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The adaptive functions of jealousy

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Chapter 7
The Adaptive Functions of Jealousy

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Abstract Jealousy is a troublesome emotional experience for those afflicted by its onset. The grip of the "green-eyed monster" has been known to cause misery and produce some drastic coping behaviors ranging from paranoid stalking to violent aggression. But rather than a product of civilized culture gone wrong or a mental disorder as some thinkers have claimed jealousy to be, the current chapter proposes from an evolutionary perspective that jealousy plays an important role in our lives by serving a critical adaptive function for humans—the vigilance over and protection of relationships that are valuable to us.

I saw the light on the night that I passed by her window
I saw the flickering shadows of love on her blind
She was my woman!
As she deceived me, I watched and went out of my mind
My my my Delilah
Why why why Delilah?
I could see, that girl was no good for me
But I was lost like a slave that no man could free
At break of day when that man drove away I was waiting
I crossed the street to her house and she opened the door
She stood there laughing!
I felt the knife in my hand and she laughed no more.

—*Delilah*, Tom Jones

Popularly personified as the "green-eyed monster"—a term attributed to William Shakespeare—jealousy has had a longstanding reputation as one of the most toxic of human emotions. Across various assessments by theologians, philosophers, artists, and writers, jealousy is known for triggering bitter feelings that may erupt into reactions as violent as that of Tom Jones's popular song, "Delilah." There is a socially shared obsession with the drama of jealousy which makes shows like *The*

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Good Wife and *Survivor* so engaging to watch, but jealousy far predates modern television. The famed sibling rivals from biblical times, Cain and Abel, are but one of the many ancient examples of the poisonous effects of jealousy. At a cocktail party, it is not uncommon for everyone's eager attention to be turned to a juicy, scandalous story where jealousy takes center stage.

This chapter reviews research on jealousy and, in particular, its function via an evolutionary lens. In contrast to other theoretical accounts of jealousy, evolutionary psychology, with its focus on the functional, adaptive origins of psychological traits, views jealousy not so much as "toxic" or "poisonous" but instead as playing an important, purposive role in our lives, thus justifying its presence within our psychological repertoire. Further, the utility of the evolutionary perspective will be explicated by discussing additional insights and predictions that prior, non-evolutionary theories of jealousy fail to elucidate. Through an analysis of its adaptive function, we may also better understand the factors that trigger jealousy, which include the various ways that the modern world we live in may be mismatched to our evolved psychological mechanisms and thus be especially conducive for maladaptive jealousy to breed.

Jealousy

"Jealousy" is a concept in many cultures that—in its broadest meaning—describes affective and behavioral responses to real or imagined situations where a highly valued possession, often a social relationship, is threatened to be diverted elsewhere and lost (Buss, 2000; Pfeiffer & Wong, 1989; Daly, Wilson, & Weghorst, 1982; Mathes, Adams, & Davies, 1985). Jealousy can be experienced for a wide range of interpersonal situations. For instance, one may fear losing a best friend to the new friends that he or she meets. When the valued relationship is a privileged or preferential working relationship with a boss, threats may come from impressive rival co-workers. When the valued relationship is a romantic mateship, threats may come from attractive or desirable "mate poachers" (Buss, 2000). Jealousy has been observed in children as young as toddlers who are sensitive to the loss of parental attention to another and try to disrupt the undesired, ongoing attention (Dunn, 1988; Hart, Field, Del Valle, & Letourneau, 1998). In many of these situations, rivals do not necessarily have to be clearly impressive, attractive, desirable, or even human. When we expect to have an exclusive relationship with a person but he or she displays interest in someone or something else, such as when a spouse is more attentive to the pet cat or devotes more time to golf, jealous feelings can also arise.

Inherent in the experience of jealousy is the experience of competitive threat—specifically the competition for valued relationships, the potential loss of these valued relationships to rivals, and the urge to act in ways that prevent such loss from occurring (Mathes et al., 1985). Jealousy is therefore subtly but significantly different from another closely related emotion: envy. Envy occurs in two-person situations in which we lack but covet a desired attribute enjoyed by another, whereas

jealousy is a "triangle of relations" where a special relationship we (believe ourselves to) possess is perceived to be at risk of being taken away by a third rival individual or interest (Parrott, 1991; p. 16).

Consequences of Jealousy

People engage in a wide array of possible coping responses when they have appraised the threat of a rival relationship. Although studies suggest that some of these jealous reactions may lead to positive outcomes, such as when it serves as a reminder to stop taking one's romantic partner for granted (Elphinston, Feeney, & Noller, 2011; Pines, 1992), the preponderance of findings points to its destructive effects, especially in romantic relationships (e.g., Marazziti et al., 2003).

The experience of jealousy is associated with many distinct negative feelings: outrage, fear, sadness, depression, embarrassment, and humiliation (Buss, 2000). When one might lose a beloved to someone else when in a relationship that is expected to be exclusive, feelings of outrage and betrayal can arise because expectations of the beloved's faithfulness or fidelity are violated. When faced with the looming threat of potential loss, paranoia and fear may grip individuals suffering from jealousy. Finally, the actual loss of a beloved to a rival can elicit sadness as well as humiliation if one feels less worthy or inferior to the rival after the loss.

These negative feelings may prompt a range of destructive behaviors that can ironically undermine the very relationship that the jealous individual is trying to preserve (Buss & Duntley, 2011). Jealousy can lead to self-harm through substance abuse as a means of distraction or seeking alternative sources of pleasure (Michael, Mirza, Mirza, Babu, & Vithayathil, 1995; Nesse & Berridge, 1997). Jealousy can inconvenience or harm others through acts of suspicion, accusation, stalking, and violence (Buss & Shackelford, 1997). Jealousy can cause the cutting off of a partner's relationships with family and acquaintances, which in turn causes the partner to experience isolation, reduced self-esteem, and fear for personal safety (Buss, 2000; Daly et al., 1982). Jealousy is a major cause of spousal battering (Daly et al., 1982) and intimate partner violence ranging from minor slaps to brutal beatings, some of which have led to miscarriages if a man suspects that his pregnant mate is carrying a child that is not his (Buss & Duntley, 2011).

The experience of jealousy is significantly responsible for a large number of murders committed by people, in particular men, on their current and previous relationship partners (Daly & Wilson, 1988). According to Buss (2013), men's murderous tendencies are triggered by two main factors: (1) when the man suspects or knows that his partner has been sexually unfaithful and when she leaves the relationship and (2) when the man believes that the departure is irrevocable or permanent. Jealousy can also cause just as much danger to those who befriend, consort with, or show interest in a mate or ex-mate. For example, Ron Goldman—suspected as having an affair with Nicole Brown Simpson—was killed when he happened to be with Ms. Simpson at the time of her murder. Suspected or known mate poachers

are frequent targets of homicidal ideation and same-sex rival murders (Duntley, 2005). Women are less likely to murder their mates out of jealousy, but women have been documented to resort to murder as self-defense against men who abuse them during episodes of jealous rage (Daly & Wilson, 1988).

Finally, because of the acute emotional effects that jealousy has on those who experience it, jealousy can also be used instrumentally by those seeking to manipulate others. "Romantic jealousy induction" is a strategic behavioral process designed to elicit a jealous reaction from a partner—for instance, openly flirting with the opposite sex in front of one's partner—to achieve a goal (de Miguel & Buss, 2011; Shackelford, Goetz, & Buss, 2005), such as to escalate attention and commitment from the partner (Jonason, Li, & Buss, 2010) or to test or control the relationship (White, 1980). Summarily, although some studies suggest that jealousy may produce positive outcomes, the vast majority of research points to the detrimental effects of jealousy on psychological well-being and social relationships.

Early Theories of Jealousy

Research on jealousy only began reaching scientifically acceptable standards in the 1980s and 1990s (Hart & Legerstee, 2010). These studies provided empirical data describing the "hows" and "whats" of jealousy, thus shedding light on the precursors and outcomes associated with jealous episodes. However, noticeably absent are theories elucidating the "whys" of jealousy. Although research has consistently indicated that perceived threats to valued relationships play a leading role in triggering the experience of jealousy (e.g., Pfeiffer & Wong, 1989), thereby hinting at an important function of jealousy in terms of relationship maintenance, this insight did not influence mainstream social science theories of jealousy over the last century. As jealousy is often viewed in a negative light due to the unpleasant outcomes it leads to, various theories have adopted as their starting point jealousy as an undesirable aberration of human nature to explain its origins and existence.

One such view of jealousy states that it originates from various cultural forces and socialization. According to Hupka (1991), the socialization of gender roles gives rise to jealousy: "The desire to control the sexual behavior of mates is the consequence of the social construction of the gender system. Social construction refers in this context to the arbitrary assignment of activities and qualities to each gender" (p. 260). From this perspective, men and women are culturally assigned roles and expected behaviors, and men are presumed to be assigned the role of controlling the sexuality of their partners. If the social construction of gender roles is arbitrary, it then follows that some (but not all) cultures should exist where only the men are jealous but the women are not, as well as vice versa.

Similarly, Bhugra (1993) argued that people are socialized to be jealous; but rather than being a product of gender roles, jealousy is instead a product of "capitalist societies," which place a premium on personal possessions and property, which then also extends to persons and "taking the partner to be the individual's personal

possession or property" (p. 272). The corollary of this view is that people living in noncapitalist (e.g., socialist or dictatorship) societies should be free of jealousy. When socialization theories of jealousy are taken together, because "motives for jealousy are a product of the culture" (Bhugra, 1993; p. 273) and social constructions are arbitrary, we should expect to find a wide variability in jealous motives across cultures.

A second set of theories invokes psychological defects or poor mental health as the cause of jealousy. These range from mild or subclinical factors such as low self-esteem, immaturity, or deviance (cf., Bhugra, 1993) to severe psychopathology (cf., Buss, 2000, 2013). According to this train of thought, normal, psychologically healthy, and well-adjusted people should experience little to no jealousy. If psychological defects create malfunctions of the human mind and give rise to jealousy, then the absence of or the curing of those defects should minimize the incidences of jealousy.

Another important perspective is the first psychological theory that was ever formulated to explain jealousy by Freud (1910). Although Freud might have also viewed jealousy as a troublesome psychological experience, his theory differs from accounts based on socialization and psychological defects in that he believed jealousy to be an integral and not so unusual feature of human nature. In his view, jealousy originated in the "Oedipus complex" where a young boy realizes that his father is a mating competitor for the affection of his mother. Later, Jung (1913) proposed and coined the term "Electra complex" to represent the female version of this intrasexual competition—between that of a young girl and her mother for the father.

Some of these explanations reflect reality to some extent. For instance, jealousy can potentially result from the mental trauma of boxing or warfare (Johnson, 1969), and the severity of expressions of jealousy can vary according to culture (e.g., among the Kipsigis in Kenya, the offended husband might simply demand a refund on the bride price he paid for his wife, whereas jealous rivals in the Ache of Paraguay settle disputes through violent ritual fights; Borgerhoff Mulder, 1988; Hill & Hurtado, 1996). However, these explanations are often inconsistent with much of the empirical data on jealousy. In particular, jealousy is a largely commonplace occurrence for many people who are socially well-adjusted and do not have psychological defects. Individuals labeled as suffering from "pathological jealousy" often *do* have partners who are indeed romancing other people (Buss, 2013). Moreover, the experience of jealousy appears to be culturally universal. That children below the age of one can experience jealousy (Hart, 2015) also suggests that jealous feelings do not have to be learned.

Anthropologists with a romanticized view of human nature have tried to unearth cultures from tropical paradises that are untainted by modernization and are thus supposedly free of jealousy. For instance, Mead (1928) made assertions based on her anthropological research that Samoans are devoid of destructive passions such as anger between a cuckold and a seducer and have no thirst for revenge. However, later anthropological studies have refuted these claims, finding instead that jealousy is a prominent cause of violence against rivals and mates, and the Samoans even

have a word for it: *fua* (Freeman, 1983). Among the Ammassalik Eskimos in Greenland, another culture that is sometimes exemplified as lacking jealousy, it is not unusual for a husband to kill an interloper who had sexual intercourse with his wife (Mirsky, 1937). Indeed, killing a wife and affair partner caught in the act of infidelity was legal in Texas until 1974 (Buss, 2000), and the killing of wives due to adultery was often treated as a "legitimate defense of honor" in Brazil up until 1991 (Brooke, 1991; although in some areas of Brazil, this is still a practice).

The Freudian view that jealousy originates from a young person's perception of his or her same-sex parent as a competitor for his or her opposite sex parent's sexual resources has not found empirical support (Buss, 2013). However, the theory may still be half right. Daly and Wilson (1990) argue that Freud conflated two different types of rivalries, one of which holds weight according to theories of parent-child conflict where a child expresses annoyance at the loss of attention or affection from one parent to another parent or even vice versa whereby a stepfather is jealous of a mother's attention to her own biological children, both of which are well-documented (e.g., Burlingham, 1973; Cavanagh, Dobash, & Dobash, 2007). According to Daly and Wilson (1990), a boy and his father may compete for the mother's attention, time, and resources, but they certainly do not compete for sexual access to the mother, and similarly this is unlikely to be the case for girls competing with mothers for sexual access to the father. Although Freudian accounts of jealousy are erroneous in terms of the types of relationship or resources that are at stake, a major insight can be gleaned whereby jealousy might be viewed as a normal feature of the human condition, rather than an abnormality unique to modern society or a malfunctioning psychology.

Jealousy from an Evolutionary Perspective

The evolutionary biologist and Eastern Orthodox Christian Theodosius Dobzhansky (1973) once wrote that "nothing in biology makes sense except in the light of evolution." It is difficult, for instance, to understand and predict the complicated workings of a stomach (e.g., the functional relationship between digestive tracts, stomach acid, and gastric pains) without awareness of the adaptive functions of nutrition and hunger. Similarly, the intricacies of our mind cannot be fully understood without knowing what it was designed to do. The evolutionary perspective thus begins its analysis of psychology with a simple question: If a psychological trait appears to be commonplace, for what specific purpose might it have been designed to serve?

All living organisms today, including humans, are well-preserved "fossils" housing a raft of traits that provide windows into the ancestral past. For instance, our callus-producing mechanisms indicate that our evolutionary ancestors repeatedly dealt with friction to the skin, and our strong desires for sugar, fat, and protein suggest that ripe fruits and succulent meat were scarce and valuable food sources in ancestral environments. Likewise, the powerful emotion of jealousy suggests that infidelity or relationship defection posed serious adaptive problems. Many of the

physical and psychological traits we carry with us today are therefore mechanisms shaped by evolution to help us do things that facilitated survival and reproduction (Tooby & Cosmides, 1992; Williams, 1966).

This focus on functional aspects means that a comprehensive understanding of jealousy resides in knowing what posed as adaptive problems to humans in the ancestral past and, correspondingly, what was therefore also valued. Throughout evolutionary history, both men and women faced the adaptive problem of producing and caring for offspring. As a result, humans have evolved to prize reproductively viable partners and commitment to share the long-term responsibility of raising children (Buss, 1989). Likewise, people face various other adaptive problems such as gaining social acceptance or social status (Baumeister & Leary, 1995). As a result, the possession of relationships with valuable individuals who were able to help us overcome those problems, such as a popular friend or a respected mentor, is also prized and guarded. The loss of such relationships to rivals becomes an important secondary adaptive challenge because losing the benefits provided by these valuable individuals can be detrimental to one's own survival and reproductive interests. Hence, sensitivity toward the health and vigilance against the loss of such relations likely was selected for over evolutionary time. People who were more careful at guarding their prized, valuable relationships were more likely to survive and reproduce than those who were less careful, and thus the genes that coded for such a psychology get passed down the generations and are present in people today (Tooby & Cosmides, 1992). Where crucial benefits and resources are at stake, from an evolutionary perspective, some of the extreme lengths to which jealous individuals will go to guard them may especially make sense. Neither is social learning necessary to experience jealousy; young children who have never had a prior episode of relationship threat can also get triggered by appropriate stimuli denoting such threats (Hart, 2015), thus suggesting that this mechanism is innate.

Specificity is an important consideration within an evolutionary analysis of psychological mechanisms. Just as the visual system evolved specifically to process light rays to see and not to process food for nutrition, our psychological mechanisms also evolved to attend to specific, distinctive stimuli and elicit correspondingly specific responses. However, as with many adaptations, distinct emotion adaptations may also share common subcomponents. The visual system, for instance, is utilized in both the mechanism for food selection (e.g., to select berries with cues to ripeness) and the mechanism for mate selection (e.g., to select mates with cues to health and fertility). Despite sharing the visual system as a common component, the mechanism for food consumption is a functionally distinct adaptation from the mechanism for sexual consummation. Likewise, envy and jealousy may appear similar as they share some affective components such as anger, but they also respond to distinct inputs, produce distinct psychological behavioral outputs, and are thus regarded as functionally distinct adaptations (Buss, Haselton, Shackelford, Bleske, & Wakefield, 1998).

To illustrate this point, "a woman might become *enraged* at a peer getting a promotion she felt she deserved instead and [similarly] become *enraged* at a husband caught *in flagrante delicto* with their neighbor's wife. However, as envy and jeal-

ousy have distinct social inputs, the input of a man having an affair provokes rage if the man is her husband, but not if the man is her co-worker. The input of a man getting an undeserved promotion provokes rage if the man is her rival co-worker, but not if the man is her husband" (Buss, 2013; p. 156). The specific behaviors that result from experiencing either of the two emotions also differ depending on the worth of the promotion or relationship and available response options. For example, the woman envious of her co-worker might increase her work efforts or try to undermine her co-worker's projects, while the woman experiencing jealousy from her husband's infidelity might engage in a retaliatory affair or seek a divorce.

The evolutionary perspective therefore provides greater specification on the conditions that will trigger jealousy. In principle, one could go through life entirely without experiencing jealousy if one's beloved, best friend, or any other valued persons never threatened defection or attended to anything else and if rivals showed no interest in these valued persons. One could also be less prone to jealousy if the context of the relationship is not intended to be long-term or exclusive. Symons (1979) proposed some mating contexts in which romantic jealousy can be suppressed, such as in the context of polyamory, open relationships, "swinging," and partner-swapping. Because such mateships do not entail expectations of exclusivity and faithfulness, violations of these expectations and feelings of betrayal are less likely to occur. Symons also suggests that men who opt for such relationships are also motivated by sexual variety and are thus willing to trade-off the monopolization of a mate and allow other men to have sex with their wives. Nonetheless, studies of swingers and polyamorous communities do note that jealousy still occurs (Buss, 2000), suggesting that it can be difficult to suppress the trigger of witnessing or knowing that a partner is having sex with others.

From this perspective, rather than being a product of socialized cultural or gender roles, jealousy is instead a product of evolutionary pressure—a mechanism designed to be attuned to specific stimuli denoting the potential loss of valued persons to rivals; signaling the potential loss through negative emotions such as fear, anxiety, or paranoia; and preventing that loss by taking action either against the rival or the valued person. And rather than being an inconvenient offshoot of psychopathology, jealousy instead played a significant role in the survival and reproductive success of our ancestral forebears and will continue to do so in modern as well as future generations of humans.

Implications from Considering Jealousy's Ultimate Functions

An evolutionary perspective addresses research gaps left behind by previous theories of jealousy, such as why jealousy is ubiquitous across cultures, expressed in psychologically healthy men as well as women, and capable of being elicited without being learned. Further, the evolutionary perspective also has utility in improving our understanding of the nature of jealousy, with various implications that follow from these improved insights.

Jealousy as a Basic Emotion One such reconsideration of jealousy is whether it should be viewed as a "complex" or "basic" emotion. Basic, primary, or fundamental emotions regulate us in response to environmental challenges and opportunities in a typically instinctive and automatic manner. Conversely, complex emotions are regarded as less automatic and composed of a blend of basic emotions. Basic emotions are often described as evolutionarily adaptive emotions, whereas most theories do not consider complex emotions to be adaptations. Much of the current research regards jealousy not as a basic emotion but instead as a complex emotion derived from a mix of different basic emotions such as anger, fear, and sadness (Buss, 2013). For an emotion to be considered basic, among various other criteria, Ekman (1994) proposed that it must be present in other primates, while Plutchik (1980) argued that it must function to help humans solve adaptive problems of survival.

Jealousy does not meet most of these traditional criteria as it is not always clearly observed in nonhumans, and romantic jealousy can also be detrimental to survival, such as when a romantically jealous man attempts to physically assault a mate poacher (Buss, 2013). Yet, there are good reasons to reevaluate the validity of these frameworks and reconsider jealousy as a basic emotion. An examination of whether an emotion or any other psychological mechanism is basic, according to modern evolutionary principles (e.g., Dawkins, 1982; Tooby & Cosmides, 2005; Williams, 1966), requires a consideration of whether it contributes not just to *survival* but also to *reproductive success*. Sexually reproducing organisms that survive well but do not mate will not pass on their genes, thus constituting evolutionary dead ends. Survival without reproduction in evolutionary terms is therefore ultimately pointless, and thus differential reproductive success, not differential survival success, is more accurately the fundamental "engine" of the evolutionary selection process (Miller, 2000). Moreover, some adaptations are detrimental to survival, but they still evolved anyway because they promote greater success in mating. Some examples include the cumbersome plumage of peacocks and elevated appetites for risk and aggression in human males (Wilson & Daly, 1985). Such traits often lead to shorter life spans for the males encumbered by them but nonetheless still exist because of their contributions to reproductive success.

This shift in the level of analysis from survival success to reproductive success is important because romantic jealousy is not designed for solving problems of survival. Rather, romantic jealousy exists because it contributed to solving the specific adaptive problem of mating and reproduction. The primary functions of male romantic jealousy include deterring sexual infidelity, deterring mate poachers, and deterring defection from the mateship—outcomes which, when successfully enacted, improve a man's reproductive success by increasing the certainty that he is the actual father of the children he is raising and monopolizing his mate's reproductive resources (Buss, 2013). The irrelevance of romantic jealousy to survival therefore does not disqualify jealousy from being basic or fundamental.

The modern evolutionary psychological framework also does not require existence in any other living organisms for an emotion or any other adaptive trait to be considered basic. To wit, "no one would deem the adaptation of echolocation not

'basic' in bats, even if it exists rarely outside of bat species" (Buss, 2013; p. 158). Likewise, just because the existence of language can hardly be found outside of humans (Pinker & Bloom, 1990) does not disqualify the capacity for language from being an adaptation that is "basic" to humans. According to this modern framework, although many emotions may indeed exist in other species or exist in precursor forms in earlier lineages, such presence in other species is neither necessary nor sufficient for deeming an emotion as basic. Taken together, a strong case can be made that jealousy is indeed a basic or fundamental emotion, thus cementing its role as an important contributor to human survival and, more importantly, reproductive success.

Sex differences in the Cues that Trigger Jealousy The evolutionary perspective also makes another key contribution to our understanding of jealousy through sex-differentiated predictions of cues that trigger jealousy. The first evolutionary-based proposition of sex differences in jealousy was posited by Symons (1979) as he suggested that "a wife's experience of sexual jealousy varies with the degree of threat to herself that she perceives in her husband's adultery, whereas a husband's experience of sexual jealousy is relatively invariant, his wife's adultery is almost always being perceived as threatening" (p. 232). Symons clarifies that this is because male sexual jealousy functions to prevent one's wife from conceiving another man's child, and yet when wives experience jealousy, their experiences can be just as strong as their husbands' jealousy. Indeed, studies that assess jealousy using "global" measures such as "how often do you experience jealousy" or "when jealous, how intense are your feelings" mostly show no sex differences (Buss, 2000).

To understand the basis of this proposed psychological sex difference, it is important to consider some fundamental biological differences between men and women. For humans to reproduce, women must invest heavily in offspring because fertilization, gestation, and placentation occur internally, and women also carry the additional parental burden associated with lactation after offspring are born (Symons, 1979; Trivers, 1972). These costs of pregnancy and childbirth impose a great deal of vulnerability on women, particularly during ancestral periods in the absence of modern food production, healthcare, and social welfare (Daly & Wilson, 1983). Women therefore value the ability of a partner to provide sustained protection and resources to her and her children (Buss & Schmitt, 1993). Men, on the other hand, face a different adaptive issue. Because human reproductive biology entails internal female fertilization, men face the problem of investing resources in children that are actually sired by rival men—an adaptive problem not faced by women.

From this insight, sex differences in romantic jealousy become apparent. Both men and women equally face the problem of losing the mating partner to an intrasexual rival if the mating partner leaves the relationship entirely (Wilson & Daly, 1996). However, a female partner's sexual infidelity may lead a man to invest in other men's offspring but not the other way around (sexual infidelity per se from a male partner is not likely to induce a woman to unknowingly invest in another woman's child). Thus, men may have evolved to value sexual loyalty more than women

have. Accordingly, men's jealousy, relative to women's, is more likely to be focused on guarding against sexual infidelity.

Although women's probability of maternity is not affected by her husband's sexual infidelity, a man's infidelity could divert his valuable investments, attention, and resources from a woman and her children to the female sexual interloper instead. Therefore, women's jealousy, relative to men's, is more likely to be heavily focused on guarding against the loss of a mate's attention, protection, and resources. Because the reproductive consequences of infidelity and partner loss are parallel for men and women in some respects and asymmetric in others, the sexes are predicted to be similarly jealous in some respects and also different where their adaptive problems diverge. That is, men more than women may focus on cues to a partner's potential sexual contact with others—termed *sexual* jealousy—while women more than men should focus on cues to the long-term diversion of a partner's commitment of time, attention, energy, and effort—termed *emotional* jealousy (Buss, Larsen, Westen, & Semmelroth, 1992).

As researchers began differentiating between sexual infidelity and emotional infidelity in their assessments of jealousy, sex differences emerged where they weren't previously observed. Buss et al. (1992) asked American college students to compare two distressing events: (a) their partner having sexual intercourse with someone else, or (b) their partner becoming emotionally involved with someone else. For emotional infidelity, 83% of women found this upsetting, whereas only 40% of the men did. In contrast, 60% of the men experienced their partner's sexual infidelity as more distressing, whereas only 17% of the women did. This sex difference was even more pronounced in people who are dispositionally more jealous (Miller & Maner, 2009), and despite criticisms from some researchers (e.g., Harris, 2000), these findings have been replicated across various cultures (e.g., Brase, Caprar, & Voracek, 2004; Buunk, Angleitner, Oubaid, & Buss, 1996; de Souza, Verderane, Taira, & Otta, 2006; Whitty & Quigley, 2008; Wiederman & Kendall, 1999).

These sex differences are also reflected in physiological responses. Buss et al. (1992) assessed men and women's responses based on corrugator muscle strain (a measure of frowning), electrodermal response (a measure of sweating), and heart rate when imagining these two jealousy scenarios (e.g., "your partner having sex with someone else" and "your partner falling in love with someone else") and found that, across all measures, men were more physiologically distressed by sexual infidelity whereas women were more physiologically distressed by emotional infidelity. Some of these physiological effects were as severe as drinking three cups of strong coffee at one time. These findings were replicated by Pietrzak, Laird, Stevens, and Thompson (2002) who also included a fourth physiological measure—skin temperature. A subsequent study by Takahashi et al. (2006) using fMRI techniques that measure neurophysiological activation also found support for the predicted sex differences. All in all, the evidence has been quite robust for sex-differentiated psychologies for sexual jealousy.

While a partner's infidelities constitute key threats to a valued romantic relationship, another key threat comes from intrasexual rivals, and the evolutionary per-

spective also predicts differences in how men and women consider rivals threatening—specifically whether a rival exceeds an individual on key components of mate value. As men especially value sexual resources in a mate, key components of women's mate value include cues to fertility, such as physical attractiveness, health, and youth (since female fertility sharply declines as a function of age). Conversely, women especially value the ability to acquire and provide resources in a partner; thus, key components of men's mate value include cues to social status and dominance (Buss, 1989; Buss & Schmitt, 1993). Indeed, women's self-assessments of their value as a marriage partner were undermined by exposure to highly physically attractive women but not by exposure to socially dominant women, whereas men's self-assessments were undermined by the social dominance than by the physical attractiveness of the men to whom they were exposed (Gutierres, Kenrick, & Partch, 1999).

Across various cultures, men more than women report greater distress when a rival surpasses them on physical strength and financial or job prospects, whereas women report greater distress than do men when rivals surpass them on physical attractiveness (Buss, Shackelford, Choe, Buunk, & Dijkstra, 2000). This distress is also not simply an artifact of unfounded insecurity. Kenrick, Neuberg, Zierk, and Krones (1994) found that when male participants were exposed to physically attractive as compared with average or socially dominant female targets, they rated their current relationships less favorably. In contrast, female participants' evaluations of their current relationships were unaffected by exposure to physically attractive males but were lower after exposure to targets high in dominance. Distress about intrasexual rivals who excel in the traits sought after by one's partner therefore reflects actual concerns about the partner's interest in those rivals with high mate value.

In summary, a considerable body of empirical evidence ranging from cross-cultural studies to physiological experiments has been amassed documenting the presence of sex differences in romantic jealousy. Specifically, men and women differ in their relative upset about sexual and emotional infidelity, which correspond to the sex-differentiated adaptive problems they historically faced in the context of forming long-term mateships.

Behavioral outputs of Jealousy From an evolutionary perspective, emotions are functional mechanisms that motivate behaviors in ways that are aimed at promoting survival and reproductive success (Nesse, 1990). Research on the behavioral outputs of romantic jealousy has focused on a broad class of behaviors called mate retention tactics (Buss & Shackelford, 1997). These tactics can be classified in terms of vigilance (e.g., checking up on a partner, dropping by unexpectedly, snooping through messages) or violence (e.g., physical threats, hitting, murder).

As predicted by evolutionary theory, mate retention intensity varies as a function of how desirable one's partner is to potential rivals. As men value youth and physical attractiveness which are associated with fertility in a mate, men's intensity of mate retention, but not women's, is predicted by their partner's age and physical attractiveness. Men who were married to younger women, relative to men who were

married to older women, were more likely to conceal their wives from other men; monopolize their time; punish flirting and other behavioral signals of unfaithfulness; engage in emotional manipulation; ratchet up their signals of relationship commitment; increase the flow of resources; demonstrate possession of the wife with words, physical proximity, and jewelry adornments; threaten rivals with violence; and actually direct violence toward potential mating rivals (Buss & Shackelford, 1997; Daly & Wilson, 1988). Similarly, men whose partners are physically very attractive were more likely than men whose partners are less physically attractive to exhibit higher levels of vigilance, commitment, resource display, verbal and physical signals of possession, and threats against other men (Buss, 2013; Haselton & Gangestad, 2006).

On the flipside, women's mate retention efforts, but not men's, are predicted by their partner's financial income and ambitiousness (Buss & Shackelford, 1997). Men who are ambitious and strive for status often find themselves rubbing shoulders with other driven, successful individuals and drawing the respect and admiration of peers and subordinates, particularly that of women (Buss & Barnes, 1986; Nettle, 2005). Consequently, women married to men who exhibit high levels of ambition and status-striving tended to punish their mates for flirting and demonstrating other cues to infidelity, engaged in emotional manipulation such as guilt induction, provided sexual inducements, enhanced their appearance, and engaged in more verbal signals of possession in public contexts. Women married to men with higher earnings also engaged in more vigilance, appearance enhancement, and possessive ornamentation than women married to men who earned less. Consistent with the expectations derived from an evolutionary perspective of jealousy, men more than women reported using resource displays and intrasexual threats to retain their mates, whereas women more than men reported using appearance enhancements and verbal signals of possession in public contexts to retain their mates (Buss & Shackelford, 1997).

People are faced with a major decision when they discover that a romantic partner has been unfaithful: Should they forgive the partner and remain in the relationship or should they break up and terminate the relationship? Although the cross-cultural finding that infidelity is a major cause of divorce suggests that many choose to break up (Betzig, 1989), a sizable minority chooses to forgive. The aftermath of infidelity certainly depends on a variety of factors, such as family pressure, the presence of dependent children, and whether the betrayed partner is economically dependent on the unfaithful partner. Another key influence resides in the nature of the infidelity or more specifically whether it involved sexual, emotional, or economic components. Men, more so than women, felt that forgiving a sexual infidelity would be harder than an emotional infidelity (Shackelford, Buss, & Bennett, 2002). This is reflected in actual behavior as men, more so than women, are more likely to end a current romantic relationship following a partner's sexual infidelity compared with an emotional infidelity. Women showed the opposite pattern of responses, being more likely, relative to men, not to forgive and to end a relationship following an emotional infidelity than a sexual infidelity. These findings have been replicated (Confer & Cloud, 2011).

Taken together, the behavioral outputs of sexual jealousy correspond with those predicted by evolutionary theory. Sex differences in the components of mate value—in particular men's resources and social status versus women's youth and physical attractiveness—predict the intensity of sex-differentiated effort allocated toward retaining mates. Men devote more effort to mate retention when their partners are young and attractive, whereas women devote more effort to mate retention when their partners are well paid and display an appetite for status-striving. Men and women also differ predictably in the types of mate retention tactics employed, with appearance enhancements being used more often by women and resource displays being used more often by men. Finally, whether men and women forgive their partners following an infidelity depends to a significant degree on whether the infidelity involved a sexual liaison or a deep emotional involvement.

Future Directions: Maladaptive Jealousy in Modern Contexts

As this chapter suggests, a fair amount of knowledge has accumulated over the years on jealousy; nevertheless, there may be various avenues for future research to pursue. For instance, there seems to be a paucity of longitudinal studies in this area—does jealousy tend to increase or decrease the stability of a relationship over time? Additionally, it may be fruitful for researchers to investigate how modern contexts may interact with—and likely increase, rather than decrease—people's jealousy psychology. That is, especially in recent years, technology has allowed humans to live in environments that differ vastly from (and are mismatched to) the ancestral conditions to which evolved psychological mechanisms (including jealousy) are adapted. As such, many cues that psychological mechanisms process as inputs have changed in intensity or number, and their relation to adaptive consequences may also have significantly changed (Li, van Vugt, & Colarelli, 2018; Tooby & Cosmides, 1990). For example, tastes for sweet things, which evolved to adaptively impel humans to eat fruits and other natural foods high in calories and nutrients, are now inducing people to ingest modern foods manufactured with high levels of sugars (e.g., candy bars, soda). For jealousy, mismatched modern environments may lead to an excessive triggering of its onset and thus, to greater subjective distress and relationship stress.

The presentation and consumption of social information, including those that can potentially cause jealousy, can be excessively skewed by social network sites (SNSs) such as Facebook, Twitter, and Instagram in today's world of profuse, ubiquitous technological usage (Yong, Li, Valentine, & Smith, 2017). SNSs give us far more access to the activities and interactions of many other people than our ancestors ever had. Through the ease of communicating with or "following" a myriad of other individuals on SNSs, we can closely keep up with the lives of others, observe what others are talking about in public comment threads as well as in private group chats, and also partake in those conversations. A mismatch that arises from this is the often high level of importance we place on social events and information that

has little relation or consequence to our own lives. In an ancestral village of approximately 100–230 people (Dunbar, 1992), events that occurred to a person would be maximally only three degrees of separation away from anybody else in that village (Christakis & Fowler, 2009). Thus, any social information was likely to be self-relevant and important because of the small size of a village community, and therefore we likely evolved to be sensitive to social information, such as gossip, and take much of it seriously.

Although the use of SNSs has its benefits, such as providing an efficient platform for maintaining social interactions, a range of psychologically detrimental effects can also arise due to mismatched interactions between our evolved psychological mechanisms and modern media technologies (cf., Yong et al., 2017). People often compare themselves and their own lives to the skewed impressions of reality presented on SNSs. As people tend to carefully select and curate the things they upload on SNSs, SNSs tend to portray only the most perfect aspects of people's lives, such as flattering photographs, nice holidays, and work success (Siibak, 2009). Our evolved psychological mechanism for digesting social information takes the information we see on SNSs seriously. As SNSs continually present information about how good-looking others are or how well others are doing, avid SNS users are apt to experience envy and dissatisfaction with various aspects of their own lives (Tandoc Jr., Ferrucci, & Duffy, 2015).

Likewise, SNSs trigger excessive jealousy by being a source of more information than people are evolved to need. Increased Facebook use is associated with increased jealousy because of a feedback loop whereby using Facebook exposes people to ambiguous information about their partner that they may not otherwise have access to, which then motivates further use to seek more information that may unwittingly be biased or self-confirming to resolve the ambiguity (Muise, Christofides, & Desmarais, 2009). Before the advent of SNSs, flirty gestures of interest or signs of subtle disregard remained relatively private and within a person's own control, and partners in intimate relationships were not subjected to the scrutiny afforded by SNSs today of their exchanges with other contacts (Utz & Beukeboom, 2011). Seeing on an SNS that one's partner had placed an arm around a member of the opposite sex or that one's partner had "liked" a post by a member of the opposite sex can also be appraised as a relationship threat. Texts on SNSs are also often ambiguous because they are devoid of emotional cues. A neutral message left by a woman on a man's public post on Facebook, such as "hey how r u," can be reinterpreted to be more flirtatious than it really is by the man's jealous partner.

SNSs also offer more avenues for partner monitoring (Utz & Beukeboom, 2011). Jealous individuals generally feel the urge to monitor their partners, such as searching their partner's bags or room when their partner isn't looking. However, jealous individuals are usually aware that such behavior is not socially accepted and forms a trust violation in itself. Visiting the SNS profiles of one's partner and related contacts, however, is a normal aspect of many users' SNS routine. This may be done with the purpose of maintaining contact and keeping up to date with others, and yet in the process, one has the opportunity to monitor the partner and check his or her activities, a practice popularly known as "stalking" (Lyndon, Bonds-Raacke, & Cratty, 2011).

Our evolved propensity for jealousy was designed for a world where the persons we were exposed to did not exceed 100–230 in a village, and social information we had access to was relatively more important, less ambiguous, and less excessive than that of the SNS-laden world we live in today. Future research may therefore examine the ways in which our sensitivity to cues denoting relationship threats can be hijacked by information on SNSs, thus overfeeding the green-eyed monster in modern contexts.

Conclusion

As reviewed in this chapter, jealousy is an emotion that, although commonly associated with negative feelings and relationship conflict, serves as an important function of preventing sexual and other resources from leaving relationships. The application of modern evolutionary theory on the analysis of jealousy not only puts many of the experiences and behaviors associated with jealousy in perspective but also raises important discussions about the nature of jealousy (e.g., jealousy as a basic emotion) and yields many specific predictions that are obscured from prior scientific research (e.g., sex differences in jealousy). Far from being some arbitrary product of culture or psychological defects, our psychology for jealousy is a typical feature of a healthy mind, an adaptive mechanism which has been carefully refined through long periods of evolutionary pressure. Yet, our minds are also vulnerable to various contexts that may excessively trigger jealousy. Armed with a better awareness of the specific cues that our evolved mechanisms for jealousy are sensitive toward, further research examining the features of our modern environment that trigger jealousy can also help us understand how best to manage this often painful and destructive emotion. An evolutionary analysis of jealousy ultimately reveals that despite it being a powerful and potentially destructive emotion, jealousy has likely contributed, over human history, to the prolonged survival of many relationships.

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