

Error Management in Relationships

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Abstract

Social judgments are made under uncertainty and pose one of the fundamental challenges of social living. Some of these judgments are also systematically biased—sometimes toward optimism and sometimes toward pessimism. For example, men optimistically overestimate women’s sexual interest, whereas parents pessimistically worry about small children to an excessive extent. Error management theory (EMT) aims to bring a wide variety of seemingly disconnected biases under one theoretical umbrella. EMT proposes that when the costs of false-positive and false-negative errors were asymmetrical over evolutionary history, natural selection designed social judgment adaptations biased in the direction of the less costly error. For example, a man could falsely infer that a woman is sexually interested (a false-positive error) or fail to detect her interest (a false-negative error). Because the reproductive costs of missing a sexual opportunity were high for ancestral men, natural selection might have favored a bias in men that leads them to overestimate a woman’s sexual interest. In this chapter, we review cognitive biases operating in mating relationships, friendships, coalitions, and kinship that can be understood in light of EMT. We discuss challenges for the future and present new predictions.

Key Words: bias, cognitive bias, error management theory, rationality, relationships, romantic relationships, sexual misperception, friendship, kinship, coalitions

In the 1990s movie *Swingers*, two friends in their 20s, Trent (played by a young Vince Vaughn) and Mike, are sitting and talking in a diner booth. Suddenly, Trent stops in the middle of a sentence as he notices a woman in a booth at the other end of the room making flirtatious gestures toward him from afar. She is acting as if she is cooing to a baby, waving and making exaggerated facial expressions. Trent is pretty sure he has not met her before—“I would definitely remember this one,” he says, and begins to gesture back at her in the same manner. It looks as if his reciprocation catches her attention, as she ramps up her flirting more and more. Finally, she stands up and starts walking in Trent’s direction . . . only to lean over and pick up her young baby, who was sitting on the other side of her booth, invisible to Trent. With her baby in her arms, she walks past Trent and Mike without noticing them.

This scene is amusing because it is unrealistic for a man to mistake cooing directed at a baby for flirting directed at him. Nevertheless, the scene is an illustration, albeit an exaggerated one, of a well-documented phenomenon: men overestimate women’s sexual interest in them (Abbey, 1982; Haselton & Buss, 2000). Psychologists have offered a variety of explanations for this bias. Perhaps men are simply not very good at interpreting women’s nonverbal cues (Farris, Treat, Viken, & McFall, 2008a; Treat, Viken, Kruschke, & McFall, 2010), possibly because interacting with women imposes high cognitive load on men that lowers their performance on a variety of cognitive tasks (Karremans, Verwijmeren, Pronk, & Reitsma, 2009). Another possibility is that social expectations cause men to view women as sexual objects and to view interactions with women through a “sexualized lens”

(Harnish, Abbey, & DeBono, 1990). Or perhaps men simply assume that women share similar sexual desires and as a result mistakenly “project” their own, higher level of sexual interest onto women (Koenig, Kirkpatrick, & Ketelaar, 2007; Shotland & Craig, 1988). These explanations have something in common: they imply that something has gone wrong in men’s thinking and that a flaw somewhere in cognitive processing has prevented men from being more accurate.

The focus of this chapter is an alternative view: that this male bias and a variety of other biases in relationship cognition can be understood as adaptations produced by natural selection. Error management theory (EMT) predicts that a bias will evolve when it minimizes the net fitness cost of errors in judgment and decision making—even if that bias produces more errors overall than alternative psychological designs. These biases have important consequences for the study of relationships because they help us understand when people misinterpret each other’s intentions, the circumstances in which people behave in an overly optimistic or paranoid fashion in relationships, and so forth. In this chapter, we review EMT and relevant research in close relationships. We also discuss recently emerging themes in EMT research as well as challenges for the future and other research directions.

Error Management Theory

EMT predicts that biases will evolve in human judgments and decisions that fit three criteria: (1) they were made under uncertainty; (2) they had consequences for survival and reproductive success over the long expanse of human evolution

(i.e., consequences for *fitness*); and (3) they were consistently associated with asymmetrical costs (Haselton & Buss, 2000; Haselton & Nettle, 2006). For instance, humans need to judge from afar whether snake-like objects are actual snakes or merely harmless sticks. We can make two types of errors: a *false-positive error* (inferring that the object is a snake when it is not) or a *false-negative error* (inferring it is not a snake when in fact it is). When making such uncertain judgments, the costs of committing the two errors are often unequal. In this particular case, a false-negative error might lead to being bitten by a snake and possibly dying, whereas a false-positive error results only in extra caution and living to see another day. Because the costs of errors are asymmetrical over evolutionary time, we have a bias that causes us to err on the “safe side” by assuming the worst: when walking in the woods, we are startled by sticks that look like snakes but almost never mistake real snakes for harmless sticks. Figure 11-1 depicts this scenario.

Detecting dangerous agents, such as snakes, fits all three EMT criteria for the evolution of a bias. Humans needed to make judgments about snakes even when unable to detect snakes with perfect accuracy; this decision problem was present throughout human evolution and associated with powerful fitness consequences; and, the costs of a false-negative error (failing to detect the snake and being bitten) were consistently greater than the costs of false-positive errors (unnecessary precautions).

Error management biases exist in other non-social domains. People tend to judge the height of a vertical surface as greater when looking from the

		Belief	
		Snake Present	Snake Absent
True State of the World	Snake Present	Correct Detection	False Negative (more costly error)
	Snake Absent	False Positive (less costly error)	Correct Rejection

Figure 11.1 The four possible combinations of actual presence of snakes and beliefs about snakes. **EMT, error management theory.** *Note.* The bias in this scenario errs toward false positives (seeing sticks as snakes) in order to minimize costly false negatives (failing to detect a real snake). In the general model of EMT biases, when the costs of the errors are reversed (e.g., women’s inferences of men’s commitment, as described in the text), the bias will be toward making false negatives.

top rather than the bottom, which might reflect the costs associated with underestimating the danger of falling from a great height (Jackson & Cormack, 2007). Similarly, people estimate that approaching sounds will arrive earlier than they actually do (Neuhoff, 2001). This phenomenon, called *auditory looming*, might help prepare people to make evasive maneuvers before being struck by a flying object.

Over the past decade, EMT has integrated old findings and generated new ones in relationships, intergroup psychology, cooperation, disease avoidance, and navigation (see Galperin & Haselton, *in press*; Haselton & Nettle, 2006; Haselton et al., 2009). This chapter focuses on a subset of error management biases that operate in relationships, specifically in mating relationships, friendships, coalitions, and families.

Error Management in Relationships

Many of the most common problems of judgment humans face are social. Each day people confront a wide range of social questions: Is a person sexually interested or just friendly? Has my romantic partner been faithful to me? Does a person I just met have cooperative intentions? How loyal is my friend? Is my baby just being fussy, or might she be seriously ill? Judgments like these meet the criteria for the evolution of error management biases: they are uncertain and error prone, they had enormous reproductive consequences for humans throughout evolutionary history, and the costs of committing a false-positive and a false-negative error were probably systematically different from one another. For example, consider the following: throughout evolutionary time, what were the fitness consequences for a man of erring by underestimating another man's interest in his partner or erring by overestimating it?

Underestimating the rival's *intent* might have resulted in not detecting his real interest and not working to maintain the relationship with the partner or obstruct an affair. It would have produced increased risk that the partner would conceive a child with a rival and even exit the relationship (both very high costs to fitness). Overestimating might have resulted in creating conflict with a same-sex individual who is not in fact interested in one's partner and could have been an ally. Both errors are costly, but over evolutionary time, the false negative (underestimating the rival's interest) was probably more costly than was the false positive (overestimating the rival's interest). EMT therefore predicts a bias in the less costly direction:

men will tend to overestimate the threat that same-sex rivals pose to their relationships. In what follows, we elaborate on this and other predictions of relationship-relevant biases and summarize the evidence for these biases.

Deception and Concealment Create Problems of Error Management

Problems of error management arise when people confront incomplete or uncertain information, conditions that surely apply to most real-world judgments of others. Perhaps even more important for error management theory is the fact that people confront concealment of true information and deceptive *misinformation* that is actively produced by targets of judgment who do not wish to have their true intentions known. This further compounds the difficult task of judging the intentions of others. To understand why error management problems were so common for our human ancestors, it is important, therefore, to understand why deception was probably common.

Motives to conceal information or deceive could evolve because the fitness-relevant goals of two individuals—even reproductive partners or close relatives—were rarely in perfect alignment. Because friends, coalition members, and even kin compete for resources, the interests of people in these relationships also differ, and strategic concealment of intentions or deception will often occur as one member of a relationship competes against another (Krebs & Dawkins, 1984). For instance, throughout human evolutionary history, it is likely that men gained greater fitness benefits than did women from having a variety of casual sex partners (Clutton-Brock & Vincent, 1991; Clutton-Brock & Parker, 1992). In order to pursue a strategy of having multiple sex partners, men might have misled women about their true intentions—perhaps indicating that they were more interested in commitment over the long-term than they actually were (Haselton, Buss, Oubaid, & Angleitner, 2005). If so, this would have favored motives to conceal casual sex desires or to deceive women concerning commitment if a man's goal of having casual sex conflicted with his partner's goal of forming a more committed relationship.

Even in long-term mating, the interests of each partner were not perfectly aligned. Each partner benefited from producing and caring for children, which might have been facilitated by long-term romantic bonds (Gonzaga & Haselton, 2008; Gonzaga, Keltner, Londahl, & Smith, 2001). However, there might also have been fitness benefits

accruing to individuals who engaged in sex outside of the relationship. In particular, men might have benefited from pursuing low-cost mating opportunities with additional mates (Li & Kenrick, 2006; Schmitt et al., 2003), whereas women might have benefited from a dual-mating strategy in which they secured investment from their primary partner and higher-fitness genes for their offspring via extrarelationship sexual affairs (Pillsworth & Haselton, 2006a). Because infidelity could damage the fitness of the partner of the unfaithful person (Buss, Larsen, Westen, & Semmelroth, 1992), evolutionary pressures favored the detection of early warning signs of infidelity. In turn, this gave rise to evolutionary pressures for the concealment of partners' interest in affair partners.

Along with general uncertainty created by a lack of complete information in nearly any decision domain, concealment and deception created problems of error management that set the stage for the evolution of cognitive biases.

Biases in Courtship *Sex Differences in Sexual Strategies*

Like males in many other species, human males are obligated to invest less than females in order to produce an offspring. In principle, ancestral men could produce a child after a single act of sex, whereas a woman needed to invest a minimum of a 9-month pregnancy and its attendant costs, along with a period of several years of breastfeeding (Dufour & Sauther, 2002; Lancaster, Kaplan, Hill, & Hurtado, 2000). Men often invest heavily in offspring (Geary, 2000; Marlowe, 2000, 2001), but their investments are not always required for offspring survival (Sear & Mace, 2008), nor are they physiologically obligatory. Therefore, in the ancestral past, engaging in mating with a variety of mates while expending relatively little parenting effort could dramatically increase a man's reproductive success, whereas there was probably very little fitness benefit of the equivalent strategy for a woman (Clutton-Brock & Vincent, 1991; Clutton-Brock & Parker, 1992). Accordingly, relative to women, men are often less selective than women in choosing sex partners (Kenrick, Groth, Trost, & Sadalla, 1993; Li & Kenrick, 2006), are more open to casual sex (Baumeister, Catanese, & Vohs, 2001; Buss & Schmitt, 1993; Clark & Hatfield, 1989; Li & Kenrick, 2006; Simpson & Gangestad, 1991), desire more numerous sex partners (Baumeister et al., 2001; Peplau, 2003; Schmitt et al., 2003), and have a stronger overall sex drive (Hyde, 2005; Peplau, 2003).

Because of their heavy investments in producing offspring, women likely gained fitness advantages by being selective in choosing partners (Trivers, 1972). In hunter-gatherer societies, which are thought to be the closest modern equivalent to the settings in which humans evolved, children raised without an investing father are significantly more likely to die at an early age than those raised with the care of two parents (Hurtado & Hill, 1992). Thus, women likely benefited from choosing mates who were willing and able to provide resources to aid in raising offspring through their long juvenile period (Buss & Schmitt, 1993; Pillsworth & Haselton, 2006b). Women also benefited from choosing mates who displayed cues of high-fitness genes that could be transmitted to offspring, enhancing their survival or future reproductive success (Gangestad & Simpson, 2000; Haselton & Gangestad, 2006; Pillsworth & Haselton, 2006b).

Reflecting these selection pressures, women place greater importance than men on attributes that reflect potential partners' ability and willingness to invest resources in offspring. For instance, women across cultures value social status and earning capacity in potential partners more than do men (Buss, 1989; see also Li, Bailey, Kenrick, & Linsenmeier, 2002). Women can accurately discern men's affinity for children by viewing men's neutral faces, and they are more interested in having a long-term committed relationship with men whose faces reflect a greater liking for children (Roney, Hanson, Durante, & Maestripieri, 2006).

Women are also attracted to male qualities that are hypothesized indicators of high-fitness genes, such as bodily symmetry (Scheib, Gangestad, & Thornhill, 1999), muscularity (Frederick & Haselton, 2007), and facial masculinity (Perrett et al., 1998). In contrast to cues of commitment and paternal investment, which women find most valuable in long-term partners, women particularly value cues of genetic quality when they evaluate men as casual sex partners (Kenrick et al., 1993; Li & Kenrick, 2006). This is probably because the only contribution from casual sex partners to potential offspring is their genes. Women's attraction to these cues also increases during the high-fertility window of the ovulatory cycle when conception is most likely (Gangestad, Thornhill, & Garver-Apgar, 2005; Garver-Apgar, Gangestad, & Thornhill, 2008; Penton-Voak et al., 1999; Pillsworth & Haselton, 2006a).

In sum, men and women appear to have mate preferences and desires that were shaped by different

selection pressures. These sex-differentiated selection pressures and the sexual strategies that arise from them are likely to have resulted in adaptive biases in the perceptions of the intentions of the other sex.

Men's Sexual Overperception Bias

Because men, more than women, benefited from having a variety of sex partners, it is likely that selection has acted to craft in men a keen ability to recognize cues of female sexual interest. For several reasons, however, the judgment of a woman's sexual interest is made under considerable uncertainty. First, women might conceal their true interest in a man in order to avoid the costs of appearing promiscuous (Buss, 2003). Second, many of the cues of women's interest are similar to those conveying mere friendliness—smiles, eye contact, and so forth. Third, women are often cautious in their choice of sex partners and require considerable knowledge about a man before even knowing whether they will ultimately be interested in him as a sex partner (Li & Kenrick, 2006; Pillsworth & Haselton, 2006b). Therefore, a woman herself might not initially know how interested she is in a man soon after encountering him. If she is initially interested, she might provide ambiguous indications of her interest in order to keep a man in close proximity and evaluate him further.

Empirically, there is indeed evidence that women's interest in a man is difficult to discern. Research on previously unacquainted dyads has shown that women's nonverbal behaviors at the beginning of the interaction, such as head nodding, smiling, touching hair, and an open posture, do not correlate with their later self-reported interest in a male interaction partner (Grammer, Kruck, Juette, & Fink, 2000). Women's behavior and interest do begin to correlate in later stages of the interaction, presumably once the woman has formed an impression of the man and established a level of interest in him. Likewise, observers of speed-dating interactions are substantially more accurate in estimating the self-reported interest of male speed-daters than female speed-daters (Place, Todd, Asendorpf, & Penke, 2009).

Because men's judgment of women's interest is made under such uncertainty, it is prone to error. It is likely that the errors ancestral men made in judging women's interest were associated with asymmetrical costs. Underestimating a woman's sexual interest could have resulted in missing a sexual opportunity, whereas overestimating her interest could have resulted merely in wasting time pursuing

a disinterested woman. Therefore, EMT predicts that inaccurate judgments should be systematically biased toward overperception—perceiving more sexual interest in a woman's behavior than truly exists.

As summarized in Table 11-1, the evidence for men's overperception is substantial and methodologically diverse. Methods for examining this bias have included comparisons of men's and women's judgments of women's sexual interest in face-to-face laboratory interactions (Abbey, 1982; Harnish et al.,

Table 11.1 Empirical Evidence of Men's Sexual Overperception Bias

Method	Result	Representative Citations
Speed-dating: repeat dyadic interactions (participant ratings)	Men rate women's interest in them as higher than women self-report	Perilloux, Easton, & Buss, <i>in press</i>
Face-to-face single dyadic interactions (participant ratings)	Men rate women's interest in them as higher than women self-report	Abbey, 1982 Harnish et al., 1990 Henningsen & Henningsen, 2010
Face-to-face single dyadic interactions (ratings of third-party observers)	Male observers rate women's interest as higher than do female observers	Abbey, 1982 Saal et al., 1989
Videos of dyadic interactions	Male video watchers rate female targets' interest as higher than do female video watchers	Shotland & Craig, 1988
Photos of dyadic interactions	Male photo viewers rate female participants' interest as higher than do female photo viewers	Abbey & Melby, 1986 Edmondson & Conger, 1995
Written scenarios	Male readers rate higher interest from women's hypothetical dating behaviors than do female readers	Haselton & Buss, 2000

(continued)

Table 11.1 (Continued)

Method	Result	Representative Citations
Naturalistic experiences	Women (especially attractive women) report more incidences of men mistaking their friendliness for sexual interest than of men making the reverse mistake Men estimate their female friends' sexual interest to be greater than their female friends self-report	Haselton, 2003 Koenig, Kirkpatrick, & Ketelaar, 2007 Bleske-Rechek et al., 2011
Experiments	When primed with romantic thoughts, men perceive sexual interest in photos of attractive women with neutral facial expressions	Maner et al., 2005

1990; Henningsen & Henningsen, 2010; Perilloux, Easton, & Buss, 2012; Saal, Johnson, & Weber, 1989; Shea, 1993), videotaped interactions and/or photos (Abbey, Cozzarelli, McLaughlin, & Harnish, 1987; Abbey & Melby, 1986; Edmondson & Conger, 1995; Saal et al., 1989; Shotland & Craig, 1988), written vignettes (Abbey & Harnish, 1995; DeSouza, Pierce, Zanelli, & Hutz, 1992; Haselton & Buss, 2000; Kowalski, 1993), experiments (Maner et al., 2005), and naturalistic surveys of histories of misperception events (Haselton, 2003; Koenig, Kirkpatrick, & Ketelaar, 2007).

In the prototypical lab interaction study, male–female stranger dyads interact in the lab and are viewed through one-way glass by an additional male and female onlooker. In the original study using these methods, male observers judged female participants' flirtatiousness and seductiveness directed toward the male participant to be more pronounced than did female observers and more pronounced than what the female participants themselves reported (e.g., Abbey, 1982). Over a dozen studies using similar methods have reported similar results

(see La France, Henningsen, Oates, & Shaw, 2009). In a representative vignette study describing behaviors enacted by a woman in a dating scenario, male respondents inferred more sexual interest than did female respondents in response to a wide range of such behaviors (Haselton & Buss, 2000).

Using experimental methods, Maner and colleagues (Maner et al., 2005) primed romantic or neutral moods in participants and then asked them to infer emotions ("microexpressions") in photographed faces that were actually emotionally neutral. Men in a romantic mood inferred more sexual arousal in attractive female faces than men in a neutral mood. Women in a romantic mood were no more likely to infer sexual arousal in neutral male faces than women in a neutral mood.

In an effort to assess sexual misperception outside of the laboratory, Haselton (2003) asked women to report past instances in which men misperceived their sexual intentions. Consistent with the notion that men systematically overestimate women's sexual intent, women reported more episodes in which men had overperceived their sexual intent than in which they had underperceived it. When men were asked about parallel experiences in which women misperceived their intentions, there was no difference in the number of instances of overperception and underperception, suggesting that whereas men show the sexual overperception bias, women do not.

Despite the volume and diversity of support for male overperception, there are complexities inherent in interpreting the evidence. Crucially, researchers must choose a standard for comparison, which they then use as a criterion to evaluate whether judgments are overperceptions, underperceptions, or accurate. Some researchers have chosen self-perceptions (i.e., women's judgments of their own sexual intent; e.g., Perilloux et al., 2012), some have chosen third-party perceptions (i.e., women's judgments of other women's sexual intent; e.g., Shotland & Craig, 1988), and some have chosen to use both in the same study (e.g., Haselton & Buss, 2000). Haselton and Buss (2000) argued that there are likely to be motivated biases working in opposite directions that affect women's reports of their own interest, on one hand, and other women's sexual interest, on the other. Women in these studies tend to report a lower level of their own sexual interest than they report for other women. Women's reports of their own interest might be biased *downward* to maintain the social appearance of choosiness and sexual reserve, qualities men might use to judge women's suitability as long-term mates (Buss & Schmitt, 1993). Women's reports of

the interest of other women might be biased *upward*, reflecting a tactic of competitor derogation (Buss & Dedden, 1990). If this is correct, the reality is located somewhere between women's self-ratings and the third-party ratings provided by other women. The most conservative standard is to compare men's ratings with *each* of these reports in turn and conclude evidence for misperception only when men's ratings are more extreme than both types of ratings. In several studies, men's ratings of women's interest were higher than women's ratings of their own interest and women's ratings of other women's interest (Haselton & Buss, 2000; also see Abbey, 1982). These results are consistent with an upward bias in men's estimation of women's interest—even in the presence of reporting biases by women as outlined above.

The “microexpressions” experiment described above is also notable for its unambiguous demonstration of a male bias because it used an objective criterion: neutral target faces, whose neutrality had been confirmed by an independent group of raters (Maner et al., 2005). The romantically primed men in this study rated the attractive female targets' neutral expressions as sexually interested, providing strong evidence that, when in a romantic mood, men's judgments of women's sexual interest are upwardly biased.

The evidence is mixed concerning whether women are biased or accurate in judging men's sexual interest. Several studies reviewed above found no compelling evidence for a bias (e.g., Haselton, 2003; Haselton & Buss, 2000). However, other studies suggest that women *underperceive* men's sexual intent (Abbey, 1982; Bleske-Rechek et al., 2011; Perilloux et al., in press). For example, a recent study of ~~face-to-face interactions while~~ speed-dating found that women's estimates of their male conversation partners' sexual interest were lower than the men's self-reported interest (Perilloux et al., 2012). In sum, multiple converging sources of evidence indicate that men tend to overestimate women's sexual interest; women are either unbiased or underestimate men's interest in them.

There have been challenges and competing explanations concerning men's sexual overperception bias. Some researchers have argued that only a small subset of men—those who support traditional gender roles and are sexually coercive—overperceive women's sexual intent (Farris, Treat, Viken, & McFall, 2008b). However, not every study finds this subgroup of men to have a stronger overperception bias, and among studies that do, this subgroup of men only partly accounts for men's overall overperception (Farris et al., 2008b).

In one study challenging the existence of sexual overperception by men, men and women viewed photos of women that were posed to present a friendly or sexually interested expression and then classified each photo into the category they believed was correct (Farris, Treat, Viken, & McFall, 2008a). Although men more than women misclassified friendly faces as sexually interested, men were also more likely than women to make the reverse mistake—that is, to misclassify sexually interested faces as friendly. The researchers interpreted this result to mean that men are not *directionally biased* but rather are generally less accurate than women at interpreting nonverbal behavior, which leads to more errors in both directions (overperception and underperception) for men than for women. This study used a novel forced-choice method to test the overperception hypothesis, whereas most other research has used continuous scale ratings of the degree of interest. In principle, either a forced-choice task or rating scale method can be a valid test of the sexual overperception hypothesis, but the particular measure in this study is problematic: whereas classifying friendly faces as sexually interested could indeed be an error, classifying sexually interested faces as friendly was not necessarily an error because most or all sexually interested expressions also look friendly. In light of this possibility it is difficult to interpret these results. This was also a single study that must be viewed in light of the voluminous existing literature indicating a directional bias.

Women's Commitment Underperception Bias

Ancestral women who selected mates who were willing and able to provide resources to aid them through the costly period of pregnancy and subsequent offspring care probably had higher fitness than those who did not (Buss & Schmitt, 1993; Pillsworth & Haselton, 2006b). It was likely, however, that not all men expressing romantic interest in a woman were interested in providing these resources over the long period of time required to raise children to reproductive maturity—only men highly committed to their partners would have done so. As a result, selection might have produced in women a keen interest in and ability to detect cues of men's commitment.

For several reasons, commitment inferences are uncertain and prone to error. First, just as a woman might not be sure about her interest in a man until she takes more time to evaluate him, a man might not be sure about his own commitment to a woman

until he takes more time to evaluate her. Second, because men have a greater desire for casual sex than do women, men might mislead women about their actual interest in commitment in order to induce those women to have sex with them (Haselton et al., 2005).

 The costs for women of the two types of errors in judging a man's commitment interest were likely ~~to have been~~ asymmetrical throughout human evolutionary history. A woman who overestimated a man's commitment risked being abandoned and undergoing pregnancy and subsequent child care with low levels of support, a situation that could dramatically decrease her fitness due to child death (Hurtado & Hill, 1992; Pillsworth & Haselton, 2006b) or a reduction in her mate value (Buss & Schmitt, 2003). In contrast, a woman who underestimated a man's commitment probably endured a much smaller cost—a temporary delay in reproduction while assessing her partner's commitment (Wachtmeister & Enquist, 1999). Therefore, EMT predicts a directional bias in women's inferences of men's commitment: because of the asymmetry in the costs of errors in assessing men's commitment, women will tend to err on the side of underestimating it.

There has been less work examining the commitment underperception bias than the sexual overperception bias, but several studies have found support for it. In a vignette study, participants rated the likelihood that a variety of dating behaviors—such as a passionate kiss or sending flowers—indicated an interest in a long-term romantic relationship (i.e., commitment; Haselton & Buss, 2000). Female raters judged men enacting these behaviors to be less interested in commitment than did male raters. As with sexual overperception, this commitment  underperception bias appears to be target specific: there was no difference between female and male raters when rating women's interest in commitment on the basis of the identical set of behaviors (Haselton & Buss, 2000).

Further evidence for commitment underperception in women was found in a recent study of face-to-face interactions between previously unacquainted male–female dyads (Henningesen & Henningesen, 2010). Dyads engaged in a 5-minute conversation and afterward filled out questionnaires about their own and their partner's perceived level of interest in a committed long-term relationship. Consistent with commitment underperception in women, women estimated lower levels of commitment interest than men reported for themselves.

In contrast, men's estimates of women's commitment were not significantly different from women's reports of their commitment interest, suggesting no equivalent bias in men's judgments of women.

The same complexities involved in interpreting evidence of biases in perceptions of sexual intent apply to biases in perceptions of commitment intent. The criterion for comparison with women's ratings is a crucial factor to consider. Men's self-ratings of commitment could possibly be biased *upward* if those men were cultivating an image that would be attractive to women. This could lead to the appearance of a bias in women when the sex difference merely reflected self-enhancement on the part of men. Men's ratings of other men's commitment could possibly be biased *downward* if men were derogating ~~their competitors~~ by indicating that they lacked commitment, ~~a quality women desire in mates~~. And, in fact, men do rate their own commitment to be higher than their ratings of the commitment of other men (Haselton & Buss, 2000). Again, a conservative standard for concluding evidence of women's bias is requiring that women's ratings are lower than each of these types of ratings by men. In the studies described above, women's perceptions were indeed lower than each ~~criterion~~ measure, men's self reports (Haselton & Buss, 2000; Henningesen & Henningesen, 2010) and men's reports of other men's likely commitment (Haselton & Buss, 2000), providing evidence that women do indeed underestimate men's commitment.

Mating Rivalry Biases

Men and women vigorously compete for mates with same-sex rivals (Buss & Dedden, 1990; Campbell, 2004; Puts, 2010; Schmitt & Buss, 1996). One element of successful mate competition is assessing the attractiveness of one's competitors to others. Hill (2007) hypothesized that there was an asymmetry in the costs of errors in judging rival attractiveness. She hypothesized that a false-negative error—underestimating the desirability of a competitor—would have resulted in decreased motives to compete and thereby increased the chances of failing to attract or retain a mate, an error with high fitness costs. She hypothesized that a false-positive error—overestimating the desirability of one's competitors—would have resulted in enhanced motives to compete, and perhaps some wasted competition effort, an error with relatively lower fitness costs. In the study testing this idea, men and women rated photos of *other-sex* individuals for attractiveness. Separately, a different group

of men and women viewed *same*-sex photos from the same set of photos and were asked to rate how attractive members of the other sex would find them. Consistent with the hypothesized error asymmetry, men and women's estimation of the photographed individuals' attractiveness to the other sex exceeded actual ratings made of those individuals by the other sex (Hill, 2007).

As noted in the introduction, a related bias is the *interloper bias*—leading people to overestimate the interest of rivals in their romantic partners. Because of paternity uncertainty and the associated risk that men could be duped into investing in offspring who are not their own, this bias could be particularly strong in men. This bias remains to be tested.

Biases in Established Long-Term Romantic Relationships *Overestimations of Partner Infidelity*

The fitness interests of long-term romantic partners were rarely perfectly aligned over evolutionary history. For example, each partner might have benefited from being open to high-quality alternative mating opportunities. Each partner also benefited from preventing his or her partner from taking advantage of such opportunities. The costs of a partner's unfaithfulness were substantial for both women and men. If a woman's male partner became involved with someone else, the woman risked losing his material investment in the relationship, which was crucial to raising potential offspring (Buss et al., 1992; Stieglitz, Gurven, Kaplan, & Winking, *in press*). If a man's female partner became involved with someone else, the man risked expending time and energy raising a child who was not genetically related to him (Buss et al., 1992; Daly, Wilson, & Weghorst, 1982). These large fitness costs created evolutionary pressure on both sexes to be vigilant of potential competitors' interest in their partner, as well as their partner's interest in others outside of the relationship. Because any interest directed toward or emanating from one's partner is likely to be cloaked in secrecy, both of these judgments are made under considerable uncertainty.

The costs of failures to detect a partner's sexual infidelity were likely to have been very high, particularly for men. The reverse—believing that a partner had been sexually unfaithful when no infidelity occurred—probably also resulted in substantial costs due to conflict in the relationship, but these costs might have been lower overall. If such an asymmetry characterizes the costs of errors in infidelity detection throughout evolutionary history,

EMT anticipates a bias toward overestimations of infidelity—a false-positive bias.

In the one study to date examining this possibility, partnered men and women separately reported their histories of infidelity under conditions of strict confidentiality (Andrews et al., 2008). They also reported their beliefs about whether their partners had been unfaithful to them. These reports were compared to examine possible false-positive errors (belief in infidelities that the partner did not report) and false-negative errors (no belief in infidelities that the partner actually did report). Men's inferences of partner infidelity contained more false positives than false negatives, consistent with an error management bias. Women's inferences contained the reverse—more false negatives than false positives. This could reflect the fact that the costs of a partner's infidelity were lower for women than for men, as long as the infidelity was strictly sexual (i.e., as long as the male partner did not leave the relationship or substantially divert resources to it; Buss et al., 1992). It could also reflect the fact that women are more oriented than men toward relationship maintenance (Baker & McNulty, 2011) and avoid the conflict that could occur as a result of potentially false suspicions or accusations.

Underestimations of Partner's Forgiveness

Because forgiveness resides in another person's mind, people remain unsure about whether they have been fully forgiven after committing a transgression in a relationship. Friesen and colleagues argued that there are asymmetric costs associated with forgiveness inferences (Friesen, Fletcher, & Overall, 2005). A false positive—assuming that the partner has fully forgiven the transgression when he or she has not—entails the risk that efforts to mend the relationship are incomplete, which could lead to the deterioration of the relationship. A false negative—assuming that the partner has not fully forgiven the transgression when in fact he or she has—could result in greater efforts to make amends than are necessary. The latter has arguably been the lower cost error, particularly in harsh ancestral contexts in which individuals were highly dependent on relationship partners for basic needs. Thus, people might be biased toward underestimating their partner's forgiveness. In a study examining this hypothesis, both partners in a relationship separately answered questions about recent transgressions in the relationship (e.g., insults, flirtation with others, broken promises). The partners committing the transgression rated the extent to which

they believed they had been forgiven; the offended partners rated the degree to which they had actually forgiven the transgressing partners. Both men and women tended to underestimate the degree to which they had been forgiven by their partners (Friesen, Fletcher, & Overall, 2005).

The Paradox of Partner Idealization and Relationship Worry

A substantial literature shows that people have positive illusions about their romantic partners (e.g., Murray, Holmes, & Griffin, 1996a, 1996b). That is, people overestimate their partners' positive traits and underestimate their negative traits, relative to third-party ratings or the partners' ratings of themselves. People also emphasize their partners' positive traits and de-emphasize their negative traits in global evaluations of the relationship (Neff & Karney, 2003). Moreover, positive illusions about the partner predict positive relationship outcomes, such as satisfaction and longevity (Murray et al., 1996a, 1996b).

Somewhat inconsistent with the body of research on positive illusions, other research indicates that people often possess realistic or even negatively skewed relationship-relevant evaluations (Archer, 1999; Friesen, Fletcher, & Overall, 2005). Additionally, these realistic or negative evaluations are sometimes associated with greater long-term satisfaction in relationships that are under stress (McNulty, O'Mara, & Karney, 2008).

Although these two findings appear paradoxical, a recent meta-analysis of the accuracy of judgments in romantic relationships helps to reconcile them (Fletcher & Kerr, 2010). The meta-analysis showed that systematically different aspects of relationships are judged positively and negatively. People appear to be positively biased when judging their partners' individual attributes, remembering the histories of their relationships, and making future predictions about the relationship. In other words, they see their partner as smarter, funnier, more attractive, and more caring than do others; they remember their past conflicts and romantic moments more positively than how they felt about them at the time; and they think they will remain in the relationship longer than turns out to be the case. In contrast, when asked about their partners' beliefs, attitudes, or behaviors about the relationship or about themselves, people respond with negatively biased estimates. For instance, they might underestimate how much their partner trusts them, or, as noted above, whether their partner has forgiven them after a transgression.

Error management principles could help to explain this pattern of results (Fletcher & Kerr, 2010). On one hand, there might have been benefits of positively skewed perceptions of the personal attributes of one's partner. Whereas the potential cost of positively skewed assessments was staying with a partner who was not quite as good as one perceived, the cost of underappreciating a good partner—an increased risk of the deterioration of the relationship and its eventual dissolution—might have been greater (Fletcher & Kerr, 2010). This hypothesized asymmetry stems in part from the transaction costs and uncertainties of leaving a relationship, finding a new partner, and forming a new committed relationship. Given the limited window for reproduction within human life spans, and substantial uncertainty about survival in ancestral conditions, these were large costs that could have reduced or eliminated reproductive opportunities. An adaptation such as romantic love (Gonzaga & Haselton, 2008) that leads people to idealize their partners could be a powerful motivating factor in keeping partners together once they have found each other. In fact, positive illusions about partners are stronger among people who are more intensely in love with their partners (Murray & Holmes, 1997; Penton-Voak, Rowe, & Williams, 2007). People who are in love with their partner also overestimate the distress they would feel in the future if the relationship ended (Eastwick, Finkel, Krishnamurti, & Loewenstein, 2008).

The cost asymmetry could flip when individuals judge their partner's attitude toward them or toward the relationship (Fletcher & Kerr, 2010). In contrast to a rosy outlook about the quality of the partner, people might have benefited from a negative bias about their partner's feelings about them. Although this bias could result in unneeded concern and effort to maintain the relationship, it also would have reduced the risk that true relationship vulnerabilities would have been missed and the partner would have failed in attempts to remediate them. Likewise, overestimating the negative feelings one would have if the relationship ended might have motivated actions to maintain the relationship.

The meta-analysis of Fletcher and Kerr (2010) also identified a sex difference, such that women's positive and negative biases were larger than men's, a result that could also be interpreted in light of error management. Women are, on average, more oriented toward relationship maintenance than men are (Baker & McNulty, 2011) because a committed relationship was probably more strongly

tied to women's reproductive success than to men's. Because of this, the error asymmetry in evaluating the partner and the relationship was enhanced for women relative to men, such that it was especially costly for women to underestimate the partner's positive qualities or underestimate emerging threats to the relationship.

Biases in Friendships and Coalitions *Mating Rivalry Bias among Female Friends*

The logic that there are high costs associated with underestimating mating rivals applies to friendships as well. Although friendships could facilitate mating success via mutual support and encouragement, they were also a source of intrasexual competition for mates (Ackerman & Kenrick, 2009; Bleske & Buss, 2000). Underestimating the extent to which an attractive friend is a potential rival might have been especially costly, and one might predict that people should perceive more mating rivalry with more attractive friends. In a study investigating this idea, pairs of female friends rated their own and each other's attractiveness as well as perceptions of mating rivalry with their friend (embedded among filler items; Bleske-Rechek & Lighthall, 2010). Attractiveness ratings were corroborated by independent judges. Within friendship dyads, the less attractive woman of the pair perceived more mating rivalry in their friendship than did the more attractive woman of the pair. More research is needed to determine whether this is a veridical perception on the part of the less attractive friend (perhaps the more attractive friend really is more competitive) or whether it reflects a bias toward overestimating rivalry.

The Social Exchange Heuristic

Cooperative dilemmas present people with opportunities to cooperate with another person for mutual benefit or to "defect" and take a larger share of the resources for themselves. A simple and well-studied dilemma is the "dictator game" (see Camerer, 2003). In this type of economic game, the experimenter provides a monetary endowment to one of the two participants, who are in separate rooms. The player with the money is then asked to decide what portion of it to allocate to the other player, thereby "dictating" the outcome unilaterally. The other player has absolutely no control over the outcome. The entire game consists of this single interaction.

In games such as this, each player personally profits more from defecting (keeping most

or all of the endowment for himself) than from cooperating (distributing the endowment more evenly). Standard economic principles predict that people will behave in ways that maximize material payoffs—that is, they will defect. However, the evidence is contrary to this prediction: players often choose to cooperate by allocating 50 percent of their endowment to the other player rather than defecting by taking most or all of the endowment for themselves (Camerer & Thaler, 1995; Caporael, Dawes, Orbell, & van der Kragt, 1989; Henrich et al., 2001; Sally, 1995), and this pattern is cross-culturally ubiquitous. These results are not easily explained by concerns about reputation. Players in single-interaction economic games are usually anonymous strangers who are given assurances that their identities will be concealed and protected. Therefore, they have seemingly little incentive to signal cooperativeness for future interactions. In sum, the games are set up so that there are no practical repercussions of defecting; players are aware of this, but they still cooperate.

What explains this seemingly mysterious cooperative behavior? One possibility is that participants in these games feel some uncertainty about whether their identities will truly remain unknown to others if they behave selfishly. Along with this uncertainty, there is a possible asymmetry in cost: Under harsh ancestral conditions, humans probably relied heavily on cooperative relationships with others (Baumeister & Leary, 1995). Therefore, behaving selfishly and having one's identity discovered was probably higher in cost than behaving cooperatively (and losing some token reward) when one's identity would in fact remain unknown. This notion predicts that people will be biased toward cooperating in situations in which they could easily act selfishly, a bias dubbed the "social exchange heuristic" (Yamagishi, Terai, Kiyonari, Mifune, & Kanazawa, 2007). This bias can be conceptualized as a combination of error management and an artifact of modern living. Although it is no longer the case in many modern settings, in ancestral environments, the probability of repeated encounters would have been high and social reputation effects important.

The social exchange heuristic is also supported by experiments in which there are minimal cues that one is being watched. In one study, anonymous strangers played a series of dictator games on the computer. For some of the participants, the researchers subtly manipulated visual cues by showing stylized eyespots on the computer's desktop background. Although the percentage of the participants who

shared any part of the endowment in this study was relatively low, the manipulation nonetheless had a striking effect: When using a computer displaying eyespots, participants on average gave significantly more money to their partners (37.9 percent of the endowment) compared with the controls (24.5 percent of the endowment; Haley & Fessler, 2005).

Sinister Attribution Bias in Coalitions

When individuals are low in status or join a new social group in which their status and social relationships are not yet established, they face the important task of evaluating how others regard them. In the ancestral past, it was important for such individuals to carefully monitor what others thought because having social support or, conversely, facing ostracism could literally mean the difference between life and death (Baumeister & Leary, 1995). Again, people face an error management problem when forming these judgments: people could overestimate or underestimate the negative regard of others, and these errors are associated with different costs. Underestimating negative evaluations and not attempting to remediate them could result in ostracism, whereas overestimating negative evaluations might have produced unneeded caution in those relationships, a lower cost error. Thus, error management logic predicts that people who have low or tenuous status within a group will be biased toward thinking that others regard them more negatively than is actually the case.

Evidence is consistent with this bias (e.g., Fenigstein, 1984; Kramer, 1994; Savitsky, Epley, & Gilovich, 2001; for a review, see Kramer, 1998). For example, when participants commit an experimentally induced social gaffe in the presence of strangers—such as failing a “simple” anagram test or being described in an embarrassing manner—they think they are judged less favorably than they actually are (Savitsky et al., 2001). Another study examined the attributions that students in a prestigious business school make about others’ ambiguous behavior toward them (Kramer, 1994). First-year students (i.e., those with less social status and newer to the group) were more likely than second-year students to infer that ambiguous behaviors by other students, such as not returning a phone call or abruptly leaving the table, reflected negative attitudes. This effect was amplified when first-year students imagined that the interaction took place with a second-year student, whereas second-year students were not affected by the same manipulation of the target’s status.

Biases in Kinship *Bias in Detecting Kin*

The most fundamental kinship bias is detecting kinship itself. For two reasons, distinguishing kin from nonkin was important throughout human evolutionary history. First, it was important to avoid mating with kin because inbreeding produces offspring with increased risks for early mortality, congenital defects, and disease (Bittles & Neel, 1994; Charlesworth & Charlesworth, 1999; Seemanova, 1971). Second, the extent of one’s own gene replication throughout evolutionary history was determined by one’s own direct reproduction and also by the reproduction of kin. This fact, called *inclusive fitness*, leads to the evolution of dispositions to assist kin in survival and reproduction (Hamilton, 1964). Ancestral humans who better distinguished kin from nonkin had greater inclusive fitness.

~~Detecting kinship is a phylogenetically ancient problem.~~ There are at least two primary mechanisms for detecting kinship that are likely to operate in both humans and nonhumans (Park, Schaller, & van Vugt, 2008). One mechanism is tracking spatial proximity and frequent contact with another individual from an early age, conditions that are correlated with kinship (e.g., being a sibling; Lieberman, Tooby, & Cosmides, 2007). Another mechanism is detecting phenotypic resemblance (e.g., DeBruine, 2005; Platek et al., 2003). Both of these mechanisms involve uncertainty and create error management problems. Because men can never be certain of paternity, problems of kin detection are characterized by more uncertainty for men.

In the case of detecting kin, there were substantial costs associated with both the false-positive and false-negative errors. For sexual decisions, treating nonkin as kin could have resulted in forgoing valuable mating opportunities, whereas treating kin as nonkin could have resulted in inbreeding. For altruistic behavior, treating nonkin as kin could have resulted in expending valuable resources that did not enhance one’s own fitness, whereas treating kin as nonkin could have resulted in failure to help a needy relative.

There are a variety of factors that were probably associated with the direction and magnitude of cost asymmetries in kin detection over evolutionary history (Park et al., 2008). One factor that might affect the detection of kin and ~~behaving~~  ~~altruistic~~ ~~toward them is resource endowment.~~ For individuals who had abundant resources, the cost of altruism was relatively low; for individuals living close to the margin of survival, the cost was high (Park et al.,

2008). Thus, individuals with abundant resources might have lower thresholds for categorizing someone as kin than individuals with scarce resources. Because kin detection is more uncertain for men, this prediction is stronger for men than women. This prediction remains to be tested—we return to it later in the chapter.

Another factor that might affect kin detection is the sex of the individual detecting kin. Although inbreeding is costly for men and women, these costs were probably substantially higher for women because of their higher obligatory investment in offspring and slower reproductive rate. Consistent with this idea, relative to men, women require smaller “doses” of kinship cues, such as coresidence duration, to rate their disgust at the maximal scale value when asked to think about sex with a relative (Lieberman, Tooby, & Cosmides, 2003).

Excessive Parental Worry

Human children are helpless and vulnerable to many dangers ranging from accidents to disease to assault. Perceptions of potential dangers to children are inherently fraught with uncertainty. For instance, it is difficult to determine whether an infant is ill or simply being fussy. Likewise, by their very nature, accidents are unpredictable and never completely controllable. This uncertainty creates an error management problem: a parent could either underestimate danger or overestimate it. Given the strong connection between fitness and successful care for vulnerable children, the ancestral cost asymmetry seems clear: false-negative errors were probably more costly, on average, than false-positive errors. The false negative—failing to detect dangers and protect a child—could lead to death or injury of children, whereas the false positive—worrying about dangers that are vanishingly rare—leads to time spent on unnecessary precautions. Thus, an error management prediction is that parents should be biased toward overestimating dangers to their children.

Some evidence supports this prediction. Obsessive-compulsive disorder (OCD) is characterized by compulsive worry and checking behaviors (e.g., repeatedly checking that the stove has been turned off; American Psychiatric Association [DSM-IV], 2000). Symptoms of OCD develop at higher than typical rates among postpartum women and are exacerbated by pregnancy and childbirth in those who already have OCD (Abramowitz et al., 2003). In one recent study, 65 percent of female and male respondents who

recently had a child reported at least some obsessive intrusive thoughts about the infant’s safety (Abramowitz et al., 2003). New mothers and fathers reported elevated concerns, although rates were higher among the mothers than the fathers. Another study found that in the early weeks postpartum, approximately 95 percent of mothers and 80 percent of fathers reported recurrent intrusive thoughts of the possibility of harm to their baby (Leckman et al., 1999). New parents’ obsessive concerns tend to reflect a fear of external dangers to the baby: suffocation, accidents, being lost or kidnapped, and contamination resulting in illness (Abramowitz et al., 2003; Leckman et al., 1999; also see Maina, Albert, Bogetto, Vaschetto, & Ravizza, 1999). A shortcoming of this evidence for the parental worry hypothesis is that research often lacks an objective baseline criterion for comparison (e.g., How common are these dangers today? How common were they throughout evolutionary history?). Nonetheless, this topic is ripe for future exploration from an EMT perspective.

Recent Developments and Future Directions for EMT

Conditional EMT Biases

Psychological adaptations are responsive to variable inputs from the environment (e.g., Gangestad, Haselton, & Buss, 2006). A critical aspect of error management logic is that ancestral asymmetries in costs were not static and instead varied depending on the context in which judgments were made, the characteristics of targets being evaluated, and the characteristics of the evaluator. If these moderating factors are recurrent and there are cues that reliably associated with them throughout evolutionary history, humans are expected to have adaptations that produce variable degrees of bias that are conditional on these cues.

Two examples discussed above demonstrate conditional variations in bias. First, although both women and men are positively biased in evaluating their partner and often negatively biased in evaluating their relationship, these biases are larger for women, possibly reflecting women’s greater dependence on the investment of romantic partners over evolutionary time. Second, the sinister attribution bias is specific to individuals who are new to social groups or low in status, possibly reflecting the greater risk of ostracism such individuals faced over evolutionary time. Table 11-2 summarizes these conditional biases; we elaborate on others below.

Table 11.2 Notable Influences of Context on Error Management Biases

Bias	Moderating Variable Is Attribute of...	Moderating Variable	Effect of High Level of Moderating Variable on Bias	Source
Men's overestimation of women's sexual interest	Target	Female target's attractiveness	Bias ↑	Haselton (2003) Maner et al. (2005) Perilloux et al. (<i>in press</i>)
Women's underestimation of men's relationship commitment	Observer–target interaction	Fertility within ovulatory cycle × Male target's physical attractiveness	Bias ↓ (high fertility, high male attractiveness)	Durante et al. (2010)
	Observer–target interaction	Female observer's sexual interest in the male target	Bias ↓	Henningesen & Henningesen (2010)
	Observer	Age (premenopausal vs. postmenopausal)	Bias ↓	Cyrus et al. (2011)
Women's overestimation of men's sexual coerciveness	Observer	Fertility within ovulatory cycle	Bias ↑	Garver-Apgar et al. (2007)
Idealization of partner	Observer	Observer's sex	Bias ↑ (female observers)	Fletcher & Kerr (2010)
Pessimism about relationship	Observer	Observer's sex	Bias ↑ (female observers)	Fletcher & Kerr (2010)
Sinister attribution	Observer	Social status	Bias ↓	Kramer (1998) Savitsky et al. (2001)
Kinship overperception	Observer	Observer's sex	Bias ↑ (women more than men)	Lieberman et al. (2003)

Examples of Conditional EMT Biases

Men's sexual overperception is greater when evaluating the interest of attractive women. According to EMT, men's overperception of women's sexual intent functioned to decrease the chances that ancestral men would miss sexual opportunities. Because attractiveness is a cue of fertility (Sugiyama, 2005; Symons, 1979), missing a sexual opportunity with an attractive woman would have been especially costly to fitness, further pushing men's bias in the direction of overperception when targets are attractive women. Consistent with this prediction, women's self-rated attractiveness is positively correlated with their self-reported history of experiencing sexual overperception by men (Haselton, 2003). Likewise, in face-to-face speed-dating interactions, the extent to which men overrate a woman's sexual interest relative to her self-report is positively correlated with men's ratings of the woman's attractiveness (Perilloux et al., 2012). Perhaps the strongest evidence for the moderating effect of attractiveness

was documented in an experiment noted earlier in which men and women viewed romantically charged films and then rated facial expressions that were actually neutral (Maner et al., 2005). Men, but not women, who were primed with romance perceived sexual arousal in female faces, especially when the faces were attractive.

Commitment underperception is absent in older women. According to EMT, commitment underperception minimized the chance that ancestral women would have sex with a man who would provide little or no paternal investment if she became pregnant. Cyrus, Schwarz, and Hassebrauck (2011) hypothesized that the bias would be present only in women of reproductive age—the only women who faced the costs of pregnancy without investment. Using methods parallel to prior work (Haselton and Buss, 2000), these authors successfully replicated evidence of commitment underperception in a younger sample but found no evidence of the bias in a sample of women of postmenopausal age. The

two groups of women in the study varied in fertility, but also in cohort. Research following women over time is therefore needed to rule out cohort effects.

Women's perceptions of men's coerciveness and commitment vary across the ovulatory cycle. Contexts can also shift on a shorter time scale. One type of shift occurs in women across the ovulatory cycle: for ancestral women, the reproductive costs of having sex with a man who had low genetic fitness increased along with the probability of conception (Gangestad & Thornhill, 2008; Pillsworth & Haselton, 2006a). Noting this, Garver-Apgar, Gangestad, and Simpson (2007) hypothesized that women will be particularly wary of sexual coercion when fertility is high within the ovulatory cycle. In a study testing this idea, women at various points in their cycle viewed videotaped interactions of men and women, and consistent with the error management prediction, women in their high-fertility phase rated men as more sexually coercive than did women in other cycle phases.

On the flip side of this logic, for ancestral women, the reproductive *benefits* to women of having sex with a man who had high genetic fitness also rose along with the probability of conception (Pillsworth & Haselton, 2006a). In men, physical attractiveness is a hypothesized indicator of genetic fitness (Gangestad & Simpson, 2000). Even if a man did not provide commitment, a woman could still receive genetic benefits for her child from a sexual encounter with him. In accordance with this logic, women's standards for physical attractiveness are higher for short-term sexual encounters than for long-term relationships (Kenrick et al., 1993; Li & Kenrick, 2006). Thus, physically attractive men are relatively more successful at obtaining short-term sexual encounters with women, enabling these men to pursue a strategy in which they do not commit to a particular woman (Gangestad & Simpson, 2000).

Noting the reproductive benefits for ancestral women of conceiving offspring with attractive men, Durante, Griskevicius, Simpson, and Li (2010) hypothesized that a woman at high fertility encountering an attractive man involves a shifted error asymmetry in perceiving the man's commitment intent. Unlike in other circumstances, the false-positive error might have been less costly for ancestral women than the false-negative error. The false-positive error—mistakenly perceiving commitment—could still have led to being abandoned but also gaining genetic benefits from the sexual encounter. The false-negative error—mistakenly

perceiving a lack of commitment—could have led to the loss of genetic benefits as well as commitment.

In a study testing this idea, in two separate sessions, one at low and one at high fertility, women viewed a set of photos of men who varied in attractiveness and commitment (described in a vignette; Durante et al., 2010). Women rated each man's interest in a committed long-term relationship and investing in children. At high fertility relative to low fertility, women thought the attractive men were more interested in commitment and raising children. This shift possibly functions to increase women's motivation to consent to mating with attractive men when fertility is high.

Another recent study involving face-to-face interactions between strangers showed that when women were more sexually interested in their interaction partner, they also perceived more commitment from him (Henningesen & Henningesen, 2010). Although this result is correlational, it accords well with the ovulation findings and provides a candidate mechanism (sexual interest) that ~~allows women to shift their~~ perceptions of men's commitment with changes in mating context.

The Past versus the Present

A challenge for EMT is that the true costs of errors over the course of evolutionary history are, of course, unknown. Instead, EMT hypotheses are based on hypothesized asymmetries that are informed by pertinent literatures in anthropology, biology, and other sciences. In some cases, the hypothesized asymmetry is based on well-established knowledge about the evolutionary past. For example, we know that sex differences in reproductive physiology are ancient and gave rise to the different reproductive constraints on men and women. The sexual overperception and commitment underperception hypotheses, although involving other considerations, have a strong basis in this knowledge about reproductive constraints.

Despite the fact that true asymmetries in costs are unknown, the impressive specificity of some biases predicted by EMT provides compelling support for the usefulness of the theory. For example, finding that a woman's fertility status within the ovulation cycle shifts her biases in perceiving men's coerciveness and commitment would have been unlikely were it not for an explicit evolutionary framework involving error management logic. Moving forward, the success with which EMT predicts specific biases, perhaps involving interactions with subtle factors

like the ~~evolution~~ cycle, will help to determine its power as a theory.

Ultimate and Proximate Causes

Another challenge concerns the integration of ultimate and proximate causes of biases. EMT is primarily a theory about ultimate causes occurring over deep evolutionary time. EMT posits that selection pressures over evolutionary time gave rise to function-specific biases that minimize the costs of errors for fitness. EMT is virtually silent on how these biases are implemented in the present by proximate causes involving genes, hormones, and social input. A complete understanding of biases, of course, needs to involve both proximate and ultimate causes.

In addition to function-specific biases shaped over evolutionary time, it is likely that there are more general proximate mechanisms that produce biases in response to a person's perception of the differential costs of errors over his or her lifetime. A person might learn through a process of conditioning, for example, that bee stings are extremely painful and costly—much more so than the modest hassle of needlessly ducking out of the way of other buzzing insects. This could produce a false alarm bias, such that buzzing insects tend to be treated as stinging insects more so than would be warranted by the true proportion of stinging versus harmless insects. It is possible that conditioning processes such as these could account for some biases in relationship cognition as well, ~~such as men's sexual overperception bias.~~

A challenge for EMT moving into the future is to test between ideas about specific error management strategies versus more general conditioning explanations for biases. One relevant source of evidence that can help to disentangle these alternative mechanisms is the perceived costs of errors. One recent study asked men explicitly which error they felt was worse to make, underestimating a woman's sexual intent or overestimating it (Henningsen & Henningsen, 2009). Men reported that overestimating it was more costly—a fact suggesting that men should underestimate women's sexual intent to avoid the error. As we have shown, abundant evidence indicates that men's actual bias is the opposite. Therefore, despite the fact that men seem to believe that overestimating interest is more costly, this is precisely what they do. Evidence like this weighs against a simple conditioning explanation of the bias.

Bias in Beliefs or Bias in Actions?

Recently, McKay and colleagues introduced a novel perspective on EMT, rooted in philosophy and economic modeling (McKay & Dennett, 2009; McKay & Efferson, 2010). While affirming the basic logic of EMT, they argued that to solve adaptive problems of the sort explained by EMT, *biased beliefs* are not needed if *biased actions* can accomplish the same ends while preserving true beliefs. McKay and Efferson (2010, p. 311) illustrated this point using sexual overperception as an example. They pointed out that a man does not need to have a biased belief that a woman is sexually interested in order to approach her. Instead, because the payoff of a short-term sexual encounter for a man, however improbable, is so large, even an *accurate* awareness of low chances of success (and the corresponding large chance of incurring a small cost, such as a slap in the face) should not deter him from taking a chance. He might think to himself, "My chances are low, but why not try?"

This is a plausible alternative design for managing the costs of errors. Although EMT was originally advanced to explain cognitive biases (i.e., biased beliefs leading to biased behavior), the core logic of the theory is neutral in predicting whether a bias must be built into belief or occur further along in the decision chain, leading more directly to biased actions. The logic of EMT is satisfied as long as humans evolve psychological systems that lead them to behave so that they minimize ~~the incidence of~~ the more costly of the two errors in question. Ultimately, the question of whether solutions to error management problems are sometimes rooted in biased *belief* is an open question that can only be answered on a case-by-case basis with empirical research (Haselton & Buss, 2009).

There is compelling empirical evidence that the sexual overperception bias, in particular, is rooted in biased beliefs. As shown in Table 11-1, there is evidence across a range of studies that men actually do overestimate women's interest in face-to-face interactions, when judging videotaped interactions and photos, in vignettes, and in friendships. It is difficult to reconcile the notion that men are biased in their actions without ~~a corresponding bias in belief with the fact that men appear to overestimate women's interest as assessed in all of these varied ways, but especially in self-report measures, which reflect biased beliefs rather than biased actions.~~

The source of evidence for each of the other biases we have discussed in this chapter is also a bias

in belief. Overestimating the attractiveness of mating rivals or the degree of mating rivalry with an attractive friend, underestimating a new partner's commitment intent, overestimating partner infidelity, idealizing one's partner, and being paranoid about the stability of the existing relationship are all **belief** biases documented using measures that tap into people's beliefs. One could imagine purely behavioral adaptations to act in ways that give people advantages in competition with one's mating rivals, protect people from a potentially uncommitted partner, enhance their current relationships, and keep their partners from straying, all without any accompanying illusions about their partner, relationship, or mating rivals. However, evidence points ~~precisely to the sort of~~ cognitive biases that motivate error management behaviors in these domains. Therefore, the argument that, in theory, error management adaptations need not involve biased beliefs does not invalidate the possibility that such biases exist. The state of the evidence indicates **otherwise**.

New Predictions

New EMT Predictions in the Domains of Friendship and Kinship

Relative to research in mating domains, there has been **relatively** little research explicitly guided by EMT in the domains of friendship and kinship. We suggest several promising directions for each domain in turn.

FRIENDSHIP

An emerging theme is a common “negative” bias causing people concern about how they are regarded by long-term partners and coalition members. Such a bias might foster vigilance that helps to protect these relationships. Friends are likely to have offered some of the same adaptive benefits as these other relationship partners. It is possible, therefore, that a similar set of biases cause concern about one's standing in a friendship and the encroachment of interlopers on friendships.

One instantiation of an error management bias might involve the “tracking” of social exchange among friends. Friends **do** not track favors exchanged as closely as do strangers—but friends do monitor the exchange of favors to some extent (Mills & Clark, 1994; Xue & Silk, 2012). For example, some evidence suggests that friends avoid strategies that allow them to explicitly track their relative contributions to a task (Clark, 1984), but over the long **haul**, people are aware of balance in social exchange and prefer balanced over unbalanced

friendships (Shackelford & Buss, 1996). Therefore, although friendships are characterized by an ideal of communalism, they could fail if one partner does not provide sufficient benefits to the other. Given the likely importance of exchange relationships like friendships ~~over evolutionary time~~, overestimating how beneficial one is to a friend might have been more costly than underestimating it, particularly when the individual estimating **their** contribution is vulnerable in some way—sick, new to a social environment, and so forth.—This could have shaped a bias in which vulnerable friends underestimate their contribution to friendships.

KINSHIP

One area in which there has been **relatively** little research directly testing EMT ideas is **in kinship cognition**. One promising hypothesis is that the costs of inbreeding are highest in pathogen-prevalent environments in which the consequences of immune weaknesses are magnified. Therefore, the psychology of kin detection might be sensitive to cues of pathogen prevalence, and this sensitivity could adjust kinship biases toward overinclusive kinship inferences and stronger inbreeding avoidance responses (Park et al., 2008). Because women are obligated to invest heavily in reproduction, the costs of inbreeding are particularly high for women relative to men. It is therefore possible that women's inbreeding avoidance is at maximal levels across ecologies (e.g., Lieberman et al., 2007). If this is the case, **variation in inbreeding avoidance, predicted by the local ecology**, could apply only to men.

As noted above, resource endowment might also affect biases in kin detection. When in possession of scarce resources, people might heighten the evidentiary threshold for judging that another person is a kin member, **saving** resources instead for **the self or other strategic uses**. Likewise, when in possession of abundant resources, people might adjust **the** threshold downward and become overinclusive in judging kinship (Park et al., 2008). Because of men's uncertainty of paternity, variation in kin inclusiveness, predicted by resource endowment, could also apply only to men.

Conclusion

In some cases, people have optimistic biases about their relationships. Men and women are optimistic about the quality of their relationship partners, and men are optimistic about their sexual prospects with potential new mates. These biases might be a necessary motivational boost that

enhances the ability to strive for outcomes that had important fitness benefits throughout evolutionary time (Haselton & Buss, 2009; Haselton & Nettle, 2006; also see Murray et al., 1996a; Murray et al., 1996b; Taylor & Brown, 1988). In other cases, people have pessimistic biases about their relationships. Men and women worry a little too much that partners have not forgiven them after a transgression, and women underestimate the extent to which potential mates are interested in forming committed relationships. These biases might be necessary to maintain vigilance about very real threats—threats existing throughout evolutionary time (Haselton & Buss, 2009; Haselton & Nettle, 2006). As we have shown in this chapter, people also have optimistic and pessimistic biases about friends, coalition partners, and kin that serve similar functions—striving for and maintaining these social connections and protecting them from harm.

Biases in the way we judge our relationships and partners are likely to emanate from many sources—quirks in cognition, constraints that necessitate cognitive shortcuts, and social pressures that might vary over time. EMT provides an additional explanation: these biases were shaped over deep evolutionary time and served to enhance fitness in the environments in which they evolved. Error management theory applies to a wide variety of domains in the study of relationships and brings existing findings—from sexual overperception to partner idealization to excessive parental worry—under one theoretical umbrella. EMT has also led to a variety of new hypotheses that have been supported, leading to findings that arguably would not have been discovered otherwise.

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