

## Chapter 21

# Madmen: An Evolutionary Perspective on Anger and Men's Violent Responses to Transgression

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**Abstract** Though often described as leading to costly and irrational decisions, anger's effects on behavior are understandable when anger is viewed as an adaptation favored by natural selection. Anger motivates responses to transgression despite our propensity to discount the future, truncating ongoing transgressions and deterring additional transgressions. An evolutionary perspective sheds light on differences in anger's effects on male and female behavior. Due to differences in the variance of reproductive success between men and women, men can be viewed as playing a higher stakes game than women, one in which the fitness consequences of transgression are generally greater. Selection has therefore favored more risky aggressive responses to transgressions in men, with corresponding differences in the propensity to engage in other forms of risky behavior. This explains both robust sex differences in rates of violence and parallel patterns in other forms of risk taking. Similarly, the cost/benefit ratio of aggression and other forms of risk taking changes both across the lifecycle and as a function of reproductive status; involvement in violence and other risky behavior directly tracks such changes. Matching the physical architecture to the tasks at hand, changes in both male musculature and underlying neurophysiology likewise correspond to changes in the payoffs of aggressive responses to transgression.

Both ethnographic accounts (Lee, 1993; Burbank, 1994; Chagnon, 1997; Gladwin & Sarason, 1953; Johnson, Johnson, & Baksh, 1986; Myers, 1988) and Western judicial records (see Daly & Wilson, 1988; Ghiglieri, 1999) suggest that the emotion that English speakers label "anger" figures prominently in violent conflict. Although both the eliciting conditions and the local construals of anger vary cross-culturally, anger is likely one of the most universally identifiable emotions (Ekman, 1994; Haidt & Keltner, 1999; Johnson et al., 1986; Myers, 1988). Western observers frequently view anger as a destructive, or at least counterproductive, emotion. However, given the costs associated with this trait, the species-typical propensity to experience anger could only have evolved and been maintained if, in ancestral populations, possessing this attribute enhanced the probability of individual survival and reproduction. Note that this does not suppose that anger continues to have such effects today – due to changes in our social and ecological environments, features that increased survival and reproduction in the world of our ancestors can now have the opposite effect (witness, for example, the contemporary health consequences of our evolved preferences for sugar and fat). Note also

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that this position does not imply moral validation of anger or its consequences, as scientific explanations do not constitute ethical justifications. With these caveats in mind, if we are to understand anger's impact on our lives today, we must begin by asking what adaptive function it performed in the past.

The first step in inferring adaptive function is to consider the circumstances in which the phenomenon occurs. I begin with two observations: (a) anger is elicited by transgression against the actor or those whom the actor holds dear, and (b) the most common behavioral outcome of anger is an attempt to harm the transgressor. Transgression can be defined as the imposition of a cost on an actor that the actor does not pay willingly, where such unwillingness derives from the actor's valuation of his own welfare relative to the other party's welfare (see Tooby, Cosmides, & Price, 2006). For example, a doting mother awoken by her squalling infant does not construe the disturbance as a transgression, yet would likely do so had she been awoken by a neighbor's dog (see also Chapter 31 by Van Kleef and also Chapter 19 by Schieman, this volume).

Across species, access to resources, such as foodstuffs and mates, is a principal determinant of biological fitness. In nonhuman social species, such access is largely determined by dominance, the ability to displace a rival by dint of force or the threat thereof (Ellis, 1995). As the foundation of social hierarchies, in humans, dominance has been partially replaced by prestige, deference that is freely granted in recognition of merit (Henrich & Gil-White, 2001). However, while prestige is important in all societies, dominance continues to play a role in human hierarchies, and this is likely particularly true in small-scale societies, akin to those of our ancestors, that lack an organized state to effectively regulate violent conflicts. Correspondingly, in ancestral human populations, differences in the willingness and ability to truncate and deter transgressions will have been a determinant of differences in the ability to maintain control over resources, and hence of differences in fitness. This suggests that natural selection will have favored a disposition to respond aggressively to transgression. However, anger is much more complex than this conclusion implies. Consider the phrase "blinded by anger": As is equally true of Southern Californians, Bengkulu Malays (Fessler, 2001) and Pintupi Aborigines (Myers, 1988), people recognize that angry individuals are often aware only of their desire to inflict costs on those who have endangered them – other considerations either fade from consciousness or else lose their motivational salience (cf. "out of control" Chapter 22 by Potegal, this volume). This aspect of anger is almost certainly not accidental, but rather constitutes a key component of an evolved mechanism designed to limit transgression. To understand why, we must first consider a pervasive feature of the relationship between cost and time.

## **21.1 Time Discounting and the Response to Transgression: Why "Over-reacting" Pays Off**

Humans, like other vertebrates, steeply discount the future – the motivational salience of rewards or punishments declines rapidly as the intervening delay increases (Frederick, Loewenstein, & O'Donoghue, 2002). The future plays a critical role in calculations concerning the utility of responding to transgression, since an aggressive response can benefit the responder not only by truncating the ongoing transgression but also by deterring future transgressions. Note, however, that even if the actual costs that multiple transgressions inflict on an individual are the same whether the transgression occurs in the present or in the future, because the future is steeply discounted, transgressions will possess wildly varying punitive salience as a function of time from the present – the longer the predicted delay before a potential transgression, the less motivational significance it holds for the victim. As a consequence, if the costs of responding to an ongoing transgression greatly exceed the benefits of truncating it, discounters may fail to respond due to subjective devaluation

of the additional benefit of deterring future transgressions. The result of such myopia, however, is that, over the long term, the individual will incur sizable costs – one can be “nickel-and-dimed to death” because one is never willing to pay the price of confronting the thief caught stealing a nickel. It is therefore advantageous to commit early to a strategy of significant deterrence. Emotions in general may motivate such commitment (Schelling, 1980), and anger in particular may usefully blind us to the immediate costs of responding to transgression, counteracting some of the detrimental consequences of time discounting (Hirshleifer, 1987; Frank, 1988).

If one crucial function of the response to a current transgression is the deterrence of future transgressions, then the responder should be willing to incur costs up to the sum of the costs of all possible future transgressions reduced by the probability that each will occur. In situations that hold the potential for a large number of future interactions, and hence a large number of possible transgressions, this sum may be huge. Accordingly, the costs that an individual ought to be willing to incur in responding to a given transgression may vastly exceed the costs that the given transgression inflicts on him – a strategically appropriate response will often appear “disproportionate” to the transgression. Such responses dramatically raise the costs inflicted on individual transgressors, with corresponding increases in the likelihood of truncation and deterrence. Anger is thus partly explicable as a mechanism produced by economically rational natural selection in order to operationalize this logic in a species of steep time discounters – when we are angry we are often motivated to inflict suffering on the transgressor that greatly exceeds our own, even at great expense to ourselves (Frank, 1988; McGuire & Troisi, 1990; Edwards, 1999, pp. 140–141).

The utility of responding disproportionately to transgression hinges on discouraging future transgressions, of which there are two types, namely (a) additional transgressions by the same transgressor, and (b) transgressions committed by others. The propensity to respond in a seemingly disproportionate fashion can evolve only when certain conditions are met. First, social relationships must extend beyond single interactions if type (a) transgressions are to be discouraged. Second, if type (b) transgressions are to be precluded, individuals must be able to (i) witness (as third parties) an actor’s responses to others’ transgressions and/or (ii) detect others’ willingness, or lack thereof, to transgress against a given actor. All of these criteria are fulfilled in many primate species, and the same was almost certainly true of our ancestors. Furthermore, the existence of language makes it possible for an actor to establish a *reputation*, that is, others can learn of his propensity to react disproportionately even before meeting him (Frank, 1988; Daly & Wilson, 1988; Schelling, 1980). Because a reputation can greatly enhance deterrence effects, the evolution of language presumably increased the (already strong) selective pressure favoring the presence of anger as a mechanism motivating aggressive response to transgressions.

## 21.2 Sex Differences in the Outcome Behaviors Associated with Anger

As reviewed by both Fischer and Evers and Schieman in this volume, contrary to many folk models, research suggests that men and women do not reliably differ in the frequency or intensity of their experience of anger (if anything, women may slightly exceed men in this regard). From an evolutionary perspective, this similarity across the sexes is understandable given that the overarching logic of the need to truncate and deter transgressions is the same for men and women. Where men and women do differ, however, is in the behaviors resulting from anger. Whereas men are more likely to approach the targets of their anger directly, and more likely to physically aggress against them, women are more likely to seek the aid of allies, and to engage in indirect aggression through the manipulation of social relationships and attempts to inflict reputational damage (see Chapter 20 by Fischer and Evers, this volume; Chapter 19 by Schieman, this volume; Campbell, 2002,

pp. 90–94; Kring, 2000). Although some authors try to downplay differences in anger-related outcome behaviors between men and women, the marked sex difference in participation in lethal violence suggests that, with regard to one of the most fitness-relevant forms of action, anger indeed leads to very different behaviors in the two sexes.

Around the globe, men have a near-monopoly on murderous violence (Daly & Wilson, 1988; Daly & Wilson, 1990; Ghiglieri, 1999). Critical to the present argument, this is true not only of instrumental violence but, more importantly, of violence linked to altercations – whereas it is arguable whether anger plays a role in the former, no such ambiguity surrounds the latter. Equally telling, despite the fact that simply apologizing or walking away often de-escalates altercations (Chapter 22 by Potegal, this volume), men are vastly more likely not only to kill but also to be killed in spontaneous acts of violence, a sex difference that, with few exceptions, holds across disparate cultures (Gartner, 1990; Daly & Wilson, 2001; Lambert, 1994).

Do sex differences in involvement in homicide truly reflect differences in the way in which anger influences men's and women's willingness to engage in potentially costly confrontations? Might it not simply be that males are more likely to be involved in violent confrontations because the costs of violence are usually lower for them than they are for women, with homicide representing an erroneous calculation on the victim's part? Two different avenues of research suggest that the answer is no.

First, while physical size is a partial determinant of sex differences in participation in violence (Felson, 1996), the relationship between coercive power and aggression is not as simple as this implies. Sell, Tooby, and Cosmides (2009) compared measures of physical strength in US subjects with self-reports of the frequency and intensity of anger, proneness to respond aggressively to transgressions, involvement in physical fights, and endorsement of coercive tactics; similar comparisons were also made in a second sample using anthropometric proxies for strength. In both studies, strength was positively correlated with all of the dependent variables, but only for men – in contrast to the prediction that follows from the claim that sex differences in violence are due to differences in size and strength, physically strong women are not more angry, more confrontational, more violent, or more coercive than are physically weak women. The relationship between strength, anger, and violence, it seems, is a uniquely male one.<sup>1</sup>

A second line of evidence arguing against the claim that sex differences in participation in violence are due primarily to sex differences in size and strength derives from a more careful reading of the epidemiological data. If women's smaller size and lesser strength were the limiting factor in their involvement in violence, then we would expect female/female homicide rates to be equivalent to male/male homicide rates, yet this is not the case. Between 1976 and 1998 male/male killings accounted for 65% of all homicides committed in the United States, while female/female killings constituted only 2.4% (Fox & Zawitz, 2000). Across societies ranging in scale from modern nation-states to small hunter-gatherer bands akin to those in which our ancestors lived, men are vastly more likely to kill men than women are to kill women (Daly & Wilson, 2001). Moreover, size and strength are no longer unique determinants of the potential costs of involvement in anger-fueled altercations – in the contemporary United States there are no significant obstacles to female firearm ownership, yet, between 1976 and 1987, women committed only 13.3% of all homicides involving a gun (Kellermann & Mercy, 1992). Even if we consider the context in which women are most likely to kill with a gun, the sex difference does not disappear: Murder of a spouse or intimate acquaintance

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<sup>1</sup> Congruent with Sell et al.'s findings, Klimesmith et al. (2006) demonstrated that handling a gun (which, like physical strength, is a determinant of the outcome of conflict) increases aggression in men; the above perspective suggests that any such effect should be reduced, or absent, in women.

constituted 54.2% of all firearm homicides committed by women in the United States (in contrast to only 11.1% of male firearm homicides) (Kellermann & Mercy, 1992). Spousal murder is an “equal opportunity” crime, since in many cases, a firearm used to kill a spouse was present in the home prior to the assault, i.e., roughly equivalent access existed for both husband and wife (Foster, Veale, & Fogel, 1989; Bailey et al., 1997; Kellermann, Somes, Rivara, Lee, & Banton, 1998). Nevertheless, in the United States women commit only 42.6% of firearm spousal homicides, and even this figure gives a vastly inflated impression of the female propensity toward spontaneous violence since, unlike husbands, wives often kill in self-defense (Kellermann & Mercy, 1992; Wilson & Daly, 1992b). In short, it is untenable to argue that the sex difference in the propensity for direct, potentially violent aggression following elicitation of anger is due to some role-related aspect of persons deriving from morphological, rather than psychological, differences between men and women. Indeed, rather than being the cause of behavioral differences between men and women, differences between male and female bodies likely derive from the same evolutionary factors as do the psychological differences in question.

### **21.3 The Evolutionary Origins of Sex Differences in Responses to Transgression**

The higher the stakes in any transgression, the more willing both parties should be to expose themselves to risks in order to win out over the other. Undoubtedly, in ancestral human populations, there were times when women faced high-stakes transgressions – think, for example, of the dangers posed by an infanticidal enemy, a rapist, or a desperate competitor during a famine. However, in contrast to the episodic and irregular nature of these events, for men, high-stakes transgressions are likely to have been both more frequent and more inevitable. As has been extensively argued by Margo Wilson and Martin Daly (see Daly & Wilson, 2001 for an overview), the reason lies in the nature of human reproduction.

Ethnographic surveys of marriage patterns around the globe suggest that, at a societal level, the most common human reproductive pattern is one of mild polygyny, meaning that many men marry a single wife, some men never marry, and a few men marry multiple wives (Murdock, 1967). Convergent evidence that this reproductive pattern characterized ancestral human populations derives from studies of the human body. Although there is variation across extant populations (Gaulin & Boster, 1992), men are typically 4–10% larger than women and considerably stronger. Comparisons across primates reveal that the degree of sexual dimorphism in size characteristic of a species in part corresponds with the degree of polygyny in the mating system (Plavcan, 2001). This variation can be understood in terms of the factors that determine the reproductive success of the two sexes. Due to the costs of gestation and lactation, mammalian females must invest a great deal in each offspring. The energetic and nutritional demands of this investment are such that access to resources is a principal determinant of female mammalian reproductive success. In contrast, although, as the human case demonstrates, males are capable of extensive investment in their offspring, this is not a prerequisite for male reproduction, and many primate males invest little or nothing in this regard. Hence, for males, reproductive success is principally determined by the degree of access to females. Given that sex ratios are generally balanced, polygyny thus necessarily introduces competition into male mating behavior – because access to females is the primary determinant of male reproductive success, the more polygynous the mating system, the higher the stakes for each male competitor, as the winners will leave many more offspring than the losers (who may not leave any at all). The greater the stakes in male–male competition, the more that it pays to invest in costly armaments. Hence, whereas female body size appears to reflect efficient exploitation of the resources available

in the given environment, in polygynous species, males appear to be “overbuilt” – their greater size and strength, inefficient when viewed in ecological terms, are presumably favored by natural selection in part due to the reproductive benefits that successful males achieve through dominance.

In seasonally breeding animals, male–male conflicts cluster in space and time around fertile females, as males attempt to both transgress against other males and defend against such transgressions in order to monopolize reproductive opportunities; outside of the breeding season, males are more tolerant of transgressions, and less interested in transgressing, since the stakes are much lower. However, in species such as ours that lack a distinct breeding season, sensitivity to transgressions cannot be regularly relaxed. Moreover, in long-lived, highly social creatures like ourselves, the scope of male–male interactions with potential reproductive consequences expands well beyond direct conflicts over access to females or territory: because even transgressions far removed from reproductive opportunities may set precedents that later encourage or discourage such direct-payoff transgressions, males must be vigilant in a wide variety of contexts. The existence of linguistically encoded reputations further increases this effect, enhancing the potential importance of a huge variety of transgressions. Lastly, the fact that, unlike other apes, human males often engage in extensive investment in their mates and offspring likely further exacerbated this situation via two avenues. First, the risk of misallocation of resources due to cuckoldry further increases the selective advantages of male psychological attributes that deter transgression (Buss, Larsen, Westen, & Semmelroth, 1992; Wilson & Daly, 1992a). Second, with male parental investment a possibility, the ability to obtain and retain resources becomes an important determinant of a man’s attractiveness to women (Buss, 1989). Accordingly, men who can successfully deter transgressions may be more attractive to women by virtue of the physical and economic security they offer.

Together, the above factors are likely to have selected for a sex difference in the subjective response to transgression – because, averaged over time, the stakes to be won or lost in transgressions were considerably higher for men than for women, consistent with dimorphism in size and strength, selection is likely to have favored males who, in comparison with females, were both more easily and more dramatically blinded by anger; the result, tragically, is the male propensity for direct aggression against, and an unwillingness to back down from, the targets of anger. In contrast, in responding to transgression, women frequently adopt lower-risk strategies that rely on political tactics: compared to men, when angry, women are more likely to cry (see Chapter 20 by Fischer and Evers, this volume), a signal that serves to recruit aid from allies (Fessler & Moya, 2009); they are more likely to turn to others for support (reviewed in Kring, 2000) and are more likely to harm the target of their anger through gossip and alliance manipulation (reviewed in Campbell, 2002, pp. 90–94).

## 21.4 Sex Differences in Non-aggressive Risk Taking

Convergent evidence in support of the argument that an evolutionary history of male intrasexual competition is responsible for the sex difference in violent responses to transgression comes from behavior that is not motivated by anger (Wilson & Daly, 1993; Daly & Wilson, 2001). Risk taking in nonconflictual situations can serve many of the same ends as confrontational risk taking by establishing a reputation for insensitivity to costs (Daly & Wilson, 2001) – competitors will think twice before transgressing against someone who routinely risks life and limb (a benefit that explains the exacerbating effects of an audience on men’s, but not women’s, risk-taking behavior [Daly & Wilson, 2001], as well as the fact that men engage in more recreational risk taking than would be optimal if their sole goal was to impress women [Farthing, 2005]). Hence, because the decision not to walk away from a brewing conflict is a decision to take risks, patterns of nonviolent risk taking

provide additional evidence that the sex difference in homicide participation stems not from a difference in costs but rather from a difference in sensitivity to them (Wilson & Daly, 1993; Daly & Wilson, 2001). For example, controlling for distance driven, at all ages except the elderly, in the United States men are more likely to be involved in fatal automobile accidents than women (Massie, Campbell, & Williams, 1995); tellingly, men are particularly overrepresented in accidents caused by a loss of control, as occurs during risky maneuvers (Tavris, Kuhn, & Layde, 2001). Men are likewise more likely to be involved in auto accidents in Spain (Claret et al., 2003), Thailand (Böhning & Na Ayutha, 1997), Chile (Bedregal et al., 1997), and the Netherlands (Kingma, 1994). U.S. male undergraduates are more likely than their female compatriots to drive, swim, or boat while under the influence of alcohol, and less likely to wear a seat belt (West, Moskal, Dziuban, & Rumbough, 1996). Among all but the elderly, Finnish men are more likely than Finnish women to be injured or killed in an accidental fall (Malmivaara, Heliövaara, Knekt, Reunanen, & Aromaa, 1993), and Dutch men are more likely than Dutch women to be injured in accidental falls, injured by a sharp instrument, and injured by falling objects (Kingma, 1994); likewise, Korean men are more likely than Korean women to suffer injuries requiring hospitalization (Paek, Chun, & Cho, 2007). Lest these patterns be dismissed as artifacts of cultural norms regarding the meaning of driving styles, a gendered division of labor, etc., consider a domain in which no such models apply, the epidemiology of rattlesnake bites: in California, 93% of bite victims are male; this is clearly a product of a sex difference in willingness to approach dangerous animals, as 85% of bites occur on the finger or hand (Wingert & Chan, 1988); similarly, in Arizona, 64% of male bite victims recognized an encounter with a snake but did not attempt to move away, while the same was true of only 9.1% of female victims (Curry et al., 1989). Turning to interactions with another dangerous reptile, 85.4% of the victims of alligator attacks in the United States are male, with “attempting to capture/pick up/exhibit” constituting the commonest precipitating activity (Langley, 2005). Men literally place their hands, and their futures, in death’s jaws.

### ***21.4.1 Aggressiveness and Impulsivity, Constituents of the Male Flash of Anger***

In light of its more frequent and more extreme manifestation in men, I term the experience of intense rage in response to transgression that leads to sudden physical aggression *the male flash of anger*. Although it is subjectively experienced as a single, unified event, the male flash of anger probably consists of at least two discrete motivational components. First is *the competitively aggressive component*, the desire to dominate others (including, but not limited to, the desire to promote one’s own interests at others’ expense). In the event of transgression, this orientation manifests as a desire to harm the transgressor. Second is *the risk indifference component*, the willingness to subject oneself to danger in order to promote one’s own interests. In the event of transgression, this orientation manifests as an insensitivity to the potential costs of efforts to harm the transgressor. As noted earlier, indifference to current costs is a core element in anger’s utility as a mechanism to counteract time discounting in protecting against transgression. Additionally, inherent features of the dynamics between actor and transgressor further favor indifference to risk. First, since transgressions are often brief, if a reaction is to effectively truncate a transgression, it must take place quickly. Second, rapid reactions are more effective than delayed reactions at deterring additional transgressions. This is because (a) rapid reactions eliminate a time lag during which further transgressions can occur, and (b) transgressors discount the future relative to the present, thus they will be more dissuaded by the prospect of an immediate reaction than by a delayed reaction of equivalent intensity. Hence, for several reasons, immediate aggressive responses to transgressions are more effective than delayed responses. However, because immediate responses do not allow the actor to control the circumstances

surrounding the action to the same degree as delayed responses, immediate responses generally entail greater risk than delayed responses. The value of immediacy thus further favors risk indifference in reactions to transgressions.

Consistent with the above logic, experimentally induced anger leads men to forgo a guaranteed monetary payout in favor of a risky bet; despite producing the same self-reported intensity of anger in women, this procedure has no effect on women's inclination to gamble (Fessler, Pillsworth, & Flamson, 2004). The male propensity for direct aggression in response to transgression thus reflects the greater male propensity to become blind to costs, and see only benefits, when angry.

### ***21.4.2 Probable Physiological Substrates of the Male Flash of Anger***

Although complex psychological phenomena are unlikely to reduce to singular physiological causes, it is useful to consider some likely substrates of the male flash of anger. First, testosterone is clearly associated with dominance behavior (Mazur & Booth, 1998). Moreover, although the picture is complex and the direction of causality not always clear, studies involving normal adults, adolescents, convicted criminals, and animal models suggest a correlation between testosterone and aggressiveness, specifically as regards responses to challenges (i.e., transgression) (Archer, 2006; van Bokhoven et al., 2006; Klinesmith, Kasser, & McAndrew, 2006). Salivary testosterone predicts whether men will pursue additional competition following an initial contest (Mehta & Josephs, 2006); of particular interest, the same measure correlates positively with both the presence of anger and the selective attention to angry faces (van Honk et al., 1999). Next, evidence supports a connection between reduced serotonergic activity and impulsivity in general, and impulsive aggression and/or anger in particular; a number of studies suggest that this connection is more robust in men than in women (see Chapter 6 by Bond and Wingrove, this volume, and Chapter 3 by Reuter, this volume, for reviews).

Experiments in rodents point toward a twofold interaction between androgens and serotonergic activity: First, males exhibit lower brain serotonin levels, particularly in the limbic system (Carlsson & Carlsson, 1988; but see also Haleem, 1992), and experimental androgenization reduces serotonin levels in the amygdala (Sundblad & Eriksson, 1997; but see also Fluegge, Kramer, Rensing, & Fuchs, 1998). Second, androgenization increases lability in serotonergic activity (Cologer-Clifford, Simon, Richter, Smoluk, & Lu, 1999), presumably resulting in substantial behavioral plasticity in males, a possibility addressed below.

## **21.5 Adaptive Modulation of Risk Taking**

In general, individuals who have a rosy future ahead of them should be averse to significant risks, while those who have poorer prospects should be more willing to gamble (Wilson, Daly, & Pound, 2002). Because personal experience constitutes the best basis for predicting one's future, we can expect individuals to be equipped to use past experiences to assess future prospects and to adjust risk-taking behavior in light of this (ongoing) assessment (Hill, Thomson Ross, & Low, 1997). Congruent with this position, highly traumatic experiences can produce post-traumatic stress disorder, in which anger plays a prominent role; reduced serotonergic functioning is implicated in this condition (reviewed in Chapter 6 by Bond and Wingrove, this volume). Experimental modification of rearing conditions in a nonhuman primate model indicates that adverse early experiences result in sub-normal levels of brain serotonin (Rosenblum, Coplan, Friedman, & Bassoff, 1994; Higley & Linnoila, 1997). In humans, exposure to harsh parenting is negatively correlated with the density



of serotonin receptors (Pine et al., 1996), and positively correlated with the risk of later committing murder (Lewis, 1985), being murdered (Allgulander & Nilsson, 2000), and being involved in an automobile accident (Harano, Peck, & McBride, 1975). Among incarcerated adult male violent offenders, recidivism is predicted by low levels of a serotonin metabolite, and this in turn is correlated with a childhood history of paternal alcoholism and violence, paternal absence, and the presence of brothers (who can be construed as competitors) in the home (Virkkunen, Eggert, Rawlings, & Linnoila, 1996). Hence, experiences indicative of a challenging local environment in which the prospects for success are poor appear to cause a decrease in serotonergic activity, predisposing the individual to violence and other forms of risk taking in a manner that, in ancestral populations, would have been adaptive.

### ***21.5.1 Changes Across the Male Life Cycle***

In addition to between-individual differences in risk taking that are driven by differences in future prospects, risk taking can be expected to vary across the life cycle as a result of differences in future prospects at different life stages. Moreover, because such within-individual variation in risk taking is likely to be patterned by features of the larger social structure, the timing of relative changes in risk taking will be similar between individuals even though the magnitude of risk taking varies. For most of human history, male social position has probably depended principally upon individual achievement. Considerable time is required to both acquire and demonstrate expertise in socially valued skills, and this was likely at least as true in the past as it is today, if not more so. For example, comparisons among extant foraging societies reveal that expertise in hunting, the principal male economic activity and an important determinant of male social influence, is only achieved after approximately 20 years of learning and practice, i.e., middle-aged men are the experts (Ohtsuka, 1989; Kaplan, Hill, Lancaster, & Hurtado, 2000). Keeping in mind that, consistent with the importance of resources in female reproduction, women highly value social status and access to resources in a prospective mate, consider, therefore, the plight of the adolescent or young adult male: showing outward signs of maturity, and motivated to gain access to the perquisites (including sexual opportunities) of successful older men, young men nevertheless enter the social arena at a competitive disadvantage. Young adulthood thus intrinsically entails a drop in status – even the most popular of boys finds himself near the bottom of the pecking order once he begins to be compared to adult men. At the same time, having few skills and a minimal track record, the young man's future is notably uncertain. Moreover, he is surrounded by age-mates who, facing the same dilemma, constitute both present and future rivals in the competition for status and mates.

Young men have little to lose and much to gain by taking risks, suggesting that men's sensitivity to potential costs will be lowest during young adulthood (Wilson et al., 2002), a prediction supported by the demography of both violent altercations and accidental injuries (Wilson & Daly, 1993; Gardner, 1993). In a variety of contemporary nation-states, young men are both more likely to kill and to be killed than older men (Daly & Wilson, 1990); young men were likewise disproportionately the victims of homicide in historic and prehistoric communities of the indigenous Chumash of California (Lambert, 1994). In the United States, excluding the elderly, young men are more likely to be involved in fatal automobile accidents (Massie et al., 1995) and auto accidents caused by a loss of control (Tavris et al., 2001); similar patterns are evident among Spanish (Claret et al., 2003) and Thai drivers (Böhning & Na Ayutha, 1997); likewise, the median age of rattlesnake bite victims is 22, and 55% of all bites are suffered by patients aged 17–27 (Wingert & Chan, 1988). Consonant with these patterns, the frequency of experiencing, the intensity of, and the likelihood of acting on anger declines with age (reviewed in Chapter 19 by Schieman, this volume).

It is possible to guess at the proximate mechanisms underlying age-related changes in male risk taking. Animal models suggest that social rank is inversely correlated with serotonergic activity, apparently because subordination decreases serotonergic activity, while dominance sometimes enhances it (Dhingra, Lakshmana, Meti, & Raju, 1996; Berton, Durand, Aguerre, Mormède, & Chaouloff, 1999; Westergaard, Suomi, Higley, & Mehlman, 1999). Because testosterone directly affects serotonergic functioning, young males suffer the serotonergic double whammy of simultaneous decreases in status and increases in testosterone, resulting in increases in impulsivity and impulsive aggression. Hence, the typical declines in risk taking and impulsivity that occur over the course of later adulthood may in part be tied to the manner in which age and experience often allow the individual to rise through the social ranks, resulting in (from an ultimate perspective) a decline in the utility of risk taking and (from a proximate perspective) an increase in serotonergic functioning.

In keeping with the match between psychology and morphology noted earlier, patterned changes in sensitivity to risk and propensity to experience anger over the life cycle may be matched by changes in the male body. Observers have noted the correlation in males between the dramatic increases in strength that occur during and following puberty and increased involvement in risk taking, importantly including violence (Wilson & Daly, 1993; Daly & Wilson, 1990). This is understandable in terms of the distribution and composition of male musculature, and the changes therein that occur later in life. First, in young adulthood, males have a large ratio of upper-to-lower-body muscle mass; as men age, this ratio decreases (Gallagher & Heymsfield, 1998). Second, changes occur in the composition of male muscles. Skeletal muscles are composed of two classes of muscle fibers, Type I, or slow twitch fibers, and Type II, or fast twitch fibers. Type I fibers contribute principally to endurance, and Type II fibers, which are metabolically more expensive, contribute principally to power (Fitts, McDonald, & Schluter, 1991; Herbison, Jaweed, & Ditunno, 1982). Beginning sometime in the 20s, there is a decline in both the size of muscles and the number of muscle fibers. This decline disproportionately affects Type II fibers (Kirkendall & Garrett, 1998), particularly in men (Lindle et al., 1997; Neder, Nery, Silva, Andreoni, & Whipp, 1999). Correspondingly, the basal metabolic rate decreases with age, in part due to a reduction in both the quantity of lean tissue and the energetic demands per unit mass of that tissue. Hence, in early adulthood, male muscle distribution is such as to maximize upper body strength, and muscle composition is such as to maximize power. Even at rest, this arrangement is energetically expensive to maintain. Moreover, the combination of a large upper body and a high percentage of easily fatigued muscle fibers greatly limits endurance.

Testosterone increases both muscle size (Bhasin et al., 1996) and the percentage of Type II fibers (Mero, Jaakkola, & Komi, 1991; Krotkiewski, Kral, & Karlsson, 1980). Paralleling age-related changes in muscle distribution and muscle composition, men experience a progressive decline in testosterone levels with age (Harman, Metter, Tobin, Pearson, & Blackman, 2001; Feldman et al., 2002), although there are substantial cross-population differences in the rate of decline, possibly due in part to dietary factors (Ellison & Panter-Brick, 1996; Ellison et al., 1998, 2002; Campbell, Leslie, & Campbell, 2006). In addition to changes in testosterone, decreases in muscle mass with age are associated with declining levels of growth hormone (Harper, 1998; Zaccaria, Varnier, Piazza, Noventa, & Ermolao, 1999), the production of which is stimulated by androgens (Angele, Ayala, Cioffi, Bland, & Chaudry, 1998).

The above findings suggest that adult male development follows a pattern in which, initially, all of the proverbial eggs are put into one basket. Early adulthood is characterized by costly muscles that are most useful in combat, muscles that maximize power at the expense of endurance. At the same time, young men are less sensitive to risk and more predisposed to attend to signs of anger in others, and to experience anger themselves, than older men. This combination leads to violent gambles in an attempt to establish a reputation as someone against whom transgression is costly. The potential costs of this gambit are further elevated by the fact that testosterone, the

proximate cause of enhanced muscular power and aggressiveness, also causes immunosuppression, thus increasing the likelihood that injury will lead to sepsis (Muehlenbein & Bribiescas, 2005; but see also Granger, Booth, & Johnson, 2000); likewise, because serotonin is involved in a variety of immune responses (Mössner & Lesch, 1998), reductions in social status associated with young adulthood are likely to compound the immunosuppressive effects of testosterone. While it might seem maladaptive to diminish immune responses precisely during that phase when trauma is most likely, the immunosuppressive effects of testosterone may be part of the “eggs in one basket” pattern: given that physiological resources are finite, and given that immune responses are energetically expensive, investing in immune responses can be viewed as trading current assets for future health (Muehlenbein & Bribiescas, 2005). However, the more equivocal the future, the less worthwhile such a trade becomes. Accordingly, young males with uncertain futures may generally be better off restricting immune responses in order to maximize the energy available for immediate needs.

The combined costs of increased caloric requirements and heightened vulnerability to pathogens make it difficult to maintain the young male configuration of high upper-to-lower body muscle mass ratio, high Type II-to-Type I muscle fiber ratio, and high-testosterone/low immune response. For successful young men, however, this limitation does not pose an obstacle: after a period of aggressive risk taking, they gradually shift to an alternate strategy, building a reputation based on socially valued skills. In ancestral environments, these skills would have demanded endurance rather than power. Hunting tactics vary markedly between groups, and the energetic demands of hunting are importantly contingent on the techniques employed (Kelly, 1995). Nevertheless, several generalizations apply across hunting techniques. First, because prey animals are likely to avoid encampments, hunting frequently entails extended foot travel; the successful hunter must then transport meat over often-considerable distances. Second, arrows and spears do not readily bring down big game, and hunters typically rely on poison or bleeding to weaken large prey (Kelly, 1995), a time-consuming process that often involves pursuit. Hunting thus likely frequently entails prolonged moderate exercise (see Worthman & Konner, 1987), and hence endurance will often be more of a determinant of success than power. For example, among the hunter-horticulturalist Aché of Paraguay, though stronger than intermediate-sized men, large men likely have poorer endurance, potentially explaining their reduced hunting return rates relative to the latter (Hill & Hurtado, 1996, p. 372).

Changes in male musculature over the life cycle can be seen as both paralleling and facilitating a change in social strategy. Men initially seek to establish a reputation that precludes transgressions; then, as they acquire skills, they scale back their physical confrontations. It is only when their prior reputations are called into question that older men may again resort to combat. However, having acquired social prominence, successful mature men are unlikely to face challengers alone, thus making up for decreases in their fighting abilities (see, for example Hart & Pilling, 1960). Hence, the trajectory of hormonally mediated mental and physical changes is understandable in terms of the varying utility of risk taking and combat during different life phases – risk-prone high-power young men are built for danger and fighting; mellower, high-endurance older men are built for hunting and politics. Lastly, because age-dependent muscular changes are likely to have a panmammalian component, these physiological changes are best viewed as having set the stage for, and perhaps having further coevolved with, the human pattern of changes in strategy over the male life course.<sup>2</sup>

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<sup>2</sup>Bringing together the threads of the argument made here, Fairbanks et al. (2004) demonstrated that, in adolescent male vervet monkeys, large body size, low serotonergic functioning, and high impulsivity (including impulsive aggression) combine to predict subsequent attainment of alpha status in adulthood. Consonant with a strategic shift in tactics over the life course, though highly impulsive as adolescents, males who reached alpha status decline in impulsivity once they have achieved high rank.

### ***21.5.2 Reproductive Status and Male Risk Taking***

While important, age is not the only factor expected to influence male competitive strategies. If differences in reproductive success were the engine driving the evolution of the male flash of anger in ancestral populations, and if the psychology of this reaction incorporates an evaluation of present and future prospects, then the extent to which a man of a given age is presently achieving success in the reproductive arena should influence his propensity to respond aggressively to transgression (Wilson & Daly, 1993). Put differently, under ancestral circumstances, whereas a young bachelor whose reproductive future was uncertain was best served by a risk-prone strategy, a married father would have done better to scale back his risk taking lest he lose those gains achieved to date (including losses incurred if, due to his death or injury, his existing dependent offspring were to lose the resources and protection he provides). This suggests that the male flash of anger should decline as a function of marital status and fatherhood.

Consistent with the above logic, there is a striking negative correlation between marital status and participation in male violence. In Canada (Daly & Wilson, 1990) and Florida (West et al., 1996) married men are less likely than same-age single men to commit violence, while in Sweden (Allgulander & Nilsson, 2000) married men are less likely to be killed than single men. Similarly, consistent with the assertion that involvement in violence reflects a willingness to take risks, the same patterns hold true with regard to automobile accidents in the United States (Harano et al., 1975), Thailand (Böhning & Na Ayutha, 1997), and Brazil (Barreto, Swerdlow, Smith, & Higgins, 1997); with regard to both driving under the influence of alcohol and driving without a seat belt in the United States (West et al., 1996), with regard to driving under the influence of cannabis in Canada (Walsh & Mann, 1999), with regard to suffering injurious or fatal falls in Finland (Malmivaara et al., 1993), with regard to all accidental causes of death among Finns (Notkola, Martikainen, & Leino, 1993) and U.S. soldiers (Garvey Wilson, Lange, Brundage, & Frommelt, 2003), and with regard to repeated admission to a hospital emergency room in Ireland (Murphy et al., 1999). The above patterns are consonant with measures of a key proximate factor thought to play a role in competitive male risk taking: with only a few exceptions, studies reveal that married men, and those in committed long-term relationships, have lower salivary testosterone levels than do single men (reviewed in Gray & Campbell, 2009).

While intriguing, correlations such as the above do not allow us to determine the direction of causality – are single men more dangerous because they are single or are they single because they are more dangerous? More specifically, consistent with the future-prospects-based-on-past-experience argument, men with a history of deprivation may well pursue a high-risk strategy aimed at maximizing status and short-term matings; because this is done at the expense of parental investment, such men are less likely to form lasting marriages, or at least less likely to do so early in adult life, than are men from more stable backgrounds who, pursuing lower risk strategies, evince signs of willingness to invest parentally (Belsky, Steinberg, & Draper, 1991; Hill et al., 1997). Two avenues of investigation provide the means to tease apart these possibilities, namely cross-sectional examinations of men who were once married and a unique longitudinal study.

Divorced men are characterized by an increased likelihood of committing murder in the Canadian sample, of being murdered in the Swedish sample, of suffering a fall or other accident in the Finnish samples, of suffering accidental injury requiring hospitalization in a Korean sample (Paek et al., 2007), and of being involved in an automobile accident in three American samples (Harano et al., 1975; McMurray, 1970; Selzer & Vinokur, 1975). These results suggest that risk taking increases when marriages fail. However, because it is possible that these men's marriages failed because they were risk takers, more compelling evidence of such an effect comes from a similar association with widowhood (Wilson & Daly, 1993): compared to married men, widowers are at increased risk of

committing murder in the Canadian sample, of being murdered in the Swedish sample, of being hurt or killed in a fall or other accident in the Finnish and Korean samples, and of being involved in an automobile accident in the U.S. samples. These results suggest that, while some of the contrasts between married and single men may be due to the pursuit of alternate strategies, marriage likely has an independent ameliorating effect on male risk taking.

In the only investigation of its kind, Farrington and West (1995) conducted a longitudinal study of 403 working-class males in London, tracking them from age 8 to 32 to explore the determinants of criminal offending (a class of behaviors that is larger than violent conflict per se, but includes it, as well as other forms of risk taking). Single men were nearly twice as likely to commit a criminal offense as married men. Importantly, this cannot be attributed to preexisting differences in inclinations between the two classes of men as, in the 5 years prior to marriage, men who ultimately married offended at almost exactly the same rate as men who were to remain single. More complexly, an examination of men who married but later separated provides support for both the notion that there are typological differences between men who stay married and men who do not, and the idea that marriage reduces risk taking. During the period in which they were married, men who later separated committed 66% more offenses than men who subsequently remained married. However, like the latter, the former displayed a reduction in offending during the period of marriage relative to the 5 years prior to marriage; most notably, they also exhibited a 44% increase in offending following the end of their marriage, strongly suggesting that marriage reduces risk taking.

From an evolutionary perspective, marriage is not an end in itself, but rather an avenue to reproduction. Accordingly, we should expect that the birth of a child in whom a man intends to invest will be accompanied by a reduction in his participation in violence and other forms of competitive risk taking (note that the qualifying clause is important given that, while investment boosts the likely success of a given child, a viable alternative strategy is to father many children and invest little in each, a trajectory consonant with increased competition with other males, and hence increased risk taking). However, in contrast to work on marital status, surprisingly little research has been done on the effects of fatherhood.<sup>3</sup> A number of studies have found that fatherhood is associated with lower testosterone levels (reviewed in Gray & Campbell, 2009); however, as in the case of the hormonal correlates of marriage, in the absence of longitudinal studies, it is not yet possible to determine the direction of causality in these correlations.

To summarize the above, consonant with theoretical predictions, there is reasonable evidence that marriage reduces behaviors of the type associated with the male flash of anger, and there is preliminary evidence that fatherhood may have a similar effect. Recall, however, that these predictions derive from the premise that a pattern of mild polygyny characterized the social worlds in which the human mind evolved. From a reproductive standpoint, in a polygynous environment, it is not optimal to permanently reduce risky competitive behavior following marriage and fatherhood. Rather, male reproductive success is maximized by adjusting such behavior as a function of its costs and benefits. As a woman ages, the number of future offspring that she might bear diminishes to zero; as children mature, the extent to which they benefit from a given unit of paternal investment likewise declines. Correspondingly, for a husband and father, the reproductive benefits of a risk-avoidant strategy decrease over time, hence the pacifying effects of these roles can be expected to exhibit a similar chronology. Specifically, within the constraints of age-related changes in male fighting ability and concomitant risk-taking propensities, the male flash of anger is predicted to exhibit

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<sup>3</sup>Although Farrington and West (1995) evaluated the relationship between fatherhood and criminal offending, they were unable to differentiate the effect of fatherhood within marriage from the effect of marriage itself. Consistent with a strategy of short-term mating, low parental investment, and high risk taking, unmarried fatherhood increased the risk of offending.

periodicity wherein aggressive response to transgression and other forms of risk taking increase as a man's wife's residual reproductive potential diminishes and as his children become more independent. More broadly, the much-debated "male midlife crisis" may reflect such a pattern in culturally monogamous societies (in which polygynous inclinations are maximally disruptive and in which norms prescribe only slight age differences between spouses), with conflicting findings reflecting the fact that it is not principally a man's age that matters, but rather those of his wife and children. Note that increased risk taking behavior in midlife can thus be expected to be a uniquely male phenomenon. While women may experience distress over the fading of their youth, because a woman's attractiveness as a prospective mate is largely age-dependent, women gain little by returning to the behaviors of their single days – whereas men can partially revive their earlier competitive status in the mating arena by altering their behavior, such changes will not suffice for women. Likewise, women with children can be expected to be more risk-averse than women without (due in part to children's vulnerability to retribution, and in part to their dependency on maternal support), but, unlike men, they should not display a return to risk-seeking behaviors as their children mature, since they cannot recapture their earlier mate value, and exposure to risk simply impairs their ability to enhance their fitness through grandmaternal investment. In sum, men, but not women, can be expected to display a rebound in risk taking, including participation in violence motivated by anger, as a function of the ages of their spouse and children.

## **21.6 Interindividual Variation in Innate Propensities**

The experience of the male flash of anger and its life course vicissitudes are predicted to be universal. However, universality is not the same as uniformity, and there is substantial evidence of heritable variation in the psychological traits, and their likely physiological substrates, that compose the male flash of anger. Considerable evidence supports the heritability of a propensity toward anger and aggression (reviewed in Chapter 3 by Reuter, this volume). Consistent with these findings, heredity is a significant determinant of testosterone levels (Kuijper et al., 2007), and polymorphisms largely responsible for interindividual variation in the degree of age-related decline in testosterone levels have been identified (Krithivas et al., 1999). Likewise, serotonergic functioning has a substantial heritable component (see Chapter 3 by Reuter, this volume; Jabbi et al., 2007).

The genetic determinants of the male flash of anger are most likely complex, involving multiple component processes. This apparently results in numerous avenues that can lead to inter-individual variation in the propensity to react violently to transgression. Given the sometimes substantial fitness consequences of reacting in accord with, or refraining from, the male flash of anger, it is not implausible that the heritable variation described above has, or had, long-term functional significance.

### ***21.6.1 Culture and Genetic Variation in the Male Flash of Anger***

Although inter-individual differences in the propensity to respond to transgression with violent anger are readily observable, some of the most dramatic differences in attitudes toward, and incidences of, male violence occurs not between individuals but between groups (Ghiglieri, 1999). Cultural anthropologists have long argued that the difference between "warlike" and "peaceful" societies derives from the meaning attached to violence itself (Robarchek & Robarchek, 1992), an argument that can be extended to include the cultural construal of anger (Myers, 1988; Johnson et al., 1986; Levy, 1973;

Fessler, 2006) and the very meaning of transgression (Nisbett & Cohen, 1996). These cultural factors may interdigitate with the determinants of aggressiveness discussed thus far in several ways. First, by shaping the environment of childhood experience, cultural factors may influence perceptions of future prospects that influence levels of risk sensitivity (Belsky et al., 1991). Second, by favoring greater or lesser degrees of aggressive risk-indifferent response to transgression, culture could conceivably constitute a source of selection operating on heritable variation in factors contributing to this trait. Of these two possibilities, the latter is far more controversial, as it suggests that individuals descended from groups having differing orientations toward violent response to transgression will differ in their baseline propensities for such behavior.

I know of no reliable data that bear directly on the question of between-population differences in the heritable components of the male flash of anger. However, other findings suggest that such differences could occur. First, culturally shaped dietary practices can modify heritable attributes: pastoralists exhibit high levels of adult lactase production, tropical populations without ready access to salt may be characterized by high sodium retention, and arctic hunters with low plant food intake efficiently produce glucose from amino acids (Lieberman, 1987). Second, findings concerning the frequency of polymorphisms of a dopamine receptor gene suggest that cultural practices may select for heritable personality traits, as a variant associated with sensation seeking is more common in pastoralists (who must be mobile) than in agriculturalists (who are sedentary) (Chen, Burton, Greenberger, & Dmitrieva, 1999). It is thus conceivable that cultural traditions that pre- or proscribe violent response to transgression might have similar effects with regard to heritable aspects of the male flash of anger. However, a number of factors raise doubts as to the likelihood of this.

In order for cultural beliefs and practices to shape frequencies of alleles contributing to the male flash of anger, those aspects of a given culture must remain constant for considerable periods of time. Although documented cases of such longevity exist (cf. Nisbett & Cohen, 1996), it is also known that cultures can change rapidly, particularly in cases of culture contact and/or assimilation (Levy, 1973; Tuzin, 1989, pp. 187–208). Contrary to stereotypes of pristine, isolated cultural traditions in small-scale societies, it is likely that diffusion and acculturation were the norm, rather than the exception, in human history. Moreover, it is not merely ideas that are exchanged between groups, but genes as well, and hence any homogenizing effects of a given culture are likely to be diluted through contact with other groups. Lastly, even in small-scale societies having a relatively monolithic approach toward anger and violence, there are often multiple pathways to social success, with repeated confrontational aggression being only one avenue (cf. Chagnon, 1997); the same may be less true of subsistence practices, and hence the cases discussed above may not generalize to other domains.

Cross-population studies of the frequencies of genetic contributors to the male flash of anger can potentially shed light on the question of the influence of culture on heritable dispositions. However, the liabilities entailed by such research are considerable given the popular media's incomplete reporting of scientific findings – often, although the same study that demonstrates heritability also illuminates how environmental conditions profoundly shape development, only the former is highlighted. Investigators must therefore exercise caution in approaching this question lest they contribute to the formation or perpetuation of racist stereotypes.

## **21.7 Moral Outrage: A Uniquely Human Form of Anger**

Although it is questionable whether specific cultural traditions have constituted sources of selective pressure shaping the heritable substrates of anger phenomena, the relationship between culture writ large and human responses to transgression is more clear-cut. While a variety of mammals and birds

possess rudimentary cultural norms governing behavior, our species is unique not only in the richness and variety of such norms but, more importantly, in the fact that individual actors enforce norms the violations of which do not affect them. From an evolutionary perspective, the latter is puzzling – all else being equal, we might expect that fitness would be reduced by incurring costs (time, energy, social capital, and risk of injury or retribution) to enforce rules that do not bear directly on one's own welfare. Several possible explanations have been advanced (reviewed in Hagen & Hammerstein, 2006). The propensity to engage in costly norm enforcement may have been favored by any of several forms of evolutionary group selection, as groups that, via such enforcement, functioned effectively would have out-competed less well-organized rivals, leading to the prevalence of the propensity to enforce. Alternately, norm enforcement may serve a communicative function, as policing others' behavior offers an opportunity to demonstrate that the enforcer shares prevailing cultural values and acts in accord with them, even at a cost to the self, attributes that make the actor attractive as an ally or member of a cooperative venture; in turn, these roles may entail benefits that outweigh the costs of policing.

A principal emotion motivating punishment of norm violators is a form of anger – phenomenologically and behaviorally, many people respond to transgressions against norms as if they constituted transgressions against the self. Because the eliciting conditions are different from that of simple anger and because the evolutionary function of the emotion necessarily differs from that of simple anger, this emotion can be usefully distinguished using the term *moral outrage* (Fessler & Haley, 2003). Evolutionary processes frequently involve modifying existing mechanisms in order to address new challenges, and moral outrage can be seen as such a modification. Importantly, whereas we can expect all complex social animals to experience something like anger, given the unique role of culture in human social behavior, the same is not true of moral outrage. Investigations of the determinants of moral outrage offer an avenue for testing the signaling hypothesis outlined above, as, being premised on reputational issues, this perspective generates predictions paralleling those for simple anger (Fessler & Haley, 2003). Briefly, we should expect the presence of an audience to increase moral outrage. Likewise, willingness to take risks in order to inflict costs on norm violators should be a function of both the level of competition and the potential benefits of establishing a positive reputation – morally outraged men can be expected to be more risk-prone than their female counterparts, and young men, who are entering the political arena for the first time, should be the most willing to take such risks. As the case of moral outrage illustrates, applying functionalist evolutionary reasoning is a productive source of hypotheses concerning the male flash of anger.

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