# Th e Evolution of Love in Humans

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CHAPTER 3

# *The Evolution of Love in Humans*

*David M. Buss*

"Love is blind," according to a common saying. "Love is a recent invention, a mere few hundred years old," some social scientists have argued. "Love is limited to Western cultures," according to others. This chapter explains why all these beliefs are radically wrong. From an evolutionary perspective, love is an adaptation, or more accurately a complex suite of adaptations, designed to solve specific problems of survival and reproduction. It is an exquisitely honed set of psychological devices that for humans served critical utilitarian functions in highly specific contexts. These functions are sufficiently numerous to give credence to another aphorism that gets closer to the truth: "Love is a many splendored thing."

## The Adaptive Functions of Love

Solitary creatures such as giant pandas and porcupines have little need for love. They live alone and survive alone, coming together only briefly to mate before parting ways. Humans, in contrast, are "the social animal" (Aronson, 2003). Group living is what we do. Other humans are the "vehicles" on which our survival and genetic legacy critically depend. Some of those vehicles are so critical that we bestow them with our psychological, emotional, and material investments. Some are so critical to our reproduction that we willingly sacrifice our lives so that they can thrive.

Natural selection, the driving engine of the evolutionary process, favors the creation of adaptations. Adaptations are anatomical, physiological, or psychological solutions to recurrent problems of survival and reproduction, defined in its modern inclusive fitness formulation (Hamilton, 1964). A strict requirement for the evolution of adaptations is the cross-time statistical recurrence of an environmental structure. Statistical regularities can be of many sorts – a link between abrasive surfaces and damage to the skin; a correlation between a discrepancy in mate value and the odds of infidelity; a correlation between prolonged eye gaze and sexual interest; a

correlation between symmetrical features and absence of environmental insults.

When these statistical regularities recur generation after generation, and when they afford information that is tributary to reproductive success, selection can exploit these statistical regularities to create adaptations designed to detect and act upon them. Thus, a callus-producing adaptation can solve the problem of damage due to repeated exposure to abrasive surfaces. A jealousy adaptation can alert an individual about an increased risk of a partner's infidelity (Buss, 2000). Courtship initiation adaptations can be designed to respond to signals of sexual interest (Greer & Buss, 2004). And standards of attractiveness can form around cues recurrently associated with physical health (Symons, 1979; Sugiyama, 2005).

These hypothesized adaptations are solutions to recurrent problems of survival or reproduction. Callus-producing mechanisms are solutions to a problem of survival, protecting the body against damage from the physical environment. Courtship initiation subroutines, jealousy, and standards of beauty solve specialized problems of mating, and hence historically contributed to reproductive success.

Could the complex psychological state we call "love," which includes emotional states, information-processing devices, and manifest acts of love be an adaptation that evolved to solve problems of reproduction (Buss, 1988a)? This chapter explores several hypotheses about the adaptive functions of love. According to an earlier evolutionary analysis, love evolved to serve several functions (Buss, 1988a, 2006):

- displaying reproductively relevant resources;
- providing sexual access;
- signaling sexual fidelity;
- providing psychological and emotional resources;
- promoting relationship exclusivity through mate guarding;
- displaying commitment – love as a commitment device;
- promoting actions that lead to successful reproductive outcomes; and
- providing signals of parental investment.

This chapter expands this evolutionary theory by postulating, and providing empirical evidence for, additional adaptive functions of love. Although conclusive proof does not yet exist to support any one of these hypotheses, enough empirical evidence exists to support the notion that a complete understanding of the psychology of love cannot be attained without understanding its possible functions – the adaptive problems it was designed to solve (see also Fletcher et al., 2015). Theoretically, the major

addition to this evolutionary conception of love center on the notion of *fitness interdependence*.

## Fitness Interdependence and the Evolution of Love

Theoretical progress in understanding the evolution of cooperative relationships centers on the concept of fitness interdependence: "The degree to which two or more organisms positively or negatively influence each others' success in replicating their genes" (Aktipis et al., in press). Genetic relatives provide the most obvious example of fitness interdependence. An individual's fitness is heavily dependent on the reproductive success of close genetic relatives – an insight that led to the inclusive fitness revolution in evolutionary biology (Hamilton, 1964). The concept of fitness interdependence applies more generally to cooperation among non-kin, including dyadic friendships and coalitional groups. And love relationships often reach a pinnacle of fitness interdependence.

Three conditions of romantic love promote maximal fitness interdependence: (1) *mutually produced offspring*, in which each parent has an equal genetic stake in promoting the welfare of children; (2) *monogamy*, with little or no chance of infidelity in or defection from the relationship; and (3) *lack of genetic kin in close proximity* (Alexander, 1987). Conversely, conditions that deviate from these conditions reduce or even undermine fitness interdependence. For example, each additional child a couple has decreases the likelihood of divorce, suggesting higher levels of commitment, whereas childless couples have the highest probability of divorce (see Buss, 2016). Infidelity and a couple's infertility, to take two other examples, are leading causes of divorce worldwide (Betzig, 1989), suggesting a rupture in commitment, love, and fitness interdependence. To my knowledge, the impact of kin from either partner in close proximity, which would create the potential conflict of one partner channeling pooled resources preferentially to their genetic relatives, has not been examined empirically.

In short, fitness interdependence and the conditions that promote or undermine it, should be key predictors of love, and especially the commitment component of love. People, of course, do not directly track fitness interdependence any more than they track fitness. Rather, the conditions that promote or impede fitness interdependence have acted as forces of selection that created, in part, the psychological adaptations involved in promoting love as well as the shattering of love.

Importantly, this hypothesis does not imply that the psychological adaptations created by selection pressures of fitness interdependence are

currently adaptive or currently track fitness. For example, men's adaptations for sexual jealousy upon discovery of a love partner's sexual infidelity get fully activated, even if his partner is taking birth control and her infidelity has no chance of compromising his paternity (and hence the level of fitness interdependence he has with his partner). I anticipate that the conditions that promote and impede fitness interdependence will continue to illuminate the evolution of love.

We now turn to additional empirical evidence for an evolutionary theory of love, starting with whether love shows universality across cultures.

## The Universality of Love

One straightforward prediction from the evolutionary theory proposed here is that the psychological circuits dedicated to love should be universal, not limited to Western cultures. Universality of psychological adaptation, of course, does not mean universality of manifest experience. Just as a person could go through life without ever having their jealousy circuit activated – if a partner never displayed cues to infidelity or defection, for example – a person could go through life never experiencing love. Nonetheless, most humans should possess the psychological circuitry, and hence love should be experienced by some people in every single culture around the world – a testable prediction not generated by non-evolutionary theories of love.

One testament to the universality of love and its obstinate refusal to be extinguished can be found in societies that have attempted to banish it (Jankowiak, 1995). In the nineteenth century, the Oneida society articulated the view that romantic love was merely disguised sexual lust, and saw no reason to encourage such deceit. The Shakers, to take another example, declared romantic love undignified and threatening to the goals of the larger community, and so sought to banish it. The Mormons in the nineteenth century also viewed romantic love as disruptive, and sought to discourage it. In all three societies, however, romantic love persisted among individuals, sometimes underground, refusing banishment, hidden from the harsh eyes of the group's elders. Within cultures, as the story of Romeo and Juliet declares with universal resonance, love can be fueled by the efforts of others to suppress it. Lovers have no choice; they can quell their feelings temporarily or muffle their expression, but they cannot exorcise them entirely.

Cultures that impose arranged marriage and permit polygyny provide a test case, for what system could be better designed to undermine love? Does love have any place within a mating system where a man's first wife

is chosen for him? Even when his elders choose a man's first wife for him, such as in polygynous Arabic cultures, men often marry a second wife for love. Taita women, in fact, state that they prefer to be the second or third wife, not the first. They feel that they will be more likely to be married for love, and hence anticipate that they will receive more favorable treatment from their husband and experience more emotional closeness (Jankowiak, 1995, p. 11).

Another testament to the universality of love comes from studies that simply ask men and women whether or not they are currently in love. Susan Sprecher and her colleagues interviewed 1,667 women and men from three different cultures (Sprecher, Aron, Hatfield, Cortese, Potapova, & Levitskaya, 1994). Seventy-three% of the Russian women and 61% of the Russian men confessed to being currently in love. The comparable figures from Japan were 63% for women and 41% for men. Americans reported roughly the same levels, with 63% of the women and 53% of the men admitting that they were currently in love. Another study of ethnographies across cultures revealed that the overwhelming majority contained explicit references to the experience of love – observed declarations of love, love songs, expressions of pain upon unrequited love, and many others (Jankowiak & Fisher, 1992).

Finally, in the most massive study ever conducted of mate preferences – in thirty-seven cultures located on six continents and five islands, consisting of 10,047 participants – "mutual attraction and love" proved to be at or near the top in every single culture (Buss, 1989; Buss et al., 1990). If the experience and expression of love were limited to only some cultures, the evolutionary theory of love would be a non-starter. Available evidence suggests that love indeed is a universal experience; no cultures have been shown to lack the experience of love. Universality of love, however, does not imply that the psychological design of love adaptations is identical in women and men.

## Sex Differences in the Psychological Design of Love

Among the half dozen or so more replicable findings in the human mating literature is that men place a greater premium than women on physical appearance in their selection of a long-term mate (Buss, 1989, 2016). This is not because men are superficial or brainlessly judge a book by its cover. Physical appearance provides a wealth of information about a woman's health and youth, and hence her fecundity (probability that an act of sexual intercourse would lead to successful conception, barring use of modern

birth control) and reproductive value (future reproductive potential). The features of physical appearance that embody standards of female attractiveness all support the attractiveness-fertility link – clear skin, smooth skin, lustrous hair, long hair, symmetrical features, absence of open sores, pustules, or lesions, relatively small waist, relatively large breasts, and a low waist-to-hip ratio (see Sugiyama, 2005, for comprehensive summaries of the empirical evidence).

Many of the qualities critical to women's selection of a long-term mate are not readily assessed through physical appearance. These include a man's ambition, industriousness, drive, and status trajectory – qualities linked with resource acquisition (Buss, 1989, 2016; Buss & Schmitt, 1993). These contrast with what women want in a short-term mate, including signals of good genes, which can be evaluated partly through physical appearance (Gangestad & Thornhill, 1997; Sugiyama, 2005). Love, however, is not an emotion typically linked with casual sex. It emerges mainly in the context of long-term mating.

Because love is an emotion tethered to long-term mating; because reproductive value is so critical to men in selecting a long-term mate; and because physical appearance provides an abundance of cues to a woman's reproductive value, we can predict that men will experience "love at first sight" more often than women. The empirical evidence supports this prediction. Men, more than women, report falling in love at first sight (Brantley, Knox, & Zusman, 2002; Kanin, Davidson, & Scheck, 1970). This evidence supports one hypothesized sex difference in the design of the psychological circuitry of love. Other evidence centers on commitment.

Short-term mating, on average, tends to be most costly and less beneficial for women than for men (Buss & Schmitt, 1993). By engaging in short-term mating, women historically risked conceiving by a less-than-ideal man – perhaps one with inferior genes or one who will not stick around to invest in her and her children. Although women can benefit from short-term mating in some circumstances (Buss, Goetz, Duntley, Asao, & Conroy-Beam, 2017; Greiling & Buss, 2000), casual sex historically did not translate into direct linear increments in reproductive success, as it did for men. Because men can reproduce with as little investment as a single act of sex, whereas women require an obligatory nine-month pregnancy to reproduce, selection has favored in men a more powerful motivation to desire and seek casual sex.

Would you agree or disagree with the statement "Sex without love is OK"? If you are a man, the chances are that you would agree with this statement. Women, on average, disagree. Indeed, attitudes toward casual

sex without love remain one of the largest sex differences in the sexual domain, as revealed by meta-analyses (Olivia & Hyde, 1993) and the cross-cultural evidence (Buss, 2016; Schmitt, 2005).

These findings support a critical hypothesis about sex differences in the psychological design of love. For women, love and sex are closely linked. Men find it easier to have sex without love. This brings us to another hypothesis anchored in an evolutionary theory of love – the emotional experience of love as a means to increase the odds of commitment.

## Love as a Commitment Device

If love is a universal human emotion, why did evolution install it in the human brain to begin with? Keys to the mystery come from three unique departures of the human animal from their most recent primate ancestors: the evolution of long-term mating; the concealment of female ovulation; and the heavy investment by men in their children. Chimpanzees, our closest primate relatives, mate primarily when the female enters estrus. Her bright red genital swellings and olfactory scents send males into a sexual frenzy. Outside of estrus, males are largely indifferent to females. Among humans, ovulation is concealed or cryptic, at least for the most part. Although there might be subtle physical changes in women – a slight glowing of the skin or an almost imperceptible increase in her sexual desire – there is no solid evidence that men can actually detect when women ovulate.

The concealment of ovulation coincided with several other critical changes. Men and women started having sex throughout the menstrual cycle, not just around ovulation. Men and women engaged in long-term pair-bonded mating over the expanse of years or decades. And men, unlike their chimpanzee cousins, began investing heavily in offspring. Meat from the hunt went to provision the children, not just the wife and kin.

It requires taking a step back to realize how extraordinary these changes are. Some females began allocating their entire reproductive careers to a single male, rather than to whoever happened to be the reigning alpha male when they happened to be ovulating. Males began to guard their partners against rival males who might be tempted to lure their mates. Surplus resources that in many species go to the female as a specific inducement to copulation now get channeled to the wife and children. Indeed, males now had added incentive to acquire surplus resources, mostly in the form of hunted meat. Long-term mating, in short, involved the allocation of

reproductively relevant resources to a single mate over a virtually unprecedented span of time.

Elementary economics tells us that those who hold valuable resources do not give them away indiscriminately. Indeed, evolution would ruthlessly select against those who frittered away reproductively valuable resources in long-term mateships that had no payoff. The evolution of long-term mating required installing in the human psychological architecture a set of circuits designed to ensure a reasonable reproductive payoff to allocating all of one's resources to a single partner. It required some means for determining that one particular mate, above all other potential mates, would be there through thick and thin, through sickness and health. It required a solution to the problem of commitment.

My own initial outline of an evolutionary theory of love (Buss, 1988a) accords with that of evolutionary economist Robert Frank – that the emotion we call love is, in part, an evolved solution to the problem of commitment (Frank, 1988). If a partner chooses you for rational reasons, he or she might leave you for the same rational reasons: finding someone slightly more desirable on all of the "rational" criteria. This creates a commitment problem: How can you be sure that a person will stick with you? If your partner is blinded by an uncontrollable love that cannot be helped and cannot be chosen, a love for only you and no other, then commitment will not waver when you are in sickness rather than in health, when you are poorer rather than richer. Love overrides rationality. It is the emotion that ensures that you won't leave when someone more desirable comes along. Love, in short, may be a solution to the commitment problem, providing a signal to the partner of strength of long-term intent and resolve.

The causal arrow almost certainly also runs in reverse. Love may be the psychological reward we experience when the problem of commitment is successfully being solved. It is a mind/body opium that signals that the adaptive problems of mate selection, sexual congress, devotion, and loyalty have met with triumph (Fisher, 2004). The scientific explanation is that evolution has installed in the human brain reward mechanisms that keep us performing activities that lead to successful reproduction. The disadvantage is that the drug sometimes wears off (Fisher, 2004).

Love is both a solution to the commitment problem and an intoxicating reward for successfully solving it. The astonishingly intricate entwinement of love was first revealed in my own study (Buss, 1988a). I started by asking several hundred women and to describe the behaviors that signal that a

person is in love. A separate sample then diagnosed each of the 115 love acts on how much it indicated being in the thrall of love.

Signals of commitment emerged as most diagnostic, but commitment can take many forms. A partner can commit resources such as food, shelter, and physical protection to a lover over the long term. A lover can commit sexual resources by remaining sexually faithful and by making love with wild abandon. Lovers commit reproductive resources to their beloved, as in successful conception, pregnancy, and childbirth. And it follows that lovers commit parental resources to their mutual children, the natural result of the love union.

Many of these acts conveyed self-sacrifice: putting one's own interests aside for the greater needs of the loved one, making a sacrifice of great importance for the partner, and giving up large amounts of free time to be with the partners. Other signals involved a sexual openness and trust that may be lacking in lesser relationships: trying out different sexual positions, swallowing during oral sex, acting out the lover's deepest sexual fantasies.

Emotional commitment emerged throughout the acts of love, including listening to problems with real attention and interest, giving up fun activities to be with the lover when he or she really needed it, and showing great concern for a partner's problems. Several people described how a partner had gone out of his or her way emotionally when they were in the most desperate psychological state. Several lovers described how their partner provided hope during their darkest hours of need, reaching down to pull them out of a pit of depression when the walls of life seemed steep and unscalable.

These findings support another critical set of design features hypothesized to be linked to love – specialized forms of commitment. Evidence for love as a commitment device, first posited independently by Buss (1988a) and Frank (1988), has accrued increasing empirical support (e.g. Fletcher et al., 2015).

## Snakes in the Garden of Love

Unfortunately, that is not the happy end to the evolutionary story. There are snakes in the garden, troubles in emotional paradise. One sort of trouble comes from the dual strategies in the human menu of mating. Once the desire for love exists, it can be exploited and manipulated. Men deceive women about the depth of their loving feelings, for example, just to gain short-term sexual access (Haselton, Buss, Oubaid, & Angleitner,

2005). As Ovid noted hundreds of years ago, "love is … a sexual behavior sport in which duplicity is used in order that a man might win his way into a woman's heart and subsequently into her boudoir." Women, in turn, have coevolved defenses against being sexually exploited by imposing a longer courtship process before to consenting to sex, attempting to detect deception, and evolving superior ability to decode nonverbal signals (Buss, 2016). The coevolutionary arms race of deception and detection of deception continues with no end in sight.

## Jealousy as a Functional but Dangerous Emotion Guarding Love

Jealousy poses a paradox. Consider these findings: 46% of a community sample stated that jealousy was an *inevitable* consequence of true love (Mullen & Martin, 1994). St. Augustine noted this link when he declared that "He that is not jealous, is not in love" (quoted in Claypool & Sheets, 1996). Shakespeare's tormented Othello "dotes, yet doubts, suspects, yet strongly loves." Women and men typically interpret a partner's jealousy as a sign of the depth of his or her love; a partner's absence of jealousy as a lack of love.

Mathes asked a sample of unmarried, but romantically involved, men and women to complete a jealousy test (Mathes, 1986). Seven years later, he contacted the participants again and asked them about the current status of their relationship. Roughly 25% of the participants had married, whereas 75% had broken up. The jealousy scores from seven years earlier for those who married averaged 168, whereas the scores for those who broke up registered significantly lower at 142. These results must be interpreted cautiously; it is one study with a small sample. Nonetheless, it points to the possibility that jealousy might be inexorably linked with long-term love.

Contrast this with another finding: In a sample of 651 university students who were actively dating, more than 33% reported that jealousy posed a significant problem in their current relationship (Riggs, 1993). The problems ranged from the loss of self-esteem to verbal abuse, from rage-ridden arguments to the terror of being stalked.

Jealousy, paradoxically, flows from deep and abiding love, but can shatter the most harmonious relationships. The paradox was reflected in O. J. Simpson's statement: "Let's say I committed this crime [the killing of his ex-wife, Nicole Brown Simpson]. Even if I did do this, it would have to have been because I loved her very much, right?" (*Newsweek*, December 28, 1998, p. 116). The emotion of jealousy, designed to shelter a relationship

from intruders, "turns homes that might be sanctuaries of love into hells of discord and hate" (E. Gillard; quoted in Ellis, 1950, Vol. 2, ch. 11).

Jealousy is one of the most commonly found correlates of being in love (Mathes, 1991). It evolved to protect love not merely from the threat of loss but more profoundly from the threat of loss to a rival. Consider which of the following scenarios would make you more jealous:

> *Loss due to fate:* Your [partner], with whom you are deeply in love, is killed in an automobile accident.
>
> *Loss due to partner's destiny:* Your [partner], with whom you are deeply in love, obtains a promotion and moves to a far away city. You know that you will never see him (her) again.
>
> *Loss due to rejection:* Your [partner], with whom you are deeply in love, explains that he (she) does not love you anymore and ends the relationship. You know that you will never see him (her) again.
>
> *Loss due to a rival:* Your [partner], which whom you are deeply in love, falls in love with another and ends his (her) relationship with you. You know that you will never see him (her) again. (Mathes, 1991, pp. 93–94)

In an experiment, Mathes asked men and women "If this happened to you, would you feel jealous?" Out of a possible range of four to twenty-eight, loss of a love due to fate scored only seven on the jealousy scale. Loss due to destiny scored nearly double at thirteen. Loss due to rejection came out at sixteen. But loss to a rival provoked the greatest jealousy scores at twenty-two. Evolution designed jealousy not just to protect the loss of love. Because evolution is an inherently competitive process, jealousy evolved to prevent the "double-whammy" of the loss of love and a rival's gain of that love.

In my studies, I discovered that signs of jealousy are accurately interpreted as acts of love (Buss, 1988b). When a man drops by unexpectedly to see what his partner is doing, this mode of jealous vigilance functions to preserve exclusivity while simultaneously communicating love. When a woman loses sleep thinking about her partner and wondering whether he is with someone else, it indicates simultaneously the depth of her love and the intensity of her jealousy. When a man tells his friends that he is madly in love with a woman, it serves the dual purposes of conveying love and communicating to potential rivals to keep their hands off.

The failure of most "open marriages" that became popular in the late 1960s and early 1970s is a stark testament to the failure of experiments to expunge jealousy from the lives of lovers. Few marriages can endure third-party intruders. One of the positive benefits of jealousy is to preserve that

inner sanctum, protecting it from interlopers who have their own hidden agendas. According to the Ayala Pines, protecting love is the primary function of jealousy: "jealousy aims to protect romantic relationships. It is not a useless flight of irrationality, but a useful signal people can learn to interpret correctly … Jealousy makes people examine their relationship … It teaches couples not to take each other for granted … ensures that they continue to value each other and … indicates that people value the love relationship it protects" (Pines, 1998, pp. 205–206).

The recent surge of interest in *polyamory* or *consensual non-monogamy* where individuals engage in open consensual love and sex with multiple partners, may pose a challenge to these views (e.g. Moors, 2017), but the field awaits good empirical evidence of their viability. There is evidence that polyamorous relationships are often, although not always, initiated by men who seek sexual variety, and sometimes women go along as a mate-retention tactic (Buss, 2016). Moreover, jealousy is a pervasive problem in consensually non-monogamous relationships.

Safe havens, however, are rarely possible in the modern world. As journalist Judith Viorst noted, "Unfortunately there is an endless supply of women out there in the big world – secretaries and dental assistants and waitresses and women executives … And wives with traveling husbands have an even wider selection of potential temptations to get aggravated over – TWA stewardesses, San Francisco topless dancers, old flames in Minneapolis, new models in Detroit" (Viorst, 1998, p. 24).

The maintenance of love, ironically, may hinge on the ever-present threat of rivals and the jealousy they evoke. "On those days when I happen to be feeling mature and secure," Viorst observes, "I'm also going to admit that a man who wasn't attractive to other women, a man who wasn't alive enough to enjoy other women, a man who was incapable of making me jealous, would never be the kind of man I'd love" (Viorst, 1998, p. 24).

## When Love Kills

Another problem is that what comes up often comes down. People fall out of love as crashingly as they fall in love. We can not predict with certainty who will fall out of love, but recent studies provide some critical clues. Just as the fulfillment of desire looms large when falling in love, violations of desire portend conflict and dissolution. A man who was chosen in part for his kindness and drive may get dumped when he turns cruel or lazy. A woman chosen in part for her youth and beauty may lose out when a newer model beckons her partner. An initially considerate partner may

turn condescending. And a couple's infertility after repeated episodes of sex prompts each to seek a more fruitful union elsewhere (Betzig, 1989).

The most crushing blow to long-term love comes from the harsh metric of the mating market. A mated couple initially equivalent on overall desirability may experience a widening gap over time. Consider an entry-level professional couple. If the woman's career skyrockets and the man gets fired, it puts a strain on both because their market values now differ. When actress Meg Ryan's career surpassed that of her husband Dennis Quaid, she promptly had an affair with rising star Russell Crowe. Sudden increases in status open up new mating opportunities. A "9" who was previously out of reach now becomes available. In the evolutionary jungle of mating, we may admire a woman who stands by her loser husband. But few of those who did are our ancestors. Modern humans descended from those who traded up when the increment was sufficient to outweigh the manifold costs that people experience as a consequence of breaking up (Buss, 2000).

Falling out of love has many dark sides. "Love's pleasure lasts but a moment; love's sorrow lasts all through life" (Celestine, a French writer of fables). The crash can be physically dangerous for women and psychologically traumatic for both sexes. Hearts broken from love lost rate among the most stressful life events a person can experience, exceeded in psychological pain only by horrific events such as a child dying. Men who get rejected by the woman with whom they are in love abuse them often emotionally and sometimes physically. Some men start stalking their exes with repeated phone calls, unexpected visits, and threats of violence. Victims of stalking experience psychological terror, disruption of work, and interference with new mateships. In our recent studies, we found that an alarming number of men who are unceremoniously dumped begin to have homicidal fantasies (Buss, 2005). Unfortunately, these fantasies sometimes turn into reality.

The mere loss of love is enough to make a man homicidal. The following case, from a systematic compilation of all homicides that occurred within one year in the city of Houston, Texas, illustrates the centrality of power of love and its loss.

> Case No. 191 begins as a domestic quarrel. A 37-year-old White woman and her 42-year-old husband were drinking and quarreling. The woman first ran next door to her sister's apartment but only found her 11-year-old nephew awake. She left her sister's house to seek assistance from a neighbor. Her husband intercepted her as she crossed their driveway, a further argument ensued, and the woman shouted for help as she walked away from her husband. The neighbors found the woman lying bleeding on the sidewalk and

> called an ambulance. The husband told police that the whole thing started because his wife did not love him anymore … [this] led him to pull out a pocketknife and stab his wife in the chest. (Lundsgaarde, 1977)

Losing love, in short, remains traumatic, both for the dumper and the dumpee. Just as evolution has installed serotonin reward mechanisms that flood our brains with pleasure when we successfully mate, it has also equipped us with brain circuits that deliver searing psychological pain when we experience mating failure. The many failures of love can bring catastrophic costs, creating adaptive problems of great moment.

In the United States between 1976 and 1984, 4,507 women were murdered annually on average (Campbell, 1992). Race was no barrier. Just over a third of the victims were African-American women; two-thirds were American women of European descent. The majority were killed by men who loved them deeply. One study of women murder victims in Dayton, Ohio, reveals proportions similar to those of most studies: 19% were murdered by their husbands, 8% by a current boyfriend, 17% by an estranged husband, and 8% by a prior sex partner. These total to an astonishing 52% of women killed in Dayton by their lovers or former lovers. In sharp contrast, in a typical year, only 3% of male murder victims die at the hands of a female lover.

Dayton is not unique. In a massive study of homicides committed within the United States between 1976 and 1998, more than a third of the women were killed by an intimate partner, whereas only 4% of the men were killed by a wife or lover (Greenfield et al., 1998). Similar statistics show up worldwide, from the Australian aborigines to murder among the Munda of India (Easteal, 1993; Saran, 1974).

It may seem strange to have the warm fuzzy emotion of love lead the vicious and bloody death. After all, love is what leads to romance. Love leads to passion. Love leads to the birth of new life. Killing seems the opposite – destruction, demolition, and final demise. How can these apparent opposites be fused in the human mind, in a jarring tangle of paradoxical emotions? Consider the following case.

> Then she said that since she came back in April she had fucked this other man about ten times. I told her how can you talk about love and marriage and you been fucking this other man. I was really mad. I went to the kitchen and got the knife. I went back to our room and asked: Were you serious when you told me that? She said yes. We fought on the bed, I was stabbing her. Her grandfather came up and tried to take the knife out of my hand. I told him to go and call the cops for me. I don't know why I killed the woman, I loved her. (Confession of a thirty-one-year-old man to police

after he stabbed his twenty-year-old wife to death, following their reunion after a six-month separation)

The killing of a mate, however, poses a more serious puzzle. How could this bizarre form of behavior possibly have evolved? Killing a mate destroys a key reproductive resource. Evolution by selection should favor preserving, not destroying, vital reproductive resources. Mate killing seems outrageously counter to self-interested reproductive survival.

The solution to this mystery requires delving into the underlying particulars of mating market logic (Buss, 2005). First, in most cases, killing a mate who has been unfaithful usually *would* have been detrimental to the killer. An unfaithful woman might still be a valuable reproductive resource to her husband. If she *continues* to be his sexual resource, then killing her would be damaging his own fitness, an instance of futile vengeful spite. As Margo Wilson and Martin Daly correctly observe, "murdered women are costly to replace" (Wilson & Daly, 1998). If the woman has borne him children, then killing her dramatically hurts his children's chances to survive and thrive. Finally, by killing her, the cuckolded man risks retribution. The woman's brother or father might be motivated to extract vengeance. For all these reasons, killing a mate is usually a remarkably ineffective solution to the problem of cuckoldry.

But sometimes the elements in the cost–benefit equation become rearranged. An infidelity might signal the man's *permanent* loss of sexual access to his mate, not just a temporary or fractional loss. She might *not* have children by him, and hence killing her would not impair his existing children's survival. She might lack a father or brothers in the vicinity, something quite common in traditional societies where marriage is usually exogamous where women migrate away from their own kin group and move in with her husband's kin group when they marry. Furthermore, a man's social reputation might be so severely damaged by his wife's infidelity that his social status would plummet unless he engaged in dramatic action to staunch the slide. Status loss cascades into a decline in mate value, undermining the man's ability to attract another mate. Finally, the man's sexual loss might become a rival's sexual gain, a valuable reproductive resource flowing to an arch enemy.

Consider for a moment the logic of the argument outside the context of mating. If you have just killed a game animal to feed yourself and your hungry family, and a scavenging animal comes along and steals it before you can eat it, you suffer a loss. But if your rival steals the meat, the loss becomes compounded in the currency of evolutionary fitness, since

selection operates on the principle of *relative* reproductive success. Your loss becomes a gain for your immediate rival, whose children survive and thrive whereas yours go hungry or perish.

The same logic applies to mating. If your mating loss bestows a sexual gain on your immediate rival, then the fitness costs of being cuckolded become compounded. This theory leads to a counterintuitive prediction: The younger, healthier, and more attractive the woman, the greater the loss to the cuckolded man and the greater the gain for the rival who now sleeps in her bed. This leads to a disturbing prediction of the theory – that the more appealing, healthy, and fertile the woman, the more motivated the man will be to kill her upon discovering a sexual infidelity.

What is extraordinary is that roughly half of the 3,400 women who are murdered in America every year are killed by the ones who presumably love them – their husbands, boyfriends, ex-husbands, or ex-boyfriends – in circumstances that are remarkably similar. The permanent loss of love sometimes activates evolved homicidal circuits in men.

## What an Evolutionary Perspective on Love Adds to Existing Theories of Love

Psychological theories of love and the empirical research they have generated have led to important insights and discoveries. These include Berscheid and Hatfield's (1978) distinction between passionate and companionate love; Sternberg's triangular theory of love, with the key components of passion, intimacy, and commitment (Sternberg, 1986); Fehr's (1988, 2015) prototype analysis of love, which identifies caring and intimacy as the most central and passion as important but less central; and Aron and Aron's (1986) self-expansion model of love. Important progress has also been made in identifying the neurobiological substrates of love (e.g. Aron et al., 2005; Cacioppo, Bianchi-Demicheli, Frum, Pfaus, & Lewis, 2012).

An evolutionary perspective does not contradict any of these theories and discoveries, but rather importantly complements them. Most centrally, it poses the question: *Has there been selection pressure over evolutionary time for adaptations for love, and if so, what are the functions of these adaptations?* Just as it is important for a medical researcher to discover *how* the heart, liver, and lungs work, it is equally important to discover the *adaptive functions* of these organs (e.g. to pump blood to the brain and muscles; to break down toxins; etc.). Analogously, if there exist psychological adaptations for love, as I have argued, it is critical to identify their

adaptive functions – the specific ways in which these adaptations have contributed to fitness or reproductive success over evolutionary time.

Evolution-based theories of love have emphasized passion and sex drive, which function to promote *sex and hence successful conception* (e.g. Buss, 1988a; Fisher, 1998); attachment, which is critical for the function of *investing in offspring* (Shaver, Hazan, & Bradshaw, 1988); commitment, which is critical for the function of *investing in those offspring over the long term* needed in our highly altricial species; and love as a commitment device, which functions to *channel reproductively relevant resources preferentially to a partner* (e.g. Buss, 1988a; Frank, 1988; for a recent treatment, see Fletcher, Simpson, Campbell, & Overall, 2015).

Buss's theory of love extends these core ideas by specifying in detail precisely what those reproductively relevant resources are (e.g. not just sex, but exclusive sexual access, signals of sexual fidelity, curtailing contact with potential alternative mates), as well as the *mate-retention adaptations* crucial for protecting love relationships from infidelity and mate poachers. The current evolutionary perspective adds the important concept of fitness interdependence, together with the conditions that promote it, with romantic love being one pinnacle of maximal fitness interdependence (another pinnacle is parental love for their children, another example of high fitness interdependence). The notion of fitness interdependence dovetails nicely with Aron and Aron's (1986) notion of love as self-expansion, giving that theory an evolutionary functional foundation. In these ways, an evolutionary perspective provides an important complement to existing psychological theories of love by bringing in the selective pressures likely to have created the psychological components of love and plausible hypotheses about the adaptive functions of those psychological components.

## Conclusions

The evolutionary theory of love proposed here contains a key feature lacking in non-evolutionary theories of love – hypotheses about its functionality in solving specific adaptive problems that have recurrently faced humans over deep time in the quest for mating success. It also contains testable, hence potentially falsifiable, predictions about the psychological design of love, including critical sex differences in design features. Although the full theory requires more extensive empirical tests, the available evidence supports several key predictions from the evolutionary theory of love.

First, evidence suggests that the experience of love is universal in the sense that some individuals in all cultures for which we have relevant data experience love. Second, the evidence supports the hypothesis that love emerges primarily in the context of long-term mating. Third, evidence points to the functions of love as a commitment device (Buss, 1988a; Frank, 1988). Specifically, Buss (1988a) found that love signals the commitment of the following: (1) displaying reproductively relevant resources; (2) providing sexual access; (3) signaling sexual fidelity; (4) promoting relationship exclusivity through mate guarding; (5) promoting actions that historically led to successful reproductive outcomes; and (6) providing signals of high parental investment in resulting children.

Although the emotion of love contains these universal psychological circuits and adaptive functions, men and women differ in a few psychological design features of love. Men experience "love at first sight" more than women – a design feature that supports the notion that physical appearance and physical attractiveness is more central to men's than to women's activation of love circuits. Women more than men *disagree* with the attitude statement "sex without love is OK," supporting the hypothesis that love and sex are more closely linked in the minds of women than men. Because of men's short-term mating strategy, they are more able to dissociate sex and love and find it easier to have sex with strangers with whom they are not in love. Although some women are like some men in this respect, women on average find it more difficult to have sex without the accompanying emotion of love.

Jealousy shows links to love in ways precisely predicted by the current evolutionary theory. Women more than men experience more intense jealousy when a partner falls in love with someone else, whereas men more than women experience more intense jealousy at signals of sexual infidelity (despite some claims to the contrary, the sex differences in the design of jealousy is extremely robust across methods – see Buss, 2018a; Edlund & Sagarin, 2017; Sagarin et al., 2012; Pietrzak, Laird, Stevens, & Thompson, 2002).

Finally, loss of love, particularly when a woman permanently leaves a man who loves her, places women in peril of violence, stalking, and murder – findings that support the hypothesis that men's psychology of love contains design features that motive then to keep a woman they love and go to desperate measures to prevent male rivals from possessing her. Infidelity and defection from the relationship lead to a rival's access to a lover's reproductively valuable resources, which in turn compromises fitness interdependence – a key criterion for the evolution of love.

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