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Economic Decision Biases in Evolutionary Perspective:

How Mating and Self-Protection Motives Alter Loss Aversion

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Abstract

Much research shows that people are loss-averse, meaning that they weigh losses more heavily than gains. From an evolutionary perspective, loss aversion would be expected to increase or decrease as a function of adaptive context. For example, loss aversion could have helped deal with challenges in the domain of self-protection, but would not have been beneficial for men in the domain of mating. Three experiments examine how loss aversion is influenced by mating and self-protection motives. Findings reveal that mating motives selectively erased loss aversion in men. In contrast, self-protective motives led both men and women to become more loss-averse. Overall, loss aversion appears to be sensitive to evolutionarily-important motives, suggesting that it may be a domain-specific bias operating according to an adaptive logic of recurring threats and opportunities in different evolutionary domains.

Key words: Evolutionary psychology, mating, self-protection, decision-biases, loss aversion

Economic Decision Biases in Evolutionary Perspective:

How Mating and Self-Protection Motives Alter Loss Aversion

Research at the interface of experimental psychology and economics has demonstrated that psychological factors often lead to seeming irrationalities and limitations in judgment and decision-making processes. Challenging the classical model of rational man, which depicts people as well-informed decision-makers, behavioral economists have incorporated the insights of cognitive and social psychology, demonstrating people's tendencies to use simplistic and sometimes irrational biases (for a review see Bettman, Luce, & Payne, 2008). A classic example is a well-known phenomenon called *loss aversion*, which is the tendency for people to weigh losses more strongly than objectively equivalent gains (Kahneman & Tversky, 1979; Tversky & Kahneman, 1991). To a rational economic mind, $100 is worth exactly $100, yet people are more psychologically moved by a loss of $100 than by a gain of an identical amount (Kahneman & Tversky, 1979). Loss aversion is considered so widespread that a recent review asserts, “There has been so much research on loss aversion that we can say with some certainty that people are impacted twice as much by losses as they are by gains” (Vohs & Luce, 2010, p. 736).

In the research we will report, we consider loss aversion through a functional evolutionary lens. Our analysis suggests that loss aversion may not be a domain-general bias. Instead, we argue that there are likely to be recurring contexts in which people systematically weigh gains more than losses. We propose that loss aversion is a cognitive bias that would have been well suited to solving certain recurring challenges related to survival, specifically, protecting oneself from physical danger. However, loss aversion may not have been as well-suited to solving problems of attracting a romantic partner. Thus, we examine experimentally how self-protection and mating motivations influence the relative valuation of gains and losses. We predict that loss aversion will be exacerbated in some contexts, but may be erased—or even reversed—in others.

Loss Aversion in Evolutionary Context

Classic economic models of behavior presumed that individuals make decisions by conducting cost-benefit analyses, subject to budget constraints. Psychological researchers have demonstrated that such decisions are often influenced by systematic biases (e.g., Kahneman & Tversky, 1979; Tversky & Kahneman, 1991). Research on financial decision-making links the field of economics not only with cognitive psychology but also with anthropology and evolutionary biology (e.g., Winterhalder, 2007). Economically based models have also been influential in the field of social psychology (e.g., Van Vugt & Van Lange, 2006).

Evolutionary approaches to behavior are inherently economic in nature, focusing on the allocation of intrinsically limited resources across various fitness-relevant activities. Whereas a traditional economic perspective has presumed a common currency for different types of judgments (general “utility”), an evolutionary perspective assumes that the human brain contains not one domain-general decision-making device, but rather a number of different decision-systems, each operating according to somewhat different rules (Kenrick, Griskevicius, Neuberg, &

Schaller, 2010). From this perspective, which motivational/emotional system governs a given decision systematically varies depending on relevant features of the current environment and individual differences (linked to factors such as the person's sex, mating strategy, and developmental ecology).

When it comes to loss aversion, a significant amount of research has shown that it is a relatively commonplace and robust finding: time and again, studies reveal that a loss of resources has more psychological impact than a gain of equivalent magnitude (e.g., Ariely, Huber, & Wertenbroch, 2005; Camerer, 2005; Novemsky & Kahneman, 2005; Zhang & Fishbach, 2005). The notion that losses loom larger than gains has had important ramifications for the study of many decision biases. For example, loss aversion is often used to help explain widespread risk-aversion (e.g., Kahneman & Lovallo, 1993). Loss aversion is also routinely invoked to explain the endowment effect (Thaler, 1980), which refers to the tendency for people to value an object more highly when it is in their possession than they would value the same object if they did not already possess it. In addition, loss aversion is used to help explain many other phenomena, such as the sunk cost fallacy, the attraction effect, the compromise effect, anticipated and experienced regret, and the status quo bias (Rick, in press).

It seems that people, whether in traditional societies or in modern market economies, are cognitively biased to ensure that they do not lose what they already have. Although it may seem peculiar that $100 is not always psychologically worth $100, a consideration of the environment in which humans evolved makes the loss aversion bias seem less perplexing and more rational. Indeed, given the universal nature of loss aversion, this tendency is believed to be rooted in evolved psychological mechanisms (Chen, Lakshminarayanan, & Santos, 2006). There is good reason to believe our ancestors often operated close to the margin, with a serious danger that they, or their children, might not survive if they misjudged how to invest their time and effort (Stephens & Krebs, 1986). Throughout most of human history, resource losses could have resulted in starvation and death, and were thus a more important consideration than gaining an extra bit of food. Even though modern, urban environments are often different from ancestral environments, our deep-seated tendency would not have been eradicated, and the bias would have continued to be adaptive to the extent that there were even occasional periods when people must live near the margin of survival.

Thus, from an evolutionary perspective, recurring biases such as loss aversion may reflect adaptive human heuristics (Krueger & Funder, 2004; Haselton & Nettle, 2006). However, this perspective also suggests that organisms generally do not evolve domain-general biases. Instead, organisms manifest different biases in different evolutionary recurring domains (e.g., self-protection, mating, etc.) (Kenrick et al. 2009). Different biases exist for people responding to different motivations, different contexts, and according to individual differences in adaptive strategies (Gigerenzer, 2000; Haselton & Nettle, 2006).

The Role of Domain Specificity and Fundamental Motivations on Biases

Traditional economic and psychological approaches to decision-making have presumed that decision biases such as loss aversion are “domain-general,” meaning that people are expected to be loss averse with regard to most types of resources in most types of contexts. Such perspectives presume that while there may be individual differences in loss aversion, these individual differences should be fairly stable across contexts (Gachter, Johnson, & Herrmann, 2007; but see Harinck, Van Dijk, Van Beest, & Mersmann, 2007).

In contrast, an evolutionary perspective posits that the human brain does not contain one domain-general decision-making device. Instead, the brain is believed to comprise a number of functionally modular, “domain-specific” decision-systems, each employing somewhat different information as input and operating according to somewhat different decision rules adapted for solving problems in that domain (Barrett & Kurzban, 2006; Tooby & Cosmides, 1992). For example, birds use different memory systems and different rules to remember species song, tastes of poisonous food, and locations of food caches (Sherry & Schacter, 1987). Many birds learn their species song during an early critical period, then reproduce it perfectly during the next breeding season without ever having practiced it. On the other hand, birds learn the characteristics of poisonous foods in a single trial during any time of life. Following still different rules, food locations are learned, updated, and erased on a daily basis. Using the same decision rules for each of these problems would be highly inefficient, and different memory systems in birds are anatomically distinct.

Likewise, much research demonstrates that humans have different domain-specific systems for dealing with certain categories of adaptive problems. For example, people learn very quickly to avoid foods that make them sick; unlike other learning systems, food aversion requires only one trial and is difficult to extinguish (Rozin & Kalat, 1971). Other systems have evolved to deal with other, sometimes conceptually incompatible tasks, such as learning a new language, spatial location, and recognizing and remembering other people's faces (e.g., Barrett & Kurzban, 2006; Domjan, 2005; Klein, Cosmides, Tooby, & Chance, 2002; Sherry & Schacter, 1987). For example, people show adaptive biases in visual detection for different types of objects. People are much faster and more accurate at detecting objects that posed threats in ancestral environments (e.g., predatory animals) than at detecting objects that pose threats only in modern-day environments (e.g., fast-moving vehicles) (New, Cosmides, & Tooby, 2007). Better detection for predatory animals than for other objects—even dangerous objects that we are taught to be wary of from early age—suggests a domain-specific monitoring system tuned to ancestral rather than to modern priorities. Similarly, people show domain-specific biases in fear conditioning. Fear is much more easily conditioned to objects that resemble snakes or spiders— objects that posed a significant threat throughout our evolutionary past—than to electrical outlets or automobiles—objects that cause many more deaths in current-day environments, but which did not exist in our evolutionary past (Öhman & Mineka, 2001).

These different domain-specific mechanisms map onto different recurring ancestral problems, such as protecting oneself from danger, acquiring a mate, and taking care of offspring (Kenrick, Griskevicius, Neuberg, & Schaller, 2010). An evolutionary perspective suggests that decision-biases can differ from one evolutionary domain to another, meaning that a given bias might be operating in one domain but not in another (Gigerenzer, 2000; Haselton & Nettle, 2006; Kenrick et al. 2009; Cosmides & Tooby, 1996; Wang, 1996). Following this logic, loss aversion might not be a domain-general bias, but might instead only be found when people are confronted with decisions in domains for which it was adaptive. On this line of reasoning, loss aversion might be non-existent (or perhaps even reversed) when people are confronted with decisions in domains where it might not have been adaptive. Below, we argue that, due to inherent sex differences in parental investment, the motivation to acquire mates could diminish the bias for losses to outweigh gains in men, but not women.

Differential Parental Investment, Sexual Selection, and Mate Acquisition

Animals vary in the extent to which they invest in their offspring (Daly & Wilson, 1983; Trivers, 1972). Those variations are found across species. Many fish and amphibians, for example, lay large numbers of eggs, but subsequently invest no effort in the care of offspring; all mammalian species, on the other hand, invest heavily in their offspring, carrying fetuses inside their bodies, and nursing the young after they are born. There are also variations within species, with females generally (though not always) making the higher investment (Daly & Wilson, 1983; Trivers, 1972). Again, in the mammalian case, females are physiologically equipped to carry the fetuses and nurse them after birth. Males are not. In a minority of mammalian species, such as *Homo sapiens*, males do contribute care and resources to the offspring, but rarely to a degree that matches female investment (Kenrick, Sadalla, Groth, & Trost, 1990)

Parental investment has been found to be directly linked to initial mate choice. To the extent that an animal invests heavily in its offspring, it will be more selective in the choice of a mate (Trivers, 1972). Because of the intrinsic difference in minimal obligatory parental investment, most females are more selective about short-term mates than are most males (Kenrick, Groth, Trost, & Sadalla, 1993; Kenrick, Sadalla, Groth, & Trost, 1990; Li & Kenrick, 2006). Consequently, to be selected as mates, and pass on their genes, ancestral males needed to stand out and demonstrate their relative value to females in a process called *sexual selection*, or the "struggle . . . for the possession of the other sex" (Darwin, 1871).

A well-known example of sexual selection is the peacock's ostentatious tail. The tail is a handicap in many ways – it is metabolically expensive to produce, even more expensive to maintain, and leads the bird to be more easily sighted and caught by predators. Attention-grabbing displays such as the peacock's tail were puzzling from the perspective of natural selection, since they were likely to hinder survival. However, because it is such a handicap, peahens use the peacock's tail as a cue to a potential mate's genetic fitness – an inferior or sickly male would not be able to produce a large and colorful tail or be agile enough to escape predators with it (Daly & Wilson, 1983; Miller, 2001; Zahavi, 1977).

Inherent in the idea of intersexual selection is costly signaling. Costly signals, which can involve investments of time, energy, or resources, signal genetic superiority, and are used by the opposite sex as cues to mate quality. Thus, the survival costs of a peacock's tail are outweighed by its benefits as a signal to attract mates. Like the peacock's tail, most costly signals are honest cues to the animal's fitness (Zahavi, 1977). That is, such signals are difficult to mimic or fake. Consistent with this reasoning, females from many species select mates that possess phenotypes linked to costly signals of their genetic quality (Zahavi, 1977; Keyser &

Hill, 2000; Dunn and Cockburn, 1999). By being choosy, females incur benefits - male genes for high viability and, in some species, direct material resources (Price, Schluter & Heckman, 1993), which in turn translate into better chances of survival and reproduction for their offspring.

Besides showing off plumage or other flashy traits, males can successfully compete for females through direct competition with other males. An example of this is the head butting of male bighorn sheep. Larger horns on males translate directly into advantages in competitions with other males. Though the fights are for dominance, the evolutionary bottom line is that the victor gains access to mates and increases his chances of passing on his genes. In humans, aggression and physical violence toward members of one's own sex have also been linked to sexual selection (Griskevicius et al., 2009a; Wilson & Daly, 1985). In line with this argument, men are more likely than women to engage in these types of competitions, and to allow that competition to escalate to dangerous aggressive levels (Byrnes, Miller, & Schafer, 1999). In addition, men are especially aggressive during adolescence (Piquero, Farrington, & Blumstein, 2003), when their status is notably low and there is maximal uncertainty regarding their prospects for attracting mates. Indeed, the male:female mortality ratio is so skewed during adolescence that the term 'young male syndrome' has been coined to depict men's excessive tendency to participate in risky or violent competitive interactions during that phase of development (Wilson & Daly, 1985).

Some evidence exists for the hypothesis that men take risks to gain mating benefits. According to some researchers, hunting is often a risky and inefficient way to generate calories. It is often more efficient, from purely an economic standpoint, for people to be gatherers and scavengers (Bird, Smith, & Bird, 2001). However, there may be more to hunting than just the acquisition of food. Anthropologists find that hunters typically have more and better quality mates, suggesting the costs of hunting may be outweighed by the increased reproductive opportunities available to men who are willing and able to do it (Smith, Bird, & Bird, 2003). In a separate line of research, women openly reported being more attracted to men who choose to take physical risks than men who do not partake in risky behaviors (Kelly & Dunbar, 2001), giving further support for the idea that risky behaviors like hunting can lead to significant fitness benefits.

Though fundamental goals like mating may seem, on the surface, to be specific to a narrow kind of behavior such as attending to and remembering desirable partners, they often have functional consequences spanning a broad range of behavior. A number of experimental findings on sexual selection and decision making suggest that a mating motivation makes men less loss focused and more gain seeking. For example, Iredale, van Vugt, & Dunbar (2008) found that men were more likely to donate money to a charity when their donation was observed by a female audience. Consistently, Griskevicius et al. (2007) found that mating motives led men to invest money in flashier consumer goods, and to be more counter-conforming (Griskevicius, Goldstein, Mortensen, Cialdini, & Kenrick, 2006). This is attributed to men's desire to stand out and impress potential mates. Other research finds that men take more physical and financial risks when motivated to seek mates (Baker & Maner, 2008, 2009; Griskevicius et al., 2009a). These findings suggest that, in order to make predictions about when people are likely to fall prey to biases such as loss aversion, it is important to consider what motivational state they are in at the time.

The Current Research

We propose that although loss aversion may have been adaptive for solving challenges in the domain of self-protection, loss aversion may not have been adaptive for solving challenges related to mating. Consistent with the principles of differential parental investment and sexual selection, men generally show greater desire for short-term variety or short-term mating than women, leading men to behave in ways that maximize such opportunities (Buss & Schmitt, 1993; Wilson & Daly, 1985). This suggests that men are likely to downplay the typical concerns about potential losses when mating opportunities are salient.

Also in line with the principles of differential parental investment and sexual selection, mating motives are not expected to produce the same tendencies regarding loss aversion in men and in women. Indeed, research has found that unlike for men, a mating motivation does *not* lead women to become more confrontational (Griskevicius et al., 2009), more impulsive and present-focused (Wilson & Daly, 2004), spend more money on flashy, expensive products (Griskevicius et al., 2007; Sundie et al., 2011), or take more unnecessary physical risks (Byrnes, Miller, Schafer, 1999). Thus, women’s valuation of gains and losses would not be expected to be influenced by mating motivation in the same way as men’s.

In line with our discussion of domain specificity, however, we would expect this sex difference to vary across different domains. In particular, as we will explore in

Study 3, we would expect that self-protective motivation will have similar effects on men and women.

Study 1

The first study experimentally tested how mating motivations influence men's and women's relative weightings of gains and losses. Mating motivation was primed via guided visualization scenarios based on previously established methods (e.g., Griskevicius et al., 2006; Sundie et al., 2011).

As discussed above, much theory and data suggest that people weigh losses more heavily than gains—that is, that people are loss-averse. However, following our discussion of sexual selection and differential parental investment, mating motives should inspire men to be less daunted about the possibility of potential losses. For women, however, mating motives should be less relevant to their perception of losses relative to gains.

Method

Participants

One hundred and seventy heterosexual students (73 female) at a large public university were recruited from introductory psychology classes as partial fulfillment of their class requirement. All participants were seated at private computers that were visually shielded from others by partitions.

Design and Procedure

The study used a 2 (Motivation: control, mating) X 2 (Participant sex) between-subjects experimental design. To minimize suspicion, participants were told that the session involved multiple studies, the first of which concerned memory for text. Consistent with this cover story, participants read a short story, purportedly selected because it was exactly 800 words, making it ideal for memory studies. After reading the story, participants responded to several items regarding financial preferences, ostensibly to allow time for memory decay of the text that was read earlier. Post-study interviews revealed no suspicion; participants did not suspect that the text was related to the financial questions.

Mating motivation manipulation. Mating was primed via guided visualization exercises. This methodology has been pretested and shown to elicit mating motives for both men and women in several published studies (Griskevicius et al., 2006, 2007, 2009a; Sundie et al., 2011). Each guided visualization scenario consisted of about 800 words. In the mating condition, participants were asked to imagine meeting a desirable person of the opposite sex. As the scenario unfolds, participants imagine spending a romantic day with the new romantic interest, and the scenario ends as the two people share a passionate kiss. This manipulation has been used successfully in previous literature to induce the desired effect. For example, one study found that, compared to a control scenario, the mating scenario elicited a higher level of romantic arousal, a higher level of sexual arousal, a stronger desire to have a romantic partner and a stronger desire to have others be attracted to the participant. There were no sex differences for any of the ratings, meaning that the mating scenario appeared to elicit fairly strong romantic emotions and motivations about equally for both men and women (Griskevicius et al. 2007).

In the control condition, people read a scenario of equal length that did not involve any romantic or sexual content. Instead, participants imagined searching for a household item. At the end of the scenario, they find the item and rejoice.

Dependent measures. The dependent measure was developed following earlier research indicating that people can easily think about social payoffs using similar economic scales as those typically used to measure monetary outcomes (Li, Bailey, Kenrick, & Linsenmeier, 2002; Li & Kenrick, 2006). Participants imagined that they had the opportunity to pay to either improve on, or prevent a worsening, of seven different aspects of their lives (“how much others respect you” (status), “how much others like you” (likeability), “safety from contagious disease” (disease avoidance), “providing for your family members” (kin care), ”safety from physical dangers” (physical safety), “romantic relationship stability” (relationship maintenance), and “ability to get dates” (mate acquisition)). These life dimensions are linked to our broader theoretical framework (Kenrick, Griskevicius, Neuberg, & Schaller, 2010). Participants were asked to consider themselves to be at the 50th percentile on these aspects of their lives (e.g., “imagine you’re at the 50th percentile of liking compared to your peers”). Participants then indicated how much money they would pay to gain or to avoid a loss on these attributes. For all items, participants were asked about *improving* (i.e., receiving a gain in) that aspect of their life and *preventing a decrease* (i.e., preventing a loss) in that aspect of their life. The budget was reset after each question, meaning that participants could spend up to $1000 for each item in $100 increments.

To increase reliability in our dependent variable, for each of the seven domains all participants indicated how much they would pay to gain or to avoid a loss in each aspect of their lives by 10 percentile points and by 30 percentile points. This means that all participants indicated how much they would spend to avoid a drop from the 50th to the 40th percentile and from the 50th to the 20th percentile; similarly, all participants indicated how much they would to spend to increase from the 50th to the 60th percentile and from the 50th to the 80th percentile. Analyses showed that features of the items (i.e., domain type, percentile change) did not moderate the Motivation X Participant sex effects reported below (*p'*s > .42); thus, we combined the 2 gain items for each of the 7 domains (i.e. 10 and 30 percentile gains in likeability, status, disease avoidance, kin care, mate acquisition, mate retention, and physical safety) into a gain percentile index (α = .90) and the 14 loss items into a loss percentile index (α = .94)[1].

Using established methods (e.g., Kermer, Driver-Linn, Wilson, & Gilbert, 2006), our measure of the gain-loss bias was computed by subtracting willingness to pay to avoid a loss (the loss percentile index) from willingness to pay for a gain (the gain percentile index). A *negative* value on this measure indicates people would pay more to avoid a loss than they would pay for a gain of the same magnitude (i.e., loss aversion). A score of *zero* on this measure indicates that people are willing to pay exactly the same amount for a gain as to avoid a loss (i.e., no bias toward loss

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[1] The pattern of results was the same for the 7 life attributes. The strongest effect sizes were found for likeability, i.e. "how much others like you", physical safety, i.e. "safety from physical dangers", and disease avoidance, i.e. "safety from contagious disease"

aversion). A *positive* value indicates people are willing to pay more for a gain than to avoid a loss of the same magnitude (i.e., gain seeking).

Results and Discussion

The gain-loss bias measure was subjected to a 2 (Motivation: mating, control) x 2 (Participant sex) between-subjects Analysis of Variance (ANOVA). This analysis revealed a significant interaction between participant sex and motivation, F (1, 166) = 5.00, p = .027, η_p^2 = .03, meaning that the mating motivation had a different effect on loss aversion for men than for women (see Figure 1).

---Insert Figure 1 about here---

Our main prediction was that a mating motivation would lead men to become less loss-averse compared to men in the control condition. Supporting this prediction, men were significantly less loss-averse in the mating condition compared to the control condition F (1, 166) = 6.59, p = .011, η_p^2 = .04 (see Figure 1). Men in the mating condition showed positive values on the gain-loss bias, willing to pay more for a gain than to avoid a loss of the same magnitude.

For women, we predicted that mating motivation would have little effect on any female bias. Indeed, mating motivation did not significantly change women's gain-loss bias compared to the control condition (F<1). As seen in the figure, a closer inspection of the specific pattern shows that mating motives led women to be slightly (though non-significantly) more loss-averse compared to the control condition.

Though the main findings are in line with our predictions, one potential limitation to the current study is that the dependent variable (i.e. the aspects for which participants had to imagine paying money for) are somewhat related to the independent variable (i.e. the mating motivation). Thus, before discussing the findings in Study 1, we attempt to replicate them in the next study, using a somewhat different set of measures.

Study 2

Study 1 revealed that a mate-seeking motivation selectively erased the well-established decision-bias of loss aversion in men. This finding, predicted by our evolutionary perspective, is inconsistent with the idea that loss-aversion is a domain-general human bias.

To enhance confidence in the validity and generalizability of the findings in Study 1, Study 2 aimed to conceptually replicate them using a measure of loss aversion adapted from previous research (Harinck, Van Dijk, Van Beest, & Mersmann, 2007) and employing a between-subjects design for gains and losses, rather than the within-subjects design of Study 1.

Method

Participants

One hundred and thirteen (53 female) heterosexual students from introductory psychology classes at a large public university completed this study for course credit. All participants were seated at private computers that were visually shielded from others by partitions.

Design and Procedure

The study had a 2 (Motivation: control, mating) X 2 (Participant sex) X 2 (Frame: gain, loss) between-subjects design. Mating was primed via the same scenario as that used in Study 1. To ensure that the findings in the first study were not an artifact of the specific content of the control scenario, the control scenario in this study involved guiding participants through the process of organizing their desk and putting papers away in files of different colors.

Dependent measures. Following Harinck et al. (2007), participants indicated how happy or unhappy they felt after either receiving a financial gain or experiencing a financial loss. Specifically, participants were asked how happy or unhappy they would be if they gained or lost $50, $500, $5000 and $50,000. This means that half of the participants indicated how happy or unhappy they would be if they *gained* $50, $500, $5000, or $50,000. Conversely, the other half of the participants indicated how happy or unhappy they would be if they *lost* $50, $500, $5000, or $50,000. Responses were provided on a scale of -5 to +5, with “extremely unhappy” and “extremely happy” as the anchors and 0 as the midpoint of the scale.

Participants were also asked to consider themselves to be at the 50th percentile of amount of personal financial assets (defined as cash or savings in a bank) and to indicate how happy or unhappy they would feel if they experienced gains or losses of 10, 20, 30 and 40 percentile points. Again, responses were provided on a scale of -5 to +5.

Analyses showed that features of the items (i.e., domain type, amount change) did not moderate the Motivation X Participant sex effects reported below. We thus averaged across the 4 dollar amounts and the 4 percentile changes to create an aggregate gain-loss composite for each participant (items in loss condition $\alpha = .98$; items in gain condition $\alpha = .95$).

Following Harinck et al. (2007), we calculated a dependent measure of the *relative* effect of gains versus losses—that is, the psychological effect of gains minus the psychological effect of losses. Thus, as in the first study, a *negative* value on this gain-loss measure indicates that people are *loss averse*; a score of *zero* indicates that people have *no bias* toward losses or gains; a *positive* value indicates that people are *gain-seeking*.

Results and Discussion

An omnibus ANOVA revealed a significant two-way interaction between motivation and participant sex, F (1, 105) = 5.32, p = .03, η_p^2 = .05. To test our specific predictions in the study, we examined the main effects of motivation for men and for women.

For men, there was a main effect of motivation, F (1, 105) = 8.54, p = .004, η_p^2 = .08. Conceptually replicating the key finding in the first study, a mating motivation led men to be significantly less loss averse compared to the control condition (see Figure 2). Thus, once again, mating motives successfully erased loss aversion for men.

---Insert Figure 2 about here---

For women, conceptually replicating the findings from Study 1, a mating motivation did not influence loss aversion compared to the control condition (F < 1). In fact, the mating motivation again led women to be slightly (non-significantly) more loss-averse compared to the control condition.

In sum, using a second, established methodology to assess gain-loss bias, and this time assessing gains and losses as a between-subjects factor, the findings from Study 2 conceptually replicated those from Study 1. Mating motivation completely erased loss aversion for men, but not women.

Study 3

The first two studies showed that the classic phenomenon of loss aversion can be erased and even reversed when men are operating in a mating motivation. This finding suggests that loss aversion is a domain-specific bias. An alternative explanation for the sex difference found in the first two studies is that men and women respond differently to arousal in general, or that women are not as aroused by the mating manipulation as men. If our fundamental motives framework is correct, though, there ought to be sources of motivation that produce different patterns of results, with men and women acting similarly in response to some motivations and differently in response to others, but in functionally predictable ways. The assumption of domain-specificity which guides this research implies that people apply different decision rules across different motives (Kenrick, Griskevicius, Neuberg, & Schaller, 2010). Thus, not all arousing motivations should lead to an erasure of loss aversion or the sex difference that we found in the previous two studies.

A self-protection goal, in particular, would be expected to produce analogous effects on loss aversion in men and women. Unlike mating, which leads to a functionally different set of opportunities and costs for males and females, self-protection leads to a set of potential costs that is similar for both sexes. When it came to protecting themselves against dangerous people, both males and females would have been well served by increasing their sensitivity to potential threats.

In line with this reasoning, previous research suggests that people make different decisions under self-protection versus mating motivations. A significant amount of research suggests that both women and men respond similarly to self-protective threats (e.g., Griskevicius et al., 2006; Griskevicius et al., 2009b). Males posed, and continue to pose, greater threats of physical violence compared to women. Consistently, both men and women are especially rapid at detecting angry facial expressions on men’s, as opposed to women’s faces (Becker, Kenrick, Neuberg, Blackwell, & Smith, 2007). People of both sexes are also biased to perceive intentions of threat more readily in members of outgroups, and surprisingly good at remembering angry males from threatening outgroups (Ackerman, et al., 2006). Consistent with the fact that our ancestors were more defenseless in the dark, ambient darkness increases threat-related prejudices against stereotypically dangerous groups (Schaller, Park, & Mueller, 2003). In addition, activating self-protective goals enhances conformity among both men and women (Griskevicius et al., 2006).

Based on the previous research and evolutionary theory, a self-protection motivation is not expected to lead anyone to value gains over losses. On the contrary – a self-protection motivation should cause *both men and women* to be even more loss averse than usual. When the environment is dangerous or unstable, it does not make adaptive sense to be gain focused. Instead one should overweight the importance of potential losses (which, under certain circumstances, may be life or limb) at the expense of underweighting the importance of possible gains. Importantly, self-protection threats should produce analogous effects on loss aversion in men and in women. Unlike the mating domain, which leads to a functionally different set of opportunities and costs for males and females, self-protection threats lead to a similar set of potential costs. When it came to protecting themselves against danger in the ancestral environment, both men and women would have been well-served by increasing their sensitivity to potential threats in their environment. We would thus expect people to be especially loss-averse when threats to survival are salient.

In the final study, we aimed to replicate the mating motivation findings from Studies 1 and 2. To further increase in the generalizability of these findings, we modified the measures in Study 3 to include more modest and realistic changes in monetary value (e.g. a maximum gain/loss of $400 in Study 3 vs. a maximum gain/loss of $50,000 in Study 2). In addition, we tested how self-protection motives influenced the relative valuation of gains and losses for men and for women. We expected to find very different patterns for the relative valuation of gains and losses when participants are primed with mating versus self-protection motives. Whereas a mating motivation should erase loss aversion for men but not women, the self-protection motivation should exacerbate loss aversion for both men and women. If mating and self-protection motives lead to a different pattern of loss aversion, this would also be evidence that the mating effects from the first two studies are not the result of mere arousal.

Method

Participants

Two hundred and eleven (134 female) heterosexual students from a large public university participated in this study. All participants were seated at private computers that were visually shielded from others by partitions. Participants were compensated $10 for their participation.

Design and Procedure

The study had a 3 (Motivation: control, mating, self-protection) X 2 (Participant sex) X 2 (Frame: gain, loss) between-subjects design. The mating and control conditions utilized the same guided visualization scenarios as in Study 2. Self-protection was also primed via a guided scenario used in previous research (Griskevicius et al., 2009b). The self-protection scenario was similar in length to the control and mating scenarios. It involved participants imagining being alone in a house late at night. As the scenario progresses, participants overhear scary noises outside and believe that someone has entered the house. After calling out and receiving no reply, the story ends as the intruder is about to enter the bedroom.

Dependent measures. Gain-loss bias was measured in the same way as in Study 2. Based on Harinck et al., 2007, participants indicated how happy or unhappy they would be if they lost *or* gained $50, $100, $200 and $400 and how happy or unhappy they would be if they lost *or* gained 10, 20, 30 and 40 percentile points in amount of financial assets (which we defined as cash or savings in a bank). Gain-loss was measured between subjects: Participants in the gain frame condition were asked how happy or unhappy they would be to *gain* money and go *up* in personal assets; participants in the loss frame condition were asked how happy or unhappy they would be to *lose* money and go *down* in personal assets. Responses were provided on a scale of -5 to +5, with “extremely unhappy” and “extremely happy” as the anchors, with 0 as the midpoint of the scale.

Analyses showed that features of the items (i.e., domain type, amount of change) did not moderate the Motivation X Participant sex effects reported below, Thus, the 4 monetary items and the 4 percentile items were combined into a single dependent measure (items in loss condition $\alpha = .87$; items in gain condition $\alpha = .86$).

As in Study 2, our dependent measure refers to the *relative* effect of gains versus losses – specifically, the psychological effect of gains minus the psychological effect of losses. Once again, a *negative* value on this measure indicates that people are *loss-averse*; a score of *zero* indicates that people have *no bias* toward losses or gains; and a *positive* value indicates people are *gain-seeking*.

Results and Discussion

An omnibus ANOVA revealed a two-way interaction between motivation and participant sex, F (2, 200) = 5.35, $p = .005$, $\eta_p^2 = .05$. To examine our specific predictions, we first aimed to replicate the effect from Studies 1 and 2 by examining the pattern of findings in the control and mating conditions.

Mating motivation. An ANOVA revealed a two-way interaction between participant sex and motivation (mating vs. control), F (1, 136) = 5.14, $p = .025$, $\eta_p^2 = .04$. For men, there was a significant main effect of motivation, F (1, 136) = 4.03, $p = .047$ $\eta_p^2 = .03$. Conceptually replicating the pattern in Studies 1 and 2, men in the mating condition were less loss averse compared to men in the control condition. In fact, men in the mating condition were significantly gain-seeking (see Figure 3).

---Insert Figure 3 about here---

For women, a mating motivation again did not significantly influence loss aversion F (1, 136) = 1.21, $p = .27$. However, as in the first two studies, the mating motivation again led women to become slightly (non-significantly) more loss-averse than in the control condition.

Self-Protection Motivation. The main prediction in this study is that a self-protection motivation should lead both men and women to become more loss-averse. As expected, there was no interaction between motivation and participant sex (p = .16), meaning that the motivation had a similar effect for men and for women. As predicted, there was a significant main effect of motivation (self-protection vs. control), F (1, 132) = 5.56, p = .020, η_p^2 = .04. Supporting our main prediction, participants in the self-protection condition were more loss-averse compared to those in the control condition (see Figure 3).

At first blush, one might expect a difference in how self-protection motivation affects men and women. One might assume, for example, that women tend to be more frightened for their safety than men and thus should exhibit more loss aversion when primed with fear. However, there is empirical evidence that suggests that men are at least as likely as, and sometimes more likely than, women to confront dangerous situations. Most homicides in North America and around the world involve men as victims, usually of other men (Daly & Wilson, 1988). Men are more likely to become violent toward other men given the differential benefits of status upon male's mating success (Wilson & Daly, 1985). In addition, previous research finds that men and women respond very similarly to this prime, and there are no sex-differences in how threatened people feel after reading the self-protection scenario (Griskevicius et al., 2006). Given these considerations, we did not expect, and did not find, sex differences for loss aversion for men and women in a self-protection motivation. Our main prediction was that this prime would, compared to a mating prime, lead men to respond very differently, as they did.

General Discussion

Much past research shows that humans are loss averse, with the notion that people weigh losses more strongly than gains generally considered to be a domain-general bias. However, an evolutionary perspective suggests that loss-aversion might be an adaptive bias in some life domains but not in others. We proposed that loss-aversion is likely to have been adaptive for solving challenges in self-protection but not for solving challenges related to mate-seeking, especially for men.

Our findings support this proposal. Across three studies, activating a mating motivation selectively erased loss aversion for men. Mating motivation had no such effect on women's gain-loss preferences. In contrast, and consistent with our reasoning that loss aversion is adaptive for solving challenges in the domain of self-protection, we found that self-protection threats led both men and women to become relatively more loss averse compared to control. That is, being fearful caused people to want to protect against potential losses and care less about possible gains.

These findings are consistent with an evolutionary perspective on decision-biases (e.g., Haselton & Nettle, 2006; Kenrick et al., 2009; Cosmides & Tooby, 1996; Wang, 1996), which suggests that a wide range of decision processes are likely to be sensitive to evolutionarily-relevant contexts. These processes should employ different information in different domains, and should generate qualitatively distinct biases depending on the recurring threats and opportunities typically present in those domains and the relative costs and benefits these threats and opportunities afford.

An interesting note is that, across the three studies, there was a trend for women to become slightly more loss averse in mating as compared to a neutral control condition. In another series of studies, we found this same tendency, especially for women who were not currently in a romantic relationship. If this trend is found to be replicable in future research, it might possibly reflect the notion that females have historically had more to lose by making mistakes in the mating domain. That is, due to the historically high costs of pregnancy and child-rearing, women might be especially cautious when mating is made salient; the adaptive strategy for women in a mating motivation might be to focus more on potential losses relative to gains. By adopting such a strategy, women might be more effective at warding off unwanted approaches from the opposite sex, and be more effective at choosing high-quality mates. One interesting possibility is that the extent of women's loss aversion might vary as a function of the quality of the potential mate, with mating-minded women becoming more gain-seeking as the quality of potential new mates increases.

Limitations and Future Directions

One limitation of the current studies is that we used hypothetical financial tasks, rather than tasks with real financial incentives. Although future research is needed to examine whether the findings in the current studies might change when real incentives are used, there is currently no clear evidence that hypothetical rewards are treated differently from real rewards (Johnson & Bickel, 2002; Lagorio & Madden, 2005; Madden, Begotka, Raiff, & Kstern, 2003; Madden et al., 2004). Indeed, previous research on loss aversion, including seminal work conducted by

Kahneman and Tversky, has found similar results when real money or when hypothetical resources are used (Tversky & Kahneman, 1981).

In terms of future directions, the fundamental motives framework is a fruitful avenue for future research on decision biases. Besides the two motivations that we have focused on in the current paper (mating and self-protection), there are several other important domain-specific motives that are likely to influence biases such as loss aversion. For example, kin care is an important recurring goal. In order to be successful at passing on one's genes, one must have children who themselves reach reproductive age. Compared to many other species, mammalian offspring need a lot of care and nurturance before they are ready to survive on their own. There is reason to believe women have been the main caregivers for offspring since ancestral times. A wide range of evidence suggest powerful mechanisms in most women to do whatever it takes to take care of their offspring (Taylor et al., 2000). Thus, when the motive to provide for kin is activated, women might become less loss averse if the safety of their child is on the line.

Besides mating, another example of a fundamental motivation that may selectively lead men to be gain-seeking is that of status acquisition. Human beings everywhere arrange themselves into status hierarchies. There are costs associated with achieving status, but high status individuals are compensated with greater access to resources. For males, there are additional benefits to gaining status, since females are more likely to mate with higher status males. Previous research shows that testosterone levels in men increase in the face of a challenge, remaining high in winners and declining in losers (Mazur & Booth, 1998). Testosterone level is significantly correlated with risk taking and new venture creation (White, Thornhill & Hampson, 2006). One might expect that a status acquisition motivation would lead men to weight losses less than gains in order to climb up the social hierarchy. In addition, men from ecologies with blocked pathways to success (e.g. low SES neighborhoods) may be especially likely to take risks to achieve this goal due to a lack of other options (Dabbs & Morris, 1990).

Another interesting future direction would be to explore situations in which loss aversion might be erased for women. Although parental investment and sexual selection theories suggest women are the “choosier” sex, there may be situations in which women must compete amongst themselves in order to attract a high quality mate. For example, mating markets where the sex ratio is heavily skewed toward women (i.e. many same-sex competitors and few potential mates for women) may increase female-female competition for mates. In such an ecology, the costs of potentially ending up without a partner would be so high that women may be more accepting of losses if it means a chance of obtaining a mate.

Conclusion

An immense amount of research in behavioral economics and decision-making has been devoted to documenting and explaining the many “errors” and “irrational” biases that appear to riddle the human brain (Krueger & Funder, 2004). An evolutionary perspective suggests, however, that such an approach can sometimes be misleading (Kenrick, Li, White, & Neuberg, in press). Rather than being riddled with errors, the human mind is optimized to solve recurring problems in the ancestral environment. Not only are humans excellent intuitive statisticians when information is presented in an ecologically-relevant way (Cosmides & Tooby, 1996; Gigerenzer, 1991), but the biases themselves represent neither errors nor irrationalities in the evolutionary sense (Haselton & Funder, 2006; Kenrick et al., 2009). Instead, human biases would be expected to vary systematically across different evolutionary domains because such domains differ systematically in the costs and opportunities they present (Haselton & Nettle, 2006).

Previous research has demonstrated that classic economic decision biases believed to be domain general, such as the framing effect, can disappear when the context or content of the decision is altered in ways reflecting particular evolutionary domains (e.g., Wang, 1996). Consistent with such logic, the current research shows that the classic bias of loss aversion can be exacerbated, erased, and even reversed when the decision context is the evolutionarily-important domain of mate-seeking. Future research is poised to investigate how the myriad of supposedly domain-general decision-biases actually operate in light of various evolutionarily-relevant motives.

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Figure 1. Extent to which men and women value gains relative to losses as a function of mating motivation (Study 1). Note: bars marked “a” indicate that the difference between gain and loss is significantly different than 0 at $p < .05$.

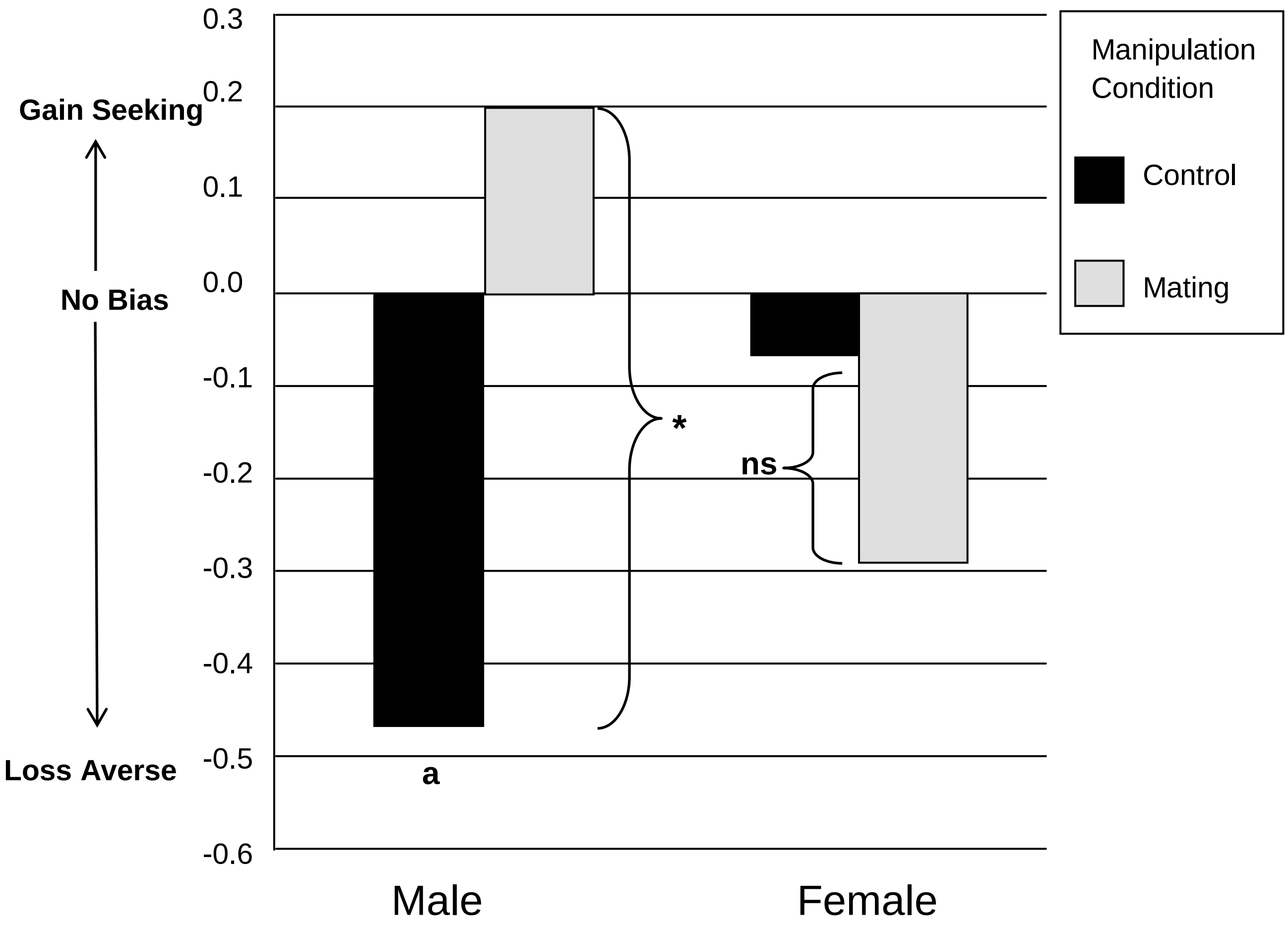

Figure 2. Extent to which men and women value monetary gains relative to losses as a function of mating motivation (Study 2). Note: bars marked “a” indicate that the difference between gain and loss is significantly different than 0 at p < .05.

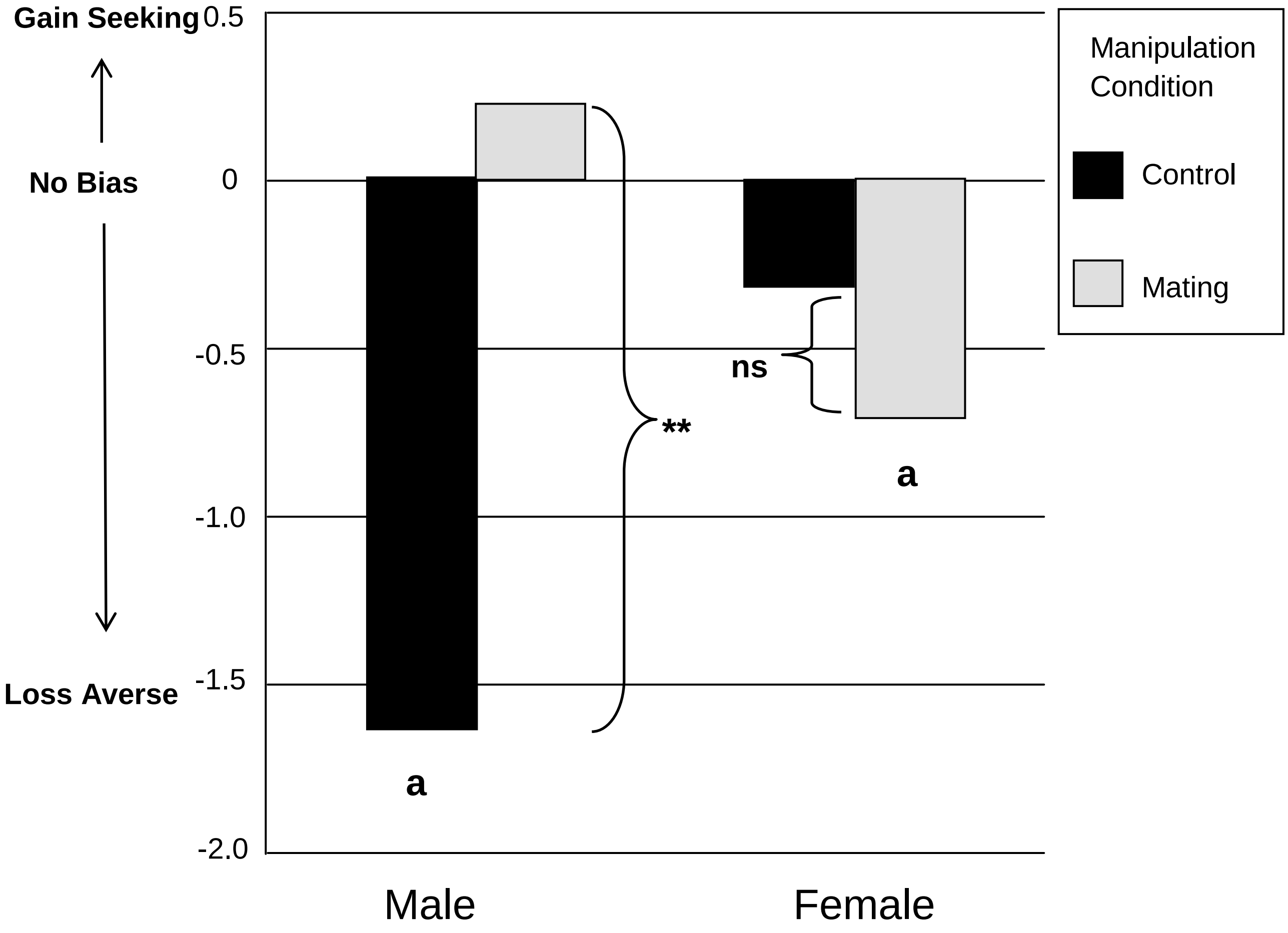

Figure 3. Extent to which men and women value monetary gains relative to losses as a function of mating and self-protective motivations (Study 3). Note: bars marked “a” indicate that the difference between gain and loss is significantly different than 0 at p < .05, “b” refers to a marginal tendency, p =.06.