are aroused to ready you for action, you become acutely aware of sounds that could indicate that you are being stalked, the threshold for

detecting movement is lowered, you no longer feel pangs of hunger, attracting a mate is the farthest thing from your mind, you recall where there are good places to hide, and you act—by running, hiding, fighting, or ceasing all movement, depending on the circumstances.

Cues associated with ancestrally recurrent threats and opportunities such as being cloaked in darkness, viewing naked, nubile mates, or smelling delicious food can automatically turn on particular emotions, thereby activating specialized strategies that in ancestral environments would have led to targeted adaptive responses. Our everyday experiences provide evidence that this general hypothesis holds some merit. Fear, for example, results in protective responses including flight, whereas sexual desire results in the pursuit of a desired mate. In the next section, we also describe several lines of research demonstrating that (1) ancestrally recurrent cues readily elicit specific emotions and (2) specific emotions lead to targeted, functional outcomes. The relevant literature has grown substantially over the last several decades (see Haidt, 2003; Keltner & Haidt, 1999; Ketelaar, 2005 for reviews). In our brief review, we have selected examples that (1) demonstrate the function-specificity of emotions, (2) would be difficult to understand without evolutionary theorizing, and (3) represent the latest updates on important theoretical questions in the study of emotion.

ANCESTRAL CUES ELICT SPECIFIC EMOTIONS FEAR AND ANCESTRAL SOURCES OF DANGER

As we have already hinted, perhaps nowhere does there exist better evidence for the domain-specificity of emotion than in the domain of fear. Modern environments possess an abundance of lethal threats that hardly evoke a moment's notice. Humans routinely operate speeding automobiles, work around sources of electrical hazard, and expose themselves to carcinogenic agents without breaking a sweat. Yet, a single harmless stinging insect can bring about behavioral changes that are detectable for several city blocks. Why do humans appear to lack fear of objects that can kill (automobiles and electrical outlets) and yet display an almost debilitating fear of objects that present only a small threat (spiders and snakes)? In this section, we illustrate how an adaptationist view on the functional-specificity of emotions allows us to make sense of this otherwise puzzling array of fear responses.

Evolutionary psychologists argue that the non-random distribution of fear stimuli is a legacy of the evolutionary past. The absence of fear responses to evolutionarily novel sources of danger (automobiles, electrical outlets, etc.), for example, suggests that emotional responses are not simply the product of rational deliberation. Instead, human fears are the result of domain-specific mechanisms that correspond to ancient sources of harm such as dangerous animals, bodily insults, heights, social evaluation, and the risk of social exclusion (Costello, 1982; Marks & Nesse, 1994; Nesse, 1990; Ohman & Mineka, 2001; Seligman, 1971). Snake fear is perhaps the best researched example. Although snakes do not pose much of a risk in modern environments, snakes and humans have coexisted for millennia and snake bites can be lethal. In the laboratory, researchers can condition people to fear snakes and snake-like stimuli using mild electrical shocks. By contrast, it is difficult to condition fear to other stimuli, even those with strong semantic associations with shock (e.g., damaged electrical outlets; see Ohman & Mineka, 2001 for a review). Unlike responses to evolutionarily novel sources of harm, biologically prepared fear responses (snakes, spiders, etc.) are notoriously difficult to extinguish (see Mineka, 1992; Cook & Mineka, 1990; Nesse, 1990; Marks & Nesse, 1994; Seligman, 1971 for reviews).

One of the curiosities of evolved fear responses is that they often appear over- responsive (Nesse, 1990, 2005). For example, prey animals express startle and flight responses at rates that suggest that they overestimate risk (Bouskila & Blumstein, 1992), and the human tendency to acquire and retain snake fears on the basis of slim evidence can also be conceived of as a bias (Haselton & Nettle, in press). Rather than indicating irrationality, this hyper-sensitivity to particular environmental cues may be due to error management (Haselton & Buss, 2000; Haselton & Nettle, in press). For example, when the costs of expressing a defensive reaction are small (e.g., a few calories spent fleeing), whereas the consequences of failing to do so can be deadly (failing to evade a predator), it pays to err on the side of making false positive errors rather than false negative errors, even if this increases overall error rates (Bouskila & Blumstein, 1992; Nesse, 1990; Haselton & Nettle, 2005). In sum, adaptive over-responsiveness in our emotional reactions may sometimes lead to the mistaken impression that defensive emotions (fear, anxiety, and aggression) are not well designed.

SPECIFIC EMOTIONS AND SEX-LINKED ADAPTIVE PROBLEMS

Function specificity is evident not only in cross-species conflicts (humans vs. dangerous animals), but also appears in a variety of within-species conflicts for which humans appear to have evolved special-purpose emotional machinery. For example, men and women have historically faced different adaptive problems in the domain of mating, and evolutionary psychologists have therefore proposed

that the sexes have evolved different solutions to a number of sex-linked adaptive problems.

Differences in parental investment can produce some of the largest conflicts between the sexes. Because men's reproductive investments can be very small, the upper limit on reproductive success for males is predicted, quite simply, by the number of fertile partners to whom they gain access (Symons, 1979; Trivers, 1972). Women's investments, on the other hand, are always large—at minimum 9 months of pregnancy, typically followed by years of breastfeeding in traditional societies. Thus, the optimal strategy for a man and a woman will often be in conflict. For women, mate quality looms larger than mate quantity, whereas for some men who are able to successfully pursue a short-term mating strategy, the reverse can certainly be true (see Gangestad & Simpson, 2000), and a variety of robust sex differences support this proposal. Women, for example, tend to desire longer delays before sex in order to assess a mate's quality and disposition to invest. Men, on average, desire sex earlier in relationships and they maintain a desire for sexual variety even after finding a long-term mate (Schmitt et al., 2003; also see Buss, 2003, for a review).

Differences in the evolved desires that underpin these sex-differentiated adaptive problems can result in sexual strategies that produce conflict. Buss (1989) proposed that negative emotions such as anger and fear may aid an individual in dealing with the attempts of others to interfere with one's strategic goals: When a source of interference is detected, negative emotions (e.g., anger) can draw attention to the source of interference, mark important events for storage in memory, and activate behavioral routines that serve to minimize current and future interference. To the degree that the sources of strategic interference differ between the sexes, one expects to observe sex differences in the emotional responses that they elicit.

An extensively-researched example is sexual jealousy. Due to internal female fertilization, men are uncertain of paternity, whereas women are always certain of maternity and hence they do not face this problem. Thus, evolutionary psychologists proposed that men should experience greater jealousy in response to cues to sexual infidelity than women do (Daly, Wilson, & Weghorst, 1982; Buss et al., 1992). Although research on this hypothesis is fraught with controversy (Buller, 2005; Buss & Haselton,

in press; Harris, 2003; Sagarin, 2005), the bulk of the evidence, including many cross- cultural studies, has found that men report greater jealousy in response to imagined infidelity than do women, though clearly both men and women find all forms of infidelity extremely upsetting (e.g., Buss et al., 1992; Buss & Haselton, in press; Haselton, Buss, Oubaid & Angleitner, 2005; Sagarin, in press). Also consistent with the jealousy hypothesis, men express more jealousy if their partners are higher in reproductive value (younger and or more attractive; Buss & Shackelford, 1997) and when their partners are nearing ovulation and the likelihood of extra-pair conception as a result of an affair is greatest (Gangestad, Thornhill, & Garver, 2002; Haselton & Gangestad, 2005).

In the realm of mating deception, women respond with far greater upset in response to a partner exaggerating his feelings in order to have sex or failing to maintain commitments after sex, whereas men respond with greater upset in response to being sexually led on (Haselton et al., 2005). Deceptive exploitations of sex-linked mate preferences also produce sex differences in degree of emotional upset. Women are more upset if a partner exaggerates his income or status, whereas men's upset is piqued by a long-term partner exaggerating her faithfulness or underreporting her level of sexual experience (Haselton et al., 2005).

Emotions also track experience-contingent shifts in costs and benefits for the sexes. First-time intercourse signals the possibility of pregnancy for a woman and therefore the importance of securing commitment from her partner. For men who pursue a short-term mating strategy, first-time sex signals both that a goal has been achieved and that there is a possibility of becoming entangled in an unwanted long-term relationship. After first-time sex, the feelings men and women experience do indeed differ. Women more than men experience a positive affective shift toward increased feelings of commitment for their partners (Haselton & Buss, 2001), whereas, men who have had many sex partners (and therefore successfully pursue a short-term strategy) experience a negative affective shift marked by a drop-off in physical attraction to their partners (Haselton & Buss, 2001). These effects are hypothesized to prompt behaviors to secure investment (for women) or to extricate oneself from a potential romantic entanglement (for short-term oriented men).

The sexes may also differ in their feelings of regret surrounding sex. The affective experience of regret is hypothesized to function to improve future decision making by enabling people to avoid mistakes that have important consequences (Roese, 2005; Haselton, Poore, von Hippel, Gonzaga, & Buss, 2005; Zeelenberg, 1999). If this hypothesis is correct, feelings of regret should track sex-differentiated adaptive problems including problems of careful partner choice for women (more than men) and problems of attracting multiple mates for men (more than women). Haselton and colleagues proposed that missed sexual opportunities (sexual omission) would have been more reproductively costly for ancestral men than for women, whereas sexual encounters with an undesirable or non-investing partner (sexual commission) would have been more reproductively costly for women than for men (Haselton et al., 2005). As predicted, in

response to hypothetical regret scenarios, women more than men reported that they

would regret having sex in a relationship that turned out to be only short-term, whereas men more than women reported they would regret missing an attractive sexual opportunity (Haselton et al., 2005). These effects were corroborated by participants' spontaneous reports of past experiences: although women and men both listed more sexual commission regrets than sexual omission regrets, women reported that they regretted acts of sexual commission more intensely than did men.

In sum, there is growing evidence that the emotions men and women experience are differentially sensitive to cues linked with the specific adaptive problems each sex faced during evolutionary history. Men react more strongly to sexual infidelity, being sexually led on, and being deceived about a partner's tendency to be faithful. Men experience predictable affective shifts after first-time sex, and they report that they would strongly regret missed sexual opportunities. Women, on the other hand, react more strongly to being deceived about a man's level of commitment in order to get sex and about his level of status. Women experience a predictable increase in feelings of commitment to a partner after first-time sex, and they experience stronger regrets after having sex with a partner who turned out not to be desirable as first believed.

THE FUNCTION-SPECIFICITY OF MORAL DISGUST

Emotions should be sensitive not only to the on-average differences in fitness costs and benefits between the sexes but also to individuating circumstances that confront members of the same sex. We now turn to two such examples in the domain of disgust.

Many theorists have proposed that disgust is designed to reject toxic or pathogenic substances (e.g., Rozin, Lowery, & Ebert, 1994) and to prevent costly sexual behaviors—for example, engaging in sex with biological relatives (Fessler & Navarrete, 2003; Lieberman, 2003). Many sources of evidence indicate that feelings of disgust are indeed opposed to feelings of sexual desire (see Fessler & Navarrete, 2003, for a review).

Lieberman (2003; Lieberman, Tooby, & Cosmides, 2003) proposed that a reliably occurring cue to siblingship is coresidence during childhood, and therefore length of coresidence should be associated with greater disgust in response to imagined sexual activities with a sibling and to greater moral disapproval of third party incest. Not surprisingly, Lieberman found that length of coresidence strongly predicted degree of relatedness, but length of co-residence also positively predicted the degree of disgust men and women reported in response to imagining sexual activities with siblings, ranging from tongue-kissing to having sexual intercourse (Lieberman, 2003; Lieberman et al., 2003). Siblings who coresided for longer periods of time also expressed greater moral sentiments prohibiting sex between relatives (Lieberman et al., 2003; also see Fessler & Navarrete, 20004, for converging results). Coresidence time predicted incest aversions after controlling for actual degree of relatedness, suggesting that time spent living together is possibly the cue to which the evolved psychology of incest avoidance is most strongly attuned (Lieberman et al., 2003). These results are striking given that the subjects in these studies (Western undergraduates) have access to explicit information about true sibship, and yet the effects of relatedness are trumped by the hypothesized ancestral cue (coresidence).

The onset of ovulation signals greater risk of conception for women and hence greater costs of suboptimal matings. Thus, Fessler and Navarrete (2003) proposed that near ovulation women should experience greater disgust sensitivity in the sexual domain but not in other domains (e.g., food, body envelope violations, or hygiene). As predicted, they found that women's probability of conception based on self-reported cycle day significantly predicted disgust sensitivity in the sexual domain, and only in the sexual domain, of the Disgust Scale (Haidt et al., 1994). In sum, these results demonstrate that two cues which were likely to predict ancestral costs of sex—length of coresidence and female cycle position—elicit sexual disgust.

EMOTIONS AND BEHAVIORAL OUTCOMES

We have already shown that emotions show an adaptive fit with the circumstances that elicit them, presumably because emotions tended to lead to adaptive outcomes in those circumstances ancestrally. However, emotions do not simply evolve because they are activated by highly specific stimuli; rather, they evolve because they yielded functional responses with real fitness effects—for example, by adaptively shifting perceptions, behaviors, and decisions. Examples of emotional influences on perception, behavior, and decision-making are well-known (Clore & Storbeck, this volume; Clore, Schwarz, & Conway, 1994; Ketelaar & Clore, 1997), yet much of this research has focused on detailed accounts of the proximate mechanisms through which emotions influence these phenomena. In this next section we focus an evolutionary lens on these domains to illustrate how an adaptationist perspective can shed light on the ultimate cognitive and behavioral functions of emotions.

EMOTIONS AND PERCEPTUAL SHIFTS: FEAR VS. ROMANTIC AROUSAL

One prediction of Cosmides and Tooby's superordinate coordination theory (2000) is that emotions should change our perceptions of others in evolutionarily predictable ways. There are several recent empirical examples that are consistent with this expectation.

In ancestral environments, between-group differences in appearance and behavior (e.g., tribal markers, signaled differences in coalition membership, etc.) would have activated the psychology of inter-group conflict. To the degree that this intergroup psychology has been shaped by evolutionary selection pressures, we might expect that features of modern environments that resemble these intergroup cues and markers will activate this ancient psychology (Kurzban, Tooby, & Cosmides, 2001; Sidanius & Veniegas, 2001). Moreover, as previously noted, emotions might play an important role in determining how we process these cues. Specifically, certain emotions might make us more responsive, and in some cases, over-responsive to particular cues that would have been predictive of specific threats and opportunities in ancestral environments. Ambient darkness, for example—a danger/fear cue—increases racial and ethnic stereotypes connoting violence, but has little effect on other negative stereotypes such as laziness or ignorance (Schaller, Park & Mueller, 2003).

Maner and colleagues (Maner et al., 2005) hypothesized that fear would increase biases toward inferring aggressiveness in others (particularly members of coalitional outgroups), whereas sexual arousal would increase men's bias toward overinferring sexual interest in women (Haselton & Buss, 2000). They showed men and women clips of scary or romantically arousing films, and then asked them to interpret "micro- expressions" in photographs of people who had relived an emotionally-arousing experience but were attempting to conceal any facial expressions that would reveal it (the faces were actually neutral in expression). In the fear condition, the study participants, who were mostly White, "saw" more anger on male faces, especially the faces of out group males (Blacks and Arabs). The fear manipulation had no effect on perceptions of sexual arousal in the faces. In the romantically arousing film condition, men perceived greater sexual arousal in female faces, particularly when the faces were attractive. The arousal manipulation did not increase men's perceptions of sexual arousal in other men's faces, and the arousal manipulation did not increase women's perceptions of sexual arousal in any of the faces. Thus, the effects were emotion and target specific, and for sexual arousal, sex specific. When fearful, men and women perceived greater threat from ethnic outgroup members; when sexually aroused, men but not women perceived greater arousal in attractive opposite-sex faces.

LOVE AND COMMITMENT

Humans pursue a mix of mating strategies. Some highly desirable men can and do engage in a multiple-female mating strategy, either through maintaining simultaneous affairs with several women (Gangestad & Simpson, 2000), or through serial remating of progressively younger women—effectively dominating the reproductive careers of many females (Buss, 2003). Men who are less able to pursue such strategies can still gain fitness advantages by committing to an exclusive long-term partnership and investing heavily in each child, thus ensuring greater offspring survival, health, and success in adulthood (Hurtado & Hill, 1992; Marlowe, 2003; also see Gangestad & Simpson, 2000). Women also engage in mixed mating strategies (Gangestad & Simpson, 2000), though most evidence suggests that they have a stronger preference for long-term partnerships than short-term affairs (Buss, 2003).

Although the optimal mating strategy for every ancestral human was not the same, many (perhaps the majority) would have benefited from exclusive coupling, at least at some point in their lives (Pillsworth & Haselton, 2005). Given the temptation of romantic alternatives, and humans' proclivity to overweight short-term temptations, Frank (1988; also see above) hypothesized that the emotion of love serves as a commitment device. Just as feelings of guilt evoked while considering cheating can deter romantic defection, feelings of love while contemplating one's mate can compel the individual to stay committed (Ketelaar & Goodie, 1998). Indeed, people in love seem to believe that there is no one more desirable than their own partner and they recurrently experience pleasant feelings toward their partner that may counteract the temptation to pursue alternative mating opportunities.

If love is a commitment device, as Frank proposed, it should suspend or suppress mate search. Along these lines, Gonzaga and colleagues (Gonzaga, Haselton, Smurda, Davies, & Poore, 2005) predicted that inductions of feelings of love should cause attractive alternatives to be less tempting. They further hypothesized that a closely related emotion, sexual desire, which is theoretically not a commitment device (e.g., Fisher, Aron, Mashek, Li, & Brown, 2002), would not yield the same effect. To test the hypothesis they made use of a subtle psychological phenomenon, thought suppression. Numerous studies have shown that when people attempt to suppress exciting thoughts they experience a paradoxical surge of the thoughts (the rebound effect) as compared to individuals who do not attempt to suppress those thoughts (e.g., Wegner, Schneider, Carter, & White, 1987; also see Wegner, Shortt, Blake, & Page, 1990). It follows that if love acts as a commitment device, this emotion may facilitate the suppression of thoughts of romantic alternatives, and thereby reduce or eliminate the rebound effect. To test this hypothesis,

Gonzaga and colleagues asked participants to either suppress or express the thought of an attractive other while writing essays about experiences of intense love or sexual desire for their current romantic partner. Consistent with their evolutionary hypothesis, after attempting to suppress the thought of the attractive other and relative to the sexual desire condition, participants in the love condition had fewer thoughts of the attractive other, indicating successful suppression of thoughts of the attractive other (Wegner & Gold, 1995).

These results provide support for the commitment theory of emotion and they suggest that discrete emotions have discrete effects—although love and desire were both elicited in reference to participants' romantic partner, only love facilitated suppression of thoughts of attractive others.

SPECIFIC EMOTIONS AND DECISION MAKING: FEAR, ANGER, & DISGUST

Social cognition research on emotion and decision-making has traditionally focused on the proximate mechanisms through which valenced mood states (positive and negative affect) influence decision-making. Recently, a number of researchers have highlighted the benefits of moving beyond the study of valence to look at the influence of specific emotional states on decision-making (Lerner & Keltner, 2000, 2001; Van Kleef, de Dreu, & Manstead, 2004). Some of this research has focused on the intrapersonal functions of emotions, such as when post-decision regret motivates one to subsequently pursue an opportunity he or she had previously rejected (Zeelenberg & Pieters, 2005).

An equally promising line of research has focused on the interpersonal functions of emotions such as when anger motivates one to punish a selfish contributor in a public goods game (Fehr & Gaetcher, 2002).

Studies that emphasize domain-specific influences of emotion quickly lead to the realization that not all negative emotions have the same effects on decision-making. For example**,** Fessler, Pillsworth, and Flamson (2004) proposed that although anger and disgust are similar in valance (both negative) they will have distinct effects on behavior. Anger is a response to experiencing a transgression and attempting to deter it through action against the source. Disgust, in contrast, is a response to a potential contaminant and it motivates distancing from the source. It follows that these two negative emotions should have very different effects on risk taking—anger should increase it and disgust should decrease it (see Lerner & Keltner, 2000, 2001; Lerner, Small, & Loewenstein, 2004 for non-evolutionary routes to this same conclusion). In addition, Fessler, Pillsworth, and Flamson hypothesized that there will be sex differences in the impact of these emotions on risk taking with men responding more to risks associated with intrasexual (male-male) competition and women responding more on risks in the domain of reproduction and child-rearing. These predicitions are based on the notion that, historically, the risk of being bested by a rival is likely to have exacted a larger fitness cost on men than on women, and thus men are expected to be particularly prone to take risks when primed to feel anger. Similarly, the risk of contamination is likely to have exacted a larger fitness cost on women than on men (e.g., through risks associated with pregnancy), and thus women are expected to be particularly averse to risks when primed to feel disgust. Consistent with these hypotheses, relative to controls, anger primes significantly increased male risk taking in an economic game with real monetary stakes; disgust primes had no such effect. Women's risk taking in the game was not affected by anger, but was substantially decreased by disgust. For women, one might expect even more dramatic effects if the task involved risks directly linked with contamination.

DISCUSSION

Functional approaches to emotion are not new in psychology. A variety of clinical, personality, and social-cognitive approaches to emotion have emphasized the role of emotion in social adjustment, mental health, subjective happiness, and well-being (e.g., see reviews in Baumeister, Vohs, & Tice, this volume; Clore & Storbeck, this volume; Erber & Markunas, this volume; Holmes & Anthony, this volume; Huppert, this volume; and Trope, Igou, & Burke, this volume). What is unique about an evolutionary approach to function, however, is its focus on why emotions operate in the manner that they do (questions about ultimate function) rather than questions about what emotions do (descriptions of proximate functions). We argue that this focus on ultimate functions yields novel insights (Ketelaar & Ellis, 2000) and in some cases can illustrate how seemingly irrational emotions aid rather than hinder reasoning. When viewed through a Darwinian lens, many of the proximate effects of emotion that appear to illustrate defects in reason can be viewed, instead, as evidence for well-designed influences on perception, decision-making, and behavior.

A focal point of any evolutionary psychological treatment of emotion is the concept of adaptation. Adaptations are specialized problem-solving machinery produced through natural and sexual selection operating over many generations during the course of human evolution (Buss et al., 1998). In this chapter we have attempted to support the utility of this adaptationist approach by illustrating empirical and theoretical contributions to our understanding of evolutionary fears and modern dangers, sex-linked

adaptive problems and the corresponding emotions that arose to address these problems, as well as a variety of emotion-outcome linkages (fear and perception, love and commitment, disgust and decision-making) that, as a collective, make sense only when viewed in light of evolution.

There are several implications of an adaptationist approach to emotion that future emotion research might consider. First, because emotions themselves are treated as cognitive programs (Tooby & Cosmides, 1990; Cosmides & Tooby, 2000), there is no dividing line between "emotion" and "cognition" that would make it sensible to contrast emotion with reason. Second, because we expect that emotions are tailored to a variety of distinct ancestral problems, we also expect to observe a great variety of emotions (rather than only a few), each with their own specialized functions. Moreover, when a single emotion operates in a variety of different domains in modern environments, we expect to observe that their effects will be moderated by contextual cues that harken back to ancestral adaptive problems. Finally, the perceptual, behavior and decision-making outcomes produced by emotions in these circumstances may sometimes make sense only when viewed from an adaptationist perspective.

Importantly, we wish to note that a focus on evolutionary insights does not entail that traditional approaches to emotion and cognition are somehow flawed. Instead, an evolutionary approach adds novel insights to current and previous emotion research, contributing to, rather than taking away from, our understanding of emotion and human nature. For example, empirical findings regarding the emotions-as-commitment devices approach are quite consistent with the familiar affect-as-information model in social cognition research (Schwarz & Clore, 1983, 1988). A central assumption of an affective- information view revolves around the idea that emotions can influence decision-making by virtue of providing information about outcomes. Research from this perspective shows us that individuals routinely consult their emotions (How do I feel about this choice?) before acting. Although this approach suggests that affective feelings provide valuable information for decisions, it does not tell us what this "information" actually refers to. Researchers using an evolutionary approach to affect-as-information have argued that "affective information" should be designed to provide information about the fitness relevant payoffs/utilities associated with particular strategy choices (Ketelaar, 2005; Ketelaar & Au, 2003; Ketelaar & Todd, 2001). Positive emotions and feeling states (happiness, lust) portend fitness benefits, whereas negative emotions (guilt, jealousy) portend fitness costs. When the influence of emotion on judgment is viewed in this light—as providing valuable information about likely future consequences—we believe that the traditional affect-as-information perspective is enriched and elaborated rather than critiqued and constrained. In this same spirit, we conclude that an adaptationist approach to emotion actually complements existing research by shedding light on the ultimate functions that may lie beneath the proximate effects that we observe in the lab.

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